1788

PROJECT DESCRIPTION
FOR THE PROPOSED PETRO-CANADA NUNA
WINTER 2002/2003 DRILLING PROGRAM

Prepared for:

Petro-Canada
Calgary, Alberta

Prepared by:

IEG
Inuvialuit Environmental & Geotechnical Inc.

Calgary, Alberta and Inuvik, Northwest Territories

July 2002
Project #5292-02

PROJECT DESCRIPTION
FOR THE PROPOSED PETRO-CANADA
NUNA WINTER 2002/2003 DRILLING PROGRAM

Submitted by:

Petro-Canada
150 – 6th Avenue S.W.
Calgary, Alberta
T2P 3E3

DISTRIBUTION:

6 Copies	John Kerkhoven, Petro-Canada Calgary, AB
11 Copies	Environmental Impact Screening Committee Inuvik, NT
20 Copies	GNWT Water Board Yellowknife, NT
30 Copies	Indian and Northern Affairs Canada Inuvik, NT
12 Copies	Inuvialuit Land Administration Tuktoyaktuk, NT
2 Copies	Department of Fisheries and Oceans Inuvik, NT and Yellowknife, NT
3 Copies	National Energy Board Calgary, AB
4 Copies	Inuvialuit Environmental & Geotechnical Inc. Calgary, AB and Inuvik, NT

EXECUTIVE SUMMARY

Petro-Canada is applying to conduct a winter 2003 drilling program in the Mackenzie Delta Region of the Northwest Territories. The proposed project is in the Inuvialuit Settlement Region (ISR) and involves three (3) proposed drill locations, one or two of which will be drilled. A north location will be drilled first, and pending seismic interpretation, one of two south locations may be drilled. The proposed drill locations are situated on tundra uplands over 20 km to the northwest of the Husky Lakes estuary with each drill pad and associated facilities expected to occupy approximately 3.6 ha. Pending regulatory approval, activities are scheduled to commence with road building in late October 2002.

Inuvialuit Environmental & Geotechnical Inc. (IEG) has been commissioned by Petro-Canada to prepare this Project Description for the Petro-Canada Winter 2002/2003 Nuna Drilling Program. The Project Description has been prepared to meet the requirements of the Inuvialuit Land Administration (ILA), Indian and Northern Affairs Canada (INAC) and fulfill the Operating Guidelines and Procedures of the Environmental Impact Screening Committee (EISC).

The proposed program is located primarily in the tundra upland environment of the lower Tuktoyaktuk Peninsula and northwest of the Husky Lakes estuary. Tundra vegetation is dominated by shrub-heath communities with hummocky terrain throughout the program area.

The drilling program has been developed with the consideration of minimizing impacts on the environment and land users. However, the potential exists for certain environmental impacts to occur over the course of the program. Potential environmental concerns for the project may include temporary alteration of vegetation, and wildlife habitat, as well as short-term wildlife displacement.

Protection measures designed to mitigate the potential environmental impacts will be utilized and no significant residual impacts have been identified. Petro-Canada and their drilling contractor, Akita-Equtak, and other contracted field services, are committed to following these measures in order to minimize the risk of potential environmental impacts and disturbance of culturally and historically significant areas.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

LIST OF DRAWINGS

1.0 CONTACT NAMES AND ADDRESSES

(Petro-Canada Primary Contact)

John Kerkhoven
Supervisor Surface Land
Petro-Canada
150 – 6th Avenue S.W.
Calgary, Alberta T2P 3E3
Phone: (403) 296-6345
Fax: (403) 296-3032
Cell: (403) 804-2387
Email: jkerkhov@petro-canada.ca

(Petro-Canada Alternate Drilling Contact)

Don Thompson
Logistics Superintendent, Drilling
Petro-Canada
150 – 6th Avenue S.W.
Calgary, Alberta T2P 3E3
Phone: (403) 296-6799
Fax: (403) 296-3740
Cell: (403) 860-9186
Email: dthompso@petro-canada.ca

2.0 REGULATORY APPROVALS

Petro-Canada is applying to construct an access road and drill one or two winter exploratory wells in the Mackenzie Delta region of the Northwest Territories. Of the three (3) well locations indicated in Figure 1, the north location will be drilled first, and pending seismic interpretation will determine whether one of the two south locations will be drilled this winter. The wellsites will be located either on Crown lands or Inuvialuit 7(1)(b) land, access will be located on private Inuvialuit lands, and therefore the application will fall under Federal and/or Inuvialuit regulatory jurisdiction. The primary agencies with jurisdiction over the project include the Inuvialuit Land Administration (ILA), Indian and Northern Affairs Canada (INAC), the National Energy Board (NEB), and the Northwest Territories Water Board.

Other agencies with regulatory interest in the approval process include: Fisheries and Oceans Canada (DFO) with reference to potential effects on fish and fish habitat; the Government of the Northwest Territories (GNWT) Resources, Wildlife and Economic Development (RWED), regarding wildlife and associated habitat; the Prince of Wales Northern Heritage Centre (PWNHC) for an archaeological and historical resources review and Environment Canada (EC) in regard to pollution prevention. The Environmental Impact Screening Committee (EISC) is an advisory committee responsible for screening all proposed projects on Crown Land.

Should the EISC determine that the project might have a significant negative impact, the Project Description will be referred to the Environmental Impact Review Board (EIRB) or other equivalent environmental review process for a public assessment and review pursuant to clause 11(24).

Approvals required for this project are summarized in Table 1. Petro-Canada will contact the agencies listed as appropriate, and will satisfy any requirements they may have in their respective areas of jurisdiction.

TABLE 1
APPROVALS REQUIRED

Agency	Approval Required/*Governing Legislation*	Status
Linda Graf Secretary Environmental Impact Screening Committee P.O. Box 2120 Inuvik, NT X0E 0T0	Approval on Project Description *Inuvialuit Final Agreement*	Submitted August 2, 2002
Rudy Cockney District Manager, Northern Mackenzie District Indian and Northern Affairs Canada P.O. Box 2100 Inuvik, NT X0E 0T0	Land Use Permit *Territorial Lands Act* *Territorial Land Use Regulations*	Submitted August 2, 2002
James Thorbourne Lands Administrator Inuvialuit Land Administration P.O. Box 290 Tuktoyaktuk, NT X0E 1C0	Class A Land Use Permit *Inuvialuit Final Agreement*	Submitted August 2, 2002
Gordon Wray Chairman Northwest Territories Water Board 4920 – 52nd Street P.O. Box 1500 Yellowknife, NT X1A 2R3	Class B Water Licence *NWT Waters Act* *NWT Waters Regulations*	Submitted August 2, 2002
Rudy Bergman Data Coordinator National Energy Board 444 – 7th Avenue SW Calgary, AB T2P 0X8	Authorization to Drill a Well *Canada Oil and Gas Operations Act*	To be submitted within 21 days of well spud

3.0 TITLE

Petro-Canada Winter 2002/2003 Nuna Drilling Program.

4.0 DEVELOPMENT SUMMARY

4.1 Project Scope

Petro-Canada is proposing to drill one or two new exploratory wells, selected from three potential locations within the Nuna area (Table 2), during the winter of 2002/2003 (Figure 1). The wells will be drilled to a depth between 3,000 – 4,000 m. The potential wellsite locations are within EL 406, and depending on the final sites selected, the wells may be drilled on Crown and/or Inuvialuit 7(1)(b) land. The wellsite locations will be finalized in October when interpretation of last year's Nuna 3D seismic data is complete. The final wellsite location(s) may differ from the conceptual locations identified, but will be

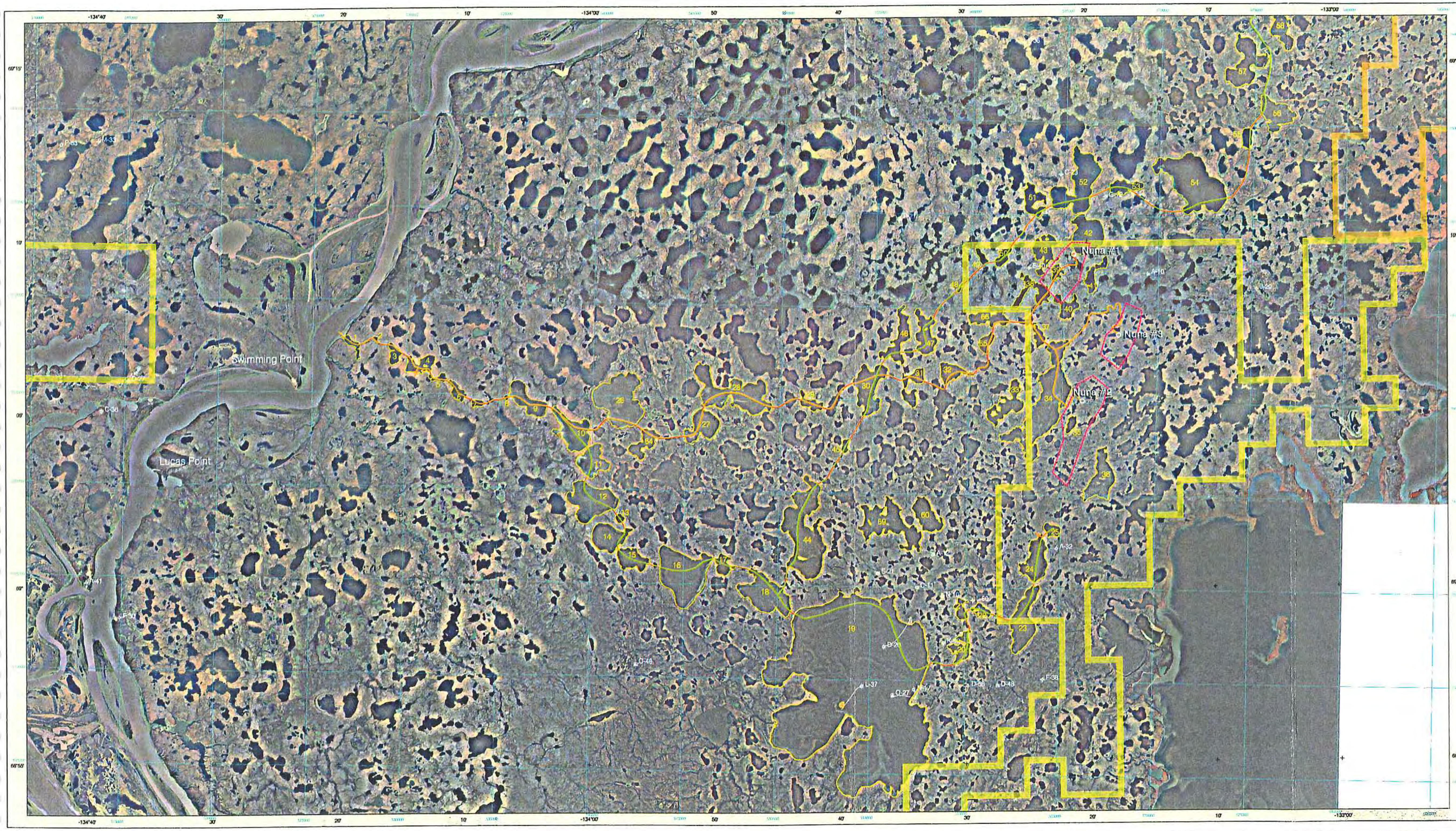
located within the prospect areas identified in Figure 1 and Table 2. The most northerly location will be drilled first (Nuna #1), and the results of seismic interpretation will better determine whether the south location (Nuna #2 or Nuna #3) will be drilled this winter. For the purposes of this environmental assessment, the areas surrounding the proposed well locations has been included within the area referred to as the proposed project location and all three potential locations have been assessed.

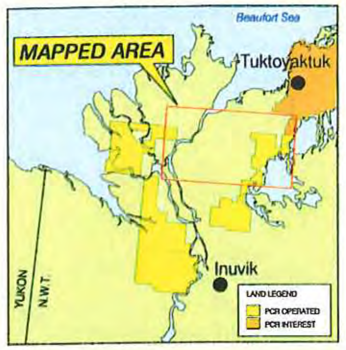
TABLE 2
PROPOSED WELLSITE LOCATIONS

WELL REFERENCE	STATUS	LOCATION
Preliminary Wellsite Locations		
Nuna #1	New	Lat/Long: 69°09.57'N – 133°20.91'W UTM: Zone 8 571256E 7666553N
Nuna #2	New	Lat/Long: 69°05.28'N – 133°20.42' W UTM: Zone 8 571812E 7660991N
Nuna #3	New	Lat/Long: 69°07.33' N – 133°17.71' W UTM: Zone 8 572549E 7663244N

The access to the wellsites will begin at Swimming Point (logistics base), utilize the access east of the Mackenzie River, and then follow a direct route to the wellsite. The access will be constructed over large lakes, with limited overland sections (Figure 1). On overland sections the width of the access will be restricted to 20 m, while on waterbodies the width will be increased to 50 m (for safety reasons). The access and drilling lease will be prepared using the same equipment and procedures. Once the ground surface is frozen and has adequate snow cover, a tracked machine will pull a rubber-tired drag over the surface, and the area will be flooded. If additional snow is required it will be collected from either snow traps or the lakes.

Akita-Equtak will be the drilling contractor and Akita-Equtak Rig #60 and/or Rig #63 will be used for drilling operations on the program. The winter well locations will have a 150 m x 150 m rig pad, with an attached 100 m x 80 m camp pad, a 50 m x 50 m fuel storage pad, a 30 m x 70 m sump area, and a detached 30 m x 30 m helipad (Drawing 1). Depending on the locations selected however, local topography may dictate that pad sizes be increased marginally.





Area of Numbered Lakes

Lake	Total Area (metres²)	Lake Centroid UTM Coordinate (X,Y)	Lake	Total Area (metres²)	Lake Centroid UTM Coordinate (X,Y)
1	396827.1	527107.9951, 7667535.6983	32	1083766.8	569073.4092, 7666544.0767
2	73839.5	528370.5829, 7667840.6423	33	* 1874471.2	562022.2548, 7664946.8933
3	636649.6	529370.6345, 7667074.3724	34	8080273.1	564042.4722, 7664902.8456
4	* 1021569.4	530780.5625, 7666535.9087	35	357994.0	565502.9539, 7663645.[illegible]
5	282389.5	531745.4508, 7666839.3941	36	2530660.3	567129.3361, 7660993.0027
6	582371.3	532747.4881, 7665113.8958	37	548021.5	563667.8201, 7666573.8511
7	208174.7	533874.8045, 7664497.9449	38	1430357.5	563117.3014, 7670606.3415
8	60414.6	535398.1310, 7664627.5740	39	385160.0	564902.5204, 7671997.0062
9	1905621.5	536461.6646, 7664712.2664	40	680078.9	565158.0080, 7670158.5419
10	2647093.8	538037.7327, 7663049.3334	41	660687.3	566508.8465, 7671830.2516
11	1823611.2	540018.1687, 7661478.0787	42	2711806.0	566178.8452, 7674019.9434
12	3740719.3	539987.6525, 7660541.8661	43	* 1058134.2	563919.6004, 7673099.7781
13	175893.5	541539.2889, 7658443.6172	44	* 7336527.9	551410.0893, 7667870.4633
14	2186939.4	540960.7317, 7657421.8873	45	230611.6	553472.3736, 7662531.6001
15	1484497.5	542214.8712, 7656763.2180	46	1828453.3	558245.2813, 7668316.0681
16	5903099.8	544985.4663, 7656499.8634	47	* 1729026.2	557647.5336, 7666607.3061
17	754467.5	547088.5718, 7656052.2739	48	82290.1	559435.6272, 7671066.9308
18	3831067.2	549372.7941, 7654512.3173	49	299968.8	560606.3125, 7672757.7908
19	* 63438161.0	554271.6291, 7649617.4716	50	519569.4	561893.4256, 7672749.6931
20	1064198.5	558038.7838, 7651781.9258	51	1286793.4	563288.0895, 7675908.4325
21	538776.7	558782.5956, 7653873.8362	52	4636718.0	565653.8940, 7676701.7644
22	438906.9	560659.7030, 7653793.2961	53	937009.7	568148.0406, 7676664.5880
23	3096143.9	563121.7725, 7653261.1149	54	6985464.3	571798.6808, 7676647.0707
24	2291529.6	563712.6966, 7656600.6580	55	628397.2	574606.5628, 7679298.6819
25	471968.0	564667.1523, 7658156.3736	56	2109642.6	576158.6662, 7680800.7875
26	5366489.4	541428.0193, 7661787.8817	57	3170081.1	574464.1718, 7683290.8159
27	2080779.6	545801.0343, 7663469.4777	58	1971679.4	576400.5801, 7685008.0078
28	5249136.2	547442.4087, 7660291.1730	59	* 4254684.2	560820.0428, 7664348.8878
29	617117.0	551585.6291, 7664807.0381	60	1795806.0	567899.7871, 7664841.5493
30	2978048.4	554717.8190, 7665657.4465	64	1773988.7	547780.4496, 7662495.8662
31	1193364.4	557013.8756, 7665779.9505	65	591103.8	560698.4190, 7668167.4564
			66	* 1495361.1	541064.2102, 7669658.4253

* Area of islands within lake has been subtracted

Distance (of land only) Between Lakes

Lake	Distance (m)	Lake	Distance (m)	Lake	Distance (m)
1 to 2	340.6	10 to 11	85.1	18 to 44	577.1
2 to 3	537.0	11 to 12	295.4	44 to 45	1453.4
3 to 4	* 373.1	12 to 13	330.4	45 to 30	1600.9
4 to 5	161.1	13 to 14	372.5	30 to 46	353.9
5 to 6	136.0	14 to 15	202.7	46 to 47	413.3
6 to 7	416.0	15 to 16	511.6	47 to 48	1246.1
7 to 8	604.3	16 to 17	94.2	48 to 49	1391.6
8 to 9	46.0	17 to 18	793.8	49 to 50	411.3
9 to 10	301.0	18 to 19	321.6	50 to 51	1789.5
10 to 26	858.6	19 to 20	1009.1	51 to 52	370.6
26 to 64	[illegible]	20 to 21	613.1	52 to 53	1216.6
64 to 27	[illegible]	21 to 22	194.4	53 to 54	2336.6
27 to 28	186.3	22 to 23	973.9	54 to 55	2774.7
28 to 29	909.5	23 to 24	143.2	55 to 56	1014.2
29 to 30	784.8	24 to 25	* 202.4		
30 to 31	636.2				
31 to 32	754.2				
32 to 65	580.6				
65 to 66	303.3				
66 to 37	476.7				
37 to 38	401.2				
38 to 39	644.1				
39 to 42	965.1				
37 to 34	229.4				

* Arrows on map indicate portions not included in totals

Traditional Access
Proposed Access
Prospects

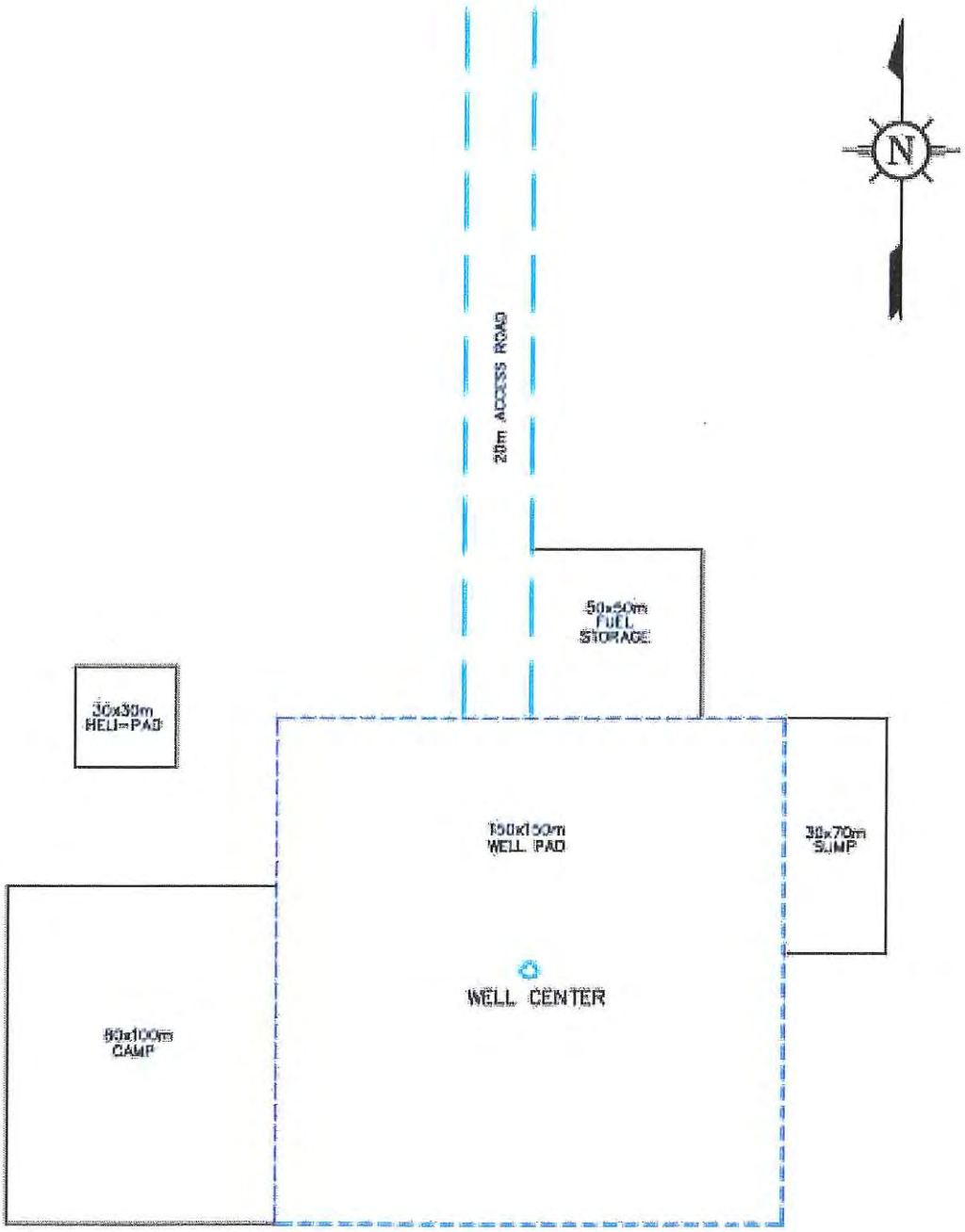
Northern Frontier
Mackenzie Delta - NWT

Swimming Point, Lucas Point Parsons Lake & Nuna Area Proposed Access Road

AUTHOR: D. THOMPSON W. ADAMS	SEISMIC:	DATE: 02-07-17
	WELLS:	REV DATE:
MAP SCALE: 1: 50 000	LAND:	C.I.:
		CADD TECH.: AG
RASTER IMAGE: 10317a.hmr; 10317lnd.hmr		FILE: 10317a.map

PETRO-CANADA

GEOLOGICAL & GEOPHYSICAL TECHNICAL GRAPHICS



INUKSHUK
Geomatics Inc.
300-8940 FISHER ROAD S.E.
CALGARY, ALBERTA T2H 2H9
PH (403) 253-0131
FAX (403) 253-1985
Email calgary@inuksuk.com

REVISION TABLE			
No.	DESCRIPTION	DATE	BY

PETRO CANADA

DRAWING 1

TYPICAL NUNA WELLSITE LAYOUT

NORTHWEST TERRITORIES
SCALE 1 : 2000

DATE :	DRAWN :	FILE No.
JUNE 27/02	B.S.S.	02-13498

4.2 Drilling Program Description

4.2.1 Well Siting and Access Route Selection

The potential well locations and access route have been selected to:

- Utilize the most direct route to the wellsite(s), thus requiring the least amount of overland disturbance;
- Satisfy technical requirements of the drilling program;
- Utilizes Swimming Point as a logistics base;
- Utilize existing and previous access routes along the East Channel and Pete's Creek, where feasible;
- Maximize safety considerations;
- Avoid known moose habitat (access route) as identified through community consultation;
- Avoid sensitive or unique habitats for plants and animals;
- Avoid any known archaeological or paleontological sites;
- Minimize cost; and
- Avoid important site-specific cultural features and traditionally important lands.

Petro-Canada is in discussions with other operator(s) who plan to utilize similar roads this season in order to share access, where feasible, to minimize overall disturbance and costs. The access route is shown in Figure 1, with distances summarized in Table 3.

TABLE 3
PROPOSED ACCESS ROUTES

ROUTE	DISTANCE (km)			AREA (ha) based on route widths of 50 m on water and 20 m on land		
	Land	*Water*	*Total*	*Land*	*Water*	*Total*
North Nuna Route	10.0	35.2	45.7	20.0	176.0	196.0

4.2.2 Access Route and Well Site Construction

Construction crews will be based at the Swimming Point Base Camp and, to facilitate an early season start, equipment will be staged on a large high gravel bar approximately 4 km northeast of Swimming Point, at Lat/Long: 68° 7' N, 134° 20' W; UTM: Zone 8, 533342E 7550885N. To facilitate this early start, one 1000 gallon (3785 litre) double-walled Enviro-Tank of diesel will also be stored at the site. The fuel will be moved at the start of construction and will advance with construction. The 45.2 km access route will be constructed primarily on lakes, with approximately 10.0 km of overland access required to connect the lakes (see map pocket and Figure 1).

Access and wellsite construction will begin once the ground surface is frozen and has adequate snow cover. Should any vegetation clearing be required, willows will be cut, and the removed vegetation will be spread evenly on the site. Where slopes are unavoidable and high banks (>1 m) hinder access, snow and/or ice ramps made of clean snow and water will be constructed to minimize erosion and disturbance by equipment. Access overland will have a maximum width of 20 m and will be built up with snow and ice. Access over waterbodies will have a maximum width of 50 m.

A hovercraft will be used for snow removal on the Mackenzie River between the sand bar staging area and Swimming Point as well as for checking ice thickness on the river. Petro-Canada and their contractors will use continuous ice profiling on waterbodies to ensure ice thickness is adequate to deploy equipment. Snow cats will be used to blade the access, pack snow and build snow ramps on lake and channel banks. The D6M crawler, with water tank, will spray water on all snow ramps, do an initial watering on the overland sections of the access and improve sections of the access as necessary to support the other road building the equipment. A Delta Three, with water tank, will follow the D6M, flooding the road sufficiently to allow water trucks to travel safely and efficiently. The plow/auger trucks will be used on the lakes for plowing and flooding and the completed access will be shaped and maintained by motor graders, plow trucks and a snow blower. A Delta Three, with a fuel tank, will be used to supply all of the lead equipment. Snow fences may be used in areas where the trapping of snow may be advantageous for use during construction.

If ice formation is delayed by warm, early season weather and/or by a heavy snowpack, a trail, with a maximum width of 10 m, will be used around the perimeter of the lakes to allow for the safe movement of heavy equipment. Only level terrain will be chosen. When ice thickness allows for safe travel across the lakes, the land trail will be abandoned and all traffic will use the lake access.

A Petro-Canada supervisor, travelling by snow machine, will mark the lease perimeter. The site will then be walked down with snow cats and packed with the D6M and a tire drag. The area will be watered initially using a Delta Three, then flooded using water trucks. The ice pad under the rig will be a minimum of 40 cm thick. If the final well sites are located on sloped or uneven terrain, it may be necessary to use tandem gravel trucks and loaders to load and haul snow from lakes and snow-trap areas to build up the low areas of the lease. Snow fences may be used in the lease area where the trapping of snow may be advantageous for construction of the pad.

4.2.3 Air Strip

The airstrip(s) will be constructed on lake(s) and will be approximately 500 m in length and 60 m wide. The location of airstrip(s) for the three potential well locations is listed in Table 4. Depending on the locations selected, a single airstrip will be used to serve both drill programs. A generator and airstrip lighting will be supplied. The drill locations selected will also include a helicopter landing pad located near the wellsite, comprised of a 30 m x 30 m flooded ice pad.

TABLE 4
PROPOSED AIRSTRIP LOCATIONS

WELL REFERENCE	LOCATION
Nuna #1	Lat/Long: 68°05' N, 133°22' W UTM: 7553055mN, 568029mE
Nuna #2	Lat/Long: 68° 08' N, 133°23' W UTM: 7558610mN, 567189mE
Nuna #3	Lat/Long: 69°07'N – 133°17' W UTM: 7668327mN, 568285mE

4.2.4 Water Requirements

Water will be withdrawn from various lakes and the Mackenzie River as identified with a maximum withdrawal of 1000 m^3/day from different sources (Mackenzie River and lakes) during access and wellsite construction, and likely from either lake #42 and/or #34 for drilling (map pocket; Figure 1). Lake #34 was assessed in the fall of 2001 (Aquatics Draft 2002) in which Lake #34 is identified as Sixth Lake. The assessment of Sixth Lake revealed high variations in depth with a maximum potential depth of 16 m and a mean depth of 7 m. Overwintering potential for fish is good, given the large volume of water in the lake, the available depth and the likelihood of high oxygen saturation throughout the winter. However, potential impacts to overwintering fish populations are expected to be negligible due to the small proportion of water that would be utilized for program activities. Petro-Canada has completed volumetric calculations for each of the lakes identified for potential withdrawal and numbered each for reference (Appendix A; Figure 1; map pocket).

Lake volume sampling was completed by sectioning the lake based on area (one sample for every 10 to 20 ha, based on lake size), and then sampling by section. Smaller lakes were sampled at a frequency of one (1) sample per 10 ha, with a minimum of three (3) samples per lake. The sampling frequency on larger lakes was one (1) sample per 20 ha.

Petro-Canada has engaged in early discussions with DFO in regards to source lake volumes. Water intake hoses will be fitted with screens of such size to prevent impingement or entrainment of fish.

4.2.5 Drilling and Mud Program

Petro-Canada proposes to drill the well sites using a KCL (potassium chloride) drilling mud system. The KCL system is a mixture of potassium chloride, bentonite, and XC polymer and has been used by Petro-Canada on the recent M-15 and L-46 wells in the Mackenzie Delta. The use of saline inhibitive muds is primarily restricted to areas where water sensitive formations are exposed for prolonged periods of time or where water sensitive producing formations are encountered.

The well lithology for the site options shows that hydratable shales and clays are present and that there is a high probability of an unstable wellbore. The addition of KCL to a water based mud system in concentrations of 2 to 7% (3% has been recommended) by weight will provide superior inhibition in comparison to a fresh water drilling fluid system. The mechanism is as follows. The K+ ion acts as an inhibitor because of its small ionic size and low hydration energy. The K+ ions can penetrate the clay lattices and becomes tightly fixed by attractive forces. This results in binding of the clay sheet together and reduction in the tendency of the clay to swell. Potassium ions are more effective than sodium or calcium ions for this purpose because of the smaller size.

The challenge of drilling through permafrost is to keep the wellbore in gauge for successful cementing. A warm circulating drilling fluid (0°C or above) through the permafrost will have the tendency to thaw or erode the permafrost and cause instability due to the large amounts of gravel and downhole debris. The larger the washout through this section, the more difficult it will be to drill. It will also increase cement volumes required to cement the casing and reduces the ability of a successful cement job due to poor mud removal. The additions of KCL will enable the drilling fluid to maintain a temperature of -1.5°C (3%) without freezing, thus having minimum thawing effect on the permafrost. Also, if the well remains static for longer periods of time, the addition of KCL will decrease the likelihood of the drilling fluid freezing in the mud tanks and freezing in the upper section of the hole.

There is the potential of encountering methane hydrates. The possibility of liberation of gas from methane hydrates increases with higher drilling fluid temperatures. If this occurs, well control becomes complex. The use of KCL will minimize this potential by allowing freezing point depression of the drilling fluid. The use of KCL will also minimize accretion and bit balling. Bit balling will sometimes occur if drilling through hydratable shales and clays with an insufficiently inhibitive fluid. The cuttings tend to be sticky in nature and will clump together around the bit and wellbore. This makes drilling new hole slow and difficult. KCL will help minimize the hydration of the cuttings and thus help prevent accretion from occurring.

Large diameter drilling holes such as 444.5 mm (17-1/2") can be difficult to clean with drilling fluids due to very low annular velocities at maximum pump rates. Therefore, increasing the mud viscosity is required to provide sufficient hole cleaning characteristics. Additions of KCL to freshly hydrated bentonite will increase the viscosity and yield point temporarily to provide increased hole cleaning efficiency. The KCL mud system is generally used in the arctic as KCL lowers the freezing point and allows the use of cold mud to reduce thermal damage to permafrost.

The use of a mud cooler will be utilized on top hole and surface holes to keep mud as close to the freezing point as possible to mitigate against permafrost melting. Permafrost retention will also be aided by the use of a refrigerated conductor pipe.

4.2.6 *Drilling Waste Disposal*

Petro-Canada has incorporated techniques into the drilling process to minimize the volume of waste. Centrifuges help to use the mud systems for longer periods of time, and a mud cooler is used to help minimize hole size and reduce the volume of the active mud system.

The drilling locations will use a sump and the site will be selected according to the following criteria:

- Terrain will be flat or gently sloping and have good surface drainage;
- Site will be located a minimum of 100 m from any permanent water body;
- Site will not be located close to an ephemeral drainage;
- Site will not act as a snow trap;
- Local snow accumulation patterns and the effect on thermal conditions will be considered, and;
- Sites with a high ground ice content will be avoided.

The preferred location for the sump will be at the well site. However, if local terrain and permafrost conditions make the site unsuitable, a remote sump location will be used. Prior to final sump siting and construction, the site will be drilled with an auger to assess the soil type and to determine acceptable thermal conditions at the sump site.

The 20m wide x 60m long x 5.4m deep sump (within the 30 m wide x 70 m long sump area) will be blasted and excavated with the excavator and the D7R. The spoil pile will be placed around the perimeter of the sump. The sump will contain approximately a 1 m depth of drilling waste, have a 2.4 m depth freeboard to ensure that drilling fluids are kept a minimum of 1.2 m below the active layer, and an additional 2 m depth as contingency to ensure the drilling wastes are adequately frozen and covered to ensue long-term integrity of the sump. Tests of the drilling waste will be completed at the sump prior to restoration. Petro-Canada will continue to work with INAC, ILA, Environment Canada and the HTCs to develop a monitoring plan for sumps. As a minimum, an electromagnetic survey will be completed the summer following the closure of the sump (summer 2004) to ensure that the contents of the sump have not migrated.

When the drilling operation is complete, a mix/bury/cover strategy for sump abandonment will be used to minimize environmental impacts. All contents will be at least 1.2 m below the active layer, based on site specific determination of such depth. The backfill cover over the sump will provide a minimum of 2 m of overlap on all sides to prevent migration due to runoff or rain entering the excavation area.

4.2.7 *Base Camps*

Petro-Canada will utilize the 60-80 person Arctic class Akita camp that is paired with Akita-Equtak rigs (both Rig #60 and Rig #63) (Drawing 1). The logistics and construction activities base for the drilling operation is located at Swimming Point and utilizes the existing camp facilities.

4.2.8 *Wastewater Treatment*

Wastewater from the rig camp will be treated using an on-site treatment system to achieve water licence criteria for land. As a contingency, a camp sump will be dug to contain the waste and backfilled at the completion of operations. If wastewater is not meeting criteria, chlorination will be used for treatment and subsequent dechlorination of the treated wastewater will be conducted before disposing to land.

4.2.9 *Testing and Flaring*

The drilling program may include a full testing program, as approved by the NEB, which will involve flow periods meant for hydrocarbon evaluation. Drill stem tests will be stopped either upon determination of well results, or once a finite fluid volume is obtained. Fluid volumes will be minimized once the test results are determined.

Resulting from testing of the well and depending on content, produced fluids will either be:

- Burned on the flare stack; or
- Burned with the aid of an incinerator; or
- Re-injected back into the well bore (with appropriate NEB approval); or
- If, at such time, all of these options prove to be insufficient, off-site disposal will be considered.

4.2.10 *Solid Waste Management*

The rig camp will be equipped with an incinerator. Solid refuse will be incinerated daily to prevent the attraction of nuisance animals. Camp waste ash will be transported to Inuvik for proper disposal at the landfill site.

4.2.11 *Fuel Storage*

A total of 2.1 million litres of fuel will be required to support Petro-Canada's drilling/construction/service rig activities. The total volumes specified below include a 7% capacity buffer to allow for expansion. This fuel will be stored with placement as follows:

- All fuel will be stored at the Swimming Point tank farm;
- Four 400 bbls tanks (63595 litres/tank) of diesel will be stored at the rig site; and
- One 1000 gallon (3785 litre) double-walled Enviro-Tank of diesel will be stored at the gravel bar off the Mackenzie River with staged equipment to facilitate an early start to access and will be moved at the start of construction and advanced with construction.

4.2.12 Other Materials Storage

A number of chemical compounds will be used during drilling operations. A list of chemicals is provided in Appendix B. The drilling rig can hold up to 300 m^3 of drilling fluids including the 40 m^3 premix tank. There will be water storage on site for drilling activities and camp contingency. There will be several days worth of fuel storage on the winter drilling location(s) for contingency if fuel is unable to be delivered to the site.

4.2.13 Personnel Required

Approximately 45 personnel will be required for the program during both the construction and drilling phases. This will consist of five (5) Petro-Canada and contractor supervisors, and up to 40 operators.

4.2.14 Equipment Required

Construction	
1	Hovercraft
4	Snow machines
2	Bombardier snow cats
2	Crawler tractors (D7R, D6M)
2	Delta Three's
4	Plow/auger trucks
2	Plow trucks
2	Motor Graders
2	Loaders c/w accessories such as blade, bucket, snow blower
6	Water trucks
1	Excavator

Equipment to be Staged	
2	Bombardier Snow Cats
2	Delta Three's
1	D6M Crawler
2	Water Trucks
1	Enviro-fuel tank
2	Light towers
1	1000 gal water tank

*Final numbers may change when the final locations are chosen.

4.2.15 Clean-up

Upon completion of the drilling program, the wells will be capped and suspended or permanently abandoned. All equipment, survey stakes and construction debris associated with the operations will be disposed of upon completion of drilling. The only permanent facility planned is the wellhead. It is planned that the wellhead will be above ground level, and appropriately marked, staked, and signed as per NEB regulations.

4.3 Site Reconnaissance

Site reconnaissance of the three potential prospect areas was completed by Petro-Canada. Descriptions of each of the prospect areas with accompanying photos are provided below.

Nuna #1 - 69°09.57' N – 133°20.91' W; UTM: Zone 8 571256E 7666553N

- Rolling landscape;
- One flat spot 120m x 180m;
- Dry; high;
- Silty clay with fist sized rock; and
- Good access to area, mostly via lakes

Plate 1 Potential Nuna wellsite #1.

Plate 2 Potential Nuna wellsite #1.

Plate 3 Dwarf and low shrubby vegetation at potential Nuna wellsite #1.

Plate 4 Potential Nuna wellsite #1 area.

Plate 5 Potential Nuna wellsite #1.

Nuna #2 – 69°05.28' N – 133°20.42' W; UTM: Zone 8 571812E 7660991N

- Rolling landscape;
- High ground is rough, undulating would require leveling;
- High ground gravel content requiring surfacing;
- Low ground is very wet with surface water;
- Access to area is fair –hilly topography with steep slopes

Plate 6 Potential Nuna wellsite #2.