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# Wrap-up Report for Water use Licence N3L1 - 1710

*A Final Report Submitted to the  
Northwest Territories Water Board*

James C. McDougall P.Eng.

NORTH OF 60 ENGINEERING LTD.  
Suite 2050, 140 4<sup>th</sup> Avenue S.W.  
Calgary, Alberta, Canada, T2P 3N3

August, 1998

WATER REGISTRY COPY  
DO NOT REMOVE

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## INTRODUCTION

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In the fall of 1997, the Inuvialuit Petroleum Corporation applied to the Northwest Territories Water Board (the Board) for a water permit to support the development drilling program associated with the Inuvik Gas Project. The Board issued a class B water licence (N3L1-1710) on January 9, 1998. A copy of the licence is contained in Appendix A.

Under the General Conditions of the Licence the Board stipulated that the Licensee submit to the Board a final report containing the following information:

- a) the total quantity of water used in cubic meters during the drilling operations
- b) an itemized list indicating the names, uses and quantities of all substances which were used during the drilling operation and which were discharged into the drilling sumps
- c) details of sampling and analysis of any decant, and the date, time, location and amount of waste or water discharged during the decant
- d) details of work completed
- e) details of the restoration of the sumps
- f) a list of unauthorized discharges;
- g) any other details of water use or waste disposal requested by the Board prior to June 30, 1998.

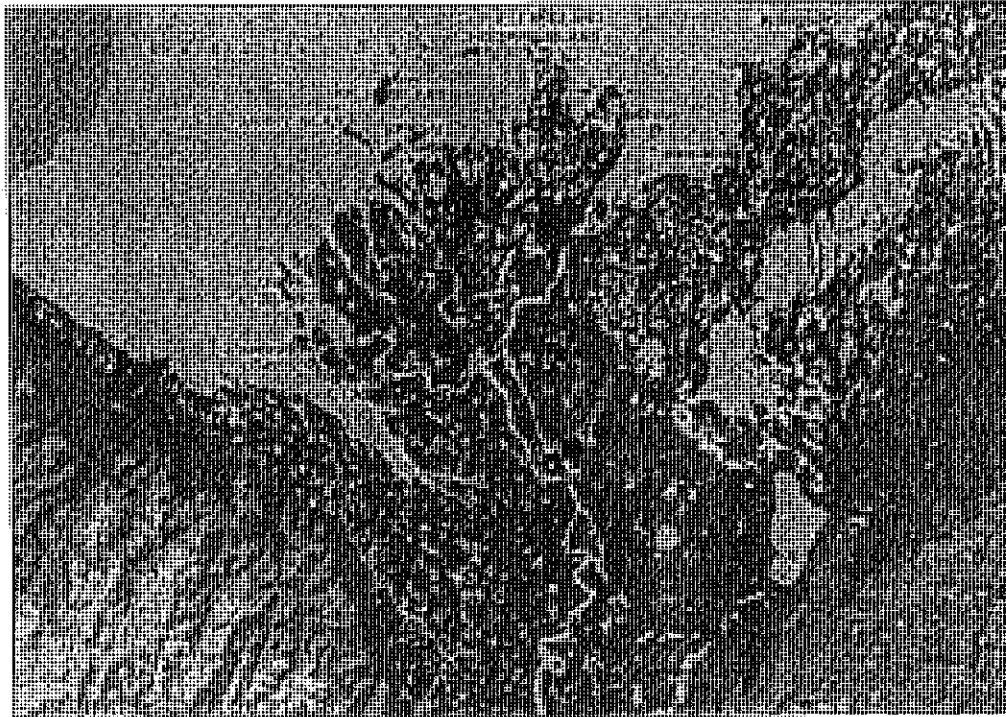
This document represents the final report as required under the Licence.

## PROJECT OVERVIEW

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The Inuvialuit Petroleum Corporation, Altgas Services Inc. and IPL Holdings Inc are developing the Ikhil gas reservoir to supply natural gas to the Town of Inuvik. This development will provide Inuvik with a secure supply of fuel for power generation and commercial and residential heating at a cheaper cost than diesel, which is now brought in from Edmonton, Alberta. In addition, natural gas is much cleaner burning than diesel oil and will have a positive effect on air quality in the Town on Inuvik.

The Ikhil gas field is located at 68° 45' North and 134° 10' West in the Caribou Hills, approximately 50 km (30 miles) to the northwest of Inuvik. The natural gas is contained in a sand layer known as the Taglu Delta, at a depth of approximately 1100 meters (3600 Feet) below ground.



**Figure 1 - Ikhil Location Map**

Gulf Canada Resources originally discovered the reservoir in 1986. The entire reservoir is within the Inuvialuit 7.1.a lands as defined by the Inuvialuit Final Agreement and the Inuvialuit Petroleum Corporation, AltaGas Services Inc. & IPL Holdings Inc. now have ownership of the gas within the reservoir.

An extensive testing program carried out by the Inuvialuit Petroleum Corporation during the winter of 1997 has confirmed that the reservoir is capable of producing gas at very high rates. The testing and subsequent development drilling have confirmed the excellent quality of the gas, and in-place gas reserves of approximately  $490 \times 10^6 \text{ m}^3$ . Marketable gas reserves

are  $365 \times 10^6 \text{ m}^3$ . At current rates of consumption, this is enough to supply all of Inuvik's heating and power needs for approximately 20 years, which makes the proposed Project economically viable.

The natural gas will be produced from the original exploration well, K-35 and a second well, J-35 that was drilled in the winter of 1998. The two wells will ensure that the supply of gas is secure and that the reservoir is drained in such a way that no gas is trapped, unnecessarily, in the sand layer.

The natural gas from the two wells will be carried in 114.3 mm diameter, above-ground pipelines to a small production facility centrally located between the wells. This facility will dry and cool the gas so that it can be transported through a buried pipeline to Inuvik. The total length of the above ground pipelines is approximately one half kilometre and the total area of gravel pads for the wells and the production facility will be less than 4000 square meters (1 acre).

The Project owners propose to construct a 168.3 mm (6 inch) diameter pipeline from the production facility at Ikhil to a regulation and metering facility near the NWTPC power plant in Inuvik. The Pipeline will be buried and will parallel the East Channel of the Mackenzie River for its entire length of approximately 50 km. (30 miles). However, it will be sufficiently distant from the river that it will not have any effect on vegetation or wildlife along the riverbank. Where the Pipeline crosses Douglas Creek, it will be supported above ground to avoid disturbance to the slopes on either side of the Creek. Since the gas will be cooled to below freezing temperatures at the Ikhil production facility, limited melting of the permafrost will occur as the gas passes through the Pipeline.

A regulator station will be installed at the Inuvik end of the Pipeline to measure and condition the gas to meet the needs of the Town and the NWTPC. The gas will be initially used by NWTPC to generate electricity and Inuvik Gas Ltd. will distribute the gas within the Town of Inuvik for commercial and residential use.

## WATER USE

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### Sources

Water to support the 1997/98 drilling program was drawn from three locations as shown on the attached map (Figure 2). The locations were, the East Channel of the Mackenzie River, a small lake adjacent to the Ikhil K35 Well location and Peter Lake.

Water taken from the first two locations was used to ice down the overland access route from the East Channel and to the camp and well sites. Water for camp use and water to support the drilling operations was taken from Peter Lake. A pump with a water intake screen was used to pump water from each of the water sources into a tank truck, which is used to haul the water to the camp for camp use and to the drilling rig to be used as boiler makeup water and for drilling fluids to support the drilling of the well.

### Overland Access Route

The overland access route from the East Channel to the Ikhil Camp was approximately 8 kilometres. Both the original K35 well and the J35 development well were located in close proximity to the camp. The N26 development well was located on the East side of Peter lake which required a 6 kilometre access road from the camp to the well.

The access roads which were approximately 8 meter in width were constructed by compacting snow with a cat pulling a drag and then watering the surface of the compacted snow using a water truck, and then allowing the snow / water mixture to freeze. This process produced a high-density snow ice mixture, which was capable of supporting vehicular traffic without disturbing the underlying permafrost.

Local contractors, who were responsible for constructing the access roads did not keep accurate records of the volume of water used to build the access roads; however the estimated volume is 200 meters of water per kilometre for a total volume of 2000 meters or the equivalent of 20 cubic meters per day during the 100 day season.

The overland access roads melted in the spring and the melt water entered the natural drainage course.

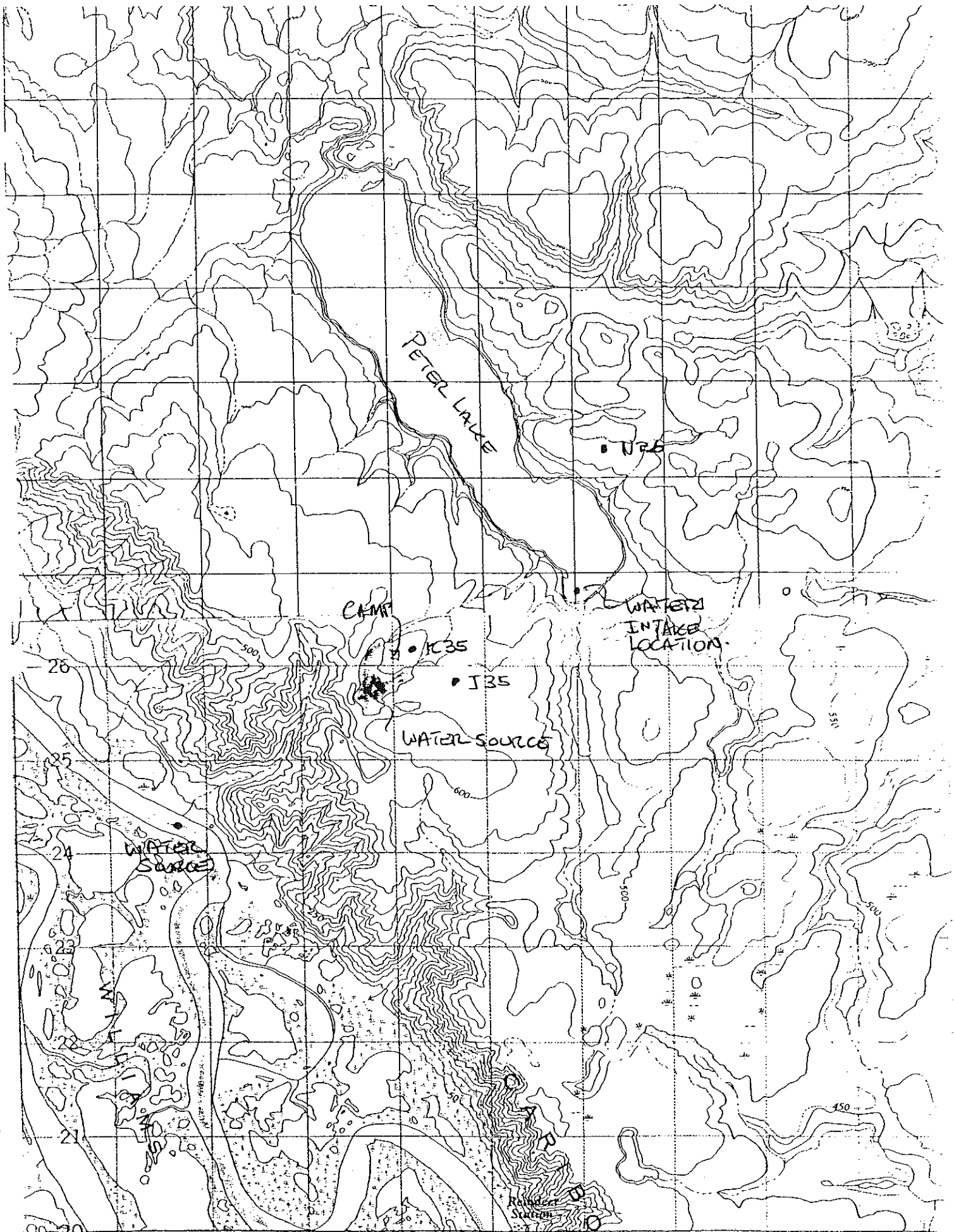


FIGURE 2

(continued)

### Camp Water and Sewage

Potable water for the 50 man camp was taken from Peter Lake. A pump with a water intake screen was used to pump water from the lake into a tank truck, which was used to haul the water to the camp where it was stored in an insulated tank. The potable water for the camp was tested every month. Samples were taken at the lake and from taps within the camp and are then submitted to the Inuvik Regional Health Board for analysis.

Total water use at the Ikhil camp was approximately 9 m<sup>3</sup> per day for a total volume of 900 m<sup>3</sup>. This volume was higher than the application estimate of 5 m<sup>3</sup> per day due to the higher number of people in camp.

Effluent from the camp was discharged to a sump adjacent to the camp (Figure 3). The sump was increased in size half way through the winter program to accommodate the higher volume of waste. At the end of the drilling program in April a small quantity (approximately 20 m<sup>3</sup>) of sewage was decanted from the sump to provide sufficient freeboard for sump restoration. The decanted fluid was hauled in a vacuum truck to Inuvik for disposal in the Town sewage lagoons. The sump was then restored as per the restoration plan discussed in the next section.

All solid waste associated with the camp was either incinerated or hauled to Inuvik for disposal in the town solid waste dump.

### Water used for Drilling

Water was used for makeup water for the boiler that provided heat for the drilling rig and for drilling fluids that are associated with the drilling of the two wells. The drilling fluids from each well were contained in sumps adjacent to each well. A plan view and cross section of the drilling sump is shown in Figure 4. Dimensions of the two sumps are shown in Table 1

Dimension	J35 Drilling Sump	N26 Drilling Sump
Length (m)	24	24
Width (m)	16	16
Depth (m)	4	4
Volume (m <sup>3</sup> )	1540	1540

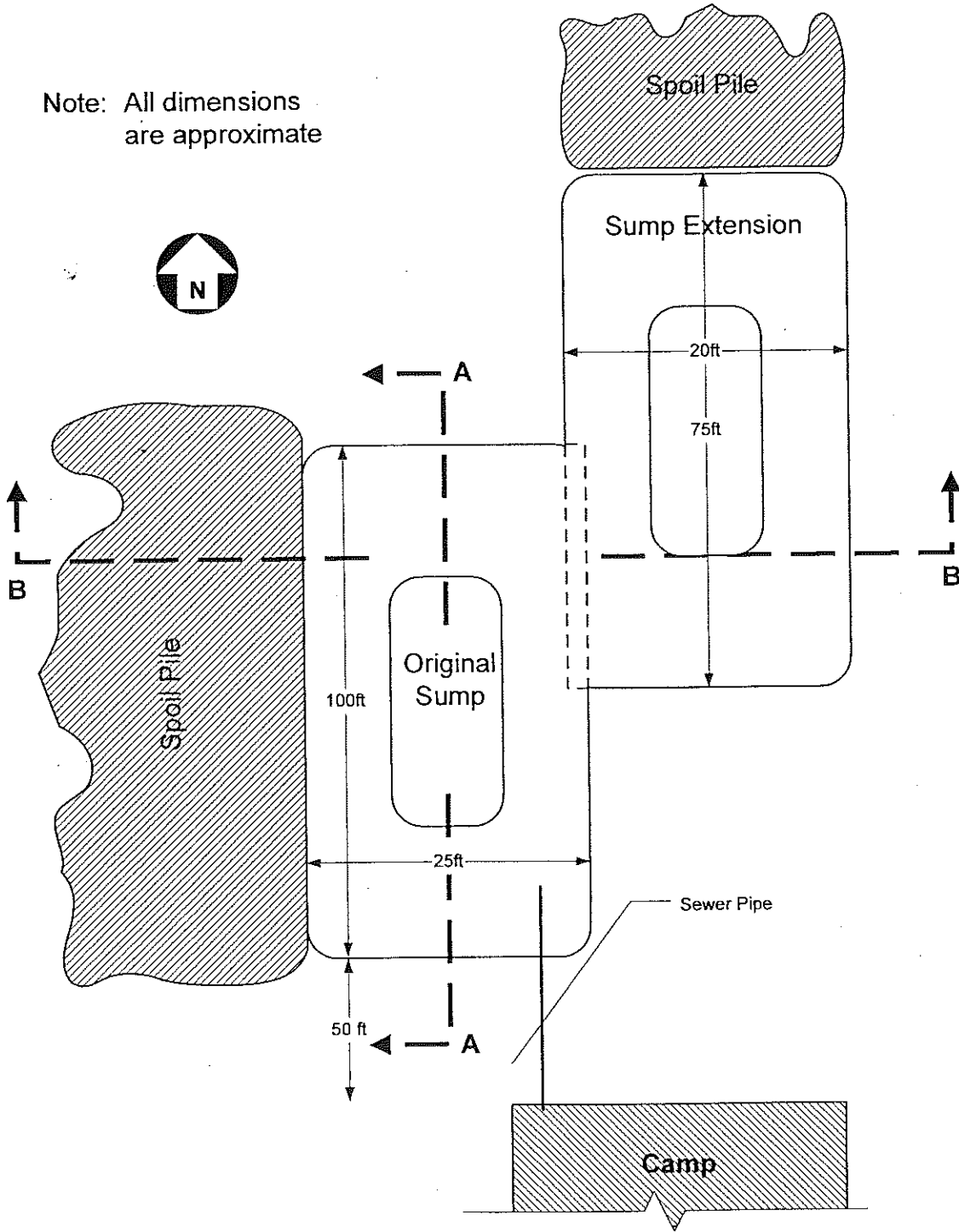
Table 1 – Drilling Sump Dimensions

Chemical additives were added to the water to condition the drilling fluid. A list of the additives and their amount are summarized in Table 2. Data sheets on the chemicals are contained in Appendix B.



Plan View

Note: All dimensions are approximate



North of 60 Engineering Ltd.  
 2050, 140 4th Ave. S.W.  
 Calgary, Alberta, T2P 3N3  
 Canada

Ikhil Camp - Wastewater Sump

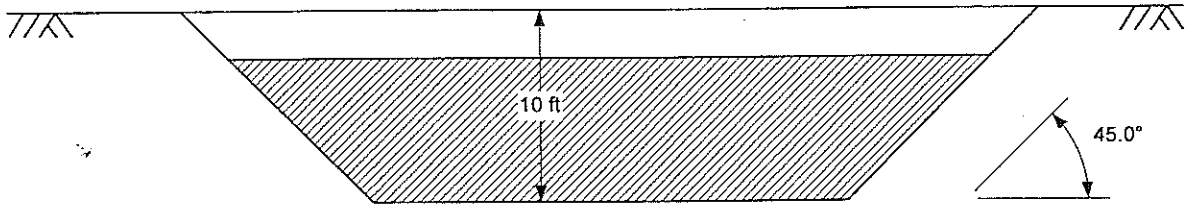
By: JCM

Date: 980402-01

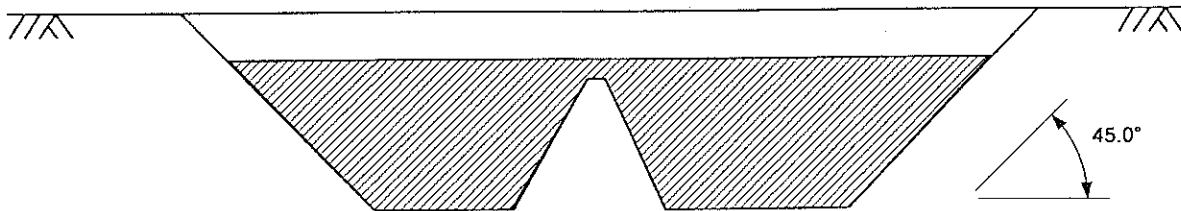
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Figure 3 - Camp Sump



Elevation View (Section AA)



Elevation View (Section BB)



North of 60 Engineering Ltd.  
 2050, 140 4th Ave. S.W.  
 Calgary, Alberta, T2P 3N3  
 Canada

Ikhil Camp - Wastewater Sump

By: JCM

Date: 980402-01

Scale: NTS

Page: 2 of 3

Figure 3 - Camp Sump

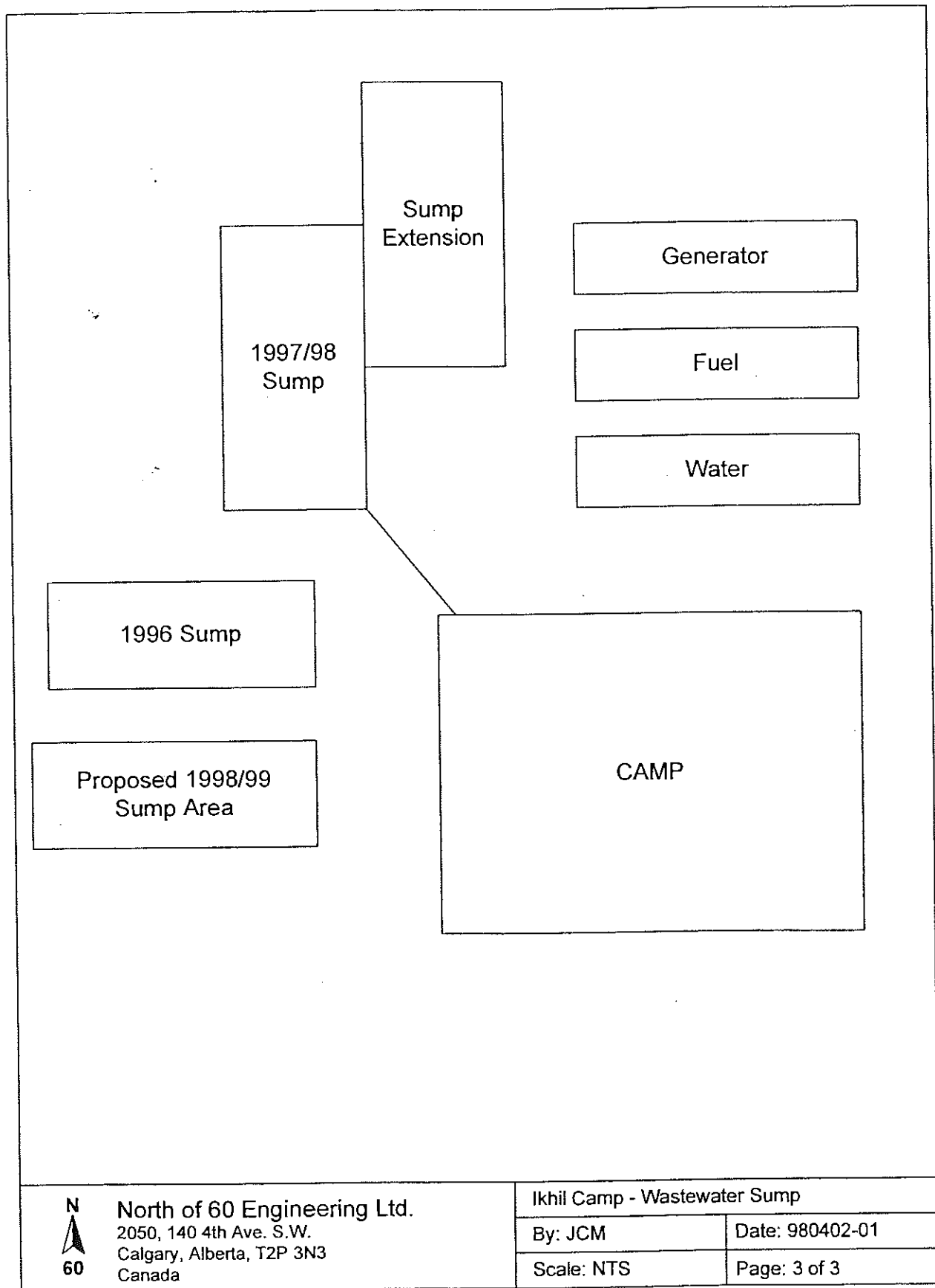
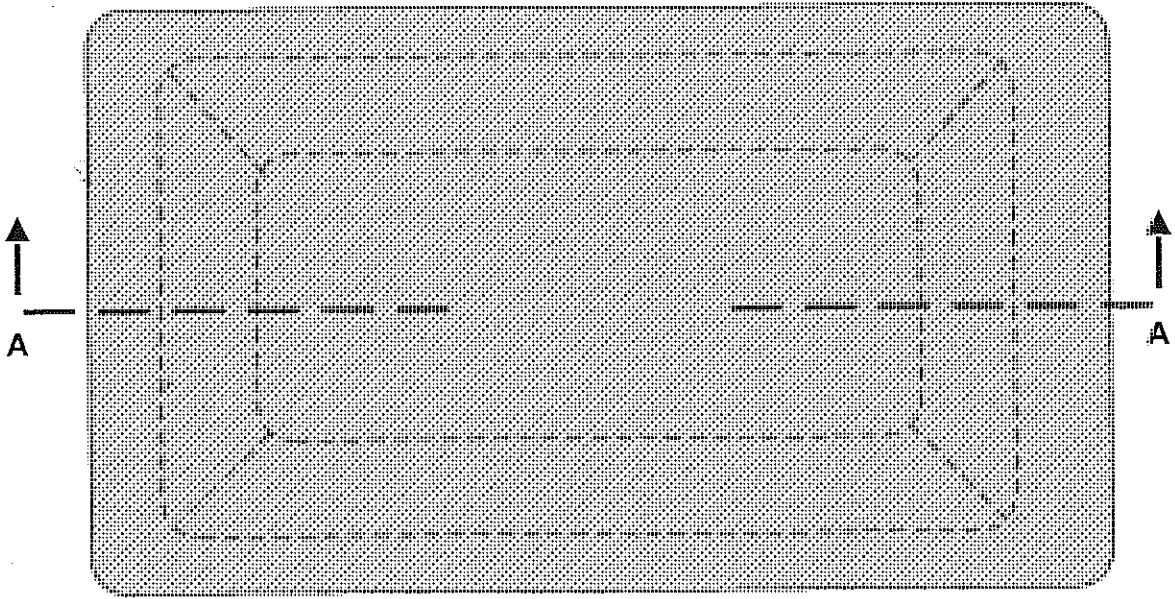
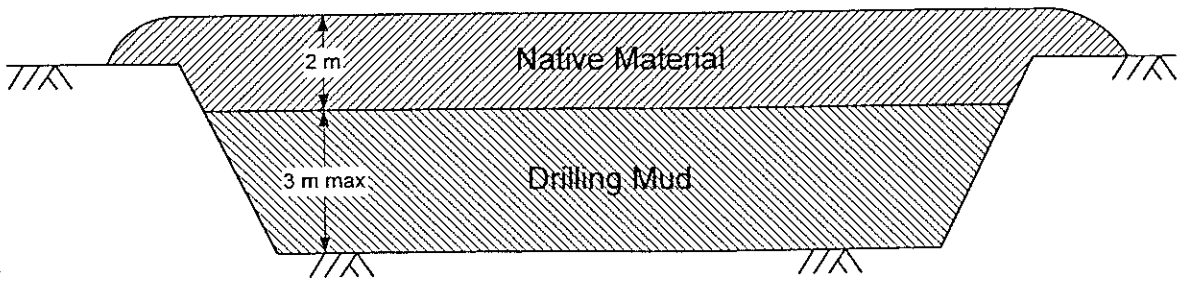


Figure 3 - Camp Sump



Plan View



Elevation View (Section AA)


	<b>North of 60 Engineering Ltd.</b> 2050, 140 4th Ave. S.W. Calgary, Alberta, T2P 3N3 Canada		Project: Town of Inuvik Gas Supply	
			By: JCM	Date: 980227-02
			Scale: NTS	Page: 1 of 1

Figure 4 - Sump Restoration Plan

Product	Function	Size	J35 Quantity	N26 Quantity
Potassium Chloride	Freeze Depressant	25 kg	624	653
Hydrogell	Viscosifier	40 kg	60	0
Barite	Weighting Agent	40 kg	40	0
Bicarbonate of Soda	Calcium Sequestor	22.7 kg	20	0
Kelzan XCD	Xanthan Gum Viscosifier	25 kg	28	20
Kwik Seal M	Lost Circulation	18.2 kg	73	20
Sawdust	Lost Circulation	18.2 kg	107	43
Soda Ash	Calcium Sequestor	25 kg	3	12
Staflor Reg	Fluid Loss Reducer	22.7 kg	28	8
Ultra Seal XP	Stability Control	11.4 kg	22	0
Sodium Sulphite	Anti Oxidant	22.7 kg	9	2
XL Defoamer	Defoamer	20.0 li	16	0

**Table 2 - Chemical Additives**

Drilling fluids from both sumps were sampled prior to capping. The chloride level was 11,500 ppm in the J35 sump and 10,500 in the N26 sump.

## RESTORATION

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In April the camp and drilling sumps were capped in accordance with the approved Abandonment and Restoration plan submitted to the Board on March 2, 1998 along with supplementary information received on April 21, 1998. A copy of the restoration plan is contained in Appendix C.

Pictures of the J35 and N26 restored sumps are shown in Figures 4 and 5 respectively. Seeding of the sumps will take place during the summer of 1999 along with the restoration of the pipeline.

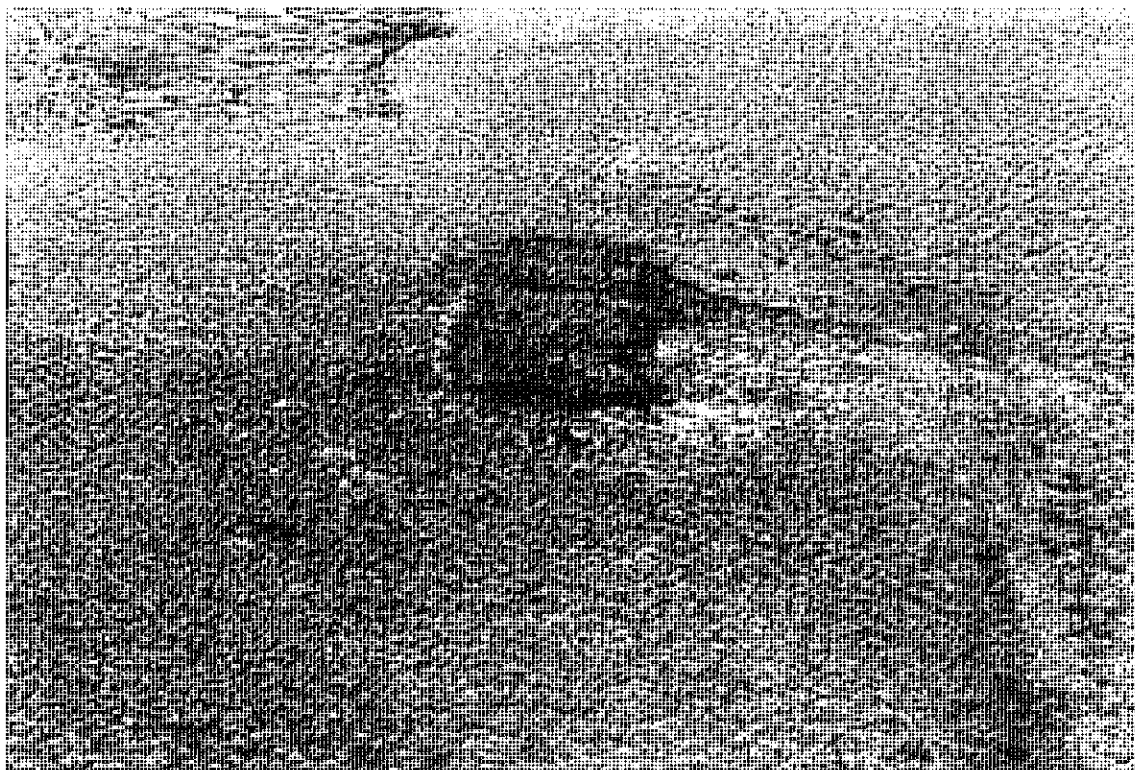


Figure 5 - J35 Sump



Figure 6 - N26 Sump

## SUMMARY

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The 1998 Development Drilling program for the Inuvik Gas project required water to support the access road construction, the camp, and the drilling activities. Under Licence N3L1-1710 water was drawn from three sources. The total water drawn was estimated to be 5,970 m<sup>3</sup> of which 2,000 m<sup>3</sup> was returned to the water course and the remainder frozen in three sumps (2 drilling and 1 camp) which were capped in accordance to the restoration plan approved by the Board in April of 1998.

WATER LICENCE N3L1 - 1710

**APPENDIX A**

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**Water Board Licence N3L1-1710**



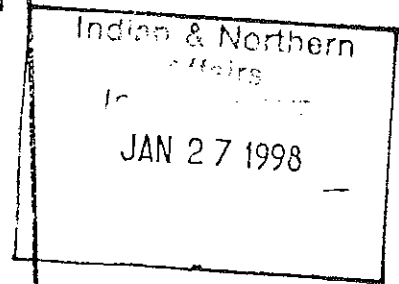
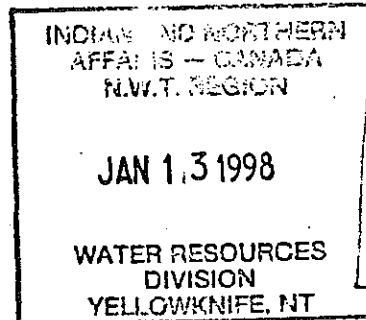
NORTHWEST  
TERRITORIES  
WATER BOARD



WATER REGISTER: N3L1-1710

January 9, 1998

James C. McDougall, P. Eng.  
Inuvialuit Petroleum Corporation  
1100, 300 - 5th Avenue S.W.  
CALGARY, AB T2O 3C4



Dear Mr. McDougall:

**RE: ISSUANCE OF A "B" TYPE LICENCE**

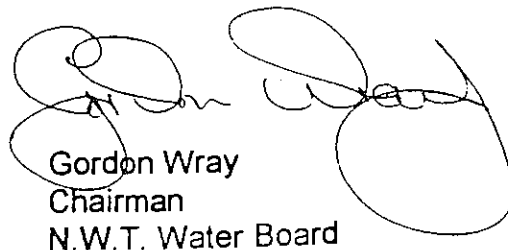
Attached is a duplicate of Licence No. N3L1-1710 granted to Inuvialuit Petroleum Corporation by the Northwest Territories Water Board in accordance with the Northwest Territories Waters Act. The other original of this Licence has been filed with the Department of Indian Affairs and Northern Development in Yellowknife, Northwest Territories.

Also attached are general procedures for the administration of licences in the Northwest Territories. I request that you review these and address any questions to the Board's office.

In conclusion, please be advised that this letter with attached procedures, all inspection reports, and correspondence related thereto are part of the public Water Register, and are intended to keep all interested parties informed of the manner in which the Licence requirements are being met. All Water Register material will be considered when the Licence comes up for renewal or amendment.

The full cooperation of the Inuvialuit Petroleum Corporation is anticipated.

Sincerely,



Gordon Wray  
Chairman  
N.W.T. Water Board

Attachments (2)

**GENERAL PROCEDURES FOR THE ADMINISTRATION OF LICENCES  
ISSUED UNDER THE NORTHWEST TERRITORIES WATERS ACT  
IN THE NORTHWEST TERRITORIES**

1. At the time of issuance, a copy of the Licence is placed on the Water Register in the Office of the Northwest Territories Water Board in Yellowknife, and is then available to the public.
2. To enforce the terms and conditions of the Licence, the Minister of Indian Affairs and Northern Development has appointed Inspectors in accordance with Section 35(1) of the Northwest Territories Waters Act. The Inspectors coordinate their activities with officials of the Water Resources Division of the Department of Indian Affairs and Northern Development. The Inspector responsible for Licence No. N3L1-1710 is located in the North Mackenzie District Office.
3. To keep the Water Board and members of the public informed of the Licensee's conformity to Licence conditions, the Inspectors prepare reports which detail observations on how each item in the Licence has been met. These reports are forwarded to the Licensee with a covering letter indicating what action, if any, should be taken. The inspection reports and covering letters are placed on the public Water Register, as are any responses received from the Licensee pertaining to the inspection reports. It is therefore of prime importance that you react in all areas of concern regarding all inspection reports so that these concerns may be clarified.
4. If the renewal of Licence No. N3L1-1710 is contemplated it is the responsibility of the Licensee to apply to the Water Board for renewal of the Licence. The past performance of the Licensee, new documentation and information, and points raised during a public hearing, if required, will be used to determine the terms and conditions of any Licence renewal. Please note that if the Licence expires and another has not been issued, then water and waste disposal must cease, or you, the Licensee, would be in contravention of the Northwest Territories Waters Act. It is suggested that an application for renewal of Licence No. N3L1-1710 be made at least eight months in advance of the Licence expiry date.
5. If, for some reason, Licence No. N3L1-1710 requires amendment, then a public hearing may be required. You are reminded that applications for amendments should be submitted as soon as possible to provide the Water Board with ample time to go through the amendment process. The process may take up to six (6) months or more depending on the scope of the amendment requested.

The Surveillance Network Program annexed to the Licence can be modified at the discretion of the Board and does not require a public hearing. A request for any proposed change to the Surveillance Network Program should be forwarded to the Board in writing, including a rationale for the change.

6. Specific clauses of your Licence make reference to the Board, Analyst or Inspector. The contact person, address, phone and fax number of each is:

**BOARD:** Executive Assistant  
Northwest Territories Water Board  
Box 1500  
YELLOWKNIFE, NT X1A 2R3

Phone No: (867) 669-2772

Fax No: (867) 669-2719

**ANALYST:** Analyst  
Water Laboratory  
Northern Affairs Program  
Department of Indian Affairs  
and Northern Development  
Box 1500  
4601 - 52nd Avenue  
YELLOWKNIFE, NT X1A 2R3

Phone No: (867) 669-2780

Fax No: (867) 669-2718

**INSPECTOR:** Inspector  
Inuvik District Office  
Northern Affairs Program  
Department of Indian Affairs  
and Northern Development  
P.O. Box 2100  
INUVIK, NT X0E 0T0

Phone No: (867) 777-3361

Fax No: (867) 777-2090



**PART A: SCOPE AND DEFINITIONS****1. Scope**

- a) This Licence entitles the Inuvialuit Petroleum Corporation to use water and dispose of waste for industrial undertakings in oil and gas exploration and associated uses in the Inuvik area at the Ikhil Gas Development Site located at 68°45' Latitude North and 134°10' Longitude West, Northwest Territories.
- b) This Licence is issued subject to the conditions contained herein with respect to the taking of water and the depositing of waste of any type in any waters or in any place under any conditions where such waste or any other waste that results from the deposits of such waste may enter any waters. Whenever new Regulations are made or existing Regulations are amended by the Governor in Council under the *Northwest Territories Waters Act*, or other statutes imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited this Licence shall be deemed, upon promulgation of such Regulations, to be automatically amended to conform with such Regulations; and
- c) Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable Federal, Territorial and Municipal legislation.

**2. Definitions**

In this Licence: N3L1-1710

“Act” means the *Northwest Territories Waters Act*,

“Regulations” mean Regulations proclaimed pursuant to Section 33 of the *Northwest Territories Waters Act*,

“Board” means the Northwest Territories Water Board established under Section 10 of the *Northwest Territories Waters Act*,

**"Inspector"** means an Inspector designated by the Minister under Section 35(1) of the *Northwest Territories Waters Act*;

**"Licensee"** means the holder of this Licence;

**"Minister"** means the Minister of Indian Affairs and Northern Development;

**"Waste"** means waste as defined by Section 2 of the *Northwest Territories Waters Act*;

**"Artesian Aquifer"** means a water-bearing rock stratum, which when encountered during drilling operations, produces a pressurized flow of groundwater that reaches an elevation above the water table or above the ground surface;

**"Drilling Fluids"** mean any liquid mixture of clay, water or chemical additives pumped downhole;

**"Modification"** means an alteration to a physical work that introduces a new structure or eliminates an existing structure and does not alter the purpose or function of the work, but does not include an expansion;

**"Permeability"** means the capacity to transmit water through a medium; and

**"Sump"** means an excavation or depression in impermeable soil for the purpose of catching or storing fluids.

**PART B: GENERAL CONDITIONS**

1. The water use fee shall be paid annually in advance.
2. The Licensee shall file a Final Report with the Board not later than October 31, 1998 which shall contain the following information:
  - a) the total quantity of water used in cubic metres during the drilling operations;
  - b) an itemized list indicating the names, uses and quantities of all substances which were used during the drilling operation and were discharged into the drilling sump;

- c) details of sampling and analysis of any decant, and the date, time, location and amount of waste or water discharged during the decant;
  - d) details of work completed;
  - e) details on the restoration of any sumps;
  - f) a list of unauthorized discharges; and
  - g) any other details of water use or waste disposal requested by the Board by June 30, 1998.
3. Meters, devices or other such methods used for measuring the volumes of water used and waste discharged shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.
  4. A copy of this Water Licence shall be located on site at all times in a readily available location.

**PART C: CONDITIONS APPLYING TO WATER USE**

1. The Licensee shall obtain all fresh water for camp use and well drilling from Peter Lake, East Channel of the Mackenzie River, and the unnamed lake near the site, or as approved by an Inspector.
2. The water intake hose used on the water pumps shall be equipped with a screen with a mesh size sufficient to ensure no entrainment of fish.
3. The daily quantity of water used for all purposes shall not exceed 30 cubic metres.

**PART D: CONDITIONS APPLYING TO WASTE DISPOSAL**

1. All wastes to be disposed of from the drilling operation shall be completely contained in a drilling sump adjacent the drill site, or at an alternate sump location, as approved by an Inspector.
2. Sumps shall be constructed of material that normally exhibit low permeability in a manner that prevents intrusion of runoff water.
3. In the event the initial Sump does not consist of low permeability materials, the Licensee shall construct an offsite Sump to the satisfaction of an Inspector.
4. There shall be no disposal of Drilling Fluids from the Sump into any waters or onto any land surface where drilling fluids may enter any waters.
5. The Licensee shall construct and maintain the Sumps to the satisfaction of an Inspector.
6. If during the drilling, an Artesian Aquifer is encountered producing water flowing at the surface, the Licensee shall notify an Inspector immediately. A sample of not less than ten (10) litres shall be collected from the flowing source at the point of discharge from the well. Five (5) litres shall be made available to an Inspector for analysis, and the Licensee shall have the remaining five (5) litres analysed.
7. The disposal of fluids generated by an Artesian Aquifer to other than a Sump requires the approval of the Inspector.
8. The sealing of an Artesian Aquifer should be to the satisfaction of an Inspector.
9. In the event where decanting Waste or water from the Sump is planned or required by an unanticipated event, the Licensee shall:
  - a) advise an Inspector;



- b) obtain a representative sample from the Sump using the information requirements outlined in the "Sampling and Analytical Requirements for Characterization of Sump Supernatant Fluids" (Appendix A).
- c) submit the results of the sampling and analyses to the Inspector at least ten (10) days prior to the requested date of commencing decant, or in the case of an unanticipated event, as soon as possible; and
- d) indicate in writing to the Inspector;
  - i) the method of decant;
  - ii) the direction of flow,
  - iii) the location of where the decanted effluent is expected to go, and
  - iv) any treatment that will be applied to the Sump.

10. The Licensee may commence decanting upon receipt of the Inspector's approval.

#### **PART E: CONDITIONS APPLYING TO MODIFICATIONS**

- 1. The Licensee may, without written approval from the Inspector, carry out Modifications to the planned undertakings provided that such Modifications are consistent with the terms of this Licence and the following requirements are met:
  - a) the Licensee has notified the Inspector in writing of such proposed Modifications at least five (5) days prior to beginning the Modifications;
  - b) such Modifications do not place the Licensee in contravention of either this Licence or the Act;
  - c) the Inspector has not, during the five (5) days following notification of the proposed Modifications, informed the Licensee that review of the proposal will require more than five (5) days; and
  - d) the Inspector has not rejected the proposed Modifications.

2. Modifications for which all of the conditions referred to in Part E, Item 1 have not been met may be carried out only with written approval from the Inspector.
3. The Licensee shall provide to the Board as-built plans and drawings on the modifications referred to in this Licence within ninety (90) days of completion of the modifications.

**PART F: CONDITIONS APPLYING TO CONTINGENCY PLANNING**

1. The Licensee shall, by February 16, 1998, submit to the Board for approval, a Contingency Plan in accordance with the Board's "Guidelines for Contingency Planning, January 1987".
2. The Licensee will maintain a copy of the approved Contingency Plan onsite in a readily available location, to the satisfaction of the Inspector.
3. The Licensee shall ensure that petroleum products, hazardous material and other wastes associated with the project do not enter any waters.
4. The Licensee shall ensure that all containment berms are constructed, of an impermeable material, to the satisfaction of an Inspector.
5. If, during the period of this Licence, an unauthorized discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:
  - a) report the incident immediately via the 24 Hour Spill Report Line (867) 920-8130; and
  - b) submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

**PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION**

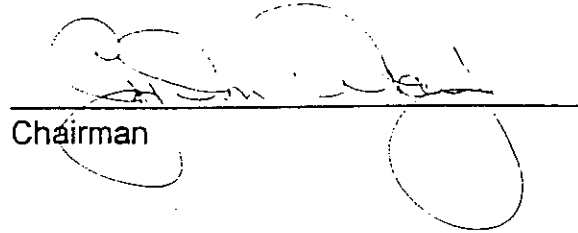
1. The Licensee shall, by February 27, 1998, submit to the Board for approval an Abandonment and Restoration Plan in accordance with the Board's "Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories, September 1990."

In addition to conforming with the Guidelines, the Plan shall also address the following items:

- a) water intake facilities;
- b) petroleum and chemical storage areas;
- c) any site affected by waste spills;
- d) water treatment and waste disposal facilities; and
- e) methods to be used in the restoration of sumps.

**NORTHWEST TERRITORIES WATER BOARD**

  
\_\_\_\_\_  
Witness

  
\_\_\_\_\_  
Chairman

## APPENDIX A - SAMPLING AND ANALYTICAL REQUIREMENTS FOR CHARACTERIZATION OF SUMP SUPERNATANT FLUIDS

In the event that decanting a sump is required, the Licensee shall sample the sump using the following method:

Divide the sump into a grid of six equal areas, take three samples in the vertical profile (surface, mid-depth, just above the mud/supernatant interface) at the centre of each area. Mix these eighteen samples together to form a single composite sample, from which as many sub-samples may be obtained as necessary for analysis. An additional sample must be taken from the surface of the sump.

The Licensee shall have the composite sample analysed for the following parameters:

Total and Dissolved Metals - Copper  
Cadmium  
Iron  
Nickel  
Lead  
Zinc  
Chromium

Sulphate  
Conductivity  
pH  
Total Suspended Solids  
Chloride  
Sodium  
Potassium  
Calcium  
Magnesium  
Oil and Grease  
Toxicity (96 hour LC50 using rainbow trout)

The surface sample should be analysed for oil and grease.

**APPENDIX B**

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**Chemical Data Sheets**



## Hydrogel

### Introduction

Hydrogel is used widely as a viscosifying agent for fresh and salt waters.

### Product Description

Light tan to grey powder.

### Chemical Nature

Sodium Montmorillonite

### Physical and Chemical Properties

Specific Gravity: 2.5  
Solubility in Water: Insoluble, forms colloidal suspension.  
pH: 8 - 10

### Application

Hydrogel is used for viscosity and filtration control in fresh water and salt water systems.

### Treatment

Concentrations can vary depending on desired viscosity and filtration loss but can be mixed at 4 - 50 kg/m<sup>3</sup>. Typically in a fresh water system, 40 kg/m<sup>3</sup> of bentonite with pH adjusted to 9.5 will give a yield point of  $\pm 5$  Pa.

### Packaging

Delivered in 40 kg sacks. J-35 60 SKS.  
N-26 ~~0~~



## Barite

### Introduction

Barite is used universally as a weighting agent in water and oil based drilling fluid systems.

### Product Description

A grey white powder with a dirt-dust like odor.

### Chemical Nature

Naturally occurring mineral  $\text{BaSO}_4$ .

### Physical and Chemical Properties

Bulk Density:	2160 $\text{kg/m}^3$
Solubility:	Insoluble in water and oil
Specific Gravity:	4.2
pH:	7.0 - 8.0
Melting Point:	1580°C

### Application

Barite is used to increase the density of all muds. Mud weights of up to 2400 - 2600  $\text{kg/m}^3$  may be obtained while still retaining a pumpable fluid. Barite is chemically inert and will not react with the various mud additives or encountered contaminants.

### Treatment

The quantity of Barite required to achieve a desired density:

$$\text{Weight of Barite required} = \frac{4250 (d1 - d2) \text{ kg/m}^3}{4.25 - d2}$$

where        d1    = initial density (SG)  
               d2    = final desired density (SG)

### Packaging

Barite is supplied in 40 kg sacks or can be supplied in bulk.

J-35 40SKS  
N-26 - 6

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Use at own discretion. Refer to MSDS for further product information.

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## Bicarbonate of Soda

### Introduction

Bicarbonate of Soda as used to precipitate any cement contamination.

### Product Description

A white odorless powder

### Chemical Nature

Bicarbonate of Soda (Sodium Bicarbonate or Baking Soda)  $\text{NaHCO}_3$

### Physical and Chemical Properties

Specific Gravity:	2.16
Solubility in water:	9.6 g/100 g water
Bulk Density:	2519 kg/m <sup>3</sup>
pH:	8.0

### Application

The primary application is in the precipitating of calcium from cement contamination. The pH should be above 8.3 for successful treatment. May be used as treatment for high calcium from other sources as well.

### Treatment

Bicarbonate of Soda should be mixed through the hopper at a concentration of 1.5 kg/m<sup>3</sup> increments over one circulation until desired results are obtained. Care should be taken not to over treat as an excess of Bicarbonate ions could occur causing a gel strength build-up. Reaction ratio is 0.45 kg/m<sup>3</sup> of Bicarb will react with 0.5 kg/m<sup>3</sup> of cement.

### Packaging

45.5 kg sacks and 22.7 kg sacks. J-35 20 SKS  
N-26 0 SKS

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## Kelzan XCD

### Introduction

Used as a viscosifier in fresh and saline water based muds.

### Product Description

A light beige powder with slight odor.

### Chemical Nature

Xanthan Gum, high molecular weight bi-polymer.

### Physical and Chemical Properties

Specific Gravity: 1.5  
Solubility in Water: 100%

### Application

Kelzan XCD is used primarily as a viscosifier in all water based mud systems. It is used to supplement the yield point when PV/YP ratios become unmanageable. Can also be used in 5 - 10 m<sup>3</sup> sized pills for sweeps to clean hole prior to casing, logging etc.

### Treatment

Kelzan XCD exhibits the rheological property of pseudoplasticity (shear thinning). Small quantities provide high yield points and low plastic viscosities. Concentrations of 0.25 - 1.0 kg/m<sup>3</sup> are normal. These may be increased depending on desired carrying capacity. When used as the sole viscosifier of a polymer fluid system, concentrations of 3-4 kg/m<sup>3</sup> of XCD may be required.

### Packaging

Delivered in 25.0 kg sacks. J-35 28  
N-26 20

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## Kwik Seal (Fine, Medium, Coarse)

### Introduction

Used alone or as supplement for lost circulation.

### Product Description

Yellow/brown particles of varying size with a slight odor.

### Chemical Nature

Blend of vegetable and polymer fibers.

### Physical and Chemical Properties

Specific Gravity: 0.9 - 1.2

### Application

Kwik Seal is an excellent lost circulation material, containing a bridging agent (granules), matting agent (fibers) and a sealing agent (flakes). With the optimum concentrations, Kwik Seal supplies efficient sealing for rigid type fractures, vugs and highly permeable or consolidated zones. Can be applied as a pill form or supplement whole systems.

### Treatment

The concentration of material and size range will depend on the severity of the losses. If pumping high concentrations of any LCM it is recommended to remove nozzles in the bit. Can be blended with most common LCM for optimum efficiency. Concentrations of pills may range from 40 - 150 kg/m<sup>3</sup> depending upon the severity of losses. For moderate surface hole losses, a pill with 10-15 kg/m<sup>3</sup> of Kwik Seal combined with 60-100 kg/m<sup>3</sup> of sawdust is often effective.

### Packaging

Kwik Seal is packaged in 18.2 kg sacks. J-35 73 SKS  
N-26 20 SKS.

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## Sawdust

### Introduction

Lost circulation material.

### Product Description

Yellow to golden brown flakes or granules

### Chemical Nature

Wood

### Physical and Chemical Properties

Light granular to powdery tan material.

### Application

Primary use as LCM either alone or in conjunction with all other common drilling industry LCM materials.

### Treatment

Concentrations will vary depending on significance of losses and other LCM used. Can be added through the hopper or right into the suction tank.

### Packaging

Packaged in 18.2 kg sacks. J-35 107 SKS  
N-26 43 SKS

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## Soda Ash

### Introduction

Used to precipitate calcium from make-up water and muds.

### Product Description

Odorless white powder or granular or crystals.

### Chemical Nature

Sodium Carbortate, Anhydrous

### Physical and Chemical Properties

Specific Gravity: 2.5  
Solubility in Water: 30%  
pH: 10.5 in 5% solution

### Application

Soda Ash is used to precipitate calcium in make-up water or while drilling anhydrite stringers. Can be used to control Ca<sup>++</sup> levels while drilling through cement although sodium bicarbonate is the preferred product for this scenario.

### Treatment

Provided the saturation level of the calcium has not been exceeded, Soda Ash can be added through the hopper at 1.0 kg/m<sup>3</sup> of Soda Ash for every 350 mg/l of excess Calcium ions in system.

### Packaging

40 kg sacks and 25 kg sacks. J-35 3 SKS  
N-26 12 SKS

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## Staflor Reg

### Introduction

Fluid Loss reducer.

### Product Description

Free flowing white powder.

### Chemical Nature

Polyanionic cellulosic polymer.

### Physical and Chemical Properties

Specific Gravity:	1.55
Solubility in Water:	Soluble
pH:	6 - 8

### Application

Staflor Reg is a high molecular weight polyanionic cellulose polymer. It is designed primarily as a fluid loss reducer in fresh and salt water muds. It provides more viscosifying effects than Staflor Ex Lo.

### Treatment

Concentrations of 3 - 10 kg/m<sup>3</sup> for saline systems are recommended, with fresh water systems requiring 1 - 3 kg/m<sup>3</sup>. These values will vary depending on temperature, zone drilled and solids content of the drilling mud.

### Packaging

Packing is in 22.7 kg sacks. J-35 28 SKS  
N-26 8 SKS

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## Ultra Seal XP

### Introduction

Organic cellulosic for control of loss circulation and seepage losses.

### Product Description

Light tan granules to powder with no odor.

### Chemical Nature

Organic cellulose fibers.

### Physical and Chemical Properties

Specific Gravity:	0.6
Solubility in Water:	Insoluble
pH:	7 - 9

### Application

Used as stand alone agent or can be combined with many of the other available LCM products in pill form or whole system treatments for the stoppage or control of lost circulation. Can also be added to whole system for prevention or control of seepage losses.

### Treatment

Concentrations will vary with extent of problem and desired results, for seepage losses a recommended level is 10 - 25 kg/m<sup>3</sup>. For lost circulation the concentration will vary with other levels of LCM.

### Packaging

11.4 kg sacks.

J-35 22 SKS  
N-26 ~~0~~



## Sodium Sulphite

### Introduction

Used as an anti-oxidant to prevent thermal degradation of polymers, as well as an oxygen scavenger to prevent corrossions caused primarily by air or entrained air.

### Product Description

Odorless white granular crystals or powder

### Chemical Nature

Sodium Sulfite, normally containing a small amount of cobalt catalyst.

### Physical and Chemical Properties

Specific Gravity:	2.6
Solubility in Water:	17% at 10°C
pH:	9.8

### Application

Sodium Sulfite is used as an oxygen scavenger in water based systems. It may also be used as an anti-oxidant to prevent polymer degradation. As an oxygen scavenger it is added continually until the residual sulfite concentration in the mud filtrate reaches or exceeds 300 mg/l.

### Treatment

It is usually diluted first in the chemical barrel and covered with a fine layer of diesel to prevent absorption of oxygen. This is allowed to trickle in at suction, initial addition of two sacks and regular maintenance of 20 - 60 kg per day as a follow up is recommended.

### Packaging

Delivered in 22.7 kg sacks. J-35 9 SKS  
N-26 2 SKS

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## XL Defoamer

### Introduction

Defoaming agent for water based drilling muds.

### Product Description

Clear water white liquid with a dish detergent odor.

### Chemical Nature

High molecular-weight alcohol, Anionic low foaming surfactant.

### Physical and Chemical Properties

Specific Gravity:	0.9
Solubility in Water:	Insoluble, dispersible in water
Percent Volatile:	60
pH:	7 - 8

### Application

Used as a defoamer intended for use with all water based mud systems for mild to severe foaming conditions. It is effective at all pH ranges, at high temperatures and over a wide salinity range. May pose a problem with Microtox failure if used in large amounts.

### Treatment

For maximum effectiveness, the defoamer should be added directly to the mud system as close to the shale shaker as possible. Concentrations will vary, however for light foam, 0.3 - 0.9 L/m<sup>3</sup> and with more difficult foams, 0.9 - 1.8 L/m<sup>3</sup> may be required.

### Packaging

Packaging is 20 litre plastic pails. J-35 16 PAILS  
N-26 0

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# MATERIAL SAFETY DATA SHEET

#1700, 407 - 2nd Street S.W., Calgary, Alberta T2P 2Y3  
Telephone: (403) 269-2242 Fax: (403) 269-2251

## Section I: IDENTIFICATION OF PRODUCT

Product Name: **BARITE**  
Product Use: Drilling Mud Additive  
Chemical Family: Barium Sulphate; Barite.

WHMIS CLASSIFICATION: Not a Controlled  
Product Under WHMIS

TDG CLASSIFICATION: Not Dangerous  
Goods

PACKAGE GROUP: Not Applicable

WORK PLACE HAZARD: Not Applicable

PIN: Not Applicable

## Section II: HAZARDOUS INGREDIENTS

Ingredient	Percent	CAS Number	LD(50)	LC(50)
No Hazardous Ingredients				

## Section III: TOXICOLOGICAL PROPERTIES

Route of Entry:  SKIN  EYE CONTACT  INHALATION  INGESTION

ACUTE (Short Term Exposure): Cough if exposed to dust at levels higher than TLV's

CHRONIC (Long Term Exposure): According to Mountain Minerals Company Ltd., this Barite does not contain respirable crystalline silica in amounts considered significant under WHMIS guidelines.

## Section IV: FIRST AID MEASURES

No first aid measures are suggested for Chronic (long term exposure).  
For Acute (short term exposure) remove patient from dusty environment.

## Section V: PHYSICAL DATA

APPEARANCE AND ODOUR:	Grey white powder; Dirt-dust like odour
SPECIFIC GRAVITY:	4.20
BOILING POINT (°C):	Not Applicable
MELTING POINT (°C):	1580°C
SOLUBILITY IN WATER:	Insoluble
PERCENT VOLATILE BY VOLUME:	Not Applicable
EVAPORATION RATE:	Not Applicable
VAPOUR PRESSURES (mm Hg):	Not Applicable
VAPOUR DENSITY (Air = 1):	Not Applicable
	pH @ 1.0%: 7 - 8

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# BARITE

## Section VI: FIRE AND EXPLOSION DATA

FLASH POINT: Not Applicable  
FLAMMABLE LIMITS: Not Applicable  
EXTINGUISHING MEDIA: Not Applicable  
SPECIAL FIRE FIGHTING PROCEDURES: Not Applicable  
UNUSUAL FIRE AND EXPLOSION PROCEDURES: Not Applicable

## Section VII: REACTIVITY DATA

STABILITY Stable  Unstable

INCOMPATIBILITY (conditions to avoid): None  
HAZARDOUS DECOMPOSITION PRODUCTS: None  
HAZARDOUS POLYMERIZATION:

Will not occur  May Occur

## Section VIII: PREVENTIVE MEASURE

### SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: Suggest NIOSH/MSHA approved respirators for silica bearing dust  
VENTILATION: Yes, if practical; personal air supply may be useful  
PROTECTIVE GLOVES: None required  
EYE PROTECTION: Suggest goggles  
OTHER PROTECTIVE EQUIPMENT (specify): None Required.

### PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Avoid breathing dust; wear an approved respirator. Practice reasonable caution and personal cleanliness.  
Avoid eye contact.

### STEPS TO BE TAKEN IN CASE THE MATERIAL IS SPILLED OR RELEASED

Vacuum or sweep-up if dry

### WASTE DISPOSAL METHOD

Dispose of material in a manner to prevent generating dust.

## Section IX: PREPARATION

The information contained herein is given in good faith, but no warranty, expressed or implied, is made.

DATE ISSUED: December 1, 1993

BY: Product Safety Committee

DATE UPDATED: October 01, 1996



# MATERIAL SAFETY DATA SHEET

#1700, 407 - 2nd Street S.W., Calgary, Alberta T2P 2Y3  
Telephone: (403) 269-2242 Fax: (403) 269-2251

## Section I: IDENTIFICATION OF PRODUCT

Product Name: **BICARBONATE OF SODA**  
Product Use: Drilling Mud Additive  
Chemical Family: Inorganic Salt

WHMIS CLASSIFICATION: Not a Controlled Product Under WHMIS  
TDG CLASSIFICATION: Not Dangerous Goods

WORK PLACE HAZARD: Not Applicable  
PACKAGE GROUP: Not Applicable  
PIN: Not Applicable

## Section II: HAZARDOUS INGREDIENTS

Ingredient	Percent	CAS Number	LD(50)	LC(50)
Sodium Bicarbonate	100	144-55-8	Not Determined	Not Determined

## Section III: TOXICOLOGICAL PROPERTIES

Route of Entry:  SKIN  EYE CONTACT  INHALATION  INGESTION

NUISANCE DUST: 10 mg/m<sup>3</sup> TWA for total dust (ACGIH-TLV)  
15 mg/m<sup>3</sup> TWA for total dust (OSHA-PEL)  
5 mg/m<sup>3</sup> TWA for respirable dust (OSHA-PEL)

### TOXICOLOGICAL DATA:

Oral LD<sub>50</sub> (rats): >4220 mg/kg body weight  
Skin effects (human): Mild irritant  
Eye effects (rabbits): Mild irritant

### EFFECTS OF SINGLE EXPOSURE:

SKIN ABSORPTION: Application of large amounts to the skin may cause alkalosis.  
SKIN CONTACT: May cause mild skin irritation.  
EYE CONTACT: Causes mild eye irritation.  
INGESTION: Mildly toxic by ingestion. May cause nausea, vomiting, and abdominal pains. Doses over 5 g/kg body weight can cause alkalosis and expansion in extracellular fluid volume with edema.

### EFFECTS OF REPEATED EXPOSURE:

Repeated exposure may lead to contact dermatitis. Prolonged contact with dusts or vapours may cause conjunctivitis.

### EXISTING MEDICAL CONDITIONS POSSIBLY AGGRAVATED BY EXPOSURE:

Skin irritation may be aggravated in persons with existing skin lesions. Breathing of dust may aggravate acute or chronic asthma and other chronic pulmonary disease.

# BICARBONATE OF SODA

## Section IV: FIRST AID MEASURES

Remove patient from immediate source of exposure and assure that the individual is breathing. If not breathing, use cardia-pulmonary resuscitation or artificial respiration. GET MEDICAL ATTENTION.

**EYE CONTACT:** Hold eyelids open and flush with a steady, gentle stream of water for at least 15 minutes. GET MEDICAL ATTENTION.

**SKIN CONTACT:** Immediately wash skin with plenty of soap and water, while removing contaminated clothing and shoes. Wash clothing separately before reuse.

**INGESTION:** If patient is conscious and alert, give 2-3 glasses of water or milk to drink. If available, give one tablespoon of Syrup or Ipecac to induce vomiting. If vomiting has not occurred in 20 minutes, the same dose of Syrup or Ipecac may be repeated an additional time. Alternatively, induce vomiting by touching back of throat with finger. Do not make an unconscious person vomit. GET MEDICAL ATTENTION.

*NOTES TO PHYSICIAN:* No specific antidote is available. Treat symptomatically. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred. Large doses, particularly in patients with renal insufficiency, may produce systemic alkalosis and/or expansion in the extracellular fluid volume with edema.

## Section V: PHYSICAL DATA

APPEARANCE AND ODOUR:	White odourless powder
SPECIFIC GRAVITY:	2.16
BOILING POINT (°C):	Decomposes
MELTING POINT (°C):	Not Applicable
SOLUBILITY IN WATER:	9.6 g/100
PERCENT VOLATILE BY VOLUME:	Not Applicable
EVAPORATION RATE:	Not Applicable
VAPOUR PRESSURES (mm Hg):	Not Applicable
VAPOUR DENSITY (Air = 1):	Not applicable
BULK DENSITY	45 - 65 lbs/cubic ft

pH @ 1.0%: 8.0 (1% solution)

## Section VI: FIRE AND EXPLOSION DATA

FLASH POINT:	Not Applicable
FLAMMABLE LIMITS:	Not Applicable
EXTINGUISHING MEDIA:	Use appropriate media to extinguish source of fire.
SPECIAL FIRE FIGHTING PROCEDURES:	Self-contained respirators required for fire fighting personnel

**UNUSUAL FIRE AND EXPLOSION PROCEDURES:** If extremely large quantities are involved, significant levels of carbon dioxide may be generated making necessary the use of self-contained breathing apparatus. (Carbon dioxide is an asphyxiate at levels >5%). Soda ash, another decomposition product existing at temperatures >93°C, is a respiratory and skin irritant.



## BICARBONATE OF SODA

### Section VII: REACTIVITY DATA

STABILITY

Stable

Unstable

STABILITY: At ambient temperatures and atmospheric pressure, tends to evolve carbon dioxide slowly and absorb moisture. At elevated temperatures carbon dioxide and water are evolved.

INCOMPATIBILITY (conditions to avoid): Moisture and Heat sensitive; decomposes weak acids releasing heat and forming salt, water and carbon dioxide.

HAZARDOUS DECOMPOSITION PRODUCTS: When temperature is raised to 87°C and beyond, carbon dioxide gas will be released to the atmosphere. The resulting dust may be irritation to the eyes, skin and respiratory tract.

HAZARDOUS POLYMERIZATION:

Will not occur

May Occur

### Section VIII: PREVENTIVE MEASURE

#### SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION:

Suggest NIOSH/MESA approved dust mask

VENTILATION:

10 changes per hour suggested

PROTECTIVE GLOVES:

Suggest plastic or rubber

EYE PROTECTION:

Suggest goggles with side shields

OTHER PROTECTIVE EQUIPMENT (specify): Chemical resistant boots. Maintain a sink, safety shower, eyewash fountain in work area. Have oxygen readily available.

#### PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Material is generally regarded as safe for humans and animals. Store in a cool, dry place in tightly closed containers away from acids. Long-term storage may result in caking.

#### STEPS TO BE TAKEN IN CASE THE MATERIAL IS SPILLED OR RELEASED

To the extent possible, clean up spillage using shovels. Scoop up loose material and place it in appropriate containers. If spilled on the ground, the affected area should be scraped clean and the material placed in an appropriate container for disposal. Wear appropriate protective clothing and equipment during cleanup activities.

#### WASTE DISPOSAL METHOD

Dispose of in accordance with local, provincial, and federal regulations.

### Section IX: PREPARATION

The information contained herein is given in good faith, but no warranty, expressed or implied, is made.

DATE ISSUED: December 1, 1993

BY: Product Safety Committee

DATE UPDATED: October 01, 1996

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# MATERIAL SAFETY DATA SHEET

#1700, 407 - 2nd Street S.W., Calgary, Alberta T2P 2Y3  
Telephone: (403) 269-2242 Fax: (403) 269-2251

## Section I: IDENTIFICATION OF PRODUCT

Product Name: **KELZAN XCD**  
Product Use: Drilling Mud Additive  
Chemical Family: Polymer

WHMIS CLASSIFICATION: Not a controlled product under WHMIS

TDG CLASSIFICATION: Not Dangerous Goods

PACKAGE GROUP: Not Applicable

WORK PLACE HAZARD: Not Applicable

PIN: Not Applicable

## Section II: HAZARDOUS INGREDIENTS

Ingredient	Percent	CAS Number	LD(50)	LC(50)
No Hazardous Ingredients				

## Section III: TOXICOLOGICAL PROPERTIES

Route of Entry:  SKIN  EYE CONTACT  INHALATION  INGESTION

Essentially non-toxic - LD<sub>50</sub> (rats) is greater than 5 mg/kg

NUISANCE DUST: 10 mg/m<sup>3</sup> total dust

INHALATION: Excessive inhalation of dust impedes respiration due to hygroscopic properties.

## Section IV: FIRST AID MEASURES

EYE CONTACT: Flush with plenty of water. If irritation develops, call a physician.  
SKIN CONTACT: Ordinary measure of personal hygiene should be adequate.  
INHALATION: Symptomatic treatment.  
INGESTION: Essentially non-toxic

## Section V: PHYSICAL DATA

APPEARANCE AND ODOUR:	Light beige powder, slight odour		
SPECIFIC GRAVITY:	1.5		
BOILING POINT (°C):	Not Applicable		
MELTING POINT (°C):	Not Applicable		
SOLUBILITY IN WATER:	Complete	pH @ 1.0%:	5.4-8.6
PERCENT VOLATILE BY VOLUME:	15% Maximum (H <sub>2</sub> O)		
EVAPORATION RATE:	Not Applicable		
VAPOUR PRESSURES (mm Hg):	Not Applicable		
VAPOUR DENSITY (Air = 1):	Not Applicable		

# KELZAN XCD

## Section VI: FIRE AND EXPLOSION DATA

FLASH POINT: Not Applicable  
FLAMMABLE LIMITS: Not Applicable  
EXTINGUISHING MEDIA: Dry chemical, foam, water fog, spray  
SPECIAL FIRE FIGHTING PROCEDURES: Self-contained respirators required for fire fighting personnel

*\*Do not use high pressure water stream. Airborne dust creates explosion hazard.*

UNUSUAL FIRE AND EXPLOSION PROCEDURES: Combustible dust in the finely divided and suspended state.

## Section VII: REACTIVITY DATA

STABILITY                      Stable                       Unstable

INCOMPATIBILITY (conditions to avoid): Strong oxidizing agents

HAZARDOUS DECOMPOSITION PRODUCTS: None

HAZARDOUS POLYMERIZATION:  
                                         Will not occur                       May Occur

## Section VIII: PREVENTIVE MEASURE

### SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: Suggest NIOSH/MESA approved dust mask.  
VENTILATION: 10 changes per hour suggested  
PROTECTIVE GLOVES: None required  
EYE PROTECTION: None required  
OTHER PROTECTIVE EQUIPMENT (specify): None required

### PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Product becomes very slippery when wet. Wash thoroughly after handling. Keep container closed. Exercise caution in the storage and handling of all chemical substances. Use in ventilated area.

### STEPS TO BE TAKEN IN CASE THE MATERIAL IS SPILLED OR RELEASED

Sweep-up spilled material and repackage. Hose spill area very thoroughly. This product becomes very slippery when wet.

### WASTE DISPOSAL METHOD

Handle as non-hazardous material.

## Section IX: PREPARATION

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DATE ISSUED: December 1, 1993  
DATE UPDATED: October 1, 1996

BY: Product Safety Committee



# MATERIAL SAFETY DATA SHEET

#1700, 407 - 2nd Street S.W., Calgary, Alberta T2P 2Y3  
Telephone: (403) 269-2242 Fax: (403) 269-2251

## Section I: IDENTIFICATION OF PRODUCT

Product Name: **KWIK-SEAL (FINE, MEDIUM, COARSE)**  
Product Use: Drilling Mud Additive  
Chemical Family: Blend of vegetable and polymer fibres

WHMIS CLASSIFICATION: Not a Controlled Product Under WHMIS  
TDG CLASSIFICATION: Not Dangerous Goods

WORK PLACE HAZARD: Not Applicable

PACKAGE GROUP: Not Applicable  
PIN: Not Applicable

## Section II: HAZARDOUS INGREDIENTS

Ingredient	Percent	CAS Number	LD(50)	LC(50)
No Hazardous Ingredients				

## Section III: TOXICOLOGICAL PROPERTIES

Route of Entry:  SKIN  EYE CONTACT  INHALATION  INGESTION

EFFECTS OF OVEREXPOSURE: None

NUISANCE DUST: 10 mg/m<sup>3</sup> Total Dust

## Section IV: FIRST AID MEASURES

EYE CONTACT: Flush with plenty of water. If irritation develops call a physician  
SKIN CONTACT: Ordinary measure of personal hygiene should be adequate.  
INHALATION: Symptomatic treatment.  
INGESTION: Essentially non-toxic

## Section V: PHYSICAL DATA

APPEARANCE AND ODOUR: Yellow/brown particles; slight odour  
SPECIFIC GRAVITY: 0.9 - 1.2  
BOILING POINT (°C): Not Applicable  
MELTING POINT (°C): Not Applicable  
SOLUBILITY IN WATER: Non Soluble  
PERCENT VOLATILE BY VOLUME: Not Volatile  
EVAPORATION RATE: Not Applicable  
VAPOUR PRESSURES (mm Hg): Not Applicable  
VAPOUR DENSITY (Air = 1): Not Applicable



# KWIK SEAL

## Section VI: FIRE AND EXPLOSION DATA

FLASH POINT: No Data Available  
FLAMMABLE LIMITS: Not Applicable  
EXTINGUISHING MEDIA: Water spray, dry chemical, foam  
SPECIAL FIRE FIGHTING PROCEDURES: Self-contained respirators required for fire fighting personnel.  
UNUSUAL FIRE AND EXPLOSION PROCEDURES: Can be combustible in a finely divided and suspended state.

## Section VII: REACTIVITY DATA

STABILITY                      Stable                       Unstable

INCOMPATIBILITY (conditions to avoid): None  
HAZARDOUS DECOMPOSITION PRODUCTS: None  
HAZARDOUS POLYMERIZATION:

Will not occur                       May Occur

## Section VIII: PREVENTIVE MEASURE

### SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: Suggest NIOSH/MESA approved dust mask  
VENTILATION: 10 changes per hour suggested  
PROTECTIVE GLOVES: None Required  
EYE PROTECTION: None Required  
OTHER PROTECTIVE EQUIPMENT (specify): None Required

### PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Avoid ingestion. Practice reasonable caution and personal cleanliness. Avoid skin and eye contact.

### STEPS TO BE TAKEN IN CASE THE MATERIAL IS SPILLED OR RELEASED

Vacuum or sweep-up if dry. If wet, pick up with dry material such as sand or dirt. Avoid flushing with water as material may become extremely slippery.

### WASTE DISPOSAL METHOD

Dispose of material in accordance with local ordinances. Landfill is suggested.

## Section IX: PREPARATION

The information contained herein is given in good faith, but no warranty, expressed or implied, is made.

DATE ISSUED: December 1, 1993

BY: Product Safety Committee

DATE UPDATED: October 1, 1996



# MATERIAL SAFETY DATA SHEET

#1700, 407 - 2nd Street S.W., Calgary, Alberta T2P 2Y3  
Telephone: (403) 269-2242 Fax: (403) 269-2251

## Section I: IDENTIFICATION OF PRODUCT

Product Name: **SODA ASH**  
Product Use: Drilling Mud Additive  
Chemical Family: Sodium Carbonate, Anhydrous

WHMIS CLASSIFICATION:  
D-2B

WORK PLACE HAZARD:  
Skin and Eye Irritant

TDG CLASSIFICATION: Not Regulated  
PACKAGE GROUP: Not Regulated  
PIN: Not Regulated

## Section II: HAZARDOUS INGREDIENTS

Ingredient	Percent	CAS Number	LD(50)	LC(50)
Sodium Carbonate	>99	(497-19-8)	4 g/kg	Not determined

## Section III: TOXICOLOGICAL PROPERTIES

Route of Entry:  SKIN  EYE CONTACT  INHALATION  INGESTION

SKIN CONTACT: May cause skin irritation from prolonged contact, especially in hot weather.  
EYE CONTACT: May irritate or burn eyes.  
INHALATION: Inhalation of product may irritate nose throat and lungs.  
INGESTION: Although low in toxicity, ingestion can be harmful. May cause nausea, vomiting, stomach ache and diarrhea.  
ACUTE TOXICITY: Moderately toxic LD<sub>50</sub> (rat): 2800 mg/kg

## Section IV: FIRST AID MEASURES

EYE CONTACT: Immediately flush eyes with lots of running water for 15 minutes, lifting the upper and lower eyelids occasionally. GET IMMEDIATE MEDICAL ATTENTION.  
SKIN CONTACT: Immediately wash skin with lots of soap and water. Remove contaminated clothing and shoes; wash before reuse. Get medical attention if irritation persists after washing.  
INHALATION: Remove to fresh air. Give artificial respiration if not breathing. GET IMMEDIATE MEDICAL ATTENTION.  
INGESTION: DO NOT INDUCE VOMITING. If conscious, give lots of water or milk. GET IMMEDIATE MEDICAL ATTENTION. DO NOT GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS OR CONVULSING PERSON.

## Section V: PHYSICAL DATA

APPEARANCE AND ODOUR:	Odourless, white powder or granular solid or crystal.		
SPECIFIC GRAVITY:	2.533		
BOILING POINT (°C):	N/A	MELTING POINT (°C):	851.111
SOLUBILITY IN WATER:	30%	pH: 10.5 (5% solution)	
PERCENT VOLATILE BY VOLUME:	Not Applicable	EVAPORATION RATE:	Not Applicable
VAPOUR PRESSURES (mm Hg):	Not Applicable	VAPOUR DENSITY (Air = 1):	Not Applicable

*"dedicated to exceeding customer expectations"*





# MATERIAL SAFETY DATA SHEET

#1700, 407 - 2nd Street S.W., Calgary, Alberta T2P 2Y3  
Telephone: (403) 269-2242 Fax: (403) 269-2251

## Section I: IDENTIFICATION OF PRODUCT

Product Name: **STAFLO-R**  
Product Use: Drilling Mud Additive  
Chemical Family: Sodium Carboxymethylcellulose

WHMIS CLASSIFICATION: Not a Controlled  
Product Under WHMIS

TDG CLASSIFICATION: Not Dangerous  
Goods

WORK PLACE HAZARD: Not Applicable

PACKAGE GROUP: Not Applicable  
PIN: Not Applicable

## Section II: HAZARDOUS INGREDIENTS

Ingredient	Percent	CAS Number	LD(50)	LC(50)
------------	---------	------------	--------	--------

No Hazardous Ingredients.

## Section III: TOXICOLOGICAL PROPERTIES

Route of Entry:  SKIN  EYE CONTACT  INHALATION  INGESTION

THRESHOLD LIMIT VALUE: None

EFFECTS OF OVEREXPOSURE: Not Determined

## Section IV: FIRST AID MEASURES

EMERGENCY AND FIRST AID PROCEDURES: Treat as Nuisance Dust

## Section V: PHYSICAL DATA

APPEARANCE AND ODOUR:	Free flowing white powder; no appreciable odour
SPECIFIC GRAVITY:	1.55
BOILING POINT (°C):	Not Applicable
MELTING POINT (°C):	Not Applicable
SOLUBILITY IN WATER:	Soluble
PERCENT VOLATILE BY VOLUME:	Not Applicable
EVAPORATION RATE:	Not Applicable
VAPOUR PRESSURES (mm Hg):	Not Applicable
VAPOUR DENSITY (Air = 1):	Not Applicable

pH @ 1.0%: 6-9 (at 10 g/l water)





# MATERIAL SAFETY DATA SHEET

#1700, 407 - 2nd Street S.W., Calgary, Alberta T2P 2Y3  
Telephone: (403) 269-2242 Fax: (403) 269-2251

## Section I: IDENTIFICATION OF PRODUCT

Product Name: **ULTRA SEAL-XP**  
Product Use: Lost Circulation Additive  
Chemical Family: Organic cellulosic fibres

WHMIS CLASSIFICATION:	Not a controlled product under WHMIS	TDG CLASSIFICATION:	Not Applicable
WORK PLACE HAZARD:	Non-hazardous	PACKAGE GROUP:	Not Applicable
SHIPPING NAME:	Ultra Seal-XP	PIN:	Not Applicable

## Section II: HAZARDOUS INGREDIENTS

Ingredient	Percent	CAS Number	LD(50)	OSHA PEL	ACGIH TLV
No Hazardous Ingredients.					

## Section III: TOXICOLOGICAL PROPERTIES

Route of Entry:  SKIN  EYE CONTACT  INHALATION  INGESTION

HEALTH HAZARDS - Acute Oral (LD 50) Not Applicable

Acute Dermal (LD 50) Not Applicable

Aquatic Toxicity (LC 50) in generic mud #7 - 1,000,000 ppm

CARCINOGENICITY: Not on NTP, LARC, or OSHA list

SIGNS AND SYMPTOMS OF EXPOSURE: Not Applicable

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Inhalation of dust may cause sneezing

## Section IV: FIRST AID MEASURES

EMERGENCY AND FIRST AID PROCEDURES: Flush all contacted areas with water. If irritation persists, contact physician

## Section V: PHYSICAL DATA

APPEARANCE AND ODOUR:	Light tan - no apparent odour	
SPECIFIC GRAVITY:	.613	
BOILING POINT (°C):	Not Applicable	
MELTING POINT (°C):	Not Applicable	
SOLUBILITY IN WATER:	Insoluble	pH: 7-9
PERCENT VOLATILE BY VOLUME:	Not Applicable	EVAPORATION RATE: Not Applicable
VAPOUR PRESSURES (mm Hg):	Not Applicable	VAPOUR DENSITY (Air = 1): Not Applicable

# ULTRA SEAL-XP

## Section VI: FIRE AND EXPLOSION DATA

FLASH POINT: None (Open cup)  
AUTOIGNITION TEMPERATURE: Not Applicable  
FLAMMABLE LIMITS: Not Applicable  
EXTINGUISHING MEDIA: Water  
SPECIAL FIRE FIGHTING PROCEDURES: None  
UNUSUAL FIRE AND EXPLOSION PROCEDURES: None

## Section VII: REACTIVITY DATA

STABILITY: Stable  Unstable   
INCOMPATIBILITY (conditions to avoid): None  
HAZARDOUS DECOMPOSITION PRODUCTS: None  
HAZARDOUS POLYMERIZATION: Will not occur  May Occur

## Section VIII: PREVENTIVE MEASURE

RESPIRATORY PROTECTION: Use a NIOSH approved mechanical filter respirator  
VENTILATION: General room ventilation  
GLOVES: Normal work duty gloves  
EYE PROTECTION: Goggles, if desired  
OTHER PROTECTIVE EQUIPMENT: Eye Wash  
WORK/HYGIENIC PRACTICES: Normal precautions for handling chemicals should be observed.

### PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Store in dry area. Avoid inhalation of dust. Store separate from flammable materials

### STEPS TO BE TAKEN IN CASE THE MATERIAL IS SPILLED OR RELEASED

Normal housekeeping. No neutralizing chemicals required.

### WASTE DISPOSAL METHOD

Dispose in general landfill

## Section IX: PREPARATION

All the recommendations and suggestions herein concerning our product are based upon tests and data believed to be reliable, however, it is the user's responsibility to determine the safety, toxicity, and suitability for his own use of the product described herein. Since the actual use by others is beyond our control, no guarantee, expressed or implied, is made by B.L. Industries, Inc. as to the effects of such use, the results to be obtained, or the safety and toxicity of the product nor does B. L. Industries assume any liability arising out of use, by others, of the product referred to herein. Nor is the information herein to be considered as absolutely complete since additional information may be necessary to desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations.

DATE ISSUED: October 21, 1991 BY: B.L. Industries, Inc.  
DATE REVISED: January 15, 1996 P.O. Box 30461  
DATE UPDATED: October 1, 1996 Lafayette, La 70593



# MATERIAL SAFETY DATA SHEET

#1700, 407 - 2nd Street S.W., Calgary, Alberta T2P 2Y3  
Telephone: (403) 269-2242 Fax: (403) 269-2251

## Section I: IDENTIFICATION OF PRODUCT

Product Name: **SODIUM SULFITE, Catalyzed**  
Product Use: Drilling Mud Additive  
Chemical Family: Sodium Sulfite

WHMIS CLASSIFICATION:  
Class D-2(B)  
WORK PLACE HAZARD:  
Skin and Eye Irritant

TDG CLASSIFICATION: Not Dangerous Goods.  
PACKAGE GROUP: Not Applicable  
PIN: Not Applicable

## Section II: HAZARDOUS INGREDIENTS

Ingredient	Percent	CAS Number	LD(50)	LC(50)
Sodium Sulfite	94.5 - 96.5	7757-83-7	2825 mg/kg	Not Determined
Cobalt Sulfate	0.04	10124-24-3	424 mg/kg	Not Determined
Sodium Metabisulfite	2.20	7681-57-4	115 mg/kg	Not Determined
Mineral Oil	.07	8012-95-1		

## Section III: TOXICOLOGICAL PROPERTIES

Route of Entry:  SKIN  EYE CONTACT  INHALATION  INGESTION

SKIN CONTACT: Dust or mist may cause skin irritation from prolonged contact. Solutions will irritate.

EYE CONTACT: Dust or mist may irritate or burn eyes. Solutions will irritate or burn/

INHALATION: Inhalation of dust or mist may irritate respiratory tract.

INGESTION: Ingestion may irritate gastrointestinal tract. May cause severe allergic reaction in some asthmatics and sulfite sensitive individuals. Large doses may cause violent colic and diarrhea; circulatory disturbances, central nervous system depression and even death.

## Section IV: FIRST AID MEASURES

EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention  
SKIN CONTACT: Promptly wash with plenty of soap and water.  
INHALATION: Remove to fresh air. If symptoms persist, get medical attention.  
INGESTION: If conscious, immediately give 2 to 4 glasses of water or milk, and induce vomiting by touching finger to back of throat. Get immediate medical attention.

## Section V: PHYSICAL DATA

APPEARANCE AND ODOUR: White granular crystals or powder. Odourless  
SPECIFIC GRAVITY: 2.63 MELTING POINT (°C): Not Applicable  
BOILING POINT (°C): Decomposes at 900°C  
SOLUBILITY IN WATER: 17% by wt. @ 10°C/ 28% by wt. pH 9.8  
PERCENT VOLATILE BY VOLUME: Not Applicable EVAPORATION RATE: Not Applicable  
VAPOUR PRESSURES (mm Hg): Not Applicable VAPOUR DENSITY (Air = 1): Not Applicable

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# SODIUM SULFITE

## Section VI: FIRE AND EXPLOSION DATA

FLASH POINT: Not Applicable  
FLAMMABLE LIMITS: Not Applicable  
EXTINGUISHING MEDIA: Use water spray to keep containers cool and to knock down fumes.  
SPECIAL FIRE FIGHTING PROCEDURES: Self-contained respirators required for fire fighting personnel.  
UNUSUAL FIRE AND EXPLOSION PROCEDURES: Not Applicable

## Section VII: REACTIVITY DATA

STABILITY Stable  Unstable

INCOMPATIBILITY (conditions to avoid): Strong oxidizers cause vigorous exothermic reactions. Acids release sulfur dioxide gas.

HAZARDOUS DECOMPOSITION PRODUCTS: Sulfur dioxide gas-toxic & corrosive. Sodium sulphide residue-flammable, dangerous fire risk, strong irritant to skin and tissue, incompatible with acids.

HAZARDOUS POLYMERIZATION: Will not occur  May Occur

## Section VIII: PREVENTIVE MEASURE

### SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: NOISH approved self-contained breathing apparatus.  
VENTILATION: 10 changes per hour  
PROTECTIVE GLOVES: Suggest plastic or rubber  
EYE PROTECTION: Suggest goggles (do not wear contact lenses)  
OTHER PROTECTIVE EQUIPMENT (specify): Suggest rubber apron. Long-sleeved shirt & trousers.

### PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING

Avoid contact with eyes, skin and clothing. Avoid breathing dust or mist. When dissolving, add water cautiously while stirring. Local exhaust if dusty or misty condition prevails or if there is release of sulfur dioxide gas. Keep incompatible materials out of hoods, ducts, etc. Provide eyewash facility near work place. Use good personal hygiene and good housekeeping practices.

Store in a cool, dry area, away from acids or oxidizers. Keep container closed. Protect from physical damage.

### STEPS TO BE TAKEN IN CASE THE MATERIAL IS SPILLED OR RELEASED

Promptly shovel up dry chemical into an empty container and cover. Store as above. Cautiously spray residue with water. Neutralize and dispose as noted below.

### WASTE DISPOSAL METHOD

Dissolve in water, using caution as solution can get hot. Neutralize with acid. Good ventilation is required due to release of SO<sub>2</sub> gas. Oxidation to sodium sulfate, may be required, by adding a slight excess of dilute hydrogen peroxide carefully and stirring. Dispose of neutralized waste consistent with the requirements of local and/or provincial waste disposal authorities.

## Section IX: PREPARATION

The information contained herein is given in good faith, but no warranty, expressed or implied, is made.

DATE ISSUED: December 1, 1993  
DATE UPDATED: October 1, 1996

BY: Product Safety Committee



# MATERIAL SAFETY DATA SHEET

#1700, 407 - 2nd Street S.W., Calgary, Alberta T2P 2Y3  
Telephone: (403) 269-2242 Fax: (403) 269-2251

## Section I: IDENTIFICATION OF PRODUCT

Product Name: **DEFOAMER - XL**  
Product Use: Drilling Mud Additive  
Chemical Family: High Molecular Weight Alcohol Anionic low foaming Surfactant

WHMIS CLASSIFICATION: D-2(B) and B-3

TDG CLASSIFICATION: Not Dangerous Goods

WORK PLACE HAZARD: Skin and eye irritant &  
Combustible Liquid.

PACKAGE GROUP: Not Applicable

PIN: Not Applicable

## Section II: HAZARDOUS INGREDIENTS

Ingredient	Percent	CAS Number	LD(50)	LC(50)
Confidential Business Information Exemption Application in process.				

## Section III: TOXICOLOGICAL PROPERTIES

Route of Entry:  SKIN  EYE CONTACT  INHALATION  INGESTION

THRESHOLD LIMIT VALUE: Not determined

EFFECTS OF OVEREXPOSURE: Skin contact may cause irritation to the skin and eyes; may cause dermatitis. Ingestion may cause nausea, vomiting and diarrhea, weakness, increased salivation and rhinitis. If large amounts are ingested, depression of central nervous system may occur. This material has a low order of Toxicity. Inhalation may cause anesthetic effect dizziness.

## Section IV: FIRST AID MEASURES

EYE CONTACT: In case of eye contact, flush with water for 15 minutes and seek medical attention  
SKIN CONTACT: In case of skin contact, wash with water.  
INHALATION: In case of inhalation, remove patient to fresh air. Consult a physician.  
INGESTION: IF INGESTED, DO NOT INDUCE VOMITING. GET PATIENT TO PHYSICIAN  
IMMEDIATELY.

## Section V: PHYSICAL DATA

APPEARANCE AND ODOUR:	Clear water white liquid	
SPECIFIC GRAVITY:	0.90 g/cc	
BOILING POINT (°C):	Not Determined	
MELTING POINT (°C):	Not Determined	
SOLUBILITY IN WATER:	Insoluble; Dispersible	pH @ 1.0%: 7.0-8.0
PERCENT VOLATILE BY VOLUME:	60%	
EVAPORATION RATE:	Not Determined	
VAPOUR PRESSURES (mm Hg):	Not Determined	
VAPOUR DENSITY (Air = 1):	Not Determined	



**APPENDIX C**

---

**Restoration Plan**



# North of 60 Engineering Ltd.

2050, 140 4th Avenue S.W.  
Calgary, Alberta, Canada  
T2P 3N3  
Telephone (403) 263-2121  
Facsimile (403) 263-2122  
E-mail North60\_Engineering@msn.com

February 27, 1998

Northwest Territories Water Board  
P.O. Box 1500, Yellowknife  
NWT, X1A 2R3

Attention Mr. Gordon Wray, Chairman

Dear Sir:

**Subject: Abandonment & Restoration Plan for Water Use Permit N3L-1710**

## **Introduction**

The Inuvialuit Petroleum Corporation is in the process of developing the Ikhil Gas reservoir to supply natural gas to the Town of Inuvik. This development plan includes the drilling of two wells, the installation of production facilities and a small diameter pipeline to deliver the gas from Ikhil to Inuvik. The first part of the development plan, which includes the drilling of the two wells and the repair of the existing K35 well, is being carried out this winter. A class B water permit, No. N3L1-1710 has been issued by the Northwest Territories Water Board to support this activity. In accordance with the permit North of 60 Engineering Ltd. is filing this Abandonment and Restoration Plan for the drilling sumps and the camp sewage sump.

## **Goal of Abandonment and Restoration Plan**

The goal of the Abandonment and Restoration Plan is to prevent progressive degradation, and to enhance the natural recovery of the drilling and sewage sump areas.

## **Objectives of Abandonment and Restoration Plan**

Specific objectives of the Abandonment and Restoration program are:

- 1) To ensure that the sumps are abandoned in such a manner that the requirement for long term maintenance and monitoring is minimized.
- 2) To prevent seepage from the sumps to the environment.
- 3) To return the affected areas to a state compatible with the original undisturbed conditions giving due consideration to practical factors including economics, aesthetics and future users.

**Overview of Current Operation**

Water to support the current operations has been drawn from three locations, the East Channel of the Mackenzie River, a small lake adjacent to the Ikhil K35 Well location and Peter Lake (see attached map). Water taken from the first two locations was used to ice down the overland access route from the East Channel and to the camp and well sites. Now that construction of the access route is complete, all water is being taken from Peter Lake. A pump with a water intake screen is used to pump water from the lake into a tank truck which is used to haul the water to the camp for camp use and to the drilling rig to be used as boiler makeup water and for drilling fluids to support the drilling of the well.

The potable water for the camp is tested every month. Samples are taken at the lake and from taps within the camp and are then submitted to the Inuvik Regional Health Board for analysis.

Effluent from the camp is discharged to a sump adjacent to the camp. All solid waste associated with the camp and drilling program is either incinerated or hauled to Inuvik for disposal in the town solid waste dump.

Drilling fluids that are associated with the drilling of the two wells will be contained in sump adjacent to each well. A plan view and cross section of the drilling sump is shown in Figure 2. Dimensions of the three sumps are shown in Table 1

Dimension	Camp Sump	J35 Drilling Sump	N26 Drilling Sump
Length (m)	24	24	24
Width (m)	11	16	16
Depth (m)	3.5	4	4

Table 1

Fuel storage is within double wall tanks located adjacent to the camp and each well site. Snow and ice berms surround each of the well sites as an added containment measure. Any fuel spills will be handled as per the Emergency Response Plan that was submitted along with the Water User Permit application.

All drilling mud and cements are contained in pallets. Specialized drilling mud additives are stored in sea can metal shipping containers.

**Sump Abandonment & Restoration Plan**

Sumps (both drilling and camp) will be covered with native material and then topped with gravel or re-vegetated in a manner acceptable to the Water Board and the Inuvialuit Land Administration. The sumps will be contoured so as to ensure future stability. A plan and cross-section of the restored sump are shown in Figure 3.

Mud from the drilling activities and gray water from the camp will be frozen within the sump, thus minimizing potential for seepage. Samples of fluids within the sump will be

February 27, 1998

taken prior to backfilling the sumps. The potential for acid generation is low. Based on criteria outlined in Table 1 of the Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories, the potential for environmental impact is classified as "Low".

A monitoring program will be implemented to assess the effectiveness of the sump restoration. This program will be carried with Water Board and ILA inspectors.

**Final Abandonment & Restoration Plans for the Gas Development Project**

The final abandonment and restoration plans for the gas development (i.e. when the field is depleted after 15 to 20 years) are contained in the Development Plan Application, which has undergone environmental and technical screening by the National Energy Board. Board approval for these plans has been received.

**Closing**

Additional information or clarification in regard to the proposed plan may be obtained from the undersigned at (403) 263-2121.

Sincerely,



James C. McDougall P.Eng.  
President

Attachments - Figures

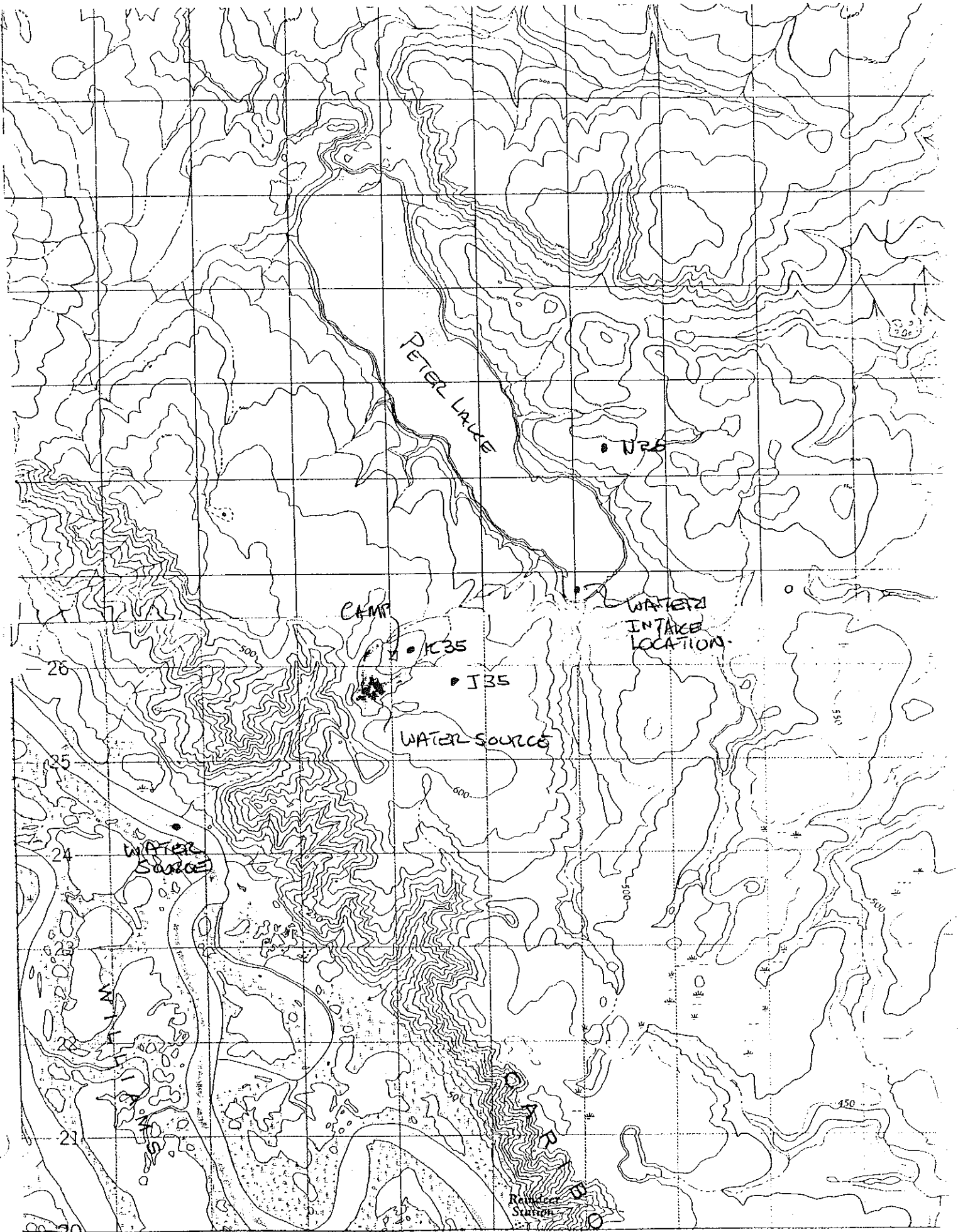


FIGURE 1

1:50,000

(1:50,000)



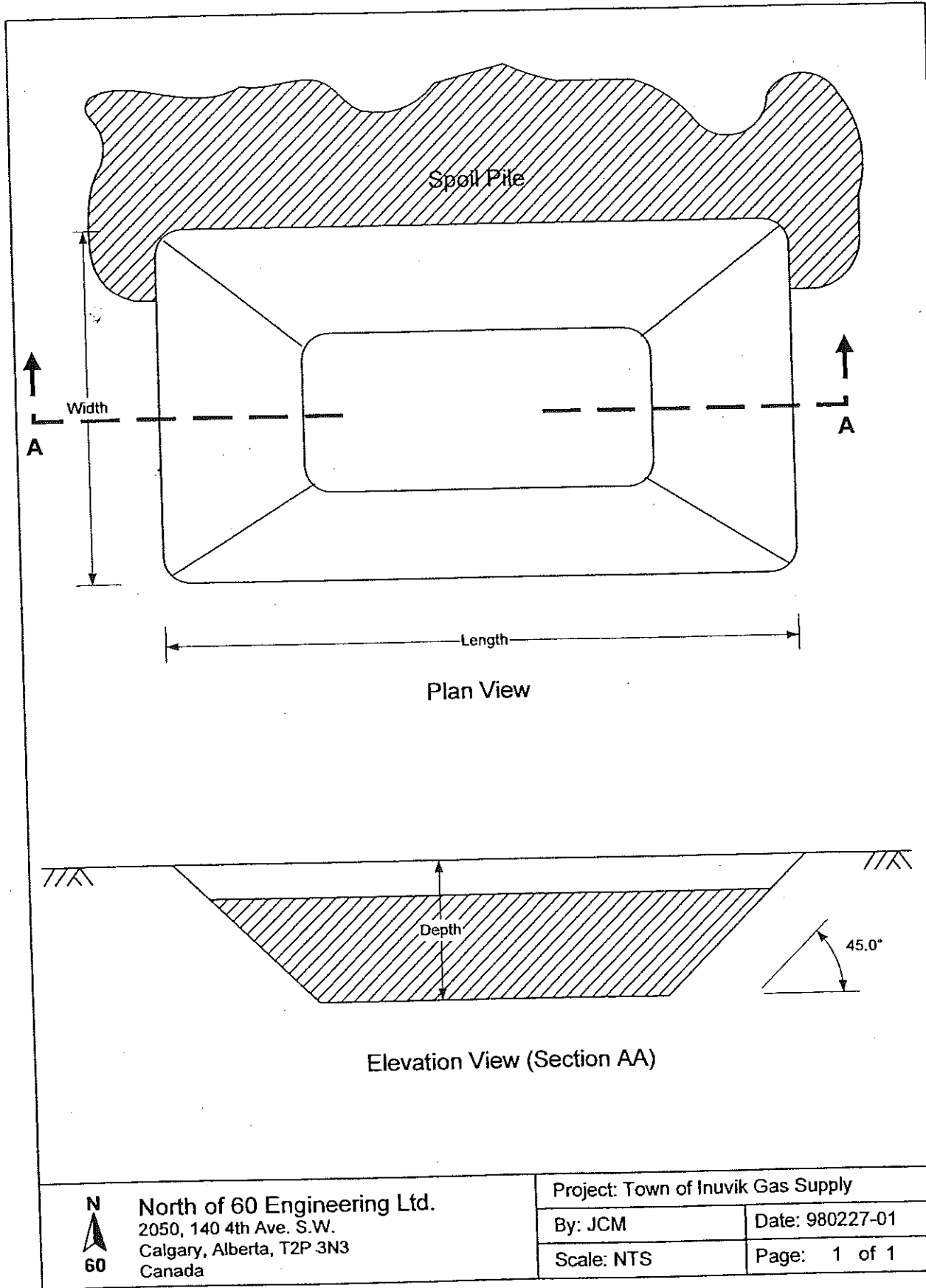


Figure 2 - Sump Profile

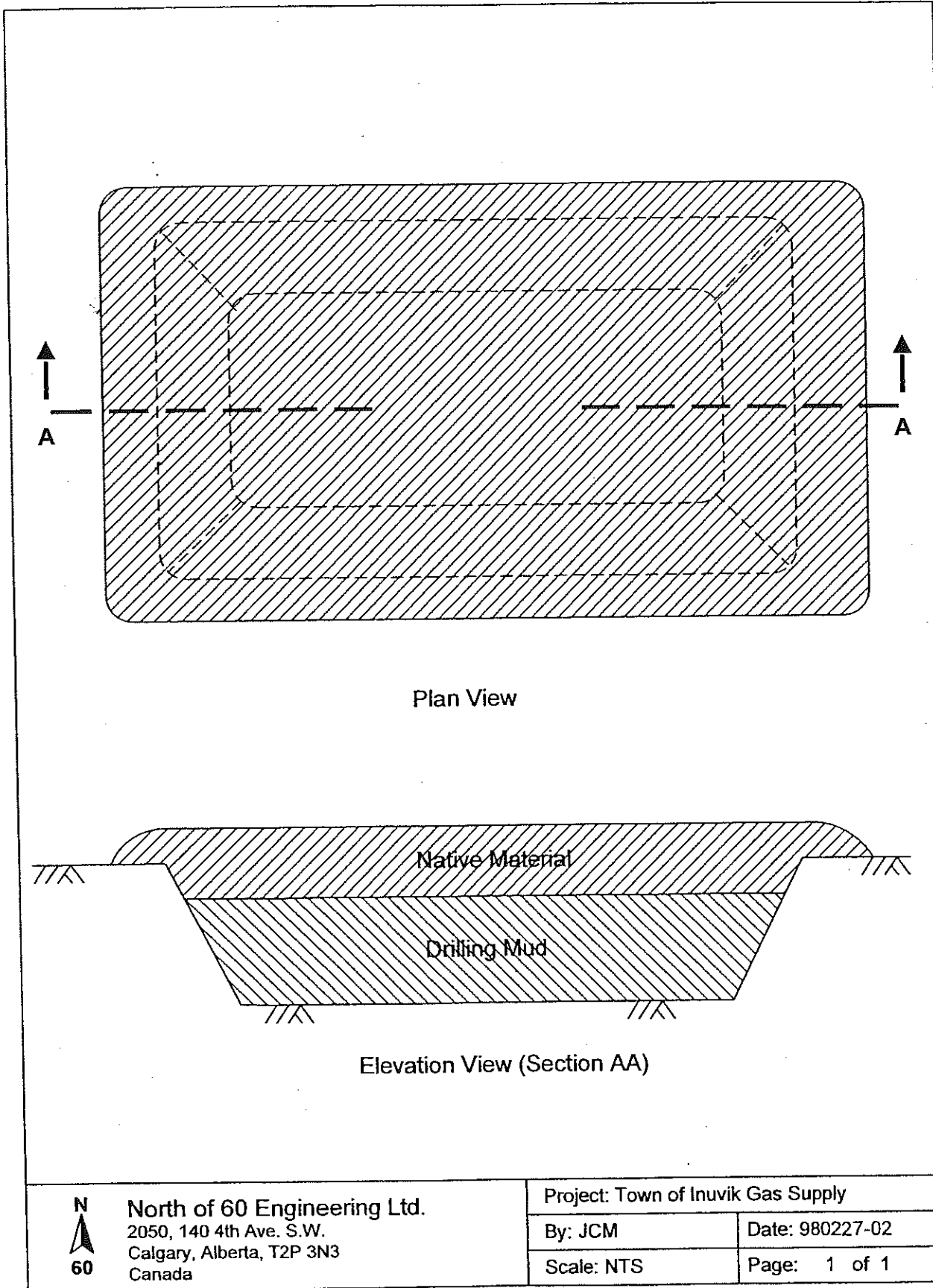


Figure 3 - Sump Restoration Plan



# North of 60 Engineering Ltd.

2050, 140 4th Avenue S.W.  
Calgary, Alberta, Canada  
T2P 3N3  
Telephone (403) 263-2121  
Facsimile (403) 263-2122  
E-mail North60\_Engineering@msn.com

## FACSIMILE

**To:** Sevn Bohnet  
**Company:** Water Resources  
**Phone:** (867) 669-2696  
**Fax:** (867) 669-2716

**From:** James C. McDougall, P.Eng.  
**Date:** April 19, 1998  
**Pages:** 7 Including this cover page

**Subject:** Ikhil Development – Class B Water Permit

Urgent    Information    For Review    For Comment    Please Reply

### Comments:

Dear Sir:

Attached is our response to questions from the NWT Water Board's Technical Advisory Committee regarding the Abandonment and Restoration Plan for the Ikhil Water Licence N3L1-1710. I would appreciate if you would treat this Fax as an addendum to the Abandonment and Restoration Plan.

### Background

As per the original plan there were three sumps associated with the Ikhil Development Drilling Program that was carried out this winter. Two of the three sumps were used to contain drill cuttings from the two wells that were drilled this winter. The third sump, which was located adjacent to a temporary camp, was used to contain wastewater from the camp. The locations and details of all three sumps are summarized in the following table.

Dimension	Camp Sump	J35 Drilling Sump	N26 Drilling Sump
Location	68°44'43.677"N, 134°09'16.067"W	68°44'35.582"N, 134°08'34.928"W	68°45'55.221"N, 134°06'37.214"W
Length (m)	24	24	24
Width (m)	11	16	16
Depth (m)	3.5	4	4

Table 1

The two drilling sumps contain drill cuttings and drilling mud that was used to lift the cuttings to surface. These drilling muds were formulated from non-toxic non-hydrocarbon compounds. A list of the mud additives used in the drilling of each well is documented in Table 2. Data sheets for each of these chemicals is attached for reference.

Ikhil J-35	Ikhil N-26
Aquagel	Potassium Chloride
Barite	Kelzan XCD
Bicarbonate of Soda	Kwik Seal M
Potassium Chloride	Q Stop XP
Kelzan XCD	Sawdust
Kwik Seal M	Soda Ash
Sawdust	Staflor Regular
Soda Ash	
Staflor Regular	
Ultra Seal XP	
XL Defoamer	

Table 2 - Mud Additives

Samples were taken from both sumps prior to back filling and tested for chloride levels as required by the Canada Oil and Gas drilling regulations. The chloride level was 11,500 ppm and 10,500 ppm in the J-35 and N-26 sumps respectively. The maximum permissible level is 15,000 ppm.

**Sump Abandonment and Monitoring**

All three sumps were abandoned according to the Abandonment and Restoration plan that was submitted to the NWT Water Board in late February. Abandonment of the sumps was carried out between April 1<sup>st</sup> and April 15<sup>th</sup>. The sumps were covered over with native silt that was removed and stockpiled from the sumps when they were excavated. The sumps will be re-vegetated this summer with after consultation with our environmental consultant and the Inuvialuit Land Administration as to an appropriate species.

The Abandonment and Restoration Plan mentioned a monitoring program, which was questioned by the Technical Advisory Committee. The proposed monitoring program will consist of at least one annual visit to each of the three sumps to visually inspect for seepage. The inspections will be carried out by representatives of the operator, IPC, the Inuvialuit Land Administration and other organizations such as DFO. This monitoring

April 20, 1998

program will continue as long as necessary to insure that there is no long-term negative impacts from the sump restoration. I envision that the sumps will be monitored for a two-year period.

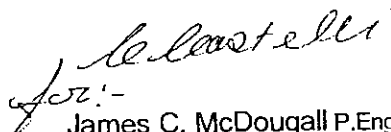
If problems such as slumping or seepage are identified during the inspections then IPC will implement remedial measures as required and as agreed upon by the ILA and other appropriate agencies.

### **Project Abandonment**

The Northwest Territories Department of Resources, Wildlife and Economic Development raised a question regarding the final abandonment of the field. As indicated on third page of the Abandonment and Restoration plan, the field abandonment plans are contained in the Development Plan Application that has been reviewed and endorsed by the National Energy Board of Canada. The Department of Wildlife and Economic Development should have a copy of the Development plan in their files. Notwithstanding, I have attached the pertinent sections from the plan for their information.

If you have any additional questions regarding this addendum or the original Abandonment Restoration Plan submitted in February please call me at (403) 263-2121.

Sincerely,

  
for:-  
James C. McDougall P.Eng.  
President

cc. Hans Arends – ILA

Attachments: Management and Restoration Plan, February 1998  
NEB Abandonment Plan