



March 4, 2011

Gerald Enns
Hazardous Waste Specialist
Environment Division, Environment and Natural Resources
P.O. Box 1320
Yellowknife, NT
X0E 0T0

Dear Mr. Enns:

RE: Proposed Containment Cell for Unipkat I-22 Sump Remediation

Thank-you for your letter dated February 24, 2011 providing further information and clarification on Environment and Natural Resources' (ENR) information requests for the management of soils generated during Shell Canada's Unipkat I-22 planned remediation program.

Having considered the information ENR has requested, the Territorial guidelines for waste management and for industrial waste discharges in the NWT, the nature and minimal environmental risks of the soil we will be transporting, our planned mitigation measures and the preference of the land owner to leave the containment cell unregistered, Shell Canada has decided to amend the proposed Unipkat I-22 soil management plan.

Under the amended management plan, soil and water collected from the remediation program at Unipkat I-22 will be transported to the containment cell in Inuvik and will be removed from the cell within 180 days of placement. No soil or water from the remediation work at Unipkat I-22 will be disposed of in the NWT. All soil from the remedial excavation will be transported to the CCS Northern Rockies Landfill in Fort Nelson BC. Any water that melts out while the soil is stored in the containment cell will be collected, analysed and treated if required prior to being placed in an evaporator. In the event that the water can not be treated or evaporated, it will be transported for disposal at the CCS Sierra Disposal Facility (Sierra) located outside of Fort Nelson BC. Any residual material from the evaporator will be sent to the Northern Rockies Landfill for disposal.

110301L Inuvik storage cell.docx
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The attachments included with this letter describe the process that Shell Canada intends follow to manage the movement of soil during the 2011 remediation of Unipkat I-22.

The attached Unipkat I-22 Soil disposal Plan includes information regarding:

- Soil and melt water handling, segregation and testing;
- Work schedule;
- Inuvik Storage Cell site characteristics and construction details;
- Monitoring program; and
- Closure Plan.

The process will allow for an open and transparent operation that should satisfy concerns that ENR has regarding the waste soil and water expected to be generated from this remediation program. Laboratory analytical results and waste transportation and volume records will be provided to ENR and will be available to the Northwest Territories Water Board and Gwich'in Land and Water Board at their request.

The available soil and groundwater data from the Unipkat I-22 site demonstrate that the materials are non-hazardous. As soon as they are available, analytical results for leachable analysis will be provided to ENR to demonstrate that the soils are below concentrations specified in Schedule IV of the *Guideline for Industrial Waste discharges in the NWT, 2004*.

Additional analysis from the excavated soil will be conducted prior to soil being transported from the site to Inuvik to confirm this analysis.

Given that the soil and water from the Unipkat I-22 remediation program:

- does not meet the definition of hazardous waste as defined by the Transportation of Dangerous Goods Act and in the *Guideline for the General Management of Hazardous Waste in the NWT*;
- is below the NWT guidelines for industrial waste discharge and will not be disposed of in the NWT;
- will be placed in a storage facility for less than 180 days; and,
- will be openly reported to ENR;

we believe that the needs of ENR can be met without the registration of the temporary storage cell in Inuvik and that registration is not required following section 3.4 of the *Guideline for the General Management of Hazardous Waste in the NWT, 1998*.

March 4, 2011

We trust that the information provided in this letter and the accompanying soil disposal plan are acceptable to ENR and will understand these plans to be accepted by ENR unless ENR submits specific rational to Shell Canada detailing how these plans do not meet ENR guidelines before March 10, 2011.

If you have any questions please feel free to contact me at (403) 990-1382 or at sbird@ieg.ca.

Yours truly,
IEG CONSULTANTS LTD.



Sam Bird B.Sc.
Environmental Scientist

Attachments

Unipkat I-22 Soil Disposal Plan
Summary Tables of Unipkat I-22 Soil and Water Analysis

c.c. Randall Warren – Shell Canada Energy
 Randy Ambler – Shell Canada Energy
 Russell Newmark – E. Gruben's Transport
 Don Arey – Indian and Northern Affairs Canada
 Mike Harlow – Northwest Territories Water Board
 Helga Harlander – Gwich'in Land and Water Board
 Christine Inglangasuk – Environmental Impact Screening Committee
 Kevin Erickson – Hazco Environmental Services

Unipkat I-22 Soil Disposal Plan

Prepared for Shell Canada Energy



Unipkat I-22 Soil Disposal Plan

Prepared for Shell Canada Energy

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1. PROJECT TITLE

Unipkat I-22 Sump Remediation Program

2. PURPOSE

This document is intended to provide information regarding the storage and management of soils from the 2011 Unipkat I-22 Sump Remediation program. This Soil Disposal Plan will outline the processes that will guide the control, storage, tracking, testing and disposal of waste soil and water temporarily staged in a lined containment cell in Inuvik NT.

3. CONTACT NAMES AND ADDRESSES

Randall Warren is the primary contact at Shell Canada energy (Shell). Regulatory support and project management is being provided by IEG Consultants Ltd. (IEG) and Hazco Environmental (Hazco).

Company	Address	Name	Position	Contact
Shell Canada Energy fax (403) 691-7948	PO Box 548, Station 100 Calgary, Alberta T2P 0J4	Randall Warren	Manager - Reclamation & Drilling Waste	randall.warren@shell. com (403) 691-2521
IEG Consultants Ltd. fax (403)-274-5349	500 – 2618 Hopewell Place NE Calgary Alberta T2Y 7J7	Sam Bird	Environmental Scientist	sbird@ieg.ca (403) 990-1382
Hazco Environmental Services fax(403) 253-3188)	103-3355 114 Avenue SE Calgary Alberta T2Z 0K7	Kevin Erickson	Project Manager	kerickson@hazco.com (403) 297-0444

4. BACKGROUND SUMMARY

Shell plans to conduct a sump remediation program at their former wellsite, Unipkat I-22 during March 2011. Unipkat I-22 is located within the Inuvialuit Settlement Region

(ISR), along the eastern bank of Arvoknar Channel, southwest of the Kendall Island Bird Sanctuary. Previous investigations at the site have identified hydrocarbons, salt and barium as the constituents of concern at the wellsite.

The sump remediation program will involve the following activities:

- building an ice road to access the site
- mobilizing heavy machinery, fuel, and camp accommodations
- clean soil stripping and stockpiling
- soil excavation
- trucking to Inuvik
- temporary soil storage in Inuvik (approximately 3000 m³)
- soil testing on the sidewalls and base of the excavation as well as stockpiled soils
- partial site backfill and re-contouring of excavation within local topography
- demobilization from site of all infrastructure and generated waste
- allowing soils to thaw and de-water in Inuvik prior to transport and disposal at CCS Ft. Nelson Landfill.

Soil from the Unipkat I-22 remediation program will be held in the containment cell for less than 180 days.

The remediation program is described in more detail in a November 2010 Project Description submitted to the Environmental Impact Screening Committee and in an Indian and Northern Affairs CEAA Screening Form (CEAR Number 10-01-59498).

Water for the camp will be supplied from Inuvik. Domestic refuse and waste water will be collected and transported to Inuvik for disposal as described in the previously screened Project Description.

5. STORAGE CELL LOCATION

The storage cell is located on industrial land in Inuvik Northwest Territories. The site is accessed from Navy Road. Figure 1 shows the surrounding land and location of the site on the north side of Inuvik. Figure 2 shows the location of the storage cell on the site.

Municipal Address	128 Navy Road, Inuvik, NT.
Legal Land Description	Lots 5, 6 and 7, Block 65, Plan 754
Municipal Zoning	M2 Heavy Industrial

A municipal land use map of Inuvik is included in Appendix I.

5.1 Site Characteristics

The storage cell is located on a gently sloping gravel pad along Navy Road in Inuvik. The gravel pad is approximately 0.5 m thick and was placed as fill on native ground cover dominated by black spruce and moss. The depth to permafrost is unknown. The area around the site drains westwards towards the Mackenzie River. A natural drainage begins along the western boundary of the lot. The storage cell location is shown on Figures 1 and 2.

5.1.1 Surficial Geology

The surficial deposits for the Inuvik area are described as Quaternary alluvium and colluvium that range in thickness from 0.5 m to more than 20 m over the bedrock (Rampton 1980 and 1987). Farther inland from the river, hummocky and rolling moraine 4 m to 10 m thick cover the bedrock. These surficial deposits are mainly composed of clays, silts and sands. The bedrock geology of the sloped land that Inuvik is built upon is underlain by shale and siltstone from the Arctic Red formation (Norris, D., 1981).

5.2 Adjacent Land Uses

Land to the north, east and south of the site is zoned as M1, Light Industrial. The land is generally used for warehouses, equipment storage and mechanic shops. Land to the west is currently undeveloped and has not been assigned a zone. However, beyond the undeveloped land to the west, the next land use is zoned as Heavy Industrial and contains a large tank farm adjacent to the River approximately 390 m down gradient of the site.

5.3 Water Bodies

The nearest standing water bodies are the municipal sewage lagoon and the Mackenzie River. The municipal sewage lagoons are approximately 245 m west of the site and the Mackenzie River is approximately 575 m west of the site. Forested land is between the site and the water bodies. An ephemeral drainage begins near the western edge of the site and joins another ephemeral drainage that runs parallel to the southern boundary. The drainages appear to run along the outside of the sewage lagoon dyke and then into the East Channel of the Mackenzie River.

6. REGISTERED LAND OWNER

The land that the containment cell is located on is owned by E. Gruben's Transport (EGT) of Tuktoyaktuk NT. Russell Newmark is the Chief Executive Officer of EGT and has assisted Shell in developing the containment cell.

EGT Address	PO Box 177 Tuktoyaktuk, NT. X0E 1C0
E-mail	newmark@egrubens.com
Phone Number	(867) 977-7000
Fax Number	(867) 977-7040

7. WASTE STREAM

The Unipkat I-22 drilling sump and surrounding affected soils will be the only source of waste placed in the Inuvik containment cell.

8. CONTAINMENT CELL CONSTRUCTION

The containment cell was constructed in October 2010. The cell is 29 m by 106 m with a hydrocarbon resistant arctic liner that extends up the 1 m high berms. The cell has an area of 3075 m². This area has been calculated to be sufficient to contain more than 5000 m³ of soil which is nearly twice the volume of soil expected to be generated by the Unipkat I-22 sump remediation. In general, the volume requirements described in the *Alberta Environmental Code of Practice for Land Treatment of Soil Containing Hydrocarbon* are based on treatment practices that require land farming and cultivation. The soil stored in the Inuvik containment cell will be placed in windrows rather in a shallow lift and the cell is therefore able to safely hold a larger volume of soil and accommodate volumes of water greater than would be generated by a one in ten year, 24-hour duration rainfall event in the area. Figure 3 shows the design to which the cell was built. The base of the cell slopes towards the southwest to facilitate the collection and removal of stored water.

Five baseline soil samples were collected from the gravel pad on-site prior to construction to determine pre-existing concentrations of BTEX, F1-F4 hydrocarbon fractions, salinity parameters and metals.

A 0.1 m layer of sand was placed on the gravel pad and overlain with a hydrocarbon resistant liner designed for use in arctic environments. Details of the Arctic Liner are in Appendix II. The two seams of overlaying liner were sealed using seam tape following the manufacturer's instructions.

A sandy aggregate was used to construct 1 m high berms around the perimeter of the containment cell and the Arctic liner was placed to overtop the peak of the berm on all sides. A protective sandy aggregate fill of 0.3 m deep was placed over the liner as a protective working surface.

Following removal and disposal of the Unipkat I-22 soil, the soils used to construct the cell will be disposed of as described in Section 9.2.2.

9. STORAGE CELL OPERATION

9.1 Responsible Parties

Hazco will remain the prime contractor for managing Unipkat I-22 soils and the condition of the containment cell. IEG Consultants will be responsible for monitoring the condition of the containment cell and advising Hazco of any management issues. Mackenzie Delta Integrated Oilfield Services will be responsible for conducting work on or within the containment cell under Hazco's direction.

In the event of a spill or release, the Transport Emergency Response Plan will be activated by the Transportation Emergency Response Manager (as per schedule A of the Waste Management Plan). Any spills will be reported to Environmental Spill Control 1-867-920-8130, HAZCO Transportation Emergency response Manager (Marc St. Pierre) 1-403-998-8014, HAZCO Project Manager (Kevin Erickson) 1-587-888-0761, Shell Canada Energy Manager DAR group (Randall Warren) 1-403-813-0408. IEG will collect confirmatory samples from the location of spills to determine if clean-up efforts were effective.

9.2 Soil Management

9.2.1 Trucking Material from Unipkat I-22 to Inuvik

Sump material will be loaded onto end dump trucks which will be tarped and end gates bolted shut. Material will be shipped frozen from the Unipkat I-22 site and transported to the temporary storage cell in Inuvik. Each truck will be manifested with HAZCO Waste dockets, to track material being transported from Unipkat I-22 to the temporary storage cell in Inuvik. Trucks will scale to determine an average weight for each truck hauling sump material. Random checks will be done during the course of hauling to ensure the accuracy of weights is acceptable to Shell.

The volume of soil in each load will be tracked in a spreadsheet that records the origin, nature, destination, volume and transport docket number for each load. After hauling is complete, the total volume of sump material will be documented and forwarded to Shell Canada for its records.

The nature and origin of the soil in each load transported will be written on the HAZCO Waste dockets by the IEG on-site representative when it leaves the Unipkat site. A Shell representative will be present at the Inuvik containment cell to direct the unloading of soils in separate windrows that will keep soils that are similar in chemical make up together and limit the possible mixing of soils. As soil is moved within the cell and eventually transported from the cell, the distinct windrows of soil will be maintained to avoid mixing.

The volume of material removed from the storage cell and transported to CCS Ft. Nelson class II landfill will be recorded on transportation dockets and each load will be weighed and subsequently recorded in the same tracking sheet as was used to track the soil movement into the storage cell.

9.2.2 Storage Cell in Inuvik

Sump material will be contained in the temporary storage cell in Inuvik for less than 180 days. Material will be dewatered over the course of the summer by the use of an excavator which will mix the sump material to evaporate off water. Any equipment operating in the treatment cell will be cleaned off prior to relocating to other work areas. Operators working with the soil in the treatment cell will be instructed to avoid digging into the protective fill above the liner. Any tears that do occur in the liner will be reported to IEG and repairs will be made according to the manufacturer's instructions.

The soil will be analysed and compared to applicable landfill parameters prior to transport to a secure landfill located in BC (CCS Ft. Nelson). Trucks will have proper manifests according to the classification of material and be weighed to track the actual mass of sump material disposed of at the BC secure landfill. Once hauling is completed, a summary will be provided to Shell for their records. The Transportation Emergency Response Plan will be used if there is an incident or spill during the transport of material from Inuvik to the BC landfill.

Berm material used to construct the storage cell and soil below the containment cell liner will be analysed for constituents of concern to determine if any parameter concentrations are present in the soils. All material that made up the temporary storage cell will be analyzed prior to disposal at an appropriate facility. The sand barrier that covers the Arctic Liner will be sampled and disposed of at the Inuvik Landfill as intermediate cover if below CCME industrial guidelines and acceptable to the Town of Inuvik or it will be taken to a landfill in BC if above criteria or unacceptable for disposal in Inuvik. The Arctic Liner will be disposed of at the Inuvik landfill and acceptable material from beneath the liner in storage cell will be utilized by EGT to re-grade their yard.

9.3 Water Management

Accumulations of water within the containment cell will be monitored on a daily basis once liquid water begins to appear in the cell. In the event that water accumulates to a depth equivalent to half the height of the berm, the accumulated water will be pumped from the cell into holding tanks adjacent to the containment cell using a 2" trash pump.

All water storage tanks used at the site will be inspected prior to use to ensure that they are free of deleterious material. The integrity of each tank will be observed each time the containment cell is monitored (see Section 9.4).

Water collecting in the temporary storage cell will be transferred by a 2" pump to a storage tank located next to the treatment cell. The collected water will be analysed for constituents of concern and, if required, will be treated by an activated carbon system designed to remove hydrocarbons. A process diagram of the treatment system and information regarding the granular activated carbon are shown in Appendix III).

Once the water has been treated, it will be re-analyzed for BTEX and hydrocarbon fractions. If the hydrocarbons have been successfully removed from the treated water it will be passed through an evaporator and any remaining sediment will be hauled to the Class II landfill in BC. Under no circumstances will water be discharged into the Town of Inuvik's sewage treatment lagoons or onto surrounding land.

9.4 Monitoring

IEG personnel will be responsible for monitoring the condition of the containment cell while waste soils are stored in the cell and will report the conditions to Hazco and Shell.

Prior to seasonal snow melt in Inuvik, IEG will inform Hazco of the cell conditions and possible removal of excess snow from the cell. Once daily temperatures promote melting of the soil within the containment cell, IEG will begin daily inspections of the stability of the stockpiles, the condition of the cell, and water levels within the cell. IEG will record the observations on a daily inspection sheet and note any trends.

In the event that the trends indicate that there is little change in the treatment cell from day to day, the frequency of inspections will be reduced accordingly. The cell will be monitored during heavy rain events regardless of the inspection schedule.

10. SITE CLOSURE

The materials used to construct the cell will be disposed of as described in Section 9.2.2.

Confirmatory samples from soils located beneath the cell location will be collected and analytical results will be compared to the results from the baseline sampling to determine if the stored soils have affected the site. In the event that the site has been affected by the stored soil or water, the site will be managed to meet local regulations.

11. SCHEDULE

The first shipment of soil is expected to be placed in the containment cell during the third week of March 2011. The soil will be scheduled to be removed from the cell in late August 2011.

12. REFERENCES

Alberta Environment, 2008, *Environmental Code of Practice for Land Treatment of Soil Containing Hydrocarbons*, Alberta Queen's Printer, Edmonton Alberta.

Norris, D. K., 1981, *Geology Aklavik, District of Mackenzie*, Geological Survey of Canada MAP 1517A, scale 1:250,000.

Rampton, V.N., 1980, *Surficial Geology Aklavik, District of Mackenzie*, Geological Survey of Canada MAP 31-1979, scale 1:250,000.

Rampton, V.N., 1987, *Surficial Geology Tuktoyaktuk Coastlands, Northwest Territories*, Geological Survey of Canada MAP 1647A, scale 1:500,000.

FIGURES




NOTES:

SOURCE : IMAGE TAKEN FROM GOOGLE EARTH.

PLAN
N.T.S

TO BE READ WITH IEG REPORT DATED

JANUARY 2011

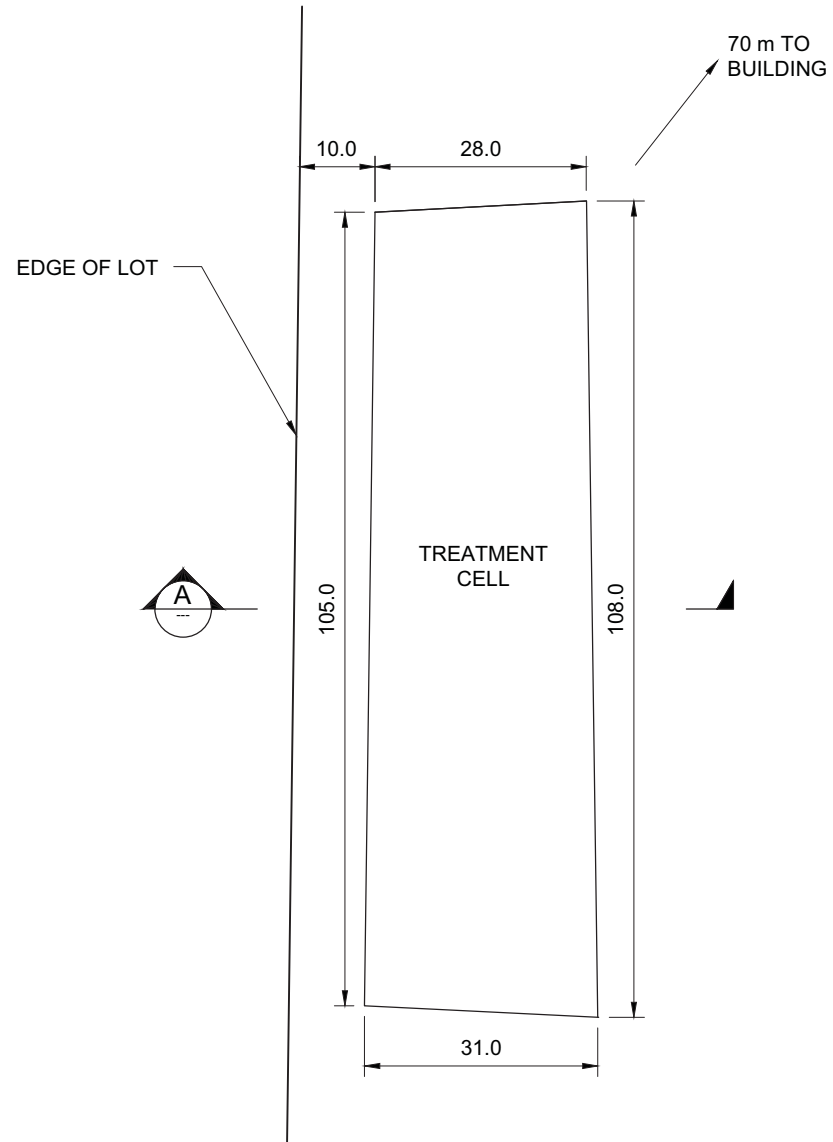
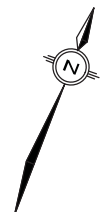
<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	CLIENT	PROJECT	
	Shell Canada Energy	UNIPKAT I-22 SUMP REMEDIATION	
	TITLE		
	TREATMENT CELL LOCATION		
	PROJECT No.	FIG. No.	
	A04025A02	FIGURE 1	



PLAN
SCALE 1:1000



TO BE READ WITH IEG REPORT DATED <u>JANUARY 2011</u>		
<small>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</small>	CLIENT Shell Canada Energy	PROJECT UNIPKAT I-22
		TITLE SITE LOCATION
	PROJECT No. A04025A02	FIG. No. Figure 2



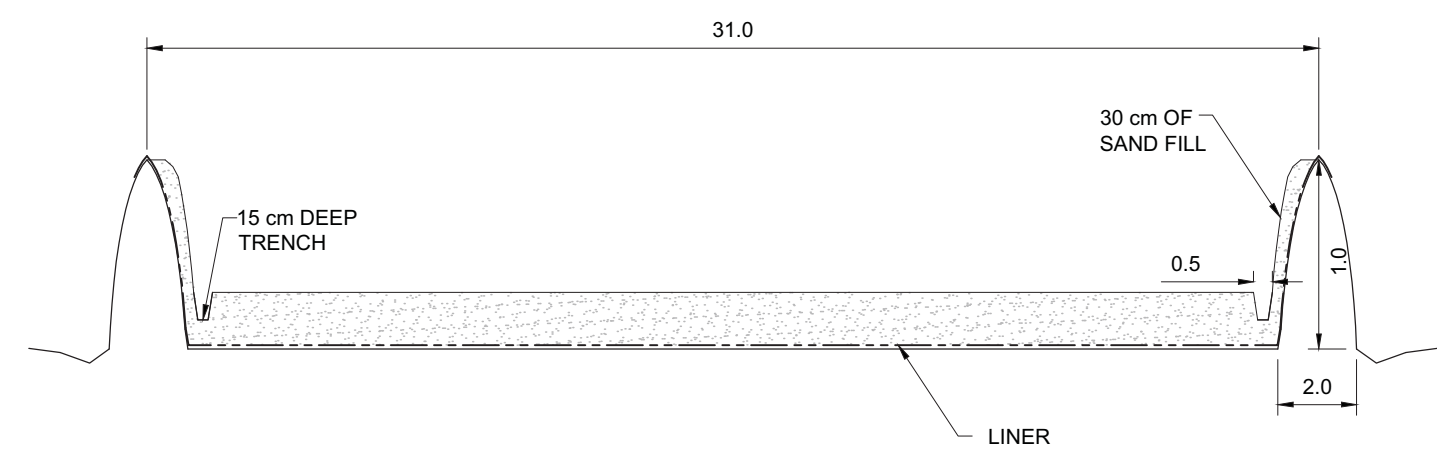
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NOTES:

1. DIMENSIONS ARE IN METRES, UNLESS NOTED OTHERWISE.


LEGEND

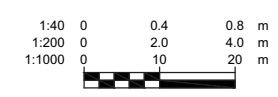
 SAND



A SECTION
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V 1:40

TO BE READ WITH IEG REPORT DATED JANUARY 2011

<p>AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.</p>	<p>CLIENT</p> <p>Shell Canada Energy</p>	<p>PROJECT</p> <p>UNIPKAT I-22</p>
		<p>TITLE</p> <p>TREATMENT CELL PLAN AND SECTION A</p>
<p>PROJECT No. A04025A02</p>		<p>FIG. No. Figure 3</p>



A04025A02-FIG-4-2.dwg

TCC-F-B-M

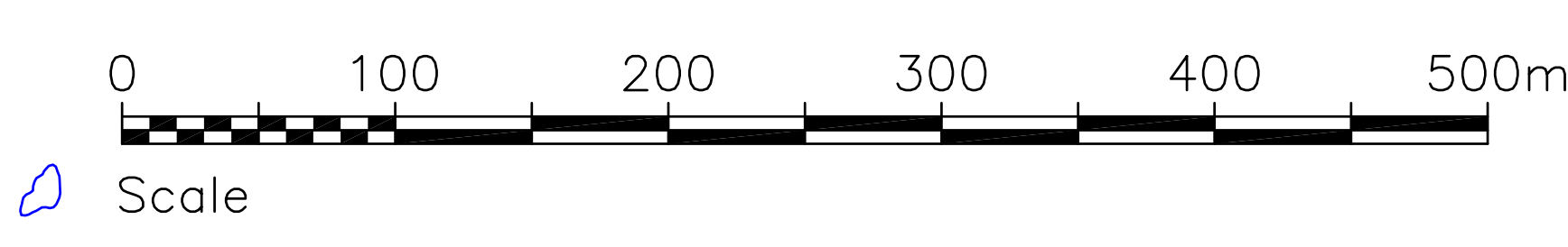
APPENDIX I

Town of Inuvik Zoning Map

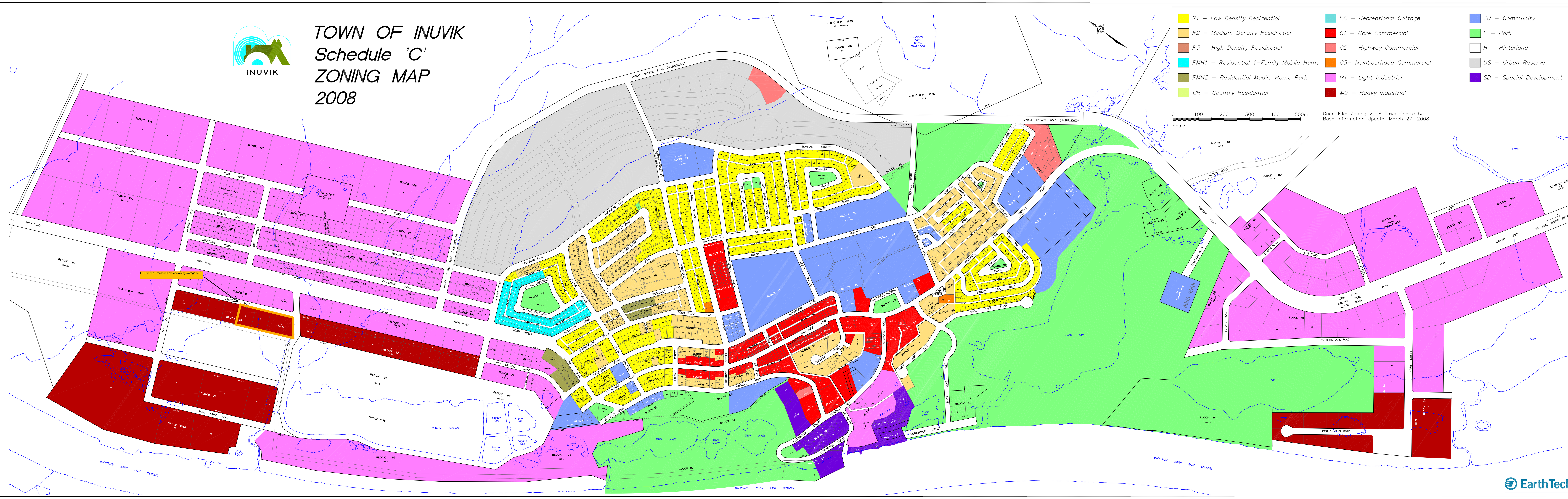


TOWN OF INUVIK Schedule 'C' ZONING MAP 2008

R1 - Low Density Residential	RC - Recreational Cottage	CU - Community
R2 - Medium Density Residential	C1 - Core Commercial	P - Park
R3 - High Density Residential	C2 - Highway Commercial	H - Hinterland
RMH1 - Residential 1-Family Mobile Home	C3- Neighbourhood Commercial	US - Urban Reserve
RMH2 - Residential Mobile Home Park	M1 - Light Industrial	SD - Special Development
CR - Country Residential	M2 - Heavy Industrial	



Cadd File: Zoning 2008 Town Centre.dwg
Base Information Update: March 27, 2008.



APPENDIX II

Arctic Liner Details



Arctic Liner

1. Product Description

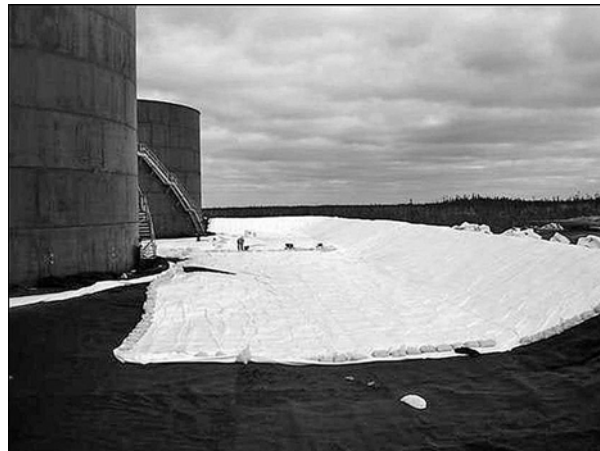
Arctic Liner® is a highly flexible geomembrane with advanced chemical resistance, it is formulated specifically for winter installation in harsh environments like the Arctic. The Arctic Liner® formulation is easily solvent bondable during periods of warm weather, making repairs an easy task even in isolated areas. This proprietary oil resistant alloy is well suited to secondary containment of combustible liquids and some fuels. Arctic Liner® is also excellent for soil remediation work and for separation of soils at contaminated sites. Arctic Liner® is often used for the secondary containment of industrial chemicals as well. Generally a short immersion test with Layfield's Field Chemical Testing Kit will show if Arctic Liner® is compatible with a given chemical. Arctic Liner® is excellent for the containment of combustible liquids and many oilfield chemicals.

2. Technical Data

Materials information is on page 2.

3. Installation

Layfield's Arctic Liner® is flexible enough to be prefabricated at our facility into large panels. The prefabricated panel is accordion folded, rolled on a core, and delivered to the job site secured to a pallet. Prefabricated panels can often cover a small project with a single panel. Local labor forces can be used to unroll and unfold the panel, while on larger projects Layfield installation forces can be used to join panels. Layfield has spent years developing innovative thin film seaming technology. All of our primary field welding of Arctic Liner® is based on hot wedge welding technology. Field wedge welding of the Arctic Liner® provides strong seams, and fast installations on large projects. Arctic Liner® can also be welded in the field with a solvent, allowing contractors to do small seams and attach pipe boots without the need for a Layfield installation crew.



4. Availability and Cost

Available from Layfield or distributors. Call 425-254-1075 Pacific time
780-453-6731 Mountain time, or
905-761-9123 Eastern time

5. Fabricated By

Layfield Environmental Systems Corp.
Layfield Geosynthetics & Ind. Fabrics Ltd.

6. Warranty

Products sold will meet Layfield's published specifications. Any extended warranty required by the buyer must be negotiated at the time of order. Extended warranties may be available on this product and may be at extra cost. Full warranty details are available from Layfield.

7. Maintenance

Geomembranes should be inspected at least once per year for damage, stress, or any other detrimental condition. The entire containment area should be visually inspected annually. Layfield provides geomembrane maintenance services on request.

8. Filing Systems

www.LayfieldGroup.com
www.geomembranes.com

9. Material Properties

18 Oct 2010	Arctic Liner® Material Properties		
Style	ASTM	Arctic Liner 30 (U) (White)	HAZGARD 100 (Green)
Thickness (Nominal)	D1593	30 mil 0.75 mm	30 mil 0.75 mm
Thickness Minimum	D1593	28.5 mil 0.72 mm	28.5 mil 0.72 mm
Tensile Strength (MD)	D882	57 ppi 10 N/mm	57 ppi 10 N/mm
Elongation	D882	500 %	500 %
Modulus at 100%	D882	18 ppi 3.2 N/mm	18 ppi 3.2 N/mm
Tear Strength (MD)	D1004	6 lbs 26.7 N	6 lbs 26.7 N
Low Temperature	D1790	-65° F -54° C	-22° F -30° C
Dimensional Stability	D1204 Max Change	4 %	4%
Water Extraction	D3083	0.25 %	0.25%
Volatile Loss	D1203 (A)	1.0 %	1.0%

10. Shop Seam Strengths

18 Oct 2010	Arctic Liner® Shop Seam Strengths		
Style	ASTM	Arctic Liner® 30 (U)	HAZGARD 100
Heat Bonded Seam Strength	D6392 25.4 mm (1") Strip	37 ppi 6.5 N/mm	37 ppi 6.5 N/mm
Heat Bonded Peel Adhesion Strength	D6392 25.4 mm (1") Strip	FTB 19 ppi 3.3 N/mm	FTB 19 ppi 3.3 N/mm

11. Field Seam Strengths

18 Oct 2010	Arctic Liner® Field Seam Strengths		
Style	ASTM	Arctic Liner® 30 (U)	HAZGARD 100
Heat Bonded Seam Strength	D6392 25.4 mm (1") Strip	Solvent 28 ppi 5.0 N/m	Solvent 28 ppi 5.0 N/m

Heat Bonded Peel Adhesion Strength	D6392 25.4 mm (1") Strip	AD-BRK 10 ppi 1.7 N/mm	AD-BRK 10 ppi 1.7 N/mm
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Layfield
Environmental Systems

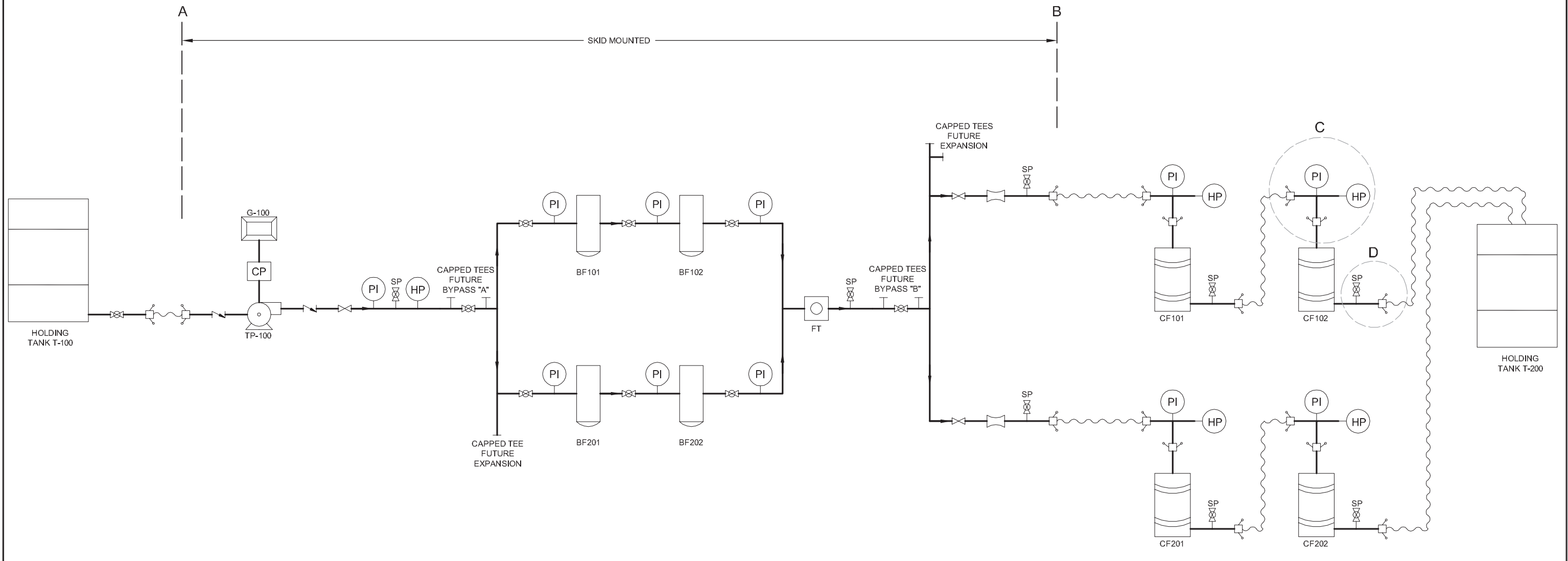
www.geomembranes.com
service@geomembranes.com

Tel (US): 1-800-796-6868
Tel (Canada): 1-800-840-2884

Design | Manufacture | Fabrication | Installation | Maintenance

APPENDIX II

Water Treatment System Details



LEGEND

- | | | | | | |
|--|--------------------------------|--|-------------------------------|--|--------------------------|
| | BALL VALVE | | FLOW TOTALIZER (TOTAL VOLUME) | | ELECTRICAL CONTROL PANEL |
| | CHECK VALVE | | HIGH PRESSURE RELIEF VALVE | | GENERATOR |
| | GLOBE VALVE | | PRESSURE GAUGE | | CARBON FILTER |
| | SAMPLE PORT VALVE | | BAG FILTER | | TRANSFER PUMP |
| | CAMLOCK FITTING | | | | |
| | FLEXIBLE HOSE BETWEEN CAMLOCKS | | | | |
| | FLOW METER (FLOW RATE) | | | | |
| | HARD PIPING | | | | |

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED <u>JANUARY 2008</u>		PROJECT UNIPKAT I-22 SUMP REMEDIATION	
AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.		TITLE WATER TREATMENT PROCESS DIAGRAM	
		PROJECT No. A4025A02	FIG. No. 2



KCC-4-44

USFILTER WESTATES CARBON

AQUACARB® 1230C AND 1230AWC

Coconut shell based granular activated carbon

(Formerly CC-602 and CC-602AW)



FOR USE IN POTABLE, WASTE AND
PROCESS WATER APPLICATIONS

Description and Applications

AquaCarb® 1230C and AquaCarb® 1230AWC are high activity coconut shell based granular activated carbons. These hard, attrition resistant high surface area carbons are designed to remove difficult to adsorb organics from potable, waste and process water. They are especially effective for adsorbing chlorine, disinfection by-products, TCE, PCE, MTBE and other trace level organics. AquaCarb® 1230AWC is acid washed yielding a very low ash content, pH neutral carbon that is ideally suited for use in potable water and high purity water systems for the micro-electronics and other industries.

- ANSI/NSF Standard 61 classified for use in potable water applications
- Fully conforms to physical, performance and leachability requirements established by the current ANSI/AWWA B604 (which includes the Food Chemical Codex requirements)

- A detailed quality assurance program guarantees consistent quality from lot to lot and shipment to shipment

Quality Control

All AquaCarb® activated carbons are extensively quality checked at our State of California certified environmental and carbon testing laboratory located in Los Angeles, CA. USFilter's laboratory is fully equipped to provide complete quality control analyses using ASTM standard test methods in order to assure the consistent quality of all AquaCarb® carbons.

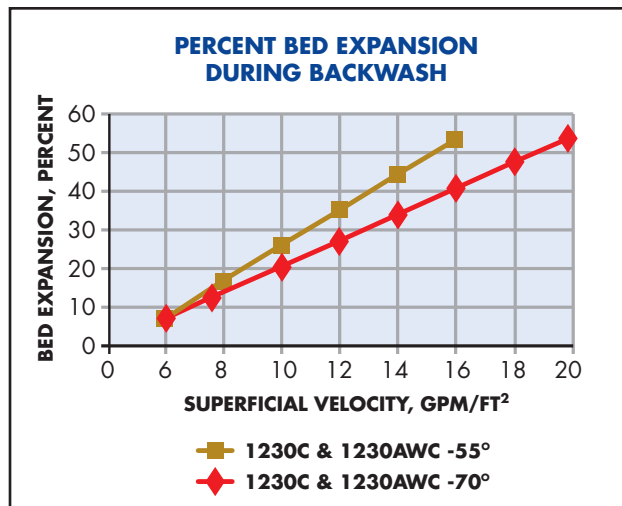
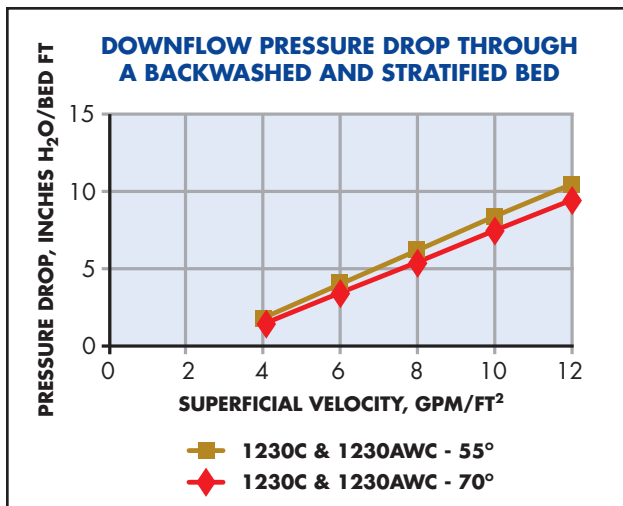
Our technical staff offers hands-on guidance in selecting the most appropriate system, operating conditions and carbon to meet your needs. For more information, contact your nearest USFilter representative.

AQUACARB® 1230C

AQUACARB® 1230AWC

Coconut shell based granular activated carbon

(Formerly CC-602 and CC-602AW)



Safety Note: Wet activated carbon depletes oxygen from the air and therefore dangerously low levels of oxygen may be encountered. Whenever workers enter a vessel containing activated carbon, the vessel's oxygen content should be determined and work procedures for potentially low oxygen areas should be followed. Read Material Safety Data Sheet (MSDS) before using this product.

All information presented herein is believed reliable and in accordance with accepted engineering practices. USFilter makes no warranties as to the completeness of this information. Users are responsible for evaluating individual product suitability for specific applications. USFilter assumes no liability whatsoever for any special, indirect or consequential damages arising from the sale, resale or misuse of its products.

SPECIFICATIONS/TYPICAL PROPERTIES		
Specification	AquaCarb® 1230C	AquaCarb® 1230AWC
Carbon Type	Coconut Shell	Coconut Shell
Mesh Size, U.S. Sieve	12 x 30	12 x 30
Effective Size, mm	0.6 - 0.85	0.6 - 0.85
Uniformity Coefficient (max.)	2.0 (max)	2.0 (max)
Iodine No., mgI ₂ /g (min.)	1100 (min)	1100 (min)
Hardness No., Wt. % (min.)	98 (min)	98 (min)
Abrasion No., Wt. % (min.)	85 (min)	85 (min)
Apparent Density, g/cc	0.45 - 0.52	0.45 - 0.52
Water Soluble Ash, Wt. % (max)	2.0	0.2
Contact pH	9.0 - 10.0	6.5 - 8.0



Westates
Customer and
Technical Service Network:

Gulf Coast Region 800.659.1723
(Louisiana) 225.744.3153
Western Region 800.659.1771
Mid-Atlantic Region 800.659.1717
Midwest Region 708.345.7290
Northwest Region 800.659.1718
Southeast Region 225.744.3153
New England Region 800.659.1717

USFilter reserves the right to change the specifications referred to in this literature at any time, without prior notice. AquaCarb is a trademark of United States Filter Corporation or its affiliates.

ASC200-SS **Specification Summary**

ASC200 Liquid Phase Adsorption Filter is designed to treat a wide range of contaminated process streams, ease of handling and economical usage. This adsorber is capable of maximum flow rate of 10 GPM.

Data Summary:

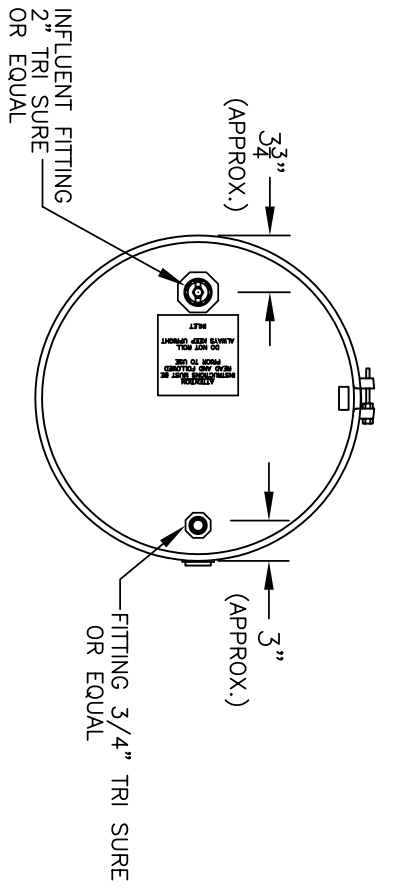
Dimensions	22" dia x 34" high
Maximum Working Pressure	3 psi.
Vessel Volume	7.4 cu-ft
Carbon Capacity	200 lbs.
Carbon Bed Volume-Typical	6.8 Ft ³
Maximum Flow	10 GPM
Empty Bed Contact Time	5 MIN @10 GPM
Material	Stainless Steel
Standard Color	Stainless Steel

UNDERDRAIN:

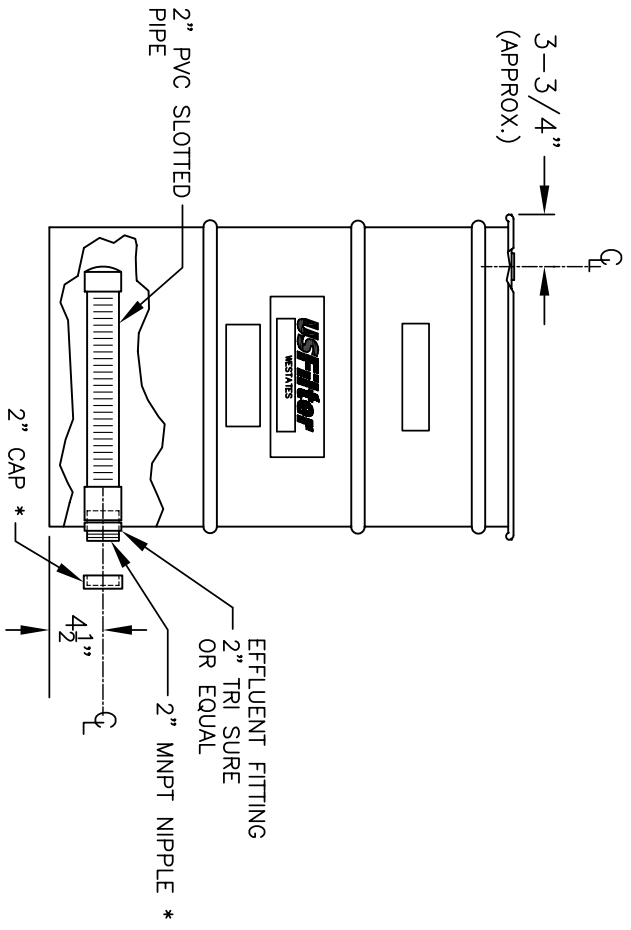
Slotted pipe..... 2" x 18" PVC

WEIGHT:

Shipping250 lb
Operating500 lb



PLAN VIEW



SIDE VIEW

* THIS IS FOR NON-HAZARDUS MATERIAL ONLY. SPECIAL FITTING REQUIRED FOR HAZARDUS MATERIAL TRANSPORTATION.

DESCRIPTION:	55 GALLON OPEN HEAD DRUM
MATERIAL:	CARBON STEEL
EXTERIOR FINISH:	HIGH GLOSS ENAMEL
LINING:	VALSPAR 285D118 RED BROWN EPOXY PHENOLIC
FITTINGS:	HEAD: TYPE 1 (2" & 3/4") BODY: 2" SIDE FITTING 4-1/2" TO CL FROM BOTTOM OF DRUM
FITTINGS GASKETS:	BUNA ON TRI SURE PLUGS
CLOSURE:	12 GA SQUARE BACK W/ 5/8" BOLT & JAM NUT
HEAD GASKET:	7/16" EPDM ROUND CORD GASKET
OUTSIDE DIAMETER:	23.5"
OVERALL HEIGHT:	34.625" +/- .5
INTERNALS:	2" PVC SLOTTED PIPE
FLOW RATE:	10 GPM MAX.
TEMPERATURE:	140° F MAX. OPERATING
PRESSURE:	6 PSI MAX. WORKING
CARBON CAPACITY:	200 LBS.
WEIGHTS:	SHIPPING: 250 LBS. OPERATING: 500 LBS.

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DESIGNER	DATE
TAC	2/1/05
CHECKER	DATE
ENGINEER	DATE
LLR	1/28/05
MANAGER	DATE
FILE:	
SCALE:	NONE

TITLE	ASC200 SALES DRAWING
CLIENT	USFILTER/WESTATES RED BLUFF, CA 1-800-795-2664
PROJECT	ASC200-Sales
DRAWING	1 OF 1
SHEET	REV

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
SOIL SAMPLE ANALYTICAL RESULTS**

SOIL HYDROCARBONS				OVA (Field Screening) ppm	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes (Total) mg/kg	F1 (C6-C8) mg/kg	F1 (C6-C9) - BTEX mg/kg	F2 (C10-C16) mg/kg	F3 (C18-C24) mg/kg	F4 (C26-C40) mg/kg
Sample ID	Location	Depth (m)	Date										
BH03	0,20	0 - 0.61 0.61 - 1.52	9-Sep-07	0 5	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<10 <10	<10 <10	12 18	43 158	11 41
BH11	20,0	0 - 0.61 0.61 - 1.52	9-Sep-07	20 5	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<10 <10	<10 <10	14 18	51 86	13 20
BH30	50,40	0 - 0.61 0.61 - 1.52	9-Sep-07	25 25	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	57 <10	57 <10	16 26	56 135	14 33
BH34	60,10	0 - 0.61 0.61 - 1.52	9-Sep-07	0 0	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<10 <10	<10 <10	20 15	189 85	56 20
BH42	60,70	0 - 0.61 0.61 - 1.52	9-Sep-07	10 5	<0.0050 <0.0050	<0.020 <0.020	<0.010 0.034	<0.040 0.15	<10 59	<10 59	14 4210	55 136	<10 <10
BH43	50,70	0 - 0.61 0.61 - 1.52	9-Sep-07	0 0	<0.0050 0.064	<0.020 0.034	<0.010 0.057	<0.040 0.27	<10 118	<10 118	<10 1250	12 59	<10 <10
BH46	70,70	0 - 0.61 0.61 - 1.52	9-Sep-07	0 10	<0.0050 <0.0050	<0.020 0.039	<0.010 0.06	<0.040 0.37	<10 261	<10 261	<10 4220	42 84	<10 <10
BH50	70,0	0 - 0.61 0.61 - 1.52	10-Sep-07	0 20	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<10 <10	<10 <10	<10 <10	<10 28	<10 <10
BH53	35,15	0 - 0.61 0.61 - 1.52	11-Sep-07	5 10	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<10 <10	<10 <10	<10 <10	<10 92	<10 56
BH55	35,35	0 - 0.61	9-Sep-07	15	<0.0050	<0.020	<0.010	<0.040	<10	<10	93	185	<10
BH57	35,55	0 - 0.61 0.61 - 1.52	11-Sep-07	20 5	<0.0050 <0.0050	<0.020 <0.020	<0.010 0.018	<0.040 0.28	<10 <10	<10 <10	<10 <10	79 1200	51 330
BH58	70,20	0 - 0.61 0.61 - 1.52 1.52 - 2.44	11-Sep-07	15 0 15	<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 <0.040 <0.040	<10 <10 <10	<10 <10 <10	<10 <10 <10	17 20 92	<10 <10 56
BH60	70,40	0 - 0.47 0.47 - 1.37 1.37 - 2.29	9-Sep-07	5 5 10	<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 <0.040 <0.040	<10 <10 <10	<10 <10 <10	<10 15 13	44 99 88	<10 <10 <10
BH61	65,65	0 - 0.61 0.61 - 1.52 1.52 - 2.13	9-Sep-07	0 0 5	<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 <0.040 <0.040	<10 <10 <10	<10 <10 <10	10 12 12	52 99 61	<10 <10 <10
BH62	65,55	0 - 0.61 0.61 - 1.52	12-Sep-07	10 0	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<10 <10	<10 <10	<10 <10	18 52	<10 <10
BH66 (Pond)	85,45	0 - 0.61 0.61 - 1.52 1.52 - 2.44	12-Sep-07	15 0 25	<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 <0.040 <0.040	<10 <10 <10	<10 <10 <10	<10 <10 <10	36 31 61	<10 <10 <10
MW1	25,80	0 - 0.61 0.61 - 1.52	8-Sep-07	5 5	<0.0050 <0.0050	<0.020 <0.020	<0.010 0.041	<0.040 <0.040	<10 57	<10 57	19 3310	121 160	44 43
MW2	20,30	0 - 0.61 0.61 - 1.52	8-Sep-07	10 5	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	1.15 <0.040	<10 <10	<10 <10	12 <10	98 115	32 47
MW3	10,40	0 - 0.61 0.61 - 1.52	8-Sep-07	10 5	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<10 <10	<10 <10	<10 13	52 101	18 30
MW4	10,20	0 - 0.61 0.61 - 1.52	8-Sep-07	35 15	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<10 <10	<10 <10	<10 <10	38 84	15 30
MW5	45,58	0 - 0.61 0.61 - 1.52	9-Sep-07	5 20	<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<10 <10	<10 <10	<10 36	34 119	<10 34
MW6	67,52	0 - 0.61	9-Sep-07	15	<0.0050	<0.020	<0.010	<0.040	<10	<10	<10	64	18
MW7	3,68	0 - 0.61	10-Sep-07	20	<0.0050	<0.020	<0.010	<0.040	<10	<10	<10	76	23
MW8	107,0	0 - 0.61 0.61 - 1.52 1.52 - 2.44	10-Sep-07	0 20 5	<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 <0.040 <0.040	<10 <10 <10	<10 <10 <10	<10 <10 <10	77 22 34	33 <10 <10
MW9	45,25	0 - 0.61 0.61 - 1.52 2.94 - 3.05	11-Sep-07	10 20 25	<0.0050 0.01	<0.020 0.054	<0.010 0.12	<0.040 0.63	<10 28	<10 27	<10 4810	24 174 300	<10 20 53
BH10-01	74,78	0-0.5 0.5-1.0 1.0-1.5	17-Aug-10		<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 0.019 0.034	<0.040 0.12 0.18	<12 85 <12	<12 85 <12	120 5000 870	100 810 100	23 180 24
BH10-02	-23,53	0.5-1.0 1.0-1.5 1.5-2.0	17-Aug-10		<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 <0.040 <0.040	<12 <12 <12	<12 <12 <12	22 12 14	70 63 48	20 15 <10
BH10-03	-32,21	0.5-1.0 1.0-1.4	17-Aug-10		<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<12 <12	<12 <12	<10 <10	42 50	10 12
BH10-04	-45,35	0.5-1.0	17-Aug-10		<0.0050	<0.020	<0.010	<0.040	<12	<12	<10	54	13
BH10-05	-40,70	1.0-1.3	17-Aug-10		<0.0050	<0.020	<0.010	<0.040	<12	<12	<10	70	13
BH10-06	-23,83	1.0-1.5 1.5-2.0 2.0-2.2	17-Aug-10		<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 <0.040 <0.040	<12 <12 <12	<12 <12 <12	<10 <10 <10	85 46 42	20 10 <10
BH10-07	-3,90	0.0-0.5 0.5-1.0 1.0-1.5 1.5-2.0 2.0-2.4	18-Aug-10		<0.0050 <0.0050 <0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020 <0.020 <0.020	<0.010 <0.010 0.043 0.029	<0.040 <0.040 0.23 0.13	<12 <12 36 18	<12 <12 36 18	25 21 930 510	58 84 85 53	16 24 21 <10
BH10-08	41,98	0.5-1.0 1.5-2.0	18-Aug-10		<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<12 <12	<12 <12	12 <10	44 39	<10 <10
BH10-09	67,91	0.0-0.5 1.0-1.5 2.0-2.5	18-Aug-10		<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 <0.040 <0.040	<12 <12 <12	<12 <12 <12	<10 11 23	33 49 65	<10 14 <10
BH10-10	-2,70	0.5-1.0 1.0-1.5 1.5-1.9	18-Aug-10		<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 0.041 <0.040	<12 20 <12	<12 20 <12	23 250 130	67 47 66	13 <10 13
BH10-11	18,87	0.5-1.0 1.0-2.0 2.0-2.4	18-Aug-10		<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 <0.040 <0.040	<12 <12 15	<12 <12 15	24 14 12	74 81 64	14 12 11
BH10-12	47,85	1.0-1.5 1.5-2.0 2.0-2.5	18-Aug-10		<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 0.017 <0.010	<0.040 <0.040 <0.040	17 14 23	17 14 23	370 940 550	88 120 110	19 21 21
BH10-13	21,67	0.0-0.5 0.5-1.0 1.0-1.5 1.5-2.0 2.0-2.5	19-Aug-10		<0.0050 <0.0050 <0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020 <0.020 <0.020	<0.010 <0.010 <0.010 <0.010 <0.010	<0.040 <0.040 0.88 0.80 0.14	<12 <12 77 150 35	<12 <12 76 150 35	16 1500 2900 1700 1100	69 180 110 160 76	18 43 26 59 <10
BH10-14	13,48	0.5-1.0 1.0-1.5 1.5-2.0	19-Aug-10		<0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020	<0.010 <0.010 <0.010	<0.040 <0.040 <0.040	<12 <12 <12	<12 <12 <12	95 27 23	120 75 65	20 11 <10
BH10-15	28,23	1.0-1.5 1.5-2.0	19-Aug-10		<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<12 <12	<12 <12	<10 <10	74 64	16 <10
BH10-16	50,22	0.0-0.5 0.5-1.0 1.0-1.5 1.5-2.0 2.0-2.5	19-Aug-10		<0.0050 <0.0050 <0.0050 <0.0050 <0.0050	<0.020 <0.020 <0.020 <0.020 <0.020	<0.010 <0.010 <0.010 <0.010 <0.010	<0.040 <0.040 <0.040 1.3 <0.040	<12 <12 <12 37 34	<12 <12 <12 35 34	11 15 19 2200 39	61 91 110 600 89	18 28 38 14 14
BH10-17	51,46	1.5-2.0 2.0-2.3	19-Aug-10		<0.0050 <0.0050	<0.020 <0.020	<0.010 <0.010	<0.040 <0.040	<12 <12	<12 <12	99 45	94 82	13 <10
BH10-18	39,38	2.5-3.0 3.0-3.5 3.5-3.8	19-Aug-10		<0.0050 <0.0050 <0.0050	0.56 0.62 0.30	0.45 0.47 0.36	3.0 3.2 2.3	180 210 160	170 210 160	6000 7400 3800	600 630 340	54 46 36
Unipkat I-22 Flare Pit	0 - 0.15	26-Aug-04	-		<0.04	<0.04	<0.04	<0.09	<10	<10	<10	<10	<10
Unipkat I-22 Flare Pit Edge	1.0	26-Aug-04	-		<0.04	<0.04	<0.04	<0.09	<20	<10	<10	<10	<10
Background Soil													
I22 BG	Background	0 - 0.25 0.25 - 0.50	13-Sep-07	20 40	<0.0050 <0.0050	<0.020 &							

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
SOIL SAMPLE ANALYTICAL RESULTS**

SOIL METALS			Arsenic (As)	Barium (Ba)	Extractable Barium (Ba)	True Total Barium (Ba)	Beryllium (Be)	Boron (B)	Cadmium (Cd)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Hexavalent Chromium (Cr6+)	Lead (Pb)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thallium (Tl)	Tin (Sn)	Vanadium (V)	Zinc (Zn)
Sample ID	Depth (m)	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
BH03	0 - 0.61	9-Sep-07	5	1620	-	-	0.4	0.2	0.5	13	7	15	<0.2	9	<0.05	1.1	20	<0.5	<1	<0.3	<1	22	75
	0.61 - 1.52		8	425	-	-	0.7	0.2	0.6	21	10	22	<0.2	12	0.06	1.7	30	0.8	<1	<0.3	<1	34	103
BH11	0 - 0.61	9-Sep-07	6	495	-	-	<0.4	0.2	0.5	13	7	15	<0.2	7	<0.05	1.1	20	<0.5	<1	<0.3	<1	24	73
	0.61 - 1.52		11	578	-	-	0.5	0.2	0.9	25	12	27	<0.2	13	<0.05	2.1	38	0.5	<1	<0.3	<1	45	124
BH30	0 - 0.61	9-Sep-07	8	564	-	-	0.4	0.3	0.8	18	9	20	<0.2	10	<0.05	1.5	28	0.5	<1	<0.3	<1	32	96
	0.61 - 1.52		8	1360	-	-	0.5	0.2	0.7	20	9	21	<0.2	11	<0.05	1.5	30	<0.5	<1	<0.3	<1	34	102
	1.52 - 2.43		9	861	-	-	0.6	0.1	0.7	23	11	25	<0.2	13	0.05	1.9	35	<0.5	<1	<0.3	<1	40	119
BH34	0 - 0.61	9-Sep-07	11	850	-	-	0.6	0.2	0.8	25	12	26	<0.2	13	0.05	2.1	37	<0.5	<1	<0.3	<1	44	122
	0.61 - 1.52		8	509	-	-	0.5	0.2	0.7	20	10	21	<0.2	10	<0.05	1.6	31	<0.5	<1	<0.3	<1	37	102
	1.52 - 2.13		11	1250	-	-	0.6	0.2	0.8	27	13	29	<0.2	15	0.06	2.3	41	<0.5	<1	<0.3	<1	50	139
BH42	0 - 0.61	9-Sep-07	7	1160	-	-	0.4	0.3	0.7	16	9	33	<0.2	12	<0.05	1.5	26	0.8	<1	<0.3	<1	30	100
	0.61 - 1.52		20	1810	-	-	1.0	0.4	1.7	44	23	79	<0.2	32	0.05	4.3	71	0.6	<1	<0.3	<1	76	240
	1.52 - 1.83		11	735	-	-	0.6	0.3	0.9	25	12	44	<0.2	17	<0.05	2.4	35	0.6	<1	<0.3	<1	44	137
	1.83 - 2.74		9	967	-	-	0.8	0.4	0.8	31	11	34	<0.2	15	0.05	3.2	40	<0.5	<1	<0.3	<1	46	131
BH43	0 - 0.61	9-Sep-07	11	706	-	-	0.7	0.2	0.9	23	12	34	<0.2	15	0.05	2.2	35	<0.5	<1	<0.3	<1	43	129
	0.61 - 1.52		11	619	-	-	0.7	0.2	0.9	22	13	32	<0.2	16	0.05	2.3	38	<0.5	<1	<0.3	<1	39	133
	1.52 - 2.13		10	490	-	-	0.5	0.5	0.9	20	10	30	<0.2	14	0.06	2.1	33	0.7	<1	<0.3	<1	33	119
BH46	0 - 0.61	9-Sep-07	9	551	-	-	<0.4	0.2	0.7	17	10	26	<0.2	11	0.05	1.6	29	<0.5	<1	<0.3	<1	31	110
	0.61 - 1.52		10	674	-	-	0.9	0.3	1	25	12	32	<0.2	18	0.05	2.6	38	0.7	<1	<0.3	<1	43	134
	1.52 - 2.44		10	668	-	-	0.7	2.3	0.9	21	12	31	<0.2	15	0.06	2.3	37	<0.5	<1	<0.3	<1	37	129
BH50	0 - 0.61	10-Sep-07	7	489	-	-	<0.4	0.2	1	13	8	18	<0.2	8	<0.05	1.4	34	1	<1	<0.3	<1	24	93
	0.61 - 1.52		7	401	-	-	<0.4	0.2	1	12	8	18	<0.2	8	<0.05	1.3	34	0.9	<1	<0.3	<1	23	77
	1.52 - 2.29		8	442	-	-	0.4	0.2	1.1	15	9	22	<0.2	10	0.05	1.7	40	0.8	<1	<0.3	<1	27	98
BH53	0 - 0.61	11-Sep-07	8	2530	-	-	<0.4	0.4	1.1	18	10	21	<0.2	24	<0.05	1.7	37	0.7	<1	<0.3	<1	20	83
	0.61 - 1.52		9	658	-	-	<0.4	0.3	1.2	13	11	21	<0.2	10	<0.05	1.7	39	0.9	<1	<0.3	<1	20	88
BH55	0 - 0.61	9-Sep-07	6	723	-	-	<0.4	0.2	0.5	13	8	21	<0.2	9	<0.05	1	24	0.5	<1	<0.3	<1	23	81
	0.61 - 1.52		7	5490	-	-	<0.4	1.5	0.6	28	9	29	<0.2	64	0.09	0.7	28	<0.5	<1	<0.3	<1	24	127
BH57	0 - 0.61	11-Sep-07	8	591	-	-	<0.4	0.2	1.1	11	9	18	<0.2	8	<0.05	1.3	36	0.7	<1	<0.3	<1	17	73
	0.61 - 1.52		10	2270	-	-	<0.4	0.3	1.3	22	11	25	<0.2	20	0.06	1.7	41	0.9	<1	<0.3	<1	21	97
BH58	0 - 0.61	11-Sep-07	9	403	-	-	<0.4	0.3	1.1	13	9	20	<0.2	9	<0.05	1.6	39	0.7	<1	<0.3	<1	21	86
	0.61 - 1.52		8	384	-	-	<0.4	0.3	1	13	8	20	<0.2	8	<0.05	1.5	38	0.8	<1	<0.3	<1	19	88
	1.52 - 2.44		9	394	-	-	0.4	0.3	1.2	16	11	23	<0.2	11	0.05	1.8	43	0.8	<1	<0.3	<1	26	95
BH60	0 - 0.47	9-Sep-07	8	1040	-	-	0.5	0.4	0.5	14	9	20	<0.2	10	<0.05	1.3	27	0.9	<1	<0.3	<1	25	92
	0.47 - 1.37		10	515	-	-	0.8	0.3	0.8	23	11	25	<0.2	13	0.06	2	34	0.9	<1	<0.3	<1	44	120
	1.37 - 2.29		10	520	-	-	0.7	0.3	0.8	24	11	25	<0.2	13	0.06	2	35	0.8	<1	<0.3	<1	43	121
BH61	0 - 0.61	9-Sep-07	8	768	-	-	0.6	0.2	0.8	20	10	22	<0.2	11	<0.05	1.7	31	<0.5	<1	<0.3	<1	39	108
	0.61 - 1.52		10	579	-	-	0.6	0.4	0.7	21	12	25	<0.2	14	0.05	1.9	35	0.9	<1	<0.3	<1	38	122
	1.52 - 2.13		9	585	-	-	0.6	0.2	0.7	20	10	22	<0.2	12	<0.05	1.8	31	0.5	<1	<0.3	<1	36	109
BH62	0 - 0.61	12-Sep-07	9	488	-	-	0.4	0.4	1.1	15	10	23	<0.2	10	0.05	1.7	41	1	<1	<0.3	<1	25	95
	0.61 - 1.52		9	916	-	-	0.5	0.3	1.2	15	10	24	<0.2	12	0.06	1.7	42	0.8	<1	<0.3	<1	24	96
	1.52 - 2.44		9	394	-	-	0.4	0.3	1.2	13	10	25	<0.2	11	0.06	1.7	42	0.8	<1	0.3	<1	23	97
BH66 (Pond)	0 - 0.61	12-Sep-07	9	484	-	-	<0.4	0.4	1.1	13	10	20	<0.2	10	<0.05	1.6	38	0.8	<1	<0.3	<1	20	84
	0.61 - 1.52		10	398	-	-	<0.4	0.3	1.3	14	12	24	<0.2	11	0.05	1.8	44	0.9	<1	<0.3	<1	25	96
	1.52 - 2.44		9	540	-	-	0.4	0.3	1.2	14	11	23	<0.2	11	0.05	1.7	42	1	<1	<0.3	<1	25	92
MW1	0 - 0.61	8-Sep-07	5	793	-	-	<0.4	0.2	0.6	13	8	18	<0.2	10	<0.05	1.2	26	0.9	<1	<0.3	<1	25	77
	0.61 - 1.52		8	404	-	-	0.6	0.6	0.7	19	11	24	<0.2	13	0.05	1.7	34	1.2	<1	<0.3	<1	36	98
	2.59 - 2.74		6	385	-	-	0.5	0.2	0.7	15	10	21	<0.2	11	<0.05	1.5	30	0.9	<1	<0.3	<1	30	85
	3.51		7	370	-	-	0.5	0.2	0.7	16	10	23	<0.2	12	<0.05	1.5	31	0.8	<1	<0.3	<1	30	92
MW2	0 - 0.61	8-Sep-07	5	1020	-	-	<0.1	0.6	1.9	8	18	<0.2	13	<0.05	1.2	28	0.5	<1	<0.3	<1	24	72	
	0.61 - 1.52		7	687	-	-	0.5	0.5	0.7	16	10	22	<0.2	14	<0.05	1.5	31	0.9	<1	<0.3	<1	31	90
	1.98		7	695	-	-	0.5	0.2	0.7	19	11	23	<0.2	14	0.05	1.7	33	0.8	<1	<0.3	<1	34	93
MW3	0 - 0.61	8-Sep-07	5	918	-	-	<0.4	0.2	0.6	12	8	18	<0.2	11	<0.05	1.1	25	0.5	<1	<0.3	<1	24	74
	0.61 - 1.52		6	510	-	-	0.5	0.5	0.7	16	10	22	<0.2	12	<0.05	1.5	30	0.7	<1	<0.3	<1	31	87
	1.83		7	463	-	-	0.5	0.3	0.7	21	10	23	<0.2	13	0.05	2.2	35	0.6	<1	<0.3	<1	31	94
MW4	0 - 0.61	8-Sep-07	5	2670	-	-	<0.4	0.2	0.6	15	8	18	<0.2	14	<0.05								

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
SEDIMENT SAMPLE ANALYTICAL RESULTS**

TABLE 9 : SEDIMENT HYDROCARBONS		OVA (Field Screening) ppm	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes (Total) mg/kg	F1 (C6-C10) mg/kg	F1 (C6-C10) - BTEX mg/kg	F2 (C10-C16) mg/kg	F3 (C16-C34) mg/kg	F4 (C34-C60) mg/kg
Sample ID	Date										
POND SEDIMENT											
SED 1	10-Sep-07	25	<0.0050	0.12	<0.010	<0.040	<10	<10	<10	58	27
SED 2	10-Sep-07	20	<0.0050	0.042	<0.010	<0.040	<10	<10	<10	66	29
SED 3	10-Sep-07	25	<0.0050	<0.020	<0.010	<0.040	<10	<10	<10	50	24
SED 4	10-Sep-07	20	<0.0050	<0.020	<0.010	<0.040	<10	<10	<10	69	30
SED 5	10-Sep-07	25	<0.0050	<0.020	<0.010	<0.040	<10	<10	<10	64	26
SED 6	10-Sep-07	30	<0.0050	<0.020	<0.010	<0.040	<10	<10	<10	48	19
ASSESSMENT GUIDELINE			-	-	-	-	-	-	-	-	-
CCME CEQG											
Interim Freshwater Sediment Quality Guidelines (ISQG)			-	-	-	-	-	-	-	-	-
Residential/Parkland land use, fine-textured soil			0.0068	0.08	0.018	2.4	-	-	-	-	-
Industrial land use, fine-textured soil			0.0068	0.08	0.018	2.4	-	-	-	-	-
GNWT CSR											
Surface soil (0 to 1.5 m)											
Residential/Parkland - Eco Soil Contact			-	-	-	-	-	260	900	800	5600
Industrial - Eco Soil Contact			-	-	-	-	-	660	1500	2500	6600

Notes:

Canadian Council of Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines (CEQG), 1999 (Update 7.0, September 2007)*

Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Summary Table, update 2002

Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Summary Table, update 6.0.2, November 2006

Government of the Northwest Territories (GNWT), Environment and Natural Resources, Environmental Guideline for Contaminated Site Remediation (CSR), November 2003

' - ' = Not applicable - parameter not analysed/reported or parameter has no applicable/relevant guideline.

< = Concentration less than the laboratory method detection limit

 = Highlighting indicates parameter exceeds the assessment guideline.

Bold = Parameter exceeds the soil guideline. **Informational purposes only.**

OVA = Organic Vapour Analysis results

mg/kg = milligrams per kilogram

ppm = parts per million

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
SEDIMENT SAMPLE ANALYTICAL RESULTS**

TABLE 10 : SEDIMENT SALINITY		Anion Sum meq/L	Cation Sum meq/L	Ion Balance -	Conductivity (Field Screening) µS/cm	Soluble Conductivity dS/m	Soluble pH -	Sodium Adsorption Ratio (SAR) -	Soluble Chloride (Cl) mg/L	Soluble Calcium (Ca) mg/L	Soluble Magnesium (Mg) mg/L	Soluble Sodium (Na) mg/L	Soluble Potassium (K) mg/L	Saturation %	Soluble Sulphate (SO4) mg/L	Theoretical Gypsum Requirement tons/ac
Sample ID	Date															
POND SEDIMENT																
SED 1	10-Sep-07	12.3	13.2	1.08	2.47	1.39	7.40	1.7	252	138	24	84	28	42.7	248	<0.1
SED 2	10-Sep-07	15.6	15.9	1.02	2.5	1.61	7.40	1.8	288	168	35	97	18	48.0	357	<0.1
SED 3	10-Sep-07	9.84	12.0	1.22	1.44	1.27	7.50	1.7	239	119	27	79	16	44.3	149	<0.1
SED 4	10-Sep-07	7.28	9.63	1.32	1.8	0.94	7.60	1.1	126	110	21	49	12	44.8	178	<0.1
SED 5	10-Sep-07	7.34	8.23	1.12	1.67	0.81	7.70	1	80	96	18	39	10	44.8	244	<0.1
SED 6	10-Sep-07	28.8	32.2	1.12	4.52	2.56	7.50	5.7	715	247	43	367	15	43.8	414	<0.1
ASSESSMENT GUIDELINE		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CCME CEQG																
Interim Freshwater Sediment Quality Guidelines (ISQG)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Residential/Parkland land use, fine-textured soil		-	-	-	-	2	6 - 8	5	-	-	-	-	-	-	-	-
Industrial land use, fine-textured soil		-	-	-	-	4	6 - 8	12	-	-	-	-	-	-	-	-

Notes:

Canadian Council of Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines* (CEQG), 1999 (Update 7.0, September 2007)

Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Summary Table, update 2002

Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Summary Table, update 6.0.2, November 2006

'-' = Not applicable - parameter not analysed/reported or parameter has no applicable/relevant guideline.

< = Concentration less than the laboratory method detection limit

 = Highlighting indicates parameter exceeds the assessment guideline.

Bold = Parameter exceeds the soil guideline. **Informational purposes only.**

mg/kg = milligrams per kilogram

µS/cm = dS/m = deciSiemens per metre

meq/L = milliequivalents per litre

tons/ac = tonnes per acre

% = Percentage

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
SEDIMENT SAMPLE ANALYTICAL RESULTS**

TABLE 11 : SEDIMENT METALS		Arsenic (As)	Barium (Ba)	Beryllium (Be)	Boron (B)	Cadmium (Cd)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Hexavalent Chromium (Cr 6 +)	Lead (Pb)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Thallium (Tl)	Tin (Sn)	Vanadium (V)	Zinc (Zn)
Sample ID	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
POND SEDIMENT																				
SED 1	10-Sep-07	6	417	0.4	0.2	0.7	13	9	19	<0.2	9	<0.05	1.2	26	2	<1	<0.3	<1	28	78
SED 2	10-Sep-07	5	401	<0.4	0.5	0.7	11	8	18	<0.2	9	<0.05	1.2	26	1.1	<1	<0.3	<1	24	86
SED 3	10-Sep-07	5	404	<0.4	0.3	0.6	11	8	17	<0.2	8	<0.05	1.1	25	1.1	<1	<0.3	<1	24	75
SED 4	10-Sep-07	6	404	0.4	0.2	0.7	13	9	19	<0.2	10	<0.05	1.2	27	1.1	<1	<0.3	<1	26	80
SED 5	10-Sep-07	5	478	0.4	0.2	0.7	12	8	18	<0.2	9	<0.05	1.3	26	1	<1	<0.3	<1	26	77
SED 6	10-Sep-07	8	404	0.6	0.6	0.7	19	11	24	<0.2	13	0.05	1.7	34	1.2	<1	<0.3	<1	36	98
ASSESSMENT GUIDELINE		5.9	-	-	-	0.6	37.3	-	35.7	-	35	0.17	-	-	-	-	-	-	-	123
CCME CEQG																				
Interim Freshwater Sediment Quality Guidelines (ISQG)		5.9	-	-	-	0.6	37.3	-	35.7	-	35	0.17	-	-	-	-	-	-	-	123
Residential/Parkland land use, fine-textured soil		12	500	4	-	10	64	50	63	0.4	140	6.6	10	50	1	20	1	50	130	200
Industrial land use, fine-textured soil		12	2000	8	-	22	87	300	91	1.4	600	50	40	50	3.9	40	1	300	130	360

Notes:

Canadian Council of Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines* (CEQG), 1999 (Update 7.0, September 2007)

Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Summary Table, update 2002

Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Summary Table, update 6.0.2, November 2006

'-' = Not applicable - parameter not analysed/reported or parameter has no applicable/relevant guideline.

< = Concentration less than the laboratory method detection limit

Yellow highlighting indicates parameter exceeds the sediment quality guideline.

Bold = Parameter exceeds the soil guideline. **Informational purposes only.**

mg/kg = milligrams per kilogram

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
WATER SAMPLE ANALYTICAL RESULTS**

TABLE 12 : SURFACE WATER HYDROCARBONS		Dissolved Hydrocarbons							
		Benzene	Toluene	Ethylbenzene	Xylenes - total	F1 (C6-C10)	F1 (C6-C10) - BTEX	F2 (C10-C16)	
Sample ID	Date	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
SURFACE WATER									
SW1	8-Sep-07	<0.4	<0.4	<0.4	<0.8	<100	<100	<RDL	<0.1
SW2	9-Sep-07	<0.4	<0.4	<0.4	<0.8	<100	<100	<RDL	<0.1
SW3 (Background)	9-Sep-07	<0.4	<0.4	<0.4	<0.8	<100	<100	<RDL	<0.1
<i>Flare Pit Channel</i>	<i>26-Aug-04</i>	<0.0004	<0.0004	<0.0004	<0.0008	-	<0.1	<RDL	<0.1
<i>Site 99-Background</i>	<i>26-Aug-04</i>	-	-	-	-	-	-	-	-
TRIP BLANK	31-Aug-07	<0.4	<0.4	<0.4	<0.8	<100	<100	<RDL	<0.1
ASSESSMENT GUIDELINE		370	2	90	-	-	-	-	-
CCME CEQG Water Quality Freshwater Aquatic Life		370	2	90	-	-	-	-	-

Notes:

Canadian Council of Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines* (CEQG), 1999 (with updates)

Canadian Water Quality Guidelines for the Protection of Aquatic Life (Update 7.1, December 2007)

' - ' = Not applicable - parameter not analysed/reported or parameter has no applicable/relevant guideline.

< = Concentration less than the laboratory method detection limit

 = Highlighting indicates parameter exceeds CCME Freshwater Aquatic Life guideline.

µg/L = Micrograms per litre

mg/L = milligrams per litre

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
WATER SAMPLE ANALYTICAL RESULTS**

TABLE 13 : SURFACE WATER ROUTINE CHEMISTRY			Physical						Cations						Anions					Nitrogen Parameters			
			Electrical Conductivity µS/cm	pH units	Total Hardness as CaCO ₃ mg/L	Total Alkalinity as CaCO ₃ mg/L	Alkalinity (PP as CaCO ₃) mg/L	TDS (Calculated) mg/L	Calcium (D) mg/L	Magnesium (D) mg/L	Sodium (D) mg/L	Potassium (D) mg/L	Iron (D) mg/L	Manganese (D) mg/L	Sulphate (D) mg/L	Chloride (D) mg/L	Bicarbonate mg/L	Carbonate mg/L	Hydroxide mg/L	Ion Balance %	Nitrite (NO ₂) as Nitrogen (N) mg/L	Nitrate (NO ₃) as Nitrogen (N) mg/L	NO ₂ + NO ₃ as N ^c mg/L
Sample ID	Sample Location	Date																					
SURFACE WATER																							
SW1	Pond - West shore	8-Sep-07	630	8.1	250	110	<1	350	63	23	29	2	<0.06	<0.004	79	89	130	<1	<1	1	<0.06	<0.2	<0.2
SW2	Pond - East shore	9-Sep-07	630	8	250	110	<1	350	63	23	29	2	<0.06	<0.004	78	89	140	<1	<1	0.99	<0.06	<0.2	<0.2
SW3 (Background)	Arvoknar Channel	9-Sep-07	300	8.1	140	100	<1	170	38	11	8.1	0.8	<0.06	<0.004	42	6	130	<1	<1	1	<0.06	<0.2	<0.2
<i>Flare Pit Channel</i>		<i>26-Aug-04</i>	-	-	-	-	-	-	99.7	35	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Site 99-Background</i>	<i>Background</i>	<i>26-Aug-04</i>	301	8.16	130	93.5	<0.5	167	36.2	9.7	8	1	-	-	46.3	9.8	114	<0.5	<0.5	0.96	<0.003	0.043	0.043
IN22-04	Pond	29-Aug-02	1140	8.11	300	75.6	<0.5	527	71.1	29	73.6	3.9	0.02	<0.004	71	233	92.2	<0.5	<0.5	0.97	<0.003	<0.003	<0.003
IN22-05	Pond	29-Aug-02	1130	8.1	290	75.8	<0.5	546	70.2	28.8	74.6	4	0.02	0.014	70.7	252	92.5	<0.5	<0.5	0.91	<0.003	<0.003	<0.003
TRIP BLANK		31-Aug-07	1	5.9	<0.5	<1	<1	<10	<0.3	<0.2	<0.5	<0.3	<0.06	<0.004	<1	<1	<1	<1	<1	NC	<0.06	<0.2	<0.2
ASSESSMENT GUIDELINE			-	6.5-9.0	-	-	-	3000	-	-	-	-	0.3	-	-	-	-	-	-	-	0.06	2.9	-
CCME CEQG Water Quality CWQG Freshwater Aquatic Life			-	6.5-9.0	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	0.06 ^A	2.9 ^B	-

Notes:

Canadian Council of Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines* (CEQG), 1999 (with updates)

Canadian Water Quality Guidelines for the Protection of Aquatic Life (Update 7.1, December 2007)

'-' = Not applicable - parameter not analysed/reported or parameter has no applicable/relevant guideline.

< = Concentration less than the laboratory method detection limit

 = Highlighting indicates parameter exceeds CCME Freshwater Aquatic Life guideline.

Bold = Indicates parameter exceeds 2x the background concentration.

TDS = Total Dissolved Solids

^A = Nitrite guideline of 0.060 mg/L is for nitrite-nitrogen (see footnote "z" of CCME CEQG).

^B = Nitrate guideline is 13 mg/L, which is equivalent to 2.9 mg/L nitrate-nitrogen (see footnote "y" of CCME CEQG).

^C = Nitrite and Nitrite+Nitrate guidelines are interpreted to be "As N".

* = Hydrocarbon odour

mg/L = Milligrams per litre

µS/cm = MicroSiemens per centimetre

TOC = Top of Casing

BOH = Bottom of Hole

NM = Not measured

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
WATER SAMPLE ANALYTICAL RESULTS**

TABLE 14 : SURFACE WATER METALS		pH	Total Hardness as CaCO ₃	DISSOLVED METALS																													
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
Sample ID	Date	units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
SW1	8-Sep-07	8.1	250	0.011	<0.0002	<0.001	-	<0.001	-	<0.0002	<0.001	<0.0003	0.0028	-	<0.0002	-	-	0.0047	0.0064	-	-	0.002	-	<0.0001	-	-	-	<0.0002	<0.001	0.002	0.0015	<0.001	<0.003
SW2	9-Sep-07	8	250	0.01	<0.0002	<0.001	-	<0.001	-	<0.0002	<0.001	<0.0003	0.0029	-	<0.0002	-	-	0.0035	0.0057	-	-	0.001	-	<0.0001	-	-	-	<0.0002	<0.001	0.002	0.0014	<0.001	<0.003
SW3 (Background)	9-Sep-07	8.1	140	0.02	0.001	<0.001	0.04	<0.001	<0.02	<0.0002	<0.001	<0.0003	0.0023	-	<0.0002	<0.02	-	0.0015	0.0036	<0.1	-	<0.001	1.8	<0.0001	-	0.22	14	<0.0002	0.002	0.001	0.0012	<0.001	<0.003

		pH	Total Hardness as CaCO ₃	TOTAL METALS																														
Sample ID	Date			units	mg/L	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphur	Thallium	Tin	Titanium	Uranium	Vanadium
SW1	8-Sep-07	8.1	250	0.061	0.001	<0.001	0.16	<0.001	<0.02	<0.0002	<0.001	<0.0003	0.0019	0.19	<0.0002	<0.02	0.013	0.0021	0.0038	<0.1	2	0.001	0.2	<0.0001	28	0.42	23	<0.0002	<0.001	0.002	0.001	<0.001	<0.003	
SW2	9-Sep-07	8	250	0.16	<0.0002	<0.001	0.18	<0.001	<0.02	<0.0002	<0.001	<0.0003	0.0023	0.43	<0.0002	<0.02	0.017	0.0021	0.0045	<0.1	2	<0.001	0.4	<0.0001	28	0.42	23	<0.0002	<0.001	0.003	0.0009	<0.001	<0.003	
SW3 (Background)	9-Sep-07	8.1	140	0.82	<0.0002	0.001	0.08	<0.001	<0.02	<0.0002	0.001	0.0007	0.0026	1.6	0.0007	<0.02	0.036	0.0011	0.004	0.1	1.3	<0.001	5	<0.0001	7.4	0.23	12	<0.0002	<0.001	0.013	0.0008	0.003	0.012	
Flare Pit Channel	26-Aug-04	-	-	12.7	0.0006	0.006	2.36	0.0005	0.03	0.0011	0.023	0.0103	0.0443	22.9	0.0802	0.022	0.506	0.0018	0.00305	1	4	<0.007	16.7	0.0001	7.6	0.32	13.5	0.0003	<0.001	0.103	0.002	0.038	0.147	
TRIP BLANK	31-Aug-07	5.9	<0.5	0.002	<0.0002	<0.001	<0.01	<0.001	<0.02	<0.0002	0.002	<0.0003	<0.0002	<0.06	<0.0002	<0.02	<0.004	<0.0002	<0.0005	<0.1	<0.3	<0.001	<0.1	<0.0001	<0.5	<0.02	<0.2	<0.0002	<0.001	<0.001	<0.0001	<0.001	<0.003	
ASSESSMENT GUIDELINE				0.1	-	0.005	-	-	-	0.0000636	1.1	-	0.004	0.3	0.007	-	-	0.073	0.15	-	-	0.001	-	0.0001	-	-	-	0.0008	-	-	-	-	0.03	
CCME CEQG Water Quality Freshwater Aquatic Life				0.1 ^A	-	0.005	-	-	-	0.0000636 ^B	1.1 ^C	-	0.004 ^D	0.3	0.007 ^E	-	-	0.073	0.15 ^F	Varies ^G	-	-	0.001	-	0.0001	-	-	-	0.0008	-	-	-	-	0.03

Notes:
 Canadian Council of Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines* (CEQG), 1999 (with updates)
Canadian Water Quality Guidelines for the Protection of Aquatic Life (Update 7.1, December 2007)
 '-' = Not applicable - parameter not analysed/reported or parameter has no applicable/relevant guideline
 '<' = Concentration less than the laboratory method detection limit
 [Yellow Highlight] = Highlighting indicates parameter exceeds CCME Freshwater Aquatic Life guideline.
 CaCO₃ - Calcium carbonate
 mg/L = Milligrams per litre
 Average pH = 8.1
 Average hardness = 213 mg/L

^A = Aluminum guideline for the protection of freshwater aquatic life varies with pH:
 0.005 mg/L at pH < 6.5
 0.1 mg/L at pH ≥ 6.5
^B - Cadmium guideline for freshwater aquatic life is a calculated value = 10^{(0.86*[LOG(Hardness value)]-0.32)}
^C = Guidelines exist for trivalent chromium (Cr(III)) and hexavalent chromium (Cr(VI)) only. The sum of Cr(III) + Cr(VI) guidelines are used as a general guideline for total chromium.
^D = Copper guideline for the protection of freshwater aquatic life varies with CaCO₃ concentration (total hardness as CaCO₃):
 0.002 mg/L at CaCO₃ = 0-120 mg/L
 0.003 mg/L at CaCO₃ = 120-180 mg/L
 0.004 mg/L at CaCO₃ = >180 mg/L

^E = Lead guideline for the protection of freshwater aquatic life varies with CaCO₃ concentration (total hardness as CaCO₃):
 0.001 mg/L at CaCO₃ = 0-60 mg/L
 0.002 mg/L at CaCO₃ = 60-120 mg/L
 0.004 mg/L at CaCO₃ = 120-180 mg/L
 0.007 mg/L at CaCO₃ = >180 mg/L
^F = Nickel guideline for the protection of freshwater aquatic life varies with CaCO₃ concentration (total hardness as CaCO₃):
 0.025 mg/L at CaCO₃ = 0-60 mg/L
 0.065mg/L at CaCO₃ = 60-120 mg/L
 0.110 mg/L at CaCO₃ = 120-180 mg/L
 0.15 mg/L at CaCO₃ = >180 mg/L
^G = CCME Total Phosphorous guidelines vary according to the trophic status of the ecosystem.

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
WATER SAMPLE ANALYTICAL RESULTS**

TABLE 15 : GROUNDWATER HYDROCARBONS		Dissolved Hydrocarbons							
		Benzene	Toluene	Ethylbenzene	Xylenes - total	F1 (C6-C10)	F1 (C6-C10) - BTEX	F2 (C10-C16)	
Sample ID	Date	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
GROUNDWATER									
MW1	11-Sep-07	<0.4	<0.4	<0.4	<0.8	<100	<100	200	0.2
MW6	11-Sep-07	<0.4	<0.4	<0.4	<0.8	<100	<100	<RDL	<0.1
MW8	11-Sep-07	<0.4	<0.4	<0.4	<0.8	<100	<100	<RDL	<0.1
MW9	12-Sep-07	28.3	76.9	9.1	92.7	516	309	600	0.6
ASSESSMENT GUIDELINE		370	2	90	-	-	-	-	-
CCME CEQG Water Quality Freshwater Aquatic Life		370	2	90	-	-	-	-	-

Notes:

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' - ' = Not applicable - parameter not analysed/reported or parameter has no applicable/relevant guideline.

< = Concentration less than the laboratory method detection limit

 = Highlighting indicates parameter exceeds CCME Freshwater Aquatic Life guideline.

µg/L = Micrograms per litre

mg/L = milligrams per litre

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
WATER SAMPLE ANALYTICAL RESULTS**

TABLE 16 : GROUNDWATER ROUTINE CHEMISTRY		Monitoring Results					Physical						Cations					Anions					Nitrogen Parameters				
		Ground to BOH m	TOC to BOH m	TOC to Static Water Level m	pH	Electrical Conductivity µS/cm	Electrical Conductivity µS/cm	pH units	Total Hardness as CaCO ₃ mg/L	Total Alkalinity as CaCO ₃ mg/L	Alkalinity (PP as CaCO ₃) mg/L	TDS (Calculated) mg/L	Calcium (D) mg/L	Magnesium (D) mg/L	Sodium (D) mg/L	Potassium (D) mg/L	Iron (D) mg/L	Manganese (D) mg/L	Sulphate (D) mg/L	Chloride (D) mg/L	Bicarbonate mg/L	Carbonate mg/L	Hydroxide mg/L	Ion Balance %	Nitrite (NO ₂) as Nitrogen (N) mg/L	Nitrate (NO ₃) as Nitrogen (N) mg/L	NO ₂ + NO ₃ as N ^C mg/L
Sample ID	Date																										
GROUNDWATER																											
MW1	11-Sep-07	4.42	5.14	4.134	6	241	3500	7.3	2700	850	<1	3100	830	140	43	14	0.11	7.5	1500	110	1000	<1	<1	1.1	<0.06	<0.2	<0.2
MW6	11-Sep-07	3.35	3.762	1.315	5.8	357	4100	7.3	2200	700	<1	3300	650	140	150	35	0.89	10	1500	390	850	<1	<1	0.92	<0.06	<0.2	<0.2
MW7	11-Sep-07	NM	3.51	2.378	5.08	1040	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW8	11-Sep-07	3.2	3.9	1.581	5.25	991	2000	7.4	1000	420	<1	1500	300	60	120	7.7	0.23	1.2	620	130	510	<1	<1	1	<0.06	0.7	0.7
MW9 *	12-Sep-07	3.048	3.535	1.575	-	-	31000	13	1500	3500	3200	16000	600	0.4	1500	5100	<0.06	<0.004	10	6300	<1	330	1000	0.91	<0.06	<0.2	<0.2
MW10 (Background)	12-Sep-07	2.1	2.99	2.27	-	-	1200	7.8	290	140	<1	790	81	20	150	11	0.43	0.075	330	110	170	<1	<1	0.98	<0.06	1	1
MW1 Lab-Dup	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1500	110	-	-	-	-	<0.06	<0.2	-
TRIP BLANK	31-Aug-07	-	-	-	-	-	1	5.9	<0.5	<1	<1	<10	<0.3	<0.2	<0.5	<0.3	<0.06	<0.004	<1	<1	<1	<1	<1	NC	<0.06	<0.2	<0.2
ASSESSMENT GUIDELINE							-	6.5-9.0	-	-	-	3000	-	-	-	-	0.3	-	-	-	-	-	-	-	0.060	2.9	-
CCME CEQG Water Quality CWQG Freshwater Aquatic Life							-	6.5-9.0	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	0.06 ^A	2.9 ^B	-

Notes:

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< = Concentration less than the laboratory method detection limit

Yellow highlighting indicates parameter exceeds CCME Freshwater Aquatic Life guideline.

Bold = Indicates parameter exceeds 2x the background concentration.

TDS = Total Dissolved Solids

^A = Nitrite guideline of 0.060 mg/L is for nitrite-nitrogen (see footnote "z" of CCME CEQG).

^B = Nitrate guideline is 13 mg/L, which is equivalent to 2.9 mg/L nitrate-nitrogen (see footnote "y" of CCME CEQG).

^C = Nitrite and Nitrite+Nitrate guidelines are interpreted to be "As N".

* = Hydrocarbon odour

mg/L = Milligrams per litre

µS/cm = MicroSiemens per centimetre

TOC = Top of Casing

BOH = Bottom of Hole

NM = Not measured

**SHELL CANADA ENERGY - UNIPKAT I-22
ENVIRONMENTAL SITE ASSESSMENT
WATER SAMPLE ANALYTICAL RESULTS**

TABLE 17 : GROUNDWATER METALS		pH	Total Hardness as CaCO ₃	DISSOLVED METALS																													
				Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
Sample ID	Date	units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
MW01	11-Sep-07	7.3	2700	0.003	0.0003	0.005	0.06	<0.001	0.05	0.0011	0.004	0.051	0.0098	-	<0.0002	0.1	-	0.0021	0.11	0.1	-	0.013	7.2	<0.0001	-	2.2	480	<0.0002	0.004	0.041	0.04	0.001	0.021
MW1 Lab-Dup	-	-	-	0.003	0.0003	0.005	-	<0.001	-	0.001	0.004	0.054	0.011	-	<0.0002	-	-	0.0021	0.12	-	-	0.014	-	<0.0001	-	-	-	<0.0002	0.005	0.045	0.039	0.002	0.022
MW06	11-Sep-07	7.3	2200	0.006	<0.0002	0.002	0.03	<0.001	0.06	0.0009	0.003	0.067	0.0078	-	<0.0002	0.1	-	0.0011	0.12	<0.1	-	0.007	4.4	<0.0001	-	2.1	420	<0.0002	0.004	0.038	0.02	<0.001	0.041
MW08	11-Sep-07	7.4	1000	0.067	<0.0002	0.002	0.1	<0.001	0.03	0.0002	0.003	0.0071	0.0052	-	0.0004	0.06	-	0.0024	0.037	<0.1	-	0.005	3.7	<0.0001	-	1.3	200	<0.0002	<0.001	0.022	0.016	<0.001	0.007
MW09	12-Sep-07	13	1500	0.038	<0.0002	<0.001	2.3	<0.001	<0.02	<0.0002	0.003	0.0009	0.0027	-	0.0003	0.36	-	0.064	0.11	0.1	-	0.006	0.4	<0.0001	-	11	6.9	<0.0002	0.001	0.005	<0.0001	<0.001	<0.003
MW1 Dup RPD	-	-	-	0%	0%	NC	NC	NC	NC	NC	NC	6%	12%	NC	NC	NC	NC	0%	9%	NC	NC	7%	NC	NC	NC	NC	NC	NC	NC	9%	3%	NC	5%

				TOTAL METALS																													
Sample ID	Date	pH	Total Hardness as CaCO ₃	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Manganese	Molybdenum	Nickel	Phosphorous	Potassium	Selenium	Silicon	Silver	Sodium	Strontium	Sulphur	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc
MW01	11-Sep-07	7.3	2700	0.47	<0.0002	0.003	0.09	<0.001	0.05	0.0007	0.001	0.031	0.0065	0.72	0.0008	0.11	7.8	0.0014	0.05	<0.1	16	0.009	11	<0.0001	46	2.2	540	<0.0002	<0.001	0.058	0.026	0.001	0.016
MW06	11-Sep-07	7.3	2200	0.12	<0.0002	0.002	0.05	<0.001	0.06	0.0004	<0.001	0.046	0.0047	1.4	0.0003	0.1	11	0.0005	0.069	0.2	37	0.005	5	<0.0001	160	2.1	460	<0.0002	<0.001	0.029	0.016	<0.001	0.032
MW08	11-Sep-07	7.4	1000	57	<0.0002	0.068	2.7	0.007	0.09	0.0054	0.11	0.082	0.18	190	0.12	0.2	4.3	0.0089	0.24	4.9	20	0.004	110	0.0006	130	1.7	180	0.0009	<0.001	0.31	0.024	0.2	0.87
MW09	12-Sep-07	13	1500	1.3	<0.0002	0.006	17	<0.001	<0.02	<0.0002	0.013	0.0022	0.01	3.7	0.013	0.2	0.067	0.041	0.073	0.3	4300	0.009	11	<0.0001	1300	9.5	11	<0.0002	<0.001	0.049	0.0003	0.003	0.032
TRIP BLANK	31-Aug-07	-	-	0.002	<0.0002	<0.001	<0.01	<0.001	<0.02	<0.0002	0.002	<0.0003	<0.0002	<0.06	<0.0002	<0.02	<0.004	<0.0002	<0.0005	<0.1	<0.3	<0.001	<0.1	<0.0001	<0.5	<0.02	<0.2	<0.0002	<0.001	<0.001	<0.0001	<0.001	<0.003
ASSESSMENT GUIDELINE				0.1	-	0.005	-	-	-	0.0004072	0.0099	-	0.004	0.3	0.007	-	-	0.073	0.15	-	-	0.001	-	0.0001	-	-	-	0.0008	-	-	-	-	0.03
CCME CEQG Water Quality Freshwater Aquatic Life				0.1 ^A	-	0.005	-	-	-	0.0004072 ^B	0.0099 ^C	-	0.004 ^D	0.3	0.007 ^E	-	-	0.073	0.15 ^F	Varies ^G	-	0.001	-	0.0001	-	-	-	0.0008	-	-	-	-	0.03

Notes:
 Canadian Council of Ministers of the Environment (CCME) *Canadian Environmental Quality Guidelines* (CEQG), 1999 (with updates)
Canadian Water Quality Guidelines for the Protection of Aquatic Life (Update 7.1, December 2007)
 - = Not applicable - parameter not analysed/reported or parameter has no applicable/relevant guideline
 < = Concentration less than the laboratory method detection limit
 [Yellow Highlight] = Highlighting indicates parameter exceeds CCME Freshwater Aquatic Life guideline.
 CaCO₃ - Calcium carbonate
 mg/L = Milligrams per litre
 Average pH = 8.75
 Average hardness = 1850 mg/L

^A = Aluminum guideline for the protection of freshwater aquatic life varies with pH:
 0.005 mg/L at pH < 6.5
 0.1 mg/L at pH ≥ 6.5

^B = Cadmium guideline for freshwater aquatic life is a calculated value = 10^{[0.86*(LOG[Hardness value]-0.32)]}

^C = Guidelines exist for trivalent chromium (Cr(III)) and hexavalent chromium (Cr(VI)) only. The sum of Cr(III) + Cr(VI) guidelines are used as a general guideline for total chromium.

^D = Copper guideline for the protection of freshwater aquatic life varies with CaCO₃ concentration (total hardness as CaCO₃):
 0.002 mg/L at CaCO₃ = 0-120 mg/L
 0.003 mg/L at CaCO₃ = 120-180 mg/L
 0.004 mg/L at CaCO₃ = >180 mg/L

^E = Lead guideline for the protection of freshwater aquatic life varies with CaCO₃ concentration (total hardness as CaCO₃):
 0.001 mg/L at CaCO₃ = 0-60 mg/L
 0.002 mg/L at CaCO₃ = 60-120 mg/L
 0.004 mg/L at CaCO₃ = 120-180 mg/L
 0.007 mg/L at CaCO₃ = >180 mg/L

^F = Nickel guideline for the protection of freshwater aquatic life varies with CaCO₃ concentration (total hardness as CaCO₃):
 0.025 mg/L at CaCO₃ = 0-60 mg/L
 0.065mg/L at CaCO₃ = 60-120 mg/L
 0.110 mg/L at CaCO₃ = 120-180 mg/L
 0.15 mg/L at CaCO₃ = >180 mg/L

^G = CCME Total Phosphorous guidelines vary according to the trophic status of the ecosystem.