

Environmental

Geosciences &

Engineering

Consulting



EXECUTIVE SUMMARY

Paramount Resources Ltd. (Paramount) proposes to re-enter two existing oil wells located at I-74 and C-75, Grid Area 60° 10', 117° 15' in the Cameron Hills area of the Northwest Territories. The project area is shown in Figure 1 (Appendix A). Site activities are proposed to begin on March 1, 1999 and expected to last approximately 20 days. All activities will be conducted during the winter.

Paramount has prepared this report to meet the requirements of the Department of Indian Affairs and Northern Development (DIAND) and the National Energy Board (NEB) for environmental assessment of proposed oil and gas developments. This report describes the proposed project, environmental setting, and potential impacts and mitigation strategies related to the project.

Information used to prepare this report was gathered using area maps, relevant publications and interviews conducted with Paramount personnel and with wildlife, fisheries, forestry, renewable resources and heritage resources officials. Paramount has submitted applications for Land Use Permits under separate cover.

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Northwest Territories portion of the Cameron Hills has been accomplished under Land Use Permits from DIAND.

Access to Paramount's leases in the Cameron Hills is by winter access road and by air. The winter access road is approximately 40 km long and runs north/south beginning from a point near Indian Cabins on the 84N NTS map sheet in northern Alberta. The portion of the road in the Northwest Territories is approximately 10 km long. Air access to the area is facilitated by a temporary winter airstrip equipped with landing lights and a radio beacon.

2.1 PROJECT DESCRIPTION

The project area is presented in Figure 2, Appendix A. Access to the wellsites follows existing winter roads and trails. Each of the wellsite leases covers an area of 140m x 110m and will be surrounded by dikes comprising snow and earthen material (Figure 3, Appendix A). The wells had originally been drilled in the early 1990s and had been left in a suspended condition. Paramount would continue to keep the wells in a suspended condition after the re-entry. No pipelining plans are in place for the immediate future. A sump will be located off-site (Figure 2, Appendix A) and will be lined and bermed to minimize potential leaching of liquids into the surrounding soil.

The anticipated date for beginning construction is March 1, 1999; all activities will take place during the winter. Site activities are expected to take approximately 20 days. The access road and wellsites will be opened using compacted snow. No vegetation clearing will be required as the access routes and wellsites had been previously disturbed and no longer have bushes or trees (E. Rejven, Consultant to Paramount, pers. comm). Grasses will be dormant and likely completely covered by snow. Surface disturbance will be avoided so as not to destroy the insulating layer of any permafrost. No significant water bodies will be crossed by the access road. Intermittent drainages or creeks will be crossed by pushing snow to fill the waterway so as to minimize disturbance to the creek banks or beds. Care will be

2.2.3 Campsite Refuse Management

Garbage will be securely stored so as not to attract wildlife. Combustible wastes will be incinerated, domestic waste will be buried and all hazardous waste will be hauled off-site for proper disposal.

2.3 CONTINGENCY PLANS

Paramount has an emergency response plan in place to enable personnel to respond effectively to an emergency, fire or hazardous material spill. Prior to initiating construction, all personnel will be made aware of their responsibilities should an emergency situation occur. Response to spills of fuel, lubricating oils or any other harmful substance will be immediate. Spills will be contained and remediated as soon as possible. Paramount is a member of the Prairie Regional Oil Spill Containment and Recovery Action Corporation (PROSCARAC) and has access to Oil Spill Containment and Recovery (OSCAR) units for use in the event of a major spill.

3 PUBLIC CONSULTATION

Paramount has contacted the Hay River Community, Hay River Reserve, Fort Providence Community and the Kakisa Reserve regarding this project. The public consultation process is on-going at this time. Concerns raised by any of these communities will be resolved by Paramount.

Paramount will also discuss the socio-economic benefits of this project to the local communities. Local labour, contractors and services will be used as much as possible.

Age (Hardy BBT Limited, 1991). The Cretaceous section unconformably overlies a Paleozoic carbonate succession consisting predominantly of limestone and to lesser degree dolomite. The Cretaceous section is interbedded with siltstones and shales throughout.

Regional strike of the Paleozoic succession is NNW-SSE, and regional dip is southwest at a comparatively shallow angle. The Fort St. John Group's attitude is likely similar and attains a collective thickness of approximately 60m; the Paleozoic sequence attains a collective thickness of approximately 1000m.

The Middle Devonian succession and specifically the Sulphur Point Formation is the primary target of exploration activity.

4.3.2 Surficial Geology

Surface materials consist of bedrock, glacial drift, and postglacial sediment (Hardy BBT Limited, 1991). The rock cropping out in the Cameron Hills area consist exclusively of the undifferentiated shales, sandstones, and siltstones comprising the Fort St. John Group.

Glacial deposits consist mostly of moraine (till) deposited during the Wisconsin advance. Two distinct surface forms comprising till, or till and bedrock have been delineated within the project area:

- Ground moraine or ablation moraine that blankets or veneers the underlying bedrock surface.
- Streamlined or fluted till and bedrock.

Meltwater channel sands and gravels are scattered throughout the uplands.

are common. The lakes are often shallow and are typically interconnected by streams to form extensive wetlands. The drainage systems fall within the extensive Mackenzie Drainage Basin which ultimately empties into the Arctic Ocean (Hardy BBT Limited, 1991).

Nearby streams, lakes or ponds can act as a water source for drilling operations and general camp use. The proposed water source for this project is an unnamed lake located northeast of the wellsites (Figure 2, Appendix A). The lake water has been used for past projects and has a volume and water quality sufficient for the drilling operations (E. Reyven, Consultant to Paramount, pers. comm). A Water Use License has been applied for by Paramount.

Although surface water quality data was not available for the water source, water quality data was found for three sample points located in the proximity of the project area. Two of the points were located along the Cameron River and one point was located along an outflow channel. The water quality analytical reports are provided in Appendix B.

According to Andrew Forbes, Resource Management Officer for DIAND, there are no agricultural or industrial water wells in the vicinity of the project area. One water well used for domestic purposes was situated at a Paramount camp located at 60°00'15"N and 117°34'W (approximately 8km southwest of the project area) in the late 1980's or early 1990's. Correspondence with Andrew Forbes is provided in Appendix B.

4.6 FISHERIES

Information on fisheries in the Cameron Hills is lacking. The following is based on regional information (Hardy BBT Limited, 1991).

Forest cover in this region comprises mixed wood which is predominantly white spruce (*Picea glauca*) (Hardy BBT Limited, 1991). Undulating to rolling morainal surfaces support open stands of stunted black spruce (*Picea mariana*) and some birch (*Betula papyrifera*) and shrubs. Upland slopes of loamy glacial till support white spruce, balsam fir (*Abies balsamea*), and aspen mixed wood forest. There are lesser amounts of trembling aspen (*Populus tremuloides*). Jack pine (*Pinus banksiana*) and lodgepole pine (*Pinus contorta* var. *latifolia*) are found on drier soils.

In the pine communities, understorey species consist of Canada buffaloberry (*Shepherdia canadensis*), prickly rose (*Rosa acicular*), and barber (*Arctostaphylos uva-ursi*). In black spruce dominated communities the understory is primarily Labrador tea (*Ledum groenlandicum*), cloudberry (*Rubus chamaemorus*), and lichens. Bog, or lowland areas, are dominated by the shrubs leatherleaf (*Chamaedaphne calyculata*) and bog rosemary (*Andromeda polifolia*).

Wetlands in the region are generally infertile ponds with little or no emergent vegetation around the edge. However, where vegetation is present, sedge (*Carex* spp.) and some bulrush (*Scirpus* spp.) dominate. Aquatic species are low in variety and abundance, although Canada Land Inventory (CLI) maps list small yellow pond-lily (*Nuphar variegatum*), arum-leaved arrowhead (*Sagittaria cuneata*), and pondweed (*Potamogeton* spp.) as occurring in this region.

4.8 WILDLIFE

The reference "Wild Mammals of North America" (John Hopkins University Press, 1982) listed 23 animal species which inhabit a range in the vicinity of the project area (these species are listed in Appendix D). Significant mammal species in the Alberta portion of the Cameron Hills include: woodland caribou, moose, black bear, wolf, coyote, and furbearers.

There are 119 bird species which have been recorded as having a breeding range within the vicinity of the Cameron Hills (Godfrey, 1966). These species are listed in Appendix D. There are also migratory birds that pass through the region of the Cameron Hills. Waterfowl pass through the area in May and again in September and October. The waterfowl use lakes in the area as fall staging sites. There are nesting bald eagles in the Cameron Hills around Bistcho Lake (approximately 13km south of the project area).

Waterfowl present in the region are dominated by the following duck species: bufflehead (*Bucephala albeola*), common golden-eye (*Bucephala clangula*), lesser scaup (*Aythya affinis*), canvasback (*Aythya valisineria*), and mallard (*Anas platyrhynchos*) (Hardy BBT Limited, 1991). Although this region is characterized by many small lakes and wetlands, waterfowl productivity is limited in the Cameron Hills. Limitations are related to poor development of edge cover, and low fertility of water and soil. Along the escarpment of the Cameron Hills, the terrain is too steep to allow optimum development of ponds.

4.9 RECREATION AND LAND USE

Access into the Cameron Hills is primarily via winter roads (Hardy BBT Limited, 1991). Clearings for seismic lines may also be used to access various areas. Based on the CLI maps for the region, the Cameron Hills capability for recreation is generally low, however, recreational use is made of the river valleys and uplands. Activities such as canoeing, camping, viewing, photography, snowshoeing, snowmobiling, and angling can all be accommodated in this area.

Current land uses in this region include oil and gas exploration, trapping, hunting and timber operations. There are no registered traplines in the project area and general hunting licenses are issued. Some traplines are found north and east of the project area but these areas are not affected by the work being completed (A. Helmer, Renewable Resource Officer, Department of Renewable Resources, Government of the Northwest Territories, pers. comm.).

regularly checked for fuel leaks and proper care will be implemented during refueling.

Based on the use of proper waste management practices and spill response procedures the potential of adversely impacting the soils and surficial geology is low.

Permafrost conditions in the area could be impacted by activities causing ground disturbance. The removal of vegetative cover, alteration of natural drainage patterns, and introduction of heat into the ground could potentially affect any permafrost. To mitigate these concerns, all staff will be briefed regarding ground disturbance, removal of vegetation and introduction of heat into the ground. The site works will take place during winter and access roads and well sites will be opened using compacted snow thereby minimizing ground disturbance. Berms will be constructed of snow or imported fill in areas having permafrost. Well pads have already been constructed using imported fill and no further construction will be required.

According to Andrew Forbes, Resource Management Officer with DIAND, no serious effects on the discontinuous permafrost in the Cameron Hills area were noted as a result of past Paramount projects.

Given that the permafrost is discontinuous sporadic and the construction plans will be in place to minimize ground disturbance, potential adverse affects associated with permafrost are considered low.

5.3 WATER RESOURCES AND FISHERIES

The potential for affecting water resources in the project area is associated with stream siltation due to erosion, drainage disruption due to the activities on site, and water contamination from accidental spills or releases. The proposed activities will take place during winter months which precludes encountering spawning or

and wellsites will be opened using compacted snow, thus minimizing surface impacts.

There are no rare plants which will be affected by the proposed activities. The leases are more than 100 meters from a major water body or wetland and water drawdown will not be a problem.

5.5 WILDLIFE IMPACTS

The re-drilling of the wellsites will use existing access routes and wellsites. The small area that will be disturbed by the project activities and the apparent low wildlife population in the area suggest that the impact of habitat loss will be negligible.

The impact of human activity on wildlife present in the area is also expected to be negligible. Wellsite personnel are prohibited from hunting or trapping in the area and from feeding or harassing the wildlife. Hunting pressure in the area will not be increased as no new access is being created. Increased traffic and noise will be limited to an approximate 20 day duration.

Waterfowl are sensitive to disturbance and degradation of their aquatic habitats. Proposed wellsite activities will be carried out during the winter that precludes affecting any sensitive breeding, nesting and migrating periods. Only minor drainages and streams will be crossed during this project, and proper crossing procedures will ensure that aquatic habitats are not adversely impacted.

In a personal communication with Alan Helmer, Renewable Resource Officer for Hay River, he expressed there were no concerns with the proposed wellsite activities. He said the activities would most likely enhance the habitat by providing better access for caribou and various other animals into the region.

proposed project will take place on previously disturbed areas (existing access roads, wellsites). Residual impacts from the project will be localized and temporary. When the residual impacts from this proposed project are factored with other activities occurring in the area, additional cumulative effects resulting from the proposed work is negligible.

6 SITE CLEAN-UP, RECLAMATION AND MONITORING

When the project has been completed, all equipment, materials and wastes will be removed from the sites. Since site activities will have taken place in the winter and will have used minimal impact techniques, it is anticipated that there will be little impact to the ground surface and only minor reclamation will be required. Compacted snow pads at the wellsites will be scraped as necessary. Any areas having a disruption in natural drainage will be re-contoured. The snow road will melt with spring break-up. Snow fills within the creek crossings will be removed prior to spring break-up. Ground disturbance should be negligible and no re-seeding of vegetation should be necessary.

The remote sump will be abandoned using a mix-bury-cover method where the backfill is added to the sump and mixed with the semi-solids prior to capping. Backfilling will be conducted as stipulated in the Environmental Operating Guidelines: Hydrocarbon Well-sites in Northern Canada. Oil and oil cuttings will have been removed from the sump prior to abandonment and transported to a registered disposal facility. The sump will be capped using the previously stripped topsoil cover, the area will be re-contoured if necessary and seeded.

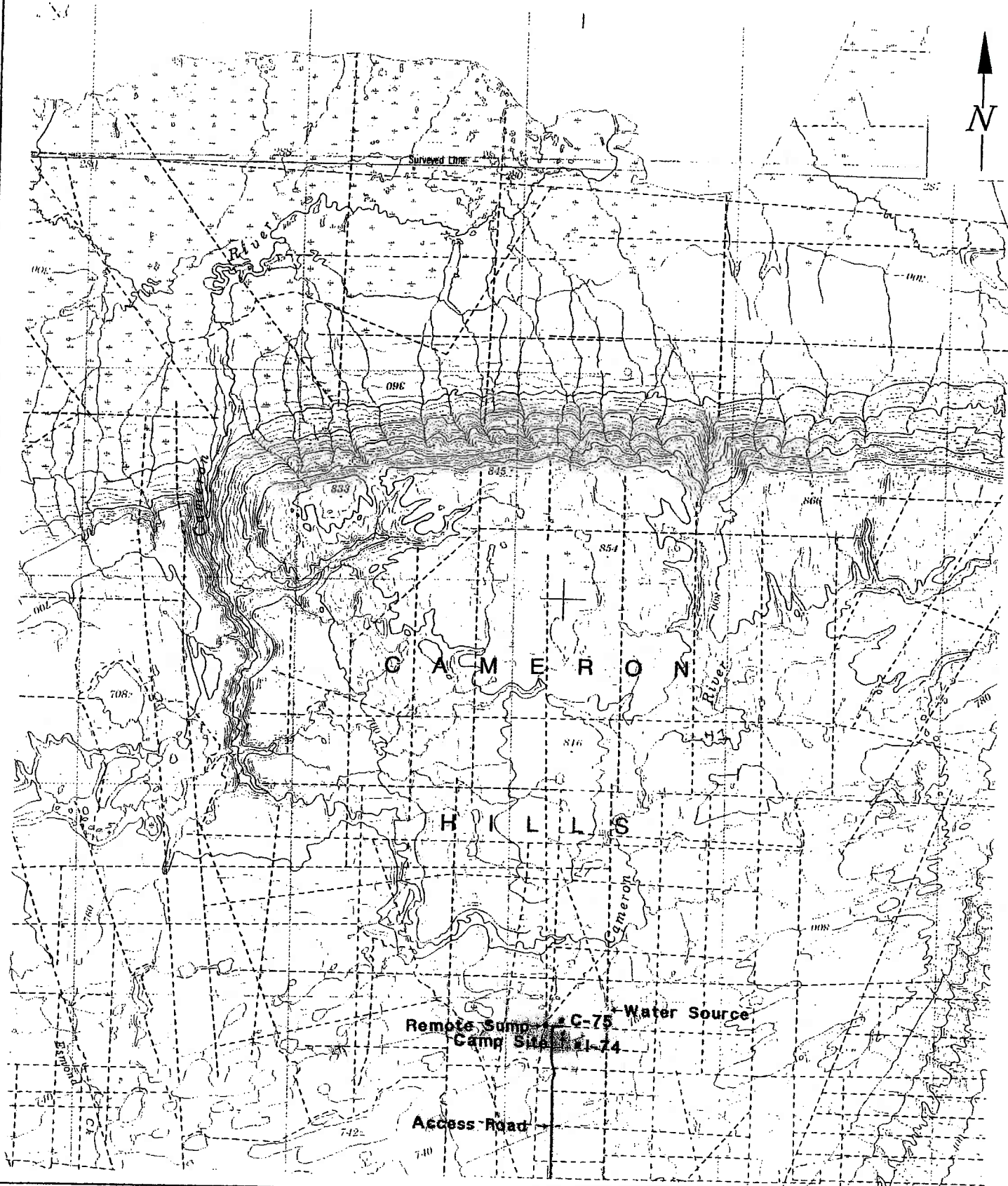
Paramount personnel will monitor the project area throughout the spring and summer to determine if there are any localized concerns and to undertake reclamation activities if needed.

7 REFERENCES

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APPENDIX A

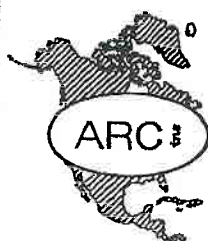
FIGURES



Paramount Resources Ltd.

C-75 AND 1-74

SITE LOCATIONS



Date:

17/12/98

Drawn By:

AP/CH/THS

Scale

1:250,000

Project No.

C069-005-01

File No.

005-01-1

Figure

No 2

APPENDIX B

WATER RESOURCES DATA

COPY

INDIAN & NORTHERN AFFAIRS
WATER RESOURCES LABORATORY
Box 1500
Yellowknife, NT. X1A 2R3
Tel. (403) 920-8129
Fax. (403) 873-9300

To: Cameron Hills Water Quality
NAP/Ft. Smith District
Box 658
Ft. Smith NT X0E 0P0
=> W. Starling

SAMPLE INFORMATION

Our Lab # : WL931890
Your Sample ID: CH1
Sample Matrix : water

Account No.: camhills

Collection:

Location: Cameron R area
Date: 09/09/93
By: AF/NM

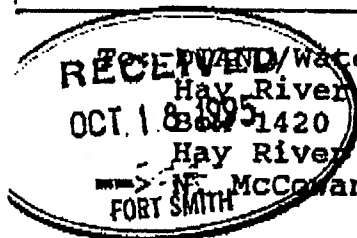
Report Date: 02/09/94

Approved by: W. Starling

- SAMPLE ANALYSIS REPORT -

Lab#	Parameter	Result Units	Detect Limit	Method Code
WL931890	Alkalinity	71.3 mg/L	0.300	10101
	Calcium	20.90 mg/L	0.040	20103
	Chloride	0.75 mg/L	0.080	17206
	Colour	60 Colour	5.000	2011
	Sp. Conduct	146.0 uS/cm	0.100	2041
	Iron-Gr. Furnace	585.0 ug/L	0.500	26309
	Filt. Residue	101 mg/L	10.000	10451
	Tot. Hardness	73.0 mg/L	0.100	10602
	Potassium	0.20 mg/L	0.050	19106
	Magnesium	5.10 mg/L	0.010	12102
	Sodium	1.00 mg/L	0.040	11102
	Non-Filt. Res.	L3 mg/L	3.000	10406
	Ammonia-N	0.007 mg/L	0.002	7509
	NO3+NO2-N	10.008 mg/L	0.008	7110
	pH	7.73 pH	0.050	10301
	Sulphate	6.0 mg/L	3.000	16306
	T. Arsenic-Hyd.	10.3 ug/L	0.300	33011
	Tot. Cadmium ICP-M	10.09 ug/L	0.090	ICP-MS
	Tot. Cobalt ICP-MS	0.06 ug/L	0.030	
	Tot. Chromium ICP-	0.83 ug/L	0.070	
	Tot. Copper ICP-MS	0.44 ug/L	0.070	ICP-MS
	Tot. Nickel ICP-MS	1 ug/L	0.100	
	Tot. Lead ICP-MS	1.3 ug/L	0.090	
	T-Phosphorous	0.003 mg/L	0.002	15403
	Turbidity	1.1 NTU	0.100	2081
	Tot. Zinc ICP-MS	0.6 ug/L	0.200	

INDIAN & NORTHERN AFFAIRS
WATER RESOURCES LABORATORY
Box 1500
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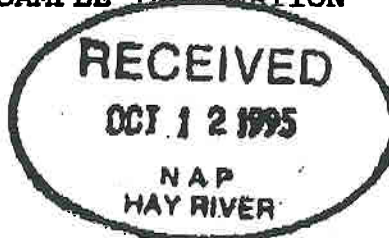
INDIAN AND NORTHERN AFFAIRS - CANADA
N.W.T. REGION

OCT 02 1995

WATER RESOURCES
DIVISION
YELLOWKNIFE, NT

SAMPLE INFORMATION

Our Lab # : 951026
Your Sample ID: 1
Sample Matrix : grab water



Account No.: camhills

Collection:
Location: Cameron Hills
Date: 09/13/95
By: AF/NM

Report Date: 09/29/95

Approved by:

- SAMPLE ANALYSIS REPORT -

Lab#	Parameter	Result Units	Detect Limit	Method Code
951026	Alkalinity	96.9 mg/L	0.300	10101
	Calcium	32.70 mg/L	0.040	20103
	T.Cadmium ICP-MS	0.2 ug/L	0.100	100133
	Chloride	0.50 mg/L	0.080	17206
	Colour	40 Colour	5.000	02021
	Conductivity	187.0 uS/cm	0.100	02041
	T.Cobalt ICP-MS	0.1 ug/L	0.100	100115
	T.Chromium ICP-MS	L2 ug/L	2.000	24009
	T.Copper ICP-MS	1.1 ug/L	0.100	100119
	Filt.Residue	130 mg/L	10.000	10451
	Tot.Hardness	111.0 mg/L	0.100	10602
	Potassium	0.29 mg/L	0.050	19106
	Magnesium	7.13 mg/L	0.010	12102
	T.Manganese ICP-MS	11.0 ug/L	0.100	100113
	Sodium	1.71 mg/L	0.040	11102
	Ammonia-N	0.007 mg/L	0.002	07562
	T.Nickel ICP-MS	1.8 ug/L	0.100	100117
	NO3-N+NO2-N	LO.008 mg/L	0.008	07110
	T.Lead ICP-MS	L2 ug/L	2.000	100145
	pH	8.12 pH	0.050	10301
	Sulphate	13.0 mg/L	3.000	16306
	T.Arsenic-Hyd.	LO.3 ug/L	0.300	33011
	T.Iron	459 ug/L	20.000	26004
	T.Iron	N/A ug/L	3.000	26002
	T-Phosphorous	0.013 mg/L	0.002	15403
	Turbidity	2.6 NTU	0.100	02081
	T.Zinc ICP-MS	5.0 ug/L	5.000	100121

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WATER RESOURCES LABORATORY
Box 1500
Yellowknife, NT. X1A 2R3
Tel. (403) 920-8129
Fax. (403) 873-9300

To: Cameron Hills Water Quality
NAP/Ft. Smith District
Box 658
Ft. Smith NT X0E 0P0
==> W. Starling

SAMPLE INFORMATION

Our Lab # : 941712
Your Sample ID: CH-3
Sample Matrix : water

Account No.: camhills

Collection:
Location: Cameron Hills
Date: 08/31/94
By: W.S./N.McC

Report Date: 11/08/94

Approved by: W. Starling

- SAMPLE ANALYSIS REPORT -

Lab#	Parameter	Result Units	Detect Limit	Method Code
941712	Alkalinity	95.8 mg/L	0.300	10101
	Calcium	34.50 mg/L	0.040	20103
	T.Cadmium ICP-MS	LO.1 ug/L	0.100	100133
	Chloride	0.82 mg/L	0.080	17206
	Colour	30 Colour	5.000	02021
	Conductivity	199.0 uS/cm	0.100	02041
	T.Cobalt ICP-MS	0.1 ug/L	0.100	100115
	T.Chromium ICP-MS	LO.2 ug/L	0.200	100111
	T.Copper ICP-MS	0.4 ug/L	0.100	100119
	Filt.Residue	137 mg/L	10.000	10451
	Tot.Hardness	115.1 mg/L	0.100	10602
	Potassium	0.29 mg/L	0.050	19106
	Magnesium	7.10 mg/L	0.010	12102
	T.Manganese ICP-MS	11.9 ug/L	0.100	100113
	Sodium	1.22 mg/L	0.040	11102
	Non-Filt Res.	L3 mg/L	3.000	10406
	Ammonia-N	0.034 mg/L	0.002	07562
	T.Nickel ICP-MS	0.7 ug/L	0.100	100117
	NO3-N+NO2-N	0.011 mg/L	0.008	07110
	T.Lead ICP-MS	LO.2 ug/L	0.200	100145
	pH	8.13 pH	0.050	10301
	Sulphate	4.0 mg/L	3.000	16306
	T. Iron	76 ug/L	20.000	26004
	T-Phosphorous	0.006 mg/L	0.002	15403
	Turbidity	0.9 NTU	0.100	02081
	T.Zinc ICP-MS	5.0 ug/L	5.000	100121

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WATER RESOURCES LABORATORY
Box 1500
Yellowknife, NT. X1A 2R3
Tel. (403) 920-8129
Fax. (403) 873-9300

To: Cameron Hills Water Quality
NAP/Ft. Smith District
Box 658
Ft. Smith NT X0E 0P0
==> W. Starling

SAMPLE INFORMATION

Our Lab # : WL931897
Your Sample ID: CH8
Sample Matrix : water

Account No.: camhills

Collection:

Location: Cameron R area
Date: 09/09/93
By: AF/NM

Report Date: 01/11/94

Approved by: W. Starling

- SAMPLE ANALYSIS REPORT -

Lab#	Parameter	Result Units	Detect Limit	Method Code
WL931897	Alkalinity	15.4 mg/L	0.300	10101
	Calcium	5.80 mg/L	0.040	20103
	Chloride	0.31 mg/L	0.080	17206
	Colour	25 Colour	5.000	2011
	Sp. Conduct	42.3 uS/cm	0.100	2041
	Iron-Gr. Furnace	503.0 ug/L	0.500	26309
	Filt. Residue	57 mg/L	10.000	10451
	Tot. Hardness	20.0 mg/L	0.100	10602
	Potassium	0.20 mg/L	0.050	19106
	Magnesium	1.30 mg/L	0.010	12102
	Sodium	0.70 mg/L	0.040	11102
	Non-Filt Res.	26 mg/L	3.000	10406
	Ammonia-N	0.012 mg/L	0.002	7509
	NO3+NO2-N	LO.008 mg/L	0.008	7110
	pH	6.93 pH	0.050	10301
	Sulphate	L3 mg/L	3.000	16306
	T. Arsenic-Hyd.	LO.3 ug/L	0.300	33011
	Tot. Cadmium ICP-M	LO.09 ug/L	0.090	ICP-MS
	Tot. Cobalt ICP-MS	0.09 ug/L	0.030	
	Tot. Chromium ICP-	LO.07 ug/L	0.070	ICP-MS
	Tot. Copper ICP-MS	0.48 ug/L	0.070	ICP-MS
	Tot. Nickel ICP-MS	0.2 ug/L	0.100	
	Tot. Lead ICP-MS	0.6 ug/L	0.090	
	T-Phosphorous	0.041 mg/L	0.002	15403
	Turbidity	4.5 NTU	0.100	2081
	Tot. Zinc ICP-MS	1.3 ug/L	0.200	

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Fax. (403) 873-9300

To: DIAND/Water Resources
Hay River Sub-District
Box 1420
Hay River NT X0E 0R0
=> N. McCowan

INDIAN AND NORTHERN AFFAIRS
N.W.T. REGION
OCT 02 1995
WATER RESOURCES
DIVISION
YELLOWKNIFE, NT

SAMPLE INFORMATION

Our Lab # : 951033
Your Sample ID: 8
Sample Matrix : grab water

Account No.: camhills

Collection:

Location: Cameron Hills
Date: 09/13/95
By: AF/NM

Report Date: 09/29/95

Approved by: L. T. [Signature]

- SAMPLE ANALYSIS REPORT -

Lab#	Parameter	Result Units	Detect Limit	Method Code
951033	Alkalinity	22.1 mg/L	0.300	10101
	Calcium	7.82 mg/L	0.040	20103
	T.Cadmium ICP-MS	0.1 ug/L	0.100	100133
	Chloride	0.48 mg/L	0.080	17206
	Colour	40 Colour	5.000	02021
	Conductivity	50.5 uS/cm	0.100	02041
	T.Cobalt ICP-MS	0.1 ug/L	0.100	100115
	T.Chromium ICP-MS	L2 ug/L	2.000	24009
	T.Copper ICP-MS	0.9 ug/L	0.100	100119
	Filt.Residue	66 mg/L	10.000	10451
	Tot.Hardness	26.8 mg/L	0.100	10602
	Potassium	0.28 mg/L	0.050	19106
	Magnesium	1.78 mg/L	0.010	12102
	T.Manganese ICP-MS	40.2 ug/L	0.100	100113
	Sodium	0.97 mg/L	0.040	11102
	NON-FIELD RES.	1.0 mg/L	0.000	0406
	Ammonia-N	0.015 mg/L	0.002	07562
	T.Nickel ICP-MS	1.0 ug/L	0.100	100117
	NO3-N+NO2-N	LO.008 mg/L	0.008	07110
	T.Lead ICP-MS	L2 ug/L	2.000	100145
	pH	7.13 pH	0.050	10301
	Sulphate	8.0 mg/L	3.000	16306
	T.Arsenic-Hyd.	LO.3 ug/L	0.300	33011
	T.Iron	312 ug/L	20.000	26004
	T.Iron	N/A ug/L	3.000	26002
	T-Phosphorous	0.072 mg/L	0.002	15403
	Turbidity	6.3 NTU	0.100	02081
	T.Zinc ICP-MS	5.0 ug/L	5.000	100121

APPENDIX C

RARE VASCULAR PLANTS LIST

Liparis loeselii
Luzula rufescens
Lycopus uniflorus
Malaxis paludosa
Mertensia paniculata var. alaskana
Mimulus guttatus
Monarda fistulosa var. menthifolia
Osmorhiza depauperata
Pedicularis macrodonta
Pellaea glabella ssp. occidentalis
Physostegia ledinghamii
Platanthera orbiculata var. orbiculata
Prunus virginiana
Ranunculus hispidus var. nitidus
Ranunculus pensylvanicus
Rhynchospora alba
Rorippa barbareifolia
Rorippa crystallina
Rosa blanda
Salix raupii
Sanguisorba officinalis
Sarracenia purpurea
Scripus rollandii
Scripus rufus var. neogaeus
Sedum rosea
Senecio sheldonensis
Symphoricarpos albus
Tanacetum bipinnatum ssp. huronense
Thalictrum sparsiflorum var. richardsonii
Vaccinium cespitosum
Valeriana dioica var. sylvatica
Viola selkirkii

Wild Mammals of North America²

Snowshoe Hares (*Lepus americanus*)

-Adams (1959) suggested habitat management should involve thinning of dense areas.

Voles (*Microtus*)

Meadow Vole (*Microtus pennsylvanicus*)

Yellow-cheeked Vole (*Microtus xanthognathus*)

Marmots (*Marmota monax*)

Woodchuck

Porcupine (*Erethizon dorsatum*)

Pine Squirrels (*Tamiasciurus hudsonicus*)

Coyote (*Canis latrans*)

Beaver (*Castor canadensis*)

Muskrats (*Ondatra zibethicus*)

Wolves (*Canis lupus*)

Red Fox (*Vulpes vulpes*)

Black Bear (*Ursus americanus*)

Grizzly Bear (*Ursus arctos*)

Fisher (*Martes pennanti*)

Weasels (*Mustela*)

Ermine (*Mustela erminea*)

Least weasel (*Mustela nivalis*)

Mink (*Mustela vison*)

Wolverine (*Gulo gulo*)

Striped skunk (*Mephitis mephitis*)

River otter (*Lutra canadensis*)

Lynx (*Felis lynx*)

Moose (*Alces alces*)

Caribou (*Rangifer tarandos groenlandicus*)

Bison (*Bison bison*)

² Biology, Management, & Economics (The Johns Hopkins University Press, 1982)

Bird Species Found in NWT (Study Area)¹

Loons – Common (*Gavia immer*), (*Gaviidae*)
Red-necked Grebe (*Podiceps grisegena*)
American Bittern (*Botaurus lentiginosus*)
Canada Goose (*Branta canadensis*)
Mallard (*Anas platyrhynchos*)
Pintail (*Anas acuta*)
Green-winged Teal (*Anas carolinensis*)
Blue-winged Teal (*Anas discors*)
American Widgeon (*Mareca americana*)
Shoveler (*Spatula clypeata*)
Redhead (*Aythya americana*)
Ring-necked duck (*Aythya collaris*)
Canvasback (*Aythya valisineria*)
Lesser Scaup (*Aythya affinis*)
Common Goldeneye (*Bucephala clangula*)
Bufflehead (*Bucephala albeola*)
White-winged Scoter (*Melanitta deglandi*)
Surf Scoter (*Melanitta perspicillata*)
Common Merganser (*Mergus merganser*)
Red-breasted Merganser (*Mergus serrator*)
Goshawk (*Accipiter gentilis*)
Sharp-shinned Hawk (*Accipiter striatus*)
Red-tailed Hawk (*Buteo jamaicensis*)
Bald Eagle (*Haliaeetus leucocephalus*)
Marsh Hawk (*Circus cyaneus*)
Osprey (*Pandion haliaetus*)
Pigeon Hawk (*Falco columbarius*)
Sparrow Hawk (*Falco sparverius*)
Spruce Grouse (*Canachites canadensis*)
Ruffed Grouse (*Bonasa umbellus*)
Sharp-tailed Grouse (*Pedioecetes phasianellus*)
Sora (*Porzana carolina*)
Killdeer (*Charadrius vociferus*)
Common Snipe (*Capella gallinago*)
Upland Plover (*Bartramia longicauda*)
Spotted Sandpiper (*Aetitis Macularia*)
Solitary Sandpiper (*Tringa solitaria*)
Lesser Yellowlegs (*Totanus flavipes*)
Short-billed Dowitcher (*Limnodromus griseus*)
Mew Gull (Short-billed Gull) (*Larus canus*)

¹ The Birds of Canada (W. Earl Godfrey, 1966)

Tennessee Warbler (*Vermivora peregrina*)
Orange-crowned Warbler (*Vermivora celata*)
Yellow Warbler (*Dendroica petechia*)
Magnolia Warbler (*Dendroica magnolia*)
Cape May Warbler (*Dendroica tigrina*)
Myrtle Warbler (*Dendroica coronata*)
Blackpoll Warbler (*Dendroica striata*)
Palm Warbler (*Dendroica palmarum*)
Ovenbird (*Seiurus aurocapillus*)
Northern Waterthrush (*Seiurus noveboracensis*)
Wilson's Warbler (*Wilsonia pusilla*)
American Redstart (*Setophaga ruticilla*)
Red-winged Blackbird (*Agelaius phoeniceus*)
Rusty Blackbird (*Euphagus carolinus*)
Brown-headed Cowbird (*Molothrus ater*)
Western Tanager (*Piranga ludoviciana*)
Rose-breasted Grosbeak (*Pheucticus ludovicianus*)
Purple Finch (*Carpodacus purpureus*)
Pine Grosbeak (*Pinicola enucleator*)
Pine Siskin (*Spinus pinus*)
Red Crossbill (*Loxia curvirostra*)
White-winged Crossbill (*Loxia leucoptera*)
Savannah Sparrow (*Passerculus sandwichensis*)
Le Conte's Sparrow (*Passerherbulus caudatus*)
Slate-colored Junco (*Junco hyemalis*)
Chipping Sparrow (*Spizella passerina*)
Clay-colored Sparrow (*Spizella pallida*)
White-crowned Sparrow (*Zonotrichia leucophrys*)
White-throated Sparrow (*Zonotrichia albicollis*)
Fox Sparrow (*Passerella iliaca*)
Lincoln's Sparrow (*Melospiza lincolnii*)
Swamp Sparrow (*Melospiza georgiana*)
Song Sparrow (*Melospiza melodia*)