Environmental Site Assessment and Cost Estimate Giant Mine



FINAL REPORT

GOVERNMENT OF THE NORTHWEST TERRITORIES

AND

INDIAN AND NORTHERN AFFAIRS CANADA

NOVEMBER 1999

DETON'CHO ENVIRONMENTAL ALLIANCE

eba

VISTA ENGINEERING

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Submitted to:

GOVERNMENT OF THE NORTHWEST TERRITORIES

AND

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YELLOWKNIFE

Submitted By:

DETON'CHO ENVIRONMENTAL ALLIANCE

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Acknowledgements

Deton'Cho Environmental Alliance would like to thank the Department of Resources, Wildlife and Economic Development, Government of the Northwest Territories, the Department of Municipal and Community Affairs, Government of the Northwest Territories, and the Department of Indian and Northern Affairs, Government of Canada for their assistance in the completion of this report.

Deton'Cho Environmental Alliance would also like to thank the employees of Royal Oak Mines for the time they spent in showing the Deton'Cho Environmental Alliance team the property, and for the information they made available to the team.

Finally, Deton'Cho Environmental Alliance would like to thank the many people who gave their time and permission to be interviewed.

This assessment could not have been completed without the assistance of all of these people.

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Executive Summary

The Giant Mine is a gold mine located five kilometres north of the City of Yellowknife, Northwest Territories. At the time of this report, the mine employed approximately 200 people and it had been in operation since 1948. Approximately 100 buildings including a mill and roaster system, a town site, six pits and extensive underground workings are components of the mine lease.

At the time that this assessment study was being undertaken in July 1999, the mine was controlled by Pricewaterhouse Coopers Incorporated who were appointed the interim receivers of the property on April 19, 1999 when the former mine operator, Royal Oak Mines Incorporated claimed bankruptcy. The future of the mine operation was uncertain as the receivers were seeking a buyer. In October 1999 the mine was placed in care and maintenance.

If a buyer was not located, or if the mine was purchased only in part, the mine and the subsequent cleanup of the mine site would revert to the government. The Department of Resources, Wildlife and Economic Development (RWED) and the Department of Municipal and Community Affairs of the Government of the Northwest Territories, and Indian and Northern Affairs Canada (INAC) expressed a need to identify environmental liabilities and provide a cost estimate of mine reclamation.

In June of 1999, RWED, MACA and INAC commissioned the Deton'Cho Environmental Alliance (DCEA), to complete a non-intrusive environmental site assessment and a reclamation cost estimate of the surface and underground components of the Giant Mine Site. The report presents the environmental risks associated with the site and includes a cost estimate for the mine clean-up. The assessment of the arsenic chambers and underground arsenic storage was excluded from this report.

In preparing the report, the DCEA assessment team conducted an extensive literature review and a series of interviews with past mine employees, regulators and local residents in order to obtain information regarding past and present mine practices and to identify data gaps. A total of four site visits were conducted in July 1999 in order to qualify and roughly quantify the environmental risks of the site. No environmental samples were obtained for this assessment and quantities of waste and contaminated soil were based on best judgment and visual observation. No intrusive investigations were conducted.

Based on the interviews, literature review and site visit, the following summarizes the environmental concerns that were identified during the assessment.

1. Ongoing care and maintenance of the site is required following the mine shut down. This includes mine de-watering, shaft operation, general maintenance, tailings and minewater treatment, dam seepage collection.

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2. There are four distinct tailing containment areas and at least two tailings deposits that are not contained (Back Bay and at the confluence of Trapper and Baker Creeks). Although there have been some studies completed on the tailings, a detailed study of the nature of the tailings, remediation alternatives, long term dust suppression and the effectiveness of the alternatives has not been completed to date. Such a study would lead to recommended closure and remediation plans for each area.
3. Based on interviews, it was surmised that the tailings disposed in Back Bay was deposited when the mine was using mercury amalgamation in their milling process. The deposit should be further studied to identify the presence or absence of Mercury. The proper combination of containment, excavation and erosion control should be developed and employed if deemed necessary.
4. Control of wind erosion on tailings needs to be addressed and implemented in order to minimize the spread of tailings. Some studies that have been completed by Royal Oak Mines to date indicate that a nutrient rich topcoat assists in the growth of vegetation.
5. Several interviewees have mentioned that hazardous and non-hazardous waste have been buried in the Central and South Ponds as well as under the tire storage area. Burial in tailings areas was a common practice of the mining industry at the time. Based on interviews, a potential exists that between 3,000 and 13,000 barrels of arsenic trioxide waste may potentially be buried in these areas. This number may be less based on the fact that spills were also vacuumed and discharged into an underground vault by a vacuum truck. More work is required to confirm or refute the presence of these drums through interviews and file research. If confirmed, efforts should be made to determine the potential environmental problems posed by buried drums of arsenic trioxide waste materials. It may be possible to locate accumulations of metal using magnetic surveys, ground penetrating radar or other suitable technology. These technologies will not show that a drum is full or empty, but will highlight the extent of buried debris.
6. It is estimated that there is 6500 cubic metres of hydrocarbon contaminated soil on site. Hydrocarbon stained areas should be delineated, and levels of contamination determined for each of the contaminated areas.
7. There are several hundred drums of various arsenic trioxide waste material stored in the hazardous waste area, which are exposed to the elements. These should be moved and stored under secure cover to avoid deterioration of the drums and prevent access by wildlife and unauthorized personnel.
8. There is a considerable quantity of Asbestos Containing Materials (ACM) in buildings and insulation (estimated 2000 cubic metres). This should be removed and disposed in accordance with Territorial regulations. This may be more feasible with the demolition of each respective building.
9. There are approximately 3500 drums of waste petroleum product as well as sludge and free product stored in tanks that require testing for suitability of disposal by incineration or by other means.

10. There are several types of hazardous materials on site including assay, mill and water treatment chemicals. In some cases it may be possible to return excess to the suppliers. In other cases it may have to be treated as hazardous waste and disposed of accordingly.
11. There are a total of 26 openings to the surface and six pits that will constitute a significant safety hazard upon closure of the mine. All pits, shafts, and other openings should be secured to prevent accidental or deliberate entry. Consultation with Mine Inspection Services of WCB is required.
12. There are approximately 100 buildings on the Giant Mine property many of which are redundant. These buildings may be demolished, salvaged, and/or landfilled as deemed appropriate. Lead paint may be an issue on older buildings. Analyses should be completed and disposal options discussed with the pertinent regulatory department.
13. The underground workings contain small quantities of hazardous materials and wastes that will require proper handling and disposal once abandoned such as potential PCB contamination in light ballasts and switch equipment, fuel tanks, lubricating oils, compressed gases and other equipment. This will need to be brought to the surface and disposed of accordingly.
14. There are many solid waste 'boneyards' on site, which contain mostly scrap metal, some machinery and discarded drums. A concern with these disposal areas is that there are some waste batteries, asbestos and potentially PCB containing equipment that will require separation before the scrap is disposed of or recycled.
15. The existing domestic landfill located north of the Northwest tailings containment areas will require an engineered closure.

The estimated cost to complete the remediation of the site to acceptable standards was calculated using the RECLAIM Version 3.1 software developed for INAC. This cost amounts to C$16 264 811.

There are a number of limiting issues associated with the undertaking of this project and the costing of the remediation activities. The following summarizes the limiting issues.

- Post closure maintenance and water treatment will have a significant cost impact, but it is difficult to estimate the costs at this time. Mine closure is a long-term operation requiring maintenance and engineering studies.
- There has been no decision made as to ultimate land-use of the site therefore proposed remedial and reclamation costs should only be construed as preliminary estimates dependent upon review and final approval by the appropriate regulatory authorities.
- Considering the unique geology of the Yellowknife area, there are currently attempts being made to establish background arsenic levels for the area. Without an established arsenic criterion, it is difficult to apply a realistic costing for remediation of surface arsenic contamination at the Giant Mine. This is an underlying issue that pertains to the remediation of most of the mine components including tailings containment areas, contaminated soil and water, and building demolition and disposal.

- The most significant limiting factor associated with the completion of this project, is the issue of the stored underground arsenic trioxide at the Giant Mine. This factor was excluded as a component of the project at the request of the client. However, the issue of the stored arsenic trioxide and the selected remedial methods will have a significant impact on potential environmental concerns and safety hazards associated with the surface, in terms of the risks associated with the chosen method/methods and the infrastructure that is required to support the remedial method.

As a result of these limiting issues, the reclamation and remediation costs can only be presented as rough estimates contingent upon factors that require decisions to be made by regulators.

The Giant Yellowknife Mine has been in operation for over fifty years. During that time it operated under the regulatory regime of the day. Increasing environmental awareness over the years has resulted in the more stringent regulations in place today. Practices that may have been commonplace in past years may not be permitted now. The historic operation of the Giant Yellowknife Mine needs to be viewed in that context. With the exception of arsenic trioxide stored underground, the Giant Yellowknife Mine in general is considered to present similar environmental concerns as other mines of similar length of operation, size and type. This study and report have identified some of these concerns, as well as areas where the authors believe more information is required. It is one of the first steps in a process of dealing with the environmental concerns on this property.

Executive Summary ES-1

Table of Contents TC-1

1.0 Introduction 1
1.1 Purpose of Study 1
1.2 Scope of Work 1
1.3 Limiting Issues to the Assessment 2

2.0 Site Description 4
2.1 Location 4
2.2 Infrastructure 4
2.3 Geology 5
2.4 Historical Activity 6
2.5 Mining Methods 7
2.6 Milling Process and Waste Streams 8
2.6.1 Historical Methods 8
2.6.2 Present Practice 8
2.7 Atmospheric Emissions 10
2.8 Solid Waste 11

3.0 Property Description 12
3.1 Present Surface Land Uses and Users 12
3.1.1 ICG Propane 12
3.1.2 Explosives Limited 12
3.1.3 Great Slave Cruising Club Marina 13
3.1.4 Northwest Territories Power Corporation 13
3.1.5 Other Occupants 14
3.2 Adjacent Properties 14
3.2.1 City of Yellowknife 14
3.2.2 N'dilo 14

4.0 Applicable Regulatory Authorities 15
4.1 Indian and Northern Affairs Minerals Directorate: Subsurface Leases 15
4.2 Municipal and Community Affairs: Surface Leases 16
4.3 NWT Water Board: Water Licence 16
4.4 Other Regulatory Authorities 17

5.0 Summary of Interviews 18
5.1 Past and Present Mine Employees 18
5.2 Regulators and Government Agents 21
5.3 First Nations 23
5.4 Local Organizations and Others 27

6.0 Site Evaluation 28
6.1 General 28
6.2 Tailings Disposal and Containment Areas 28
6.2.1 Tailings History 28
6.2.2 Tailings Geochemistry 31
6.2.3 Tailings ARD Potential 31
6.2.4 Tailings Pore Water Chemistry 33
6.2.5 Erosion 34
6.2.6 Effluent Treatment System 34
6.3 Hazardous Material Storage 36
6.3.1 Chemical Storage and Inventory 38
6.3.2 Explosives 38

6.4 HAZARDOUS WASTE MANAGEMENT 39
6.4.1 Designated Hazardous Waste Storage Area 39
6.4.2 Surface Arsenic Trioside Waste 40
6.4.3 Waste Petroleum Products 41
6.4.4 Asbestos Containing Materials 42
6.4.5 Lead Based Paints 43
6.4.6 Polychlorinated Biphenyls 44
6.4.7 Waste Batteries 45
6.4.8 Sumps 45
6.5 SOLID WASTE MANAGEMENT 46
6.5.1 Designated Landfills 46
6.5.2 Bone Yards 47
6.6 IMPACTED SOIL 47
6.6.1 Hydrocarbon Contaminated Soil 47
6.6.2 Other Contaminated Soil 49
6.7 SITE BUILDINGS, INFRASTRUCTURE AND EQUIPMENT 52
6.7.1 Mine and Town Site Buildings 52
6.7.2 Equipment 52
6.7.3 Infrastructure 53
6.8 PITS AND SHAFTS 53
6.8.1 Mine Openings to the Surface 53
6.8.2 Open Pits 54
6.9 WASTE ROCK AND BORROW AREAS 55
6.9.1 Waste Rock Storage 55
6.9.2 Acid Rock Drainage Potential 55
6.9.3 Quarries, Borrow Areas, and Overburden Piles 58
6.10 BAKER CREEK AND TRAPPER CREEK 59
6.10.1 Baker Creek 59
6.10.2 Trapper Creek 60

7.0 Underground Inspection 62
7.1 GENERAL 62
7.2 MAINTENANCE SHOPS (SCOOP TRAM SHOPS) 62
7.3 FUEL STORAGE 63
7.4 ELECTRICAL SUBSTATIONS 64
7.5 EXPLOSIVES STORAGE 64
7.6 SEWAGE 64
7.7 INFRASTRUCTURE 65

8.0 Conclusions: Summary of Environmental, Health and Safety Concerns 66
8.1 CONCLUSION 66
8.2 SUMMARY OF CONCERNS 66
8.3 INFORMATION GAPS 70

9.0 Action Plans 71
9.1 DURING MINE OPERATIONS 71
9.2 UPON MINE CLOSURE 72

10.0 Reclamation Cost Estimate 73

11.0 References 75

List of Figures

		After Page
FIGURE 1:	LOCATION OF GIANT MINE	4
FIGURE 2:	OVERALL SITE PLAN	4
FIGURE 3:	MILL PROCESS FLOW SHEET	8
FIGURE 4:	MINING CLAIMS & SUBSURFACE LEASES	15
FIGURE 5:	TAILINGS CONTAINMENT AREAS AND DAMS	28
FIGURE 6:	EFFLUENT TREATMENT FLOWCHART	34
FIGURE 7A:	LOCATION OF HAZARDOUS MATERIAL STORAGE – SITE PLAN	37
FIGURE 7B:	LOCATIONS OF HAZARDOUS MATERIAL STORAGE – BUILDING PLAN	37
FIGURE 8:	SOLID & HAZARDOUS WASTE STORAGE & DISPOSAL	39
FIGURE 9A:	HYDROCARBON IMPACTED SOIL - SITE PLAN	48
FIGURE 9B:	HYDROCARBON IMPACTED SOIL – BUILDING PLAN	48
FIGURE 10:	ARSENIC IMPACTED SURFACE SOIL	50
FIGURE 11:	BUILDINGS AND INFRASTRUCTURE	53
FIGURE 12:	SURFACE OPENINGS & PITS HYDROCARBON CONTAMINATED SOIL AREAS – SITE PLAN	54
FIGURE 13:	LOCATION OF WASTE ROCK, CLAY, PEAT AND BORROW AREAS	56
FIGURE 14:	CROSS SECTION OF UNDERGROUND WORKINGS	62

List of Tables

		Page
TABLE 1.:	GIANT MINE SUBSURFACE OPERATING LEASES	15
TABLE 2:	CURRENT FUNCTION OF TAILINGS STRUCTURES	29
TABLE 3:	TAILINGS ARD POTENTIAL	32
TABLE 4:	LOCATION & ESTIM. VOLUME OF HYDROCARBON CONTAM. SOIL AT GIANT MINE	48
TABLE 5:	SURFACE OPENINGS	54
TABLE 6:	GIANT MINE WASTE ROCK ARD POTENTIAL	57
TABLE 7:	GIANT MINE WASTE ROCK ARD POTENTIAL	58
TABLE 8:	UNDERGROUND SCOOP TRAM SHOPS	63
TABLE 9:	RECLAMATION COST ESTIMATE	AFTER 74

List Of Appendices

A. PHOTOGRAPHS
B. CITY OF YELLOWKNIFE LONG RANGE PLAN
C. OWNERSHIP DOCUMENTATION
D. SPIRIT YK PROPOSAL
E. TAILINGS DAMS STABILITY REPORT
F. SUGGESTED TAILINGS ARD STUDY
G. INVENTORY OF HAZARDOUS MATERIALS
H. PCB REMOVAL AND ASBESTOS STUDY
I. B-1 PIT DISPOSAL REQUIREMENTS
J. BUILDING INSPECTION SUMMARY
K. EQUIPMENT INVENTORY
L. QUALIFICATIONS OF ASSESSORS

1.0 Introduction

1.1 Purpose of Study

The Ontario Court General Division appointed Pricewaterhouse Coopers Inc. as interim receiver of the properties and assets of Royal Oak Mines Incorporated on April 19, 1999. The property acquired by the receiver includes the Giant Mine property located near Yellowknife, Northwest Territories. Currently, the receiver is maintaining operations at the Giant Mine site until a purchaser is identified. In the event that a purchaser does not come forth, the mine will cease operation and the responsibility for the remediation and reclamation of the property will revert to the Department of Indian and Northern Affairs Canada (INAC) and to the Government of the Northwest Territories (GNWT).

The Department of Resources, Wildlife and Economic Development (RWED) and Municipal and Community Affairs (MACA) of the GNWT and Indian and Northern Affairs Canada (INAC), collectively referred to herein as the Client, commissioned the Deton'Cho Environmental Alliance (DCEA) to complete a non-intrusive environmental site assessment and a reclamation cost estimate of the Giant Mine Site.

The purpose of the assessment was to collect information regarding environmental and safety issues at the site that will have to be addressed upon closure of the mine. Information collected comprised documentation such as reports, records and leases, and unconfirmed verbal reports from interviews. The reclamation cost estimate, which was based on the described remediation measures herein, is also included in this report.

The following report presents the results of the environmental site assessment of the Giant mine and includes, a brief summary of historical land use and mining activities of the property, current land uses and users, a summary of information gathered via interviews of persons knowledgeable with the site, and the results of site observations made during the course of this study. A preliminary cost estimate is presented at the end of the report. Site photographs are presented in Appendix A.

1.2 Scope of Work

The terms of reference for the Giant Mine Environmental Site Assessment (ESA) project, as outlined by the Client in the request for proposal (RFP) is summarized as follows:

> *"The Government of the Northwest Territories and Indian and Northern Affairs Canada want to contract a consultant to identify environmental liabilities that exist on surface and underground at Giant Mine and provide a cost estimate of reclamation. The scope of work will include reviewing relevant information, conducting an on-site survey and assessment and providing a first order estimate of reclamation costs using the RECLAIM 3.1 model."*

The RECLAIM 3.1 Cost Estimating model was prepared by Brodie Consulting Limited for the Indian And Northern Affairs Canada, Water Resources Division to serve as a guide for regulatory agencies, mining companies and others to estimate the cost of mine reclamation. A disclaimer appended to the model recognizes that one model can not cover the full range of possibilities encountered during reclamation activities. It is however expected to be flexible and comprehensive to provide a user with a forecasting tool to meet most reclamation situations. As with all models, the output is only as accurate as the input; therefore the cost estimate produced from a non-intrusive site visit is considered a first order cost estimate. It is a preliminary cost estimate based on the synthesis of site-related data and the current state of the site, and is expected to evolve and change as additional site information becomes available.

1.3 Limiting Issues to the Assessment

This non-intrusive environmental site assessment seeks to understand the extent of environmental contamination and the associated costs in remediation and reclamation associated with the Giant Mine site. There are a number of factors that influence the costing of such an undertaking, including the ultimate land-use of the property following closure, and reclamation of the mine site and the criteria to which the site is to be remediated in order to meet the requirements for this land-use. A number of issues and decisions were pending concerning arsenic and the future land uses of the Giant mine property.

The initial environmental assessment consists of a review of existing information on the property, an inspection of the property, and interviews with people knowledgeable about the property. This assessment is based on normally accepted engineering practices for evaluations of this type.

The purpose of the assessment is to identify existing and potential contamination on the property, and determine whether further testing is required to quantify the level of risk present.

Discussions with the city and the GNWT 's Department of Municipal and Community Affairs (MACA), indicated that the land surrounding and adjacent to the Giant Mine lease has been identified as future residential development. Future residential land use, even in close proximity to the Giant Mine poses more stringent remedial guidelines for all potential contaminants, both inorganic and organic, as opposed to an industrial setting. Establishment of the future land-use on the Giant Mine lease, as well as areas in close proximity to the mine site, will determine the extent and degree with which a final site closure would be accepted by appropriate regulatory agencies, and ultimately the associated costs. Until a decision is made on the ultimate land use of the site, proposed remedial and reclamation costs could only be construed as preliminary estimates, dependent upon review and final approval by the appropriate regulatory authorities. The City of Yellowknife long-range land use plan is presented in Appendix B.

The Giant Mine and surrounding area of Yellowknife is situated in a geological region that exhibits naturally elevated levels of arsenic in soil and bedrock. Mining and extraction of gold from these ores does not introduce arsenic into the process, rather releases it from its mineralogical form.

The Yellowknife Arsenic Soil Remediation Committee (YASRC) was formed to deal with the issue of realistic remediation criteria for the Giant Mine and Con Mine properties. It comprises representatives from the Federal Government - Indian And Northern Affairs Canada (INAC), Environment Canada (EC); Territorial Government – Resources, Wildlife and Economic Development (RWED), Municipal and Community Affairs (MACA), Health and Social Services; City of Yellowknife – Stanton Regional Health Board, city officials; as well as interest groups – Aboriginal groups, Ecology North and Canadian Public Health Association. Their mandate is to determine an acceptable remediation criterion for arsenic contaminated soil in the Yellowknife area.

Once this level has been determined they are to recommend the value to the Northwest Territories Water Board and/or other relevant regulatory agencies. The Committee Chair, Elaine Berthelet, indicated in an interview that the committee has yet to reach a decision as to the arsenic remediation criteria. They are still in the process of attempting to establish the background level of arsenic in the Yellowknife area.

The Recommended Canadian Soil Quality Guidelines as established by the Canadian Council of Ministers of the Environment (CCME, March 1997) outlines soil quality guidelines for contaminated site management. It does not establish a binding norm or affect legal rights or obligations; rather it is intended for general guidance only. For arsenic the soil quality guidelines recommend a level of 12 ppm regardless of land use category. However, the document clearly states:

"Where local or regional background soil concentrations of arsenic differ markedly from the 12 ug/g, then site- or region- specific guidelines should be derived, incorporating the local/regional background soil concentrations"

Without an established arsenic criterion, it is difficult to apply a realistic costing for remediation of surface arsenic contamination at the Giant Mine. This is an underlying issue that pertains to the remediation of most of the mine components including tailings containment areas, contaminated soil and water, and building demolition and disposal. Although the soil concentrations of arsenic based on the property have been previously assessed (EBA, 1998), costing of mitigation measures is difficult without having an established remedial criterion.

The most significant limiting factor associated with the completion of this project, is the issue of the stored underground arsenic trioxide at the Giant Mine. This factor was excluded as a component of the project at the request of the client. However, the issue of the stored arsenic trioxide and the selected remedial methods will have a significant impact on potential environmental concerns and safety hazards associated with the surface, in the terms of the risks associated with the chosen method/methods and the infrastructure that is required to support the remedial method. Therefore reclamation and remediation costs can only be presented as preliminary estimates contingent upon factors that are yet to be decided upon.

2.0 Site Description

2.1 Location

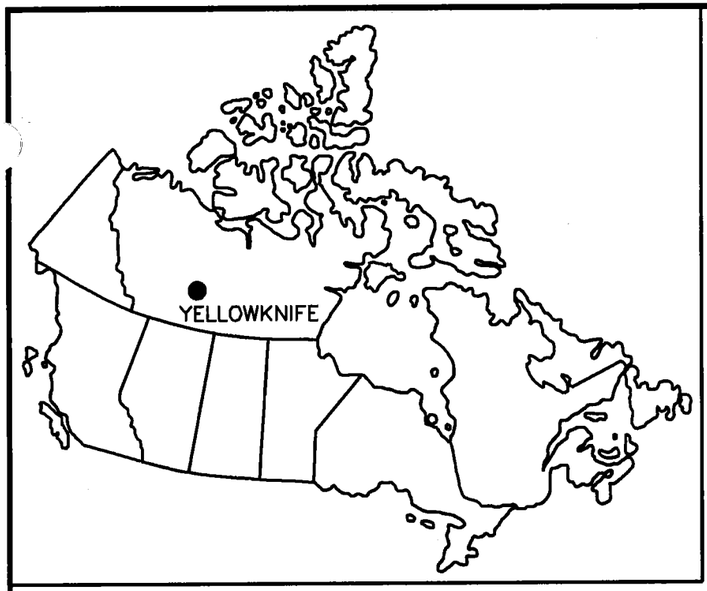
The Giant Mine Site is situated at 62°30' N Latitude and 114°21' W Longitude, approximately five kilometers north of the City of Yellowknife, adjacent to the Great Slave Lake along the western shore of Yellowknife Bay. The site is accessed by the No. 4 Highway (Ingraham Trail), which was historically constructed to gain access to the Giant Mine site and is now also used to access cabins situated along the Ingraham Trail. The site location is shown on Figure 1.

The mine site is located in a zone of discontinuous permafrost, with a mean annual air temperature (MAAT) of -5.2°C [Climate Normals, 1990]. Total annual precipitation ranges from 200 to 500 mm. Normal annual precipitation at Yellowknife is 267 mm, of which 144 mm occurs as snowfall.

2.2 Infrastructure

Giant Mine has a total of about 100 buildings, on the mine and town site, many dating back as far as the original construction of the mine. The first structures were built in the late 1940's and consisted of the crushing, milling, and roasting plants along with the development of the A, B and C shafts. In 1950, living accommodations at the main camp were expanded, the main warehouse was built, the mill was expanded, and construction began on the Cottrell Plant. By the mid 1950's, the mill lab, a warehouse at C-Shaft, machine shop, the fluid bed roaster, the brick roaster stack, kiln plant, and many of the residences in the Yellowknife townsite were built. Improvements to various components of the mill and roaster, plus various additions and renovations, continued through the 1960's and 70's. Effluent quality standards prompted the construction of the Effluent Treatment Plant in 1981. A new refinery building was also constructed that same year. Through the rest of the 1980's, a surface crusher was installed and the Tailings Retreatment Plant (TRP) and the new C-dry were built.

The infrastructure that links all the main buildings, underground workings, and tailings disposal areas together comprises access roads, utilidors, power lines, tailings lines, bridges and culverts. These items are shown on Figure 2 and Figure 11. The access roads are generally made up of crushed waste rock that has been generated over the life of the mine. Wooden utilidors link the main buildings together, distributing water, sewage, oil, and electricity. Electricity is also supplied to high electrical consuming buildings by overhead power lines. Culverts and small wooden bridges allow passage for vehicles over utilidors and surface runoff.



RYAN LAKE

WALSH LAKE

PRELUDE LAKE

RATER LAKE

VEE LAKE

PROSPEROUS LAKE

MADELINE LAKE

MARTIN LAKE

YELLOWKNIFE RIVER

ROYAL OAK GIANT MINE

FOX LAKE

LONG LAKE

FIDDLER LAKE

DUCK LAKE

YELLOWKNIFE

NERCO CON MINE

KAM LAKE

DETAH

YELLOWKNIFE BAY (GREAT SLAVE LAKE)

0 5 Km

HIGHWAY

VISTA PROJ NO 815-01

Deton'Cho Environmental Alliance

JOB TITLE

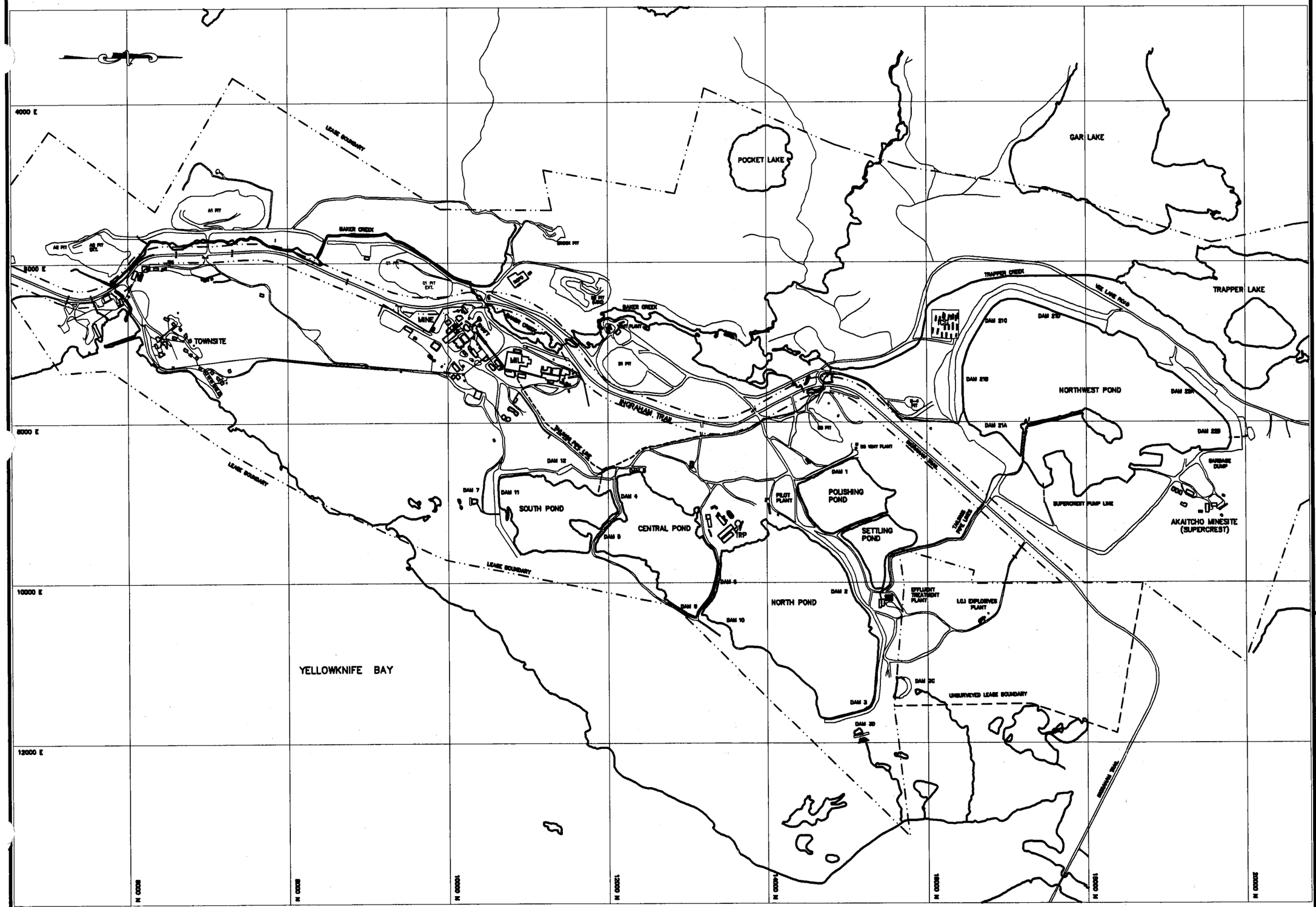
ENVIRONMENTAL SITE ASSESSMENT

GIANT MINE, NT

DRAWING TITLE

LOCATION OF GIANT MINE

DESIGNED BY	SCALE
	SHOWN
DRAWN BY	DATE
D.J.G	99-07-24
CHECKED BY	FIGURE
SHEET	DRAWING NO
OF	FIGURE 1



NOTES:

1. DIGITAL MAPPING SUPPLIED BY ROYAL OAK MINES

VISTA PROJ NO 815-01

eba | VISTA ENGINEERING

Deton'Cho Environmental Alliance

JOB TITLE

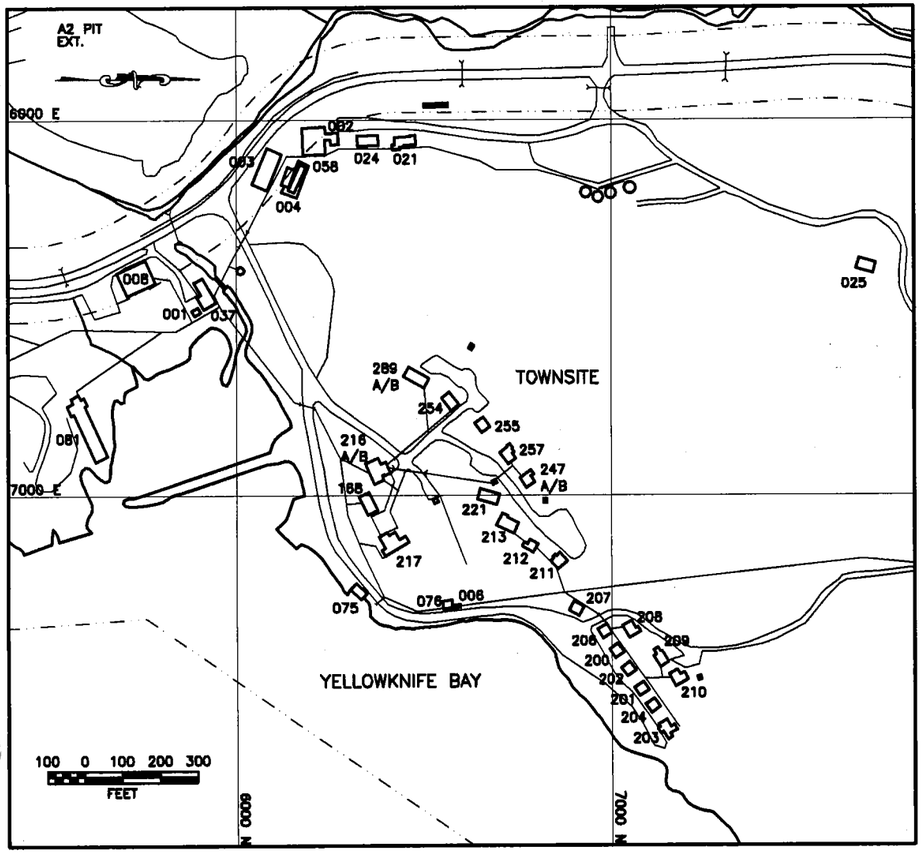
ENVIRONMENTAL SITE ASSESSMENT

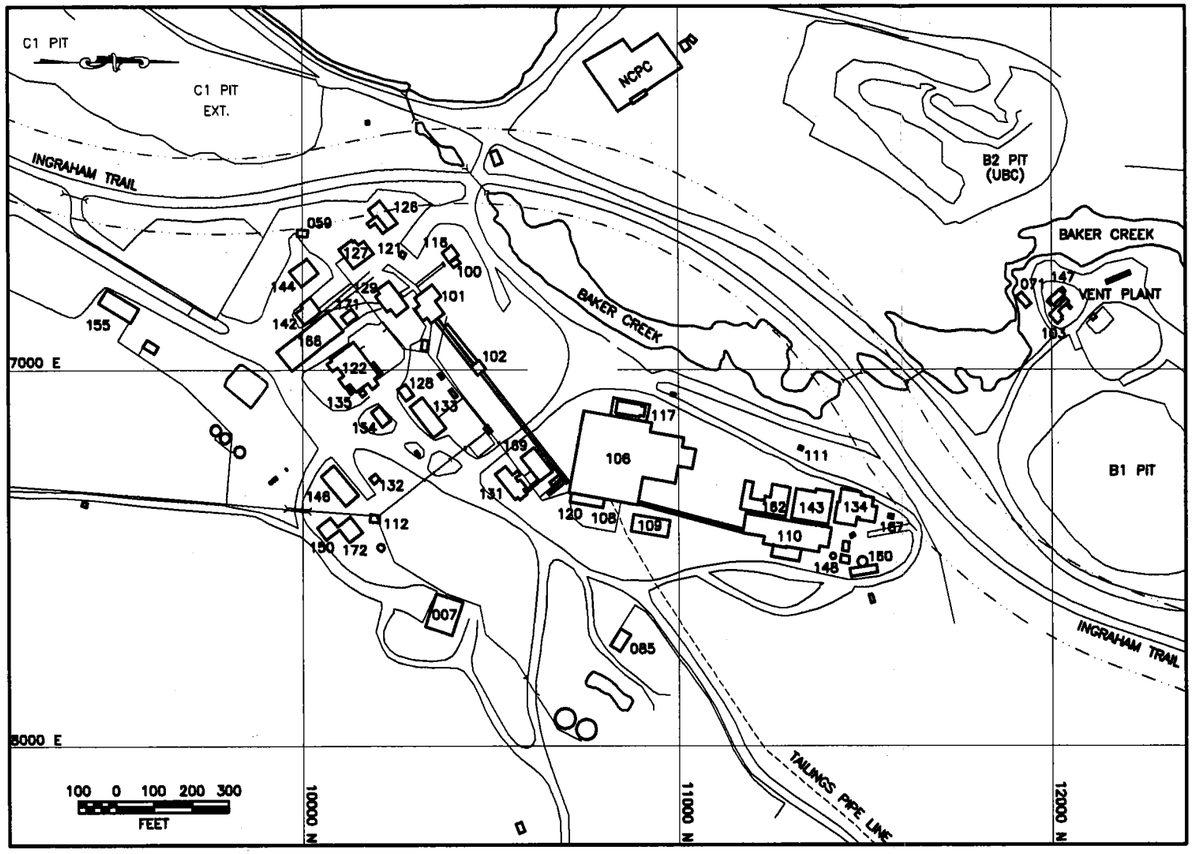
GIANT MINE, NT

DRAWING TITLE

OVERALL SITE PLAN

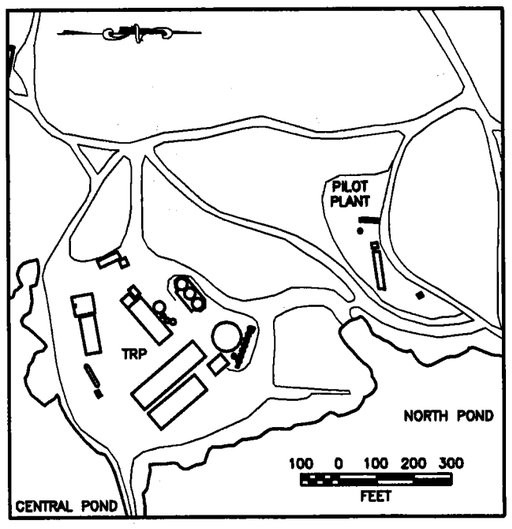
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SHEET OF	DRAWING NO FIGURE 2





TOWN SITE

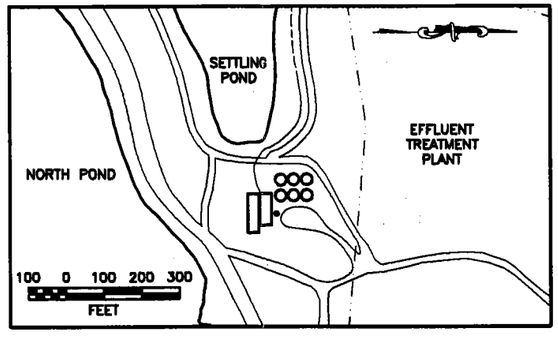
BLDG. NO.	DESCRIPTION
001	SEWAGE LIFT STATION
002	OLD HOISTROOM
003	EXPLORATION SHOP
004	NO.1 TRANSFORMER SUBSTATION
006	BAYVIEW SEWAGE PUMP HOUSE
008	RECREATION HALL
021	STORAGE
024	A – HEAD FRAME
025	OLD POWDER MAGAZINE
037	BOILER HOUSE
040	MOTOR STORAGE
058	OLD DIESEL PLANT
075	NEW PUMP HOUSE
076	NO. 2 MAIN PUMP HOUSE
081	CURLING RINK
188	GUEST HOUSE
200	RESIDENCE
201	RESIDENCE
202	RESIDENCE
203	RESIDENCE
204	RESIDENCE
206	RESIDENCE
207	RESIDENCE
208	RESIDENCE
209	RESIDENCE
210	RESIDENCE
211	RESIDENCE
212	RESIDENCE
213	RESIDENCE
216A	RESIDENCE
216B	RESIDENCE
217	RESIDENCE
247A	RESIDENCE
247B	RESIDENCE
254	RESIDENCE
255	RESIDENCE
257	RESIDENCE
289A	RESIDENCE
289B	RESIDENCE



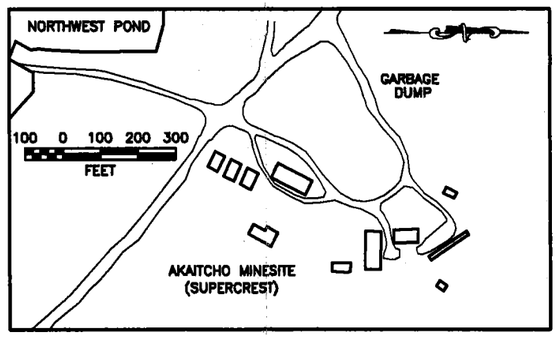
TRP SITE

MINE SITE

BLDG. NO.	DESCRIPTION
007	MOBILE EQUIPMENT GARAGE
058	BUILDING SUPPLIES STORAGE
059	NEW DIESEL PLANT
071	OLD COMPRESSOR HOUSE
085	BUILDING SUPPLIES STORAGE
100	NEW SURFACE ROCK BREAKER
101	MILL CRUSHER HOUSE
102	SCREEN HOUSE AND CONVEYORS
103	PROPANE STORAGE TANK
106	MILL PLANT
108	SWITCH HOUSE
109	REAGENT WAREHOUSE
110	MILL PIPE SHOP
111	ROASTER CHANGE HOUSE
112	MILL FIRE PUMP HOUSE
116	SURFACE CRUSHER
117	NEW REFINERY
120	ELECTRIC BOILER HOUSE
121	ORE PASS BUILDING
122	MACHINE SHOP
123	ORE BIN AND WASTE BIN
126	NO. 5 TRANSFORMER STATION
127	C – HOIST ROOM
128	PIPE RACK
129	C – HEADFRAME
131	ASSAY OFFICE
132	OIL STORAGE SHED
133	WAREHOUSE
134	COTTRELL
135	OIL STORAGE SHED
140	FAN AND HEATER HOUSE
142	CARPENTRY SHOP
143	DORRCO ROASTER
144	PLANNER SHOP
148	OLD WAREHOUSE NO. 4
149	ROASTER STACK FAN HOUSE
150	ELECTRICAL SHOP
154	STEEL RACK
155	MAIN OFFICE AND EXTENSION
160	SILO LOAD–OUT
162	CALCINE PLANT
166	NEW C – DRY
167	BAG HOUSE
169	MILL LAB
171	FIST AID TRAINING ROOM
172	NEW BOILER HOUSE



EFFLUENT TREATMENT PLANT



AKAITCHO MINE SITE

VISTA PROJ NO 815-01

Deton'Cho Environmental Alliance

JOB TITLE

ENVIRONMENTAL SITE ASSESSEMENT

GIANT MINE, NT

DRAWING TITLE

BUILDINGS AND INFRASTRUCTURE

DESIGNED BY	SCALE: SHOWN
DRAWN BY: D.J.G	DATE: 99-08-02
CHECKED BY	FIGURE
SHEET OF	DRAWING NO: FIGURE 11

2.3 Geology

The Giant Mine is located within the structurally complex Yellowknife Greenstone Belt of Archean Age on the geological time scale. The belt extends from Great Slave Lake for a distance of over 50 kilometers and is comprised of a homoclinal steep easterly to vertically dipping sequence of metabasalts and metagabbros intruded by sheeted dykes and overlain by sedimentary units. The package of rocks was subsequently intruded by granitic intrusions. The ore is characterized by 40 to 80% quartz-carbonate and approximately 10% pyrite-arsenopyrite. Considerable amounts of stibnite and antimony sulphosalts are also present. Gold exists in the native state as sub-microscopic particles intimately associated with the arsenopyrite.

Arsenopyrite is a naturally occurring arsenic bearing mineral. The gold mineralization associated with the mine is refractory meaning that the arsenopyrite mineralization must be physically broken down to permit the recovery of the gold.

Three prominent geological fault trends occur on the Giant Mine; 000 to 025°, 060°, and 160°, with the main structural features known as the Town site Fault, the 3-12 Fault, and the West Bay Fault. The 160° faults are prominent faults with variable easterly dips and are characterized by clay fault gouge and breccia. The sense of movement on these faults is sinistral. The 060° faults are generally characterized by having little or no clay gouge and may appear as thin hairline fractures. The sense of motion on these faults is dextral and they dip to the west. Faults with the 060° trend may occur as major faults or appear as lesser faults. Ground water seepage into the mine generally occurs along the major fault zones.

The Yellowknife region has been subjected to numerous periods of glaciation. During the most recent glaciation, the Laurentide Ice Sheet advanced to the southwest and retreated northeast. Glacial Lake McConnell was formed in the basins now occupied by Great Bear, Great Slave, and Athabaska Lakes as a result of this melting ice sheet. With the rise of glacial Lake McConnell, the entire Yellowknife area was flooded, and during this flooding, lake silts and clays were deposited in topographic lows [Wolf, 1998]. They are varved, with red-brown and dark grey clay laminae alternating with laminae of grey-brown and light grey clayey silt [Aspler, 1978].

These silts and clays have been identified in many areas of the mine site during construction of the tailings retainment structures and stripping for the open pits. Prior to construction of Dam 11, the soil conditions typically consisted of 0.3 to 0.6 m of organics over 6.4 to 8.8 m of silty clay. Approximately 0.3 m to 2 m of sand and gravel over bedrock was found below the silty clay [Geocon, 1982]. Similar soil conditions were found during the geotechnical investigation for the Northwest TCA design. In this area, silt and clay overburden up to 7 m deep were underlain by up to 4 m of silty sand with gravel [Geocon, 1987]. The silty clay was found to be ice rich in many areas. The Giant mine site is located within the zone of widespread discontinuous permafrost.

2.4 Historical Activity

Bear Exploration and Radium Ltd. began exploration and staking of the southern part of the Yellowknife River basin in 1933. The company incorporated Yellowknife Gold Mines Limited in March 1934 to acquire a portion of claim group. This company in turn incorporated Burwash Yellowknife Mines in October 1934. The original Giant group (Giant 1-21, Giant X1 - X5, Law 2 - 3) was staked in July of 1935 by C.J. Baker of Burwash Yellowknife Gold Mines Limited. Bear-Exploration, through its subsidiaries, optioned a 60 per cent interest in the Giant group in 1937 to Anglo-Huronian Limited who were to fund exploration and development. Giant Yellowknife Gold Mines Ltd. was incorporated in August 1937 to develop the property. Development was shut down between 1938 and 1941 because of World War II, but was reinitiated in 1941 by Frobisher Exploration Company Ltd. who acquired control of Giant Yellowknife Gold Mines Ltd. in 1943. It was at this time that A.S. Dadson discovered, in the Baker Creek Valley, the largest tonnage of gold ore known in the Northwest Territories. In all some 15 mineralized shear zones and veins were located.

The No. 1 (A-Shaft) and No. 2 (B-Shaft) Shafts were constructed in 1946, while the No. 3 (C-Shaft) was collared in 1947. Akaitcho Yellowknife Gold Mines (Akaitcho) was incorporated in 1945 to develop the Supercrest group of claims. The Akaitcho Shaft was subsequently collared in 1948. Giant acquired 87.5% of the Lolor group of claims in 1948 and in 1953, Lolor Mines Ltd was incorporated.

Plans for the crushing, milling and roasting plants also began in 1947. Milling operations began in 1948 when a 450 ton per day (tpd) mill was put into production and the first gold brick was poured on June 3rd of that same year. Original bullion was produced by mercury amalgamation of jig concentrates while flotation concentrates were stockpiled until the roasting and cyanidation plants were completed in 1949.

The mill capacity was increased to 700 tpd in 1952 and then to 900 tpd in 1960, the year that Giant Yellowknife Gold Mines amalgamated with Consolidated Sudbury Basin Mines Ltd. to form Giant Yellowknife Gold Mines Ltd. In 1962, Giant Yellowknife merged with Ventures Ltd. to become one of the Falconbridge Group of Companies.

Giant Yellowknife Gold Mines Ltd. and Akaitcho jointly formed Supercrest Mines Ltd. in 1964 to develop the Supercrest property. Both Lolor Mines Ltd. and Supercrest Mines Ltd. went into production in 1967.

Sharply increasing gold prices in 1973 and 1974 prompted an increase in exploration in areas that were previously considered to be submarginal. In 1974, production started from the A-1 open pit. Soon after, other open pits were developed and accounted for nearly 40% of the mill feed.

By the 1980's gold prices were at $612 US an ounce and Giant was being mined from the ASD Shear Zone. In 1986, Pamour Inc. acquired Falconbridge Ltd.'s 19.2% share in Giant Yellowknife Mines Ltd. as well as 36.7% held in Akaitcho Yellowknife Gold Mines Ltd. Giant Yellowknife acquired Pamour's mines in the Timmins area of Ontario, increasing Pamour's interest in Giant to 50.2%.

In 1987, a 100 tpd pilot plant was built to determine the feasibility of recovering gold from the tailings. After a three-month trial period and a recovery rate of 38%, a decision was made to construct a Tailings Retreatment Plant (TRP). The TRP went into production in 1988, but recovery rates were only 17.1% in 1988 and 28.6% in 1989. By 1990, gold prices had leveled to $400 US an ounce and Pamour went into bankruptcy.

In 1990, Royal Oak Resources Ltd. purchased control of the Pamour Group of Companies. Upon a review of the corporate mining strategy and a search for ways to reduce the overall production cost, the TRP project was shut down. By 1991, Royal Oak Mines Inc. was formed as a result of the amalgamation of Royal Oak Resources Ltd., Pamour Inc., Giant Yellowknife Mines Ltd., Pamorex Minerals Inc., and Akaitcho Yellowknife Gold Mines Ltd. The recent decrease in the price of Gold to $260 US per ounce in 1999 placed the operations at Giant mine in jeopardy. On April 16 1999, Royal Oak Mine Inc. went into receivership and is currently operated by the Interim receiver Pricewaterhouse Coopers Inc. who is currently seeking a purchaser/operator. Operations at the Giant Yellowknife Mine came to an end in October 1999.

2.5 Mining Methods

Underground and open pit mining methods were both practiced at Giant Mine at one time. However, open pit operations were closed in 1990 with the exhaustion of mineable reserves. There are seven inactive pits on site. These are the A1, A2, C1, B1, B2, B3 and Brock Pits. Underground mining has largely been carried out using shrinkage, longhole and mechanized cut and fill methods. Cut and fill mining previously incorporated hydraulic backfill of floatation tailings that was capped with concrete, or backfill of tails mixed with cement to produce hard floors in the stopes. Waste rock was primarily used underground for backfill on an as required basis.

The underground workings of the mine extend over 11 levels to a depth of about 610 m (2,000 ft). Near surface workings extend over 4,877 m (16,000 ft) and decrease to about 1,829 m (6,000 ft) on the 2000 mine level. The recent mine workings are accessed through a main production shaft C and two ramp systems located in the B2 (UBC) and B3 pit.

Gold is extracted from the ore body at a rate of 1,100 tonnes per day. The rock is drilled and then blasted with an ammonium nitrate and fuel-oil (ANFO) based explosive. The rock is transported underground by battery powered locomotives to the C-Shaft where the ore is lifted to the surface by electric hoist to the mill circuit.

2.6 *Milling Process and Waste Streams*

2.6.1 Historical Methods

Production at the Giant Mine site commenced in May 1948 treating 250 tons per day (tpd) by conventional methods, which included gravity separation for coarse gold and mercury amalgamation. A flat-hearth roaster was installed in January 1949 because the gold encountered was becoming refractory and therefore impossible to remove from the rock using gravity separation. A cold Cottrell precipitator was installed in October 1951 to collect gold bearing arsenic dust for pretreatment in a separate processing circuit.

By 1952, tonnage had been increased to 850 tpd and roasting of concentrate became a more important component in the process. A prototype split-compartment fluosolids roaster was placed in service to assist the flat-hearth handling of the increased concentrate load. By 1958, tonnage had increase to 1000 tpd. A new two-stage fluosolids roaster handled all concentrate and a 60,000 cubic feet per Bag House was collecting arsenic from the roaster exhaust gasses following the Cottrell treatment. Amalgamation was discontinued as the ore character had changed to refractory gold, which was only accessible through roasting.

As flotation recovery improved the flotation tails, the cyanidation circuit became uneconomic and, in 1967, this circuit was shut down and modified to treat the increased calcine tonnage from the roaster. The most recent modifications allow the mill to treat 1250 tpd in a conventional bulk-flotation circuit with calcine cyanidation following two-stage fluosolids roasting. Gold bearing Cottrell dust has been treated in a separate cyanide leaching circuit with activated carbon adsorption since 1960.

2.6.2 Present Practice

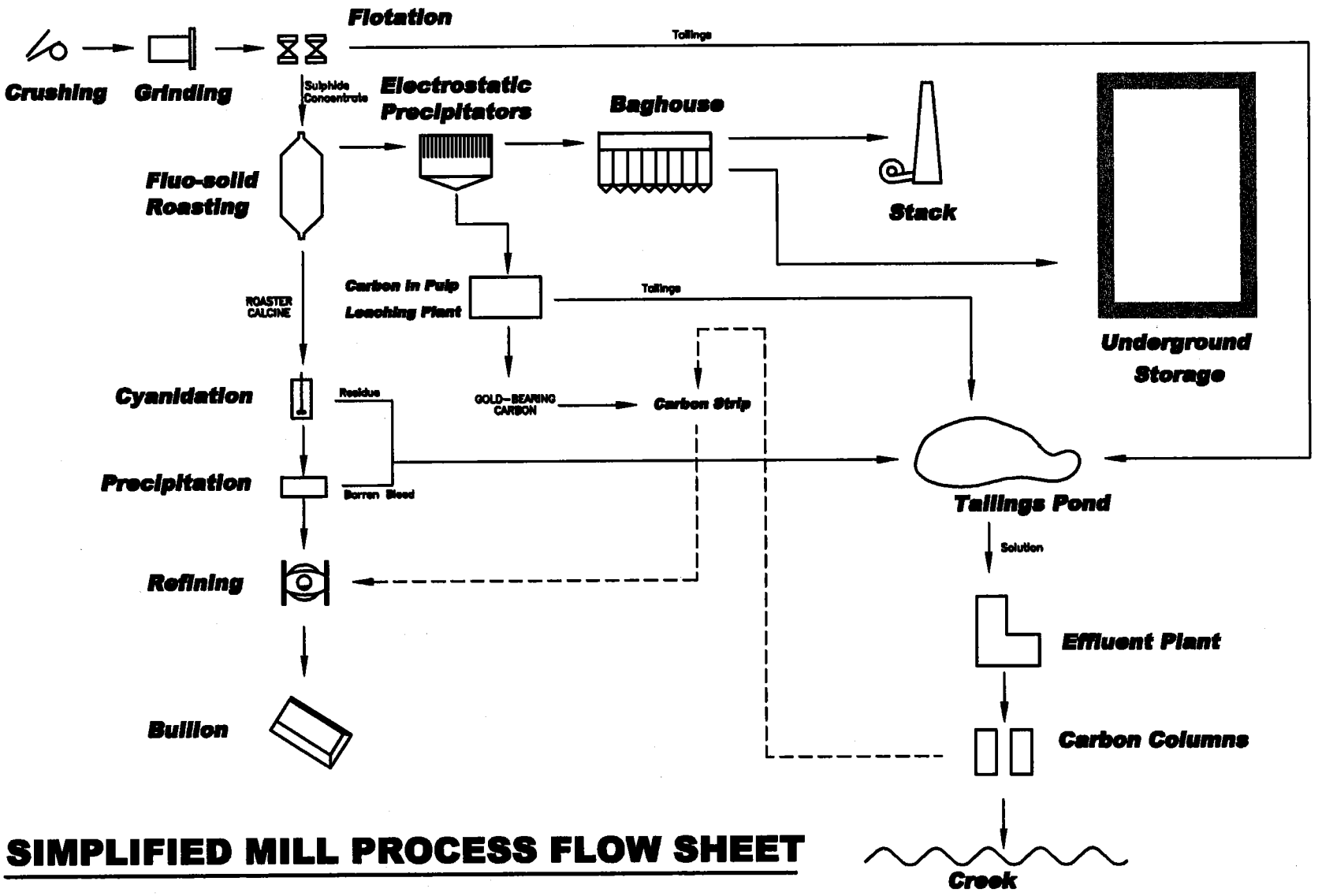
Gold is currently removed from the ore through a series of crushing and grinding, flotation, roasting, and cyanidation circuits. A simplified mill flow sheet of the process is shown on Figure 3 and described below.

Crushing and Grinding

Ore is initially crushed underground to 3/8 inch or less, in a primary jaw crusher and then hoisted to a three stage crushing plant on the surface consisting of a surface jaw crusher, and two cone crushers. The ore is then conveyed to two parallel primary grinding circuits, each consisting of a ball mill working in closed circuit with a spiral classifier. The feed to the ball mill is ground down with 3 inch forged steel balls. The larger particles are separated through spiral classifiers and returned to the primary ball mills for additional grinding. The classifier overflow is screened for removal of wood chips and passed on to the next stage of processing.

Froth Flotation

Classifier overflow is split and fed to two 12 cell parallel tanks of flotation cells. Tails are fed to a secondary ball mill for regrinding.



SIMPLIFIED MILL PROCESS FLOW SHEET

eba VISTA ENGINEERING

Deton'Cho Environmental Alliance

Figure 3
GIANT MINE
ENVIRONMENTAL SITE ASSESSMENT
SIMPLIFIED MILL PROCESS FLOW SHEET

The Froth Flotation Process is used to recover approximately 95 percent of the gold in the form of a sulphide mineral concentrate. Copper sulphate is added to the ball mills to coat the sulphide minerals contained within the ore. The flotation frother, *xanthate* is added to the classifier overflow, which selectively coats the surfaces of the sulfide minerals. The coated sulphide particles have a high affinity for oxygen, which is bubbled through the flotation cells in the form of low pressure air. A frothing agent is added to help the mineral rich bubbles form a strong and stable froth.

The froth is skimmed off into a launder as flotation concentrate. This step acts primarily as a mass reduction step. Of the 1300 tons of ore that may be processed in a day, approximately 130 tons report to the flotation concentrate. The remaining 1070 tons, called flotation tailings, are deposited directly into the TCA. In the past, floatation tails were used as backfill in the underground workings. The flotation concentrate is thickened to 75 percent solid prior to further treatment in a two-stage fluid bed roaster.

Roasting

Arsenopyrite, which is an arsenic-iron sulphide mineral has the gold intrinsically locked in its mineral matrix. Sulfur, arsenic and antimony interfere with the recovery of gold. The roaster feed is 78% solid as it enters the roaster operating at temperatures in excess of 482°C. The sulphur and arsenic contained in the pyrite and arsenopyrite are oxidized by the addition of air, which is blown in at the bottom of each roaster stage. There are two roaster stages. The arsenic contained in the arsenopyrite is oxidized and fumed off as gaseous arsenic trioxide. The remaining partially oxidized mineral is transferred into the second stage of the roaster and again oxidized at high temperature. Off gases from the two stages of roasting are combined, cycloned to remove coarse entrained dust particles, and then passed through an electrostatic precipitator or Cottrell. The Cottrell uses electrical energy to charge the fine particles of entrained dust contained in the gas and then to remove these particles from the stream by collecting them on oppositely charged rods. The dust collected in the precipitator is mixed with water and processed in a separate carbon and cyanidation circuit to recover the contained gold. The roaster treats 170 tpd of which about 130 tons is recovered in calcine the rest is released as gases.

Mixing the gas with large volumes of outside air cools tail gas from the precipitator. As the gas cools to 193 ° c, arsenic trioxide condenses from the gas to a white arsenic trioxide dust. The arsenic trioxide dust particles are filtered from the gas stream in a Bag House dust collector. The Bag House is an eight-compartment unit with each compartment containing 300 orlon bags. The remaining gas stream, which is a dilute mixture of residual arsenic trioxide, sulphur dioxide and air, passes through the bags and is exhausted to the atmosphere through a 46 m high stack. The arsenic trioxide dust, which is collected in the Bag House, is pneumatically conveyed into underground storage vaults.

The material remaining after roasting the flotation concentrate is called calcine. Calcine is reddish in color due to the gold bearing iron oxides that remain after the majority of the sulphur and arsenic has been removed. The calcines are mixed with water and then ground in two ball mills that work in a closed circuit with cyclone particle size classifiers. The ground calcines are washed in a thickener to remove soluble impurities plus increase the slurry density for subsequent gold leaching. The wash thickener overflows are rejected to the tailings containment area. The regrinding process breaks down the iron oxide particles and exposes the contained gold.

Cyanidation

The calcine slurry is made alkaline (pH 11.0) through the addition of lime. Sodium cyanide is added to the alkaline calcine solution and the gold is leached from the calcine in a two stage agitated leach circuit. The gold is dissolved into solution, which produces a gold cyanide complex. After the first stage of leaching, the calcine is partially dewatered in a thickener. Fresh cyanide solution is added to the thickened calcine slurry and then leached in a second stage of agitated leaching. The slurry is once again dewatered in a thickener with the solution recovered for subsequent processing. The thickened slurry is then filtered to remove the gold bearing solution. The filtered solids are called calcine residue and are pumped to the tailings containment area.

The gold bearing solutions (pregnant solution) recovered from the calcine leach circuit are combined and filtered in a leaf clarifier using canvas bags coated with diatomaceous earth. The pregnant solution is then deoxidized in a Merrill Crowe tower. Zinc dust is added to the de-oxygenated solution, allowing the gold cyanide complex contained in solution to precipitate on to the zinc dust. The zinc dust is then filtered from the solution using a press filter. Lead nitrate is added to the pregnant solution at the clarifier to enhance the precipitation of gold onto the zinc dust by complexing ionic species. The solution that passes through the press is aerated and returned to the circuit as barren solution. The barren solution is recycled to the leach circuit to make effective use of the contained unreacted cyanide. A portion of the barren solution is bled to the tailings containment area to remove the build up of impurities that inhibit the cyanide dissolution of gold.

The gold bearing filtered zinc dust is periodically removed from the press and melted in the refinery to form gold ore bullion.

2.7 Atmospheric Emissions

Arsenic and sulphur dioxide are released to the atmosphere via the 45m roaster stack as a byproduct of the ore roasting process. Below temperatures of 193°C the arsenic is a solid and is emitted as suspended particulate. The sulfur dioxide dissolves in water droplets, converting to the sulphate ion, which contributes to acid rain. This waste is dispersed by the atmosphere and falls out over time and therefore contributes to the arsenic contaminated soil on site and vegetation loss due to acidic precipitation [Dillon, 1995].

Atmospheric emissions for arsenic in 1949, prior to any controls, were 7,300 kg/day. As gold was literally blown out the stacks, the mine was prompted to install a cold electrostatic precipitator in 1951 to recover gold and reduce the arsenic emissions to 5,550 kg/day. A hot electrical precipitator was installed in 1955 reducing emissions to 2,900 kg/day, then a Dracco Bag House was installed in 1958 reducing arsenic emissions to 150 kg/day. In 1962, the original cold electrostatic precipitator was converted to a hot unit and in the 1970's the control equipment was retrofitted and improvements were made in operation procedures. Since then, emissions have ranged from 15 kg/day to 232.8 kg/day [EPD, RWED, 1993]. Tests conducted by Royal Oak Mines Limited in 1998 indicated arsenic emissions of in the range of 3.5 kg/day.

Sulphur dioxide was measured by the Environmental Protection Division in 1983, 1990, and twice in 1991 with results of 32.2 t/day, 35 t/day, 82.9 t/day and 49.5 t/day respectively. Damage to trees was found along Vee Lake road as far north as 5 km from the roaster stack [EPD, RWED, 1993]. There are no regulations or standards in place to limit emission rates of air pollutants from Giant Mine.

2.8 Solid Waste

Domestic waste from the town site is disposed of at the City of Yellowknife landfill. Domestic waste from the mine site, including lunchroom, office, and bathroom debris as well as cleaned chemical containers and construction waste is disposed of at the landfill located on the north shore of the Northwest TCA.

Scrap metal and other scrapped equipment is disposed of in the B1 pit as well as other bone yard areas throughout the site as described in Section 6.5. Disposal of hazardous materials is described in detail in Section 6.4.

3.0 Property Description

3.1 Present Surface Land Uses and Users

The area of land contained within the Giant Mine surface lease boundary is 949 hectares (2,345 acres) and of that area, 95% serves the purposes of mining activities and mine employee residences.

Under the Surface Lease #L-3668T, Giant Mine is permitted to sub-lease land to other operations (Appendix C). There are other occupants of the Giant surface lease. The terms and conditions of their agreements with Giant Mine as well as the condition of the sites are described in the following sections:

3.1.1 ICG Propane

ICG Propane operates a propane tank farm south of the Northwest Tailings Containment Area (TCA) that is accessed from the Vee Lake Road, which runs off the Ingraham Trail. Propane is stored in a number of various sized cylindrical tanks and services the Yellowknife area as well as the Giant Mine Property.

It was reported that there is an official sublease between Giant and ICG via a telephone interview with the ICG Local Manager. The manager was unable to locate the current agreement, but had a copy of the second agreement (ie. previous) issued in 1979. The first agreement was issued in 1969. The 1979 agreement outlines the parameters of the sublease including the rental rate, a clause for tax liability, a six-month termination clause and a clause which requires ICG to operate the site within the law. There are no utilities to the site. The site appears to be well kept and no spills have been reported to have occurred at the site.

3.1.2 Explosives Limited

Explosives Ltd. is an explosives production plant and storage facility that supplies the Giant Mine as well as other mines in the NWT with the explosive ANFO (ammonium nitrate/fuel oil). The plant was previously owned by CIL who sold to ICI then to ORIKA, current owners of the plant. Explosives Ltd. is an independent distributor under ORIKA.

The plant is located at the north end of the Giant leased property and is accessed from a gravel road maintained by the mine. The assessors visited the Explosives Ltd. site during the site investigation and spoke with the Explosives Ltd. Manager.

It was discussed that Giant Mine and Explosives Ltd. have a written agreement whereby Explosives Ltd. has the use of the property and power supplied to the plant by Giant Mine operations. In exchange, Explosives Ltd. provides a discount on the explosives that the mine uses. Water delivery and sewage disposal at the plant is by truck contracted out of Yellowknife (Kavanaugh Brothers) under the authority of Explosives Ltd. A copy of the lease agreement could not be supplied upon request.

The site was neat in appearance and environmental concerns were not observed. The NWT Spill Line reported a spill that occurred at the plant site in 1990 when 150 litres of diesel fuel were spilled by the fuel delivery truck. The current plant manager has since replaced the fuel storage system and surface signs of spill residuals were not observed.

3.1.3 Great Slave Cruising Club Marina

The Great Slave Cruising Club, located on Back Bay near the Giant Mine town site became a licensed club under the Societies Act in 1987. The club has maintained a marina located near the south end of the property on the Yellowknife Bay (Back Bay) for approximately 15 years. The marina is privately run by the Great Slave Cruising Club and provides moorage for approximately 40 boats for people in the Yellowknife area.

The assessors interviewed a Club representative who confirmed that the Club operates the marina with permission of the Mine Manager at Giant Mine. Written correspondence outlining the informal agreement is available in Club records. The marina is subject to the mines security rounds as it is on mine property and is required to maintain the environmental integrity of the property.

The Club maintains an outhouse with the City of Yellowknife supplying water and power. There are small quantities of hazardous material stored on site such as lubricants and boat fuel supplied for each boat by the boat owners. The Club property is neat in appearance and no environmental concerns were noted.

3.1.4 Northwest Territories Power Corporation

Northwest Territories Power Corporation (NWTPC) occupies Parcel A, Giant 10 & 12 MC, L214 & L216, G964. The Giant substation, located near the B2 pit workings is entirely within the Yellowknife City limits and is zoned as Limited Development. Historically, the substation and the transmission lines from the Giant substation to Snare Rapid serviced the Giant Mine property. A separate line now services the City of Yellowknife. The Giant substation was abandoned when the Jackfish substation was built. A copy of the lease agreement was not obtained for this report.

A previous Phase I Environmental Assessment of the NWTPC property completed in 1997, identified the potential occurrence of PCB soil contamination and PCB paint, based on visual observations of the paint pliability and age and use of the building. Asbestos exterior sheathing was also noted. No intrusive samples were taken during the Phase I assessment; therefore these suspicions were not confirmed. According to interviews with an NWTPC employee, it is the responsibility of NWTPC to demolish the substation as well as the section of power line between the Giant substation and the Jackfish Lake substation. The section of line between the Giant Substation and Snare Rapids will be maintained as a back-up line for the City power line.

3.1.5 Other Occupants

The Air Cadets are currently occupying the mine recreation hall located near the mine town site in agreement with the Mine Manager. The Cadets use the building for meetings, events and storage of firearms, camping equipment and camp fuel.

As well, currently the Department of Transportation, GNWT is storing two bridges on the property near the B1 pit. Little more is known of this agreement or the condition of the bridges.

3.2 Adjacent Properties

The following section outlines the properties adjacent to the mine surface lease:

3.2.1 City of Yellowknife

The City of Yellowknife, founded on the developments of resident Giant and Con mines, has a population of about 18,000. In interviews with City of Yellowknife officials, it was revealed that the City has development plans that incorporate the shoreline of Back Bay, where Giant property fronts, and the undisturbed areas surrounding the Giant mine surface lease to the Yellowknife River bridge. This area is zoned as residential and is considered for development if the population of Yellowknife increases to 50,000.

The closest residents are the Rocher property situated at the Yellowknife River bridge and the Bayly residence situated on Back Bay immediately south of the mine site.

3.2.2 N'dilo

N'dilo is a Yellowknives Dene First Nation community located on Latham Island directly across Back Bay (east) from the mine site. Historically, concern has been expressed that mine site activities have impacted the community and Yellowknife through the release of arsenic trioxide from the roaster stack and water-borne wastes from the tailings ponds. Health risks throughout the community were historically associated with contact with arsenic fallout.

4.0 Applicable Regulatory Authorities

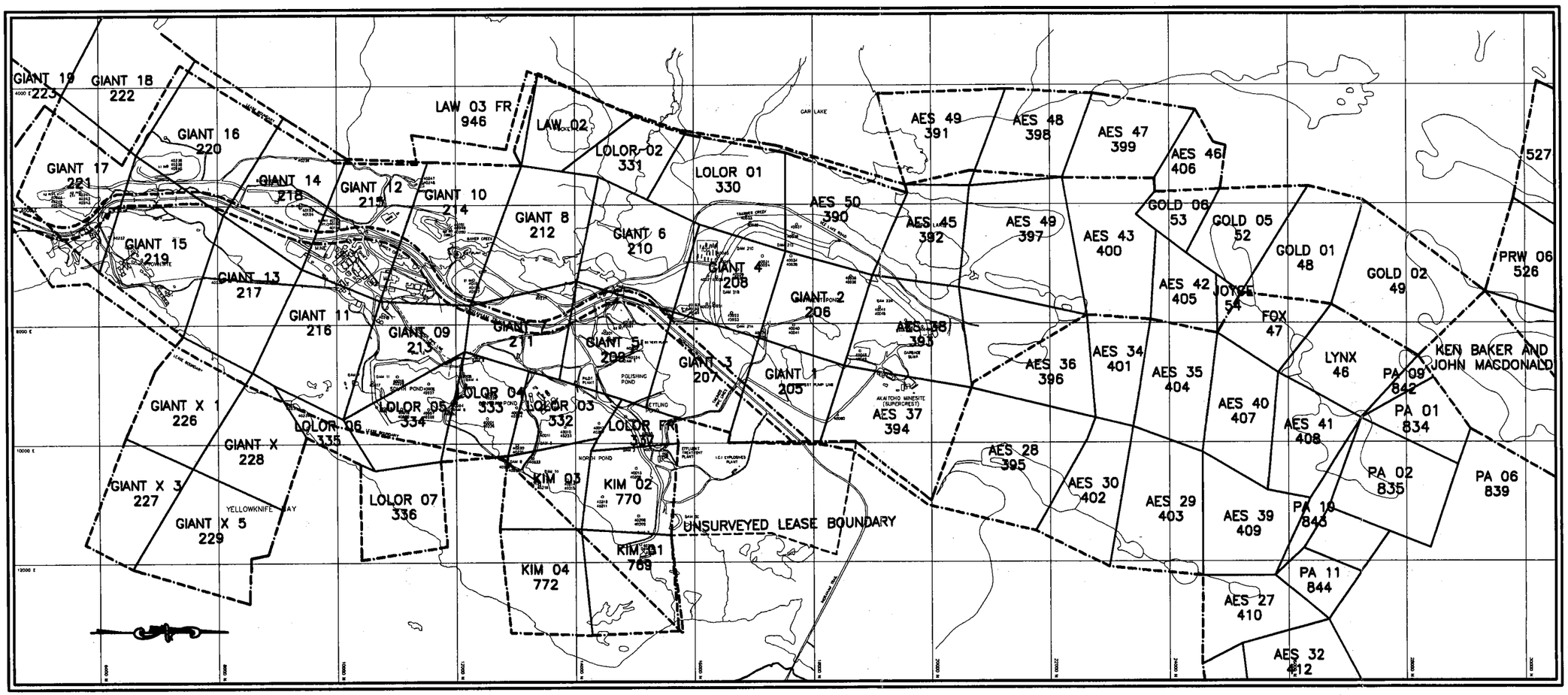
Operation of the Giant mine is governed by several regulatory agencies, as represented by various municipal, territorial and federal representatives. The various agencies regulate the activities that may occur on the property such as the discharge of waste either in a liquid, solid or gaseous state, the extraction of water for milling purposes and the transportation and storage of dangerous goods. The roles and responsibilities of several of these agencies are defined in the following sections. Leases and water licenses are presented in Appendix C.

4.1 Indian and Northern Affairs Minerals Directorate: Subsurface Leases

The Giant Mine consists of 40 individual subsurface leases, either in part or whole, that comprise the operating lease. Subsurface leases are governed by Indian and Northern Affairs Canada - Minerals Directorate. A summary of the individual leases is presented in Table 1. Locations of the leases are presented on Figure 4.

Table 1: Giant Mine Subsurface Operating Leases

Claim	Tag No.	NTS	Area (ha)	Date of Lease	Lot No	Parcel/Lease No.
Giant No. 1	32982	85-J-09	24.6	08/06/1990	205	1537
Giant No. 2	32983	85-J-09	20.9	08/06/1990	206	3329
Giant No. 3	32984	85-J-09	24.6	08/06/1990	207	3329
Giant No. 4	32985	85-J-09	21.2	08/06/1990	208	3329
Giant No. 5	32986	85-J-09	26.0	08/06/1990	209	3329
Giant No. 6	32987	85-J-09	27.7	08/06/1990	210	3329
Giant No. 7	32988	85-J-09	19.0	08/06/1990	211	3329
Giant No. 8	32989	85-J-09	29.2	08/06/1990	212	3329
Giant No. 9	32990	85-J-09	21.5	08/06/1990	213	3329
Giant No. 10	32991	85-J-09	36.0	08/06/1990	214	3330
Giant No. 11	32992	85-J-09	29.7	08/06/1990	215	3330
Giant No. 12	32993	85-J-09	28.8	08/06/1990	216	3330
Giant No. 13	32994	85-J-09	27.7	08/06/1990	217	3330
Giant No. 14	32995	85-J-09	26.1	08/06/1990	218	3330
Giant No. 15	32996	85-J-09	33.4	08/06/1990	219	3331
Giant No. 16	32997	85-J-09	32.2	08/06/1990	220	3331
Giant No. 17	32998	85-J-09	31.1	08/06/1990	221	333
Giant No. 19	33000	85-J-09	33.5	08/06/1990	223	3331
AES 36	36091	85-J-09	42.5	23/08/1993	396	2582
AES 37	36092	85-J-09	26.5	23/08/1993	394	2583
AES 38	36093	85-J-09	31.9	23/08/1993	393	2584
AES 42	36097	85-J-09	12.8	23/08/1993	405	2588
AES 43	36098	85-J-09	22.7	23/08/1993	400	2589
AES 44	36099	85-J-09	40.8	23/08/1993	397	2590
AES 45	36100	85-J-09	18.5	23/08/1993	392	2591
AES 50	36105	85-J-09	27.4	23/08/1993	390	2596
KIM 1	47698	85-J-09	23.7	24/08/1976	769	2817
KIM 2	47699	85-J-09	19.8	24/08/1976	770	2818
KIM 3	47700	85-J-09	18.0	24/08/1976	771	2819
LAW 2	N35449	85-J-09	17.53	28/06/1995	946	2690



NOTES:

1. DIGITAL MAPPING SUPPLIED BY ROYAL OAK MINES

LEGEND:

LEASE BOUNDARY

CLAIM BOUNDARY

VISTA PROJ NO 815-01

eba

Deton'Cho Environmental Alliance

JOB TITLE

ENVIRONMENTAL SITE ASSESSMENT

GIANT MINE, NT

DRAWING TITLE

MINING CLAIMS & SUBSURFACE LEASES

DESIGNED BY	SCALE 1:75,000
DRAWN BY D.J.C	DATE 99-07-28
CHECKED BY	FIGURE
SHEET OF	DRAWING NO FIGURE 4

Table 1: (Con't)

Lolor No. 1	36512	85-J-09	29.3	14/07/1991	330	3348
Lolor No. 2	36513	85-J-09	13.6	14/07/1991	331	3349
Lolor No. 3	36604	85-J-09	15.2	14/07/1991	332	3350
Lolor No. 4	36605	85-J-09	17.5	14/07/1991	333	3351
Lolor No. 5	36606	85-J-09	20.8	14/07/1991	334	3352
Lolor Fraction	37282	85-J-09	7.7	14/07/1991	337	3355
Gold 1	36373	85-J-09	22.5	11/01/1986	48	3193
Gold 2	36374	85-J-09	33.4	11/01/1986	49	3193
Gold 5	36377	85-J-09	19.0	11/01/1986	52	3193
Gold 6	36378	85-J-09	8.3	11/01/1986	53	3193

4.2 Municipal and Community Affairs: Surface Leases

A surface lease #L-3668T was issued to Giant Yellowknife Mines Ltd. by the Municipal and Community Affairs (MACA: Lands Division) of the GNWT. The current lease was issued on October 18, 1983 and expires June 1, 2013. The Lease governs all use of the Commissioners Land (land under the jurisdiction of the GNWT) occupied by the Mine subject to the Commissioner's Land Act.

The Giant Mine operating surface lease consists of Lots 1038 and 1039 in Quad 85 J/9 in the City of Yellowknife. An amendment to the Lease added two unsurveyed parcels of the City of Yellowknife Land known as Goodwin 11 and Goodwin 12 mining claims as well as Lots 47 and 48 in Group 964 of the City of Yellowknife, which became effective in May 1989. (Figure 4).

Terms and conditions of the leases are presented in Appendix C. Historically the terms and conditions of the leases were not enforced and inspections were generally not made.

4.3 NWT Water Board: Water Licence

Pursuant to the Northwest Territories Waters Act and Regulations, the Northwest Territories Water Board was responsible for issuing the Water Licence # N1L1 - 0043 to Giant Mine management. Inspectors of INAC, Water Resources Division enforce the terms and conditions of the Water Licence. The current Water Licence was renewed on June 30, 1998 and expires on June 29, 2003.

The Water Licence was issued to "regulate the taking of water and the depositing of waste of any type in any waters or in any place under any conditions where such waste or any other waste that results from the deposits of such waste may enter any waters" (Water Licence #N1L1-0043). Therefore, the Water Licence regulates the water use and disposal of wastes for industrial undertakings in mining and milling production and associated uses such as sewage, tailings, and mine water.

The current Water Licence is included in Appendix C of this report.

4.4 Other Regulatory Authorities

Other government agencies that may play a role in the events that surround the potential closure and remediation activities at the site include the following:

- The City of Yellowknife;
- GNWT - Resources, Wildlife and Economic Development (Environmental Protection Services);
- GNWT Municipal and Community Affairs (Office of the Fire Marshall);
- Environment Canada (Environmental Protection Branch);
- Fisheries and Oceans Canada;
- Worker's Compensation Board (Prevention Services Division, Mines Inspection Branch);
- Health Canada (Occupational and Environmental Health Services);
- GNWT Health and Social Services;
- Transport Canada - Transportation of Dangerous Goods.

5.0 Summary of Interviews

As a component of the non-intrusive environmental assessment, interviews were conducted with past and present mine employees, regulators and local residents, including aboriginal groups. The interviews were conducted in accordance with generally accepted industry standards to obtain subjective information pertaining to unreported spills, past operational practices and methods that may have a potential environmental impact as well as other information that could not or was not previously reported. This information was then utilized in the generation of the cost estimate for reclamation purposes. The interviews were an integral part of the assessment because they may lead to the identification of matters affecting the evaluation of the site and the subsequent remediation costing. However, it should be remembered that responses are subjective and may be subject to bias. Information obtained in the interviews has not been confirmed by field investigation.

There were over 30 people interviewed for this assessment. A list of questions was drafted and used as a guideline in conducting the interviews. Not all of the questions were relevant to the interviewee and not all the questions were necessarily asked. The following sections summarize the interview results.

5.1 Past and Present Mine Employees

The following past and present mine employees were interviewed.

- Kent Morton - Present Mill Superintendent;
- Jim Gauthier - Present Surface Maintenance/Boiler man;
- Sandy Hamilton - Present Surface Maintenance personnel;
- Noel O'Sullivan - Former Foreman and Mine Superintendent;
- Rob Moore - Present Mine Superintendent;
- Stephen Schultz - Present Environmental Superintendent;
- John Stard - Present Mine Manager;
- Dave Emery - Former Geologist, Manager, President;
- Dale Johnston - Former Cottrell Operator;
- Ken Hall - Former Laboratory Technician (Also interviewed as a Regulator);
- Eric Madsen - Former Environmental Superintendent;
- Norm Plante - Cottrell Operator.

Interview Summary

Recount times and location of contaminant spills as a result of Giant Mine operations.

- Arsenic trioxide spill from the discharge line near the roaster stack. It was cleaned up and stored in drums at the hazardous waste storage area near the NW TCA.
- Spring 1980 - tailings spill at the East dam.
- Underground arsenic trioxide spills from vaults.
- Large (80,000 L) Bunker C spill from A-shaft tanks in the 1960's.

Where are the current hazardous waste storage locations above and under the ground? What hazardous wastes are stored in these locations?

- at the NW tailings TCA near the Akaitcho shaft - arsenic trioxide, asbestos and batteries.

Do you know of any areas where arsenic trioxide from the baghouse dust was stored above ground?

- only aware of the NW TCA hazardous waste storage location.

Has there been any hazardous materials disposal into the tailings TCAs?

- Asbestos cladding in the NW TCA.
- Many drums of arsenic trioxide and other hazardous waste into Central, NW and South tailings TCAs. Everything went into the tailings TCAs from the beginning of the mine.

Are you aware of any historical abandoned underground fuel storage tanks or hazardous waste storage areas?

- Arsenic storage vaults.
- Underground fuel storage at gas pump and behind the C-dry.

Are you aware of any unregulated hazardous dump areas that exist as a result of Giant operation either on or off the property?

- Central and South Tailings TCAs.
- Bone yards with batteries and asbestos.

Are you aware of historical disposal practices of PCB's on site?

- Likely into tailings TCAs [Note: There have been no PCB analyses completed of tailing effluent to date although levels of hydrocarbons are below Water Licence criteria.]
- PCB removal program in the early 90's (Waste transported to Swan Hills, Alberta for disposal).

Are you aware of any oil-filled transformers/capacitors/electrical equipment that is potentially PCB contaminated?

- There might be some underground and in Bone yards [Note: in subsequent interviews, it was confirmed that all underground PCB contaminated transformers were removed and that only the dry-type exist underground.].

Are you aware of any urea-formaldehyde insulation or ozone depleting substances?

- no

What are mine policies for disposal of waste oil, antifreeze, waste chemicals, batteries, sewage, tailings, and any other hazardous wastes? What was the past practice of disposing of this waste?

- Waste oil, antifreeze and other materials were put into barrels. Many drums may contain mixed substances.
- Past practice was likely dump waste into tailings areas and cover with tailings.
- Batteries were sold for scrap. Waste oil was stored in tanks at the repair shop.
- Many drums were disposed of in the TCA. Most hazardous waste was placed in TCAs.
- Sewage is pumped to TCA.

Are you aware of any historical contamination or hazardous waste that was covered up during the mine operations and development?

- Tailings beach on Back Bay.

- Hazardous Waste in tailings TCAs.
- There was mention of buried hazardous material under the tire pile.
- Mercury contaminated sediment has built up at the mouth of Baker Creek, but is now under subsequent sedimentation.

The B1 pit is an authorized dump for non-hazardous wastes. Are you aware of any hazardous materials disposed of in the pit?

- Not aware of anything other than scrap metal.
- Some batteries.

Recount past milling practices (i.e. mercury amalgamation or changes in chemical used)?

- Mercury amalgam was used for the first few years of the operation.
- Flat hearth roasting used to take place.

Are you aware of any unconfined tailings deposits on site?

- Tailings beach on Back Bay.
- Tailings deposit at Baker TCA.

Where has underground backfill of tailings occurred? The type of tailings used.

- Throughout the entire underground. Tailings piped from mill to underground workings.
- Only flotation tails were used as backfill.

Are you aware of any chronic seepage from tailings TCAs or leaking from tailings transfer pipes?

- Dam 7 south of South TCA.
- Freezing of tailings pipes and pumps causing seepage.
- Leakage from the NW TCA over Vee Lake Road.
- Seepage through drill holes under the NW Tailings TCA into the underground workings. This seepage was detected because cyanide is appearing in the mine water.

Have you observed any excessive transport of tailings due to wind?

- Yes, from South, Central and Northwest TCAs.

According to historical records, the arsenic trioxide was disposed underground from 1951 to present. Are you aware of where the waste was disposed of prior to this date?

- The company did have a market source for selling some of the arsenic. Only a few trucks went out.
- Central and South Tailings TCAs.

Recount any occasions on which mill effluent was piped directly to Baker Creek.

- Every time there was mechanical failure or power outage, the tails were pumped directly into Baker Creek. (No specific dates or incidences were recounted by the interviewee)

Are there any buildings or locations on/adjacent to the site that had historically been used to store or dispose of contaminants/hazardous materials?

- Core boxes were stored in Akaitcho buildings. Other things may be stored there.
- PCBs in storage building near Old tailings area.
- Transformers in old powder magazine near A-shaft.

- Old powder magazine contained explosives.

Are you aware of any buildings that were demolished and disposed of on-site?

- The firehall was demolished in 1987 or 1988. Some materials may have been disposed in B1 pit.
- Bunkhouse and cookshack.
- Main office Building.
- Buildings were burned, salvaged by local contractors, or disposed of in tailings TCA.

Many of the buildings on site contain asbestos. Are you aware of, if any, asbestos removal and disposal on site?

- There was some asbestos removed from the roaster and Cottrell buildings by professional consultants in December 1996 and disposed of according to regulations.
- Only aware of material stored in hazardous waste storage area at NW TCA.
- Asbestos containing materials were properly disposed of according to regulations in effect at the time.

Some old light ballasts contain PCB's. Do you recall any lighting upgrades since 1975? Where could this waste have been deposited?

- No knowledge of this. New buildings do not contain PCB light ballasts.

Currently ICG Propane, Explosives Ltd., the Great Slave Cruising Club Marina, and NWT PC occupy areas of the mine property. Are you aware of any other historical uses of the property by other businesses or organizations?

- Curling club.
- Gun club renovated a building to use as a shooting range. It burned down immediately after it was completed. (interview with Regulator)
- Air Cadets in old Recreation Hall.

What are your concerns regarding site closure?

- Oil seepage on rock near the compressor building.
- Arsenic in the water table.
- Highway was realigned several times in the past; therefore, there might be some implications under the Highways Act. (interview with Regulator)

5.2 Regulators and Government Agents

Several regulators were interviewed. The interviews are summarized in the following paragraphs. The regulators who were interviewed include the following:

- Neill Thompson - Head of Regulatory Approvals Section, Water Resources, Indian and Northern Affairs Canada;
- Jim Coughlin - Manager, Community Planning, MACA;
- Mark Davy - Senior Environmental Planner, MACA;
- Emery Paquin - Director, EPS- GNWT;
- Ken Hall - Manager, EPS - GNWT;
- David Milburn - Manager, Water Resources Division, Indian and Northern Affairs;

- David Lovell - Mayor - City of Yellowknife;
- Monty Christenson - Planning Dept. City of Yellowknife;
- Max Hall - City Administrator, City of Yellowknife;
- Eric Madsen - Former Water Resources, Indian and Northern Affairs (also interviewed as former Environmental Superintendent at Giant Mine);
- Brenda Becker - Former MACA employee;
- Buddy Williams - Former MACA employee;
- Sean Gorman - Lands Officer, City of Yellowknife;
- Julie Dahl -Arctic Habitat Coordinator, NWT Area/ Nunavut Area, Department of Fisheries and Oceans;
- Laura Johnston - Manager, Environmental Protection Branch, Northern Division, Environment Canada;
- Steve Harbicht - Head of Assessment and Monitoring, Environmental Protection Branch, Northern Division, Environment Canada.

Interview Summary

Describe in general, the historic record of regulatory compliance of Giant Mine. Recount occasions on which Giant Mine has been charged with non-compliance and for what reasons.

Giant Mine has generally complied with regulations and any permits issued. One of the interviewees believed that Giant Mine had been charged at times under the NWT Waters Act but could not recall any specific occasions. Water and fish activity did not seem disturbed. General effluent testing of TCA's with bioassay resulted in one or two failures but no charges.

Although there were no regular inspections by MACA, inspections were carried out when a problem was reported and any requests to stop or change certain operational practices were adhered to. There are no regulations for ambient air quality standards. There were also no pollution abatement controls on sulphur dioxide. The discharge periodically exceeds national ambient air quality objectives for short periods. Giant Mine did voluntarily implement new emission controls throughout the history of the site.

Recall significant contamination of the property due to mine operations (spills, leaks, waste disposal)

Contamination of the property due to mine operations includes the following:

- Used oil spills from tanks which were a result of tanks having been placed the wrong way;
- Northwest tailings TCA spill over V-Lake Road;
- Waste oil used on the road as a dust control agent;
- Tailings leak from the mill box that caused a plume in Baker Creek in the late 1960's;
- Tailings leakage through Dam 3;
- Tailings leakage from the north end of northwest TCA;
- Laboratory chemicals that were discharged to the tailings stream;
- Breaks in pipes on the land;
- Fuel spills reported with the NWT Spill Response Line;
- A mill spill into Baker Lake in 1993;
- The first roaster operated in a building with a dirt floor;

- General arsenic contamination across the site.

Once mining operations cease at Giant, what land-use category should the property be reclaimed to (i.e. Residential, Parkland, Commercial, Industrial)

Most regulators interviewed indicated that the Giant Mine property should be reclaimed for Industrial use. Surrounding areas may possibly be considered for residential use but should be safe and compatible with the surrounding land uses. Clean up and restoration options should also consider potential future uses. Other comments were that the restoration of Baker Creek should allow for productive capacity for fish habitat and the historical beach tailings on Yellowknife Bay should be carefully reclaimed.

Other Questions/Concerns of Regulators

- Giant Mine (as well as Con Mine) over the years has sold mine muck, black dirt, and clay. This material was used as fill or topsoil at several locations throughout Yellowknife.
- The mine should remediate (the property) to an acceptable standard to avoid future environmental concerns.
- Whatever Abandonment and Restoration plan is utilized such that the end result does not have a significant impact on the receiving environment. This includes both on land and water.
- Building 007 – heavy equipment shop is contaminated with hydrocarbons due to years of use.
- Old electrical shop was located in the parking lot in front of the C-dry. Soil may be contaminated at this location.
- Where are bags from baghouse disposed?
- Where are bricks from roaster disposed?
- Employees used to change their vehicle lube oil on the ground near house #207.
- 100 lb. chlorine cylinder lost in water near the lakeshore pumphouse in the late 1970's and was never recovered.
- PCB ballasts/capacitors; old lighting was predominantly incandescent.
- PCB transformers could still be in use underground as they are more fire-safe.
- PCB's were sometimes used for cleaning solvent in shops/garage floor drains.
- Flotation tails were mixed with cement and used for backfill.
- Dam seeps at Dams 3D, 3C, 22B and 7.
- Trapper Creek erosion.
- Laundry, electric shop, firehall, bunkhouses, and cookhouse near camp are gone.

How do you feel about salvaging the town site?

- The town site should be taken down with the mine to avoid problems with liability in the future. The buildings contain asbestos therefore, may not be worth salvaging. Once the mine takes out the boiler, there will be no heat supply to the homes. Soil contamination may be an issue.

5.3 First Nations

The majority of the First Nation interviewees have lived in Yellowknife for most of their lives, and as such are familiar with historical activities. The First Nations and local residents interviewed include the following:

- Allison Rippen, Dene Nation Band Land and Environment Manager;
- Robert Turner, North Slave Metis Alliance;
- Fred Erasmus, Elder;
- Fred Sangris, Chief of Yellowknives Dene First Nations, Ndilo;
- George Blondin, Fort Rae Elder;
- Joe Martin, Yellowknives First Nation Elder;
- Judy Charlo, Dettah, First Nations Elder, Council Member;
- Mike Francois (Drygeese) First Nation member, Land & Environment First Nations;
- Muriel Betsina, Yellowknives Dene First Nation Member.

Interview Summary

Recall any historic spill, leaks or contaminant disposal at or near the mine site?

All but one interviewee have seen or know of people who have seen spills, leaks or contaminants at or near the mine site. These include:

- barrels open, powder in cans.
- spill reports prior to arsenic being stored underground that exceeded the level of contaminants in water.
- in 1962 the water in Yellowknife Bay & Baker Creek was a brownish colour.
- In 1972 a dog team on the trail north of Giant tailings TCA became blind and had no fur on their feet because of contaminants in the area – the tailings leak from the tailings TCA down to the lake and the tailings leak from just north of the roaster.
- spill from a dam break that resulted in a $5,000 fine.
- towards the Yellowknife River muddy water was running down the hill towards Yellowknife Bay – there was a warning not to drink water or eat the fish.
- Contaminants have been seen on site in small TCAs beside Vee Lake Road across from 138 Portal, as well as a white substance seen along the shoreline of Yellowknife Bay.

What was the site used for before the mine was constructed?

Before the mine site was constructed it was used for several things including:

- fishing;
- berry picking;
- moose hunting;
- traditional campsite & gathering area;
- trapping;
- harvesting;
- firewood;
- burial site – Northwest tailings TCA on Vee Lake Rd.

Do you recall any historic mine practices that appeared damaging to the environment and health of the local people? (i.e. Hazmat storage, air pollution, waste disposal)

- arsenic poisoning from roaster;
- trees dying, fish harmful to eat, children dying from eating snow;
- complaints of fish in the Back Bay area tasting like gas;

- concerns regarding drinking water.

Have you noticed any changes to the environment (plants, animals, etc.) that may have been as a result of Giant Mine operations?

- trees died/firewood covered in dust;
- plant life in area deteriorated;
- fish deformed;
- colour of water has changed;
- fish are soft and different color;
- rocks have changed to red/orange colour;
- no more berries for approx. 10 miles;
- wildlife (ie. caribou and fowl) no longer come in the area ;
- landscape has changed significantly - Giant Mine area covered with dust.

Does the property have any cultural importance to the Dene/Metis? (i.e. Archeological features, ancient hunting camp, burial site etc.)?

- traditional gathering site/camp;
- hunting, fishing camp, berry picking area;
- duck hunting past Northwest tailings TCA;
- burial site close to Baker Creek a long time ago;
- Big Tree on west side of YK River bridge is a sacred site for Weledeh people;
- Big Hill by Dettah junction is a sacred site;
- Baker Creek was an archeological area;
- traditional harvesting and traditional medicine.

Is the mine near an environmentally significant or sensitive area?

- Yes it is near Baker Creek, Yellowknife River, Great Slave Lake, Back Bay.
- Baker Creek was good for fish.

Are there any buildings/tanks/structures that used to be there but have since been removed?

- All answers to this question have either been no or no recollection.

What do you think that the Giant Mine property should be used for after it is closed down?

- All those interviewed who answered the question said they would not spend time on property and that they would not believe anyone, knowing the history of the property would spend time there.
- General consensus of the interviewees was to clean the site up and fence it. One interviewee suggested industrial use.

Do you know of any times when Giant Mine pumped anything into Yellowknife Bay or other areas off of their property?

- Half of the interviewees answered that they did not know, the other half said the following:
- In the 1970's traveling on west side of the Yellowknife River mine waste has been seen coming down from the hill.
- Awareness of contaminants being pumped off at the property, primarily arsenic and sulphur from the roaster.
- Sewer has been pumped into the Bay.

- In the 1950's the roaster pumped smoke all over the area, the snow was dirty from the roaster, and boats in Yellowknife Bay had oil on them from the Bay.

Has anyone you know ever become sick as a result of mining activity?

- All interviewees but two said yes – one was not sure the other did not answer the question.
- Children had stomach cramps and died from eating snow that was yellow in colour.
- Many had skin rashes.
- Dogs died from eating the fish.
- People were becoming sick easily.
- Some had arsenic poisoning.
- There were people who had nose bleeds.
- There were a lot of people who had cancer.
- Many animals died from arsenic poisoning.

Do you know of any other problems at the Giant Mine?

- Tailings TCAs were not covered up, tailings were blowing in the wind, tailings in Yellowknife Bay.
- There were safety problems for the mine employees.
- Ground water ran at a faster rate than predicted.
- Permafrost does not exist anymore due to mining activity.
- Tailings TCA close to full capacity.
- Cyanide not dissipating at rate anticipated.
- Arsenic dust for miles around mine.
- There was no education given about the mine and its hazards.
- The site cannot be used for traditional purposes.

What are your biggest concerns about the closure of Giant Mine?

- arsenic and site remediation;
- pollution;
- compensation for loss of hunting area;
- safety and health of workers cleaning up the site;
- arsenic stored underground and seeping out of mine;
- surface remediation.

Have there been any complaints by locals due to the operation of the facility (health, smells, and contaminated soil/water.

- environmentalists concerns about arsenic and tailings blowing around;
- employees complain about their health;
- arsenic dust that is being tracked around town and blowing into the lake;
- yes, but nothing has been done about it;
- health complaints to doctors;
- the smell of rotten eggs;
- blasting creating a bad smell;
- health complaints about cancer;

- skin problems;
- complaints of contamination of water and soil.

5.4 Local Organizations and Others

Local organizations, adjacent homeowners and other long-term residents were interviewed. The following is a list of those interviewed.

- Adjacent home owner on Back Bay
- Member of Spirit YK

Interview Summary

An adjacent landowner has lived on a freehold property adjacent to Giant Mine on Great Slave Lake for 24 years. The access road to the property is from the old Giant bunkhouse parking lot. He brings the perspective of a private citizen living in very close proximity to the mine for over 2 decades. He makes the following points:

- Mine has been a good neighbor.
- His family swam in the lake but never drank the water.
- He remembers a drum of arsenic fell into Baker Creek in 1976.
- The area below the tailings TCA is a vegetation dead area.
- He has not seen a noticeable change in the environment around his property. After improvements in stack technology in the 1980's, lichens and other vegetation started to come back.
- There are fish in Baker Creek. Other wildlife frequents the Creek area.
- During the Peggy Witte era, there was a noticeable increase in the smell of sulphur.
- There have been no abnormal health problems in his family.

Spirit YK mentioned other properties that were connected to the Giant mine operations. Gold Lake, which was mined in the 1980's sent ore to Giant for processing. The underground workings are closed off, but a waste rock pad still exists. Crestaurum Mine at the end of Vee Lake Road was worked in the late 1940's. Ore was not recovered, but a shaft does exist on site. Giant operated this mine. Spirit YK is interested in maintaining a historical site at the A-Shaft area. The Spirit YK proposal is included in Appendix D of this report.

6.0 Site Evaluation

6.1 General

The project team completed several site visits to undertake a non-intrusive site investigation of the property in accordance with the requirements of the Terms of Reference and generally accepted industry standards. Visits were completed on June 30, 1999, July 12, 1999, July 13, 1999 and July 28,1999. During these visits the tailings containment areas, pits, waste disposal areas and hazardous materials storage areas, selected buildings, known and suspected hydrocarbon contamination areas, the town site and the water treatment plant as well as other components were visited. The team members were accompanied by Don Helfrick of the GNWT on all site visits with the exception of the under-ground mine tour. Mine employees also accompanied the project team members during the site visits with appreciation given to the Mine Superintendent, Rob Moore, Stephen Schultz, Environmental Superintendent, and John Stard, Mine Manger.

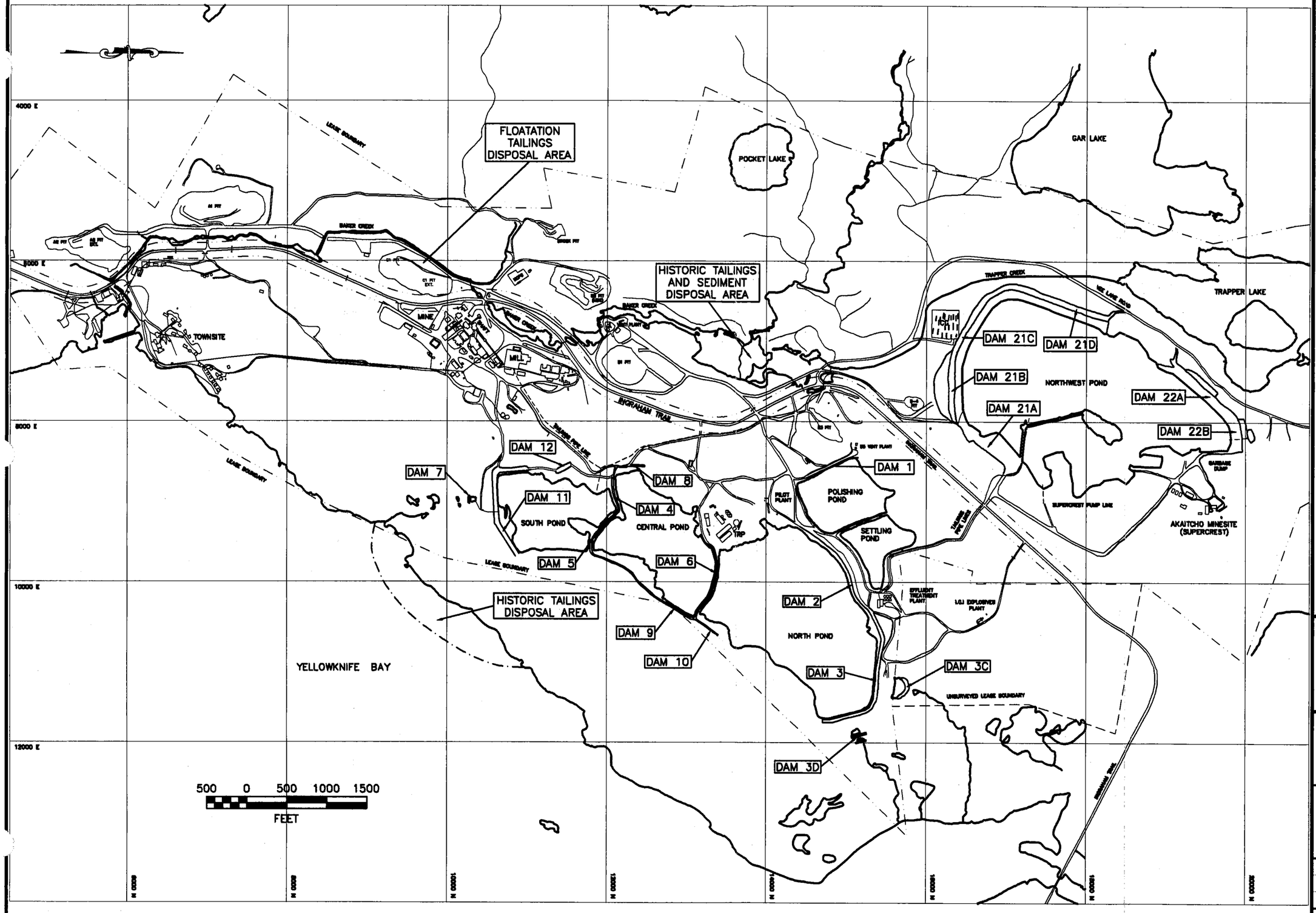
The following section summarizes the literature, history, present practices and site observations of each potential environmental and safety issue at the mine site, as observed by the site assessors.

6.2 Tailings Disposal and Containment Areas

6.2.1 Tailings History

Mine tailings have been deposited at the Giant mine site since production began in 1948. Aerial photographs and interviews indicate that tailings were initially deposited east of the mill site in a drainage channel to Back Bay. This is known as the Beach Tailings area, where tailings have been eroded and transported over time and redistributed over a large area along the southeast shoreline toward Yellowknife River. Mercury amalgamation was used in the milling process during the time the tailings were deposited here. Studies have not been completed to date to confirm the presence or levels of mercury in the sediment associated with the beach tailings.

Tailings from the operation were deposited into a small lake north of the mine in 1951. The liquid portion of the tailings drained into Baker Creek, which discharges into Back Bay, until 1968. As well, spills had historically occurred within areas that drained northeastward into Back Bay. Review of aerial photographs identified a loss of vegetation in the area. Direct and accidental flow to both areas was stopped by the construction of Dams 1, 2, 3, 4A , and 4B that were engineered to provide additional storage and create the polishing and settling ponds. These dams were constructed in stages and are composed of mine waste rock fill over bedrock, silty clay or mine tailings [Geocon, 1974]. The location or each dam is shown in Figure 5.



NOTES:

1. DIGITAL MAPPING SUPPLIED BY ROYAL OAK MINES

VISTA PROJ NO 815-01

eba VISTA

Deton'Cho Environmental Alliance

JOB TITLE

ENVIRONMENTAL SITE ASSESSMENT

GIANT MINE, NT

DRAWING TITLE

TAILINGS CONTAINMENT AREAS AND DAMS

DESIGNED BY	SCALE: SHOWN
DRAWN BY: D.J.G	DATE: 99-08-03
CHECKED BY	FIGURE
SHEET / OF	DRAWING NO: **FIGURE 5**

From 1950 to the 1960's the bulk of mine tailings was deposited northeast of the mill in an area that is known today as the Central Tailings Containment Area (TCA). At some time in the 1960's, the North TCA was separated from the central TCA and used as the main disposal area. In 1974, the original tailings containment areas had reached their operating capacity and additional storage was required. Subsequently, Dams 5, 6 and 7 were also constructed [Geocon, 1975]. Dam 8 had been constructed by 1979 and further construction was planned for Dams 2, 3, 4A, 4B, 4C, 5, 6, and 8 [Geocon, 1980]. Dams 9, 10, and 11 were constructed in 1983 and further raised in 1984 to create additional storage and to form what is now called the South TCA. With construction of the South TCA, some of the internal dams and dykes became redundant.

From 1956 to 1978, approximately 2,738,812 tons of flotation tails were used for mine backfill. During this period, a plant was constructed to mix flotation tails with cement before being directed underground. Flotation tails were also deposited in the C-1 pit during an emergency discharge in the 1980's. Flotation tails are discharged from the mill circuit immediately after grinding, therefore no chemicals have been added and it is essentially crushed rock. Past studies completed by Royal Oak (1994, 1995) have indicated that acid rock drainage potential of on-site tailings is not expected to be a problem. The data show that the tailings are net acid consuming.

Additional tailings storage requirements prompted the design and construction of the Northwest tailings containment area (TCA). Subsequently, Dams 21 A, B, and 22 A, B, C, and D were designed and constructed in 1987. No major construction of retention structures has taken place since construction of the Northwest TCA. Locations of the tailings retention structures are identified on Figure 5. The current function of each dam is summarized in Table 2.

Table 2: Current Function of Tailings Structures

Dam #	Location	Function
1	West end of Polishing TCA	- Final decant before entering Baker Creek; - Retains Polishing TCA.
2	North end of North TCA	- Minor retention of water and tailings.
3	Northeast side of North TCA	- Principally holds back dry tailings.
3C	North of Dam 3	- Seepage collection for Dam 3.
3D	East of Dam 3	- Seepage collection for Dam 3.
Dyke 4	Northwest side of South TCA	- Access road.
Dyke 5	Northeast side of South TCA	- Access road.
Dyke 6	North side of Central TCA	- Retains some tailings.
7	South of South TCA and Dam 11	- Seepage collection for Dam 11.
8	West side of Central TCA	- Retains dry tailings from Central TCA.
9	Northeast side of Central TCA	- Retains dry tailings.
10	Southeast side of North TCA	- Retains dry tailings.
11	South limit of South TCA	- Tailings retention and return seepage hold back.
12	West side of South TCA	- Retains tailings beach.

Table 2: (Cont'd)

Settling TCA Dyke	West side of Settling TCA	- Partition between Settling and Polishing TCA.
21A	Southeast side of Northwest TCA	- Left abutment of Dam 21.
21B	South side of Northwest TCA	- Retains water and tailings.
21C	Southwest side of Northwest TCA	- Retains water and tailings.
21D	West side of Northwest TCA	- Retains water and tailings.
22A	Northwest side of Northwest TCA	- Retains water and tailings.
22B	North side of Northwest TCA	- Retains water and tailings.
B-2	North side of B-2 Pit	- Directs Baker Creek away from B-2 Pit

While the Northwest TCA was under construction, the pilot tailings re-processing plant was being developed to recover gold from the tailings in the North and Central TCAs. The pilot project was successful and the tailings re-treatment plant was constructed. Processing of the tailings in the North and Central TCAs began in May 1988. The plant was expected to run for five years, but the project was abandoned soon after due to complications with excavating frozen tails and cost overruns.

According to Stephen Schultz, Mine Environmental Superintendent, the Northwest TCA is currently the winter deposit area for tailings. After a recent survey was completed of the South TCA it was determined that there was some available space for tailings disposal, therefore the South TCA is presently used for discharge in the summer months.

In February 1999 Royal Oak submitted a report to the Water Board entitled "Tailings Management Plan - Giant Mine, Yellowknife, NWT", prepared by Golder Associates Ltd., which outlines the current and future plans for tailings disposal. In summary, the existing containment facilities will provide adequate storage capacity until the fall of the year 2000 at which time tailings deposition will recommence in the North TCA. Some dam reconstruction is required before the North TCA can be used again. The five year plan outlined in the report does not call for any new impact on undisturbed land.

Inspections of the dams are carried out annually as a requirement of the Water Licence. Golder Associates Ltd. has carried out this examination from 1983 to the present. Prior to 1983, Geocon provided inspection of the dams.

A summary of Golder Associates 1998 Geotechnical Inspection of each dam is included in Appendix E.

6.2.2 Tailings Geochemistry

The characterization of the geochemistry of the tailings facilities must address two major conditions:

- The short-term potential for metal leaching as reflected by the tailings porewater; and,
- The longer-term potential for acid generation and metal leaching.

It is well recognized in the industry that the potential geochemical issues related to acid rock drainage are not confined simply to the development of net acidic conditions. The oxidation of sulphide minerals produces acidity and releases metals over a wide range of pH values as oxidation develops. This can result in elevated metal and dissolved solids concentrations in drainage that remains near neutral.

An additional consideration in a tailings deposit is the release of contaminants (primarily metals) by mechanisms other than oxidation (leaching, reductive dissolution) from the tailings solids and leached/treated concentrate.

The current porewater chemistry (ie, the water trapped between the tailings particles) provides an indication of the readily soluble component of the tailings, and of the mechanisms which are currently controlling contaminant leaching and mobility. Testing of field samples is required to characterize the longer term potential for oxidation, acid generation, acid neutralization and reductive dissolution from the tailings.

The recommendations for testing to address both short-term and long-term tailings geochemistry are provided in Appendix F. The suggested field program includes sampling for assessment of porewater and longer-term ARD potential. Testing of the solids for both short-term and long-term potential is addressed in the ARD characterization. Testing of porewater is addressed in the section on porewater characterization.

6.2.3 Tailings ARD Potential

Preliminary geochemical characterization of the ARD potential of the older tailings was completed by Royal Oak (1994, 1995). The current site Water Licence requires sampling of the final mill tailings for ARD characterization. Test procedures are to be in accordance with the Department of Indian and Northern Affairs and Northern Development's "Guidelines for Acid Rock Drainage Prediction in the North, September 1992". These data summarized in Table 3 show that the majority of the tailings are net acid consuming.

Table 3: Tailings ARD Potential

Location	Paste pH	Wt% Total Sulphur	Max. Potential Acidity (kg/MT)	Gross Neutralization Potential (kg/MT)	Net Neutralization Potential (kg/MT)	Ratio of NP/MPA
South Pond	8.5	0.685	21	205	184	9.6
Central Pond	8.5	0.522	16	238	222	14.8
North Pond	8.4	0.450	14	196	182	14.0
YK Bay Beach	8.6	0.069	3	243	241	97.2
Baker Creek	7.9	0.292	9	48	39	5.9

The data also indicate that the tailings would not be expected to create a major acid rock drainage problem. The reported average total sulfide content is less than 1% and there is considerable alkalinity associated with the tailings (at up to 243 kg/tonne). This is consistent with the description of the orebody and metallurgy; the gold values are associated with the pyrite and arsenopyrite, which would be recovered to a concentrate. This arsenopyrite/ pyrite concentrate is roasted, thereby oxidizing the sulphides, and thus when the leached concentrate is added to the tailings the acid generation potential has essentially been removed.

However, results presented in the 1994 report show that there are some samples which display a marginal potential for acid generation particularly in the older "Back Bay" samples. It would be expected that there are zones of higher sulphide content in the tailings, due to either problems in the mill or changes in the ore that may result in local pockets of oxidation and possibly net acid generation. In addition, there is still residual sulphide within the tailings. While these factors would not be expected to result in net acid generation for the tailings mass as a whole, oxidation and possibly net acid generation within local areas may result in mobilization of dissolved metals. This could then adversely affect pore water and drainage water chemistry.

A suggested Tailings ARD study is presented in Appendix F. The data from the study could then be combined with the physical assessment of the tailings to assess alternative remediation and reclamation measures; freezing, covers, water treatment. It is recognized that while net acid generation is probably not the major concern for closure of these tailings, it is possible that there may be a longer term leaching issue dominating closure requirements with respect to water quality.

6.2.4 Tailings Pore Water Chemistry

In 1997, a preliminary study of tailings ponds on the Giant Mine was undertaken by the Environmental Sciences Group (Mace, 1998). Solid phase arsenic levels in the Northwest TCA ranged between 3072 - 4842 ppm (at 0-5cm depth) with levels from the Central and South TCAs ranging from 1738 - 4431 ppm. The Beach Tailings area was also included in the study with up to 1000 ppm arsenic found on both the land and in Back Bay. All TCAs were also analyzed for inorganic elements iron, manganese, zinc, copper, nickel, cobalt, antimony, and gold. Concentrations of these elements were highly elevated when compared to background sample locations.

Sequential extraction tests were performed on TCA samples to determine the amount of arsenic in various solid phases and to infer relative stability. It was found that although the majority of the arsenic was bound up as a non-extractable form (residual - most probably mineralogical form), that between 20 - 40 % of the arsenic in the TCAs was bound to iron and manganese oxides. Arsenic bound to iron and manganese oxides is considered to have a much higher remobilization potential than the arsenic found in the residual phase.

To further investigate the potential environmental availability of arsenic in the solid phase from the TCAs, leachate tests were conducted. The Ontario Ministry of the Environment Regulation 347 Leachate Test was performed at pH 5 over a 24-hour period. To qualify as stable, the resulting leachate collected must contain less than Canadian drinking water criterion (25 ppb) when analyzed. Although none of the TCA samples exceeded the criterion of 2500 ppb to qualify as "leachate toxic waste" the resultant leachates were not considered stable.

The results of this preliminary study of the TCA's indicated that the arsenic in solid phase tailings is not inert and is to some extent being remobilized into the porewater and overlying surface water. Again this was a surficial examination of tailings chemistry from the TCA's. Further work is required to understand the tailings chemistry at depth, the hydrogeology, and the redox conditions in the TCA's.

In the recent literature there is evidence to suggest that arsenic contained within TCA's is not as stable as once believed. In particular, microbes have been shown to release arsenic from relatively stable forms (ferric arsenate) under anoxic conditions. Depending on the hydro-geological regimes found within these ponds there is a potential for the arsenic to undergo migration to adjacent surface water bodies. Therefore, further examination of the TCAs would be prudent to ensure that the correct method of long-term stabilization of the material is employed.

6.2.5 Erosion

Mine tailings in general are fine grained (less than 0.5mm grain size) and susceptible to water and wind erosion. This has proven to be the case at the Giant Mine in some areas. Tailings were historically deposited along the shore of Back Bay before being discharged to the present Central Pond site. Over time, wave action has eroded the beached tailings and some have been carried into Back Bay. A ridge approximately 1.5 m high marks the beach where the extent of erosion has occurred. The condition of the beached tailings as of September 1998 is shown on Plate 13.

There is evidence of wind erosion in the dry tailings deposits. This has been particularly evident in the North Pond, where the water level has dropped, leaving dry tailings adjacent to Dam 3. The Northwest TCA and the Central TCA and also subject to considerable wind erosion.

6.2.6 Effluent Treatment System

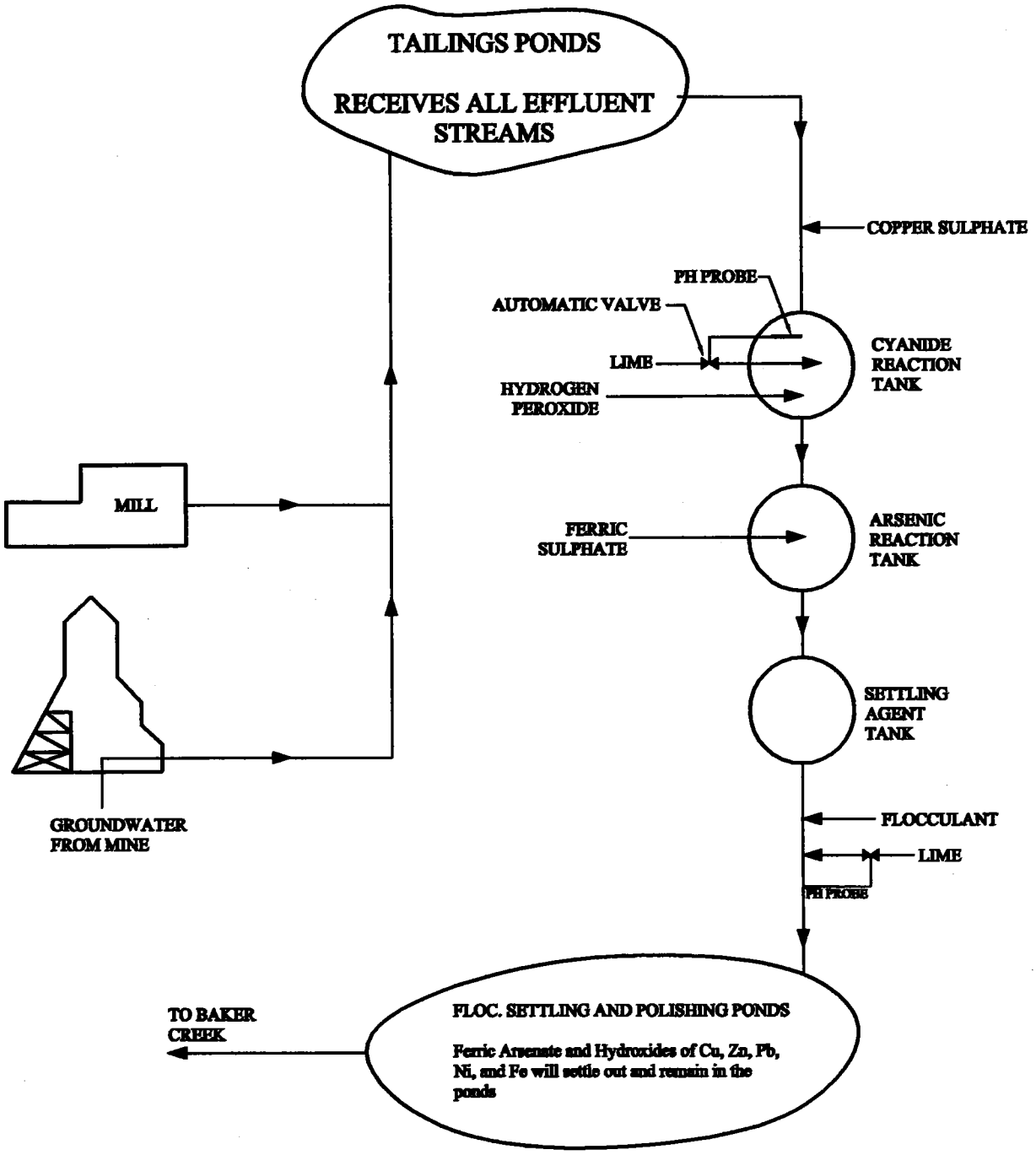
Giant Mine and Environment Canada began conducting research in 1976, with the aim of reducing cyanide from the effluent. This research lead to the installation in 1981 of an alkaline chlorination - ferric sulphate precipitation effluent treatment plant, which was the first such plant in North America. In 1988, the system was upgraded, with the assistance of Dupont Corp., from alkaline chlorination to hydrogen peroxide oxidation to eliminate the problems arising from high levels of chlorine. Some modifications were incorporated into the system in 1994 to reduce the concentration of arsenic being released to Baker Creek.

The current Effluent Treatment Plant (ETP) operates throughout the annual period of thaw, treating the overflow water from the TCA's. A flow schematic of the ETP is shown as Figure 6.

The ETP uses hydrogen peroxide to oxidize and break down cyanide to cyanate. Copper sulphate is added as a catalyst to speed up the cyanide destruction process. In the polishing TCA cyanate breaks down further to carbon dioxide (CO_2) and nitrogen (N_2) gases. Hydrogen peroxide also oxidizes arsenic ions from a +3 valence state to the +5, allowing stable precipitants to form with ferric sulphate. Lime is added to each step of the treatment process to control the pH.

Ferric sulphate is added in the arsenic reaction tank to reduce the pH to 7.0 so that the arsenic precipitates out as ferric arsenate with hydroxides of copper, lead, zinc, and nickel. The precipitate settles out in the settling and polishing ponds.

A non-ionic polyacrylamide flocculant is added before discharge to the settling pond to enhance settling of solids. The water is decanted from the polishing pond through a series of four carbon column tanks for gold recovery and then released into Baker Creek. The carbon is collected and replaced once each year and the gold is reclaimed through a separate milling process.



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Figure 6
GIANT MINE
ENVIRONMENTAL SITE ASSESSMENT
EFFLUENT TREATMENT FLOWCHART

Once chemicals are mixed, the ETP runs without an operator. Monitoring devices with high and low alarms will shut the plant down if there is a malfunction. If the ETP should shut down for any reason, the computer is programmed to telephone the appropriate supervisor. This is an important feature when considering reclamation measures and long term water treatment.

The aim of the effluent treatment process employed at Giant Mine is to produce ferric arsenate. However, if conditions were such that ferric hydroxides were formed, then arsenic would be removed in an adsorbed state. Such ferric hydroxide - arsenic compounds would afford less environmental long-term stability. It should also be noted that although the majority of precipitate settles out in the settling and polishing ponds, there is a regulated release of all compounds into Baker Creek. Water discharged from the TCA's must meet the discharge criteria as established in the water license or the discharge is terminated.

Tailings Observations

During the site investigation, all known tailings containment areas and deposits were visited. Given the time and monetary constraints of the project, the purpose of the inspection was to acquaint the assessors with the features.

The following summarizes the observations and concerns of the assessors with regard to environmental issues of the tailings containment areas located on the site:

General

1. Tailings are currently deposited into the Northwest TCA (winter) and the South TCA (summer). The North TCA is used periodically for limited minewater storage.
2. Tailings dust, generated from dry tailings, was observed in the Northwest and Central TCA's. This issue was also emphasized by many of the interviewees. Studies have been undertaken by Royal Oak Mines to assess the effectiveness of dust suppression agents and covers. Soil Sement® was used in recent studies with good initial results. The compound is reported to be water soluble, therefore this product may not present a long-term solution. Another dust suppression study included the application of a mixture of cow manure with local peat onto areas of tailings where dust is a problem. The result was a thick green growth of alfalfa that grew from the seeding the manure. The growth appears to be effective at suppressing the dust.

Old Tailings Area (Collectively the South, Central and North TCA's)

1. Trenches and gullies exist in the North and Central TCA's as a result of an excavation that occurred during the operation of the TRP. Dust formation conditions are favourable as a result of the disturbance of the natural crust, which forms on the tailings.
2. Drums of waste produced from cleaning the roaster, including crushed drums partially full of what appears to be, and is reported to be, arsenic trioxide material (ROM), and protective clothing were deposited and partially buried in the Central containment area. Based on rough calculations, approximately 450 cubic metres of debris is visible. This disposal area became inactive when the Northwest Hazardous Waste Disposal area was activated in 1988. A more detailed discussion of this disposal area is in Section 6.5.1

3. A peat and manure mixture was spread in two plots onto a 100,000 square foot section of the Central TCA in the summer of 1998 to test the success of vegetation regeneration to suppress dust in the dry tailings area. Although the mixture had not been seeded, the seeds that are inherent in the manure have produced vegetation that appears to be thriving. It is not known if the roots of the vegetation penetrate to the tails or if the plants are accumulating metals.

Northwest Tailings Containment Area

1. The hazardous waste disposal area located on the north shore of the pond is a potential hazard. A description of this area can be found in Section 6.4.1.
2. The solid waste landfill also located on the north shore of the pond contains small quantities of hazardous waste and requires proper closure. A description of this area can be found in Section 6.5.1.
3. Air-suspended tailings due to wind erosion were observed at the north shore.

Other Tailings Deposits

1. The flotation tailings that were deposited into the C1 pit is grown over with a lush cover of natural vegetation indicating that there is currently enough moisture and nutrients in the flotation tails to support vegetation.
2. There is evidence that the Beach tailings area are being eroded by wave action and surface runoff. Excavation or erosion control is required to reduce the further dispersement of this material into Back Bay.
3. The sediment deposited at Baker Pond is suspected by ROM personnel to be layers of tailings deposited from years of mine operations and sediment deposited from the diversion of Trapper Creek.

6.3 Hazardous Material Storage

The Transportation of Dangerous Good Act and Regulations defines a hazardous material or dangerous good and include such substances as explosives, compressed gases, flammable liquids, radioactive material, corrosives and poisons that are still in original form for its intended use. Examples of hazardous materials that are stored at the Giant Mine site include unopened drums of lube oils, greases, water treatment chemicals, mill reagents, bulk fuels and propane.

A non-intrusive inspection was conducted during the site visit of the various components of the mine site including all existing surface buildings, site electrical substations, outside storage areas, petroleum storage sites, and the existing hazardous material. Hazardous waste storage sites and hazardous wastes such as waste oil, PCBs and arsenic trioxide are discussed in the following Section 6.5. Locations where hazardous materials, such as chemicals, petroleum products and explosives, are stored were documented and evaluated.

There are a number of buildings and locations on site where hazardous materials are stored. The Mine purchasing department supplied a current inventory of these products, but the quantities are continuously fluctuating. Upon mine closure, most of the chemicals and petroleum products can be returned to the supplier if unopened.

The locations of hazardous material storage are indicated in Figures 7A and 7B. The following sections outline the type, quantities and locations of petroleum, chemical and explosive products on site.

Petroleum Product Storage and Inventory.

A variety of petroleum products are used, and have been used historically, on site as heating fuels, automotive fuels and hydraulic and lubricating oils. Heat for the mine and townsite buildings is provided by the A-boiler (located at the town site) and C-boiler (located at the mine site). For the last three years, the boilers have been burning Newalta™ Heavy Burner Fuel, which is currently delivered by tanker trucks to storage locations on site as described in Appendix G. Prior to the introduction of Newalta to the site, the mine was burning Bunker C Burner Fuel to heat the site buildings, which was delivered by barge, therefore most of the bolted metal tanks on site reported to still contain some Bunker C and Bunker C sludge. The estimated combined storage capacity of the Petroleum, Oil, Lubricant (POL) tanks on site is 5,600,000 L within 39 tanks. Twenty-six of these tanks are currently in use. Additional heat is provided to outlying buildings on the site by small furnaces that burn P-40 type diesel fuels that is stored in small adjacent tanks. Air to the underground workings is heated at B-shaft and B3 ventilation plants by propane fired furnaces.

Most of the domestic vehicles on site are gasoline fuelled and the mobile heavy equipment for both surface and underground is powered with diesel fuel. Leaded fuel was used on site up until the 1970's, when it was phased out in North America.

Other petroleum products used on site include hydraulic and lubricating oils, shipped to the mine in pails or drums and stored in the Fenced Yard and at the Warehouses.

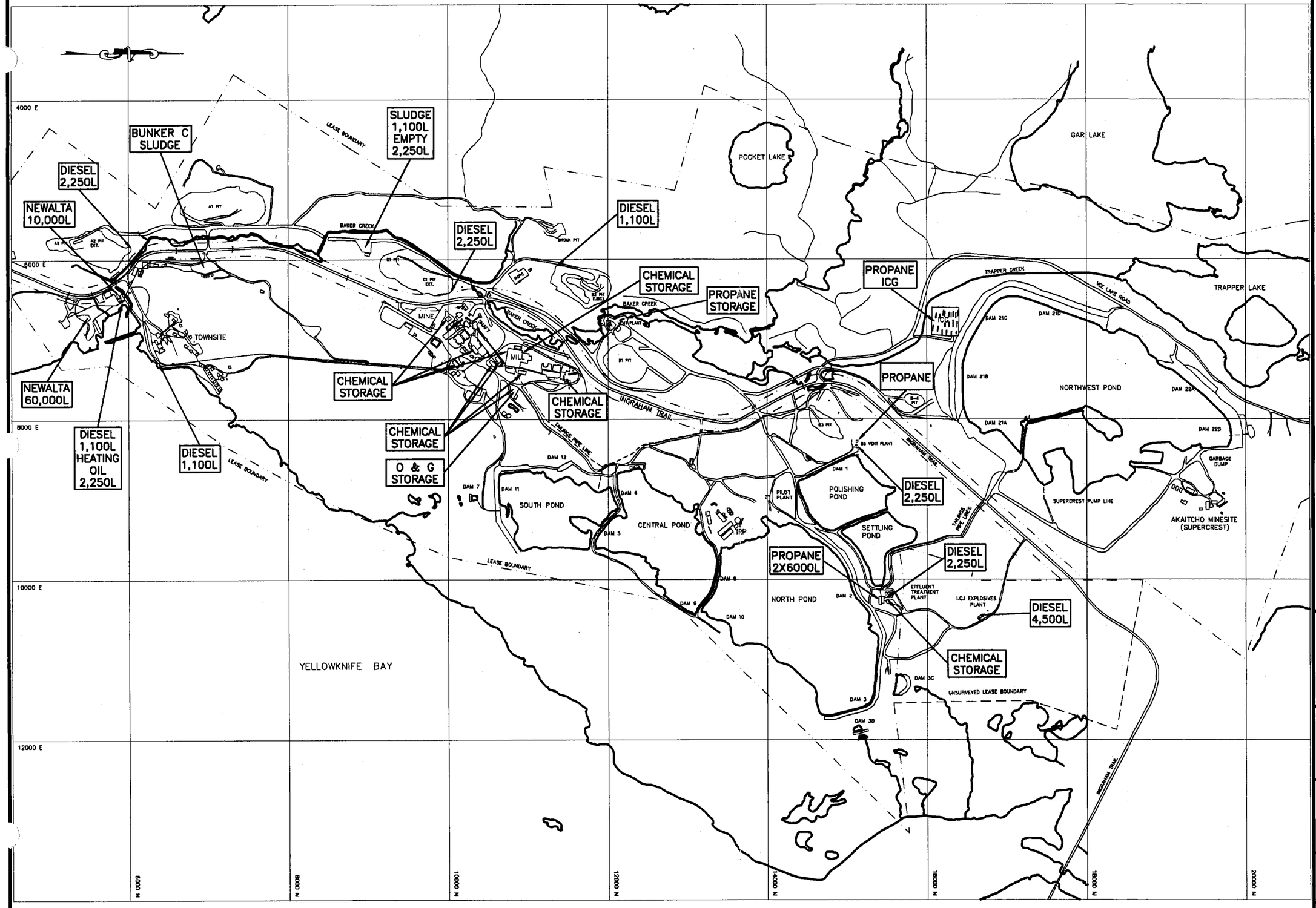
There are four bolted metal tanks located near the A-shaft, three near the Mine site Mobile Equipment Garage and two near the lumber yard. These tanks are no longer in service and according to interviews with mine employees, contain Bunker C product and Bunker C sludge. One of the tanks located near the lumberyard was cut off and is now in use as a secondary containment for three 80,000 litre tanks containing Newalta™ fuel.

All the large bolted metal tanks were constructed on gravel pads with a down-gradient spill containment trench. The spill containment trenches are now filled with water and are covered by aquatic vegetation.

There are also two underground tanks located at the warehouse and behind the C-dry, which store gasoline and diesel heating fuel respectively. A connection pipe sticking out of the ground in front of the A-shaft fuel tanks may be connected to a third underground tank. None of the interviewees could confirm the purpose of the pipe.

Oil and grease products are stored in the Fenced Yard, Oil shed #4, Warehouse, heated oil shed and in smaller quantities where the product is used. Quantities of the products are continually fluctuating while the mine is in operation.

An inventory of petroleum product storage tanks and of oil and grease products that are used on site is included in Appendix G. A spill inventory from the GNWT is included in Appendix G and hydrocarbon contaminated soils are discussed in Section 6.6.1. Hazardous hydrocarbon wastes such as waste oil are discussed in Section 6.4.3.



NOTES:

1. DIGITAL MAPPING SUPPLIED BY ROYAL OAK MINES

VISTA PROJ NO 815-01

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Deton'Cho Environmental Alliance

JOB TITLE

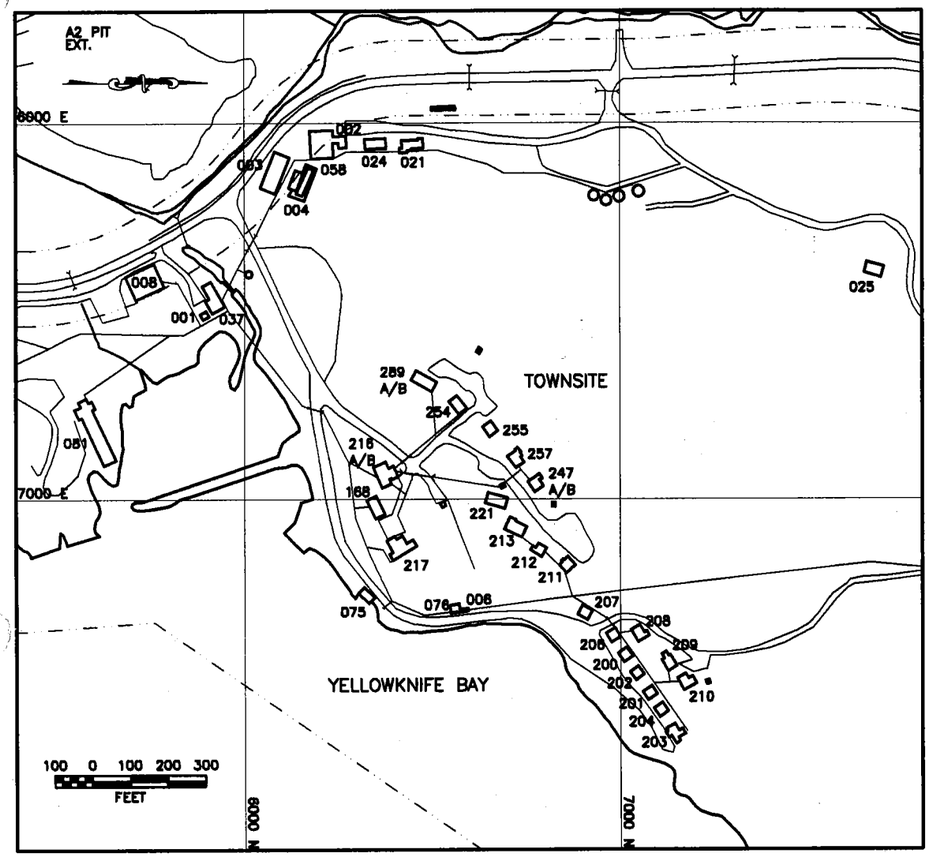
ENVIRONMENTAL SITE ASSESSMENT

GIANT MINE, NT

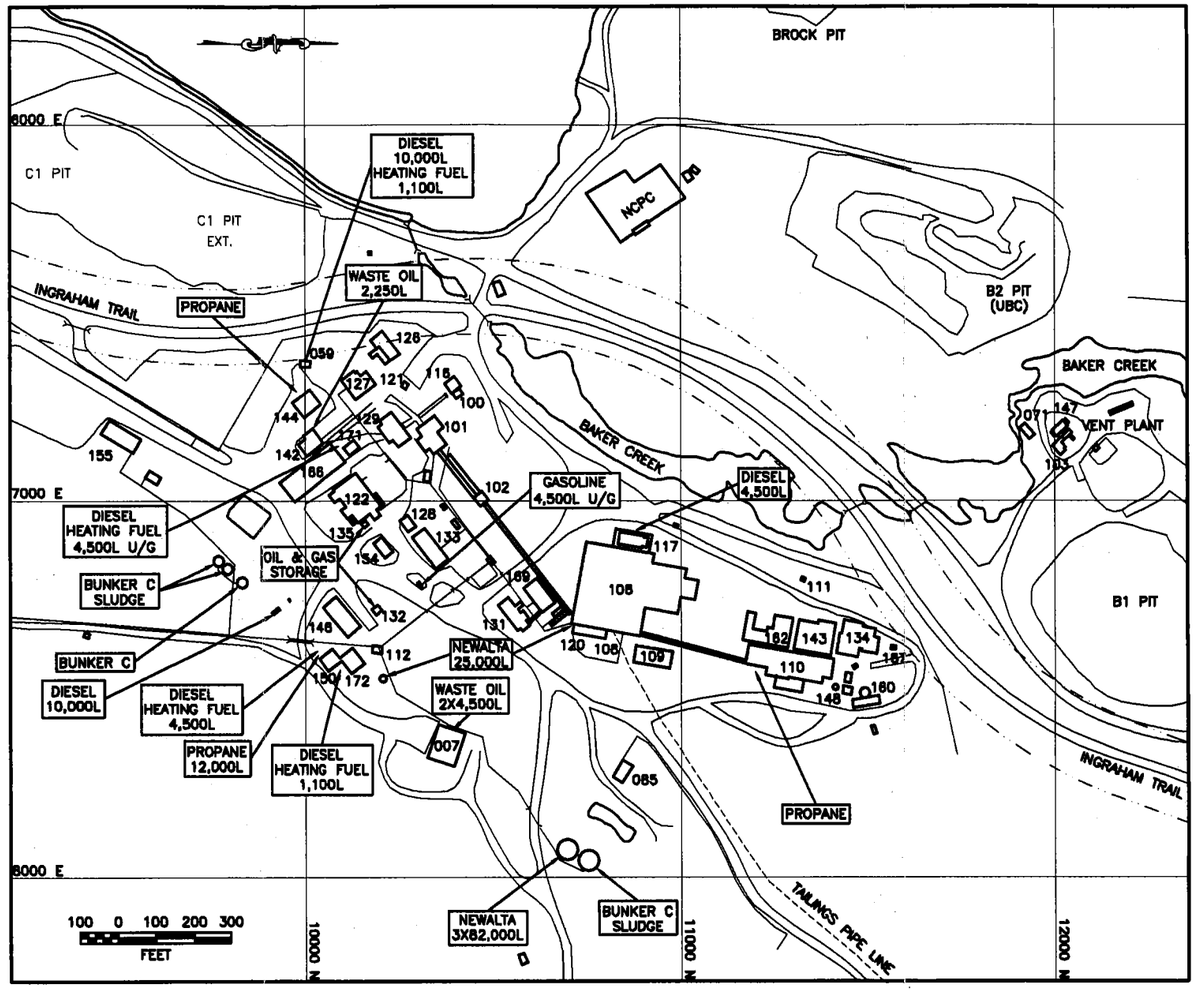
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LOCATION OF HAZARDOUS MATERIAL STORAGE

DESIGNED BY	SCALE: SHOWN
DRAWN BY: D.J.G	DATE: 99-08-02
CHECKED BY	FIGURE
SHEET OF	DRAWING NO: FIGURE 7A



TOWN SITE



MINE SITE

BLDG. NO.	DESCRIPTION
001	SEWAGE LIFT STATION
002	OLD HOISTROOM
003	EXPLORATION SHOP
004	NO.1 TRANSFORMER SUBSTATION
006	BAYVIEW SEWAGE PUMP HOUSE
008	RECREATION HALL
021	STORAGE
024	A – HEAD FRAME
025	OLD POWDER MAGAZINE
037	BOILER HOUSE
040	MOTOR STORAGE
058	OLD DIESEL PLANT
075	NEW PUMP HOUSE
076	NO. 2 MAIN PUMP HOUSE
081	CURLING RINK
168	GUEST HOUSE
200	RESIDENCE
201	RESIDENCE
202	RESIDENCE
203	RESIDENCE
204	RESIDENCE
206	RESIDENCE
207	RESIDENCE
208	RESIDENCE
209	RESIDENCE
210	RESIDENCE
211	RESIDENCE
212	RESIDENCE
213	RESIDENCE
216A	RESIDENCE
216B	RESIDENCE
217	RESIDENCE
247A	RESIDENCE
247B	RESIDENCE
254	RESIDENCE
255	RESIDENCE
257	RESIDENCE
289A	RESIDENCE
289B	RESIDENCE

BLDG. NO.	DESCRIPTION
007	MOBILE EQUIPMENT GARAGE
058	BUILDING SUPPLIES STORAGE
059	NEW DIESEL PLANT
071	OLD COMPRESSOR HOUSE
085	BUILDING SUPPLIES STORAGE
100	NEW SURFACE ROCK BREAKER
101	MILL CRUSHER HOUSE
102	SCREEN HOUSE AND CONVEYORS
103	PROPANE STORAGE TANK
106	MILL PLANT
108	SWITCH HOUSE
109	REAGENT WAREHOUSE
110	MILL PIPE SHOP
111	ROASTER CHANGE HOUSE
112	MILL FIRE PUMP HOUSE
116	SURFACE CRUSHER
117	NEW REFINERY
120	ELECTRIC BOILER HOUSE
121	ORE PASS BUILDING
122	MACHINE SHOP
123	ORE BIN AND WASTE BIN
126	NO. 5 TRANSFORMER STATION
127	C – HOIST ROOM
128	PIPE RACK
129	C – HEADFRAME
131	ASSAY OFFICE
132	OIL STORAGE SHED
133	WAREHOUSE
134	COTTRELL
135	OIL STORAGE SHED
140	FAN AND HEATER HOUSE
142	CARPENTRY SHOP
143	DORRCO ROASTER
144	PLANNER SHOP
146	OLD WAREHOUSE NO. 4
148	ROASTER STACK FAN HOUSE
150	ELECTRICAL SHOP
154	STEEL RACK
155	MAIN OFFICE AND EXTENSION
160	SILO LOAD-OUT
162	CALCINE PLANT
166	NEW C – DRY
167	BAG HOUSE
169	MILL LAB
171	FIST AID TRAINING ROOM
172	NEW BOILER HOUSE

NOTES:

1. DIGITAL MAPPING SUPPLIED BY ROYAL OAK MINES

VISTA PROJ NO 815-01

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JOB TITLE

ENVIRONMENTAL SITE ASSESSEMENT

GIANT MINE, NT

DRAWING TITLE

LOCATION OF HAZARDOUS MATERIAL STORAGE

DESIGNED BY	SCALE: SHOWN
DRAWN BY: D.J.G	DATE: 99-08-02
CHECKED BY	FIGURE
SHEET OF	DRAWING NO: FIGURE 7B

6.3.1 Chemical Storage and Inventory

Mill reagents and assay chemicals are stored in various locations throughout the site (Figures 7A and 7B). These storage locations include the Main Warehouse, #4 Warehouse, Reagent Shed, Mill Chemical storage area (north end of building) and the lumberyard. Chemicals are also stored in the Assay Laboratory, Mill Laboratory and Mill buildings at chemical mixing stations where the chemical is added to the circuit. An inventory of the chemicals on site on July 21, 1999 as provided by the mine warehouse employees, is included in Appendix G.

During the site visit, it was noted that the floor of the reagent shed is gravel and that some containers of dry bulk chemical were open and spilling onto the floor. Further testing of the soil in and around the reagent shed will be required in order to estimate soil contamination. This is also the case with the fenced storage yard.

The other chemical storage facilities have either wood flooring (old warehouse #4), tile flooring (mill and assay laboratories) or concrete floors (mill storage and mixing area, main warehouse). Evidence of spills such as staining, discoloration and dry chemical were noted at each storage area except the main warehouse, which appeared well maintained and orderly.

Water treatment chemicals are used and stored in the effluent treatment plant, in the mine water treatment plant that is attached to the south side of the Mill Plant (bldg. 106), and at Boiler-C and Boiler-A. Chemicals for these operations are also stored at the reagent shed and in silos at the Mill and Effluent Treatment Plant.

Quick lime is delivered in bulk and stored in silos at the Mill and Effluent Treatment Plants. Hydrogen peroxide is delivered in bulk liquid form and stored in stainless steel tanks next to the Effluent Treatment Plant. Other chemicals such as sodium cyanide (white powder) and copper sulphate (blue powder) are delivered in drums or crates as a dry chemical and mixed with water daily to form the solutions needed for the operations. Solutions are stored in tanks at the Mill Plant, Effluent Treatment Plant and Mine Water Treatment Plant. Small quantities of dry chemical are also stored at mixing stations in the Mill and Effluent Treatment Plants.

There are also approximately 60 - 20 litre containers of Unifoam AFFF/Angus Expanol fire retardant stored in the Planer Shop.

6.3.2 Explosives

The mine uses an explosive called ANFO, which is a mixture of ammonium nitrate and fuel oil. It is currently stored in powder magazines at each level of the underground workings and at the producer's plant. The surface powder magazines identified on the site have not been in use for a number of years. ANFO is produced by Explosives Limited (owned by Orika), which is located on the Giant mine property. Deliveries of ANFO are made twice a week to the mine site. Some of the explosives storage areas, which contain ANFO, caps, and fuses were observed underground during the site visit and are described in Section 7.0 of this report. Underground storage of explosives is a common mining practice.

6.4 Hazardous Waste Management

Hazardous waste is defined as a contaminant, which is a dangerous good that is no longer used for its original purpose and is intended for recycling, treatment, disposal or storage. Examples of hazardous wastes that are stored on the Giant site and are common to operating and abandoned mines, include waste oil, mixed bulk chemicals, mill and assay chemicals, arsenic trioxide and batteries.

6.4.1 Designated Hazardous Waste Storage Area

Historically there were no designated hazardous waste storage or disposal procedures. It was not required, nor was it a common practice in the North American mining industry to set aside hazardous wastes for recycling or treatment. It was common practice in the mining industry to dispose of waste materials in the tailings area and allow them to gradually be buried by tailings discharge. This was an accepted method of disposing of mine wastes and debris. Historical practices at the Giant Yellowknife Mine were similar.

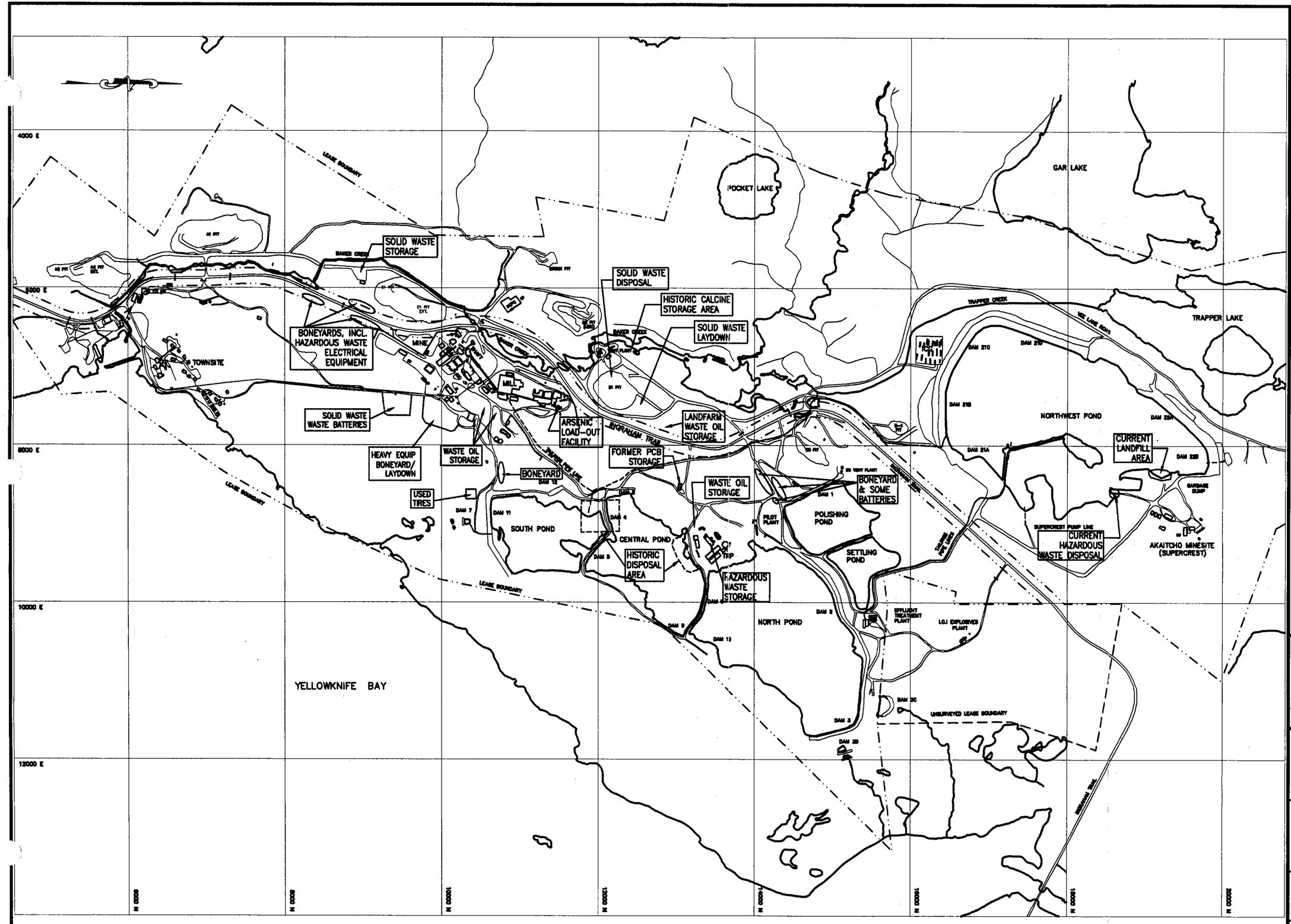
According to interviews with past employees, in the early years at Giant mine, waste was either deposited into the Central TCA or in a landfill area reported to be located between the Central and South TCA's, which is now covered by the South TCA, and by the scrap tire pile. In interviews with mine employees and former mine employees, it was reported that everything from scrap metal to waste oil and waste chemicals were discarded into the TCA's.

Present day effluent samples do not indicate that contaminants in the TCA's are leaching. The Royal Oak Mines Water Licence requires oil and grease sample analyses. Analytical data to date indicates oil and grease levels are below Water Licence criteria.

The present hazardous waste storage area is located on the north side of the Northwest TCA (Figure 8). It is understood that the site has been in use since 1988. The site is generally used for the surface storage of arsenic contaminated material such as bags from the Bag House, contaminated clothing and encrusted arsenic from the Cottrell and Bag House.

Drums of arsenic material were initially deposited directly into the Northwest TCA and covered with tailings over time. According to the ROM Environmental Superintendent, this procedure endured until the early 1990's and was ceased to reduce the costs of tailings effluent treatment. Drums were then deposited near the shoreline of the TCA at the Northwest hazardous waste storage area (Figure 8). This transition area of drums covers approximately 20 metres by 30 metres. The contents consist of approximately 50 percent crushed drums mixed with scrap steel and 50 percent assorted wood wastes and gravel. Most of the drums are either crushed or punctured. This was done to render the barrels unusable. Based on visual observations it appears that most residual chemicals present in the barrels have been altered by physical deterioration and weather exposure.

Topographically up-gradient of the crushed drums there is a storage area approximately 18 metres by 40 metres consisting of about 500 drums, of which approximately 10 percent were open or crushed, 30 percent damaged, and 60 percent sealed, but fallen over. The ROM Environmental Superintendent reports that most of these drums contain arsenic trioxide waste material such as filter bags, clean-up equipment, and encrusted arsenic trioxide removed from the roaster and baghouse equipment.



NOTES:

1. DIGITAL MAPPING SUPPLIED BY ROYAL OAK MINES

VISTA PROJECT NO: 815-01

Deton'Cho Environmental Alliance

JOB TITLE

ENVIRONMENTAL SITE ASSESSMENT

GIANT MINE, NT

DRAWING TITLE

SOLID & HAZARDOUS WASTE STORAGE & DISPOSAL

DESIGNED BY	SCALE: 1:45,000
DRAWN BY: D.J.G	DATE: 99-07-23
CHECKED BY	FIGURE
SHEET OF	DRAWING NO: FIGURE 8

The current area of drum storage covers an area of approximately 35 metres by 65 metres and is about 2 to 3 metres high. Approximately 1400 steel drums, generally in good condition, were observed. The drums are strapped together on wooden pallets and placed up right. Some pallets are stacked two levels high. More than 100 drums were identified to contain arsenic trioxide wastes and labelled with the Product Identification Number (PIN) 1561. This is an international numbering system that is designated for arsenic trioxide. The historic surface disposal of arsenic material is summarised in Section 6.4.2 - Surface Arsenic Trioxide Disposal.

Stored adjacent to the arsenic trioxide drums are an estimated 150 drums containing asbestos wastes removed from the Cottrell and Roaster building ceilings. A 2250 L fuel tank stored with the drums of arsenic at the site is also reported to contain asbestos material. Approximately 14 - 8 cubic metre crates of lime and a limited number of drums containing hydrocarbons were also noted during the site inspection. Also stored near the Hazardous Waste Storage Area were several waste batteries, several empty 20 litre plastic hydrochloric acid jugs and numerous empty mine stench gas cylinders.

6.4.2 Surface Arsenic Trioxide Waste

Cottrell maintenance personnel have historically been responsible for the cleaning and maintenance of the Bag House, Cottrell and Roaster. This procedure involves removing any built up arsenic trioxide from the units that cannot be pneumatically disposed of to the underground vaults as well as used filter bags and other contaminated equipment. This compacted material must be disposed of by other means. Up until the 1980's this waste was reported to be placed in drums, laid out in the Central or South TCA and covered with tailings, according to statements of several of the interviewees. After the Northwest TCA was built in 1987, the drums of arsenic trioxide wastes were deposited in the tailings water of the Northwest TCA near the present Hazardous Waste Disposal Area (Figure 8). According to the ROM Environmental Superintendent, this method of disposal was common practice at the mine because arsenic is a constituent of the tailings.

Disposal directly into the TCA was ceased in the early 1990's to reduce the costs of tailings effluent treatment. The waste from the Bag House and Cottrell is currently stored in drums, strapped to pallets and placed near the Northwest TCA at the Hazardous Waste Disposal Area (See previous section for detailed description of hazardous waste storage area).

It is possible to estimate the number of drums of arsenic trioxide contaminated waste disposed of on site at Giant Mine since 1955 when the first precipitator and collection system was installed. The life of a Bag House collection bag is approximately two years after which time the Bag House operators change all 2400 bags and dispose of them in drums. Cleaning the Bag House results in approximately 20 drums of arsenic-contaminated waste each time it is cleaned. Arsenic trioxide dust is also caked on the Cottrell and requires cleaning. According to interviews with Cottrell operators, the Cottrell used to be cleaned every two years resulting in about 13 drums of waste. Due to the declining economic situation at the mine, the Cottrell has not been cleaned for approximately 6 years.

As well, Cottrell operators estimate that there are on average two spills of Bag House material per year due to mechanical failures, reported to result in 50 - 300 drums of cleanup waste per spill. It is also reported that it was common practice to vacuum spills with the vacuum truck and discharge the recovered material to underground vaults via valves in the rock (Plate 39). Therefore the number of drums of waste created due to spillage may be considerably less than that estimated based on interviews. The roaster has been in operation since 1951 (48 years), the Cottrell has been in operation since 1955 (44 years), the baghouse has been in operation since 1958 (41 years).

It can therefore be estimated that there are from 3000 to 13,000 drums of arsenic waste including filter bags and discarded spill clean-up equipment buried on site, mostly in the South, Central and Northwest TCA. It should be emphasised that these numbers are extrapolated based on interviews and that no interviewees were able to confirm the quantity of drums or debris that was deposited in tailings ponds. Historical 1:5000 aerial photographs were examined in order to confirm the deposition of debris near or in the tailings area, but nothing was concluded.

Disposal of various materials into tailings was common practice for many years. Confirmation of the presence and location of buried debris is required to develop a proper closure plan for the tailings disposal areas.

The mine operated an arsenic load-out facility in the early 1980's. It was designed to store the arsenic trioxide in a silo until the material could be pumped into a transport vehicle and shipped south for sale as wood preservative. The load-out facility located next to the Roaster Stack (Figure 2) consists of a 15,000 cubic foot storage silo and a load-out building equipped with a scale. The mine only sold arsenic trioxide to the chemical industry for a few years, but it is anticipated that the silo and conveyer systems are now contaminated with arsenic trioxide. The load-out building is now used to containerise Baghouse and Cottrell waste for disposal to the hazardous waste storage area. The mine also used an MS Vactor truck to vacuum arsenic trioxide spills (Plate 38). The truck is still on site, but the vacuum is reported by interviewees to be no longer in service.

Occasionally, arsenic trioxide dust would be blown into a storage vault from a truck through pipes that are accessed by valves on the surface above the arsenic storage chambers. This method of transport would only be employed if the pneumatic transfer system was not operating, or if an arsenic spill was cleaned up. A representative valve is shown on Plate 39.

6.4.3 Waste Petroleum Products

There were numerous locations noted where petroleum products such as lubricating and hydraulic oil as well as waste antifreeze and solvents are stored. Storage locations are shown in Figure 8 and include the Tailings Retreatment Plant (TRP) site, the lumberyard, the road leading to the South TCA, and near the land farm at B1 Pit. Other storage locations for smaller volumes of waste product include the C1 Pit laydown area and outside the Mobile Equipment Garage.

It is estimated that there is approximately 720,000 litres (3512 drums) of waste petroleum product from the Colomac Mine site, many of which contain a mixture of antifreeze and waste oil currently stored at the TRP. In addition, approximately 100,000 litres (500 drums) of waste petroleum product are stored on site at the lumberyard, near the B2 pit and in smaller quantities in various buildings, presumably from Giant mine operations.

Giant mine currently burns waste oil in the existing waste oil furnace located in the C-dry. There is a second waste oil furnace that is to be installed in the Mill building.

Hydrocarbon staining was noted on the soil in and around the waste oil storage areas and is likely the result of unsealed drums and/or spillage that may have occurred. Most drums are stored directly on the ground and are not on pallets.

The historic handling procedure of waste oil has not been confirmed, but according to many interviewees, it was common practice to dispose of all waste products in the TCA. This was common practice in the mining industry in general.

6.4.4 Asbestos Containing Materials

Asbestos containing materials (ACM) were widely used during industrial building construction at the time when the Giant Mine was originally constructed. Therefore, ACM was expected throughout the Giant Mine site. An asbestos survey completed in the early 90's confirmed the presence of crysotile, crocidolite and amosite asbestos in the roaster, Cottrell and bag house buildings (Appendix H). Epoxy encapsulation and the removal of asbestos from the ceilings of the roaster and Cottrell buildings was completed in 1997 to reduce the health risk to employees. Various maintenance and demolition projects have also produced small quantities of asbestos waste, which was disposed of in accordance with applicable regulations.

Varying quantities and types of ACM are found in most buildings and in other site components such as boilers and utilidors. The estimated inventory is summarized as follows:

- Exterior sheathing, containing ACM is found on most site buildings including Town site residences and most mine site buildings. This includes the Curling Rink, buildings located near A-Shaft, C- Shaft, the Conveyor, Mill, Roaster and Bag House, Carpentry and Planing shops, Electrical shops, Warehouses, Machine shop, water and fuel supply, pumphouses, and the former Akaitcho buildings. Some of the town and mill site buildings have new siding placed over the asbestos sheathing.

  It is estimated that there are 485 cubic metres, 700 cubic metres and 10 cubic metres of asbestos sheathing at the Town site, Mine site and Akaitcho site respectively for a total of 1195 cubic metres. This was calculated based on an average asbestos sheathing thickness of three millimetres.

- Asbestos roofing shingles were noted to be present in association with the majority of the preceding buildings. These amount to approximately 500 cubic metres of asbestos shingles.

- Most of the areas that have been used at the mine for electrical switchgear, pumps, compressors and motors, or where a potential for an electrical fire exists, contained ACM. This was primarily evident in the form of asbestos cemented sheeting on the interior walls and ceilings. The material was generally found to be in good condition throughout the site and it is not considered friable because it is cemented. Buildings that currently store petroleum products were also panelled with cemented asbestos sheeting. The total estimated amount of asbestos cemented board was based on the 20 rooms and small buildings that were found to contain this material. The total amount calculated is 200 cubic metres.
- ACM was identified in exposed portions of the oil and water utilidor systems throughout the property. The entire utilidor system was not exposed for the evaluation, although sections of the utilidor that were exposed appeared to contain asbestos material. No known analyses of the insulation have been observed. If it is assumed that the entire utilidor is asbestos insulated and that there are approximately 2000 metres of utilidor, based on site plans, the estimated quantity of asbestos insulation is 60 cubic metres.
- Other areas that contain friable asbestos insulation include the interior Roaster walls, Cottrell and rotary kiln walls, boiler doors, interior pipe insulation and tank insulation, which amounts to approximately 200 cubic metres of asbestos.
- The total estimated amount of all types of ACM on site is rounded to 2000 cubic metres.

The Town site residences are currently occupied therefore the interiors were not inspected for ACM or lead based paints. The volumes of exterior ACM on the residences are included in the above calculations.

6.4.5 Lead Based Paints

Most buildings at the mine have been painted on the exterior and interior surfaces. Lead was used as a component in some paints until about 1977. Consequently, lead based paints probably exist at Giant Mine. This was not confirmed, however, as samples were not collected for analytical testing. For some of the older buildings, especially those no longer in use, the paint was observed to be peeling, cracking or flaking. Flaking lead paints could potentially cause some degree of lead contamination in soils adjacent to these buildings.

In recent years, non-lead based paints have been applied over the original paint for most interiors and some exterior surfaces. Adequate care will be required during the demolition and disposal of these structures.

The issue of disposal of lead painted demolition debris will require consultation with Regulators.

6.4.6 Polychlorinated Biphenyls

Polychlorinated biphenyls (PCB's) are synthetic chemical compounds consisting of chlorine, carbon and hydrogen. PCBs are relatively fire-resistant and very stable under extremely high temperatures. They were commonly mixed with mineral oil and used as an insulating fluid in electrical equipment manufactured during this century. They were also used in high quality paints, waxes, sealants and as a fire retardant in lubricating oils. In North America, the most common brand names for PCB's transformer oils were Aroclor, Inerteen, Pyranol and Hyvol. PCB's were banned for use in new electrical equipment manufactured after September 1, 1977. A number of approved treatment methods are now available for oils containing PCB's.

Royal Oak undertook an investigation of PCB electrical equipment on site in 1993 and shipped the contaminated items south to the Swan Hills, Alberta registered disposal facility for high temperature incineration. A total of seven transformers and six capacitors were destroyed. Supporting documentation of the PCB removal program and laboratory results from the two sampled transformers located near the TRP is included in Appendix H.

Discarded transformers, capacitors, ballasts and other electrical equipment were identified near the service road leading to the Town site and amongst discarded electrical equipment in the bone yard located on the road to A Shaft (Figure 8). These units are older transformers and any fluids remaining in them may contain PCB's. This will require additional investigation. There were also four oil-filled ballasts located at the back of the switch station in the Old Diesel Plant at the A-shaft, a leaking transformer stored in the A-shaft storage building, and numerous pieces of electrical equipment stored in the old powder magazine on the road to the A-shaft. It is not confirmed if these pieces contain PCB waste and will require additional testing.

There are at least 10 pieces of oil containing electrical equipment that may not have been analyzed by Royal Oak Mines, for PCB's. No one interviewed could confirm whether or not this was the case. This estimate does not include light ballasts and small capacitors found in switch panels.

The transformers used underground were also checked during the 1993 PCB investigation. The Mine Electrical Supervisor confirmed that dry-type transformers had replaced all oil-filled underground transformers.

Potential additional sources of PCB's at the mine site are fluorescent lighting ballasts manufactured before 1979. There is approximately two tablespoons of oil in each ballast that may be PCB contaminated. A portion of the buildings throughout the site has fluorescent lighting systems that are suspected to contain PCB's. However, most of the lighting on site is incandescent lighting, which does not utilize ballasts, therefore there is no PCB concern with incandescent lighting. Only those locations at the mine where the fluorescent lighting system has been upgraded in the last 15 years can be considered non-PCB type.

It is therefore assumed that the Main Office, C-DRY, TRP and New Diesel Plant lighting ballasts are less than 15 years old and likely do not contain PCB's. Buildings that are suspected to contain PCB light ballasts are as follows: A-Exploration shop, MEG, recreation hall, A-area garage, A-boiler house, A-pumphouse, A-#2 main pumphouse, curling rink, machine shop, C-hoistroom, C-headframe, Cottrell, carpenter shop, and planer shop. With the exception of the residences, which were not investigated, all other buildings are equipped with incandescent lighting.

Light ballasts should be checked during building demolition and those suspected of PCB material, based on the serial number and brand, should be removed and disposed in accordance with applicable regulations.

Associated with the #1, #5 and Roaster electrical substation locations and with the buildings in the C1 lay down area, is evidence of stained soils near the equipment. It has not been confirmed that the stained soil is PCB contaminated. Any PCB contaminated soil should be excavated and stored in containers for shipment to a licensed disposal facility. There are also solvent treatment processes that may be more economical for large quantities of soil.

Analysis for PCB contaminated paints should be undertaken as well. PCB paint is generally found in high heat areas such as boiler rooms, electrical rooms and kitchens. Dry PCB paint chips are generally pliable as opposed to brittle.

Locations of discarded electrical equipment are shown in Figure 8. Potentially PCB contaminated soil locations are designated as electrical "Substation" and are shown in Figure 9B.

6.4.7 Waste Batteries

Royal Oak completed an inventory of waste batteries stored on site in May 1998. Based on the inventory, it was found that waste batteries were scattered about the mine property. The main storage locations include the Hazardous Waste Storage Area, south of the Polishing Pond (3 sites), near the Maintenance Equipment Garage, the mobile equipment "Boneyard", south of the "Boneyard", and across from the Electrical Shop. Royal Oak identified four types of batteries including, 928 Loki cells, 189 miner's lamps, 141 automotive and 47 heavy duty commercial.

It is likely that not all the batteries have been accounted. There were batteries beneath debris piles at the bone yard south of the settling pond and there were batteries that were still in use.

6.4.8 Sumps

Buildings such as the Mobile Equipment Garage, Effluent Treatment Plant, Mill, Electrical Shop, Power Plants, TRP, and Refinery have floor drains or sumps that collect liquid wastes. Most sumps drain directly to the sewage system and are discharged to the tailings ponds. Residual wastes and sludge from these sumps will require analysis, for associated hazardous waste such as chemicals and waste hydrocarbon products. Sumps that were observed contain some form of liquid waste that appeared to be hydrocarbon waste, in buildings such as Power Plants, Mobile Equipment Garage and Shop. In buildings such as the Mill and Effluent

treatment plant, the sumps contain liquid that appears to be as a result of spilled and dissolved chemicals from the floors.

6.5 Solid Waste Management

The location of landfills, disposal areas and bone yards is shown in Figure 8 of this report.

6.5.1 Designated Landfills

Historically Giant Mine disposed of most of the solid and hazardous wastes into the tailings containment areas, as was common practice of the mining industry at the time. The central tailings containment area was used initially to dispose of arsenic trioxide and other hazardous materials. A disposal area located between the South and Central TCAs was generally used to dispose of other solid wastes such as scrap metal, building material, and empty drums. In interviews with past mine employees, it was found that the wastes were not necessarily sorted and that it is very likely that hazardous wastes including oil filters, drums of waste oil and chemical, batteries and PCB electrical equipment were also deposited into the disposal area.

The disposal area is now covered by the South TCA. There were no visual signs of the South TCA being used as a disposal site during the site visit. The Central TCA disposal area, next to the Tailings Retreatment Plant was observed to contain several exposed drums and metal waste.

The current landfill is located on the north shore of the Northwest TCA and has been used since 1988. According to Royal Oak Mines personnel, only non-hazardous waste such as mine site lunch room and office garbage is to be disposed of at this location. Common domestic waste generated by the mine town site is collected by the City of Yellowknife and disposed of at the city's solid waste disposal site. During the site visit, it was noted that the landfill site contained waste building material, oil filters, empty drums, paper and some scrap metal. It is common practice to push the waste into the pond therefore some waste is buried by tailings although most waste is exposed and uncovered.

The Department of Municipal and Community Affairs, Government of the N.W.T. (MACA), approved the disposal of scrap metal into B1 Pit in 1997. A letter of approval from the MACA to the mine is included in Appendix I. The letter reports that waste to be disposed of in the pit must first be decontaminated and placed on the adjacent lay-down area for approval by the Mine Environmental Superintendent before it is pushed into the pit. This has been the procedure to date.

During the site evaluation it was observed that there is a full bank of Loki batteries disposed of in the pit. No other concerns were noted. The pit has an estimated volume of 350,000 cubic metres.

Used rubber tires are primarily stockpiled in an area west of Dam 11. There were approximately 800 cubic metres of rubber stored in this location. During interviews, it was noted that there might be contaminants or hazardous material buried under the tire storage area.

6.5.2 Bone Yards

Additional waste areas, consisting mostly of scrap metal, parts from old machinery and vehicles, used electrical equipment and waste mill parts are stored at various locations throughout the mine property. The most concentrated areas are found at an area located south of the maintenance garage, along the access road from the Mill to A-Shaft, south of Dam 1 and south of B3 Pit. Many of the bone yards contain hazardous materials such as old transformers, used batteries and asbestos. It is estimated that there is a collective volume of 200,000 cubic metres of scrap metal in all the bone yards. This volume would be significantly reduced if containers such as drums were crushed prior to disposal. Location of Bone yards is shown on Figure 8.

6.6 Impacted Soil

6.6.1 Hydrocarbon Contaminated Soil

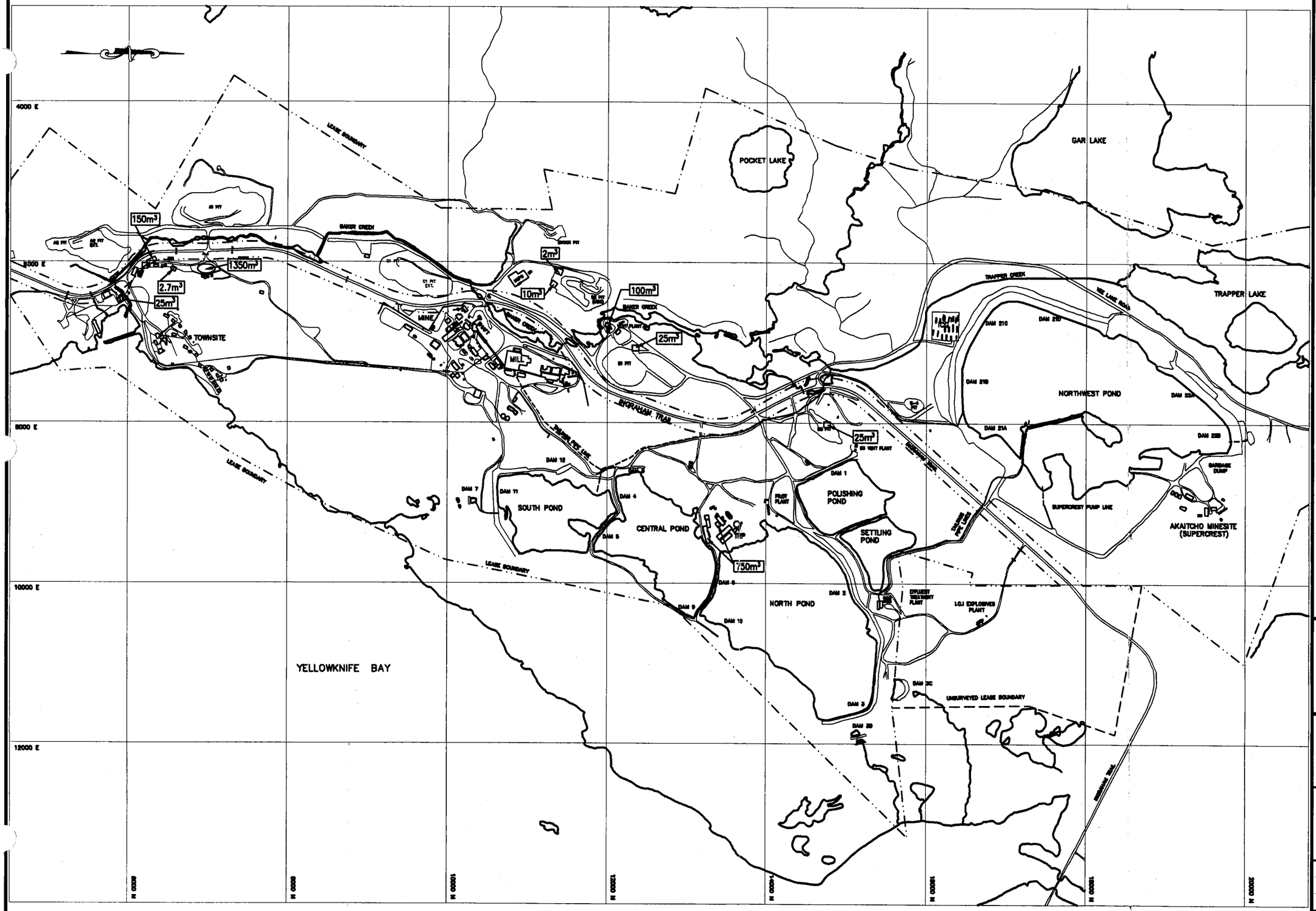
Hydrocarbon impacted soils have been observed or reported at several locations on the mine lease property, generally at fuel storage locations. Quantities of contaminated soil reported here are best-educated estimates that are based on visual observations of the extent of stains, spill data, surrounding natural topography and soil type. Sampling and delineation of the contaminated areas will be required in order to properly quantify and qualify the impacted soil, as they were not included in this project.

Location and estimated volumes of hydrocarbon contaminated soil on site is summarized in Table 4. Figures 9A and 9B show the location of the impacted soil. Based on the calculations, there are approximately 6500 cubic metres of hydrocarbon contaminated soil on site.

The mine has recently located an area adjacent to the B1 pit that is used to reclaim hydrocarbon contaminated soils through a landfarming process (Figure 9A). This area is reported to have a clay base that presumably provides a barrier to contaminant leaching. The landfarm location was recently used to treat soil contaminated with Bunker C product.

Table 4: Location and Estimated Volume of Hydrocarbon Contaminated Soil at Giant Mine.

Location	Substrate	Estimated Volume (Stain LxWxD =cu. metres)	Comments
B2 Pit Diesel tank	½ in crush with visible bed rock.	2x2x0.5 = 2	
B2 Pit pipe leak	Bedrock	5x2 = 10 m^2	Stain down the pit wall from a leak in the pipe. No depth to the stain on bedrock.
B-Shaft	Clay with gravel	20x5x1.0 = 100	Old stain located immediately adjacent to Baker Creek. Seepage may be to creek. Some vegetation growing in stained area.
Landfarm area - Waste oil storage	Crush and clay with visible bedrock	5x5x0.5= 12.5	Area spotted with individual stains.
B3 Pit diesel tank	Crush with Bedrock visible	10x5x0.5= 25	
TRP Waste Oil Storage Area	½ inch crush	50x50x0.5 = 1250	The storage area is spotted with small individual stains. Area extent of each stain is difficult to estimate because drums impede the view.
A-Shaft Fuel Tank pad	Crush pad in a bedrock depression.	Visible stain: 3x3x1.0 = 9 Possible non-visual impact: 30x15x3.0 = 1350	Interviews with past mine employees report that an 80,000 litre spill occurred at these tanks in the 1960's.
A-shaft utilidor pump connection	Natural soil and visible bedrock	3x3x0.3= 2.7	
A-shaft Diesel Plant	Compacted crush	15x5x2.0 = 150	Old attenuating stain.
A-boiler	Crush and exposed bedrock	5x5x1=25	
New diesel plant	Compacted crush	3x2x1.0 = 6	
Compressor Bldg.	Bedrock and large stones.	20x20x0.5 = 200	Stain down the hill. Part is on bedrock, part is on crush.
Hoist Bldg.	Crush	20x20x1.0 = 400 10x5x1.0= 50	Group of stains surrounding hoist bldg.
C-dry Valve room tank	Crush	10x10x2.0 = 200	Next to fuel tank.
C-dry Valve room underground tank	Crush	?	Possible underground contamination if tank has been leaking.
Drill repair shed	Crush	4x8x1.0=32	Draining down a small hill.
Gas Pump	Crush	?	No contamination is visible, but possible contamination at underground tank and surface contamination at pump fill area.
Electrical Shop	Crush	4x4x1 = 16	
Electric Shop	Crush	2x2x2 = 8	Stain below tank fill pipe.
Fire Pumphouse utilidor	Crush	2x3x1 = 6	
Mine Site tanks	Crush and Bedrock	5x1x0.3 = 1.5	Stain mostly on the bedrock.



NOTES:

1. DIGITAL MAPPING SUPPLIED BY ROYAL OAK MINES

VISTA PROJ NO 815-01

eba | Deton'Cho Corporation | VISTA ENVIRONMENTAL

Deton'Cho Environmental Alliance

JOB TITLE

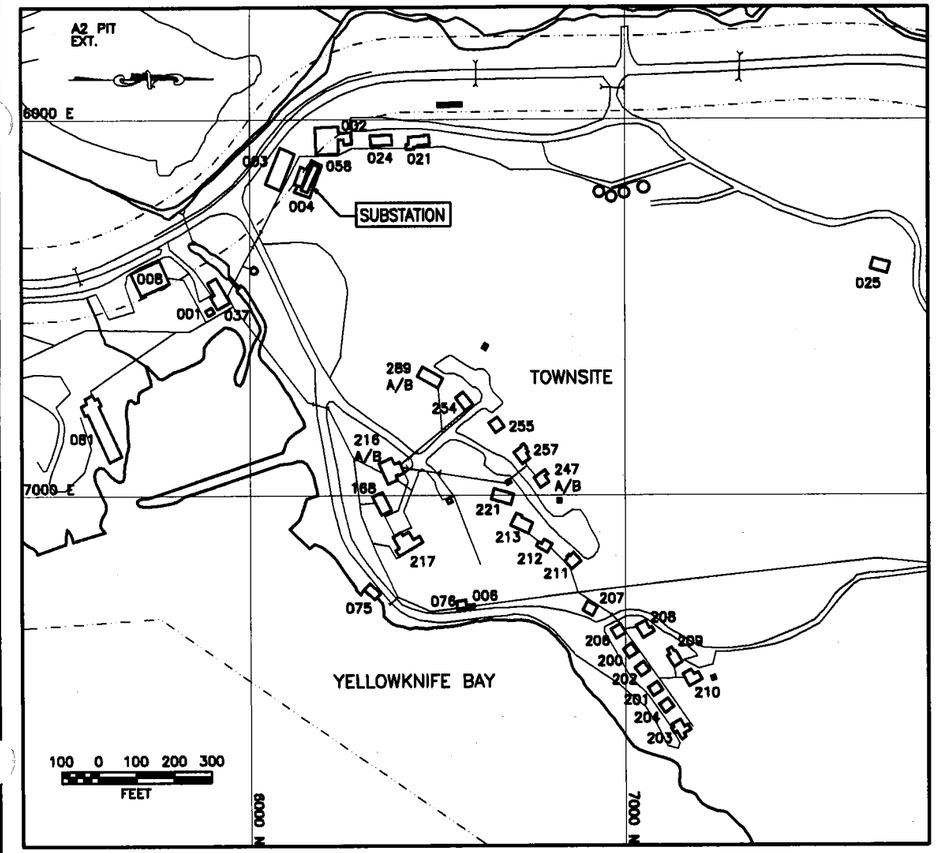
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GIANT MINE, NT

DRAWING TITLE

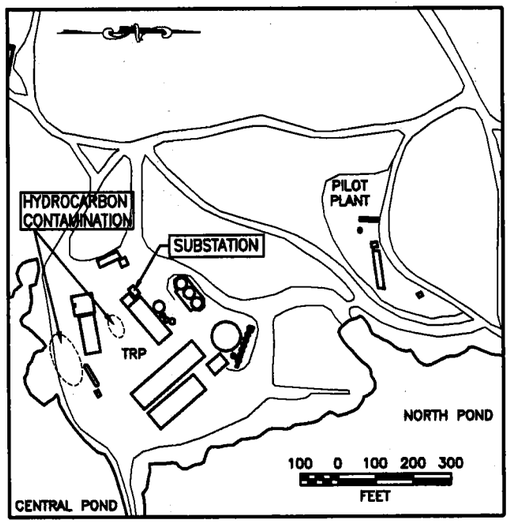
HYDROCARBON CONTAMINATED SOILS

DESIGNED BY	SCALE 1:45,000
DRAWN BY D.J.G	DATE 99-07-23
CHECKED BY	FIGURE
SHEET OF	DRAWING NO. FIGURE 9A

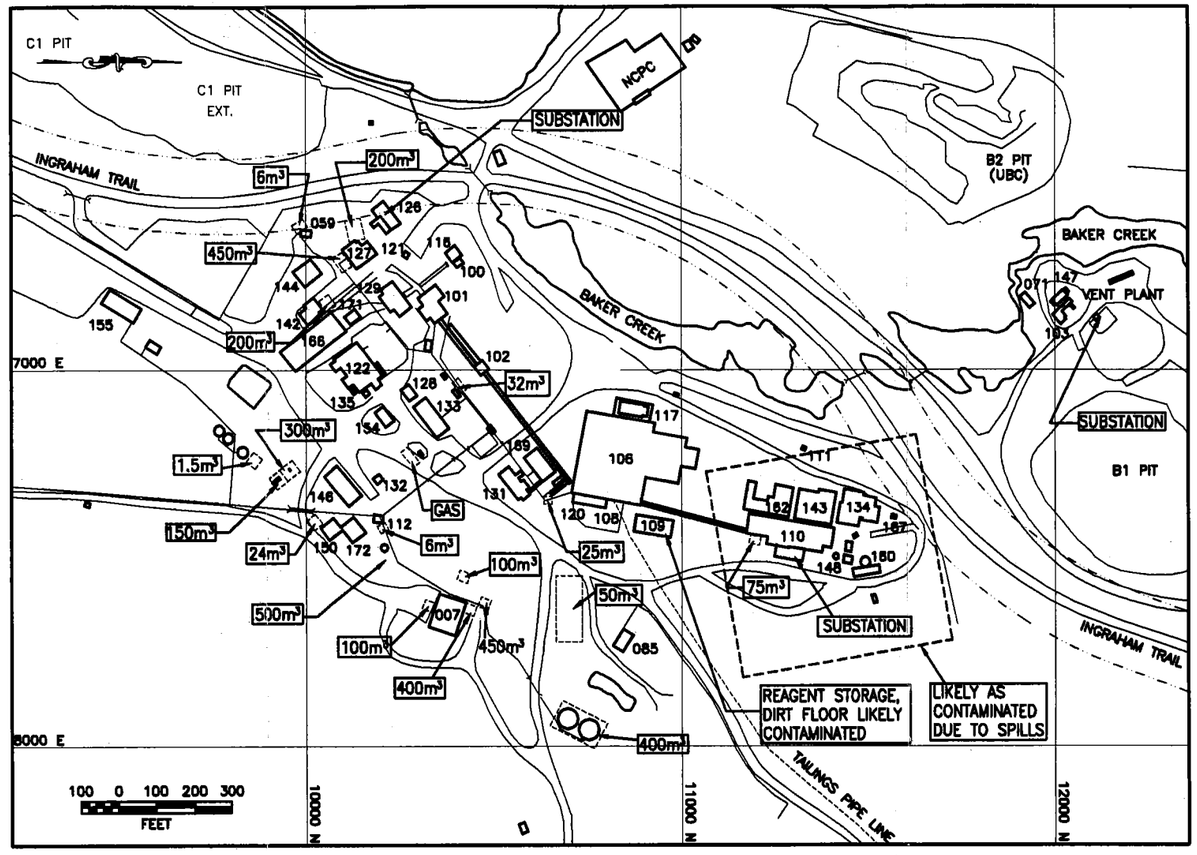


TOWN SITE

BLDG. NO.	DESCRIPTION
001	SEWAGE LIFT STATION
002	OLD HOISTROOM
003	EXPLORATION SHOP
004	NO.1 TRANSFORMER SUBSTATION
006	BAYVIEW SEWAGE PUMP HOUSE
008	RECREATION HALL
021	STORAGE
024	A – HEAD FRAME
025	OLD POWDER MAGAZINE
037	BOILER HOUSE
040	MOTOR STORAGE
058	OLD DIESEL PLANT
075	NEW PUMP HOUSE
076	NO. 2 MAIN PUMP HOUSE
081	CURLING RINK
168	GUEST HOUSE
200	RESIDENCE
201	RESIDENCE
202	RESIDENCE
203	RESIDENCE
204	RESIDENCE
206	RESIDENCE
207	RESIDENCE
208	RESIDENCE
209	RESIDENCE
210	RESIDENCE
211	RESIDENCE
212	RESIDENCE
213	RESIDENCE
216A	RESIDENCE
216B	RESIDENCE
217	RESIDENCE
247A	RESIDENCE
247B	RESIDENCE
254	RESIDENCE
255	RESIDENCE
257	RESIDENCE
289A	RESIDENCE
289B	RESIDENCE

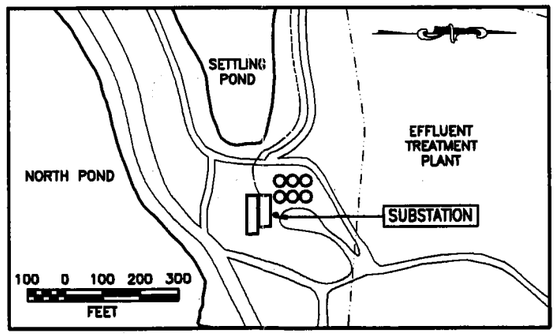


TRP SITE

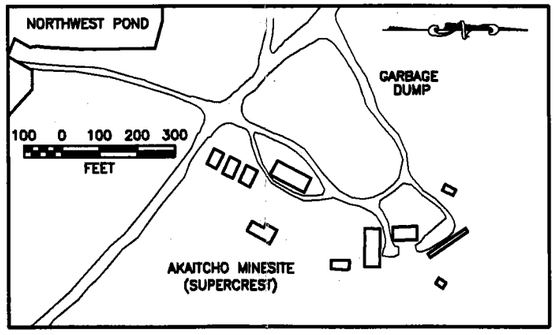


MINE SITE

BLDG. NO.	DESCRIPTION	BLDG. NO.	DESCRIPTION	BLDG. NO.	DESCRIPTION
007	MOBILE EQUIPMENT GARAGE	117	NEW REFINERY	142	CARPENTRY SHOP
058	BUILDING SUPPLIES STORAGE	120	ELECTRIC BOILER HOUSE	143	DORRCO ROASTER
059	NEW DIESEL PLANT	121	ORE PASS BUILDING	144	PLANNER SHOP
071	OLD COMPRESSOR HOUSE	122	MACHINE SHOP	148	OLD WAREHOUSE NO. 4
085	BUILDING SUPPLIES STORAGE	123	ORE BIN AND WASTE BIN	149	ROASTER STACK FAN HOUSE
100	NEW SURFACE ROCK BREAKER	126	NO. 5 TRANSFORMER STATION	150	ELECTRICAL SHOP
101	MILL CRUSHER HOUSE	127	C – HOIST ROOM	154	STEEL RACK
102	SCREEN HOUSE AND CONVEYORS	128	PIPE RACK	155	MAIN OFFICE AND EXTENSION
103	PROPANE STORAGE TANK	129	C – HEADFRAME	160	SILO LOAD-OUT
106	MILL PLANT	131	ASSAY OFFICE	162	CALCINE PLANT
108	SWITCH HOUSE	132	OIL STORAGE SHED	166	NEW C – DRY
109	REAGENT WAREHOUSE	133	WAREHOUSE	167	BAG HOUSE
110	MILL PIPE SHOP	134	COTTRELL	168	MILL LAB
111	ROASTER CHANGE HOUSE	135	OIL STORAGE SHED	171	FIST AID TRAINING ROOM
112	MILL FIRE PUMP HOUSE	140	FAN AND HEATER HOUSE	172	NEW BOILER HOUSE
116	SURFACE CRUSHER				



EFFLUENT TREATMENT PLANT



AKAITCHO MINE SITE

NOTES:

1. DIGITAL MAPPING SUPPLIED BY ROYAL OAK MINES

VISTA PROJ NO 815-01

eba VISTA

Deton'Cho Environmental Alliance

JOB TITLE

ENVIRONMENTAL SITE ASSESSEMENT

GIANT MINE, NT

DRAWING TITLE

HYDROCARBON CONTAMINATED SOILS

DESIGNED BY	SCALE
	SHOWN
DRAWN BY	DATE
D.J.G	99-08-02
CHECKED BY	FIGURE
SHEET OF	FIGURE 9B

Table 4: (Cont'd)

Mine Site tanks pumphouse	Crush and Bedrock	2x1x0.5 = 1	
Mine site tanks located enroute to South TCA.	Crush foundation pad	20x10x2 = 400	
Fuel tank near bldg. 146	Compacted crush	10x15x1= 150	
Diesel fuel pump station drive-up	Compacted crush	10x15x2=300	
Behind C-boiler	Crush	10x10x5 = 500	Spill in containment area. Free product still in bermed area. Some evaporation has occurred. Pump shack is also very contaminated.
Behind C-boiler	Crush	5x1x2=10	Stain adjacent to the tank..
Mobile Equipment Garage Bldg. (south door)	Crush and some bedrock outcrops	10x10x1= 100	
Mobile Equipment Garage Bldg. (north door)	Crush and some bedrock outcrops	20x20x1=400	Stain near back door where waste oil is stored.
Mobile Equipment Garage Bldg. (north side)	Crush and some bedrock outcrops	15x15x2= 450	Leaking utilidor.
Mobile Equipment Garage Bldg. (west side near tanks)	Bedrock outcrops	10x10= 100	Stain on the rock outcrop.
East Side of Mill	Crush	5x5x3 = 75	Large stain near compressor vent on east side.
Waste oil storage next to Lumber yard	Compact Crush	10x10x0.5=50	
Next to Assay Laboratory	Crush	5x5x1 = 25	

PCB soil contamination is suspected at each transformer substation and at the old electrical shop location (Figure 9B). The old electrical shop was demolished in the 1980's and the area is now a mobile equipment parking lot that has a layer of fill over it. Sampling at these locations will be required in order to evaluate the presence or absence of PCB contaminated soils.

6.6.2 Other Contaminated Soil

It is acknowledged that surface contamination issues at the Giant Mine resulting from industrial activities associated with the extraction of gold bearing ores are both a perceived and real public concern. Surface contamination occurring at the mine site is characterized as inorganic contamination due to elevated metals levels (i.e. arsenic, lead copper, etc.) and organic contamination associated predominantly with the storage, transfer, and usage of petroleum hydrocarbons. For the purposes of this study, intrusive sampling was not completed in accordance with the terms of reference for the project. Therefore in the evaluation of surface contamination issues, reliance was placed on historical documents and previously completed studies. On this basis the volume of impacted soils can only be estimated, as both the lateral and vertical extents of potential contaminants within the soil have not been defined.

Several limited studies were completed to initiate the process of identifying the level and extent of inorganic surface contamination at the mine site including a study that was implemented during the summer of 1998(EBA, 1998). These studies generally focused on identifying the aerial extent of surface arsenic soil contamination due to the existing milling process used at the site and the continued storage of arsenic trioxide dust within storage chambers, but other metal parameters have also been identified.

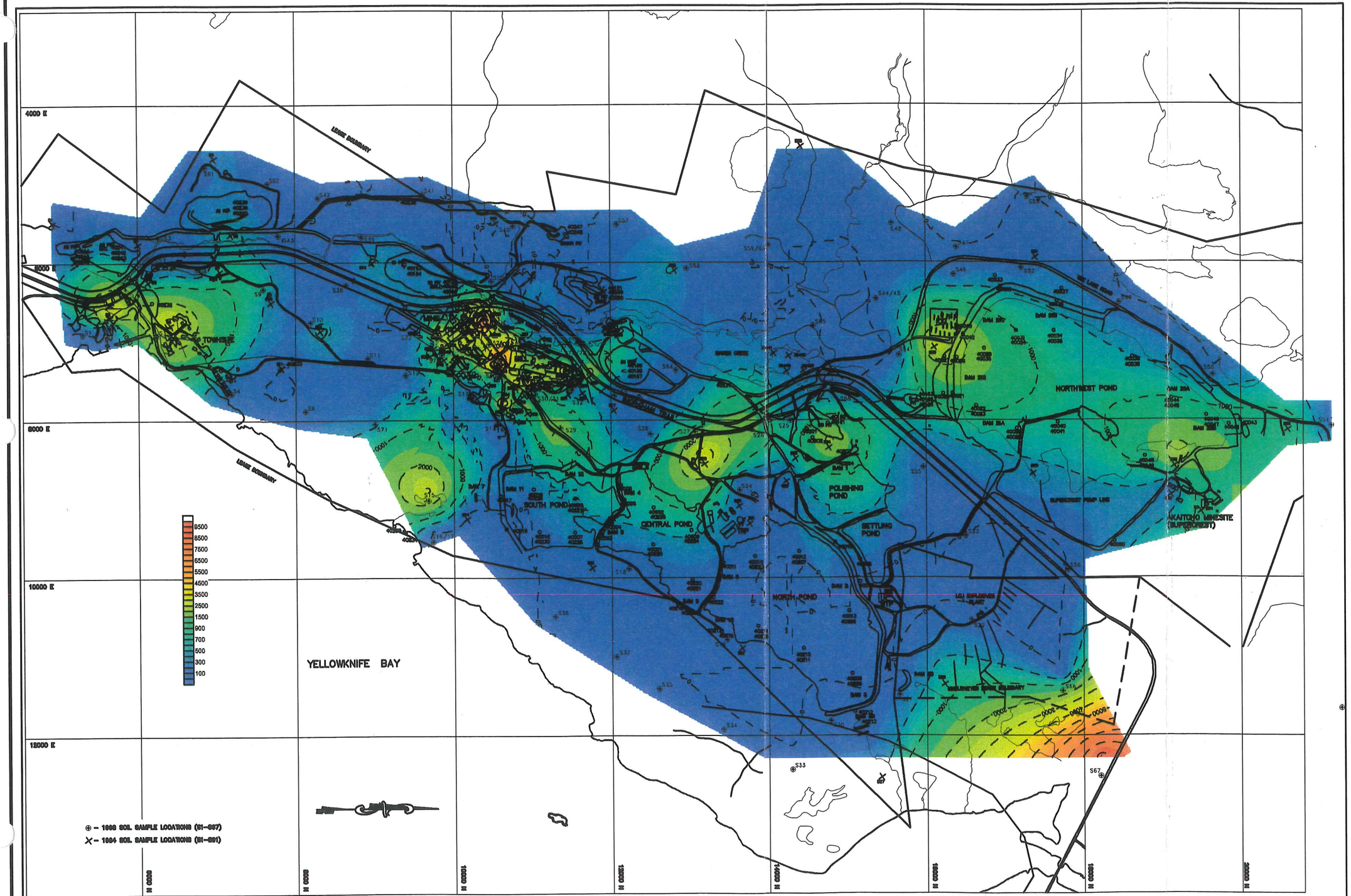
The inorganic contaminant studies were also designed to assist in the development of a site specific remediation criterion for arsenic, as it has been an acknowledged assertion that the existing "Recommended Canadian Soil Quality Guidelines" as established by the Canadian Council of Ministers of the Environment (CCME), for arsenic (i.e. 12 mg/kg) may not be applicable, due to the occurrence of naturally arsenic-enriched bedrock in the Yellowknife area.

Data obtained during the 1998 study confirmed the presence of elevated soil levels of arsenic and heavy metals at the Giant site. Arsenic levels ranged from 5.5 ppm to a high of 9720 ppm with an average arsenic level of 384 ppm. Distribution of arsenic levels in soil from the 1998 study is depicted in Figure 10. Elevated levels of sulphur, copper, zinc and chromium were also identified in several of the samples. The 1998 surface contamination study provided a succinct but limited assessment of the regional distribution of arsenic and other heavy metals across the mine property.

It is recognized that arsenic is present in the local environmental naturally. Arsenic enriched bedrock in the Yellowknife area is known to exist. Arsenic enrichment in the form of arsenopyrite mineralization is a common characteristic of Archean lode gold deposits, a feature which is also prevalent throughout the Yellowknife Greenstone Belt. The two operating gold mines in the Yellowknife area, the Giant and Miramar Con mines extract gold from ore zones which are naturally enriched with arsenic, in the form of arsenopyrite mineralization. Granite intrusions, adjacent to the greenstone belts, are also known to contain arsenopyrite mineralization.

Arsenic levels within bedrock from the Yellowknife area can range from less than 5 ppm to values in excess of 6500 ppm (Boyle, 1979). Soil, which is comprised of weathered and decomposed bedrock, would therefore be expected to also contain significant levels of arsenic in excess of generally accepted background levels. Previous Royal Oak studies makes reference to the National Academy of Science (1977) study which indicates that natural arsenic concentrations within soil can vary from 0.1 to 40 mg/kg with an average of 5 to 6 mg/kg. It is to be noted that the referenced data did not include geochemical information from the Yellowknife region since, to date, no generally accepted control sites have been identified.

Historically, two major sources of anthropogenic arsenic were known for the Yellowknife area. These include the former gold roaster that was located at the Con mine which ceased operation in 1971, and the existing roaster at the Giant mine. Studies both published and unpublished indicate that approximately 8.8 tonnes of arsenic is released into the atmosphere per year (presumably from roaster operations) within the Yellowknife area. Improvements to the roaster system at the Giant Mine have decreased the levels of arsenic being released to the atmosphere to an approximate level of 3.5 kilograms per day of arsenic equivalent, significantly reduced from a release level of several tons per day during the early and mid-1950's.



VISTA PROJ NO 815-01

Deton'Cho Environmental Alliance

JOB TITLE

ENVIRONMENTAL SITE ASSESSMENT

GIANT MINE, NT

DRAWING TITLE

ARSENIC IMPACTED SURFACE SOIL

DESIGNED BY	SCALE 1: 45,000
DRAWN BY D.J.G	DATE 99-08-05
CHECKED BY	FIGURE
SHEET OF	DRAWING NO FIGURE 10

Discussions with staff members of the Giant Mine have also indicated that waste rock material, possibly enriched in arsenopyrite mineralization, has been used as fill material throughout the Giant site. The use and distribution of such material would also contribute to the overall presence of arsenic within the local environment, specifically in close proximity to the mine infrastructure.

Two major factors currently exist which prevent the full identification of impacts resulting from inorganic (i.e. metal) contaminates. These factors include the identification of the ultimate land use for the site following reclamation according to CCME remediation criteria. This issue is of importance, as residential remediation criteria is more restrictive as opposed to the remediation criteria for industrial sites, and thus the volume of impacted soil requiring mitigative measures will be substantially higher.

The second issue, one that has more relevance to arsenic containing soil, is the identification of a background level of soil leading towards the establishment of a remediation criterion for arsenic in soil. The lack of a control site(s) exhibiting background soil conditions does currently not allow for an overall assessment of the degree of arsenic contamination at Giant Mine resulting from anthropogenic sources. The selection of such a site should be considered a priority for future sampling purposes.

Arsenic and its compounds, which are numerous, are designated as toxic materials under Section 11 of the Canadian Environmental Protection Act. Scientific evidence indicates that inorganic arsenic compounds are carcinogens and are considered to be "non-threshold" toxins which means that arsenic compounds may have adverse health effects at any exposure level.

Therefore, during the development of a site specific remediation criterion for arsenic, both total arsenic and as well as the various forms of arsenic and their associated ecological and health risks must be considered and evaluated to ensure an accurate and representative value is selected.

For the purposes of this study, a volume of 40, 500 cubic metres has been used as being impacted by inorganic contamination (including arsenic), using the existing CCME remedial guidelines for arsenic of 12 ppm. This volume was originally used for the development of the RECLAIM cost estimate developed by John Brodie and was based on an approximate area of 135, 000 square metres to a depth of 0.3 metres below grade. This soil volume will require adjustments dependent upon the establishment of a specific remedial criterion.

Further adjustments to the volume of soil requiring remediation may also be required dependent upon the selection of a remedial method for the underground arsenic trioxide. A remedial method that will require the arsenic trioxide being transported from underground to the surface will result in additional impacts to the existing soil conditions. These impacts would result in a volume adjustment to the soil requiring remediation.

6.7 Site Buildings, Infrastructure and Equipment

6.7.1 Mine and Town Site Buildings

Giant Mine has a total of about 100 buildings, on the mine and town site, many dating back as far as the mines original construction. The first structures were built in the late 1940's and consisted of the crushing, milling, and roasting plants along with the development of the A, B and C shafts. In 1950, living accommodations at the main camp were expanded, the main warehouse was built, the mill was expanded, and construction began on the Cottrell Plant. By the mid 1950's, the mill lab, a warehouse at C-Shaft, machine shop, the fluid bed roaster, the brick roaster stack, kiln plant, and many of the residences in the Yellowknife townsite were built. Improvements to various components of the mill and roaster, plus various additions and renovations, continued through the 1960's and 70's. Effluent quality standards prompted the construction of the Effluent Treatment Plant in 1981. A new refinery building was also constructed that same year. Through the rest of the 1980's, a surface crusher was installed and the TRP and the new C-dry were built.

Most of the buildings are numbered on the exterior and tracked as part of an overall equipment inventory. Some of these buildings are no longer used and have been abandoned for some time. The old dry and an electrical shop were demolished, as they became derelict.

The townsite is located at the south end of the mine, on Back Bay. There are currently 22 residential buildings in the townsite, most occupied by staff working at the mine. The buildings are about 40 years old and constructed mainly of concrete foundations, wood framing, with an asphalt/asbestos sheathing. Attempts have been made to upgrade some houses with new roofing, siding, and windows. Heat and sewage disposal is supplied by the mine infrastructure while electricity is supplied by the City's main electrical grid. Water is supplied from a line off the City's main line and chlorinated at the Lakeshore pumphouse.

It is understood that at least one of the town site buildings (House No. 168) has been demolished. One of the bunkhouses and the mess hall were destroyed by fire in the early 1990's. Other bunkhouses were subsequently demolished. The historic Main Office was demolished when the excavation of the A1 pit commenced in the late 1970's.

A site plan of the buildings is shown on Figure 11. A summary of hazardous materials related to the demolition of each building is included in Appendix J.

6.7.2 Equipment

The Giant mine currently has over 1,100 pieces of stationary and mobile equipment operating or stored on site and underground. A general description and location of this equipment was maintained by Giant's accounting department and is presented in Appendix K. This information will be valuable in determining salvage values, or the ultimate disposal of the equipment.

6.7.3 Infrastructure

The infrastructure that links all the main buildings, underground workings, and tailings disposal areas is comprised of access roads, utilidors, power lines, tailings lines, and culverts. These items are identified on Figure 11.

The access roads are generally made up of crushed waste rock that has been generated over the life of the mine. The waste rock is indicated to be non-acid generating, as described in Section 6.9. Wooden, insulated utilidors link the buildings together, distributing water, sewage, oil, and electricity. Electricity is also supplied to high electrical consuming buildings by overhead power lines. Culverts and small wooden bridges allow passage for vehicles over utilidors and surface runoff.

Other parties utilize some of the access roads. These include the access roads to Vee Lake, Explosives Ltd., Great Slave Cruising Club Marina, the old NWTPC Giant substation and the ICG Propane access road.

6.8 Pits and Shafts

6.8.1 Mine Openings to the Surface

A total of 26 surface openings are present at the mine site. These include:

1. Four shafts identified as A, B, C, and Brock;
2. Seven portals located in the A2, A1, UBC, B3 , B4, and Brock pits;
3. Ten raises used for ventilation, fuel supply, conveying arsenic trioxide, and ore handling;
4. The Brock adit that leads to the bottom of the shallow Brock Shaft;
5. The B3 adit which leads from the Ingraham Trail to the B3 Pit;
6. The B1 Pit drift;
7. The DWC open stope.

Many of these mine openings are already secured. The Workers Compensation Board Mine Inspectors direct the safety precautions to be taken during the closure of a mine and are the regulators responsible for ensuring that mine openings do not present a safety risk to employees and to the general public.

A general description of size and current status of each opening is presented in Table 5 and locations are shown on Figure 12. One additional surface opening includes a break through in the bottom of the A2 Pit. The opening is backfilled completely with collapsed rock and waste rock.

Table 5: Surface Openings

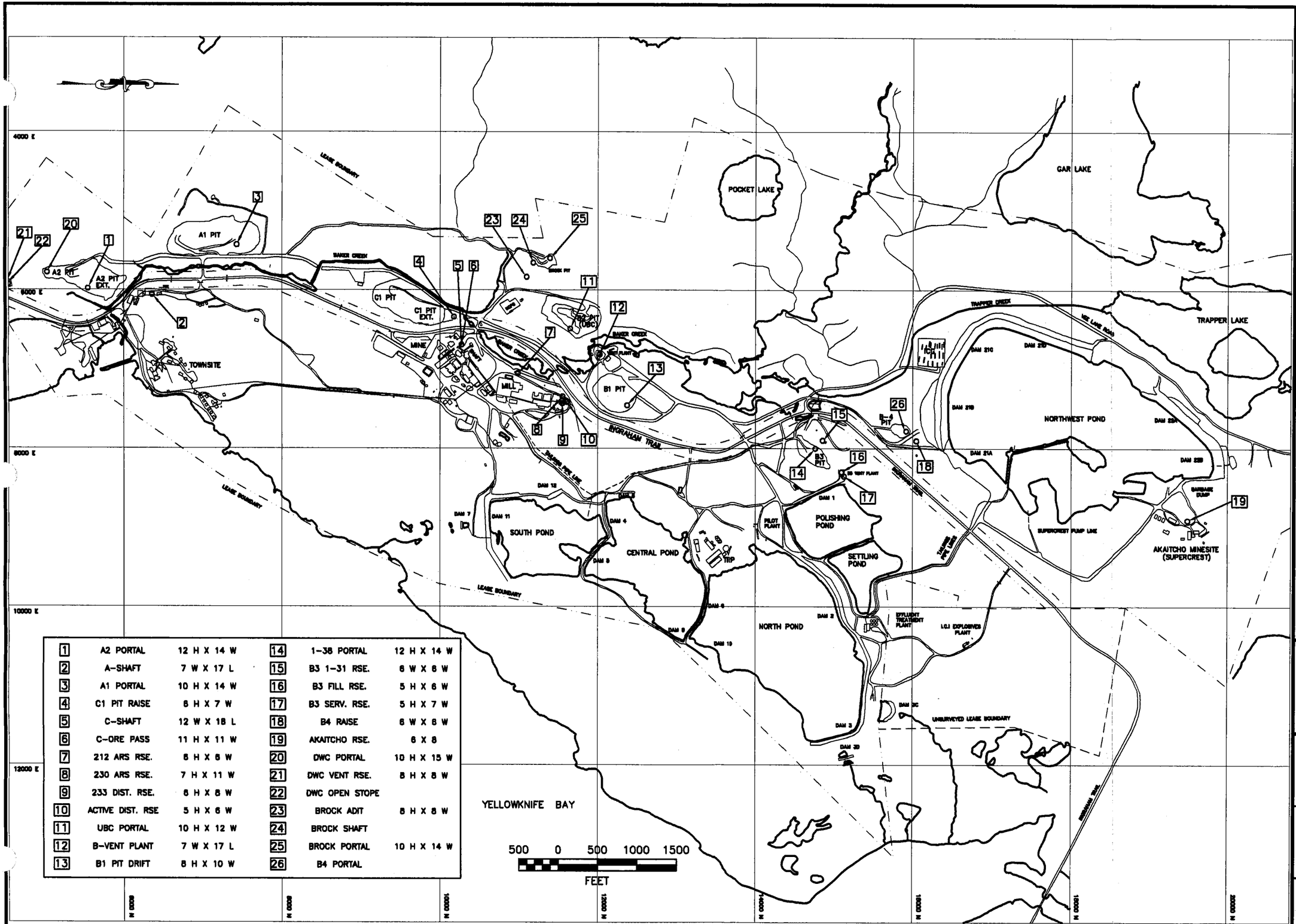
Surface Opening	Size (ft)	Current Status
1. A2 Portal	12 x 14	- not active; open
2. A-Shaft	7 x 17	- not active; old headframe remains
3. A1 Portal	10 x 14	- not active; open
4. C1 Pit Raise	6 x 7	- active; underground fuel supply
5. C-Shaft	12 x 18	- active; main ore pass, access for personnel and servicing, extends to below 2000'
6. C-Ore Pass	11 x 7	- not active; open ore pass for surface works
7. 212 Arsenic Raise	6 x 6	- not active; covered by small shed, concrete bulkhead at depth
8. 230 Arsenic Raise	7 x 11	- not active, concrete capped below foundation of Bag House
9. 233 Distribution Raise	6 x 8	-not active; concrete collared, covered by small shed
10. Active Distribution Raise	5 x 6	- active; arsenic feed to underground storage, covered by wooden planks
11. UBC Portal	10 x 12	- active; provides access to the central part of the mine.
12. B-Vent Plant (Shaft)	7 x 17	- active; ventilation supply
13. B1 Pit Drift	8 x 10	- not active;
14. 1-38 Portal	12 x 14	- active; access to Supercrest area of mine
15. B3 1-31 Raise	6 x 6	- abandoned; backfilled with waste rock
16. B3 Fill Raise	5 x 6	- active; ventilation supply
17. B3 Service Raise	5 x 7	- active; ventilation supply
18. B4 Raise	6 x 6	- abandoned; concrete capped
19. Akaitcho Raise	6 x 8	- active; exhaust plant
20. DWC Portal	10 x 15	- not active; open at south end of A2 Pit
21. DWC Vent Raise	8 x 8	- not active; open at base of DWC open stope
22. DWC Open Stope		- not active; warning signs with steel fencing
23. Brock Adit	8 x 8	- not active; open
24. Brock Portal	10 x 14	- not active; backfilled with mine waste
25. Brock Shaft		- abandoned; backfilled with mine waste
26. B-4 Portal		- abandoned; backfilled with mine waste rock

Reference: Royal Oak Abandonment and Restoration Plan, 1998

6.8.2 Open Pits

Open pit mining were employed at the Giant Yellowknife Mine from 1974 to the early 1980's. There are currently eight open pits on the Giant Mine property, as shown on Figure 12. These are known as the A1, A2, C1, B1, B2, B3, B4 and Brock pits. A-1 pit is the largest, which is about 243 m (800 ft.) by 732 m (2400 ft.) and about 46 m (150 ft.) deep. The smallest is the B-4 pit, which is about 98 m (320 ft.) by 146 m (480 ft.) and about 15 m (50 ft.) deep.

The pit walls were originally designed by benching at 6m (20 ft) intervals in both overburden and rock [Horne, 1998]. The overburden contained ice rich clay and silt permafrost and sloughing was found to be a problem when construction occurred in the summer months. To reduce the occurrence of sloughing due to permafrost degradation, the benched overburden was covered with mine waste.



1	A2 PORTAL	12 H X 14 W	14	1-38 PORTAL	12 H X 14 W
2	A-SHAFT	7 W X 17 L	15	B3 1-31 RSE.	6 W X 6 W
3	A1 PORTAL	10 H X 14 W	16	B3 FILL RSE.	5 H X 6 W
4	C1 PIT RAISE	6 H X 7 W	17	B3 SERV. RSE.	5 H X 7 W
5	C-SHAFT	12 W X 18 L	18	B4 RAISE	6 W X 6 W
6	C-ORE PASS	11 H X 11 W	19	AKAITCHO RSE.	6 X 6
7	212 ARS RSE.	6 H X 6 W	20	DWC PORTAL	10 H X 15 W
8	230 ARS RSE.	7 H X 11 W	21	DWC VENT RSE.	6 H X 6 W
9	233 DIST. RSE.	6 H X 6 W	22	DWC OPEN STOPE	
10	ACTIVE DIST. RSE	5 H X 6 W	23	BROCK ADIT	6 H X 6 W
11	UBC PORTAL	10 H X 12 W	24	BROCK SHAFT	
12	B-VENT PLANT	7 W X 17 L	25	BROCK PORTAL	10 H X 14 W
13	B1 PIT DRIFT	6 H X 10 W	26	B4 PORTAL	

NOTES:

1. DIGITAL MAPPING SUPPLIED BY ROYAL OAK MINES

VISTA PROJ NO: 815-01

Deton'Cho Environmental Alliance

JOB TITLE

ENVIRONMENTAL SITE ASSESSMENT

GIANT MINE, NT

DRAWING TITLE

SURFACE OPENINGS AND PITS

DESIGNED BY	SCALE 1:45,000
DRAWN BY D.J.C	DATE 99-08-03
CHECKED BY	FIGURE
SHEET OF	DRAWING NO FIGURE 12

Some sloughing of overburden has occurred on the northwest side of the A-1 Pit. The sloughing has extended partially into an access road on the west side of the Pit and undermines part of the road. The sloughing has reportedly occurred as a result of permafrost degradation in the area. Additional sloughing may also occur as a result of surface runoff from the natural slope adjacent to the west side of the pit. However, with the exception of the A1 Pit, the pit walls have reportedly been stable over time. Some cracking of the roads immediately adjacent to the pits was observed at the A1, A2 and B1 pits suggesting instability of the pit walls.

Many of the pits have portals to underground operations and access into the pits is gained by ramps along the sides of the pit walls. Currently the underground is accessed through adits in the B2 and B3 pits. The pits are generally dry, and probably drain into the underground mine.

After mining was completed in the B1 pit, it was designated as the disposal site for non-hazardous waste generated during progressive remediation of inactive mine facilities. To date, a small amount of scrap metal and wood have been deposited in this pit.

The C1 Pit has been partially backfilled with flotation tailings and natural till. Vegetation has established on the surface of this backfill. Some seepage water collects in the bottom of the pit. It is reportedly pumped to the mine water treatment plant and reused in the milling process.

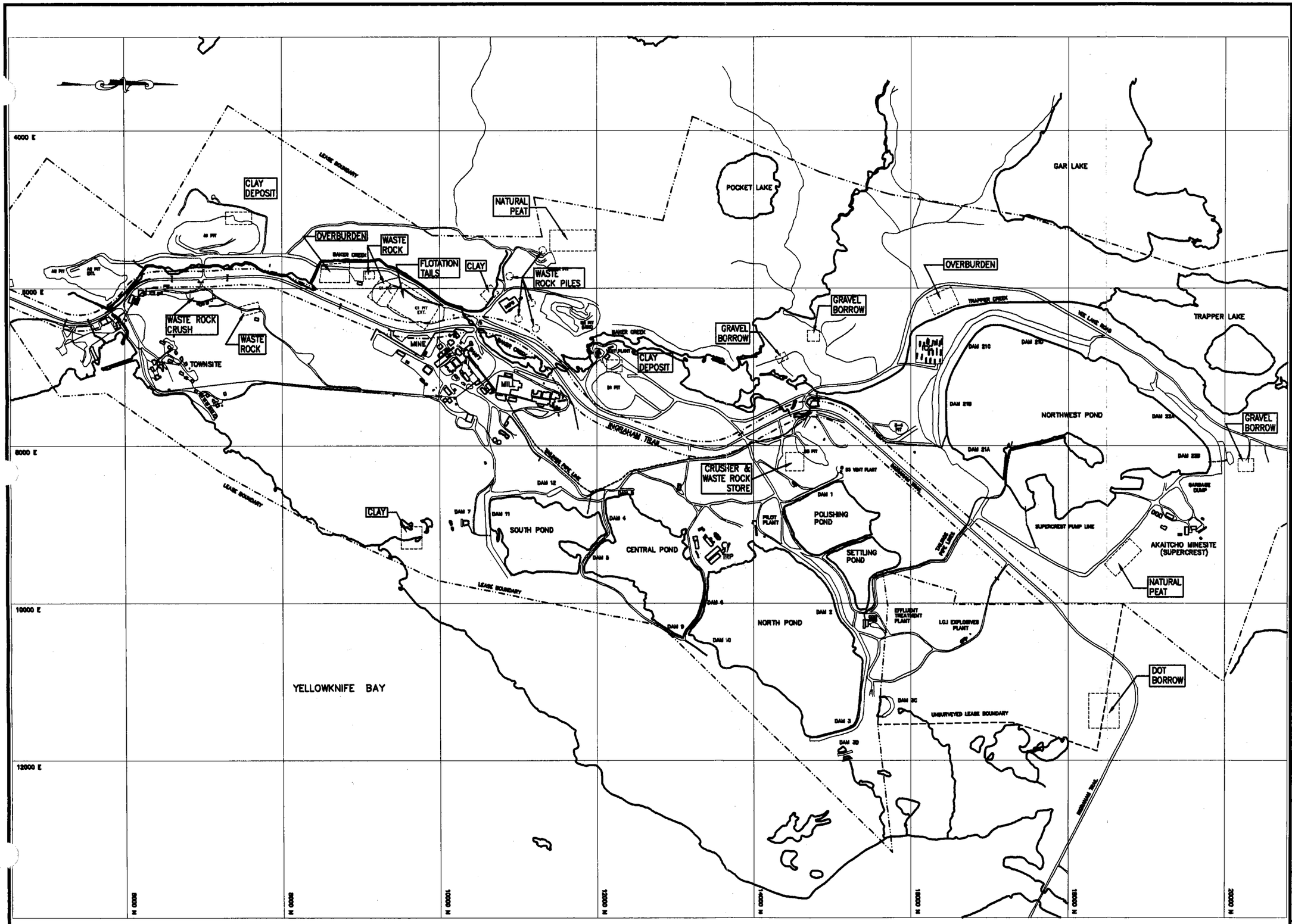
6.9 *Waste Rock and Borrow Areas*

6.9.1 Waste Rock Storage

Waste rock has been used at the mine for the development of tailings retention structures, access roads and ramps, lay-down areas, berms, and mine backfill. There are three main areas that waste rock is currently stockpiled on the mine site, as shown on Figure 13. The mine is currently constructing the #15 arsenic storage vault. Waste rock excavated from the vault is deposited adjacent to B2 pit. It has been sampled for acid rock drainage potential by ROM personnel and the results show that the rock is acid consuming with a low acid production potential.

6.9.2 Acid Rock Drainage Potential

The bulk of the waste rock generated over the mine life has been used for construction of tailings structures, road work and laydown areas. Geochemical testing of mine rock (waste rock and pit wall) to date has include acid base accounting on samples collected semi-annually as required by the current Water Licence, and a survey completed by Royal Oak in 1994. The average results reported in the A&R Plan show that high acid consuming potential with NP values typically greater than 100 kg $CaCO_3$ eq./tonne and total sulphur values ranging from 0.1 to 1.5%. Testing has not been done to address metal leaching potential.



NOTES:

1. DIGITAL MAPPING SUPPLIED BY ROYAL OAK MINES

VISTA PROJ NO 815-01

eba | Deton'Cho Corporation | VISTA ENGINEERING

Deton'Cho Environmental Alliance

JOB TITLE

ENVIRONMENTAL SITE ASSESSMENT

GIANT MINE, NT

DRAWING TITLE

LOCATION OF WASTE ROCK, CLAY, PEAT & BORROW AREAS

DESIGNED BY	SCALE 1:45,000
DRAWN BY D.J.G	DATE 99-07-23
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While it is not anticipated that there is a significant ARD potential associated with the waste rock, or structures constructed from waste rock, it would be prudent to conduct a small confirmatory sampling program. Where possible, it would be useful to do field testing and limited rock sampling of the same areas as the 1994 survey to determine if there have been any changes. Given that there is sulphide content in the ore, there may be isolated areas in underground exposures or, possibly, pit walls that could generate acidity and dissolved metals. Quantifying this potential would allow evaluation of any potential long-term water quality issues.

Acid Base Accounting test results are presented in Tables 6 and 7.

Table 6: Giant Mine Waste Rock ARD Potential

Tailings Dam Waste Rock	Paste pH	Wt% Total Sulphur	Max. Potential Acidity (kg/MT)	Gross Neutralization Potential (kg/MT)	Net Neutralization Potential (kg/MT)	Ratio of NP/MPA
Dam #1 - Upper Berm	8.3	0.289	9	140	131	15.6
Dam #1 - Upper Berm	7.9	0.335	10	104	94	10.4
Dam #1 - Lower Berm	8.2	0.692	22	136	114	6.2
Dam #1 - Lower Berm	8.2	0.594	19	167	148	8.8
Dam #2 - North	7.8	0.113	4	38	34	9.5
Dam #2 - South	7.8	0.089	3	39	36	13.0
Dam #3 - Upper Berm	8.2	0.499	16	125	109	7.8
Dam #3 - Lower Berm	8.5	0.381	12	142	130	11.8
Dam #4 - West	8.4	0.780	24	196	172	8.2
Dam #4 - East	8.1	0.458	14	157	143	11.2
Dam #5 - West	8.4	0.564	18	148	130	8.2
Dam #5 - East	8.2	0.524	16	140	124	8.8
Dam #6 - West	8.4	0.510	16	204	188	12.8
Dam #6 - East	8.5	0.421	13	174	161	13.4
Dam #9 - North	8.3	0.386	12	154	142	12.8
Dam #9 - South	8.2	0.411	13	144	131	11.1
Dam #10 - North	7.9	0.382	12	188	176	15.7
Dam #10 - South	8.5	0.303	9	137	128	15.2
Dam #11- West	7.9	0.177	6	59	53	9.8
Dam #11 - East	8.5	0.477	15	173	158	11.5
Dam #21B-Lower Berm	8.4	0.367	11	113	102	10.3
Dam #21B-Upper Berm	8.6	1.130	35	188	153	5.4
Dam #21B-Upper Berm	8.2	0.669	21	135	114	6.4
Dam #21B-Lower Berm	8.1	0.459	14	195	181	13.9
Dam #21C-Upper Berm	8.1	0.618	19	156	137	8.2
Dam #21C-Lower Berm	8.1	0.809	25	155	130	6.2
Dam #21D-Upper Berm	8.3	1.450	45	186	141	4.1
Dam #21D-Lower Berm	8.6	0.147	5	75	70	15.0
Dam #22B-Upper Berm	8.1	0.618	19	156	137	8.2
Dam #22B-Lower Berm	8.1	0.809	25	155	130	6.2
Average	**8.2**	**0.515**	**16**	**143**	**127**	**8.9**

Table 7: Giant Mine Waste Rock ARD Potential

Site Roadways & Laydown Areas	Paste pH	Wt% Total Sulphur	Max. Potential Acidity (kg/MT)	Gross Neutralization Potential (kg/MT)	Net Neutralization Potential (kg/MT)	Ratio of NP/MPA
Rock laydown near Giant Townsite	8.3	0.432	14	91	77	6.5
Back Road between Townsite and Mine	8.2	0.777	24	143	119	6.0
Haul Road between A1 & Brock Pits	8.1	0.561	18	210	192	11.7
Haul Road between B1 Pit & Polishing TCA	8.1	0.484	15	153	138	10.2
Access Road to Akaitcho Mine Site	8.5	0.817	26	203	177	7.8
Access Road to Effluent Treatment Plant	8.3	0.475	15	78	63	5.2
Access Road to Tailings Dam #11	8.5	0.456	14	120	106	8.6
Average	**8.3**	**0.572**	**18**	**143**	**125**	**7.9**

6.9.3 Quarries, Borrow Areas, and Overburden Piles

Over the course of mine development, several quarry and borrow areas have been established on the mine lease property. Construction of the Northwest Tailings area required the excavation of significant amounts of clay and till material. Evidence of this borrow area can be seen immediately south of the ICG propane storage area near the Northwest TCA. A similar, but smaller borrow area, is evident south of the South TCA and was assumed to be used for development of Dam 11.

A small quarry site is located at the southwest side of the Northwest TCA. The site serves no current purpose. It is understood that a similar site was located inside the Northwest TCA, but is now partially submerged under mine tailings.

A quarry site operated by the Department of Transportation (DOT) is located at the north end of the mine lease. The site was opened by the DOT in 1996 to provide blast rock for the construction of the highway embankment on either side of the Yellowknife River Bridge [Malloch, 1998]. The Ingraham Trail, km 0 to km 69, Reconstruction and Surfacing Program, is scheduled to be carried out over the next several years.

Several overburden stockpiles are evident adjacent to the A2, A1 and C1 Pits. These stockpiles apparently are the product of surface stripping prior to open pit mining and likely consists of silty clay and silty till material.

There are also many locations where peat is available for reclamation projects. The mine is currently excavating peat from an area near the Akaitcho mine site. The location of these areas is presented in Figure 13.

6.10 Baker Creek and Trapper Creek

6.10.1 Baker Creek

Baker Creek is a natural watercourse that flows east from Lower Martin Lake through a series of wetland ponds and bedrock outcrops and passes through the Giant Mine operating lease. It is the receiving water body for the mine's process effluent and it's course has been altered over time to accommodate mining activities.

To meet a requirement of the Water Licence renewal in 1997, Royal Oak commissioned Dillon Consulting Limited (Dillon) to undertake a study of the options to rehabilitate Baker Creek. The report, *"Baker Creek Fish Habitat and Rehabilitation Study for Abandonment and Restoration Planning"* was completed in 1998.

The purpose of the report was to:

- compile relevant historic data on Baker Creek fish habitat;
- characterize creek habitat from Yellowknife Bay north to the confluence with the effluent discharge point and Trapper Creek;
- to determine the existing use by fish and the full habitat potential;
- to identify options for creek habitat rehabilitation prior to and upon mine closure;
- and to provide methods of enhancement that will ensure full recovery of the habitat.

A three-phase scenario is envisioned to rehabilitate Baker Creek. Phase 1 will occur once mine effluent ceases to flow. At that time, the following measures have been recommended to enhance in-stream creek habitat:

- the realignment of Trapper Creek near the Northwest Tailings Pond;
- the promotion of vegetation along Baker Creek in the form of willow cuttings and spruce seedlings with large woody debris and transplanted aquatic plants;
- incorporate the B4 Pit to create a settling basin;
- create a creek through the North/Central/South tailings basin to increase the drainage basin area contributing to Baker Creek.

Phase 2 is intended to create a functional habitat for a period of about five to seven years, prior to the final phase where the open pits reach a natural static water level and are interconnected with the Baker Creek system. Phase 2 measures include:

- creation of an upstream pool at the culvert crossing of Ingraham Trail;
- initiate flooding of open pits;
- remove remaining weir structure at the "B" Shaft Vent Plant;
- enhancement of the creek with structural changes such as rocky ramps, anchored log jams, and root wad bank deflectors;
- re-grade creek banks near "B" Shaft Vent Plant;
- remove access roads and culverts downstream of "B" Shaft Vent Plant with some re-grading and planting;
- re-grade banks near Creek Mouth;
- remove remains of A1 Pit access road;

- the option of isolating Baker Creek along the west margin of Baker Creek Pond by constructing a new channel, through bio-engineering, of earth and rock berm/islands;
- creation of a resting pool adjacent to the A2 Pit.

Phase 3 was envisioned as the final scenario where the open pits will be flooded to a static water level and connected to Baker Creek. It is estimated that mine flooding will take between five and seven years [Fracflow, 1998]. In that time period, sensitive fish species could re-inhabit the Baker Creek watershed. With that in mind, the following Phase 3 measures were considered:

- regrading the side slopes on at least one-quarter of the pits perimeter to create a spawning/nursery habitat;
- option of flooding the pits by combining rainfall, seepage, and some high stage creek flow;
- option of creating a wetland downstream of the "B" shaft Vent Plant;
- construction of the inlet and outlets to/from the newly formed lakes.
- preparing the bottom of the pits with artificial topsoil.

Royal Oak conducted a topographic survey around the largest of the open pits (A1, A2, C1, B1, B2) to determine if and where water would eventually overflow when the mine is flooded. From this information and available topographic contours of the area, a better idea of static water levels were obtained in the pits along with possible channel alignments from the pits to Baker Creek.

For the most part, the survey confirmed that the channel alignment proposed could be achieved with two variances. The first is removing the south outlet from the B2 Pit to Baker Creek. After examining the contour information in this area, a 10 m deep channel would have to be constructed to create this outlet. The second is moving the outlet from the A2 Pit further north due to minimum grades in this area.

If the B1 pit is to be used as a solid waste disposal area, it may not be acceptable to include it as part of the Baker Creek system.

During interviews it was noted that mercury may be a contaminant of concern in the lower layers of the Baker Creek sediment, particularly at the mouth of the creek. Mercury amalgamation was used during the early production at the mine, and tailings were discharged into Baker Creek from time to time.

6.10.2 Trapper Creek

During construction of the Northwest Tailings Impoundment, Trapper Creek was diverted around the impoundment. One section of this diversion runs through till which resulted in extensive erosion and resulted in significant release of silt into Baker Creek at each spring freshet.

Royal Oak Mines took remediation measures to stabilize this portion of Trapper Creek. In the fall of 1994 the till banks along this section of Trapper Creek were regraded to significantly reduce the slopes of the creek banks to reduce erosion.

The 1995 spring freshet caused extensive erosion along the Trapper Creek bed, both at the points where excavation and grading had been completed as well as in areas where no remediation work had taken place.

After consultation with DFO and DIAND additional work was recently completed as follows:

- The creek bed to the south east of dam 21 b was graded as far as the Vee Lake Road, to achieve a 3:1 slope along both sides. To achieve this, material on the creek banks was pulled back and graded to form a gentle contour above each bank. As much as possible, the existing water course and grade was maintained. The creek bed was widened from less than 12" in some places to a minimum width of 36" to reduce the hydraulic force through this section of Trapper Creek.
- All large stones (cobbles) accumulated during the excavation were placed in the creek bed, to serve as rip-rap and stabilize the creek bed.
- Where a 3:1 slope could not be achieved, broken rock was placed along and two feet above the creek bed, to stabilize the slopes and prevent erosion.
- Where a curve in the water course existed cobbles and broken rock were placed to prevent erosion.
- The exposed banks were hand seeded and fertilized in August and September of 1995 and again in the spring of 1996.

It is reported that this area of Trapper Creek handled the 1996 and 1997 spring freshet with significantly less release of sediment than in previous years [Royal Oak Annual Report, 1998], and was observed to be low in suspended solids throughout 1981. Vegetation is now reported to be re-established. It can then be assumed that Trapper Creek has stabilized and may not require further attention in the future unless it is disturbed again.

7.0 Underground Inspection

7.1 General

The underground workings were visited by Sheila Street of Vista Engineering and Noel O'Sullivan, former Mine Superintendent on July 29, 1999. Rob Moore, present Mine Superintendent accompanied the assessors. The purpose of the investigation was to inspect operational components of the underground workings including electrical substations, fuel storage facilities, explosive magazines and maintenance shops.

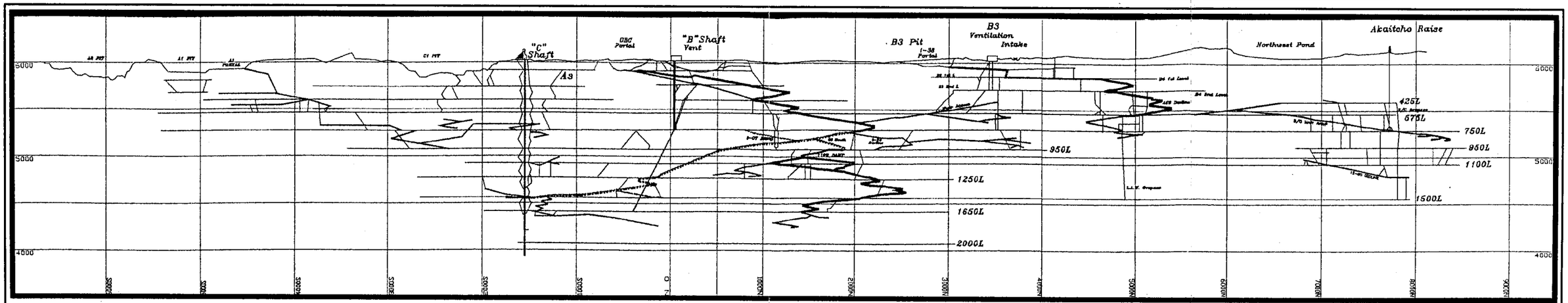
Two representative scoop tram shops were evaluated including the 5-75 shop and the 7-12 shop. One representative electrical substation, one representative fuel and lubricant storage areas and one representative explosive magazine were inspected. An inactive powder magazine was also inspected. At the time of the site visit, the areas where active mining was taking place included the Supercrest, LAW, 7-12, 16-50, 7-14 and the 3rd level sections.

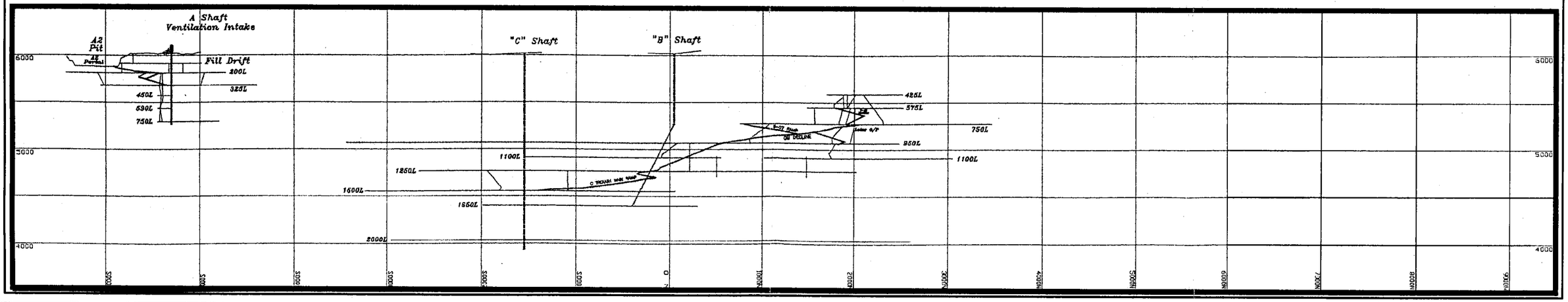
The environmental concerns of the underground workings are minimal. Ventilation is dependent on mechanical air transfer and the workspace is confined compared to above ground, therefore it is necessary to maintain an environment that is non-hazardous to the employees. This includes proper storage, handling and maintenance of the explosive and flammable materials utilized in the mine workings.

A cross section of the underground workings is presented as Figure 14.

7.2 Maintenance Shops (Scoop Tram Shops)

Most of the mining equipment that is used underground is battery or diesel powered and is maintained in shops that are placed at central locations on each level. There were five active and six inactive scoop tram shops in the underground workings at the time of the site visit. Table 8 summarizes the locations and status of each shop.





Deton'Cho Environmental Alliance

JOB TITLE

ENVIRONMENTAL SITE ASSESSMENT

GIANT MINE, NT

DRAWING TITLE

UNDERGROUND WORKINGS

DESIGNED BY	SCALE N.T.S
DRAWN BY D.J.G	DATE 99-07-28
CHECKED BY	FIGURE
SHEET OF	DRAWING NO FIGURE 14

Table 8: Underground Scoop Tram Shops

Location of Shop	Status
5-75	Active
7-12	Active
7-14	Active
1500	Active
16-50	Active
11-02	Inactive
11-04	No longer exists - mined through
7-30	Buried under mine muck
12-80	Inactive
3rd level A-shaft	Abandoned and no longer accessible due to ice buildup
A-2 area	Abandoned and no longer accessible due to ice buildup

According to the Mine Superintendent, the shops that are inactive are completely dismantled and all equipment is taken to an active shop to be reinstalled. Hazardous materials such as lubricating oil, solvents and fuel tanks are also moved to an active shop. Waste oil is taken above ground to be stored. Lighting and switch panels are generally left behind in case the section is reactivated for mining at a later date.

Typically, the types of hazardous waste that were found at an active scoop tram shop included waste oil, empty containers, waste spill absorbents and waste batteries. Empty gas cylinders and other empty containers were also noted. It was also suspected that the fluorescent light ballasts that are used throughout the mine, may be PCB-containing. There were typically 25 sets of single ballast units in each shop.

Hazardous materials that were typically stored in the active shops included small quantities of lubricating oils and greases (20 L containers or less), compressed oxygen, nitrogen and acetylene, small quantities of solvents, cleaners and fire suppressants.

Larger quantities of motor oil were stored in containment areas constructed of a concrete wall and located near the shop. Typically five to ten 205 L drums of lubricants were stored in these areas.

Some hydrocarbon staining was observed in the lubricating oil storage areas and in the shops.

7.3 Fuel Storage

There were three diesel fuel storage locations underground at the time of the site visit; one each on level one, level 7-12 and level 15. A fuel storage area typically consists of a 4500 litre tank on a stand that is contained within a concrete containment berm.

When an area is deemed inactive, fuel storage tanks are moved to the active area, therefore it is reported that there are no abandoned fuel tanks in the underground workings.

7.4 Electrical Substations

There were six active substations in the underground mine workings at the time of the site visit. These were located at level 12, level 18, level 9, and three substations on level 7. Typically the substations consist of one transformer and a switch panel.

Transformers that were used underground were the dry type, which replaced oil-filled transformers in the 1990's when PCBs on the Giant mine site were identified and destroyed. It is suspected that PCBs had been in use underground in the past, and any maintenance on the transformers would have taken place at the substation. The name plate on the level 7-12 substation dry-type transformer reads as follows:

Babco Electric and Engineering LTD

Date: 88-10-18.

Volts: 2.8 Amps: 63 Hertz: 60 PO: 3 Type: HVS-1 No.: 5-16878

When an area is deemed inactive, electrical power to the area is no longer required therefore the substation is dismantled and the equipment is used else where in the mine. There are many locations throughout the mine workings where substations had existed, but interviewees, could not recall all the locations.

A typical switch panel at the substations consists of older equipment dating back to the 1960s therefore very small quantities of PCBs may be associated.

Substations were fenced and locked to limit access.

7.5 Explosives Storage

There was one explosive storage area in each active area and many inactive storage areas throughout the underground workings. Caps were stored in cardboard boxes off the ground within a fenced area. ANFO was stored in a separate powder magazine on shelves.

When an explosive storage area was deemed inactive, the shelves and fencing were left in tact and the explosives were moved to an active magazine.

7.6 Sewage

The "honey bucket" system of sewage collection was utilized underground. Full bags were transported above ground for disposal.

7.7 *Infrastructure*

Underground infrastructure consists of many kilometers of ventilation tubes and pipes, electrical wires and Loki tracks that were embedded into the rock in the older section of the mine. There were no concerns associated with these materials.

8.0 Conclusions: Summary of Environmental, Health and Safety Concerns

8.1 Conclusion

The Giant Yellowknife Mine has been in operation for over fifty years. During that time it operated under the regulatory regime and standard operative practices of the day. Increasing environmental awareness over the years has resulted in the more stringent regulations in place today. Practices that may have been commonplace in past years may not be permitted now. The historic operation of the Giant Yellowknife Mine needs to be viewed in that context.

With the exception of arsenic trioxide stored underground, the Giant Yellowknife Mine in general is considered to present similar environmental concerns as other mines of similar length of operation, size and type. The Giant Yellowknife Mine is perhaps unusual in that it is within the limits of a city and has a highway crossing the property. This puts it more in the public eye than many other mines.

Any mine that has operated for over fifty years, most of it under less stringent environmental regulations than are in place today would be anticipated to have environmental concerns upon its abandonment and closure. The Giant Mine is no exception. This study and report have identified some of these concerns, as well as areas where the authors believe more information is required. It is one of the first steps in a process of dealing with the environmental concerns on this property.

8.2 Summary of concerns

There were a number of environmental and health and safety concerns that were identified during the assessment. Should the mine close and become the responsibility of the Government of the Northwest Territories and Government of Canada, these concerns will need to be addressed on a priority basis.

The following section summarizes the environmental, health and safety concerns that have been identified. Section 9.0 proposes an action plan for the mine remediation.

Ongoing care and maintenance of the site is required following the mine shut down. This includes mine de-watering, shaft operation, general maintenance, tailings and minewater treatment, dam seepage collection.

1. There is a difference of opinion between Royal Oak's Abandonment & Reclamation Plan and Brodie's comments as to remediation procedures for the tailings. It is beyond the scope of this report to resolve this difference and determine the final remediation procedure.

Detailed study of the nature of the tailings, remediation alternatives, and the effectiveness of the alternatives should be completed, leading to a recommended closure and remediation plan. Further ARD and porewater studies should also be undertaken.

2. There is some concern that the erosion control methodology proposed in the Royal Oak A&R Plan is not adequate to contain the Beach tailings located in Back Bay. There is also concern that these tailings contain mercury due to the mill process employed historically. The current mine management is currently undertaking erosion control measures as proposed in the A & R plan.

   Tailings disposed of in Back Bay should be further studied to identify the presence or absence of mercury. The proper combination of containment, excavation and erosion control should be developed and employed.

3. There has been some indication by interviewees, that the sediment at the mouth of Baker Creek is particularly mercury contaminated at depth. No mercury analyses have been conducted on this sediment, therefore it is a concern that requires further investigation.

   Mercury analyses of Baker Creek sediment should be undertaken to assess the presence or absence and the accessibility to aquatic organisms and humans.

4. There appears to be several tailings cover materials to promote vegetation regeneration and subsequent dust suppression. These include manure, clay, peat and floatation tails. No studies have been conducted to date to evaluate the effects of tailings porewater uptake on vegetation or the depth to which the roots will penetrate, and few studies have been conducted to develop a cost effective and suitable vegetation supporting cover.

   Vegetation cover options should be thoroughly investigated to evaluate the effects of uptake of plant growing in tailings. Studies should be undertaken to develop a cost effective and suitable cover material that will support vegetation.

5. Wind erosion of tailings is a continuing, and visible, problem. Control of wind erosion needs to be addressed and implemented in order to minimize the spread of tailings. As well as spreading tailings off-site, wind erosion creates a significant public perception problem for the mine operators and regulatory agents. However, the method adopted for wind erosion control while the mine is operating should not interfere with, or make more difficult, the ultimate tailings remediation scheme.

   Determine the preferred method of wind erosion control and implement it as expeditiously as possible.

6. Several interviewees have mentioned that hazardous and non-hazardous waste have been buried in the Central and South Ponds as well as under the tire storage area. Based on interviews, a potential exists that between 3,000 and 13,000 barrels of arsenic trioxide waste material may potentially be buried in these areas. This raises a number of questions: How much is buried? Where is it buried? Will it eventually be released to the environment? Is the arsenic trioxide stable?

It may be possible to confirm or refute the presence of these drums by interviews or other research. If there is reasonable probability that the drums exist a risk assessment is recommended to determine whether they pose environmental or safety concerns. Locating the drums may prove an onerous task, and may not be necessary if the drums do not pose risks.

More work should be done to confirm or refute the presence of arsenic trioxide in drums in the tailings through interviews and determine the potential environmental problems posed by buried drums of arsenic trioxide waste material. An attempt should be considered to locate buried metal using magnetic surveys and test pits.

7. Numerous hydrocarbon-stained areas have been identified. These stains have not been delineated, particularly in the vertical dimension.

   Hydrocarbon stained areas should be delineated, and levels of hydrocarbon contamination determined for each of the stained areas.

8. Treatment for hydrocarbon-contaminated soil often involves some form of aeration, either landfarming or treatment in a biopile. There is potential that this aeration could take place on the tailings, as part of the wind erosion control, either mixed with peat and flotation tails or by itself. This should be considered if hydrocarbons will not mobilize into the tailings significantly.

   Concerns in using this method include the effect of the hydrocarbons on revegetation efforts and whether deleterious hydrocarbon components will leach through the tailings and enter groundwater or Back Bay, or interfere with the effluent treatment process.

   Investigation should be undertaken to determine feasibility of establishing vegetation on a hydrocarbon contaminated soil blended with other soils and placed over tailings.

9. There are several hundred drums of arsenic trioxide stored in the hazardous waste area which are exposed to the elements. These should be stored under secure cover to avoid deterioration of the drums.

   Move drums of arsenic trioxide into an unused building that can be secured against access by wildlife and unauthorized personnel.

10. There is a considerable quantity of Asbestos Containing Materials (ACM) in buildings and insulation. This should be removed and disposed in accordance with Territorial regulations. Personnel handling ACM must be trained in proper procedures. Waste ACM must be landfilled in accordance with regulations or shipped to a licensed disposal facility.

    Remove and dispose of waste ACM in accordance with applicable regulations. This disposal may be more feasible with the demolition of each respective building.

11. There is a large quantity of waste lubricating oil stored in drums. There may be other fluids mixed with the oil. It is unknown whether this oil is suitable for incineration or for recycling. It will be necessary to complete representative sampling and analyses to

qualify the waste. It may be more cost efficient to ship to a licensed disposal facility or recycle facility.

It is reported that this waste oil is difficult to burn in the waste oil furnaces, but this may also be a disposal option.

A sampling and analysis program should be developed for waste oil to determine its suitability for incineration, recycling, or as fuel in a waste oil furnace.

12. There are several types of hazardous materials on site. In some cases it may be possible to return them to the suppliers. In other cases they may have to be treated as hazardous waste and disposed of accordingly.

    Where hazardous materials are stored in bulk, the containers will have to be cleaned and dismantled and the contents disposed of accordingly.

    Suppliers of hazardous materials should be contacted and arrangements made for return where appropriate. Clean and dismantle tanks as required. Dispose of contents accordingly.

13. Pits and shafts will constitute a significant safety hazard upon closure of the mine. All pits, shafts or other openings should be secured to prevent accidental or deliberate entry by unauthorized personnel.

    Shafts, raises and other vertical openings should be secured with reinforced concrete caps designed by a professional engineer. Adits, portals, and other horizontal openings should be secured with waste rock plugs.

    Access to pits should be prevented by construction of berms across access routes and, if necessary, around the top.

    All openings to the mine should be closed to prevent access to the public. This should be done in consultation with Mine Inspection Services at the Workers Compensation Board, as well as other appropriate regulatory agencies.

14. Pits walls may require stabilization to prevent erosion. This should be reviewed on a case-by-case basis, considering whether the pit will eventually be flooded.

    Review stability of pits. Stabilize as required.

15. Flooding of some pits and connecting them to Baker Creek is proposed. This will require cleaning of debris and some earthworks.

    Clean debris from pits and connection areas. Connect pits to Baker Creek and allow to flood.

16. Ensure all hazardous materials are removed from redundant buildings prior to demolition. Explore the options for future use, salvage and/or demotion and landfilling of waste building materials as appropriate, for example, some buildings may be maintained as a museum. Deal with hazardous waste according to appropriate regulations. Secure access to all buildings that are no longer in use.

    Remove buildings, as they become redundant.

17. The underground workings contain small quantities of hazardous materials and wastes that will require proper handling and disposal once abandoned. Light ballasts and switch equipment will require further evaluation to determine the likelihood of PCB contamination. Fuel tanks, lubricating oils, compressed gases and other equipment will need to be brought to the surface and disposed of accordingly. This should be done before mine entrances become blocked with ice or portions of the underground are allowed to flood with groundwater

    A plan of action should be developed and employed to access and remove materials used underground.

8.3 Information gaps

The following information gaps, above and beyond those gaps addressed at the beginning of the report, have been identified as a result of this investigation as well as others:

- Tailings geochemical model;
- Long term stability of tailings containment dams;
- Beach tailings mercury and Baker Creek sediment mercury analyses;
- Soil and tailings vegetation and cover studies;
- Long term stability of Crown Pillars;
- Delineation of hydrocarbon contamination including PCB near transformer pads;
- Sample paint for lead and PCB contaminants;
- Delineation of point source contamination such as hazardous waste storage areas, chemical mixing areas, drainage pathways and sumps;
- Distribution and delineation of arsenic, and other inorganic components, impacted soils on the site;
- Identification of PCB-containing light ballasts on site.

9.0 Action Plans

The following action plans are intended to provide a course of action in addressing environmental concerns on the Giant Mine property. Some of these tasks can be completed while the mine is in operation others can only be implemented upon closure of the mine. Because of this requirement, the tasks have been divided into two action plans.

9.1 During mine operations

The following operations should be completed, if possible, in conjunction with the mine operator while the mine is still in operation. The co-operation of the mine operator in completing these tasks will be invaluable.

- Undertake tailings study to determine preferred tailings remediation plan;
- Secure unnecessary mine openings;
- Secure redundant buildings;
- Demolish buildings that are not in use and that will have no future purpose;
- Delineate surface hydrocarbon contamination and upgrade volume estimates;
- Separate flotation tails for use in remediation;
- Undertake additional interviews and research to determine the likelihood of buried drums of arsenic trioxide.
- If it still seems probable that they exist, undertake a risk assessment to determine if arsenic trioxide waste buried in tailings poses an unacceptable environmental risk;
- If the risk assessment determines that arsenic trioxide buried in tailings poses an unacceptable risk, locate and delineate hazardous materials which may be buried in tailings. Investigate use of ground penetrating radar, magnetic anomaly and and/or other equipment to locate buried waste;
- Stabilize and reclaim open pits no longer in use;
- Establish a wind erosion control regime in inactive tailings ponds;
- Move arsenic trioxide drums from NW pond hazardous waste area out of the weather to a secure building;
- Landfill Asbestos Containing Materials in accordance with territorial regulations;
- Analyze waste oil for suitability for use in the waste oil incinerators. Segregate unsuitable waste and dispose in accordance with applicable regulations. Incinerate suitable oil;
- Clean debris from Baker Creek and from pits which are no longer in use but will be incorporated in to Baker Creek;
- Work with heritage groups and the mine operator to establish historical value of infrastructure.

9.2 Upon mine closure

In addition to the above activities, these tasks should be completed upon mine closure.

- Secure all mine openings;
- Stabilize remaining pits. Where appropriate, make changes necessary for pits to be incorporated into Baker Creek;
- Implement tailings reclamation program;
- Salvage equipment and infrastructure where appropriate;
- Demolish redundant buildings and barricade entrances to others;
- Implement Baker Creek reclamation as outlined by Dillon;
- Remove all hazardous material and dispose according to applicable regulations;
- Landfill waste stored at NW Pond dump;
- Incinerate clean waste oil. Ship contaminated waste oil to a licensed facility for disposal.

10.0 Reclamation Cost Estimate

A preliminary reclamation cost estimate was prepared for the Giant Mine in accordance with the Terms of Reference using the RECLAIM 3.1 model developed for Indian and Northern Affairs Canada. It is expected that the cost estimate will evolve as more information becomes available.

The 1999 estimate was developed by Deton'Cho Corporation and reflect 1999 costs based on local knowledge, experience, and discussions with local contractors and suppliers where possible. In general, local rates tend to be closer to the high-end range provided in the RECLAIM program.

Where a rate could not be obtained due to specialties not locally available, best judgement was made to develop the rates for reclamation. This is the case for demolition and disposal of the buildings, electrical substations, and power lines. Revlyn Demolition and Recycling Ltd., based out of Edmonton, Alberta, was contacted in an attempt to estimate a rate that may reflect the conditions at Giant Mine. As expected, the contractor did not feel comfortable providing rates without having a better background of the mine and seeing the buildings that were to be demolished.

The rates that were used for this estimate were based on a Memorandum from Giant Yellowknife Mines Limited with the subject, *"Mine Closure - Salvage & Restoration"*, dated August 16, 1982. The memorandum provides a breakdown of cost estimates for surface salvage and rehabilitation at Giant. Equipment rates that were used in the 1982 estimate were transposed to reflect 1999 rates, and a pro-rated cost was established for these demolition items.

Item 4.0 under Rehabilitation Action Item - Tailings Impoundment - North, Central, and South Pond, shows a cost of $500,000 to create a landfill area. This landfill is to encapsulate contaminated building materials such as asbestos and lead paint. The estimate does not include the cost for decommissioning and removal of the large mill items such as the ball mill, roaster, and bag house.

Reclamation components such as disposal of Chemicals, Wastes and Contaminated Soils are largely unknown since an extensive investigation has not been made to determine the quantity of these items. These items either reflect the cleanup estimate presented by Brodie Consulting Ltd. as part of a report, *"Report on Giant Closure Cost Estimate"*, dated November 27, 1997, or make an estimate based on review of an aerial photograph of the mine site.

The cost of decontamination and disposal of 11 large stationary fuel tanks was estimated based on probable equipment time and manpower and their respective rates. Disposal of fuel drums was based upon removing them from site and shipping to a disposal facility in Edmonton, Alberta.

An established quantity of cover soil had not been established at the time of preparing this estimate. The soil cover is assumed to be locally available based on geotechnical information previously collected at the mine and potential sites identified on aerial photographs. The suitability of this material will have to be determined if a local source of sufficient quantity can be identified through future testing.

The total capital cost assumes that all work will be carried out concurrently and is presented in 1999 Canadian dollars. It does not include the cost for monitoring and maintenance (such as operating the water treatment facility) since it is unknown how many years will be required for these items. The cost reflects current levels of technology and does not account for new technology or inflationary measures beyond the year 1999. The estimate assumes that there will not be an appreciable salvage value for any materials or equipment.

The following tables provide an estimate for the reclamation and cleanup of all surface components of Royal Oak's Giant Mine. It has been largely developed from items that were addressed in Royal Oak's Giant Mine, Abandonment and Restoration (A&R) Plan, dated December 1998. Components in the tables follow the structure of the RECLAIM Version 3.1 reclamation cost estimating model software developed for DIAND by Brodie Consulting Ltd.

The annual monitoring and maintenance cost has been estimated. The present value of this annual cost over a 20 year period has been calculated (the sum needed at present to meet the annual costs over 20 years) at a 5% discount rate.

REHABILITATION ACTION ITEM: Open Pits

Activity	Units	Quantity	Unit Cost	Cost
1.0 CONTROL ACCESS				
Signage	each	8	$150.00	$1 200
Create Berm	m3	38000	$7.55	$286 900
Block Roads	m3	1140	$4.00	$4 560
2.0 FLOOD PIT				
Ditch, material	m3	1500	$12.00	$18 000
3.0 BACKFILL A2 EXTENSION				
Fill material	m3	NA	NA	$0
3.1 BACKFILL BROCK/B4 PIT				
Fill material	m3	6500	$6.00	$39 000
Subtotal				$349 660

REHABILITATION ACTION ITEM: Quarries and Borrow Areas

1.0 COVER/CONTOUR SLOPES				
Grade slopes/block entrances	m3	300	$5.00	$1 500
Vegetate	ha	2.95	$1 100.00	$3 245
Subtotal				$4 745

REHABILITATION ACTION ITEM: Underground Mine

1.0 CONTROL ACCESS				
Signage	each	23	$150.00	$3 450
Cap Shaft (A, B, C)	m3	36	$1 200.00	$43 200
Cap 11 Raises	m3	100	$1 200.00	$120 000
Cap 6 Raises	m3	NA	NA	$0
Cap Akaitcho Shaft	m3	NA	NA	$0
Backfill 5 Portals	m3	467	$7.55	$3 526
Cement 6 Portals	m3	76	$350.00	$26 600
Backfill Brock Adit	m3	17	$7.55	$128
Cement Brock Adit	m3	5	$350.00	$1 750

REHABILITATION ACTION ITEM: Underground Mine

Activity	Units	Quantity	Unit Cost	Cost
1.0 CONTROL ACCESS (Cont.)				
Block B3 Portal	m3	NA	NA	$0
Backfill Brock Shaft	m3	NA	NA	$0
Backfill B3 Raise	m3	NA	NA	$0
Backfill DWC Open Stope	m3	4500	$5.00	$22 500
2.0 STABILIZE GROUND				
Contour DWC Open Stope	m3	550	$2.50	$1 375
3.0 FLOOD MINE				
Plug Adits	each	NA	NA	$0
4.0 REMOVE HAZARDOUS MAT'L	est	1	$15 000.00	$15 000
Subtotal				$237 529

REHABILITATION ACTION ITEM: Tailings Impoundment - North, Central, South Pond

1.0 STABILIZE EMBANKMENT				
Dams 3 and 11	m3	14000	$7.55	$105 700
2.0 CONTOUR TAILINGS				
Grade Tailings, South Pond	m3	8000	$0.75	$6 000
Grade Tailings, Central Pond	m3	10000	$0.75	$7 500
Grade Tailings, North Pond	m3	20000	$0.75	$15 000
Place Soil Cover	m3	510000	$7.55	$3 850 500
Place Rock	m3	510000	$7.55	$3 850 500
Vegetate	ha	NA	NA	$0
3.0 DRAINAGE CHANNEL				
Excavate Channel	m3	10500	$6.54	$68 670
Rip Rap (unscreened mine waste)	m3	3500	$7.55	$26 425
4.0 CREATE LANDFILL AREA				
Excavation/cover	m3	30000	$10.00	$300 000
Liner	m3	20000	$10.00	$200 000

REHABILITATION ACTION ITEM: Tailings Impoundment - North, Central, South Pond

Activity	Units	Quantity	Unit Cost	Cost
5.0 STABILIZE DECANT SYSTEM				
Plug/backfill	m3	83	$350.00	$29 050
6.0 REMOVE TAILINGS LINE				
Pipe	m3	2800	$1.00	$2 800
Subtotal				$8 462 145

REHABILITATION ACTION ITEM: Tailings Impoundment - Northwest Tailings

1.0 CONTOUR TAILINGS				
Grade Tailings	m3	31000	$0.75	$23 250
Vegetate	ha	46	$3 300.00	$151 800
2.0 SEEPAGE COLLECTION				
Dam	m3	1800	$7.67	$13 806
Ditches	m3	600	$6.54	$3 924
Pumphouses	each	2	$10 000.00	$20 000
3.0 DRAINAGE CHANNEL				
Excavate Channel	m3	7200	$6.54	$47 088
Rip Rap (unscreened mine waste)	m3	2400	$7.55	$18 120
4.0 STOP LOG SPILLWAY				
Drill/blast	m3	200	$12.00	$2 400
Concrete	m3	120	$1 000.00	$120 000
5.0 REMOVE TAILINGS LINE				
Pipe	m3	1200	$1.00	$1 200
Subtotal				$401 588

REHABILITATION ACTION ITEM: Tailings Impoundment - Historic Tailings Yellowknife Bay

Activity	Units	Quantity	Unit Cost	Cost
1.0 TEMPORARY ACCESS				
Road from mine waste rock	m3	175	$7.55	$1 321
2.0 STABILIZE EMBANKMENT				
Flatten slope	m3	270	$7.50	$2 025
3.0 COVER TAILINGS				
Rip Rap (screened mine waste)	m3	4700	$18.00	$84 600
Geotextile	m2	6100	$3.00	$18 300
Subtotal				$106 246

REHABILITATION ACTION ITEM: Buildings and Equipment

1.0 DISPOSE MOBILE EQUIP.				
Decontaminate & dispose	each	140	$1 000.00	$140 000
2.0 DECONTAMINATE BLDGS				
Asbestos	m2	1	$400 000.00	$400 000
Sampling leach test lead paint	est	1	$10 000.00	$10 000
Fixed equip (non arsenic)	est	1	$20 000.00	$20 000
3.0 REMOVE BUILDINGS				
MILL BLDGS				
Buildings, steel	m2	2040	$35.00	$71 400
Buildings, wood	m2	6240	$17.25	$107 640
Buildings, concrete	m2	307	$15.00	$4 605
ROASTER				
Buildings, steel	m2	762	$35.00	$26 670
Buildings, wood	m2	9096	$17.25	$156 906
Buildings, concrete	m2	480	$15.00	$7 200
A SHAFT				
Buildings, steel	m2	558	$35.00	$19 530
Buildings, wood	m2	2017	$17.25	$34 793
Buildings, concrete	m2	102	$15.00	$1 530

REHABILITATION ACTION ITEM: Buildings and Equipment

Activity	Units	Quantity	Unit Cost	Cost
3.0 REMOVE BUILDINGS (Cont.)				
B SHAFT				
Buildings, steel	m2	49	$35.00	$1 715
Buildings, wood	m2	16	$17.25	$276
Buildings, concrete	m2	30	$15.00	$450
AKAITCHO				
Buildings, steel	m2	558	$35.00	$19 530
Buildings, wood	m2	1222	$17.25	$21 080
Buildings, concrete	m2	60	$15.00	$900
EFFLUENT TREATMENT PLANT				
Buildings, steel	m2	678	$35.00	$23 730
Buildings, concrete	m2	394	$15.00	$5 910
TAILINGS TREATMENT PLANT				
Buildings, steel	m2	1487	$35.00	$52 045
Buildings, concrete	m2	1227	$25.00	$30 675
POWER LINES				
Akaitcho	m	5304	$5.20	$27 581
B3 to Tailings Plant	m	5395	$6.12	$33 017
Residential Area	m	2560	$7.55	$19 328
C" Area	m	3048	$6.02	$18 349
"A" Shaft Area	m	5120	$4.40	$22 528
ELECTRICAL SUBSTATIONS				
"B" Shaft Area	each	1	$7 896.00	$7 896
"A" Shaft Area	each	1	$22 564.00	$22 564
Residential Area	each	1	$9 270.00	$9 270
Main Electrical Substation	each	1	$18 117.00	$18 117
"A" SHAFT TANK FARM				
Remove/dispose	each	1	$14 629.00	$14 629
"A" BOILER PLANT				
Remove/dispose	each	1	$20 462.00	$20 462
REC HALL, CURLING RINK				
Remove/dispose	each	1	$15 344.00	$15 344
TOWNSITE				
Buildings, wood	m2	2750	$17.25	$47 438
Hazardous materials	m2	1	$10 000.00	$10 000

REHABILITATION ACTION ITEM: Buildings and Equipment

Activity	Units	Quantity	Unit Cost	Cost
4.0 GRADE AND CONTOUR				
Grade Mill Area	ha	13.5	$3 750.00	$50 625
Place Soil Cover	m3	13000	$7.55	$98 150
Vegetate	ha	15	$1 100.00	$16 500
Grade B1 Pit	m3	10625	$7.55	$80 219
5.0 RECLAIM ROADS				
Scarify and install water breaks	ha	17	$3 750.00	$63 750
Vegetate	ha	17	$1 100.00	$18 700
Berms for access control	m3	1700	$5.00	$8 500
6.0 TOWNSITE				
Confirmatory sampling	each	1	$50 000.00	$50 000
Subtotal				$1 829 551

REHABILITATION ACTION ITEM: Chemicals and Contaminated soils

1.0 LABORATORY CHEMICALS				
Unopened	pallets	80	$2 000.00	$160 000
Opened	est	1	$2 000.00	$2 000
2.0 FUEL TANKS				
Decontaminate (large tanks)	each	11	$500.00	$5 500
Dispose (large tanks)	each	11	$8 205.00	$90 255
Dispose (drums to be shipped to Edmonton)	each	3512	$15.00	$52 680
Sludges	kg	135000	$0.15	$20 250
3.0 GENERAL REFUSE				
Debris at NW Tailings	m3	7190	$3.40	$24 446
Debris at mill site	m3	7000	$3.40	$23 800
As2O3 pallets at NW Tailings	barrels	1000	$20.00	$20 000
4.0 CONTAMINATED SOILS				
Gas/diesel	m3	10000	$50.00	$500 000
Arsenic	m3	40500	$7.55	$305 775
Subtotal				$1 204 706

REHABILITATION ACTION ITEM: Water Management - Effluent Treatment Plant, Settling and Polishing Pond

Activity	Units	Quantity	Unit Cost	Cost
1.0 COLLECTION DITCHES				
Excavate Channel	m3	1200	$6.54	$7 848
Rip Rap (unscreened mine waste)	m3	800	$5.00	$4 000
2.0 COVER SLUDGE				
Geosynthetic	m2	34000	$20.00	$680 000
Rockfill cover	m3	50000	$7.55	$377 500
3.0 CONSTRUCT SPILLWAY				
Excavation	m3	1750	$7.55	$13 213
Concrete	m3	120	$1 000.00	$120 000
4.0 REMOVE PIPELINES				
Fill decant with concrete	m3	62	$350.00	$21 700
Subtotal				$1 224 261

REHABILITATION ACTION ITEM: Baker Creek

1.0 CONSTRUCT CHANNELS				
Excavate Channel	m3	10170	$12.00	$122 040
Vegetate	ha	0.15	$50 000.00	$7 500
2.0 STABILIZE EX. CHANNELS				
Regrade slopes	m3	1440	$6.54	$9 418
Vegetate	ha	0.2	$50 000.00	$10 000
3.0 REMOVE CULVERTS				
Remove/dispose culverts	each	4	$500.00	$2 000
Subtotal				$150 958

REHABILITATION ACTION ITEM: Contractor Mobilization/Demobilization

1.0 MOBILIZE HEAVY EQUIP.				
Demolition Contractor	lump	1	$20 000.00	$20 000
Hazardous materials contractor	each	1	$10 000.00	$10 000
Asbestos Contractor	each	1	$20 000.00	$20 000
Subtotal				$50 000

REHABILITATION ACTION ITEM: Monitoring and Maintenance

Activity	Units	Quantity	Unit Cost	Cost
1.0 INSPECTIONS				
Visual Inspections	each	10	$3 000.00	$30 000
Water Sampling	each	20	$4 500.00	$90 000
Reporting	each	1	$4 000.00	$4 000
2.0 MAINTENANCE				
Security	month	1	$5 000.00	$5 000
Seepage Pumping	month	12	$1 000.00	$12 000
3.0 WATER TREATMENT				
Operate treatment plant	m3	156900	$1.04	$163 176
Subtotal				$304 176

Monitoring and Maintenance estimated to be 20 years

$3 790 702

Component Name	99 Total Cost
Open Pits	$349 660
Borrow Areas	$4 745
Underground Mine	$237 529
Old Tailings System	$8 462 145
Northwest Tailings System	$401 588
Historic Tailings	$106 246
Buildings and Equipment	$1 829 551
Chemicals and Contaminated Soils	$1 204 706
Water Management - Effluent Treatment Plant	$1 224 261
Baker Creek	$150 958
Mobilization/demobilization	$50 000
Subtotal	**$14 021 389**
PROJECT MANAGEMENT	$420 642
ENGINEERING	$420 642
CONTINGENCY	$1 402 139
TOTAL CAPITAL COST	**$16 264 811**
Monitoring and maintenance for 20 years (not included in total capital cost)	**$3 790 702**

Notes:

1. Total capital cost is in 1999 Canadian dollars and does not include monitoring and maintenance. It is unknown how many years will be required for monitoring and maintenance.

2. The total capital cost reflects current levels of technology and does not account for new technology of inflationary measures beyond the year 1999.

3. Present value of annual monitoring and maintenance cost of $304,176 over 20 years, 5% discount rate.

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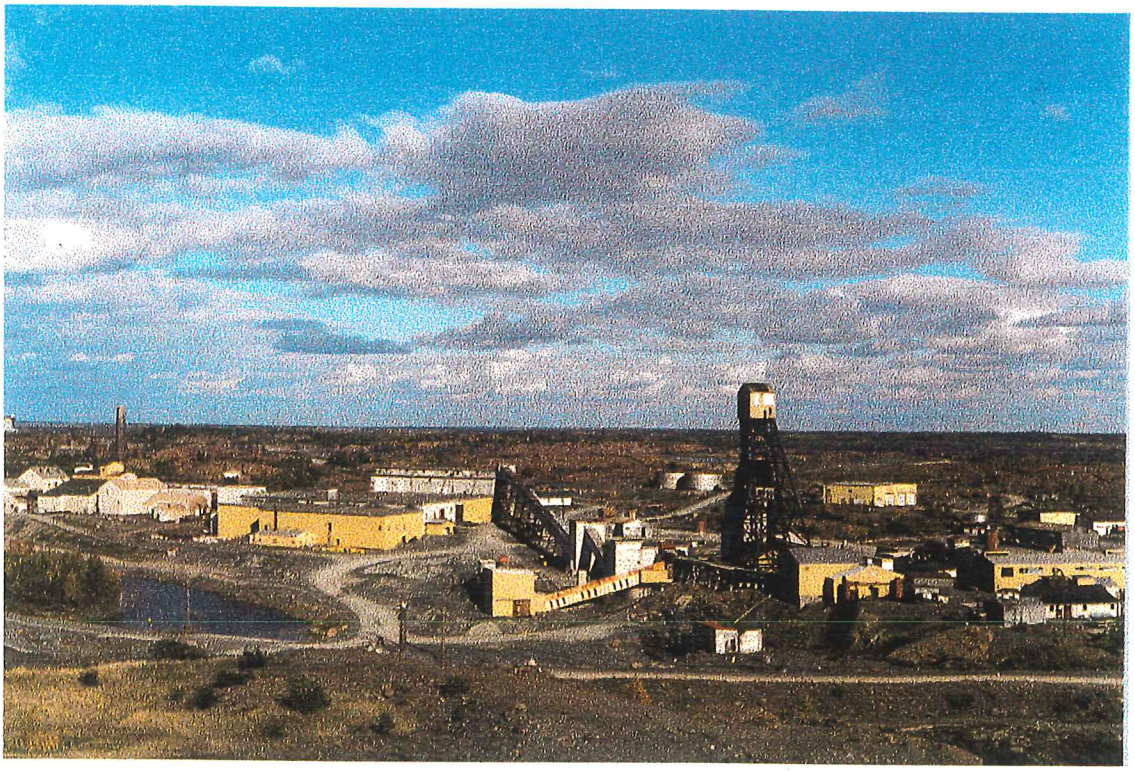


Plate 1: View of Giant Mine from the west.

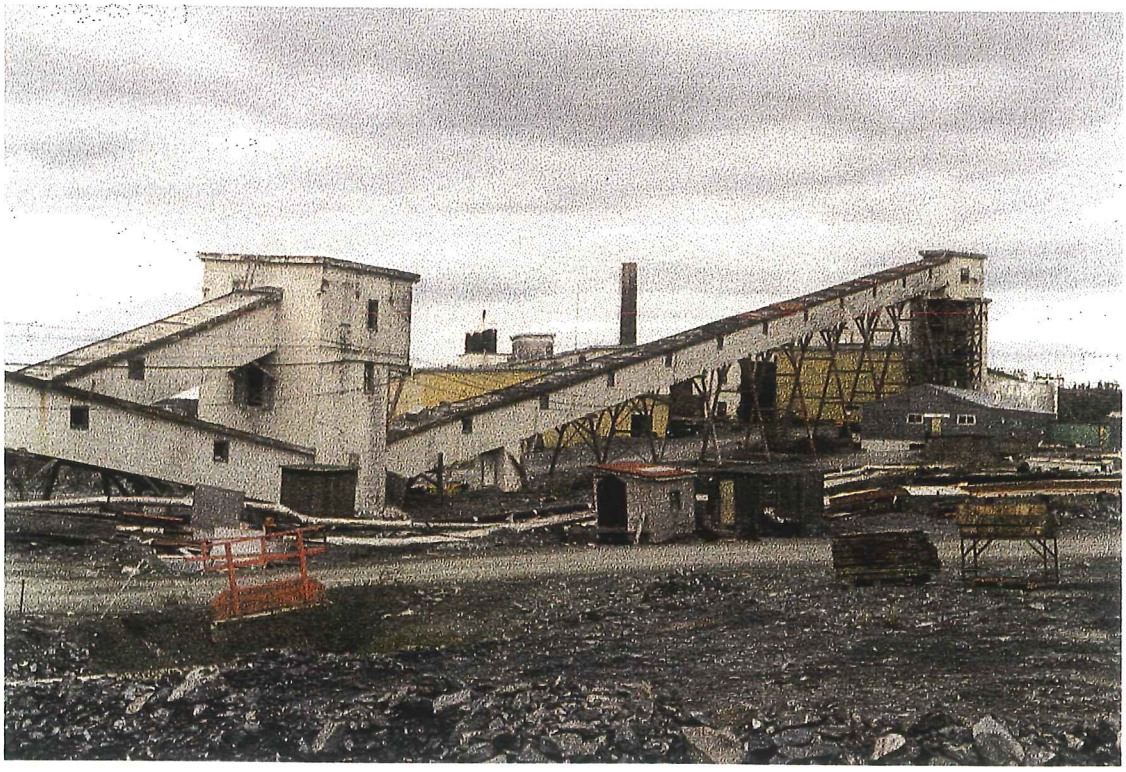


Plate 2: Conveyer gallery from crusher to mill. Note asbestos sheathing



Plate 3: Mill building. Lime storage silo in right background, reagent storage quonset in right foreground.

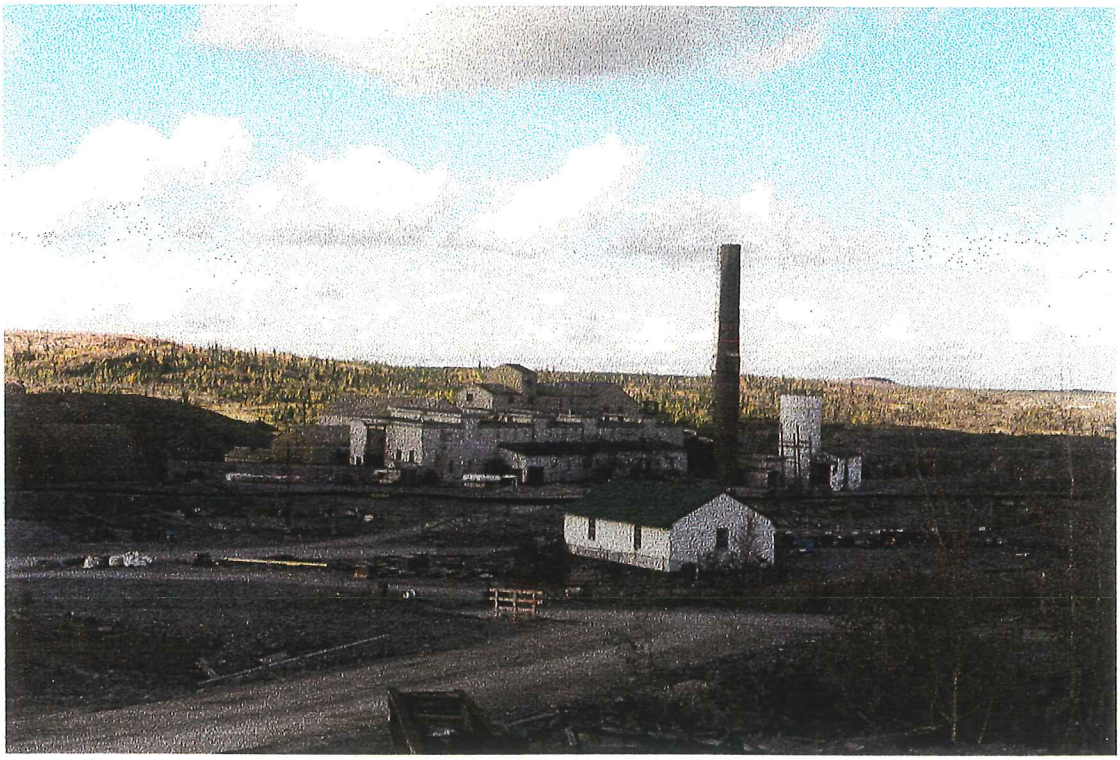


Plate 4: Roaster, Kiln, bag house. Roaster stack right of roaster, arsenic loadout facility and storage silo. Lumber yard in foreground.



Plate 5: A-shaft headframe. Note asbestos sheathing.



Plate 6: Akaitcho hoist building and headframe.



Plate 7: Floatation Tailings in C1 Pit



Plate 8: B1 Pit solid waste disposal



Plate 9: Partially buried drums at the Central TCA disposal area. Tailings Retreatment Plant in background



Plate 10: North TCA. Note trenches and gullies caused by excavation for the TRP.



Plate 11: Central TCA looking north.

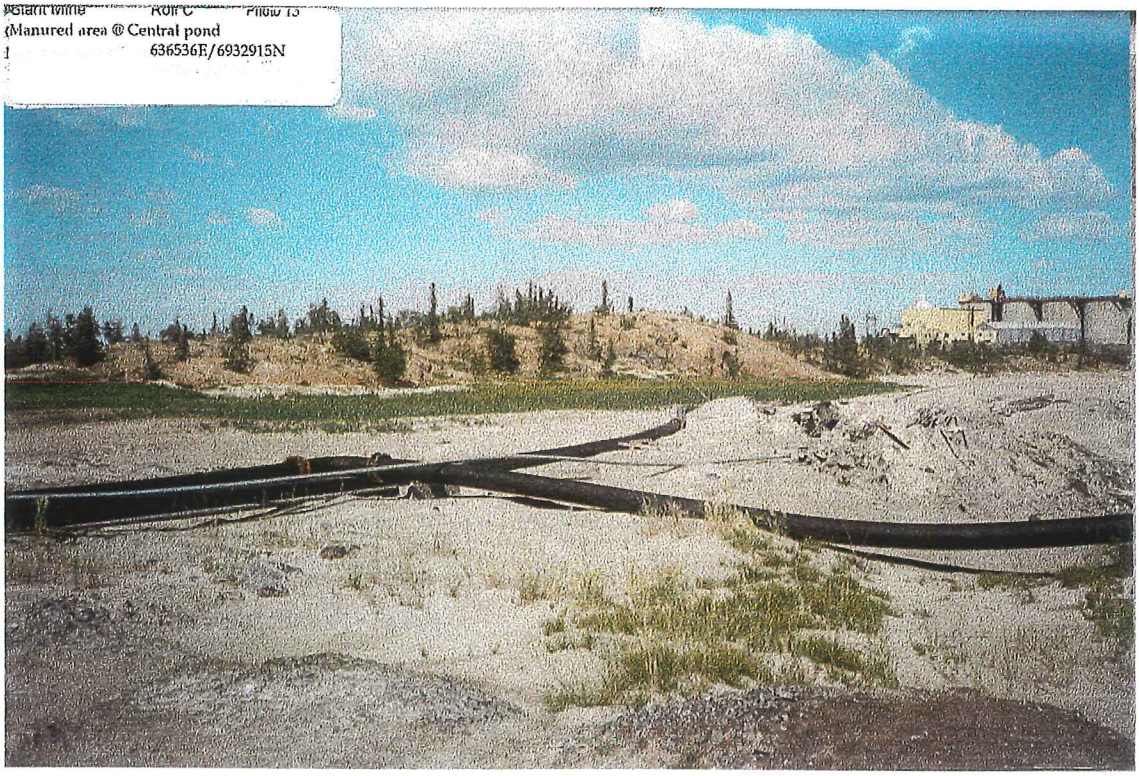


Plate 12: Manure reclamation test plot at Central TCA. (Lush vegetation at base of rock outcrop)



Plate 13: Beach tailings

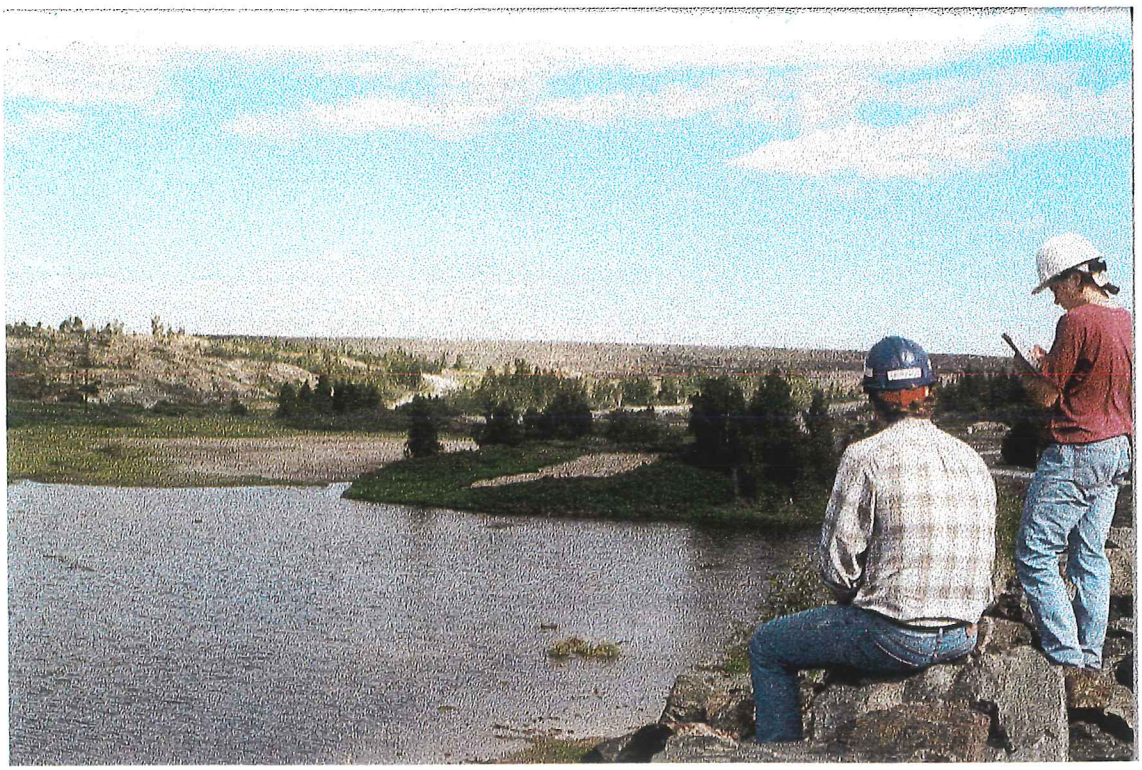


Plate 14: Tailings and Trapper Creek sediment deposit at Baker Pond.

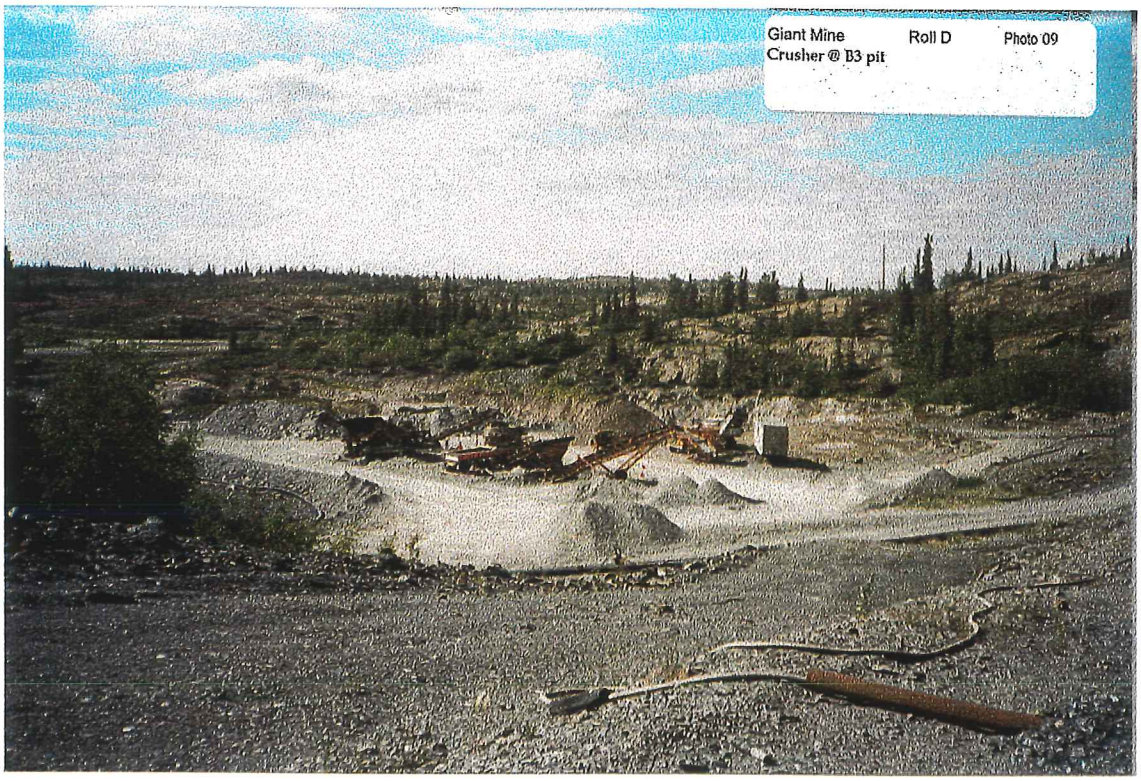


Plate 15: Crusher at B3 Pit and waste rock stock piles

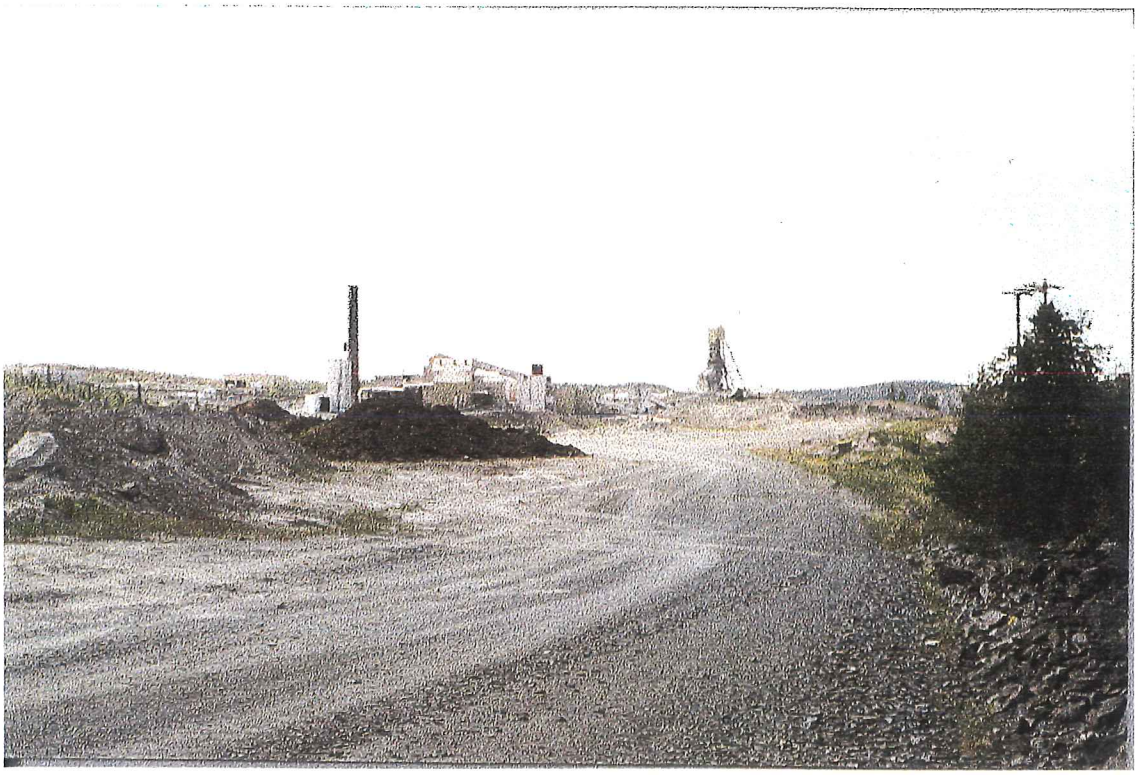


Plate 16: Peat and crush rock stockpiles. Roaster, mill and C-shaft headframe in the background.



Plate 17: Calcine storage area covered with manure. Note revegetation.



Plate 18: Hydrocarbon stain and B-Shaft ventilation



Plate 19: Hydrocarbon stain down from C-hoistroom.

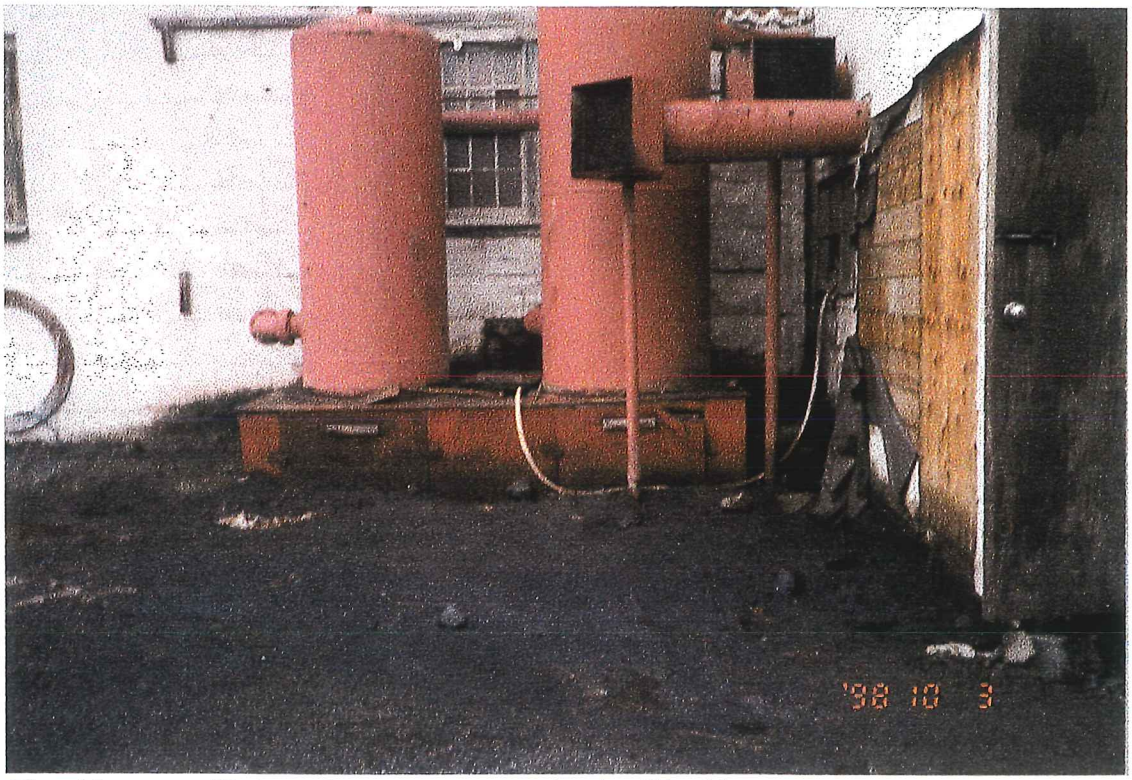


Plate 20: Hydrocarbon stain on east side of Mill building.



Plate 21: Mine site bolted metal tanks containing Bunker C and Bunker C sludge. Note stain down rocks.



Plate 22: Oil stain under transformer next to Mill.

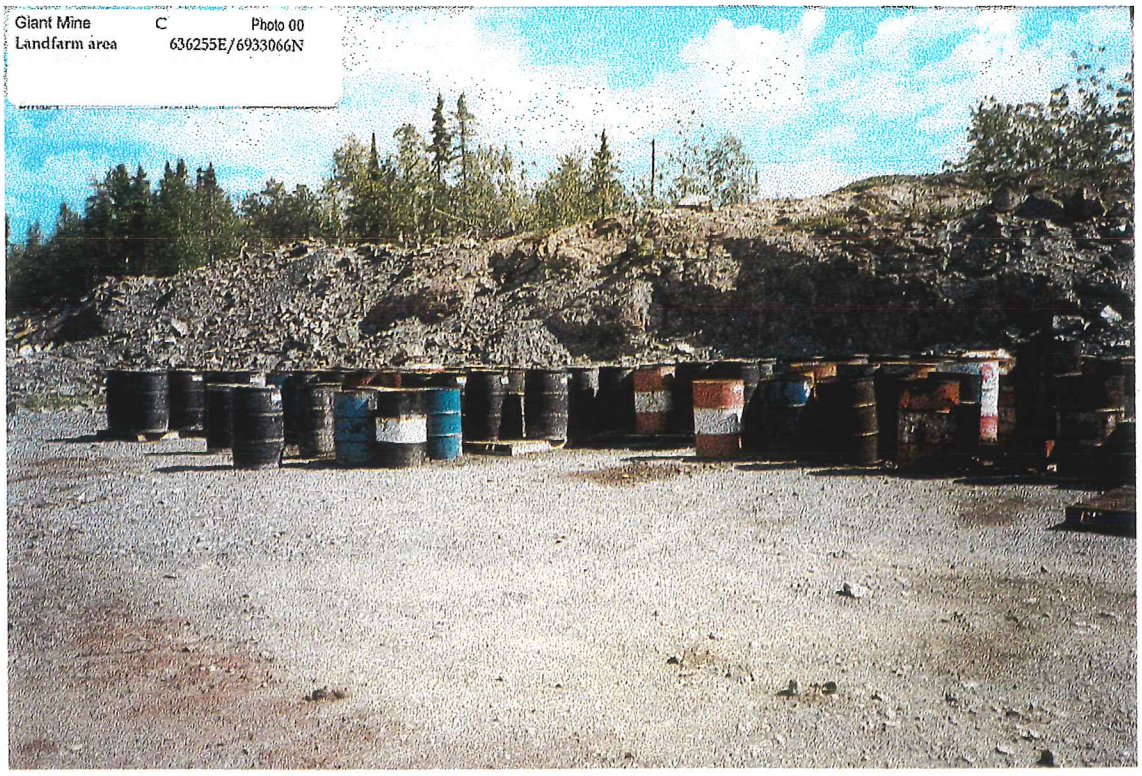


Plate 23: Waste oil storage near B2 pit.



Plate 24: Petroleum product in unlined clay containment area next to C-boiler.



Plate 25: Waste Oil storage and stained soil outside of MEG.



Plate 26: Waste oil storage tanks adjacent to MEG.

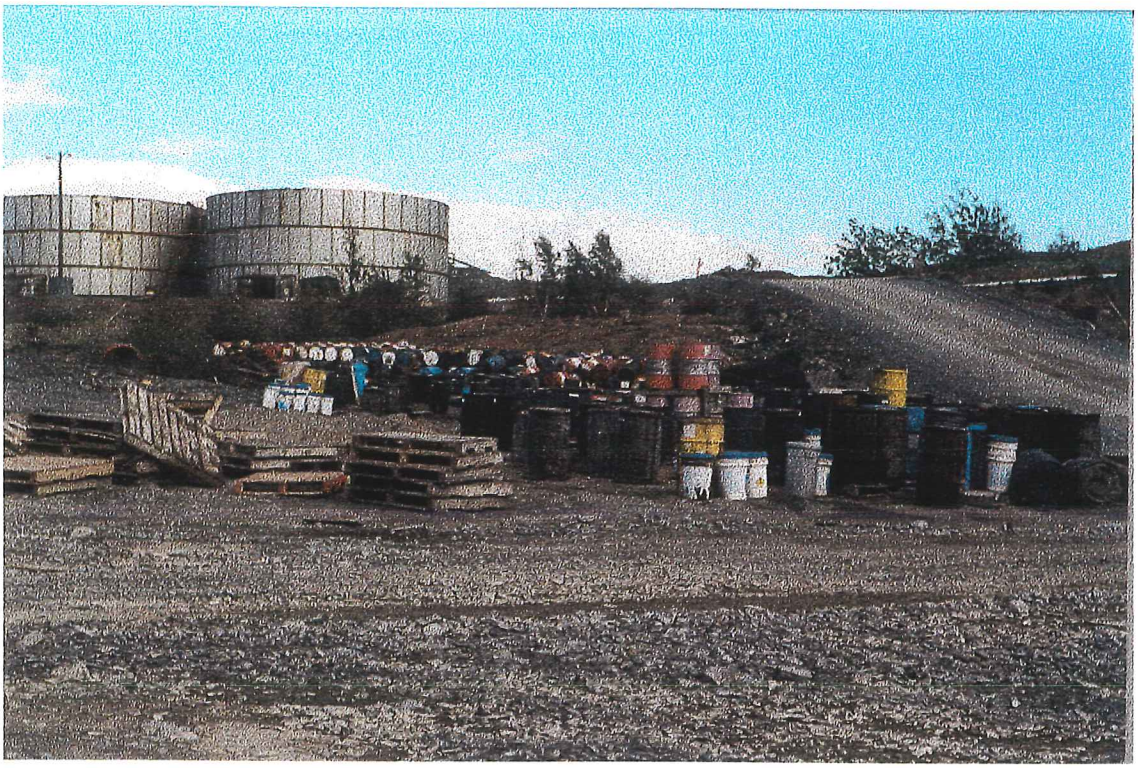


Plate 27: Waste oil and drum storage adjacent to lumber yard.



Plate 28: Waste Oil storage and stained oil south side of C-Dry valve room.

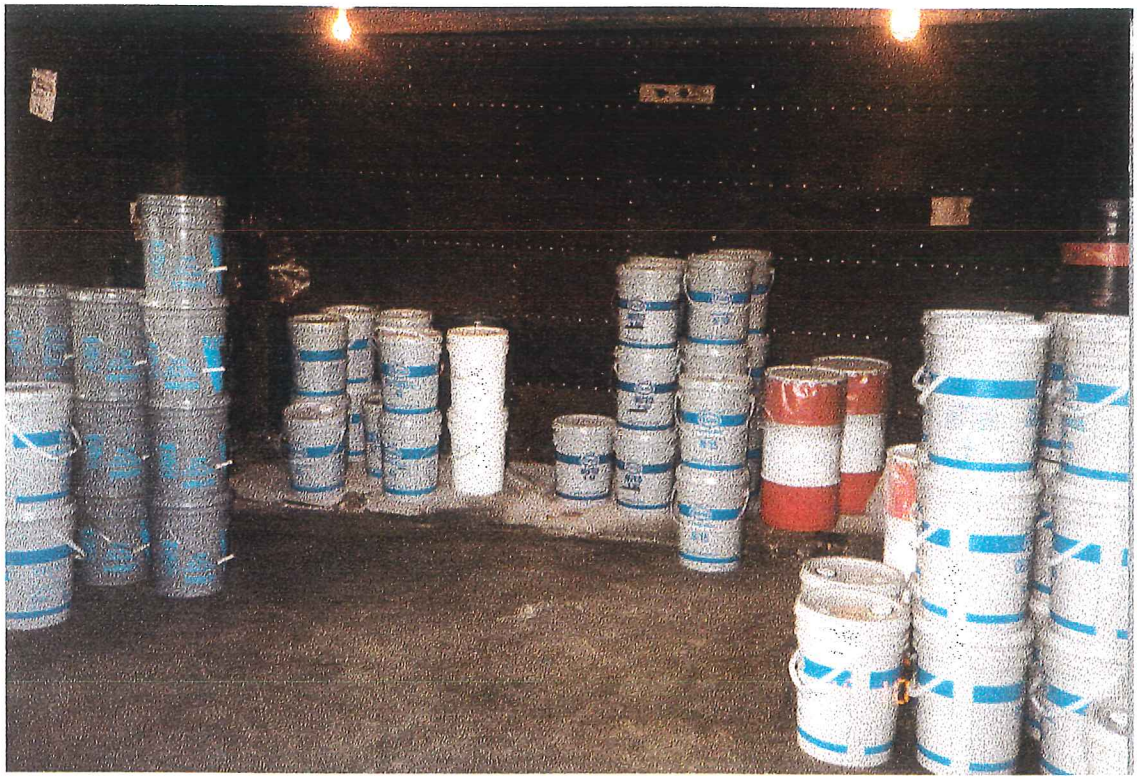


Plate 29: Oil storage shed



Plate 30: Water treatment chemicals in mine water treatment plant next to Mill.



Plate 31: Hydrogen peroxide tanks and white lime silo in background at the effluent treatment plant.



Plate 32: Angus Expandol™ fire retardant stored in the Planer building.



Plate 33: Stored chemicals at the lumberyard.



Plate 34: Stored chemicals in Reagent shed. Note spills on dirt floor.



Plate 35: Cyanide mixing area inside Mill



Plate 36: Inside Mill laboratory.



Plate 37: Precipitators in the Cottrell building. Note asbestos insulation on back wall.

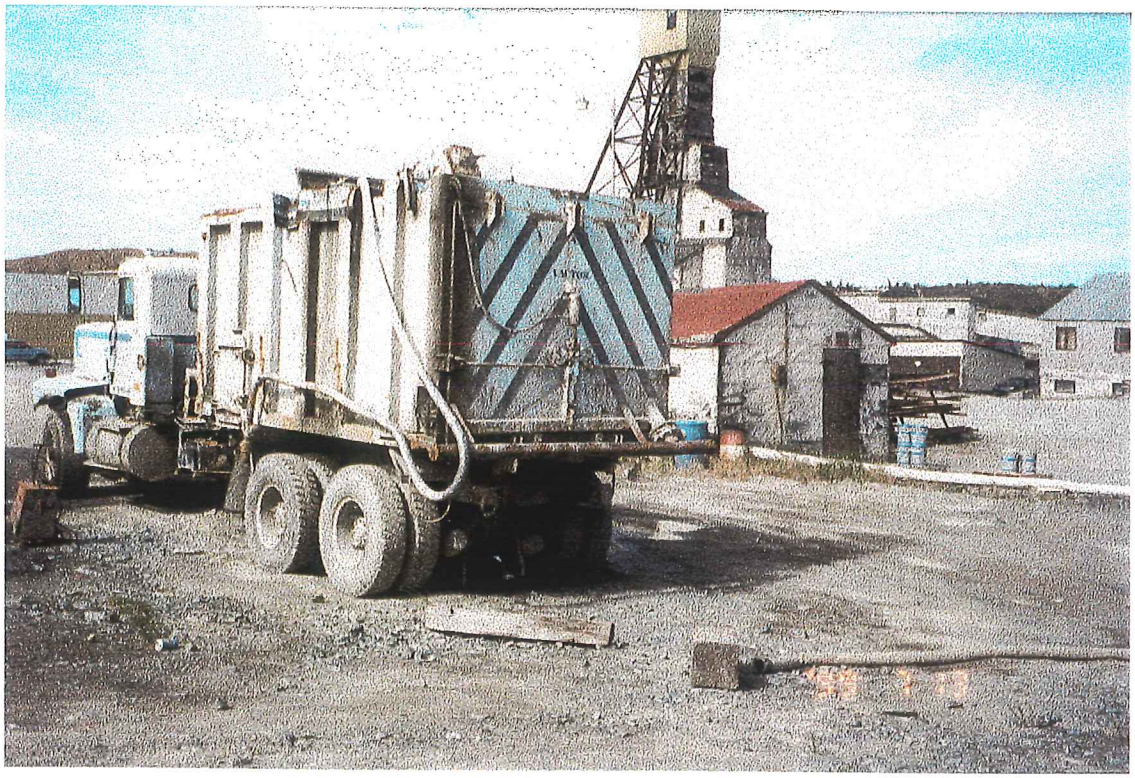


Plate 38: Vacuum truck used for cleaning arsenic and other spill. Vacuum is no longer in service.



Plate 39: Valve used for truck access to arsenic storage vault.



Plate 40: Waste batteries at the bone yard near South TCA.



Plate 41: Discarded transformers in Bone yard on the road to A-shaft.



Plate 42: Waste asbestos in bone yard to A-shaft.



Plate 43: Example of asbestos wall board in electrical room

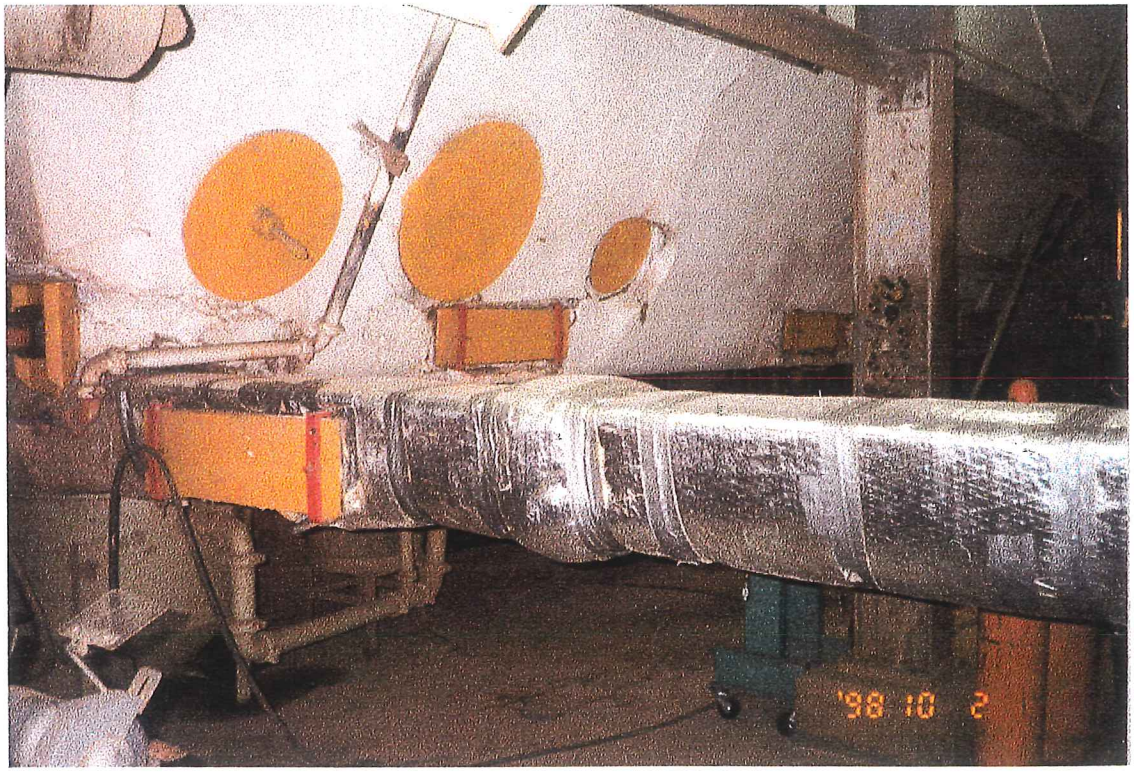


Plate 44: Asbestos insulated bag compartment in bag house.



Plate 45: Asbestos on inside of boiler door at C-boiler.



Plate 46: One of many scrap metal piles near the B3 Pit.



Plate 47: Panoramic view of waste oil from Colomac. Stored near TRP.



Plate 48: Panoramic view of landfill at Northwest TCA



Plate 49: Hazardous waste disposal area north side of Northwest TCA

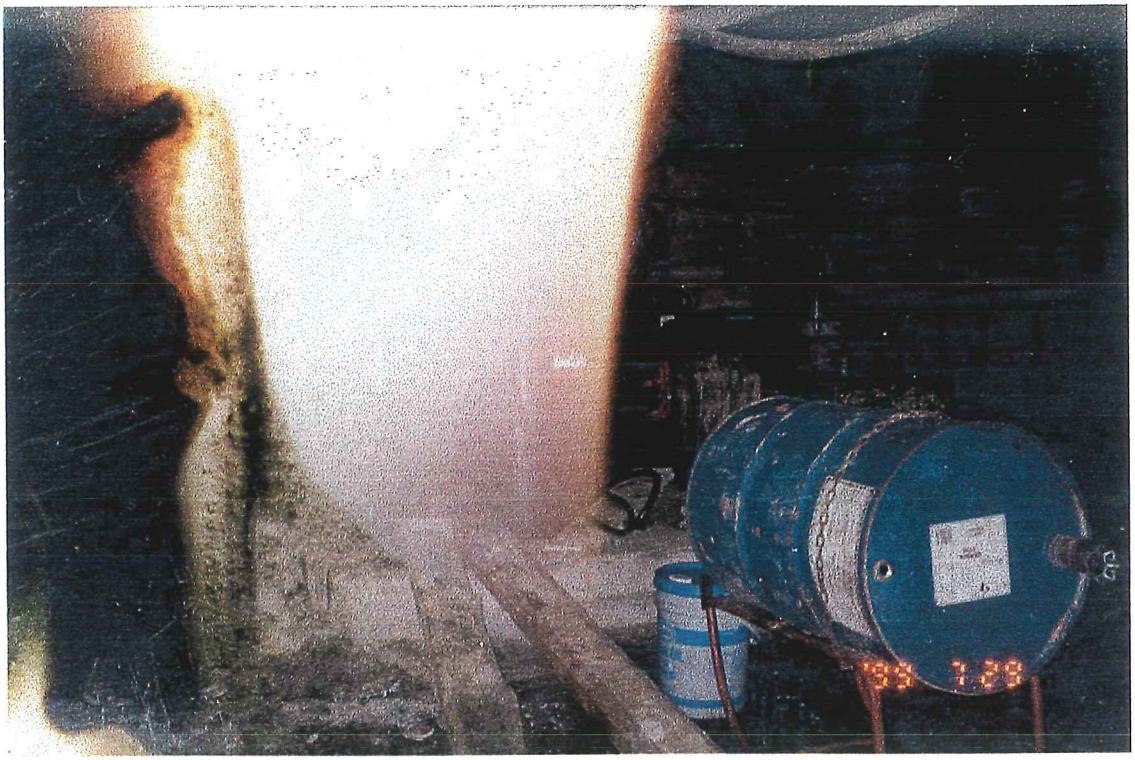


Plate 50: Lube oil near storage area near 7-12 scoop tram shop



Plate 51: Lube oil storage area near 7-12 scoop tram shop



Plate 52: 7-12 scoop tram shop – 24 fluorescent lights

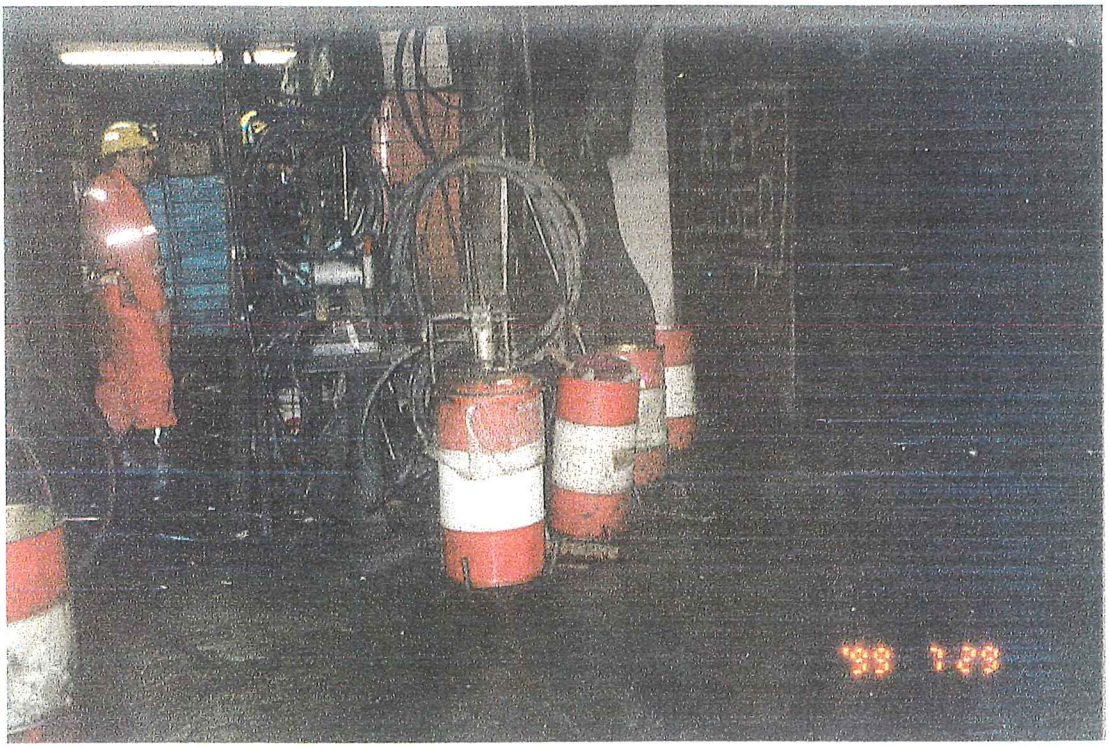


Plate 53: 7-12 scoop tram shop



Plate 54: 7-12 scoop tram shop

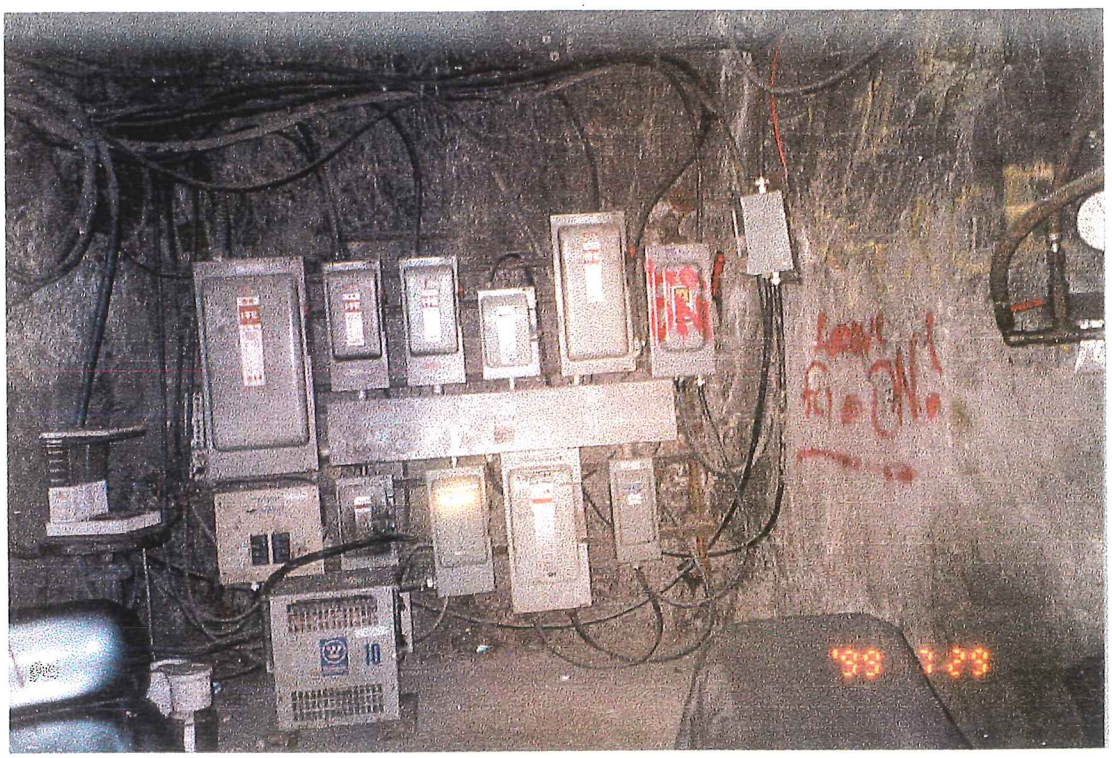


Plate 55: 7-12 scoop tram shop



Plate 56: 7-12 scoop tram shop

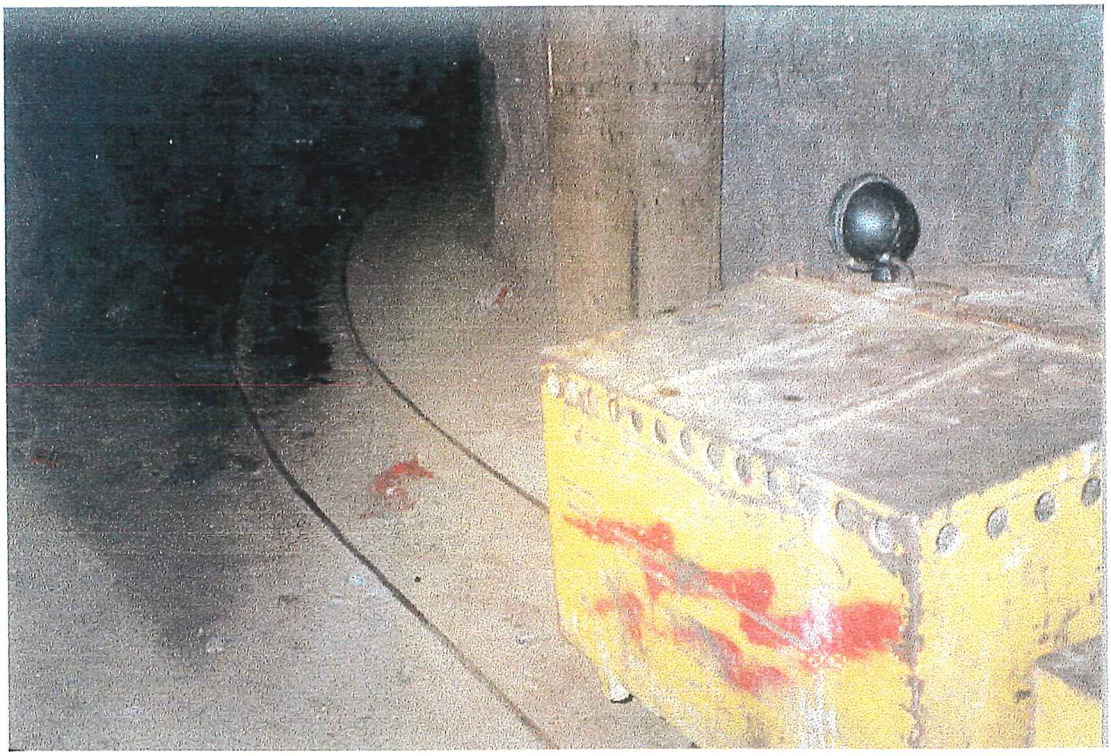


Plate 57: Outside door of 7-12 scoop tram shop



Plate 58: 7-12 scoop tram shop – spilled oil in oil storage area – floating on water

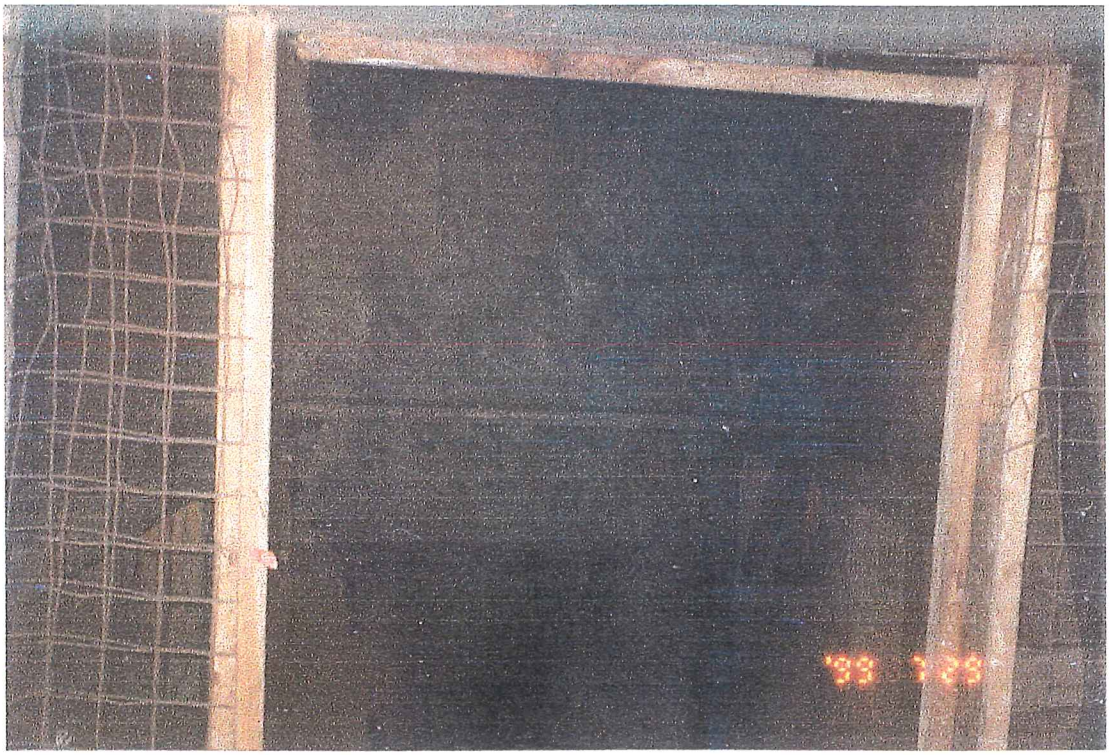


Plate 59: Empty powder mag. – B-3 Ramp to 575

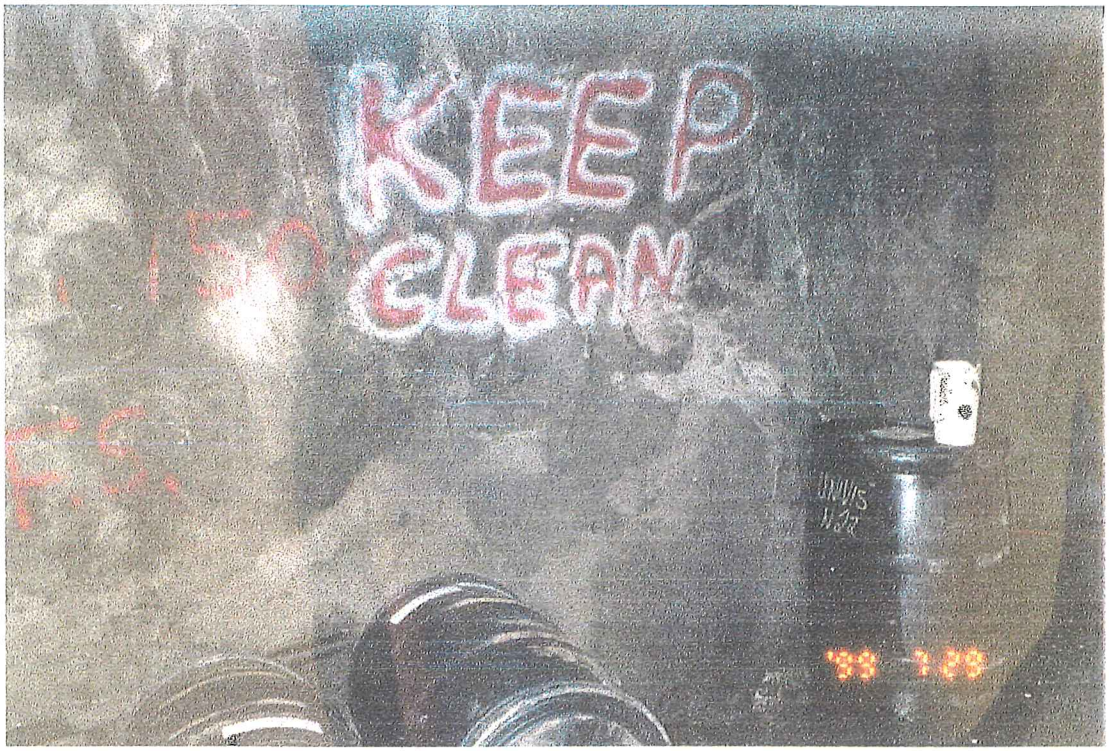


Plate 60: 575 Lube oil storage



Plate 61: 575 Lube oil storage



Plate 62: 575 Sump



Plate 63: 575 Scoop tram shop parking



Plate 64: Rear 575 scoop tram shop – parking area



Plate 65: 575 scoop tram – acetylene and nitrogen



Plate 66: 575 scoop tram shop



Plate 67: 575 scoop tram shop

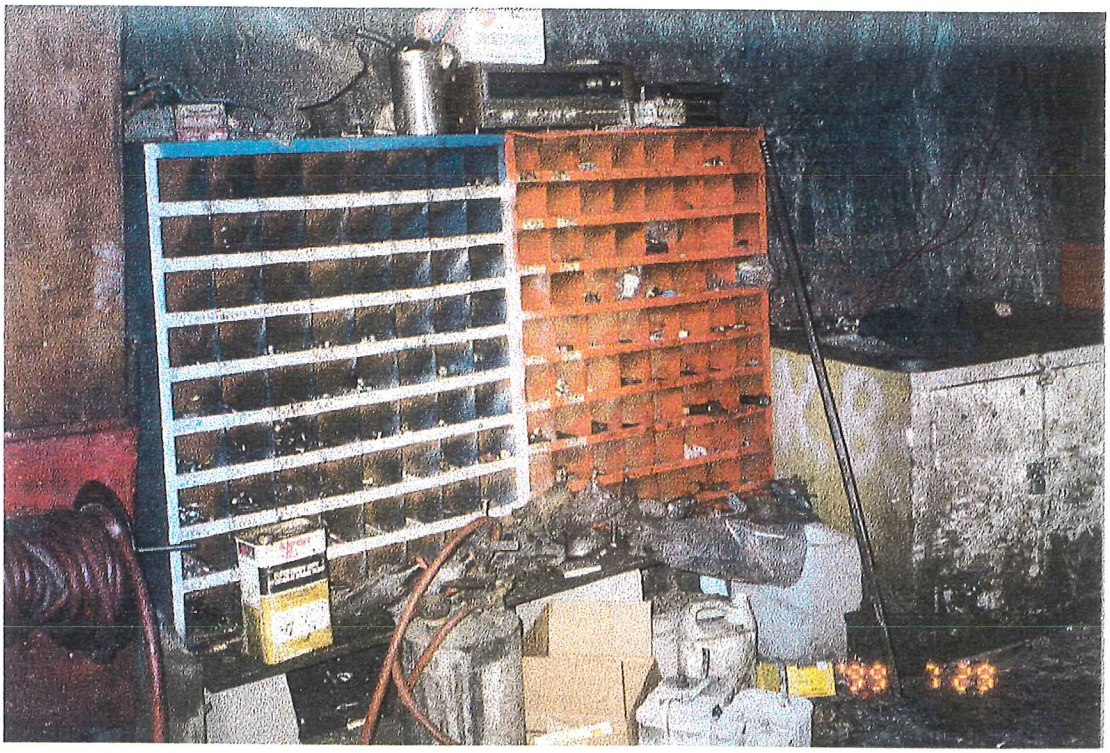


Plate 68: 575 scoop tram shop



Plate 69: 575 scoop tram shop

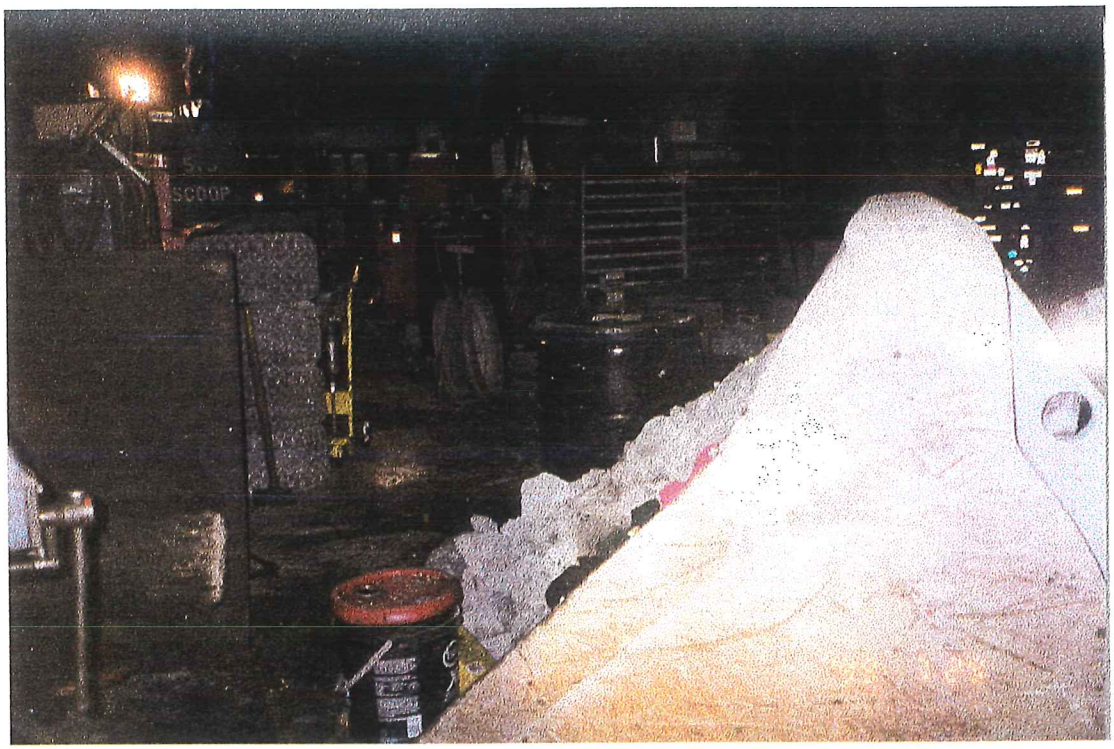


Plate 70: 575 scoop tram shop



Plate 71: 575 scoop tram shop



Plate 72: 575 scoop tram shop



Plate 73: 575 scoop tram shop

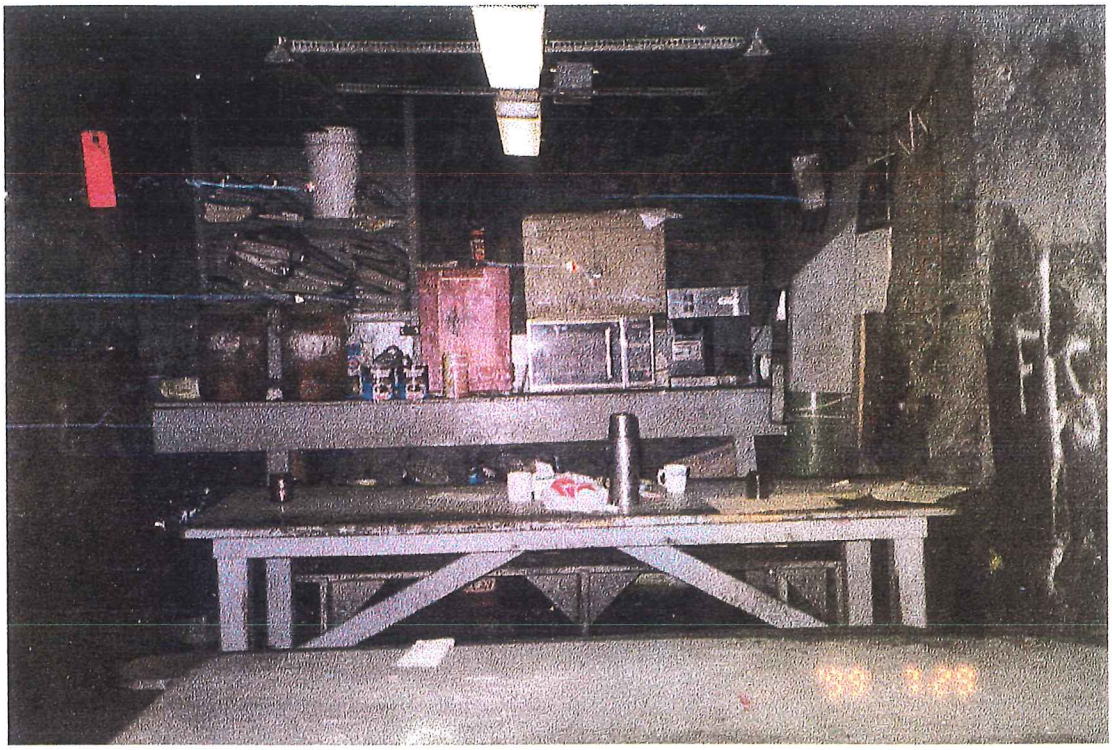


Plate 74: Lunch Room – 575 scoop tram shop



Plate 75: Representative explosives mag. in particular a Caps Mag. near 7-12 scoop tram shop



Plate 76: 7-12 substation switch panel



Plate 77: Example of dry transformer typical of sub stations located at 7-12 near scoop tram shop.

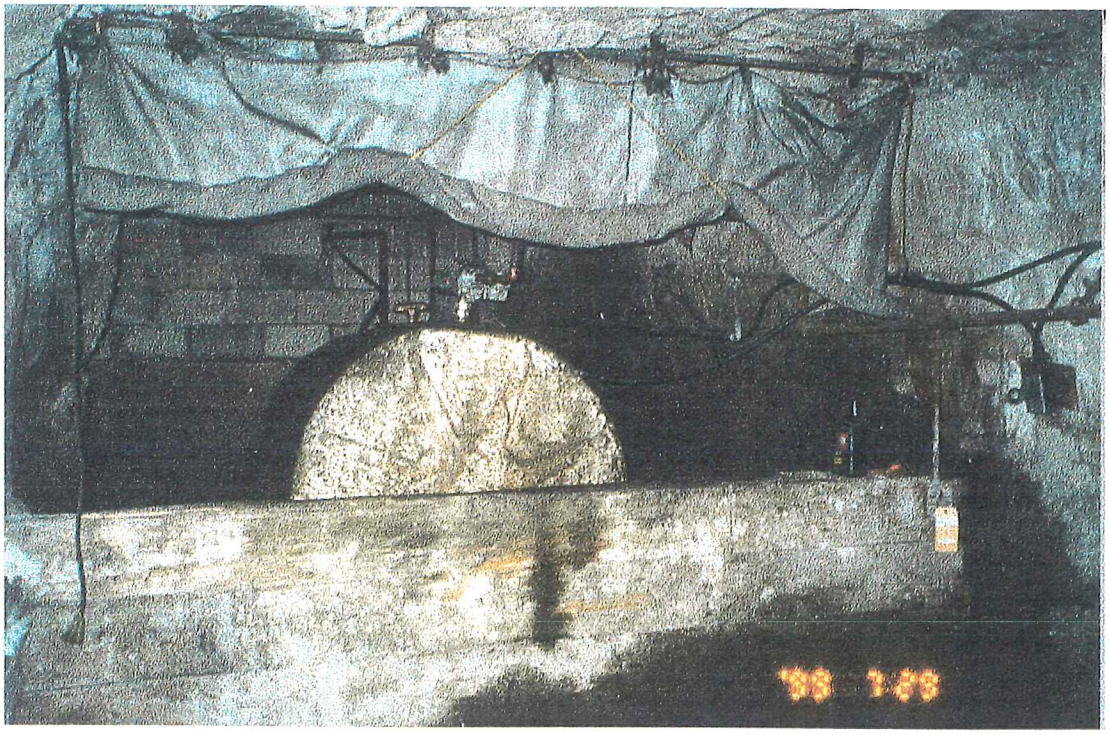
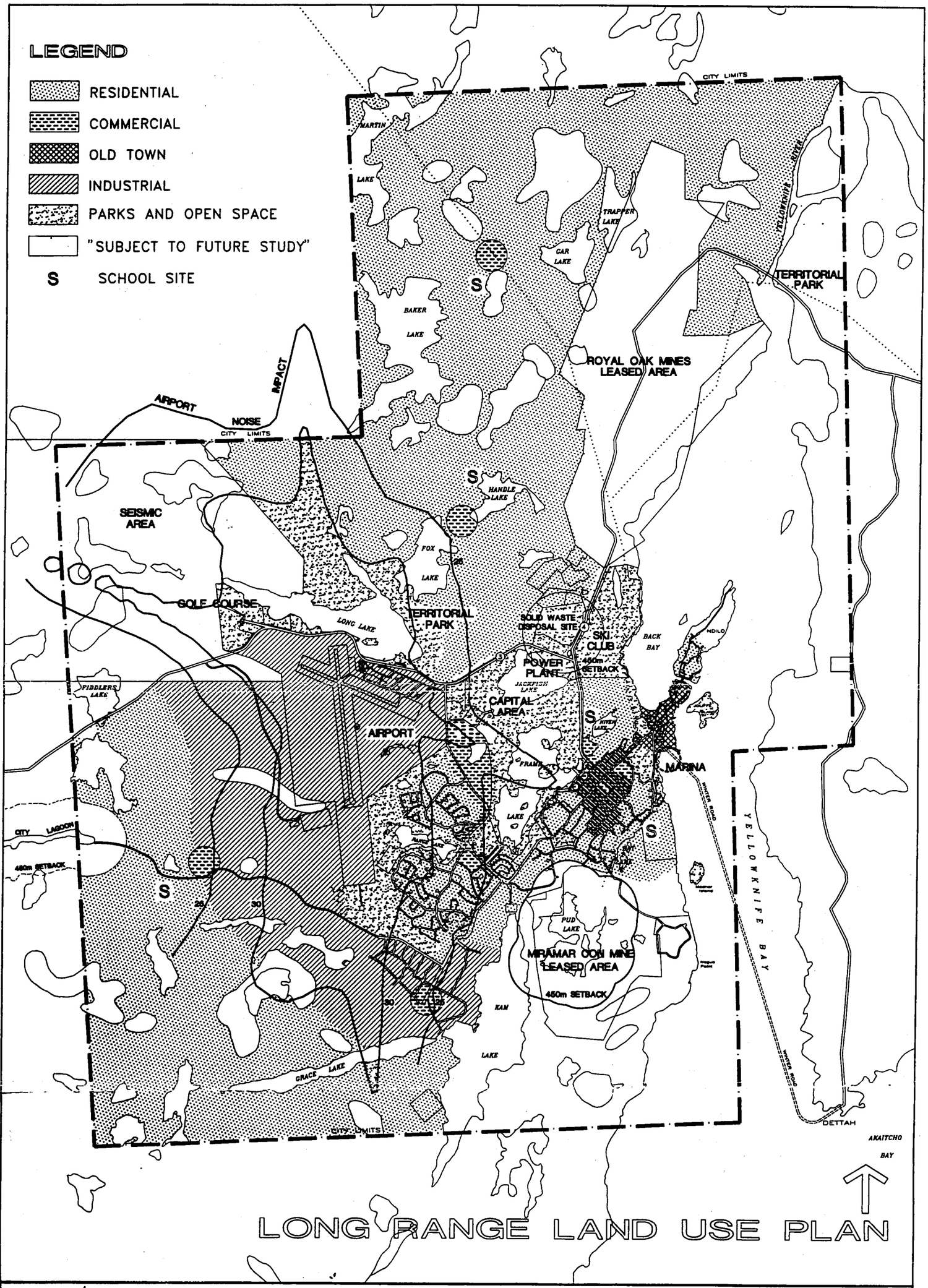


Plate 78: Representative fuel tank diesel 4500L located at 7-12 near scoop tram shop



CITY OF YELLOWKNIFE GENERAL PLAN 1996

KARL STEVENS AND ASSOCIATES LTD.
Urban Design and Planning
TERRIPLAN CONSULTANTS
Landscape Architecture
REID CROWTHER & PARTNERS LTD.
Municipal Engineering
RETHINK GROUP
Community Services
R.G.P TRANSTEC INC.
Traffic Engineering

1

JANUARY 1996

NORTHWEST TERRITORIES WATER BOARD

Pursuant to the *Northwest Territories Waters Act* and Regulations the Northwest Territories Water Board, hereinafter referred to as the Board, hereby grants to

ROYAL OAK MINES INC.
(Licensee)

of 2nd Floor - 1425 WEST PENDER STREET
VANCOUVER, BRITISH COLUMBIA V8G 2S3
(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use water subject to the restrictions and conditions contained in the *Northwest Territories Waters Act* and Regulations made thereunder and subject to and in accordance with the conditions specified in this Licence.

Licence Number	N1L2-0043 (RENEWAL)
Licence Type	"A"
Water Management Area	NORTHWEST TERRITORIES 01
Location	Latitude 62°30' N Longitude 114°21' W GIANT MINESITE, YELLOWKNIFE, NORTHWEST TERRITORIES
Purpose	WATER USE AND WASTE DISPOSAL FOR INDUSTRIAL UNDERTAKINGS
Description	GOLD MINING AND MILLING PRODUCTION AND ASSOCIATED USES
Quantity of Water Not to be Exceeded	SEE PART C, ITEM 2
Effective Date of Licence	JUNE 30, 1998
Expiry Date of Licence	JUNE 29, 2003

This Licence issued and recorded at Yellowknife includes and is subject to the annexed conditions.

NORTHWEST TERRITORIES WATER BOARD

Witness

Vice-Chair

PART A: SCOPE AND DEFINITIONS

1. Scope

a) This Licence entitles Royal Oak Mines Inc. to use water and dispose of waste for industrial undertakings in gold mining and milling production and associated uses at Royal Oak Mines Inc. - Giant Mine located at 62°30'N Latitude and 114°21'W Longitude, Northwest Territories.

b) This Licence is issued subject to the conditions contained herein with respect to the taking of water and the depositing of waste of any type in any waters or in any place under any conditions where such waste or any other waste that results from the deposits of such waste may enter any waters. Whenever new Regulations are made or existing Regulations are amended by the Governor in Council under the *Northwest Territories Waters Act*, or other statutes imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited this Licence shall be deemed, upon promulgation of such Regulations, to be automatically amended to conform with such Regulations.

c) Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable Federal, Territorial, and Municipal legislation.

2. Definitions

In this Licence: **N1L2-0043**

"Act" means the *Northwest Territories Waters Act*;

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

"Average Concentration" means the running average of any four consecutive analytical results submitted to the Board in accordance with the sampling and analysis requirements specified in the "Surveillance Network Program";

"Board" means the Northwest Territories Water Board established under Section 10 of the *Northwest Territories Waters Act*;

"Effluent Treatment Facility" means the Effluent Treatment Plant and includes the Settling and Polishing Ponds as described in Drawing Titled "Effluent Treatment Facilities", dated May 25, 1998;

"**Freeboard**" means the vertical distance between the water line and the effective water containment crest on a dam or dyke's upstream slope;

"**Geotechnical Engineer**" means a professional engineer registered with the Association of Professional Engineers, Geologists, and Geophysicists of the Northwest Territories and whose principal field of specialization is the design and construction of earthworks in a permafrost environment;

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

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

"**Minewater**" means groundwater, any seepage from tailings ponds or any water used in mining which is pumped or flows out of any underground workings or open pit;

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

"**Progressive Reclamation**" means those activities conducted during the operating period of the mine to modify and reclaim the land and water to acceptable standards at the time.

"**Regulations**" mean Regulations proclaimed pursuant to Section 33 of the *Northwest Territories Waters Act;*

"**Sewage**" means all toilet wastes and greywater;

"**Tailings Containment Areas**" include the tailings containment basin and the engineered structures designed to contain solid and liquid waste fractions as described in Drawing Titled "Tailings Containment Areas" dated May 26, 1998. The ponds designated for tailings deposition are the North, Central, South and Northwest Ponds;

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

"**Waste Rock**" means all rock materials, except ore, which are produced as a result of mining operations.

PART B: GENERAL CONDITIONS

1. The water use fee shall be paid annually in advance.

2. Pursuant to Section 17(1) of the *Act* and Section 12 of the Regulations, the Licensee shall have posted and shall maintain a security deposit according to the following schedule:

   a) upon issuance of this Licence, a security deposit in the amount of $400,000;

   b) on the first and second anniversary of this Licence, an additional amount of $1,300,000;

   c) on each of the subsequent two anniversaries thereafter, an additional amount of $2,000,000 throughout the term of the Licence; and

   d) such further or other amounts as may be required by the Board based on annual estimates of current mine reclamation liability in accordance with Part B, Item 5 p) of this Licence.

3. The security deposit shall be maintained until such time as it is fully or in part refunded by the Minister pursuant to Section 17 of the *Act*. This clause shall survive the expiry of this Licence or renewals thereof and until full and final restoration has been completed to the satisfaction of the Minister.

4. A Reclamation Trust Fund may be established during the term of this Licence. The Licensee shall implement the terms of the Trust Agreement as approved by the Board.

5. The Licensee shall file an Annual Report no later than March 31 of the year following the calendar year reported which shall contain the following information:

   a) the monthly and annual quantity in cubic metres of water obtained from Great Slave Lake for use in the mining and milling process;

   b) the monthly and annual quantity in cubic metres of water obtained from the City of Yellowknife and Great Slave Lake for domestic use;

   c) the monthly and annual quantity in cubic metres of Minewater pumped from the mine;

   d) the monthly and annual quantity in cubic metres of waste discharged from the Effluent Treatment Facility;

   e) tabular summaries of all data generated under the "Surveillance Network Program" in both, an electronic and printed format acceptable to the Board;

   f) a detailed record of all major maintenance work carried out on the water distribution and effluent treatment systems and all associated structures;

g) a detailed report on methods being used or planned to recycle and reduce water use, so that the total quantity of waste can be reduced;

h) a detailed description of progressive reclamation activities and associated costs carried out on the site during the period being reported, any related studies that have been completed or are ongoing, and an outline of any anticipated work for the next year;

i) a list of all unauthorized discharges or spills;

j) the monthly and annual quantity in cubic metres of Minewater recycled;

k) approved revisions to the Spill Contingency Plan and the Abandonment and Restoration Plan;

l) results from the acid-base accounting analysis on the mill tailings solids and waste rock as described in Part D, Item 2 of the Surveillance Network Program;

m) details of any activity or maintenance to control till erosion on Trapper Creek;

n) any updates to the evaluation referred in Part D, Item 5;

o) a detailed report on measures taken during the year to contain and prevent windblown tailings, and what measures will be taken in the upcoming year;

p) an updated estimate of the current mine reclamation liability based upon the results of the mine reclamation research, the mine development monitoring, any modifications to the mine plan, utilizing the Reclaim version 3.1 mine reclamation cost estimate model, or equivalent; and

q) any other details on water use or waste disposal as requested by the Board by November 1st of the previous year.

6. The Licensee shall comply with the "Surveillance Network Program" annexed to this Licence, and any amendment to the said "Surveillance Network Program" as may be made from time to time, pursuant to the conditions of this Licence.

7. The "Surveillance Network Program" and compliance dates specified in the Licence may be modified at the discretion of the Board.

8. Meters, devices or other such methods used for measuring the volumes of water used and waste discharged shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.

5. The Licensee shall, by February 1, 1999, submit to the Board for approval, a Tailings Management Plan complete with a schedule for the placement of tailings, an assessment of the remaining capacity of the Tailings Containment Areas, an assessment of the nature and quality of seepage from the Tailings Containment Areas, methods to contain and eliminate seepage, quality of pore water contained within the tailings solids, stability of dams and alternative methods of containment upon abandonment.

6. The Licensee shall consult with an Inspector and the Department of Fisheries and Oceans ten (10) days prior to any proposed discharge of waste from the Effluent Treatment Facility and receive approval, from the Inspector, to discharge water.

7. The Licensee shall advise an Inspector three (3) days prior to cessation of the discharge each year.

8. All wastes decanted from the Effluent Treatment Facility shall be discharged to Baker Creek, according to Drawing Titled "Effluent Treatment Facilities" dated May 25, 1998, or as otherwise approved by the Board.

9. All waste discharged shall meet the following effluent quality requirements:

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
Total Ammonia	15.0 mg/L	
Total Arsenic	0.50 mg/L	1.00 mg/L
Total Copper	0.30 mg/L	0.60 mg/L
Total Cyanide	0.80 mg/L	1.60 mg/L
Total Lead	0.20 mg/L	0.40 mg/L
Total Nickel	0.50 mg/L	1.00 mg/L
Oil and Grease		5.0 mg/L
Total Suspended Solids	15.0 mg/L	30.0 mg/L
Total Zinc	0.20 mg/L	0.40 mg/L

The waste discharged shall have a pH between 6.0 and 9.5.

10. Effective April 1, 2000, the effluent quality requirement for Total Ammonia shall be reduced to:

12.0 mg/L

PART E: CONDITIONS APPLYING TO MODIFICATIONS

1. The Licensee may without written consent from the Board, carry out modifications to the water supply and waste disposal facilities provided that such modifications are consistent with the terms of this Licence and the following requirements are met:

   a) the Licensee has notified the Board in writing of such proposed modifications at least forty-five (45) days prior to beginning the modifications;

   b) such modifications do not place the Licensee in contravention of either the Licence or the *Act*;

   c) the Board has not, during the forty-five (45) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than forty-five (45) days; and

   d) the Board has not rejected the proposed modifications.

2. Modifications for which all of the conditions referred to in Part E, Item 1, have not been met, can be carried out only with written consent from the Board.

3. The Licensee shall provide as-built plans and drawings of the modifications referred to in this Licence within ninety (90) days of completion of the modifications. These plans and drawings shall be submitted to the Board on material that will reproduce with the use of a standard printer/copier.

PART F: CONDITIONS APPLYING TO CONTINGENCY PLANNING

1. The Licensee shall update the existing approved Contingency Plan dated September 28, 1994 in accordance with the Northwest Territories Water Board's "Guidelines for Contingency Planning, January 1987" and submit it to the Board for approval by August 1, 1998.

2. The Licensee shall revise the Contingency Plan referred to in Part F, Item 1, if not acceptable to the Board. The revised Plan shall be submitted to the Board for approval within ninety (90) days after notification.

3. The Licensee shall annually review the Contingency Plan and modify the Plan to reflect changes in operation, technology and personnel. Any proposed modifications shall be submitted to the Board for approval.

4. The Licensee shall employ the appropriate Contingency Plan in Part F, Item 1 and notify an Inspector within 24 hours of any exceedance or any anticipation of exceedance of the requirements in Part D, Item 9.

5. If, during the period of this Licence, an unauthorized discharge occurs, or if such a discharge is foreseeable, the Licensee shall:

   a) employ the appropriate Contingency Plan;

   b) report the incident immediately via the 24-Hour Spill Report Line (867) 920-8130; and

   c) submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event. The report should include changes in operations, modifications, or improvements to prevent repeat occurrences.

PART G: CONDITIONS APPLYING TO ARSENIC TRIOXIDE MANAGEMENT

1. The Licensee shall submit to the Board for approval by October 1, 1999 an Arsenic Trioxide Management Project Description suitable for environmental assessment for the permanent management and disposal of arsenic trioxide material generated and stored on site. This project description shall include, but not be limited to the following:

   a) a detailed description of the proposed methods for the disposition of arsenic trioxide waste stored in underground vaults and on the surface;

   b) the rationale for choosing the preferred method;

   c) a risk assessment for the preferred method;

   d) a detailed description of the contingencies proposed should the preferred method fail;

   e) an implementation schedule to complete the recovery and processing facility and the associated costs;

   f) a detailed description of the management methods for the residual arsenic trioxide material and any waste byproducts; and

   g) a detailed monitoring plan.

2. The Licensee shall submit to the Board for approval, a detailed progress report beginning October 1, 1998 and quarterly thereafter, describing activities undertaken, progress made during reporting period towards meeting the project description referred to in Part G, Item 1.

3. The Licensee shall implement the plan referred to in Part G, Item 1, as and when approved by the Board.

4. The Licensee shall incorporate the findings and recommendations of the approved plan referred to in Part G, Item 1, into the Abandonment and Restoration Plan.

PART H: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

1. The Licensee shall submit to the Board for approval by November 1, 1998 a final Abandonment and Restoration Plan in accordance with the Northwest Territories Water Board's "Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories, September 1990" and incorporating progressive reclamation. The Abandonment and Restoration Plan shall include, but not be limited to the following:

   a) areas scheduled for progressive reclamation;

   b) open pits;

   c) rehabilitation of Baker Creek;

   d) underground mine;

   e) quarries and till borrow pits;

   f) waste dumps;

   g) tailings impoundments;

   h) mill and surface facilities;

   i) town site;

   j) roads;

   k) water management system;

l) wastes, chemicals, contaminated soil;

m) arsenic trioxide vaults;

n) restoration measures to be undertaken at inactive tailings deposition areas; and

o) maintenance of Trapper Creek watershed to prevent erosion.

2. The Licensee shall revise the Abandonment and Restoration Plan referred to in Part H, Item 1, if not acceptable by the Board. The revised Plan shall be submitted to the Board for approval within ninety (90) days after notification.

3. The Licensee shall incorporate the findings and recommendations of the following reports into the Abandonment and Restoration plan as and when approved by the Board:

a) Arsenic Trioxide Management, dated March 31, 1998;

b) Evaluation of Surface Contamination Data, dated March 1998; and

c) Tailings Cover Study, dated April 1998.

4. The Licensee shall carry out abandonment and restoration as outlined in the Abandonment and Restoration Plan, unless revisions to the Plan have been approved by the Board.

5. The Licensee shall complete all reclamation work within the time schedule specified in the Abandonment and Restoration Plan, or as subsequently revised and approved by the Board.

6. The Licensee shall annually review the Abandonment and Restoration Plan and shall modify the Plan to reflect changing operations, technology and the results of reclamation and other studies. The proposed modifications shall be submitted to the Board for approval.

7. Compliance with the Abandonment and Restoration Plan specified in this Licence shall not limit the legal liability of the Licensee, other than liability arising from provisions of the *Act* and its Regulations.

PART I: CONDITIONS APPLYING TO HAZARDOUS WASTE MANAGEMENT

1. The Licensee shall, by May 1, 1999 submit to the Board for approval, a Hazardous Waste Management Program for the mine site. The program shall include, but not be limited to: an inventory of hazardous wastes such as batteries, chemicals, hydrocarbon waste, PCB's, asbestos building materials, contaminated soils, contaminated maintenance materials from the arsenic trioxide recovery facilities, surface storage of arsenic trioxide and procedures for the ongoing management and disposal of these materials.

NORTHWEST TERRITORIES WATER BOARD

Witness

Vice-Chair

NORTHWEST TERRITORIES WATER BOARD

LICENSEE:	Royal Oak Mines Inc. Giant Mine
LICENCE NUMBER:	N1L2-0043
EFFECTIVE DATE OF LICENCE:	June 30, 1998
EFFECTIVE DATE OF SURVEILLANCE NETWORK PROGRAM:	June 30, 1998

SURVEILLANCE NETWORK PROGRAM

A. **Location of Surveillance Stations**

Station Number	Description
43-1	Final treated effluent downstream of the Polishing Pond before entering Baker Creek
43-4	Raw water intake at Yellowknife Bay.
43-5	Baker Creek at boiler house utilidor crossing, prior to discharge to Yellowknife Bay.
43-6	Each open pit Minewater discharge to Baker Creek.
43-7	Treated Minewater pumped from the mine and discharged to Baker Creek
43-8	"A" Shaft compressor cooling water discharge to Baker Creek.
43-9	Influent pipe to the Effluent Treatment Plant.
43-10	Effluent pipe exiting Effluent Treatment Plant.
43-11	Baker Creek, upstream of Station 43-1

43-12	End of the breakwater at the outlet of Baker Creek to Back Bay.
43-13	Control site located offshore from Latham Island.
43-14	Site thirty (30) metres out from the breakwater - in the likely path of the plume.
43-15	Site located at the outflow of Trapper Creek from Trapper Lake
43-16	Trapper Creek, below the tailings dams and above the confluence point of Trapper Creek and Baker Creek
43-17	Final tailings discharge from the Mill to the Tailings Containment Areas
43-18	Minewater discharge at Mill

B. <u>Sampling and Analysis Requirements</u>

1. During periods of Treated Effluent discharge to Baker Creek, twenty-four (24) hour composite samples shall be collected four times weekly, at Station Number 43-1 and analysed for the following parameters:

Total Arsenic	pH
Total Copper	Temperature
Total Cyanide	Total Suspended Solids
Total Nickel	

2. A twenty-four (24) hour automated composite sampler shall be used to collect samples as specified in Part B, Item 1 above, unless otherwise approved by an Inspector.

3. Water at Station Number 43-1 shall be sampled twice monthly during periods of effluent discharge and analyzed for the following:

Total Lead	Total Zinc

4. Water at Station Number 43-5 shall be sampled twice monthly during periods of effluent discharge and analyzed for the following parameters:

Total Arsenic	Total Nickel
Total Copper	Total Suspended Solids
Total Cyanide	Total Zinc
Total Lead	

5. Water at Station Numbers 43-1, 43-5 and 43-12 shall be sampled one week prior to commencement of discharge from the effluent treatment plant and then weekly, during periods of flow and shall be analyzed for the following parameters:

Total Ammonia	Temperature	pH

6. Water at Station Numbers 43-11, 43-15, and 43-16 shall be sampled once per month during periods of flow and analyzed for the following parameters:

Total Ammonia	pH	Temperature
Total Arsenic	Total Suspended Solids	

7. Water at Station Number 43-18 shall be sampled monthly and analyzed for the following parameters:

Total Ammonia	Total Lead	Total Suspended Solids
Total Arsenic	Total Nickel	Temperature
Total Copper	Oil and Grease	Total Zinc
Total Cyanide	pH	

8. Effluent at Station Number 43-17 shall be sampled monthly and analyzed for per cent solids and temperature. The supernatant that forms after a one-hour settling period shall be filtered with a 0.45 micron filter and analyzed for the following parameters:

Total Ammonia	Total Cyanide	Oil and Grease
Total Arsenic	Total Lead	pH
Total Copper	Total Nickel	Total Zinc

9. Effluent at Station Numbers 43-1 and 43-5 shall be sampled twice each year at Spring break-up and before freeze-up in the Fall, and the samples will be provided to the Environmental Protection Branch of Environment Canada for the purpose of performing a static LC_{50} bioassay for both rainbow trout and *Daphnia magna* (per Environment Canada's Environmental Protection Series Biological Test Methods).

10. All sampling, sample preservation and analysis shall be conducted in accordance with methods prescribed in the current edition of "Standard Methods for Examination of Water and Wastewater" or by such other methods as are approved by the Analyst.

11. All analysis shall be performed in a laboratory approved by the Analyst.

12. A revised quality assurance/quality control plan, which includes both field and laboratory requirements, shall be submitted to the Analyst for approval by January 15, 1999.

13. The plan referred to in Part B, Item 12, shall be implemented as approved by the Analyst.

C. **Flow Measurement Requirements**

1. The volume of treated effluent discharged at Station Number 43-1 shall, during periods of flow, be measured and recorded monthly in cubic metres.

2. The volume of water pumped from Great Slave Lake at Station Number 43-4 shall be measured and recorded monthly in cubic metres.

3. The volume of tailings pumped to the Tailings Containment Areas shall be measured and recorded monthly in cubic metres.

4. The volume of water obtained from the City of Yellowknife and Great Slave Lake for domestic purposes shall be measured and recorded monthly in cubic metres.

5. The volume of Minewater pumped from the mine shall be measured at station 43-18 and recorded daily and monthly in cubic metres.

D. **Other Requirements**

1. The quantity of ore milled shall be measured in tonnes and recorded monthly.

2. Composite samples shall be collected semi-annually to determine acid generation potential using acid-base accounting procedures in accordance with the Department of Indian Affairs and Northern Development's "Guidelines for Acid Rock Drainage Prediction in the North, September 1992". Analysis should include: paste pH, total weight percentage sulphur, maximum potential acidity and neutralizing potential for the following locations:

   a) Final mill tailings solids discharged to the Tailings Containment Areas;

   b) Waste rock generated from underground mining operations; and

   c) Waste rock generated from underground and removed to surface.

E. **Reports**

1. The Licensee shall, within thirty (30) days following the month reported, submit to the Board all of the data and information in an electronic and printed format acceptable to the Board required by the "Surveillance Network Program" including results of the approved quality assurance/quality control program.

NORTHWEST TERRITORIES WATER BOARD

Witness

Vice-Chair

Northwest Territories Canada

AMENDMENT TO LEASE

AL-7160T
FILE NO.: 105-GIANT-1

THIS INDENTURE made in duplicate this 1st day of May..., 1989

BETWEEN

THE COMMISSIONER OF THE NORTHWEST TERRITORIES,

hereinafter called **"the Commissioner"**
OF THE FIRST PART

AND

GIANT YELLOWKNIFE MINES LTD., a body corporate, incorporated under the Laws of Ontario and registered under Part VII of the Companies Act of the Northwest Territories, having a registered office in the City of Yellowknife in the said Territories,

hereinafter called **"the Lessee"**
OF THE SECOND PART

WHEREAS the **Commissioner** has demised and leased, to the **Lessee**, under Lease Number 3668T dated the 18th day of October, 1983 all that certain parcel of land more particularly described therein as:

> the whole of Lots One Thousand and Thirty-eight (1038) and One Thousand and Thirty-nine (1039) in Quad 85 J/9 in the City of Yellowknife in the Northwest Territories, according to an Explanatory Plan of Lots certified by Ambrose J. Wrzosek, C.L.S. on the 7th day of March, 1983, as shown outlined in red on a copy of the said plan annexed hereto and forming part of this lease.
>
> excepting thereout and therefrom all bodies of water contained within the said Lots, and
>
> subject to the right of entry for authorized representatives of Northern Canada Power Commission and Cominco Ltd., their executors, administrators and assigns for the installation, construction, maintenance and repair of the powerlines in and on those rights-of-way as shown on plans of survey of record 39801, 41833 and 42177 in the Canada Lands Surveys Records at Ottawa,

AND WHEREAS the lessee wishes to expand their lease boundaries to accommodate the construction of an explosives manufacturing plant;

NOW THIS INDENTURE WITNESSETH that the parties hereto covenant and agree that Lease No. 3668T be and is hereby amended by revocation of the present description of the land contained in Lease No. 3668T and the substitution of the following therefor:

FIRSTLY:

> the whole of Lots One Thousand and Thirty-eight (1038) and One Thousand and Thirty-nine (1039) in Quad 85 J/9 in the City of Yellowknife in the Northwest Territories, according to an Explanatory Plan of Lots certified by Ambrose J. Wrzosek, C.L.S. on the 7th day of March, 1983, as shown outlined in red on a copy of the said plan labelled "Schedule A" annexed hereto and forming part of this lease;

INITIALS.....

AFFIDAVIT OF ATTESTATION

CANADA)
NORTHWEST TERRITORIES)
TO WIT:)
)

I, BRENDA BECKER
of the City of Yellowknife
in the Northwest Territories,
make oath and say:

1. **THAT** I was personally present and did see D.J. LINKERT..., on behalf of the Commissioner of the Northwest Territories, the person named in the within instrument who is personally known to me, to be the person named therein, duly signed and executed the same for the purposes named therein;

2. **THAT** the said instrument was executed at the City of Yellowknife in the Northwest Territories and that I am the subscribing witness thereto;

3. **THAT** I know the said person and that he/she is in my belief of the full age of nineteen years.

SWORN before me at Yellowknife)
in the Northwest Territories)
this 16th day of May 1989.)

A Commissioner for Oaths
or ~~Notary Public~~ in and
for the Northwest Territories

B Becker
witness

My Commission expires: 24 Feb 92

excepting thereout and therefrom all bodies of water contained within the said Lots, and the portion of the road, commonly known as the "Vee Lake Road", also lying within the said Lots, and;

SECONDLY:

all that unsurveyed parcel of land in the City of Yellowknife in the Northwest Territories, more commonly known as "Goodwin 11", Mining Claim No. 32960, as shown outlined in green on the attached "Schedule A" annexed hereto and forming part of this lease; AND

THIRDLY:

all that unsurveyed parcel of land in the City of Yellowknife in the Northwest Territories, more commonly known as "Goodwin 12", Mining Claim No. 32961, as shown outlined in yellow on the attached "Schedule A", annexed hereto and forming part of this lease.

FOURTHLY:

the whole of Lot Forty-seven (47), in Group Nine Hundred and Sixty-four (964) in the City of Yellowknife in the Northwest Territories according to a survey done by T.W. Brown, D.L.S., on 24th day of July, 1938, as shown outlined in red on a copy of the said plan labelled "Schedule B", annexed hereto and forming part of this lease;

FIFTHLY:

the whole of Lot Forty-eight (48), in Group Nine Hundred and Sixty-four (964) in the City of Yellowknife in the Northwest Territories according to a survey done by T.W. Brown, D.L.S., on the 8th day of August, 1938, as shown outlined in red on a copy of the said plan labelled "Schedule C", annexed hereto and forming part of this lease;

subject to the right of entry for authorized representatives of the Northwest Territories Power Commission and Cominco Ltd., their executors, administrators and assigns for the installation, construction, maintenance and repair of the powerlines in and on those rights-of-way as shown on plans of survey of records 39801, 41833 and 42177 in the Canada Lands Surveys Records at Ottawa,

AND the **Commissioner** and the **Lessee** agree that all other terms and conditions of the said lease are confirmed.

INITIALS.....

IN WITNESS WHEREOF the **Deputy Minister**, Department of Municipal and Community Affairs, on behalf of the **Commissioner** of the Northwest Territories, and Giant Yellowknife Mines Ltd. have hereunto set their hand and seals.

SIGNED, SEALED AND DELIVERED)
by)
in the presence of)
)
)
B Becker)
witness)

THE COMMISSIONER OF THE NORTHWEST TERRITORIES

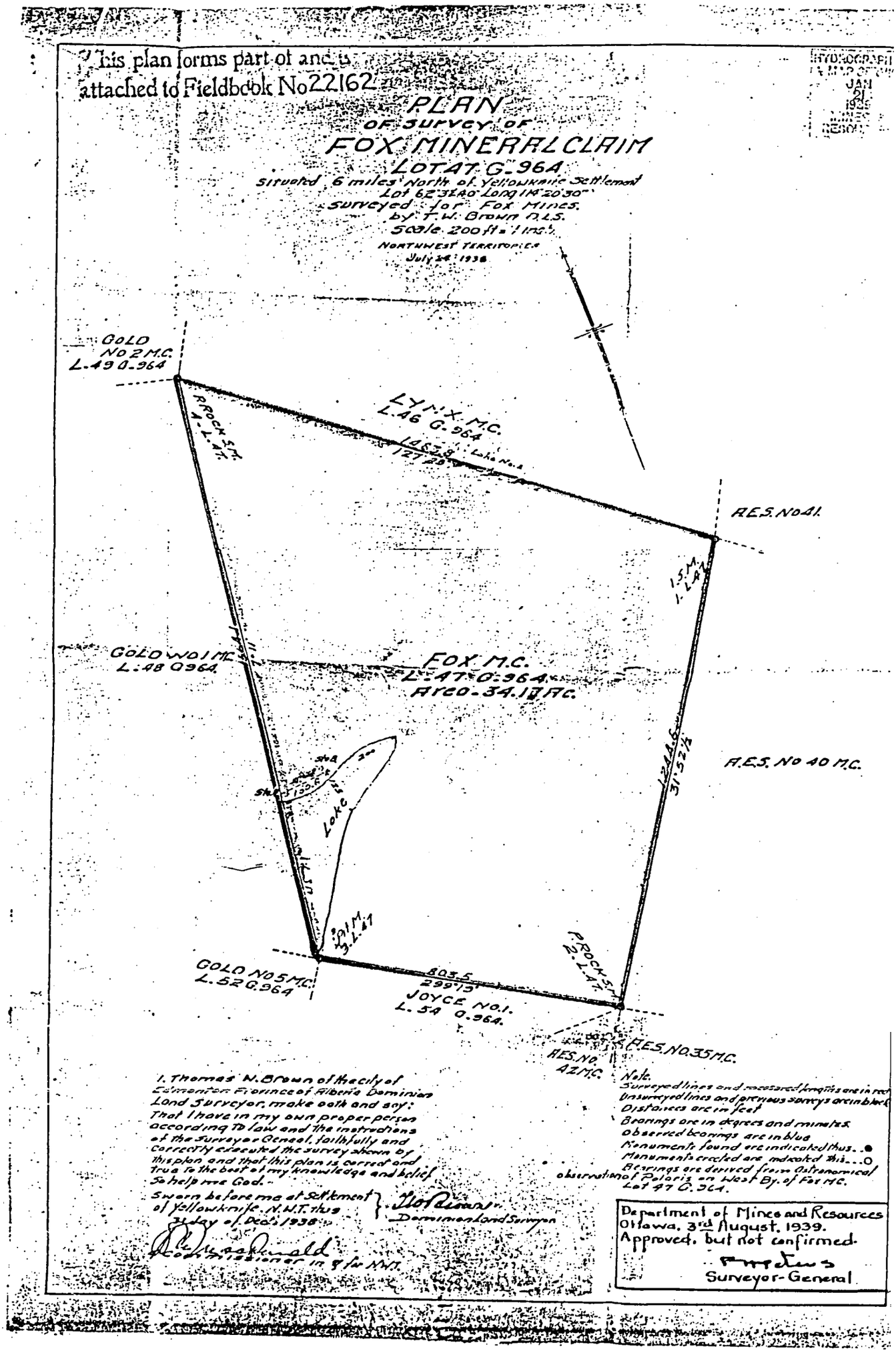
PER _____ (SEAL)

SIGNED, SEALED AND DELIVERED)
by the PRESIDENT)
and by the VICE PRESIDENT)
)
of Giant Yellowknife Mines Ltd.)

_____
Lessee

_____ (SEAL)
Lessee

SCHEDULE "B" ATTACHED TO AND FORMING PART OF
AMENDMENT TO LEASE NO. 7160T



Northwest Territories Canada

LEASE

L- 3668T
File No.: 105-GIANT-1

THIS LEASE made this 18the day of October, 1983.

BETWEEN

THE COMMISSIONER OF THE NORTHWEST TERRITORIES, hereinafter called **"the Commissioner"**

OF THE FIRST PART,

AND **GIANT YELLOWKNIFE MINES LTD.**, a body corporate, incorporated under the Laws of Ontario and registered under Part VII of the Companies Ordinance of the Northwest Territories, having a registered office in the City of Yellowknife in the said Territories,

hereinafter called **"the Lessee"**

OF THE SECOND PART,

WITNESSETH that in consideration of the rents, covenants and agreements herein reserved and contained on the part of the **Lessee** to be paid, observed and performed, and subject to the **Commissioner's Land Ordinance** and the **Commissioner's Land Regulations, the Commissioner** demises and leases unto the **Lessee** all that(those) certain parcel(s) or tract(s) of land situate, lying and being in the Northwest Territories and being composed of

the whole of Lots One Thousand and Thirty-eight (1038) and One Thousand and Thirty-nine (1039) in Quad 85 J/9 in the City of Yellowknife in the Northwest Territories according to an Explanatory Plan of Lots certified by Ambrose J. Wrzosek, C.L.S. on the 7th day of March, 1983 as shown outlined in red on a copy of the said plan annexed hereto and forming part of this lease.

excepting thereout and therefrom all bodies of water contained within the said Lots, and

subject to the right of entry for authorized representatives of Northern Canada Power Commission and Cominco Ltd., their executors, administrators and assigns for the installation, construction, maintenance and repair of the powerlines in and on those rights-of-way as shown on plans of survey of record 39801, 41833 and 42177 in the Canada Lands Surveys Records at Ottawa,

hereinafter called "the land" subject to the reservations and exceptions contained in the **Commissioner's Land Ordinance** and the **Commissioner's Land Regulations** and to the following reservations:

a) all mines and all minerals whether solid, liquid or gaseous which may be found to exist within, upon or under the land together with the full powers to work the same and for the purpose to enter upon, use and occupy the land or so much thereof and to such an extent as may be necessary for the effectual working and extracting of the said minerals;

INITIALS

THIS DOCUMENT IS SUBJECT TO A MORTGAGE/ CAVEAT/ EASEMENT RECORDED ON THE REVERSE OF PAGE ONE

THIS LEASE HAS BEEN AMENDED BY WAY OF AN INDENTURE DATED 89-05-01 AND NUMBERED AL-7160T

(SIGNED) 890516 (DATE)

GENERAL ASSIGNMENT

lis lease is subject to a mortgage dated the 23rd
ly of October A.D. 1987 and filed on the
3rd day of December A.D. 1987 at 1:05 o'clock
P. M. under number 605

Name of Parties	Amount and rate of Interest of Mortgage
TANT YELLOWKNIFE MINES LIMITED + BARCLAYS BANK OF CANADA	n/a
	Date from which Principal and Interest Secured: n/a

Department of
Municipal and Community Affairs

The Mortgage (Caveat) Filed as No. 605, is discharged (withdrawn) by filing of Discharge of General Assignment on the 5th day of October 1990 at 1:50 o'clock P. M. under number 1140.

Department of
Municipal and Community Affairs

FIXED AND FLOATING CHARGE DEMAND DEBENTURE

lease is subject to a mortgage dated the 22nd
of October A.D. 1987 and filed on the
1 day of December A.D. 1987 at 1:10 o'clock
P. M. under number 606

Name of Parties	Amount and rate of Interest of Mortgage
NT YELLOWKNIFE MINES LIMITED + CLAYS BANK OF CANADA	Prime plus 2.5%
	Date from which Principal and Interest Secured: 22nd October 1987

Department of
Municipal and Community Affairs

The Mortgage (Caveat) Filed as No. 606 is discharged (withdrawn) by filing of Discharge of Debenture on the 5th day of October 1990 at 1:52 o'clock P. M. under number 1141.

Department of
Municipal and Community Affairs

b) the rights of the recorded holders of mineral claims and any other claims or permits affecting the land;

c) all timber that may be on the land excepting what must be removed for the purpose of landscaping or the construction of improvements;

d) the rights to enter upon, work and remove any rock outcrop required for public purposes;

e) such rights of way and of entry as may be required under regulations in force in connection with construction, maintenance and use of works for the conveyence of water for use in mining operations; and

f) the right to enter upon the land for the purpose of installing and maintaining any public utility.

TO HAVE AND TO HOLD for and during the term of Thirty (30) years, commencing on the 1st day of June, 1983.

YIELDING AND PAYING THEREFOR yearly and every year in advance a rental of Two Thousand, Nine Hundred ($2,900.00) dollars or such rental as may be fixed by the **Deputy Minister** pursuant to Clause #6 below.

THE PARTIES COVENANT AND AGREE AS FOLLOWS:

DEFINITION

1. In this lease **"Deputy Minister"** means the **Deputy Minister** of the **Department of Local Government** and any person authorized in writing by the **Commissioner** to act on behalf of the **Deputy Minister.**

COMPLIANCE

2. The **Lessee** will comply with the said **Ordinance** and **Regulations.**

PAYMENT

3. The **Lessee** shall during the said term, pay the said rental and all taxes, rates and assessments charged upon the land or upon the **Lessee** in respect thereof.

NON-COMPLIANCE

4. Where any portion of the rental herein reserved is unpaid for more than thirty days after it is due, whether formally demanded or not, or where the **Lessee** fails to perform or observe any of the covenants or agreements herein contained, the **Deputy Minister** may by notice in writing terminate this lease, and on the day following the mailing of the notice this lease is terminated.

TERMINATION

5. Termination of this lease shall not prejudice the **Commissioner's** right to unpaid rental or any other right with respect to a breach of any covenant or agreement herein contained.

INITIALS .....

AMENDED RENTAL

6. The **Deputy Minister** may, not less than three months before the expiration of the first five year period of the said term, or of any subsequent five year period of the said term, notify the **Lessee** in writing of an amended rental payable for the following five year period and, failing further notification, for the rest of the term, the said amended rental is to be based upon the fair appraised value of the land at the time of such notification, but without taking into account the value of any improvements placed thereon by the **Lessee.** In the event that the rental as determined by the **Deputy Minister** is not acceptable to the **Lessee,** the determination of the fair appraised value will be made by the **Trial Division of the Territorial Court,** at the request and expense of the **Lessee** or as the **Court** may decide.

LAND USE

7. The **Lessee** shall use the land for its mining and processing operations or purposes incidental or necessary for such operations and the benefits of the general public purposes only.

EXISTING IMPROVEMENTS

8. The **Lessee** shall maintain the existing improvements now situated on the land, or any similar improvements which may be constructed, in a manner and condition satisfactory to the **Deputy Minister.**

EASEMENTS

9. The **Commissioner** may, where the **Deputy Minister** deems it necessary in the public interest, establish easements through, under or over any portion of the land for any public utility purpose, but said easements shall not unreasonably interfere with the rights granted to the **Lessee** hereunder or with any improvements made by the **Lessee** on the land.

ROAD CONSTRUCTION

10. The **Commissioner** may re-enter and occupy any portion of the land for construction of roads or other public works, but such construction shall not unreasonably interfere with the rights granted to the **Lessee** hereunder, or with any improvements made by the **Lessee** on the land.

DISCHARGE OF WASTE

11. The **Lessee** shall not discharge or deposit any refuse substances or other waste materials in any lake, river, stream or creek, or on the banks thereof, which will, in the opinion of the **Deputy Minister,** impair the quality of the waters or the natural environment and any areas designated for waste disposal shall not be located within 30.48 metres (100 feet) of the Ordinary High Water Mark of any body of water.

REPLACEMENT GUARANTEE

12. If the **Lessee** duly performs and observes all the covenants and agreements herein, and on the part of the **Lessee** to be performed and observed, the **Commisioner** shall, at the expiration of the said term, grant to the **Lessee** a new lease of the land for a further term of Thirty (30) years, at a rent to be determined by the **Deputy Minister,** and subject to the same covenants and agreements as are herein contained with the exception of this clause.

INITIALS

ASSIGNMENT REQUIREMENT

13. The **Lessee** may not assign this lease without the consent of the **Deputy Minister** in writing, such consent shall not be unreasonably withheld.

SUBLEASE APPROVAL

14. The **Lessee** hereby has the consent of the **Deputy Minister** to sublease all or a portion of the land, and the Sublessee shall be bound by all terms and conditions of this lease. Pursuant to this approval, the **Lessee** shall provide the **Deputy Minister** with a **Certified True Copy** of every sublease so entered into by the **Lessee,** within 60 days of the execution of any such sublease.

HIGHWAY ENCROACHMENTS

15. The **Commissioner** acknowledges encroachments within the highway right-of-way, shown outlined in green on the attached explanatory plan, of buildings, structures, fixtures or means of access. The **Commissioner** will issue to the **Lessee** a permit for the noted encroachments upon execution of the lease. The **lessee** hereby agrees to remove all or any of the noted encroachments as and when they are not required in its mining and processing operations.

ENVIRONMENT

16. The **Lessee** will at all times keep the land in a reasonably clean condition. The **Lessee** will ensure that its agents, employees, contractors and their employees are served due notice regarding environmental protection requirements.

INSPECTION

17. It shall be lawful for the **Commissioner** or any person duly authorized, at all reasonable times to enter upon the land for the purpose of examining the condition thereof.

RESTORATION

18. At the expiration of the term herein granted, or of any renewal thereof, or any termination, the **Lessee** at his own expense shall remove buildings, equipment, or appertenances thereto and restore the land to a condition satisfactory to the **Commissioner.** A period of five (5) years from the expiration, renewal, or termination will be granted at a yearly rental payment concurrent with that paid for the preceeding year, to accomplish said removal.

TIME

19. **Time** shall be of the essence in this agreement.

WAIVER

20. Unless a waiver is given in writing by the **Deputy Minister,** the **Commissioner** shall not be deemed to have waived any breach by the **Lessee** of any of the covenants or agreements herein contained, and a waiver relates only to the specific breach to which it refers.

IMPLICATION

21. No implied covenant or implied liability on the part of the **Commissioner** is created by the use of words, **"demise** and **lease"** contained herein.

SURVIVORSHIP

22. This lease enures to the benefit of and is binding upon the **Commissioner** and his successors, and the **Lessee,** its successors and assigns.

INITIALS

ADDRESS FOR NOTICES

23. Wherever in this lease it is required or permitted that notice or demand be given or served by any party to this lease to or on the other, such notice or demand shall be given or served in writing and forwarded by registered mail, addressed as follows:

To the **Deputy Minister:**

Deputy Minister,
Department of Local Government,
Government of the Northwest Territories,
P.O. Box 1320,
YELLOWKNIFE, N.W.T.
X1A 2L9.

To the Lessee at:

Giant Yellowknife Mines Ltd.
P.O. Box 40
Commerce Court West,
Toronto, Ontario
M5L 1B4

c.c. Giant Yellowknife Mines Ltd.
Yellowknife, N.W.T.

or to such other address as either of the parties may from time to time notify the other in writing in the manner hereinbefore provided.

IN WITNESS WHEREOF the parties have executed this agreement as of the date and year first above written.

SIGNED, SEALED AND DELIVERED)
by A. MENARD)
in the presence of)
)
)
)
)
witness)

THE COMMISSIONER OF THE
NORTHWEST TERRITORIES

PER _____ (SEAL)

GIANT YELLOWKNIFE MINES LIMITED

SIGNED, SEALED AND DELIVERED)
by the VICE-PRESIDENT)
and by the SECRETARY)
)
of)
Giant Yellowknife Mines Ltd.)

_____ VICE PRESIDENT
Lessee

_____ (SEAL) SECRETARY
Lessee

Petroleum Product Tank Storage

Location	Tank Size (L)	Product	In Use (Y/N)	Comments
A-boiler	1100	Diesel heating oil	Yes	For backup generator
A-boiler	2250	Diesel heating oil	No	Horizontal tank no longer in use
Old rec hall	10000	Newalta heating fuel	Yes	New white tank
Near curling rink	35,000 60,000	Newalta heating fuel	60,000 is still in use	Older upright tanks. Surrounded by a lined containment area, which contains about 30 cm of water.
Lakeshore Pumphouse	1100	Diesel P40	Yes	Fuel for backup pump no containment.
A-shaft	4 x 500,000 bolted tanks	Bunker C sludge	No	Bolded metal tanks with bunker C sludge. There used to be 8 tanks at this location. Interviewees recounted a spill in the 1960's of about 80,000 litres. There is evidence of recent seepage from attachments.
A1 pit (north side)	2250 horizontal	Diesel	No	Tank used to supply trucks in the pit.
C1pit laydown area, Bldg 017	1100 oval 2250 horizontal	Unknown, likely diesel	No	Older tanks, likely containing sludge
C1 pit (north side)	4500 horizontal	Diesel P40	Yes	Older tank that supplies the underground trucks
B2 pit (south side)	1100 horizontal	Diesel P40	Yes	Older tank, supplies underground vehicles. Some leaking from the transfer pipe is evident.
B – Shaft Vent Plant	114,000	Propane	Yes	Heats air in the winter. Caged to prevent rock damage during open pit blasting
B-3 Pit	2250 horizontal	Diesel P40	Yes	Supplies fuel to underground.
Effluent Treatment Plant	10,000 horizontal	Diesel heating fuel	Yes	Tank is bermed – exposed liner
Effluent Treatment Plant	2 x 6000 L	Propane	Yes	
Mine Site tanks	3 x 500,000 bolted tanks	Bunker C	One is still in use	The most southern two tanks contain Bunker C sludge and are no longer in use. The third tank is about 2/3 full of Bunker C.
Mine site tanks located enroute to South TCA.	1 x 1,600,000 bolted tank 3 x 80,000 in cut off bolted tank	Bunker C sludge and Newalta heating fuel	Yes	The most northern tank is no longer in use, but contains bunker C sludge. The southern tank is used as a containment area for three 80,000 L tanks storing New Alta fuel oil product.

Behind C-boiler (Bldg. 172)	45,000 upright	Newalta heating fuel	Yes	Large spill in adjacent containment area with an estimated 3000 L of free product.
Electrical Shop	12,000 L	Propane	Yes	
Electrical Shop	1100 Oval tank	Diesel heating fuel	Yes	
C-boiler	4500 horizontal	Diesel heating fuel	Yes	Paint is beginning to chip.
Fuel pump near bldg. 146	10,000 horizontal	Diesel P40	Yes	Older tank up gradient of the refuelling station.
Gasoline Fuel pump next to bldg, 133, Warehouse	4500 L Underground tank	Gasoline	Yes	Underground tank. Some staining around gas pump.
Mobile Equipment Garage Bldg.	2 x 4500 L	Waste Oil	Yes	Two tanks are connected by a pipe. Very large stain down gradient of the second tank.
Planer Shop Bldg. 144	20 ton	Propane	Yes	
New diesel plant Bldg. 059	10,000 L horizontal	Diesel P40	Yes	Partially buried
New diesel plant Bldg. 059	1100 Oval	Diesel heating fuel	Yes	
Roaster	4500	Diesel heating fuel	Yes	Stained soil beneath.
Bag House/Cottrel	1100 L Oval	Varsol	Yes	Stored inside the building
Refinery (north of building)	4,500 L	Diesel Heating Fuel	Yes	Stored within a fenced area
Roaster	3 x 6000L	Propane	Yes	
Next to Assay Laboratory	45,000 upright	Newalta	Yes	
C-Dry valve house	2250 horizontal	Waste oil	Yes	Tank is inside a cut off old tank that is used for containment. The containment has about 30 cm of product in it, exposed to the air.
C-Dry valve house	4500 L Underground	Diesel heating fuel	Yes	Underground tank

Oil and Grease Products Presently Used on Site.

Product	Volume Stored (July 19, 1999)	Container	Storage Location
Arox EP22	1640 L	205 l drums	Lumber Yard
Arox EP100	320 L	4 l jugs or 20 l pails	Oil Shed #4 Warehouse
Cable Floatcoat			Oil Shed #4 Warehouse
Esso Extra 10W30	48	1 litre jugs	Main Warehouse
Hydraulic Essolube HD 10W	0	205 l drums	Lumber Yard
Essolube HD 20	0	205 l drums	Lumber Yard
Essolube HD 30	4100	205 l drums	Lumber Yard
Essolube Plus HDX 20-20 W	36	1 l jugs	Warehouse
Essolube Hydraulic XD3-10 W	12	20 l pails	Warehouse
Essolube XD30	0	205 l drums	Lumber Yard
Esstic 32	205	205 l drums	Lumber Yard
Esstic 68	1025	205 l drums	Lumber Yard
Esstic 100	410	205 l drums	Lumber Yard
Esso GX7580	0	20 l pails	Oil Shed # 4 Warehouse
Esso GX80W/90	5	20 l pails	Oil Shed #4
Esso GX85W/140	12	20 l pails	Warehouse
Hydraulic Univis J13	0	1 l jugs	Warehouse
Hydraulic Univis N20	0	205 l drums	Lumber Yard
Hydraulic Univis N22	1025	205 l drums	Lumber Yard
Tresso 32	205	205 l drums	Lumber Yard
Thread Cutting Dark	4	4.5 l jugs	Main Warehouse
Thread Cutting Clear Ridgid	0	4.5 l jugs	Main Warehouse
Voltesso 35	205	205 l drums	Lumber Yard
ATF Type A	84	1 l jugs	Main Warehouse
ATF Type F	0	1 l jugs	Main Warehouse
Hydraulic ATF Type A	205	205 l drums	Lumber Yard
Diamond Drill DDR-3	1	17 kg pails	Oil Shed #4
Gear Cover 3000	2	55 kg kegs	Oil Shed #4
Kubloa 30	1	Case lots	Oil Shed #4
Lo-Temp EP Cartridge	60	400 gr tubes	Main Warehouse
MPH Cartridge	80	400 gr tubes	Main Warehouse
Nebula EP	0	17 kg pails	Oil Shed #4
Spartan EP 220	0	205 l drums	Lumber Yard
Spartan EP 320	820	205 l drums	Lumber Yard
Spartan EP 460	1025	205 l drums	Lumber Yard
Spartan EP 1000	205	205 l drums	Lumber Yard
Unirex EP 1	40	400 gr tubes	Main Warehouse
Unirex EP 2 Cartridge	60	400 gr tubes	Main Warehouse
Unirex EP 2	2	55 kg kegs	Oil Shed #4 Warehouse
Unirex N2L Cartridge	0	400 gr tubes	Main Warehouse
EP102 Epic Synthetic	20	17 kg pails	Main Warehouse

Miscellaneous Petroleum Products

Product	Volume Stored (July 19, 1999)	Unit Volume/Container Type	Storage Location
Acetone	0	4.5 l jugs	Assay Lab
Acetylene B Size	3	15 kg cylinder	Warehouse Compressed Gas Storage
Acetylene WS Small	2	4.5 kg cylinder	Warehouse Compressed Gas Storage
Acetylene WTL Large	2	80 kg cylinder	Warehouse Compressed Gas Storage
Additive Fuel Oil EG275F	1	205 l drums	Lumber Yard
Alcohol Methyl Hydrate	2	20 l pails	Warehouse #4
Antifreeze Gasoline K425	13/4 oz		Main Warehouse
Antifreeze Automotive	28 L	4 l jugs	Main Warehouse
Antifreeze Automotive	205 L	205 l drums	Lumber Yard
Antifreeze Frost X	820 L	205 l drums	Lumber Yard
Cleaner Electrosol	20	20 l pails	Main Warehouse
Cleaner Imperial	0		Main Warehouse
Cleaner Lectra Clean 2018	4/14 oz	Spray cans	Main Warehouse
Degreaser 5107T1 Ripper II	0	205 l drums	Lumber Yard
Belt Spraygrip	12	Spray cans	Main Warehouse
Layout Spray	4	Spray cans	Main Warehouse
Glyptal Blue Grey G1237	3	Spray cans	Main Warehouse
Glyptal Light Grey G1228	3	Spray cans	Main Warehouse
Glyptal Red G1201	3	Spray cans	Main Warehouse
Glyptal Red Spray G1201A	3	Spray cans	Main Warehouse
Glyptal 1202	5	Spray cans	Main Warehouse
Glyptal Thinner	2	Spray cans	Main Warehouse
Glyptal Thinner 3190	0	Spray cans	Main Warehouse
Rockwell 147B	1 Box	Boxes	Main Warehouse
Rockwell 147C		Boxes	Main Warehouse
Rockwell #775256		Boxes	Main Warehouse
Lectra Clean	4	Spray cans	Main Warehouse
Pyridine	5 pt.		Main Warehouse
Solvent C-666	4	20 l pails	Main Warehouse
Solvent Varasol	410	205 l drums	Lumber Yard
Turpentine	1	4.5 l cans	Main Warehouse

Chemical Products, Volume and Storage Locations

Chemical Name	Volume Stored (July 19, 1999)	Unit Volume/Container Type	Storage Location
Alchem Balls	225 kg	22.7 kg bags	Reagent Shed
Armac HT Flake	1062 kg	27 kg boxes	Reagent Shed
Borax, Anhydrous Granular	1021 kg	25 kg bags	Reagent Shed
Calcium Chloride	346 kg	25 kg bags	Reagent Shed
Calcium Hypochlorite	315 kg	30 kg drums	Reagent Shed
Caustic Soda	589 kg	25 kg bags	Reagent Shed
Carbon, Activated Granular	1620	908 kg bags	Reagent Shed
Copper Sulphate	9000	1000 kg bags & 25 kg bags	Effluent Treatment Plant and Reagent Shed
Ferric Sulphate	50998	Bulk	Effluent Treatment Plant
Filter Aid, Kenite 700	5819	22.7 kg bags	Reagent Shed
Flocculant – Percol 351	50	25 kg bags	Reagent Shed
Frother- Dowfroth 1012	1306	204 kg drums	Lumbar Yard
Hydrogen Peroxide	61158	Bulk	Effluent Treatment Plant
Keytone	165	165 kg drums	Lumber Yard
Lead Nitrate	150	25 kg bags	Reagent Shed
Lime, Quick Pulverized	66208	Bulk	Silos at Mill & Effluent Treatment Plant
Manganese Dioxide	600	25 kg bags	Reagent Shed
Millsperse B10 Dispersant	222	270 kg drum	Roaster Building
Silica Flour	492	25 kg bags	Reagent Shed
Soda Ash	1900	25 kg bags	Reagent Shed
Sodium Cyanide	68200	1000 kg Bag/Box	Lumbar Yard
Sodium Metabisulfite	567	22.7 kg bags	Reagent Shed
Sodium Nitrate	1357	25 kg bags	Reagent Shed
Xanthane – Potassium Amyl	3000	125 kg drums	Lumber Yard
Xanthane – Sodium Isopropyl	9600	125 kg drums	Lumber Yard
Zinc Dust	533	22.7 kg pails	Reagent Shed

FAX TRANSMISSION

Date: June 28, 1999

Pages: 6, Including Cover

To: **Ms. Sheila Street**
Vista Engineering
Fax: (867).920-7245

Northwest Territories

From: **Lisette Self**
Research Assistant
Environmental Protection Service
Resources, Wildlife and Economic Development
Government of the Northwest Territories
600, 5102 – 50th Avenue
Yellowknife NT X1A 3S8

Telephone: (867) 873-7654
Fax: (867) 873-0221

Subject: **Giant Mine Property**

Attached is the list of reported Spills that I was able to generate from the Spills database. If you should require any additional information please feel free to contact us.

Lisette Self

The transmission and the documents accompanying this transmission contain confidential information intended for a specific individual and purpose. The information is private and is legally protected by law. If you are not the intended recipient, you are hereby notified that any disclosure, copying, distribution or taking of action in reference to the contents of this telecommunicated information is strictly prohibited. If you have received this communication in error, please notify the Environmental Protection Service immediately by telephone and return the original to us by regular mail, postage due

Resources, Wildlife and Economic Development
investing in our future

Hazardous Materials Spill Database

Enviromental Protection Service of RWED
600, 5102-50th Avenue; Yellowknife, NT X1A 3S8
Phone: (867) 873-7654 Fax: (867) 873-0221

Northwest Territories

Monday, June 28, 1999 — **Grouped by Location:** Giant — **For the year(s) :** 1971-2009

Spill Date	Spill No	Region	Location	Description	Commodity	Quantity (L or kg)	Party	Source	Agency
17-Mar-74	1974005	NSL	Giant	Between Tailings Pond & Back Bay	Mine Effluent	22730000	Giant Mine	TP	-
08-Apr-74	1974008	NSL	Giant	Shaft C	Bunker C	3182	Giant Mine	UK	-
01-Dec-76	1976035	NSL	Giant	Boiler House	Bunker C	909	Giant Yellowknife Mines	UK	INAC
	1977003	NSL	Giant	Seepage Pond Below Dam #3D	Tailings	0	Giant Mine	TP	INAC
07-Apr-77	1977014	NSL	Giant	Baker Creek	Arsenic Solution	0	Giant Yellowknife Mines	UK	-
06-Oct-77	1977051	NSL	Giant	Tailings Backfill Line Beside Highway	Tailings	0	Giant Yellowknife Mines	TP	INAC
19-May-78	1978011	NSL	Giant	-	Bunker C	273	Giant Yellowknife Mines	PL	GNWT
12-Sep-78	1978029	NSL	Giant	Tailings Pond Outfall	Mill Tailings	22730	Giant Yellowknife Mines	TP	-
02-Jan-79	1979001	NSL	Giant	Tailings Outfall	Tailings	0	Giant Yellowknife Mines	TP	INAC
22-Dec-78	1979003	NSL	Giant	Baker Creek	Lube Oil	0	Giant Yellowknife Mines	PL	EPS
04-Aug-79	1979041	NSL	Giant	Tailings Dam #5	Tailings Water	0	Giant Yellowknife Mines	TP	Inac
02-Jan-79	1979059	NSL	Giant	In Ditch Opposite Roaster Building	Unknown	2273	Giant Yellowknife Mines	ST>	EPS
10-Mar-80	1980011	NSL	Giant	Dam #5	Tailings	82000	Giant Yellowknife Mines	TP	-
17-Apr-80	1980017	NSL	Giant	Dam #5	Tailings	0	Giant Yellowknife Mines	UK	-
07-Oct-80	1980113	NSL	Giant	West Side of Highway & Baker Creek	Gasoline	9092	Giant Yellowknife Mines	ST>	-
03-Jul-81	1981043	NSL	Giant	West Side of Mill Building	Floatation Tailings	0	Giant Yellowknife Mines	ST>	inac
10-Mar-82	1982017	NSL	Giant	Tailings Dam #4	Clear Effluent	45460	Giant Yellowknife Mines	OTH	Inac
08-May-84	1984047	NSL	Giant	South of Mine Entrance	Waste Engine Oil	909	Giant Mine	ST>	Inac
28-Sep-85	1985098	NSL	Giant	Baker Creek Near Roaster Building	Mill Tailings	22700	Giant Yellowknife Mines	ST>	Inac
04-Apr-86	1986026	NSL	Giant	Near B Shaft	Arsenic Trioxide	0	FDS Drilling Ltd	OTH	Inac
25-Oct-86	1986107	NSL	Giant	B2 Open Pit	Diesel Fuel	200	Giant Yellowknife Mines	UK	Inac
20-Feb-87	1987020	NSL	Giant	West of the Mill	Mill Solution	2000	Giant Yellowknife Mines	ST>	inac
12-Mar-87	1987023	NSL	Giant	Mill Complex	Arsenic Trioxide Dust	200	Giant Yellowknife Mines	OTH	inac
07-Apr-87	1987030	NSL	Giant	Below Refinery Building	Tailings Effluent	45000	Giant Yellowknife Mines	PL	inac
21-Aug-87	1987088	NSL	Giant	Baker Creek	Process Water	74000	Giant Yellowknife Mines	PL	inac
23-Nov-87	1987121	NSL	Giant	Mine Mill Sump	Tailings Solution	16000	Giant Yellowknife Mines	PL	inac
22-Dec-87	1987133	NSL	Giant	Tailings Area Below Dam #11	Tailings	32000	Giant Mine	PL	Inac
22-Dec-87	1987134	NSL	Giant	Mill West Wall	Tailings	9600	Giant Yellowknife Mines	PL	inac
09-May-88	1988052	NSL	Giant	West Side of Mill	Tailings	0	Giant Yellowknife Mines	PL	inac
22-May-88	1988058	NSL	Giant	Tailings Retreatment Plant Site	Tailings	90000	Giant Yellowknife Mines	PL	inac
07-Jun-88	1988067	NSL	Giant	Behind Arsenic Silo	Arsenic Trioxide	100	Giant Yellowknife Mines	ST>	inac

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Spill Date	Spill No	Region	Location	Description	Commodity	Quantity (L or kg)	Party	Source	Agency
26-Jul-88	1988100	NSL	Giant	Crusher Building	Minewater	109000	Giant Yellowknife Mines	ST<	inac
28-Jul-88	1988102	NSL	Giant	Crusher Building	Minewater	1600	Giant Yellowknife Mines	ST<	inac
17-Aug-88	1988122	NSL	Giant	Main Office Road	Water	0	Two Way Enterprises	ST>	GNWT
24-Nov-88	1988166	NSL	Giant	Northwest Side of Dam 22B	Tailings Water	45000	Giant Yellowknife Mines	TP	inac
02-Dec-88	1988168	NSL	Giant	Junction of North & South Pond Lines	Tailings	109000	Giant Yellowknife Mines	PL	inac
11-Jan-89	1989001	NSL	Giant	500 - 700 Feet From Mill	Minewater	454000	Giant Yellowknife Mines	PL	inac
20-Apr-89	1989044	NSL	Giant	Vee Lake Road Turnoff	Tailings	4546	Giant Yellowknife Mines	UK	inac
25-Apr-89	1989050	NSL	Giant	Northwest Tailings Pond	Tailings Solution	250	Giant Yellowknife Mines	PL	inac
	1989053	NSL	Giant	Hill in front of Northwest Tailings Pond	Tailings Solution	205	Giant Yellowknife Mines	TRU	inac
08-May-89	1989058	NSL	Giant	Tailings Pipeline	Tailings Water	4546	Giant Yellowknife Mines	TP	inac
02-Jun-89	1989074	NSL	Giant	MillOutside South Door	Minewater	4546	Giant Yellowknife Mines	PL	inac
30-Jun-89	1989093	NSL	Giant	Tailings Line	Tailings	0	Giant Yellowknife Mines	PL	inac
10-Aug-89	1989119	NSL	Giant	Catchment Pond	Minewater	270000	Giant Yellowknife Mines	PL	inac
07-Oct-89	1989161	NSL	Giant	Vee Lake Road	Mill Tailings	5000	Giant Yellowknife Mines	PL	inac
17-Oct-89	1989166	NSL	Giant	Mill	Minewater	20450	Giant Yellowknife Mines	PL	inac
13-Mar-90	1990034	NSL	Giant	South of Mill	Condensate Water	900	Giant Yellowknife Mines	PL	inac
	1990054	NSL	Giant	Near Mouth of Baker Creek	Tar-like Substance (Un	0	Unknown	UK	inac
02-Aug-90	1990136	NSL	Giant	Explosives Limited's Plant	Diesel Commercial	150	TC Oil Distributors Esso	TRU	inac
30-Sep-90	1990173	NSL	Giant	Dock Site	Gasoline	0	Unknown	UK	inac
04-Dec-90	1990205	NSL	Giant	Pit Access Ramp A-2	Diesel	1800	Giant Mine	PL	inac
13-Jan-91	1991004	NSL	Giant	Vee Lake Road Area Beside B136 Portal Area	Tailings	180	Giant Mine	PL	inac
30-Apr-91	1991050	NSL	Giant	Baker Creek, "A" Shaft Boilerhouse	Bunker C	45	Royal Oak Mines Inc	UK	inac
07-May-91	1991054	NSL	Giant	Mill	Roaster Dust Slurry	14000	Giant Mine	PL	inac
09-May-91	1991059	NSL	Giant	Catch Basin #7	Run-off Water from Me	0	Giant Mine	NS	inac
13-Mar-91	1991062	NSL	Giant	Vee Lake Road Area	Reclaim Water	0	Giant Mine	PL	inac
15-May-91	1991065	NSL	Giant	Carbon Plant	Fresh Water	0	Giant Mine	UK	inac
27-Jul-91	1991136	NSL	Giant	Main Tailings Line	Tailings	22000	Royal Oak Mines Inc	PL	inac
17-Aug-91	1991156	NSL	Giant	Adjacent to Vee Lake Road	Tailings	350000	Royal Oak Mines Inc	PL	inac
21-Aug-91	1991164	NSL	Giant	Adjacent to Mill	Tailings	45000	Royal Oak Mines Inc	PL	inac
28-Aug-91	1991169	NSL	Giant	Adjacent to Vee Lake Road	Tailings	22500	Royal Oak Mines Inc	PL	inac
06-Nov-91	1991207	NSL	Giant	Adjacent to Dam #4	Mill Tailings	1135	Royal Oak Mines Inc	PL	inac
18-Dec-91	1991226	NSL	Giant	Near Dam #8	Tailings	10000	Royal Oak Mines Inc	PL	inac
29-Jan-92	1992005	NSL	Giant	Boiler House Tank	Bunker C	900	Royal Oak Mines Inc	ST<	inac
04-Apr-92	1992028	NSL	Giant	Fresh Water Intake Line	Water	45460	Royal Oak Mines Inc	PL	inac
26-Apr-92	1992054	NSL	Giant	Old Pit Across from Mill	Diesel Fuel	455	Royal Oak Mines Inc	PL	inac
11-May-92	1992072	NSL	Giant	Millsite	Cyanide Solution	100000	Royal Oak Mines Inc	ST>	inac
07-May-92	1992083	NSL	Giant	Vee Lake Turnoff	Tailings Solution	250	Royal Oak Mines Inc	TP	inac
23-May-92	1992089	NSL	Giant	Akaitcho Line	Minewater	454	Royal Oak Mines Inc	PL	inac

SENT BY:Scotia Centre 7th Flr ; 6-30-99 ; 13:05 ;RWED Env. Protection→ 8679207245;# 3/ 6

Spill Date	Spill No	Region	Location	Description	Commodity	Quantity (L or kg)	Party	Source	Agency
26-May-92	1992091	NSL	Giant	Vee Lake Road	PVC Contamination	0	Picketers on Strike	OTH	inac
26-May-92	1992094	NSL	Giant	Tank Farm Along Highway 4	Bunker C	25	Royal Oak Mines Inc	PL	inac
30-May-92	1992101	NSL	Giant	Baghouse & Cottrell	Arsenic Trioxide	0	Royal Oak Mines Inc	OTH	GNWT
05-Jun-92	1992110	NSL	Giant	Near Gate #6	Tailings Solution	9092	Royal Oak Mines Inc	PL	inac
06-Jun-92	1992112	NSL	Giant	Sewage Pumphouse on Lakeshore Corner	Sewage	0	Royal Oak Mines Inc	ST<	inac
13-Jun-92	1992122	NSL	Giant	Tailings Line to North Pond	Tailings	0	Royal Oak Mines Inc	PL	inac
13-Jun-92	1992123	NSL	Giant	Bag House to Cottrell	Gases Arsenic/SO2	0	Royal Oak Mines Inc	OTH	GNWT
27-May-92	1992127	NSL	Giant	Carbon Plant	Fresh Process Water	2273	Royal Oak Mines Inc	PL	inac
14-Jun-92	1992128	NSL	Giant	Feed Line to the EPT	Tailings Water	0	Royal Oak Mines Inc	PL	inac
	1992129	NSL	Giant	Tank Fram Behind Mill	Bunker C	45	Royal Oak Mines Inc	PL	inac
28-Jun-92	1992140	NSL	Giant	Gate #7	Tailings Solution	90	Royal Oak Mines Inc	PL	inac
01-Jul-92	1992147	NSL	Giant	Gate #7	Tailings Water	0	Royal Oak Mines Inc	PL	inac
02-Jul-92	1992149	NSL	Giant	Supercrest	Unknown	1818	Royal Oak Mines Inc	PL	inac
13-Sep-92	1992202	NSL	Giant	Adjacent to Mill	Barren/Pregnant Soluti	200	Royal Oak Mines Inc	ST<	inac
28-Sep-92	1992215	NSL	Giant	Mill Area	Floatation Concentrate	9092	Royal Oak Mines Inc	OTH	inac
23-Sep-92	1992216	NSL	Giant	Baker Creek	Oil	0	Royal Oak Mines Inc	PL	inac
23-Oct-92	1992228	NSL	Giant	Vee Lake Road and Adjacent Mill	Tailings	0	Royal Oak Mines Inc	TP	inac
23-Oct-92	1992229	NSL	Giant	Tailings Line Adjacent to Mill	Tailings Mine Water	450000	Royal Oak Mines Inc	PL	inac
31-Jan-93	1993012	NSL	Giant	Roaster Building South Door	Water/Mill Solution	2500	Royal Oak Mines Inc	ST>	inac
14-Mar-93	1993026	NSL	Giant	Catch Basin 226 Vee Lake Road	Tailings Liquid Effluent	0	Royal Oak Mines Inc	TP	inac
26-Mar-93	1993036	NSL	Giant	Adjacent to Pit 138	Mill Tailings	500	Royal Oak Mines Inc	PL	inac
	1993044	NSL	Giant	Roaster Building	Untreated Roaster Ga	0	Royal Oak Mines Inc	OTH	GNWT
10-May-93	1993060	NSL	Giant	Refinery Catchment Basin South of Mill	Mill Tailings & Run-Off	1350	Royal Oak Mines Inc	TP	inac
14-May-93	1993062	NSL	Giant	Tailings Line Adjacent Road	Mill Tailings	22000	Royal Oak Mines Inc	PL	inac
15-May-93	1993063	NSL	Giant	Adjacent to Vee Lake Road	Mill Tailings	45000	Royal Oak Mines Inc	PL	inac
18-May-93	1993065	NSL	Giant	Day Tank Northeast of Mill	Diesel Fuel	6800	Royal Oak Mines Inc	ST>	inac
08-Jun-93	1993082	NSL	Giant	Carbon Tanks	High Ammonia Tailing	0	Royal Oak Mines Inc	TP	inac
26-Jun-93	1993090	NSL	Giant	Vee Lake Road Area	Mill Tailings	90000	Royal Oak Mines Inc	PL	inac
02-Jul-93	1993102	NSL	Giant	Vee Lake Road Area	Mill Tailings Solution	100000	Royal Oak Mines Inc	PL	inac
03-Jul-93	1993103	NSL	Giant	Vee Lake Road Area	Mill Tailings	25000	Royal Oak Mines Inc	PL	inac
16-Jul-93	1993110	NSL	Giant	Barge Loading Area	Bunker C	45	Royal Oak Mines Inc	PL	inac
16-Aug-93	1993156	NSL	Giant	Northwest Pond Area	Mill Tailings	22000	Royal Oak Mines Inc	PL	inac
03-Oct-93	1993170	NSL	Giant	150 Metres Past Pinch Valves	Mill Tailings	15000	Royal Oak Mines Inc	PL	inac
24-Oct-93	1993172	NSL	Giant	Corner of Ingraham Trail & Vee Lake Road	Tailings	205	Royal Oak Mines Inc	PL	inac
01-Nov-93	1993174	NSL	Giant	Near Catch Basin at Point 138	Mill Tailings	30000	Royal Oak Mines Inc	PL	inac
28-Oct-93	1993178	NSL	Giant	Tailings Reclamation Plant	Propane	50000	Royal Oak Mines Inc	ST>	inac
04-Dec-93	1993183	NSL	Giant	Roaster Building Area	Concentrate Thickener	7000	Royal Oak Mines Inc	PL	inac
06-Dec-93	1993184	NSL	Giant	By Refinery Building	Mill Tailings	20000	Royal Oak Mines Inc	TP	inac

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Spill Date	Spill No	Region	Location	Description	Commodity	Quantity (L or kg)	Party	Source	Agency
30-Dec-93	1993192	NSL	Giant	Carbon Plant Catchment Pond	Fresh Water	0	Royal Oak Mines Inc	OTH	inac
13-Jan-94	1994005	NSL	Giant	Tailings Line Near Catch Basin	Mill Tailings	100000	Royal Oak Mines Inc	PL	inac
13-Jan-94	1994009	NSL	Giant	-	Mill Tailings	20000	Royal Oak Mines Inc	PL	inac
19-Jan-94	1994013	NSL	Giant	B-138 on Northwest Tailings Line	Mill Tailings	15000	Royal Oak Mines Inc	PL	inac
21-Jan-94	1994014	NSL	Giant	Northwest Line Vee Lake Road	Mill Tailings	100000	Royal Oak Mines Inc	PL	inac
25-Jan-94	1994017	NSL	Giant	Adjacent to Refinery	Pregnant Solution & T	20000	Royal Oak Mines Inc	OTH	inac
28-Jun-94	1994113	NSL	Giant	Tailings Line Next to North Tailings Pond	Tailings	30000	Royal Oak Mines Inc	PL	inac
28-Jun-94	1994114	NSL	Giant	Tailings Line Next to North Tailings Pond	Mill Tailings	2273	Royal Oak Mines Inc	PL	inac
03-Jul-94	1994118	NSL	Giant	Pipebox Between Mill & AC Roaster	Concentrator Process	2200	Royal Oak Mines Inc	PL	inac
27-Mar-95	1995031	NSL	Giant	Pinch Valves East of Mill	Mill Tailings	2000	Royal Oak Mines Inc	TP	inac
03-Apr-95	1995035	NSL	Giant	Base of Dam #21A	Tailings Slurry	10000	Royal Oak Mines Inc	TP	inac
29-Apr-95	1995051	NSL	Giant	#138 Catch Basin	Mill Tailings	10000	Royal Oak Mines Inc	PL	inac
04-Jun-95	1995078	NSL	Giant	Ingraham Trail Area North of Lower Access R	Mill Tailings	120000	Royal Oak Mines Inc	PL	inac
04-Sep-95	1995148	NSL	Giant	East Side of Mill Near Refinery Catch Basin	Mill Tailings	20000	Royal Oak Mines Inc	PL	inac
12-Sep-95	1995152	NSL	Giant	Tailings Pipe at Crossing of Ingraham Trail	Tailings Solution	50	Royal Oak Mines Inc	PL	inac
30-Oct-95	1995174	NSL	Giant	#10 Fuel Storage Tank Across From Boilerhou	Diesel P-40	0	Royal Oak Mines Inc	ST>	inac
10-Nov-95	1995182	NSL	Giant	North Side of Cottrell Plant	Arsenic Trioxide Dust	13	Royal Oak Mines Inc	PL	EPS
25-Nov-95	1995190	NSL	Giant	Mill Area	Minewater & Solution	1364	Royal Oak Mines Inc	PL	inac
27-Dec-95	1995203	NSL	Giant	Winch Building	Oil/Water Residue	1	Royal Oak Mines Inc	OTH	inac
10-Feb-96	1996018	NSL	Giant	Dam 22-B Northwest Tailings Pond	Tailings Effluent	15000	Royal Oak Mines Inc	TP	inac
13-Feb-96	1996021	NSL	Giant	Tailings Line to North Pond	Tailings	60000	Royal Oak Mines Inc	PL	inac
13-Feb-96	1996022	NSL	Giant	Refinery Catch Basin West Side of Mill	Mill Tailings Water	20000	Royal Oak Mines Inc	OTH	inac
02-Jul-96	1996120	NSL	Giant	SE Side of NW Tailings Pond	Tailings Solution	70000	Royal Oak Mines Inc	PL	inac
02-Jul-96	1996121	NSL	Giant	South Door of Roaster Building	Process Water	500	Royal Oak Mines Inc	ST>	inac
02-Jul-96	1996122	NSL	Giant	Southwest Corner of Mill	Leach Solution	500	Royal Oak Mines Inc	PL	inac
28-Jul-96	1996144	NSL	Giant	Back Road Between Hill & North Road	Mill Tailings	2000	Royal Oak Mines Inc	PL	inac
27-Aug-96	1996164	NSL	Giant	Near B8 Portal Adjacent to Ingraham Trail	Tailings Solution	70000	Royal Oak Mines Inc	PL	inac
29-Aug-96	1996166	NSL	Giant	NW Side of Leach Berm Adjacent to Mill	Leach Slurry	45000	Royal Oak Mines Inc	ST>	inac
29-Aug-96	1996169	NSL	Giant	Road to NW Pond Adjacent to Ingraham Trail	Tailings Solution	2000	Royal Oak Mines Inc	PL	inac
29-Aug-96	1996170	NSL	Giant	Road to NW Pond Adjacent to Ingraham Trail	Tailings Solution	8000	Royal Oak Mines Inc	PL	inac
17-Oct-96	1996222	NSL	Giant	B-138 Pit NE Corner	Diesel Fuel	1591	Royal Oak Mines Inc	ST<	inac
22-Oct-96	1996229	NSL	Giant	Effluent Dicharge to Baker Creek	Treated Effluent (Copp	0	Royal Oak Mines Inc	TP	inac
22-Nov-96	1996240	NSL	Giant	East Side of Mill	Mine Tailings	6000	Royal Oak Mines Inc	PL	inac
17-Apr-97	1997065	NSL	Giant	NW End of 'C' Dry Building	Thermal Oil	170	Royal Oak Mines Inc	PL	inac
14-Jun-97	1997123	NSL	Giant	Adjacent to Main Mill Building	Mill Tailings	25000	Royal Oak Mines Inc	PL	inac
15-Jun-97	1997127	NSL	Giant	SE Side of Northwest Tailings Pond	Water/Dilute Tailings	10000	Royal Oak Mines Inc	PL	inac
02-Jul-97	1997144	NSL	Giant	Storage Tank Near Assay Lab, SE of Access	Mixed Waste Oils	75	Royal Oak Mines Inc	DRUM	inac
18-Aug-97	1997195	NSL	Giant	NE Corner of Mill Bldg.	Mill Tailings	5000	Royal Oak Mines Inc	PL	inac

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Spill Date	Spill No	Region	Location	Description	Commodity	Quantity (L or kg)	Party	Source	Agency
22-Aug-97	1997200	NSL	Giant	North Corner of 'C' Dry Building	Diesel Fuel	15	Royal Oak Mines Inc/Imperial	TRU	inac
16-Sep-97	1997220	NSL	Giant	Storage Tank Berm Area near Assay Lab	Used Oil	54700	Royal Oak Mines Inc	ST>	inac
09-Oct-97	1997240	NSL	Giant	Adjacent to 'A' Boiler Bldg. near Townsite	Oily Water	70	Royal Oak Mines Inc	OTH	inac
16-Jun-98	1998100	NSL	Giant	Polishing Pond & Baker Creek	Treated Effluent with H:	0	Royal Oak Mines Inc.	TP	inac
27-Oct-98	1998173	NSL	Giant	East Side of Mill Building	Tailings Slurry	10000	Royal Oak Mines	PL	inac
04-Dec-98	1998186	NSL	Giant	Adjacent to Baghouse Buildling	Arsenic Trioxide	2	Royal Oak Mines Inc	PL	inac
29-Apr-99	1999054	NSL	Giant	South Wall of B-2 Open Pit	Diesel Fuel	20	Royal Oak Mines Inc	ST<	INAC

Total Spills in the Mine, Oil Field, etc of Giant: 152

Total Spills on this Report: 152

This report contains information regarding spills that were reported to the NWT 24-Hour Spill Line. The absence of information on any particular location in no way guarantees that contamination has not occurred at that location.

LEGEND

Region:
BAF - Baffin
DEH - Deh Cho
INU - Inuvik
KEE - Keewatin
KIT - Kitikmeot
NSL - North Slave
SAH - Sahtu
SSL - South Slave

Source:
AIR - Aircraft
DRUM - Drum or Barrel
MV - Marine Vessel
NS - Natural Seepage
OTH - Other Transportation
PL - Pipe or Line
RT - Rail Train
SL - Sewage Lagoon
ST< - Storage Tank 4000 litres
ST> - Storage Tank >4000 litres
TP - Tailings Pond
TRU - Truck
UK - Unknown
WELL - Wet Wells Flaring Boom

Agency:
CCG - Canadian Coast Guard
EPS - Environment Canada
GNWT - Government of the Northwest Territories
ILA - Inuvialuit Lands Administration
INAC-Indian and Northern Affairs Canada

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Royal Oak Mines Inc.

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2nd Floor - 1425 W. Pender St.
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V6G 2S3

Tel: (604) 682-8320
Fax: (604) 682-4286

Mr. Neil Thompson
Manager, Land Protection,
Northwest Territories Renewable Resources,
Government of the Northwest Territories,
Yellowknife, N.W.T.,
X1A 2L9

August 23,1994

Dear Mr. Thompson:

Re: Disposal of PCB Contaminated Materials Stored at the Giant Mine

I am writing to advise you that all of the PCB contaminated transformers, capacitors and other materials that were both in use and in storage at the Giant mine site in Yellowknife were shipped to the Alberta Special Waste Management System facility in Swan Hills, Alberta in mid June of this year. Please find attached the Certificate of Disposal from the Alberta Special Waste Management System for the PCB contaminated capacitors (waste profile sheet # 13342), for the PCB contaminated tools (waste profile sheet # 13345) and for the PCB contaminated clothing and rags (waste profile sheet # 13343). A total of nine undrained transformers were also shipped to the Swan Hills facility however we have not yet received the Certificate of Disposal covering the destruction of these items. I will forward this to you when it becomes available.

The label # on the items shipped were as follows:

Waste Profile Sheet # 13341 (7 Containers + 2 Drums)

NR20710 - Transformer
NR20709 - Transformer
NR20710 - Transformer
NR20728 - Transformer
NR20729 - Transformer
NR20730 - Transformer
NR20731 -Transformer
NR20732 - Transformer
NR20733 - Transformer

Waste Profile Sheet # 13342 (3 Drums + 1 Crate)

NR00520 - Capacitor
NR00521 - Capacitor
NR00522 - Capacitor
NR00523 - Capacitor
NR00524 - Capacitors
NR00525 - Capacitor

Waste Profile Sheet # 13343 (2 Drums)

WN06376 - Tools/Gloves
WN06377 - Clothes/Rags

Waste Profile Sheet # 13345 (3 Drums)

WN06374 - Electrical Wires/Parts
WN06375 - Pipes/Fittings
WN06384 - Wires and Fittings

The items from Centra Power that were stored in the Giant PCB storage facility were also shipped under separate contract to the Alberta Special Waste Management System facility at the same time. The Giant PCB storage facility no longer contains any PCB contaminated materials.

Due to further staff changes at the Giant mine, the "Contact 1" name on the Giant PCB inventory list should be changed from Kiedock Kim to Phil MacIntyre who is the new mill Superintendent at the Giant mine. We will keep you advised of any further developments or changes. If you have any questions please feel free to contact me at your convenience.

Regards,

Larry Cornell

Larry Cornell
Manager of Environmental & Metallurgical Services

ROYAL OAK MINES INC. – Giant Mine @ Yellowknife, N.W.T.
Inventory of PCB Contaminated Materials

Container #	Dimensions W x L x H Inches	Container Contents	EC Label
1	41 x 53 x 65	1 Transformer carrying 209.57 liters of PCB Oil	NR–20732
2	39 x 51 x 66	1 Transformer carrying 204.57 liters of PCB Oil	NR–20731
3	41 x 53 x 65	1 Transformer carrying 159.11 liters of PCB Oil	NR–20733
4	39 x 51 x 65	1 Transformer carrying 204.57 liters of PCB Oil	NR–20730
5	35 x 41 x 44	3 Capacitors each carrying 11.37 liters of PCB Oil	NR–00520 NR–00522 NR–00525
6	45 Gallon Drum	1 Capacitors carrying 11.37 liters of PCB Oil	NR–00523
7	45 Gallon Drum	1 Capacitors carrying 11.37 liters of PCB Oil	NR–00524
8	45 Gallon Drum	Electrical wire & Miscellanous parts in contact with PCB Oil	WN–06374
9	45 Gallon Drum	1 Capacitors carrying 11.37 liters of PCB Oil	NR–00521
10	45 Gallon Drum	Gloves, hammer, slings, chain block, clevis, hatchet miner's light & visors in contact with PCB Oil	WN–06376
11	45 Gallon Drum	Clothes and rags in contact with PCB Oil	WN–06377
12	45 Gallon Drum	Clothes and rags in contact with PCB Oil	WN–06375
13	37 x 50 x 49	1 Transformer carrying 109.11 liters of PCB Oil	NR–20709
14	38 x 51 x 49	1 Transformer carrying 109.11 liters of PCB Oil	NR–20728
15	38 x 52 x 50	1 Transformer carrying 109.11 liters of PCB Oil	NR–20729
D	30 Gallon Drum	Gloves, fittings and wire potentially in contact with PCB Oil	WN–06384

Item # A & B belong to Centra Power

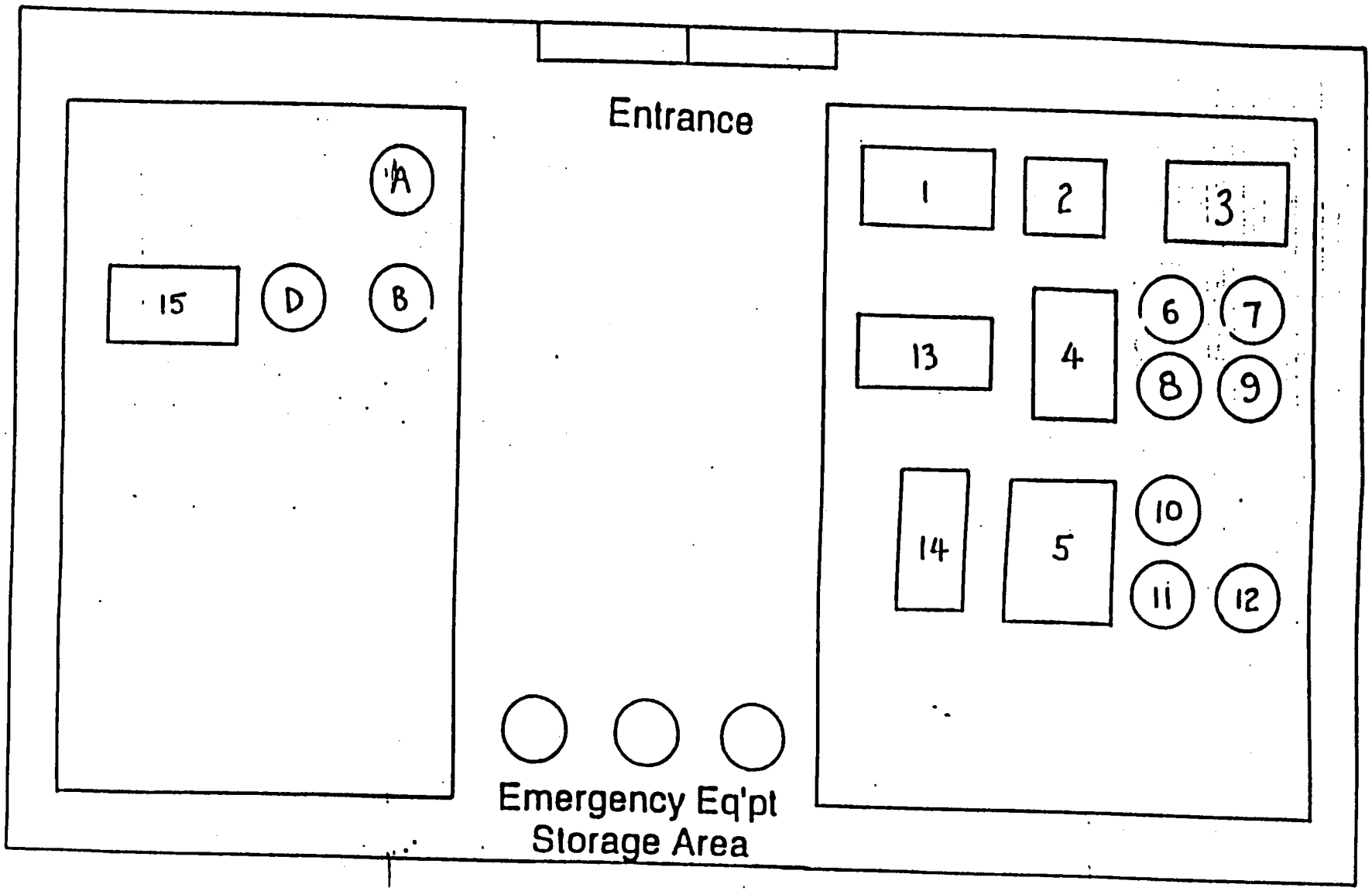
Two additional transformers are to be added to this inventory before shipment to Swan Hills

1 Transformer carrying 11.27 liters of PCB Oil	NR–20708
1 Transformer carrying 95.47 liters of PCB Oil	NR–20710

Royal Oak Mines Inc.
(Yk Div.) Giant Mine

Ref: Mar. 22/93

PCB Storage Layout



Note: Key access through beet lock code X3 - G. Halverson/ D. Powers

Philip Services Corporation

CERTIFICATE OF ANALYSIS

Client:(2941) Envirocare Env. Services Ltd., Regina — Reported:18-Nov-98 — Page: 1

Project Number:
Attention: Jeff Wszolek
Work Order: 64083 — Client Ref.#:Royal Oak Mine
Purchase Order:
Date Received: 3-Nov-98
Sample Type: Oil

Sample #	Test	Result	Units	RDL	Comment
98-A025467	Sample Description: 278032 #4		Date & Time Sampled: 2-Nov-98		
	Total PCB (Oil)	< 1	mg/kg	1	
	SURROGATE STANDARD RECOVERIES				
	Decachlorobiphenyl	95.	%		
98-A025468	Sample Description: 278031 #3		Date & Time Sampled: 2-Nov-98		
	Total PCB (Oil)	< 1	mg/kg	1	
	SURROGATE STANDARD RECOVERIES				
	Decachlorobiphenyl	96.	%		
98-A025469	Sample Description: 252368 #1		Date & Time Sampled: 2-Nov-98		
	Total PCB (Oil)	< 1	mg/kg	1	
	SURROGATE STANDARD RECOVERIES				
	Decachlorobiphenyl	98.	%		
98-A025470	Sample Description: 252369 #2		Date & Time Sampled: 2-Nov-98		
	Total PCB (Oil)	< 1	mg/kg	1	
	SURROGATE STANDARD RECOVERIES				
	Decachlorobiphenyl	96.	%		

MONICA: NO PCB PROBLEMS WITH THESE UNITS!

Jeff.

EXPLANATION OF CODES
RDL Reporting Detection Limit

Philip Analytical Services Corporation
921 Leathorne Street, London, Ontario, Canada N5Z 3M7 (519) 686-7668 1-800-268-7396 FAX (519) 686-6374

Asbestos Assessment at the Giant Yellowknife Mine

RECEIVED
SEP 08 1998
EBA ENGINEERING
CONSULTANTS LTD.
YELLOWKNIFE

Prepared for Royal Oak Mines Inc.

Prepared by Robert J. Valleau, P. Ag.

Arctic Environmental Services Ltd.

(DECEMBER 1996)

1. INTRODUCTION

Arctic Environmental Services Ltd. (ARS Ltd.) was commissioned by Royal Oak Mines Inc. to complete an assessment of asbestos materials within selected buildings at the Giant Yellowknife Mine near Yellowknife, Northwest Territories. This assessment was conducted between November 21 and December 3, 1996.

1. SCOPE OF WORK

Royal Oak Mines Inc. was asked by the NWT Workers Compensation Board to develop, by December 20 (1996), a plan of action addressing asbestos problems specific to the Roaster, Cottrell and Baghouse buildings at the Giant Yellowknife Mine. Royal Oak Mines Inc. provided AES Ltd. with parameters under which the action plan measures are to be developed, which include:

- the asbestos rehabilitation plan, if implemented, will not be a health concern to Royal Oak Mines Inc. employees;
- no plant shutdown or loss of productivity through the mill;
- stringent safety measures in keeping with government regulations, Royal Oak Mines Inc.'s safety protocols; and AES Ltd.'s safety protocols;
- a staged program set out on a priority basis.

3. METHODOLOGY

The methodology employed by AES Ltd. to address the Scope of Work is provided on a Task basis as outlined below.

Task 1: Conduct an intensive inventory and status report on condition of existing asbestos

- this information was collected and included asbestos area measurements, volume estimates for asbestos material to be removed, photographs, and asbestos sampling/analyses (where necessary only to confirm presence or type of asbestos)

Task 2: Determine a progressive asbestos rehabilitation program, complete with projected annual budgets, if appropriate

- establish priorities to govern a staged project. This was completed in conjunction with Royal Oak staff, and will include asbestos type and condition, frequency of building use (human exposure) mill flexibility, cost, and temperature conditions

4. RESULTS

4.1 BAGHOUSE BUILDING

Walls

The Baghouse Building walls do not contain asbestos. They are comprised of sheet metal.

Hoppers

There are 4 hoppers in the Baghouse Building. The original covering cement material on the hoppers contain asbestos (70% Chrysotile), and this material covers asbestos containing fibre (80% Chrisotile). Current repairs to the hoppers use a non-asbestos containing product ("Target" brand "Post Haste" concrete), which accounts for approximately 5% of total hopper insulation area.

The combined area of the hoppers and the conveyor is provided on Table 1.

Table 1: Area of Asbestos Containing Materials

Floor	Area in Square Feet
First	5174
Second	3300
Total	8474

4.2 COTTRELL BUILDING

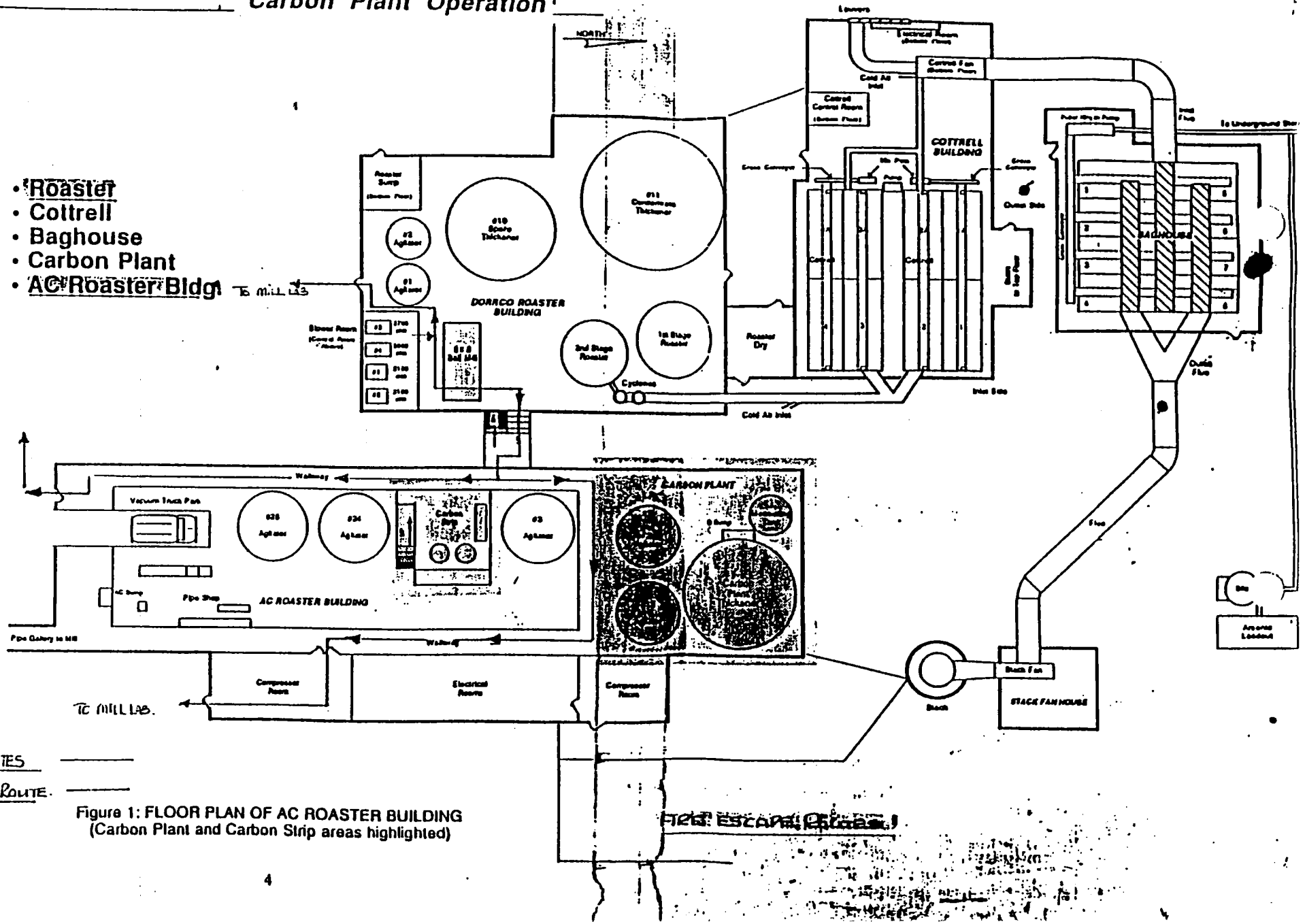
Walls

Walls in the Cottrell Building contain two types of asbestos which occur in five forms, two of which were applied by trowel (Crocidolite on south wall, main floor; and Chrysotile on south wall on second floor), one was sprayed on as a loose fibre with an encapsulant (Chrysotile in most outside walls), another was nailed on as a resilient/flexible siding (outside of MCC Room), and the last was applied as a hardboard (inside of MCC Room). Table 2 provides the total estimated area in square feet which comprise each wall on each floor.

Identify Major System Components

Carbon Plant Operation

- Roaster
- Cottrell
- Baghouse
- Carbon Plant
- AC Roaster Bldg



IARY ESCAPE ROUTES

DNATE ESCAPE ROUTE

Figure 1: FLOOR PLAN OF AC ROASTER BUILDING
(Carbon Plant and Carbon Strip areas highlighted)

Table 2: Asbestos Coverings on Walls within the Cottrell Building

Floor	North	South	East	West	Interior Walls	Total Area in Square Feet
1st Floor	Chrysotile*	Crocidolite	Chrysotile*	Chrysotile*	Chrysotile*	8118
Stairwell	Chrysotile*	Chrysotile*	Chrysotile*	Chrysotile*	Chrysotile*	1247
Flu System	Chrysotile*	Chrysotile*	Chrysotile*			2420
MCC Room	Hardboard and asbestos siding, both Chrysotile*	Hardboard and asbestos siding, both Chrysotile*	Hardboard and asbestos siding, both Chrysotile*	Chrysotile*		1302
2nd Floor	Chrysotile (90%)	Chrysotile	Chrysotile*	Chrysotile*	Steel	2349

*indicates not sampled, but appears to be this asbestos type based upon adjacent areas

Hoppers and Cross Conveyors

The 4 hoppers within the Cottrell Building are insulated with asbestos. This covering consists of asbestos fibres coated (by trowel) with asbestos cement (80% and 70% Chrysotile respectively) and it is under constant repair to mechanical support structures, and covering integrity. A number of openings through this coating layer have been cut to provide access to portals into the hopper structure. The edges of these openings have not been encapsulated and could permit fibre access to the building. In addition, friable asbestos is exposed along the length of each hopper at the base. It is a common practice for personnel to duck under and between these hoppers, thus causing damage to the structure over time, and potentially releasing fibres while doing so. Only two hoppers operate at any given time, thus allowing remedial work on a cool hopper system.

Two cross conveyors are employed (1-2 and 3-4) between the hoppers, both of which contain friable asbestos and are in bad shape due to constant vibration, brushing, scrapes and collisions in the narrow hallway. These require encapsulation followed by cement application (by trowel) and protection by wire mesh.

Table 3: Estimated Area of Asbestos Coverage
Cottrell Building Hopper Systems
(Area in Square Feet)

Hopper# 1	Hopper #2	Hopper #3	Hopper #4	Cross Conveyors
1188	1188	1188	1188	158
Total	4910			

Pipes

Only one pipe was observed to contain asbestos. This was located within the stairwell to the second floor (40'), and continued along the main floor ceiling for some 60'. The pipe covering within portions of the stairwell were in terrible shape from constant wear and tear. Fibre release from this source has occurred. This material could be removed using the glove bag technique with minimal disturbance.

Exhaust (Flu)System

A large portion of exhaust system runs through this building. It is coated with asbestos (troweled-on Chrysotile) for insulation. This system contains three valve openings and two narrow corridors, all of which have sustained damage from wear and tear and require repair following encapsulation. The square footage estimate for this structure is 2420 square feet.

4.3 ROASTER BUILDING

Walls

Walls in the Roaster Building contains two forms of asbestos, and have two forms of coating. Chrysotile and Amosite asbestos both have been used for wall insulation. The major portion of this was applied as a loose fibre and then was encapsulated with a sprayed-on product. A portion of the main floor level was applied with a trowel.

The basement level is approximately half covered with a plywood protective barrier over the asbestos. A portion of the east wall has been prepared for plywood with a 2x2 frame covered by plastic. The remaining northeast wall area is bare, and has been damaged by wear and tear. Covering this portion of wall with plywood may have been avoided because it coincides with the location of the roasters and may have presented a fire hazard.

The main floor level walls in the Roaster Building contains two visible forms of coating. Chrysotile and Amosite asbestos both have been used for wall insulation. The major

portion of this was applied as a loose fibre and then was encapsulated with a sprayed-on product. A portion of the main floor level along the east wall was applied with a trowel and is generally in good condition, although it is due for re-encapsulation. It includes the north half of the east wall, and the electrical room. The remaining central portion of the wall is loose fibre which is in poor condition (due to damage from wear and tear) and requires some removal and some encapsulation..

The second, third and fourth floor walls have loose fibre insulation, which is in very poor condition on the south wall of the second floor. The remainder is undamaged and is well attached to the wall, but requires re-application of encapsulant.

Table 4 provides the total estimated area in square feet which comprise each wall on each floor.

Table 4: Asbestos Coverings on Walls Within the Roaster Building

Floor Level	Area in Square Feet
Basement	1650. The remainder is covered by plywood or plastic
1st	5280
2nd	3120
3rd	3300
4th	1980

Roasters

The roasters extend from the basement to the second and third floors. The roaster coverings contain up to 80% Chrysotile asbestos in its steel mesh (grill) cement and fibre.

Portions of the roasters asbestos have been exposed and require repair following encapsulation. Both roaster units require encapsulation in their entirety. Their approximate square footage is (Roaster Unit #1) 1000 square feet and (Roaster Unit #2) 800 square feet.

Entry/Stairwell

The entry stairwell along the east wall connecting with the adjacent AC Roaster Building contains Chrysotile asbestos in loose fibre form. The original encapsulation has been worn off by wear and tear, and the fibres are loose and exposed to the constant airflow that streams from the opening between the two adjacent buildings. To be properly

protected, these entry walls should be re-encapsulated and then protected with plywood or metal sheeting to avoid re-damaging the asbestos fibres. The estimated square footage of asbestos in the stairwell is 900 square feet.

5.0 CONCLUSIONS

1. Table 4 provides a summary of the total area of asbestos to be encapsulated within each of the three buildings in the assessment, plus a grand total. It also provides an estimate of the asbestos volume that should be removed.

Table 4: Total Area/Volume of Asbestos

Building	Total Area (Square feet)	Removal (cubic feet)	Encapsulation Required Area (Square Feet)
Bag House	8474	<2	8474
Cottrell	20350	<5	20350
Roaster	18030	<5	18030
Totals	46854		46854

2. ***Risk of Asbestos Exposure to Workers - Priority List***

AES Ltd. wishes to stress that, despite the following risk factors, air quality samples recently collected by WCB in the Roaster Building produced a "no detect" result in the laboratory.

Asbestos exposure hazard is based upon three items:

- the frequency of unprotected worker presence and numbers in the area of asbestos occurrence;
- the type of asbestos present; and
- the integrity of the current asbestos encapsulation.

With respect to the first item, the Roaster Building and the Cottrell building have approximately equivalent worker numbers and presence. These workers have occasional respiratory protection. The Baghouse Building requires only occasional daily worker presence, and has mandatory full time respiratory protection. Clearly, the Roaster and Cottrell buildings offer more risk to the worker.

With respect to the type of asbestos present:

- the Baghouse Building has Amosite asbestos (2% in Baghouse cement) and Chrysotile (60% on hopper cement and fibre);
- the Roaster Building has the Chrysotile (80% on 1st and 2nd stage roaster cement and fibre) form of asbestos;
- the Cottrell building has Chrysotile (70-90% on hopper fibre and cement, and on three walls), Amosite (on 1 wall) and Crocidalite (on south wall).

In terms of the exposure risk to these various forms of asbestos fibres (Alberta Chemical Hazard Regulation 303/92) the risk (based upon the length of fibre) rates Amosite, as the worst, followed by Crocidolite and then Chrysotile asbestos. This being the case, **AES Ltd.** feels that the Cottrell building offers the worst situation, followed by the Baghouse Building.

With respect to the integrity of current asbestos encapsulation, the asbestos encapsulation was in poor shape in all buildings. The Baghouse Building had exposed friable asbestos on the hoppers and has current maintenance activities that would raise the free fibre count during concrete cutting/reapplication processes. The Cottrell building has poor pipe wrap integrity resulting in exposed friable asbestos, each of the hoppers and conveyors have exposed friable asbestos, and the north wall is comprised of Crocidilite asbestos which is unpainted and has been damaged by items leaned up against it. The Roaster building has exposed asbestos fibres on the walls, on the roasters themselves, and on exhaust system pipe joints.

Considering these factors, **AES Ltd.** would rate the exposure risk in descending order of priority, as follows:

1. Risk of exposure is greatest in the entryway of the Roaster building (Chrysotile), where air currents are continuous year round, frequency of unprotected worker presence is highest in the building, and encapsulant integrity is poor due to wear and impact damage.

2. Risk of exposure is high in the Cottrell building, where friable asbestos (Chrysotile) is present on all hoppers and conveyors 1-2 and 3-4. Asbestos integrity is poor due to vibration, wear, and impact. Workers are unprotected against asbestos fibres in the airstream.

3. Risk of exposure is high on hoppers on which asbestos insulation has become detached and requires either removal or mechanical re-attachment to hopper surface. Major repairs have been initiated in both the Baghouse and Cottrell buildings to alleviate this problem.

4. Risk of exposure is high in the Cottrell building stairwell, where asbestos encapsulant integrity is poor due to wear and impact damage, particularly on hot pipes. There is an airflow between floors which could serve to loosen and move asbestos fibres into each floor of the building proper.

5. Risk of exposure is high on walls on which asbestos insulation has become detached from walls. This has occurred primarily in the Roaster Building, but also on the 2nd floor of the Cottrell Building.

6. Risk of exposure is high on walls that have been damaged. This is common in both the Cottrell and Roaster buildings.

7. Risk of exposure is high in the Baghouse building, where friable asbestos is present on all hoppers (Chrysotile) and conveyor cement (Amosite). Asbestos integrity is poor due to vibration, wear, and impact. Respirator protection in this building is manditory, however this does not specify that HEPA filters be used. Therefore workers are only partially protected.

8. Risk of exposure is high on walls and structures which are due for an additional coating of encapsulant. This is required on all asbestos containing materials in all three buildings.

3. Combining all of the above risk factors, the priorities for segments of each building have been outlined in Table 5.

Table 5: Priority of Asbestos Action Required

Building	Frequency of Use	Asbestos Type	Encapsulant Integrity	Overall Priority Rating*
Baghouse	Occasional daily, with manditory respiratory protection	**Amosite:** cement on conveyor	Not thoroughly encapsulated	7
		Chrysotile: cement on hopper, hopper fibre	Not thoroughly encapsulated	7
Cottrell	Full time worker presence, at least 1 man	**Amosite:** Walls on **Crocidolite:**	Encapsulant recoat required	5/6/8

		South wall	Encapsulant recoat required	6
		Chrysotile: Hopper fibre/cement;	Not thoroughly encapsulated	2/3
		North wall 2nd floor;	Encapsulant recoat required	6/8
		Stairwell to 2nd floor	Encapsulant recoat required	4
		1st floor electrical room	Not thoroughly encapsulated	8
Roaster	Full time worker presence, at least 1 man	**Amosite:** Walls	Encapsulant recoat required	8
		Chrysotile: Walls	Encapsulant recoat required	6/8
		Stairway entry	Encapsulant recoat required	1
		Roaster #1	Not thoroughly encapsulated	5/6/8
		Roaster #2		5/6/8

*Refer to Section 5, Item 2 for priority rating description

6.0 RECOMMENDATIONS

1. Asbestos Removal

Asbestos should be removed from portions of the north and south walls on the 1st and 2nd floors (respectively) of the Roaster Building, from under the window on the 2nd floor of the Cottrell Building, and from around approximately 100' of pipe in the Contrell Building (1st floor/stairwell). The asbestos in these areas has come loose from the original structure either by damage or by wear. Loose material on walls can be saturated in place and then removed/bagged. Glove bags can be used to safely remove asbestos pipe coverings.

2. Encapsulation

Asbestos should be encapsulated or re-encapsulated in the remainder of each building, including all insulated outside and inside walls, stairwells, hoppers and exhaust systems. Every item with asbestos content should receive encapsulation.

AES Ltd. is recommending the following products used in succession (refer to Appendix B for data sheets on these products):

- **CHIL-ABATE CP-210**
  This product is applied as the first coat by low pressure, airless sprayer so as not to cause fibre release. Once applied, it will penetrate into the asbestos material to a depth of approximately ½ inch and effectively lock the fibres together. Any rock dust on the walls will be sealed in as well. The recommended application rate is 2 gallons per 100 square feet.

- **CHIL-CASE 215**
  This product is applied after CP-210, once again using low pressure airless spray equipment. Its purpose is to effectively bridge and encapsulate the asbestos to protect workers from asbestos fibres (by providing a layer of coating over all asbestos containing materials). The recommended application rate is 2 gallons per 100 square feet.

3. Asbestos Protection and Post-Encapsulation Maintenance

The following structures require major maintenance in the form of application of concrete to seal/reseal openings cut into asbestos concrete, or portions of structures that have fallen off or were removed. This often means sealing around the edges of openings for left for operating valves or maintenance ports. This work should be completed after encapsulation by Royal Oak Mines Inc. staff (who have performed well doing similar

work in the Baghouse and Cottrell Building hoppers), and using concrete that does not contain asbestos.

Baghouse Building: conveyor, hopper openings

Cottrell Building: Exhaust structure, hoppers, conveyors 1-2 and 3-4.

Roaster Building: roasters 1 and 2

The following walls and structures should be sheeted with plywood or covered with expanded metal once the encapsulation is complete. All of these walls showed signs of damage from personnel, tools, or general wear and tear from movements of personnel and materials.

Baghouse Building: bottom of hoppers, conveyor system

Cottrell Building: south east section of wall (Crocidolite), lower 8' of north west corner, stairwell to 2nd floor, exhaust system on lower east and west side where damage will otherwise constantly reoccur due to confined hallways (refer to photographs, Appendix C), bottom of hoppers, conveyors 1-2 and 3-4.

Roaster Building: Entry stairwell (entire section), corner wall at electrical room entry.

105-SK-026

May 11, 1993

Northwest Territories Municipal and Community Affairs

Larry Connell
Manager of Environmental & Metallurgical Services
Royal Oak Mines Inc.
2nd floor-1425 West Pender Street
Vancouver, B.C. V6G 2S3

Dear Mr. Connell:

Giant Minesite
Use of the B1 pit for disposal
Yellowknife, N.W.T.

The procedure for use of the B1 pit for the disposal of NON-HAZARDOUS WASTE materials has been reviewed, and approved in principle.

This approval is subject to the following conditions:

1) the disposal of waste into this pit will be carried out as per the procedure guidelines dated March 12, 1993, and drafted by Royal Oak Mines. Any amendments or changes to these guidelines are subject to the approval of this office in writing.

2) the management and disposal of asbestos and other hazardous materials shall be carried out in accordance with the attached guidelines, and under the notification of the groups listed on the attached contact list.

3) use of the pit shall not create an unsightly condition and/or be visible from the Ingraham Trail.

4) in consultation with Environment Canada, all structures shall be investigated for PCB contamination prior to the disposal.

Given the historical nature of some of the buildings, we would suggest that you consult with the City of Yellowknife Heritage Committee prior to carrying out your disposal program.

Periodical inspections will be carried out by officials of this Government to monitor the use of the B1 pit. The mine will be advised in advance of any inspections in this regard.

Should you have any questions or are uncertain if a material meets the criteria for disposal in the B1 pit, please contact this office at 873-7573.

Yours sincerely,

Leslie Huget
Manager, Land Operations
Lands Division

cc. Richard Zerr
Director, Planning and Lands
City of Yellowknife

Neill Thompson,
Manager, Land Protection
Pollution Control Division

Carey Ogilvie
Co-Chair
Commissioner's Land Review Committee

To: All Department Heads

From: Larry Connell

Date: March 12,1993

Subject: **Procedure for the Disposal of Waste Materials in the B1 Open Pit - Giant Minesite Abandonment & Restoration Plan**

Royal Oak has applied to the Northwest Territories Department of Municipal and Community Affairs for permission to use the B1 open pit as a disposal site for non hazardous waste materials generated through demolition of surplus buildings or the clean up of abandoned equipment or scrap metals that have no salvage value. Demolition and disposal of these materials and buildings during the mine's active life serves to reduce the economic liability at final abandonment.

The Northwest Territories Department of Municipal and Community Affairs have granted Royal Oak conditional approval for the use of the B1 open pit. The conditions attached to this approval are as follows:

1. Only non hazardous wastes are to be disposed of in the B1 open pit.

2. All materials which have held or have come into contact with contaminants should be washed prior to their disposal in the B1 pit. Only clean scrap metal should be discarded in this pit.

3. A list of items to be disposed of in the B1 open pit is to be provided to the Land's Division of the NWT Department of Municipal and Community Affairs prior to its use.

To ensure compliance with these conditions the following procedure is to be used when any department is planning to dispose of material in the B1 open pit.

A. No material may be disposed of in the B1 open pit without the prior authorization of the mine's environmental officer (Gary Halverson).

B. Building Disposal:
The following procedure should be used when a building is to be demolished and the debris disposed of in the B1 open pit:

- All external wall sheeting or insulating material containing asbestos must be removed prior to demolition and disposed of in an approved manner in the minesite's designated hazardous waste disposal site (consult with the mine's environmental officer before proceeding).

- All hazardous materials should be removed from the building prior to demolition and disposed of in an approved manner. Such materials may include chemicals, fuel, oils and lubricants, electrical transformers or capacitors which may contain PCB's, lead acid batteries, refrigeration or air conditioning systems which may contain CFC's, etc. The mine's environmental officer should be consulted if there are any doubts as to what constitutes a hazardous material or how it should be disposed of.

- All components of the building that have come into contact with hazardous materials should be washed to remove these contaminants prior to demolition and disposal in the B1 open pit.

C. Equipment or Scrap Metal Disposal:
The following procedure should be used when any piece of equipment or scrap metal demolished and the debris disposed of in the B1 open pit:

- All hazardous materials should be removed from the piece of equipment and discarded in an approved manner prior to the piece of equipment being disposed of in the B1 open pit. Such materials may include fuel, oils and lubricants, lead acid batteries, air conditioning systems which may contain CFC's, etc. The mine's environmental officer should be consulted if there are any doubts as to what constitutes a hazardous material or how it should be disposed of.

- All components of the piece of equipment or scrap metal that have come into contact with hazardous materials should be washed to remove these contaminants prior to disposal in the B1 open pit. For example pipe used in the milling process should have any contaminants washed from the pipe before it is disposed of in the B1 pit. If the contaminant cannot be removed then it must be considered a hazardous waste and alternate arrangements made for its disposal.

MINING-GEOLOGICAL MUSEUM for the NWT

Spirit YK is a nonprofit Yellowknife organization. It is our goal to try to save the Norths mining, geological and exploration history, when ever and where ever possible. We are currently working towards establishing a Mining-Geological Museum for the NWT. It would be located in Yellowknife.

We are trying to get the old Mine Rescue Building from the GNWT for a year round downtown museum. We are also exploring the possibilities of acquiring the old A Shaft Area at Giant Mine for possible underground tours, geological walks and as a site to display larger mining equipment. It would probably be operated seasonally. The A shaft area is just out of town, on the Ingram Trail and occupies a picturesque spot by the Back Bay of Great Slave Lake.

We want to create more than just a series of static displays. We want it to be interactive, educational and interesting. We want to display Mining and Geology in the North: past, present and future. We would also like to include a section on Oil and Gas, Diamonds, rock hounding and the geological potential and history of the north.

THE MINE RESCUE STATION

The old Mine Rescue Station is located in downtown Yellowknife within walking distance of the local hotels, the Visitors Center, City Hall, the Chamber of Mines and the Federal and Territorial geological divisions. The building has a history associated with Mining. Turning it into a museum, would save an old relic of a by gone era. We feel it would be a great location and good building for a Mining Geological Museum.

Such a museum would be a draw for tourists and could help foster rock-hound tourism (an as yet untapped form of tourism for the north). It would employ at least one full time and two part time people. It would be a focal point for the mining and geological industries in the north. It would be an educational resource for residents and students alike.

To build such a museum we need your support.

First we have to lobby the Territorial Government to give us the old Mine Rescue Station at a reasonable rate. Letters of support in this matter would be very helpful. We must also have a plan of action. Due to the governments timetable we have to make a pitch for the building by the end of January 1999.

We need seed money to get started and we also need pledges for financial support as the project develops. The Walter Gibbins Memorial Fund has pledged up to $5,000.00 to get things started and we would ask any Companies, mining or exploring in the NWT, to consider contributing. The size and scope of the museum will of course be determined by the amount of monies we can raise.

If you decide to contribute to the Spirit YK Museum Fund we would ask that you do so before January 30, 1999 so we will know how much monies are available to us. If contributions are better given in the new fiscal year, a pledge of support may be made for payment later. If for some reason the project does not fly, all monies will be returned to the contributors.

This project can be funded through a combination of private fund raising and through government grants. There are two sources of government funding we have identified, the GNWT Community Initiatives Program and the Federal Millenium Fund. Both could be applied for on April 1st 1999 and both require that the groups applying, have some seed money. They seem to require the groups have at least 20% of the costs of the project and the funds will contribute up to 80% of the costs (to various limits).

WHAT WE NEED

First off, we need letters from as many individuals, companies and organizations as possible supporting the idea of a geological-mining museum. We would also like support for using the old Mine Rescue Building and for the A Shaft area of Giant.

We need some seed money to develop our plans.

We need pledges of financial support for such a museum.

We will also need things to fill the museum, so would like pledges of mining equipment, artifacts or first rate geological specimens.

We also need people who are willing to work towards making such a museum a reality. You may also have some great ideas we have not thought of yet.

For years, people have talked about establishing a Mining-Geological Museum for the NWT, we feel it is time to make it happen and with your help maybe it will.

Sincerely,

Walt Humphries for Spirit YK 873-5486

Merlin Williams president Spirit YK 873-~~4676~~ 5150

Mike Piro member Spirit YK 873-~~5150~~ 4676

Spirit YK Museum Fund
C/o NWT Chamber of Mines
4910-50th Avenue
Yellowknife NT X1A 2R1
Phone (867) 873-5281
Fax (867) 920-2145

To: JOE HANDLEY Deputy Minister RWED
MARK CLEVELAND Deputy Minister Education, Culture and Employment
GNWT

From: Walt Humphries
P.O. Box 1856
Yellowknife, NT
X1A 2P4

Gentlemen, Dec.11, 1998

Spirit YK recently held a meeting with Mr. Rattray of Department of Public Works. We are trying to acquire the old Mine Rescue Building in order to turn it into a Mining-Geological Museum for the NWT.

Mr. Rattray suggested that your departments might be interested in helping to sponsor us in this endeavor. We understand that the GNWT will be looking at disposing of the building in some fashion at the end of January 1999 and we feel both for historic reasons and for its location it would be ideally suited for a museum. We are currently canvassing our membership and the mining geological community for moral and financial support.

We would appreciate any help or consideration your departments could offer us in this regard.

Unfortunately I will be out of town until Dec. 28 but you can contact Mr.Williams or Mr.Piro in this regard or if you have any questions or advice for us.

Sincerely,

Walt Humphries, Spirit YK 873-5486

Mr. Merlin Williams, Spirit YK 873-5150

Mr. Mike Piro, Spirit YK 873-4676

We can also be reached through the NWT Chamber of Mines

TO: Mr. Bruce Rattray
Deputy Minister
Department of Public Works
Government of the Northwest Territories

FROM: Walt Humphries
Spirit YK
873-5486
Dec. 3, 1998

Concerning: Old Mine Rescue Building

Dear Mr. Rattray,

Spirit YK is a Yellowknife based organization that over the years has tried to save old mining equipment and artifacts from being destroyed.

We are currently working at establishing a "MINING and GEOLOGICAL MUSEUM for the NWT" here in Yellowknife.

The Old Mine Rescue Building would be an ideal building for such an endeavor. It is centrally located, it is a historic building and it has a mining history. We feel such a museum would be quite an asset for the city and for the Territories.

We envision more then just a building filled with static displays. We hope it would become a focal point for the Mining and Geological Communities in the NWT and a place where they could interact with the public at large and visitors and tourists to the north. The museum would be actively engaged at documenting, salvaging and restoring this aspect of the history of the NWT. It would also be encouraging "rockhounds" to visit the NWT as another as yet untapped form of tourism and it would also encourage Northerners to get into the mineral specimen trade. Students would also be encouraged to visit and learn about the NWT's mining history and geological potential.

We would like to discuss acquiring and/or purchasing the Old Mine Rescue Building from the GNWT, for the purpose of turning it into such a museum. Please contact one of us at your convenience. Thank-you.

Sincerely,

Walt Humphries or Mike Piro or Merlyn Williams
Box 1856 873-4676 873-5150
Yellowknife NWT
X1A 2P4
(873-5486)

Member's Statement 212-13(6): Proposal for a Yellowknife Mining Museum

MR. OOTES: Thank you, Mr. Speaker. Two weeks ago, about 20 people attended a meeting of an organization known as Spirit YK to review the question of, does Yellowknife need or want a mining museum? The answer among those who attended was a yes. Such a museum is long overdue, especially if one considers the role of mining and exploration that they have played in the history of the city and of the Northwest Territories. This city really does need a place where visitors, residents and school children can learn about the varied and colourful history of mining in the north. Yellowknife was born from a mining boom and mining continues to be a major part of our existence. This is true not only for Yellowknife, but for the whole of the Northwest Territories.

In a statement I made back in February, 1998, I suggested the Department of Education, Culture and Employment initiate discussions with Spirit YK members. The idea of a mining museum is good. Everyone, tourists and residents alike, are curious to know and learn more about mining. The popularity of activities during mining week certainly attest to this. Now that diamond mining has started in the Northwest Territories, we have yet another exciting opportunity to show and tell others about our mining activity and history. There are several ideas of where to locate a mining museum. The old mine rescue building is one location. Another idea is to develop a museum out at Giant Mine.

Everyone agrees the museum needs to be interactive. That is what people want. They want to experience, first-hand, underground tunnels and the smell and feel of fresh-cut rock. People also agree that, if funding permits, the museum should focus not just on Yellowknife's mining history, but also cover mining ventures in other parts of the Northwest Territories.

Mining is such a huge part of the north's history. It is a shame we do not yet have the interactive type of museum Spirit YK talks about. It is high time we got started on a mining museum. Already we have 20 interested people willing to spearhead the task and I would urge our government to show its support.

Thank you, Mr. Speaker.

MINING - GEOLOGICAL MUSEUM

Spirit YK recently hosted a meeting on Nov. 17 1998, to discuss the question "Does Yellowknife need or want a MINING – GEOLOGICAL MUSEUM?" The answer among those in attendance was "Yes, such a museum would be an asset to the City and is long overdue, especially if one considers the role mining and exploration have played in the history of the city and the NWT"

Several aspects of such a project were discussed. It was felt the museum should try to cover the entire history of Mining in the NWT, with some emphasis on Yellowknife since that is where it would be located. It should be interactive wherever possible. It should be entertaining and educational as well. It would be a resource center for tourists, visitors, school kids and residents.

The following is a list of features such a museum could include: outdoor displays, indoor displays, a collection of rocks and minerals including ore samples from each of the NWT mines, the history of exploration in the NWT, information on all the mines in the NWT past and present, geological walks and the underground experience. It was also felt that the museum could include pieces about the colorful characters and flavor of the industry representing NWT's history.

How to proceed with such a project was discussed. It was felt possible funding sources might be available or sought through the Millenium Fund, the Community Initiatives Program, from the Department of Parks and Tourism, from other government programs, as well as from the mining industry, the public, and the City of Yellowknife.

Two possible sites were discussed.

First is the old Mine Rescue Station owned by the GNWT. It is centrally located downtown within walking distance to other Yellowknife attractions, hotels and geological related offices and organizations such as the Mining Recorders Office, Chamber of Mines, DIAND NWT Geology Division Archives, Minerals Oil and Gas Division of RWED. The Mine Rescue station already has a history associated with mining and it is a building which represents Yellowknifes heritage. It would need some renovation and upgrading, and it has

meter parking along the streets. Two garage doors would allow access for equipment in and out. If the building did become available, it was felt it could be turned into a small museum fairly quickly.

The second site is on Royal Oaks Giant Mine Property, around the "A SHAFT". This site is a few miles out of town, but it is a picturesque site near the lakeshore. It would allow for large outdoor displays of mining equipment and a geological tour of the Yellowknife Volcanic Section. There are a couple old buildings on the site, which could be utilized and a new building could be erected. It would allow for a larger museum with the intent of including an interactive underground tour down the A-shaft. This is a more costly and ambitious undertaking, but one we would like to pursue as well.

One could make an argument for either site or to use the two together.

One suggestion, which has some merit, would be to start with The Mine Rescue building. It could be turned fairly quickly into a small downtown Mining and Geological Museum. Then as larger funds become available the Giant A Shaft Site could be developed and turned into the larger Mining Museum. The Mine Rescue Station would remain as a satellite or Geological Museum. It would be a focal point for activities "in town" while the Giant Site would become the Mining Museum. The Mine Rescue would be run year round while the larger museum might only be run during the summer months.

Currently Spirit YK is investigating the availability of these sites and others, and looking for possible sources of financing. If you could be of any assistance in this regard Spirit YK would appreciate your help, ideas or support. Spirit Yk plans to have the next meeting in early December.

For further information contact:

Walt Humphries 873-5486 (member Spirit YK)

Merlyn Williams 873-5150 (pres. Spirit YK)

NWT Chamber of Mines 873-5281

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Golder Associates

REPORT ON

NORTHWEST TERRITORIES WATERBOARD
OCT - 9 1998
YELLOWKNIFE, N.W.T.

1998 GEOTECHNICAL INSPECTION OF GIANT MINE TAILINGS DAMS YELLOWKNIFE, N.W.T.

Submitted to:

Royal Oak Mines Inc.
Yellowknife, N.W.T.

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Royal Oak Mines Inc.
c/o Giant Mine, Highway #4
P. O. Bag 3000
Yellowknife, N.W.T.
X1A 2M2

Attention: Mr. Stephen Schultz
Superintendent - Environmental Services

RE: 1998 INSPECTION REPORT - GIANT MINE TAILINGS CONTAINMENT DAMS

Dear Sir:

Herewith following is the above-captioned report, which covers the results of inspections made by the writer in the company of Mr. Stephen Schultz. These inspections were made on June 17, 19 and 20, 1998, and comprised examination of dams associated with both the Original Tailings Area, the Northwest Tailings Area, and the B-2 Pit dam.

This report should be read in conjunction with prior annual inspection reports on the same works prepared by Mr. Matich (MAJM Corporation/Geocon for 1992 and prior years) and by the undersigned (1993 to 1997 inspections). Reference to these reports will preserve continuity of comment to the maximum extent possible.

Finally, this inspection by a representative of Golder Associates Ltd. does not constitute an assumption of responsibility concerning assured performance of the structures examined, nor of the adequacy of their design or construction.

Yours truly,

GOLDER ASSOCIATES LTD.

PROFESSIONAL ENGINEERS
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THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
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TABLE OF CONTENTS

SECTION **PAGE**

1.0 INTRODUCTION 1
2.0 BACKGROUND AND SYSTEM OPERATION 2
3.0 ORIGINAL TAILINGS AREA 5
4.0 NORTHWEST TAILINGS AREA 6
5.0 SUMMARY OF CONCLUSIONS 7
5.1 Original Tailings Area Dams 7
5.2 Northwest Tailings Area 7
5.3 Other Dams 9
DAM 1 (Original Tailings Area) 10
DAM 2 (Original Tailings Area) 11
DAM 3 (Original Tailings Area) 12
DAM 3C (Original Tailings Area) 13
DAM 3D (Original Tailings Area) 14
DYKE 4 (Original Tailings Area) 15
DYKE 5 (Original Tailings Area) 16
DYKE 6 (Original Tailings Area) 17
DAM 7 (Original Tailings Area) 18
DAM 8 (Original Tailings Area) 19
DAM 9 (Original Tailings Area) 20
DAM 10 (Original Tailings Area) 21
DAM 11 (Original Tailings Area) 22
DAM 12 (Original Tailings Area) 24
SETTLING POND DYKE (Original Tailings Area) 25
DAM 21A (Northwest Tailings Area) 26
DAM 21B (Northwest Tailings Area) 27
DAM 21C (Northwest Tailings Area) 28
DAM 21D (Northwest Tailings Area) 29
DAM 22A (Northwest Tailings Area) 31
DAM 22B (Northwest Tailings Area) 32

FIGURES

Figure 1	Giant Mine Site Plan
Figure 2	Dam 1 Photographs
Figure 3	Dam 3 Photographs
Figure 4	Dam 7 and Dam 8 Photographs
Figure 5	Dam 11 Photographs
Figure 6	Seepage Pump Operating Hours Plot - Dam 11
Figure 7	Dam 21A Photographs
Figure 8	Dam 21B and 21C Photographs
Figure 9	Dam 21D Photographs
Figure 10	Dam 22A Photographs
Figure 11	Dam 22B Photographs
Figure 12	Dam 22B Photographs
Figure 13	Seepage Pump Operating Hours Plot - Dam 22B

APPENDICES

Appendix I	Maintenance Items Field Memo

1.0 INTRODUCTION

Giant Mine, owned and operated by Royal Oak Mines Inc., is located just north of Yellowknife. Royal Oak's NWT Water License (NIL2-0043) for this mine requires that the tailings containment area (TCA) be inspected annually by a qualified geotechnical engineer. As such, Mr. S. Schultz, Environmental Superintendent for Royal Oak, requested that Golder Associates Ltd. conduct an inspection of the tailing dams at Giant Mine. A proposal to conduct this inspection, dated 19 May 1998, was submitted and Purchase Order No. 163705 was issued to Golder Associates to proceed with the work.

This inspection and the preparation of a report are required in partial satisfaction of Giant Mine's Water Licence obligations. Other conditions in the Water Licence that apply to the annual inspection are as follows:

- a minimum freeboard limit of 0.5 m should be maintained at all times,
- any erosion of the facilities should be rectified immediately and
- the inspection report should be forwarded to the Water Board within 60 days of the inspection date.

The objectives of the inspection are to visually assess the performance of the water retaining dams from a geotechnical perspective and to bring deficiencies and points of concern to Royal Oak's attention.

The subject inspection was made during the afternoon of June 17, all day on June 19 and during the morning of June 20, 1998. The inspection was undertaken in the company of Mr. Stephen Schultz of Royal Oak on the 19th and 20th. Climatic conditions for the inspection duration included temperatures around 15°C, clear skies and no major precipitation events during the period. Some precipitation had fallen during the previous weekend (June 16/17).

Following the inspection tour, a Field Memo summarising required maintenance for the tailings dams was faxed to Royal Oak on 24 June 1998; a copy is attached in Appendix I.

2.0 BACKGROUND AND SYSTEM OPERATION

Information concerning tailings deposition history is beyond the scope of this report. However, it is believed that the Original Tailings Area, consisting of the South, Central and North Ponds shown in Figure 1, evolved cell by cell over a long period of time. As it was filled to its ultimate capacity, the Northwest Tailings Area was built for ongoing storage. Several years ago, a portion of the tailings in the North Pond of the Original Tailings Area was reprocessed and it is understood that these tailings were consigned to the Northwest Tailings Area.

At the time of the inspection this year, tailings was being consigned to the Northwest Tailings Area, for beach building from Dam 21C, and it is only during periods when the delivery line is down that tailings has been consigned to the Original Tailings Area. During the past year, deposition areas have been at various locations around the periphery of the Northwest Tailings Area, as detailed in Table 1:

Table 1: Summary of Production Tonnages and Discharge Locations

Month / Year	Ore Milled (tonnes)	Location of Tailings Discharge
Aug-97	31,448	NW Pond - Dam 21A
Sep-97	30,977	NW Pond - Dam 21B/C
Oct-97	29,199	NW Pond - Dam 21B/C
Nov-97	26,747	NW Pond - Dam 21B/C
Dec-97	30,404	NW Pond - Dam 21B/C
Jan-98	28,716	NW Pond - Dam 21B/C
Feb-98	26,988	NW Pond - Dam 21B/C
Mar-98	29,611	NW Pond - Dam 21B/C
Apr-98	25,980	NW Pond - Dam 21B/C
May-98	26,416	NW Pond - Dam 21B/C
Jun-98	24,198	NW Pond - Dam 21C

Within the past year, major beach building has been accomplished against Dams 21B and 21C. It should also be noted that Royal Oak is proposing to utilise some existing capacity within the South Pond (Royal Oak letter to the NWT Water Board dated 30 June, 1998), and hence, tailings deposition from Dam 11 will be undertaken during the latter portion of 1998. Supernatant water is to be conveyed by pipeline to the North Pond (downstream of Dyke 6) before being pumped to the

Environmental Treatment Plant (ETP). The data from Table 1 also indicates that Giant Mine's production level averaged slightly less than 1000 tonnes/day.

Tailings transport water that accumulates is returned to the ETP for initial treatment. It is then discharged to the Settling Pond, where from it seeps to the Polishing Pond for ageing. It is decanted from the Polishing Pond for final processing at the carbon columns enroute to being released to the environment. This process of water return from the Northwest Tailings Area for treatment and release begins only after spring break-up. Hence, the maximum water level in the Northwest Tailings Area is reached each spring, and the minimum level occurs at the end of the period of pumping from the area. Table 2 provides a summary of the water levels for the various ponds, over the past year:

Table 2: Summary of Tailings Basin Water Levels

Month / Year	Northwest Pond Water Elevation (ft.)	North Pond Water Elevation (ft.)	Polishing Pond Water Elevation (ft.)
Aug-97	6088.8		
Sep-97	6084.2		
Oct-97	6083.8		
Nov-97	6084.5		
Dec-97	6088.7		
Jan-98	6091.5		
Feb-98	6093.2		
Mar-98	6094.0		
Apr-98	6095.9		
May-98	6095.6	6037.9	6035.5
Jun-98	6094.9	6038.5	6034.2

In general agreement with previous years observations, the lowest water level in the Northwest Pond occurred last October and the highest level occurred in April of this year. The water level in the North Pond rose slightly as a consequence of discharging some tailings behind Dyke 6 and the excess water reporting to the North Pond. It should be noted that the maximum recommended water level (by Fred Matich, P.Eng.) for the North Pond was set at 6037 ft. Hence, according to the data in Table 2, the North Pond level has exceeded the recommended level by 1.5 ft. and reduction in the level is recommended.

Table 3 provides a yearly comparison of pond levels, for the months of September and June:

Table 3: Comparison of Yearly Northwest Pond Water Levels since 1990

Year	September Elevation[1] (ft.)	June Elevation (ft.)
1990-91	6085.0	6095.6
1991-92	6082.2	6095.2
1992-93	6081.6	6094.6
1993-94	6074.5	6093.1
1994-95	6074.8	6094.6
1995-96	6082.5	6096.7
1996-97	6081.5	6094.5
1997-98	6084.2	6094.9

The water level in the Northwest Tailings pond in June was 6094.9 ft., which is approximately the same level as last year.

[1] Referenced to mine datum in feet.

3.0 ORIGINAL TAILINGS AREA

This area comprises three sub-basin storage areas, viz. the South Pond, the Central Pond, and the North Pond as shown on Figure 1. They form a cascade with the divisions being described by internal retaining dykes and the perimeter by retaining dams to the extent required to close off topographic lows to design elevation of the individual ponds involved.

In that emerging seepage is potentially beyond discharge licence limits, provision has been made for its containment and recovery. All seepage water is returned to the system for routing to central discharge.

Referring to Figure 1, the internal dykes are labelled as Dykes 4, 5, and 6. The perimeter dams are labelled as Dams 2, 3, 9, 10, 11 and 12. The seepage collection dams are labelled Dams 3C, 3D, and 7. Decant water was traditionally routed through a small concrete structure in Dam 2 from which it flowed to the Polishing Pond formed by Dam 1. A pump is now used to convey ponded water over Dam 2 to the ETP. Several years ago the Polishing Pond was partitioned by building the Settling Pond Dyke to improve capture of suspended solids and to better manage the chemistry of the waters.

Each of the dams noted above will be separately discussed in numerical order, concluding with the Settling Pond dyke. A standard format presentation is employed and reference is made to site photographs presented in the Figures 2 - 13 of this report.

4.0 NORTHWEST TAILINGS AREA

The Northwest Tailings Area is described by about 5000 ft of constructed dam sub-identified as Dams 21A, 21B, 21C, 21D, 22A, and 22B. The remainder of the perimeter of this 85 (approx.) acre area is described by bedrock highs as shown on Figure 1. The dams are of zoned fill construction, the principal zones comprising core material supported by quarried rock shells.

The tailings area is being exploited as planned whereby beach deposition upstream of the dams is intended to promote a low phreatic line from beach edge, thereby reducing seepage gradient through the dams, and thus seepage quantities. Beach deposition requires large volumes of material and, as of the 1998 inspection, the tailings deposited upstream of Dams 21B and 21C has formed high elevation beach. Relatively speaking, the lowest beach elevations are now those along the north end of Dam 21D.

General operation of the area is understood to consist of deposition of beach as a primary goal of operation with return of clarified water taking place only during the summer and fall. As such, the width of the beach diminishes as the pond area annually fills with water, the beach becoming almost submerged in some areas. As well, beach construction must take place while pond water level is high otherwise the beach deposits will be inundated by later, higher pond water levels.

At the time of the inspection, the tailings stream was being directed to the Dam 21C beach area.

Each of the dams noted above is separately discussed in numerical order; the standard format presentation sheets follow those relating to discussion of the Original Tailings Area dams.

5.0 SUMMARY OF CONCLUSIONS

5.1 Original Tailings Area Dams

On the basis of the geotechnical inspection of the dams associated with the Original Tailings Area, it has been concluded that all of the dams are performing acceptably in terms of their current function but that some attention to instrumentation and water level control will serve to better-demonstrate geotechnical performance and avoid embankment deterioration. These items of recommended work and management practice are as follows:

- The 30 to 50 m long crest (western portion) crack and the upstream erosional gullies on the upstream side of Dam 2 should be repaired to prevent further erosion from occurring;
- Backfill the three small sinkholes on the crest of Dam 3 and grade entire crest to prevent water ponding on the crest;
- Two small sinkholes on the crest of Dyke 5 should be graded over;
- The stability of Dyke 6 is marginal and should not be used to retain any water;
- Perform final repairs to the backslope of Dam 8 by further addition of mine waste between the existing backslope and the shoulder of the adjacent road;
- Grading of the southern portion of Dam 10 crest should be undertaken;
- Thermistor data for Dam 11 is recorded monthly for monitoring purposes, but a formal plan for review of that data needs to be developed. Plans should be initiated for checking the function of installed piezometers in Dam 11 and for systematically recording and reviewing obtained data. This data will be valuable when evaluating the dam performance in light of its value in planning for abandonment.

5.2 Northwest Tailings Area

On the basis of the geotechnical inspection of the dams associated with the Northwest Tailings Area, it has been concluded that:

- On a visual assessment basis, all of the dams appear to be performing safely;
- In view of likely future high water levels, raising of final beach levels to above freeboard limit will be of value in reducing seepage for Dams 21A, 21B, 21C, and 21D;
- Performance of Dam 21D will be better-understood when information to be gained from foundation investigation, an instrumentation program and monitoring of a suite of surface movement monuments is consolidated and made available for review. This item should be given serious consideration this year based on the longitudinal cracking which was noted.
- Three sinkholes located in the crest of Dam 21D should be backfilled, preferably with some soil/bentonite mixture, to prevent the infiltration of surface water into the dam.
- When discharging tailings for beach building, the discharge point should be situated far enough out on the beach to prevent any erosion to the upstream side of the dam and to prevent any transport water from flowing back up against the face (such as occurred at Dam 21C during the inspection). Additionally, when discharging any pump-back water to the upstream side (such as occurred on Dam 22B), care should be taken to ensure this water runs away from the face and does not pond against the rockfill or flow back into the shell zone of the dam.
- The seepage pond at return pump at Dam 22B must be monitored on a weekly basis to record pumping volume (extend hours times discharge rate) vs. time; a V-notch weir and staff gauge are recommended as a physical check on a major portion of the toe seepage.
- Prioritisation of additional beach construction should be in the order of Dam 21D, Dam 21C, Dam 21A, Dam 22A and Dam 21B.

5.3 Other Dams

A dam known as "B-2 Dam" adjacent to the north side of B-2 Pit prevents Baker Creek from flooding the pit and underground works accessed from the pit. On the basis of this year's site inspection, the dam is concluded to be in good condition, although the previously noted minor crest-parallel and crest-perpendicular cracking of the pit-side shell and crest are still apparent. Under normal creek flow conditions, almost no head is imposed upon the dam. A sump is located below the dam, adjacent to the portal entrance. No pump was installed in the sump, but piping is in place for the pump back of water, if required.

As noted in previous inspection reports, any plan to steepen the pit wall immediately behind the dam should not be permitted pending review of data which would afford a better appreciation of the dam's integrity and its response to blasting accelerations.

DAM 1 (Original Tailings Area)

LOCATION: West end of Polishing Pond; see Figure 1.

FUNCTION: Retains Polishing Pond; contains Giant Mine's principal decant to environment.

LENGTH: +/- 900 ft. **MAX HEIGHT:** +/-30 ft est.

CREST WIDTH AND CONDITION: Exceeds 50 ft due to post-construction (1996) upstream face dumping of seepage-sealing materials and placement of riprap; condition is good. No evidence of continued cracking at edge of propane truck turnaround (Figure 2A). Inactive cracking observed just downstream of concrete decant tower. Slight cracking on upstream crest edge (Figure 2B).

RIPRAP: Riprap extends from the north end to near the south (unused) concrete decant tower (see Figure 2); condition is good. No concern expressed related to slight upstream cracking at this time, except to lower water level (see below).

BACKSLOPE: Two berms for stability reasons; no evidence of active cracking but some remnants of aged (prior years) cracking, condition good. The upper stability berm at the north end of the dam has been partially filled to facilitate turning of propane-service trucks.

TOE AREA WATER: Small seepage collection pond located near north end of dam, at the first berm level below the crest; no pump currently installed. No seepage noted on cut ramp, which leads down to the floor of the B3 pit; seepage had been noted here previously. Remedial work done in 1996 was effective in reducing seepage.

MAINTENANCE RECOMMENDATIONS: None required.

CONCLUSIONS: The dam appears in good condition with none to very little seepage passing through or beneath the dam. Pond water level appears high; at least 0.5 m freeboard is required by license but, operationally, one metre of freeboard is recommended to accommodate natural runoff and for operational emergencies.

DAM 2 (Original Tailings Area)

LOCATION: North boundary of North Pond; see Figure 1.

FUNCTION: Previously retained tailings and water; currently minor (partially dismantled in 1991 to supply materials for other construction); retained head reference pond surface vs. Settling Pond water level is only a few feet.

LENGTH: +/- 1200 ft **MAX HEIGHT:** +/-40 ft (est.)

CREST WIDTH AND CONDITION: Old cracks situated near upstream side of crest (western portion) appear to be reactivating. Small sinkholes and surface depressions are now formed in association with the cracking.

RIPRAP: None; central portion of the upstream slope has been dozed toward the water line and the upstream slope is gentle. Note that several significant erosional gullies have been formed on the upstream side; two near the middle of the dam where water has been discharged and two at the west abutment where a leak in the tailings line has occurred.

BACKSLOPE: Variable, partially dismantled, no evidence of deficient performance, area used for temporary stockpiling of waste rock.

TOE AREA WATER: No seepage was seen at downstream toe road level.

MAINTENANCE RECOMMENDATIONS: Small sinkholes and active cracking on upstream side of crest (western portion) should be backfilled / graded over to prevent further infiltration of surface water. Several erosional gullies on the upstream side should be repaired to prevent further erosion from occurring. Pond water must be lowered to recommended level of 6037 ft.

CONCLUSIONS: The dam appears safe respecting its current function; future reconstruction must be based on careful assessments and attention to construction detail.

DAM 3 (Original Tailings Area)

LOCATION: Describes northeast perimeter of North Pond; see Figure 1.

FUNCTION: Retains dry tailings surface (tailings mass water table not known); mass may be substantially frozen.

LENGTH: +/- 1500 ft **MAX HEIGHT:** +/-50 ft (est.)

CREST WIDTH AND CONDITION: Variable to about 35 ft; crest condition is good, (see Figure 3A); three small sinkholes / settlement troughs on crest should be backfilled. The west abutment area must be rehabilitated in conjunction with reconstruction of Dam 2.

RIPRAP: No riprap; dry tailings surface upstream of crest.

BACKSLOPE: Approx. 1.5H:1V with toe berm(s) below.

TOE AREA WATER: Very little reports to Dam 3C and Dam 3D; both equipped for return pumping if needed. No seepage noted at Dam 3D. See Dam 3C and Dam 3D discussions for further details.

MAINTENANCE RECOMMENDATIONS: Sinkholes and small settlement troughs, near curve in dam, to be backfilled / graded over. Pronounced depression on the upstream side of the crest should also be graded to prevent surface water ponding. The west abutment area must be rehabilitated in conjunction with reconstruction of Dam 2.

CONCLUSIONS: The dam is in good condition with very little seepage passing through or beneath the dam.

DAM 3C (Original Tailings Area)

LOCATION: North of west limb of Dam 3; (see Figure 1)

FUNCTION: Low fill to create seepage collection pond for return pumping.

LENGTH: +/- 150 ft **MAX HEIGHT:** +/-5 ft (est.)

CREST WIDTH AND CONDITION: Variable to about 10 ft; crest condition is good.

RIPRAP: No riprap; upstream slope of dam heavily vegetated.

BACKSLOPE: Shallow slope, low height, vegetated with grass and small shrubs.

TOE AREA WATER: Heavy, green growth downstream suggests extra (perhaps nutrient-carrying) moisture available to the plants due to seepage; no overflow across the crest of the dam. No pumping apparatus in place.

MAINTENANCE RECOMMENDATIONS: No maintenance required.

CONCLUSIONS: The dam is performing its function well.

DAM 3D (Original Tailings Area)

LOCATION: East of east limb of Dam 3; (see Figure 1)

FUNCTION: For return of seepage by pumping; consists of an earthfill dam paralleling the downstream toe of the east limb of Dam 3 and a bedrock-founded, free-standing, counterforted concrete wall positioned farther downslope again to create a final seepage collection pond.

LENGTH: +/- 100 ft **MAX HEIGHT:** +/-10 ft (est.)

CREST WIDTH AND CONDITION: Earthfill section appears good; concrete wall condition appears good.

RIPRAP: Not required on earthfill; concrete dam- not applicable.

BACKSLOPE: Earthfill dam backslope in good condition, near-vertical concrete wall with counterforts- good condition.

TOE AREA WATER: No retained water observed behind the concrete wall. Contrary to conditions observed by previous inspections, there is no wetness of the south wall of the gully downstream of the concrete wall dam. Dryness appears to have been progressing since 1994 inspection.

MAINTENANCE RECOMMENDATIONS: No maintenance required.

CONCLUSIONS: The dams (earthfill dam and concrete wall dam) appear capable of handling a seepage collection function well.

DYKE 4 (Original Tailings Area)

LOCATION: West part of north boundary of South Pond; see Figure 1.

FUNCTION: Division between South Pond and Central Pond; sideslopes almost fully inundated by tailings both upstream and downstream, currently functions as a roadway. Occasionally, tailings and site water discharged just downstream of the west abutment of Dyke 4 into the Dyke 6 "canyon".

LENGTH: +/- 250 ft. **MAX HEIGHT:** +/-6 ft above tailings.

CREST WIDTH AND CONDITION: Functions as roadway; no depth of water retained. Some inactive cracking near the centre and upstream edge of the crest.

RIPRAP: Roadway only, waste material face retains no depth of water.

BACKSLOPE: Waste material.

TOE AREA WATER: Dyke is redundant and mostly buried in tailings; while groundwater flow through its section is likely, none would come to surface.

MAINTENANCE RECOMMENDATIONS: Roadway only, no maintenance required because structure no longer functioning as a dyke.

CONCLUSIONS: The structure's function as a dyke has expired as a consequence of the high level of Central Pond tailings on its downstream side.

DYKE 5 (Original Tailings Area)

LOCATION: East part of north boundary of South Pond; see Figure 1.

FUNCTION: Division between South Pond and Central Pond; sideslopes almost fully inundated by tailings both upstream and downstream; a shallow pond is present upstream of the east limb of the dyke.

LENGTH: +/- 450 ft. **MAX HEIGHT:** +/-6 ft above tailings.

CREST WIDTH AND CONDITION: Functions as roadway; typically no depth of water retained. Inactive cracks noted. Two small sinkholes noted near the upstream side of the crest still need to be repaired.

RIPRAP: Roadway only, waste material face adequate for possible riprap function.

BACKSLOPE: Waste material.

TOE AREA WATER: Dyke is redundant and mostly buried in tailings.

MAINTENANCE RECOMMENDATIONS: Small sinkholes on crest should be graded over.

CONCLUSIONS: The structure's function as a dyke has expired as a consequence of the high level of Central Pond tailings on its downstream side. Proposed South Pond deposition for 1998 will increase the level of ponded water on the upstream side. Royal Oak also indicates that a decant pipe will be placed through Dyke 5 to convey accumulated water to the North Pond.

DYKE 6 (Original Tailings Area)

LOCATION: North boundary of Central Pond; see Figure 1.

FUNCTION: Recently reconstructed from prior breached conditions; function appears to be to aid in exploiting tailings storage in erosional "canyon", formed south of Dyke 6. Reinstatement construction appears to comprise only rockfill placed over and mixed with tailings. Decant pipe also installed through the dyke section to convey water.

LENGTH: +/- 800 ft. **MAX HEIGHT:** +/- 40 ft.

CREST WIDTH AND CONDITION: Reinstatement material has caused tailings solids be retained behind Dyke 6 once again. Water is seeping under the dyke. East abutment had eroded during the recent reconstruction of the dyke; now regraded.

RIPRAP: No formal rip rap placement; only various zones of crest rockfill over tailings material.

BACKSLOPE: Formed of waste rock. Numerous bulges in the underlying tailings foundation material indicate only marginal stability.

TOE AREA WATER: Dam is pervious (rockfill); subsurface seepage would be to the north into the North Pond during periods of tailings deposition into the "canyon" in the Central Pond. Seepage water as noted above.

MAINTENANCE RECOMMENDATIONS: Structure should not be used for water retaining. Proper reconstruction required, if dyke required in the future.

CONCLUSIONS: The structure, previously destroyed over part of its length as a consequence of tailings reclaim in the North pond, has been again reconstructed. Observations and stability analyses indicate marginal stability when retaining any head of water (Golder Associates letter of 25 June 1998). Dyke 6 should not be used to retain water.

DAM 7 (Original Tailings Area)

LOCATION: Beyond west boundary (Dam 11) of South Pond; see Figure 1.

FUNCTION: Retains seepage from Dam 11 for return to tailings area by pumping.

LENGTH: +/- 50 ft **MAX HEIGHT:** +/-8 ft (est.)

CREST WIDTH AND CONDITION: Dozer-blade width; capped with waste rock; no apparent change from prior inspections, good condition (see Figure 4A).

RIPRAP: Incidental as a consequence of section improvements using waste rock.

BACKSLOPE: General condition is good.

TOE AREA WATER: No evidence of seepage issuing downstream; seepage return pumping must be maintained to prevent discharge via the spillway.

MAINTENANCE RECOMMENDATIONS: No embankment maintenance required; seepage return pump quantity to be monitored on a weekly basis.

CONCLUSIONS: The dam appears in satisfactory condition.

DAM 8 (Original Tailings Area)

LOCATION: West side of Central Pond; see Figure 1.

FUNCTION: Typically retains dry tailings associated with the Central Pond deposit.

LENGTH: +/- 250 ft **MAX HEIGHT:** +/-10 ft (est.)

CREST WIDTH AND CONDITION: Broad crest; untravelled since last inspection; inactive downstream crest-edge cracking visible; central portion of crest is in good condition.

RIPRAP: Appears to have been dressed with waste rock.

BACKSLOPE: Steep ramp cut into backslope has caused local cracking of the crest edge (see Figure 4B).

TOE AREA WATER: Downstream toe area dry; no dampness found on west side of haul road opposite the dam; seepage performance concluded to be acceptable.

MAINTENANCE RECOMMENDATIONS: Additional fill is required to partially backfill the backslope ramp, followed by general smoothing of the backslope. Regrade the crest of the dam on completion.

CONCLUSIONS: The dam is currently capable of fulfilling its function but the noted maintenance would satisfactorily complete the required work.

DAM 9 (Original Tailings Area)

LOCATION: Southwest extension from east abutment of Dyke 6; see Figure 1.

FUNCTION: Retains dry tailings.

LENGTH: +/- 250 ft **MAX HEIGHT:** +/-35 ft (est.)

CREST WIDTH AND CONDITION: Broad crest that carries roadway leading from Dyke 5; one 20 m long crack near north end.

RIPRAP: No specific requirement; retains dry tailings.

BACKSLOPE: Approx. 2H:1V (variable) and benched at mid-height.

TOE AREA WATER: None seen and retained dry tailings suggests little reason for seepage to be present.

MAINTENANCE RECOMMENDATIONS: No maintenance required.

CONCLUSIONS: The dam is in satisfactory condition.

DAM 10 (Original Tailings Area)

LOCATION: Northeast extension from east abutment of Dyke 6; see Figure 1.

FUNCTION: Originally to retain tailings; reclaim of tailings from North Pond has promoted drainage of water from tailings in the local area.

LENGTH: +/- 200 ft **MAX HEIGHT:** +/-15 ft (est.)

CREST WIDTH AND CONDITION: Broad crest of clayey material, partially dressed with waste rock. Shallow depression in crest at south end.

RIPRAP: Incidental waste rock cover at northeast end, otherwise none exposed.

BACKSLOPE: Approx. 2H:1V and variable.

TOE AREA WATER: Conditions for seepage not present; upstream area is dry and surface drainage is to the northwest away from the dam.

MAINTENANCE RECOMMENDATIONS: Grade shallow depression in crest near south end (Dyke 6) to prevent concentration of surface water runoff.

CONCLUSIONS: The dam is in good condition.

DAM 11 (Original Tailings Area)

LOCATION: Describes the south boundary of South Pond, dogleg extends to the north off the west end; see Figure 1.

FUNCTION: Currently retains only tailings, surface gradient on tailings away from the dam; retains water locally in seepage pump-back discharge erosion gully if South Pond level were high (Figure 5A). Royal Oak proposes to discharge off Dam 11 this year to exploit South pond capacity.

LENGTH: +/- 1400 ft **MAX HEIGHT:** +/-50 ft est.

CREST WIDTH AND CONDITION: More than 30 ft; downstream and upstream shells of waste rock confine a clayey core zone. Portion of the crest, both core and shells, reconstructed in June to eliminate low point in the crest. Crest of northward-extending leg in good condition.

RIPRAP: Waste rock; redundant under current conditions; only narrow beach width between dam face and ponded water near north end of north leg; in 1995 pond was higher and water contacted u/s face of dam; erosion protection acceptable. Proposed beaching will push accumulated water against Dyke 5.

BACKSLOPE: Approx. 1.5H:1V slope separated by two berms; piezometer and thermistor in place; some local well-infilled (old) cracking noted on mid-level berm; possibly settlement-related.

TOE AREA WATER: Low point seepage reports to the basin associated with Dam 7 for pumped return. Figure 6 illustrates a plot of the seepage pump hours versus time. Data since April, 1995 appears relatively consistent at approximately 2 to 3 hours per day. Pump hours peaks each Spring, likely as a result of snowmelt surcharging water levels in the pond and catchment area runoff. Need to determine discharge capacity for pump and plot actual pumpback quantity vs. time. Seepage observed by prior inspections near the north end of the north extension of the dam now not present, suspected to be due to lower pond water level

MAINTENANCE RECOMMENDATIONS: New crest level at reconstructed area should be surveyed. Instrumentation readings are to be continued. Thermistor readings in Dam 11 are taken monthly. Plots supplied this year show that the dam section stays frozen below a depth of approximately 30 feet.

Temperatures at depths greater than 45 feet are at or just slightly above 0°C. Generally in agreement with previous temperature readings taken.

CONCLUSIONS: The dam is in good condition with some seepage passing through or beneath the dam; data from instrumentation (piezometric levels and temperature data) should be provided for external review on an annual basis; seepage return pumping quantity should be recorded and results provided also. Any tailings deposition in the South Pond should include initial beaching off the north dogleg portion in order to minimise seepage through this area of the dam.

DAM 12 (Original Tailings Area)

LOCATION: West side of South Pond 2; see Figure 1.

FUNCTION: Saddle closure; carries tailings discharge line, retains tailings beach.

LENGTH: +/- 200 ft **MAX HEIGHT:** +/-10 ft (est.)

CREST WIDTH AND CONDITION: Broad crest, evidence of clay core zone, carries little-used road, condition good, some well-weathered, cracks near downstream crest edge, apparently associated with steep backslope and loose near-surface material.

RIPRAP: Waste rock, redundant for current use.

BACKSLOPE: Variable to angle of repose.

TOE AREA WATER: Retains no surface water, broad beach upstream from dam, seepage would not be expected. Water west of the adjacent mine site road seen at the time of the inspection associated with other factors, and local runoff.

MAINTENANCE RECOMMENDATIONS: No maintenance required.

CONCLUSIONS: The dam is in good condition, but should be monitored as water level in South Pond rises in 1998.

SETTLING POND DYKE (Original Tailings Area)

LOCATION: West side of Settling Pond; see Figure 1.

FUNCTION: Partitions the Settling Pond from the Polishing Pond; flow-through structure.

LENGTH: +/- 650 ft **MAX HEIGHT:** generally +/-2 ft above u/s pond elev.

CREST WIDTH AND CONDITION: Appears that some additional material has again been placed on the southern portion of the crest. Cracking noted on upstream side and some new cracking possible on the downstream side.

RIPRAP: Derived from rockfill material by wave action; adequate.

BACKSLOPE: Condition is similar to upstream slope; water level is essentially similar.

TOE AREA WATER: Dyke performs as a flow-through structure, carrying all the decant flow from the Settling Pond to the Polishing Pond, head loss is small.

MAINTENANCE RECOMMENDATIONS: No maintenance immediately necessary. Cracking due to relative steepness of rockfill and saturation. Extreme care must be exercised when filling of the crest because of danger of sudden slope failures. Should crest-dressing be contemplated for operational or access reasons, it should be done after adequate design investigation.

CONCLUSIONS: The dyke is fulfilling its function but upstream and downstream water levels should be prevented from diverging by more than a metre because the dyke backslope stability would be further jeopardised.

DAM 21A (Northwest Tailings Area)

LOCATION: Northeast end of Dam 21 sequence; see Figure 1.

FUNCTION: Major perimeter closure; left abutment accommodates access ramp and tailings transport / water recovery pipelines causeway.

LENGTH: +/- 300 ft **MAX HEIGHT:** +/-35 ft (est.)

CREST WIDTH AND CONDITION: Approx. 50 ft; some waste rock and core zone clay used in May, 1995 to close the east abutment against higher ground, north of the east end of the causeway. Crest condition is good (Figure 7A).

RIPRAP: Quarried rock upstream shell constitutes riprap but broad tailings beach now in place. The beach contains several funnel-like depressions which are believed related to flow of water into the upstream shell of the dam; conditions dry at the time of inspection so no direct evidence seen. No change in sinkhole configuration observed.

BACKSLOPE: Approx. 1.5H:1V formed of quarried rock, good condition.

TOE AREA WATER: Although some stranding water at the toe was noted, no seepage seen during this year's inspection (Figure 7B), probably due to somewhat lower pond level.

MAINTENANCE RECOMMENDATIONS: Additional beach building recommended because seepage may result when general water level is high, hence the observed funnel-like depressions next to the upstream edge of the dam. No other maintenance required.

CONCLUSIONS: The dam is in good condition.

DAM 21B (Northwest Tailings Area)

LOCATION: Forms south boundary of the tailings area; see Figure 1.

FUNCTION: Retains tailings and associated water; east-central portion of Dam 21 sequence; contiguous with Dam 21A and Dam 21C.

LENGTH: +/- 800 ft **MAX HEIGHT:** +/-50 ft (est.)

CREST WIDTH AND CONDITION: Approx. 50 ft; flanked by tailings beach (see Figure 8A). Crest comprises quarried rock shell and clay core zones. No significant sinkholes noted in new upstream beach deposit.

RIPRAP: Adequate, comprises quarried rock of the shell zone; functional when pond water level rises sufficiently to inundate the tailings beach (not desirable from seepage perspective). Tailings beach covering all of the upstream rip rap in some locations.

BACKSLOPE: Backslope composed of 2 benches with approx. 1.5H:1V connecting slopes; bench surfaces and slopes appear to be in good condition and benches reflect prior minor settlement.

TOE AREA WATER: Localised seepage/ ponding at the propane tank farm and also east of its access road, with some overflow to lower areas; respective seepage rates judged this year to be 4 - 8 l/min and 1 - 2 l/min (same as last year or slightly less).

MAINTENANCE RECOMMENDATIONS: No maintenance required.

CONCLUSIONS: The dam appears to be in good condition; rate of seepage is equivalent to last year and no significant concern expressed at this time.

DAM 21C (Northwest Tailings Area)

LOCATION: Forms southwest boundary of the tailings area; see Figure 1.

FUNCTION: Retains tailings and associated water; central portion of Dam 21 sequence; contiguous with Dam 21B and Dam 21D.

LENGTH: +/- 900 ft **MAX HEIGHT:** +/-50 ft (est.)

CREST WIDTH AND CONDITION: Crest comprises quarried rock shell, filter and clay core zones; approx. 50 ft wide; crest is in good condition. Currently depositing tailings off 21C and only two small sinkholes noted within the new beach.

RIPRAP: Adequate, comprises quarried rock of the shell zone; functional only when pond water level rises sufficiently to inundate the tailings beach (not desirable from seepage perspective). Tailings discharge was occurring directly onto the rip rap which was subsequently fixed after the inspection tour.

BACKSLOPE: Backslope composed of 2 benches with approx. 1.5H:1V connecting slopes; condition is good.

TOE AREA WATER: Previously, seepage was observed between large rock fragments forming the toe zone, near the junction of 21C and 21D; not seen this year. Small amount of seepage noted at corner between 21B and 21C; approximately 2 l/min.

MAINTENANCE RECOMMENDATIONS: Additional beach should be placed where narrowness remains so to improve seepage performance when pond water levels are again to minimum freeboard elevation.

CONCLUSIONS: The dam appears to be in good condition; observed seepage is not of physical concern.

DAM 21D (Northwest Tailings Area)

LOCATION: Forms west boundary of the tailings area; see Figure 1.

FUNCTION: Retains tailings and associated water; north-most portion of Dam 21 sequence; contiguous with Dam 21C.

LENGTH: +/- 1200 ft **MAX HEIGHT:** +/-40 ft (est.)

CREST WIDTH AND CONDITION: Approx. 50 ft wide crest comprises quarried rock shell and clay core zones. One 50 to 70 m long crack noted at core/shell contact (Figure 9); otherwise crest considered to be in good condition. Three sinkholes noted proximal to northerly instrumentation location should be backfilled.

RIPRAP: Adequate, comprises quarried rock of the shell zone; over-steep areas being flattened by sloughing.

BACKSLOPE: Approx. 1.5H:1V backslope flanked by a wide berm, condition is good.

TOE AREA WATER: Ponded water is present at several locations along the toe of the berm, particularly north of the access ramp leading from the Vee Lake road, making observation of toe seepage difficult. Elevation of ponded water levels appear consistent with last years observations.

MAINTENANCE RECOMMENDATIONS: Thermistor data, taken on a monthly basis, indicates ground temperatures just below and just above freezing (-0.5° to 1.5°C) at depths of 40 to 70 feet, according to two thermistors installed. Unsure if values area reasonable and some effort should be put forward to synthesise all the relevant thermistor data and interpret properly. Need to institute a formal plan for review of the thermistor data, as it is collected. Also need to review data from piezometers previously installed with these thermistors.

Additional beach construction is required to raise the area to the elevation of other beaches around the Northwest pond; target should be a continuous and wide beach as is generally present at Dam 21B and 21C. A flow measurement weir should in the channel leading from the toe area into the Trapper Creek diversion. Survey hubs installed along the crest in October, 1994 should be observed from a stable (bedrock) reference point west of

the site to obtain dependable movement data (perpendicular to dam centerline, *i.e.* in an east-west direction).

CONCLUSIONS: The dam is in apparently good condition, some seepage may be present but difficult to quantify. Beach deposition is yet to be completed. Geotechnical review of the results of the 1994 instrumentation program and related data should be undertaken to gain a more definitive appreciation of the dam's performance. A seepage measurement weir should be installed.

DAM 22A (Northwest Tailings Area)

LOCATION: Forms western portion of the northwest closure; see Figure 1.

FUNCTION: Retains tailings and associated water; contiguous with Dam 22B.

LENGTH: +/- 800 ft **MAX HEIGHT:** +/-40 ft (est.)

CREST WIDTH AND CONDITION: Approx. 50 ft; crest comprises quarried rock shell and clay core zones (see Figure 10); significant beach-building has been accomplished but more still required at west abutment. Beach contains ice collapse settlement and some sink holes along the edge of the rockfill slope, indicating loss of water into the upstream shell. Dam crest in good condition.

RIPRAP: Adequate, comprises quarried rock of the shell zone; remains functional at the western portion of the dam, and all along the dam when water level is high.

BACKSLOPE: Approx. 1.5H:1V backslope flanked by a wide berm, both appear to be in good condition.

TOE AREA WATER: Some standing water noted at the toe, but difficult to determine if seepage water. Previously, toe seepage was observed at 1993 and 1995 inspections, none was seen in 1994, but flow in 1996 was unchanged at an estimated 1/2 l/minute.

MAINTENANCE RECOMMENDATIONS: Beach construction should be continued at west end to completion of a high level, wide beach; the target should be a continuous wide beach as is generally present at Dam 21B .

CONCLUSIONS: The dam appears to be in good condition; seepage performance is presently not of concern.

DAM 22B (Northwest Tailings Area)

LOCATION: Forms eastern portion off the northwest closure; see Figure 1.

FUNCTION: Retains tailings and associated water; contiguous with Dam 22A.

LENGTH: +/- 600 ft **MAX HEIGHT:** +/-40 ft (est.)

CREST WIDTH AND CONDITION: Approx. 50 ft; crest comprises quarried rock shell and clay core zones); beach-building is completed (see Figure 11); crest condition is good. Some cracks located in the upstream shell material.

RIPRAP: Adequate, comprises quarried rock of the shell zone.

BACKSLOPE: Approx. 1.5H:1V backslope flanked by a wide berm, both appear to be in good condition, some cracks along the steep edge of the berm (loose material).

TOE AREA WATER: Historically, seepage has issued from the toe of the berm near the west abutment of the dam. Comparative observations from last year note that the amount of toe seepage is equivalent (Figure 12). Seepage possibly noted at the east abutment resulting from the flow of pump-back water from the toe; need to discharge this pump back further upstream from the crest.

Figure 13 illustrates plot of Dam 22B seepage pump hours, since April, 1996. Data is not as consistent as that seen at Dam 11, but lowest values are generally in late Winter/Spring. Summer 1998 data reporting higher values than previously recorded. Need to obtain data on a weekly basis and extend pump hours to quantity.

MAINTENANCE RECOMMENDATIONS: Weir should be installed in small channel at toe to physically measure the major portion of the toe seepage volume. The seepage return pump data should be collected weekly; plotting of that data will provide a cumulative record of seepage flow rate and changing rate can be compared with pond level changes.

CONCLUSIONS: The dam appears to be in good condition.

Royal Oak Mines Inc.

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NORTHWEST TERRITORIES WATERBOARD
OCT - 9 1998
YELLOWKNIFE, N.W.T.

October 8, 1998

Mr. Gordon Wray
Chairman
Northwest Territories Water Board
P.O. Box 1500
Yellowknife, N.T.
X1A 2R3

Dear Mr. Wray,

Re: Giant Mine - 1998 Geotechnical Inspection of the Tailings Containment Areas

Please find enclosed, three (3) copies of a report by Golder Associates Ltd. on a geotechnical inspection of the Giant Mine tailings dams, conducted in June of this year. An additional, unbound copy is provided for reproduction and further distribution.

Mr. Jim Cassie, P.Eng., inspected the dams on June 17, 19 and 20. The submission of this report is overdue, due to delays on the part of both Golder Associates and Royal Oak Mines. On June 24th, at Royal Oak's request, Mr. Cassie provided a summary of the maintenance required on the dams. Action on these maintenance issues was commenced on June 25th.

This letter will describe the actions taken, and planned, to address the maintenance recommendations in the final report. Please refer to Section 5.0 of the report, for a summary of these recommendations.

With regard to the dams in the ***Original Tailings Area***, the following actions and plans should be noted:

- Plans for the resumed discharge of tailings in the South Pond, and management of the supernatant water, were described in a letter to the NWT Water Board dated June 30, 1998. These plans were implemented as described and mill tailings have been discharged to this pond continuously since early July. Repairs to the crest of Dam 11 were completed successfully and substantial beaching has been achieved on both the north 'dogleg' extension to Dam 11, and in the erosional gully formed by seepage discharge at the centre of the dam, as recommended by Mr. Cassie.

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- Supernatant water from the South Pond has been conveyed directly to the North Pond through a graded pipeline and, as recommended by Mr. Cassie, Dyke 6 has not been used to retain water. Water elevations in the North Pond were above the recommended limit early in the summer, but have been maintained within the limit since mid-July.

- The small sinkholes observed in the crests of Dam 3 and Dyke 5 will be backfilled this month. The recommended repairs to structures that do not retain water and are not involved in the long-term tailings management plan have been delayed this summer, due to other commitments to site surface work, and will be addressed next year.

- Data from the thermistors installed in Dam 11 is collected on a bi-weekly basis and is reviewed internally, however, data from the piezometer installations is not currently collected. The piezometer read-out instrument has recently been sent out for re-calibration and arrangements are being made for training mine site personnel in it's use. This data will be collected during summer months, according to the requirements of the mine's geotechnical consultant.

With regard to Mr. Cassie's conclusions on the structures of the ***Northwest Tailings Area***, the following actions and plans should be noted:

- Significant beaching has been achieved over the last year in the area of Dams 21B and 21C. Advancement of this beaching will continue this winter along Dam 21D to the western bedrock outcrop. Additional beaching is also warranted in the area of Dam 21A and will be conducted this winter.

- Data from thermistor installations at Dam 21D is recorded on a bi-weekly basis and is reviewed internally. This data is provided to Golder Associates on an annual basis. The piezometer installations and surface movement monuments have not been monitored for many years. This data will be collected during summer months, according to the requirements of the geotechnical consultant.

- Three sinkholes identified in the crest of Dam 21D were repaired, commencing June 25th. A trench was excavated to intersect all three sinkholes and find the bottom of the holes. At a depth of five feet, no further damage was found. The trench was backfilled with a layer of dry bentonite and capped with damp clay.

- The tailings discharge point at Dam 21C, noted by Mr. Cassie to be too close to the rockfill shell of the dam, was relocated immediately after the inspection. This issue has been reviewed with the Mill Shift Supervisors, who are responsible for daily management of the tailings facilities. The seepage return line at Dam 22B was extended, following the dam inspection, in an attempt to prevent ponding of this water against the dam face. A further extension to this line is required to direct the water towards the centre of the pond.

- Recording of the operating hours of the seepage return pump at Dam 22B will continue, on a bi-weekly basis. This data has been provided to Golder Associates as a graph of pumping hours per day. In future, this data will be reported as seepage volume, based on the discharge rate of the pump. This method of determining flow rates should be quite adequate for the characterization of seepage rate changes, however, further consideration will be given to the benefits of a V-notch weir to measure a portion of the seepage flow.

We trust that these actions will address Mr. Cassie's recommendation to your satisfaction. Please contact me at (867) 669-3729, if you have any questions or concerns.

Yours sincerely,

Royal Oak Mines Inc.

Stephen Schultz
Superintendent, Environmental Services
NWT Division

cc: Ron Breadmore (DIAND - South Mackenzie District)
John Stard (ROM)
Kent Morton (ROM)
Al Goetz (ROM)
Denis Gratton (ROM)

Appendix F

Suggested Tailings ARD Study

The assessment of ARD and metal leaching potential from the tailings comprises three components:

- Field sampling in each of the tailings deposits to characterize sulphide, alkali and metal distribution over the planimetric area, depth, and age of tailings deposits.
- Laboratory testing of oxidation and metal leaching potential.
- Physical and geochemical modelling to assess metal mobility and thence remediation and reclamation alternatives.

The field program would be combined with the geotechnical program for characterization of the physical properties of the tailings. It is understood that there has been some limited drilling of the tailings at depth in the South and Central Ponds (A&R Plan, Section 4.7.5), and these data would be incorporated into the testing program.

The specific objective of the field sampling program is to develop a geochemical characterization of the tailings in each pond over depth and in plan. To accomplish this, the following field program is proposed:

- For each of the South, Central and North Ponds six to ten drillholes (depending on the variability), from which solid samples of tailings can be collected at intervals over depth. In the shallow areas of the tailings it may be possible to sample by hand auger.
- Since geochemical sampling has been done for the newer tailings, it is anticipated that four or five holes may be sufficient for characterization of the tailings in the Northwest Pond.
- Collection of tailings samples from each of the drillholes. Solid samples need to be collected over discrete intervals in the tailings, typically where there is a change in colour, moisture or measured field parameters. Sample intervals should be no larger than 1 metre. Sampling continues until fresh tailings are consistently encountered at depth.
- Sampling of porewater (where possible) from discrete intervals within the tailings. It may be necessary to dig some shallow test pits to collect sufficient pore water for this initial characterization of the near surface zone – the zone where the most significant oxidation would have occurred.
- Installation of piezometers for pore water sampling of discrete intervals within each of the tailings areas. It may be possible to determine the interval from field measurements, however, the laboratory testing results may be required.
- Laboratory testing.

The laboratory testing program for characterization of oxidation and metal leaching should include the following:

- Field testing of pH, conductivity on each sample.

- Static geochemical tests on each sample (acid base account, complete suite of metals, etc.).
- Mineralogical assessment of selected samples.
- Extraction tests on selected intervals to evaluate the readily soluble products.
- Kinetic geochemical tests on selected samples to evaluate short and longer term leaching potential. These tests would include enhanced oxidation rate testing, column or humidity cell testing under oxidizing, and possibly reducing conditions.

The characterization of the chemistry of the tailings porewater is part of the work that is required for assessment of longer term water chemistry and ARD. The existing data indicate that the primary metal of concern in the porewater is dissolved arsenic. The objective of this part of the assessment is to determine:

- The short and long term potential for continued release of arsenic to porewater; and,
- The potential for release of other metals in the short and long term.

It is very important to understand the geochemical mechanisms and the sources controlling the metal (arsenic) release in order to evaluate the long-term requirements for remediation and reclamation of these tailings. There is considerable research in progress and field evidence from other tailings sites regarding arsenic mobility. The objective of this task and the previous task is not to reproduce that work, but rather to characterize and quantify the sources for this site in order to use the research information to assess remediation and closure requirements.

The specific issues to be addressed with respect to porewater chemistry are:

- the sources and mechanisms of arsenic release within the tailings solids;
- the duration over which this release can be expected;
- the speciation and mobility of other metals associated with the tailings;
- the extent to which freezing with limit geochemical reactions and metal mobility; and,
- the extent to which site hydrology, infiltration, flux through the tailings and covers can control water quality from the tailings.

The testing program for characterization of porewater should include:

- Sampling of porewater from field installations over at least a one year period;
- Collection of tailings samples sufficient to allow extraction of porewater from both shallow and deeper (anoxic) tailings;
- Installation of field piezometers to allow sampling of discrete intervals within the tailings of both shallow and deeper porewater;
- Analyses of porewater samples to include physical parameters, major ions and a full suite of metals, including mercury and selenium. Low level analyses may be required for selected parameters;

- Geochemical modelling (including the solids mineralogical data) to determine solubility constraints and longer term porewater chemistry.

The analyses of the tailings solids for characterization of leaching potential are included in the characterization of ARD potential. The mineralogical analyses described above will be particularly critical for the evaluation of porewater. These data, combined with extraction testing data, porewater analyses and the physical characterization will provide input data for geochemical modeling of the tailings and porewater.

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
"A" Sewage Lift Station	001	3.8 x 3.8	- metal building on concrete	2 pumps, elec.	in use	-some hydrocarbon storage
"A" Shaft Headframe	002		- wood frame construction - concrete footing on bedrock - asphalt/asbestos shingled	no services	abandoned	-asbestos sheathing -open shaft
"A" Exploration Shop	003	30.6 x 12.2	- steel clad building - appears to be wooden foundation on bedrock - concrete sidewalk	electric, oil (AG)	storage for drill core and winter gear	-Suspected asbestos under metal siding. -Interior paint may contain lead. -Possible PCB light ballasts -Small quantities of lube oil and camp fuel stored here.
#1 Transformer Substation	004		- bldg/wood frame construction - steel transformer on concrete base		in use	-some soil staining -asbestos interior wall board -asbestos pipe insulation and insulated tank -6 Ferranti transformers
Bayview Sewage Pumphouse	006	1.8 x 3.6	- metal building - concrete slab	2 sewage pumps, elec.	In use	
Mobile Equipment Garage	007	28 x 22	- steel clad building - concrete slab-on-grade	electric, oil (AG)	6 bay service garage for vehicles	-suspected asbestos under metal siding -PCB paint ballasts suspected -sump contains signs of contaminants -waste oil sink discharges to tanks outside -considerable concrete and outside soil staining. -acetylene tanks and other small quantities of solvents and oils stored.
		20.6 x	- wood frame	electric, oil	Air Cadets	-asbestos sheathed under metal siding

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
Recreation Hall	008	24.7x10	construction - poured concrete foundation - asphalt/asbestos shingled covered by aluminum siding	(AG) from mine, water from City	club house	-lead paint suspected -PCB light ballasts suspected -above ground fuel storage tank located adjacent. -some camp fuel and motor oil.
Lunch/Wash Trailer	016		- steel "ATCO" trailer - timber crib foundation		not in use	No concerns
"A" Area Garage	018	19 x 23	- wood frame construction - concrete footing on bedrock - asphalt/asbestos shingled	no services	abandoned	-Oil filled ballasts behind switch panel. Potential for PCBs -asbestos pipe insulation -liquid filled sumps -stained concrete -stored fire extinguishers
"A" Storage	021	7.5 x 17	- wood frame construction - asphalt/asbestos shingled	no services	abandoned	-asbestos exterior sheathing and interior wall board. -leaking wall mount transformer -other electrical equipment
"A" Boiler House	037	5 x 23	- concrete slab-on-grade	electric, oil (AG)	services heat to townsite	-2273 litre tank out of service -1150 litre tank in use for standby generator. -some scaling treatment chemicals stored. -suspect asbestos, lead paint, and PCB light ballasts -oil in floor drains, which discharge to sewage. -acid canisters
Utility Shed (adjacent to Boiler House)		23.3 x 7.4	- steel clad building - concrete grade beams	electric, oil (AG)	services boiler house	

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
"A" #1 Powder Magazine	040	3.7 x 5.1	- steel sided (Butler Type) building - concrete grade beams, wood piers	electric (AG)	storage for old electric motors	-some electrical equipment stored here.
"C" New Diesel Plant	059	6.5 x 15	- steel clad building - concrete slab-on-grade - heat exchanger on concrete slab at west end of building	electric (BG), oil (AG)	Standby generator	-fuel storage adjacent -two fuel storage tanks inside - asbestos interior wall board
"B" #2 Transformer Substation	063	3.6 x 3.6	- concrete slab-on-grade	breaker panels	active transformer	-some staining beneath transformer
"B" Old Compressor House	071		- wood frame structure	not in service	not in use	-one drum of waste oil -exterior asbestos sheathing -interior asbestos wall board -some staining on floor -Baker Creek flows over a small weir at this location.
"A" New Pump House	075	7.5 x 12.5	- steel clad building - concrete slab-on-grade	electric (AG)	water supply for townsite and mine	-Suspected lead paint and PCB light ballasts. -exterior asbestos sheathing and interior wall board. -chlorine also stored in this building
"A" #2 Main Pump House	076	3.8 x 3.8	- wood frame structure - concrete slab-on-grade	electric, steam heat	in use	-Asbestos exterior sheathing and fire fighting equipment -lead paint and PCB ballasts suspect -1150 litre tank for back up fire pump.
"A" #1 Old Pump House	077	3.8 x 7.6	- wood frame structure - concrete slab-on-grade	electric, steam heat	in use	

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
"ABC" Surface Pipelines	078		- utilidors are wood structures			
"C" Gasoline Service Pump	079	1.2 x 2.4	- concrete slab-on-grade		fuel supply for vehicles	-underground storage tank services the pump.
"A" Curling Rink	081	9.7 x 44.8 + 15 x 7.3	- wood frame structure - on grade wood timber foundation - asbestos/asphalt shingled	electric, oil (AG), heat exchanger	Building is not used	-exterior asbestos sheathed. -suspect lead paint and pipes -suspect PCB ballasts -used to store 22 kg bags of calcium chloride.
Lumber yard Storage	085	3.8 x 6.1	- wood structure on timber support	electric	in use	-exterior asbestos sheathing -bags of cements and oxygen cylinders stored inside. -drums of chemical and hydrocarbon products stored in fenced yard.
"B" #2 Powder Magazine	087		- steel clad building	no services	storage for historic files, formerly used to store PCB's	-no concerns
New Surface Rock Breaker	100	3.8 x 3.8	- steel structure		has not been used for two years	-no concerns
Mill Crusher House	101	25 x 25	- wood/steel frame structure - concrete slab-on-grade - asbestos/asphalt shingled	electric, oil (AG)	main ore crusher	-some lubricating oil stored inside
Screen House	102	6 x 6	- wood frame structure	electric	secondary	Exterior asbestos sheathing

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
and Conveyors			- asphalt/asbestos shingled		ore screening	
Propane Storage Tank	103		- steel tank on concrete support			-propane
Processing Mill	106	100 x 70	- steel frame, steel clading - partial asbestos/asphalt siding - concrete footing/concrete floor	electric, oil (AG)	main refinery building	-exterior asbestos sheathing -chemical storage and mixing stations. -some hydrocarbon storage
"C" #3 Substation	107	23 x 38	- concrete slab-on-grade		active transformer	-oil staining below transformers
"C" Switch House	108		- wood frame structure		Active	-old electrical equipment
"C" Reagent Warehouse	109	12.7 x 30.5	- steel frame (arched) building - wood perimeter on rock filled bins - gravel floor	no services	storage for reagents	-stored mill and water treatment chemicals including Armac HT, sodium nitrate, Percol and sodium metabisulfite. -gravel floor is contaminated with spilled chemical
Mill Pipe Shop	110	70 x 20	- asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)		
Roaster Change House	111	3 x 3	- wood frame structure	electric, oil (AG)	change house	-potential arsenic contamination
"C" Mill Fire Pump House	112	5 x 7	- wood frame structure - concrete foundation	electric (AG)	fire pump house	-exterior asbestos sheathing and interior asbestos wall board

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
			and floor - asbestos/asphalt shingled			-utilidor adjacent is leaking hydrocarbon
New Surface Crusher	116	9 x 9	- steel clad building - concrete pier at loading ramp	electric, oil (AG)	Primary crusher	No concerns
New Refinery	117	9 x 21	- steel clad building - concrete slab-on-grade on granular fill	electric, oil (AG)	ore refinery	-hydrocarbon storage -chemical storage
Electric Boiler House	120	6 x 10	- wood frame building	electric, oil (AG)	2 condensate pumps, compressor	
Ore Pass Building - Pit Ore	121		- wood frame buiding	electric	in use	No concerns
Machine Shop	122	35 x 23	- wood building	electric, oil, water (AG)	in use	-Asbestos pipe insulation and potential for lead paint and PCB light ballasts. Some stored lubricants and solvents.
"C" Ore Bin & Waste Bin	123	6.1 x 6.1	- wood structure	steam heat, elec.	In use	No concerns
Roaster #4 Substation	125	6.1 x 7.6	- concrete slab-on-grade		active transformer	-some oil staining beneath transformers
"C" #5 Transformer Substation	126	6.1 x 23	- concrete slab-on-grade		active transformer	-transformers date back to 1953 -stained soil beneath transformers observed -asbestos sheathed building and asbestos wall board interior. -suspected lead paint.
"C" Hoistroom	127	20 x 20	- steel clad building	electric, oil	Hoist for "C"	- potential for PCBs in old electrical equipment and light ballasts.

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
			- concrete walls on bedrock	(AG)	Shaft	- suspected lean paint - stains on floor -oil in sump - staining outside of building
"C" Pipe Rack	128	7 x 11	- wood frame structure - timber pile foundation - asbestos/asphalt shingled	no services	storage for steel/ABS pipe	-Asbestos sheathed
"C" #3 Headframe	129	27 x 17	- steel clad and combined wood frame - concrete slab-on-grade - part asbestos/asphalt sided - wood frame anchored to bedrock - steel frame anchored to concrete blocks	electric, oil (AG)	Main shaft for ore	-asbestos sheathed -some waste oil in drums -potential for PCBs in electrical switch panel -staining on interior floor
Assay Office	131	9.5 x 25	- steel sided (Butler Type) building with plywood skirting - wood piling - concrete/wood grade beams	electric, oil (AG)	assay office	-asbestos board throughout interior - storage of small quantities of reagents including lead, acids, cyanide.
"C" Oil Storage Shed	132	5 x 5.5	- wood frame structure - wood foundation on grade - asbestos/asphalt shingled	electric, oil (AG)	storage for various oil products	-20 L pails of various oils and greases
"C" #3	133	12 x 30	- two storey steel clad	electric, oil	Main	-storage of small quantities of lab chemicals and water treatment chemicals. Small

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
Warehouse			building - lower floor is asbestos/asphalt shingled	(AG)	warehouse	quantities of hydrocarbons. - asbestos board interior throughout on main floor and in basement.
Cottrell	134	30 x 15	- fibreglass sided - concrete foundation	electric, oil (AG)	Arsenic precipitator	-significant asbestos interior walls, flooring, exterior sheathing -PCB light ballasts suspected -lead paint suspected -1150 L tank of varsol -lube oil stored -arsenic contamination suspected
"C" Oil Storage Shed	135	3 x 3.6	- wood structure on skids	electric	in use	-asbestos exterior sheathing -storage for 20 L pails of lubricating oils and greases.
"B" Fan & Heater House	140	1.8 x 3.6	- steel building	electric	in use	-20 L pails of coolant and drums of lube oil stored inside. -asbestos -staining beneath transformers -propane storage location
Carpenter Shop	142	7.5 x 17 (original) 2.5 x 9.5 (addition) 3.5 x 15 (addition)	- one storey wood frame structure - wood crib foundation - wood clap-board sides - steel clad building on wood grade beams - wood frame, tin sided	electric, oil (AG)	General wood working	- exterior asbestos clad - interior asbestos wall board - potential PCBs in wall mount electrical equipment. - lead paint suspected
Dorrco Roaster	143	25 x 30	- fibreglass siding - concrete foundation	electric, oil (AG)	active roaster	-arsenic contamination suspected -large quantities of asbestos
			- one storey wood frame	electric		-Asbestos cladding

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
Planer Shop	144	17 x 13.5	structure - wood crib foundation - wood clap-board sides - wood silo on north side	(AG) propane heat (AG)	In use	-potential for lead paint and PCB light ballasts -small quantities of lubricants -Expanol™ fire retardant
#4 Warehouse	146	30 x 12	- steel clad building (Butler Type) - wood foundation on grade - 2.5 m x 37 m wood loading dock at front	electric (BG), oil (AG)	In use	-stored lubricants -stored assay chemicals
"C" Cap House	147	5.1 x 7.8	- wood frame structure - wood crib foundation on conc. pads - asbestos/asphalt shingled	no services	main powder magazine. No longer in use	No concerns
Roaster Stack Fan House #2	148	10 x 7	- steel clad building - concrete slab-on-grade	electric, oil (AG)	housing for blowers	-arsenic contamination suspected
"C" Lumber Storage Building	149	---	-------	-----	REMOVED	
Electrical Shop (Former "C" Boiler House #3)	150	12.5 x 12	- steel clad structure	electric, oil (AG)	services vehicles and boiler house	-hydrocarbon contamination -some hydrocarbon and chemical storage
"C" Steel Rack	154	15 x 8	- one storey wood frame structure - wood foundation on grade - asbestos/asphalt shingled	no services	storage for steel flat bar, rolled round bar, angle iron	-asbestos sheathing

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
Main Office and Extension	155	30 x 18	- two storey wood frame structure - poured concrete foundation with basement - vinyl sided	electric, oil (AG)	Main gate house and office	No concerns
Utility Shed (adjacent to Main Office)		3 x 4.5	- steel clad building - concrete slab-on-grade	electric (BG)	Utility Shed	No concerns
Arsenic Fill Raise House	161	2 x 3	- concrete collar - wood frame structure - asphalt/asbestos shingled	no services		-arsenic contamination suspected
Calcine Plant	162	25 x 40	- fibreglass sided - concrete foundation	electric, oil (AG)	no longer used	-metals contamination suspected -asbestos insulation -small quantities of chemical storage
New "C" Dry	166	51 x 19.5	- two storey steel clad building - concrete grade beams on piles	electric, oil (AG)	"Dry" on main floor ; offices on second floor	No concerns
Bag House	167	5.8 x 22	- steel clad building - concrete slab-on-grade	electric	arsenic bag house	-arsenic contamination -extensive asbestos
Mill Laboratory	169	12 x 24	- steel sided (Butler Type) building - concrete pier foundation with wood grade beams - crawl space below	electric, oil (AG)		-stores of lab reagents including caustic soda, hydrochloric acid, acetone. -asbestos sheathed on exterior walls. -asbestos wall board on interior walls. -staining observed an lead paint suspected.

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
			main floor			
B-3 #413 Service & Fill Raise	170		- 2 compressors in a steel building - concrete floor	electric	in use	-some hydrocarbon contamination
"C" First Aid Training Room	171	7 x 10	- steel clad building (Butler Type) - concrete slab-on-grade	electric, oil (AG)	Underground first aid	-first aid chemicals -compressed gases
"C" New Boiler House	172	11.5 x 15	- steel clad building (ARMCO) - concrete slab-on-grade	electric, oil (AG)	Heats mine site	-some water treatment chemicals and hydrocarbons -asbestos on inside of boilers and insulating tanks
"C" New Gate House	174	-----	-----	-----	REMOVED	
"C" Main Gate Guard Shack	175	-----	-----	-----	REMOVED	
G.K.P. Lunch Room	176	-----	-----	-----	REMOVED	
G.K.P. Generator Building	177	-----	-----	-----	REMOVED	
"A" Res. # 200-Exploration	200	9 x 9	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)		-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 201	201	5 x 8	- wood framed - asbestos/asphalt/steel siding	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
"A" Residential # 202	202	8 x 15	- wood framed - vinyl sided	electric, oil, water (AG)	occupied	Did not investigate interior
"A" Residential # 203	203	8 x 15	- wood framed - wood siding	electric, oil, water (AG)	vacant	Did not investigate interior
"A" Residential # 204	204	8 x 15	- wood framed - vinyl sided	electric, oil, water (AG)	occupied	Did not investigate interior
"A" Residential # 206	206	8 x 8	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 207	207	8 x 9	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	vacant	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 208	208	8 x 10	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 209	209	8 x 10	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 210	210	12 x 11	- wood frame - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
						-exterior asbestos sheathed (Did not

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
"A" Residential # 211	211	9 x 9	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	investigate interior)
"A" Residential # 212	212	8 x 8	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 213	213	10 x 15	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 216A	216A	9 x 9	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	vacant	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 216B	216B	9 x 9	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 217	217	15 x 15	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 221	221	8 x 17	- double wide trailer	electric, oil, water (AG)	occupied	
"A" Residential #	247A		- wood framed structure - asbestos/asphalt	electric, oil,	occupied	-exterior asbestos sheathed (Did not investigate interior)

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
247A			shingled - concrete foundation	water (AG)		
"A" Residential # 247B	247B		- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 254	254	8 x 14	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 255	255	8 x 10	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	occupied	-exterior asbestos sheathed (Did not investigate interior)
"A" Residential # 257	257	8 x 12	- wood framed structure - asbestos/asphalt shingled - concrete foundation	electric, oil, water (AG)	vacant	-exterior asbestos sheathed
"A" Residential # 286	286				demolished	
"A" Residential # 289A	289A	8 x 10	REMOVED		REMOVED	
"A" Residential # 289B	289B	8 x 10	REMOVED		REMOVED	
Carbon Storage Warehouse	TRP (BU 515)	11.4 X 30.5	- steel clad building - concrete foundation	not service	no current purpose	-storage of equipment -no concerns

Appendix J: Giant Mine Building Inventory

Building	Bldg. No.	Approx. Size (m)	Construction Type	Utilities	Current Use	Hazardous Materials
TRP Office	TRP (BU 510)	15.2 x 15.2	- steel clad building - concrete foundation	not service	no current purpose	-some older electrical equipment in the trailer -Colomac waste oil stored adjacent
TRP		42 x 15	- steel clad building - concrete foundation	no services	no current purpose	-contains storage tanks labeled as cyanide, caustic soda and acid solutions. -transformer pad stained -adjacent storage building contains spills carbon and 2 pallets of bagged sulphur.
Effluent Treatment Plant	ETP (BU 901)	23 x 30.5	- steel clad building - concrete foundation	electric	seasonally	-two above ground stainless steel tanks storing hydrogen peroxide and one fibre glass tank for ferric sulphate. -eight above ground, open top steel tanks used for water mixing. -copper sulphate is mixed inside building in plastic tanks. Dry chemical is stored inside -fuel tank and propane tanks on site -silo contains lime

EQUIPMENT BY EQP #

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
AC002	SURF	Compressor - CIR 1000 C-S	UNDERGROUND	3072	D		01
AC003	SURF	Compressor - CIR 1500 C-S	UNDERGROUND	3072	D		01
AC004	SURF	Compressor - CIR 1500 Roa	MILL	3072	D		01
AC006	SURF	Compressor - CIR 1000 Roa	MILL	3072	D		01
AC009	SURF	Compressor - CIR 2500 C-S	UNDERGROUND	3072	D		01
AC015	SURF	Compressor-CIR SSR 200 - M	MILL	3072	D		01
AC038	SURF	Compressor - CIR 1500 A-S	UNDERGROUND	3072	D		01
AC039	SURF	Compressor - CIR 1500 B-S	UNDERGROUND	3072	D		01
AC044	SURF	Compressor - CIR DXL 1200	SURFACE	3072	D		01
AC045	SURF	Compressor - CIR DXL 850	SURFACE	3072	D		01
AC046	SURF	Compressor Atlas Copco XA5	SURFACE	3072	D		01
AC048	SURF	Compressor - CIR DXL 1200	SURFACE	3072	D		01
AC060	SURF	Compressor - Quincy "B" Sh	UNDERGROUND	3081	D		01
AC061	SURF	Compressor - Quincy "B" Sh	SURFACE	3081	D		01
AC062	SURF	Compressor - Quincy "B" Sh	UNDERGROUND	3081	D		01
AC063	SURF	Compressor - Quincy "B" Sh	UNDERGROUND	3081	D		01
AC064	SURF	COMPRESSOR - CIR2000	SURFACE	3081	D		01
AG101	MILL	DUST MIXER CRUSHER(DENVER)	CRUSHER	3282	D		01
AG301	MILL	Xanthate Agitator (DENVER)	FLOTATIONS	3284	D		01
AG302	MILL	COPPER SULPHATE AGITATOR	FLOTATIONS	3284	D		01
AG401	MILL	#1 MINE WATER AGIT (16X13'	SOLUTIONS	3284	D		01
AG402	MILL	LIME STGE AGIT (DOL 16X13'	SOLUTIONS	3285	D		01
AG403	MILL	MINE WATER AGIT (DOL 16X13	SOLUTIONS	3285	D		01
AG404	MILL	#5 AGITATOR (DOL 16X13')	SOLUTIONS	3285	D		01
AG405	MILL	#7 CALC AGIT (STEEL 24X18'	SOLUTIONS	3285	D		01
AG406	MILL	CALC AGIT (DOL 24X18')	SOLUTIONS	3285	D		01
AG407	MILL	#9 CALC AGIT (DOL 24X18')	SOLUTIONS	3285	D		01
AG408	MILL	CYANIDE MIXER (LIGHTNING)	SOLUTIONS	3285	D		01
AG409	MILL	LIME MIX AGIT	SOLUTIONS	3285	D		01
AG501	MILL	#6 AGITATOR	CIL	3288	D		01
AG502	MILL	Surge Tank Agitator	TRP	3288	D		01
AG503	MILL	Attrition Tank Agitator	TRP	3288	D		01
AG504	MILL	Carbon Trans Pumpbox Agita	TRP	3288	D		01
AG505	MILL	CIL Tank #1 Agitator	TRP	3288	D		01
AG506	MILL	CIL Tank #2 Agitator	TRP	3288	D		01
AG507	MILL	CIL Tank #3 Agitator	TRP	3288	D		01
AG508	MILL	CIL Tank #4 Agitator	TRP	3288	D		01
AG509	MILL	CIL Tank #5 Agitator	TRP	3288	D		01
AG510	MILL	CIL Tank #6 Agitator	TRP	3288	D		01
AG511	MILL	Flocculant Mix Tank Agitat	TRP	3288	D		01
AG512	MILL	Attrition Tank Agitator	TRP	3288	D		01
AG513	MILL	Lime Slurry Hold Tank Agit	TRP	3288	D		01
AG514	MILL	Cyanide Mix Tank Agitator	TRP	3288	D		01
AG515	MILL	Caustic Mix Tank Agitator	TRP	3288	D		01
AG516	MILL	#26 Agitator	CIL	3288	D		01
AG517	MILL	#27 Agitator	CIL	2176	D		01
AG601	MILL	#13 CARBON PLNT AGIT (DOL)	CARBON PLANT	3287	D		01
AG602	MILL	#14 CARBON PLNT AGIT (DOL)	CARBON PLANT	3287	D		01
AG603	MILL	MEASURING TANK AGITATOR	CARBON PLANT	3287	D		01
AG604	MILL	#19 AGITATOR (ACID)	CARBON PLANT	3287	D		01
AG605	MILL	#20 AGITATOR (CN)	CARBON PLANT	3287	D		01
AG606	MILL	#24 AGITATOR	CARBON PLANT	3287	D		01
AG607	MILL	#25 AGITATOR	CARBON PLANT	3287	D		01
AG701	MILL	ROAST SURGE AGIT #3 (20X18	ROASTER	3289	D		01
AG702	MILL	ROASTER #1 AGITATOR	ROASTER	3289	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
AG703	MILL	SLURRY TANK AGIT (DOL)	ROASTER	3289	D		01
AG801	MILL	MIX POT AGIT (N) (DENVER)	COTTRELL/BAGHOUSE	3290	D		01
AG802	MILL	MIX POT AGIT (S) (DENVER)	COTTRELL/BAGHOUSE	3290	D		01
AG901	MILL	Copper Sulphate Mixer (ETP	ETP	3294	D		01
AG902	MILL	FLOC MIXER	ETP	3294	D		01
AG903	MILL	REACTION AGITATOR #1 ETP	ETP	3294	D		01
AG904	MILL	REACTION AGITATOR #2 ETP	ETP	3294	D		01
AG905	MILL	FERRIC MIXER	ETP	3294	D		01
AG906	MILL	LIME MIXER	ETP	3294	D		01
AG907	MILL	REACTION AGITATOR #3 ETP	ETP	3294	D		01
AG908	MILL	REACTION AGITATOR #1A ETP	ETP	3294	D		01
AG910	MILL	REACTION AGITATOR 2A ETP	ETP	3294	D		01
AG911	MILL	REACTION AGITATOR #3 A ETP	ETP	3294	D		01
AUGER	MILL	GRAIN AUGER 40' 8"	MILL	2171	D		01
BD001	SURF	"A" Sewage Lift Station	SURFACE	3053	D		01
BD003	SURF	"A" Exploration Shop	SURFACE	3053	D		01
BD004	SURF	#1 Transformer Sub-Station	SURFACE	3053	D		01
BD006	SURF	Bayview Sewage Pumphouse	SURFACE	3053	D		01
BD007	SURF	Mobile Equipment Garage	SURFACE	3053	D		01
BD008	SURF	Recreation Hall	SURFACE	3053	D		01
BD015	SURF	Oil Storage Tank #1 TO #8	SURFACE	3053	D		01
BD016	SURF	Lunch/Wash Trailer - Open	SURFACE	3053	D		01
BD018	SURF	"A" Area Garage (Employees	SURFACE	3053	D		01
BD021	SURF	"A" Heater House	SURFACE	3053	D		01
BD033	SURF	"A" Transformer Installati	SURFACE	3053	D		01
BD037	ABOIL	"A" Boiler House	A BOILER HOUSE	3053	D		01
BD040	SURF	"A" #1 Powder Magazine	SURFACE	3053	D		01
BD044	SURF	"A" Switch House	SURFACE	3053	D		01
BD059	SURF	"C" New Diesel Plant	SURFACE	3053	D		01
BD063	SURF	"B" #2 Transformer Sub-Sta	SURFACE	3053	D		01
BD071	SURF	"B" Old Compressor House	SURFACE	3053	D		01
BD075	SURF	"A" New Pump House	SURFACE	3053	D		01
BD076	SURF	"A" #2 Main Pump House	SURFACE	3053	D		01
BD077	SURF	"A" #1 Old Pump House	SURFACE	3053	D		01
BD078	SURF	"ABC" Surface Pipelines	SURFACE	3053	D		01
BD079	SURF	"C" Gasoline Service Pump	SURFACE	3053	D		01
BD081	SURF	"A" Curling Rink	SURFACE	3053	D		01
BD085	SURF	Building Supplies Storage	SURFACE	3053	D		01
BD087	SURF	"B" #2 Powder Magazine	SURFACE	3053	D		01
BD090	SURF	"ABC" Surface Power Lines	SURFACE	3053	D		01
BD100	SURF	New Surface Rockbreaker	SURFACE	3053	D		01
BD101	SURF	Mill Crusher House	SURFACE	3053	D		01
BD102	SURF	Screen House & Conveyors	SURFACE	3053	D		01
BD103	SURF	Propane Storage Tank	SURFACE	3053	D		01
BD106	SURF	Mill Sand Plant	SURFACE	3053	D		01
BD107	SURF	"C" #3 Sub Station	SURFACE	3053	D		01
BD108	SURF	"C" Switch House	SURFACE	3053	D		01
BD109	SURF	"C" Reagent Warehouse	SURFACE	3053	D		01
BD110	SURF	Mill Pipe Shop	SURFACE	3053	D		01
BD111	SURF	Roaster Change House	SURFACE	3053	D		01
BD112	SURF	"C" Mill Fire Pump House	SURFACE	3053	D		01
BD116	SURF	New Surface Crusher	SURFACE	3053	D		01
BD117	SURF	New Refinery	SURFACE	3053	D		01
BD120	SURF	Electric Boiler House	SURFACE	3053	D		01
BD121	SURF	Ore Pass Building - Pit Or	SURFACE	3053	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
BD122	SURF	Machine Shop	SURFACE	3053	D		01
BD123	SURF	"C" Ore Bin & Waste Bin	SURFACE	3053	D		01
BD125	SURF	Roaster #4 Sub-Station	SURFACE	3053	D		01
BD126	SURF	"C" #5 Transformer Station	SURFACE	3053	D		01
BD127	SURF	"C" Hoistroom	SURFACE	3053	D		01
BD128	SURF	"C" Pipe Rack	SURFACE	3053	D		01
BD129	SURF	"C" #3 Headframe	SURFACE	3053	D		01
BD131	SURF	Assay Office	SURFACE	3053	D		01
BD132	SURF	"C" Oil Storage Shed	SURFACE	3053	D		01
BD133	SURF	"C" #3 Warehouse	SURFACE	3053	D		01
BD134	SURF	Cottrell	SURFACE	3053	D		01
BD135	SURF	"C" Oil Storage Shed	SURFACE	3053	D		01
BD140	SURF	"B" Fan & Heater House	SURFACE	3053	D		01
BD141	SURF	Switch Room & Compressor H	SURFACE	3053	D		01
BD142	SURF	Carpenter Shop	SURFACE	3053	D		01
BD143	SURF	Dorrco Roaster	SURFACE	3053	D		01
BD144	SURF	Planer Shop	SURFACE	3053	D		01
BD146	SURF	#4 Warehouse	SURFACE	3053	D		01
BD147	SURF	"C" Cap House	SURFACE	3053	D		01
BD148	SURF	Roaster Stack Fan House #2	SURFACE	3053	D		01
BD149	SURF	"C" Lumber Storage Buildin	SURFACE	3053	D		01
BD150	SURF	"C" Boiler House #3	SURFACE	3053	D		01
BD151	SURF	"C" Oil Tank Storage	SURFACE	3053	D		01
BD154	SURF	"C" Steel Rack	SURFACE	3053	D		01
BD155	SURF	Main Office & Extension	SURFACE	3053	D		01
BD161	SURF	Arsenic Fill Raise House	SURFACE	3053	D		01
BD162	SURF	Calcine Plant	SURFACE	3053	D		01
BD163	SURF	Tailings Dam #2	SURFACE	3053	D		01
BD166	SURF	New "C" Dry	SURFACE	3053	D		01
BD167	SURF	Bag House	SURFACE	3053	D		01
BD168	SURF	"A" New Guest House	SURFACE	3053	D		01
BD169	SURF	Research Laboratory	SURFACE	3053	D		01
BD170	SURF	B-3 #413 Service & Fill Ra	SURFACE	3053	D		01
BD171	SURF	"C" First Aid Training Roo	SURFACE	3053	D		01
BD172	SURF	"C" New Boiler House	SURFACE	3053	D		01
BD173	SURF	"ABC" Property Fencing	SURFACE	3053	D		01
BD177	SURF	G.K.P. Lunch Room	SURFACE	3053	D		01
BD178	SURF	G.K.P. Generator Building	SURFACE	3053	D		01
BD200	SURF	"A" Res.# 200-EXPLORATION	SURFACE	3053	D		01
BD201	SURF	"A" Res. # 201 - FOLKES	SURFACE -	3053	D		01
BD202	SURF	"A" Res. # 202 - CANAM, T.	SURFACE	3053	D		01
BD203	SURF	"A" Res. # 203 - VACANT	SURFACE	3053	D		01
BD204	SURF	"A" Res. # 204 - GOETZ, A.	SURFACE	3053	D		01
BD206	SURF	"A" Res. # 206 - B. CROSS	SURFACE	3053	D		01
BD207	SURF	"A" Res. # 207 - VACANT	SURFACE	3053	D		01
BD208	SURF	"A" Res. # 208 - B. MERCER	SURFACE - ENGINEER	3053	D		01
BD209	SURF	"A" Res. # 209 - GRATON, D	SURFACE	3053	D		01
BD210	SURF	"A" Res. # 210-RANDALL, M.	SURFACE	3053	D		01
BD211	SURF	"A" Res. # 211 - HENRY,B.	SURFACE - COLOMAC	3053	D		01
BD212	SURF	"A" Res. # 212 - MORTON, K	SURFACE	3053	D		01
BD213	SURF	"A" Res. # 213-JEANNOTTE,Y	SURFACE - COLOMAC	3053	D		01
BD216A	SURF	"A" RES. # 216A VACANT	SURFACE	3053	D		01
BD216B	SURF	"B" RES. # 216B COOMBS, G.	SURFACE	3053	D		01
BD217	SURF	"A" Res. # 217 - STARD, J.	SURFACE -	3053	D		01
BD221	SURF	"A" Res. # 221 - MERCER	SURFACE	3053	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
BD247A	SURF	"A" RES. # 247A STEWART,A.	SURFACE	3053	D		01
BD247B	SURF	"B" RES. # 247B SUITE	SURFACE	3053	D		01
BD254	SURF	"A" Res. # 254 - MOORE, R.	SURFACE - COLOMAC	3053	D		01
BD255	SURF	"A" Res. # 255 - BIENIAS,T	SURFACE	3053	D		01
BD257	SURF	"A" Res. # 257 - PATTERSON	SURFACE	3053	D		01
BD286	SURF	"A" Res. # 286 -	SURFACE-DEMOLISH	3053	D		01
BD289A	SURF	"A" RES. # 289A CREED, R	SURFACE	3053	D		01
BD289B	SURF	"B" RES. # 289B GRANEY, B.	SURFACE	3053	D		01
BD292	SURF	"A" RES. # 292 TIETZ, K.	4913-44 ST. YK	3053	D		01
BI101	MILL	CRUSHER RETURN BIN	CRUSHER	3282	D		01
BI201	MILL	#1 FINE ORE BIN (28'X28')	GRINDING	3283	D		01
BI202	MILL	#2 FINE ORE BIN (28'X28')	GRINDING	3283	D		01
BI203	MILL	#3 FINE ORE BIN (28'X28')	GRINDING	3283	D		01
BI204	MILL	#4 FINE ORE BIN (28'X28')	GRINDING	3283	D		01
BI501	MILL	Carbon Kiln Feed Bin	TRP	3288	D		01
BI601	MILL	Carbon Kiln Feed Bin	CARBON PLANT	3287	D		01
BL001	SURF	#1 H.B. Smith Boiler - "C"	SURFACE	3062	H		01
BL002	SURF	#2 H.B. Smith Boiler - "C"	SURFACE	3062	D		01
BL004	SURF	#4 Foster Wheeler Boiler	SURFACE	3062	D		01
BL005	SURF	#5 Cleaver Brooks Boiler	SURFACE	3062	D		01
BL007	SURF	#7 Cleaver Brooks Boiler	SURFACE	3062	D		01
BL010	SURF	#10 Saskatoon Boiler	SURFACE	3062	D		01
BM201	MILL	#1 BALL MILL (10'X 8' DOM)	GRINDING	3283	D		01
BM202	MILL	#2 BALL MILL (10'X8' DOM)	GRINDING	3283	D		01
BM203	MILL	#3 BALL MILL (6'X12' DOM)	GRINDING	3283	D		01
BM204	MILL	#4 BALL MILL (5'X8' DOM)	GRINDING	3283	D		01
BM401	MILL	#6 BM (4X8 ALLIS CHALMERS)	SOLUTIONS	3285	D		01
BM701	MILL	#7 BALL MILL (5X8 DOMINION	ROASTER	3289	D		01
BOBCAT	SURF	BOBCAT	MILL BOBCAT	3120	D		01
BU101	MILL	CRUSHER CONTROL ROOM	CRUSHER	3282	D		01
BU201	MILL	MILL MECHANIC SHOP	GRINDING	3283	D		01
BU301	MILL	Flotation Control Room	FLOTATIONS	3284	D		01
BU401	MILL	Solutions Control Room	SOLUTIONS	3285	D		01
BU501	MILL	Monitor Shack	TRP	3288	D		01
BU502	MILL	Mobile Monitor Shack	TRP	3288	D		01
BU503	MILL	Trash Screen Building	TRP	3288	D		01
BU504	MILL	CIL Screen Room	TRP	3288	D		01
BU505	MILL	Loaded Carbon Screen Room	TRP	3288	D		01
BU506	MILL	CIL Control Room	TRP	3288	D		01
BU507	MILL	Generating Room	TRP	3288	D		01
BU508	MILL	Storage Trailer #1	TRP	3288	D		01
BU509	MILL	Storage Trailer #2	TRP	3288	D		01
BU510	MILL	TRP Office	TRP	3288	D		01
BU511	MILL	Electrical Room	TRP	3288	D		01
BU512	MILL	Compressor Room	TRP	3288	D		01
BU513	MILL	Strip and Regeneration Roo	TRP	3288	D		01
BU514	MILL	Volcano Room	TRP	3288	D		01
BU515	MILL	CARBON STORAGE WAREHOUSE	TRP	3288	D		01
BU701	MILL	Roaster Control Room	ROASTER	3289	D		01
BU801	MILL	Cottrell Lunchroom	COTTRELL/BAGHOUSE	3290	D		01
BU802	MILL	Cottrell Washroom	COTTRELL/BAGHOUSE	3290	D		01
BU901	MILL	ETP CONTROL ROOM	ETP	3294	D		01
B0	860	BUILDING	FIRE ALARM SYSTEMS (	3941	D		02
B1	810	CRUSHER BUILDING	PRIMARY CRUSHER	3901	D		02
B10	860	BUILDING	MEDICAL SERVICES	3941	D		02

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
B11	860	BUILDING	DINNING ROOM	3941	D		02
B1301	U/G	130 SCOOP BUCKET	JC 130	3120	D		01
B2	860	MILLING PLANT	MAIN PLANT	3901	D		02
B2201	U/G	220 SCOOP BUCKET	JCI 220	3120	D		01
B2202	U/G	220 SCOOP BUCKET	JCI 220	3120	D		01
B2203	U/G	220 SCOOP BUCKET	JCI 220	3120	D		01
B2501	U/G	250 SCOOP BUCKET	JCI 250	3120	D		01
B2502	U/G	250 SCOOP BUCKET	JCI 250	3120	D		01
B2503	U/G	250 SCOOP BUCKET	JCI 250	3120	D		01
B2504	U/G	250 SCOOP BUCKET	JCI 250	3120	D		01
B2505	U/G	250 SCOOP BUCKET	JCI 250	3120	D		01
B2801	U/G	285 SCOOP BUCKET	EJC 285	3120	D		01
B2802	U/G	285 SCOOP BUCKET	EJC 285	3120	D		01
B2803	U/G	285 SCOOP BUCKET	EJC 285	3120	D		01
B2804	U/G	285 SCOOP BUCKET	EJC 285	3120	D		01
B2805	U/G	285 SCOOP BUCKET	EJC 285	3120	D		01
B2806	U/G	285 SCOOP BUCKET	EJC 285	3120	D		01
B2807	U/G	285 SCOOP BUCKET	EJC 285	3120	D		01
B2808	U/G	285 SCOOP BUCKET	EJC 285	3120	D		01
B2809	U/G	285 SCOOP BUCKET	EJC 285	3120	D		01
B2810	U/G	285 SCOOP BUCKET	EJC 285	3120	D		01
B3	700	BUILDING	POWERHOUSE	3951	D		02
B3001	U/G	300 SCOOP BUCKET	JC 300	3120	D		01
B3002	U/G	300 SCOOP BUCKET	JC 300	3120	D		01
B3003	U/G	300 SCOOP BUCKET	JC 300	3120	D		01
B3004	U/G	300 SCOOP BUCKET	JC 300	3120	D		01
B3005	U/G	300 SCOOP BUCKET	JC 300	3120	D		01
B4	209	BUILDING	RAW WATER PUMPHOUSE	3701	D		02
B6	850	BUILDING	RECLAIM WATER	3703	D		02
B8	860	BUILDING	NEW MINE SHOP COMPLE	3921	D		02
B9	860	BUILDING	ADMINISTRATION COMPL	3931	D		02
B9201	U/G	921 BUCKET	921	3120	D		01
B9202	U/G	921 SCOOP BUCKET	921	3120	D		01
B9203	U/G	921 SCOOP BUCKET	921	3120	D		01
B9204	U/G	921 SCOOP BUCKET	921	3120	D		01
CB000	SITE	CARPENTER SHOP	COLOMAC CAMPSITE	3941	D		01
CB001	SITE	KITCHEN FREEZER	COLOMAC CAMPSITE	3941	D		01
CB002	SITE	TRAILER 2	COLOAMC CAMPSITE	3941	D		01
CB003	SITE	TRAILER 3	COLOMAC CAMPSITE	3941	D		01
CB004	SITE	TRAILER 4	COLOMAC CAMPSITE	3941	D		01
CB005	SITE	TRAILER 5	COLOMAC CAMPSITE	3941	D		01
CB006	SITE	TRAILER 6	COLOMAC CAMPSITE	3941	D		01
CB007	SITE	TRAILER 7	COLOMAC CAMPSITE	3941	D		01
CB008	SITE	TRAILER 8	COLOMAC CAMPSITE	3941	D		01
CB009	SITE	KITCHEN	COLOMAC CAMPSITE	3941	D		01
CB010	SITE	FIRST AID TRAILER	COLOMAC CAMPSITE	3941	D		01
CB011	SITE	RTL ADCO	COLOMAC CAMPSITE	3941	D		01
CB012	SITE	MAINTENANCE BUILDING	COLOMAC CAMPSITE	3921	D		01
CB013	SITE	ADMINISTRATION BUILDING	COLOMAC CAMPSITE	3941	D		01
CB014	SITE	BOILER HOUSE	COLOMAC CAMPSITE	3941	D		01
CB015	SITE	POWERHOUSE	COLOMAC CAMPSITE	3941	D		01
CB016	SITE	MILL	COLOMAC CAMPSITE	3901	D		01
CB017	SITE	WAREHOUSE STORAGE 1	COLOMAC CAMPSITE	3941	D		01
CB018	SITE	WAREHOUSE STORAGE 2	COLOMAC CAMPSITE	3921	D		01
CB019	SITE	BXL ANFO STORAGE	COLOMAC CAMPSITE	3941	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
CB020	SITE	BXL OFFICE BUILDING	COLOMAC CAMPSITE	3941	D		01
CB021	SITE	PRIMARY CRUSHER	COLOMAC CAMPSITE	3941	D		01
CB022	SITE	AIRPORT GENERATOR SHACK	COLOMAC CAMPSITE	3941	D		01
CB023	SITE	BUILDING, TRAILER #1	CAMP AREA	3941	D		01
CB024	SITE	PEBBLE CRUSHING BUILDING	COLOMAC MINESITE	3723	D		01
CL401	MILL	NORTH CLARIFIER	SOLUTIONS	3285	D		01
CL402	MILL	SOUTH CLARIFIER	SOLUTIONS	3285	D		01
COMP625	MOBILE	COMPRESSOR, GARDNER-DENVER	TIRE TRUCK	3585	D		02
CONSUMABLES	MOBILE	SHOP SUPPLIES	COLOMAC MINE SITE	3596	D		02
CO501	MILL	Machine Shop Compressor	TRP	3288	D		01
CO502	MILL	Instrument Air Compressor	TRP	3288	D		01
CO503	MILL	Leach Air Compressor	TRP	3288	D		01
CO504	MILL	Low Pressure Air Blower	TRP	3288	D		01
CO505	MILL	Flocculant Room Compressor	TRP	3288	D		01
CO506	MILL	Low Pressure Blower	TRP	3288	D		01
CO507	MILL	CIL BLOWER	CIL	3288	D		01
CO801	MILL	FULLER COMPRESSOR (GATX)	COTTRELL/BAGHOUSE	3290	D		01
CPD-1	860	CAMP	POWER DISTRIBUTION	3951	D		02
CP033	ABOIL	DARLING PUMP, CONDENSATE	A BOILER HOUSE	3046	D		01
CP035	MILL	DARLING PUMP, CONDENSATE	#15 COMPRESSOR ROOM	3046	D		01
CP036	MILL	DARLING PUMP, CONDENSATE	#15 COMPRESSOR ROOM	3046	D		01
CP066	MILL	FAIRBANKS MORSE.CONDENSATE	#1 CONVEYOR, CRUSHER	3046	D		01
CP085	MILL	SIHI PUMP CONDENSATE	AC ROASTER, BY DOOR	3046	D		01
CP086	MILL	SIHI PUMP, CONDENSATE	MILL,3RD FLOOR,SOLNS	3046	D		01
CP133	ABOIL	DARLING PUMP, CONDENSATE	A BOILER HOUSE	3046	D		01
CP145	MILL	SIHI PUMP, CONDENSATE	COTTRELL,	3046	D		01
CP148	SURF	DARLING PUMP, CONDENSATE	C BOILER HOUSE	3046	D		01
CP149	SURF	DARLING PUMP, CONDENSATE	C BOILER HOUSE	3046	D		01
CP164	SURF	DARLING PUMP, CONDENSATE	MEG SHOP	3046	D		01
CP359	MILL	MONARCH PUMP, CONDENSATE	REFINERY SEWAGE SUMP	3046	D		01
CP625	MOBILE	COMPRESOR	HD SHOP	3585	H		02
CP803	MOBILE	COMPRESSOR, RD800 GARDNER	MAINTENANCE BUILDING	3585	D		02
CP804	MOBILE	COMPRESSOR, SULLIAR SHOP	HEAVY DUTY SHOP	3585	D		02
CP837	MILL	MONARCH PUMP, CONDENSATE	CIL PLANT, N MILL	3046	D		01
CP838	MILL	MONARCH PUMP, CONDENSATE	SCREENHOUSE, CRUSHER	3046	D		01
CP839	SURF	DARLING PUMP, CONDENSATE	C SEWAGE STATION	3046	D		01
CP916	MOBILE	COMPRESSOR, SHOP	MAINTENANCE BUILDING	3584	D		02
CR001	SURF	U/G Crusher - Buchanan 36	SURFACE	3094	H		01
CR007	SURF	CRUSHER WASTE	SURFACE	3094	H		01
CR101	MILL	DOM JAW (DOM ENG 30"X42")	CRUSHER	3282	D		01
CR102	MILL	#3 CONE CR (SYMONS 1 1/4')	CRUSHER	3282	D		01
CR103	MILL	#4 CONE CR (SYMONS 4')	CRUSHER	3282	D		01
CR104	MILL	#5 CONE CR (SYMONS 4')	CRUSHER	3282	D		01
CR105	MILL	PULVERIZER	ASSAY	3292	D		01
CR106	MILL	PULVERIZER	ASSAY	3292	D		01
CR107	MILL	PULVERIZER RING TYPE	ASSAY	3292	D		01
CR108	MILL	CONE CRUSHER	ASSAY	3292	D		01
CR109	MILL	JAW CRUSHER	ASSAY	3292	D		01
CR110	MILL	JAW CRUSHER	ASSAY	3292	D		01
CR401	MILL	BARREL CRUSHER SOLUTIONS	SOLUTIONS	3285	D		01
CR402	MILL	JAW CRUSHER REFINERY	REFINERY	3286	D		01
CR601	MILL	BARREL CRUSHER CARBON PLAN	CARBON PLANT	3287	D		01
CR801	MOBILE	CRANE, 150 TON MANITOWAC	MAINTENANCE	3585	H		02
CR802	MOBILE	CRANE, 30 TON GROVE CRANE	MAINTENANCE	3585	H		02
CV100	MILL	#27 CV (DODGE DRIVE BELT)	CRUSHER	3282	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
CV101	MILL	#1 CV (42"X130' 3 PLY)	CRUSHER	3282	D		01
CV102	MILL	#2 CV (42"X66' 3 PLY)	CRUSHER	3282	D		01
CV103	MILL	#3 CV (30"X68' 3 PLY)	CRUSHER	3282	D		01
CV104	MILL	#4 CV (30"X 444' 3 PLY)	CRUSHER	3282	D		01
CV105	MILL	#5 CV (21"X370' 3 PLY)	CRUSHER	3282	D		01
CV106	MILL	#6 CV (24"X18' 3 PLY)	CRUSHER	3282	D		01
CV107	MILL	#7 CV (24"X18' 3 PLY)	CRUSHER	3282	D		01
CV108	MILL	#8 CV (20"X840' 3 PLY)	CRUSHER	3282	D		01
CV109	MILL	#9 CV (20"X170' 3 PLY)	CRUSHER	3282	D		01
CV110	MILL	#10 CV (20"X62' 3 PLY)	CRUSHER	3282	D		01
CV111	MILL	#11 CV (20"X62' 3 PLY)	CRUSHER	3282	D		01
CV112	MILL	#12 CV (20"X62' 3 PLY)	CRUSHER	3282	D		01
CV213	MILL	#13 CONVEYOR (36"X40')	GRINDING	3283	D		01
CV214	MILL	#14 CONVEYOR (36"X65')	GRINDING	3283	D		01
CV215	MILL	#15 CONVEYOR (36"X65')	GRINDING	3283	D		01
CV216	MILL	#16 CONVEYOR (36"X65')	GRINDING	3283	D		01
CV217	MILL	#17 CONVEYOR (18"X75')	GRINDING	3283	D		01
CV218	MILL	#18 CONVEYOR (18"X67')	GRINDING	3283	D		01
CV219	MILL	#19 CONVEYOR (18"X68')	GRINDING	3283	D		01
CV220	MILL	17-1 CONVEYOR (18"X75')	GRINDING	3283	D		01
CV801	MILL	#1 CONVEYOR	COTTRELL	3290	D		01
CV802	MILL	#2 CONVEYOR	COTTRELL	3290	D		01
CV803	MILL	#3 CONVEYOR	COTTRELL	3290	D		01
CV804	MILL	#4 CONVEYOR	COTTRELL	3290	D		01
CV805	MILL	#1/#2 CROSS CONVEYOR	COTTRELL	3290	D		01
CV806	MILL	#3/#4 CROSS CONVEYOR	COTTRELL	3290	D		01
CV810	MILL	CROSS CONVEYOR	BAGHOUSE	3290	D		01
CV811	MILL	#1 CONVEYOR	BAGHOUSE	3290	D		01
CV812	MILL	#2 CONVEYOR	BAGHOUSE	3290	D		01
CV813	MILL	#3 CONVEYOR	BAGHOUSE	3290	D		01
CV814	MILL	#4 CONVEYOR	BAGHOUSE	3290	D		01
CY201	MILL	#1 CLASSIFIER (AKINS 72")	GRINDING	3283	D		01
CY202	MILL	#2 CLASSIFIER (AKINS 72")	GRINDING	3283	D		01
CY203	MILL	REGRIND CYCL (10" KREBS)	GRINDING	3283	D		01
CY401	MILL	KREBS CYCLONE (NORMAL) 10"	SOLUTIONS	3285	D		01
CY402	MILL	KREBS CYCLONE (BYPASS) 10"	SOLUTIONS	3285	D		01
CY701	MILL	ROASTER CYCLONES KREBS 10"	ROASTER	3289	D		01
CY702	MILL	ROASTER CYCLONE DORRCO 6"	ROASTER	3289	D		01
C0	860	BUILDING	CAMP GENERAL [MISC]	3941	D		02
C1	860	BUILDING	BUNKHOUSE 1	3941	D		02
C2	860	BUILDING	BUNKHOUSE 2	3941	D		02
C3	860	BUILDING	BUNKHOUSE 3	3941	D		02
C4	860	BUILDING	BUNKHOUSE 4	3941	D		02
C5	860	BUILDING	BUNKHOUSE 5	3941	D		02
C6	860	BUILDING	BUNKHOUSE 6	3941	D		02
C7	860	BUILDING	BUNKHOUSE 7	3941	D		02
C8	860	BUILDING	BUNKHOUSE 8	3941	D		02
DC101	MILL	CRUSHER DUST COLLECT (SLY)	CRUSHER	3282	D		01
DC102	MILL	SCREEN HOUSE DUST COLLECTO	CRUSHER	3282	D		01
DC103	MILL	DUST COLL !SURF CR (MURPHY)	CRUSHER	3282	D		01
DC301	MILL	DUST COLLECTOR MILL LUNCH	FLOTATIONS	3284	D		01
DC801	MILL	BAGHOUSE (GATX FULLER)	COTTRELL/BAGHOUSE	3290	D		01
DC802	MILL	COTTRELL SECT #1/#2 (JOY)	COTTRELL/BAGHOUSE	3290	D		01
DC803	MILL	DUST COLLECTOR COTTRELL	COTTRELL/BAGHOUSE	3290	D		01
DC804	MILL	DUST COLLECTOR COTT. LUNCH	COTTRELL/BAGHOUSE	3290	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
DC805	MILL	COTTRELL SECT #3/#4 (JOY)	COTTRELL/BAGHOUSE	3290	D		01
DD009	SURF	Ditchdigger	SURFACE	3075	H		01
DL101	MOBILE	DRILL, D25K DRILLTECH 1994	DRILL FLEET	3555	H		02
DL102	MOBILE	DRILL, D90K DRILLTECH 1993	DRILL FLEET	3550	H		02
DL103	MOBILE	DRILL, D40K DRILLTECH 1990	DRILL FLEET	3555	H		02
DL104	MOBILE	DM45E INGERSOL RAND	COLOMAC MOBILE	3550	H	T	02
DL105	MOBILE	DRILL, C25K DRILLTECH 1995	DRILL FLEET	3555	H		02
DL106	MOBILE	DRILL, 45R GM-CM	COLOMAC MINESITE	3556	H		02
DOOR-1	860	DOOR	OVERHEAD / AUTOMATIC	3941	D		02
DR001	SURF	GARDNER DENVER 3800 DRILL	ATLAS COPCO DRILL	3080	D		01
DW015	SURF	Wilden M15 - All	SURFACE	3075	H		01
DW190	SURF	Gor Rupp-Standard Centrifu	SURFACE	3085	D		01
DW500	SURF	Pump - M&P 1A-10 Pluro 9 S	SURFACE	3085	D		01
DW501	SURF	Pump - M&P 1A-10 Pluro 9 S	SURFACE	3085	D		01
DW502	SURF	Pump - M&P 1A-10 Pluro 9 S	SURFACE	3085	D		01
DW503	SURF	FLYGHT PUMP 7.5 HP	SURFACE	3085	D		01
DW504	SURF	Pump - M&P 00 Pluro 10 Sta	SURFACE	3085	D		01
DW512	SURF	Flygt	SURFACE	3085	D		01
DW513	SURF	Flygt	SURFACE	3085	D		01
DW517	SURF	Pump - M&P 00 PLuro 10 Sta	SURFACE	3085	D		01
DW518	MILL	8.0 HP FLYGT	MILL	3293	D		01
DW579	U/G	30 HP FLYGT PUMP	UNDERGROUND PUMP	3076	D		01
DW580	U/G	30 HP FLYGT PUMP	UNDERGROUND PUMP	3076	D		01
DW581	U/G	30 HP FLYGT PUMP	UNDERGROUND PUMP	3076	D		01
DW582	U/G	13 HP FLYGT PUMP	UNDERGROUND PUMP	3076	D		01
DW583	U/G	30 HP FLYGT PUMP	UNDERGROUND PUMP	3076	D		01
DW584	U/G	13 HP FLYGT PUMP	UNDERGROUND PUMP	3076	D		01
DW585	U/G	8 HP FLYGT PUMP	UNDERGROUND	3076	D		01
DW709	SURF	Flygt	SURFACE	3085	D		01
DW802	SURF	Flygt Pump - 7 1/2 Electri	SURFACE	3085	D		01
DW803	SURF	Flygt Pump - 7 1/2 Electri	SURFACE	3085	D		01
DW834	SURF	Pump - Toyo DP-10	SURFACE	3085	D		01
DW835	SURF	Pump - M&P 1A Pluro 6 Stag	SURFACE	3085	D		01
DW836	SURF	Pump - M&P 1A Pluro 6 Stag	SURFACE	3085	D		01
DW837	SURF	Pump - Ebera - Lakeshore P	SURFACE	3046	D		01
DW838	SURF	Pump - M&P 1A Pluro 6 Stag	SURFACE	3085	D		01
DW839	SURF	Pump - M&P 1A PLuro 4 Stag	SURFACE	3085	D		01
DW840	SURF	Pump - M&P 1A Pluro 10 Sta	SURFACE	3085	D		01
DW841	SURF	Pump - M&P 1A Pluro 6 Stag	SURFACE	3085	D		01
DW842	SURF	TRP - 100B Toyo Pump #1	SURFACE	3085	D		01
DW843	SURF	TRP - 100B Toyo Pump #2	SURFACE	3085	D		01
DW844	SURF	TRP - 100B Toyo Pump #3	SURFACE	3085	D		01
DW845	SURF	TRP - DP50 Toyo Pump	SURFACE	3085	D		01
DW848	SURF	Pump - Toyo DP-10	SURFACE	3085	D		01
DW849	SURF	Pump - Toyo HK10SE - 4 Sta	SURFACE	3085	D		01
DW850	SURF	Pump - Toyo HK10SE - 6 Sta	SURFACE	3085	D		01
DW851	SURF	Pump - Toyo TPNA 10946	SURFACE	3293	D		01
DYE TANK	860	TANK	AIRSTRIP DYE MARKING	3962	D		02
DZ001	U/G	D3 CAT 1979	D3 CAT 1979	3120	D		01
DZ501	MOBILE	DOZER, D9L 1982	DOZER FLEET	3582	H		02
DZ502	MOBILE	D9L DOZER 1989	COLOMAC MOBILE	3582	H	T	02
DZ503	MOBILE	DOZER, D8L 1982	DOZER FLEET	3582	H		02
DZ505	MOBILE	DOZER, D6D	DOZER FLEET	3582	H		02
DZ506	MOBILE	DOZER, RT824C 1990	DOZER FLEET	3578	H		02
DZ507	MOBILE	DOZER, D8K	DOZER FLEET	3582	H		02

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
DZ510	MOBILE	DOZER, D10N	DOZER FLEET	3582	H		02
D0707	840	UNDERFLOW DENSITY LOOP	THICK. U/F DENSITY	3731	D		02
ED040	SURF	Engine Cummins (G-2 Genera	SURFACE	3075	H		01
EMD001	PHOUSE	POWERHOUSE GENERATOR	COLOMAC MINESITE	3951	H		02
EMD003	PHOUSE	POWERHOUSE GENERATOR	COLOMAC MINESITE	3951	H		02
EMD004	PHOUSE	POWERHOUSE GENERATOR	COLOMAC MINESITE	3951	H		02
EMD005	PHOUSE	POWERHOUSE GENERATOR	COLOMAC MINESITE	3951	H		02
EMD006	PHOUSE	POWERHOUSE GENERATOR	COLOMAC MINESITE	3951	H		02
EMD01	MILL	DIESSEL GENERATOR #1	POWERHOUSE	3951	H		01
EMD02	MILL	DIESSEL GENERATOR #2	POWERHOUSE	3951	H		01
EMD03	MILL	DIESSEL GENERATOR #3	POWERHOUSE	3951	H		01
EMD04	MILL	DIESSEL GENERATOR #4	POWERHOUSE	3951	H		01
EMD05	MILL	DIESEL GENERATOR #5	POWERHOUSE	3951	H		01
EMD06	MILL	DIESEL GENERATOR #6	POWERHOUSE	3951	H		01
FA101	MILL	FAN PORCH AREA	ASSAY	3292	D		01
FA102	MILL	FAN WET LAB	ASSAY	3292	D		01
FA103	MILL	FAN PARTING ROOM	ASSAY	3292	D		01
FA104	MILL	FAN DUCKING ROOM	ASSAY	3292	D		01
FA301	MILL	FLOTATION BLOWER (SPENCER)	FLOTATIONS	3284	D		01
FA302	MILL	Vent Fan Reagent Deck	FLOTATIONS	3284	D		01
FA303	MILL	Vent Fan Midds Tank	FLOTATIONS	3284	D		01
FA401	MILL	SOUTH ROOF FAN REFINERY	REFINERY	3286	D		01
FA402	MILL	NORTH ROOF FAN REFINERY	REFINERY	3286	D		01
FA403	MILL	Areation Tank Fan	SOLUTIONS	3285	D		01
FA404	MILL	Barren Weir Tank Vent Fan	SOLUTIONS	3285	D		01
FA405	MILL	#7 Agitator Vent Fan	SOLUTIONS	3285	D		01
FA406	MILL	#5/#6 Thickener Vent Fan	SOLUTIONS	3285	D		01
FA407	MILL	South Clarifier Vent Fan	SOLUTIONS	3285	D		01
FA501	MILL	Acid Wash Surge Tank Vent	TRP	3288	D		01
FA502	MILL	Barren Tank Vent Fan	TRP	3288	D		01
FA503	MILL	Electrowinning Area Vent F	TRP	3288	D		01
FA504	MILL	Combustion Air Fan	TRP	3288	D		01
FA505	MILL	Kiln Discharge Vent Fan	TRP	3288	D		01
FA506	MILL	Cyanide Area Vent Fan	TRP	3288	D		01
FA507	MILL	Compressor Room Fan	TRP	3288	D		01
FA508	MILL	CIL BLOWER	CIL	3288	D		01
FA602	MILL	#13 Agitator Vent Fan	CARBON PLANT	3287	D		01
FA603	MILL	#14 Agitator Vent Fan	CARBON PLANT	3287	D		01
FA604	MILL	#25 Agitator Vent Fan	CARBON PLANT	3287	D		01
FA605	MILL	Electrowinning Cell Vent F	CARBON PLANT	3287	D		01
FA701	MILL	2ND STG BOOST BLOWER (COPP	ROASTER	3289	D		01
FA702	MILL	#1 ROASTER BLOWER (SPENCER	ROASTER	3289	D		01
FA703	MILL	#2 ROASTER BLOWER (SPENCER	ROASTER	3289	D		01
FA704	MILL	#3 ROASTER BLOWER (SPENCER	ROASTER	3289	D		01
FA705	MILL	#4 ROASTER BLOWER (SPENCER	ROASTER	3289	D		01
FA706	MILL	1ST STG BOOST BLOWER (CAN)	ROASTER	3289	D		01
FA707	MILL	Roof Vent Fans	ROASTER	3289	D		01
FA801	MILL	COTTRELL FAN	COTTRELL/BAGHOUSE	3290	D		01
FA802	MILL	STACK FAN	COTTRELL/BAGHOUSE	3290	D		01
FE101	MILL	ROSS FEEDER	CRUSHER	3282	D		01
FE401	MILL	NORTH ZINC FEEDER	SOLUTIONS	3285	D		01
FE402	MILL	ZINC FEEDER SPARE	SOLUTIONS	3285	D		01
FE403	MILL	SOUTH ZINC FEEDER	SOLUTIONS	3285	D		01
FE501	MILL	Lime Screw Feeder	TRP	3288	D		01
FI101	MILL	VACUUM FILTERS	ASSAY	3292	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
FI102	MILL	PRESSURE FILTERS	ASSAY	3292	D		01
FI103	MILL	CRUSHER OIL FILTER	CRUSHER	3282	D		01
FI401	MILL	BELT FILTER (EIMCO)	SOLUTIONS	3285	D		01
FI501	MILL	Lime Silo Vent Filter	TRP	3288	D		01
FI701	MILL	6 FT DISC FILTER (DOL)	ROASTER	3289	D		01
FI801	MILL	HI VAC VACUUM SYSTEM	COTTRELL/BAGHOUSE	3290	D		01
FI901	MILL	Lime Silo Vent Filter	ETP	3294	D		01
FK608	MOBILE	TYRE MANIPULATOR	HEAVY DUTY SHOP	3585	D		02
FK618	MOBILE	FORKLIFT, JCB930 1990	WAREHOUSE	3585	D		02
FL301	MILL	MAXWELL CELL #1 (M20)	FLOTATIONS	3284	D		01
FL302	MILL	MAXWELL CELL #2 (M20)	FLOTATIONS	3284	D		01
FL303	MILL	W PRI FLOT CELL (DENVER)	FLOTATIONS	3284	D		01
FL304	MILL	E PRI FLOT CELL (DENVER)	FLOTATIONS	3284	D		01
FL305	MILL	W SEC FLOT CELL (DENVER)	FLOTATIONS	3284	D		01
FL306	MILL	E SEC FLOT CELL (DENVER)	FLOTATIONS	3284	D		01
FL307	MILL	#3 Maxwell Cell (M8)	FLOTATIONS	3284	D		01
FL308	MILL	WEST SCAVENGERS	FLOTATIONS	3284	D		01
FL309	MILL	EAST SCAVENGERS	FLOTATIONS	3284	D		01
FL310	MILL	WEST SCAVENGER AGITATOR #1	FLOTATIONS	3284	D		01
FL311	MILL	WEST SCAVENGER AGITATOR #2	FLOTATIONS	3284	D		01
FL312	MILL	EAST SCAVENGER AGITATOR #3	FLOTATIONS	3284	D		01
FL313	MILL	EAST SCAVENGER AGITATOR #4	FLOTATIONS	3284	D		01
FL314	MILL	CLEANER CELL MOTOR #1	FLOTATIONS	3284	D		01
FS001	U/G	FIRE SUPPRESSION - 1ST	UNDERGROUND	3036	D		01
FS1500	U/G	FIRE SUPPRESSION - 1500	UNDERGROUND	3036	D		01
FS712	U/G	FIRE SUPPRESSION - 712	UNDERGROUND	3036	D		01
FU101	MILL	ELECTRIC FURNACE	ASSAY	3292	D		01
FU102	MILL	ELECTRIC FURNACE ROOM	ASSAY	3292	D		01
FU401	MILL	#1 PRECIP FURNACE (WABI)	REFINERY	3286	D		01
FU402	MILL	#2 PRECIP FURNACE (WABI)	REFINERY	3286	D		01
FU403	MILL	#3 PRECIP FURNACE (WABI)	REFINERY	3286	D		01
FU404	MILL	#4 PRECIP FURNACE (WABI)	REFINERY	3286	D		01
FU501	MILL	Carbon Reactivation Kiln	TRP	3288	D		01
FU601	MILL	REACTIVATION KILN (AC)	CARBON PLANT	3287	D		01
F0404	830	WATER ADDITION LOOP	PRIMARY MILL FEED	3721	D		02
F1061A	850	TAILS FLOW LOOP (PLANT)	TAILINGS LINE- PLANT	3702	D		02
F1061B	850	TAILS FLOW LOOP (POND END)	TAILINGS LINE (POND)	3702	D		02
F1113	850	ELUATE FEED FLOW LOOP	ELUATE HEAT-XCHANGER	3733	D		02
F1205	850	FLOW TO EW CELL LOOP	EW FEED LINE	3733	D		02
F2727	850	RECLAIM WATER FLOW LOOP	RECLAIM WATER LINE	3703	D		02
GE201	MILL	Generator Portable (Homeli	MECHANIC SHOP	3266	D		01
GE202	MILL	Generator Portable (Diesel	GRINDING	3283	D		01
GE203	MILL	Generator Portable (Homeli	GRINDING	3283	D		01
GE501	MILL	AC Generator #1	TRP	3288	D		01
GE502	MILL	AC Generator #2	TRP	3288	D		01
GRADER	860	CAT GRADER	CAT GRADER	3582	D		02
GR508	MOBILE	GRADER, 14G 1987	GRADER FLEET	3579	H		02
GR509	MOBILE	GRADER, 16G 1981	GRADER FLEET	3579	H		02
GS901	MOBILE	GENERATOR	COLOMAC MINESITE	3585	D		02
GS902	MOBILE	LISTER GENERATOR(AIRPORT)	COLOMAC MINE SITE	3585	D		02
GS917	MOBILE	GENERATOR, CUMMINS ENGINE	COLOMAC MINE SITE	3585	D		02
GS918	MOBILE	GENERATOR, CUMMINS 2	DEWATERING EQUIPMENT	3585	D		02
HE501	MILL	Solution Heater Volcano	TRP	3288	D		01
HE502	MILL	Solution Heater Flocculant	TRP	3288	D		01
HE601	MILL	SOL'N HEATER (CHROMALOX)	CARBON PLANT	3287	D		01

1998-11-20 ROYAL OAK MINES INC. (N.W.T. DIVISION)
EQUIPMENT BY EQP #

EQUIPMENT	LOCATION	EQP. DESC.	JC. DESC.	ACCT	CYCLE	TAG OUT	ST
H0101	MILL	Surface Crusher Crane	CRUSHER	3282	D		01
H0102	MILL	CRUSHER CRANE	CRUSHER	3282	D		01
H0103	MILL	CRUSHER HOIST (HYDRAMACH)	CRUSHER	3282	D		01
H0201	MILL	Crane Mechanic Shop	MECHANIC SHOP	2136	D		01
H0301	MILL	BALL MILL CRANE	FLOTATIONS	3284	D		01
H0302	MILL	SOUTH REAGENT HOIST	FLOTATIONS	3284	D		01
H0303	MILL	NORTH REAGENT HOIST	FLOTATIONS	3285	D		01
H0401	MILL	HOIST PRECIPITATE	SOLUTIONS	3285	D		01
H0402	MILL	HOIST SOUTH CLARIFIER (IR)	SOLUTIONS	3288	D		01
H0501	MILL	Overhead Gantron Crane	TRP	3288	D		01
H0502	MILL	Overhead Hoist (Carbon)	CIL	3288	D		01
H0503	MILL	AMERICAN CRANE	TRP	3287	D		01
H0601	MILL	CARBON PLANT HOIST	CARBON PLANT	3287	D		01
H0602	MILL	#25 Agitator Hoist	CARBON PLANT	3287	D		01
H0603	MILL	Strip Hoist	CARBON PLANT	3289	D		01
H0701	MILL	ROASTER ELEVATOR	ROASTER	3289	D		01
H0702	MILL	AC ROASTER HOIST	ROASTER	3294	D		01
H0901	MILL	ETP Crane	ETP	3294	D		01
H0902	MILL	ETP REAGENT HOIST	ETP	3130	H		01
HT052	U/G	EJC - JDT 413 TRUCK 1984	JDT413	3130	H		01
HT055	U/G	EJC JDT 413 TRUCK 1984	JDT413	3130	H		01
HT059	U/G	EJC TJDT 413 TRUCK 1987	JDT413	3130	H		01
HT060	U/G	EJC JDT 413 TRUCK 1988	JDT413	3130	H		01
HT061	U/G	EJC JDT 413 TRUCK 1988	JDT413	3130	H		01
HT090	U/G	Jarvis Clark JDT 1990	JD 415	3130	H		01
HT092	U/G	EJC 413 TRUCK (BRENDA)	JDT413	3288	D		01
IN501	MILL	Variable Speed Controller	TRP	3288	D		01
IN502	MILL	Variable Speed Controller	TRP	3288	D		01
IN503	MILL	Variable Speed Controller	TRP	3140	D		01
JD035	U/G	EJC MJM-20B JUMBO 1976	MJM20B	3140	D		01
JD046	U/G	EJC MJM-20B JUMBO 1988	MJM20B	3140	D		01
JD047	U/G	EJC MJM-20B JUMBO 1988	MJM20B	3140	D		01
JD049	U/G	EJC MJM-20B JUMBO 1984	MJM20B	3140	D		01
JD053	U/G	EJC MJM-20B JUMBO 1986	MJM20B	3140	D		01
JD057	U/G	EJC MJM-20B JUMBO 1985	MJM20B	3080	D		01
JL003	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL008	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL403	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL405	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL413	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL414	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL415	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL416	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL417	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL418	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL419	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL420	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL426	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL613	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL648	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL656	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL657	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL665	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL669	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL673	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
JL675	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL678	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL679	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL681	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL684	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL690	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL691	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL692	U/G	S025 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL693	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL694	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL697	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL699	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL700	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL713	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL716	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL717	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL718	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL722	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL723	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL725	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL727	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL728	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL729	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL730	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL731	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL732	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL734	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL737	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL739	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL741	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL743	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL746	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL747	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL748	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL751	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL752	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL753	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL754	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL755	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL756	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL757	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL758	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL761	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL762	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL764	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL765	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL766	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL767	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL768	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL769	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL770	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL771	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL772	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL773	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
JL774	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01

EQUIPMENT	LOCATION	EQP. DESC.		LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
JL775	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL780	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL782	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL783	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL784	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL785	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL786	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL787	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL789	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL804	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL808	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL826	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
JL830	U/G	S250 JACKLEG DRILL		UNDERGROUND	3080	D		01
J0204	810	MOTOR DRAW INDICATOR		PRIM. CRUSHER MOTOR	3711	D		02
J0406	830	POWER DRAW LOOP PRI. MILL		PGM MILL MOTOR #1	3721	D		02
J0408	830	POWER DRAW LOOP PRI. MILL		PGM MILL MOTOR #2	3721	D		02
J0508	830	SGM.#1 POWER DRAW LOOP		SECONDARY GRINDING	3722	D		02
J0510	830	LEVEL INDICATOR		#2 SGM DISCH. BOX	3722	D		02
J0521	830	MOTOR POWER DRAW LOOP		SGM #2 MOTOR	3722	D		02
J508	830	POWER DRAW LOOP		SGM #1 MOTOR	3722	D		02
LAB	860	BUILDING		METALLURGICAL	3931	D		02
LA201	845	LOOP / LIME AUTO ADDITION		LIME ADDITION	3731	D		02
LM001	SURF	Locomotive Mancha #1		SURFACE	3075	D		01
LM002	SURF	Locomotive Mancha #2		SURFACE	3075	D		01
LM003	SURF	Locomotive Mancha #3		SURFACE	3075	H		01
LM004	SURF	Locomotive Mancha #4		SURFACE	3075	D		01
LM005	SURF	Locomotive Mancha #5		SURFACE	3075	H		01
LM006	SURF	Locomotive Mancha #6		SURFACE	3075	H		01
LM007	SURF	Locomotive Mancha #7		SURFACE	3075	H		01
LM009	SURF	Locomotive Mancha #9		SURFACE	3075	D		01
LM010	SURF	Locomotive Mancha #10		SURFACE	3075	H		01
LM011	SURF	Locomotive Mancha #11		SURFACE	3075	D		01
LM012	SURF	Locomotive Mancha #12 (D7)		SURFACE	3075	D		01
LM013	SURF	Locomotive Mancha #13		SURFACE	3075	D		01
LM014	SURF	Locomotive Mancha #14		SURFACE	3075	H		01
LM015	SURF	Locomotive Mancha #15		SURFACE	3075	D		01
LM016	SURF	Locomotive Mancha #16		SURFACE	3075	D		01
LM017	SURF	Locomotive Mancha #17		SURFACE	3075	D		01
LM018	SURF	Locomotive Mancha #18		SURFACE	3075	D		01
LM019	SURF	Locomotive Mancha #19		SURFACE	3075	D		01
LM070	SURF	Locomotive Titan #70		SURFACE	3075	H		01
LM071	SURF	Locomotive Titan #71		SURFACE	3075	H		01
LM072	SURF	Locomotive Titan #72		SURFACE	3075	H		01
LM074	SURF	Locomotive Titan #74		SURFACE	3075	H		01
LM075	SURF	Locomotive Titan #75		SURFACE	3075	H		01
LM076	SURF	Locomotive Titan #76		SURFACE	3075	H		01
LM077	SURF	Locomotive Titan #77		SURFACE	3075	H		01
LM078	SURF	Locomotive Titan #78		SURFACE	3075	H		01
LM079	SURF	Locomotive Titan #79		SURFACE	3075	H		01
LM080	SURF	Locomotive Titan #80		SURFACE	3075	H		01
LM090	SURF	LOCOMOTIVE TITAN #90		1500 LEVEL	3075	D		01
LM091	SURF	LOCOMOTIVE TITAN #91		1500 LEVEL	3075	D		01
LO301	MOBILE	LOADER, 992C		LOADER FLEET	3581	H		02
LO302	MOBILE	LOADER, 992C	1978	COLOMAC MOBILE	3581	H		02
LO306	MOBILE	LOADER, 966C	1975	LOADER FLEET	3580	H		02

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
LO307	MOBILE	LOADER, 966D 1987	LOADER FLEET	3580	H		02
LO308	MOBILE	CASE UNI LOADER #1840	COLOMAC MINE	3581	H	T	02
LO309	SURF	FORKLIFT, BOBCAT 763 1995	SURFACE USEAGE	3210	H		01
LO310	SURF	FORKLIFT, BOBCAT 763 1995	MILL DEPARTMENT	3210	H		01
LO311	SURF	LOADER,RAMROD - COLOMAC 98	MILL OPERATIONS	3210	D		01
LO614	MOBILE	BACKHOE, 235 1980	BACKHOE	3577	H		02
LO615	SURF	245 CAT BACKHOE -COL. 98	BACKHOE	3210	H		01
LP902	MOBILE	LIGHT PLANT, GENERATOR SET	MINE DEPARTMENT	3585	D		02
LU101	MILL	DOMINION JAW LUBE (TRABON)	CRUSHER	3282	D		01
LU201	MILL	#1 BM LUBE (TRABON)	GRINDING	3283	D		01
LU202	MILL	#2 BM LUBE (TRABON)	GRINDING	3283	D		01
LU203	MILL	#3 BALL MILL LUB (TRABON)	GRINDING	3283	D		01
LU204	MILL	#4 BALL MILL LUBE (TRABON)	GRINDING	3283	D		01
LU401	MILL	#6 BALL MILL LUBE (TRABON)	SOLUTIONS	3285	D		01
LU501	MILL	Safety Screen Lubricator	CIL	3288	D		01
LU502	MILL	Carbon Screen Lubricator	TRP	3288	D		01
LU701	MILL	#7 BALL MILL LUBE (TRABON)	ROASTER	3289	D		01
LV602	MOBILE	TRUCK, 8000 FORD TRACTOR	MEDIUM LV EQUIPMENT	3585	D		02
LV603	MOBILE	TRUCK, GMC C-70 LUBE 1986	MEDIUM LV EQUIPMENT	3585	H		02
LV604	MOBILE	TRUCK, KENWORTH VACCUUM	MEDIUM LV EQUIPMENT	3585	D		02
LV610	MOBILE	TRUCK, FORD FALT DECK F800	MEDIUM LV EQUIPMENT	3585	H		02
LV612	MOBILE	TRUCK, FUEL INTERNATIO1979	MEDIUM LV EQUIPMENT	3585	H		02
LV615	MOBILE	TRUCK, MACK FUEL TRUCK	MEDIUM LV EQUIPMENT	3585	H		02
LV617	MOBILE	TRUCK, FUEL/LUBE	COLOAMC MINE SITE	3585	D		02
LV619	MOBILE	TRUCK, INTERNATIONAL FIRE	SAFETY MOBILE	3585	H		02
LV621	MOBILE	CEMENT MIXER, INTERNATIONA	COLOAMC MINE SITE	3585	D		02
LV624	MOBILE	BUS,8-700 44 PASSENGER	MEDIUM LV EQUIPMENT	3585	D		02
LV625	MOBILE	MEDIUM TRUCK, TIRE TRUCK	MAINTENANCE DEPT.	3585	D		02
LV626	MOBILE	BUS, B600 THOMAS	MEDIUM LV EQUIPMENT	3585	H		02
LV628	MOBILE	TRUCK, TANKER TRUCK	MEDIUM LV EQUIPMENT	3585	H		02
LV630	MOBILE	TRUCK, KENWORTH WINCH	MEDIUM LV EQIUPMENT	3584	D		02
LV700	MOBILE	ALL LIGHT VEHICLES	MINE MAINTENANCE	3584	D		02
LV701	MOBILE	PICK-UP, 2500 SIERRA 1989	LIGHT VEHICLE FLEET	3584	D		02
LV702	MOBILE	PICK-UP, SIERRA 1500 1989	LIGHT VEHICLE FLEET	3584	D		02
LV703	MOBILE	PICK-UP, F350 4X4 1994	LIGHT VEHICLE FLEET	3584	D		02
LV704	MOBILE	PICK-UP, F350 4X4 1994	LIGHT VEHICLE FLEET	3584	D		02
LV705	MOBILE	1500 BLACK SUBURBAN 1989	COLOMAC MOBILE	3584	D	T	02
LV706	MOBILE	VAN, VALLY STX 1989	SAFETY MOBILE	3584	D		02
LV707	SURF	PICK-UP,F350 SERVICE 1990	MEG	3220	D		01
LV708	MOBILE	F250 WHITE (4X4) 1987	COLOMAC MOBILE	3584	D	T	02
LV709	MOBILE	PICK-UP, F250 4X4 1994	LIGHT VEHICLE FLEET	3220	D		02
LV710	MOBILE	PICK-UP, F250 4X4 1994	LIGHT VEHICLE FLEET	3584	D		02
LV711	MOBILE	PICK-UP, F250 FORD 1994	LIGHT VEHICLE FLEET	3584	D		02
LV712	MOBILE	PICK-UP, 1500 1/2 TON 1990	LIGHT VEHICLE FLEET	3584	D		02
LV713	MOBILE	PICK-UP, 1/2 TON CHEV 1990	LIGHT VEHICLE FLEET	3584	D		02
LV714	MOBILE	PICK-UP, CHEV 1/2 TON 1989	LIGHT VEHICLE FLEET	3584	H		02
LV715	MOBILE	PICK-UP, 1500 1/2 TON 1989	LIGHT VEHICLE FLEET	3584	D		02
LV716	MOBILE	PICK-UP, F250 4X4 1994	LIGHT VEHICLE FLEET	3584	D		02
LV717	MOBILE	PICK-UP, F250 4X4 1994	LIGHT VEHICLE FLEET	3584	D		02
LV721	MOBILE	350XL 4X4 CREW CAB 1989	COLOMAC MOBILE	3584	D	T	02
LV725	MOBILE	PICK-UP, F250 FORD	LIGHT VEHICLE FLEET	3584	D		02
LV726	MOBILE	PICK-UP, F250	LIGHT VEHICLE FLEET	3584	D		02
LV727	MOBILE	PICK-UP, F250 1994	LIGHT VEHICLE FLEET	3584	D		02
LV728	MOBILE	PICK-UP, F250 4X4 1995	LIGHT VEHICLE FLEET	3584	D		02
LV729	MOBILE	PICK-UP, F250 4X4 1994	LIGHT VEHICLE FLEET	3584	D		02

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
LV730	MOBILE	PICK UP, CHEVY GMC SIERRA	WAREHOUSE	3584	D		02
L0003	MOBILE	LOUBOY, TRAILER FLAT DECK	LOUBOY, TRAILER	3584	D		02
L0202	810	SURGE BIN LEVEL INDICATOR	PRIM.CRU. SURGE BIN	3711	D		02
L0411	830	PUMP BOX LEVEL LOOP	PGM DISCHARGE BOX	3721	D		02
L0510	830	PUMP BOX LEVEL LOOP	#1 SGM DISCHARGE BOX	3722	D		02
L0523	830	PUMP BOX LEVEL LOOP	#2 SGM DISCHARGE BOX	3722	D		02
L0707	840	LIME ADDITION LOOP	THICKENER	3721	H		02
L1001	850	PUMP BOX LEVEL LOOP	TAILINGS BOX	3702	D		02
L1111	850	ELUATE TANK LEVEL LOOP	LOADED ELUATE TANK	3733	D		02
L1140	850	LEVEL LOOP LOAD. CARB.TANK	LOADED CARBON TANK	3733	D		02
L1210	850	BARREN TANK LEVEL LOOP	ELUATE BARREN TANK	3733	D		02
L1701	850	PROCESS TANK LEVEL LOOP	PROCESS WATER TANK	3703	D		02
L1702	850	TANK LEVEL LOOP	GLAND/PLANT H2O TANK	3703	D		02
L2201	700	FUEL TANK LEVEL INDICATOR	POWERHOUSE DAY TANK	3951	D		02
MA101	MILL	#3 MAGNET	CRUSHER	3282	D		01
MA102	MILL	#6 MAGNET	CRUSHER	3282	D		01
MA103	MILL	#7 MAGNET	CRUSHER	3282	D		01
MBD001	DOOR	DOOR, BAY DOOR #1	STEAM BAY	3921	D		02
MBD002	DOOR	DOOR, BAY DOOR #2	MAIN SHOP	3921	D		02
MBD003	DOOR	DOOR, BAY DOOR #3	MAIN SHOP	3921	D		02
MBD004	DOOR	DOOR, BAY DOOR #4	MAIN SHOP	3921	D		02
MBD005	DOOR	DOOR, BAY DOOR #5	MAIN SHOP	3921	D		02
MBD006	DOOR	DOOR, BAY DOOR #6	MAIN SHOP	3921	D		02
MBD007	DOOR	DOOR, BAY DOOR #7	MAIN SHOP	3921	D		02
MBD008	DOOR	DOOR, BAY DOOR #8	MAIN SHOP	3921	D		02
MBD009	DOOR	DOOR, BAY DOOR#9	WELDING BAY	3921	D		02
MBD010	DOOR	DOOR, BAY DOOR #10	LIGHT DUTY BAY#1	3921	D		02
MBD011	SITE	DOOR, BAY DOOR #11	LIGHT DUTY BAY#2	3921	D		02
MBD012	DOOR	DOOR, AMBULANCE BAY DOOR	MACHINE SHOP	3921	D		01
MBD013	DOOR	SHOP OVERHEAD BAY DOOR	WAREHOUSE WEST DOOR	3921	D		02
MBD014	DOOR	DOOR, BAY DOOR #14	WAREHOUSE NORTH	3921	D		02
MC001	SURF	JOHN DEERE GATOR (NEW)'98	SURFACE	3220	D		02
MC002	SURF	RBL-MANCARRIER (HOPEBROOK)	SURFACE	3210	D		01
MC003	SURF	GATOR -	SURFACE	3220	D		01
MC004	SURF	GATOR - 1998 6 X 4	SURFACE -	3220	D		01
MC501	MILL	American Crane	TRP	3288	D		01
MECH-GEN	860	MECHANICAL GENERAL	MECHANICAL GENERAL (	3911	D		01
MECHSHOP	860	MECHANIC SHOP	MECHANICAL	3911	D		02
MEDICAL	860	MEDICAL	MEDICAL EQUIPMENT -	3941	D		02
METER#01	SURF	MINE FRESH H20 METER	"C" HEADFRAME	3046	D		02
METER#02	SURF	MILL FRESH H20 PROCESS	MILL	3046	D		01
METER#03	SURF	FIRE FRESH H20 METER	SURFACE	3046	D		01
METER#04	SURF	TAILS DISCHARGE METER	SURFACE	3281	D		01
METER#05	SURF	"A"BOILER FRESH H20 MAKEUP	"A" BOILER	3046	D		01
METER#06	SURF	"C"BOILER FRESH H20 MAKEUP	"C" BOILER	3046	D		01
METER#07	SURF	8" MINE DISCHARGE H20	MILL	3046	D		01
METER#08	SURF	10" MINE DISCHARGE H20	MILL	3046	D		01
METER#09	SURF	DOMESTIC FRESH H20 METER	LAKE SHORE	3046	D		01
METER#10	SURF	MAIN PUMPHOUSE FRESH H20#1	LAKE SHORE	3046	D		01
METER#11	SURF	MAIN PUMPHOUSE FRESH H20#2	LAKE SHORE	3046	D		01
METER#12	SURF	"C" COMPRESSOR METER	"C" HEADFRAME	3046	D		01
MH001	SURF	Rope - "C" U/W Mancage(G-9	SURFACE	3090	D		01
MH002	SURF	Rope - "C" O/W CWT (911028	SURFACE	3090	D		01
MH003	SURF	Manhoist - "C" Shaft	SURFACE	3091	D		01
MH004	SURF	"C" SHAFT U/W SKIP	SURFACE	3090	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
MH006	SURF	Mancage CWT (Homemade)	SURFACE	3090	D		01
MH023	SURF	Sheave Wheel-"C" U/W Manca	SURFACE	3091	D		01
MH024	SURF	Sheave Wheel-"C" O/W CWT	SURFACE	3091	D		01
MINESHOP	860	SHOP	MINE	3921	D		02
MI102	MILL	FLASK SHAKER WET LAB	ASSAY	3292	D		01
MI103	MILL	FLASK SHAKER STORAGE	ASSAY	3292	D		01
MI104	MILL	WATER STILL OVER OFFICE	ASSAY	3292	D		01
MI401	MILL	PRECIPITATE MIXER (REFINER	REFINERY	3286	D		01
MI501	MILL	Monitor Controls	TRP	3288	D		01
MI502	MILL	Monitor Controls	TRP	3288	D		01
MI503	MILL	Pelton Wheel	TRP	3288	D		01
MI504	MILL	Eductor Tank #1	TRP	3288	D		01
MI505	MILL	Eductor Tank #2	TRP	3288	D		01
MI506	MILL	Eductor Tank #3	TRP	3288	D		01
MI507	MILL	Eductor Tank #4	TRP	3288	D		01
MI508	MILL	Eductor Tank #5	TRP	3288	D		01
MI509	MILL	Eductor Tank #6	TRP	3288	D		01
MI510	MILL	CIL Feed Sampler	CIL	3288	D		01
MI511	MILL	CIL Tails Sampler	CIL	3288	D		01
MI512	MILL	Acid Wash Unloaded Eductor	TRP	3288	D		01
MI513	MILL	Strip Vessel #1 Eductor	TRP	3288	D		01
MI514	MILL	Strip Vessel #2 Eductor	TRP	3288	D		01
MI515	MILL	Kiln Feed Bin Reducer	TRP	3288	D		01
MI516	MILL	Lime Slaker	TRP	3288	D		01
MI517	MILL	Generator Engine #1	TRP	3288	D		01
MI518	MILL	Generator Engine #2	TRP	3288	D		01
MI519	MILL	Recovery Heat Exchanger	TRP	3288	D		01
MI520	MILL	Pregnant Cooling Exchanger	TRP	3288	D		01
MI601	MILL	Loaded Carbon Transfer Edu	CARBON PLANT	3287	D		01
MI602	MILL	STRIPPED CARBON EDUCTOR	CARBON PLANT	2166	D		01
MI901	MILL	Barge	ETP	3294	D		01
MN501	MILL	Memory Monitor (Blue)	TRP	3288	D		01
MN502	MILL	Memory Monitor (Red)	TRP	3288	D		01
MN503	MILL	Memory Monitor (Orange)	TRP	3288	D		01
MN504	MILL	Memory Monitor (Yellow)	TRP	3288	D		01
MOBILE53101	MOBILE	DIAMOND JAW CRUSHER	MINE DEPARTMENT	0680	D		02
MO501	MILL	Spr Acid Wash Sump Pump Mo	TRP	3288	D		01
MO502	MILL	Spr Acid Wash Drain Pump M	TRP	3288	D		01
MO503	MILL	Spr Barren Sol'n Trnfer Mo	TRP	3288	D		01
MO504	MILL	Spr Regen Area Sump Pump M	TRP	3288	D		01
MO505	MILL	Lime Slaker Motor	TRP	3288	D		01
MO506	MILL	Lime Screw Feeder Motor	TRP	3288	D		01
MO507	MILL	Lime Silo Shaker Motor	TRP	3288	D		01
MO508	MILL	Lime Silo Sump Pump Motor	TRP	3288	D		01
MO509	MILL	Lime Circulating Pump Moto	TRP	3288	D		01
MO510	MILL	Lime Circulating Pump Moto	TRP	3288	D		01
MO511	MILL	Lime Slurry Hold Tank AG M	TRP	3288	D		01
MO512	MILL	Lime Grit Conveyor Motor	TRP	3288	D		01
MO513	MILL	Cyanide Mix Tank AG Motor	TRP	3288	D		01
MO514	MILL	Cyanide Transfer Pump Moto	TRP	3288	D		01
MO515	MILL	Cyanide Circ Pump Motor #1	TRP	3288	D		01
MO516	MILL	Cyanide Circ Pump Motor #2	TRP	3288	D		01
MO517	MILL	Reagent Area Sump Pump Mot	TRP	3288	D		01
MO518	MILL	Spr Reagent Sump Pump Moto	TRP	3288	D		01
MO519	MILL	Spr Cyanide Trnfer Pump Mo	TRP	3288	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
MO520	MILL	Caustic Mix Tank AG Motor	TRP	3288	D		01
MO521	MILL	Caustic Sol'n Circ Pump Mo	TRP	3288	D		01
MO522	MILL	Machine Shop Compressor Mo	TRP	3288	D		01
MO523	MILL	Instrument Compressor Moto	TRP	3288	D		01
MO524	MILL	Leach Air Compressor Motor	TRP	3288	D		01
MO901	MILL	BARGE PU MOTOR #1 (GE 150)	ETP	3294	D		01
MO902	MILL	BARGE PU MOTOR #2 (GE 150)	ETP	3294	D		01
MO903	MILL	Barge Pump Motor #3	ETP	3294	D		01
MS906	MOBILE	LATHE, MACHINE SHOP	MACHINE SHOP	3585	D		02
MS907	MOBILE	PRESS, HYDRAULIC	MACHINE SHOP	3585	D		02
MS908	MOBILE	PRESS, DRILL	MACHINE SHOP	3585	D		02
MS909	MOBILE	MILLING, MACHINE	MACHINE SHOP	3585	D		02
MS910	MOBILE	SAW, BAND	MACHINE SHOP	3585	D		02
MT201	MILL	Pipe Fusing Machine	MECHANIC SHOP	3266	D		01
MT202	MILL	Vulcanizer	MECHANIC SHOP	3266	D		01
MT203	MILL	PIPE THREAD MACH (RIDGID)	MECHANIC SHOP	3266	D		01
MT204	MILL	Grinder 4"	MECHANIC SHOP	3266	D		01
MT205	MILL	Bottle Jacks 15 Ton	MECHANIC SHOP	3266	D		01
MT206	MILL	Drill	MECHANIC SHOP	3266	D		01
MT207	MILL	Chainsaw	MECHANIC SHOP	3266	D		01
MT208	MILL	Fusion Machine	MECHANIC SHOP	3266	D		01
MT209	MILL	Welding Fume Extractor	MECHANIC SHOP	3266	D		01
MT801	MILL	Sandblaster and Hood	COTTRELL/BAGHOUSE	3290	D		01
OC033	SURF	M.E.G. Hoist - 20 Ton	SURFACE	3091	H		01
OC034	SURF	M.E.G. Hoist - 5 Ton	SURFACE	3091	D		01
PA901	MOBILE	COMPACTOR, ROAD	AIR STRIP	3585	H		02
PC068	UGSURF	TOYOTA LANDCR.WHITE 1993	TOYOTA	3150	D		01
PC069	UGSURF	TOYOTA LANDCR. WHITE 1993	TOYOTA	3150	D		01
PC070	UGSURF	TOYOTA LANDCR. 1996	TOYOTA	3150	D		01
PC071	UGSURF	TOYOTA LandCruiser 1985	TOYOTA	3150	D		01
PC073	UGSURF	TOYOTA LANDCR. 1996	TOYOTA	3150	D		01
PC079	UGSURF	Toyota Landcruiser 1988	TOYOTA	3150	D		01
PD001	MILL	POWER DISTRIBUTION SYS	POWERHOUSE	3951	H		01
PD403	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
PD405	U/G	S250 JACKLEG DRILL	UNDERGROUND	3080	D		01
PD408	U/G	S250 JACK LEG DRILL	UNDERGROUND	3080	D		01
PD416	SURF	TAMROCK DRILL HEL-550	SURFACE	3080	D		01
PD417	SURF	TAMROCK DRILL HEL-550	SURFACE	3080	D		01
PD418	SURF	TAMROCK DRILL HEL 550	SURFACE	3080	D		01
PD419	SURF	TAMROCK DRILL HEL 550	SURFACE	3080	D		01
PD420	SURF	Tamrock Drill HEL 550	SURFACE	3080	D		01
PD503	U/G	JACKLEG DRILL	UNDERGROUND	3080	D		01
PHONE	860	TELEPHONE	SATELLITE	3931	D		02
PL101	MILL	PIPING CRUSHER	CRUSHER	3282	D		01
PL201	MILL	PIPING FLOTS & GRIND	GRINDING	3283	D		01
PL301	MILL	PIPING FLOTATION	FLOTATIONS	3284	D		01
PL401	MILL	GENERAL PIPING SOL'N	SOLUTIONS	3285	D		01
PL402	MILL	TAILS LINE 10" (DR 17 HPDE	SOLUTIONS	3285	D		01
PL403	MILL	General Piping Refinery	REFINERY	3286	D		01
PL501	MILL	General Piping CIL/TRP	CIL/TRP	3288	D		01
PL601	MILL	GENERAL PIPE CARBON PLANT	CARBON PLANT	3287	D		01
PL701	MILL	GENERAL PIPING ROASTER	ROASTER	3289	D		01
PL801	MILL	GENERAL PIPING COTTRELL	COTTRELL/BAGHOUSE	3290	D		01
PL901	MILL	PIPING ETP	ETP	3294	D		01
PMEMD2	700	GENERATOR	DIESEL NO. 2	3951	H		02

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
PM335	830	LUBRICATION	PREVENTIVE MAINTENAN	3722	D		02
PM420	860	ELECTRICAL	PREVENTIVE MAINTNEAN	3911	D		02
PM470	860	INSTRUMENT	PREVENTIVE MAINTENAN	3911	D		02
PM475	860	MECHANICAL	PREVENTATIVE MAINTEN	3911	D		02
PP806	MOBILE	PUMP, WISCONSIN WATER	MAINTENANCE, COLOMAC	3585	D		02
PP914	MOBILE	PUMP, SANDPIPER TRASH	HEAVY DUTY SHOP	3585	D		02
PR401	MILL	#1 PRESS (PERRIN)	SOLUTIONS	3285	D		01
PR402	MILL	#2 PRESS (PERRIN)	SOLUTIONS	3285	D		01
PR403	MILL	#3 PRESS (PERRIN)	SOLUTIONS	3285	D		01
PR404	MILL	#4 PRESS (PERRIN)	SOLUTIONS	3285	D		01
PS903	MOBILE	STEAMER, PORTABLE HYTROTEX	HEAVY DUTY SHOP	3585	D		02
PS915	MOBILE	PRESSURE WASHER, HYDROTEX2	MILL OPERATIONS	3585	D		02
PS916	MOBILE	PRESSURE WASHER, HOTSY	HEAVY DUTY SHOP	3585	D		02
PT003	SURF	1996 FORD TAURUS - SEDAN	P. BEDARD	3584	D		01
PT061	SURF	Ford 1989 E-150 Van	GOETZ/PIPEFITTERS	3220	D		01
PT064	SURF	1989 GMC SUBURBAN	POWER/SECURITY	3220	D		01
PT068	SURF	GMC 1987 1-Ton Truck	GOETZ/MAINTENANCE	3220	D		01
PT079	SURF	Ford 1988 F-350 Crew Cab	MORTON/MILL	3220	D		01
PT084	SURF	GMC 1988 4x4 1 Ton	GOETZ/MOBILE EQUIP	3220	D		01
PT092	SURF	GMC 1992 3/4 Ton Pick Up	MOORE/MINE	3220	D		01
PT093	SURF	GMC 1992 3/4 Ton Pick Up	GOETZ/MAINTENANCE	3220	D		01
PT094	SURF	GMC 1992 3/4 Ton Pick Up	GOETZ/MAINTENANCE	3220	D		01
PT095	SURF	GMC 1992 YUKON	POWER/SECURITY	3220	D		01
PT096	SURF	GMC 1992 3/4 Ton Pick Up X	GOETZ/ELECTRICAL	3220	D		01
PT097	SURF	GMC 1992 3/4 Ton Pick Up	MORTON/MILL	3220	D		01
PT100	SURF	BUS 1975 CHEV C60	MOORE/MINE	3210	D		01
PT101	SURF	1997 GM 3/4 TON 4X4 PICKUP	GOETZ-MAINT.	3220	D		01
PT102	SURF	1997 GM 3/4 TON 4X4 PICKUP	GRATTON/CANAM-ENG..	3220	D		01
PT103	SURF	1997 GM 3/4 TON 4X4 PICKUP	MORTON - MILL	3220	D		01
PT104	SURF	1997 GM 3/4 TON 4X4 PICKUP	MOORE - MINE	3220	D		01
PT105	SURF	1997 GMC EXPIDITION	STARD - MANAGEMENT	3220	D		01
PT106	SURF	1997 GM 1 TON CAB/CHAS.4X2	BEXSON - WAREHOUSE	3220	D		01
PU101	MILL	CR DUST PUMP (CAN BUF 2X3)	CRUSHER	3282	D		01
PU102	MILL	SEAL WATER PU (CAN BUF 2X3	CRUSHER	3282	D		01
PU103	MILL	CR SUMP PUMP (WILDEN M8)	CRUSHER	3282	D		01
PU104	MILL	CR SUMP PUMP SPARE (WILDEN	CRUSHER	3282	D		01
PU105	MILL	SC HOUSE SUMP (7.5 FLYGHT)	CRUSHER	3282	D		01
PU106	MILL	CRUSHER OIL FILTER PUMP	CRUSHER	3282	D		01
PU301	MILL	CHIP SCRN PU #1 (5X5 SRL)	FLOTATIONS	3284	D		01
PU302	MILL	FLOT CONC PU (N) (5X5 SRL)	FLOTATIONS	3284	D		01
PU303	MILL	FLOT CONC PU (E) (5X5 SRL)	FLOTATIONS	3284	D		01
PU304	MILL	CONE FEED PUMP 6X6 (SRL)	FLOTATIONS	3284	D		01
PU305	MILL	CONE BYPASS PUMP 5X5 (SRL)	FLOTATIONS	3284	D		01
PU306	MILL	#4 BM DISCHARGE PUMP 3X3	FLOTATIONS	3284	D		01
PU307	MILL	#3 TH U/F PUMP (3" DOL)	FLOTATIONS	3284	D		01
PU308	MILL	XANTH TRNSF PUMP (FLOTECH)	FLOTATIONS	3284	D		01
PU309	MILL	COPPER SULPH PUMP (FLOTECH	FLOTATIONS	3284	D		01
PU310	MILL	2X2 SRL (SPARE)	FLOTATIONS	3284	D		01
PU311	MILL	S FLOT SUMP (2.4 GALIGHER)	FLOTATIONS	3284	D		01
PU312	MILL	GLAND WATER PU W (CAN BUF)	FLOTATIONS	3284	D		01
PU313	MILL	GLAND WATER PU E (CAN BUF)	FLOTATIONS	3284	D		01
PU316	MILL	CYCLOPAC O/F PUMP 5X5 (SRL	FLOTATIONS	3284	D		01
PU317	MILL	#3 TH O/F PU (3X2 CAN BUF)	FLOTATIONS	3284	D		01
PU318	MILL	#2 CYCLO FEED PU 6X6 (SRL)	FLOTATIONS	3284	D		01
PU319	MILL	Midds Tank U/F Pu (3" DOL)	FLOTATIONS	3284	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
PU320	MILL	CHIP SCR PUMP #2 5X5 (SRL)	FLOTATIONS	3284	D		01
PU321	MILL	PUMP SPARE 2X2 (SRL)	FLOTATIONS	3284	D		01
PU322	MILL	PUMP SPARE 6X6 CONE (SRL)	FLOTATIONS	3284	D		01
PU323	MILL	#5/#6 WASH TH O/F PU (SRL)	FLOTATIONS	3284	D		01
PU324	MILL	N FLOT SUMP PUMP 2.5 GALIG	FLOTATIONS	3284	D		01
PU401	MILL	SOL'N CALC PUMP 5X5 (SRL)	SOLUTIONS	3285	D		01
PU402	MILL	#5 TH U/F PUMP (DOL 4")	SOLUTIONS	3285	D		01
PU403	MILL	#6 TH U/F PUMP (DOL 4")	SOLUTIONS	3285	D		01
PU404	MILL	WASH TH DISCH PU 3X3 (SRL)	SOLUTIONS	3285	D		01
PU405	MILL	SPARE 3X3 SRL	SOLUTIONS	3285	D		01
PU406	MILL	#8 TH DISCH PU 3X3 (SRL)	SOLUTIONS	3285	D		01
PU407	MILL	#8 TH U/F PUMP (DOL 4")	SOLUTIONS	3285	D		01
PU408	MILL	#7 TH U/F PUMP (DOL 4")	SOLUTIONS	3285	D		01
PU409	MILL	#7 TH DISCH PUMP (3X3 SRL)	SOLUTIONS	3285	D		01
PU410	MILL	#1 NORTH PREG PUMP (CANBUF	SOLUTIONS	3285	D		01
PU411	MILL	#2 N PREG PU (3X3 CAN BUF)	SOLUTIONS	3285	D		01
PU412	MILL	SOUTH SLUDGE PUMP 2X2 (SRL	SOLUTIONS	3285	D		01
PU413	MILL	NORTH SLUDGE PUMP 2X2 (SRL	SOLUTIONS	3285	D		01
PU414	MILL	SOUTH PRECIP PUMP 2X3 (CAN	SOLUTIONS	3285	D		01
PU415	MILL	NORTH PRECIP PUMP (CANBUF)	SOLUTIONS	3285	D		01
PU416	MILL	#1 BARREN PUMP (DORR K)	SOLUTIONS	3285	D		01
PU417	MILL	#2 BARREN PUMP (2X3 CANADA	SOLUTIONS	3285	D		01
PU418	MILL	OLD SOUTH TAILS PUMP (SRL)	SOLUTIONS	3285	D		01
PU419	MILL	SPARE PUMP (SRL)	SOLUTIONS	3285	D		01
PU420	MILL	8X6 BOOSTER PUMP (SRL)	SOLUTIONS - S.TAILS	3285	D		01
PU421	MILL	10X8 BOOSTER PUMP (SRL)	SOLUTIONS -N.TAILS	3285	D		01
PU422	MILL	10X8 TAILS PUMP (SRL)	SOLUTIONS - N.RRIMAR	3285	D		01
PU423	MILL	S SOL'N SUMP PU (2.4 GALIG	SOLUTIONS	3285	D		01
PU424	MILL	MAIN SUMP PUMP (3" SALA)	SOLUTIONS	3285	D		01
PU425	MILL	EMERG SUMP PUMP (2.5 GALIG	SOLUTIONS	3285	D		01
PU426	MILL	#5 FILTRATE PU (3X2 CAN BU	SOLUTIONS	3285	D		01
PU427	MILL	8X6X18 TAILS PUMP (SRL)	SOLUTIONS - S PRMARY	3285	D		01
PU428	MILL	#2 THICKENER PUMP (SRL)	SOLUTIONS	3285	D		01
PU429	MILL	SPARE 5X5 (SRL)	SOLUTIONS	3285	D		01
PU430	MILL	LIME MIX TANK PU (4X2 GALI	SOLUTIONS	3285	D		01
PU431	MILL	LIME LOOP PUMP (WILFLEY)	SOLUTIONS	3285	D		01
PU432	MILL	CN MIX TANK PU (FLOTECH)	SOLUTIONS	3285	D		01
PU433	MILL	CN LOOP PUMP (FLOTECH)	SOLUTIONS	3285	D		01
PU434	MILL	COOLING WATER PUMP (MONARC	SOLUTIONS	3285	D		01
PU436	MILL	PUMP SPARE 3X3 SLUDGE SRL	SOLUTIONS	3285	D		01
PU437	MILL	PUMP SPARE 2X2 SLUDGE SRL	SOLUTIONS	3285	D		01
PU438	MILL	#8 TH 3X3 SRL SPARE PUMP	SOLUTIONS	3285	D		01
PU439	MILL	#7 TH 3X3 SRL SPARE PUMP	SOLUTIONS	3285	D		01
PU442	MILL	AIR PUMP M8 (WILDEN)	SOLUTIONS	3285	D		01
PU443	MILL	AIR PUMP M8 (WILDEN)	SOLUTIONS	3285	D		01
PU444	MILL	EMERG CATCH BASIN PU (FLYG	SOLUTIONS	3285	D		01
PU445	MILL	TAILS BOOSTER (MONARCH)	SOLUTIONS	3285	D		01
PU446	MILL	TAILS BOOSTER (MONARCH)	SOLUTIONS	3285	D		01
PU447	MILL	8x6 TAILS PU (NEW) (SRL-C)	SOLUTIONS	3285	D		01
PU448	MILL	REFINERY OIL PUMP (DOL)	REFINERY	3285	D		01
PU449	MILL	Tails 10x8 Warman Booster	SOLUTIONS	3285	D		01
PU450	MILL	Tails 10x8 Warman Pump	SOLUTIONS	3285	D		01
PU451	MILL	MINEWATER DISTR PU (GOULDS	SOLUTIONS	3285	D		01
PU452	MILL	TAILS LINE BOOST PU (WARMA	SOLUTIONS	3285	D		01
PU453	MILL	N SOL'N SUMP PU (3X3 SRLV)	SOLUTIONS	3285	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
PU454	MILL	#6 BM DISCH PUMP 5X4 SRL-C	SOLUTIONS	3285	D		01
PU455	MILL	WASH TH O/F PUMP 3X3 SRL	SOLUTIONS	3285	D		01
PU456	MILL	#2 TH U/F PUMP 3" (DOL)	SOLUTIONS	3285	D		01
PU501	MILL	PUMP SPARE	CIL	3288	D		01
PU502	MILL	Hydraulic Pump & Reservoir	TRP	3288	D		01
PU503	MILL	Hydraulic Pump & Reservoir	TRP	3288	D		01
PU504	MILL	Spare Hydraulic Pump	TRP	2176	D		01
PU505	MILL	Tailings Slurry Pump	TRP	3288	D		01
PU506	MILL	Tailings Slurry Pump	TRP	3288	D		01
PU507	MILL	Tailings Slurry Pump	TRP	3288	D		01
PU508	MILL	Tailings Slurry Pump	TRP	3288	D		01
PU509	MILL	Tailings Slurry Pump	TRP	3288	D		01
PU510	MILL	Tailings Slurry Pump	TRP	3288	D		01
PU511	MILL	Trommel Screen U/F Pump	TRP	3288	D		01
PU512	MILL	Thickener Feed Pump	TRP	3288	D		01
PU513	MILL	Thick O/Flow Re-circ Pump	TRP	3288	D		01
PU514	MILL	CIC Feed Pump	TRP	3288	D		01
PU515	MILL	Carbon Addition Pump	TRP	3288	D		01
PU516	MILL	Eductor Booster Water Pump	TRP	3288	D		01
PU517	MILL	Carbon Dewater Transfer Pu	TRP	3288	D		01
PU518	MILL	Simplicity Screen U/F Pump	TRP	3288	D		01
PU519	MILL	Carbon Advance Pump #1	TRP	3288	D		01
PU520	MILL	Carbon Advance Pump #2	TRP	3288	D		01
PU521	MILL	Carbon Advance Pump #3	TRP	3288	D		01
PU522	MILL	Carbon Advance Pump #4	TRP	3288	D		01
PU523	MILL	Carbon Advance Pump #5	TRP	3288	D		01
PU524	MILL	Carbon Advance Pump #6	CIL	3288	D		01
PU525	MILL	Safety Screen O/S Return P	CIL	3288	D		01
PU526	MILL	Tailings Disposal Pump	TRP	3288	D		01
PU527	MILL	Flocculant Transfer Pump	TRP	2176	D		01
PU528	MILL	Flocculant Dosage Pump	TRP	3288	D		01
PU529	MILL	CIL Sump Pump	CIL	3288	D		01
PU530	MILL	Acid Wash Circulating Pump	TRP	3288	D		01
PU531	MILL	Acid Wash Drain Pump	TRP	3288	D		01
PU532	MILL	Acid Barrel Pump	TRP	3288	D		01
PU533	MILL	Acid Wash Area Sump Pump	TRP	3288	D		01
PU534	MILL	Strip Vessel Feed Pump	TRP	3288	D		01
PU535	MILL	Strip Area Sump Pump	TRP	3288	D		01
PU536	MILL	Barren Sol'n Transfer Pump	TRP	3288	D		01
PU537	MILL	Eductor Water Booster Pump	TRP PLANT BLDG	3288	D		01
PU538	MILL	Attrition Tank Discharge P	TRP	3288	D		01
PU539	MILL	Quench Tank Discharge Pump	TRP	3288	D		01
PU540	MILL	Reactivation Area Sump Pum	TRP	3288	D		01
PU541	MILL	New Carbon Transfer Pump	TRP	3288	D		01
PU542	MILL	Carbon Advance Pump #27	CIL	3288	D		01
PU543	MILL	DECANT TANK PUMP (SRL)	CIL	3288	D		01
PU544	MILL	Lime Circulating Pump	TRP	3288	D		01
PU545	MILL	Lime Circulating Pump	TRP	3288	D		01
PU546	MILL	Cyanide Transfer Pump	TRP	3288	D		01
PU547	MILL	Cyanide Circulating Pump #	TRP	3288	D		01
PU548	MILL	Cyanide Circulating Pump #	TRP	3288	D		01
PU549	MILL	Reagent Area Sump Pump	TRP	3288	D		01
PU550	MILL	Caustic Sol'n Circ Pump	TRP	3288	D		01
PU551	MILL	Process Water Pump	TRP	3288	D		01
PU552	MILL	Process Tank Recir Pump	TRP	3288	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
PU553	MILL	TRP Supply Pump (2X3 GOULD	TRP	3288	D		01
PU554	MILL	Lime Silo Sump Pump	TRP	3288	D		01
PU555	MILL	TAILS PUMP	CIL	3288	D		01
PU556	MILL	CIL FEED PUMP (SRL)	CIL	3288	D		01
PU601	MILL	AC SUMP PUMP (GALIGHER)	CARBON PLANT	3287	D		01
PU602	MILL	#1 HI PRESS.PUMP (MONARCH)	CARBON PLANT	3287	D		01
PU603	MILL	#2 HI PRESS PUMP (MONARCH)	CARBON PLANT	3287	D		01
PU604	MILL	STRIP SOL'N PUMP (SRL)	CARBON PLANT	3287	D		01
PU605	MILL	#12 TH U/F PUMP (DOL 3")	CARBON PLANT	3287	D		01
PU606	MILL	MEASUR TANK PU (2X2 SRL)	CARBON PLANT	3287	D		01
PU607	MILL	CARB PLT SUMP PU (M8 WILDE	CARBON PLANT	3287	D		01
PU608	MILL	MOYNO PUMP CARBON STRIP	CARBON PLANT	3287	D		01
PU609	MILL	CARB STRIP SUMP PU (GALIGH	CARBON PLANT	3287	D		01
PU612	MILL	#12 TH O/F PUMP (3" LINATE	CARBON PLANT	3287	D		01
PU614	MILL	CARBON TRNSF PU (2X2 WEMCO	CARBON PLANT	3287	D		01
PU615	MILL	AGIT DISCH PUMP (2X2 WEMCO	CARBON PLANT	3287	D		01
PU616	MILL	Spare Strip 1X2 (CAN-BUF)	CARBON PLANT	3287	D		01
PU617	MILL	TAILS PUMP (SRL)	CARBON PLANT	3287	D		01
PU618	MILL	#25 AG DISCH PUMP 3X3 (SRL	CARBON PLANT	3287	D		01
PU701	MILL	ROAST CONE FEED PU (3X3 SR	ROASTER	3289	D		01
PU702	MILL	#10 TH U/F PUMP (DOL 3")	ROASTER	3289	D		01
PU703	MILL	#11 TH U/F PU (DOL DUPLEX)	ROASTER	3289	D		01
PU704	MILL	#11 TH O/F PUMP 5X5 (SRL)	ROASTER	3289	D		01
PU705	MILL	SPARE PUMP	ROASTER	3289	D		01
PU706	MILL	#3 AGIT DISCH PU 3X3 (SRL)	ROASTER	3289	D		01
PU707	MILL	ROAST FILT PU 2X1 (CAN BUF	ROASTER	3289	D		01
PU708	MILL	#1 MOYNO	ROASTER	3289	D		01
PU709	MILL	#2 MOYNO	ROASTER	3289	D		01
PU710	MILL	#1 ROAST FEED PU 3X3 (SRL)	ROASTER	3289	D		01
PU711	MILL	#2 ROAST FEED PU 3X3 (SRL)	ROASTER	3289	D		01
PU712	MILL	QUENCH DISCH PU 5X5 (SRL)	ROASTER	3289	D		01
PU713	MILL	#7 BM DISCH PU 5X5 (SRL)	ROASTER	3289	D		01
PU714	MILL	ROASTER CALCINE PUMP	ROASTER	3289	D		01
PU715	MILL	SUMP PUMP (GALIGHER)	ROASTER	3289	D		01
PU716	MILL	ROASTER OIL PUMP (AC)	ROASTER	3289	D		01
PU717	MILL	#12 AGITATOR PUMP (WILFLEY	ROASTER	3289	D		01
PU718	MILL	QUENCH PUMP (SPARE) (SRL)	ROASTER	3289	D		01
PU719	MILL	#2 CALCINE 5X5X14 (SRL)	ROASTER	3289	D		01
PU721	MILL	#2 O/F 5X5 (SRL)	ROASTER	3289	D		01
PU722	MILL	SPARE (SRL)	ROASTER	3289	D		01
PU723	MILL	#1 AG DIS. 3X3 (SRL)	ROASTER	3289	D		01
PU724	MILL	#1 BOOST PU 2X3 (CAN BUF)	ROASTER	3289	D		01
PU725	MILL	#2 BOOST PU 2X3 (CAN BUF)	ROASTER	3289	D		01
PU801	MILL	HOT COTTRELL PUMP 3X3 (SRL	COTTRELL/BAGHOUSE	3290	D		01
PU802	MILL	SUMP PUMP (2.5 GALIGHER)	COTTRELL/BAGHOUSE	3290	D		01
PU803	MILL	#1 FULLER KINYON	COTTRELL/BAGHOUSE	3290	D		01
PU804	MILL	#2 FULLER KINYON	COTTRELL/BAGHOUSE	3290	D		01
PU806	MILL	CATCH BASIN SUMP (FLYGT)	COTTRELL/BAGHOUSE	3290	D		01
PU901	MILL	Process Water Pump 200	ETP	3294	D		01
PU902	MILL	MIX WATER PUMP	ETP	3294	D		01
PU903	MILL	ETP SUMP PUMP (1.5 GALIGHE	ETP	3294	D		01
PU904	MILL	SPARE PUMP (OLD LIME PUMP	ETP	3294	D		01
PU905	MILL	SPARE PUMP (OLD LIME PUMP	ETP	3294	D		01
PU906	MILL	COPPER TRANSFER PUMP ETP	ETP	3294	D		01
PU907	MILL	#1 LIME PUMP ETP (WILFLEY)	ETP	3294	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
PU908	MILL	#2 LIME PUMP ETP (WILFLEY)	ETP	3294	D		01
PU909	MILL	HYDROGEN PEROXIDE PUMP #2	ETP	3294	D		01
PU910	MILL	FERRIC SULPH PUMP A (LMI)	ETP	3294	D		01
PU911	MILL	HYDROGEN PEROXIDE PUMP #1	ETP	3294	D		01
PU912	MILL	COPPER SULPH PUMP A (LMI)	ETP	3294	D		01
PU913	MILL	FERRIC SULPH PUMP B (LMI)	ETP	3294	D		01
PU914	MILL	FLOC PUMP ETP (LMI)	ETP	3294	D		01
PU915	MILL	#7 CATCH BASIN PU (7.5 FLY	ETP	3294	D		01
PU916	MILL	BARGE PUMP #1 (PEERLESS)	ETP	3294	D		01
PU917	MILL	BARGE PUMP #2 (PEERLESS)	ETP	3294	D		01
PU918	MILL	#22 CATCH BASIN PU (FLYGHT	ETP	3294	D		01
PU919	MILL	#3 CATCH BASIN PU (FLYGHT)	ETP	3294	D		01
PU920	MILL	COPPER SULPH PUMP A (LMI)	ETP	3294	D		01
PU921	MILL	50 HP FLYGHT PUMP	ETP	3294	D		01
PU922	MILL	BARGE #3 SPARE (PEERLESS)	ETP	3294	D		01
PU923	MILL	CLEANER FEED PUMP 3X3	GRINDING/MECHANICAL	3283	D		01
PW100	SITE	HYDROTEX PRESSURE WASHER	HEAVY DUTY SHOP	3921	D		01
PW568	U/G	MAGIKIST PRESSURE WASHER	UNDERGROUND	3085	D		01
P1105	850	STRIP VESSEL PRESSURE LOOP	CARBON STRIP VESSEL	3733	D		02
P1938	830	LUBE OIL PRESURE LOOP	PGM MAIN BEARING	3721	D		02
P1939	830	BEARING OIL PRESSURE LOOP	PGM MAIN BEARING	3721	D		02
P1944	830	PGM LUBE PRESSURE LOOP	PGM MAIN BEARING	3721	D		02
P1945	830	PGM LUBE OIL PRESSURE LOOP	PGM MAIN BEARING	3721	D		02
RADIOS	860	RADIO	PORT.2WAY RADIOS(INC	3911	D		02
RB038	U/G	ROCK BREAKER (1500 Level)	ROCKBREAKER	3082	D		01
RB039	U/G	Rockbreaker Surface Ore Pa	U/G	3082	D		01
RB040	U/G	Rock Breaker (1650 Level)	U/G	3082	D		01
RB041	U/G	Rock Breaker Surface Crush	U/G	3082	D		01
RC001	SURF	Chutes - 1300 Crusher	SURFACE	3094	D		01
RC002	SURF	Chutes - Headframe Ore/Was	SURFACE	3094	D		01
RC003	SURF	Chute - Headframe Waste Do	SURFACE	3094	D		01
RC004	SURF	Herman Nelson BT 400-45	SURFACE	3094	D		01
RC005	SURF	Chute - Headframe Waste Bi	SURFACE	3094	D		01
RC007	SURF	Chutes - Stopes	SURFACE	3094	D		01
RC008	SURF	Chains - Ore/Waste Passes	SURFACE	3094	D		01
RC009	SURF	Tip Plates - Skip Dump	SURFACE	3094	D		01
RC010	U/G	1300 LEVEL CRUSHER	UNDERGROUND	3094	D		01
REFINERY	850	PUMP	SOCK FILTER RETURN P	3741	D		02
RO701	MILL	ROASTER 1ST STAGE (DORRCO)	ROASTER	3289	D		01
RO702	MILL	ROASTER 2ND STAGE (DORRCO)	ROASTER	3289	D		01
SB002	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB008	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB009	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB011	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB012	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB013	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB014	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB015	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB016	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB018	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB020	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB021	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB022	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB040	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB043	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
SB044	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB047	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB048	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB050	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB051	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB053	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB057	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB058	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB061	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB063	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB069	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB070	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB071	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB072	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB073	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB074	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB075	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB076	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB077	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB078	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB080	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB081	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB082	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB085	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB086	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB088	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB093	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB094	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB095	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB096	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB097	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB098	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SB099	U/G	S250 STOPER DRILL	UNDERGROUND	3080	D		01
SC101	MILL	#1 SCREEN (WEST) (DILLON)	CRUSHER	3282	D		01
SC102	MILL	#2 SCREEN (EAST) (DILLON)	CRUSHER	3282	D		01
SC103	MILL	AC SCREEN (ALLIS CHALMERS)	CRUSHER	3282	D		01
SC301	MILL	CHIP SCREEN (LINK BELT)	FLOTATIONS	3284	D		01
SC302	MILL	SIEVE BEND SCRN (SPECIALTY	FLOTATIONS	3284	D		01
SC501	MILL	Trommel Screen	TRP	3288	D		01
SC502	MILL	Trash Screen	TRP	3288	D		01
SC503	MILL	Trash Screen	TRP	3288	D		01
SC504	MILL	Simplicity Screen	TRP	3288	D		01
SC505	MILL	CIC Safety Screen	TRP	3288	D		01
SC506	MILL	Carbon Safety Screen #1	CIL	3288	D		01
SC507	MILL	Carbon Safety Screen #2	CIL	3288	D		01
SC508	MILL	Carbon Safety Screen #3	TRP	3288	D		01
SC509	MILL	Loaded Carbon Screen	TRP	3288	D		01
SC510	MILL	Carbon Dewatering Screen	TRP	3288	D		01
SC511	MILL	Carbon Bagging Screen DSM	TRP	3288	D		01
SC601	MILL	CARBON SCREEN #1 (DSM)	CARBON PLANT	3287	D		01
SC602	MILL	DEWATERING SCREEN (DSM)	CARBON PLANT	3287	D		01
SC603	MILL	CARBON SAFETY SCRN (LIQUIT	CARBON PLANT	3287	D		01
SC604	MILL	CARB REMOVAL SCRN #3 (DSM)	CARBON PLANT	3287	D		01
SC901	MILL	DSM Screen Carbon Columns	ETP	3294	D		01
SE007	MOBILE	Kenworth Vactor Vacuum Tru	COLOMAC MOBILE	3584	D	T	02

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
SE009	SURF	1981 CHEV C70 VACUUM TRUCK	MILL	3120	D		01
SE010	SURF	Ford LT-9000 Tractor Truc	SURFACE	3210	D		01
SE025	SURF	Champion D-600 Grader	CHAMPION D-600 GRADE	3210	H		01
SE026	SURF	CAT 769-B TRUCK	MICHIGAN-70	3210	H		01
SE028	SURF	Cat 769-B 1975	769-B CAT 1975	3210	D		01
SE029	SURF	Michigan L-70 Loader	LOADER	3210	H		01
SE031	SURF	Cat 920 Loader	LOADER	3210	H		01
SE033	SURF	Cat D8K Dozer	D8KCAT	3210	H		01
SE036	SURF	BACKHOE, 245	BACKHOE	3210	H		01
SE039	SURF	Cat 988-B Loader	LOADER	3210	H		01
SE042	SURF	Freuhoff N-2216 Trailer	FREUHOFF	3210	H		01
SE043	SURF	Peerless 65-T Lowboy	LOWBOY	3210	H		01
SE048	SURF	Ford F-700 Tractor Truck(H	TRACTOR	3210	D		01
SE049	SURF	Ford 10 Ton Truck	FORD 10 TON	3210	D		01
SE082	SURF	Cat 769-C Truck	769CAT	3210	H		01
SE085	SURF	Truck Mack (10 Ton)	MACK	3210	H		01
SE090	SURF	Clark 720 Hydraulic Crane	CRANE	3210	D		01
SH001	SURF	Skip Cage - "C" Shaft	SURFACE	3090	D		01
SH002	SURF	Skip Cage - "C" Shaft	SURFACE	3090	D		01
SH003	SURF	Rope-O/W Skip(911028-02-2)	SURFACE	3090	D		01
SH004	SURF	Rope-U/W Skip/Cage-910068-	SURFACE	3090	D		01
SH005	SURF	Skip Hoist - "C" Shaft	SURFACE	3090	D		01
SH014	SURF	"C" SHAFT SKIP #14 (NEW)	SURFACE	3090	D		01
SH015	SURF	"C" SHAFT SKIP #15 (NEW)	SURFACE	3090	D		01
SH021	SURF	Sheave Wheel-"C" O/W Skip	SURFACE	3090	D		01
SH022	SURF	Sheave Wheel-"C" U/W Skip/	SURFACE	3090	D		01
SL095	U/G	Getman Scissorlift (#268)	SCIS.LIFT	3086	D		01
ST010	U/G	JCI 250 M SCOOPTRAM 1991	2 YD	3120	H		01
ST011	U/G	JCI 300 M SCOOPTRAM 1993	3 YD	3120	H		01
ST012	U/G	JCI 300 M SCOOPTRAM 1993	3 YD	3120	H		01
ST013	U/G	JCI 300 M SCOOPTRAM 1993	3 YD	3120	H		01
ST014	U/G	JCI 300 M SCOOPTRAM 1993	3 YD	3120	H		01
ST015	U/G	JCI 300 M SCOOPTRAM 1993	3 YD	3120	H		01
ST016	U/G	EJC 3.5 SCOOPTRAM 1996	3.5 YD.	3120	H		01
ST017	U/G	2.85 EJC SCOOPTRAM 1996	2.85 YD	3120	H		01
ST018	U/G	2.85 EJC SCOOPTRAM 1996	2.85 YD	3120	H		01
ST065	U/G	JCI 250 M SCOOP 1983	2 YD	3120	H		01
ST066	U/G	JCI 250 M SCOOP 1983	2 YD	3120	H		01
ST067	U/G	JCI 250 M SCOOP 1983	2 YD	3120	H		01
ST075	U/G	EIMCO-JARVIS CLARK, LEASED	UNDERGROUND	3120	H		01
ST076	U/G	Eimco 921 SCOOPTRAM 1988	EIMCO 921	3120	H		01
ST077	U/G	Eimco 921 SCOOPTRAM 1988	EIMCO 921	3120	H		01
ST080	U/G	JARVIS CLARK SCOOP 1987	2.85 YD	3120	H		01
ST081	U/G	JARVIS CLARK SCOOP 1987	2.85 YD	3120	H		01
ST082	U/G	JARVIS CLARK SCOOP 1987	2.85 YD	3120	H		01
ST083	U/G	JARVIS CLARK SCOOP 1987	2.85 YD	3120	H		01
ST085	U/G	JARVIS CLARK SCOOP 1987	2.85 YD	3120	H		01
ST087	U/G	JARVIS CLARK SCOOP 1988	2.85 YD	3120	H		01
ST088	U/G	JARVIS CLARK SCOOP 1987	2.85 YD	3120	H		01
ST091	U/G	JARVIS CLARK SCOOP 1990	3.5 YD	3120	H		01
SV201	MOBILE	SHOVEL,EX1800 HITACHI 1994	SHOVEL FLEET	3560	H		02
SV202	MOBILE	SHOVEL,EX1800 HITACHI 1994	SHOVEL FLEET	3560	H		02
SYS 36	700	LIGHTING/RECEPT./TRAYS	SURFACE BUILDINGS	3901	D		02
SYS 37	700	MCC ROOMS	MCC CONTROL ROOMS	3901	D		02
SYS1	845	SYSTEM	CALCIUM CYANIDE	3731	D		02

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
SYS10	860	SYSTEM	GLYCOL	3951	D		02
SYS11	840	SYSTEM	LOW PRESSURE AIR (CI	3732	D		02
SYS12	830	SYSTEM	PROCESS WATER	3721	D		02
SYS13	860	SYSTEM	PLANT WATER	3732	D		02
SYS14	860	SYSTEM	LOW PRESS GLAND SEAL	3732	D		02
SYS15	860	SYSTEM	HI PRESS GLAND SEAL	3702	D		02
SYS16	860	SYSTEM	EYE WASH AND DOMESTI	3732	D		02
SYS17	860	SYSTEM	PLANT AIR	3951	D		02
SYS18	860	SYSTEM	INSTRUMENT AIR	3951	D		02
SYS19	840	AIR LANCES IN LEACH TANK.	LEACH SPARGING AIR	3731	D		02
SYS2	860	SYSTEM	SODIUM CYANIDE	3731	D		02
SYS20	860	SYSTEM	CARBON HANDLING	3732	D		02
SYS21	860	SYSTEM	HYDROCHLORIC	3733	D		02
SYS22	830	SYSTEM	PRIMARY GRINDING	3721	D		02
SYS23	860	SYSTEM	SECONDARY GRINDING	3722	D		02
SYS24	830	SYSTEM	GRAVITY SEPARATION	3722	D		02
SYS25	860	SYSTEM	THICKENING AND LEACH	3731	D		02
SYS26	860	SYSTEM	CARBON IN PULP	3732	D		02
SYS27	860	SYSTEM	TAILINGS	3702	D		02
SYS28	860	SYSTEM	PRIMARY CRUSHING	3711	D		02
SYS29	845	SYSTEM	EDUCTOR WATER	3733	D		02
SYS3	830	SYSTEM	LIME	3731	D		02
SYS30	860	SYSTEM	PEBBLE CRUSHER	3723	D		02
SYS31	860	SYSTEM	POWERHOUSE	3951	D		02
SYS32	860	SYSTEM	GOLD PRODUCTION	3733	D		02
SYS33	860	SYSTEM	THERMAL FLUID	3733	D		02
SYS34	830	CRANES & HOISTS	MILL BUILDING ONLY	3901	D		02
SYS35	860	SYSTEM	HVAC	3901	D		02
SYS36	700	MILL LIGHTING GENERAL	MILL & POWERHOUSE	3901	D		02
SYS37	830	MCC / GENERAL	MOTOR CONTROL CENTRE	3901	D		02
SYS38	860	SYSTEM	PROGRAMMABLE LOGIC C	3721	D		02
SYS39	815	7' SHORTHEAD CRUSHER	PEBBLE CRUSHER BLDG	3711	D		02
SYS4	860	SYSTEM	CAUSTIC	3733	D		02
SYS40	700	GROUNDING OF POWER	GROUNDING WORK	3951	D		02
SYS41	830	CRANE & HOIST	OVERHEAD CRANES	3901	D		02
SYS42	830	INST	POWER DRAW CHART REC	3721	D		02
SYS43	840	AGITATOR	LEACH AGITATOR GENER	3731	D		02
SYS44	820	CONVEYORS	BELT CONVEYORS	3711	D		02
SYS45	830	SAFETY WORK PERFORMED	GRINDING GENERAL	3721	D		02
SYS46	810	SAFETY WORK IN CRUSHER	CRUSHING SYSTEM	3711	D		02
SYS47	840	SAFETY WORK ON SOLUTIONS	THICK. LEACH. CIP	3731	D		02
SYS48	850	SAFETY WORK IN REFINERY	REFINERY	3741	D		02
SYS5	860	SYSTEM	FLOCCULANT	3731	D		02
SYS6	860	SYSTEM	RECLAIM WATER	3721	D		02
SYS7	860	SYSTEM	RAW WATER	3732	D		02
SYS8	830	FIRE SYSTEM MILL	MILLING PLANT	3911	D		02
SYS9	860	SYSTEM	DIESEL FUEL	3921	D		02
TA101	MILL	DISTILLED WATER TANK	ASSAY	3292	D		01
TA301	MILL	XANTHATE MIX TANK	FLOTATIONS	3284	D		01
TA302	MILL	XANTHATE STORAGE TANK	FLOTATIONS	3284	D		01
TA303	MILL	CuSO4 MIX TANK MILL	FLOTATIONS	3284	D		01
TA304	MILL	CuSO4 STORAGE TANK MILL	FLOTATIONS	3284	D		01
TA305	MILL	Conditioning Tank .	FLOTATIONS	3284	D		01
TA306	MILL	MIDDS TANK (DOL)	FLOTATIONS	3284	D		01
TA401	MILL	CN MIX TANK	SOLUTIONS	3285	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
TA402	MILL	CN STORAGE TANK	SOLUTIONS	3285	D		01
TA501	MILL	Monitor Water Tank #1	TRP	3288	D		01
TA502	MILL	Monitor Water Tank #2	TRP	2176	D		01
TA503	MILL	Monitor Water Tank #3	TRP	3288	D		01
TA504	MILL	Trommel Screen U/F Pumpbox	TRP	3288	D		01
TA505	MILL	Surge Tank Feed Pumpbox	TRP	3288	D		01
TA506	MILL	Surge Tank	TRP	3288	D		01
TA507	MILL	Dearation Tank	TRP	3288	D		01
TA508	MILL	Trash Screen Splitter Box	TRP	3288	D		01
TA509	MILL	Thickener O/Flow Re-circ T	TRP	3288	D		01
TA510	MILL	CIC Tank #1	TRP	3288	D		01
TA511	MILL	CIC Tank #2	TRP	3288	D		01
TA512	MILL	CIC Tank #3	TRP	3288	D		01
TA513	MILL	CIC Tank #4	TRP	3288	D		01
TA514	MILL	CIC Tank #5	TRP	3288	D		01
TA515	MILL	CIC Tank #6	TRP	3288	D		01
TA516	MILL	Carbon Attrition Tank	TRP	3288	D		01
TA517	MILL	Carbon Transfer Pumpbox	TRP	3288	D		01
TA518	MILL	CIC Tailings Tank	TRP	3288	D		01
TA519	MILL	CIL Tank #1	TRP	3288	D		01
TA520	MILL	CIL Tank #2	TRP	3288	D		01
TA521	MILL	CIL Tank #3	TRP	3288	D		01
TA522	MILL	CIL Tank #4	TRP	3288	D		01
TA523	MILL	CIL Tank #5	TRP	3288	D		01
TA524	MILL	CIL Tank #6	TRP	3288	D		01
TA525	MILL	Safety Screen Splitter Box	TRP	3288	D		01
TA526	MILL	O/S Return Pumpbox	CIL	3288	D		01
TA527	MILL	Tailings Disposal Pumpbox	TRP	3288	D		01
TA528	MILL	Flocculant Storage Tank	TRP	3288	D		01
TA529	MILL	Flocculant Mixing Tank	TRP	3288	D		01
TA530	MILL	Acid Wash Tank	TRP	3288	D		01
TA531	MILL	Acid Wash Surge Tank	TRP	3288	D		01
TA532	MILL	Strip Vessel #1	TRP	3288	D		01
TA533	MILL	Strip Vessel #2	TRP	3288	D		01
TA534	MILL	Barren Strip Sol'n Surge T	TRP	3288	D		01
TA535	MILL	Attrition Tank	TRP	3288	D		01
TA536	MILL	Quench Tank	TRP	3288	D		01
TA537	MILL	Electrowinning Cell #1	TRP	3288	D		01
TA538	MILL	Electrowinning Cell #2	TRP	3288	D		01
TA539	MILL	Fine Carbon Disposal Pumpb	TRP	3288	D		01
TA540	MILL	Lime Storage Silo	TRP	3288	D		01
TA541	MILL	Lime Slurry Holding Tank	TRP	3288	D		01
TA542	MILL	Lime Transfer Pumpbox	TRP	3288	D		01
TA543	MILL	Cyanide Mix Tank	TRP	3288	D		01
TA544	MILL	Cyanide Holding Tank	TRP	3288	D		01
TA545	MILL	Caustic Mix Tank	TRP	3288	D		01
TA546	MILL	Process Water Tank	TRP	3288	D		01
TA547	MILL	Potable Water Tank	TRP	3288	D		01
TA548	MILL	ELECTROWINNING CELL #3	TRP	3288	D		01
TA601	MILL	STRIP VESSEL NORTH	CARBON PLANT	3287	D		01
TA602	MILL	STRIP VESSEL SOUTH	CARBON PLANT	3287	D		01
TA603	MILL	ELECT CELL (CUSTOM EQUIP)	CARBON PLANT	3287	D		01
TH301	MILL	#3 THICKENER (DOL 30' D)	FLOTATIONS	3284	D		01
TH401	MILL	#1 THICKENER (DOL 32' D)	SOLUTIONS	3285	D		01
TH402	MILL	#2 THICKENER (DOL 32' D)	SOLUTIONS	3285	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
TH403	MILL	#5 THICKENER (DOL 40' D)	SOLUTIONS	3285	D		01
TH404	MILL	#6 THICKENER (DOL 40' D)	SOLUTIONS	3285	D		01
TH405	MILL	#7 THICKENER (DOL 40' D)	SOLUTIONS	3285	D		01
TH406	MILL	#8 THICKENER (DOL 40' D)	SOLUTIONS	3285	D		01
TH501	MILL	Thickener	TRP	3288	D		01
TH601	MILL	#12 CARBON PLT TH (DOL 30'	CARBON PLANT	3287	D		01
TH701	MILL	#10 THICKENER (DOL 30')	ROASTER	3289	D		01
TH702	MILL	#11 THICKENER (DOL 40')	ROASTER	3289	D		01
TL611	MOBILE	TRAILER, FIELD MECHANIC'S	MINE MAINTENANCE	3585	D		02
TR401	MOBILE	TRUCK, 769B CAT 1975	TRUCK FLEET	3570	H		02
TR404	MOBILE	TRUCK, 777 CATAPILLAR	TRUCK FLEET	3570	H	T	02
TR406	MOBILE	TRUCK,777A CATAPILLAR	TRUCK FLEET	3570	H		02
TR407	MOBILE	TRUCK, R85 EUCLID 1994	TRUCK FLEET	3570	H		02
TR408	MOBILE	TRUCK, R85 EUCLID 1994	TRUCK FLEET	3570	H		02
TR409	MOBILE	TRUCK, R85 EUCLID 1994	TRUCK FLEET	3570	H		02
TR410	MOBILE	TRUCK, R85 EUCLID 1994	TRUCK FLEET	3570	H		02
TR411	MOBILE	TRUCK, R85 EUCLID 1994	TRUCK FLEET	3570	H		02
TR412	MOBILE	TRUCK, R85 EUCLID 1994	TRUCK FLEET	3570	H		02
TR413	MOBILE	TRUCK, R85 EUCLID 1994	TRUCK FLEET	3570	H		02
TR414	MOBILE	TRUCK, R85 EUCLID 1994	TRUCK FLEET	3570	H		02
TV	860	TELEVISION	CAMP	3941	D		02
T0405	830	PGM RTD LOOP	PRIMARY MILL	3721	D		02
T0503	830	SGM #1 RTD LOOP	#2 SECONDARY MILL	3722	D		02
T0516	830	SGM #2 RTD LOOP	#2 SECONDARY MILL	3733	D		02
T1106	850	STRIP VESSEL TEMP. LOOP	CARBON STRIP VESSEL	3733	D		02
T1118	850	ELUATE/STRIP TEMP LOOP	FEED TO STRIP VESSEL	3733	D		02
UARB	900	RADIO	NAVIGATIONAL	3962	D		02
UNIT 701	860	TRUCK	GM / BROWN 1/2 TON T	3584	D		02
UNIT 705	900	GM TRUCK	SUBURBAN	3584	D		02
UNIT 713	860	TRUCK	WHITE 1/2 TON TRUCK	3584	D		02
VA501	MILL	Air Actuated Gate Valve	TRP	3288	D		01
VA502	MILL	Spare Air Actuated Gate Va	TRP	3288	D		01
VA503	MILL	Spare Air Actuated Gate Va	TRP	3288	D		01
VP001	SURF	#1 Vent Plant - "B" Shaft	SURFACE	3071	D		01
VP002	SURF	#2 Vent Plant - G.K.P.	SURFACE	3071	D		01
VP003	SURF	#3 Vent Plant - "A" Shaft	SURFACE	3071	D		01
VP004	SURF	#4 VENT PLANT - B3	SURFACE	3071	D		01
VU101	MILL	VAC PUMP (GARDENER DENVER)	ASSAY	3292	D		01
VU102	MILL	VAC PUMP (GARDENER DENVER)	ASSAY	3292	D		01
VU401	MILL	SPARE PUMP	SOLUTIONS	3285	D		01
VU402	MILL	NASH VACUUM PUMP (350 CFM)	SOLUTIONS	3285	D		01
VU403	MILL	NASH VAC PU (SPR) (350 CFM	SOLUTIONS	3285	D		01
VU404	MILL	ROT VAC PUMP (NASH 2000 CF	SOLUTIONS	3285	D		01
VU405	MILL	SPARE PUMP	SOLUTIONS	3285	D		01
VU701	MILL	ROT VAC PUMP (NASH)	ROASTER	3289	D		01
VU702	MILL	Vacuum Pump Roaster (Pisto	ROASTER	3289	D		01
W/H YARD	860	BIG SPACE	FOR STUFF STORAGE	3921	D		02
WE201	MILL	Welder Arc	MECHANIC SHOP	3266	D		01
WE202	MILL	Welder Electric	MECHANIC SHOP	3266	D		01
WE203	MILL	WELDER ARC	MECHANIC SHOP	3266	D		01
WE204	MILL	MILL WELDER	MECHANIC SHOP	3266	D		01
WE205	MILL	WELDER ELECTRIC (GAS ENG)	MECHANIC SHOP	3266	D		01
WE206	MILL	WELDING MACHINE	MILL	3266	D		01
WE207	MILL	ELECTRIC WELDER	MECHANIC SHOP	3266	D		01
WE208	MILL	Mill Welder (Gas)	MECHANIC SHOP	3266	D		01

EQUIPMENT	LOCATION	EQP. DESC.	LOC. DESC.	ACCT	CYCLE	TAG OUT	SITE
WE905	MOBILE	WELDER, LINCOLN WIRE FEED	HEAVY DUTY SHOP	3585	D		02
WE906	MOBILE	WELDER, MILLER PORTABLE	HEAVY DUTY SHOP	3585	D		02
WHSE-1	860	BUILDING	WAREHOUSE #1-MINE SH	3921	D		02
W0301	810	FRESH BELT SCALE LOOP	# 2 CONVEYOR	3711	D		02
W0302	810	PRIM. BELT SCALE LOOP	#2 CONVEYOR	3711	D		02
Y1	860	YARD	MILLING AREA	3901	D		02
Y2	900	AIR STRIP	AIR CRAFT	3962	D		02
Y4	500	POND	TAILINGS	3702	D		02
Y5	860	YARD	DIESEL STORAGE	3921	D		02
Y6	860	YARD	CAMP FACILITIES	3941	D		02
Z0205	810	MANTLE POSITION INDICATOR	PRIMARY CRUSHER	3711	D		02
10010010	860	DRILL	TAMROCK DRILL / UNIT	3550	D		02
10098030	860	LOADER	980C LOADER / UNIT 3	3581	D		02
19007	SURF	PROCON TRUCK RENTAL JDT413	JDT 413	3130	H		01
20954501	209	PUMP, FRESH WATER MAKE-UP	N.END OF PLANT	3701	H		02
20954502	209	PUMP, FRESH WATER MAKE-UP	N.END OF THE PLANT	3701	H		02
20954503	209	PUMP	FIRE WATER	3901	D		02
20954504	209	PUMP, FIRE WATER JOCKEY	LAKESHORE PUMPHOUSE	3901	H		02
20954601	209	PUMP	DOMESTIC WATER CHLOR	3701	D		02
20955601	209	IMMERSION WATER HEATER	INTAKE WATER HOUSE	3701	H		02
20957301	209	TANK	FIRE WATER PUMP FUEL	3961	D		02
20958501	209	CHLORINATOR	DOMESTIC WATER	3701	D		02
20959201	209	HOIST	FRESH WATER PUMPHOUS	3701	D		02
49103	SURF	PROCON RENTAL JUMBO-TAMROC	MJM20B	3140	D		01
50054501	500	PUMP 12X10X25 SRL-C A-BANK	TAILINGS PUMP NO.1	3702	H		02
50054502	500	PUMP 12X10X25 SRL-C A-BANK	TAILINGS PUMP NO.2	3702	H		02
50054503	500	PUMP 12X10X25 SRL-C A-BANK	TAILINGS PUMP NO.3	3702	H		02
50054504	500	PUMP 12X10X25 SRL-C B-BANK	TAILINGS PUMP NO.4	3702	H		02
50054505	500	PUMP	RECLAIM WATER NO#1	3703	D		02
50054506	500	RECLAIM WATER PUMP # 2	RECLAIM BARGE	3703	H		02
50054507	500	PUMP 12X10X25 SRL-C B-BANK	TAILINGS PUMP NO.5	3702	H		02
50054508	500	PUMP 12X10X25 SRL-C B-BANK	TAILINGS PUMP NO 6	3702	H		02
50054509	500	RECLAIM WATER BOOSTER PMP	BARGE ON TAILS POND	3703	D		02
50054601	500	PUMP	RECLAIM BARGE DE-ICI	3703	D		02
50054602	500	PUMP	TAILINGS AREA SUMP	3702	H		02
50055001	500	SAMPLER	PRIMARY TAILINGS	3702	D		02
50055003	500	SAMPLER	SECONDARY TAILNGS	3702	D		02
50057301	500	PUMPBOX	TAILINGS	3702	D		02
50059801	500	BARGE	TAILINGS RECLAIM	3702	D		02
60051201	600	LUBRICATION SHACK HEATER	TANK FARM	3961	D		02
60054601	600	PUMP	DIESEL FUEL TRANSFER	3961	D		02
60054602	600	PUMP	DIESEL FUEL TRANSFER	3961	D		02
60054603	600	DISPENSER	DIESEL FUEL UNIT	3961	D		02
60057401	600	TANK	DIESEL FUEL STORAGE	3961	D		02
60057402	600	TANK	DIESEL FUEL STORAGE	3961	D		02
60057403	600	TANK	DIESEL FUEL STORAGE	3961	D		02
60057404	600	TANK	DIESEL FUEL STORAGE	3961	D		02
60057405	600	TANK	DIESEL FUEL STORAGE	3961	D		02
60057406	600	TANK	DIESEL FUEL STORAGE	3961	D		02
60057407	600	TANK	DIESEL FUEL STORAGE	3961	D		02
60057408	600	TANK	DIESEL FUEL STORAGE	3961	D		02
60057409	600	TANK	DIESEL FUEL STORAGE	3961	D		02
60073201	600	MCC #6	DESIEL FARM AREA MCC	3961	D		02
70051201	700	HEATER	GLYCOL	3951	D		02
70051202	700	HEATER	GLYCOL	3951	D		02

Appendix L: Qualifications of Assessors

The Deton'Cho Environmental Alliance (DCEA) was contracted to undertake this project. It is a co-operative venture between three Yellowknife based firms. The Alliance was formed in 1998 to offer environmental and environmental engineering services in northern Canada, and comprises Deton'Cho Corporation (DCC), EBA Engineering Consultants Ltd (EBA), and Vista Engineering (VE). Deton' Cho Corporation is the commercial arm of the Yellowknives Dene First Nation. EBA and VE are two Yellowknife based consulting firms.

The three founding alliance members were joined for this project by EAN North, the Environmental Sciences Group, Royal Military College, Kingston Ontario, and Watermark Consulting, all three parties with extensive northern experience as well as extensive experience and familiarity with the Giant Mine.

EBA provided its knowledge and on-site experience in completing the abandonment and restoration plan and surface contamination study for the Giant Mine. Deton'Cho Corporation and Vista Engineering provided their experience in completing environmental assessments of mining properties and fuel facilities. DCC's ties with the Yellowknives Dene First Nation assisted in the efficient collection of information regarding conditions prior to development. The Environmental Sciences Group assessment, remediation, and research experience, and experience at the Giant Mine and in the Yellowknife area enhanced the technical capacity of the project team. Local experience from the mine was provided to the team by Michael Ballantyne of EAN North, who was employed at Giant as surface foreman, and Noel O'Sullivan who was mine foreman and mine superintendent for many years. In addition, acid rock drainage (ARD) expertise was provided by Linda Broughton of Watermark Consulting, who has previous experience with the Giant Mine, as well as strong northern experience credentials.

The following outlines the qualifications of the assessment team members:

Brent Murphy

Mr. Murphy has over 14 years of experience in the area of applied environmental science with extensive experience in evaluating environmental liabilities associated with operating and abandoned mines situated across the country. He currently resides in Yellowknife where he is responsible for leading and developing EBA's Mining Services programs in the NWT. He has university degrees in geology, with specialization in geochemistry, and has technical knowledge in arsenic related issues having attended and participated in arsenic chemistry related conferences and workshops held in North America. He has also obtained practical experience with arsenic liability issues associated with mines, having worked extensively at the former Lake George Antimony and Mount Pleasant Tin mines, both located in New Brunswick, where he dealt with issues pertaining to arsenic enrichment in soils, the bedrock aquifer, mine water discharge and TCA's and water polishing TCA sludges.

Recently, Mr. Murphy has lead and managed EBA's efforts at the Giant Mine over the past two years, where he has acted in the role of technical advisor and project manager to Giant mine staff. Based on his recent experiences, he has developed a thorough knowledge, and understanding, of the existing and potential environmental liability issues associated with the Giant site.

John Clark

John is an environmental/civil engineer and principal of Vista Engineering. He has 24 years of engineering experience, 18 of those years in the Northwest Territories. He has been responsible for assessment of several mines, in conjunction with Deton'Cho Corporation. These include Tundra, Old Parr, North Inca, Crestaurum, Hope Bay, Northrim, Viking Yellowknife, Negus, Ribb, and Sun-Rose mines/claims. John was responsible for remediation design of the Tundra Mine on McKay Lake. Remediation of this mine site is estimated at approximately $5 to 7 million. John was also leading the assessment of 20 petroleum products storage and handling facilities in the Northwest Territories including Phase I, II and III Environmental Site Assessments.

Sheila Street

Sheila is an environmental specialist with Vista Engineering. Sheila led field teams for the assessment of nine abandoned mine sites. She was instrumental in the remediation design of the Tundra mine, and completed the assessment of two petroleum storage and handling facilities for the Petroleum Products Division, Public Works and Services, GNWT. Sheila is currently a technical advisor to Nunavut Tungnavik Inc. regarding cleanup of the Distant Early Warning (DEW) Line sites. Sheila completed testing for PCB-containing transformer oil at Miramar Con Mine and Tundra Mine, and organized the removal to an approved disposal facility of three transformers from the Tundra Mine.

Don Kaluza

Mr. Kaluza is currently with the EBA office in Yellowknife, responsible for the management of geotechnical engineering services for the Northwest Territories. He has 12 years of experience in geotechnical, municipal, hydraulics and mining engineering, including the development of reclamation options for mines. He has extensive experience in the design and construction of tailings dams and spillways both throughout Ontario and the NWT. Mr. Kaluza recently completed the development of the Abandonment and Restoration Plan for the giant Mine site on behalf of Royal Oak Mines, in which he developed a thorough knowledge of the mine site and reclamation cost estimates with the use of the **Reclaim 3.1** computer program. As a result of this cost development Mr. Kaluza was familiar with the existing reclamation cost estimates and assumptions as developed by Brodie Consulting Ltd.

Noel O'Sullivan

Mr. O'Sullivan was mine foreman and mine superintendent for many years prior to his retirement. Mr. O'Sullivan is personally aware of many of the underground environmental liabilities, and knows many former employees who may be aware of others.

Don Hayley

Mr. Hayley is Principal Engineer for EBA's Frontier Practice. His entire consulting career has been focused on arctic engineering, primarily related to northern resource development. He has contributed to numerous feasibility and design studies for projects such as transportation facilities over permafrost terrain, arctic pipelines, northern mining developments, and exploratory drilling and production structures. Mr. Hayley has developed innovative approaches to the design of structures for permafrost conditions. He is particularly familiar with construction practice, environmental regulatory aspects and environmental standards in arctic regions worldwide and has provided technical advice on the selection of final disposal options for the stored arsenic trioxide at the Giant Mine site, particularly permafrost disposal options.

Linda Broughton

Ms. Broughton has 15 years of experience specializing in the environmental engineering aspects of mine development, including the prediction, prevention, and control of acid rock drainage for mines. She has completed several assignments in the independent evaluation of environmental liability for the privatization of base and precious metal mines in Latin America. She also has northern experience, having acted as the geochemical advisor to the NWT Water Board during the permitting of the BHP Etaki Diamond Mine.

Dr Ken Reimer

Dr. Ken Reimer is the founder and Director of the Environmental Sciences Group (ESG). He is a Professor of Chemistry & Chemical Engineering at the Royal Military College of Canada and is cross-appointed as a Professor in the School of Environmental Studies, Queen's University. He is the Senior Environmental Scientific Advisor to the Department of National Defence. Dr. Reimer has been involved in arsenic research for over 20 years, and is considered one of Canada's leading arsenic researchers. As Director of ESG, he has gained expertise in dealing with environmental assessment, site remediation and risk communication. Under his direction, ESG has been working on the Yellowknife arsenic issues for the last decade.

Chris Ollson

Christopher Ollson has a B.Sc.(Hons.) in Biology from Queen's University, specializing in toxicology and genetics. He is due to graduate with a MSc. in Environmental Chemistry, from the Royal Military College of Canada in the summer of 1999. His Master's thesis involved determining the environmental effects of gold mining operations in the Yellowknife area, specifically dealing with arsenic speciation. Within the Environmental Sciences Group his responsibilities include, Team Leader for site delineation and remediation projects, and advising on environmental assessment and regulatory issues.

Joe Selann

Mr. Selann has over 21 years of experience in the field of environmental sciences. His particular emphasis has been on environmental management systems and compliance auditing, pollution monitoring techniques, environmental risk assessments, and the theoretic determination of environmental impacts of new facilities. Mr. Selann was instrumental in developing and recommending intrusive site assessment studies undertaken at the Giant Mine site, providing a database that would ultimately lead toward the development of site specific remediation criteria.

Blake Rasmussen

Blake is a project coordinator with Deton'Cho Corporation, responsible for environmental projects. He is a former employee of Royal Oak Mines and has knowledge of the surface and underground mining. He has both surface and underground NWT shift boss certificates, as well as a Mine Rescue and Blasting Certificate.