



SÄ DENA HES MINE

DETAILED DECOMMISSIONING & RECLAMATION PLAN JANUARY 2006 UPDATE





TECK COMINCO LTD.

SÄ DENA HES MINE

DETAILED DECOMMISSIONING & RECLAMATION PLAN

JANUARY 2006 UPDATE

VOLUME I - MAIN REPORT

Report Distribution

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Prepared by:



In accordance with the Engineers Profession Act of the Yukon, I the undersigned acknowledge that the geotechnical engineering sections, including plans, drawings and specifications of this Detailed Abandonment and Reclamation Plan for the Sa Dena Hes mine have been prepared by me or under my control.



Peter Healey P.Eng
Senior Engineer

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1.0 INTRODUCTION

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

In March 1994, the Joint Venture Partnership, consisting of Cominco Ltd. (25%), Teck Corporation (25%) and Pan-Pacific Metal Mining Corporation, a wholly owned subsidiary of Korea Zinc (50%) purchased the Sä Dena Hes mine from Coopers and Lybrand Ltd., the Receiver appointed by the Supreme Court. Curragh Resources Inc. had previously operated the mine until December 3, 1992 when mining and milling operations were suspended.

Cominco Ltd. (“Cominco”) presently operates the Sä Dena Hes mine under an agreement with the Joint Venture Partners (Sä Dena Hes Operating Corporation). The mine has been in a state of temporary suspension with care and maintenance programs continuing since 1994. Cominco has conducted limited underground development work at the property and prepared the operations for eventual mine reopening when metal prices become favorable.

The Sä Dena Hes Operating Corporation has a Type A Water Use Licence (QZ97-025) issued pursuant to the Yukon Waters Act and Regulations for the mine and milling operations. Cominco continues to ensure that all water licence obligations are fulfilled on behalf of the Sä Dena Hes Operating Corporation.

This document is submitted towards fulfillment of the requirements of Section 67 of Water Licence QZ97-025.

This Detailed Decommissioning and Reclamation Plan (“the plan”) addresses closure issues related to the decommissioning of operations at Sä Dena Hes and reclamation of the site. Since the mineable reserves at the property have not yet been fully extracted, the plan has been developed to address two possible scenarios:

- 1) The Mine site in its current state is permanently decommissioned, and
- 2) The mine is permanently decommissioned after production resumes and ore reserves are exhausted.

Most decommissioning and reclamation measures however, are not dependent on eventual reopening of the mine. The current status of the mine and reopening plans are presented later in this report.

A thorough plan, complete with detailed designs, is presented for all activities that need to be undertaken for an environmentally safe and responsible closure of the Să Dena Hes Mine. The plan recognizes that a reserve base exists on the property and that the mine will reopen when metal prices are favorable. The plan addresses both the long term physical and chemical stability of the site including reclamation of surface disturbances. A program is presented for site management and monitoring both during implementation of closure and after decommissioning and reclamation measures are completed. The plan is based on the best information available at the present time. As additional planning, information, and/or experience at the site becomes available, the details of the plan will be updated and/or altered as necessary. Decommissioning and reclamation costs estimates are provided and financial security requirements reviewed.

1.1 CLOSURE PHILOSOPHY

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

In keeping with its worldwide high standards for environmental and social responsibility, Cominco intends to implement an environmentally sound and technically feasible decommissioning and reclamation plan for the Să Dena Hes mine. Closure planning and the implementation of this phase at a minesite must be undertaken with appropriate environmental care, while respecting local laws, public interest and ensuring that the company's high environmental standards are achieved. The approach to mining and reclamation to be followed at Să Dena Hes will be to undertake progressive reclamation as appropriate. Assuming the Jewelbox Hill ore zone is depleted first, then this would be a candidate site for carrying out reclamation (recontouring, establishing proper pit drainage, etc.) using mine personnel and equipment available at that time. Cominco does not propose to initiate reclamation prior to opening the mine. Necessary environmental protection measures have been adopted in the development of this decommissioning and reclamation plan to ensure that a healthy

environment exist after mine closure. This approach is consistent with Cominco's Corporate Environmental Policy (see Appendix A).

A principal philosophy followed during the development of this plan was to work towards an eventual passive closure. This involved an assessment of the key mine components that could potentially place the public or the environment at risk following closure. Mitigation measures have been designed to address public safety issues and environmental concerns with post closure monitoring and inspections planned to ensure that this objective is met. Once the effectiveness of the mitigation measures are assured, then management of the site can be safely reduced to a level that is consistent with closure. Post-closure monitoring has been designed to ensure that performance objectives are closely monitored and inspected during the initial years following implementation of closure measures. It is anticipated that final determination of the effectiveness of closure measures for passive status will be the subject of review and concurrence with regulatory agencies and the public.

Where possible performance-based criteria have been adopted for the decommissioning and reclamation plan. The Water Licence decommissioning and reclamation plan performance criteria for physical structures has been reviewed and criteria selected to conform to the closure philosophy. Licensed effluent discharge standards were used as criteria for waters emanating from the tailings management facility while CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME,1999) were used to assess effectiveness of closure measures to local downstream receiving waters. These same performance based criteria will be used to determine the effectiveness of closure measures during post-closure monitoring. It is expected that post-closure monitoring and inspection results would be reviewed to ensure that closure objectives continue to be met well after decommissioning. If these objectives are not met, maintenance or contingency plans would be developed as necessary to address potential areas requiring further remediation.

To ensure that the closure philosophy can be achieved the following objectives were emphasized during the development of this plan:

- Protection of public health and safety;

- Implementation of environmental protection measures that prevent adverse environmental impact;
- Ensuring land use commensurate with surrounding lands;
- Recognize mine reopening in the short term and incorporate long term closure measures;
- Progressive reclamation measures implemented during mine operations;
- Post closure monitoring of the site to assess effectiveness of closure measures for the long term
- Passive post closure monitoring and management of the site until the former mine presents evidence of long term compliance of closure criteria.

1.2 SCOPE OF PLAN

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

The scope of the Sä Dena Hes Mine Decommissioning & Reclamation Plan was the subject of a Yukon Territory Water Board public hearing held in Whitehorse on November 19, 1997. Following this public hearing and deliberations by the YTWB, requirements for the Detailed Decommissioning & Reclamation Plan were set out as outlined in Water Licence QZ97-025, section 66. The plan is to include the following components:

- *“Detailed designs to address long-term physical stability of all closure structures, including designs for upgrading the permanent tailings impoundment structures to withstand natural events with a probability of occurrence similar to their expected service life (1:1000 year to PMF/MCE);*
- *Plans for addressing any short-term or long-term chemical stability or water quality problems;*
- *Plans for mitigating effects of access and surface disturbance;*
- *Plans for post closure monitoring and maintenance;*
- *Consideration of the need for, and as necessary, the establishment of, water balance and water quality models; and*
- *An updated cost estimate for decommissioning and post closure monitoring and maintenance.”*

To achieve these goals, a complete review of all pertinent historical information regarding the Sä Dena Hes operation was undertaken. Table 1-1 Global Information List, presents a listing of reports and other information sources that were reviewed in the writing of this plan. Cominco felt that this review was necessary since the original mine ownership had changed and the mine has not been operational since the property was purchased. Company, government and the YTWB records were reviewed and a detailed inspection of the site was completed.

Table 1-1 Global Information List

Report Title / Topic	Author	Date
Mt. Hundere Project - Project Overview and Plan for IEE	SRK	Aug-89
Mt. Hundere Joint Venture IN90-002, Volume I - Report, Volume II - Appendices and Interventions	SRK	Jul-90
Mt. Hundere Joint Venture IN90-002, Transcript of Hearing; Additional Exhibits Entered at Hearing (Oct. 10&11/90)	YT Water Board	12-Oct-90
Mt. Hundere Joint Venture IN90-002 - Geotechnical Investigations and final Design for Mill and Tailing Disposal Facilities	SRK	Dec-90
Screening Report under the Environmental Assessment & Review Process Guidelines Order - Mt. Hundere Development	DIAND	16-Dec-90
EARP Decision Report - Mt. Hundere Development Proposal	DIAND	Jan-91
Sä Dena Hes Mine IN90-002 - As Built Construction Report for Reclaim Dam Toe Buttress	James B. Edward	3-Jan-92
Mt. Hundere Joint Venture IN90-002 - Sä Dena Hes Mine - As Built Report - North, South & Reclaim Dams & Instrumentation SRK Project 1203	SRK	24-Jan-92
Sä Dena Hes Mine Spill Contingency Plan	Curragh Inc.	Mar-92
1991 Annual Report to the Water Board	Curragh Resources	10-Mar-92
Sä Dena Hes Mine IN90-002 - Inspection of Facilities at the Tailings Impoundment and Reclaim Pond	SRK	20-Jul-92
Mt. Hundere Joint Venture IN90-002 - Sä Dena Hes Mine, Inspection Report Reclaim Dam Spillway & Camp Creek Diversion Reconstruction SRK S101104	SRK	19-Nov-92
Sä Dena Hes Mine IN90-002 - South Dam Extension Design Report SRK Project 101204	SRK	25-Nov-92
Sä Dena Hes Temporary Closure Plan Report #WH9209	Curragh	Dec-92
Sä Dena Hes Joint Venture Concentrator Operation	Curragh	Jan-93
WGM Due diligence report	Curragh	25-Jan-93
Sä Dena Hes Joint Venture 1992 Annual Report	Ewald Pengal	Feb-93
Environmental Assessment of False Creek Canyon - 1992 Study	P.A. Harder & Associates Ltd.	Mar-93

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Report Title / Topic	Author	Date
Assessment of Environmental Liabilities <i>Sä Dena</i> Hes Mine near Watson Lake	Norecol, Dames & Moore	12-Oct-93
Application for Temporary Amendment to Water Licence IN90-002, <i>Sä Dena</i> Hes	Coopers & Lybrand	19-Nov-93
<i>Sä Dena</i> Hes 1993 Annual Report to the YT Water Board Licence IN90-002	Coopers & Lybrand & Cominco	Feb-94
<i>Sä Dena</i> Hes 1994 Annual Report - Yukon Water Licence IN90-002	Cominco	Feb-95
1994 Annual Inspection of Tailings Management Facility, July 27 & 28, 1994 - <i>Sä Dena</i> Hes Mine	SRK	7-Oct-94
Construction Report Remedial Work, <i>Sä Dena</i> Hes Mine, Yukon Territory	SRK	Nov-94
Environmental Monitoring at False Canyon Creek 1994	LES & White Mountain	Jan-95
North Creek Dyke, <i>Sä Dena</i> Hes Mine, Yukon Territory, C104105	SRK	Feb-95
<i>Sä Dena</i> Hes Preliminary Decommissioning and Reclamation Plan	Cominco	Nov-95
<i>Sä Dena</i> Hes Preliminary Decommissioning and Reclamation Plan	Cominco	Jan-96
Water Use Licence IN90-002 - Amendment	Water Resources	25-Jan-96
<i>Sä Dena</i> Hes 1995 Annual Report Yukon Water Licence IN90-002	Cominco	Feb-96
1995 Annual Inspection - Tailing Management Facility - <i>Sä Dena</i> Hes	SRK	Oct-95
Environmental Monitoring at False Canyon Creek 1996	LES	Dec-96
<i>Sä Dena</i> Hes 1996 Annual Report Yukon Water Licence IN90-002	Cominco	Feb-97
Submission in Support of the Amendment of Water Licence IN90-002	Cominco	Aug-97
QZ97-025 <i>Sä Dena</i> Hes Operating Corporation Amendment to IN90-002	YT Water Board	26-Sep-97
Review of Reclamation Cost Estimates	DIAND	Oct-97
Construction Report South Dam extension Toe Buttress	SRK	Nov-97
Review of Application for Water Licence amendment	Gartner Lee	Nov-97
<i>Sä Dena</i> Hes Amendment	Conservation Society	7-Nov-97
Amendment to IN90-002 (<i>Sä Dena</i> Hes)	YT Water Board	19-Nov-97
QZ97-025 <i>Sä Dena</i> Hes Register Public Hearing Amend to IN90-002	YT Water Board	19-Nov-97
<i>Sä Dena</i> Hes 1997 Annual Report - Yukon Water Licence IN90-002	Cominco	Feb-98
1997 Annual Inspection Tailings Management Facility, <i>Sä Dena</i> Hes, Yukon Territory	SRK	15-Oct-97
Application for a Type B Licence - Reconstruction of a run-off catchment berm	Access	Feb-98
Water Use Application MS97-091, response to Water resources comments	Cominco	Mar-98

COMINCO LTD., SÄ DENA HES MINE
DETAILED DECOMMISSIONING & RECLAMATION PLAN

Report Title / Topic	Author	Date
Water Licence QZ97-025	Water Board	19-May-98
QZ97-025 - Amendment to Water Licence IN90-002	YTG Renewable	7-Nov-98
Sä Dena Hes Joint Mine (Overview)	Curragh	1991 or 19992
Sä Dena Hes Articles (Northern Miner, etc.)	Various	1991 to 1993
Water Use Licence IN90-002	YT Water Board	31-Jan-91
The Sä Dena Hes Socio-Economic Participation Agreement	Cominco	21-Oct-97
Reclamation Guidelines for Northern Canada	Land Resources, DIAND	1987
Site Review of October 18, 1993 Tailings Dams & Diversion Channel – Remedial works, Sä Dena Hes Mine, Yukon Territory	SRK	Oct. 1993
Final Report - Assessment of Environmental Liabilities, Sä Dena Hes Mine, Near Watson Lake, Yukon Territory	Norecol, Dames & Moore	Oct. 1993
Addendum to 1997 Construction Report, South Dam Toe Buttress, Sä Dena Hes, Yukon Territory	SRK	Nov. 1997
Aquamin Case Studies - Sä Dena Hes	Working Group 6 (BC & YT)	N/A
Mt. Hundere Development, Initial Environmental Evaluation of the Mt. Hundere Development on the Watson Lake Area & Yukon (in drawer B210-B240 Vancouver) * see note	SRK	1990
1998 Annual Report	Cominco	Feb. 1999
1998 Annual Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Dec. 1998
Water Licence MS97-091	YT Water Board	May 1998
Sä Dena Hes Water Licence Security	YT Water Board	Mar. 1998
Sä Dena Hes Water Licence Amendments	YT Water Board	Mar. 1998
Reason for Decision - Water Licence QZ97-025 amendment to IN90-002 Sä Dena Hes	YT Water Board	Mar. 1998
Water Licence and Temporary Closure Plan	G.B. Acott, Environmental Affairs Curragh Inc.	Dec. 1992
Environmental Priorities – Sä Dena Hes	Norecol, Dames & Moore	N/A
Environmental Permits/Licences/ Approvals Needed to Mine in Yukon	DIAND	1999
Cominco Ltd./Teck Corporation-Pacif Metal Mining Group - Sä Dena Hes Project, Reclamation Cost Review	Cominco	

* Note: The IEE consists of 6 volumes as follows:

Volume I - Project Description

Volume II - Mine Access Road Evaluation

Volume III - Socio-Economic Evaluation

Volume IV - Biophysical Evaluation for the Project Site

Volume V - Appendices

Volume VI - Overview & Summary

Various closure options were assessed to ensure that closure objectives were met for each mine component.

The approach taken to this plan is to present a brief description of each mine component and the closure issues related to that component. Closure measures are then presented for mine, tailings management facility, and infrastructure components. A summary of the environmental setting for the project, complete with results from all ongoing licensed monitoring programs are presented in Appendix B (*“Environmental Baseline Update and Technical Basis for Closure Assumptions”*). This approach ensures that the reader is given a picture of the existing facilities at the site and the local environmental conditions without having to review previous historical information. Previous work or reports on the project have been referenced without repeating details so that this document is focused on decommissioning and reclamation.

1.3 CORPORATE BACKGROUND

This section has been updated.
Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

The Sä Dena Hes Mine is owned by the Sä Dena Hes Joint Venture which is comprised of Cominco Ltd. (25% ownership), Teck Corporation (25% ownership), and Pan Pacific Metal Mining Corp., a wholly owned subsidiary of Korea Zinc, (50% ownership). The Joint Venture purchased the Sä Dena Hes lead/zinc property in March, 1994. Cominco is the operator under the Joint Venture Agreement.

Cominco is an integrated natural resource company whose principal activities are mineral exploration, mining, smelting and refining. The Vancouver-based company was incorporated in 1906 and is Canada's oldest continually operating mining company. Cominco is an integrated metal producer. Its' active operations include two metallurgical complexes and five mines.

Cominco is the world's largest producer of zinc concentrate and one of the largest producers of lead concentrate. It is also a major producer of refined zinc and lead metals. Other products produced by Cominco include copper, molybdenum, silver, gold, germanium, copper, ferronickel, cadmium, bismuth and indium. Several other by-products are produced at Cominco's Trail Metallurgical Operations, the world's largest lead smelting and zinc refining complex.

The company has significant experience in exploration and mining, particularly in the north, in Canada, Alaska and Greenland. Exploration crews have been working in the north since the 1920's with successful results.

Cominco's northern mines past and present include:

- *Con*, Yellowknife, NWT – Con was the first gold mine in the NWT, beginning production in 1937. It is still producing, although under different ownership since 1986.
- *Pine Point*, Pine Point, NWT – This open pit lead-zinc mine operated between 1965 and 1988. It was located near the south shore of Great Slave Lake. Forty-eight deposits containing approximately 64 million tonnes of ore were mined. The Pine Point Minesite has been successfully decommissioned in accordance with the Northwest Territories Waters Act.
- *Black Angel*, Greenland – The Black Angel lead-zinc underground mine operated between 1973 and 1990, although not under Cominco ownership from 1986 onwards. It was located at 73°N in extremely rugged terrain, approximately 500 kilometres north of the Arctic Circle on Greenland's west coast.
- *Polaris*, NWT – The Polaris zinc-lead underground mine began production in 1981 and is still operating, producing 1 million tonnes of ore per year. It is the world's most northerly base metal mine, located at 75°N on Little Cornwallis Island approximately 100 kilometres northwest of Resolute, NWT.
- *Red Dog*, Alaska – The Red Dog zinc-lead open pit mine began producing in 1990 and has a projected mine life of at least another 40 years. It is currently the largest zinc concentrate producer in the world at about 8,000 tonnes of ore per day (2.8 million t/yr). The mine is located 145 kilometres north of Kotzebue. The North Alaska Native Association (NANA) Regional Corporation Inc. owns the land and leases it to Cominco, which operates the mine and owns the facilities. NANA shareholders work at the mine and NANA receives annual royalty payments. It is a model for cooperation between aboriginal people and mining companies.

1.4 PROPERTY LOCATION

The Sä Dena Hes property is located close to Yukon's southern boundary with British Columbia, approximately 70 kilometres by road from the Town of Watson Lake. The minesite (see Figure 1-1) is reached via the Robert Campbell Highway, north of Watson Lake. At approximately km 47 of the Robert Campbell Highway, a 25 km access road designed to accommodate the safe and efficient haulage of concentrate extends to the property.

Most of the mineral occurrences are situated above the treeline on weathered hills ranging in elevation from 1,200 to 1,500 metres above sea level. The plant site is below the mine workings and lies in boreal woodlands. Snowfall is relatively light (approximately 230 cm/year) and temperatures vary from an average of -26.3°C in January, to an average of 14°C in July.

The Sä Dena Hes mine comprises the Jewelbox and Burnick underground mines, and two undeveloped mineralized zones – Gribbler Ridge and Attila, and a number of other identified exploration targets within the claims group (see Figure 1-2).

1.5 STATUTORY AND REGULATORY RESPONSIBILITIES

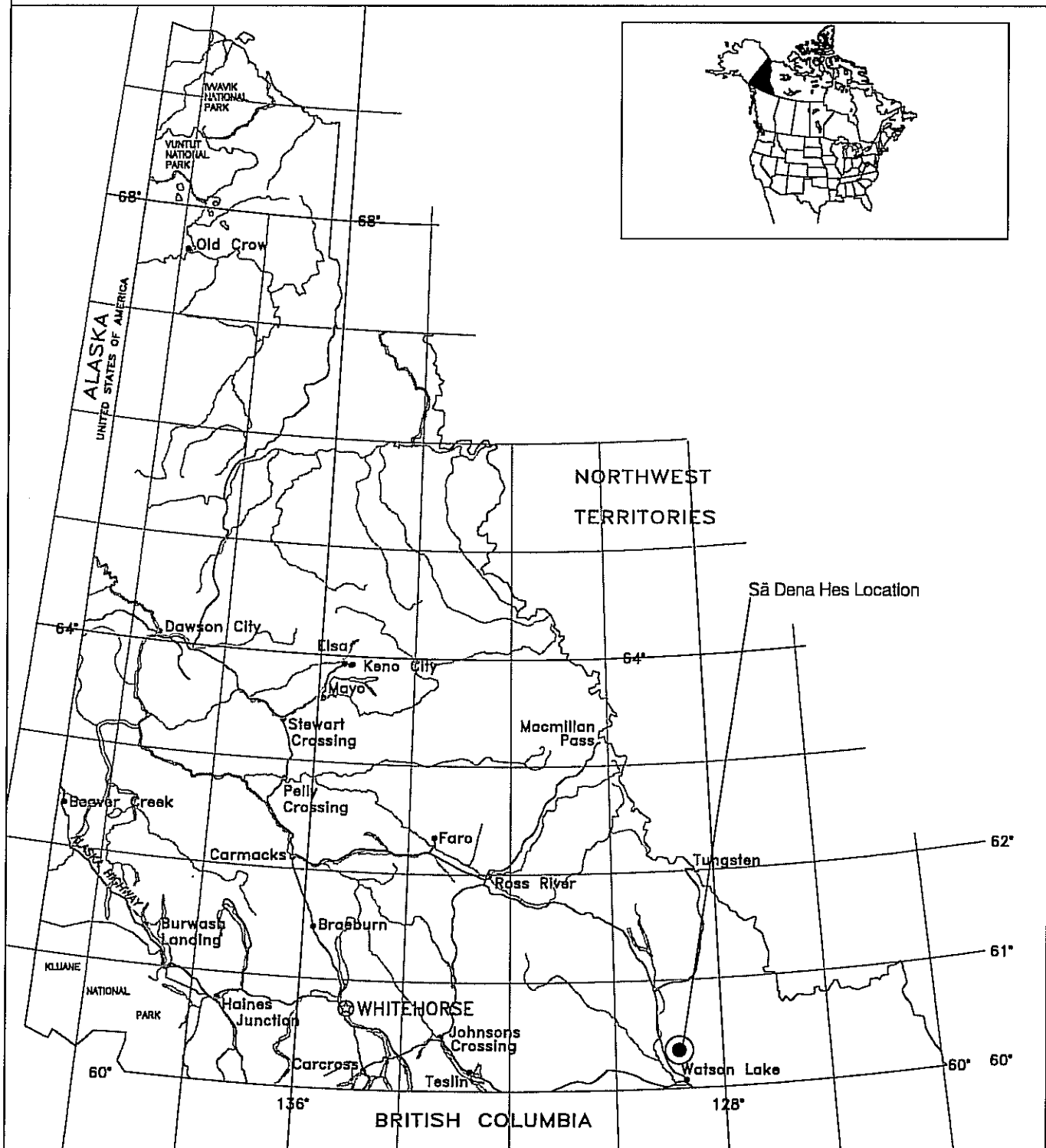
This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

1.5.1. Regulatory Agencies

Several agencies are involved in authorizing and monitoring mining projects in Yukon. Pursuant to the Yukon Waters Act and *Yukon Waters Regulations*, the Yukon Territory Water Board (YTWB) has granted a Water Use Licence to authorize Quartz mining at Sä Dena Hes Mine. The Yukon Territory Water Board has permitted this undertaking after its review of an environmental screening completed for the project. An environmental assessment pursuant to the Environmental Assessment Review Process Guidelines Order was completed for this project in December, 1990.

Yukon Territory



0 100 200 300
KILOMETRES

Lambert Conformal Conic Projection
with Standard Parallels at 49°N and 77°N



ACCESS MINING CONSULTANTS LTD.



Legend

- Populated Settlements
- ⊙ Territorial Capital

Sä Dena Hes Detailed Decommissioning and Reclamation Plan

General Location Map (Map of Yukon)

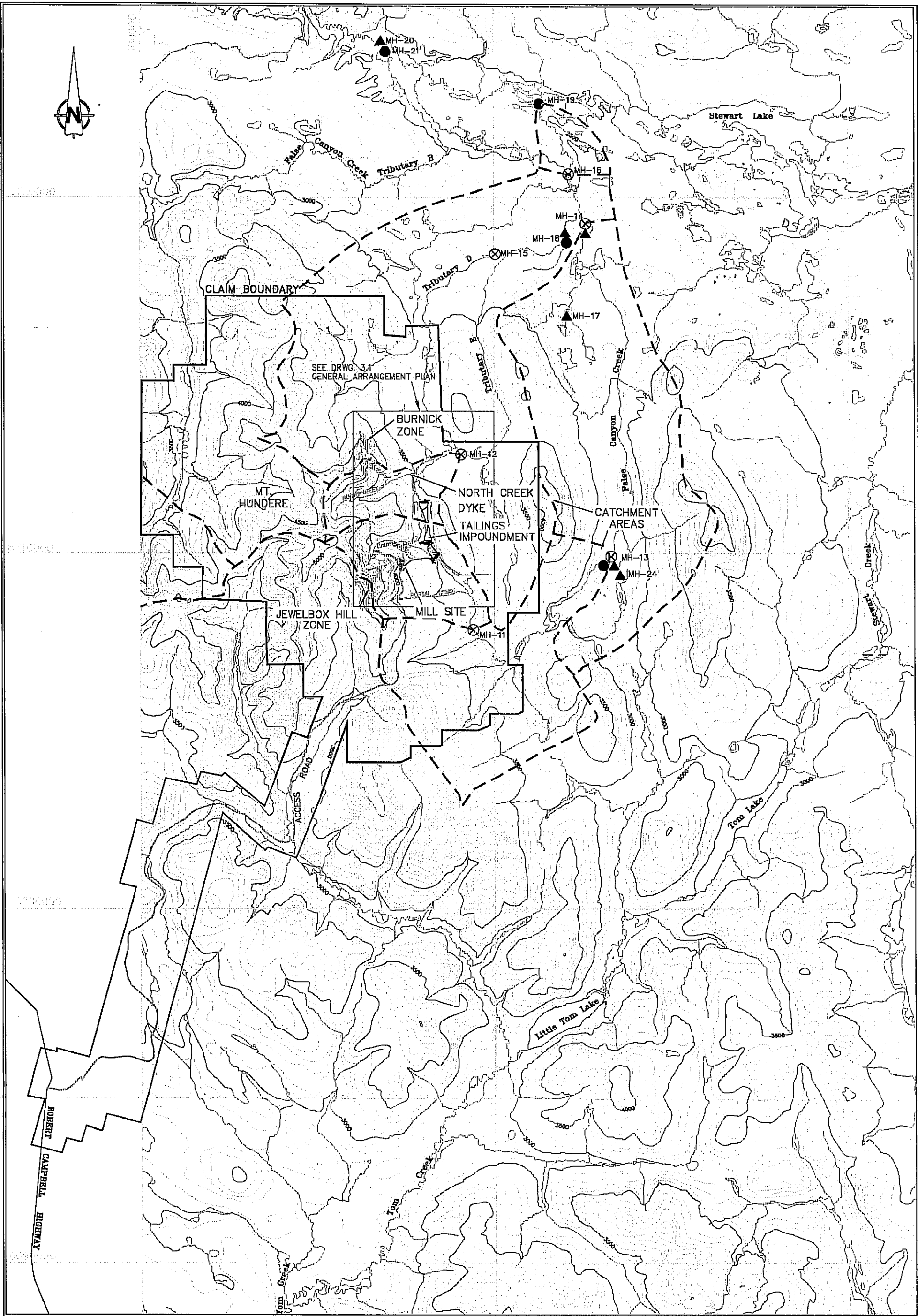
DRAWN BY: ASH

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DATE: FEB/2000

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Fig No. 1-1

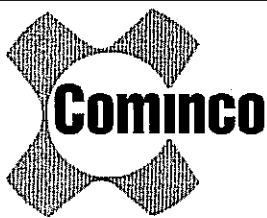


NTS: 105 A/06, 105 A/07
105 A/10, 105 A/11

CONTOUR INTERVAL 100 FEET

0 1000 2000 3000 4000 5000 metres
1:100,000

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927



- LEGEND**
- ⊗ WATER MONITORING STATION
 - ▲ FISH MONITORING STATION
 - BENTHIC MONITORING STATION

S&D HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

SITE LOCATION PLAN

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	REV.
DATE: JULY 29, 1999	PROJ. NO. 1CC005.05	1-2	

In November 1997, Cominco made application to amend the Water Use Licence to address fresh water use, licence monitoring, decommissioning and reclamation. The Water Board held a public hearing into this application. This hearing saw interventions from DIAND, Environment Canada, Yukon Conservation Society, and the Liard First Nation. During this process both the proponent and intervenors attempted to reach agreement on licensing issues. Although most issues were agreed upon either before or during the hearing, outstanding items were deliberated by the YTWB and the licence amendment was issued.

Cominco has taken a proactive approach towards their regulatory responsibilities by meeting with various government regulatory agencies, boards, and local First Nations. Periodic meetings are held to provide project updates. A similar approach is planned for implementation of the Decommissioning & Reclamation Plan.

Since the issuance of Water Licence QZ97-025, Cominco undertook, in accordance with this Licence, additional monitoring including biological monitoring in the North Creek Drainage, and a beaver activity survey in the False Canyon Creek drainage.

Prior to implementing the closure measures described in this plan, both the YTWB and DIAND, Water, Land & Mineral Divisions, will be informed of Cominco's plans to implement the Decommissioning & Reclamation Plan. Meetings will also be held with Environment Canada, Environmental Protection, Department of Fisheries and Oceans, Environmental Health, and Yukon Government departments of Renewable Resources and Occupational Health and Safety to appraise regulators of planned site activities. A similar meeting will be held with the Liard First Nation and the local community. These meetings should ensure that regulatory agencies' concerns with closure implementation are met. As well as the more formal review of the plan as indicated above, concepts presented in this plan will be used to guide operations, specifically the components related to progressive reclamation.

Cominco will also cooperate with the Mining Land Use Division of DIAND to address non-water related issues. This agency governs Mining Land use Regulations and is responsible for the issuance of Production Licences.

1.5.2. *Approvals and Licences*

The project proponent currently holds a Type A Water Licence: QZ97-025 formerly IN90-002 for quartz mining, which expires on September 15, 2000. The company is required to comply with the terms and conditions of licence and of the Yukon Waters Act and Regulations. Compliance with licence terms and conditions is monitored by DIAND Water Resources Division.

A Production Licence will be secured prior to re-opening the mine pursuant to Section 139 of the Yukon Quartz Mining Act. Cominco will also apply for a closure certificate under this same legislation at the conclusion of the implementation of the closure measures to seek Government approval of conditions at the site.

Various other agencies grant the permits necessary to develop, operate and close a project of this nature. A detailed summary of the approvals and licences that may be issued for this project and the associated permitting bodies are presented in Table 1-2.

As part of implementing the Decommissioning & Reclamation Plan, Cominco would ensure that the various other licences and/or permits that are required for undertaking various closure measures are secured and followed.

Table 1-2 Summary of Permits and Licences

Purpose	Permit/Application Name, and/or Act, and/or Program	Responsible Authority/Agency	Contact
Permission to use/discharge water	Water Licence issued under the <i>Yukon Waters Act</i> .	Yukon Territory Water Board DIAND Water Resources	Judi Doering, Manager (867) 667-3980 (Fax) 668-3628 Dave Sherstone, Regional Manager (867) 667-3145 Fax: 667-3195
Permission to use gravel/sand from a quarry	Application for Quarrying Permit & Quarrying Permit	DIAND - Subject to Territorial Quarrying Regulations; Referenced to a Land Use Permit or Licence of Occupation issued by the Land Use Section	Marjorie Fraser, Supervisor of Lands (867) 667-3241 (Fax) 667-7073
Gas Permit	Gas Permit Application	Dept. of Community and Transportation Services, Public Safety Branch	Del Young, Gas Inspector (867) 667-5217 (Fax) 667-7209
Sewage disposal	(1) Application for a Permit to Install a Private Sewage Disposal System (2) Notification of Installation and Undertaking to Maintain a Private Sewage Disposal System	Health Canada, Occupational and Environmental Health Services	Fred O'Brien, Senior Environmental Health Officer 1-800-661-3921
To install plumbing for the camp	Plumbing Permit Application	Dept. of Community and Transportation Services, Public Safety Branch	Richard Harder, Chief, Plumbing/ Building Inspector (867) 667-5445 (Fax) 393-6249
Approval to use a low energy radioactive source	Radioisotope Licence	Atomic Energy Control Board	
Approval to burn refuse	Burning Permit issued April to September under the <i>Yukon Forest Protection Act</i>	DIAND, Watson Lake office	Mike Sparks, Resource Management Officer (867) 536-7335 (Fax) 536-7331

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Purpose	Permit/Application Name, and/or Act, and/or Program	Responsible Authority/Agency	Contact
Permission to undertake land use activities on mineral claims or leases	Approval of a Notification or Operating Plan issued under the Yukon Quartz Mining Land Use Regulations	DIAND, Mining Land Use	Marion Dejean, Chief of Mining Land Use (867) 667-3265 (Fax) 667-3899
Transportation of Heavy Equipment	Under the <i>Motor Vehicles Act</i> , an Oversize Permit (\$5.00) is required. If transportation is from outside of Yukon, a Temporary Certificate (\$150) is required. Temporary Certificates are limited to six per year. If transportation is within Yukon, a Freight Vehicle Permit (\$60 + \$3/metric tonne on total gross weight) and a Fuel Permit (\$0.04/km) is required. One pilot car is required for widths over 10'6". for widths of 11'4" or more, two pilot cars are required.	Transport Services Branch, Community and Transportation Services, Government of Yukon	Weigh Station (867) 667-5729 (Fax) 668-2408
Transport of Dangerous Goods/Waste	Certificate and/or Permit for Transport of Dangerous Goods issued under the Transportation of <i>Dangerous Goods Act</i>	Transport Services Branch, Community and Transportation Services, Government of Yukon	Robert Thompson, Transportation & Dangerous Goods Inspector, Motor Vehicle Section (867) 667-3032 (Fax) 667-3608
Confirm Closure Compliance	<i>Yukon Quartz Mining Act</i> , Certificate of Closure	DIAND – Mining Land Use	Marion Dejean, Chief of Mining Land Use (867) 667-3265 (Fax) 667-3899
Permit for Storage and Handling of Petroleum products and other Hazardous Substances	<i>Environment Act, Yukon</i> . Storage Tank Regulations	Dept. of Community and Transportation Services, Public Safety Branch	John Holesworth or Folkie Johnson, Fire Marshall (867) 667-5217 (Fax) 393-6249

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Purpose	Permit/Application Name, and/or Act, and/or Program	Responsible Authority/Agency	Contact
Solid Waste (garbage) Management	Draft Solid Waste Regulations, <i>Environment Act, Yukon</i>	Environmental Protection and Assessment Branch, Renewable Resources, Government of Yukon	Janine Kostelnik, Standards and Approvals Section (867) 667-5456 (Fax) 393-6205
Installation, operation, closure, abandonment or renovations to above or underground storage tanks	Storage Tank Regulations, <i>Environment Act, Yukon</i>	Public Safety Branch, Community & Transportation Services, Government of Yukon	Jack Holesworth, Public Safety (867) 667-3787 (Fax) 393-6249
Mixing and Dilution, Generation, Handling, Collection, Release or Disposal of Special Hazardous Wastes	Special Waste Permit issued under the Special Waste Regulations of the <i>Environment Act, Yukon</i>	Environmental Protection and Assessment Branch, Renewable Resources, Government of Yukon	Janine Kostelnik, Standards and Approvals Section (867) 667-5456 (Fax) 393-6205
Safe Operation of Mines; Public Safety Upon Closure	<i>Occupational Health and Safety Act</i> and Regulations	Mine Safety Branch, Yukon Workers' Compensation Health & Safety Board	Naresh Prasad, Chief, Mining Engineer (867) 667-3777 Fax: 393-6279

1.6 DOCUMENT ORGANIZATION

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

This report is presented in two volumes. The main report “Detailed Decommissioning & Reclamation Plan” is presented in Volume I, with supporting documentation presented in Volume II “Technical Appendices”.

Section 1 of this document introduces the philosophy and scope for the decommissioning and reclamation plan and Cominco’s corporate background. Information is provided on the property and it’s history and a discussion of regulatory responsibilities regarding closure.

Section 2 provides a brief overview of the current status of the Să Dena Hes mine and Cominco’s plans for eventual mine reopening.

Section 3 provides a detailed description of the decommissioning and reclamation plan for the various components including mine workings, tailings management facility, infrastructure and reagents, and site access and haul roads. This section presents a description of each of the project components and outlines potential closures issues. The plan for decommissioning and reclamation activities for each of these areas is then presented.

Section 4 presents the implementation schedule for the plan, in the format of a Gantt Chart.

Section 5 deals with post closure site management plans and activities. This section presents the environmental management measures proposed for the decommissioning and post closure period.

Section 6 provides an updated cost estimate for implementing the decommissioning and reclamation plan.

Section 7 presents a discussion of the licensed financial security requirements and arrangements.

Section 8 provides report references.

ACKNOWLEDGEMENTS:

This report benefited from input by the following companies:

Cominco Ltd. – Senior staff provided overall direction for the Project as well as the corporate policy framework and senior technical review of the proposed closure measures.

Access Mining Consultants Ltd. – Responsible for preparing sections on Introduction, Mining Activities, Implementation Schedule, Post Closure Site Management, and Costing and Financial Security. Also developed closure measures for the infrastructure and industrial reagents. Also prepared and/or coordinated the environmental baseline update, and had responsibility for overall project management, document preparation and coordination.

SRK Consultants Ltd. – Responsible for sections on closure measures and costing for mine workings and the tailings management facility, and geochemistry, climate, and hydrology components of the environmental baseline update.

Laberge Environmental Consultants – Responsible for environmental baseline update for aquatic resources and helped develop the land reclamation closure measures.

2.0 MINING ACTIVITIES

2.1 MINE HISTORY

The original surface showings were discovered in 1962 by prospectors working for the Francis River Syndicate, and for the next few years geochemical and geophysical surveys were conducted, together with some diamond drilling. Between 1979 and 1982, Cima Resources Ltd. and Canadian Natural Resources Ltd. carried out diamond drill programs totaling almost 3,000 metres in 72 holes, and outlined an estimated 250,000 tonnes of zinc and lead mineralization.

In 1984, Canamax purchased the property and began systematic geological and geochemical prospecting, including airborne geophysical surveys, with follow-up ground geophysics. By the end of 1988, Canamax had completed 23,333 metres of drilling in 193 holes and estimated a zinc-lead-silver mineral inventory of over 5 million tonnes in a number of zones.

In 1989, the Mount Hundere Joint Venture (Curragh Resources Ltd. - 80%, and Hillsborough Resources Ltd. - 20%) purchased the property from Canamax and completed 29,000 metres of diamond drilling in 150 holes in order to upgrade reserves in the Jewelbox Hill and North Hill areas. This program resulted in an assessment of proven plus probable mineable reserves of 3.9 million tonnes at 11.5% Zn, 3.8% Pb, and 53 grams/tonne Ag.

In 1990, Kilborn Ltd. prepared a development plan, the project secured financing from the Bank of Nova Scotia, and the property was put into production in August 1991.

The first zinc and lead concentrate shipment to the port of Skagway, Alaska occurred in September, 1991. Mine production rates and mill processing exceeded design capacity of 1,500 tonnes per day during the production period. The maximum mill throughput was over 1,800 tonnes per day. During the 16 months of production, some 700,000 tonnes of ore were mined and processed. Approximately 120,000 tonnes of zinc concentrates were produced with a grade of 59% Zn and 54,000 tonnes of lead concentrates at a grade of 77% Pb. The concentrates were trucked in covered containers to Skagway for shipment to European and

Asian smelters. A sharp downturn in metal prices forced the mine to shut down in December 1992, at which time the property was put on a care and maintenance basis.

Curragh Resources sought and received Court protection under the *Corporations and Creditors Arrangement Act* in 1993. On September 20, 1993, Coopers & Lybrand Ltd. was appointed by the court as Receiver and Manager of the Sä Dena Hes property. In March 1994, the current owners purchased the property through the Receiver according to a Court Order. The property has been kept on care and maintenance except for a brief period in the winter of 1998 when Cominco began preparations for reopening. A downturn in metal prices forced a re-evaluation, and subsequent suspension of work.

2.2 CURRENT STATUS

The Sä Dena Hes Mine is currently idle, awaiting the return of more favorable metals prices. The entire site is clean, inventoried, and kept in a 'standby' mode for the resumption of production. The site is under the care of a full time, onsite caretaker. The caretaker provides security for the site, conducts daily checks of the mill and the general area, daily checks of the Tailings Management Facility, as well as conducting monthly and quarterly environmental sampling. Preparations (such as placing the ball mill on blocks, and draining and cleaning the reagent cells, draining fluids, and covering and sealing the electrical generators, etc.) have been made for the mill and related facilities to be brought on-stream in a timely and cost-effective manner. Details of the current state of all facilities are provided in later sections of this report.

Geotechnical inspections of the tailings management facility, as required by Water Licence QZ97-025, are conducted on an annual basis. This ensures that any potential geotechnical problems are identified early to enable remedial measures to be undertaken if required. Cominco has followed up on recommendations that have resulted from these inspections.

2.3 REOPENING PLANS & PROJECTIONS

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

The Sä Dena Hes Operating Corporation plans to recommence mining and milling operations when satisfactory metal prices return. Cominco is confident that this will occur as world zinc and lead markets return to a more balanced supply and demand situation.

The mine was scheduled for reopening by Cominco in late 1998. To this end, the Jewelbox underground workings were dewatered and prepared for production. In February 1999, due to the sudden downturn in metal prices, the company decided to suspend the reopening plans to await for improved metal prices.

2.4 PERMANENT AND TEMPORARY CLOSURE STATUS

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

Cominco recognizes the legitimate concern that government and the public have surrounding mines continuing for lengthy periods of time in a state of 'temporary' closure. At the same time, it must be recognized that world commodity prices are difficult to predict and are not under the control of Cominco, and, consequently, we can not definitively state when the S• Dena Hes mine will reopen.

During 'temporary' closure, Cominco intends to be a responsible steward of the site and demonstrate its commitment to reopening the site by:

- Continuing to have the site be under the care of an on-site caretaker;
- Continuing to maintain the main access road in a manner that heavy equipment can be brought on site on short notice to deal with any environmental emergency;
- Adequately monitor and maintain buildings and facilities (i.e. tailings facilities) on the site;

- Ensuring that major fixed equipment and buildings remain essentially intact onsite.

It would be reasonable for the government to review the 'temporary' status of the mine periodically, such as every 4 years. If the above conditions were not substantially met, then the closure should be deemed to be of a 'permanent' nature unless the government could be otherwise convinced. If closure is deemed to be 'permanent', then implementation of the Decommissioning and Reclamation Plan must occur.

2.5 DECOMMISSIONING AND RECLAMATION PLAN REVIEW

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

As Cominco continues to manage the site, additional information about the site and its operational plans will be improved. Over time, both regulations and technology change. It is important that this plan is reviewed periodically and updated. It is proposed that this plan be reviewed every 5 years or within 2 years of resumption of operations, whichever occurs first.

It cannot be predicted when metal prices will begin to rise enough to make the Sä Dena Hes Mine economically viable. Proven and probable reserves are estimated at 1,300,000 tonnes @ 10.5% Zn, 2.3% Pb and 4.3 grams/tonne Ag. The mine life is projected to be 3.8 years. At this point, the property is considered relatively well explored. However, as in all mines, the potential does exist to contribute new reserves as mining progresses. While the mill is capable of higher throughput rates, production is severely limited by mining and hauling constraints. At this time, the other potential ore zones, such as Gribbler, are considered exploration targets at best and are considered unlikely to provide any significant additional tonnage.

3.0 DETAILED DECOMMISSIONING & RECLAMATION PLAN

3.1 OVERVIEW

This section presents a detailed discussion of the planned decommissioning and reclamation measures for the various facilities located on the Sä Dena Hes property.

The approach to each subsection is to present a description of each area so that readers are familiar with the existing facility and do not have to refer back to previous reports or information. Next, specific closure issues are discussed as they relate to each closure activity.

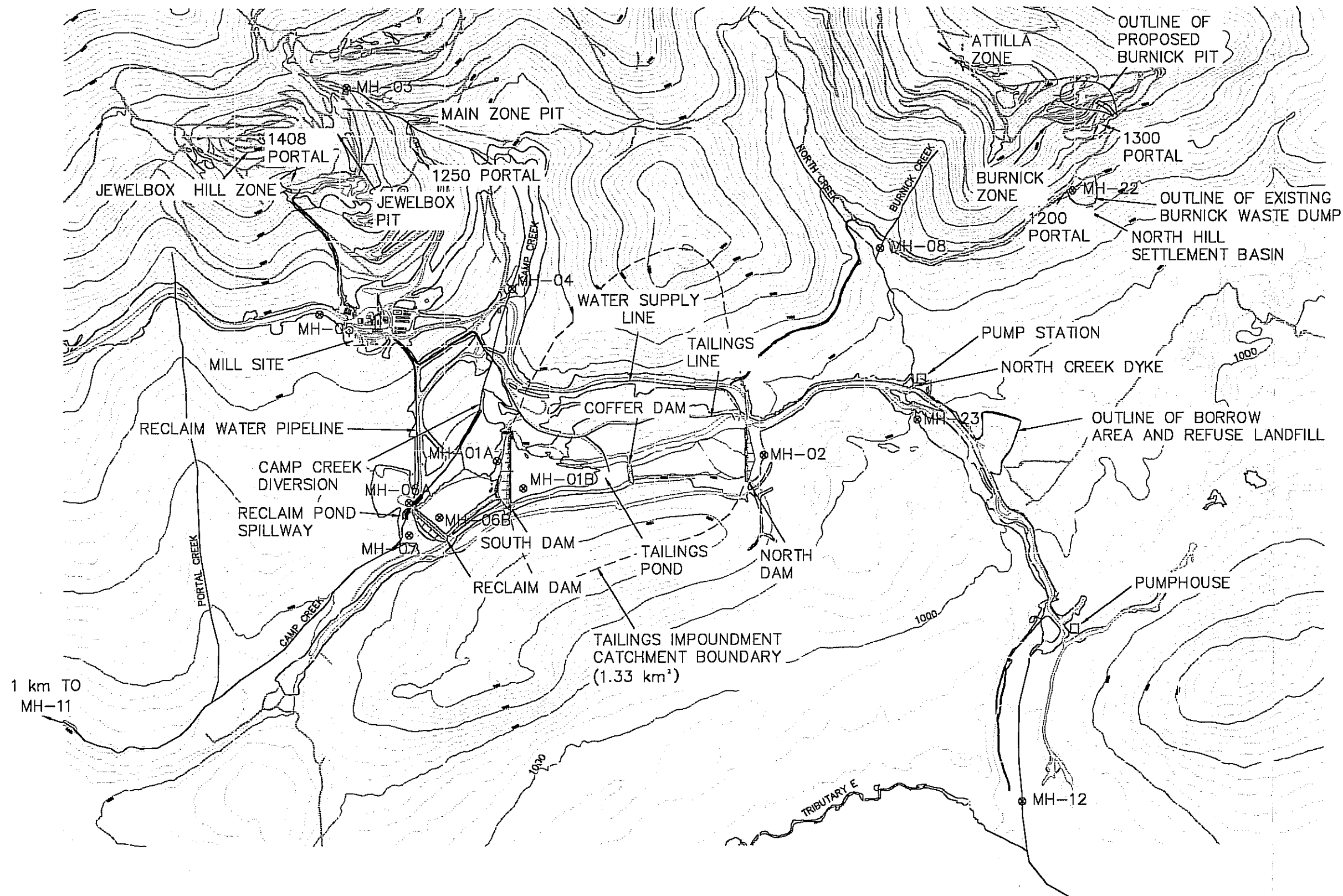
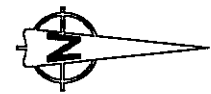
Finally, planned closure measures are presented. Each section is supported with detailed figures and tables as required. Where needed, references are made to previous reports or supporting documentation. Figure 3-1 provides a general arrangement plan for current conditions at the site. Figure 3-2 presents a summary of the various closure measures for features on the general arrangement plan.

3.2 MINE WORKINGS

This section has been updated.
Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

This section discusses the mine features that require action upon closure of the operation. This section restricts its discussions to the physical safety and stability of these features. Surface facilities such as buildings, electrical services, air/water services, fuels storage tanks and access roads will be discussed in other sections of this report. Reclamation issues related to these features are discussed in Section 3.6.

Potential water chemistry issues are discussed at length as part of the geochemistry discussions in Section 4 of Appendix B Volume II.



LEGEND

⊗ WATER MONITORING STATION

≡≡≡ CLEARED AREA

NTS: 105 A/06, 105 A/07
105 A/10, 105 A/11

0 200 400 600 800 1000 metres

1:20,000

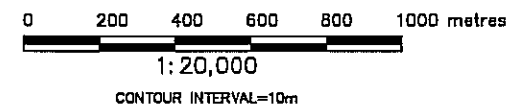
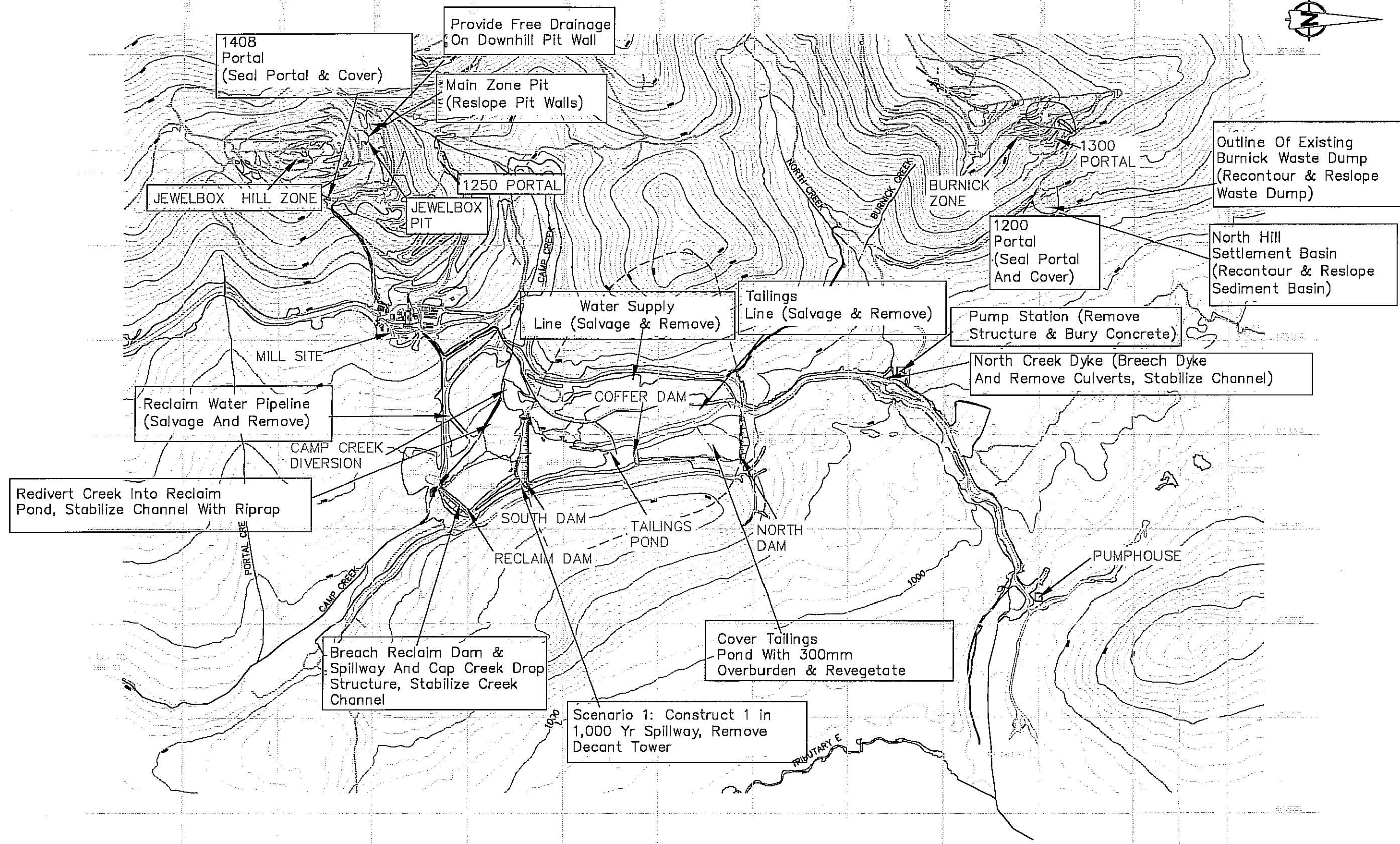
CONTOUR INTERVAL=10m

NOTE:
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

SĂ DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

GENERAL ARRANGEMENT PLAN CURRENT CONDITIONS

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	REV.
DATE:	JULY 29, 1999	PROJ. NO.	1CC005.05	3-1	



NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

S&D DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

GENERAL ARRANGEMENT PLAN CLOSURE MEASURES

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	3-2	REV.
DATE:	JULY 29, 1999	PROJ. NO.	1CC005.05			

3.2.1. *Jewelbox Ore Body*

The Jewelbox ore body is located near the top of Jewelbox Hill (Figure 3-1) immediately west of the mill complex. Curragh started development of this ore body in 1990 and produced ore using several different underground mining methods. These methods included room and pillar, mechanized cut and fill, and longhole stoping.

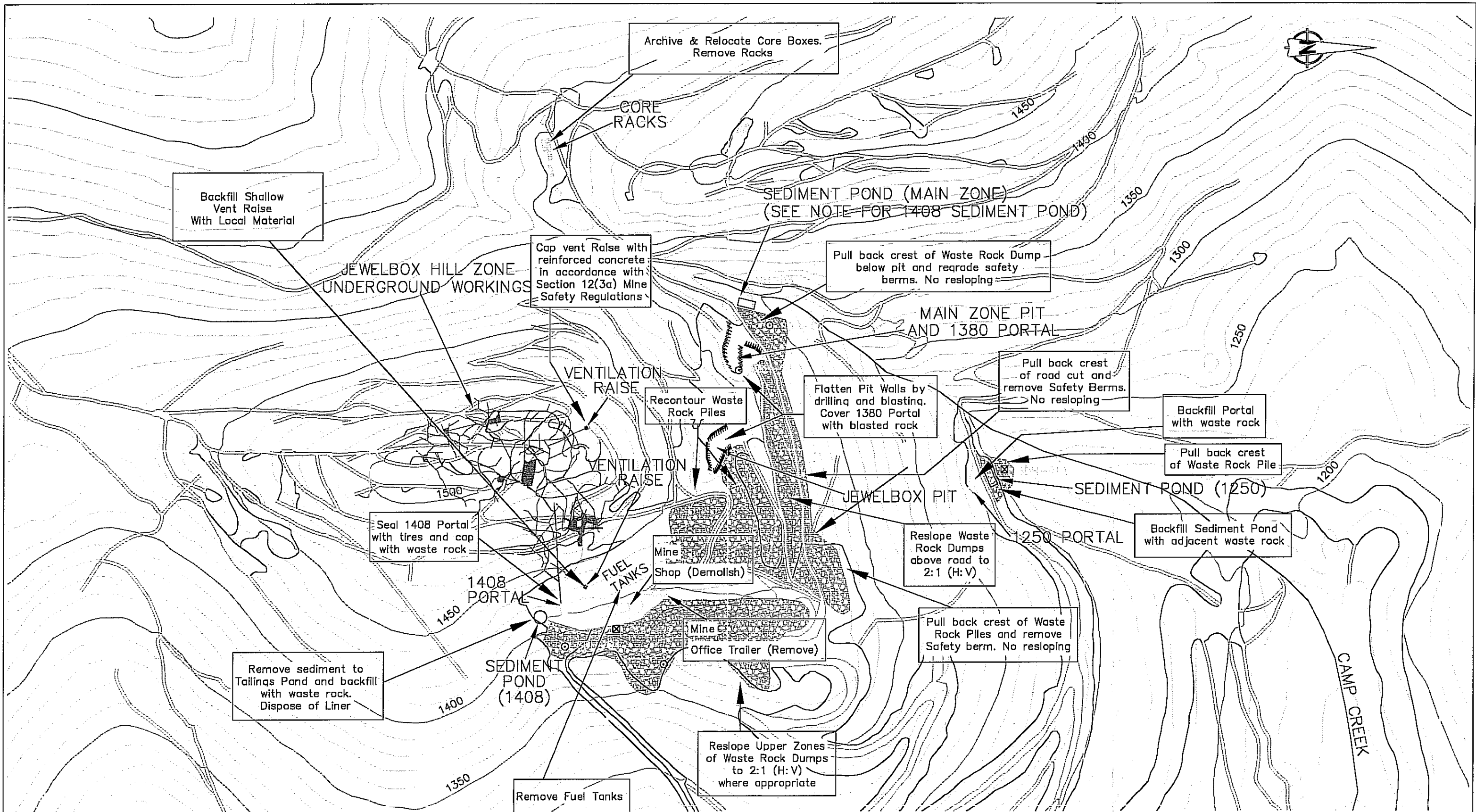
Jewelbox has a number of features that will require work upon closure. They include the 1408 Portal, the 1250 Portal, two ventilation raises, a small open pit and the associated waste rock dumps. These features along with a plan view of the extent of the underground workings are shown in Figure 3-3.

3.2.1.1. *Jewelbox 1408 Portal*

(i) Description

The 1408 portal, is located immediately above the mill site, as shown on Figures 3-1 and 3-3. A haul road from the mill provides access to the main ramp of the underground workings at the Jewelbox zone. The portal is roughly 4.5 m by 4.5 m section and is set back into the hillside about 8 m. This portal is one of only 3 openings that intersect the underground mine workings at the Jewelbox ore zone.

Currently the water level in the workings is at the 1344 metre elevation and is slowly increasing. Prior to the dewatering of the workings by Cominco in December 1998, the water level had been recorded at the 1350 metre elevation after the mine had been closed for approximately four years. The source(s) of the water is from fractures in the rock below the 1350 metre elevation. There are no signs of water flowing down the decline from the portal elevation.



ACCESS MINING CONSULTANTS LTD.

SRK Consulting
Engineers and Scientists

LEGEND

- SDH-S4 - SEEP SAMPLE
- MH-03 - WATER MONITORING STATION
- ⊠ SDH-R1 - WASTE ROCK SAMPLE
- EXPLORATION TRAILS

WASTE ROCK DUMPS

HAUL ROADS

CLEARED AREA

0 50 100 150 200 250 metres

1:5,000
CONTOUR INTERVAL=10m

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

Sä DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

JEWELBOX HILL AND MAIN ZONE
CLOSURE MEASURES

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	REV.
DATE:	JULY 30, 1999	PROJ. NO.	1CC005.05	3-3	

(ii) Closure Issues

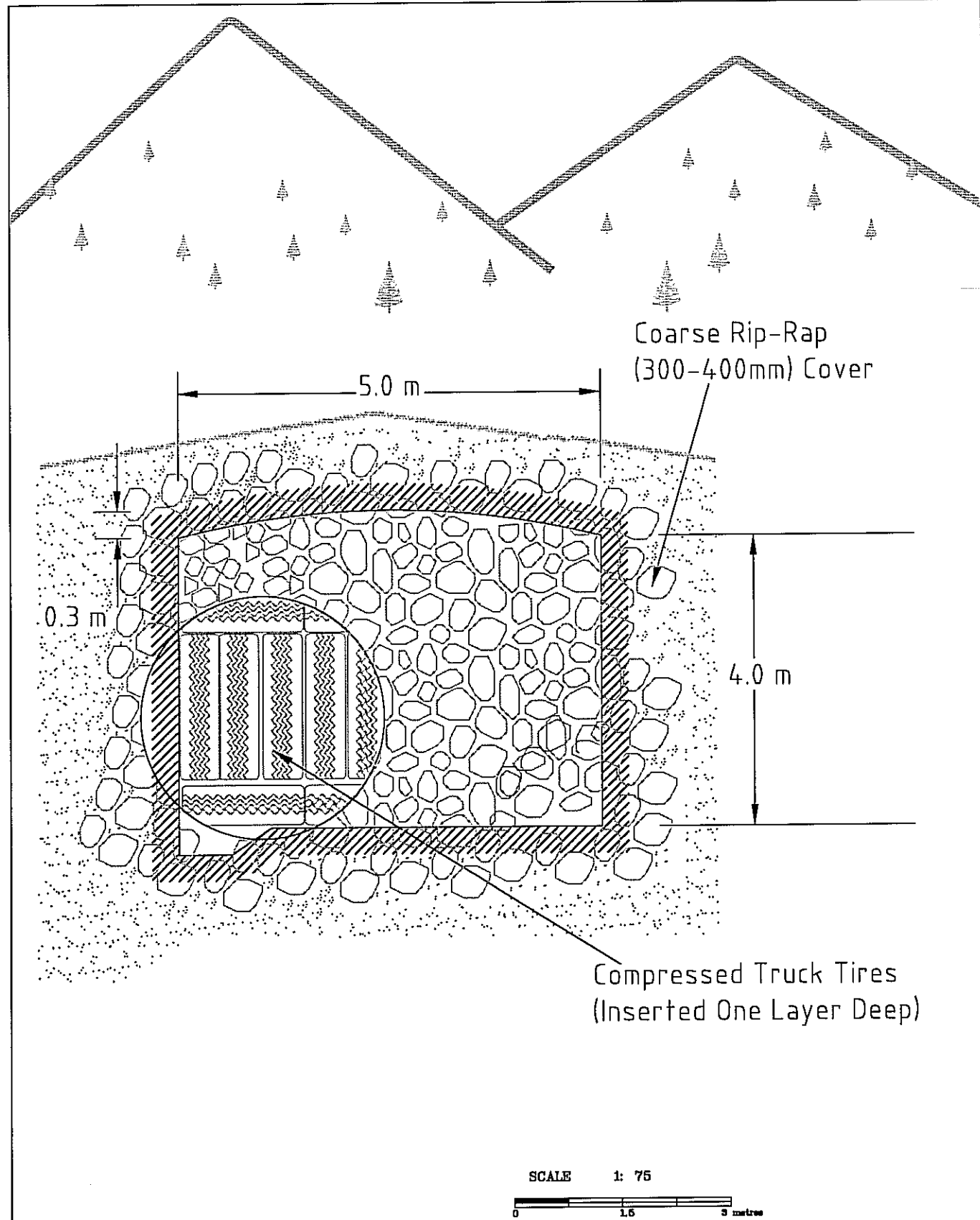
The Jewelbox ore zone has several openings to surface. The lowest opening is the 1408 Portal which is the main entrance to the Jewelbox mine. It has two ventilation raises that exit at a higher elevation. All other mine workings are lower than the 1408 Portal. Water from the mine workings does not flow out of this opening. After the mine was closed for many years, only the lower portion of the mine had flooded. Even if the mine were to completely flood, the vast majority of the water would be below the elevation of the 1408 Portal, so there is no risk of major quantities of water being build up above the 1408 Portal.

The primary concern is to prevent access into the mine by either the public or by wildlife. It is not expected that ice plug formation will occur at this site.

(iii) Closure Measures

At closure, the 1408 Portal will be sealed off by a tire and rock composite barrier to prevent access by the public and wildlife. It is proposed to construct a barrier of tires from heavy earth moving equipment. This is a technique that has been used in Alberta and British Columbia. The tires would be compressed (by a 235-class excavator equipped with a "thumb" attachment), and inserted (forced) into the opening using the excavator. Figure 3-4 presents a typical cross section of the portal barrier. This barrier has several advantages:

- a) in the absence of sunlight, the rubber will not degrade;
- b) the compression of the tires ensures the tires are locked tight against the wall rock of the tunnel. Even if over time the rock on the surface of the tunnel walls loosen, the tires will have some expansion capabilities to maintain the tight fit;
- c) the configuration of the tires has enough gaps to ensure that it is permeable to water without permitting access by people or animals (the tires are placed on edge so there are no large gaps).



ACCESS MINING CONSULTANTS LTD.

STEVEN ROBERTSON AND KIRSTIN
Consulting Engineers

Sã Dena Hes Detailed Decommissioning and Reclamation Plan

Typical Portal Barrier

DRAWN BY: ASH

CHECKED BY: RLM

DATE: 05/08/09

Fig No. 3-4

A cap of coarse waste rock will be placed over the tires to control degradation of the tires by sunlight and to provide a permeable barrier. This barrier is designed to prevent water from being sealed into the mine, which could gradually pressurize and become a potential safety hazard. The cap of waste rock over the portal will be contoured to restore the natural slope of the surrounding terrain. The detailed plans for the seals will be submitted to the mine safety branch for review and approval prior to starting work.

A rock lined channel will be constructed from the base of the portal to direct any potential mine drainage water around the waste rock dump. The ground at the base of the portal entrance will be sloped to ensure precipitation drains away from the portal. Similar methods will be used at the other mine portals that access underground workings.

3.2.1.2. Jewelbox Ventilation Raises

(i) Description

The mine workings at Jewelbox are ventilated by two ventilation raises that extend up from the underground workings to 'daylight' on the hillside above the 1408 Portal. One of the ventilation raises is located near the summit of Jewelbox Hill, while the other is located immediately up slope behind the shop building at 1408 Portal.

(ii) Closure Issues

Both raises must be permanently sealed to prevent access into the mine by the public and by wildlife. The openings should be sealed in a manner that prevents water from entering the mine working as these tunnels are steeply dipping down into the mine.

(iii) Closure Measures

Both ventilation raises will be sealed with a reinforced concrete cap in accordance with Mine Safety Regulations. The seals will provide the physical barrier to eliminate the potential for the public or wildlife to access the mine through ventilation raises. In addition, the concrete seals will prevent water from being able to enter the mine workings by flowing into these openings.

3.2.1.3. *Jewelbox - 1250 Portal*

(i) Description

The 1250 Portal is located on the north side of Jewelbox Hill, in the Camp Creek catchment as shown on Figures 3-1 and 3-3. Original mine plans called for production to come from this portal, but subsequent diamond drilling and increased knowledge of orebody geometry forced a relocation of the production portal to the current 1408 Portal. Construction of the mine workings had been started by mining the portal, but the tunnel extends only 3 metres (approximately) into the hillside. The tunnel has not exposed any ore and has no water flowing from it. The sediment pond contains only benign material.

(ii) Closure Issues

The loose rock at the entrance to this short tunnel could be a potential safety hazard to the public. A small quantity of waste rock produced from starting this short tunnel requires contouring. There are no other issues related to this minor item.

(iii) Closure Measures

The opening will be capped with waste rock borrowed locally and the cap will be shaped to form a 2:1 (H:V) slope to ensure stability. The minor amount of waste rock, at the portal entrance, will be regraded, scarified and revegetated.

3.2.1.4. *Jewelbox Pit*

(i) Description

The Jewelbox pit is located above the Main zone pit as shown on Figure 3-3. The pit bottom is at an elevation of 1400m and rises steeply to 1430m. The pit is not free draining but seepage through the fractures in the rock causes the ponded water in the bottom of the pit to fluctuate. Weathering of the pit walls results in rock gradually loosening and falling into the pit.

(ii) Closure Issues

The loose rock and steep slope of the pit walls are a safety concern. During the spring freshet, water collects in the bottom of this pit and may drain through a fault into the 1380 Portal. Further investigations are required to confirm if this assumption is correct.

(iii) Closure Measures

The pit walls will be stabilized by resloping them by drilling and blasting. The blasted rock material will partially fill the pit. A channel filled with coarse rock will be made to ensure that if water levels within the pit were to increase, that it would have a route to flow out of the pit. Water quality from this discharge is expected to meet acceptable levels. This will ensure that there is no free standing pool of water within the pit and reduces the potential for this water to flow into the 1380 Portal through fractures in the rock.

3.2.1.5. *Jewelbox Waste Rock Dumps*

(i) Description

The waste dumps associated with the development of Jewelbox and Main Zone make up the bulk of the current waste rock at the Sä Dena Hes minesite. Waste rock from the Jewelbox underground was placed immediately below the 1408 Portal as shown on Figure 3-3 and covers an area of 2.6 hectares. In the upper section of this dump (1.3 ha), the material was placed in two to three lifts with berms providing an overall slope of about 2:1 (H:V). However, the lower sections were end-dumped on relatively steep slopes leaving slopes at the angle of repose (1.3:1). Since the shut down of the mine in 1992, there has been no evidence of any instability of the dump. No tension cracks, toe bulges or subsidence have been noted.

Waste rock mined from the Jewelbox Pit is located on a ridge immediately east of the pit as shown in Figure 3-3. The dump was built in two phases with the ultimate crest at El. 1442m and covers an area of about 1.9 hectares. The side slopes of the dump are generally 2:1 (H:V).

Waste rock was also deposited on relatively steep ground immediately below the upper Jewelbox pit dump as shown on Figure 3-3. The face of this dump is about 1.3:1 (H:V) and the crest has been over-steepened. The dump covers an area of about 0.4 hectares.

Waste rock from the Jewelbox pit can also be found above and below the access road to the Main Zone Pit. This material sits on relatively steep ground with the dump faces at slopes of 1.3:1 and covers an area of about 0.9 ha. Safety berms are located along the crest of access road and stand about 1 metre high.

(ii) Closure Issues

All of the waste rock dumps at Jewelbox and the main zone pit are in the alpine zone (above the tree line), and, as such, are not naturally vegetated. Therefore, the closure issues at these sites are restricted to recontouring to conform to natural surrounding slopes in order to avoid ponding of water. Long term physical stability is the issue for these waste rock dumps..

(iii) Closure Measures

At closure the upper section of the waste dump below the 1408 Portal will be resloped to about 2:1 (H:V) to provide a more stable configuration. No specific action will be carried out on the lower slopes of this dump.

The waste rock in the Jewelbox pit dump on the ridge above the 1408 Portal will be recontoured to provide a continuous slope of 2:1(H:V).

As the sidehill dump below the Jewelbox pit dump is on relatively steep ground, no resloping of this dump is possible. However the crest will be pulled back to remove the oversteepened sections.

All safety berms along the access roads will be removed either with an excavator or by dozer.

3.2.2. *Main Zone Ore Body*

The Main Zone is located on the south flank of the Camp Creek catchment. It is on Jewelbox Hill just north of the Jewelbox Zone. Locations of these mine features are shown in Figures 3-1 and 3-3. The Main Zone workings consist of a pit, an adit and waste dumps. There are no significant underground workings associated with this ore zone.

3.2.2.1. *Main Zone - Open Pits*

(i) Description

The main zone pit is the lower of the two open pits located on the south flank of the Camp Creek catchment. The pit is a sidehill excavation with the pit floor at El. 1370 rising to an elevation of about 1400m with relatively steep slopes. Unravelling of the highwalls is a dynamic process and would likely continue. With the low concentrations of iron sulphides in association with abundant carbonates, acid generation will not occur and therefore no additional measures to provide chemical stability of the pit walls are required. As discussed in Section 3.2.2.2, the drainage from the 1380 Portal flows into fractures within the pit floor and through the waste dump into Camp Creek.

(ii) Closure Measures

The pit walls will be stabilized by drilling and blasting the high wall to reduce the wall slope, and where possible, resloped using a dozer. The blasted rock and resloped material will be used to fill the pit and cover the 1380 portal. The coarser rock fragments will be placed at the base of the fill to allow free drainage from the pit. It is expected that when the mine does reopen, this work will be carried out while the mine is operating.

3.2.2.2. *Main Zone – 1380 Portal*

(i) Description

The 1380 Portal is located within the Main Zone Pit as shown on Figure 3-3. The portal is about 4.5 m by 4.5 m in section and is collared in limestone and skarn. This portal does not connect with any other underground workings. The mining of this tunnel (adit) was apparently stopped due to very poor ground conditions. During spring freshet water drains from this portal. The water flow dries up once the spring freshet is over. The source is believed to be from the Jewelbox pit which is thought to be connected by a fault. Water is draining through the broken rock, exiting the portal and disappearing into the ground a short distance outside the portal.

(ii) Closure Issues

Closure issues related to this site include stability of the opening and prevention of inadvertent access by the public or by wildlife. The short duration flow of water from this portal has elevated zinc levels.

(iii) Closure Measures

The 1380 Portal will be sealed off to prevent access by the public and wildlife. Material to bury the portal will come from the resloping of the Main Zone pit walls as discussed in Section 3.2.2. As the cover material is expected to be very coarse, the water that flows out of the portal will not be obstructed by the rock. The use of tires to provide a secure physical barrier is not required here due to the volume of rock fill that will bury the entrance to this tunnel. The discharge from this Portal, newly discovered in June, 1999, is expected to be related to seasonal snow melt at the adit entrance, and possibly the ponded water above the Portal in the upper main zone pit. Closure measures for this pit include blasting out a channel in the downhill lip of the pit to provide positive drainage out of the pit. Regardless, starting this spring, this site will be monitored for flow quantities, duration and water to assess the significance of this discharge. Further investigation will be made to establish if the Jewelbox Pit is the source of the water.

3.2.2.3. *Main Zone – Waste Dump*

(i) Description

Waste from the Main Zone pit was end-dumped on hillside slopes below the pit floor and above the headwaters of Camp Creek (Figure 3-3). The slope of the dump is about 1.3:1 and consists of very coarse, broken rock. The dump covers an area of about 0.3 ha. The waste rock is composed primarily of limestone with some ore-type skarn material. Some of the skarn had decomposed resulting in the release of coarse sphalerite and galena-rich sand. Water was seen flowing inside the dump presumably originating from the Main Zone pit or the Jewelbox pit.

Phyllite waste rock was also end-dumped on the hillside above Camp Creek and adjacent to the 1250 Portal. This dump is relatively small (< 0.2 ha) with a slope of about 1.3:1. The dump contains no mineralized material.

(ii) Closure Measures

As the dump below the Main Zone Pit is on relatively steep ground, no resloping is possible. However the crest will be pulled back to remove the over steepened sections and the safety berms will be removed.

3.2.3. *Burnick Ore Body*

The Burnick ore body is located on the North Hill which is approximately 4 km north of the mill site as shown in Figure 3-2. There are 3 portals and a waste dump related to this area of the mine. Very little development has been done to date but future mining has been planned in preliminary detail. The mining plan for Burnick includes development of the Atilla ore zone, access provided by a ramp from Burnick underground. Therefore, closure measures and resultant costing for the Atilla zone is included in the discussions about the Burnick waste dumps.

3.2.3.1. *Burnick Zone – 1200 Portals*

(i) Description

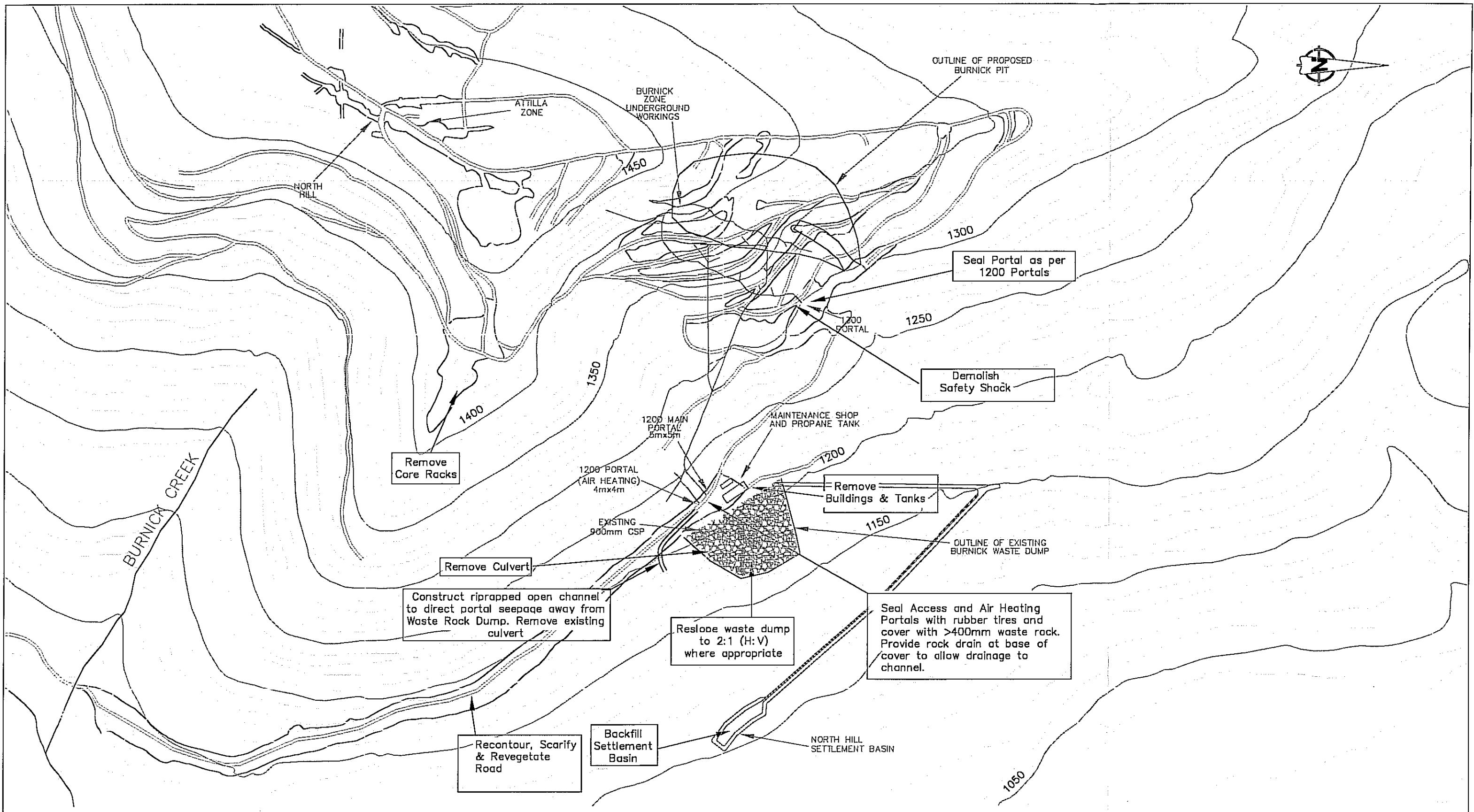
At the 1200 Level of Burnick, there are two portals separated by several metres. They are shown on Figure 3-5. One of the portals is the main access to the Burnick ore body and the second portal provides propane heating for the ventilation air. Water from the mine drains from the ventilation portal. In 1998, Cominco built a temporary shotcreted dam inside the ventilation portal to create a settling sump to contain any sediment in the discharge. The flow rate of this water ranges from approximately 800 l/min during spring to 15 l/min during winter low flows. The water flows into a culvert beneath the portal pad which directs the flow over the existing waste rock dump.

The source of the majority of this water appears to be fractures and drill holes located near the entrance of the 1300 Portal. It flows down hill from this portal, exiting the mine from the 1200 Level. Only preliminary development has been completed at Burnick so the underground workings are not extensive. A plan view of the present workings at Burnick are shown in Figure 3-5.

(ii) Closure Issues

The two portals at the 1200 Level must be sealed to prevent public and wildlife access into the mine workings. They will be sealed in a manner that allows 800 L/min flow exiting the mine to be free draining so that that water does not back up into the mine workings creating as safety hazard. Water from the portals must be redirected around the waste dump.

In the Yukon, there have been instances of ice plugs forming in open portals of mines after closure. The ice plugs have resulted in water being stored behind the plugs and being released in an uncontrolled fashion when the ice plugs break.



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LEGEND

WATER MONITORING STATION



WASTE ROCK DUMPS
AND ROAD CUT



CLEARED AREA

0 50 100 150 200 250 metres

1:5,000

CONTOUR INTERVAL=10m

NOTE

BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

Sä DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

BURNICK ZONE CLOSURE MEASURES

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	3-5	REV.
DATE:	JULY 30,1999	PROJ. NO.	1CC005.05			

(iii) Closures measures

Any sediment collected in the sump behind the shotcrete dam will be removed to the tailings pond. Both portals will be sealed with tires and covered with coarse waste (in the same manner as described for the Jewelbox 1208 Portal in Section 3.2.1.1). The waste rock will be taken from the Burnick waste dump. Refer to Figure 3-4 for a typical portal barrier drawing. An engineered rock drain will be placed at the base of the waste rock fill to provide free drainage from the portal.

The rock fill drain at the base of the portal seal will be designed to accommodate a peak flow that will be determined during final design. The closure measures presented are conceptual in nature and are not to be considered as final engineering designs.

The channel will be constructed several metres back and parallel with the crest of the resloped rock dump. The outlet of the channel would be located at the south end of the dump to ensure no discharge over the rock fill.

When Cominco took over management of the mine, inspections revealed that the Burnick workings had ice building up within the main access tunnel near the 1200 Portals. To control the formation of this ice built up, Cominco installed a ventilation bulkhead (blockage) at the 1300 Portal to prevent air from freely flowing through the mine during the winter. Inspections since then have shown that controlling the air flow has stopped the formation of ice within the mine workings. Cominco will continue to monitor for formation of ice buildup within the mine workings while the mine is in temporary shutdown. This on-going monitoring during the temporary shutdown period is confirming the adequacy of this approach. Upon permanent closure of the mine, permanent seals will be built to prevent access to the mine and to prevent air from flowing within the mine. This will eliminate the potential for ice plugs to form.

3.2.3.2. *Burnick Zone – 1300 Portal*

(i) Description

The 1300 Portal is accessible via an old exploration road and is currently sealed to limit movement of air through the workings (Figure 3-5). There is no drainage from the portal as it is the highest point of the mine and any water in the mine flows down to the 1200 Portal.

(ii) Closure Issues

This entry must be able to be sealed to prevent access to the mine opening by both the public and wildlife. The entrance must be sealed and contoured in a manner to prevent water from entering the mine workings. The seal will prevent air movement through the mine necessary to prevent buildup of ice plugs within the mine workings.

(iii) Closure Measures

The portal will be sealed with tires and covered with waste rock. Surrounding topography will be contoured to ensure water drains away from the portal.

3.2.3.3. *Burnick Zone - Proposed Pit*

(i) Description

An open pit is planned for the mine at the Burnick Zone. The outline in plan view of this pit is shown on Figure 3-5. Planning is at the conceptual stage and will likely be revised as more detailed planning is done. It is currently planned to have three portals entering the mine from the wall of the pit. The pit would have an ultimate floor elevation of 1300 m, and is scheduled to be developed for the third year of operation.

The majority of the waste rock produced from this pit is currently planned to be used as underground backfill.

(ii) Closure Issues

It is premature to detail the closure issues here. It would be typical of open pits to have public safety issues related to the slope of the pit walls. There are not expected to be significant quantities of waste placed in dumps so any issues related to this will be minor.

(iii) Closure Measures

The pit walls will be stabilized by drilling and blasting to address the physical stability and public safety concerns.

3.2.3.4. *Burnick Zone – Waste Dump*

(i) Description

The waste rock from the underground workings at the Burnick Zone is located in a sidehill dump immediately below the portal and covers an area of about 1.4 ha. There are several tension cracks along the crest of this dump and settlement is evident. The crest is about 100 metres long and the vertical dimension from crest to toe is about 50 metres.

(ii) Closure Issues

The main closure issue is physical stability and recontouring to ensure positive drainage. There has been evidence of some instability at the north end of the dump.

(iii) Closure Measures

At closure, the Burnick dump will be resloped to as flat an angle as the surrounding terrain will accommodate. Where practical, the mine will contour the ground around the dump to minimize the impact on the dump due to runoff.

With regards to long-term integrity of the dump, the area of current instability is concentrated at the north end of the dump. The 1300 Portal drainage channel, as discussed in Section 3.2.3.1 above, would be constructed at the south end of the dump. The south end has not shown any

movement or instability in the 2 to 3 years since construction. Once the waste rock dump is resloped at closure, long-term integrity of the dump and the channel will be maintained.

3.3 TAILINGS MANAGEMENT FACILITY

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

3.3.1. General

Two scenarios for the closure of the Tailings Management Facility (“TMF”) at the Sä Dena Hes mine are presented in this closure plan. The first scenario considers the option that if Cominco does not reopen the mine, closure of the TMF would focus on the current conditions (see Figure 3-6).

The second scenario assumes that the mine will reopen and tailings will be deposited in to the existing facility over a period of 4 years (see Figure 3-8). It is estimated that about 1.8 million tonnes of dry tailings would be deposited into the facility. To achieve this, the North Dam would need to be raised to an ultimate elevation of 1102 m and the South Dam to 1100 m. No changes would be made to the Reclaim Dam.

Only upon a decision to close the mine would efforts begin to decommission and reclaim the TMF. Timelines may differ slightly between the scenarios, due to the increase in areal extent of the TMF in Scenario 2.

The following section presents a description of the existing TMF, followed by a discussion of the closure measures for each option. Many of the measures are common to both and will not be repeated for the second scenario.

3.3.2. Description

The TMF consists of three earth structures, which are referred to as the North Dam, the South Dam and the Reclaim Dam as shown on Figure 3-6. The North and South Dams, which

impound the tailings, were constructed between July 1990 and October 1991. The starter dams for both structures were built to a height of about 13 metres. A small, two metre high cofferdam was also constructed halfway between the two dams to control flow of water and tailings from the north end of the impoundment.

In addition to the North and South Dams, a Reclaim Dam was built to retain supernatant water decanted from the tailings pond for reuse in the mill. The Reclaim Dam is about 15 metres high at the maximum section. The mine plan involved recycling of the reclaimed water to the mill with a controlled discharge into Camp Creek from April to October each year. During operations and when the pond water level becomes too high, water is decanted from the tailings pond to the Reclaim through a concrete decant tower located adjacent to the upstream crest of the South Dam as shown Figure 3-6. Details of the decant tower are shown on Figure 3-7.

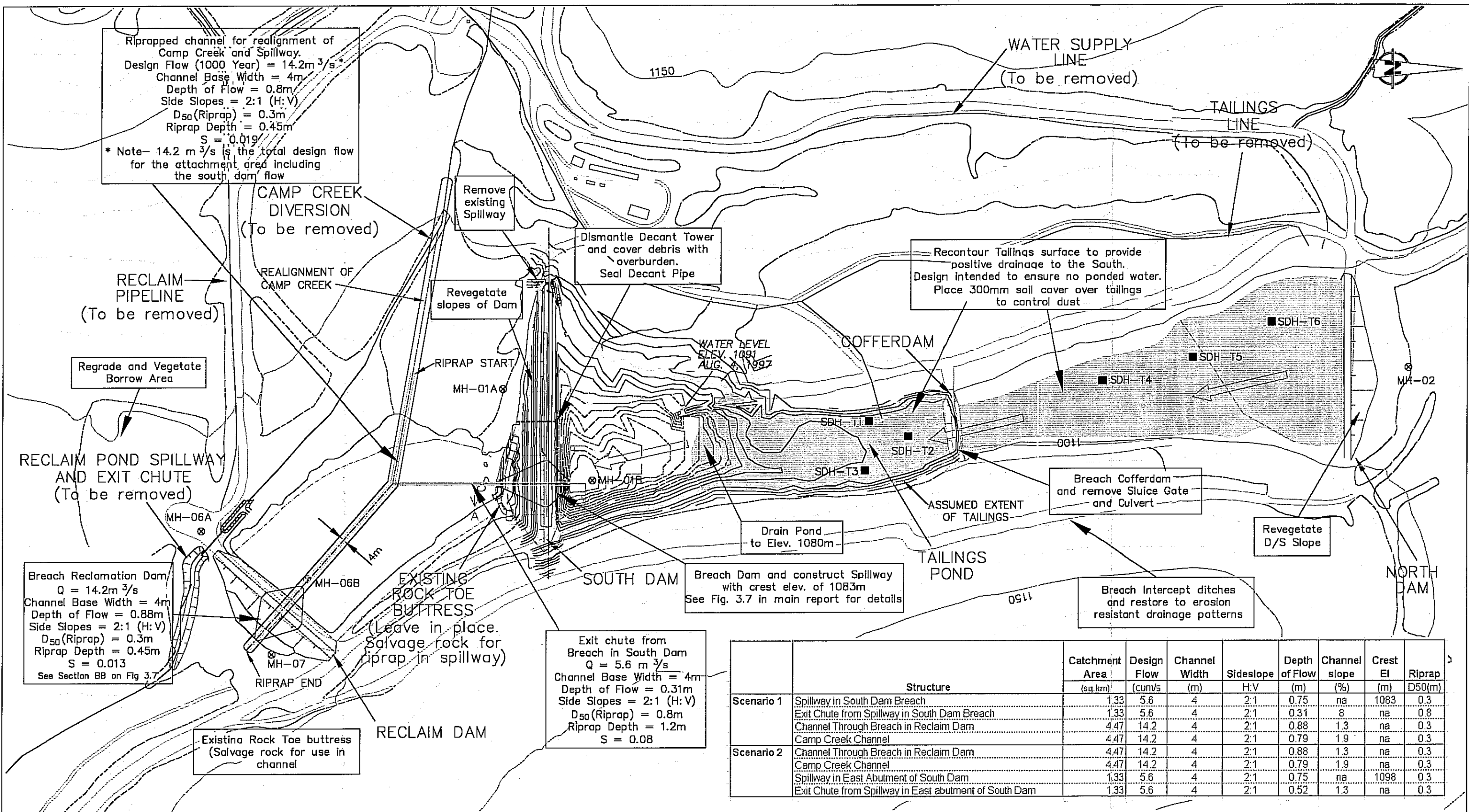
A 0.5m dia. corrugated steel pipe ("CSP") decant culvert discharges the water from the tower, beneath the dam and into the Reclaim Pond. Water is discharged from the Reclaim pond to Camp Creek during the licensed allowable discharge period, April through to October.

An emergency spillway, consisting of two 900 mm dia. CSP culverts, is located at the west abutment of the South Dam as shown on Figure 3-6. The spillway has the capacity to discharge flow from a 200-year flood event into the Reclaim pond. An emergency spillway is also located on the west flank of the Reclaim pond which would discharge into the Camp Creek Diversion.

The reclaim pipeline ($\cong$ 300 mm dia.) is located along the west side of the access road to the mill as shown on Figure 3-6. A short section of the pipe near the reclaim pumphouse is buried. The tailings pipeline ($\cong$ 250mm dia. HDPE) lies, above ground, along the side of the road as shown on Figure 3-6.

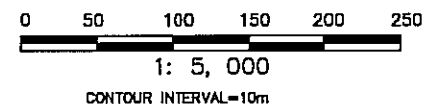
Camp Creek is currently diverted into a channel along the west side of the Reclaim Pond and discharges through a twin culvert spillway (two 1.2m dia CSP's) into a riprap lined exit chute. The channel is designed to accommodate the 200-year flood event.

In March of 1992, the previous operators, Curragh Resources, built a rockfill buttress along the toe of the Reclaim dam to provide extra protection against sloughing and erosion of the toe.



LEGEND

- WATER MONITORING STATION
- TAILINGS SAMPLE
- SURFACE DRAINAGE

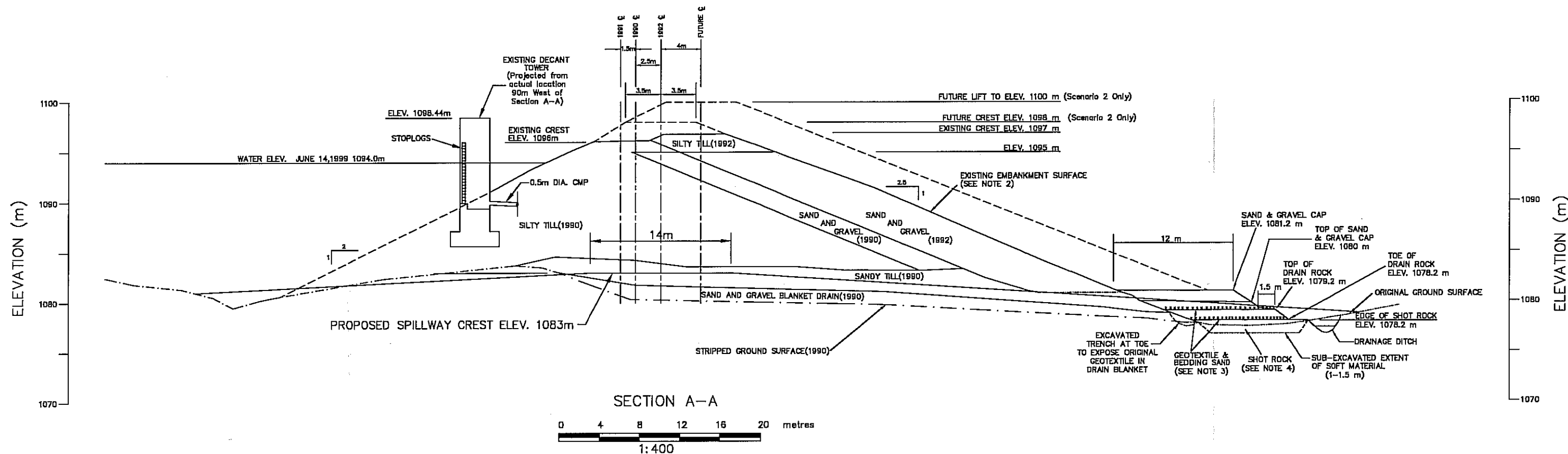


NOTE
 BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
 ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
 ADJUSTED FROM NAD 1927

SA Dena HES DETAILED
 DECOMMISSIONING AND RECLAMATION PLAN

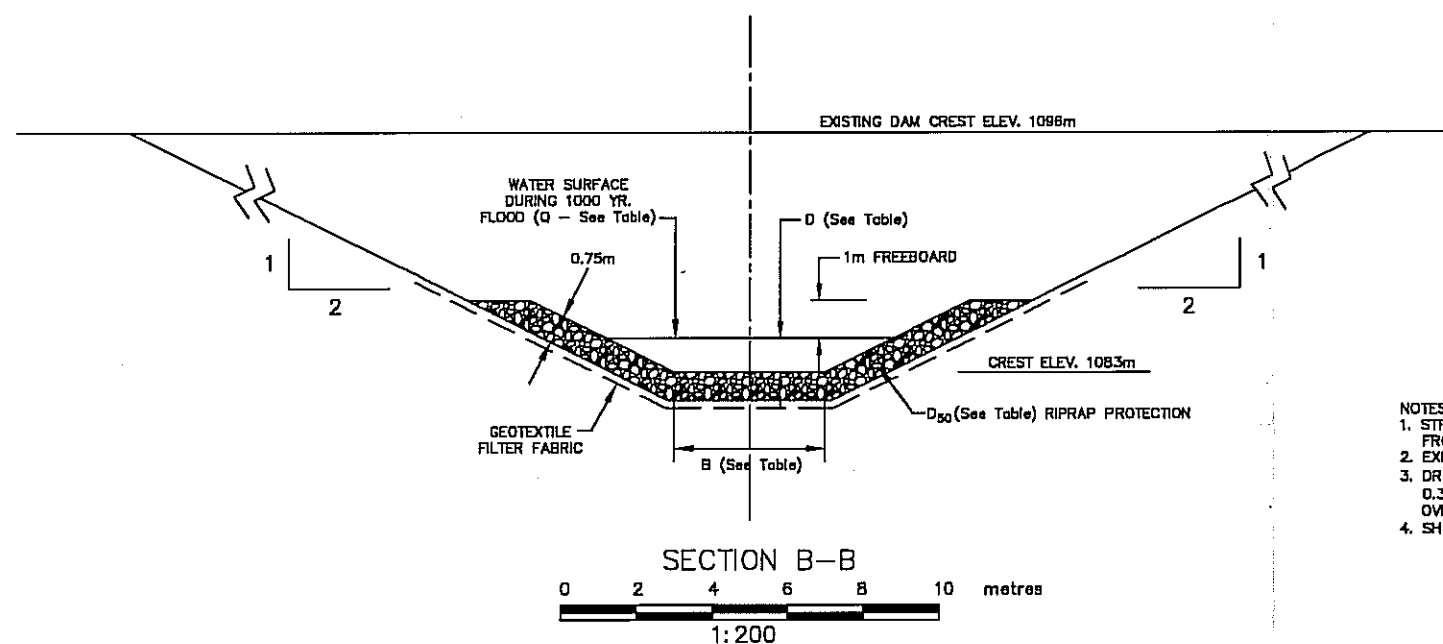
TMF CLOSURE MEASURES
 SCENARIO 1

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	REV.
DATE: AUGUST 2, 1999	PROJ. NO. 1CC005.05	3-6	



	RECLAIM DAM BREACH CHANNEL	SOUTH DAM SPILLWAY
Q (m ³ /s)	14.2	5.6
B (Crest width)	4m	4m
D (Depth of flow)	0.88m	0.75m
D ₅₀ (Riprap)	0.3m	0.3m
Sideslopes	2:1	2:1
Depth of Riprap	0.45m	0.45m
Crest Elevation	N/A	1083m
Channel Slope	0.013	N/A

N/A = Not Applicable



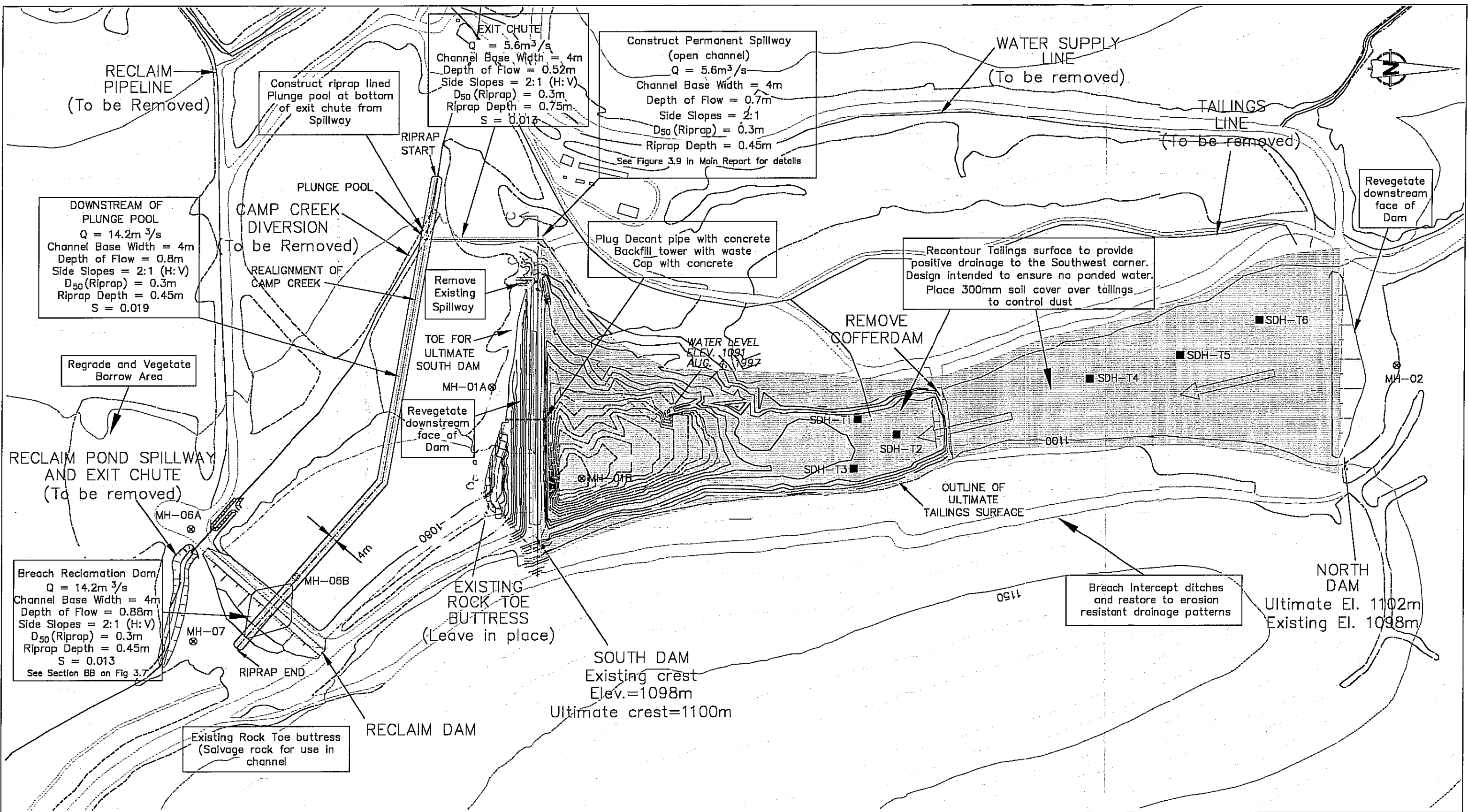
- NOTES**
1. STRIPPED GROUND SURFACE AND EXISTING DAM ZONES FROM Y.E.S. AS-BUILT DRAWINGS, JULY 1991.
 2. EXISTING DAM SURFACE FROM SURVEY COMPLETED AUGUST 1997.
 3. DRAIN ROCK FILTER CRITERIA - 5mm < D₁₅ < 25mm
0.3m THICK BEDDING LAYER OF PIT RUN SAND AND GRAVEL OVER SHOT ROCK PLATFORM.
 4. SHOT ROCK CONSISTS OF BLASTED LIMESTONE FROM JEWELBOX PIT.



SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

TMF CLOSURE MEASURES - SCENARIO 1
SECTIONS A-A AND B-B

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	REV.
DATE: AUG. 4, 1999	PROJ. NO. 1CC005.05	3-7	



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LEGEND

⊗ WATER MONITORING STATION

■ TAILINGS SAMPLE

← SURFACE DRAINAGE

0 50 100 150 200 250 metres

1:5,000

CONTOUR INTERVAL=10m

NOTE

BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

**SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN**

**TMF CLOSURE MEASURES
SCENARIO 2**

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	REV.
DATE: AUGUST 4, 1999	PROJ. NO. 1CC005.05		3-8

In September 1992, work commenced on a 2-metre raise of the South Dam to El. 1098. Work on the extension was shutdown on October 14, 1992 because of the construction difficulties experienced due to sub-zero temperatures. No further work has been done to raise the dam.

In 1997 Cominco initiated work on a toe buttress at the South Dam in advance of the planned reopening of the mine in 1998. Although the decision to re-open the mine was postponed, the buttress was completed in the fall of 1998.

Interceptor ditches are located above the TMF on the east side of the catchment. These ditches direct runoff away from the TMF both to the north and the south. Drainage ditches associated with the access roads on the west side of the TMF direct runoff away from the TMF on the west side.

3.3.3. *Closure Issues*

The long-term physical stability of the tailings embankments and the chemical stability of the tailings are the key items that have been addressed in this closure plan. The key physical stability issues are related to the design flood and seismic events. The only chemical stability issue, as discussed in Section 4 of Appendix B, is related to the zinc loading from the tailings.

(i) Physical Stability Issues

As the Reclaim Dam will be breached after closure in both of the two scenarios being considered, the physical stability of this structure is not addressed in the plan. Furthermore, as the South Dam will also be breached in Scenario 1, the physical stability of the current configuration of the South Dam will not be discussed.

The stability analyses of the tailings embankments, which is presented in Section 10 of Appendix B, concluded that both dams for both closure scenarios will have an adequate factor safety under both static and seismic loading.

However, physical stability of the South Dam requires that a spillway be constructed to pass the mean annual runoff and peak flood events. The spillway has been designed for the 1000-year return event.

The selection of the 1000 year design event for the emergency spillway at the South Dam for scenario 2, is based on the guidelines presented in Table 8. of "Mine Reclamation in the Northwest Territories and The Yukon", Indian and Northern Affairs Canada (INAC), 1992. The size of the embankment is classified as large (>7.5m), but the potential impact or hazard associated with the failure of the spillway is considered to be moderate. In the event of a spillway failure, tailings and embankment soil would be released and transported downstream into False Canyon Creek. The volume of tailings release is expected to be less than for a dam breach due to other hazards such as a seismic event (lower probability of occurrence). The tailings are not acid generating, but once the flood levels have subsided, there is potential for a moderate increase in metal concentrations such as zinc in the stream due to oxidation of sphalerite in the exposed tailings. There would be no loss of life expected, no damage to buildings or agricultural land, and no loss to roads.

This spillway design is considered conservative. There is a freeboard of 1.1m above the 1000 year, which would easily accommodate the PMF of 14.8 m³/s without overtopping. Furthermore, the spillway design ignores the attenuation effect of the impoundment. If the flood is routed through the spillway allowing for this attenuation effect, the current design is expected to accommodate the PMF with freeboard.

With the present spillway design, it is expected that minimal maintenance would be required following a 1000 year event or perhaps a smaller flood event. In the event of a 1000 year flood event, an inspection of the site will be conducted to determine if any maintenance work is required.

(ii) Chemical Stability

As discussed in detail in Section 4.4 in Appendix B under Scenario 1, the zinc load from the tailings is not expected to have a significant impact on the receiving water quality at MH-11 or MH-16, and consequently no additional engineered measures to control leaching are required

for closure. Furthermore, since temporary shut down of the mine in 1992, effluent water quality levels have been in compliance with the water licence.

Based on the most recent water quality monitoring data collected at MH-02 for 1999 (Appendix B, Section 3.3.1.3), total metals concentrations for lead and cadmium have continued to remain stable. Total zinc concentrations appear to have also stabilized and showed a decreasing trend for 1999 (Appendix B, Figure 3-13).

To ensure that the long-term chemical stability of the tailings facility and seepage from the tailings is not an issue at closure, a geochemical test program will be conducted. This test program will be designed to characterize tailings pore water within the South and North dam impoundments. The results of this testwork would be used to confirm geochemical predictions regarding tailing stability and the adequacy of closure measures. It is expected this work would begin in summer, 2000. To compliment this program, the water quality monitoring program at station MH-02 and MH-07 would be expanded to include sampling for dissolved metals.

Although more tailings will be deposited into the TMF for the scenario 2, the actual zinc load in the long-term would not increase because the tailings surface area exposed to oxidation will not change significantly. Similarly, no additional control measures for chemical stability of the tailings are required for Scenario 2.

3.3.4. *Closure Measures (Scenario 1)*

3.3.4.1. *Tailings Embankments*

At closure, the ponded water above the South Dam will be pumped down to a practical level that will enable construction and demolition work to proceed at the toe of the dam. As discharge from the TMF is limited under the current water licence, careful management of the draindown and discharge will be required to ensure compliance with the licence. The South Dam will be breached at the low point in the dam and a permanent spillway constructed within the breach at a crest elevation of 1083 m. Breaching of the dam will be done by removing the material by excavator and rock trucks.

The spillway will result in a small pond of water forming upstream of the dam that will fluctuate seasonally. Details of the spillway are discussed in Section 3.3.4.6. The sideslopes of the South Dam will be revegetated to provide erosion control. The existing CSP spillway will be removed. The cofferdam will be cut down flush with the tailings and the sluice gate and pipe beneath the dyke will be removed.

As the stability analyses concluded that the North Dam has adequate factors of safety against failure under both static and seismic conditions, no specific action to stabilize the dam is required. However the downstream slope will be vegetated to provide erosion control.

3.3.4.2. Dust Control

To prevent ponding of water on the surface of the tailings, the latter will be recontoured to provide positive drainage towards the south end of the impoundment. A nominal 300 mm cover of soil will be placed over the contoured tailings to control dust and provide a growth medium for revegetation. The soil will consist of locally available overburden with sufficient amount of fines for seeding and planting.

As the southern extent of the existing tailings deposit is currently covered with water, the proximity of the tailings to the upstream toe of the dam and the depth of the tailings is unknown. However, an estimate of the extent of the tailings was made and is shown on Figure 3-6.

3.3.4.3. Interceptor Ditches

The interceptor ditches on the east hillside above the TMF will be breached and regraded to restore the ground to erosion resistant drainage patterns.

3.3.4.4. Tailings Pond Decant Tower

The decant tower will be dismantled to the ground level and the resulting debris buried on site. All exposed rebar will be cut off. The decant pipe will be completely filled with concrete to eliminate the possibility of corrosion resulting in settling of the dam or tailings escaping through

a hole in the pipe. This practice is consistent with current requirements of the Ministry of Energy and Mines in British Columbia.

3.3.4.5. *Tailings Pipelines*

The high density polyethylene (HDPE) tailings pipelines will be salvaged, and all drop boxes will be removed.

3.3.4.6. *South Dam Spillway*

The tailings impoundment spillway located within the breach of the South Dam is shown in Figure 3-6. It has been designed to pass the 1000-year flood event. Details of the hydrology and flood estimate for this event are presented in Section 3.1 of Appendix B. The design flow was estimated to be 5.6 m³/s. Sections of the proposed spillway are shown in Figure 3-7. Once the South Dam is breached in Scenario 1, the flow through the breach will be related to the drainage area upstream. However, seepage flow through the tailings, which is anticipated to be a small component of the overall flow, will be influenced by the permeability, the depth, and the areal extent of the tailings impoundment (1.33 km).

The spillway crest and sideslopes will be riprapped. Below the spillway, a riprapped channel will convey the flow to the restored Camp Creek as shown on Figure 3-6. Details of the channel geometry are presented in the table on Figure 3-6. It should be noted that the use of geotextiles in drainage ditches carrying concentrated flows is recognized as an appropriate design solution in the Reclamation Guidelines for Northern Canada as published by DIAND (INAC, 1992).

3.3.4.7. *Reclaim Pond*

(i) Reclaim Dam

At closure, the water ponded behind the dam will be pumped down to a workable level. As discussed above, discharge of the water to Camp Creek must be planned to ensure compliance with licence requirements. Once the water is removed, an assessment will be completed of the

sediment that has accumulated over time in the bottom of the pond. The sediments will be analyzed for metals levels. If significant elevated metals are discovered, then the pond will either be capped, or the sediments will be hauled to the main tailings pond area for capping and reclamation. A riprapped channel will need to be constructed from the outlet of the South Dam spillway to the confluence with the restored Camp Creek. A similar riprapped channel will also be required to convey the flow in Camp Creek through the Reclaim Dam breach. Both channels will be designed for the 1000-year flood event. Details of the channel are provided on Figure 3-6.

(ii) Channel in Breach

The location of the channel through the breach in the Reclaim Dam (not a spillway) is shown in Figure 3-6. It has been designed to pass the 1000-year flood event. Details of the hydrology and flood estimate for this event are presented in Section 3.1 of Appendix B. The design flow is estimated to be $14.2 \text{ m}^3/\text{s}$. A section through the channel in the breach is similar to the spillway section at the South Dam and is shown on Figure 3-7. The breach flow would include the contribution from the entire catchment of Camp Creek (4.47 km^2). The channel will be riprapped to provide erosion protection. Below the reclaim dam breach, the channel will be riprapped for a distance of about 70 metres.

(iii) Camp Creek Diversion

At closure the Camp Creek diversion will be breached and contoured to provide natural drainage patterns. Camp Creek will be restored to its original alignment within a riprapped channel designed to accommodate the 1000-year event. Details sections of the channel are presented on Figure 3-6.

(iv) Reclaim Lines

The existing HDPE reclaim lines on surface will be salvaged and all culverts used to convey the line to the mill will be removed. The pumphouse will be removed, and the buried sections of the reclaim line and the discharge pipe to the existing Camp Creek spillway channel will be left in place.

3.3.5. *Closure Measures (Scenario 2)*

3.3.5.1. *Tailings Embankments*

At closure, assuming Scenario 2, both the North and South dams will remain in place. The downstream slope of the North Dam will be revegetated and the crest of the dam will be cut down flush with the tailings surface. The cut material will be pushed out over the tailings surface as part of the overall tailings cover.

The crest of the South Dam will also be cut down flush with the final surface of tailings. However, as a permanent spillway will be constructed at the west abutment of the South Dam (see Section 3.3.5.6 for details), a 1m freeboard will be left above the contoured tailings in this area to provide an approach apron for the spillway.

The downstream slope of the South Dam will be revegetated to provide erosion control. The stability analyses concluded that the stability is adequate without any modifications or upgrading of the dam.

3.3.5.2. *Dust Control*

The surface of the tailings will be recontoured to provide positive drainage towards the southwest corner of the impoundment. A 300 mm cover of soil will be placed over the contoured tailings to control dust and provide a suitable growth medium for revegetation. The soil cover will be re-vegetated as discussed in Section 3.6.

3.3.5.3. *Interceptor Ditches*

As for Scenario 1.

3.3.5.4. *Tailings Pond Decant Tower*

As the pond is raised, the decant tower will be raised accordingly. Any section of the tower remaining above the tailings surface will be cut down flush with the tailings and covered with

available material. At closure, the decant pipe would be plugged with concrete through its entire length, and the tower filled with waste rock. The surface of the pond will be contoured to provide drainage away from the backfilled tower, therefore no ponding of the water will occur. This practice is consistent with the current requirement of the Ministry of Energy and Mines in B.C.

3.3.5.5. *Tailings Pipelines*

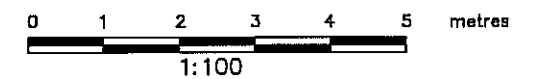
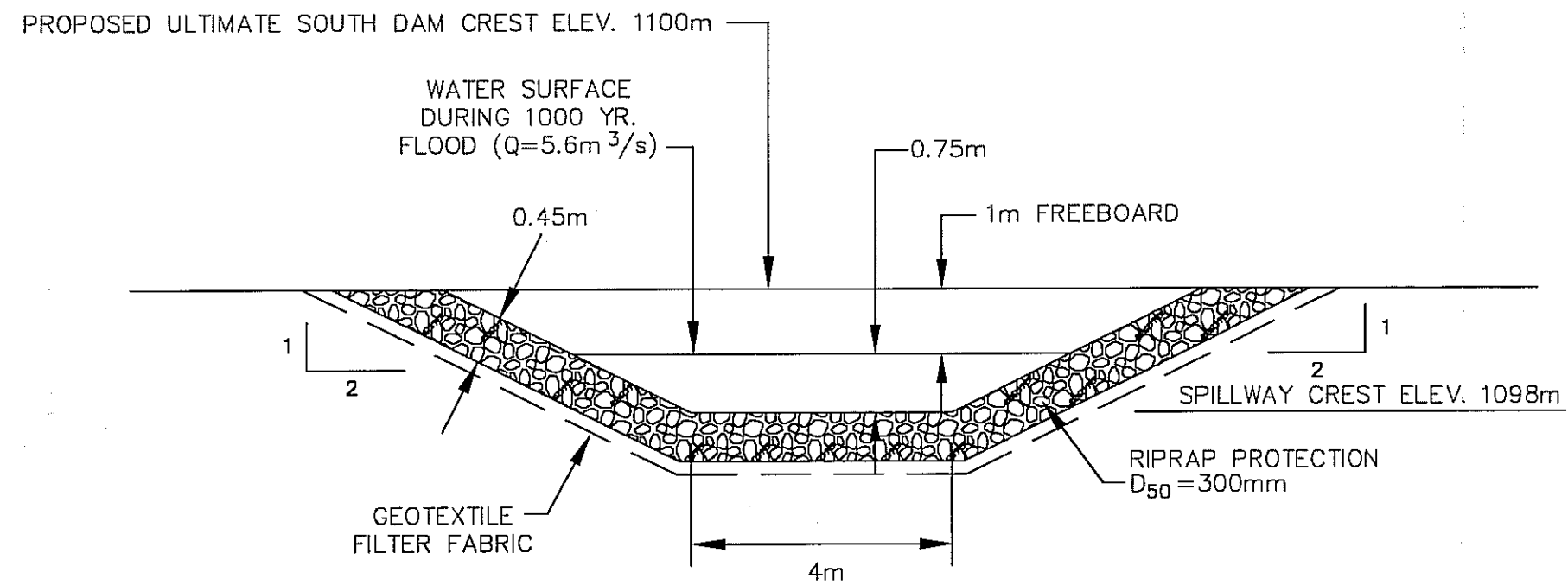
As for Scenario 1.

3.3.5.6. *South Dam Spillway*

The tailings impoundment spillway will be located in native soil at the west abutment of the South dam as shown in Figure 3-8. It has been designed to pass the 1000-year flood event. Details of the hydrology and flood estimate for this event are presented in Section 3.1 of Appendix B. The design flow was estimated to be $5.6 \text{ m}^3/\text{s}$. A section through the proposed spillway is shown in Figure 3-9. The flow would include the contribution from the entire catchment of the Tailings impoundment (1.33 km^2). The spillway crest and adjacent slopes will be riprapped. Below the spillway, a riprapped channel will convey the flow to the restored Camp Creek as shown Figure 3-8. As the flow during the 1000-year event will be supercritical, a plunge pool to dissipate the energy will be required at the confluence with the Camp Creek Channel as shown on Figures 3-6 and 3-8.

3.3.5.7. *Reclaim Pond*

As for Scenario 1



SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

TMF SPILLWAY DETAIL
SECTION C-C — SCENARIO 2

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	REV.
DATE:	AUG. 4, 1999	PROJ. NO.	1CC005.05	3-9	

3.4 INFRASTRUCTURE: BUILDINGS, STRUCTURES AND SERVICES

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

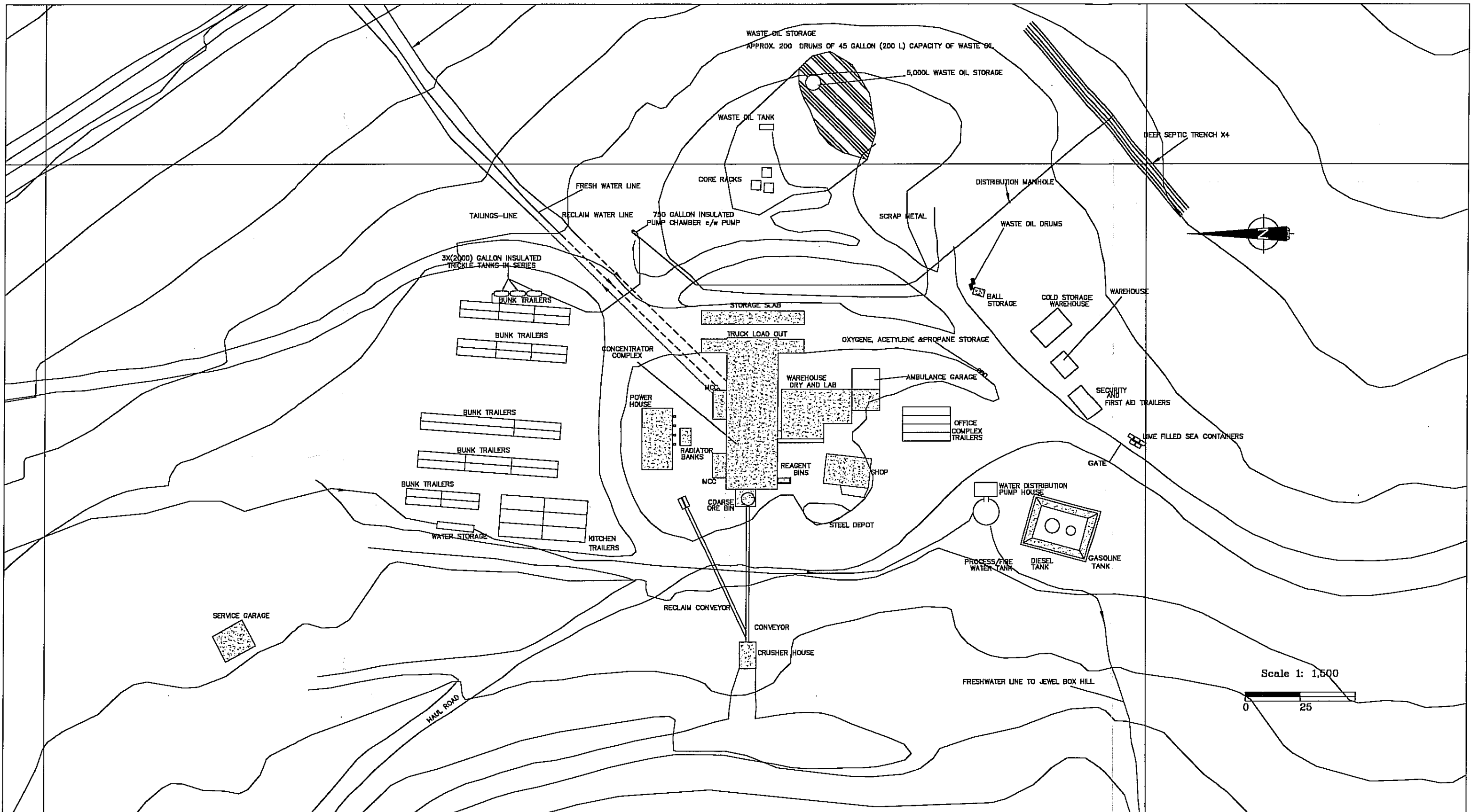
The approach to the decommissioning of the constructed infrastructure is to completely remove all materials with the exception of concrete foundations, which will be demolished and buried *in situ*. This will be accomplished by contracting the work out to a company experienced in demolition. It is expected that there will be a salvage value for much of the materials (particularly structural steel and other crushing, grinding and processing equipment from the mill). However, salvage values have not been used to offset closure costs.

In all cases, concrete foundations and other concrete structures will be broken up to ground level and buried.

The reader is referred to Figure 3-10, Mill Site Plan, for the location of the infrastructure components that are dealt with in this section.

Closure issues related to infrastructure include public health and safety, site stabilization aesthetics, and restoration of disturbed lands.

The approach to closure for the infrastructure components of Sä Dena Hes is to first remove any equipment that may be used at other Cominco operations that are within a feasible hauling distance, and then assess the remaining facilities and equipment for disposal through demolition and salvage contracts. It is impossible at this time to accurately predict freight haulage costs and supply and demand economics for salvage at the time of closure; however, closure measures assumptions have been made based upon current market conditions. If it is not economical to remove material from the site, it will be buried in the landfill.



Legend



CONCRETE SLAB



UNDERGROUND WATER LINE



UNDERGROUND TAILINGS LINE



OIL WASTE DRUM STORAGE AREA

SÅ DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN Infrastructure- Mill and Office Complex Detail Current Conditions

DRAWN BY: ASH

CHECKED BY: RLM

DATE: 27/07/99

SCALE 1:1,500

Fig No. 3-10

Table 3-1 provides a brief dimensional description of the various infrastructure components, and Figure 3-10 depicts the general arrangement of the central office, accommodation and mill site buildings and services. Figure 3-11 depicts the generalized closure measures for this area.

Other infrastructure and facilities associated with outlying mine components, such as the Jewelbox mine shop and office, are listed in Table 3-1, and are depicted on the drawing particular to each component (Figures 3-3 and 3-5).

3.4.1. *Concentrator Buildings*

The ore concentrator (the “mill”) is comprised of the mill building itself, the crusher house, conveyors, and truck load out facility. All buildings are made from steel and constructed on concrete slab flooring. A list of equipment currently located in the mill is found in Table 3-2.

The mill building itself houses what is expected to be the most attractive components from a salvage perspective; in particular, the ball and sag mills and structural steel, as well as other scaffolding and processing equipment.

Buildings and equipment that are not salvaged will be demolished and the debris will be hauled for burial in the refuse landfill. The concrete foundations will be demolished to ground level, and the rubble will be buried on site after being covered.

Table 3-1 Infrastructure Description

Component	Description (see Figure 3-9 for layout)
	(Note all concrete slabs 0.20 m thick)
Concentrator Buildings	
Concentrator Complex	Area of 1761 m ² , 352 m ³ concrete slab
Crusher House	8 m x 12 m, Metal Building, 91 m ³ concrete slab
MCC	6 m x 11 m metal building, 14 m ³ concrete slab
MCC	6 m x 13 m, 16 m ³ concrete slab
Reagent Bins	2 m x 5 m, 2 m ³ concrete slab
Coarse Ore Bin	9 m x 8 m, 14 m ³ concrete slab
Power House	13 m x 27 m, Metal Building, 77 m ³ concrete slab
Service Garage	13 m x 15 m, Metal Clad Building, 41 m ³ concrete slab
Accommodation Buildings	
Bunk Trailer x 10	7 m x 33 m, Metal Trailer (removable)
Bunk Trailer x 10	8 m x 64 m, Metal Trailers (removable)
Bunk Trailer x 10	8 m x 50 m, Metal Trailers (removable)
Kitchen Trailers x4	19 m x 39 m, Metal Trailer (removable)
Office Trailers Complex	22 m x 23 m, 98 m ³ concrete slab
Miscellaneous Buildings/ Structures	
Ambulance Garage	13 m x 10 m, Metal Building
Water Distribution + Pump House	Area= 182 m ² , Metal Clad Building
Warehouse	10 m x 8 m, Metal Clad Building
Security and First Aid Building	8 m x 14 m, Metal Trailer (removable)
Cold Storage Warehouse	10 m x 16 m, Metal building
1480 Portal Shop	20 m x 10 m metal clad building, earth floor, concrete footings
1480 Portal Office	4 m x 10 m Atco trailer
1480 Portal Fuel Tanks	2 tanks 2,000 l, in bermed enclosure
Burnick 1200 Portal Shop	40 x 20 m metal clad building, earth floor, concrete footing
Burnick 1200 Portal Fuel Tank	
Miscellaneous Core Racks, Gribbler Ridge	Wooden structures
Water Storage	17 m x 3 m, storage tank
Radiator Banks	5 m x 8 m, 8 m ³ concrete slab
Storage Slab	6 m x 47 m, 57 m ³ concrete slab
Warehouse and Dry Lab	Area of 760 m ² , 152 m ³ concrete slab
Ball Storage	3 m x 5 m, 3 m ³ concrete slab
Diesel – 5,000 l; Gasoline – 2,000 l	Area of 729 m ² , 56 m ³ concrete slab
Decant Tower	50 m ³ reinforced concrete structure
North Creek Dyke	
1480 Portal Electrical Transformer	Power poles, chain link fence
Water Intake Pumphouse/Shop	2 m x 3 m wooden sheds (x3); 1.2 m ³ concrete pad

Table 3-2 Mill Equipment List

EQUIPMENT	MANUFACTURER	QUANT.	SIZE	REMARKS
Grizzly		1	760mm x 760mm	
Rock Breaker	Teledyne	1	30 kW	Hydraulic
Reciprocating Feeder	Universal engineering	1	1525mm x 4267mm	
Jaw Crusher	Allis Chalmers	1	1220mm x 1067mm	Used
Ore Conveyor	Trans-Continental	1	900mm	500 t/p
Belt Magnet	J.F. Comer	1	3 H.P.	
Reclaim Conveyor	Trans-Continental	1	900mm	250 t/h
Reclaim Vibrating Feeder	AISCO	1	1067mm x 2240mm, 5 H.P.	
Ore Bin	GEM Steel	1	200t	
SAG Vibrating Feeder	AISCO	1	1067mm x 2240mm, 5 H.P.	
SAG Feed Conveyor	Trans-Continental	1	900mm	100 t/h
SAG Mill	MPSI	1	5500mm DIA. x 2134mm, 970 H.P., Var.Sp.	
Liner Handler	McLellan Industries	1		
SAG Discharge Pumps	G.I.W.	2	150mm x 100mm, 60 H.P.	
Vibrating Screens	Simplicity	1	1525mm W x 3600mm L, 10 Mesh, 25 H.P.	
Ball Mill	Allis Chalmers	1	3050mm DIA. x 3680mm, 900 H.P.	Used
B.M. Disch. Pumps	I.T.T.	2	250mm x 200mm, 60 H.P.	
B.M. Cyclones	Technequip/Krebs	2	D20B	
Lead Unit Flotation Cells	Outokumpu	4	5.1m ³ , 25 H.P./Cell	
Lead Unit Cell Blower	Roots	1	297m ³ /hr, 24.8 kPa	
Flotation Cells, Lead Rgh and zinc Rgh	Denver	2 sets, 15/set	5.7m ³ , 25 H.P./Cell	Used
Lead and Zinc CLNR Flotation Cells	Denver	2 sets, 14/set	1.4m ³ , 7.5 H.P./Cell	
Lead Re grind Mill	Taylor	1	1830mm x 2140mm, 150 H.P.	
Lead Rgr Cyclones	Techniquip/Krebs	3	D6B	
High Rate Thickener	Outokumpu/ Supaflo	2	4600mm DIA.	
Lamella Clarifier	Lamella	2	570mm x 55°	
Slurry Storage Tank	GEM Steel	3	5500mm DIA. x 14000mm	
Pressure Filters	Filtra Systems	2	Lead-28m ² , Zinc-32m ²	100 psi
Concentrate Bin	GEM Steel	2	3500mm DIA. x 9000mm	

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EQUIPMENT	MANUFACTURER	QUANT.	SIZE	REMARKS
Minifab Flocculant Mixer	Allied Colloids	1	1m ³	Flocculant Mixing
Lime Grinding Mill	SALA	1	900mm DIA. x 1525, 10 H.P.	
Fresh Water Tank	GEM Steel	1	200,000 USG	
Flotation Air Blower	Spencer	1	21240 lm ³ /hr, 14.5 kPa	Used
Air Compressor	Ingersol Rand	2	2550m ³ /hr, 750 kPa, 350 H.P.	
Air Dryer	Xebic	1	170 lm ³ /hr, 758 kPag	
Pressure Filter air Receiver Tank	Ingersol Rand	1	1830mm DIA. x 4000mm	
Courrier 30 OSA	Outokumpu	1	10 streams, Lead Zinc, Iron, % solids	
DCS	Fisher Controls	1		
PLC	Allen Bradley	1		
Truck Scale	Canadian Weigh Scale	1	100 t	Computerized loading system
Diesel Generator	Midwest	2	2 MW	
Diesel Generator	Midwest	2	1 MW	

Note: Unless otherwise stated, dimensions are in millimetres

3.4.2. *Power House and Power Lines*

The power house contains three diesel generators which supply power for the entire mining operation. It is expected that these generators will have an appreciable salvage value, which would be realized upon closure. The power is distributed via approximately 6 km of three phase, overhead power lines. There is also approximately 600 metres of 60 mm dia. "TEC" cable leading from Jewelbox 1440 portal to the Main Zone pit. The distribution lines would be respooled for salvage or buried. The power poles (approx. 120) will be removed and either sold for salvage if in good condition, or sawn and buried in the refuse landfill if in poor condition.

It is not known if the power poles that were installed by the previous operator were treated with a preservative such as creosote. If it turns out that they are creosote-treated, the contaminated portion of the poles will be disposed of in conformity with the Special Waste Regulations of the Yukon Environment Act.

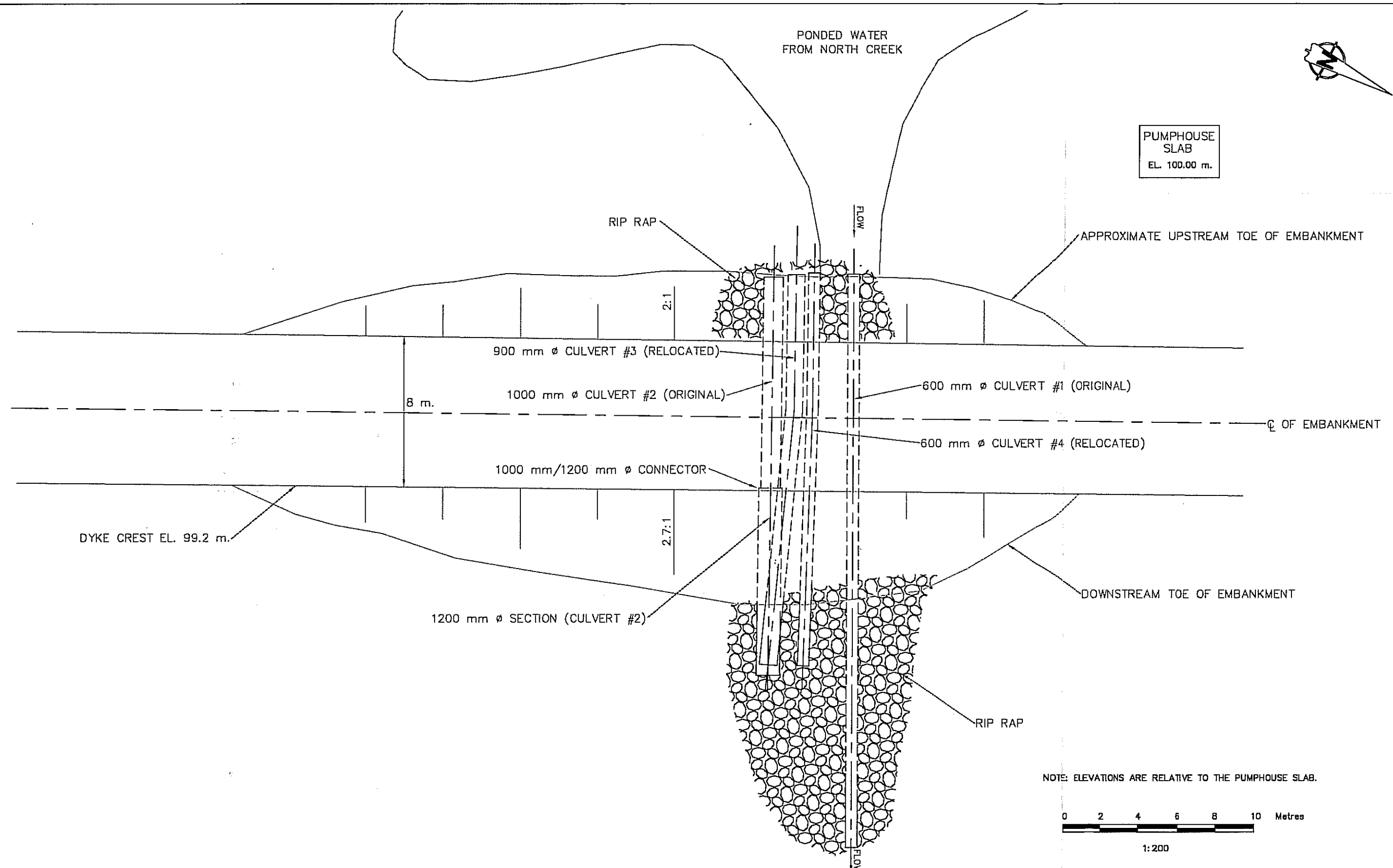
3.4.3. *Water Supply*

The water supply system consists of a series of three electrical 100 hp water pumps housed in 2.5 m x 2 m wooden shacks. These pumphouses are located in the lower North Creek drainage (Figure 3-1). The pumps will be removed for salvage and the shacks destroyed. The approximately 2 km of water line (300 mm dia.) will be removed for salvage. The entire disturbed area around the pumphouses at False Canyon Creek was previously reclaimed (see Section 3.6 *Land Reclamation and Revegetation* for a discussion of this activity).

3.4.4. *North Creek Dyke*

(i) Description

The North Creek dyke is located about 1 km north of the existing tailings impoundment, as shown in Figure 3-12. The dyke was constructed in the summer of 1991 by Golden Hill Ventures (GHV). The dyke was constructed to provide a reservoir from which water was pumped to the northern end of the tailings impoundment in preparation for the start-up of the mill.



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SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

PLAN OF NORTH CREEK DYKE

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	REV.
DATE:	AUG. 4, 1999	PROJ. NO.	1CC005.05	3-12	

The dyke has a maximum height above original ground of about 5 m and is about 50 m in length. Fill used to construct the dyke is a silty sandy till and it is estimated that about 2000 m³ of this material was placed.

A 600 mm dia. pipe at the base of the dyke allows flow in the North Creek to pass through the dyke. Three other culverts varying in size from 600 to 1000mm in dia. provide capacity to pass the 200-year event. A plan of the dyke showing the current location of the culverts and layout of the dyke is shown on Figure 3-12.

(ii) Closure Measures

At closure the dyke will be breached and the culverts will be removed. Riprap will be placed across the breach to provide erosion protection. The size of the breach will be based on the 1000-year event.

3.4.5. *Service Garage*

The service garage is located north of the mill and office complex (Figure 3-10). A 13 m x 15 m metal clad building will be demolished and removed (debris hauled to the refuse landfill). The 41 m³ concrete slab will be demolished to ground level and buried on site with approximately 200 mm of native soil material.

3.4.6. *Accommodation/Camp Buildings*

The campsite accommodation was provided by approximately 30 sleeping/wash Atco trailers and 6 kitchen/recreation Atco trailers. The wooden skirting around the trailers will be removed, and all piping and cable connections cut at ground level. These trailers will all be removed from the property for resale following the initial three year post closure implementation period. During site reclamation, crews will utilize the accommodation.

3.4.7. *Explosive Magazine*

Assuming the mine reopens prior to the implementation of this closure plan, additional explosives magazine(s) would be brought to site and used. The closure measure for explosives magazines would be to either return these to the supplier for credit, or to ship to other nearby Cominco facilities. Unused explosives will be checked for condition and either returned to the supplier for credit where in safe condition or destroyed through appropriate procedures. Detonation devices will be returned to the supplier for credit.

3.4.8. *Miscellaneous Buildings & Structures*

- The office complex consists of six Atco trailer units set up on wood block footings and joined under a common roof. Useable office furniture and equipment will be sold where appropriate, or shipped to other Cominco facilities where economically feasible. The skirting and roofing materials will be destroyed, the trailers hauled away from the site or destroyed, and the ground surface regraded, recontoured, and revegetated.
- At the Jewelbox 1480 Portal, there is a 13 m x 40 m metal shop building with earthen floor and concrete footings. The building is to be demolished and hauled to the refuse landfill site. Concrete footings are to be demolished and buried at site under 400 mm of native soil materials cover. Fuel tanks will be hauled away for salvage. Fuel berms are to be recontoured, the liner removed and hauled to refuse landfill. The diesel generators for shop power will be removed for salvage. There is also a mine office trailer at this location. It will be hauled away from the site. The power transformer and power line will be removed for salvage, power poles destroyed or hauled out for salvage depending on conditions; chain link fencing enclosure demolished and buried on site.
- At the Burnick 1200 Portal, there is a 13 m x 40 m metal shop with an earthen floor and concrete footings. The shop building is to be demolished, the debris hauled to the refuse landfill, the footings demolished and buried on site. All scrap steel is to be removed (roof bolts/plates, rebar) for salvage. The diesel generator will be salvaged and fuel and propane tanks removed.

- At the Burnick 1300 Portal, there is a 2 m x 4 m safety shack which will be demolished and the debris removed to the landfill for burial. The site is to be regraded.
- Core racks are all that remain from previous exploration at the property. The core will be removed from the property for secure storage (possibly at the H.S. Bostock Core Library in Whitehorse), and the racks will be demolished.

3.5 INDUSTRIAL REAGENTS AND WASTES

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

For details of closure measures and disposal methods discussed in the following sections the reader is referred to Table 3-3.

3.5.1. Mill Reagents

A variety of mill reagents have been utilized in the grinding/floatation process. For a more thorough discussion of mill reagents, the reader may review the Sä Dena Hes Mine, Spill Contingency Plan that was originally submitted in accordance with Water Licence IN90-002. This Plan has been updated in 1998. Product utilization forms for each of the reagents including information on historical rates of consumption, tank size, normal warehouse inventory levels and other pertinent information can be found in Appendix A of the aforementioned Spill Contingency Plan. The information contained in the plan will be utilized during closure.

Some of the reagents used at the mine have included Quicklime (CaO), Soda Ash (Na₂CO₃), Copper Sulphate (CuSO₄), Sodium Cyanide (NaCN), Aerofloat R242, Percol 351, Methyl Isobutyl Carbinol, Stanfroth 250, Zinc Sulphate, and Sodium Isopropyl Xanthate.

In August of 1998 a review of inventory, storage practices, and of potential environmental concerns was conducted on site. An additional inspection was conducted on June 16, 1999 to confirm current status. Table 3-3 provides a summary of current reagents on-site, their quantities, storage locations, and their disposition upon closure of the mine. Storage of reagents in the mill provides containment within a concrete foundation in the event of leakage.

Table 3-3 Industrial Reagents: Inventory, Storage Location, and Closure Measures

Product	Quantity	Plan View Location Number (refer to Figures 3-13 and 3-14)	Closure Measures (Refer to Note)
Diesel Engine Coolant (Glycol)	5 - 45 IG barrels	2 & 7	1
Coal Deicer	69 - 45 IG barrels	3, 4, & 5	1
Xanthate (NAX31)	55 - 130 kg barrels	8 & 17	1
Zinc Sulphate (ZnSO ₄)	433 - 25 kg bags	10, 14, & 25	1
Dowfroth 250	4 full and 1 partial 45 IG barrels	11 & 15	1
AeroFloat 242	13 - 45 IG barrels	12 & 21	1
Copper Sulphate (CuSO ₄)	52 - 45 IG barrels, 100 - 25 kg bags, and 5 - 1 tonne IBC's	16, 19, 20, & 23	1
Cement	2 - 1 tonne pallets	19	2
Percol 351	13 - 25 kg bags	13 & 22	1
Sodium Cyanide	85 - 100kg barrels	3, 4, 5, & 9	1
Methyl Isobutyl Carbinol (MIBC)	37 - 165 kg barrels	18 & 24	1

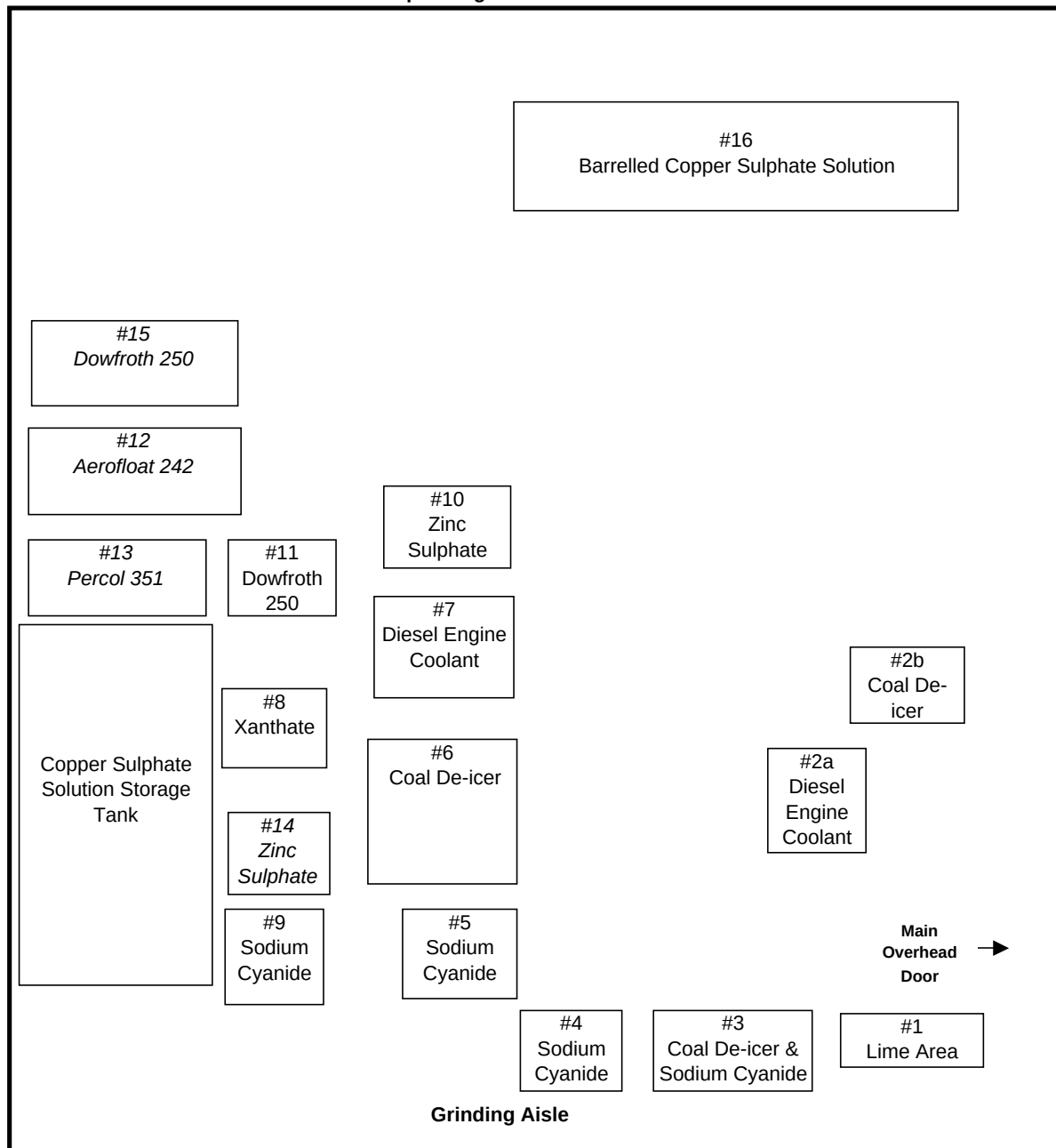
Note: **1** Use in closure and/or determine economic viability of re-sale and expedite, otherwise ship to other Cominco properties or have removed to appropriate hazardous waste disposal facility (approved under Yukon Environment Act)
2 Sell or donate to a local group.

Closure issues and measures for these items are highlighted in Table 3-3 and the current storage locations within the mill are presented in Figures 3-13 and 3-14.

Some chemicals and reagents on-site are more likely than others to be sold. Primarily on the basis of material condition, demand, and value. These chemicals and reagents include, but are not restricted to:

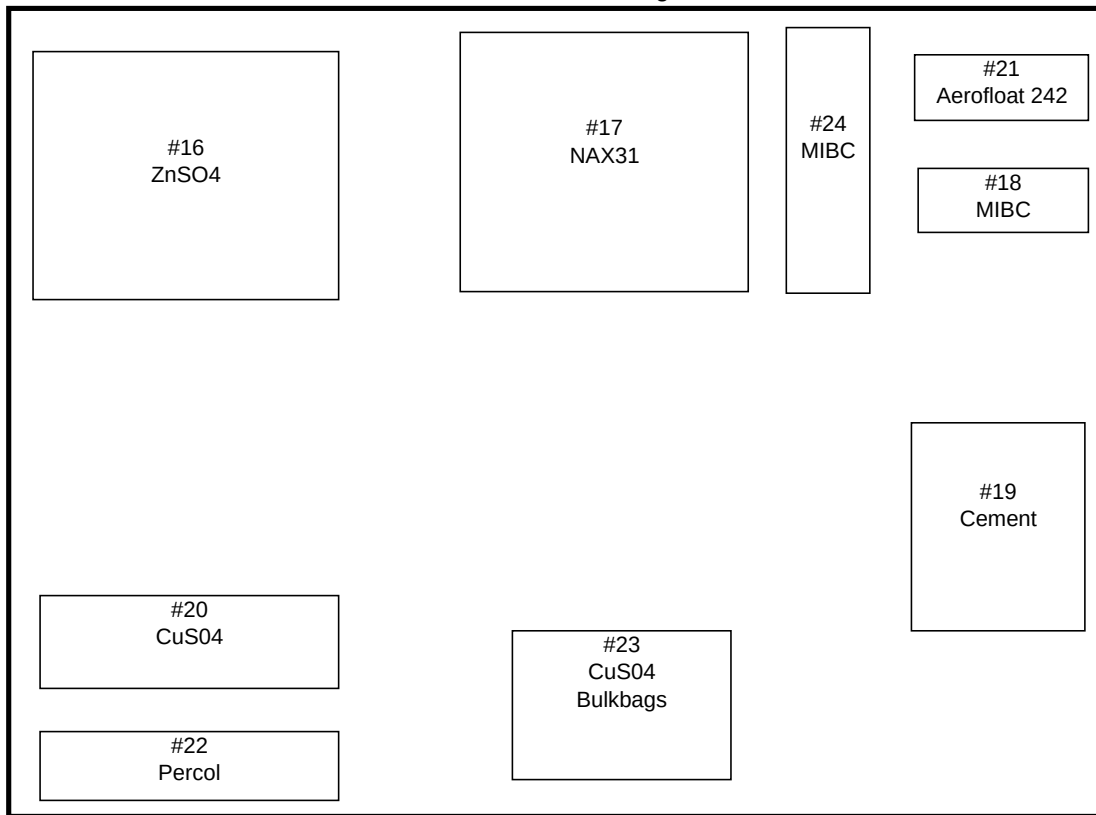
- (i) **Sodium Cyanide:** There are 85 @ 100 kg barrels. The barrels are stored at several locations within the concentrator and are in good condition and are marketable. Other operations using such material could be approached in order to sell the material (Kimberley operations has been suggested as one option).
- **Methyl Isobutyl Carbinol (MIBC):** There are 37 @ 165 kg. barrels of MIBC stored in the outside sheds. The material is readily marketable and may be sold to Kimberley operations or to other, closer facilities. Storage of reagents in the mill provide containment within a concrete foundation in the event of leakage or fire.

Figure 3-13 Plan View - Current Locations of Chemicals and Reagents at the Sa Dena Hes Mine Site - Mill Basement and Operating Floor



NB: Storage Locations (12, 13, 14, 15) are on Operating Floor, in Reagent Mix Area

Figure 3-14 **Plan View - Current Locations of Chemicals and Reagents at
the Sa Dena Hes Mine Site - Outside Storage Shed**



Main Double Door

3.5.2. *Other Chemicals*

These materials may include, but are not limited to: solvents, paints, cleansers, and battery acid. They will be removed from the minesite by one of the following three procedures:

- returned to the original supplier for credit and reuse;
- given to a third party user; or
- removed from the minesite and disposed of through a licensed hazardous waste disposal firm. In such an event, the disposal will only take place following consultation with and approval from the appropriate regulatory authorities.

Waste vehicle batteries can be segregated, stored in a containment area for periodic shipment to a licensed battery disposal facility. This procedure will continue through the end of mine closure operations.

The mine maintains a sewage system designed to service a 160 person camp with a water consumption of approximately 40 gal/person/day. The current system was installed in 1997 and is comprised of three sewage tanks and a pump-out chamber which then drains to the soil absorption area (septic field) (see Figure 3-10).

Upon closure the three septic tanks would be pumped out, desludged, with sludges deposited in the tailings pond. The pump out chamber would also be removed. The remaining infrastructure (i.e. piping and related materials, including the septic field) would remain buried.

3.5.3. *Fuels and Lubricants*

It is expected that the inventory of hydrocarbon products at the Sä Dena Hes site will be consumed as mine operations are brought to a close. Fuels and lubricants will be required during the three year period for implementation of the closure measures after mine shutdown (as discussed in Section 5). The inventory remaining on site once all activity has ceased will be removed from the site by one of three methods:

- returned to the original supplier for credit wherever possible;
- sold to a third party user; or
- trucked to an authorized disposal agency to be recycled or destroyed.

It should be noted that the operation of diesel powered vehicles and the diesel fired electrical generators used on site will provide the Company with a method of reducing remaining inventory of diesel fuel as the mining operations cease. Gasoline will be similarly removed, and it is predicted that any remaining inventories of diesel and gasoline will be successfully returned to suppliers or sold based on its wide spread local use.

The bulk diesel fuel storage tanks will be emptied of their contents in accordance with one of the above mentioned procedures. The tanks will then be drained and where feasible removed from the site and sold for their salvage value. For tanks too large to be removed, the tanks will be cleaned out utilizing a licensed tank cleaning contractor with the sludge being treated or removed in accordance with procedures approved by the Yukon regulatory authorities. The cleaned out tanks will then be dismantled and either be salvaged or disposed of as scrap metal and buried in the site landfill area.

Rental propane tanks will be removed by the propane supplier. Associated fuel delivery lines at any portals and at the camp will be removed and disposed of in a manner similar to that of the gasoline and diesel fuels.

Other hydrocarbon products used at the minesite are primarily hydraulic fluids, lubricating oils, greases, antifreeze and solvents packaged in either 1000 litre bulk cubes, 200 litre drums or smaller packaging. It is predicted that in most cases the remaining inventory of these materials will be successfully returned to the original suppliers for reuse or sold to other third party users in the local area. In certain circumstances, specialized products may have to be disposed of through a licensed waste disposal firm. It is anticipated that such material will be small in volume.

During the final site assessment, petrochemical contaminated soils will be identified and processed for remediation. Any fuel storage areas and refueling stations, once

decommissioned, will then be assessed for soil contamination. The affected soils may be removed from the minesite and disposed of through a licenced hazardous waste disposal firm. The second, and more probable method of disposal will be to have the soils landfarmed where bioremediation will work to renovate the soils. In either event, the disposal will only take place following consultation with and approval from appropriate regulatory authorities.

3.5.4. *Scrap Metal*

Scrap equipment has been stored in various lay down areas (known as "bone yards") located on site and along the access road. This is primarily scrapped equipment that was stored so that it could be utilized on the minesite as a source of spare parts or good recyclable scrap material. At mine closure, salvageable material from these sites will be sold as scrap and removed from the site. Material that has no scrap value will be disposed of in the existing site landfill area, located north of the tailings management facility (see Figure 3-1). Prior to disposal in the landfill all of this material will be examined to ensure that all hazardous materials have been removed. Hazardous materials so removed will be shipped off site to a licensed waste disposal site.

3.5.5. *Site Landfill*

The site landfill, located in the gravel pit near the North Dam, will be an area used for the disposal of non-putrescible wastes that have no salvage value, such as lumber and scrap steel. Although the exact volumes of the scrap material have not been calculated, it is expected that the current site is adequate for the entire mine site. If, however, this turns out to not be the case on closure, expansion of this site or selection of a new site will accommodate increased volumes. Where permitted, the combustible wastes in this landfill area will be burned and the non-combustible debris buried under a soil cover. Final demolition and reclamation of the site will generate some non-hazardous waste material that will be disposed of in this landfill area. Once use of this site has been completed, i.e. at the end of demolition, the landfill area will be covered by two compacted layers of 200 mm thick compactable soil material obtained from local borrow sources. The existing groundwater wells will be monitored this year. Also, as part of the complete environmental site assessment just prior to closure, sampling of the groundwater around the landfill will be done. The cover material will be graded to prevent pooling of precipitation runoff and to encourage the shedding of water. The site would then be revegetated.

3.6 LAND RECLAMATION & REVEGETATION

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

The primary objectives of land reclamation and revegetation at the Sä Dena Hes minesite are to provide short and long term erosion control, to ensure land use compatible with the surrounding lands, and to leave the area as a self-supporting ecosystem.

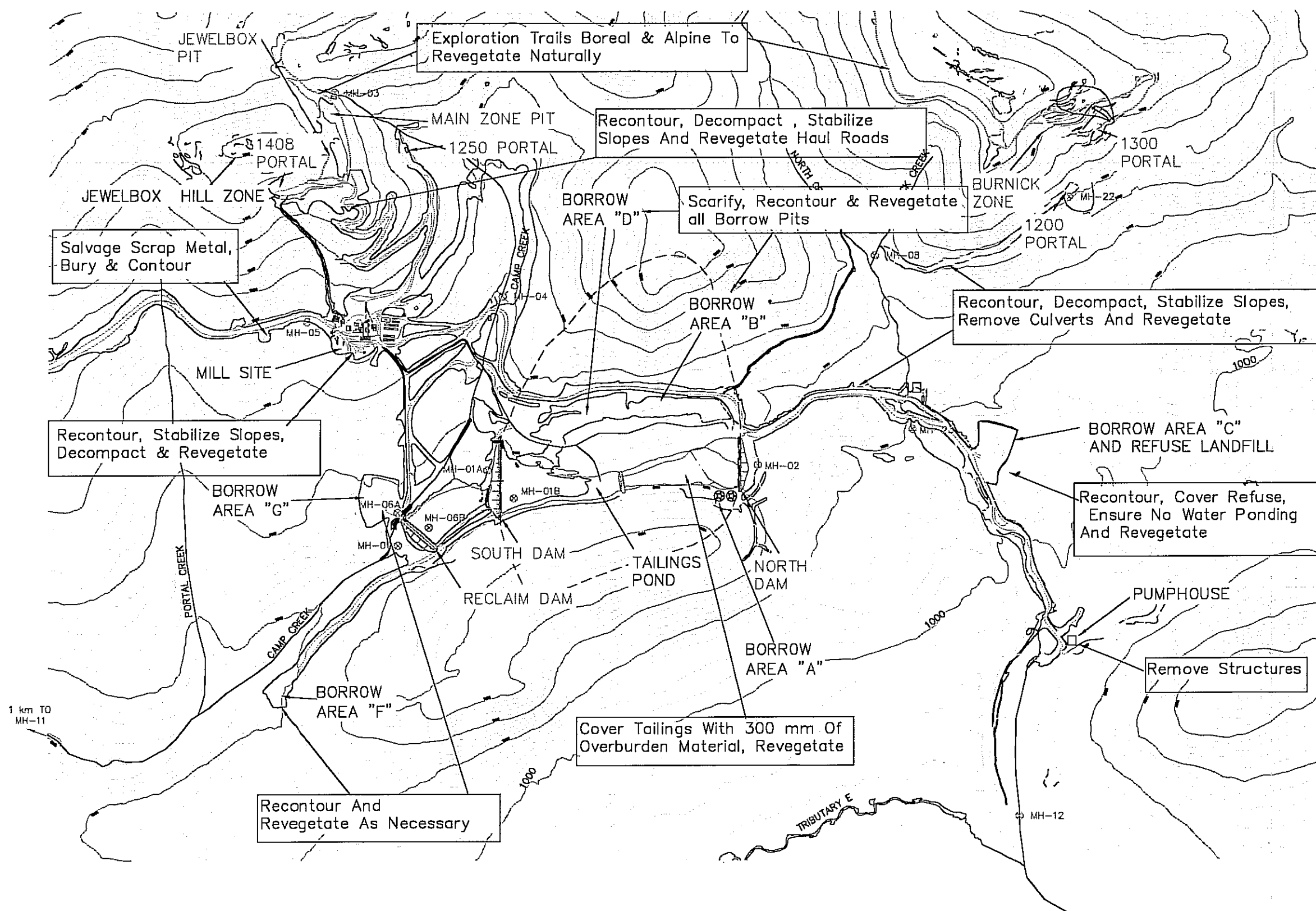
The overall goal is to prepare the site so that the vegetation returns to a state as near as possible to that in existence prior to mining activities.

This section describes the current areas slated for reclamation, and the closure issues and measures proposed. Previous reclamation activities that have occurred on the property were observed during a June and July 1999 site visit. The extent of natural revegetation on previously disturbed areas was also observed. These observations were used to develop an overall reclamation and revegetation strategy for the site. Reclamation options for various types of disturbed lands were developed and are discussed below. Figure 3-15 provides a summary of the reclamation and revegetation plan for the Sä Dena Hes property.

Previous Revegetation Initiatives

The disturbed land around the freshwater pumphouse and access route to this location was revegetated in 1992. It is understood that the area was cleared of debris, rototilled and seeded with a fertilizer mixture (R. Flanigan, pers. com.); however, no records are available on this reclamation work. The site was inspected in July 1999 with the following observations.

A robust growth of graminoids and legumes now cover this area. The most prevalent graminoids here now are creeping red fescue (*Festuca rubra*), reed fescue (*Festuca arundinaceae*), polar grass (*Agrostis latifolia*), small-flowered wood-rush (*Luzula parviflora*) and sedges (*Carex* spp). Legumes include alsike clover (*Trifolium hybridum*). Other colonizing plant species in this area are little-tree willow (*Salix arbusculoides*) and annual hawk's-beard (*Crepis tectorum*).



LEGEND

⊗ SOIL SAMPLE LOCATIONS

0 200 400 600 800 1000 metres

1:20,000

CONTOUR INTERVAL=10m

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

Sa DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

RECLAMATION & REVEGETATION PLAN

DRAWN BY:	ASH	CHECKED BY:	Someone	FIGURE NO.	3-15	REV.
DATE:	JULY 29, 1999	PROJ. NO.	1CC005.05			

Natural Revegetation

Areas that are revegetating naturally on the site include disturbed lands adjacent to the tailings management facility, old borrow sources, exploration trails, and the old site access road. Although an extensive survey was not conducted to document the extent of natural revegetation, the following observations were noted.

The primary colonizing plant species now found around the minesite are willows and graminoids. The most prevalent willows are little-tree willow (*Salix arbusculoides*), Alaska willow (*Salix alaxensis*), blue-green willow (*Salix glauca*), diamond-leaf willow (*Salix planifolia*) and Barclay's willow (*Salix barclayi*). Arctic willow (*Salix arctica*) occurs above treeline in the Jewelbox adit area. The colonizing graminoid species in the mine area include small-flowered wood-rush (*Luzula parviflora*), spike tristeum (*Tristeum spicatum*), orchard grass (*Dactylis glomerata*) and blue grass (*Poa* spp.). Other herbaceous pioneering species include annual hawk's-beard (*Crepis tectorum*) and arrowleaf senecio (*Senecio triangularis*). Alfalfa (*Medicago sativa*), timothy (*Phleum pratense*) and smooth brome (*Bromus inermis*) also occur and have presumably been introduced.

The extent of recolonization at each location is dependent on local conditions, including soil conditions (type and moisture content) and aspect. Generally, revegetation is occurring more extensively next to undisturbed areas. Most of the exploration trails are completely recolonized.

Revegetation Options

The establishment of an initial ground cover of graminoids has historically been viewed as a desirable objective on most disturbed areas to stabilize slopes and control soil erosion. Reclamation and revegetation efforts on site will ensure that this objective is achieved; however, the establishment of existing or natural vegetative communities and species is also another desirable objective. Based on recent reclamation research, it is noted that there is typically an abundance of natural seed or reproductive seed material available for local surroundings and that these naturally occurring seed sources should be considered as part of the reclamation program (Craig, et al., 1998).

The natural vegetation found on undisturbed sites around the mine generally indicate the underlying soil properties, including texture, drainage, and pH, and the level of available nutrients. Revegetation seed mixtures will be formulated for the Sä Dena Hes minesite using knowledge of the naturally occurring vegetation and soil conditions. Additional soil sampling on disturbed sites is required in order to determine areas of localized nutrient deficiencies.

Evidence indicates that revegetation by the seeding of sod-forming grass species will inhibit the invasion of the area's natural colonizing species by competing for space, light, nutrients, sunlight and moisture (Craig, et al., 1998). Experimentation with seeding and fertilizer rates will be carried out at the Sä Dena Hes minesite in order to determine the optimum mixes for preventing seeded species from becoming too firmly established. Seed mixtures have been recommended for initial use.

The nutrient uptake by northern native seed varieties on nutrient deficient soil is usually more effective than nutrient uptake by southern agronomic species. Seeding with agronomic species at the Sä Dena Hes minesite may be required because of the high cost and limited availability of northern native revegetation species.

Although there is no evidence of wildlife use of the tailings area currently, that will change over time as revegetation success establishes grasses and herbaceous plant species. As part of the vegetation test plot program that will be conducted, Cominco will test various plant species for metals uptake to assess if there are any potential concerns of ingestion of the plants by grazing and/or browsing animals.

In order to establish a successful revegetation program, Cominco will initiate a methodical program to confirm:

- a) An inventory of available soils around the site - Soil was stripped from the tailings pond area as part of the site preparation process. The original thickness of the cover is not known at this time. Preliminary plans are to place a 300 mm soil cover over the tailings facility. While this is more than adequate to support long term healthy plant growth, it is not known whether there is a sufficient quantity of soils available at the mine site. If there is a shortage of soil cover material, then testing of thinner covers would be necessary to establish the minimum thickness that would permit successful long term plant growth.

- b) The nutrients in the available soils - Initial testing indicates some nutrient deficiencies in the surrounding soils. While fertilizers will likely be necessary to encourage quick initial establishment of healthy growth, the plant mixtures used must be capable of sustaining long term growth without the aid of artificial fertilizers.
- c) Practical seed mixes - While it is known what seed types have been used at the site previously and what types of plants have been naturally revegetating the site, further reviews are necessary to confirm the appropriate seed mixes that should be used. The evaluation process will require the development of test plots.
- d) The potential for metals uptake by the plants - Different plant varieties and species, tailings characteristics, cover designs and other environmental conditions are all factors influencing uptake of metals by plant tissues. Sampling of plant tissues from the test plots will be conducted to assist in designing the revegetation program.

It is proposed to initiate planning of the test program this year and to initiate a program of test plots starting in the summer of 2001.

In the larger, more open disturbed areas at the minesite (borrow areas, mill and camp site area), where natural seed sources are less available, the seeding/planting of indigenous shrub species (primarily willows, birch and alders) may be required to encourage the later seral stages of plant succession on these sites. Shrub species would be planted concurrently with the revegetation program.

3.6.1. *Roads and Trails*

3.6.1.1. *Exploration Trails*

The exploration trails outside of the immediate minesite have not actively been used for a number of years. These are smaller trails than the main service or haul roads and generally follow topographic contours; they were not constructed with cut and fill methods. They will be left to allow natural vegetation to occur, which should be successful due to the proximity of the seed source and the minimal compaction during original construction and subsequent use. Stabilization may be required in a few locations where significant erosion is a concern. These exploration trails include 6.0 ha of boreal and 1.5 ha of alpine area (see Table 3-4).

Table 3-4 Summary of Spatial Disturbance for Sä Dena Hes Property

Component		Approach	Approximate Area of Disturbance (ha.)	Subtotals
Exploration Trails	Boreal	Natural Revegetation	6.0	
	Alpine	Natural Revegetation	1.5	7.5
Access Road (including pullouts and borrows 0.5 ha.)		Scarify, recontour, pull culverts, active revegetation	65.0	65.0
Site Haul Roads		Scarify, recontour, pull culverts, active revegetation	16.0	16.0
Non-Linear Disturbances	Tailings Management Facility Scenario #1	Cover and Revegetate	11.8	
	Reclaim Pond Scenario #1	Cover and Revegetate	4.0	
		Subtotal Scenario #1:		15.8
	Tailings Management Facility Scenario #2	Cover and Revegetate	22.0	
	Reclaim Pond Scenario #2	Cover and Revegetate	4.0	
		Subtotal Scenario #2:		26.0
	Borrow Pits & Refuse areas, Mill & Camp	Scarify, Recontour and Revegetate	7.0	7.0

Total Area in Hectares Scenario #1: 111.3

Total Area in Hectares Scenario #2: 121.5

3.6.1.2. *Main Access Road*

Although the main access road is not covered as part of Water Licence QZ97-025, consideration of the access road has been included in order to ensure the reclamation plan is complete.

The main access road to the property was constructed in 1990. Figure 1-2 illustrates the overall routing for this road. This road was constructed to facilitate traffic from 26 ton ore concentrate trucks. The road was constructed by cut and fill methods with a road width of 8 m and associated ditch drainage and culvert installations. A typical cross section for the main site access road appears in Figure 3-16 (Typical Road Cross Section).

The plan proposes to reclaim the road after it is no longer required for access to the site. Cominco will continue to maintain the road until it is established that the reclamation program has been successful and that the physical structures at the site are stable. While Cominco would be willing to consider a responsible party taking over the responsibility for the road (rather than it being closed), the Yukon Territorial Government has indicated that it would not be willing to do so.

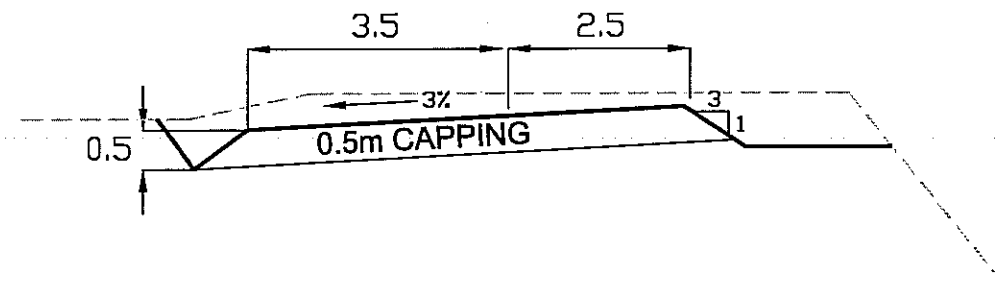
Closure measures related to road decommissioning include final timeframe for road closure, stabilization of slopes and prevention of erosion, and stabilization of stream crossings.

Decommissioning of this road will include recontouring, scarification, and removal of stream culverts. On steeper slopes, erosion barriers will be placed at frequent intervals to ensure stability.

A number of culverts will be removed upon final closure of the road. Figure 3-17 shows the location of the culvert crossings along the access road, with a listing of culvert sizes. Of key importance is the removal of culverts at stream crossings which are fish bearing. At these stream crossings, the road bed would be cut down to the culvert and original stream bed elevation with side slopes brought back to 2:1. Material removed during culvert removal will

TYPICAL SECTION SINGLE LANE WITHOUT BERM

Sta. 0+000 to 2+413



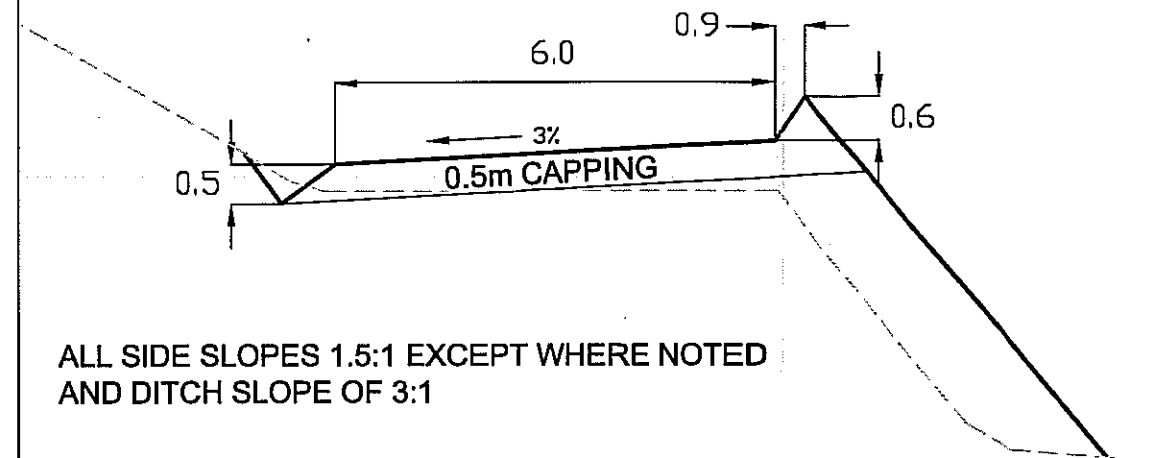
ALL SIDE SLOPES 1.5:1 EXCEPT WHERE NOTED
AND DITCH SLOPE OF 3:1

H= 1:200 V= 1:100

HAUL ROAD - TYPICAL

TYPICAL SECTION SINGLE LANE WITH BERM

Sta. 0+000 to 1+400



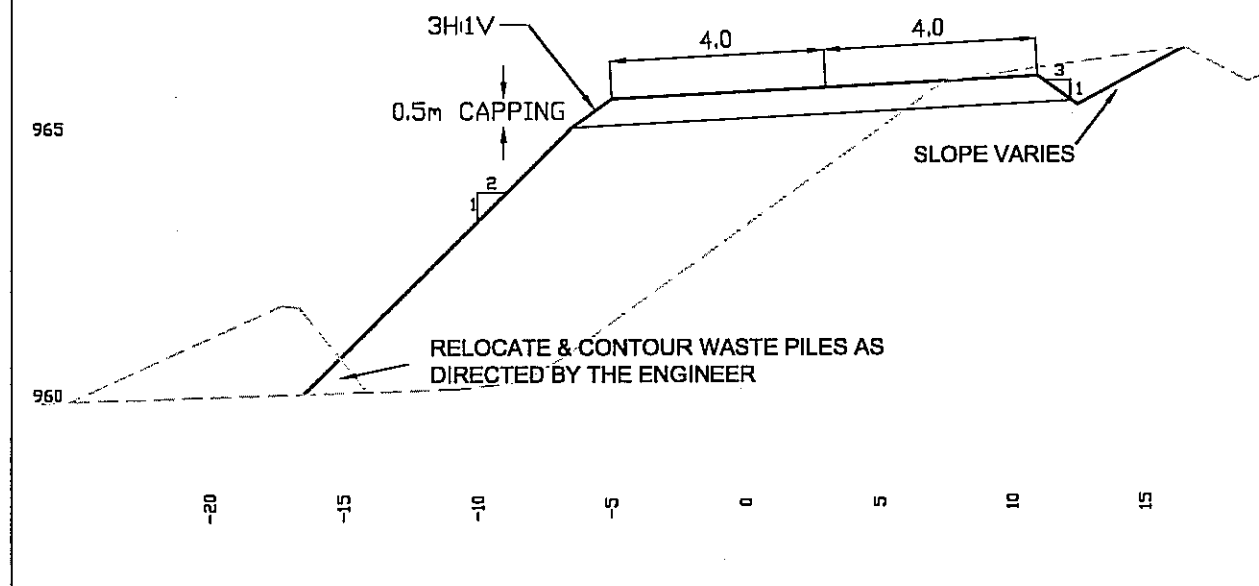
ALL SIDE SLOPES 1.5:1 EXCEPT WHERE NOTED
AND DITCH SLOPE OF 3:1

H= 1:200 V= 1:100

HAUL ROAD - TYPICAL

TYPICAL CROSS SECTION

STATION 15+800
H= 1:400 V= 1:200



ACCESS ROAD - TYPICAL



STEFFEN ROBERTSON AND KIRSTEN
Consulting Engineers

Sä Dena Hes Detailed
Decommissioning and Reclamation Plan

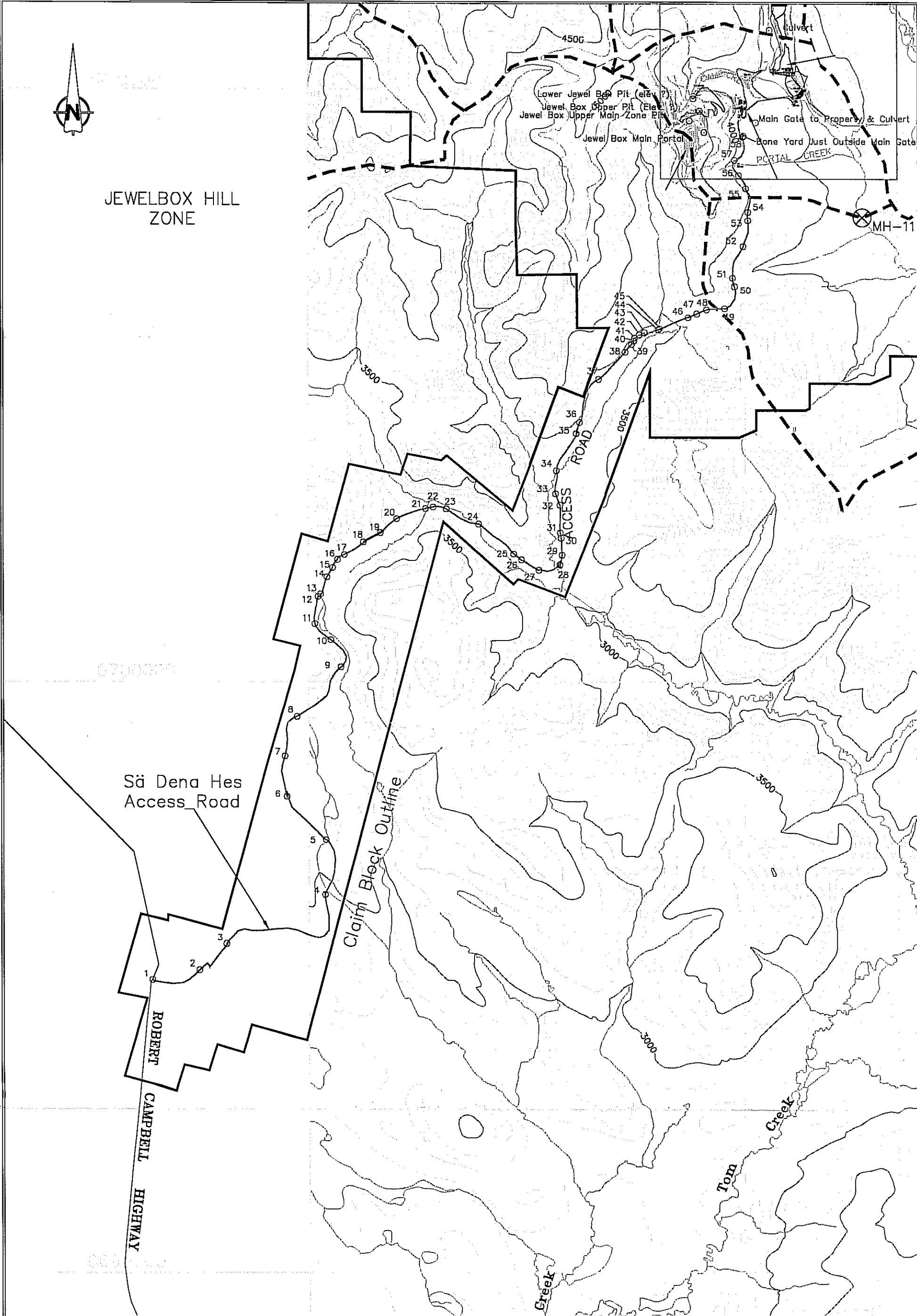
Typical Road Sections

DRAWN BY: ASH

CHECKED BY: RLM

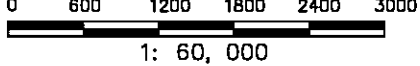
DATE: 04/08/99

Fig No. 3-16



NTS: 105 A/06, 105 A/07
105 A/10, 105 A/11

CONTOUR INTERVAL 100 FEET



NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927



LEGEND
○ Culvert Location

Sä DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

Access Road Culvert Locations

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	REV.
DATE: JULY 29, 1999	PROJ. NO. 1CC005.05	3-17	

be spread loosely on adjacent road surface to promote revegetation. No specific design event has been selected for the stream channel reconstruction after culvert removal. The intention is to restore the stream channel to the original grade, width and channel configuration so that historic flood events are accommodated as they were prior to road construction. The stream channel would be stabilized and slopes revegetated. A typical section outlining closure measures at stream crossings appears in Figure 3-18.

The preferred methodology is to encourage natural revegetation to occur, after first preparing the road surface by scarifying and fertilizing. However, it is proposed to conduct test plots to confirm the success of this method. If test plots indicate that this can not be successfully done and the vegetative cover established within a few years, these areas will be re-seeded. For the purposes of budgeting, the decommissioning and reclamation plan assumes that the access road will be seeded.

The road surface (approximately 65 hectares) will be revegetated with graminoids and legumes. The seed mixes used for revegetating this road will include either the agronomic selections recommended for linear development in the greater Watson Lake region by Kennedy (1993) or the alternative native selections if economically available. For costing purposes, it is assumed that these seed mixtures include:

<u>Agronomic Selections</u>		<u>Native Alternatives</u>	
Red top <i>Agrostis gigantea</i>	4 kg/ha	Red top <i>Agrostis gigantea</i>	2 kg/ha
Meadow foxtail <i>Alopecurus pratensis</i>	6 kg/ha	Meadow foxtail <i>Alopecurus pratensis</i>	3kg/ha
Smooth brome <i>Bromus inermis</i>	8 kg/ha	Violet wheatgrass <i>Agropyron violaceum</i>	5 kg/ha
Sheep fescue <i>Festuca ovina</i>	4 kg/ha	Sheep fescue <i>Festuca ovina</i>	2 kg/ha
Creeping red fescue <i>Festuca rubra</i>	3 kg/ha	Tufted hairgrass <i>Deschampsia caespitosa</i>	2 kg/ha
Fowl bluegrass <i>Poa palustris</i>	6 kg/ha	Glaucous bluegrass <i>Poa glauca</i>	3 kg ha
Alfalfa <i>Medicago</i> sp.	3 kg/ha	Mackenzie's hedysarum <i>Hedysarum mackenzii</i>	2 kg/ha
Alsike clover <i>Trifolium hybridum</i>	3 kg/ha	Arctic lupine <i>Lupinus arcticus</i>	2 kg/ha
Total	37 kg/ha		21 kg/ha

The nutrient requirements for this seed mix are nitrogen (100 kg N/ha) and phosphorus (120 kg P₂O₅/ha).

Access to the road entrance will be blocked by installing ditches and berms or boulders near the highway entrance. The entrance will be recontoured to make it less apparent from the Robert Campbell Highway. Shrubs, such as willows, aspens and poplars, will be seeded or seedlings planted near the entrance to reduce the visibility of the entrance to the deactivated road.

Revegetate & Dress Slope with
Erosion Protection Blanket (Soil/Gravel/Cobbles)

Existing Access Road Surface

Remove
CSP Culvert

Road Bed

Rip Rap
0% Gradient

Original Ground:

Stream Crossing

Scale: 1 cm=20 cm



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ACCESS MINING CONSULTANTS LTD.

Sä Dena Hes Detailed
Decommissioning and Reclamation Plan

Typical Access Road Culvert Removal

DRAWN BY: ASH

CHECKED BY: RLM

DATE: 03/08/99

Fig No. 3-18

3.6.1.3. *Service and Haul Roads within the Minesite*

A network of service and haul roads exist on the property (Figure 3-1). These roads provide access to the mine workings, tailings management facilities, and site infrastructure. Figure 3-16 (Typical Section Haul Road) provides a typical section through a haul road, with and without safety berms.

Closure objectives for the site access roads include slope and drainage stabilization, erosion prevention and revegetation.

Figure 3-19 depicts the typical treatment of haul road and service road closure measures.

All of the service and haul roads within the minesite will be decommissioned. All culverts will be removed and the roadbeds will be recontoured to restore original drainage patterns and to provide stability and long term erosion control. On the steeper slopes, erosion barriers will be placed at frequent intervals to ensure soil stability. These access roads cover an area of approximately 16.0 ha (Table 3-4).

The road surfaces will be decompacted and revegetated with graminoids and legumes. Most of these service roads are located within the subalpine fir vegetation community. In these areas, including subalpine sites such as the haul roads leading to the Jewelbox and Burnick deposits, the agronomic seed mixes recommended by Kennedy (1993) for subalpine fir community soils are being considered for use. Native seed mixes may be substituted where economically available. This seed mixture includes:

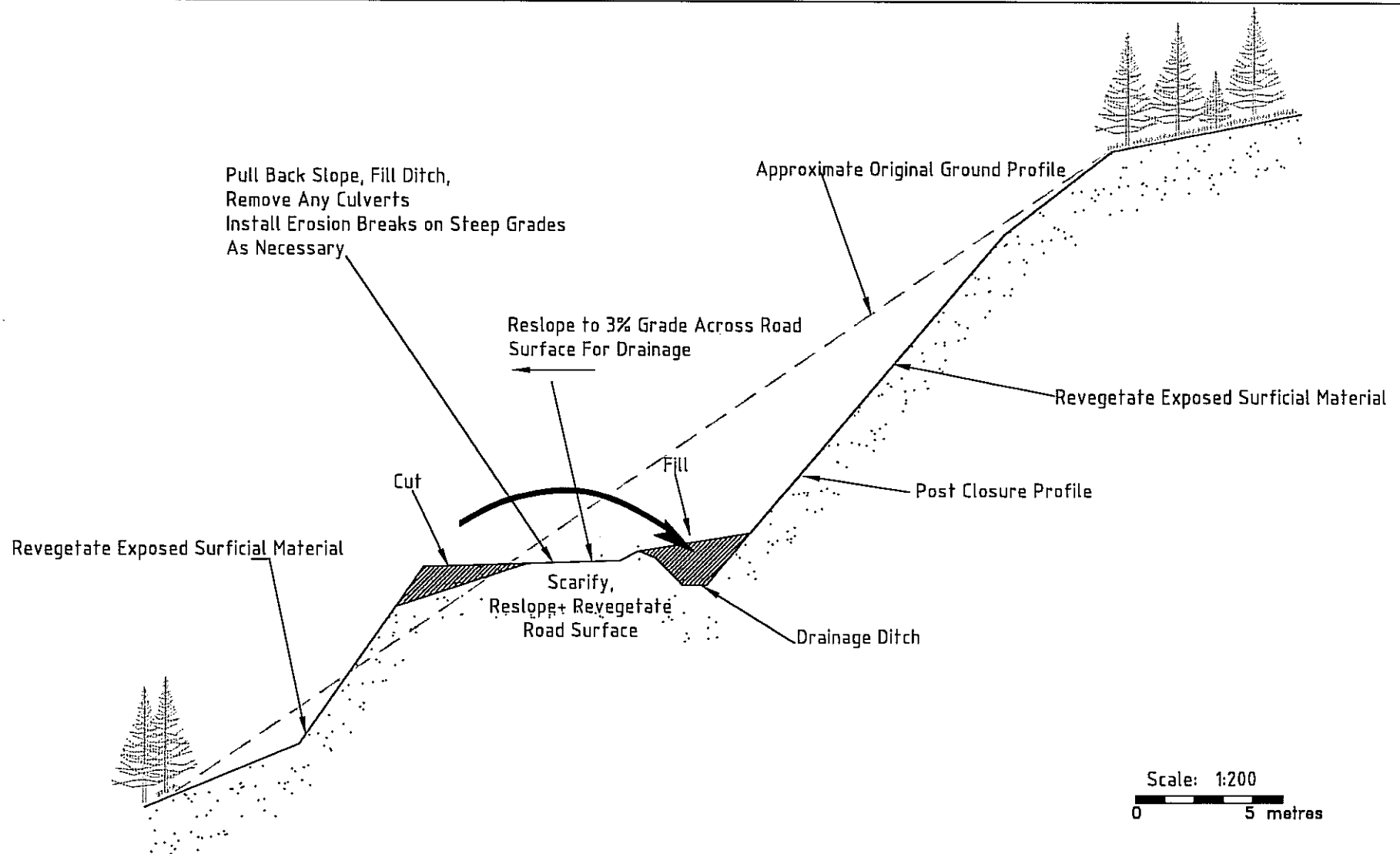
<u>Agronomic Selections</u>		<u>Native Alternatives</u>	
Meadow foxtail <i>Alopecurus pratensis</i>	8 kg/ha	Meadow foxtail <i>Alopecurus pratensis</i>	3 kg/ha
Tufted hairgrass <i>Deschampsia caespitosa</i>	4 kg/ha	Tufted hairgrass <i>Deschampsia caespitosa</i>	2 kg/ha
Timothy <i>Phleum pratense</i>	8 kg/ha	Violet wheatgrass <i>Agropyron violaceae</i>	5 kg/ha
Sheep fescue <i>Festuca ovina</i>	6 kg/ha	Sheep fescue <i>Festuca ovina</i>	3 kg/ha
Creeping red fescue <i>Festuca rubra</i>	8 kg/ha	Alpine bluegrass <i>Poa alpina</i>	2 kg/ha
		Glaucous bluegrass <i>Poa glauca</i>	3 kg/ha
Alsike clover <i>Trifolium hybridum</i>	4 kg/ha	Mackenzie's hedsarum <i>Hedysarum alpinum</i>	2 kg/ha
Total	38 kg/ha		20 kg/ha

The nutrient requirements for this seed mix are nitrogen (150 kg N/ha) and phosphorus (150 kg P₂O₅/ha) and potash (50 kg K₂O/ha).

3.6.2. *Non-Linear Disturbances (Mill Site, Camp, Tailings Management Facility, and Mine Workings)*

Non-linear disturbances include the areas around the mill and camp, tailings management facility, mine workings including open pits and waste rock dumps, and the refuse landfill site and borrow pit areas. They bear special treatment in this revegetation plan because they are not as conducive to natural revegetation as are roads, etc., because of the distance from seed sources. The location of these non-linear disturbances appear in Figure 3-15. The TMF covers an area ranging from 11.8 ha to 22.0 ha, depending on the closure scenario, and the remaining non-linear disturbances include an area of about 11.0 ha (Table 3-4).

A complete description of the facilities associated with these non-linear disturbances was presented in the previous sections. Closure objectives include slope and drainage stabilization, erosion prevention, and revegetation.



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Sand & Gravel



Existing Vegetation

Sā Dena Hes Detailed
Decommissioning and Reclamation Plan

Typical Haul Road Closure Cross-section

DRAWN BY: ASH

CHECKED BY: RLM

DATE: 03/08/99

Fig No. 3-19

3.6.2.1. *Tailings Management Facility*

The tailings will be covered with a nominal 300 mm soil cover from the overburden originally stripped from the pond area. Cominco's experience at its other operations indicates that a 200 mm soil cover would be more than adequate for plant growth. However, based on our experience at Kimberley operations, it is felt that it would be more practical from a constructability perspective to place a nominally 300 mm thick cover. Additional soil material would be removed from the northeast slope beside the North Dam. The soil will eliminate tailings dusting concerns and provide a growth medium for revegetation. Prior to placing the 300 mm soil cover, it is assumed that approximately 25% of the tailings area (the assumed wet area) will be covered with a 1.0 m thick layer of coarse rock. The purpose of the rock is to provide a solid base for equipment to operate on. Revegetation of the tailings area will occur after placement of the soil cover.

Analyses of soil samples collected from the north end of the overburden stock pile (near the north tailings impoundment dam) in June 1999 show that this soil is deficient in available phosphorous (3.2 mg/kg phosphate) and available potassium (30 mg/kg potassium) (Table 3-5). Although this soil sample has lower levels of available sulphur (19 mg/kg sulfate) and available nitrogen (11.2 mg/kg nitrate) than the sample collected from the south end of the stockpile, the seed and fertilizer requirements are the same as that prescribed for the reclaim pond revegetation.

Test plots will be established on the tailings impoundment area in order to determine the optimum soil treatments and seed mixtures. These test plots will include applications of topsoils, fertilizers, as well as different agronomic seed mixes. A control plot with no treatment will be used to measure the success of the test plots and to monitor any natural revegetation that occurs.

Until further information is gained from the test plots planned, it is assumed that the agronomic seed mixture recommended by Kennedy (1993) for white spruce/black spruce vegetation communities will be used to revegetate the TMF. Native seed mixture may be substituted where economically available.

Table 3-5 Soil Analysis for Overburden Pile – Near North Dam

	Sample Identification			
	45523-1 - SDH-SS-001 North Dam Waste Overburden Pile (South End)	45523-2 - SDH-SS-002 North Dam Waste Overburden Pile (North End)		
Depth	Near Surface	Near Surface		
Date/Time Sampled	June 18/1999	June 18/1999		
Matrix	Soil	Soil		
Sampling Method	Grab	Grab		
Number of Containers	One (1)	One (1)		
Available N,P,K,S			Detection Limits	Units
Nitrate-N	41	11.2	0.1	mg/kg
Phosphate-P	3.2	3.2	1	mg/kg
Potassium K	40	30	10	mg/kg
Sulfate-S	150	19	0.1	mg/kg
C/N Ratio	13.8	20.8		
Electrical Conductivity	0.4	0.29	0.01	mS/cm
Organic Matter	2.2	6.3	0.05	%
pH in Soil (1:2 water)	7.13	7.43	0.01	pH
Total Nitrogen in Soil	0.09	0.17	0.01	%
Total Organic Carbon in Soil	1.24	3.54	0.05	%

Note: See Figure 3-15 for a location of soil sample sites.

The seed mixture includes:

<u>Agronomic Selections</u>		<u>Native Alternatives</u>	
Red top <i>Agrostis gigantea</i>	2 kg/ha	Ticklegrass <i>Agrostis gigantea</i>	1 kg/ha
Meadow foxtail <i>Alopecurus pratensis</i>	8 kg/ha	Meadow foxtail <i>Alopecurus pratensis</i>	4 kg/ha
Fowl bluegrass <i>Poa palustris</i>	6 kg/ha	Fowl bluegrass <i>Poa palustris</i>	4 kg ha
Reed canarygrass <i>Phalaris arundinaceae</i>	5 kg/ha	Altai fescue <i>Festuca altaica</i>	1 kg/ha
Timothy <i>Phleum pratense</i>	9 kg/ha	Violet wheatgrass <i>Agropyron violaceae</i>	5 kg/ha
Alsike clover <i>Trifolium hybridum</i>	3 kg/ha	Bear root <i>Hedysarum alpinum</i>	3 kg/ha
Total	33 kg/ha		18 kg/ha

The nutrient requirements for this seed mix are nitrogen (50 kg N/ha) and phosphorus (100 kg P₂O₅/ha) and potash (50 kg K₂O/ha).

The sides of the pond areas will be revegetated with this same seed and fertilizer mixture.

3.6.2.2. Reclaim Pond

After the reclaim pond has been drained and the original drainage channel of Camp Creek has been restored, the sediments will be covered with overburden and revegetated. The area required for cover and revegetation is approximately 4.0 ha. Overburden that was originally stripped from the pond area (a nominal cover of 300 mm) will be used as the growth medium. Analyses of soil samples taken from the south end of the overburden stock pile (the end closest to the reclaim pond) show that this overburden is deficient in available phosphorous (3.2 mg/kg phosphate) and available potassium (40 mg/kg potassium), but has marginally adequate available nitrogen (41 mg/kg nitrate) and available sulphur (150 mg/kg sulphate) (see Table 3-5). The seed and fertilizer mix used for the reclaim pond will be the same as that recommended for the TMF (see Section 3.6.2.1).

3.6.2.3. *Pits and Waste Dumps*

As pits and waste dumps are primarily in the alpine zones with little original vegetation, they will not be actively revegetated. The exception is the Burnick 1200 waste rock dump which is located below treeline in the Boreal Zone. This waste rock area will be planted with locally available herbaceous shrub seedlings. Due to the rocky nature and relatively steep slopes of this waste dump, seedling planting will be accomplished by hand planting.

3.6.2.4. *Sediment Ponds*

There are four sediment ponds corresponding to the Jewelbox 1408, Main Zone Pit, Burnick 1200 Portal, and the Jewelbox 1250 Portal (see Figures 3-3 and 3-5). They are all approximately 4 m x 3 m, constructed of unlined locally available materials, except the Jewelbox 1408 portal sediment pump which is lined. They were used to provide retention time to mitigate settleable solids levels in the water draining from the mine workings. While confirmatory soil testing has not been conducted, it is expected that three of the sediment ponds (all but Jewelbox 1250, which saw virtually no production and does not have a flow), will contain elevated metals levels. The contaminated soils will be removed to the TMF, and the sites will be regraded. Only the Burnick 1200 sediment pond occurs in the Boreal Zone, therefore, this site alone will be actively revegetated by the application of seed mix developed as per this plan.

3.6.2.5. *Refuse Areas and Borrow Pits*

The site presently has one main refuse area and a number of smaller waste metal sites. A number of borrow areas also exist on the property. The location of these areas are shown in Figure 3-15.

Closure issues associated with these areas are similar with other disturbed lands discussed previously; however, contouring of refuse areas to eliminate water ponding and seepage is also a concern to be addressed. All landfill, refuse and borrow pit areas will be graded to prevent ponding of water and revegetated with the same seed and fertilizer mixes recommended for white spruce-willow vegetation communities. This seed mix includes:

<u>Agronomic Selections</u>		<u>Native Alternatives</u>	
Sheep fescue <i>Festuca ovina</i>	6 kg/ha	Sheep fescue <i>Festuca ovina</i>	3 kg/ha
Creeping red fescue <i>Festuca rubra</i>	4 kg/ha	Glaucous bluegrass <i>Poa glauca</i>	2 kg/ha
Fowl bluegrass <i>Poa palustris</i>	6 kg/ha	Fowl bluegrass <i>Poa palustris</i>	5 kg ha
Streambank wheatgrass <i>Agropyron riparian</i>	8 kg/ha	Yukon wheatgrass <i>Agropyron yukonense</i>	4 kg/ha
Slender wheatgrass <i>Agropyron trachycaulum</i>	8 kg/ha	Violet wheatgrass <i>Agropyron violaceum</i>	4 kg/ha
Kentucky bluegrass <i>Poa pratensis</i>	2 kg/ha	Kentucky bluegrass <i>Poa pratensis</i>	1 kg/ha
Alfalfa <i>Medicago</i> sp.	2 kg/ha	Showy locoweed <i>Oxytropis splendens</i>	1 kg/ha
Alsike clover <i>Trifolium hybridum</i>	2 kg/ha	Arctic lupine <i>Lupinus arcticus</i>	1 kg/ha
Total	38 kg/ha		21 kg/ha

The nutrient requirements for this seed mix are nitrogen (75 kg N/ha) and phosphorus (75 kg P₂O₅/ha).

4.0 IMPLEMENTATION SCHEDULE

For this decommissioning and reclamation plan it has been assumed that active mining at the Sä Dena mine will cease once ore reserves at Jewell Box and the Burnick zones are depleted and ore is processed through the concentrator. The timing for completion of active mining is not known at this time and would be dependent on the decision to reopen the mine. This decision is largely dependent on metal prices, which cannot be predicted with any certainty. Mine reopening remains a function of future economics and ore reserves. Based on the present property ore reserves, it is anticipated that the mine would run for a further 3.8 years.

It is anticipated that 3 years will be required to fully implement and complete all aspects of the decommissioning and reclamation works. The work would be conducted seasonally during the ice-free period (May-September). During the first year of closure, the majority of site decommissioning works would be initiated. Some concurrent reclamation works will be initiated with the commencement of mine reopening. For example, the Main Zone open pits and associated waste rock dumps on Jewelbox hill will be progressively reclaimed during operations.

As one of the first steps in decommissioning the site, a comprehensive environmental site assessment will be done to identify any closure issues not addressed at the time of writing this plan.

Once the concentrator facility has been cleaned and flushed of tailings residue, the tailings management facility will be decommissioned. Decommissioning and final closure of the main property access road off the Robert Campbell Highway will be the last closure measure to be completed. A program of post closure monitoring and inspection will be carried out during the implementation of closure measures and for a five year period following closure. The details of the post closure monitoring program are discussed in Section 5. The program would continue until it is demonstrated that closure objectives have been met and the physical and chemical performance of remaining site structures in the long term is assured, through periodic monitoring and possibly some minor maintenance.

The general schedule for closure of the mine is summarized in Table 4-1. A more detailed schedule for closure measure implementation is presented in Table 4-2 in Gantt chart format.

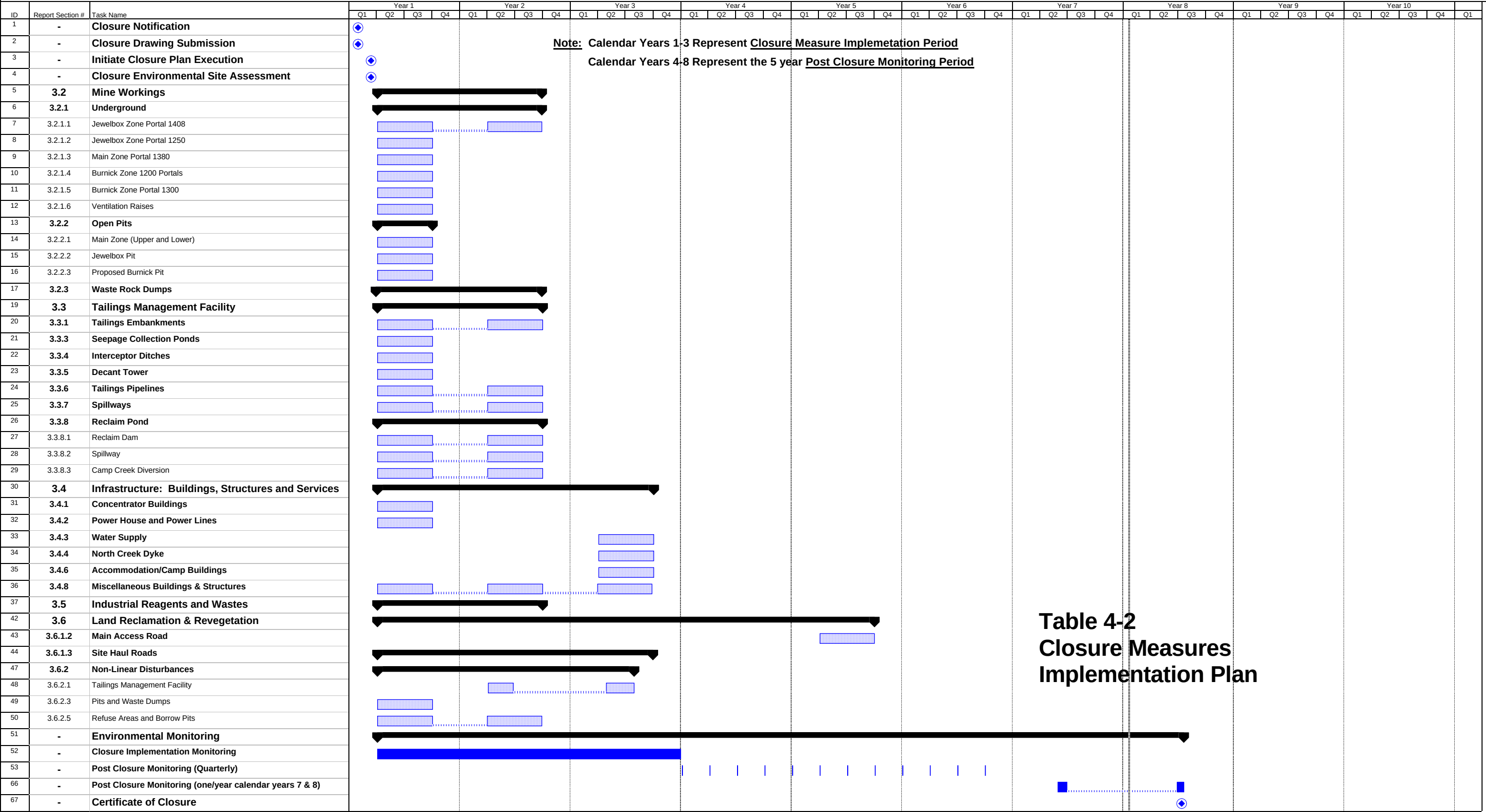
The Gantt chart displays closure issues that follow directly with the discussion in the body of the text. The associated section numbers are shown where appropriate.

Table 4-1 General Closure Schedule for the Sä Dena Hes Mine

Phase of Operation	Key Triggering Event or Timeline	General Reclamation Activity
Temporary Closure/ Current Conditions	Continued through ongoing care and Maintenance	- Continued environmental monitoring programs - Implement vegetation test plots and monitor - Tailings Management Facility (pond water) geochemical test work
Production Mining	Production Mining will cease once the existing ore reserves in the Jewell Box and Burnick Zones are depleted (current reserves estimated at 1,300,000 tonnes).	Once the mine reopens, a program of progressive reclamation will be initiated to the cessation of production mining. It is expected that reclaiming of the Main zone and Jewelbox open pits, 1380 and 1250 portals and associated waste rock storage areas would be conducted concurrently with ongoing mining activities
Closure Implementation	It is anticipated that a 3-year period is required to implement the various site closure measures. Work to be done seasonally (May-September)	Dismantling of site infrastructure and implementation of the tailings management facility closure measures will commence in year 1. Work will then begin on the reclamation of the open pits, waste rock storage areas and haul roads that have not been previously reclaimed. Reclamation and revegetation of disturbed lands will occur throughout the 3-year period.
Main Access Road Closure	Main property access road will be maintained during closure implementation and for a period following post closure. Decision to permanently close the main access road made in consultation with regulatory agencies and Liard First Nation.	Main access road will be blocked, recontoured and sloped, decompacted, culverts removed and revegetated
Post Closure Monitoring	Post closure environmental monitoring will continue during closure implementation. Once environmental monitoring results are reviewed and performance of reclamation objectives demonstrated a final certificate of closure will be sought.	Environmental monitoring and inspection frequency will reduce with time, assuming sampling results are satisfactory. Data review to determine that reclamation objectives have been achieved.
Temporary Closure/ Current Conditions	Continued/ongoing care & maintenance	- Continued environmental monitoring programs - Implement vegetation test plots and monitor - Tailings Management Facility (pond water) Geochemical test work



Sa Dena Hes Mine
Detailed Decommissioning and Reclamation Plan
Closure Measures Implementation Plan



Note: Calendar Years 1-3 Represent Closure Measure Implemetation Period
Calendar Years 4-8 Represent the 5 year Post Closure Monitoring Period

Table 4-2
Closure Measures
Implementation Plan



Task Progress Summary Rolled Up Task Rolled Up Milestone Rolled Up Progress Split External Tasks Project Summary

5.0 POST CLOSURE SITE MANAGEMENT

The closure phase of the Sä Dena Hes mine will commence with the cessation of open pit and underground production mining at both Jewelbox Hill and Burnick and the milling of ores and stockpiles from these ore zones. Once all mineable ore reserves have been processed, the mill and concentrator will be flushed and the tailings management facility will be decommissioned. During the active decommissioning phase which is expected to last approximately 3 years, the number of personnel required will vary depending on site activities, however it is expected that as the major decommissioning and reclamation tasks are completed the number of site personnel required will decline.

It is expected that a Water Use Licence will be required for the decommissioning phase of the operation as water use will continue on a limited basis and wastewater will be released from the tailings management facility in a controlled fashion. The need for a Water Use Licence following the decommissioning phase will be dependent on site conditions, performance of closure measures in achieving stated objectives and legislated requirements. Post closure management and monitoring of the site will be guided to some extent by water licence or other permit requirements, the performance of physical structures remaining on site and the ability of achieving and demonstrating long-term compliance with existing waste discharge standards. Once overall closure performance has been demonstrated for all aspects of decommissioning, the necessity of maintaining licences or permits would be re-examined. The following section provides a general outline of the site management approach that will be taken at the Sä Dena Hes operations during the closure phase.

5.1 ORGANIZATION, SITE ACCESS & SECURITY

A number of personnel will be required on site to implement the various decommissioning and closure tasks. Generally these tasks entail closure of mine workings, regrading of waste rock piles, decommissioning of the tailings management facility, salvage and removal of infrastructure, equipment and reagents, decommissioning of access roads and reclamation and revegetation of disturbed lands. These activities would be undertaken on a seasonal basis and

directed by an onsite manager responsible for decommissioning and reclamation of the Sä Dena Hes mine.

During site decommissioning, it is anticipated that at least a portion of the existing camp accommodations would remain on site to support site personnel. At present, a caretaker remains on site year round to provide site security, maintenance, monitoring and inspection requirements. It is anticipated that during the initial post closure phase, site security requirements will continue with the caretaker remaining on site following seasonal closure of the site. Security personnel will no longer be required once decommissioning and reclamation activities are completed on the property. Table 5-1 provides a summary of the personnel requirements by year for decommissioning and reclamation works.

Prior to undertaking closure activities as part of a comprehensive environmental site assessment, areas of suspected oil, chemical, or other contaminant spills will be tested to confirm locations and quantities requiring clean-up.

During the first two years of closure, the majority of site decommissioning works would be initiated and completed. During this period the mine workings, open pits and waste rock storage area would be decommissioned. Closure measures on the tailings management facility will have commenced and the dismantling of mine and mill site infrastructure completed. The number of personnel required on site will be reduced once these activities have been completed.

The main access road and property security gate will be maintained during implementation of the post closure phase. Site access along the main road will be required for personnel and truck haulage requirements to and from the site. The present security gate and fencing would be maintained while the main access road is in use. Decommissioning and reclamation of various property haul and site access roads will be completed once closure measures have been completed at each facility and site access is no longer required.

Once decommissioning activities are completed on site and following a period of post closure monitoring a determination will be made to permanently close the main site access road and security gate. Closure of the main access road is expected to be consistent with the plan's closure philosophy; however, it is recognized that the performance of physical reclamation and

the chemical stability of water drainage from the site must be assured before a final determination of the main access road closure is made.

Table 5-1 Site Decommissioning and Reclamation Seasonal Personnel Requirements

Personnel	Post Closure Year 1	Post Closure Year 2	Post Closure Year 3
Project Manager	1	1	1
Mine Engineer	1	-	-
Construction Supervisor	1	1	1
Environmental Monitoring	1	1	1
Equipment Operators	15	3	3
Equipment Mechanics/Welders/ Fabricators/Electricians	5	5	1
General Labourers	5	3	2
Catering Staff	2	1	1
Total Seasonal Personnel	17	11	10
Off Season Site Security/Caretaker	1	1	-

Note: Although some of the above personnel will be Cominco staff, the closure costing presented in Section 6 of this report reflects costs for 3rd party contractors.

5.2 SUPERVISION AND DOCUMENTATION OF WORK

All decommissioning and reclamation works will be properly supervised to ensure that works are constructed according to their design and that this work is properly carried out and documented. The project manager or the construction supervisor would supervise all closure works. Daily inspection procedures would be completed to document work progress, deficiencies and completion. Existing plans for spill response or other site internal procedures for fuel handling, waste disposal, fire control and suppression, health and safety and environmental management systems would be followed as necessary.

For the tailings management facility, construction plans for all earthen works would be prepared and submitted to the Yukon Territory Water Board for reviews and approval prior to construction. These plans would be submitted in a timely manner to facilitate agency review and Board approval prior to implementation. A competent engineer following standard quality control and assurance procedures would also inspect and document this construction work. As built plans and drawings would be completed and the results of the closure work completed on the tailings management facility documented in a final as built report. This report would be submitted to the Yukon Territory Water Board and regulatory agencies upon completion of closure activities.

Upon completion of the decommissioning and reclamation works, a final site plan report (summary text and drawings) would be prepared which would outline the facilities or works remaining on the site following closure. This plan would identify the location of buried concrete structures or scrap and landfill disposal areas. It is expected that this plan would accompany an Application for a Certificate of Closure under the Yukon Quartz Mining Act.

5.3 MINE RECORDS

As noted in the previous section, all decommissioning and reclamation works would be documented. Mine records comprising the extent of underground and open pit workings would be retained by Cominco. Other site records, files and plans would be archived. Where plans or drawings are required for mine safety reasons, these plans would also be submitted to government mine safety offices. As-built reports for structures completed for closure and the

final site closure report would be retained for record and submitted to government agencies and boards.

5.4 COMPLIANCE MONITORING AND REPORTING

This section has been updated.
Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

Environmental compliance monitoring, internal monitoring of earthworks and independent geotechnical inspections are presently ongoing at the property. The environmental monitoring at the Sä Dena Hes mine employs several types of scheduled periodic inspections to ensure that the facility is meeting environmental performance objectives and complying with appropriate regulatory standards. These inspections entail:

- Scheduled inspections of the tailings management facility and mine components to monitor environmental performance;
- Scheduled water quality sampling and flow measurements of effluent streams and local receiving water streams;
- Scheduled receiving water programs for benthic invertebrates, stream sediments and fish to monitor downstream environmental quality;
- Scheduled piezometric monitoring of water levels in wells and the decant structure at the tailings management facility;
- Annual summer inspections by a qualified geotechnical engineer of tailings management facility, storage dikes, diversion channel and waste rock storage areas for structural stability; and,
- Scheduled environmental tours and audits of the property by Cominco staff to look for environmental hazards and site stability. Cominco will endeavor to invite various Government agencies' representatives as part of the environmental inspections.

At present, the site caretaker undertakes the scheduled environmental monitoring and inspection programs with the exception of the annual geotechnical inspection and the benthic invertebrates, stream sediment and fish monitoring programs, which are conducted by qualified professionals. All results from the licensed compliance monitoring programs are reported to the Yukon Territory Water Board and the Department of Indian Affairs and Northern Development as monthly or annual reports.

During the closure phase environmental compliance monitoring and inspections will continue according to the present water use licence utilizing site based personnel. A summary of the present environmental compliance and inspection program as outlined in Water Use Licence QZ97-025 is shown in Table 5-2, with monitoring station locations described in Table 5-3. Figures 1-2 and 3-1 provide the station locations for the environmental monitoring programs.

It is expected that the amount of environmental monitoring and inspection (frequency and quantity) will decline once all closures measures have been implemented. The approach to post closure monitoring has been to continue with the present licence monitoring and inspection programs until decommissioning and reclamation measures have been completed and then reduce the frequency of site monitoring and the number of monitoring stations over time as satisfactory closure performance is confirmed. Revisions to the current water licence requirements will be required upon closure to authorize them. The plan specifies the details of the monitoring planned for the 5 years immediately following completion of reclamation work (Table 5-4). The purpose of these periodic inspections, ranging from monthly to every 3 years, would be to ensure that waste discharges remain compliant, downstream receiving waters meet CCME Guidelines for the Protection of Freshwater Aquatic Life, and physical structures are performing as designed. Should these inspections identify issues of concern, then plans would be developed to address the concerns.

It is important to note that it is not proposed that all monitoring would completely cease after the 5 year monitoring plan. Based on the results from this monitoring and in discussion with the appropriate regulators during this period, the need for and the frequency of additional site monitoring will be determined at that time. If the results from monitoring indicate that the site is stable with acceptable geotechnical and environmental performance, then Cominco would propose to continue to decrease the frequent monitoring. If the results from monitoring indicate there are concerns with either geotechnical conditions at the site or with environmental issues,

then the site would continue to require more frequent monitoring than otherwise proposed and possibly additional remedial work would be required.

Table 5-2 Licensed Surveillance Program During Temporary Cessation of Operations

		Stations																				
		MH-1	MH-2	MH-3	MH-4*	MH-5	MH-6a	MH-6b**	MH-7	MH-8	MH-9	MH-10	MH-11	MH-13	MH-14	MH-16	MH-18	MH-19	MH-20	MH-22	MH-24	
W A T E R Q U A L I T Y	Water Quality Monitoring																					
	pH (Field)	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	Flow Rate	Q	M	M	Q	M	M	Q	M	M	M	M	M/C***	Q	Q	Q	--	--	--	M	--	
	Temperature	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	Conductivity	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	Alkalinity	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	pH(Lab)	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	Tot. Sus. Solids	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	Dissolved Solids	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	ICP Scan - Total	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	Ammonia - Total	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	Sulphate	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	Hardness	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	
	Cyanide - Total	Q	M	--	--	--	M	Q	Q	M	--	--	--	M	Q	Q	Q	--	--	--	--	--
Bioassay - LC50	--	--	--	--	--	Q	Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--	
M O P E R A T I O N S	Environmental Monitoring																					
	Benthic Invertebrates	--	--	--	--	--	--	--	--	--	--	--	--	--	2Y	2Y	--	2Y	2Y	--	--	2Y
	Stream Sediments	--	--	--	--	--	--	--	--	--	--	--	--	--	2Y	2Y	--	2Y	2Y	--	--	2Y
	Fish Monitoring	--	--	--	--	--	--	--	--	--	--	--	--	--	2Y	--	--	2Y	--	2Y	--	2Y
	Physical Monitoring																					
	Internal Monitoring (Earthworks)	Monthly internal inspection of all earthworks on site																				
	Annual Geotechnical Inspection	Annual Geotechnical Inspection of all earthworks																				
	Piezometers Monitoring	Monthly piezometric readings from wells located in tailings management facility																				
Settlement Marker Monitoring	Annual readings taken during geotechnical inspection																					
Seepage Monitoring	Monthly seepage readings from seepage weirs located in tailings management facility																					

LEGEND: Q = Quarterly M = Monthly 2Y = every second year during September C = Continuous

NOTES: -- Monitoring for this parameter at this station is not required as per water use licence schedule
 * To be monitored as an alternative site to MH-3 only when there is no discharge from the Camp Creek Sediment Pond.
 ** To be monitored as an alternative site to MH-6a only when there is no discharge from the reclaim pond.
 *** Monitor a minimum of monthly or continuous flow recording year round.

Table 5-3 Licensed Surveillance Network – Water Quality Monitoring Site

MH-1:	Tailings Pond Outflow – discharge from the tailings pond, through the decant tower, to the reclaim pond or if no discharge, the pond water.
MH-2:	Tailings North Dam Seepage – seepage water collected immediately below the downstream face of the north tailings dam.
MH-3:	Camp Creek Pond Outflow – discharge from a sedimentation pond located in upper Camp Creek which drains the Jewelbox Hill 1250 Portal and Main Zone Waste Dump.
MH-4:	Alternate Site – Lower Camp Creek – on Camp Creek located immediately above the West Interceptor Ditch; this is an alternative site to be sample <u>only</u> when there is no discharge from MH-3.
MH-5:	Portal Creek – a small intermittent stream which drains the East face of Jewelbox Hill, immediately below the 1408 portal, to False Canyon Creek; releases discharge from the portal sedimentation pond and water from the Jewelbox Waste Dump.
MH-6a:	Reclaim Pond Outflow – discharge from the reclaim pond through the overflow spillway.
MH-6b:	Reclaim Pond – To be monitored as a alternative to MH-6a only when there is no discharge from the reclaim pond.
MH-7:	Reclaim Pond Seepage – water accumulating within the seepage collection system located immediately below the downstream face of the reclaim dam.
MH-8:	Burnick Creek – a small intermittent drainage south of the Burnick pit and portal sites which will consolidate drainage within a sediment pond from those sites as well as Burnick pit access road runoff; the drainage contributes to the upper end of Tributary E, east fork, of False Canyon Creek.
MH-9:	Burnick West Pond Outflow – discharge from a small sediment pond, which collects drainage from the west and north faces of the Burnick Dump and drains to the upper end of Tributary E, west fork, of False Canyon Creek.
MH-10:	Burnick East Pond Outflow – discharge from a small sediment pond, which collects drainage from the east face of the Burnick Dump, to a branch of Tributary E, west fork, of False Canyon Creek.
MH-11:	Upper False Canyon Creek located one kilometre downstream of the tailing management facility.
MH-12:	Tributary E, east fork – of False Canyon Creek, approximately 2 kilometres downstream of the north tailings dam .
MH-13:	The main channel of False Canyon Creek, approximately 10 kilometres downstream of the reclaim pond.
MH-14:	The main channel of False Canyon Creek, approximately 20 kilometres downstream of the reclaim pond just upstream of the confluence with Tributary E.
MH-15:	Tributary E, west fork, upstream of the confluence with Tributary E, east fork, approximately six kilometres downstream of the North Hill development.
MH-16:	The main channel of False Canyon Creek, downstream of the confluence of Tributary D, approximately 22 kilometres downstream of the reclaim pond.
MH-18:	Lower reaches of Tributary E, approximately one kilometre above the confluence with False Canyon Creek.
MH-19:	The main channel of False Canyon Creek, approximately four kilometres downstream of the Tributary D confluence.
MH-20:	The main channel of False Canyon Creek, approximately 13 kilometres upstream of the mouth and immediately above the Tributary B confluence.
MH-22:	Burnick portal discharge, the end of pipe discharge point into the North Hill Settlement Basin.
MH-23:	North Creek immediately downstream of the impoundment.
MH-24:	The east tributary that joins False Canyon Creek just downstream of MH-13.

Table 5-4 Environmental Monitoring and Inspection Program - Post Closure

		Post Closure Implementation Year			Post Closure Monitoring Year					
		1	2	3	1	2	3	4	5	>6
	Calendar Year	1	2	3	4	5	6	7	8	>9
W A T E R M O N I T O R I N G	Water Quality Monitoring Stations *									
	MH-1	Q	Q	Q	Q	Q	Q	A	A	P
	MH-2	M	M	M	Q	Q	Q	A	A	P
	MH-3	M	M	M	--	--	--	--	--	--
	MH-4	Q	Q	Q	Q	Q	Q	A	A	P
	MH-5	M	M	M	Q	Q	Q	A	A	P
	MH-6	M	M	M	--	--	--	--	--	--
	MH-7	M	M	M	--	--	--	--	--	--
	MH-8	M	M	M	--	--	--	--	--	--
	MH-9	M	M	M	--	--	--	--	--	--
	MH-10	M	M	M	--	--	--	--	--	--
	MH-11	M	M	M	Q	Q	Q	A	A	P
	MH-13	Q	Q	Q	Q	Q	Q	A	A	P
	MH-14	Q	Q	Q	Q	Q	Q	A	A	P
	MH-16	Q	Q	Q	--	--	--	--	--	--
	MH-18	--	--	--	A***	--	A***	--	A***	P
	MH-19	--	--	--	A***	--	A***	--	A***	P
	MH-22	M	M	M	Q	Q	Q	A	A	P
	MH-24	--	--	--	A***	--	A***	--	A***	P
M O P E R A T I O N S	Environmental Monitoring **									
	Benthic Invertebrates		2Y		2Y	--	2Y	--	2Y	--
	Stream Sediments		2Y		2Y	--	2Y	--	2Y	--
	Fish Monitoring		2Y		2Y	--	2Y	--	2Y	--
	Physical Monitoring									
	Internal Monitoring (Earthworks)	M	M	M	--	--	--	--	--	--
	Annual Geotechnical Inspection	A	A	A	A	A	A	A	A	P
	Piezometers Monitoring	M	M	M	Q	Q	Q	A	A	P
	Settlement Marker Monitoring	A	A	A	A	A	A	A	A	P
	Seepage Monitoring	M	M	M	Q	Q	Q	A	A	P

LEGEND:

Q = Quarterly; M = Monthly; A = Annually; 2Y = every second year during September; P = Periodic Inspection

NOTES: Post Closure starts after all mining & milling is completed. Post Closure phases include reclamation implementation and long term monitoring.

* Water quality parameters include pH, Flow, Temperature, Conductivity, Alkalinity, Suspended solids, Dissolved solids, ICP scan - Total and Dissolved metals, Ammonia, Sulphate, Hardness and Total cyanide

** Monitoring stations for this program includes MH-13, MH-14, MH-18, MH-19 & MH-24

*** Water Quality monitored annually in conjunction with Environmental Monitoring Programs

Access to the property for post closure monitoring would continue via the main access road until it is eventually decommissioned. Following this, site access would be via helicopter. A summary of the post closure monitoring and inspection program is outlined in Table 5-4.

During the post closure period, reporting on all environmental and inspection programs carried out on the property will continue. These reports will be filed with the Yukon Territory Water Board, Department of Indian Affairs and Northern Development and the Yukon Government according to requirements contained in the Water Use Licence, surface lease, Mine Production Licence and other operating permits and approvals as may be.

Cominco personnel responsible for the management of the Sä Dena Hes property would continue to meet with regulatory agencies, the Liard First Nation, and the community on an as-needed basis to appraise interested parties of decommissioning activities and the results of post closure monitoring.

It is expected that a review of the environmental performance of the mine following closure would be made with DIAND and or other interested parties. Once this review is completed, Cominco would apply to the Minister of DIAND for a Certificate of Closure for the Sä Dena Hes mine under the Yukon Quartz Mining Act Mine Production Regulations. The Certificate of Closure will confirm that Cominco has fulfilled their closure obligations for the site.

6.0 CLOSURE COSTS

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

The estimated costs to implement the Detailed Decommissioning and Reclamation Plan described in this report, are presented in Table 6-1 through to 6-10. Table 6-1 presents the summary of cost estimates for various mine components including mine workings, tailings management facility, infrastructure, land reclamation and revegetation and post closure monitoring and maintenance.

As shown in Table 6-1, a closure cost of **\$4,811,755.00** is estimated for current conditions with no mine reopening (Scenario 1). Closure costs for Scenario 2, wherein the mine resumes operation to exhaust the known ore reserves (additional 3.8 years mining), is estimated at **\$5,342,296.00**. Where there is a different cost for closure measures for Scenario 1 or 2, they are presented separately. All costs are in constant 1999 dollars.

The costs have been developed using current unit rates for Yukon construction projects and assumes all work is conducted by contractors. The unit costs have been applied to levels of effort in sufficient detail to allow thorough scrutiny by the reader.

- Table 6-1 provides a summary of all cost estimates;
- Table 6-2 sets out unit rates used in the calculations;
- Table 6-3 provides closure cost estimates for the existing mine workings (Scenario 1);
- Table 6-4 outlines the additional mine workings closure costs associated with mine reopening (Scenario 2);
- Table 6-5 presents cost estimates for the tailings management facility Scenario 1;
- Table 6-6 estimates costs for the tailings management facility for reopening (Scenario 2);
- Table 6-7 presents the decommissioning cost estimates for site infrastructure. These costs are common to both Scenario 1 and 2;
- Table 6-8 presents cost estimates for land reclamation and revegetation for Scenario 1;
- Tables 6-9 presents cost estimates for land reclamation and revegetation for Scenario 2;

- Table 6-10 outlines costs associated with the site management during closure implementation and presents post closure costs for compliance monitoring and maintenance for the entire projected 8 year post closure monitoring life (These costs are common to both Scenario 1 and 2).

All of the individual mine component cost estimate tables provide the detailed breakdown of the costs to implement each of the main elements of the works as described in the Decommissioning & Reclamation Plan.

Table 6-1 - Estimated Decommissioning Costs, Summary Table

Scenario 1

Item	Description	Cost
1	Mine Workings	\$218,109
2	Tailings Management Facility	\$491,485
3	Infrastructure	\$837,276
4	Land Reclamation and Revegetation	\$929,964
5	Post Closure Site Management (Including Monitoring & Maintenance)	\$1,707,300
	Sub-total	\$4,184,134
	Contingency Allowance @ 15%	\$627,620
	Sub-total	\$4,811,755
	Total Estimated Scenario 1 Closure Cost	\$4,811,755

Scenario 2

Item	Description	Cost
1	Mine Workings	\$237,929
2	Tailings Management Facility	\$583,250
3	Infrastructure	\$837,276
4	Land Reclamation and Revegetation	\$1,279,720
5	Post Closure Site Management (Including Monitoring & Maintenance)	\$1,707,300
	Sub-total	\$4,645,475
	Contingency Allowance @ 15%	\$696,821
	Sub-total	\$5,342,296
	Total Estimated Scenario 2 Closure Cost	\$5,342,296

Table 6-2: Unit Costs

Personnel & Equipment Rates			
Equipment	All found Rates/hr	Rate/mc Rate/day	
D9H Dozer	\$180		
Haul Truck D250E	\$100		
Tandem Haul Truck	\$65		
Drill Rig	\$186		
36" Walk Behind Roller	\$40		
Cat 235 Excavator	\$186		
Cat 16H grader	\$108		
Hammer	\$40		
988B Loader	\$110		
Hiab Flatdeck truck	\$30		
Cat 950 loader	\$75		
Personal Vehicles		\$2,000	
Blaster	\$50		
Labourer	\$40		
Tradesman	\$55		
Site Supervisor	\$80		
Design Engineer	\$115		
Project Manager		\$8,800	
Camp Labourer		\$3,000	
Site Caretaker		\$5,500	
Environmental Monitor		\$4,500	

Other Materials	
Revegetation Seed Mix	\$8.57 per kg
Fertilizer	\$0.80 per kg
Tree Seedlings	\$1,250 per ha (1,000 seedlings per ha)
Seed/Fertilizer Application	\$1,325 per ha
Erosion barrier	\$1,000 per linear km

Contractor Unit Rates & Camp Costs		
Excavation of Soil	\$3.00	cu.m
Supply and place Geotextile	\$4.00	sq m
Haul and place soil cover	\$5.00	cu.m
Haul & Place rock cover	\$5.00	cu.m
Drill, Blast & Haul Rip Rap	\$10.00	cu.m
Place Riprap	\$10.00	cu.m
Camp Cost	\$100.00	per day per person

Table 6-3: Estimated Decommissioning Costs, Mine Workings Scenario 1

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
1.0	MINE WORKINGS						
1.1	JEWELBOX ZONE						
1.1.1	Jewelbox Zone - 1408 Portal						
	Plug portal with tires	Cat 235 Hoe	hrs	20	\$186	\$3,720	\$3,720
	Place waste rock cap over tires	Cat 235 Hoe	hrs	10	\$186	\$1,860	
		Cat 250E Truck	hrs	10	\$100	\$1,000	\$2,860
	Supply broken rock for drain at base of plug and discharge channel riprap	Cat 235 Hoe	hrs	10	\$186	\$1,860	
		Cat 250E Truck	hrs	20	\$100	\$2,000	\$3,860
	Construct rock drain at base of plug	Cat 235 Hoe	hrs	5	\$180	\$900	\$900
	Supply till to seal discharge channel	Cat 235 Hoe	hrs	4	\$186	\$744	
		Cat 250E Truck	hrs	4	\$100	\$400	\$1,144
	Construct lined open channel for discharge from portal	Cat 235 Hoe	hrs	15	\$186	\$2,790	
		Compactor	hrs	10	\$40	\$400	\$3,190
	Misc. Supplies & Shipping & Mod/Demob of Tire Installation Contractor					\$10,000	\$10,000
	Labour to assist with placing tires & cap	Labourer	hrs	40	\$40	\$1,600	\$1,600
	Supervision to design & install tires & cap	Supervision	hrs	40	\$80	\$3,200	\$3,200
	Sub-Total						\$30,474
1.1.2	Jewelbox Zone - 1250 Portal						
	Place waste rock cap in opening	Cat 235 Hoe	hrs	10	\$186	\$1,860	
		Cat 250E Truck	hrs	20	\$100	\$2,000	\$3,860
	Supervision of work	Supervision	hrs	10	\$80	\$800	\$800
	Sub-Total						\$4,660
1.1.3	Jewelbox Zone - Ventilation Raises						
	Construct Concrete cap over upper vent openings (both upper & lower)	Cat 235 Hoe	hrs	40	\$186	\$7,440	
		Labourer	hrs	40	\$50	\$2,000	
		Supplies	L.S			\$7,500	\$22,440
	Contour Slope around opening	Cat 235 Hoe	hrs	10	\$186	\$1,860	\$1,860
	Design and Site Supervision of Cap	Engineering	hrs	75	\$115	\$8,625	\$8,625
	Sub-Total						\$32,925
1.1.4	Jewelbox Zone - Open Pit						
	Drill and blast highwall	Drill Rig	hrs	20	\$186	\$3,720	
		Blaster	hrs	20	\$50	\$1,000	
		Helper	hrs	20	\$40	\$800	
		Supplies			\$2,500	\$2,500	
		Cat D9H Dozer	hrs	20	\$180	\$3,600	\$11,620
	Construct rock filled Spillway	Cat 235 Hoe	hrs	40	\$186	\$7,440	
		Drill Rig	hrs	20	\$186	\$3,720	
		Blaster	hrs	20	\$50	\$1,000	
		Labourer	hrs	20	\$40	\$800	
		Cat D9H Dozer	hrs	10	\$180	\$1,800	
		Cat 250E Truck	hrs	10	\$100	\$1,000	\$15,760
	Layout and Site Supervision of Spillway	Supervision	hrs	80	\$80	\$6,400	\$6,400
	Sub-Total						\$33,780
1.1.5	Jewelbox Zone - Waste Dumps						
	Reslope Upper Zone of Dump below Portal (1.3ha)	Cat D9H Dozer	hrs	30	\$180	\$5,400	\$5,400
	Reslope Jewelbox pit waste on ridge (1.9 ha)	Cat D9H Dozer	hrs	20	\$180	\$3,600	\$3,600
	Pull Back crest of waste dump and road cut below access road to Main Pit	Cat 235 Hoe	hrs	30	\$186	\$5,580	\$5,580
	Reslope Jewelbox pit waste dump above road (0.8ha)	Cat D9H Dozer	hrs	30	\$180	\$5,400	\$5,400
	Supervision	Supervision	hrs	55	\$80	\$4,400	\$4,400
	Sub-Total						\$24,380
1.2	MAIN ZONE						
1.2.1	Main Zone - 1380 Portal (see Main Zone Pit)						
1.2.2	Main Zone - Open Pit						
	Drill and blast highwall and cover Portal 1380	Drill Rig	hrs	20	\$186	\$3,720	
		Blaster	hrs	20	\$50	\$1,000	
		Labourer	hrs	20	\$40	\$800	
		Supplies			\$2,500	\$2,500	
		Cat D9H Dozer	hrs	20	\$180	\$3,600	\$11,620
	Sub-Total						\$11,620
1.2.3	Main Zone - Waste Dump						
	Pull Back crest of waste dump below pit (0.3ha)	Cat 235 Hoe	hrs	20	\$186	\$3,720	\$3,720
	Pull Back crest of waste dump below 1250 portal	Cat 235 Hoe	hrs	5	\$186	\$930	\$930
	Supervision	Supervision	hrs	12	\$80	\$960	\$960
	Sub-Total						\$5,610
1.3	BURNICK ZONE						
1.3.1	Burnick Zone - 1200 Portal						
	Plug portals with tires	Cat 235 Hoe	hrs	30	\$186	\$5,580	\$5,580
	Supply & Place waste rock cap over tires	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Cat 250E Truck	hrs	40	\$100	\$4,000	\$7,720
	Supply broken rock for drain at base of plug and discharge channel riprap	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Cat 250E Truck	hrs	40	\$100	\$4,000	\$7,720
	Construct rock drain at base of portal plugs	Cat 235 Hoe	hrs	10	\$186	\$1,860	\$1,860
	Supply till to line discharge channel	Cat 235 Hoe	hrs	10	\$186	\$1,860	
		Cat 250E Truck	hrs	20	\$100	\$2,000	\$3,860
	Construct lined open channel for discharge from portal	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Compactor	hrs	10	\$40	\$400	\$4,120
	Misc. Supplies (Mob/Demob of Contractor included in 1.1.7)					\$4,500	\$4,500
	Labour to assist with placing tires & cap	Labourer	hrs	80	\$40	\$3,200	\$3,200
	Design of rock drain and channel	Engineering	hrs	40	\$115	\$4,600	\$4,600
	Supervision installation of tire plug & rock drain	Supervision	hrs	50	\$80	\$4,000	\$4,000
	Sub-Total						\$47,160
1.3.2	Burnick Zone - 1300 Portal						
	Plug portals with tires	Cat 235 Hoe	hrs	30	\$186	\$5,580	\$5,580
	Supply & Place waste rock cap over tires	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Cat 250E Truck	hrs	40	\$100	\$4,000	\$7,720
	Misc. Supplies (Mob & Demob of Contractor included in 1.1.7)						
	Labour to assist with tire installation	Labourer	hrs	40	\$40	\$1,600	\$3,200
	Supervision to design & install tires & cap	Supervision	hrs	20	\$80	\$1,600	\$1,600
	Sub-Total						\$16,500
1.3.3	Burnick Zone - Open Pit						
	Does not exist in Senario 1					\$0	\$0
	Sub-Total						\$0
1.3.4	Burnick Zone - Waste Dump						
	Reslope Dump below Portal (1.4ha)	Cat D9H Dozer	hrs	50	\$180	\$9,000	\$9,000
	Supervision	Supervision	hrs	25	\$80	\$2,000	\$2,000
	Sub-Total						\$11,000
Total Estimated Cost in Reclaiming Mine Workings							\$218,109

Estimated Decommissioning Costs
Table 6-4: Mine Workings Scenario 2, Additional Costs

No.	Work Item Description	Labour	Units	Quantity	Cost	Cost	Cost
1.0	MINE WORKINGS						
1.1	JEWELBOX ZONE						
1.1.1	Jewelbox Zone - 1408 Portal						
	Plug portal with tires	Cat 235 Hoe	hrs	20	\$186	\$3,720	\$3,720
	Place waste rock cap over tires	Cat 235 Hoe	hrs	10	\$186	\$1,860	
		Cat 250E Truck	hrs	10	\$100	\$1,000	\$2,860
	Supply broken rock for drain at base of plug and discharge channel riprap	Cat 235 Hoe	hrs	10	\$186	\$1,860	
		Cat 250E Truck	hrs	20	\$100	\$2,000	\$3,860
	Construct rock drain at base of plug	Cat 235 Hoe	hrs	5	\$180	\$900	\$900
	Supply till to seal discharge channel	Cat 235 Hoe	hrs	4	\$186	\$744	
		Cat 250E Truck	hrs	4	\$100	\$400	\$1,144
	Construct lined open channel for discharge from portal	Cat 235 Hoe	hrs	15	\$186	\$2,790	
		Compactor	hrs	10	\$40	\$400	\$3,190
	Misc. Supplies & Shipping & Mod/Demob of Tire Installation Contractor	Misc.				\$10,000	\$10,000
	Labour to assist with placing tires & cap	Labourer	hrs	40	\$40	\$1,600	\$1,600
	Supervision to design & install tires & cap	Supervision	hrs	40	\$80	\$3,200	\$3,200
	Sub-Total						\$30,474
1.1.2	Jewelbox Zone - 1250 Portal						
	Place waste rock cap in opening	Cat 235 Hoe	hrs	10	\$186	\$1,860	
		Cat 250E Truck	hrs	20	\$100	\$2,000	\$3,860
	Supervision of work	Supervision	hrs.	10	\$80	\$800	\$800
	Sub-Total						\$4,660
1.1.3	Jewelbox Zone - Ventilation Raises						
	Construct Concrete cap over upper vent openings (both upper & lower)	Cat 235 Hoe	hrs	40	\$186	\$7,440	
		Labourer	hrs	40	\$50	\$2,000	
		Supplies	L.S			\$7,500	\$22,440
	Contour Slope around opening	Cat 235 Hoe	hrs	10	\$186	\$1,860	\$1,860
	Design and Site Supervision of Cap	Engineering	hrs	75	\$115	\$8,625	\$8,625
	Sub-Total						\$32,925
1.1.4	Jewelbox Zone - Open Pit						
	Drill and blast highwall	Drill Rig	hrs	20	\$186	\$3,720	
		Blaster	hrs	20	\$50	\$1,000	
		Helper	hrs	20	\$40	\$800	
		Supplies			\$2,500	\$2,500	
	Construct rock filled Spillway	Cat D9H Dozer	hrs	20	\$180	\$3,600	\$11,620
		Cat 235 Hoe	hrs	40	\$186	\$7,440	
		Drill Rig	hrs	20	\$186	\$3,720	
		Blaster	hrs	20	\$50	\$1,000	
		Labourer	hrs	20	\$40	\$800	
		Cat D9H Dozer	hrs	10	\$180	\$1,800	
		Cat 250E Truck	hrs	10	\$100	\$1,000	\$15,760
	Layout and Site Supervision of Spillway	Supervision	hrs	80	\$80	\$6,400	\$6,400
	Sub-Total						\$33,780
1.1.5	Jewelbox Zone - Waste Dumps						
	Reslope Upper Zone of Dump below Portal (1.3ha)	Cat D9H Dozer	hrs	60	\$180	\$10,800	\$10,800
	Reslope Jewelbox pit waste on ridge (1.9 ha)	Cat D9H Dozer	hrs	20	\$180	\$3,600	\$3,600
	Pull Back crest of waste dump and road cut below access road to Main Pit (0.5ha)	Cat 235 Hoe	hrs	30	\$186	\$5,580	\$5,580
	Reslope Jewelbox pit waste dump above road (0.8ha)	Cat D9H Dozer	hrs	30	\$180	\$5,400	\$5,400
	Supervision	Supervision	hrs	70	\$80	\$5,600	\$5,600
	Sub-Total						\$30,980
1.2	MAIN ZONE						
1.2.1	Main Zone - 1380 Portal (see Main Zone Pit)						
1.2.2	Main Zone - Open Pit						
	Drill and blast highwall and cover Portal 1380	Drill Rig	hrs	20	\$186	\$3,720	
		Blaster	hrs	20	\$50	\$1,000	
		Labourer	hrs	20	\$40	\$800	
		Supplies			\$2,500	\$2,500	
		Cat D9H Dozer	hrs	20	\$180	\$3,600	\$11,620
	Sub-Total						\$11,620
1.2.3	Main Zone - Waste Dump						
	Pull Back crest of waste dump below pit (0.3ha)	Cat 235 Hoe	hrs	20	\$186	\$3,720	\$3,720
	Pull Back crest of waste dump below 1250 portal	Cat 235 Hoe	hrs	5	\$186	\$930	\$930
	Supervision	Supervision	hrs	12	\$80	\$960	\$960
	Sub-Total						\$5,610
1.3	BURNICK ZONE						
1.3.1	Burnick Zone - 1200 Portal						
	Plug portals with tires	Cat 235 Hoe	hrs	30	\$186	\$5,580	\$5,580
	Supply & Place waste rock cap over tires	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Cat 250E Truck	hrs	40	\$100	\$4,000	\$7,720
	Supply broken rock for drain at base of plug and discharge channel riprap	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Cat 250E Truck	hrs	40	\$100	\$4,000	\$7,720
	Construct rock drain at base of portal plugs	Cat 235 Hoe	hrs	10	\$186	\$1,860	\$1,860
	Supply till to line discharge channel	Cat 235 Hoe	hrs	10	\$186	\$1,860	
		Cat 250E Truck	hrs	20	\$100	\$2,000	\$3,860
	Construct lined open channel for discharge from portal	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Compactor	hrs	10	\$40	\$400	\$4,120
	Misc. Supplies (Mob/Demob of Contractor included in 1.1.7)	Misc.				\$4,500	\$4,500
	Labour to assist with placing tires & cap	Labourer	hrs	80	\$40	\$3,200	\$3,200
	Design of rock drain and channel	Engineering	hrs	40	\$115	\$4,600	\$4,600
	Supervision installation of tire plug & rock drain	Supervision	hrs	50	\$80	\$4,000	\$4,000
	Sub-Total						\$47,160
1.3.2	Burnick Zone - 1300 Portal						
	Plug portals with tires	Cat 235 Hoe	hrs	30	\$186	\$5,580	\$5,580
	Supply & Place waste rock cap over tires	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Cat 250E Truck	hrs	40	\$100	\$4,000	\$7,720
	Misc. Supplies (Mob & Demob of Contractor included in 1.1.7)						
	Labour to assist with tire installation	Labourer	hrs	40	\$40	\$1,600	\$1,600
	Supervision to design & install tires & cap	Supervision	hrs	20	\$80	\$1,600	\$3,200
	Sub-Total						\$16,500
1.3.3	Burnick Zone - Open Pit						
	Drill and blast highwall and cover portals	Drill Rig	hrs	20	\$186	\$3,720	
		Blaster	hrs	20	\$50	\$1,000	
		Labourer	hrs	20	\$40	\$800	
		Supplies				\$2,500	
		Cat D9H Dozer	hrs	20	\$180	\$3,600	
		Supervisor	hrs	20	\$80	\$1,600	\$13,220
	Sub-Total						\$13,220
1.3.4	Burnick Zone - Waste Dump						
	Reslope Dump below Portal (1.4ha)	Cat D9H Dozer	hrs	50	\$180	\$9,000	\$9,000
	Supervision	Supervision	hrs	25	\$80	\$2,000	\$2,000
	Sub-Total						\$11,000
Total Estimated Cost in Reclaiming Mine Workings							\$237,929

Estimated Decommissioning Costs
Table 6-5: Tailings Management Facility, Scenario 1, Closure Costs

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
2.0	TAILINGS MANAGEMENT FACILITY - SENARIO 1						
2.1	South Dam						
2.1.1	Remove Existing Spillway	Cat 235 Hoe	hrs	10	\$186	\$1,860	
2.1.2	Breach Dam	Cat 250E Truck	hrs	20	\$100	\$2,000	\$3,860
2.1.3	Construct Spillway and Exit Channel	Unit Cost Basis	cu.m	16,300	\$3	\$48,900	\$48,900
	Excavate Channel	Unit Cost Basis	cu.m	4,125	\$3	\$12,375	
	Supply and Place Geotextile (Spillway and Channel)	Unit Cost Basis	sq.m	4,250	\$4	\$17,000	
	Supply and Place Riprap (Spillway and Channel)	Unit Cost Basis	cu.m	2,625	\$20	\$52,500	
	Design Spillway & Channel	Engineering	hrs	50	\$115	\$5,750	
	Site Supervision Spillway and channel	Supervision	hrs	60	\$80	\$4,800	\$92,425
	Sub-Total						\$145,185
2.2	Decant Tower						
2.2.1	Dismantle Decant Tower and Bury debris	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Hammer	hrs	20	\$40	\$800	\$4,520
2.2.2	Specifications/Design Plug for Decant Pipe	Man hours	hrs	24	\$115	\$2,760	\$2,760
2.2.3	Plug Decant Pipe	Labourer	hrs	80	\$40	\$3,200	
		Materials				\$5,000	\$8,200
2.2.4	Supervision	Supervision	hrs	40	\$80	\$3,200	\$3,200
	Sub-Total						\$18,680
2.3	Tailings Surface						
2.3.1	Recontour tailings surface (11ha)	Cat D9H Dozer	hrs	100	\$180	\$18,000	\$18,000
2.3.2	Remove Cofferdam and bury culvert	Cat D9H Dozer	hrs	16	\$180	\$2,880	\$2,880
2.3.3	Supervision	Supervision	hrs	50	\$80	\$4,000	\$4,000
	Sub-Total						\$24,880
2.4	Reclaim Dam						
2.4.1	Remove Existing Spillway and exit channel. Regrade	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Cat D9H Dozer	hrs	30	\$180	\$5,400	
		Cat 250E Truck	hrs	40	\$100	\$4,000	\$13,120
2.4.2	Breach Dam	Unit Cost Basis	cu.m	21,800	\$3	\$65,400	\$65,400
2.4.3	Construct Spillway and Exit Channel						
	Supply and Place Geotextile (Spillway and Channel)	Unit Cost Basis	sq.m	1,700	\$4	\$6,800	
	Supply and Place Riprap (Spillway and Channel)	Unit Cost Basis	cu.m	1,050	\$20	\$21,000	
	Design of Spillway and Channel	Engineering	hrs	50	\$115	\$5,750	
	Site Supervision of Spillway and channel	Supervision	hrs	60	\$80	\$4,800	\$38,350
	Sub-Total						\$116,870
2.5	Camp Creek Diversion and restoration						
2.5.1	Breach existing diversion, remove culverts, regrade	Cat 235 Hoe	hrs	40	\$186	\$7,440	
		Cat D9H Dozer	hrs	30	\$180	\$5,400	
		Cat 250E Truck	hrs	20	\$100	\$2,000	\$14,840
2.5.2	Realign Camp Creek and riprap						
	Excavate Channel	Unit Cost Basis	cu.m	9,250	\$3	\$27,750	
	Supply and Place Geotextile (Spillway and Channel)	Unit Cost Basis	sq.m	6,290	\$4	\$25,160	
	Supply and Place Riprap (Spillway and Channel)	Unit Cost Basis	cu.m	3,885	\$20	\$77,700	
	Design of Channel Realignment	Engineering	hrs	40	\$115	\$4,600	
	Site Supervision of channel realignment	Supervision	hrs	60	\$80	\$4,800	\$140,010
	Sub-Total						\$154,850
2.6	Interceptor Ditches						
2.6.1	Breach ditches and recontour	Cat D9H Dozer	hrs	30	\$180	\$5,400	\$5,400
	Sub-Total						\$5,400
2.7	Tailings pipeline (1.9km)						
2.7.1	Remove Pipeline	Cat 235 Hoe	hrs	50	\$186	\$9,300	
		Cat 250E Truck	hrs	50	\$100	\$5,000	
		Labour	hrs	100	\$40	\$4,000	\$18,300
	Sub-Total						\$18,300
2.8	Reclaim pipeline (0.8km)						
2.8.1	Remove Pipeline	Cat 235 Hoe	hrs	20	\$186	\$3,720	
		Cat 250E Truck	hrs	20	\$100	\$2,000	
		Labour	hrs	40	\$40	\$1,600	\$7,320
	Sub-Total						\$7,320
Total Estimated Cost in Reclaiming TMF (Scenario 1)							\$491,485

Estimated Decommissioning Costs
Table 6-6: Tailings Management Facility Scenario 2, Closure Costs

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
2.0	TAILINGS MANAGEMENT FACILITY - SENARIO 2						
2.1	South Dam						
2.1.1	Remove Existing Spillway	Cat 235 Hoe	hrs	10	\$186	\$1,860	\$3,860
		Cat 250E Tr	hrs	20	\$100	\$2,000	
2.1.2	Construct Spillway and Exit and Entrance Channels						\$102,330
	Excavate Channel		cu.m	6,500	\$3	\$19,500	
	Supply and Place Geotextile (Spillway and Channel)		sq.m	4,420	\$4	\$17,680	
	Supply and Place Riprap (Spillway and Channel)		cu.m	2,730	\$20	\$54,600	
	Design Spillway and Channel	Engineering	hrs	50	\$115	\$5,750	
	Site Supervision for Spillway and channel	Supervisor	hrs	60	\$80	\$4,800	
2.1.3	Plunge Pool						
	Excavate Channel		cu.m	350	\$3	\$1,050	
	Supply and Place Geotextile (Spillway and Channel)		sq.m	300	\$4	\$1,200	
	Supply and Place Riprap (Spillway and Channel)		cu.m	206	\$20	\$4,120	
	Design Pluge Pool & Channel	Engineering	hrs	32	\$115	\$3,680	
	Design and Site Supervision for Spillway and channel	Supervisor	hrs	80	\$80	\$6,400	\$16,450
	Sub-Total						\$122,640
2.2	Decant Tower						
2.2.1	Backfill Decant Tower and break up exposed section	Cat 235 Hoe	hrs	20	\$186	\$3,720	\$4,520
		Hammer	hrs	20	\$800	\$16,000	
2.2.2	Specifications/Design Plug for Decant Pipe	Engineering	hrs	24	\$115	\$2,760	\$2,760
2.2.3	Plug Decant Pipe	Labourer	hrs	80	\$40	\$3,200	\$8,200
		Material				\$5,000	
2.2.4	Supervision	Supervisor	hrs	40	\$80	\$3,200	\$3,200
	Sub-Total						\$18,680
2.3	Tailings Surface						
2.3.1	Recontour tailings surface (11.8 ha)	Cat D9H Doz	hrs	200	\$180	\$36,000	\$36,000
2.3.2	Remove Cofferdam and bury culvert	Cat D9H Doz	hrs	5	\$180	\$900	\$900
2.3.3	Supervision	Supervisor	hrs	100	\$80	\$8,000	\$8,000
	Sub-Total						\$44,900
2.4	Reclaim Dam						
2.4.1	Remove Existing Spillway and exit channel. Regrade	Cat 235 Hoe	hrs	20	\$186	\$3,720	\$13,120
		Cat D9H Doz	hrs	30	\$180	\$5,400	
		Cat 250E Tr	hrs	40	\$100	\$4,000	
2.4.2	Breach Dam		cu.m	21,800	\$3	\$65,400	\$65,400
2.4.3	Construct Spillway and Exit Channel						\$38,350
	Supply and Place Geotextile (Spillway and Channel)		sq.m	1,700	\$4	\$6,800	
	Supply and Place Riprap (Spillway and Channel)		cu.m	1,050	\$20	\$21,000	
	Design of Spillway and channel	Engineering	hrs	50	\$115	\$5,750	
	Site Supervision of Spillway and channel	Supervisor	hrs	60	\$80	\$4,800	
	Sub-Total						\$116,870
2.5	Camp Creek Diversion and restoration						
2.5.1	Breach existing diversion, remove culverts, regrade	Cat 235 Hoe	hrs	40	\$186	\$7,440	\$14,840
		Cat D9H Doz	hrs	30	\$180	\$5,400	
		Cat 250E Tr	hrs	20	\$100	\$2,000	
2.5.2	Realign Camp Creek and riprap						\$234,300
	Excavate Channel		cu.m	15,900	\$3	\$47,700	
	Supply and Place Geotextile (Spillway and Channel)		sq.m	10,800	\$4	\$43,200	
	Supply and Place Riprap (Spillway and Channel)		cu.m	6,700	\$20	\$134,000	
	Design of Spillway and channel	Engineering	hrs	40	\$115	\$4,600	
	Design and Site Supervision of channel	Supervisor	hrs	60	\$80	\$4,800	
	Sub-Total						\$249,140
2.6	Interceptor Ditches						
2.6.1	Breach ditches and recontour	Cat D9H Doz	hrs	30	\$180	\$5,400	\$5,400
	Sub-Total						\$5,400
2.7	Tailings pipeline (1.9km)						
2.7.1	Remove Pipeline	Cat 235 Hoe	hrs	50	\$186	\$9,300	\$18,300
		Cat 250E Tr	hrs	50	\$100	\$5,000	
		Labour	hrs	100	\$40	\$4,000	
	Sub-Total						\$18,300
2.8	Reclaim pipeline (0.8km)						
2.8.1	Remove Pipeline	Cat 235 Hoe	hrs	20	\$186	\$3,720	\$7,320
		Cat 250E Tr	hrs	20	\$100	\$2,000	
		Labour	hrs	40	\$40	\$1,600	
	Sub-Total						\$7,320
Total Estimated Cost in Reclaiming TMF (Scenario 2)							\$583,250

Estimated Decommissioning Costs
Table 6-7 Infrastructure: Buildings, Structures and Services Scenario 1 & 2

Item No.	Work Item Description	Equipment/Labour	Units	Quantity	Unit Cost	Cost	Total Cost
3.0	INFRASTRUCTURE: BUILDINGS, STRUCTURES AND SERVICES						
3.1	Concentrator Buildings (incl. Whse, crusher building, load out)						
	Remove salvageable equipment	General Labour	hrs	704	\$40	\$28,160	
		Trades Labour	hrs	880	\$55	\$48,400	
	Dismantle Building - Manpower	General Labour	hrs	1200	\$40	\$48,000	
	Dismantle Building - Manpower	Trades Labour	hrs	720	\$55	\$39,600	
	Dismantle Building - Equipment	Cat 235	hrs	120	\$186	\$22,320	
	Concrete Demolition	Cat 235	hrs	80	\$186	\$14,880	
		Hammer	hrs	80	\$40	\$3,200	
	Reslope, contour & bury	Cat D9H	hrs	48	\$180	\$8,640	
	Misc. Supplies & Tools	Misc.	l.s.			\$10,000	
	Scrap haul to landfill	Truck D250E	hrs	240	\$100	\$24,000	
	Subtotal:						\$247,200
3.2	Power House and Power Lines						
	Remove salvageable equipment	General Labour	hrs	240	\$40	\$9,600	
		Trades Labour	hrs	240	\$55	\$13,200	
	Salvage and remove powerline and poles		l.s.			\$25,000	
	Dismantle Building - Manpower	General Labour	hrs	160	\$40	\$6,400	
		Trades Labour	hrs	80	\$55	\$4,400	
	Dismantle Building - Equipment	Cat 235	hrs	40	\$186	\$7,440	
	Concrete Demolition	Cat 235	hrs	40	\$186	\$7,440	
	Reslope, contour & bury	Cat D9H	hrs	24	\$180	\$4,320	
	Misc. Supplies & Tools	Misc.	l.s.			\$1,500	
	Scrap haul to landfill	Truck D250E	hrs	40	\$100	\$4,000	
	Subtotal:						\$83,300
3.3	Water Supply						
	Remove salvageable equipment - pipeline/pump	General Labour	hrs	48	\$40	\$1,920	
		Trades Labour	hrs	98	\$55	\$5,390	
	Remove pipeline	Truck D250E	hrs	100	\$100	\$10,000	
		Cat 235	hrs	100	\$186	\$18,600	
		General Labour	hrs	200	\$40	\$8,000	
	Dismantle Building - Manpower	General Labour	hrs	20	\$40	\$800	
	Dismantle Building - Equipment	Cat 235	hrs	16	\$186	\$2,976	
	Misc. Supplies & Tools	Misc.	l.s.			\$500	
	Reslope, contour & bury	Cat D9H	hrs	16	\$180	\$2,880	
	Subtotal:						\$51,066
3.4	North Creek Dyke						
	Excavate channel	Unit Cost Basis	cu.m	1600	\$3	\$4,800	
	remove culverts	Misc.	l.s.			\$4,000	
	supply rip rap	Unit Cost Basis	cu.m	20	\$10	\$200	
	Subtotal:						\$9,000
3.5	Service Garage						
	Dismantle Building - Manpower	General Labour	hrs	48	\$40	\$1,920	
		Trades Labour	hrs	24	\$55	\$1,320	
	Dismantle Building - Equipment	Cat 235	hrs	10	\$186	\$1,860	
	Concrete Demolition	Cat 235	hrs	10	\$186	\$1,860	
	Reslope, contour & bury	Cat D9H	hrs	8	\$180	\$1,440	
	Misc. Supplies & Tools	Misc.	l.s.			\$500	
	Scrap haul to landfill	Truck D250E	hrs	8	\$100	\$800	
	Subtotal:						\$9,700
3.6	Accommodation/Camp Trailers Buildings/Office						
	Remove salvageable equipment	General Labour	hrs	140	\$40	\$5,600	
		Trades Labour	hrs	48	\$55	\$2,640	
	Dismantle Buildings - Manpower	General Labour	hrs	380	\$40	\$15,200	
		Trades Labour	hrs	32	\$55	\$1,760	
	Dismantle Building - Equipment	Cat 235	hrs	20	\$186	\$3,720	
	Remove septic tanks & clean line	Labour	hrs	24	\$40	\$960	
	Reslope, contour & bury	Cat D9H	hrs	48	\$180	\$8,640	
	Misc. Supplies & Tools	Misc.	l.s.			\$750	
	Scrap haul to landfill	Truck D250E	hrs	20	\$100	\$2,000	
	Subtotal:						\$41,270
3.7	Explosive Magazine						
	remove from site	Misc.	l.s.			\$2,500	
	Subtotal:						\$2,500
3.8	Miscellaneous Buildings & Structures						
	Remove salvageable equipment	General Labour	hrs	280	\$40	\$11,200	
		Trades Labour	hrs	280	\$55	\$15,400	
	Remove salvageable equipment	Hiab truck	hrs	280	\$30	\$8,400	
	Remove salvageable equipment	Cat 950 loader	hrs	280	\$75	\$21,000	
	Dismantle Building - Manpower	General Labour	hrs	280	\$40	\$11,200	
		Trades Labour	hrs	140	\$55	\$7,700	
	Dismantle Building - Equipment	Cat 235	hrs	40	\$186	\$7,440	
	Concrete Demolition	Cat 235	hrs	40	\$0	\$0	
	Reslope, contour & bury	Cat D9H	hrs	80	\$180	\$14,400	
	Misc. Supplies & Tools	Misc.	l.s.			\$2,500	
	Scrap haul to landfill	Truck D250E	hrs	40	\$100	\$4,000	
	Subtotal:						\$103,240
3.9	Industrial Reagents, Fuels & Waste						
	Industrial Reagents	Misc.	l.s.			\$15,000	
	Fuels	Misc.	l.s.			\$10,000	
	Wastes	Misc.	l.s.			\$10,000	
	Subtotal:						\$35,000
3.10	Spill Clean						
	Concentrator haul out	lump sum	l.s.			\$75,000	
	Other Building/Site spill clean up	lump sum	l.s.			\$75,000	
	Subtotal:						\$150,000
3.11	Demolition Overheads						
	Supervision	Supervision	hrs	1000	\$80	\$80,000	
	Mod/Demob	Misc.	l.s.			\$20,000	
	Office/Admin Costs	Misc.	L.S.			\$5,000	
	Subtotal:						\$105,000
Total Estimated Cost in Infrastructure: Buildings, Structures and Services							\$837,276

Estimated Decommissioning Costs
Table 6-8 Land Reclamation & Revegetation - Scenario 1

Item No.	Work Item Description	Equipment/Labour	Units	Quantity	Unit Cost	Cost	Total Cost
4.0	LAND RECLAMATION & REVEGETATION						
4.1	Roads and Trails						
4.1.1	Exploration Trails						
	stabilize slopes - erosion barriers	Unit Cost Bas	per linear k	4	\$1,000	\$4,000	
	revegetate - seed	Unit Cost Bas	per kg	45.6	\$8.57	\$391	
	revegetate - fertilizer	Unit Cost Bas	per kg	420	\$0.80	\$336	
	application labour	General Labo	hrs	10	\$40.00	\$400	
	Subtotal:						\$5,127
4.1.2	Main Access Road						
	road barrier	Misc.	I.s.			\$3,000	
	culvert excavation	Cat 235	hrs	500	\$186	\$93,000	
	culvert removal	haul truck	hrs	500	\$65	\$32,500	
	scarify	Cat 16H grad	hrs	200	\$108	\$21,600	
	recontour slopes	D9H Dozer	hrs	200	\$180	\$36,000	
	stabilize slopes - erosion barriers	Unit Cost Bas	per linear k	5	\$1,000	\$5,000	
	revegetate - seed	Unit Cost Bas	per kg	2405	\$8.57	\$20,611	
	revegetate - fertilizer	Unit Cost Bas	per kg	14300	\$0.80	\$11,440	
	application cost	Unit Cost Bas	ha	65	\$1,325	\$86,125	
	seedlings	Unit Cost Bas	per ha	2	\$1,250	\$2,500	
	Subtotal:						\$311,776
4.1.3	Service and Haul Roads within the Minesite						
	road barrier	Misc.	I.s.			\$3,000	
	culvert excavation	Cat 235	hrs	200	\$186	\$37,200	
	culvert removal	haul truck	hrs	200	\$65	\$13,000	
	scarify	Cat 16H grad	hrs	48	\$108	\$5,184	
	recontour slopes	D9H Dozer	hrs	60	\$180	\$10,800	
	stabilize slopes - erosion barriers	Unit Cost Bas	per linear k	3.5	\$1,000	\$3,500	
	revegetate - seed	Unit Cost Bas	per kg	608	\$8.57	\$5,211	
	revegetate - fertilizer	Unit Cost Bas	per kg	5600	\$0.80	\$4,480	
	application cost	Unit Cost Bas	ha	16	\$1,325	\$21,200	
	Subtotal:						\$103,575
4.2	Non-Linear Developments						
4.2.1	Tailings Management Facility						
	Cover installation - rock fill for base in wet areas (25% of 11.8 ha, 1 m depth)	Unit Cost Bas	cu.m	29,500	\$5	\$147,500	
	Cover installation - haul soil and spread (300 mm depth over entire area)	Unit Cost Bas	cu.m	35400	\$5	\$177,000	
	revegetate - seed	Unit Cost Bas	per kg	389.4	\$8.57	\$3,337	
	revegetate - fertilizer	Unit Cost Bas	per kg	4130	\$0.80	\$3,304	
	application cost	Unit Cost Bas	ha	11.8	\$1,325	\$15,635	
	Subtotal:						\$346,776
4.2.2	Reclaim Pond						
	pond clean up	Misc.	I.s.			\$10,000	
	Cover installation - rock fill for base in wet areas (25% of 4 ha, 1 m depth)			10000	\$5	\$50,000	
	Cover installation - haul soil and spread (300mm cover on rock cover area)			3000	\$5	\$15,000	
	revegetate - seed	Unit Cost Bas	per kg	66	\$8.57	\$566	
	revegetate - fertilizer	Unit Cost Bas	per kg	700	\$0.80	\$560	
	application cost	Unit Cost Bas	ha	4	\$1,325	\$5,300	
	Subtotal:						\$81,426
4.2.3	Waste Dumps						
	Burnick waste rock - seedlings	Unit Cost Bas	per ha	0.3	\$1,250	\$375	
	application labour	General Labo	man hours	16	\$40	\$640	
	Subtotal:						\$1,015
4.2.4	Sediment Ponds						
	Jewel Box sediment pond - recontour and slope	Cat 235	hrs	12	\$186	\$2,232	
	Main Zone sediment pond - recontour and slope	Cat 235	hrs	6	\$186	\$1,116	
	Sediment Pond solids haul	Truck D250E	hrs	20	\$100	\$2,000	
	Burnick sediment pond - recontour and slope	Cat 235	hrs	10	\$186	\$1,860	
	Burnick sediment revegetate - seed	Unit Cost Bas	per kg	6.6	\$8.57	\$57	
	Burnick sediment revegetate - fertilizer	Unit Cost Bas	per kg	70	\$0.80	\$56	
	application labour	General Labo	man hours	40	\$40	\$1,600	
	Subtotal:						\$8,921
4.2.5	Disturbed Sites (incl. Mill), Refuse Areas and Borrow Pits						
	recontour refuse area	D9H Dozer	hrs	50	\$180	\$9,000	
	bury refuse areas	D9H Dozer	hrs	50	\$180	\$9,000	
	revegetate - seed	Unit Cost Bas	per kg	231	\$8.57	\$1,980	
	revegetate - fertilizer	Unit Cost Bas	per kg	2450	\$0.80	\$1,960	
	application cost	Unit Cost Bas	ha	7	\$1,325	\$9,275	
	Subtotal:						\$31,215
Total Estimated Cost in Land Reclamation and Revegetation							\$929,964

Estimated Decommissioning Costs
Table 6-9 Land Reclamation & Revegetation - Scenario 2

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
4.0	LAND RECLAMATION & REVEGETATION						
4.1	Roads and Trails						
4.1.1	Exploration Trails stabilize slopes - erosion barriers revegetate - seed revegetate - fertilizer application labour	unit rate basis unit rate basis unit rate basis general labour	per lineal per kg per kg man hour	4 45.6 420 10	\$1,000 \$8.57 \$0.80 \$40.00	\$4,000 \$391 \$336 \$400	
	Subtotal:						\$5,127
4.1.2	Main Access Road road barrier culvert excavation culvert removal scarify recontour slopes stabilize slopes - erosion barriers revegetate - seed revegetate - fertilizer application cost seedlings	misc. Cat 235 haul truck Cat 16H grad D9H Dozer unit rate basis unit rate basis unit rate basis unit rate basis unit rate basis	l.s. hrs hrs hrs hrs per lineal per kg per kg ha per ha	 500 500 200 200 5 2405 14300 65 2	 \$186 \$65 \$108 \$180 \$1,000 \$8.57 \$0.80 \$1,325 \$1,250	\$3,000 \$93,000 \$32,500 \$21,600 \$36,000 \$5,000 \$20,611 \$11,440 \$86,125 \$2,500	
	Subtotal:						\$311,776
4.1.3	Service and Haul Roads within the Minesite road barrier culvert excavation culvert removal scarify recontour slopes stabilize slopes - erosion barriers revegetate - seed revegetate - fertilizer application cost	misc. Cat 235 haul truck Cat 16H grad D9H Dozer unit rate basis unit rate basis unit rate basis unit rate basis	l.s. hrs hrs hrs hrs per lineal per kg per kg ha	 200 200 48 60 3.5 608 5600 16	 \$186 \$65 \$108 \$180 \$1,000 \$8.57 \$0.80 \$1,325	\$3,000 \$37,200 \$13,000 \$5,184 \$10,800 \$3,500 \$5,211 \$4,480 \$21,200	
	Subtotal:						\$103,575
4.2	Non-Linear Developments						
4.2.1	Tailings Management Facility Cover installation - rock fill for base in wet areas (1 m depth for 25% of 4 ha) Cover installation - haul soil and spread (300 mm depth for 22 ha) revegetate - seed revegetate - fertilizer application cost	unit rate basis unit rate basis unit rate basis unit rate basis unit rate basis	cu.m cu.m per kg per kg ha	55000 66000 726 7700 22	\$5 \$5 \$8.57 \$0.80 \$1,325	\$275,000 \$330,000 \$6,222 \$6,160 \$29,150	
	Subtotal:						\$646,532
4.2.2	Reclaim Pond pond clean up Rock fill for soft areas (1 m depth for 25% of 4 ha) Cover installation (on rock filled areas) - haul soil and spread revegetate - seed revegetate - fertilizer application cost	misc. unit rate basis unit rate basis unit rate basis unit rate basis unit rate basis	l.s. cu.m cu.m per kg per kg ha	 10000 3000 66 700 4	 \$5 \$5 \$8.57 \$0.80 \$1,325	\$60,000 \$50,000 \$15,000 \$566 \$560 \$5,300	
	Subtotal:						\$131,426
4.2.3	Waste Dumps Burnick waste rock - seedlings application labour	unit rate basis general labour	per ha man hour	0.3 16	\$1,250 \$40.00	\$375 \$640	
	Subtotal:						\$1,015
4.2.4	Sediment Ponds Jewel Box sediment pond - recontour and slope Main Zone sediment pond - recontour and slope Sediment Pond solids haul Burnick sediment pond - recontour and slope Burnick sediment revegetate - seed Burnick sediment revegetate - fertilizer application labour	Cat 235 Cat 235 Truck D250E Cat 235 unit rate basis unit rate basis general labour	hrs hrs hrs hrs per kg per kg man hour	12 6 20 10 6.6 70 40	\$186 \$186 \$100 \$186 \$8.57 \$0.80 \$40.00	\$2,232 \$1,116 \$2,000 \$1,860 \$57 \$56 \$1,600	
	Subtotal:						\$8,921
4.2.5	Disturbed Sites, Refuse Areas and Borrow Pits recontour refuse area bury refuse areas revegetate - seed revegetate - fertilizer application cost	D9H Dozer D9H Dozer unit rate basis unit rate basis unit rate basis	hrs hrs per kg per kg ha	50 50 231 2450 7	\$180 \$180 \$8.57 \$0.80 \$1,325	\$9,000 \$9,000 \$1,980 \$1,960 \$9,275	
	Subtotal:						\$31,215
Total Estimated Cost in Land Reclamation and Revegetation							\$1,279,720

Estimated Decommissioning Costs
Table 6-10 Post Closure Site Management

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
5.0	POST CLOSURE SITE MANAGEMENT						
5.1	Organization, Site Access & Security, Overhead Costs						
	Pre-Closure Planning/Organizing	Managemen	monthly	2	\$8,800	\$17,600	
	Project Manager	Managemen	monthly	21	\$8,800	\$184,800	
	Camp Cost	Labour	monthly	4500	\$100	\$450,000	
	Site Security, Routine Water Sampling Till end to Year 3 of P	Labour	monthly	30	\$5,500	\$165,000	
	Pre-Closure Site Environmental Assessment	Contract	l.s.	1		\$75,000	
	Post-Closure Environmental Cleanup Confirmation Assessm	Contract	ls	1		\$50,000	
	Main Access Road Maintenance	Misc.	per year	3	\$50,000	\$150,000	
	Vehicles for Security & Manager	Light trucks	months	51	\$2,000	\$102,000	
	Misc. Office/Supply/Misc. Costs	Misc.	per year	3	\$15,000	\$45,000	
	Subtotal:						\$1,221,800
5.2	Supervision and Documentation of Work						
	Site environmental monitoring, reporting, documentation	Man hours	monthly	15	\$4,500	\$67,500	
	Document Reviews/Storage	Misc.	ls	1		\$5,000	
	Final as built plan	Man hours	hrs	120	\$115	\$13,800	
	Subtotal:						\$86,300
5.3	Compliance Monitoring and Reporting						
	Water Quality Monitoring - During Closure implementation -	Misc.	l.s.			\$59,000	
	Water Quality Monitoring - During Closure implementation -	Misc.	l.s.			\$16,800	
	Water Quality Monitoring - Post Closure - Analytical/Collectio	Misc.	l.s.			\$69,600	
	Water Quality Monitoring - Post Closure - Heli/Travel	Misc.	l.s.			\$70,800	
	Geotechnical Inspection - During Closure implementation	Misc.	years	3	\$12,000	\$36,000	
	Geotechnical Inspection - Post closure	Misc.	years	5	\$12,000	\$60,000	
	Biological Monitoring - Professional fees - Closure implemen	Misc.	per event	1	\$10,000	\$10,000	
	Biological Monitoring - Helicopter & Lab Analysis - implemen	Misc.	per event	1	\$5,500	\$5,500	
	Biological Monitoring - Professional fees - Post closure	Misc.	per event	3	\$10,000	\$30,000	
	Biological Monitoring - Helicopter & Lab Analysis - Post clos	Misc.	per event	3	\$5,500	\$16,500	
	Subtotal:						\$374,200
5.4	Post Closure Maintenance						
	Misc. Maintenance work related to the site after closure	Misc.	per year	5	\$5,000	\$25,000	
	Subtotal:						\$25,000
Total Estimated Cost in Post Closure Site Management							\$1,707,300

7.0 FINANCIAL SECURITY

7.1 WATER LICENCE REQUIREMENTS

This section has been updated.
Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

The financial security called for in Water Licence QZ97-025 is set out in Part B – Security, as follows:

“14. The Licensee shall provide security in the total amount of four million and fifteen thousand dollars. (\$4,015,000.)

15. The schedule for payment of security shall be as follows:

- (a) \$3,725,000 within thirty (30) days of the effective date of this licence,*
- (b) \$290,000 within one year of the commencement of commercial production.*

16. For clarity, if there is no commencement of commercial production under this licence, then the total amount of security shall be \$3,725,000.”

As part of developing the costing section for this plan, Cominco reviewed the basis for the security called for as set out above. It is our understanding that the licence security requirements were based upon DIAND's intervention to the Water Board Public Hearing (November, 1997), which in turn was based upon a detailed closure costing review prepared by Mr. Robert Rodger in October, 1997.

As discussed in Section 6, detailed cost estimates were prepared for each mine component based on whether or not the mine reopened. Closure costs for the present mine site (Scenario 1) are estimated at \$4,811,755.00 (Table 6-1). With eventual mine reopening (Scenario 2), closure costs are estimated at \$5,342,296.00.

The closure cost estimate for the Sä Dena Hes mine as prepared by Mr. R. Rodger was \$3,434,000.00 (R. Rodger, October 1997, Table 2.1).

7.2 UPDATED FINANCIAL SECURITY

Cominco recognizes that based on its estimates that the bonding currently in place does not meet the revised estimates presented in this report. Cominco will be proposing the bonding requirements should be increased to the revised estimates when Cominco applies to renew its current water licence that expires on September 30, 2000.

7.3 RETURN OF FINANCIAL SECURITY

This section has been updated.
Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

Although it is recognized that no mechanism exists for formal review and return of security in accordance with completion of specific components of the plan, the scheduling and costing has been prepared in such a manner as to facilitate this approach to the return of security. The plan also contemplates the completion of certain components as mining progresses (such as reclamation of Jewelbox area when mining shifts to the Burnick zone). It would therefore be reasonable to expect the return of that portion of security identified for that work once it is judged to be complete.

It is Cominco's intention to enter into discussions with the Department of Indian Affairs and Northern Development and the Yukon Territory Water Board about the above-mentioned approach in the near future.

8.0 REFERENCES

This section has been updated.

Please see Appendix D–2006 Updates to Detailed Decommissioning & Reclamation Plan.

Table 1-1, in Section 1, provides a complete list of documents and reports that were reviewed in preparation of this plan. The following references were particularly useful.

Canadian Council of Ministers of the Environment, (CCME), 1999. “CCME Canadian Water Quality Guidelines”.

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Craig, D.B., Craig, J.E., Pelletier, K., Emond, D. and Copland, H., 1998. “Reclamation Practices and Research on Mineral Exploration Properties in the Yukon Territory”. Mineral Resources Directorate, Yukon Region, Indian & Northern Affairs Canada, 36 p.

Curragh Resources, March 1992 (Revised Edition). “Sä Dena Hes Mine – Spill Contingency Plan”.

Curragh Resources Ltd. – Mt. Hundere Joint Venture, 1992. “*Sä Dena Hes Joint Venture, 1991 Annual Report to the Yukon Territory Water Board. Licence IN90-002*”.

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INAC, 1992. *Mine Reclamation in Northwest Territories and Yukon*. Northern Water Resources Studies, Indian and Northern Affairs Canada.

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Rodger, R., 1997. “*DIAND Closure Costing Estimates*”. Attachment 1 to *Intervention to the Yukon Territory Water Board, Water Licence Application QZ97-025. Sä Dena Hes Operating Corporation, Amendment to Licence IN90-002, Sä Dena Hes Mine*, November 7, 1997.



**TECK COMINCO LTD.
SÄ DENA HES MINE**

**DETAILED DECOMMISSIONING & RECLAMATION PLAN
JANUARY 2006 UPDATE**

VOLUME II - TECHNICAL APPENDICES

Prepared by:





COMINCO LTD.

SÄ DENA HES MINE

DETAILED DECOMMISSIONING & RECLAMATION PLAN

APPENDIX A – COMINCO CORPORATE ENVIRONMENTAL POLICY

FEBRUARY 2000

Prepared by:



Cominco & The Environment

Cominco supports the principle of environmentally and socially responsible development. The company recognizes that this is important to employees, shareholders and the communities and countries in which it operates. The principle is also vital to future success as a company. While the minerals extracted and metals produced are essential to the daily needs of an advancing world, the wider implications of business activities must be fully considered. In all jurisdictions in which Cominco operates, the company is committed to advancing environmental protection and providing safe working conditions for employees. All aspects of the business, from exploration to mining and refining, are conducted with appropriate environmental care, respecting the local laws and applying the high standards established at the company's operations in North America.

Environmental Policy

Cominco recognizes that maintaining a healthy environment goes hand-in-hand with a strong economy. We understand that in order to prosper over the long-term, we must incorporate environmental considerations into all aspects of our business dealings. This policy is adopted to guide all Cominco employees in the daily performance of their jobs.

1. Cominco will explore, develop, and process resources and market products in an environmentally sound manner.
2. Cominco will provide information to counsel customers, transporters, and others in the safe and proper handling of our products.
3. Appropriate environmental care will be exercised in the planning, development, operating, and closure phases of Cominco operations in all jurisdictions. Environmental protection measures appropriate to site specific conditions will be applied in the absence of regulation.
4. Cominco will promote the development of open and constructive partnerships with the public to address environmental concerns and advance necessary protection measures.
5. Cominco will promote the advancement of scientific knowledge to be applied to the identification and effective resolution of real environmental problems.
6. Cominco will encourage pollution prevention, waste minimization, and recycling efforts throughout its worldwide operations.
7. Observance of environmental legislation will be a priority in all company activities.
8. Cominco will conduct audits of operations to ensure adherence to this policy.



COMINCO LTD.

SÄ DENA HES MINE

DETAILED DECOMMISSIONING & RECLAMATION PLAN

APPENDIX B
ENVIRONMENTAL BASELINE UPDATE AND TECHNICAL BASIS
FOR CLOSURE ASSUMPTIONS

FEBRUARY 2000

***THIS APPENDIX HAS BEEN UPDATED
PLEASE SEE APPENDIX "D" FOR DETAILS***

Prepared by:



Laberge Environmental Services

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INTRODUCTION

This report, prepared in support of the Decommissioning & Reclamation Plan, presents a summary of the environmental conditions at the Să Dena Hes mine site. Data from the initial environmental baseline surveys, and results from ongoing environmental monitoring programs, have been incorporated to provide an update on the current environmental conditions.

Key findings or pertinent information is summarized with references made to the individual reports where the data was originally presented. The reader is referred to those reports for a complete discussion.

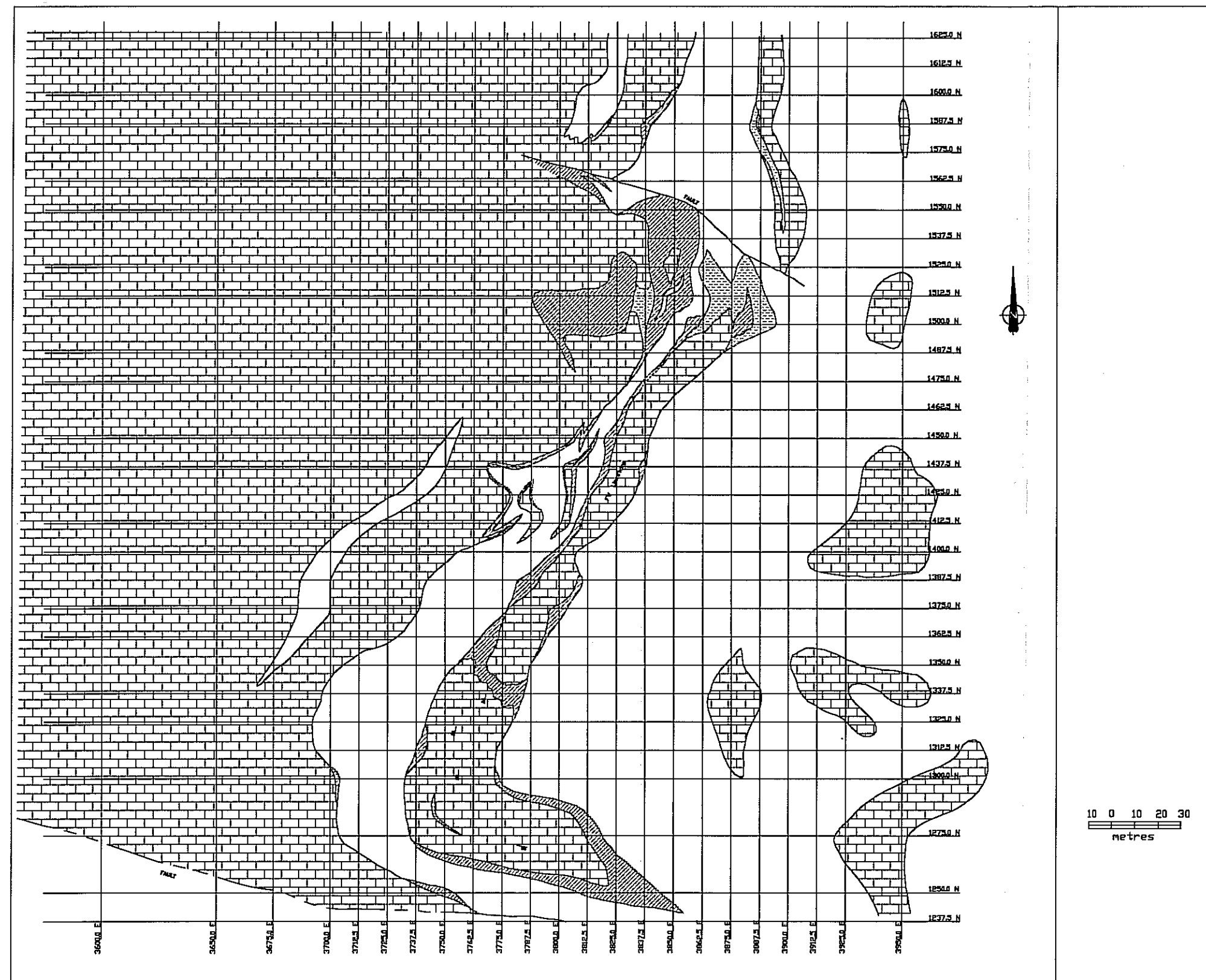
1.0 GEOLOGY AND ORE RESERVES

The following discussion is generally from the Să Dena Hes Reopening Study, November 1995.

1.1 GEOLOGY

The Să Dena Hes Property is underlain chiefly by lower Palaeozoic metasedimentary rocks, including both calcareous and non-calcareous pelitic phyllite and limestone. (Refer to Figure 1-1 “Typical Geology, Jewelbox Deposit”, and Figure 1-2 “Typical Geological Section, Burnick Deposit”, for a depiction of the typical geometry of the ore deposits and the associated rock types). Limestone comprises about five percent of the stratigraphic sequence and consists of discontinuous units which are up to 100 metres thick, and which typically pinch and swell over short distances. The thicker limestone units can be traced along strike for hundreds of metres. There is evidence locally that the limestone grades laterally into calcareous phyllite.

Intrusive igneous rocks on the property include three suites: mafic to intermediate, intermediate, and quartz porphyry. These intrusives are of limited size, and their age has been estimated at 50 million years. Although larger igneous bodies are not found on the property, it has been speculated that the area is underlain by a granitic pluton of the mid-Cretaceous Selwyn Plutonic Suite.



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Engineers and Scientists

Legend

ROCK TYPES

- Marble / limestone
- Phyllite
- Lowgrade Skarn (< 8% Pb+Zn)
- Highgrade Skarn (>= 8% Pb+Zn)
- Oxide Skarn

Structural Symbols

- overturned syncline axis
- overturned anticline axis
- anticline axis
- syncline axis
- dip and strike of bedding

Cross and Long Section Lines

- 12300.0 N
- 1537.5 N
- 1525.0 N

Geology corresponds to 1380.0 m elevation

SÅ DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

Typical Geology - Jewelbox Deposit

DRAWN BY: ASH*

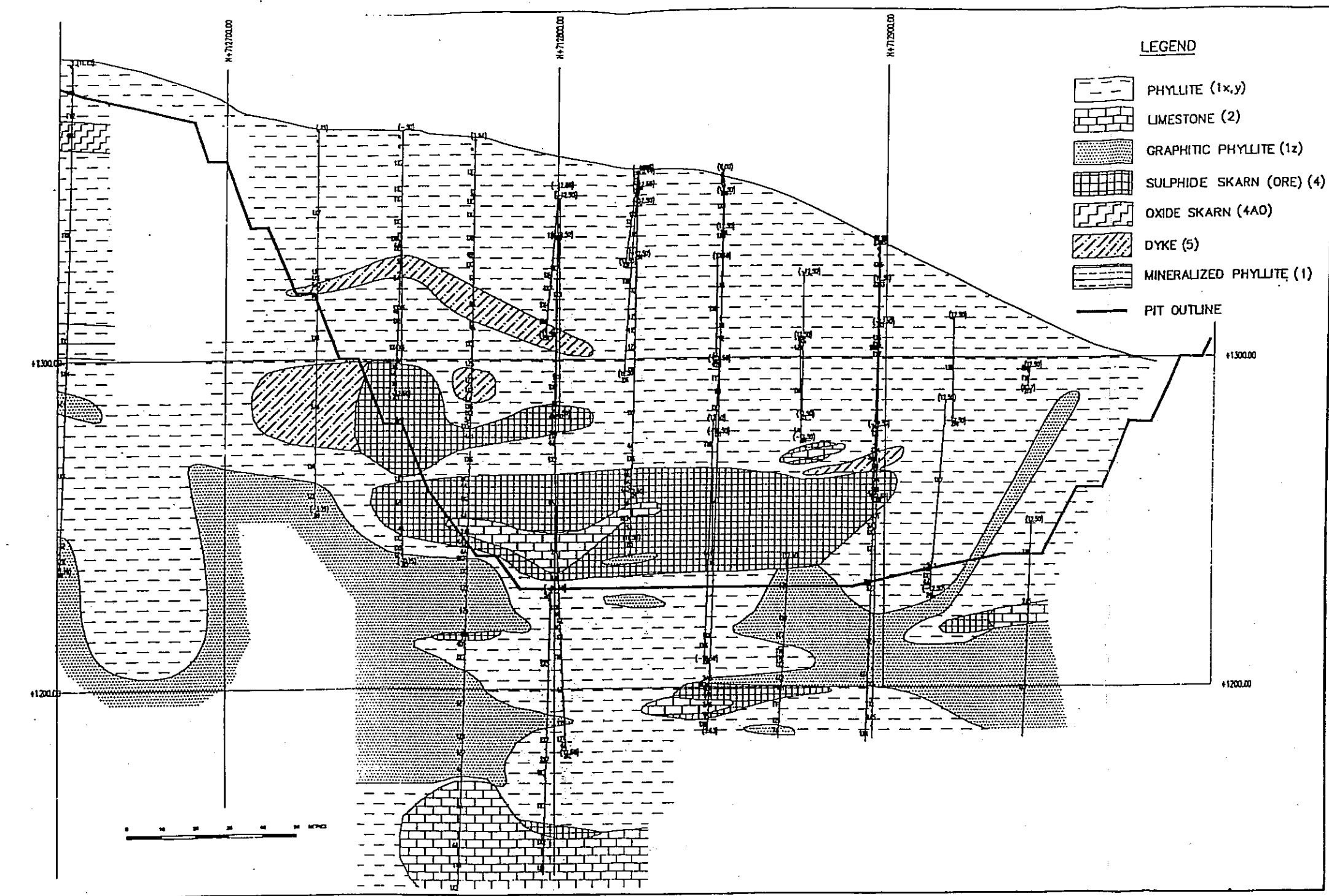
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SCALE 1 : 2,000

Fig No. 1-1

* Taken From a Drawing by L. Pigage



STEFFEN ROBERTSON AND KIRSTEN
Consulting Engineers

Sā Dena Hes Mine
Detailed Decommissioning and Reclamation Plan

Typical Geological Section- Burnick Deposit

DRAWN BY: ASH
DATE: 05/08/99

CHECKED BY:

Fig No. 1-2

The sedimentary strata are complexly folded and metamorphosed muscovite-chlorite phyllites of the greenschist facies. Several sets of steeply dipping faults occur on the property which post-date the folding. Most of these faults are thought to have normal displacement; however, some may be strike-slip. On Jewelbox Hill, a shallow-dipping shear zone follows the upper contact of the main limestone/marble body. A prominent conjugate fracture set trending approximately 100 degrees and dipping steeply north and south is considered to be an important control of mineralization.

Mineralization on the property is hosted by skarns which are commonly developed along the contact of limestone or phyllite with marble. Most of the important skarns are formed from a limestone protolith; however, there are good examples of skarn development from phyllite and locally from intrusive rocks. The grades of the latter skarns are generally on the low side.

Sulphide mineralization consists mainly of medium to coarse grained sphalerite and galena which are heavily disseminated in skarn layers. Iron sulphide is present in only minor quantities, or is absent altogether. Close to the peripheries of areas of lead-bearing skarn, there is local development of magnetite skarns. These peripheral skarns occasionally contain pyrrhotite and pyrite, and traces of chalcopyrite in some areas.

The mineralized horizons are commonly heavily oxidized to soft incompetent masses of clay, quartz, smithsonite, anglesite and cerussite to a depth of 130 metres, and some oxides have been encountered at depths of 300 metres and more. Locally, smithsonite has been mobilized from the oxidized skarns and deposited in nearby open fractures.

In some areas the phyllites are modestly to intensely hornfelsed, a feature that is broadly associated with skarn mineralization. Hornfelsing is more readily apparent in the calcareous phyllites than in non-calcareous types; consequently, the contact marking the outer limits of the hornfels suggests that the highly altered phyllites may be closely associated with faults or fractures which form conduits for mineralizing (and hornfelsing) fluids.

Alteration

Prominent alteration zones, up to 2 km long and 1 km wide, occur in four locations: Jewelbox Hill, Gribbler Ridge, North Hill and Porcupine Hill. From current information, the alteration pattern appears to be similar in all four areas. The phyllite is altered to hornfels over a large vertical distance, at least 300 metres. Limestone beds are converted to marble in most cases (the Burnick area is the main exception), and more locally to an actinolite, diopside or garnet skarn. The skarn zones are up to 30 metres thick and have lateral dimensions up to several hundred metres. They usually occur at limestone-phyllite contacts; for example, at the upper and lower contacts of thick limestone units, along phyllite beds within the thicker limestone beds, or in association with thin limestone beds within the phyllites. Zinc-lead-silver (Zn, Pb, Ag) mineralization is directly associated with the skarn zones.

Mineralization

The sulphide mineralization is fairly similar throughout the Sä Dena Hes property, although mineral proportions vary from place to place. It consists of medium to coarse grained sphalerite and galena more or less evenly distributed in skarn layers. There is very little iron sulphide present (Section 4.2). Variable but minor amounts of quartz and calcite are commonly present as blebs. The Pb:Zn ratio is generally in the order to 1:2 to 1:3. The Burnick Zone at North Hill is an exception with a 1:30 ratio.

Silver values are associated with the galena and no separate silver bearing minerals have been identified. The ratio of Ag to Pb is variable.

Parts of some of the mineralized zones show varying degrees of oxidation. At an early stage, smithsonite develops from sphalerite, and iron and manganese oxides from the skarn silicates. In extreme cases, the sphalerite and calc-silicates are completely converted to smithsonite and iron oxides, and the galena to cerussite. Although most of the oxidized mineralization appears to occur in-situ, there are a few cases where downward migration has apparently occurred, resulting in smithsonite healed cracks in unaltered limestone in the footwall of oxidized skarn mineralization.

A few drill holes have intersected steeply dipping faults with a different type of mineralization, consisting of drusy quartz, chalcedony, fluorite and calcite, over widths of up to 10 metres. Fluorite is occasionally present in the skarn Pb-Zn mineralization, but is minor.

Geological Reserves

In most cases, individual zones of mineralization can be correlated with stratigraphy with a high degree of certainty. Normally, the mineralized skarn layers occur at either the borders of relatively thick, easily identified limestone units or form bands that parallel the contacts of the main limestone bands.

In parts of the Jewelbox and Burnick Zones, where there are structural complexities, the correlation is less certain, but the implications regarding tonnage possibilities are probably not too serious because alternative interpretations provide a similar tonnage in blocks of mineable size.

Based on visual estimates, close to 20% of the Jewelbox mineralization has been oxidized to a significant degree, but the oxidation appears to be mostly restricted to well defined areas (mainly the East Zone). Although minor oxidation is present in the Main Zone and the parts of the JB-1 Zone that are close to surface, no problem is anticipated in mining essentially unoxidized material on a selective basis. The oxidized material is not included in the mineable reserves.

Mineral Reserves

As reported in the Cominco Ltd. 1998 Annual Report, mineral reserves are as follows:

Proven and probable 1,300,000 tonnes @	10.5% Zn
	2.3% Pb
	4.3 G/T Ag

1.2 PHYSIOGRAPHY

The following is a summary from the Mt. Hundere Development Initial Environmental Evaluation, by SRK Consultants Ltd., April 1990.

“The mountainous area around Mount Hundere is part of the Hyland Plateau physiographic unit. To the west, the Hyland Plateau gives way to the Liard Plain, a broad southeasterly trending intermontane basin which contains the Liard and Frances Rivers (Bostock, 1970).

Surface drainage flows both north and south from the Mount Hundere area. A number of valley streams, of which Tom Creek is the largest, drain southward to the Frances river. North of Hundere ridge, most creeks flow northward to join False Canyon Creek which eventually flows to the Frances River, northwest of the study area.

A broadly rolling, till plain, forms the dominant glacial landform traversed by the Robert Campbell Highway in the Liard Plain. Isolated pockets of fluvial and glaciofluvial sands and gravels, glaciolacustrine silts and shallow organic materials mantle the subdued till in places. Surface till on the Liard Plain is variable in colour, moderately stony and has a silty sandy matrix (Klassen, 1987).

The plateau area features broad valleys and rounded ridge crests, Relief is 450 to 600 m within the claim block; Mount Hundere is the highest point at 1576 m. Late Wisconsin ice covered all of the area during glacial maxima. It likely flowed southward to join the southeasterly flowing piedmont glacier in the Liard Plain. As glaciation commenced and the ice sheet retreated and downwasted, glaciers remained in the valleys while ridge crests and upper slopes were ice-free. Till deposits in the valley bottoms and on lower slopes are the result of direct glacial deposition. Tills with a silty sandy matrix reflect the regional glaciation; in the upper valleys a coarser, looser till may be found which reflects deposition from an ablating valley glacier.

Large volumes of meltwater emanated from the retreating ice. Loose, surficial deposits were eroded from slopes, transported by meltwater streams and deposited as glaciofluvial terraces, outwash plains and ice-contact kames and eskers. These granular sediments infilled much of the valley lowlands. In places they are associated with silt deposits laid down in glacial lakes formed by temporary ponding of meltwater.

In post-glacial time, deposition and erosion continued. Colluvial deposits are gravity-transported materials common to sloping ground. Angular bedrock fragments with interstitial sand and silt are ubiquitous on ridge crests and upper and mid-slope positions. Fluvial sediments and organic materials accumulated on floodplains, fans and adjacent valley lowlands. Fluvial erosion, lateral and vertical cutting through existing surface materials, is an on-going but generally imperceptible process; it is usually most dynamic in steeper-gradient channels and where unstable bank materials exist. Landsliding and snow avalanching are rapid mass movement processes which are modifying some areas of sloping terrain. Periglacial processes (driven by the freeze-thaw cycle) are slowly modifying alpine and subalpine slopes.”

2.0 CLIMATE

2.1 CLIMATOLOGICAL SETTING

The Sä Dena Hes property is located in the upper basin of the Liard River, some 40 km north of Watson Lake. The climate is dictated by a number of factors, mainly altitude, latitude and distance to mountain barriers. The property is in the rain shadow of the Coast and St. Elias Mountains. These two mountain ranges form an effective barrier against Pacific influences and allow a continental climate to exist over most of the Yukon. The Cassiar Mountains cause a secondary rain shadow effect.

2.2 CLIMATOLOGICAL DATA SOURCES

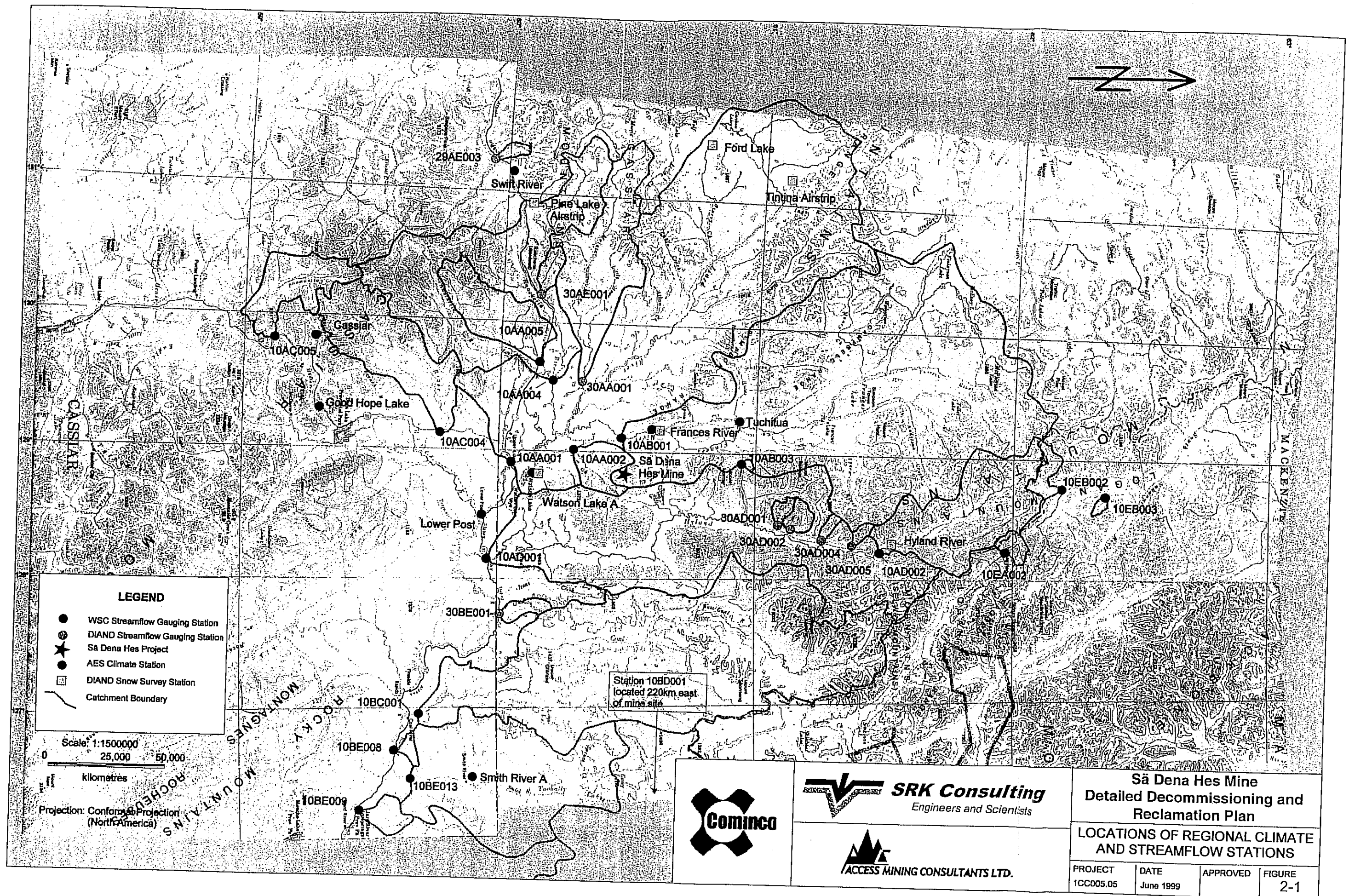
Although long-term climatological records are not available at the Sä Dena Hes mine site, the climate of the mine site can be adequately inferred from the data of regional climate stations. The records of nine stations operated by the Atmospheric Environment Service (AES) were used to assist in characterization of the mine site climate. In addition, six snow survey records collected by the Department of Indian Affairs and Northern Development (DIAND) were employed in estimating snowpack levels. Details of these regional stations are provided in Table 2-1. The table also identifies the types of climatological parameters each station provided for the study. The locations of the regional stations except for the single evaporation station, which is located several hundred kilometres from the mine site, are shown on Figure 2-1.

Table 2-1 Details of Regional Climate Stations

Station Name	Latitude		Longitude		Elevation (m)	Authority *	Information Applicable to Study
	Deg	Min	Deg	Min			
Cassiar	59	17	129	50	1077	AES	Precipitation/Temperature
Frances River	60	35	129	11	732	AES	Precipitation
Francis River	60	35	129	11	730	DIAND	Snowpack
Good Hope Lake	59	18	129	17	770	AES	Precipitation/Temperature
Hyland River	61	31	128	16	855	DIAND	Snowpack
Lower Post	59	56	128	30	583	AES	Precipitation
Pine Lake Airstrip	60	6	130	56	995	DIAND	Snowpack
Smith River A	59	54	126	26	673	AES	Precipitation
Swift River	60	0	131	11	891	AES	Precipitation/Temperature
Tintina Airstrip	61	5	131	15	1067	DIAND	Snowpack
Tuchitua	60	56	129	15	724	AES	Precipitation
Watson Lake A	60	7	128	49	689	AES	Precipitation/Temperature
Watson Lake A	60	7	128	50	685	DIAND	Snowpack
Whitehorse A	60	43	135	4	703	AES	Evaporation
Ford Lake	60	47	131	28	1110	DIAND	Snowpack

Note: * AES: Environment Canada, Atmospheric Environment Service

DIAND: Department of Indian Affairs and Northern Development



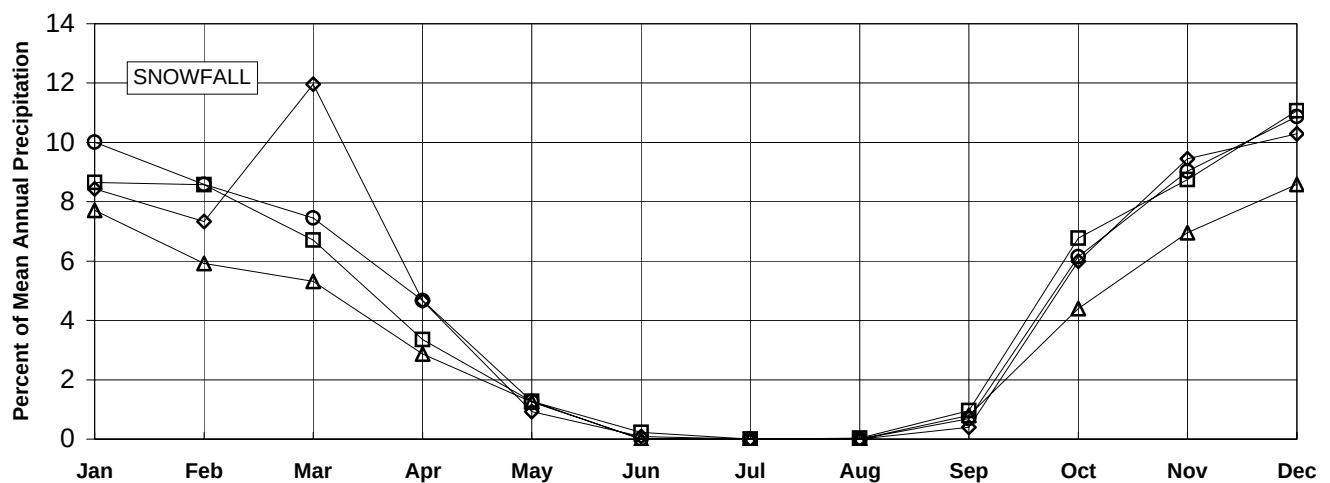
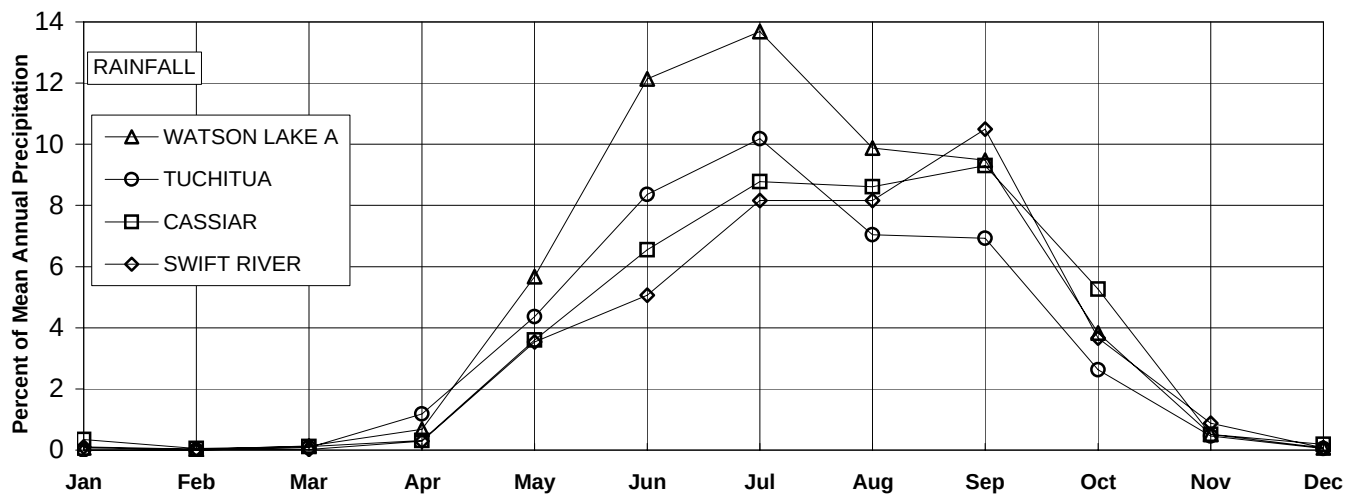
2.3 PRECIPITATION CORRECTION FOR NORTHWEST TERRITORIES AND YUKON

The density of recording stations in the Northwest Territories (“NWT”) and Yukon is sparse compared to the rest of Canada, and the measurement of precipitation is subject to a number of measurement errors (Metcalf, 1999). Most stations still use non-recording or manual methods of measuring precipitation in the form of rainfall and snowfall. The most significant measurement errors are:

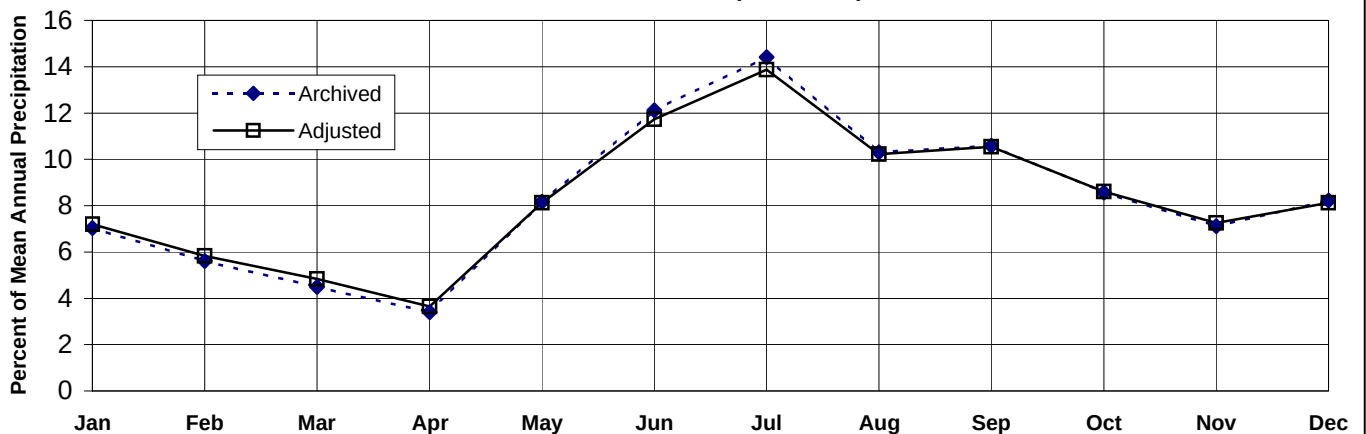
- the standard Type-B rain gauge has been shown to interact with the wind, deflecting a portion of the rainfall away and underestimating the precipitation;
- the standard Nipher snow gauge is used at many of these stations, and these demonstrate a systematic error, underestimating snowfall;
- snowfall is also manually recorded using a ruler at the remaining stations and the depth of snow is converted into a “water equivalent” using an assumed density of 100 kg/m³. Studies have shown that the average densities of snow in these regions can actually be as much as 20% less than this assumed density, leading to another source of error in the snowfall record; and,
- wind has been shown to be a major cause of error in precipitation gauge measurements.

On balance, the measurements combine to cause an underestimation of precipitation at first-order stations equipped with a Nipher snow gauge. AES have embarked on a program to correct the precipitation archive for such stations. The only first-order station of value to the current study is Watson Lake Airport. The bottom graph on Figure 2-2 shows a comparison of the archived and corrected precipitation record for the Watson Lake Airport. The graph shows the total monthly precipitation, normalized to a percentage of the mean annual precipitation (“MAP”). This demonstrates that the correction process has not significantly changed the shape of the monthly precipitation distribution and therefore precipitation normals can safely be used to characterize the snowfall and rainfall distributions for the minesite.

Therefore, the corrected MAP for Watson Lake of 490mm will be used in the analysis. The previous archived value from the 1961 – 1990 normals was 413 mm. For all other stations, the archived MAP value will be used. The correction of the archived records for these other stations is the focus of on-going research at the AES.



Comparison of Archived and Corrected Precipitation Records
for Watson Lake A. - (1953-1993)



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SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN
MEAN MONTHLY PRECIPITATION
DISTRIBUTIONS AT REGIONAL CLIMATE
STATIONS

PROJECT
1CC005.05

DATE
AUG. 1999

APPROVED

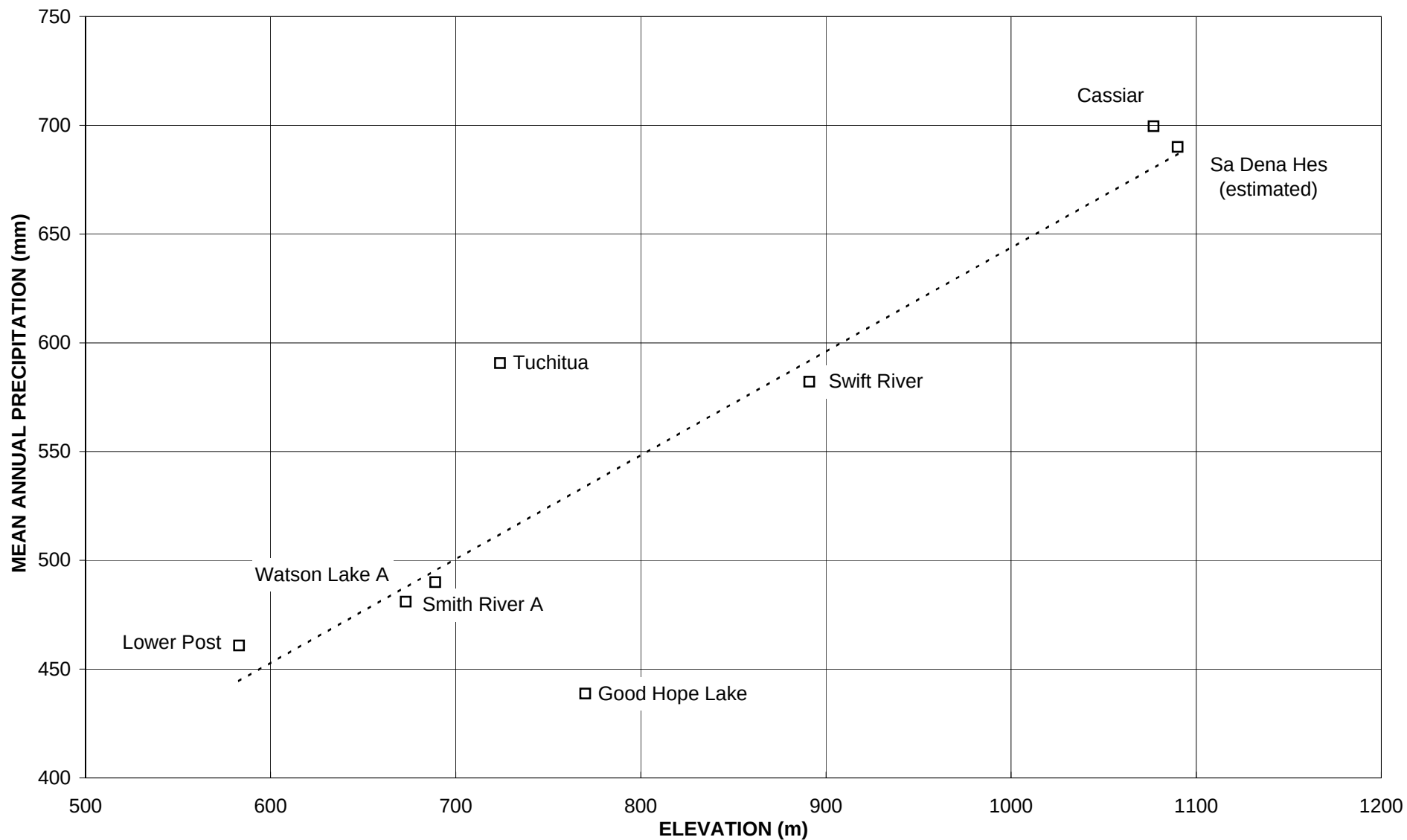
FIGURE

2-2

2.4 PRECIPITATION ESTIMATE

Elevation is the principal control on the distribution of precipitation in the region. Figure 2-3 illustrates this control and is a plot of MAP versus elevation as derived from the data of regional AES stations. A best-fit linear regression of these data showed that the average precipitation gradient in the region is about 48 mm per 100 m of ascent. Using Watson Lake Airport as a base (elevation 689 m and MAP 490 mm) and applying the observed regional precipitation gradient, the tailings impoundment (elevation 1090 m) was estimated to experience a MAP of about 690 mm. Because of local variations in topography which affect precipitation, the actual mean precipitation at the tailings impoundment may differ by as much as 100 mm from the value calculated.

The seasonal precipitation distribution at the tailings impoundment was approximated using normalized monthly average distributions of regional AES stations. The two upper graphs in Figure 2-2 graphically present the monthly rainfall and snowfall distributions for two high altitudes (Cassiar and Swift River) and two low altitude (Tuchitua and Watson Lake A) AES stations. The rainfall and snowfall (as water equivalent) distributions are expressed as percentages of the MAP. The high altitude stations exhibit fairly different distribution patterns than the low altitude stations. It is assumed that the difference is primarily a result of an elevation dependency, however, it may also be related to spatial variations. The two low altitude stations are located along the valley floors of the Frances and Liard Rivers in fairly close proximity to the mine site whereas the two high altitude stations are sited further to the west within the Cassiar Mountains. The normalized distributions for the two high altitude stations coincide remarkably well despite the fact that the stations have an elevation difference of about 170 m. The one difference is the anomalously high, and probably erroneous, average snowfall at Swift River during March. Based on the similarities between the distributions at the two high altitude stations, the Cassiar distribution was adopted, without any adjustments, to represent the precipitation pattern at the tailings impoundment. This distribution was used to reflect the fact that a higher proportion of precipitation falls as snow at elevations as high as the proposed tailings impoundment than at the valley floor. It should be noted that the snowfall at Cassiar is converted to a water equivalent by applying a factor of 0.1.



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**REGIONAL RELATIONSHIP BETWEEN MEAN
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FIGURE

2-3

The estimated average monthly snowfall and rainfall amounts for the tailings impoundment are shown in Table 2-2 together with other estimated climatic parameters for the tailings impoundment. The mean annual precipitation can be expected to comprise about 300 mm rainfall and 390 mm snowfall as water equivalent. Precipitation is common throughout the year with the driest month typically being April, and the wettest being October.

Table 2-2 Estimated Mean Monthly Climatic Parameters for Tailings Impoundment Site

Parameter	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Rainfall (mm)	2.4	0.4	0.8	2.2	24.9	45.2	60.6	59.4	64.2	36.3	3.6	1.3	301
Snowfall (cm)	60	59	46	23	9	2	0	0	7	47	60	76	389
Total Precipitation (mm)	62	60	47	25	34	47	61	60	71	83	64	78	690
Daily Maximum Temp (°C)	-20.2	-12.3	-5.3	1.3	8.1	14.2	17.1	14.5	8.4	-0.4	-13.1	-18.0	-0.5
Daily Minimum Temp (°C)	-31.3	-28.2	-22.6	-13.2	-3.2	1.7	5.3	3.7	-2.3	-10.1	-24.4	-27.9	-12.7
Daily Mean Temp (°C)	-25.7	-20.3	-14.0	-6.0	2.5	7.9	11.2	9.1	3.0	-5.3	-18.7	-22.9	-6.6
Evaporation (mm)	0	0	0	0	53	105	130	99	43	0	0	0	430

The Cassiar climatological record can also provide an indication of the extreme daily precipitation events at the mine site. The greatest 24-hour rainfall measured at this station over its 26-year history was 48 mm while the greatest 24-hour snowfall was 53 cm. The average number of days with measurable precipitation at Cassiar was 155.

The extremes in annual precipitation at the tailings impoundment were estimated assuming they exhibit a similar variability as observed at Cassiar. The coefficient of variation (standard deviation divided by mean) was used to quantify the amount of variability and has a value of 0.14 for this AES station. Table 2-3 shows the extreme precipitation values as projected using a normal distribution.

Table 2-3 Estimated Precipitation Extremes: Tailings Impoundment

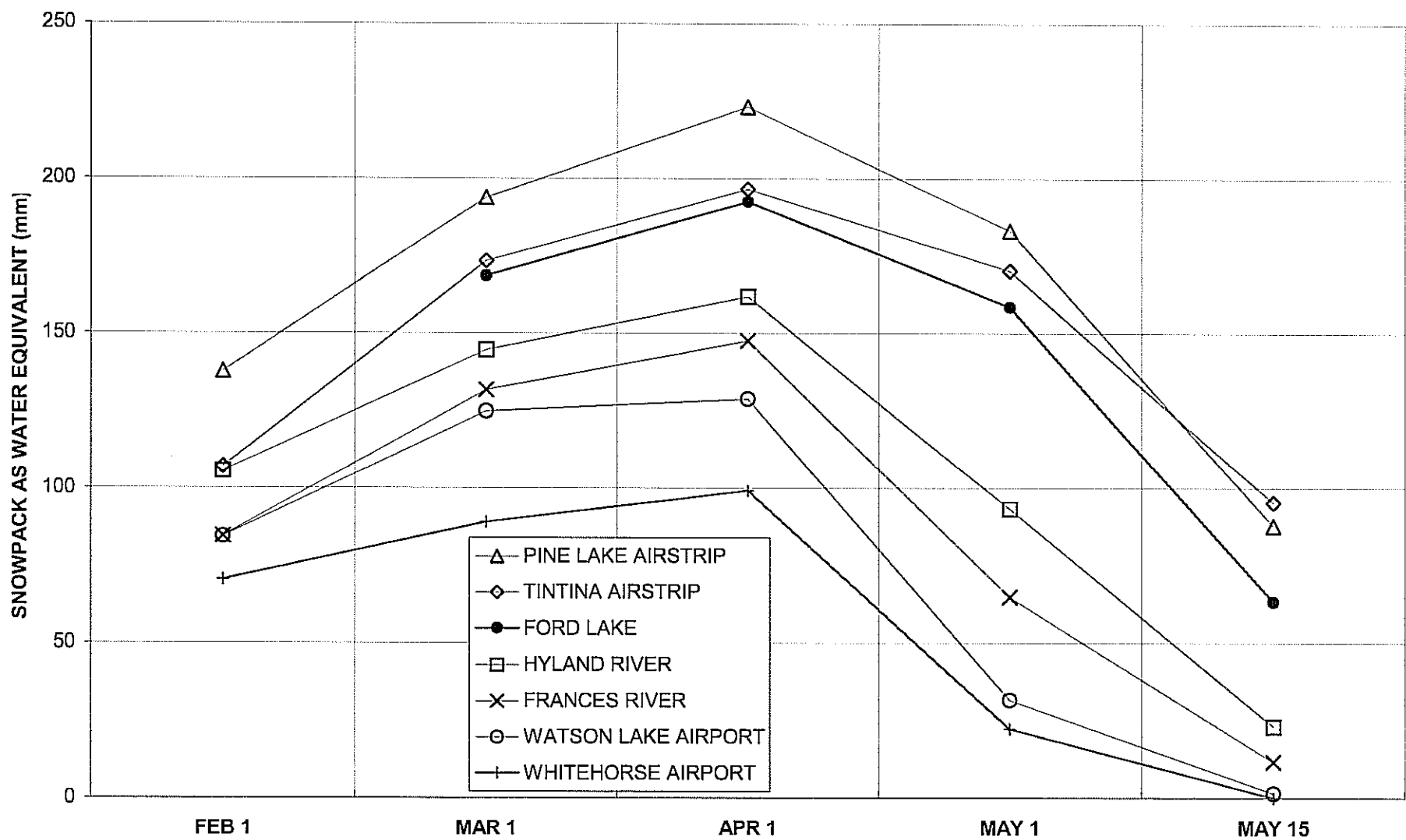
Return Period	Total Precipitation (mm)
100-yr High	920
20-yr High	850
Mean Annual	690
100-yr Low	540
20-yr Low	470

2.5 SNOWPACK ESTIMATE

The DIAND operates a relatively dense network of snow survey stations in the region of the Sä Dena Hes minesite. Figure 2-4 is a graphical presentation of the average snowpack statistics for the five closest long-term (i.e., greater than 10 years) stations for various dates during the winter and spring. Inspection of these data reveals the expected general trend of increasing snowpack with increasing elevation. The three highest elevation stations, Pine Lake Airstrip (elev. 995 m), Tintina Airstrip (elev. 1067 m) and Ford Lake (elev. 1110) have similar elevations as the Sä Dena Hes minesite and are, therefore, judged to be indicative of the snowpack conditions likely experienced at the tailings impoundment. The accumulation of snow at the tailings impoundment site will typically begin in October and snowmelt will usually be complete by early June. At maximum snowpack in April, the density of the snowpack is about 240 kg/m³.

2.6 TEMPERATURE ESTIMATE

A regional analysis was used to characterize the temperature regime at the tailings impoundment site. Examination of the spatial temperature differences between the AES stations, especially those on the valley floors, revealed that the mean annual temperature followed a decreasing trend in both the northward and eastward direction in the region. This observation was taken into account in extrapolating regional temperature data to the mine site.



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SNOW SURVEY STATIONS

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FIGURE

2-4

The first step in performing the analysis was to evaluate a typical vertical temperature gradient between a valley station and a high altitude station. The stations at Cassiar and Good Hope Lake were judged to be appropriate for this purpose, as they are located fairly close to each other in horizontal distance.

The temperature gradient between this pair of stations, on an annual average basis, was calculated at $-0.0084^{\circ}\text{C}/\text{metre}$. A significant variation around this number is, however, observed on a month to month basis. The second step involved using these monthly temperature gradients in conjunction with the climate record of the Watson Lake Airport to extrapolate the regional temperature data to the tailings impoundment site. The Watson Lake Airport, being the closest AES station to the mine site that measures temperature, was selected as the base for the extrapolation to implicitly account for the observed northward and eastward regional trends in temperature. The elevation difference between Cassiar and Good Hope Lake is similar to that between the tailings impoundment and the Watson Lake Airport (307 m versus 401 m). Therefore, the analysis involved multiplying the incremental temperature differences between the Cassiar and Good Hope Lake stations by the factor 1.3 (401/307) and then adding the resulting numbers to the 1961 – 1990 temperature normals for the Watson Lake Airport. The resulting estimated monthly temperature distribution at the tailings impoundment is listed in Table 2-2. The mean annual temperature at the mine site is predicted to be -6.6°C , which compares to a value of -3.1°C at the Watson Lake Airport.

A rough indication of the temperature extremes at the mine site can be made by referencing the long-term (52 year) and reliable climatological record at the Watson Lake Airport. The extreme minimum temperature experienced at this station was -59°C ; the extreme maximum temperature was 34°C .

2.7 EVAPORATION ESTIMATE

The network of evaporation stations is sparse in the Yukon and northern British Columbia. The closest evaporation pan is located at the Whitehorse Airport AES station, some 340 km west of the mine site. This station experiences higher air temperatures than does the mine site and as a result probably experiences higher evaporation rates.

In order to account for this temperature dependency, the evaporation rate at the tailings impoundment was approximated using the Thornthwaite Method (Gray, 1973), an empirical formula that uses average monthly air temperature and latitude to calculate potential evapotranspiration. The temperature regime derived in Section 2.6 provided the input data for the Thornthwaite Method. The calculated monthly average evaporation values are listed in Table 2-2. Using this empirical method, the annual evaporation rate was estimated to be 430 mm.

The accuracy of the Thornthwaite Method was tested by applying it to the same conditions as experienced at the Whitehorse Airport. This empirical relationship predicted an evaporation rate for the period May to September that was only 2% less than the value derived from pan measurements.

3.0 WATER RESOURCES

3.1 SURFACE WATER HYDROLOGY

3.1.1 Hydrological Setting

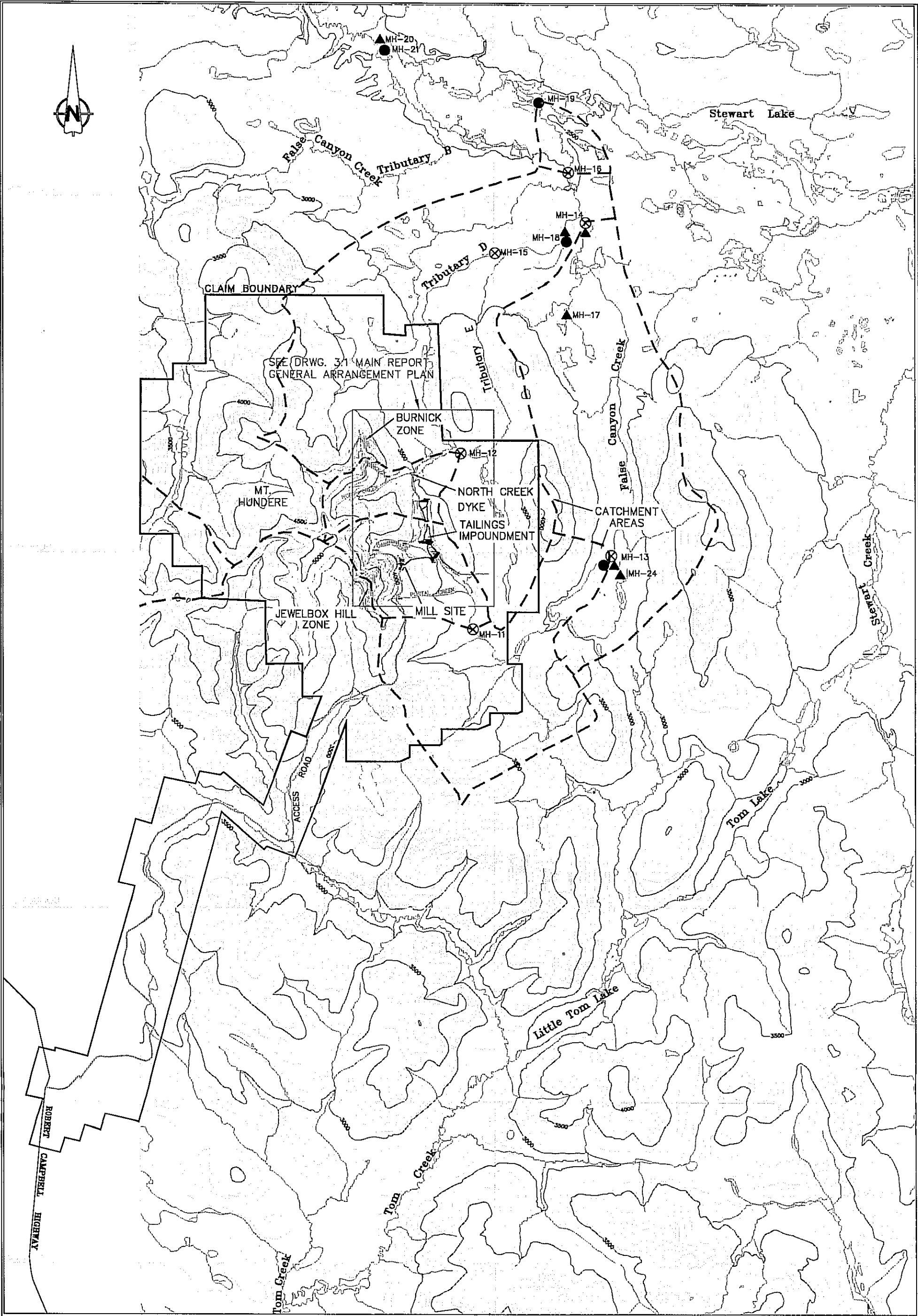
The Sä Dena Hes mine is located in the drainage basin of False Canyon Creek, a left bank tributary of Frances River. False Canyon Creek has a total catchment area of 492 km² and discharges some 55 km above the Frances River and Liard River confluence. Access to the mine development is from the south across the drainage basin of Tom Creek, a left bank tributary of Liard River.

Figure 2-1 shows the location of the mine in relation to the major rivers and lakes of the region.

The open pits, underground workings and waste rock dumps associated with the Jewelbox ore zones are located near the drainage divide between Tom and False Canyon Creeks. All drainage from the Jewelbox development is directed to Camp Creek, a steep-gradient tributary of False Canyon Creek that drains the eastern flank of Mount Hundere. The mill site is also located in the catchment of Camp Creek. The Burnick development is entirely confined in the headwaters of another False Canyon Creek tributary, which has been designated Tributary D. The tailings impoundment is constructed in a saddle that lies along the drainage divide between Camp Creek and Tributary E. Figure 3-1 shows the locations of the major mine elements relative to the catchments of False Canyon and Tom Creeks. Figure 3-2 is a larger scale map showing the drainage basin for the Tailings Management Facility.

3.1.2 Available Data

Data collected at the Sä Dena Hes mine (site-specific data) and data collected at government stations (regional data) were both used in preparing this hydrology study. The site-specific data were extracted from three sources:



NTS: 105 A/06, 105 A/07
105 A/10, 105 A/11

CONTOUR INTERVAL 100 FEET

0 1000 2000 3000 4000 5000 metres
1:100,000

NOTE:
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927



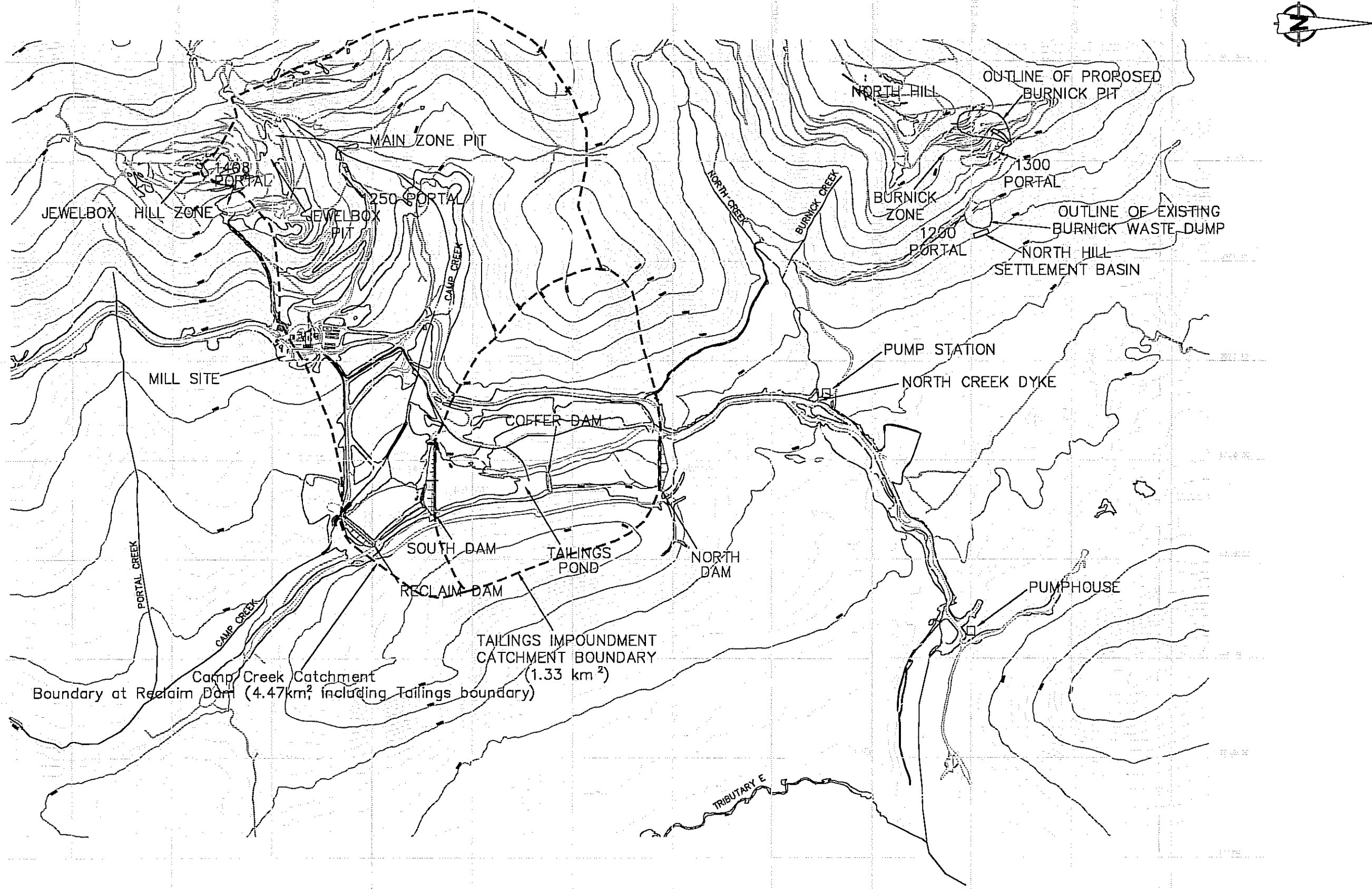
LEGEND

- ⊗ WATER MONITORING STATION
- ▲ FISH MONITORING STATION
- BENTHIC MONITORING STATION

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LOCATION PLAN

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	REV.
DATE: JULY 29, 1999	PROJ. NO. 1CC005.05	3-1	



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LEGEND

WATER MONITORING STATION

0 200 400 600 800 1000 metres

1: 20,000

CONTOUR INTERVAL=10m

NOTE

BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

Sä DENA HES DETAILED
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CAMP CREEK AND TMF
CATCHMENT BOUNDARIES

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	REV.
DATE:	JULY 29, 1999	PROJ. NO.	1CC005.05	3-2	

- the series of Annual Reports prepared for Water Licences IN90-002 and QZ97-025 (which present and evaluate water quality and quantity data collected at the Să Dena Hes mine and its immediate receiving environment);
- the records of spot flow measurements made by DIAND personnel at several of the water quality monitoring sites in the project area; and,
- the records of spot flow measurements made by SRK personnel in 1989 as part of the permitting studies for the mine development.

The site-specific data can be grouped into two categories. One category is groundwater discharge and encompasses seepages from dams and discharges from underground workings. The other category covers the measurement of flows in the streams draining the mine development. For the purpose of this hydrology study, emphasis was placed on locating data in the latter category. From the sources of information outlined above, records of flow were assembled for a total of eleven sites located on streams draining the mine development. All eleven correspond to water quality monitoring sites, as set out in the mine's water licence. Ten of the eleven records proved to be of limited value to the hydrology study because they contained only a small number of flow measurements. The one exception was the flow record assembled for Station MH-11. This station commands a catchment area of 8.9 km² and is located on Upper False Canyon Creek about 1 km downstream from Portal Creek and about 2.3 km downstream of the Reclaim Dam. The record for this station spans the period 1989 to 1998 and comprises a total of 30 spot flow measurements (see Table 3-1). Seven of the measurements were made by DIAND, three by SRK, and the remainder by mine personnel. The present streamflow regime of Station MH-11 is likely to be virtually indistinguishable from its pre-development regime. The construction of the tailings impoundment may have acted to slightly increase the baseflow at this station.

Table 3-1 Observed Flows at Station MH-11

Date	Discharge m³/s	Source
July 13, 1989	0.105	SRK
August 15, 1989	0.031	SRK
September 14, 1989	0.021	SRK
May 7, 1991	0.106	Company
September 25, 1991	0.195	DIAND
September 17, 1992	0.081	Company
October 15, 1992	0.069	Company
November 25, 1992	0.047	Company
December 9, 1992	0.038	DIAND
April 7, 1993	0.029	DIAND
August 31, 1993	0.064	Company
October 8, 1993	0.048	Company
May 31, 1994	0.281	Company
July 21, 1994	0.093	DIAND
June 6, 1995	0.178	DIAND
June 3, 1996	0.648	Company
July 4, 1996	0.175	Company
August 1, 1996	0.093	Company
September 1, 1996	0.099	Company
September 10, 1996	0.046	DIAND
October 1, 1996	0.062	Company
June 1, 1997	0.208	Company
July 1, 1997	0.234	Company
August 1, 1997	0.077	Company
September 1, 1997	0.044	Company
June 1, 1998	0.491	Company
July 1, 1998	0.107	Company
August 2, 1998	0.051	Company
August 30, 1998	0.035	Company
October 6, 1998	0.0396	DIAND

The site-specific data on their own were inadequate to fully characterize the hydrology of the minesite streams. This is because the record of spot flow measurements at Station MH-11 is sparse and does not cover the winter period. Furthermore, the 10-year period of record is too short to assess extreme drought and flood conditions.

In the absence of long-term and complete records of streamflow for the minesite streams, the data used was collected at the hydrometric networks of the Water Survey of Canada (WSC) and the Water Resources Division of DIAND. The WSC stations are all equipped with automatic stage recorders and are operated on a year-round basis. The streamflow data for the DIAND stations, on the other hand, have been obtained from either crest gauges or seasonally operated automatic

recorders. The streamflow records for this latter group were collected for the specific purpose of characterizing the flood hydrology of small basins in the Yukon. The networks of both government agencies were examined to identify regional gauging stations that could be useful in characterizing the low, average and flood flows of the minesite streams. A total of 25 stations were selected for this purpose, 18 operated by the WSC and 7 operated by DIAND. Table 3-2 provides details of these stations, including period of record, catchment area, catchment median elevation and mean annual runoff (MAR). Median elevation is a physiographic characteristic of the catchment and is defined as the contour that divides the catchment exactly into halves (i.e., half the catchment area lies above the median elevation and half below). The MAR for each regional gauge is expressed in two types of units, namely as a long-term average flow rate and as a depth. The latter unit may be interpreted as the depth to which the average annual runoff volume would spread uniformly over the contributing catchment area. All of the selected WSC and DIAND stations measure unregulated flows, or flows that have been minimally influenced by human activity.

The data collected by the WSC and DIAND were used to characterize the minesite hydrology using a technique known as Regional Analysis. Essentially, this involved deriving empirical relationships between the measured streamflow of the regional stations and the physical characteristics of the catchments that generated the streamflow. These empirical relationships then formed the basis for estimating flows at ungauged locations on the minesite streams. The subsections below describe the steps undertaken to apply the regional analysis to the minesite streams.

Table 3-2 Details of Regional Streamflow Gauging Stations

Streamflow Gauging Station		Period of Record	Catchment Area (km ²)	Catchment Median Elevation (m)	Mean Annual Runoff	
ID No.	Name				As a Flow (m ³ /s)	As a Depth (mm)
WATER SURVEY OF CANADA						
10BD001	Beaver River below Whitefish River	1977 - 1993	7280	1020	62.5	271
10AA005	Big Creek at km 1084.8 Alaska Highway	1989 - 1998	991	1210	6.93	221
10AC004	Blue River near the mouth	1963 - 1995	1700	1280	18.2	338
10BC001	Coal River at the mouth	1961 - 1995	9190	1130	96.8	332
10AC005	Cottonwood River above Bass Creek	1964 - 1998	888	1380	18.2	647
10EA002	Flat River at Cantung Camp	1973 - 1988	128	1680	2.46	606
10AB001	Frances River near Watson Lake	1962 - 1998	12800	1210	158	390
10BE008	Geddes Creek at the mouth	1979 - 1996	77.8	700	0.192	78
10AD002	Hyland River at km 108.5 Nahanni Range Road	1976 - 1994	2150	1550	44.1	647
10AD001	Hyland River near Lower Post	1947 - 1993	9450	1080	136	454
10AB003	King Creek at kilometre 20.9 Nahanni Range Road	1975 - 1988	13.7	1310	0.125	288
10EB003	Lened Creek above Little Nahanni River	1982 - 1992	34.3	1650	0.767	706
10AA001	Liard River at Upper Crossing	1960 - 1998	33400	1210	374	353
10EB002	Mac Creek near the mouth	1978 - 1992	188	1530	3.32	557
10AA004	Rancheria River near the mouth	1985 - 1998	5100	1270	50.5	312
10BE013	Smith River above Smith Falls	1983 - 1996	3740	830	24.2	204
10BE009	Teeter Creek near the mouth	1979 - 1996	211	1160	1.24	185
10AA002	Tom Creek at km 34.9 Robert Campbell Highway	1974 - 1993	435	1020	2.97	215
DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT						
30AD005	Flood Creek at km 100.3 Nahanni Range Road	1975 - 1979	42.8	1600	-	-
30AD001	Jackpine Creek at km 62.2 Nahanni Range Road	1975 - 1979	74.6	1550	-	-
30AA001	Meister River above Liard River	1993 - 1997	2135	1220	-	-
29AE003	Partridge Creek at km 1184.9 Alaska Highway	1978 - 1994	63.7	1450	-	-
30AD004	South Moose Creek at km 84.8 Nahanni Range Rd.	1975 - 1979	55.5	1450	-	-
30AE001	Spencer Creek at km 1118.6 Alaska Highway	1978 - 1982	156	1340	-	-
30AD002	Spruce Creek at km 66.4 Nahanni Range Rd.	1975 - 1979	135	1350	-	-

3.1.3 Average Flow Estimates

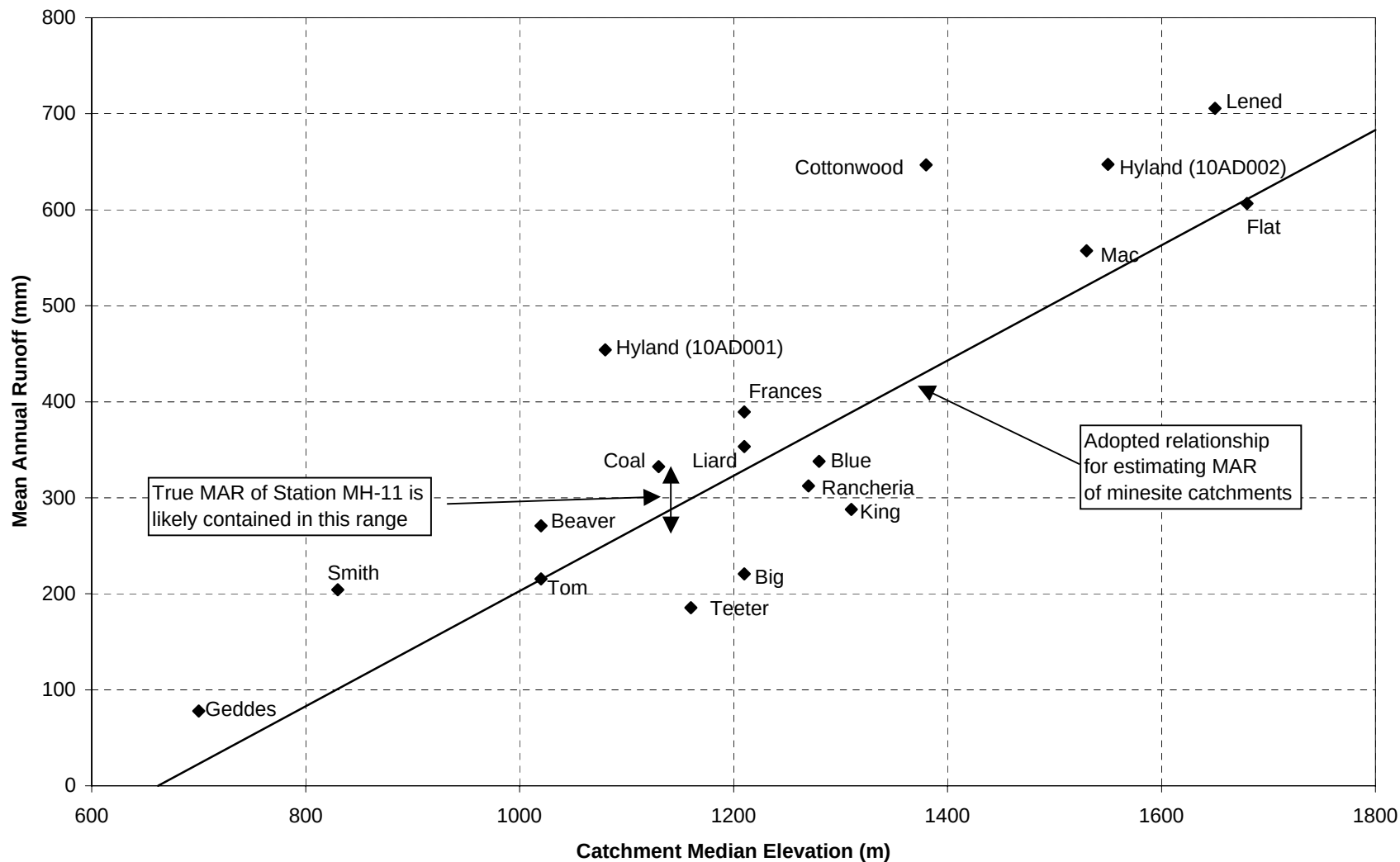
As indicated in Section 2.4 in Appendix B, elevation generally accounts for a large proportion of the variation in mean annual precipitation within a mountainous region. It follows, therefore, that mean annual runoff (MAR) would also be a function of elevation. Figure 3-3 shows how this observation was exploited to estimate the average flows of the minesite streams. The vertical axis of this figure displays values of MAR expressed as equivalent depths of water. The horizontal axis shows values of median elevation, which is the variable adopted to quantify the elevation characteristics of the regional and minesite catchments. The 18 pairs of MAR and median elevation values assembled in Table 3-2 for the WSC stations were plotted on this figure. These data demonstrate a reasonably strong relationship between the two variables.

The data plotted on Figure 3-3 were used to develop a relationship that was believed to represent the conditions at the minesite. Two steps were undertaken to develop the relationship. Firstly, a linear regression was fitted to all 18 data points. This defined a straight line with a slope of 0.60 mm per m. Secondly, the intercept of this straight line was adjusted to force the line through the data point for Tom Creek. This adjustment was based on the premise that, of all the WSC catchments, the one for Tom Creek is probably the most representative of the conditions within the False Canyon Creek catchment. These two catchments share a significant portion of their respective drainage divides and also possess similar elevational characteristics.

Expressed as an equation, the adopted relationship between mean annual runoff (MAR in mm) and catchment median elevation (E in m) is:

$$\text{MAR} = 0.60 E - 397$$

The above relationship was derived exclusively from the regional data. The site-specific data collected at Station MH-11 were reserved for validation purposes. As described in Section 3.2, the streamflow record for this station comprises a series of spot flow measurements made over a 10-year period. One way to estimate the MAR for this station would be to take the average of all the spot measurements available for this station. The accuracy of this estimate would, however, be suspect since the streamflow record is sparse and the flows during the winter season are underrepresented.



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ELEVATION

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FIGURE

3-3

To provide a greater degree of confidence in the estimate, the observed flows at Station MH-11 were correlated with the coincidental flows of neighbouring WSC Stations. Three stations were selected for this purpose, Station 10AA005 on Big Creek, Station 10AA004 on Rancheria River and Station 10AA002 on Tom Creek. Figure 3-4 is a graphical presentation of the correlations. These correlations were performed on log-log graphs in recognition of the differences between the flow regimes of small and large catchments. Station MH-11 commands a much smaller catchment than the three WSC Stations and, accordingly, is expected to experience a more erratic flow regime (i.e., the ratio between the highest and lowest flow for Station MH-11 should be greater than the corresponding ratios for the other three stations).

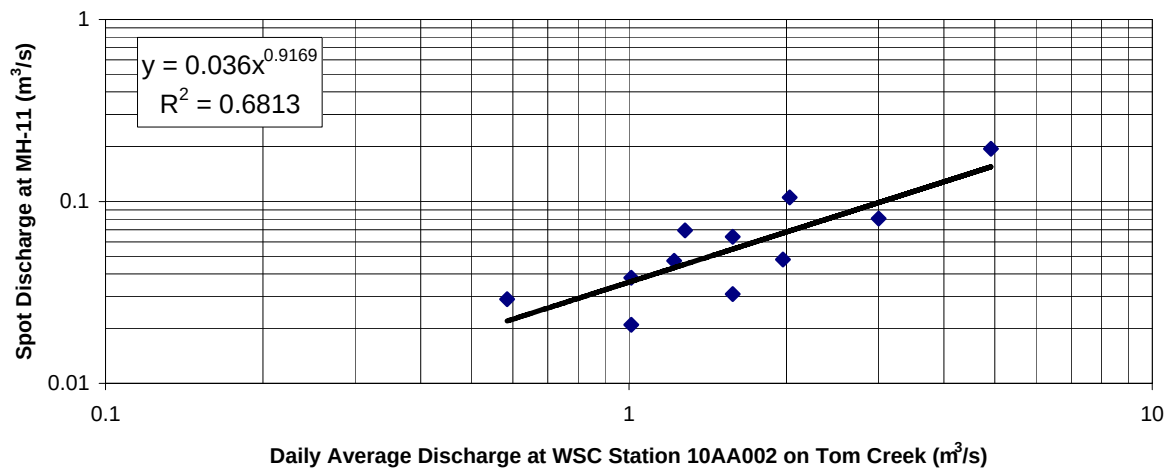
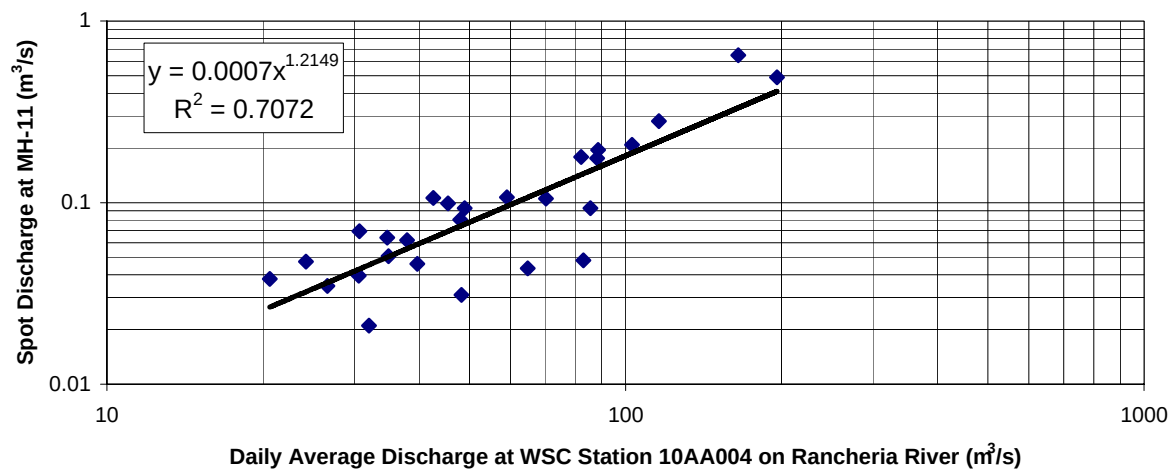
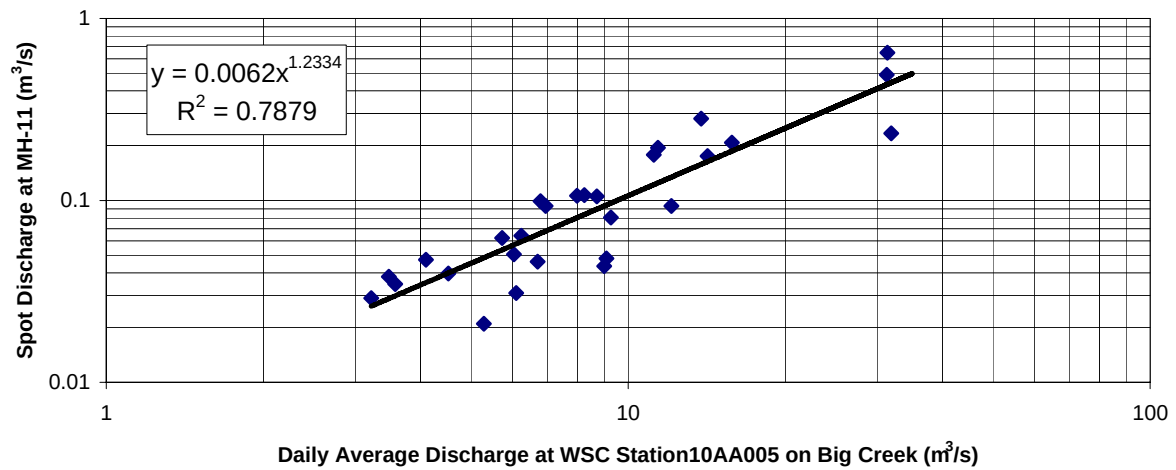
The correlations were used to make estimates of the MAR at Station MH-11. Table 3-3 summarizes the results. These correlations provided estimates that fall in a fairly narrow range from 266 mm to 330 mm. To validate the adopted relationship between MAR and elevation, this range was plotted on Figure 3-3. As can be seen, the adopted relationship passes through the range believed to contain the true MAR of Station MH-11. This suggests that the relationship is reasonably accurate, at least for catchments with similar median elevations as Station MH-11 (1140 m).

The above discussion centred on finding a means of determining the average annual runoff volume at an ungauged site. The remainder of this section presents a technique for distributing this annual volume amongst the twelve months of the year. To implement this technique, an examination was made of the average monthly hydrographs observed at the regional gauging stations. The top plot on Figure 3-5 graphically presents the distributions for five regional stations. The average monthly flows for these distributions have been expressed as percentages of MAR to facilitate comparisons amongst the distributions. Of all the 18 WSC stations selected for the hydrology study, the five selected ones were judged to be the most representative of the minesite catchments, largely on the basis of a similarity in catchment median elevation. Three of the WSC stations (Geddes Creek, Teeter Creek and Smith River) were rejected because their seasonal runoff patterns are extremely subdued with low spring freshet flows and high winter baseflows. These conditions are not observed on the minesite streams. The subdued distributions are indicative of substantial groundwater storage and suggest that limestone dominates the geology of the catchments of Geddes Creek, Teeter Creek and Smith River.

Table 3-3 Estimated Streamflow Characteristics at Station MH-11

Location	Streamflow Characteristic				
	Mean Annual Runoff ^a		7-Day Low Flow for the following Return Periods:		
	As a Flow (m ³ /s)	As a Depth (mm)	2-Year (m ³ /s)	10-Year (m ³ /s)	50-Year (m ³ /s)
Big Creek at WSC Station 10AA005	6.93	221	1.97	1.31	0.97
Station MH-11 (estimated using regression between MH-11 and 10AA005)	0.075	266	0.014	0.009	0.006
Rancheria River at Station 10AA004	50.5	312	10.1	5.21	2.79
Station MH-11 (estimated using regression between MH-11 and 10AA004)	0.087	308	0.011	0.005	0.002
Tom Creek at WSC Station 10AA002	2.97	215	0.374	0.182	0.104
Station MH-11 (estimated using regression between MH-11 and 10AA002)	0.093	330	0.015	0.008	0.005
Average estimate for Station MH-11	0.085	301	0.013	0.007	0.004

Note: a) Based on the complete daily record of the WSC Station, a daily streamflow record was synthesized for Station MH-11. This was done by applying the regression equation to every observed daily flow value in the record of the WSC station. The MAR of Station MH-11 was then taken to equal the average of the synthesized record.



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STREAMFLOW DATA

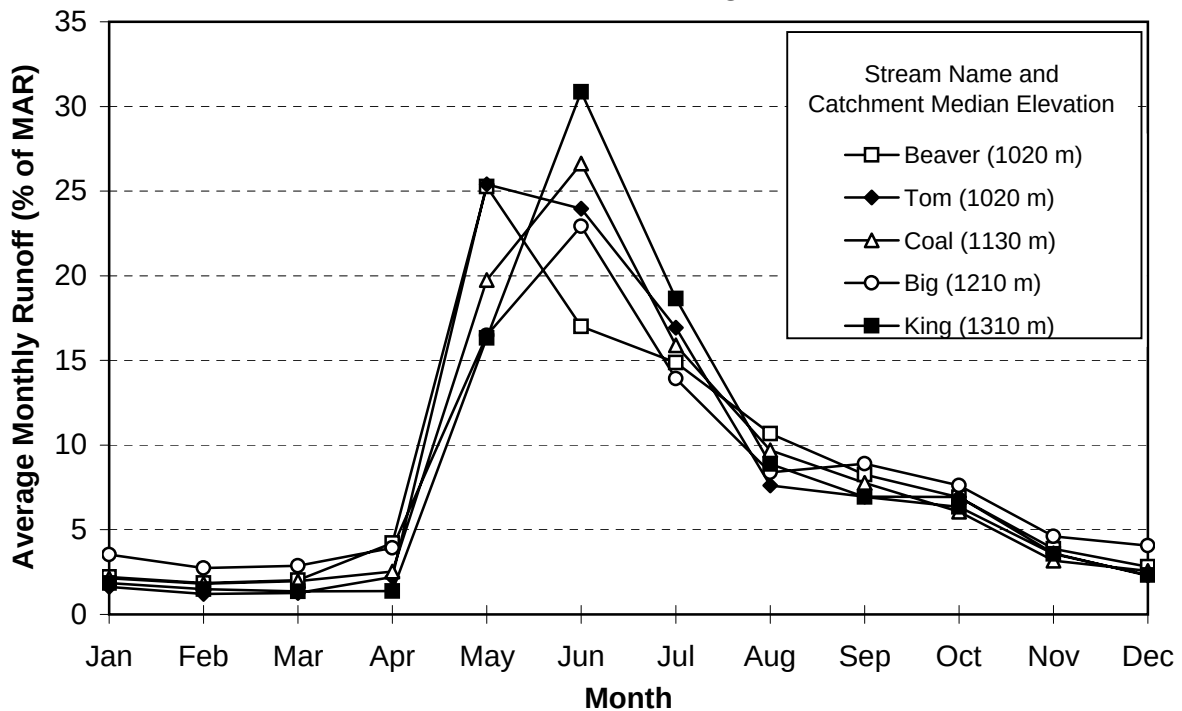
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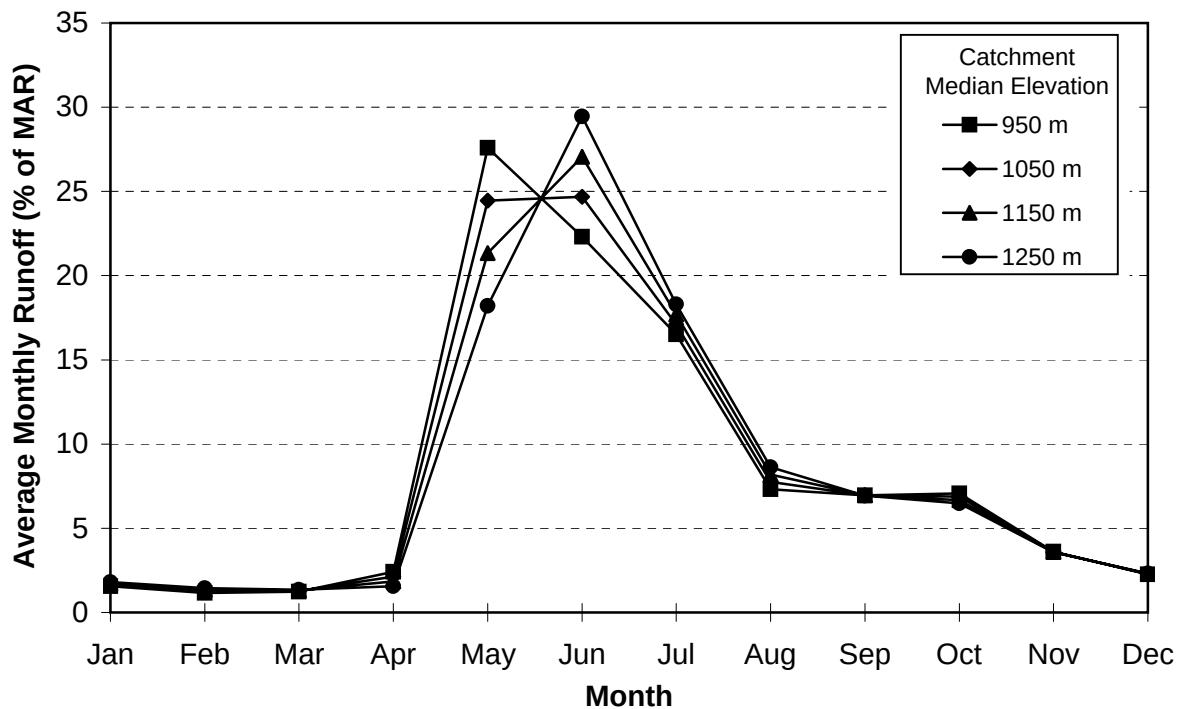
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FIGURE
3-4

Observed Streamflow Distributions at Regional WSC Stations



Estimated Streamflow Distributions for Minesite Streams



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DISTRIBUTIONS

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FIGURE

3-5

The distributions for the five selected stations are characterized by high spring flows during snowmelt and low winter flows during prolonged freezing conditions. All five distributions are remarkably similar over the period August to April, especially considering they represent runoff from significantly different catchment areas ranging from 13.7 km² to 9190 km². The major difference that exists amongst the five distributions is the proportion of runoff that occurs during the months of May, June and July. Examination of these distributions and the characteristics of their associated catchments revealed that median elevation is a reasonably good predictor of the shape of the average monthly hydrograph. As expected, low-elevation catchments generally experience earlier peaks than high-elevation catchments. The median elevations for the catchments of the five stations are shown in the legend of the top plot.

The observed relationship between hydrograph shape and catchment median elevation was used to estimate the shape of the average monthly hydrograph at ungauged locations around the minesite. The bottom plot on Figure 3-5 shows how this was implemented. The normalized distributions for Tom Creek and King Creek were used to establish the hydrograph shape at median elevations of 1020 m and 1310 m, respectively. Interpolation between the shapes of these two hydrographs was used to estimate the distribution for intermediate median elevations. Figure 3-5 shows the estimated shapes of the hydrographs for four distinct elevations.

3.1.4 Low Flow Estimates

Low flows in southeastern Yukon occur in the winter months due to the prolonged freezing conditions. This is a consistent phenomenon, as evidenced by the WSC streamflow records assembled for this study. For 16 of the 18 records, the annual minimum daily flow was observed to always occur in the period November to early May. Even for the other two records, low flows outside this period were infrequent. For the Cottonwood River, the annual minimum was outside the winter period on only one occasion over a total of 35 years of record. In the case of Geddes Creek, the annual minimum was outside the winter period a total of four times in a 17-year record. This latter streamflow record should, however, not be given much credence in assessing the low-flow behaviour of the minesite streams because, as discussed in Section 3.1.3, the streamflow regime of Geddes Creek is substantially attenuated and not representative of the conditions at the minesite.

The magnitude of low flows at the minesite was estimated using Regional Analysis. To apply this technique, three steps were undertaken. Firstly, the annual series of 7-day low flows was extracted from each of the 18 WSC streamflow records assembled for this hydrology study. For the purpose of selecting the annual low-flow values, the year was defined as the period June 1 to May 31. Use of a calendar year was rejected for this purpose to avoid missing any low-flow periods that might span the period from late December to early January. It is interesting to note that the annual low flows for durations of 1, 3, 10 and 30 consecutive days have values very close to the 7-day low flow. This is a consequence of the low flows occurring in the winter rather than the late summer. The winter flows originate from storage releases (lake and groundwater) and, accordingly, vary only slightly over lengthy periods of time.

The second step involved fitting a theoretical frequency distribution (Log-Pearson Type III) to each annual series to estimate the magnitude of extreme low flow events. This step and the previous one were performed using a suite of computer programs developed by the U.S. Geological Survey (Jones and Fahl, 1994) for processing hydrological data (viz., IOWDM2.4, SWSTAT3.2 and ANNIE2.5). Table 3-4 summarizes the results obtained from these programs. Estimates of the 7-day low flow are presented for return periods of 2, 5, 10, 20, 50 and 100 years. Because the 18 WSC stations measure the flow from a wide range of catchment areas, some method was sought to normalize the low flow values so that comparisons amongst the stations could readily be made. The method adopted was to express the values as percentages of the mean annual runoff. For example, the table indicates that the 7-day, 50-year low flow for the Blue River station is 6.3% of MAR. This corresponds to a flow rate of $1.1 \text{ m}^3/\text{s}$ (i.e., 6.3% of $18.2 \text{ m}^3/\text{s}$).

The third and final step entailed finding a way of transposing the low flow values in Table 3-4 to the minesite. To accomplish this, an examination was made of the relationship between low flow and the physical characteristics of the catchments that generated the flow. Two such characteristics were investigated: catchment median elevation and catchment area. Correlation with the former characteristic was poor but catchment area was discovered to help explain at least some of the variation in the low-flow characteristics of the WSC stations. A relationship with catchment area is plausible because channel storage and floodplain area tend to increase as drainage area increases. Increases in these two features of a catchment provide a larger unit storage of water from which to sustain the baseflow.

Table 3-4 Estimated Low Flow Magnitudes at Regional Streamflow Gauging Stations

Streamflow Gauging Station		Catchment Area (km ²)	Mean Annual Runoff (m ³ /s)	Annual Minimum 7-Day Discharge as a Percentage of Mean Annual Runoff					
ID No.	Name			2-Year	5-Year	10-Year	20-Year	50-Year	100-Year
10BD001	Beaver River below Whitefish River	7280	62.5	22.3	18.4	16.2	14.3	12.3	10.9
10AA005	Big Creek at km 1084.8 Alaska Highway	991	6.93	28.4	22.1	19.0	16.5	14.0	12.4
10AC004	Blue River near the mouth	1700	18.2	19.3	14.0	11.0	8.7	6.3	5.0
10BC001	Coal River at the mouth	9190	96.8	20.7	18.0	16.7	15.7	14.6	13.9
10AC005	Cottonwood River above Bass Creek	888	18.2	12.5	9.2	7.1	5.4	3.8	2.9
10EA002	Flat River at Cantung Camp	128	2.46	11.4	9.2	8.2	7.4	6.5	6.0
10AB001	Frances River near Watson Lake	12800	158	13.6	11.8	10.9	10.3	9.5	9.1
10BE008	Geddes Creek at the mouth	77.8	0.192	42.7	32.3	27.6	24.0	20.8	18.8
10AD002	Hyland River at km 108.5 Nahanni Range Road	2150	44.1	9.2	8.0	7.4	6.9	6.4	6.0
10AD001	Hyland River near Lower Post	9450	136	13.5	10.9	9.5	8.4	7.1	6.3
10AB003	King Creek at km 20.9 Nahanni Range Road	13.7	0.125	12.0	0.0	0.0	0.0	0.0	0.0
10EB003	Lened Creek above Little Nahanni River	34.3	0.767	8.2	6.1	5.2	4.6	3.8	3.4
10AA001	Liard River at Upper Crossing	33400	374	17.3	15.0	13.9	13.1	12.1	11.6
10EB002	Mac Creek near the mouth	188	3.32	3.4	1.8	1.2	0.8	0.5	0.3
10AA004	Rancheria River near the mouth	5100	50.5	20.0	13.6	10.3	7.9	5.5	4.2
10BE013	Smith River above Smith Falls	3740	24.2	53.4	45.5	42.0	39.3	36.6	34.9
10BE009	Teeter Creek near the mouth	211	1.24	44.9	33.2	27.3	22.6	17.7	14.9
10AA002	Tom Creek at km 34.9 Robert Campbell Highway	435	2.97	12.7	8.1	6.2	4.8	3.5	2.9

Figure 3-6 is a graphical presentation of the analysis involved in the third step. This figure shows three plots, one each for the 2-year, 10-year and 50-year events. The vertical axis of each plot shows values of 7-day low flow expressed as a percentage of MAR. The horizontal axis presents the independent variable, or catchment area. At first glance, the data on these plots appear to exhibit considerable scatter. However, the situation improves when the data points for Geddes Creek, Smith River and Teeter Creek are removed from further consideration (denoted by open diamonds on the plots). As explained earlier, the catchments of these streams probably have a geology that promotes the development of substantial groundwater storage. This storage results in an attenuated hydrograph shape with very high baseflows.

Even with the removal of these three “high-yield” catchments, a significant amount of scatter still remained. Given this scatter, the decision was made to develop a prediction equation that would provide conservative estimates of low flow for the minesite streams. To do this, the remaining 15 WSC stations were separated into two groups. The first group comprised the stations that, in effect, formed a lower-bound envelope on all the data. This group was designated the “low-yield catchments” (solid squares on the plots of Figure 3-6). The second group was named the “moderate-yield catchments” and covered the stations lying just above the first group (open squares on the plots). To provide a convenient means of estimating the low flows at ungauged locations, a set of logarithmic regressions were fitted to the data from the first group.

These logarithmic regressions appear as straight lines on the three plots of Figure 3-6. In equation form, these lines are expressed as:

$$Q_{7,2} = Q_{MAR} (0.0235 \log A + 0.0583)$$

$$Q_{7,10} = Q_{MAR} (0.0413 \log A - 0.0541)$$

$$Q_{7,50} = Q_{MAR} (0.0351 \log A - 0.0571)$$

where:

$Q_{7,2}$ = annual minimum 7-day flow with 2-year return period (m^3/s);

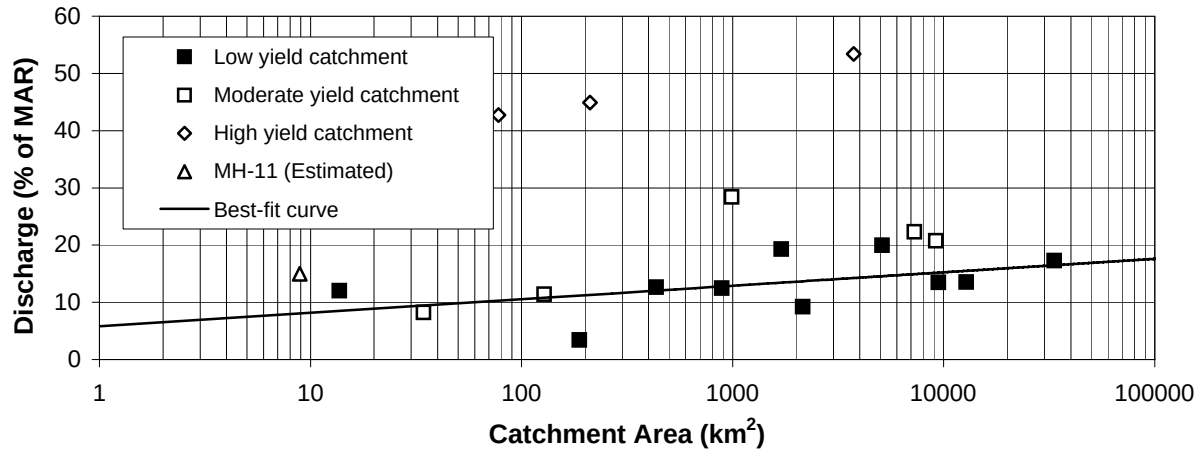
$Q_{7,10}$ = annual minimum 7-day flow with 10-year return period (m^3/s);

$Q_{7,50}$ = annual minimum 7-day flow with 50-year return period (m^3/s);

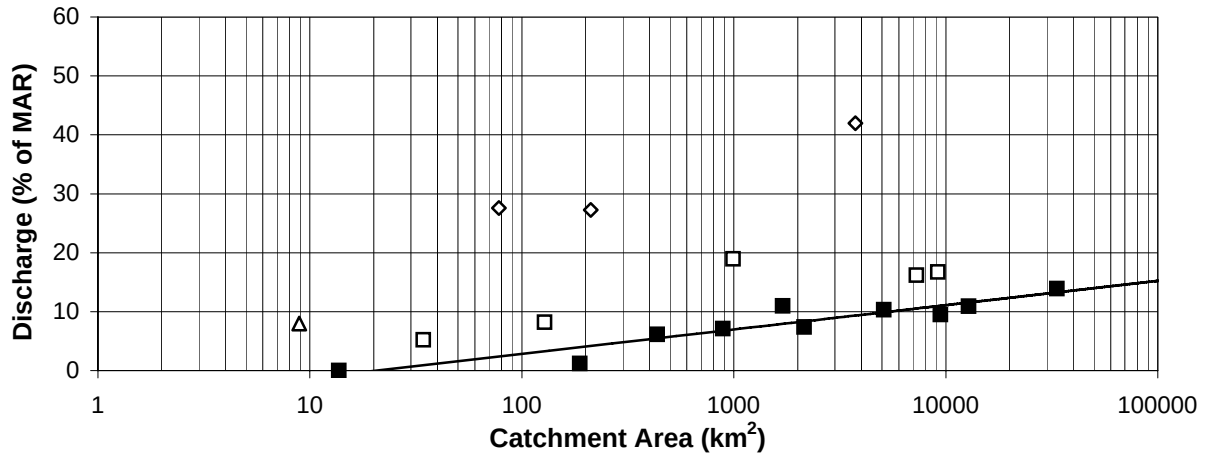
Q_{MAR} = mean annual runoff (m^3/s); and,

A = catchment area (km^2).

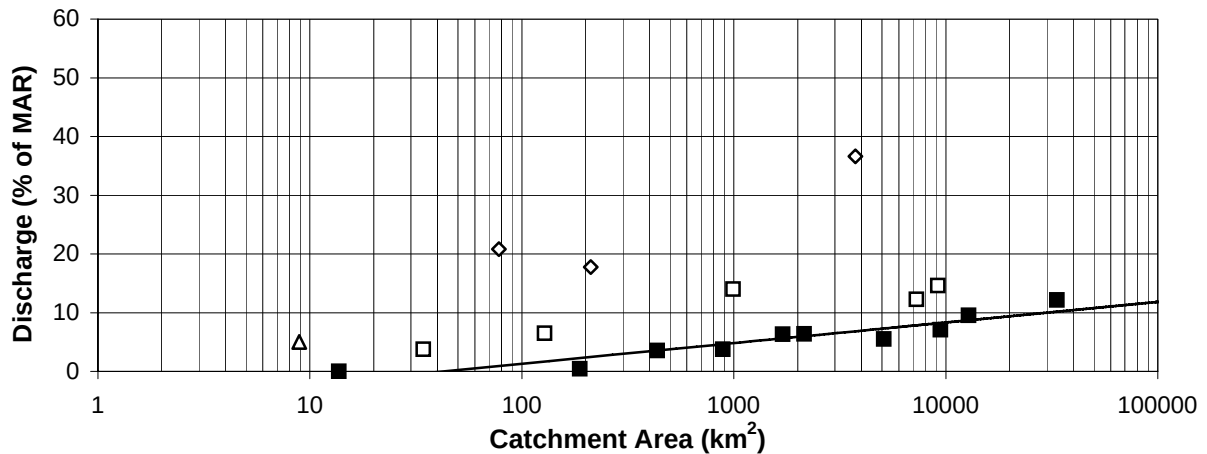
7-Day Low Flow with 2-Year Return Period



7-Day Low Flow with 10-Year Return Period



7-Day Low Flow with 50-Year Return Period



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FIGURE
3-6

These equations suggest that the flow in small catchments (i.e., with areas less than about 10 to 50 km²) may completely freeze-up at a return period of 10 years.

As was done for average flows, the streamflow record of Station MH-11 was used as a check on the low-flow analysis. Extreme low flow events for this station were estimated using the correlations developed in Section 3.1.3. The mechanics of computing the low flow events are set out in Table 3-3. The estimated 7-day low flows at Station MH-11 for return periods of 2, 10 and 50 years have been plotted on the graphs of Figure 3-6. As can be observed, the MH-11 values suggest that the “moderate-yield” catchments, rather than the “low-yield” catchments, may better represent the Upper False Canyon Creek. However, this observation must be viewed with caution because none of the flow measurements at MH-11 were conducted in the period January to April, or the period most likely to contain the annual minimum flow. Until such measurements become available, the equations based on the “low-yield” catchments should be used to estimate the low-flow characteristics of the minesite streams. Based on the preliminary comparison made with the MH-11 data, these equations will likely provide conservative (i.e., low) estimates for the Upper False Canyon Creek. This is not necessarily the case for locations further downstream in False Canyon Creek. It is noteworthy that the data point for Tom Creek falls within the group of “low-yield” catchments.

3.1.5 Flood Estimates

Due to their remote locations, failure of the tailings dams does not pose a significant risk to the public health and safety after closure. The environmental impact would be limited. For this reason, the minimum return period specified as a requirement in the water licence (1000-year) was used as the design event. For comparison purposes the MAF and the 200-year events were also estimated. As no long-term and continuous streamflow records exist at the minesite, it was necessary to resort to empirical and modelling procedures to estimate the design floods. Two separate procedures were employed, namely the Rational Method and the Regional Analysis.

3.1.5.1 *Rational Method*

For small catchments in the Yukon, most of the annual floods are caused by snowmelt, as evidenced by the high frequency of annual flood peaks occurring in the months of May and June. Despite this observation, the most extreme floods on small catchments are undoubtedly generated by another mechanism, namely intense rainstorms. In recognition of the importance of this second mechanism, the Rational Method was adopted to assess the design floods for the minesite streams. The Rational Method is essentially a modelling technique that simulates the magnitude of floods caused by intense rainstorms.

The Rational Method entails applying the following formula:

$$Q = CIA/3.6$$

where: Q is the peak instantaneous discharge of the flood (m³/s);
 C is a runoff coefficient (dimensionless);
 I is the average rainfall intensity which causes the flood (mm/h); and,
 A is the catchment area (km²).

The runoff coefficient specifies the proportion of the rainfall that quickly runs off the catchment to form the flood hydrograph. The remainder of the rainfall is retained on the catchment for subsequent evaporation or slow release to the catchment's streams. The value of the runoff coefficient varies from storm to storm depending on the initial moisture content of the soils and the extent of frozen soils within the catchment. For rural catchments, such as those at the minesite, standard practice is to assume a low runoff coefficient for frequent floods and a high coefficient for rare events. Accordingly, values of 0.3, 0.9, and 0.95 were adopted to represent the "wetness" of the study catchments during, respectively, the mean annual flood, the 200-year flood, and the 1000-year flood. A value of C equal to 0.95 implies a very wet catchment in which practically all of the rainfall is converted to flood runoff.

In order to apply the Rational Method, it was necessary to estimate a characteristic of each study catchment known as the "time of concentration". This is a measure of the response time of the catchment. It may be interpreted as the time it takes for the most remote portion of the catchment to contribute to the flow at the outlet of the catchment. The time of concentration was estimated using empirical relationships that depend on the physical characteristics of the catchment (Leopold, 1991 and McCuen, 1982).

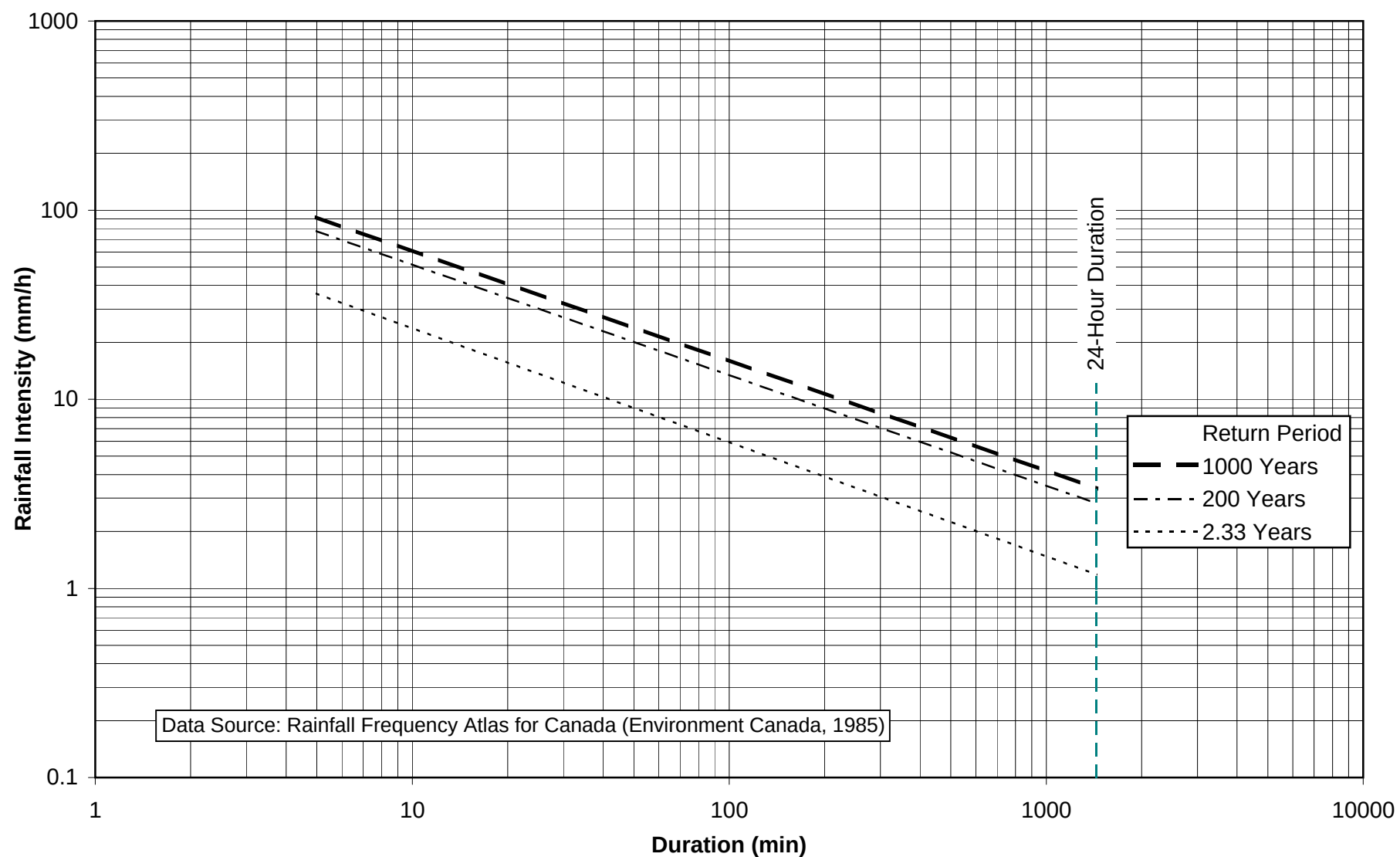
Information on design storm rainfalls likely to be experienced at the minesite was obtained from the "Rainfall Frequency Atlas for Canada" (Hogg and Carr, 1985). The data extracted from this publication are presented in Figure 3-7 in the form of an intensity-duration-frequency relationship. The curves on this figure represent the characteristics of rainfall storms with return periods of 2.33 (i.e., mean annual), 200 and 1000 years.

The calculation of flood peaks using the Rational Method is set out in Table 3-5. Note that the basic premise of the Rational Method is the largest flood will occur when the selected rainfall intensity has a duration exactly equal to the time of concentration. Furthermore, the computed flood peak is assumed to have the same frequency of occurrence as the causative rainfall intensity.

Table 3-5 Flood Peak Estimates Using the Rational Method

Item	Tailings Dam Catchment
Drainage area (A) - km ²	1.33
Lag time (T _L) – h	1.00
Time of concentration (T _c) - h	1.66
Time of concentration (T _c) - min	100
Rational coefficient (C)	
Mean annual maximum	0.3
200-year maximum	0.9
1000-year maximum	0.95
Rainfall intensity (I) - mm/h (for duration = T _c)	
Mean annual maximum	5.94
200-year maximum	13.4
1000-year maximum	16.0
Flood peak (Q) - m ³ /s (Q = CIA/3.6)	
Mean annual maximum	0.7
200-year maximum	4.5
1000-year maximum	5.6

Notes: 1. $T_L = 0.89 A^{0.395}$ 2. $T_c = 1.67 T_L$



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ESTIMATED RAINFALL INTENSITY-DURATION- FREQUENCY CURVES FOR MINE SITE			
PROJECT 1CC005.05	DATE AUG. 1999	APPROVED	FIGURE 3-7

3.1.5.2 *Regional Analysis*

As indicated above, no long-term and continuous streamflow records are available at the Sä Dena Hes minesite. However, the region encompassing the minesite is served by a reasonably dense network of streamflow gauging stations. The data collected at these regional stations were used to estimate the flood hydrology of the minesite streams by a variation on the technique used to estimate the average and low flows. Application of this approach involved four steps, as outlined below.

The first step entailed data gathering. A total of 25 regional streamflow gauging stations were selected to provide the necessary data for the Regional Analysis. Table 3-6 provides details of these stations. The WSC operated 18 of the selected stations while DIAND was responsible for the remainder. From the streamflow record of each of the 25 stations, an annual series of flood peaks was extracted. The length of these annual series ranged from 2 to 41 years.

The second step involved a statistical analysis of the assembled data. For each station, the average of its annual series of flood peaks was calculated to provide an estimate of the mean annual flood. The annual series was then fitted to a theoretical frequency distribution (Generalized Extreme Value) to provide an estimate of the flood events. Table 3-6 presents the estimated mean annual, 200-year and the 1000-year floods for the regional streamflow gauging stations.

The third step involved transposing the above-mentioned flood estimates to the minesite. This was done by exploiting a well-known observation that flood discharge is correlated with catchment area. The most useful way of examining this correlation was to prepare a logarithmic plot of "unit" discharge versus catchment area. Unit discharge means the flood peak is expressed as a flow rate per unit area (i.e., the absolute flood value is divided by the contributing catchment area).

Figure 3-8 presents the plots used to examine the relationship between unit discharge and catchment area for the mean annual, the 200-year and the 1000-year floods. Examination of these plots reveals that the data exhibits the expected inverse trend between unit flood discharge and catchment area (i.e., the unit flood discharge increases as catchment area decreases).

Table 3-6 Estimated Flood Magnitudes at Regional Streamflow Gauging Stations

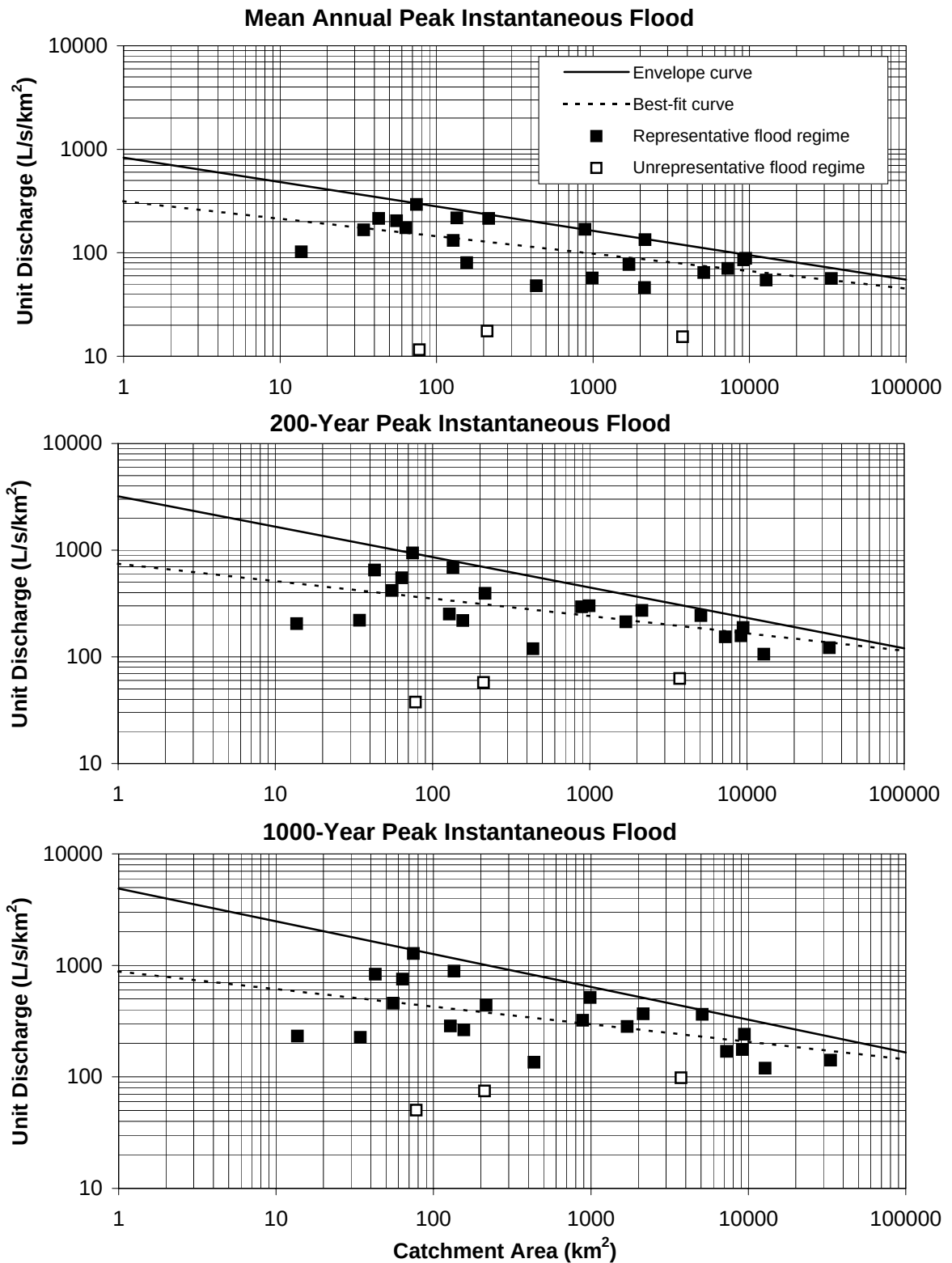
Streamflow Gauging Station ^a		Sample Size (No. of years)	Catchment Area (km ²)	Estimated Maximum Instantaneous Discharge (m ³ /s)			Estimated Maximum Instantaneous Unit Discharge (L/s/km ²)		
ID No.	Name			Mean Annual Flood	200-Year Flood	1000-Year Event	Mean Annual Flood	200-Year Flood	1000-Year Event
10BD001	Beaver River below Whitefish River	16	7280	514	1120	1230	71	154	169
10AA005/30AE002	Big Creek at km 1084.8 Alaska Highway ^b	20	991	56.5	298	510	57	301	515
10AC004	Blue River near the mouth	33	1700	131	361	480	77	212	282
10BC001	Coal River at the mouth	32	9190	784	1442	1610	85	157	175
10AC005	Cottonwood River above Bass Creek	35	888	149	261	285	168	294	321
10EA002/10EA004	Flat River at Cantung Camp ^c	19	128	16.8	32.1	36.6	131	251	286
30AD005	Flood Creek at km 100.3 Nahanni Range Road	5	42.8	9.2	27.8	35.7	215	650	833
10AB001	Frances River near Watson Lake	36	12800	697	1350	1530	54	105	120
10BE008	Geddes Creek at the mouth	16	77.8	0.90	2.92	3.91	12	38	50
10AD002	Hyland River at km 108.5 Nahanni Range Road	17	2150	288	585	790	134	272	367
10AD001	Hyland River near Lower Post	41	9450	834	1780	2280	88	188	241
30AD001	Jackpine Creek at km 62.2 Nahanni Range Road	5	74.6	21.8	70	95	292	938	1273
10AB003	King Creek at km 20.9 Nahanni Range Road	12	13.7	1.4	2.8	3.2	102	204	232
10EB003	Lened Creek above Little Nahanni River	10	34.3	5.7	7.55	7.73	166	220	225
10AA001	Liard River at Upper Crossing	39	33400	1884	4060	4720	56	122	141
10EB002	Mac Creek near the mouth	15	216	46.4	85	94	215	394	437
30AA001	Meister River above Liard River	2	2135	98.4	-	-	46	-	-
29AE003	Partridge Creek at km 1184.9 Alaska Highway	16	63.7	11.1	35	48	174	549	752

Streamflow Gauging Station ^a		Sample Size (No. of years)	Catchment Area (km ²)	Estimated Maximum Instantaneous Discharge (m ³ /s)			Estimated Maximum Instantaneous Unit Discharge (L/s/km ²)		
ID No.	Name			Mean Annual Flood	200-Year Flood	1000-Year Event	Mean Annual Flood	200-Year Flood	1000-Year Event
10AA004	Rancheria River near the mouth	13	5100	328	1240	1850	64	243	363
10BE013	Smith River above Smith Falls	12	3740	57.6	234	367	15	63	98
30AD004	South Moose Creek at km 84.8 Nahanni Range Road	5	55.5	11.3	23.2	25.4	204	418	457
30AE001	Spencer Creek at km 1118.6 Alaska Highway	5	156	12.5	34.1	41.2	80	219	264
30AD002	Spruce Creek at km 66.4 Nahanni Range Road	5	135	29.3	93	119	217	689	885
10BE009	Teeter Creek near the mouth	17	211	3.7	12.1	15.7	18	57	75
10AA002	Tom Creek at km 34.9 Robert Campbell Highway	18	435	20.9	51.8	58.9	48	119	135

Notes: a) DIAND recently established a gauging station on Contact Creek (30BE001), located some 60 km east of Watson Lake. The period of record for this station was too short to include in the present analysis. This station commands a small catchment and, accordingly, will be a valuable resource in the future for characterizing the flood hydrology of small basins.

b) This station was originally operated by DIAND from 1978 to 1988 (30AE002). The WSC assumed responsibility for this station in 1989 and gave it a new identification number (10AA005). This station was active in 1998.

c) The WSC has operated two stations on Flat Creek in the vicinity of the Cantung Mine. The first station (10EA002) was operated from 1973 to 1988 and commanded a catchment area of 128 km². The second station (10EA004) was located 3 km downstream of the first, was operated from 1988 to 1992, and controlled a total area of 160 km². Owing to the closeness in their catchment areas, the flood data for the two stations were combined to create a single record spanning 19 years. The flood values at 10EA004 were scaled by a factor of $(128/160)^{0.75}$ to make them representative of the conditions at 10EA002.



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FIGURE
3-8

Two different approaches are commonly used to quantify the correlation between flood discharge and catchment area. One is to fit a power regression to the data and the other is to draw an upper-bound curve which envelops all of the data. Both approaches were used in this study. The respective curves are shown on the plots of Figure 3-8. It is interesting to note that the three upper-bound curves possess a slope close to -0.25 on the logarithmic plot. This same slope is common to flood envelope curves for other parts of the Yukon and for British Columbia. The fourth and final step entailed using the curves on Figure 3-8 is to provide flood estimates for ungauged points on the minesite. For any ungauged point, this was done by planimetering the catchment area controlled by the point of interest. The best fit curves in the plots on Figure 3-8 were used to determine a unit discharge for the given catchment area. The product of unit discharge and catchment area was then calculated to provide the required flood estimates.

3.1.5.3 *Recommended Design Flood Estimates*

Table 3-7 summarizes the flood estimates made for the tailing impoundment catchment (1.33 sq. km²). Three different flood events (the mean annual, the 200-year and the 1000-year floods) were evaluated.

For the 200-year and 1000-year floods, the objective was to provide conservative estimates so that any structure designed to either of these standards would, in effect, possess an inherent factor of safety. This objective was met by selecting the higher of the two estimates provided by the Rational Method and the Regional Analysis. Using the Regional Analysis Envelope Curve, the adopted 1000 year flood event for the Camp Creek catchment, including the tailings pond, would have a peak flow of 14.2m³/sec.

Table 3-7 Estimated Peak Instantaneous Flood Discharges for Tailings Impoundment Spillway

Location	Flood-Prediction for Tailings Impoundment Spillway by Methods				Breached Reclaim Dam
	Rational Method (m³/s)	Regional Analysis, Best-fit Curve (m³/s)	Regional Analysis, Envelope Curve (m³/s)		
CATCHMENT AREA (SQ.KM)				1.33	4.47
MEAN ANNUAL FLOOD	0.7	0.4	1.0	0.4	NA
200-YEAR RETURN PERIOD FLOOD	4.5	1.0	3.9	4.5	NA
1000-YEAR RETURN PERIOD FLOOD	5.6	1.1	5.6	5.6	14.2

NA =not applicable

3.2 TAILINGS MANAGEMENT FACILITY - SEEPAGE ESTIMATES

3.2.1 Introduction

This section presents a discussion on existing and projected seepage rates from the tailings at the Să Dena Hes Mine tailings impoundment.

Direct seepage flows from the toes of the North and South dams, which contain the tailings, have not been consistently measured. However visual estimates of the seepage have been recorded since 1993. In order to better understand the quantities of seepage flow through the dams, available data and simple calculations were used to refine these estimates. These “semi-quantitative” estimates provided a basis for projecting future seepage for the two closure scenarios presented in this closure plan.

Section 3.2.2 discusses the “semi-quantitative” approach used to determine current seepage estimates.

Sections 3.2.3 discusses the potential for future seepage, for the two closure scenarios.

3.2.2 Seepage Under Current Conditions

3.2.2.1 South Dam

Visual observations made at the toe of the South Dam indicated a seepage rate along a 115 m zone at the low point in the dam of approximately 60 L/min. To refine this seepage rate, an estimation of seepage was calculated based on changes in pond water level and evaporation (water balance method). The estimates for seepage losses from the South Dam for existing conditions are based on this water balance method, developed using average annual meteorological data. Seepage loss estimates are relatively insensitive to net evaporation values because of the volume of water in the pond. For example, if evaporation drops to 0 mm, the seepage loss number rises to 238 l/min from 218 l/min. As shown in this example, it is the difference between the values of evaporation and precipitation that are important, not the absolute values for each.

Currently, there is not enough data to estimate groundwater inflow and outflow at the TMF. Therefore, seepage loss estimates do not include the effect of groundwater infiltration/exfiltration.

The method is described below.

The water level in the tailings pond has been monitored since 1993. A record of these levels is shown in Figure 3-9.

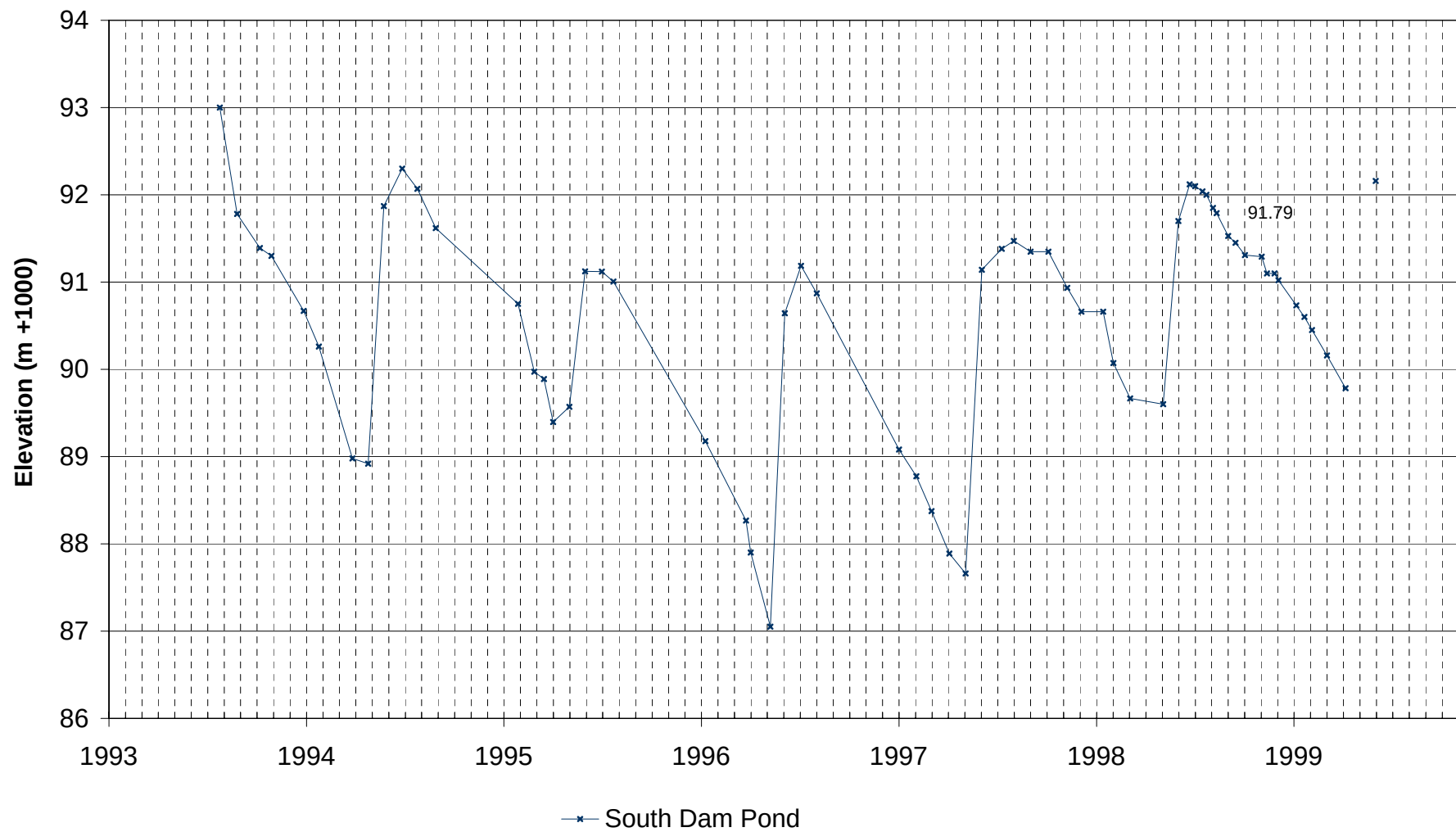
The graph shows a regular seasonal fluctuation in the pond level. The highest levels generally occur in late June or early July, corresponding to the end of the spring snowmelt. These levels steadily decrease to a minimum level in April or May of the following year. There are three possible mechanisms that could cause a drop in the pond level:

1. removal of pond water from the decant tower;
2. net evaporation (precipitation minus pan evaporation) from the ponds surfaces; and,
3. seepage through the dam.

The decant tower was sealed sometime during 1996, therefore the drop in pond levels over the winters of 1997/98 and 1998/1999, and possibly the winter of 1996/1997, would have been due solely to losses from net evaporation and seepage. Table 3-8 shows the estimated losses due to seepage for these three periods based on average evaporation and precipitation values. Since the highest value of 218 L/Min corresponding to the winter of 1996/1997 disregards potential flow that may have occurred from the decant tower, it has been removed from consideration. The average estimated seepage flow through the toe of the south dam for the two succeeding years is 180 L/Min.

Table 3-8 Seepage Estimates Through Toe of South Dam Based on Water Balance

Start Recession			End Recession			Avg Evap over Year	Avg Precip over Year	Change in Dam Volume/Time		Net Evaporative Flux (Evap - PPT)		Seepage
Date	Pond Volume	Pond Area	Date	Pond Volume	Pond Area							
	(Mm ³)	(m ²)		(Mm ³)	(m ²)	(mm/yr)	(mm/yr)	(Mm ³ /day)	(L/Min)	(m ³ /yr)	(L/Min)	(L/Min)
07/04/96	130.1	31212.2	05/04/97	39.1	14756.2	450.0	690.0	0.30	207.79	-5516.21	-10.50	218.29
08/01/97	139.8	32756.1	05/04/98	82.2	23187.1	450.0	690.0	0.21	145.06	-6713.19	-12.77	157.83
07/02/98	162.8	36297.1	04/06/99	87.1	24066.2	450.0	690.0	0.27	189.00	-7243.59	-13.78	202.78



**SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN**

South Dam Pond Levels

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1CC005.05

DATE
AUG. 1999

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FIGURE
3-9

3.2.2.2 *North Dam*

Visual observations at the North Dam indicated seepage along an 80 metre zone of the downstream toe. This flow combines with seepage from the surrounding hillside to the west as well as seepage from the east side of the valley to constitute the total flow measured at the downstream pipe weir (MH-02). Visual observations made during the site inspections estimated that approximately 60% of the flow at the pipe weir came from the west side of the valley (tailings pond and surrounding hillside).

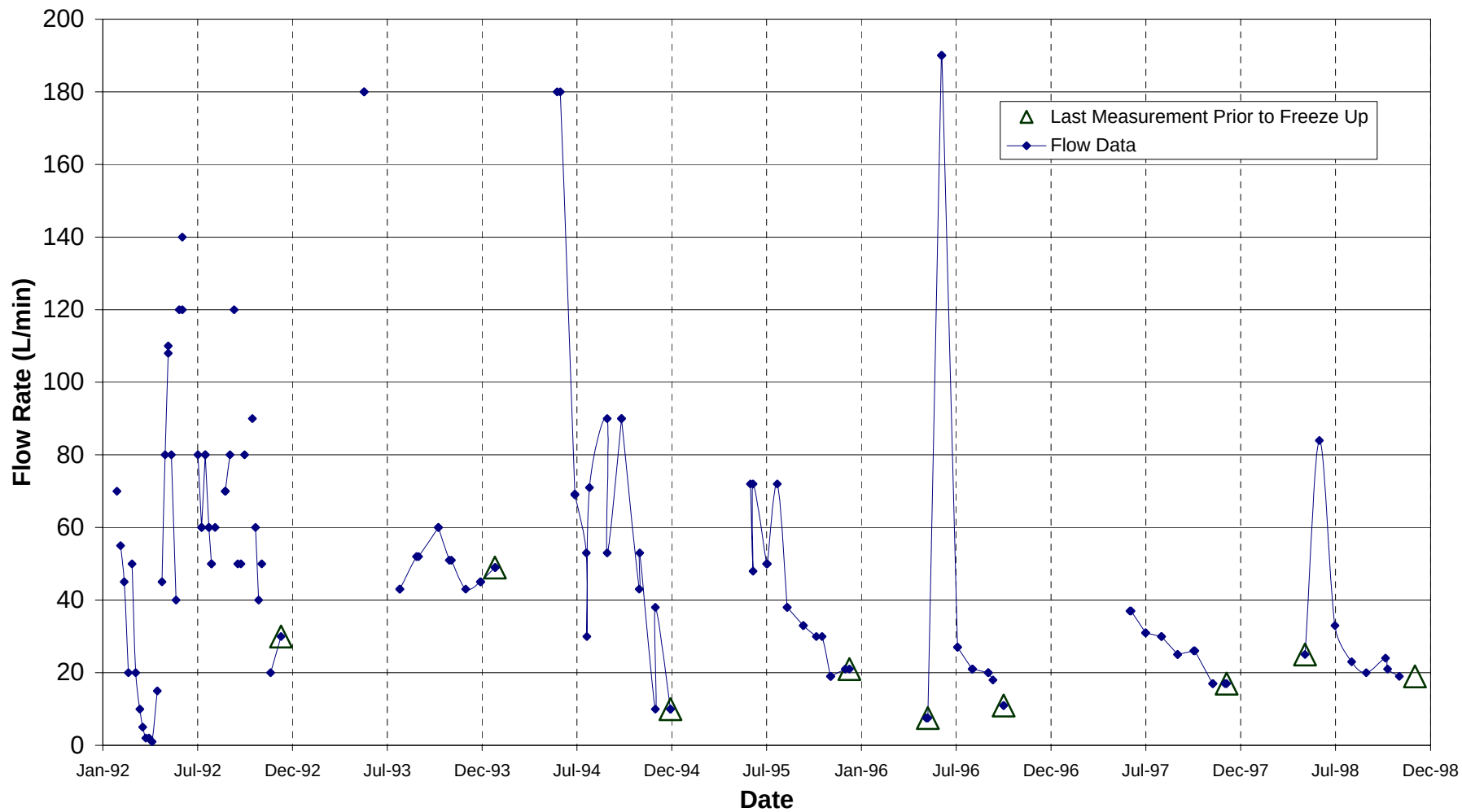
Standing water on the North Dam tailings forms discrete pools of which the occurrence and extent vary seasonally. Therefore a back-calculation of seepage flows could not be performed using a water balance method, as was carried out for the South Dam. Instead, an analysis of the seasonal flow measured at MH-02 was used to estimate seepage from the toe of the North Dam.

The flow measured at MH-02 is comprised of three components:

1. flow from the surrounding hillside to the west;
2. flow from the east side of the valley; and,
3. seepage directly from the toe of the North Dam.

Figure 3-10 shows flows measured at MH-02. The figure shows that the highest flows occur in late May/early June corresponding to the spring snowmelt event. The flows taper off more or less exponentially, reaching an approximate steady-state by early autumn. Generally, the last measurement of flow at the weir prior to the winter freeze showed the lowest flow.

Assuming that the contribution to flow from the surrounding hillside to the west and the east side of the valley is negligible at the end of the season, then the low flow measured at MH-02 is more or less representative of the flow directly from the toe of North Dam. The lowest flows for each season are marked by hollow triangles on the graph, and are fairly consistent from year to year. The average of these low flows is 20 L/Min.



			SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN			
			North Dam (MH-02) Flow Readings			
	PROJECT 1CC005.05		DATE AUG. 1999	APPROVED	FIGURE 3-10	

3.2.3 Tailings Seepage After Closure

The two closure scenarios currently under consideration are:

Scenario 1 Close mine as is, drain pond at south end, breach South Dam and cover tailings;
 and

Scenario 2 Re-open mine, raise the level of both the North and South Dams to 1102 m and
 1100 m respectively and deposit tailings into impoundment over a 4 year period.

Figures 3-11 and 3-12 show the conceptual pathways for flow through and out of the tailings for the two closure options respectively.

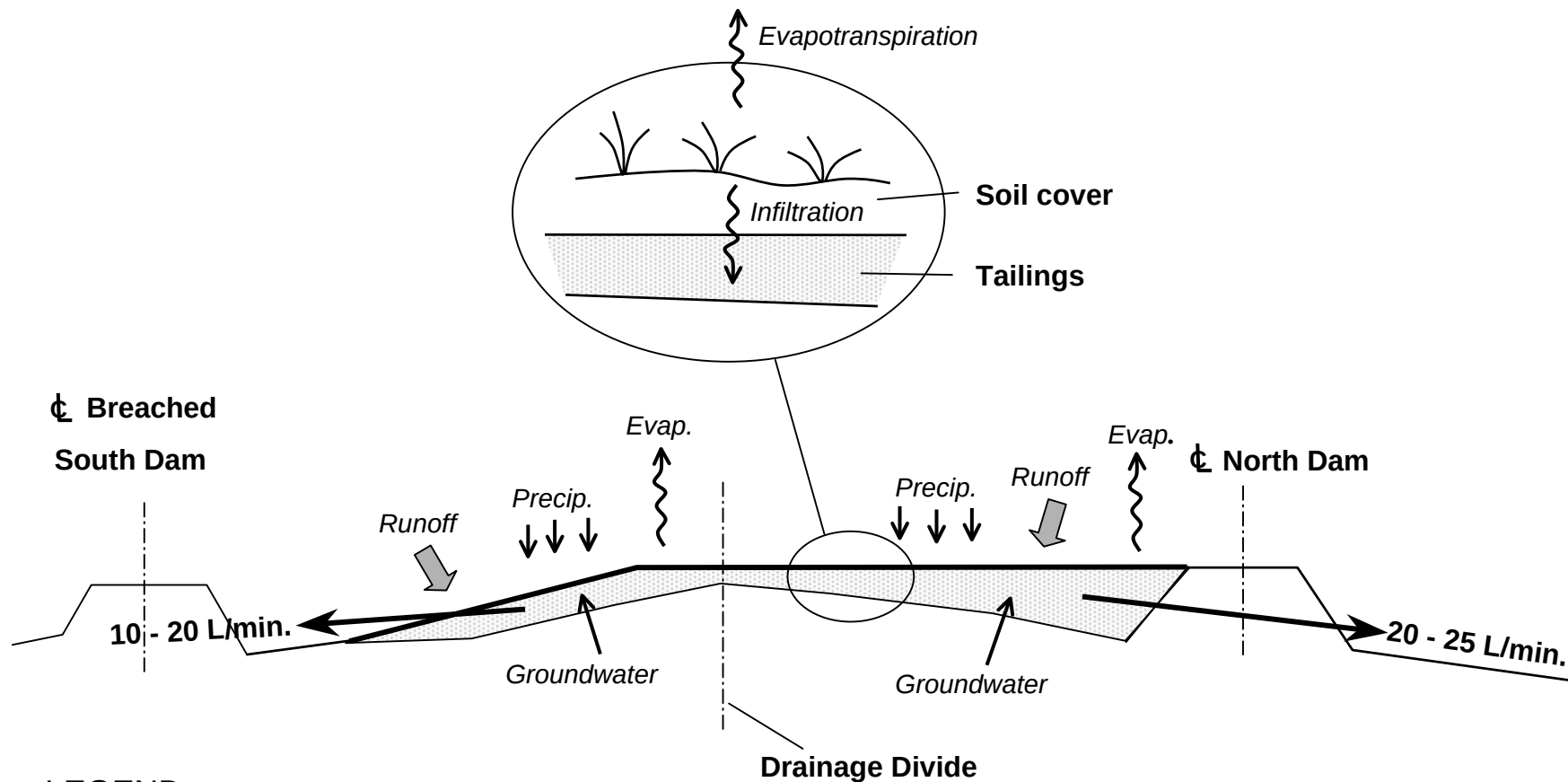
(i) Scenario 1 (see Figure 3-11)

This closure options involves breaching the South Dam and applying a soil cover to the existing tailings area.

As shown in Figure 3-10, flow into the tailings will come from groundwater recharge and infiltration through the cover. However, it is also thought that the vegetation cover will reduce the flow.

Tailings at the North end of the impoundment will likely remain saturated after application of the cover, and therefore piezometric levels and hydraulic gradients within the tailings will likely not change. Since seepage through a permeable material is directly related to the hydraulic gradient across that material, the seepage rates through the North Dam will likely not change either and will therefore remain around 20 l/min.

For the South Dam, the current pond of water will be drained and the cover applied for the exposed tailings. Since the tailings are likely to remain saturated, a hydraulic gradient will be established resulting in seepage from the lowest point of the tailings area.



LEGEND

Seepage
Flux through
Tailings

Scenario 1



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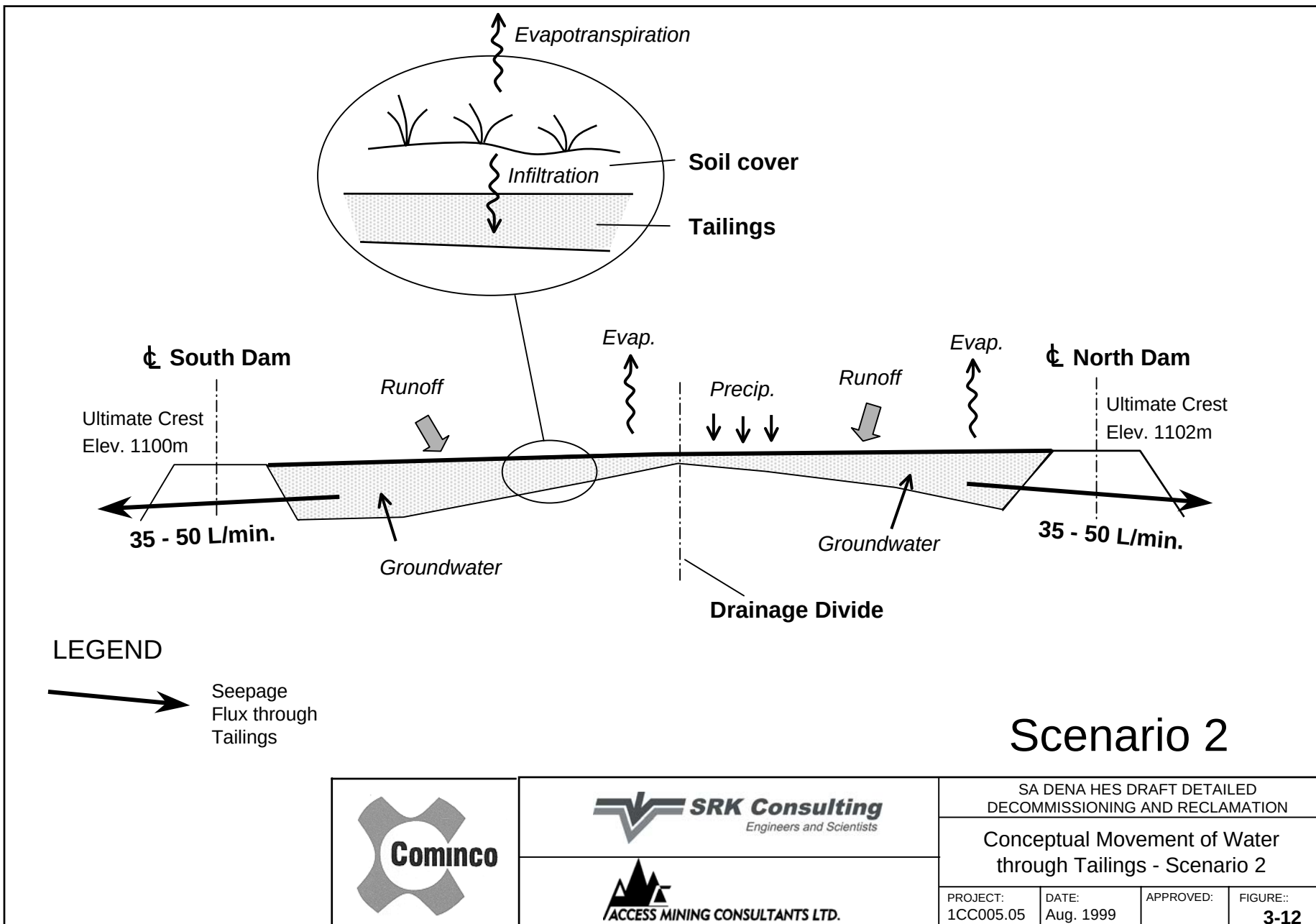
Conceptual Movement of Water
through Tailings - Scenario 1

PROJECT:
1CC005.05

DATE:
Aug. 1999

APPROVED:

FIGURE::
3-11



Scenario 2

	 SRK Consulting Engineers and Scientists	SA DENA HES DRAFT DETAILED DECOMMISSIONING AND RECLAMATION		
		Conceptual Movement of Water through Tailings - Scenario 2		
	 ACCESS MINING CONSULTANTS LTD.	PROJECT: 1CC005.05	DATE: Aug. 1999	APPROVED: FIGURE:: 3-12

Given the smaller area and volume of tailings present at the south end, the seepage rate after application of a cover will likely be lower than that of the existing south end. Although the volume and areal extent of tailings at the South end are not known, they are thought to be approximately half that of the North Dam. Therefore a steady seepage rate, in the range of 10 to 20 L/min, is expected from the tailings at the south end after closure.

(ii) Scenario 2 (see Figure 3-12)

This closure option results in a final tailings level at the North end of about 1102 and 1100m at the south end.

Under these conditions, seepage from the North Dam would likely increase due to the incremental head of water contributed by the addition of saturated tailings. Assuming the tailings will remain saturated after closure, an incremental increase to 1102 m would result in raising the piezometric surface of the tailings by 25 percent, and increasing the cross sectional area of the tailings dam by approximately 20 percent. This could result in a 50 to 100 percent increase in seepage from the North Dam after closure, which roughly correlates to a flow of 35 to 50 L/Min

Since the volume and surface area of the South Dam tailings area will be very similar to that of the North Dam at closure, it is expected that seepage from the South Dam after closure would be in the same range of 35 to 50 L/min. This reduction in seepage rates from estimates of 180 L/min in 1997 and 1998 can be explained as follows: It is reasonable to conclude that the difference between the seepage from the South end of the impoundment (180 L/min) and the seepage from the North end is due to the tailings buildup behind the North Dam. Scenario 2 intends to involve focussed tailings deposition at the upstream face of the South Dam by spigotting tailings from the crest. It is expected that this will significantly reduce seepage at the toe. In addition, the flow of surface run-off will be positively directed to the southwest, around the South Dam in Scenario 2, residence times of surface waters will be substantially reduced. The South Dam will no longer be containing surface run-off and will only experience seepage from saturated tailings, minimal surface water penetration, and any groundwater recharge in the area above the dam. The reduced water head pressure at the South Dam will reduce seepage rates to a level similarly experienced at the North Dam.

3.3 WATER QUALITY

3.3.1 Surface Water Quality

3.3.1.1 Background

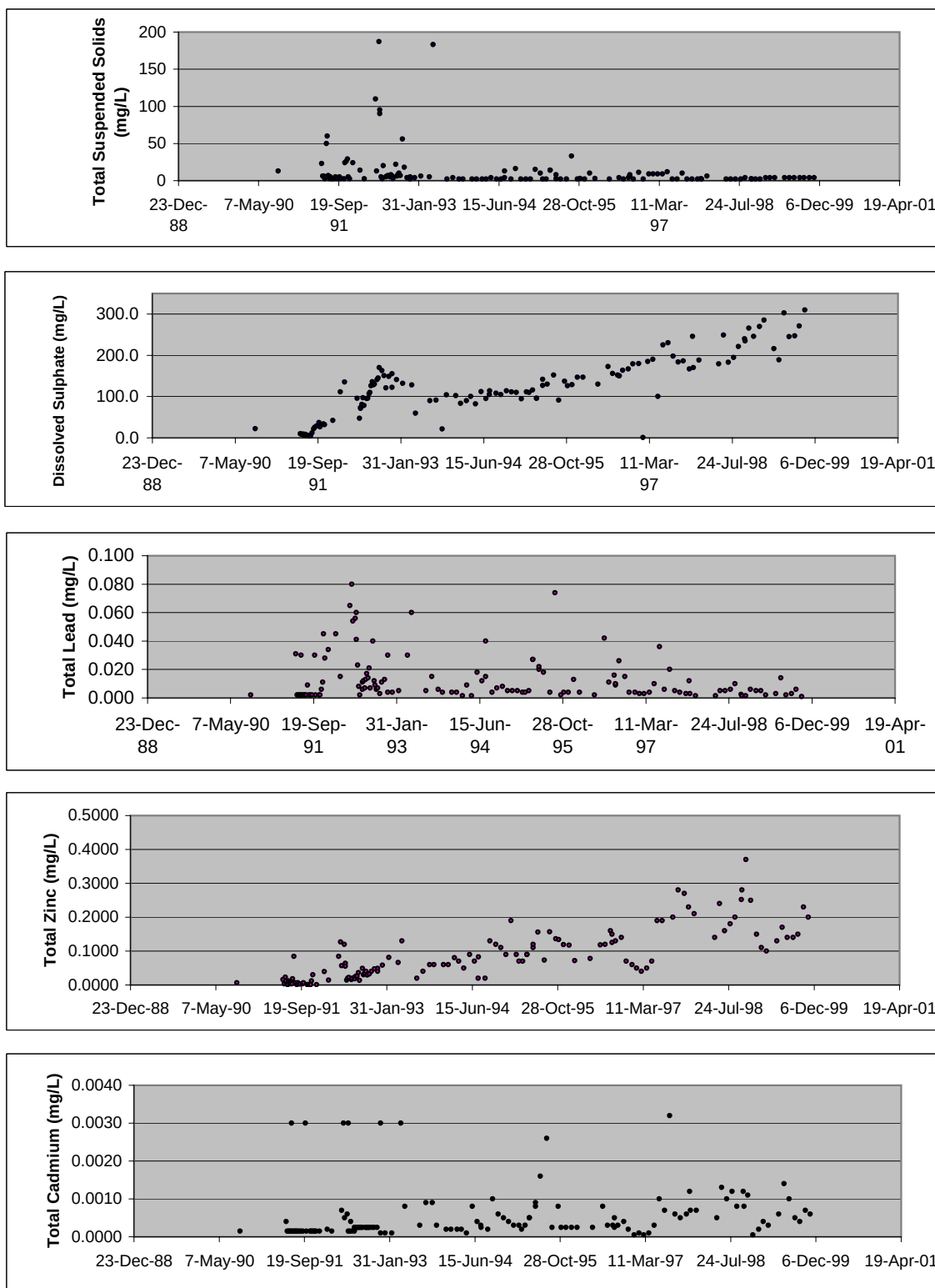
The objective of this section is to summarize the trends in water quality at and around the site since the time the initial baseline program was completed and mine development began through to the present day. A second objective is to provide a basis for post-closure predictions of water chemistry.

An extensive water monitoring program is conducted year-round at the mine site and has been in place since the Initial Environmental Evaluation (IEE) was prepared. The results of this monitoring and detailed discussions of the pre-mine (baseline) site water chemistry are available in the IEE (Steffen, Robertson and Kirsten, 1990). The annual reports submitted by the project proponents (Curragh Inc. 1991-1993 and Cominco Ltd., 1994-1998) contain a complete record of all the water quality sample results from each monitoring station during the operational and temporary closure periods. Complete water quality data for the monitoring program is presented in Appendix C – Water Quality Monitoring Data, and will also be available in electronic form. Appendix C contains water quality data from both pre-mining (baseline) surveys, collected by DIAND, Environment Canada (EPS), and Curragh resources Inc. (1985 and 1988-1990), and surveillance network monitoring as per Water Use Licence requirements by Curragh Resources Inc. and Cominco from 1991-1998.

Figures 3-13 to 3-21 highlight key water quality data collected over the life of the project for selected parameters at several stations.

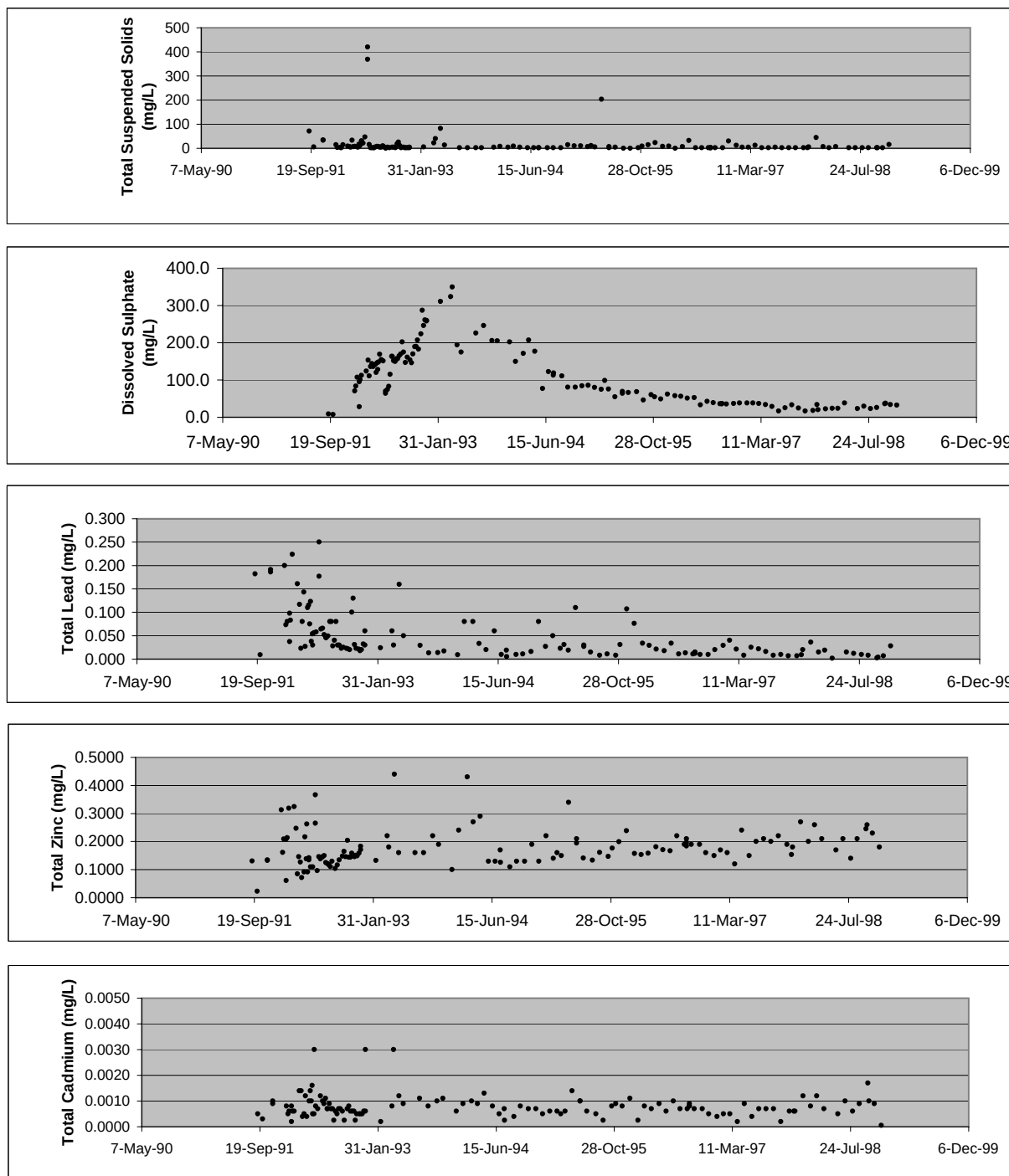
Prior to 1991, baseline water quality sampling sites were established in the Tom Creek Drainage (refer to project IEE). The current water quality monitoring program is conducted within the immediate mine site area extending north on the main channel of False Canyon Creek to within 13 km of it's confluence with the Frances River. The water quality monitoring program has stations located at strategic locations around the mine site to monitor effluent releases and within the False Canyon Creek catchment to track downstream receiving water quality. Figure 3-22 and Figure 3-23 show the network of surface water quality monitoring stations currently in operation.

Figure 3-13 Water Quality for Selected Parameters at Monitoring Station MH-2.



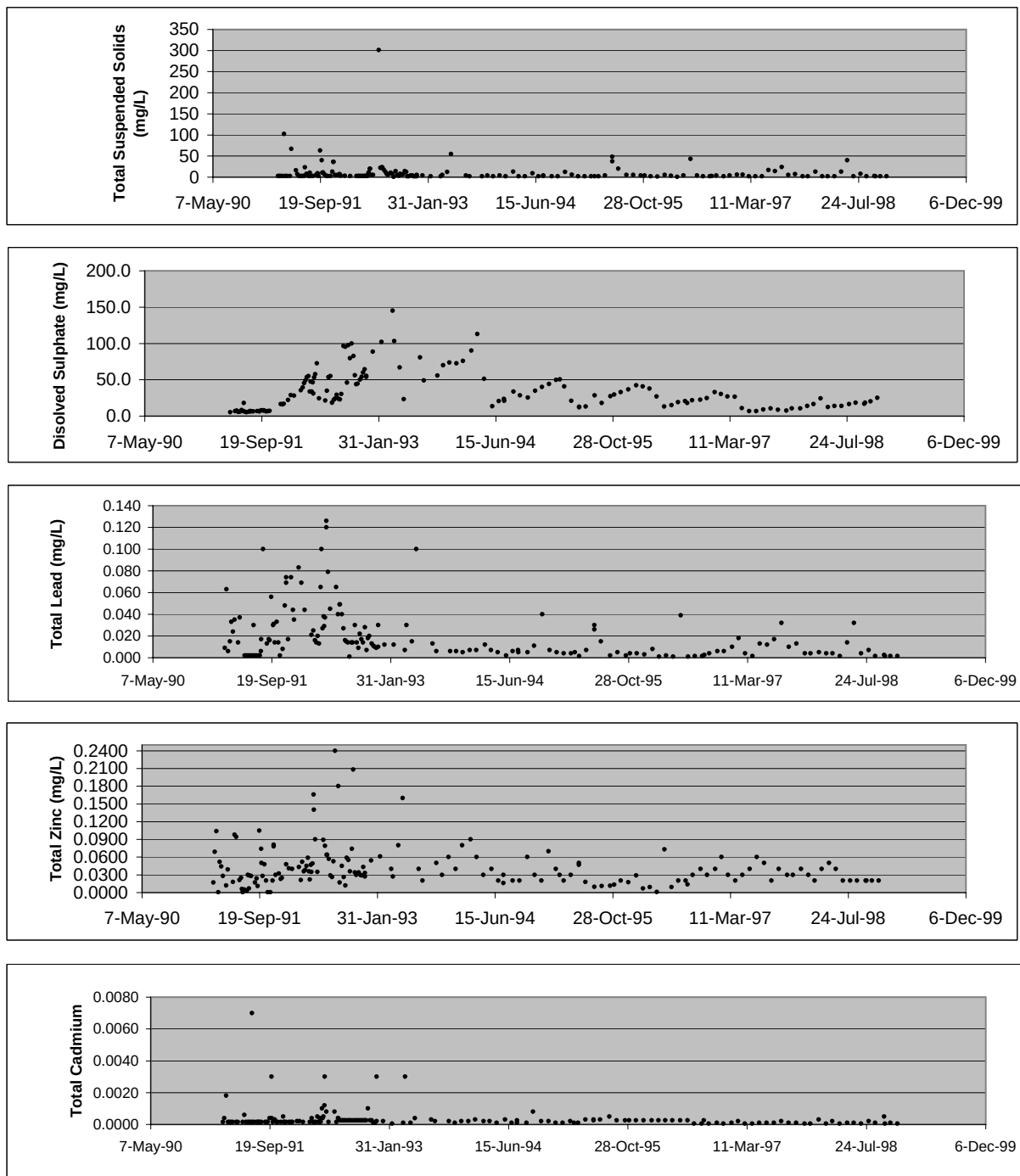
Waste Water Effluent Discharge Standards under Water Use Licence QZ97-025 are: 50 mg/L Total Suspended Solids, 0.2 mg/L Lead, 0.5 mg/L Zinc, and 0.02 mg/l Cadmium

Figure 3-14 Water Quality for Selected Parameters at Monitoring Station MH-7.



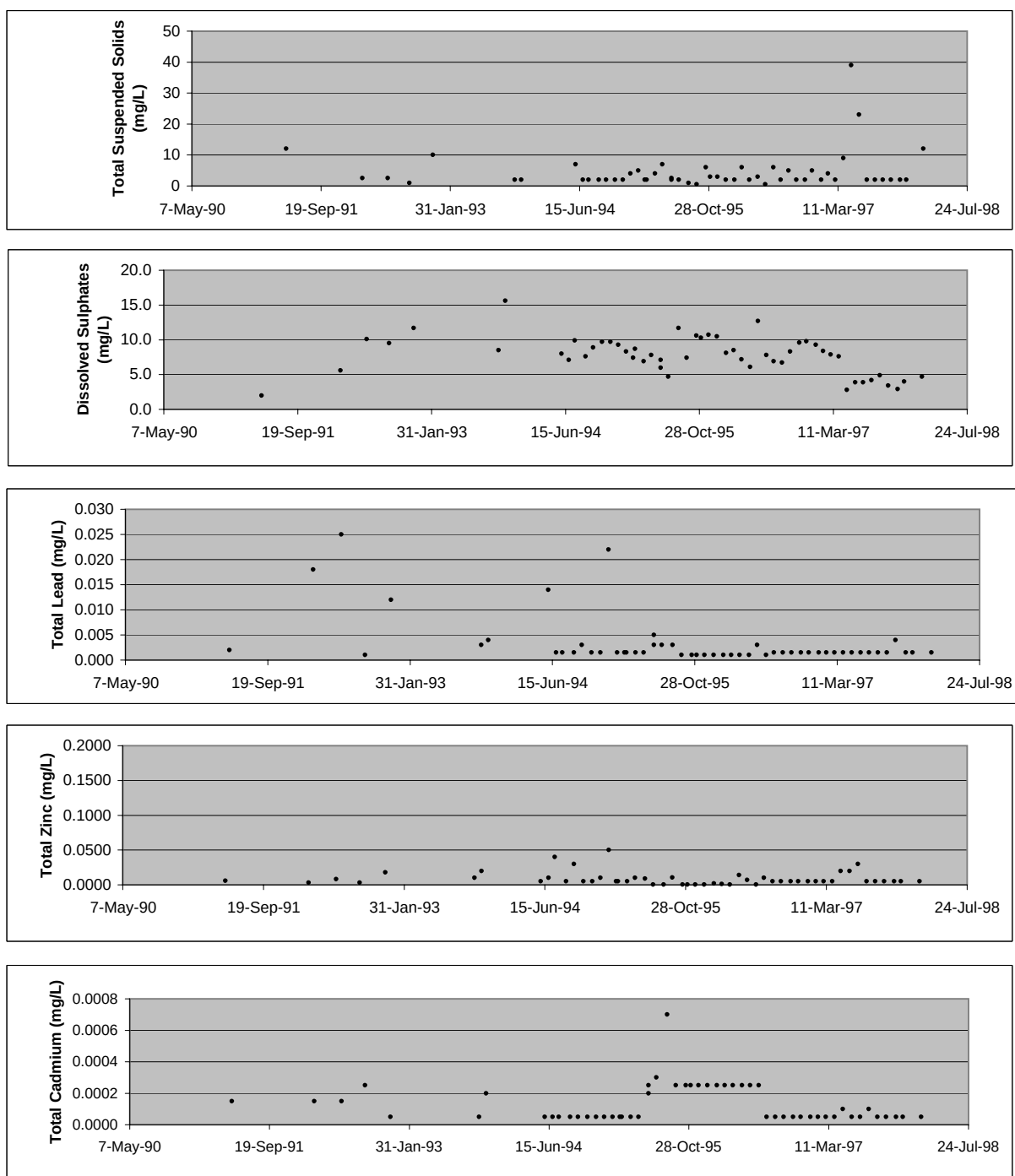
Waste Water Effluent Discharge Standards under Water Use Licence QZ97-025 are: 50 mg/L Total Suspended Solids, 0.2 mg/L Lead, 0.5 mg/L Zinc, and 0.02 mg/l Cadmium

Figure 3-15 Water Quality for Selected Parameters at Monitoring Station MH-11.



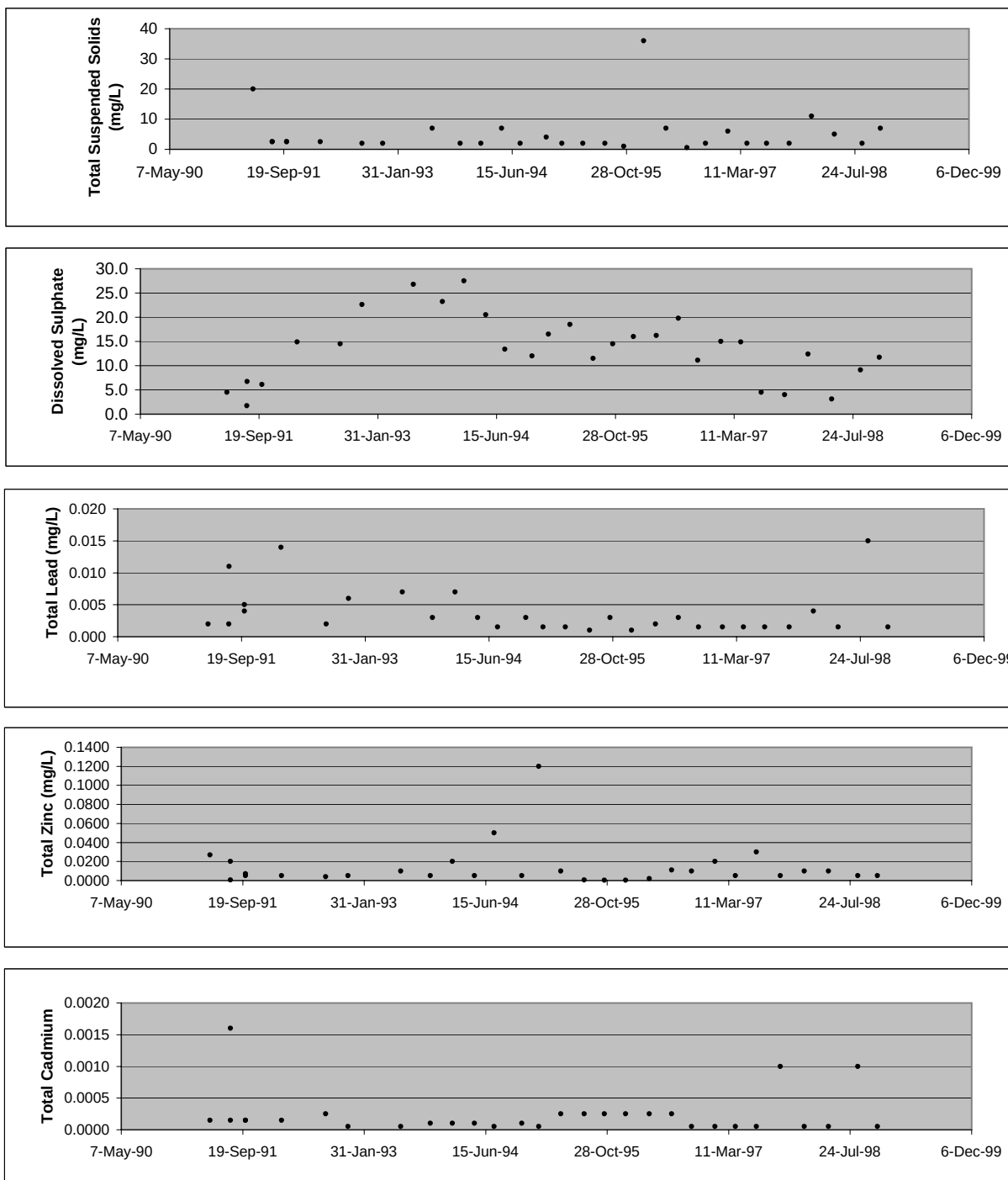
CCREM Guidelines for Freshwater Aquatic Life for lead is 0.007 mg/L, 0.03 mg/L for Zinc, and 0.0018 mg/L for Cadmium

Figure 3-16 Water Quality for Selected Parameters at Monitoring Station MH-12.



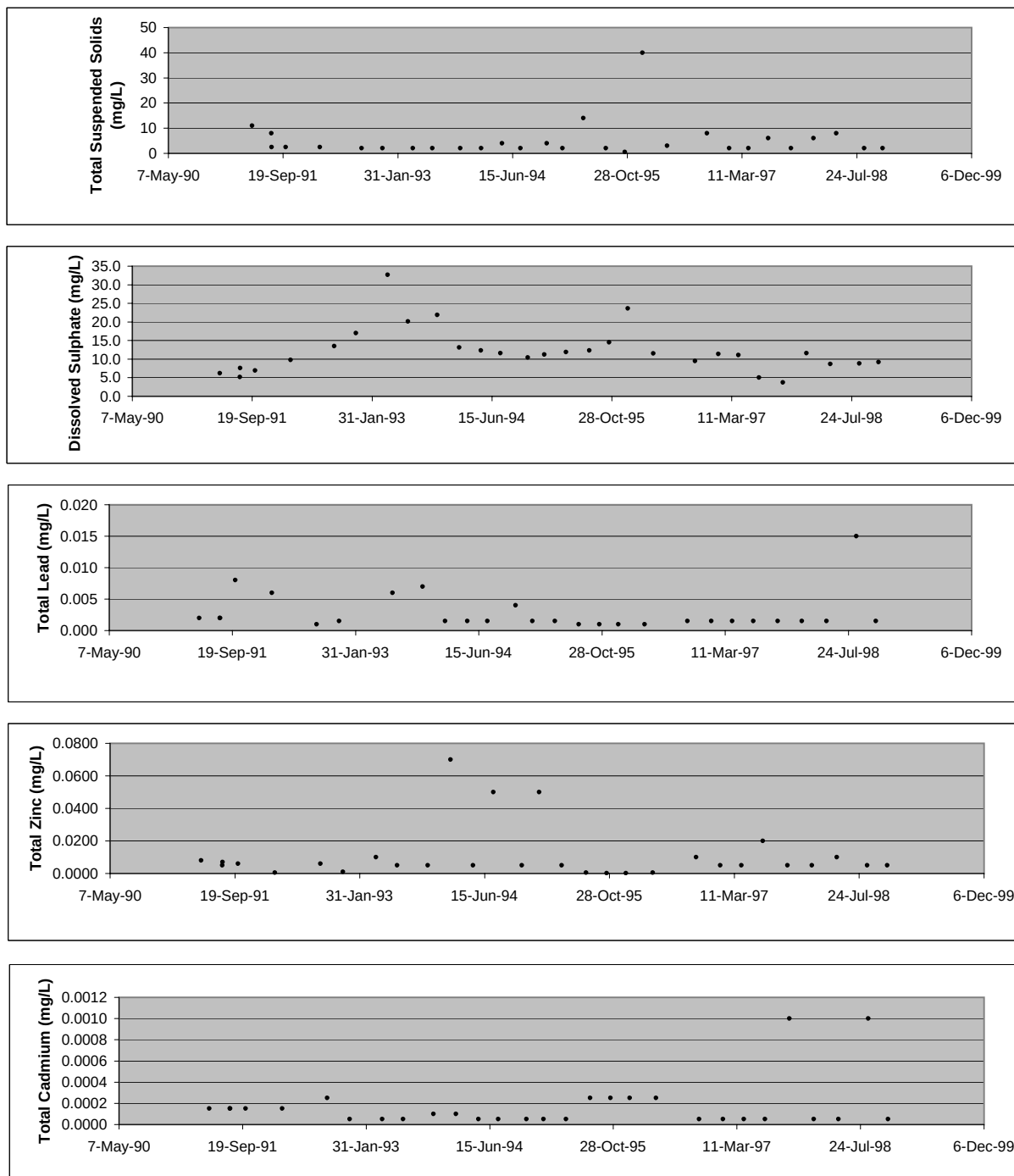
CCREM Guidelines for Freshwater Aquatic Life for lead is 0.007 mg/L, 0.03 mg/L for Zinc, and 0.0018 mg/L for Cadmium

Figure 3-17 Water Quality for Selected Parameters at Monitoring Station MH-13.



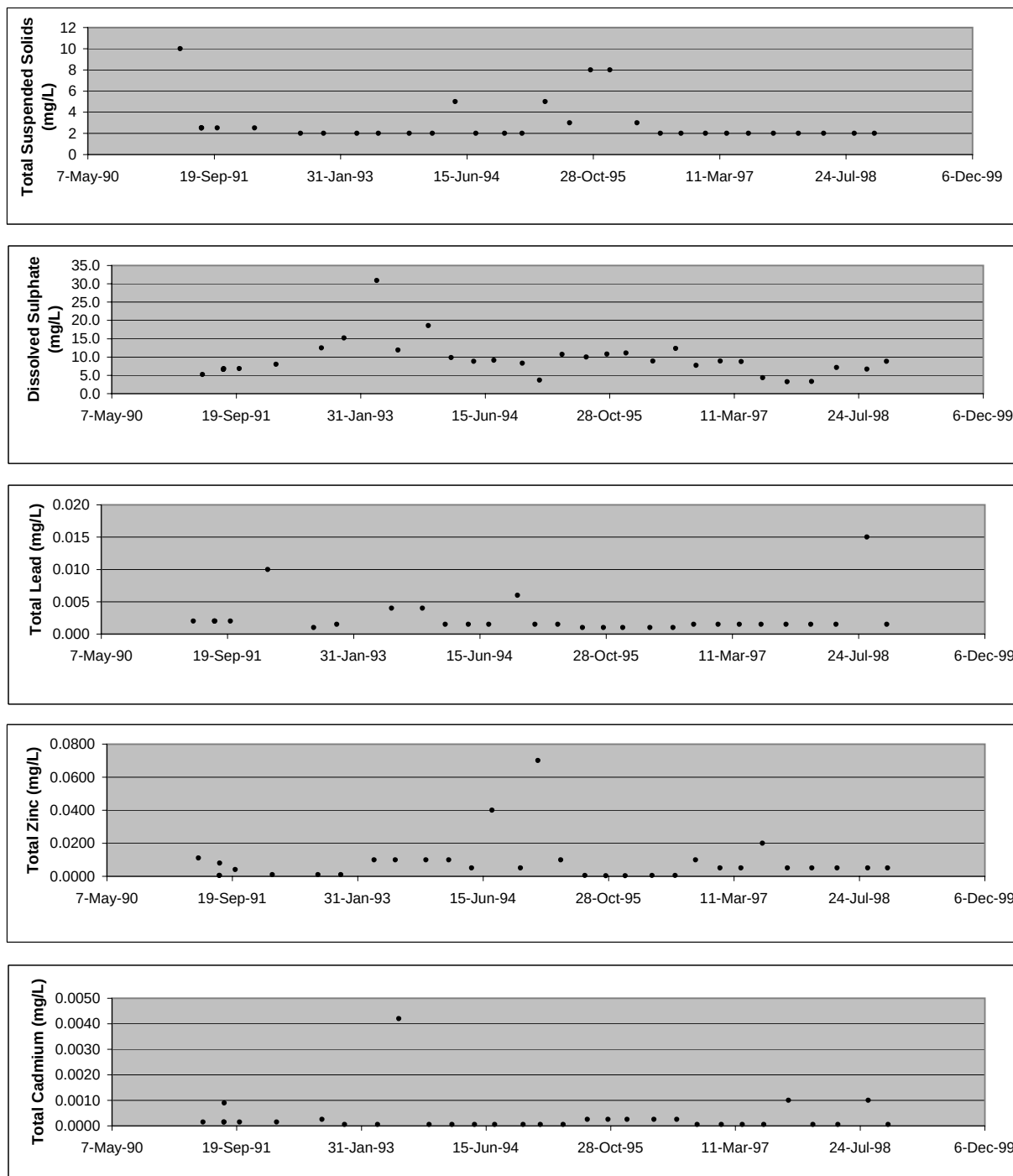
CCREM Guidelines for Freshwater Aquatic Life for lead is 0.007 mg/L, 0.03 mg/L for Zinc, and 0.0018 mg/L for Cadmium

Figure 3-18 Water Quality for Selected Parameters at Monitoring Station MH-14.



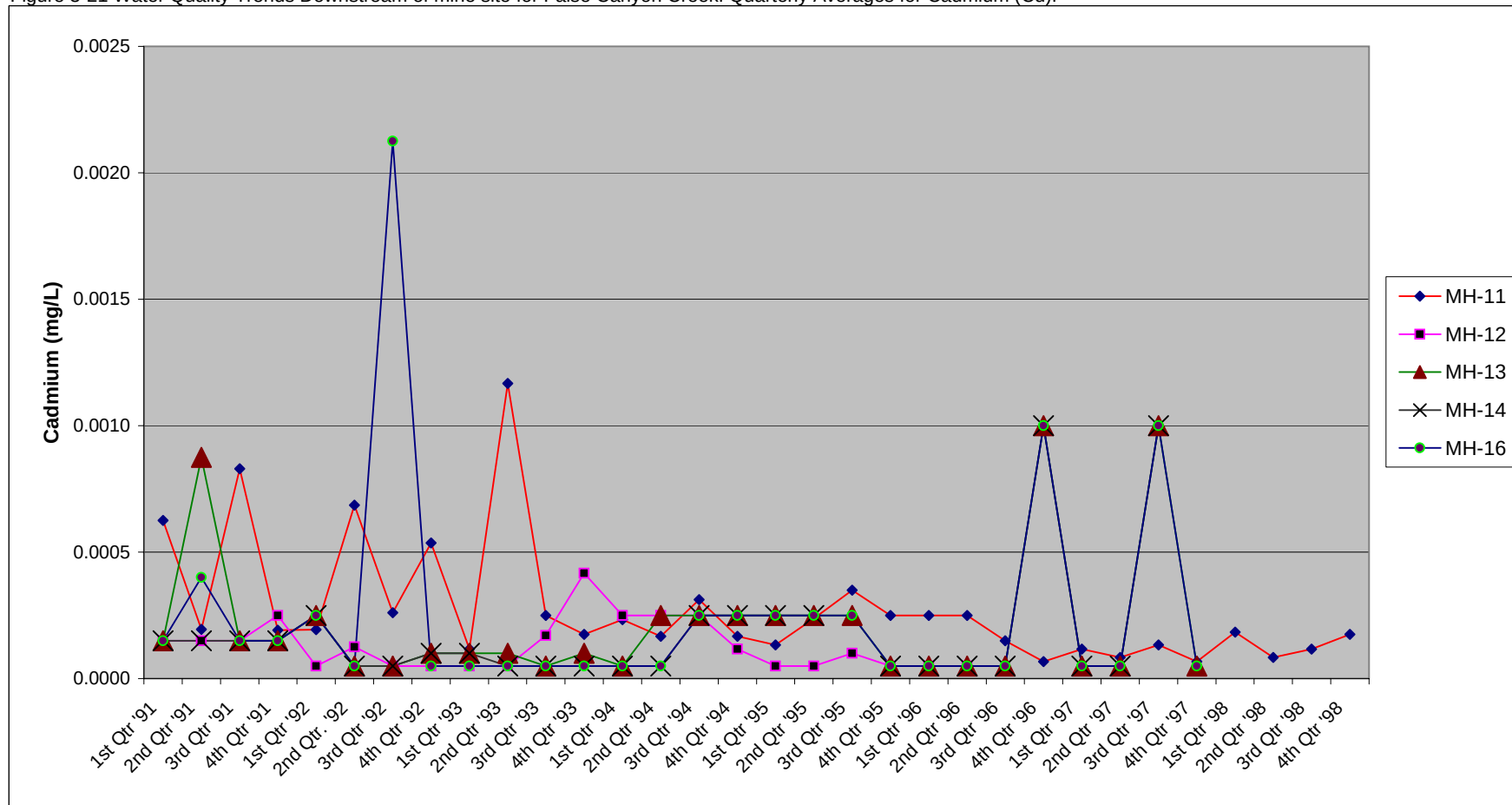
CCREM Guidelines for Freshwater Aquatic Life for lead is 0.007 mg/L, 0.03 mg/L for Zinc, and 0.0018 mg/L for Cadmium

Figure 3-19 Water Quality for Selected Parameters at Monitoring Station MH-16.



CCREM Guidelines for Freshwater Aquatic Life for lead is 0.007 mg/L, 0.03 mg/L for Zinc, and 0.0018 mg/L for Cadmium

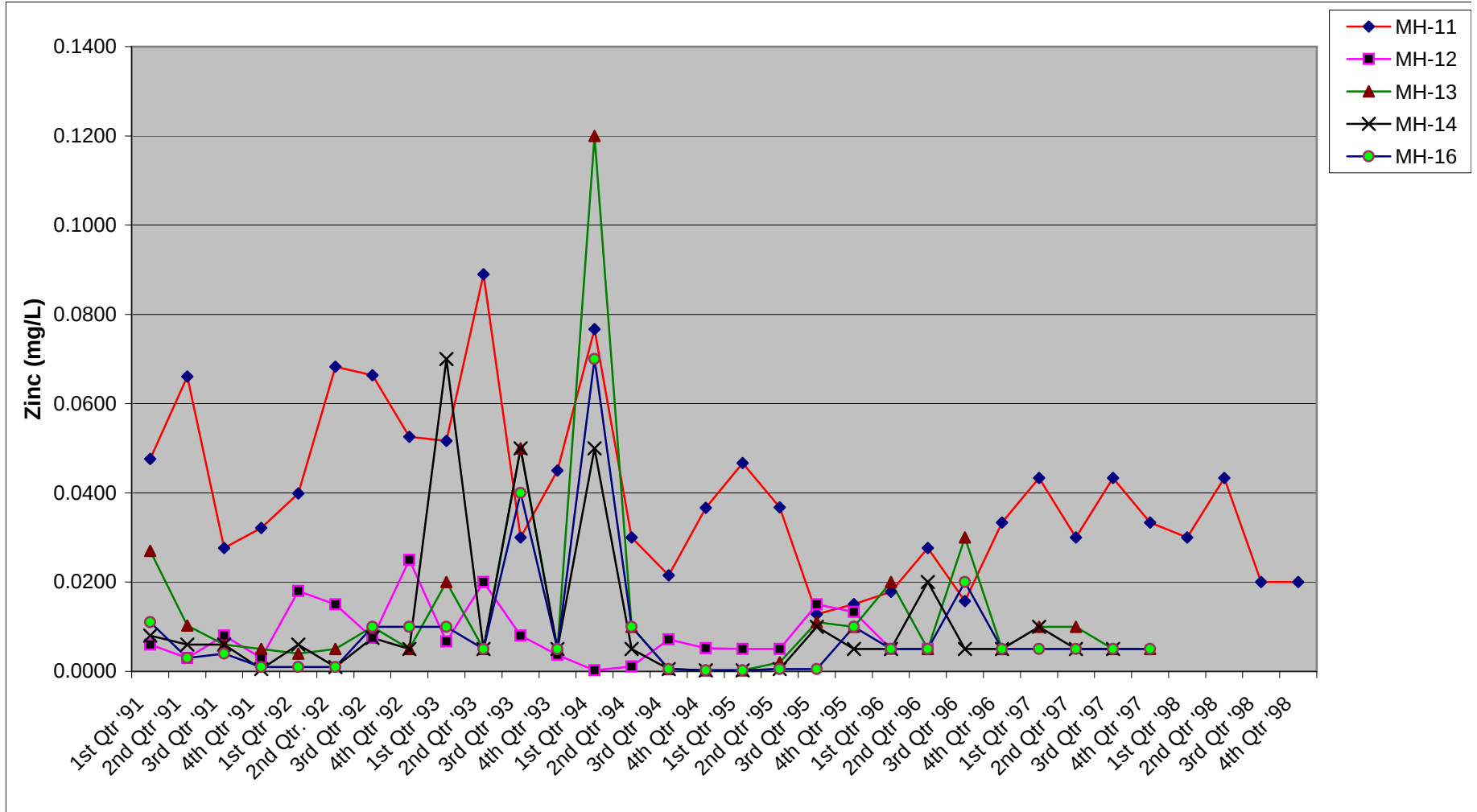
Figure 3-21 Water Quality Trends Downstream of mine site for False Canyon Creek: Quarterly Averages for Cadmium (Cd).



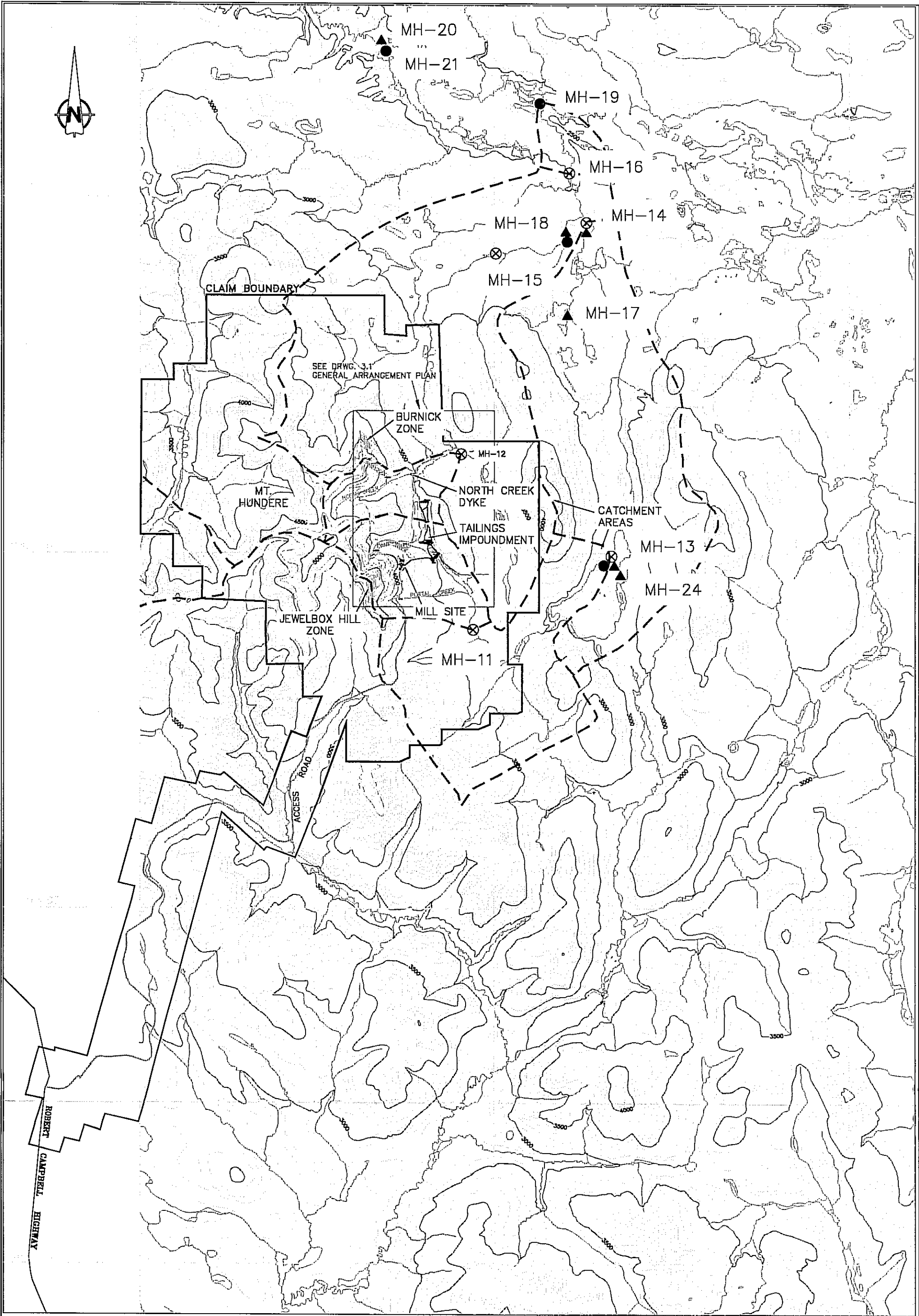
CCREM Guidelines for Freshwater Aquatic Life: **0.0018 mg/L** Cadmium (Cd)

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 APPENDIX B – ENVIRONMENTAL BASELINE UPDATE AND TECHNICAL BASIS FOR CLOSURE ASSUMPTIONS

Figure 3-20 Water Quality Trends Downstream of mine site for False Canyon Creek: Quarterly Averages for Zinc (Zn).

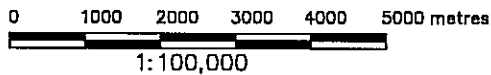


CCREM Guidelines for Freshwater Aquatic Life: **0.03 mg/L Zinc (Zn)**



NTS: 105 A/06, 105 A/07
105 A/10, 105 A/11

CONTOUR INTERVAL 100 FEET



NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

LEGEND

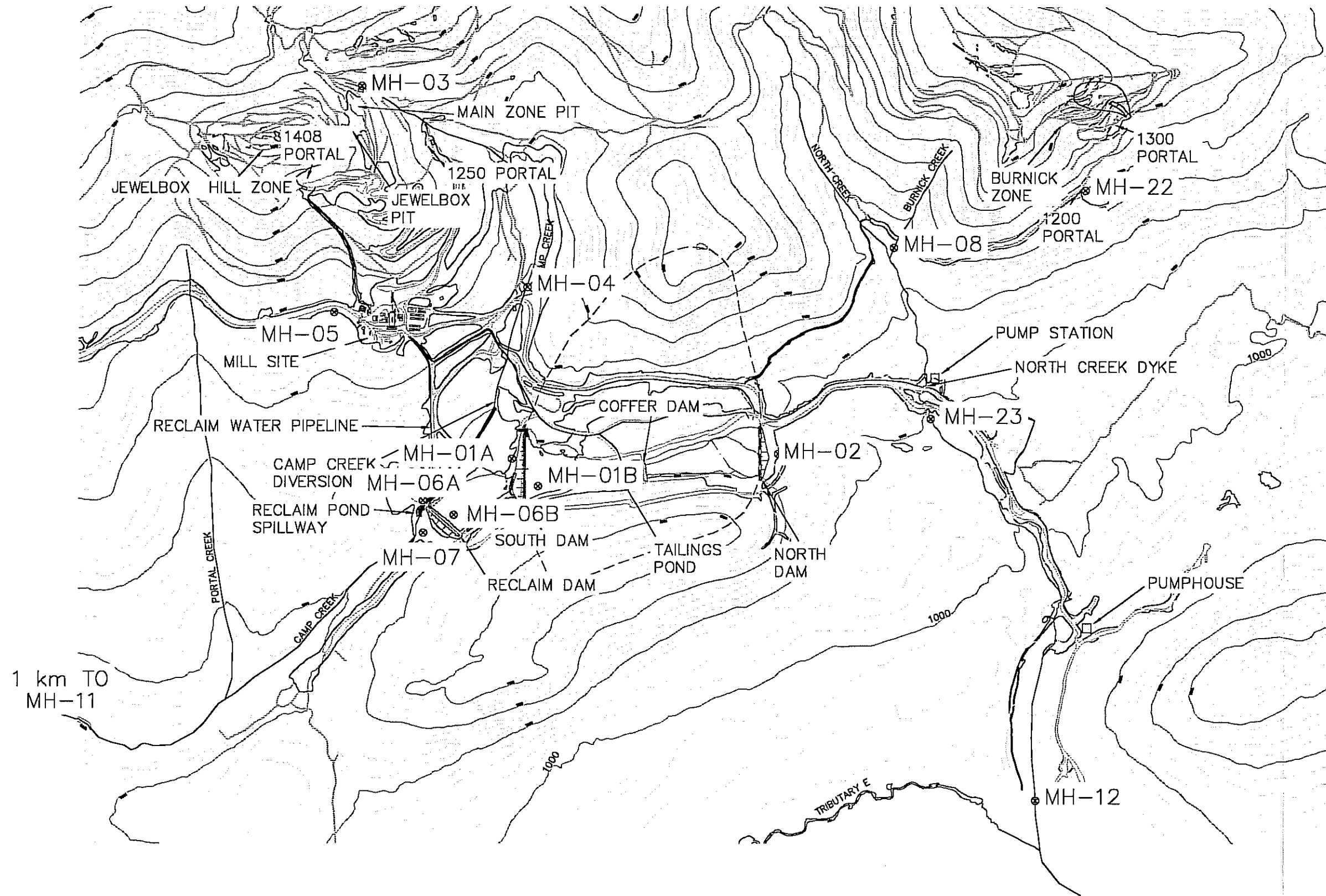
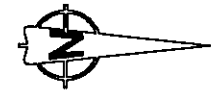
- ⊗ WATER MONITORING STATION
- ▲ FISH MONITORING STATION
- BENTHIC MONITORING STATION

SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

REGIONAL WATER QUALITY,
FISH + BENTHIC MONITORING STATIONS

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	REV.
DATE: JULY 29, 1999	PROJ. NO. 1CC005.05	3-22	





1 km TO
MH-11



LEGEND

⊗ WATER MONITORING STATION

≡≡≡ CLEARED AREA

NTS: 105 A/06, 105 A/07
105 A/10, 105 A/11

0 200 400 600 800 1000 metres

1:20,000

CONTOUR INTERVAL=10m

NOTE:
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

SĂ DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

Mine Site Water Quality Stations

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	3-23	REV.
DATE:	JULY 29, 1999	PROJ. NO.	1CC005.05			

3.3.1.2 *Summary of Pre-Mining (Baseline) Water Quality*

During the period from July to August, 1989, SRK conducted three surveys to determine the baseline water quality of directly effected project watersheds, specifically in Tom Creek and False Canyon Creek. SRK added these sites to complement existing sites established by Curragh Resources (CRI), and Environment Canada (EPS) in conjunction with DIAND Water Resources.

A summary of baseline water quality is provided in Table 3-9, which also lists Water Use Licence water quality discharge limits for wastewater (effluent quality standards) and CCME Canadian Water Quality Guidelines (CCME, 1993).

The baseline water chemistry data collected prior to development showed that the waters in the project area are moderately hard to very hard. Water hardness is a measure of dissolved metal cations, and of specific importance when discussing other water quality parameters, particularly metals such as copper, lead, or zinc. The chemical behavior of these metals affects the health of aquatic resources as the water hardness changes. The creeks within the study region were thought to have had good buffering capacities and therefore should display low sensitivities to acid inputs and pH alterations. Seasonal changes were evident in the water chemistry, particularly for total metals and suspended solids which were elevated during high flow periods (April to July).

Key water quality parameters of interest at the site include lead, zinc, cadmium, and total suspended solids. These parameters were selected from a review of the historic water quality database and from geochemical and metallurgical investigations conducted prior to mine development. Sulphate, a conservative element and one indicative of the extent of geochemical oxidation and metal leaching, was also evaluated.

Table 3-9 Pre-Mining Background for Selected Water Quality Parameters

Catchment	Monitoring Station	Total Suspended Solids (mg/L)	Dissolved Sulphate (mg/L)	Total Lead (mg/L)	Total Zinc (mg/L)
False Canyon Creek	MH-7	82.5	4.5	<0.001	0.018
	MH-11	301.7	7	<0.001	<0.005
	MH-12	337	3.9	<0.001	<0.005
	MH-14	325	8.4	<0.001	<0.005
	MH-16	337	6.8	<0.001	<0.005
CCME Guideline (1999)		<i>Increase of 10% above background</i>	≤ 300	0.001@0-60 mg/L (CaCO₃) 0.002@60-120 mg/L (CaCO₃) 0.004@120-180 mg/L (CaCO₃) 0.007@>180 mg/L (CaCO₃)	0.03

Note: Current stations correspond to IEE Monitoring stations in the following manner MH-7=E2, MH-11=F8, MH-12=F6, MH-14=F7, MH-16=F3.

3.3.1.3 *Summary of Water Quality 1991 – Present*

Water quality monitoring at the minesite began in 1991 as set out in Schedule 'A' and Part 'C' and Part 'D' of Water Use Licence IN90-002 and it continues under the 1998 amendment to that licence, now water licence QZ97-025. At present, the licensed temporary cessation monitoring program is followed. The mine operates with water quality permit limits for wastewater as stated in the YTWB licence (effluent quality standards). These permit limits are consistent with the Metal Mine Liquid Effluents Regulations issued under the Fisheries Act. The Water Use Licence does not stipulate downstream receiving water quality standards, however for closure planning purposes the CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME,1999) are used to assess downstream water quality and possible effects to aquatic life.

Tailings Management Facility Discharges

The primary effluent releases from the mine site to the receiving waters occur from the tailings dam seepage discharges at MH-2 and MH-7. Water quality data for the period May, 1991 to November, 1998 is presented for these two stations. Additional data from January, 1999 to November, 1999 has been included for station MH-02. At station MH-02, water quality discharges standards have been consistently met for all parameters, except total suspended solids, which showed occasional exceedances during the operational period (Figure 3-13). Concentrations of lead and zinc are generally within permit limits as set out in the Water Use Licence (QZ97-025). Occasional increases in lead and zinc concentrations at MH-07 were observed during the operating period (Figure 3-14).

Dissolved sulphate concentrations are generally declining over time at those stations near the mine site itself indicating that no significant oxidation and leaching of sulphides is occurring (see Appendix B, Section 4.3.4). The beginning of production in 1991 showed a rapid increase in sulphate concentrations at tailings dam seepages. These high levels began to decrease upon cessation of mining in 1992, with the exception at Station MH-2.

The results for sulphate and zinc at MH-2 show an increasing trend, but within permit limits; however, the water chemistry downstream of MH-2 (MH-12) shows no significant sulphate

concentrations above baseline. Water quality monitoring data collected at MH-02 in 1999 further indicates that zinc concentrations are remaining stable at this station. Section 4.4.2 discusses the implications of metal loadings from the North Dam seepage (Station MH-2) to downstream receiving waters. Similarly, high concentrations of sulphate at MH-7, which peaked at 350 mg/l, are decreasing with time and diluted slightly once in receiving waters at MH-11 and decrease significantly (to near baseline) upon reaching station MH-13. This trend is expected to similarly occur at station MH-02 for sulphate.

Waste permit limits for the project are periodically exceeded at the portal discharges, and the corresponding parameters at monitoring stations further downstream consistently show levels less than CCME criteria.

Receiving Water Quality – False Canyon Creek

Project activities and effluent discharges from the site primarily affect the False Canyon Creek drainage. Monitoring stations in this catchment are on various tributaries of the False Canyon Creek (Tributaries D and E), and the main stem of False Canyon itself. From upstream to downstream, the stations on the main stem of False Canyon Creek are numbered MH-11, MH-13, MH-14, MH-16, and MH-19. Monitoring stations on Tributary E include MH-23 and MH-12, with MH-15 located on Tributary D.

Water quality monitoring summaries for selected key parameters and monitoring sites within the False Canyon Creek drainage are presented in Figures 3-15 to 3-19. Figures 3-20 and 3-21 track water quality trends in False Canyon Creek starting at the headwater stations (MH-11 and MH-12), and moving downstream to the lower station on False Canyon Creek (MH-16) for zinc and cadmium respectively.

Water quality monitoring from the beginning of production has shown no significant effect to downstream water chemistry in the False Canyon Creek drainage area. Seasonal variations in suspended sediment loading and some metal concentrations (lead and zinc) has occurred, with individual sampling dates showing some exceedance of CCME Guidelines for Freshwater Aquatic Life.

Total Suspended Solids (TSS) concentrations are reasonably consistent over the monitoring period. There are a few examples of sampling occasions where the concentrations were elevated, particularly at station MH-11. These exceedances occurred mainly during the operational period and were related to spill events.

The graphs for total lead, cadmium, zinc and sulphate (Figures 3-15 to 3-19) indicate that there does not appear to be a significant change in the water chemistry of False Canyon Creek over time. Generally, higher values are noted at the stations located closer to the mine (MH-11, see Figure 3-20 for zinc, and Figure 3-21 for cadmium); however, metal concentrations decrease as one moves further downstream in False Canyon Creek. The majority of test results are below the CCME Guidelines for the Protection of Freshwater Aquatic Life. During the operational period, a few high concentrations of total lead and zinc were reported at Station MH-07 and were related to a tailings spill event. Sulphate concentrations show seasonal and annual trends.

4.0 GEOCHEMISTRY

4.1 METHODS

The site was visited on June 17 and 18, 1999. Areas of the site inspected included:

- Jewelbox Zone – 1408 portal and waste rock dump; underground mine workings; Jewelbox Pit; 1250 portal; and waste rock dump. The Jewelbox Zone underground workings were entered at the 1408 portal and descended to the elevation that the mine has flooded to.
- Main Zone – 1380 portal, Main Zone Pit and waste rock dumps.
- Burnick Zone – 1200 portal and waste rock dump; mine workings, sealed 1300 portal (from inside mine). The Burnick Zone workings were entered at the 1200 portal and the entire workings inspected up to the 1300 portal.
- Tailings Impoundment.

Each area was described and photographed. Any significant seeps or discharges not currently included in the monitoring program were sampled. Runoff obviously originating from snow melt was not sampled. Water samples were filtered (syringe 0.45 µm filter), preserved (nitric acid) and refrigerated in the field. All samples were from seeps and discharges, therefore, unfiltered samples were not collected. Some samples of rock and tailings were collected.

Water samples were analyzed for pH, electrical conductivity, total suspended solids, alkalinity, sulphate and metals. Rock and tailings samples were submitted for acid-base accounting, total metal analysis and determination of soluble metals using a 24-hour 20:1 deionized-water shake flask test.

4.2 BACKGROUND ROCK GEOCHEMICAL INFORMATION

Rock sampling and testing for the IEE indicated that sulphur content of the rock was variable but the abundance of carbonate in the ore and host rocks offset the acid generation potential. Some ore grade materials with greater than 5% sulphur were identified as potentially acid generating. However, the sulphur may have occurred dominantly as sphalerite and galena which can be sources of dissolved zinc and lead but not acidity. Deionized water shake flask tests on the

samples indicated leachable sulphate and zinc in several rock types including ore and oxidized ore. Humidity cells which were conducted for 20 weeks in 1990 indicated ongoing leaching of zinc from ore-type materials.

4.3 RESULTS

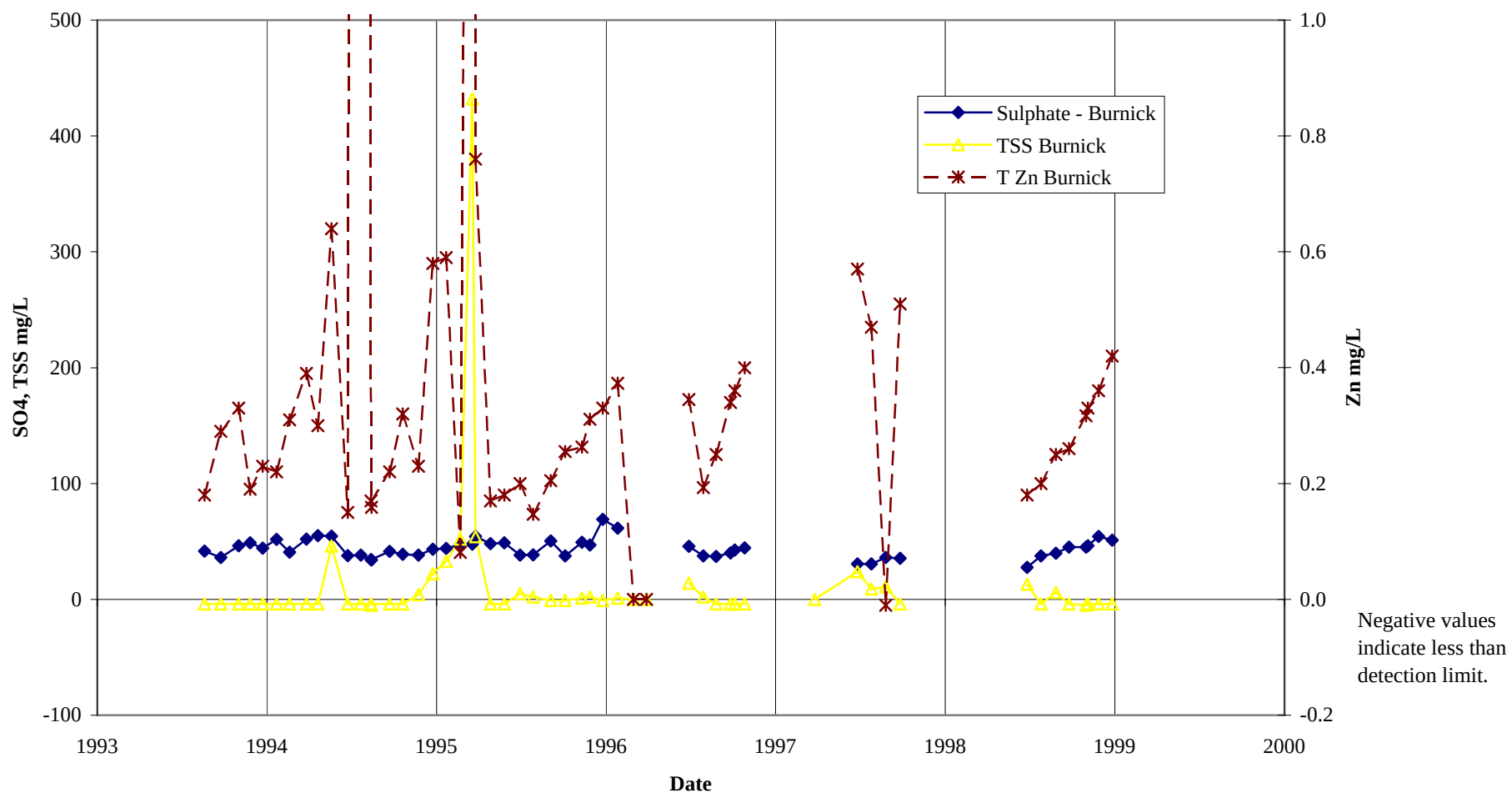
4.3.1 Underground Mine Workings

4.3.1.1 Burnick Zone

Water was observed to be flowing from fractures and drill holes throughout the workings. The water flows down to the 1200 portal (the lowest point in the workings) and discharges. Monitoring of electrical (EC) conductivity and pH in the workings indicated no significant changes in general chemistry in the workings. The water was pH-neutral and had ECs of about 110 μ S. No significant evidence of oxidation was noted in the mine walls. Several ore exposures were inspected and appeared to be competent and unoxidized. Very little rubble was noted. The 1300 Portal had been sealed by Cominco to limit movement of air through the workings. At the time of the inspection, atmospheric oxygen conditions were present throughout the workings.

Discharge monitoring since construction indicates stable zinc concentrations between 0.15 and 0.6 mg/L, and sulphate concentrations between 30.7 and 50 mg/L (Figure 4-1). The flow from the Burnick 1200 Portal, once it enters the willow vegetation at the toe of the rock dump, flows at surface for approximately 100 m before going underground. Historically higher zinc concentrations correspond to elevated total suspended solids. The lack of acid generating rock in the workings and lack of evidence of accelerated weathering of exposed sulphides indicates that these conditions will persist indefinitely. A discussion of zinc loadings from this source is presented in section 4.4.2.

Burnick 1200 Portal



		SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN			
		Burnick 1200 Portal Discharge			
	PROJECT 1CC005.05	DATE AUG. 1999	APPROVED	FIGURE 4-1	

4.3.1.2 *Main Zone*

The 1380 portal in the Main Zone Pit is collared in limestone and skarn. The adit was apparently stopped due to very poor ground conditions. Water was observed to be draining through the broken rock, exiting the portal and disappearing into the ground a short distance outside the portal. The flow rate was probably a few litres per second (Table 4-1). The water was pH-neutral (pH 6.9) and contained 183 mg/L sulphate. Dissolved Zn concentrations were 41 mg/L. Other significant components were Cd (0.4 mg/L) and Pb (0.3 mg/L).

The flow at this portal is intermittent and therefore does not represent a significant loading source to False Canyon Creek. The flow occurs only during spring freshet. The adit does not connect to any other mine workings. There is a fault in the adit which may be providing a hydraulic connection to water ponded at the Jewelbox Pit located nearby and approximately 20 meters higher in elevation. Further investigations of this flow will be conducted in the spring of 2000 to further evaluate the source, rate, duration and metals content of the flow.

The presence of abundant limestone associated with the 1380 portal indicates that the drainage will not be acidic. However, elevated zinc, cadmium and lead concentrations are expected to persist due to weathering of exposures of sphalerite-rich skarn in the workings.

4.3.1.3 *Jewelbox Hill Zone*

From the 1408 portal, a declined ramp provides access to the workings below the elevation of the portal. Since the mine was closed in 1992, the lower portion of the mine has been gradually flooding. At the time of the June 1998 inspection, very little water was observed to be flowing underground. The inspection was done in the spring when one would expect the most water to be present. Based on the observations, it is assumed that the flooding of the mine is the result of groundwater. As the mine fills, the head will increase which will reduce the flow and possibly stop the flow. The maximum water elevation recorded was at the 1350 m elevation. The portal to the mine is at 1408 m. It is unknown at this time whether or not the lower levels of the mine would

completely flood. Based on visual observations of the rate of increase in water level, the flow rates are very low.

Like the Burnick Zone, little evidence of oxidation of the walls was noted. Exposures of sphalerite-rich rock were fresh and dry.

The pool of water in the mine had a pH of 7.6, EC of 370 μ S, sulphate of 82 mg/L, and dissolved zinc of 0.87 mg/L (Table 4-1). This compares well to pH of 8.6, sulphate of 104 mg/L and total zinc of 0.69 mg/L (Table 4-2) measured by Cominco during de-watering of the workings in late 1997. As de-watering proceeded, zinc concentrations decreased to 0.3 mg/L.

It is expected that the chemistry of the pool will change as the water continues to rise, though the similarity of results for the late 1997 monitoring and June 1999 monitoring suggests that the zinc concentrations will remain comparable to the current concentrations. Dissolution of weathering products from walls will influence the mine pool chemistry but the lack of significant build-up of soluble salts indicates that this will not be a significant effect.

A short adit was begun in the Jewelbox Zone at 1250 elevation. The 1250 portal is collared in phyllite. The adit was not draining.

Table 4-1 Results of Seep Sampling – June 1999

Sample Location		Main Pit Portal (1380)	Main Pit Waste Dump	Jewelbox Underground Pool	Jewelbox Dump Seep	Jewelbox Dump Seep
Sample ID		SDH-S1	SDH-S2		SDH-S3	SDH-S4
Physical Tests	Units	99 06 17	99 06 17	99 06 17	99 06 18	99 06 18
Cond.		421	364	370	200	447
pH		6.9	7.28	7.58	7.29	7.24
Tss.	mg/L	87	115	12	69	325
Diss. Anion.						
Alkalinity-Total	mg/L	23	43	65	33	39
SO ₄	mg/L	183	137	82	50	161
Dissolved Metals						
Al	mg/L	<0.005	<0.005	<0.005	0.008	0.014
Sb	mg/L	0.0004	0.0003	0.0027	0.0008	0.0011
As	mg/L	<0.0001	<0.0001	0.0009	0.0015	0.0004
Ba	mg/L	0.012	0.017	0.014	0.019	0.036
Be	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Bi	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Bi	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Cd	mg/L	0.363	0.0989	0.0154	0.0027	0.0074
Ca	mg/L	49	57.3	54.7	28.6	74.8
Cr	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Co	mg/L	0.011	0.002	0.003	<0.001	0.002
Cu	mg/L	0.002	<0.001	<0.001	0.002	<0.001
Pb	mg/L	0.345	0.097	0.04	0.06	0.052
Li	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Mg	mg/L	1.55	1.76	3.81	1.78	3.39
Mn	mg/L	0.351	0.045	0.247	0.101	0.329
Mo	mg/L	<0.001	0.001	0.003	0.002	0.002
Ni	mg/L	<0.001	<0.001	0.009	<0.001	0.002
K	mg/L	0.75	0.7	1.61	1.63	1.83
Se	mg/L	0.003	0.003	0.02	0.002	0.008
Ag	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sr	mg/L	0.059	0.066	0.143	0.058	0.124
Tl	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Sn	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
U	mg/L	0.00004	0.00019	0.00578	0.00006	0.00053
V	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Zn	mg/L	40.6	10.8	0.87	0.22	0.842

Table 4-2 Jewelbox Zone De-watering - Monitoring Results

Report Date	Sample Date	Time	Sample #	pH	TSS	Zn/T	Pb/T	Pb/D	Zn/D	Ammonia Nitrogen	Sulphate
	25-Nov-97	14:25	UMW@SUMP15&16(?)	8.6	7	0.69	0.1			0.458	
	27-Nov-97	16:32	UMW SUMP 027&28	8.2	7	0.65	0.09				
	4-Dec-97	19:42	UMW@SUMP 054&55&56	8.5	13	0.58	0.12	0.04	0.34		
	7-Dec-97	14:35	UMW@SUMP 064(was mislabelled)	8.6	16	0.51	0.07	0.02	0.24	0.936	104
	11-Dec-97	19:45	UMW@SUMP 072	8.4	<4	0.54	0.1				
	15-Dec-97	6:40	UMW@SUMP 073								
24-Dec-97	15-Dec-97	6:40	UMW@SUMP073	8.5	6	0.49	0.08				92.6
20-Jan-98	15-Jan-98		UMW@SUMP 076	8.56	4	0.432	0.121				
26-Jan-98	22-Jan-98		UMN@SUMP 081	9.11	5	0.392	0.066				
2-Feb-98	29-Jan-98		UMW@SUMP092	9.29	5	0.339					
9-Feb-98	7-Feb-98		UMW@SUMP097	9.34	3	0.341					
17-Feb-98	12-Feb-98		UMW@SUMP100	9.28	3	0.314					
23-Feb-98	19-Feb-98		UMW@SUMP103	8.99	9	0.298					

4.3.2 Pit Walls

Rock exposures in the two small Main Zone and Jewelbox pits are small. The Main Zone Pit has exposures of limestone, phyllite and skarn. The Jewelbox Pit has exposures of limestone and phyllite. The reactive surface area represented by these exposures is much smaller than the associated waste rock.

4.3.3 Waste Rock

4.3.3.1 Burnick Zone

Waste rock was dumped along the slope outside the 1200 portals. On-surface, the waste rock consists primarily of mixed weakly mineralized calcareous and non-calcareous phyllite. This rock was reported to be non-acid generating in the IEE. Visual observation confirmed this finding. A pile (<200 m³) of oxidized ore-type skarn material was located on top of the dump near the portals. This material consists generally of sphalerite with calcite and actinolite, and minor pyrite. The material was non-acidic. A sample of similar rock from the Jewelbox Zone (SDH-R2) contained 2.5% Zn and 1.27% sulphur (Table 4-3). The molar quantities of Zn and S are very similar indicating that zinc sulphide is the dominant sulphur-containing mineral and that the rock will not be acidic. A deionized water leach test on the sample indicated low zinc concentrations (0.009 mg/L) but elevated sulphate (45 mg/L) (Table 4-4).

No toe seeps were visible during the June 1999 site inspection.

The Burnick Zone waste rock dumps are expected to be chemically stable. The skarn material is currently oxidizing but is not expected to generate acid, and therefore will continue to oxidize at current rates.

Table 4-3 ABA and Metal Analysis Results for Rock and Tailings

	Description	Paste	CO2	CaCO3	Total	Sulphate	Sulphide	MPA ²	NP ³	NNP ⁴	Fizz	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb
		pH	Inorg.	Equiv. ¹	Sulphur	Sulphur	Sulphur				Rating															
Sample ID			(Wt.%)		(Wt.%)	(Wt.%)	(Wt.%)					ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Main Zone 1250 Dump																										
1CC005.05 SD001	SDH-R1	7.6	0.35	7.9	0.31	0.22	0.09	2.8	13.8	11.0	none	190	1612	1294	4.3	95	9	395	4.11	177	43	2	14	121	8.1	20
Jewel Box Zone 1408 Dump Ore																										
1CC005.05 SD004	SDH-R1	7.9	1.58	35.9	1.27	0.04	1.23	38.4	77.5	39.1	moderate	34	36176	25026	18.1	41	18	3910	4.74	< 2	< 8	< 2	< 2	16	161.7	15
South Tailings																										
1CC005.05 SD008	SDH-T1	8.6	10.63	241.3	0.13	<0.01	0.13	4.1	241.3	237.2	moderate	47	4146	3071	4.6	9	4	1857	1.8	17	< 8	< 2	< 2	120	17.7	4
1CC005.05 SD009	SDH-T2	8.6	9.08	206.1	0.20	<0.01	0.20	6.3	208.8	202.6	moderate	20	2892	4129	3.3	8	5	1598	1.6	19	< 8	< 2	2	97	23	3
1CC005.05 SD0010	SDH-T3	8.4	10.91	247.7	0.55	<0.01	0.55	17.2	251.3	234.1	moderate	27	5016	11341	4.3	11	7	1554	1.47	17	< 8	< 2	< 2	119	67.9	4
North Tailings																										
1CC005.05 SD0013	SDH-T4	8.0	7.60	172.5	0.11	0.05	0.06	1.9	181.3	179.4	moderate	70	7607	8241	5.6	21	8	3040	2.83	27	< 8	< 2	2	99	48.2	6
1CC005.05 SD0012	SDH-T5	8.5	10.28	233.4	0.12	0.02	0.10	3.1	233.8	230.7	moderate	45	4769	4208	4.9	51	7	1807	2.02	60	< 8	< 2	2	130	22.4	4
1CC005.05 SD0011	SDH-T6	8.4	10.91	247.7	0.16	<0.01	0.16	5.0	247.5	242.5	moderate	41	4960	7137	3.7	29	7	1713	1.79	41	< 8	< 2	2	117	36.4	4

¹ (Kg CaCO3/Tonne)
² Maximum Potential Acidity
³ Neutralization Potential
⁴ Net Neutralization Potential

Table 4-4 Deionized Water (20:1) Leach Extraction Results for Rock and Tailings

Sample	Description	Ag ppb	Al ppm	As ppb	Cd ppb	Cu ppb	Fe ppm	Mo ppb	Pb ppb	Se ppb	Zn ppb	Final pH	SO4 mg/L
1CC005.05 SD001 -2MM	SDH-R1	< 5	< .1	< 30	< 2	6	0.02	16	< 10	< 20	< 5	8.0	19
1CC005.05 SD004 -2MM	SDH-R2	< 5	< .1	< 30	2	2	0.03	< 5	< 10	< 20	9	8.4	45
1CC005.05 SD008	SDH-T1	< 5	< .1	< 30	< 2	4	0.08	13	25	27	13	9.0	3
1CC005.05 SD009	SDH-T2	< 5	< .1	< 30	< 2	3	0.06	11	14	< 20	13	9.1	3
1CC005.05 SD0010	SDH-T3	< 5	< .1	< 30	< 2	5	0.05	9	19	26	13	9.0	3
1CC005.05 SD0011	SDH-T6	< 5	< .1	< 30	< 2	3	0.1	19	22	< 20	39	9.0	2
1CC005.05 SD0011 Dup.	SDH-T6	< 5	< .1	< 30	< 2	4	0.2	23	53	< 20	85	9.0	2
1CC005.05 SD0012	SDH-T5	< 5	< .1	< 30	< 2	4	0.05	31	< 10	< 20	12	9.0	13
1CC005.05 SD0013	SDH-T4	< 5	< .1	< 30	2	5	0.02	18	11	< 20	13	8.5	52
BLANK		< 5	< .1	< 30	< 2	3	0.01	< 5	< 10	< 20	< 5	5.6	<1

4.3.3.2 *Main Zone*

Phyllite waste rock was dumped inside and downslope from the Main Zone Pit. All locations are above Camp Creek.

The Main Zone Pit waste rock dumps are composed primarily of limestone with some ore-type skarn material. Some of the skarn had decomposed resulting in release of coarse sphalerite and galena-rich sand. Water was seen flowing inside the hillside waste rock dump below the Main Zone pit. The water chemistry resembles the effect of water discharging intermittently from the 1380 portal (Table 4-1) immediately upslope with modification by contact with limestone (higher pH, alkalinity, calcium, magnesium). Cominco believes that this flow is ephemeral. Zinc and sulphate concentrations were lower (11 mg/L, 137 mg/L, respectively), probably due to dilution.

The presence of abundant limestone associated with the waste rock indicates that the drainage will not be acidic. However, elevated zinc, cadmium and lead concentrations may persist due to weathering of sphalerite-rich skarn rock.

4.3.3.3 *Jewelbox Hill Zone*

The small phyllite waste rock dump outside the 1250 Portal contained no mineralized material. A composite sample collected along the crest of the dump (SDH-R1) contained about 0.3% combined lead and zinc (Table 4-3) and 0.3% total S. Neutralization potential was 14 kg CaCO₃/t (Table 4-3). Leachable sulphate (19 mg/L) indicated the rock is oxidized but zinc, lead and cadmium were not detected.

No evidence of seepage was found along the toe.

Waste rock was dumped primarily downslope from the 1408 portal. The dump is composed of calcareous and non-calcareous phyllite to the south and limestone and skarn to the north. Oxidized and decomposed skarn boulders were present along the crest of the dump. A sample of the skarn (SDH-R2) was analyzed and the results described in Section 4.3.2.1 (Tables 4-3 and 4-4).

Two seeps were identified near the toe of the dump emerging from limestone waste rock. Seep SDH-S3 did not emerge but flowed within the waste rock and disappeared. Seep SDH-S4 appeared to emerge from the waste rock/soil contact. Both seeps were non-acidic. Seep SDH-S3 had sulphate of 160 mg/L and zinc of 0.84 mg/L. Seep SDH-S4 was more dilute (50 mgSO₄/L, 0.22 mgZn/L).

The presence of calcareous rock in the waste indicates that the drainage will not be acidic. However, elevated zinc concentrations in seeps are expected to persist due to weathering of sphalerite-rich skarn boulders in the dumps.

Small quantities of waste rock were dumped inside and downslope from the Jewelbox Pit. This rock is similar to the rock from the Main Zone Pit (see 4.3.3.2).

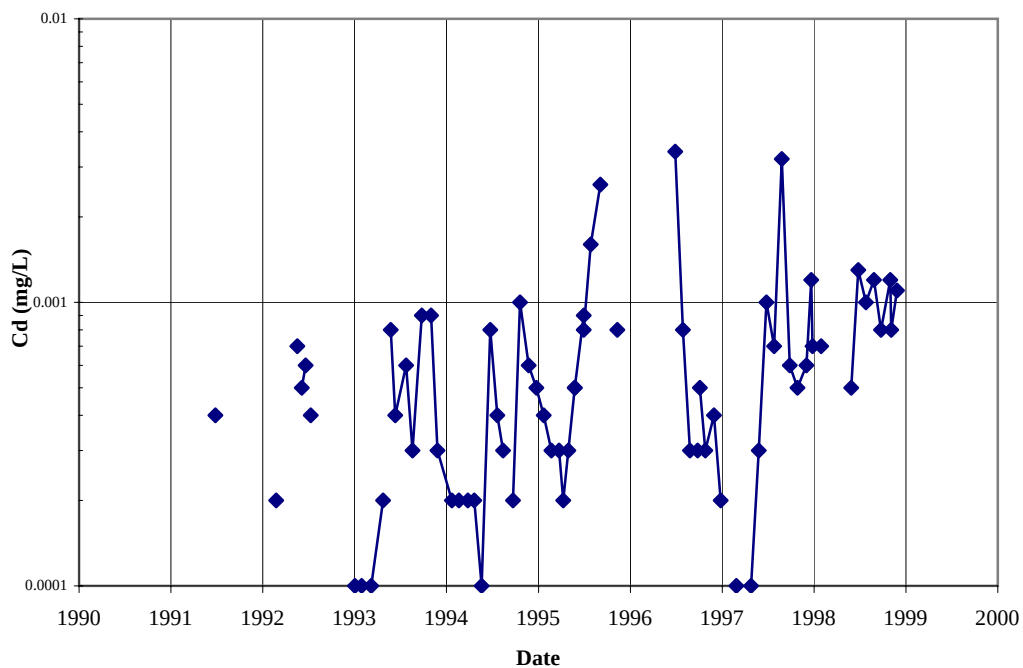
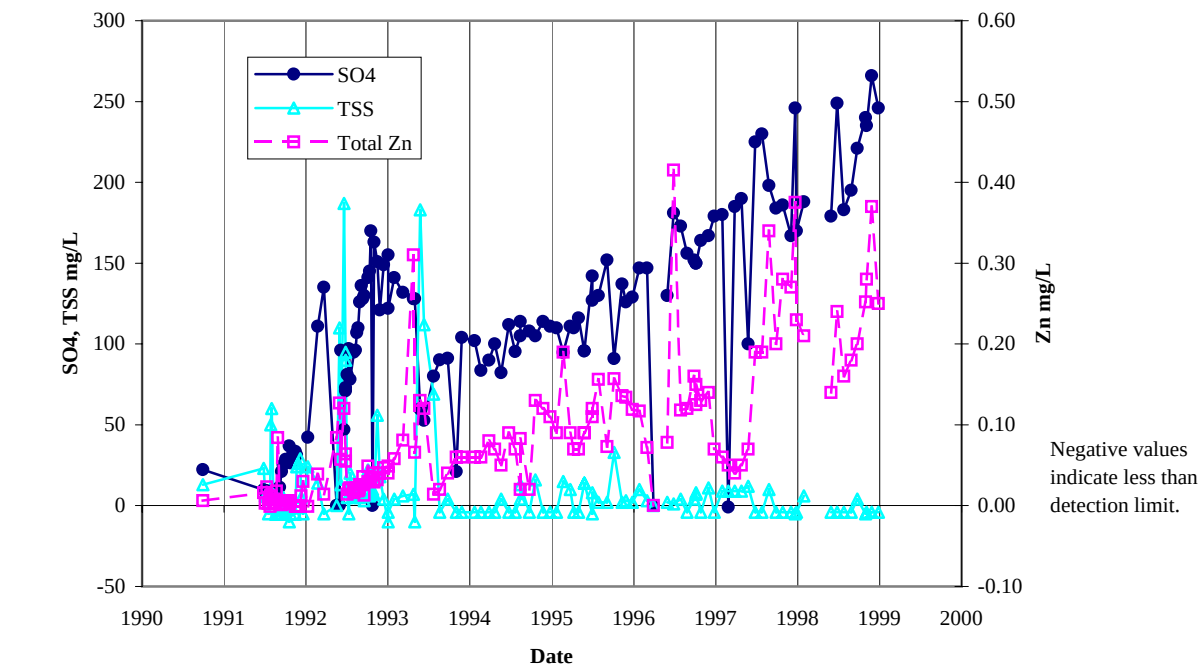
4.3.4 Tailings

Tailings are exposed in both the north and south tailings area. The north tailings beach is aerially greater than the south tailings beach. Tailings in both areas are olive-brown with some coarse and fine layering. Partly saturated tailings are grey. The tailings are uniformly calcareous. Salt crusts were not observed on the tailings.

Total sulphur content of six surface samples varied from 0.1 to 0.6% and neutralization potentials were 180 to 250 kg CaCO₃/t (Table 4-3). Carbonate content indicated similar levels of neutralization potential. Zinc concentrations varied from 0.4 to 1.1%, and lead from 0.2 to 0.7%. The near molar equivalence of sulphur with lead and zinc content indicates that the residual sulphide content is principally sphalerite and galena with very little iron sulphide. The tailings are therefore not potentially acid generating.

Deionized water leachates of tailings contained low sulphate (2 to 3 mg/L), zinc (0.01 to 0.09 mg/L) and lead (<0.01 to 0.05 mg/L) concentrations. These results indicate oxidation of sphalerite and galena is occurring in the near surface tailings (Table 4-4).

MH-2



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SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

MH-2 Seepage Chemistry

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FIGURE
4-2

Monitoring of seepage from the North Dam (MH-2) which originates from the tailings in the north end of the impoundment indicates that sulphate, cadmium, and zinc concentrations began increasing in 1992. In 1997, zinc and cadmium concentrations stabilized (Figure 4-2). Since concentrations decreased in 1999. Although the seepage sample occasionally contained suspended matter, the same trend is also apparent in dissolved concentrations. Zinc load shows a similar trend (Figure 4-2). The load decreased in 1999 due to a slight decrease in seepage flow.

The increase may possibly be attributed to oxidation of near surface tailings. It has also been suggested that the increase may be due to leaching of wind-blown tailings. The former explanation seems more probable. During tailings deposition, oxidation would have been suppressed by the continual deposition of new tailings. When the tailings began to oxidize, zinc and sulphate concentrations were released near surface increasing the zinc concentration in near surface pore water and gradually displacing process water with probably lower zinc concentrations. The observed cumulative zinc load at MH-2 is equivalent to oxidizing about 0.1% of the total zinc content from the top 5 cm of tailings. The volume of wind-blown tailings is not sufficient to cause the observed effect.

The continuing increase in sulphate concentrations, but decrease in zinc concentrations, possibly indicates that a solubility control has been reached for zinc but not for sulfate. The cadmium concentrations and alkalinity of the water are consistent with solubility control by cadmium carbonate, which indicates that cadmium concentrations will not increase. Zinc may also be constrained by zinc carbonate in the tailings surface. These affects will be investigated further in 2000.

As the tailings areas are drained, the water will be affected by tailings pore water. It is possible that this water may contain elevated Zn concentrations. The current zinc concentrations are well below the permit level, and it is unlikely that the water released during draining will require treatment. Increase in zinc levels in pore water can be caused by loss of lime and lowering of pH. However, the monitoring data for North Dam seepage indicates that the zinc is derived from oxidation of sphalerite in near surface tailings because zinc and sulphate are increased together. This is not consistent with rinsing of lime.

It should be noted that the South Dam currently impounds much less tailings than the North Dam. Most tailings were deposited near the coffer dam. When these are drained (Scenario 1), the

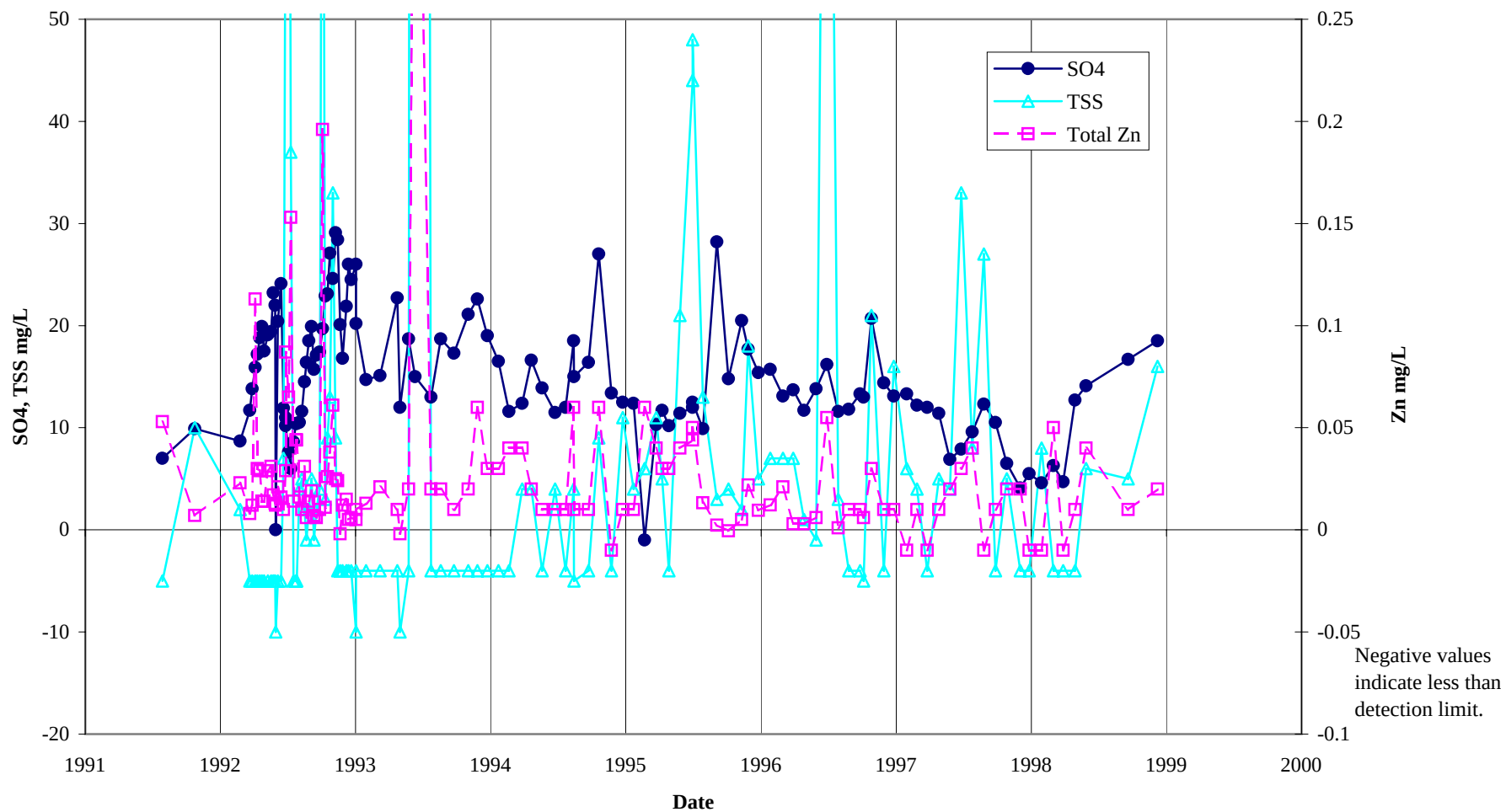
exposed area will be much less than the current exposure at the North Dam, and therefore, less zinc expected.

The monitoring suggests that zinc load is not likely to increase substantially and zinc concentrations will stabilize. Also, subsequent analysis of loading sources, as discussed in Section 4, indicate that this is not a significant source in the False Canyon Creek basin. Substantial increases in the load from this source can occur without a noticeable impact on False Canyon Creek.

4.3.5 Conclusions

The mineralization at Sä Dena Hes is characterized by zinc and lead sulphides with low concentrations of iron sulphides in association with abundant carbonates. Therefore, acid generation will not occur. Zinc, cadmium and lead leaching are controlled by the oxidation of sphalerite (Zn, Cd) and galena under pH-neutral atmospheric conditions. Breakdown of sphalerite is apparent throughout the site. Acceleration of sphalerite oxidation is not expected in the absence of a mechanism to lower pH. Zinc and cadmium leaching will continue but is not expected to accelerate. Most sources will continue to leach zinc and cadmium at the current rates. This is demonstrated by the stable zinc and sulphate concentrations at MH-4 which receives drainage from the Main Zone (Figure 4-3).

MH-4



SA DENA HES DETAILED DECOMMISSIONING & RECLAMATION PLAN

MH-4 Chemistry

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1CC005.05

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FIGURE

4-3

4.4 WATER QUALITY PREDICTION

4.4.1 Methods

Mass loadings in the False Canyon Creek (FCC) basin were calculated to assess the degree to which flows (measured and calculated) combined with measured concentrations account for the various sources of chemical load in the basin. In general, the load observed in FCC at a location downstream of the mine can be described as:

Total Load = Background

- + Discharge from the Burnick Portal
- + Runoff and groundwater from the Burnick Zone waste rock dumps
- + Runoff and groundwater from the Main Zone Pits
- + Runoff and groundwater from the Main Zone Pits waste rock dumps
- + Runoff and groundwater from the Jewelbox Zone waste rock dumps
- + Runoff and groundwater from the north tailings
- + Runoff and groundwater from the south tailings

The loading to FCC was assessed using the following methods:

1. Monthly statistics were calculated for water quality for several monitoring stations. The statistics included number of samples, mean, median, maximum and minimum. The above sources of loadings have not been monitored separately but influence various downstream monitoring locations.

MH-22 captures the Burnick Portal. MH-2 is the seepage from the North end of the tailings impoundment. MH-12 reflects the effect of the Burnick Portal, the Burnick Zone dumps and the North Dam on the East Fork of Tributary E. A substantial background component is included. MH-4 represents the effect of the Main and Jewelbox Zone Pits, waste rock dumps and background from North Hill. MH-5 is located by the gate house at the mill site and receives intermittent surface water flow from the Jewelbox Hill Zone waste rock dumps. MH-7 is seepage from the south end of the TMF. MH-11 represents the total of these sources with

background from the same catchment area. MH-13 is the same basin with additional background effect.

MH-16 was selected as a downstream monitoring location reflecting the effect of both Tributary E and FCC.

2. Median concentrations for selected months formed the basis for the subsequent loading analysis (Table 4-5). The months were January (winter low flow), June (freshet), August (summer low flow), and October (fall and early winter).
3. Flows for loading calculations were estimated from field measurements (seeps and portal discharge) and regional mean annual runoff analysis (creeks).
4. Median loads for routinely analyzed parameters (sulphate, hardness, ammonia, nitrate, barium, cadmium, iron, manganese, lead and zinc) at each location were calculated in kg/month (Table 4-6).
5. The proportion of load at each point as a proportion of the load in the basin (MH-16) was calculated to evaluate the contribution of each source to the total load in FCC (Table 4-7). This is graphically shown in Figure 4-4.
6. Background concentrations for sampling locations influenced by non-mined areas were calculated by subtracting the loads and flows attributable to all upstream locations (Table 4-8). For example, the background concentration for the MH-12 catchment was calculated from:

$$\frac{M_{MH12} - (M_{MH2} + M_{MH22})}{Q_{MH12} - (Q_{MH2} + Q_{MH22})}$$

where Ms are the mass loadings and Qs are the associated flows. These concentrations also assist with identifying sources of unaccounted for load at the monitoring locations. If the calculated background concentration is higher than expected background, the unaccounted for load may include the effect of an unmonitored source.

Table 4-5
Summary of Concentrations in False Canyon Creek(FCC)

Parameter	Units	Tributary E			False Canyon Creek					FCC	
		North Dam	Burnick Portal	D/S	Jewelbox Pits and Dumps	Jewelbox Portal	1408 Dump	South Dam Seepage	D/S	D/S	Main
		MH-2	MH-22	MH-12	MH-4	MH-5	MH-7	MH-11	MH-13	MH-16	
January											
Flow	m3/mo	2187	3393	30525	14850	#N/A	#N/A	10736	42759	137835	413117
pH		8	8	8	8	#N/A	#N/A	8	8	8	8
Conductivity	us/cm	1070.00	353	360	314	#N/A	#N/A	531	473	435	395
Susp Solids	mg/L	6.00	2	2	6	#N/A	#N/A	2.25	3	6	2
Alkalinity (CaCO3)	mg/L	425.00	118	184	154.5	#N/A	#N/A	240	210	214	213
Sulphate	mg/L	188.00	47.4	9.4	12.45	#N/A	#N/A	66.6	40.45	16	8.9
Hardness (Total)	mg/L	526.00	168	194	173.5	#N/A	#N/A	309	256	234	220
Ammonia (Nitrogen)	mg/L	0.17	0.038	0.0025	0.0055	#N/A	#N/A	0.182	0.019	0.016	0.007
Nitrate (Nitrogen)	mg/L	0.05	0.43	0	1.14	#N/A	#N/A	0.5	0.425	0	0
Barium (Total)	mg/L	0.15	0.0201	0.103	0.0275	#N/A	#N/A	0.07975	0.092	0.166	0.173
Barium (Dissolved)	mg/L	0.00	0.019	0	0.0295	#N/A	#N/A	0.1	0.1325	0	0
Cadmium (Total)	mg/L	0.00	0.0009	0.00005	0.0002	#N/A	#N/A	0.0005	0.000225	0.00005	0.00005
Cadmium (Dissolved)	mg/L	0.00	0.0005	0	0.0002	#N/A	#N/A	0.0007	0.00015	0	0
Iron (Total)	mg/L	0.57	0.06	0.238	0.0385	#N/A	#N/A	0.075	0.142	0.33	0.14
Iron (Dissolved)	mg/L	0.00	0.003	0	0.006	#N/A	#N/A	0.001	0.031	0	0
Manganese (Total)	mg/L	3.64	0.028	0.024	0.007	#N/A	#N/A	0.299	0.077	0.02635	0.0107
Lead (Total)	mg/L	0.00	0.004	0.0015	0.00325	#N/A	#N/A	0.0245	0.006	0.0015	0.0015
Lead (Dissolved)	mg/L	0.00	0.002	0	0.002	#N/A	#N/A	0.0185	0.0035	0	0
Zinc (Total)	mg/L	0.21	0.31	0.005	0.0126	#N/A	#N/A	0.1705	0.047	0.02	0.005
June											
Flow	m3/mo	3750	10914	488501	248570	#N/A	17856	10736	667269	2093002	5993369
pH		8.1	8.05	7.9	8.05	#N/A	7.9	8.1	8.1	8.1	8.4
Conductivity	us/cm	1030	250	257	274.5	#N/A	384	531	324	220	354
Susp Solids	mg/L	2	9	2	38.5	#N/A	2	2.25	6.5	13	2
Alkalinity (CaCO3)	mg/L	366	86.4	130	135	#N/A	101	240	160	109	183
Sulphate	mg/L	249	38.15	7.1	12.25	#N/A	63.4	66.6	17.2	26.8	11.9
Hardness (Total)	mg/L	539	130	141	154.5	#N/A	191	309	182	125	208
Ammonia (Nitrogen)	mg/L	0.162	0.134	0.005	0.0225	#N/A	0.006	0.182	0.00425	0.05	0.034
Nitrate (Nitrogen)	mg/L	0.03	0.37	0.06	0.6	#N/A	#N/A	0.5	0.705	0.185	0.04
Barium (Total)	mg/L	0.152	0.01735	0.075	0.03695	#N/A	0.011	0.07975	0.0625	0.08	0.14
Barium (Dissolved)	mg/L	0	0.015	0.066	0.019	#N/A	#N/A	0.1	0.044	0.0935	0.138
Cadmium (Total)	mg/L	0.0013	0.0008	0.0002	0.000275	#N/A	0.0002	0.0005	0.000275	0.00015	0.0042
Cadmium (Dissolved)	mg/L	0	0.0005	0.00005	0.0002	#N/A	#N/A	0.0007	0.000125	0.0001	0.00005
Iron (Total)	mg/L	0.46	0.32	0.62	0.856	#N/A	0.025	0.075	0.305	0.42	0.12
Iron (Dissolved)	mg/L	0	0.0015	0.016	0.00825	#N/A	#N/A	0.001	0.04	0.0295	0.026
Manganese (Total)	mg/L	3.16	0.0515	0.012	0.028	#N/A	0.0010	0.299	0.046	0.045	0
Lead (Total)	mg/L	0.005	0.0065	0.003	0.008	#N/A	0.002	0.0245	0.01	0.007	0.004
Lead (Dissolved)	mg/L	0	0.001	0.0005	0.002	#N/A	#N/A	0.0185	0.0085	0.012	0.004
Zinc (Total)	mg/L	0.24	0.195	0.01	0.037	#N/A	0.0200	0.1705	0.035	0.031	0.01
August											
Flow	m3/mo	893	3437	145727	71502	#N/A	#N/A	4464	203186	651751	1937863
pH		8	8.2	8.1	8.2	#N/A	#N/A	8.2	8.3	8.45	8.2
Conductivity	us/cm	991	292	316	309	#N/A	#N/A	523	397	0	396.5
Susp Solids	mg/L	4	2	2	2.5	#N/A	#N/A	2	2	2	2
Alkalinity (CaCO3)	mg/L	395	103	168	147	#N/A	#N/A	243	196	190.5	206.5
Sulphate	mg/L	221	39.7	7.25	16.55	#N/A	#N/A	38.7	19.1	11.8	9.25
Hardness (Total)	mg/L	525	157	192.5	169	#N/A	#N/A	290	225	205	215
Ammonia (Nitrogen)	mg/L	0.046	0.005	0.00375	0.0025	#N/A	#N/A	0.153	0.0025	0.013	0.00375
Nitrate (Nitrogen)	mg/L	0.01	0.38	0	0.83	#N/A	#N/A	0.12	0.32	0	0.07
Barium (Total)	mg/L	0.155	0.018	0.085	0.02655	#N/A	#N/A	0.086	0.075	0.1355	0.1515
Barium (Dissolved)	mg/L	0	0.019	0	0.027	#N/A	#N/A	0.079	0.079	0.125	0.075
Cadmium (Total)	mg/L	0.0008	0.00085	0.000075	0.0002	#N/A	#N/A	0.0007	0.0002	0.000625	0.00015
Cadmium (Dissolved)	mg/L	0	0.0003	0	0.0002	#N/A	#N/A	0.0002	0.0002	0.00025	0.00005
Iron (Total)	mg/L	0.9	0.025	0.224	0.025	#N/A	#N/A	0.025	0.13	0.1805	0.15
Iron (Dissolved)	mg/L	0	0.004	0	0.01	#N/A	#N/A	0.032	0.032	0.043	0.057
Manganese (Total)	mg/L	2.94	0.0165	0.0164	0.007	#N/A	#N/A	0.3195	0.055	0.013	0.01
Lead (Total)	mg/L	0.01	0.0015	0.0015	0.0045	#N/A	#N/A	0.01	0.005	0.0085	0.0015
Lead (Dissolved)	mg/L	0	0.002	0	0.004	#N/A	#N/A	0.007	0.007	0.0005	0.0005
Zinc (Total)	mg/L	0.2	0.25	0.005	0.01	#N/A	#N/A	0.16	0.02	0.0045	0.0075
October											
Flow	m3/mo	937	1049	114935	51151	#N/A	#N/A	3928	168422	568190	1825002
pH		8	8.095	8.1	8.3	#N/A	#N/A	8.2	8.3	8.2	8.2
Conductivity	us/cm	1020	299	316	307	#N/A	#N/A	503	397	392	396.5
Susp Solids	mg/L	2	2	2	2	#N/A	#N/A	2	4	2	2
Alkalinity (CaCO3)	mg/L	383	103.5	165	149	#N/A	#N/A	236	194	190.5	206.5
Sulphate	mg/L	235	45.6	8.5	20.5	#N/A	#N/A	37.5	21.8	11.1	9.25
Hardness (Total)	mg/L	536	157	180	174	#N/A	#N/A	284.5	221.5	207	215
Ammonia (Nitrogen)	mg/L	0.023	0.00375	0.0025	0.0025	#N/A	#N/A	0.208	0.0025	0.0175	0.00375
Nitrate (Nitrogen)	mg/L	0.7975	0.86	0.18	1.57	#N/A	#N/A	0.12	0.3	0.26	0.07
Barium (Total)	mg/L	0.15	0.0175	0.075	0.026	#N/A	#N/A	0.086	0.074	0.123	0.1515
Barium (Dissolved)	mg/L	0	0.017	0.072	0.025	#N/A	#N/A	0.101	0.072	0.111	0.075
Cadmium (Total)	mg/L	0.0008	0.0011	0.00005	0.0002	#N/A	#N/A	0.0008	0.0002	0.00015	0.00015
Cadmium (Dissolved)	mg/L	0	0.0013	0	0.0003	#N/A	#N/A	0.0009	0.00005	0.0001	0.00005
Iron (Total)	mg/L	0.89	0.025	0.21	0.025	#N/A	#N/A	0.025	0.13	0.26	0.15
Iron (Dissolved)	mg/L	0	0.0015	0.052	0.008	#N/A	#N/A	0.012	0.03	0.031	0.057
Manganese (Total)	mg/L	3.22	0.011	0.01645	0.0085	#N/A	#N/A	0.366	0.06665	0.0184	0.01
Lead (Total)	mg/L	0.0015	0.002	0.0015	0.004	#N/A	#N/A	0.008	0.004	0.003	0.0015
Lead (Dissolved)	mg/L	0	0.003	0	0.003	#N/A	#N/A	0.01	0.003	0.002	0.0005
Zinc (Total)	mg/L	0.28	0.3235	0.005	0.02	#N/A	#N/A	0.22	0.03	0.005	0.0075

Table 4-6
Summary of Loads in False Canyon Creek Basin

		Tributary E				False Canyon Creek						FCC
		North Dam	Burnick Portal	D/S		Jewelbox Pits and Dumps	Jewelbox Portal	1408 Dump	South Dam Seepage	D/S	D/S	Main
Parameter	Units	MH-2	MH-22	MH-12		MH-4		MH-5	MH-7	MH-11	MH-13	MH-16
January												
Flow	m3/mo	2187	3393	30525		14850	#N/A	#N/A	10736	42759	137835	413117
January - Loads												
Sulphate	kg/mo	411	161	287		185	#N/A	#N/A	715	1730	2205	3677
Hardness (Total)	kg/mo	1151	570	5922		2577	#N/A	#N/A	3317	10946	32254	90886
Ammonia (Nitrogen)	kg/mo	0.38	0.13	0.08		0.08	#N/A	#N/A	1.95	0.81	2.21	2.89
Barium (Total)	kg/mo	0.32	0.07	3.14		0.41	#N/A	#N/A	0.86	3.93	22.88	71.47
Cadmium (Total)	kg/mo	0.002	0.003	0.002		0.003	#N/A	#N/A	0.005	0.010	0.007	0.021
Iron (Total)	kg/mo	1.25	0.20	7.27		0.57	#N/A	#N/A	0.81	6.07	45.49	57.84
Manganese (Total)	kg/mo	7.96	0.09	0.73		0.10	#N/A	#N/A	3.21	3.29	3.63	4.42
Lead (Total)	kg/mo	0.00	0.01	0.05		0.05	#N/A	#N/A	0.26	0.26	0.21	0.62
Lead (Dissolved)	kg/mo	0.00	0.01	0.00		0.03	#N/A	#N/A	0.20	0.15	0.00	0.00
Zinc (Total)	kg/mo	0.46	1.05	0.15		0.19	#N/A	#N/A	1.83	2.01	2.76	2.07
June												
Flow	m3/mo	3750	10914	488501		248570	#N/A	17856	10736	667269	2093002	5993369
June - Loads												
Sulphate	kg/mo	934	416	3468		3045	#N/A	1132	715	11477	56092	71321
Hardness (Total)	kg/mo	2021	1419	68879		38404	#N/A	3410	3317	121443	261625	1246621
Ammonia (Nitrogen)	kg/mo	0.61	1.46	2.44		5.59	#N/A	0.11	1.95	2.84	104.65	203.77
Nitrate (Nitrogen)	kg/mo	0.11	4.04	29.31		149.14	#N/A	#N/A	5.37	470.42	387.21	239.73
Barium (Total)	kg/mo	0.57	0.19	36.64		9.18	#N/A	0.20	0.86	41.70	167.44	839.07
Barium (Dissolved)	kg/mo	0.00	0.16	32.24		4.72	#N/A	#N/A	1.07	29.36	195.70	827.08
Cadmium (Total)	kg/mo	0.005	0.009	0.098		0.068	#N/A	0.004	0.005	0.183	0.314	25.172
Iron (Total)	kg/mo	1.72	3.49	302.87		212.78	#N/A	0.45	0.81	203.52	879.06	719.20
Iron (Dissolved)	kg/mo	0.00	0.02	7.82		2.05	#N/A	#N/A	0.01	26.69	61.74	155.83
Lead (Total)	kg/mo	0.02	0.07	1.47		1.99	#N/A	0.03	0.26	6.67	14.65	23.97
Lead (Dissolved)	kg/mo	0.00	0.01	0.24		0.50	#N/A	#N/A	0.20	5.67	25.12	23.97
Zinc (Total)	kg/mo	0.90	2.13	4.89		9.20	#N/A	0.36	1.83	23.35	64.88	59.93
August												
Flow	m3/mo	893	3437	145727		71502	#N/A	#N/A	4464	203186	651751	1937863
August - Loads												
Sulphate	kg/mo	197	136	1057		1183	#N/A	#N/A	173	3881	7691	17925
Hardness (Total)	kg/mo	469	540	28052		12084	#N/A	#N/A	1295	45717	133609	416641
Ammonia (Nitrogen)	kg/mo	0.04	0.02	0.55		0.18	#N/A	#N/A	0.68	0.51	8.47	7.27
Nitrate (Nitrogen)	kg/mo	0.01	1.31	0.00		59.35	#N/A	#N/A	0.54	65.02	0.00	135.65
Barium (Total)	kg/mo	0.14	0.06	12.39		1.90	#N/A	#N/A	0.38	15.24	88.31	293.59
Barium (Dissolved)	kg/mo	0.00	0.07	0.00		1.93	#N/A	#N/A	0.35	16.05	81.47	145.34
Cadmium (Total)	kg/mo	0.001	0.003	0.011		0.014	#N/A	#N/A	0.003	0.041	0.407	0.291
Iron (Total)	kg/mo	0.80	0.09	32.64		1.79	#N/A	#N/A	0.11	26.41	117.64	290.68
Iron (Dissolved)	kg/mo	0.00	0.01	0.00		0.72	#N/A	#N/A	0.14	6.50	28.03	110.46
Manganese (Total)	kg/mo	2.62	0.06	2.39		0.50	#N/A	#N/A	1.43	11.18	8.47	19.38
Lead (Total)	kg/mo	0.01	0.01	0.22		0.32	#N/A	#N/A	0.04	1.02	5.54	2.91
Lead (Dissolved)	kg/mo	0.00	0.01	0.00		0.29	#N/A	#N/A	0.03	1.42	0.33	0.97
Zinc (Total)	kg/mo	0.18	0.86	0.73		0.72	#N/A	#N/A	0.71	4.06	2.93	14.53
October												
Flow	m3/mo	937	1049	114935		51151	#N/A	#N/A	3928	168422	568190	1825002
October - Loads												
Sulphate	kg/mo	220	48	977		1049	#N/A	#N/A	147	3672	6307	16881
Hardness (Total)	kg/mo	502	165	20688		8900	#N/A	#N/A	1118	37305	117615	392375
Ammonia (Nitrogen)	kg/mo	0.02	0.00	0.29		0.13	#N/A	#N/A	0.82	0.42	9.94	6.84
Nitrate (Nitrogen)	kg/mo	0.75	0.90	20.69		80.31	#N/A	#N/A	0.47	50.53	147.73	127.75
Barium (Total)	kg/mo	0.14	0.02	8.62		1.33	#N/A	#N/A	0.34	12.46	69.89	276.49
Barium (Dissolved)	kg/mo	0.00	0.02	8.28		1.28	#N/A	#N/A	0.40	12.13	63.07	136.88
Cadmium (Total)	kg/mo	0.001	0.001	0.006		0.010	#N/A	#N/A	0.003	0.034	0.085	0.274
Iron (Total)	kg/mo	0.83	0.03	24.14		1.28	#N/A	#N/A	0.10	21.89	147.73	273.75
Iron (Dissolved)	kg/mo	0.00	0.00	5.98		0.41	#N/A	#N/A	0.05	5.05	17.61	104.03
Manganese (Total)	kg/mo	3.02	0.01	1.89		0.43	#N/A	#N/A	1.44	11.23	10.45	18.25
Lead (Total)	kg/mo	0.00	0.00	0.17		0.20	#N/A	#N/A	0.03	0.67	1.70	2.74
Lead (Dissolved)	kg/mo	0.00	0.00	0.00		0.15	#N/A	#N/A	0.04	0.51	1.14	0.91
Zinc (Total)	kg/mo	0.26	0.34	0.57		1.02	#N/A	#N/A	0.86	5.05	2.84	13.69

Table 4-7
Summary of Load Proportions in False Canyon Creek Basin at MH-16

		Tributary E			False Canyon Creek							FCC	
		North Dam	Burnick Portal	Downstream		Jewel Box Pits and Dumps	Jewel Box Portal	1408 Dump	South Dam Seepage	D/S	D/S	Main	
Parameter	Units	MH-2	MH-22	MH-12		MH-4		MH-5	MH-7	MH-11	MH-13	MH-16	
January - Load Proportions of MH-16													
Sulphate	%	11%	4%	8%		5%	#N/A	#N/A	19%	47%	60%	100%	
Hardness (Total)	%	1%	1%	7%		3%	#N/A	#N/A	4%	12%	35%	100%	
Ammonia (Nitrogen)	%	13%	4%	3%		3%	#N/A	#N/A	68%	28%	76%	100%	
Barium (Total)	%	0%	0%	4%		1%	#N/A	#N/A	1%	6%	32%	100%	
Cadmium (Total)	%	7%	15%	7%		14%	#N/A	#N/A	26%	47%	33%	100%	
Iron (Total)	%	2%	0%	13%		1%	#N/A	#N/A	1%	10%	79%	100%	
Manganese (Total)	%	180%	2%	17%		2%	#N/A	#N/A	73%	74%	82%	100%	
Zinc (Total)	%	22%	51%	7%		9%	#N/A	#N/A	89%	97%	133%	100%	
June - Load Proportions of MH-16													
Sulphate	%	1%	1%	5%		4%	#N/A	2%	1%	16%	79%	100%	
Hardness (Total)	%	0%	0%	6%		3%	#N/A	0%	0%	10%	21%	100%	
Ammonia (Nitrogen)	%	0%	1%	1%		3%	#N/A	0%	1%	1%	51%	100%	
Nitrate (Nitrogen)	%	0%	2%	12%		62%	#N/A	#N/A	2%	196%	162%	100%	
Barium (Total)	%	0%	0%	4%		1%	#N/A	0%	0%	5%	20%	100%	
Barium (Dissolved)	%	0%	0%	4%		1%	#N/A	#N/A	0%	4%	24%	100%	
Cadmium (Total)	%	0%	0%	0%		0%	#N/A	0%	0%	1%	1%	100%	
Cadmium (Dissolved)	%	0%	2%	8%		17%	#N/A	#N/A	3%	28%	70%	100%	
Iron (Total)	%	0%	0%	42%		30%	#N/A	0%	0%	28%	122%	100%	
Iron (Dissolved)	%	0%	0%	5%		1%	#N/A	#N/A	0%	17%	40%	100%	
Lead (Total)	%	0%	0%	6%		8%	#N/A	0%	1%	28%	61%	100%	
Lead (Dissolved)	%	0%	0%	1%		2%	#N/A	#N/A	1%	24%	105%	100%	
Zinc (Total)	%	2%	4%	8%		15%	#N/A	1%	3%	39%	108%	100%	
August - Load Proportions of MH-16													
Sulphate	%	1%	1%	6%		7%	#N/A	#N/A	1%	22%	43%	100%	
Hardness (Total)	%	0%	0%	7%		3%	#N/A	#N/A	0%	11%	32%	100%	
Ammonia (Nitrogen)	%	1%	0%	8%		2%	#N/A	#N/A	9%	7%	117%	100%	
Nitrate (Nitrogen)	%	0%	1%	0%		44%	#N/A	#N/A	0%	48%	0%	100%	
Barium (Total)	%	0%	0%	4%		1%	#N/A	#N/A	0%	5%	30%	100%	
Barium (Dissolved)	%	0%	0%	0%		1%	#N/A	#N/A	0%	11%	56%	100%	
Cadmium (Total)	%	0%	1%	4%		5%	#N/A	#N/A	1%	14%	140%	100%	
Cadmium (Dissolved)	%	0%	1%	0%		15%	#N/A	#N/A	1%	42%	168%	100%	
Iron (Total)	%	0%	0%	11%		1%	#N/A	#N/A	0%	9%	40%	100%	
Iron (Dissolved)	%	0%	0%	0%		1%	#N/A	#N/A	0%	6%	25%	100%	
Manganese (Total)	%	14%	0%	12%		3%	#N/A	#N/A	7%	58%	44%	100%	
Lead (Total)	%	0%	0%	8%		11%	#N/A	#N/A	2%	35%	191%	100%	
Lead (Dissolved)	%	0%	1%	0%		30%	#N/A	#N/A	3%	147%	34%	100%	
Zinc (Total)	%	1%	6%	5%		5%	#N/A	#N/A	5%	28%	20%	100%	
October - Load Proportions of MH-16													
Sulphate	%	1%	0%	6%		6%	#N/A	#N/A	1%	22%	37%	100%	
Hardness (Total)	%	0%	0%	5%		2%	#N/A	#N/A	0%	10%	30%	100%	
Ammonia (Nitrogen)	%	0%	0%	4%		2%	#N/A	#N/A	12%	6%	145%	100%	
Nitrate (Nitrogen)	%	1%	1%	16%		63%	#N/A	#N/A	0%	40%	116%	100%	
Barium (Total)	%	0%	0%	3%		0%	#N/A	#N/A	0%	5%	25%	100%	
Barium (Dissolved)	%	0%	0%	6%		1%	#N/A	#N/A	0%	9%	46%	100%	
Cadmium (Total)	%	0%	0%	2%		4%	#N/A	#N/A	1%	12%	31%	100%	
Cadmium (Dissolved)	%	0%	1%	0%		17%	#N/A	#N/A	4%	9%	62%	100%	
Iron (Total)	%	0%	0%	9%		0%	#N/A	#N/A	0%	8%	54%	100%	
Iron (Dissolved)	%	0%	0%	6%		0%	#N/A	#N/A	0%	5%	17%	100%	
Manganese (Total)	%	17%	0%	10%		2%	#N/A	#N/A	8%	62%	57%	100%	
Lead (Total)	%	0%	0%	6%		7%	#N/A	#N/A	1%	25%	62%	100%	
Lead (Dissolved)	%	0%	0%	0%		17%	#N/A	#N/A	4%	55%	125%	100%	
Zinc (Total)	%	2%	2%	4%		7%	#N/A	#N/A	6%	37%	21%	100%	

Table 4-8
Summary of Inferred Background Concentrations in False Canyon Creek Basin

		Trib. E. East Fork		FCC	FCC		FCC
Parameter	Units	MH-12		MH-11	MH-13		MH-16

January

Sulphate	mg/L	-11		35	5		5
Hardness (Total)	mg/L	168		230	224		215
Ammonia (Nitrogen)	mg/L	-0.017		0.080	0.015		0.002
Barium (Total)	mg/L	0.111		0.049	0.199		0.186
Cadmium (Total)	mg/L	0.000		0.000	0.000		0.000
Iron (Total)	mg/L	0.233		0.054	0.415		0.021
Manganese (Total)	mg/L	-0.294		0.130	0.004		0.000
Lead (Total)	mg/L	0.001		0.012	-0.001		0.002
Lead (Dissolved)	mg/L	0.000		0.009	-0.002		0.000
Zinc (Total)	mg/L	-0.054		0.079	0.008		-0.003

June

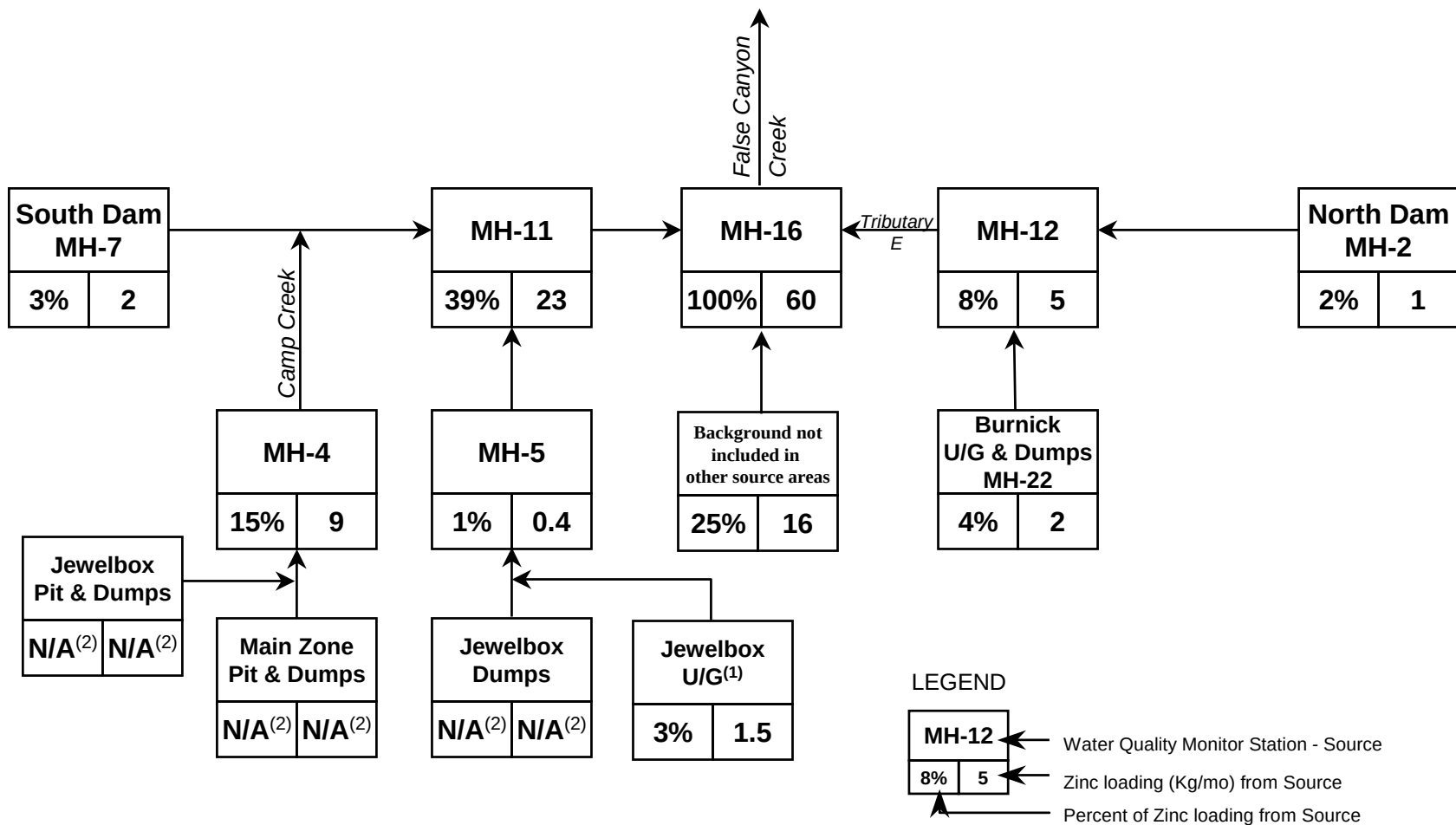
Sulphate	mg/L	4.470		15	31.293		3.447
Hardness (Total)	mg/L	138.104		161	98.323		268.509
Ammonia (Nitrogen)	mg/L	0.001		0.029	0.071		0.028
Nitrate (Nitrogen)	mg/L	0.053		0.596	-0.058		-0.052
Barium (Total)	mg/L	0.076		0.039	0.088		0.186
Barium (Dissolved)	mg/L	0.068		0.022	0.117		0.176
Cadmium (Total)	mg/L	0.000		0.000	0.000		0.007
Iron (Total)	mg/L	0.628		0.824	0.474		-0.136
Iron (Dissolved)	mg/L	0.016		0.008	0.025		0.025
Lead (Total)	mg/L	0.003		0.009	0.006		0.002
Lead (Dissolved)	mg/L	0.000		0.003	0.014		0.000
Zinc (Total)	mg/L	0.004		0.043	0.029		-0.003

August

Sulphate	mg/L	5.112		17.852	8.493		8.048
Hardness (Total)	mg/L	191.264		176.110	195.941		223.590
Ammonia (Nitrogen)	mg/L	0.003		0.011	0.018		-0.002
Nitrate (Nitrogen)	mg/L	-0.009		0.788	-0.145		0.119
Barium (Total)	mg/L	0.086		0.030	0.163		0.169
Barium (Dissolved)	mg/L	0.000		0.030	0.146		0.056
Cadmium (Total)	mg/L	0.000		0.000	0.001		0.000
Iron (Total)	mg/L	0.225		0.025	0.203		0.123
Iron (Dissolved)	mg/L	0.000		0.011	0.048		0.072
Manganese (Total)	mg/L	-0.002		0.025	-0.006		0.007
Lead (Total)	mg/L	0.001		0.005	0.010		-0.003
Lead (Dissolved)	mg/L	0.000		0.004	-0.002		0.001
Zinc (Total)	mg/L	-0.002		0.019	-0.003		0.010

October

Sulphate	mg/L	6.276		21.712	6.592		8.405
Hardness (Total)	mg/L	177.259		181.881	200.891		222.504
Ammonia (Nitrogen)	mg/L	0.002		0.017	0.024		-0.003
Nitrate (Nitrogen)	mg/L	0.169		1.467	0.243		-0.036
Barium (Total)	mg/L	0.075		0.030	0.144		0.173
Barium (Dissolved)	mg/L	0.073		0.030	0.127		0.057
Cadmium (Total)	mg/L	0.000		0.000	0.000		0.000
Iron (Total)	mg/L	0.206		0.025	0.315		0.089
Iron (Dissolved)	mg/L	0.053		0.008	0.031		0.070
Manganese (Total)	mg/L	-0.010		0.034	-0.002		0.005
Lead (Total)	mg/L	0.001		0.004	0.003		0.001
Lead (Dissolved)	mg/L	0.000		0.003	0.002		0.000
Zinc (Total)	mg/L	0.000		0.034	-0.006		0.009



ACCESS MINING CONSULTANTS LTD.

SA DENA HES DRAFT DETAILED
DECOMMISSIONING AND RECLAMATION

Estimated Zinc Loading Distribution
for June

PROJECT:
1CC005.05

DATE:
Aug. 1999

APPROVED:

FIGURE:
4-4

7. The effect of increasing zinc and cadmium in seepage from the North end of the TMF and discharge of mine water from the Jewelbox Hill Zone 1408 Portal were assessed. The loading from the Jewelbox Hill Portal was estimated by assuming that the mine will discharge at the rate which it is currently flooding and the discharge quality will be comparable to the current underground pool chemistry. The former assumption at least is conservative because flooding tends to be more rapid initially as the water table recovers.
8. The effect of the proposed TMF closure scenarios 1 and 2 were assessed qualitatively.

The model is generally conservative. It is assumed that chemical loads originating at the mine site are responsible for loads observed at downstream locations in the receiving environment. This assumes that there is no attenuation of loads in the streams below the mine. In reality, attenuation of heavy metals does occur, and the contribution from background will be greater than indicated. The current analysis generally ignores downstream attenuation by assuming that loads are conserved. It is possible that attenuation is occurring within the mine site, and that capacity for attenuation could be reduced at some time in the future. Attenuation over short distances is likely to occur as water flows through fine grained materials, for example, the North Dam seepage, South Dam seepage and flow in talus below the Burnick Portal. Both the dam seepage flow paths are very short, therefore, attenuation capacity was likely initially limited and is probably not a significant effect. The current analysis assumes that all the load from the Burnick Portal enters the receiving environment because the load is based on the discharge from the portal, not the flow after it emerges from the talus. This analysis therefore assumes that no attenuation is occurring. Additional geochemical studies are planned for 2000 to investigate these effects

The model used is considered conservative for the following reasons. The increase in loadings at MH-02 is acknowledged. The conclusion that the load from MH-02 is insignificant is based on the loading analysis. This loading at MH-02 is 1 or 2% of the total load to False Canyon Creek.

Less conservative assumptions that were used in the modeling include:

- Additional exposure of tailings will likely result in higher Zn loadings, but the increase in area will only possibly result in an additional 1 or 2%. This was not modeled because the effect was considered small.

- It is probable that submergence of tailings in the South Dam is having a beneficial effect. however, the volume submerged currently is negligible.

Results

Comparison of loads for the Tributary E and False Canyon Creek (“FCC”) indicate that Tributary E contributes a relatively small load to the FCC basin (Table 4-7 and Figure 4-4). Sulphate and zinc are probably the best indicators of the effect of mining and weathering of mineralized rock. Total sulphate load in Tributary E varies from 300 to 3000 kg/month whereas FCC at MH-11 varies from 2000 to 11,000 kg/month. Zinc load varies from 0.2 to 5 kg/month and 2 to 20 kg/month, respectively.

Tributary E indicates relatively complete accounting of load observed from the measured sources. The loads observed at MH-2 and MH-22 account for most load at MH-12. The weakest accounting occurs in January when the load at the sources exceeds the load at MH-12. This may reflect loss of load due to formation of ice in the creek. Back-calculation of background concentrations at MH-12 indicates low concentrations which are reasonable values for the region (Table 4-8). For example, sulphate is 5 to 6 mg/L and zinc is less than 0.004 mg/L. Sulphate and zinc at MH-21 have been 10 and 0.006 mg/L, respectively, and the concentrations are less than the whole basin inferred background at MH-16 (Table 4-8). Several negative concentrations were predicted for January due to the loss of load at MH-12.

Attenuation of metals in soils from the flow path between the Burnick underground and waste dumps (MH-22 and MH-12) is not expected to contribute significantly to downstream zinc concentration, if attenuation is lost at some point in time. The extra load added at MH-16 is 4 – 6% (see Figure 4-4) if attenuation capacity is used up. This conservative assumption demonstrates that the load for Burnick is not large, and would therefore not impact downstream receiving waters.

The North Dam (MH-2) is the only source of increasing zinc concentrations in the mine area. Zinc loads appear to have stabilized. It is, nonetheless, a small source (<1 kg Zn/month) of metals in the FCC basin, typically representing 2% or less of the load observed MH-16. In January, the load is 22% of the load at MH-16, however, due to freezing, most of the load probably does not actually report to MH-16. Since this seepage is a small load, any increase of zinc concentrations or loads

in the seepage will not have a significant effect on downstream water quality, even if zinc concentrations increase by a factor of 100%.

Loadings to FCC from the Main and Jewelbox Zones indicate that MH-4 is the largest single source of the load observed at MH-11 in June (3000 kg SO₄/month, 9 kg Zn/month). In other months, loads are lower and comparable to South Dam Seepage (MH-7), the only consistently flowing source. MH-5 flows intermittently and appears to account for a small proportion of surface water load in June (2% and 1% of sulphate and zinc, respectively). The calculations indicate that the bulk of zinc and sulphate load observed at MH-11 is not accounted for by the monitored sources (see Figure 4-4). Back-calculation of the concentrations applicable to the unaccounted for load indicates elevated sulphate and zinc concentrations (up to 20 mg SO₄/L and 0.079 mgZn/L). These concentrations are greater than the concentrations at MH-21 and the whole basin background values (Table 4-8). They are slightly greater than concentrations in MH-4. The unaccounted for load may reflect locally elevated background in the vicinity of Mt. Hundere or emergence of water originating in the Main and Jewelbox Zones. Pre-mining baseline monitoring was not specifically designed to separate sources of elevated background metal concentrations, hence, the actual source of the load cannot be evaluated. As noted previously, leaching is not expected to accelerate in any part of the Jewelbox or Main Zones. The current water chemistry is expected to persist indefinitely.

Attenuation of metals in the flow path down-gradient of MH-04 is not anticipated to be a significant factor in removal of zinc loads. Based on a comparison of the Main Pit load (105 kg/month at assumed 1 litre/second flow) with MH-04 (9² kg/month) it is considered unlikely that 90% of the load could be lost in the reach above MH-04. Camp Creek is fast flowing in coarse materials, providing little surface area for attenuation. A more likely explanation is that the flow from the Main Pit is short-lived (ie. Not a continuous load addition) and is therefore not reflected at MH-04. Additional water quality sampling in Camp Creek at several locations when the Main Pit is discharging could confirm this.

Calculated sulphate and zinc loads potentially discharged from the Jewelbox 1408 Portal are 150 kg/month and 1.5 kg/month (annual average based on 30 day month). Lower loads might be expected during low flows in winter. The loads are comparable to current loads from the Burnick Portal and consequently represent a small probably stable load to FCC.

4.4.1.1 *Tailings Management Facility (TMF) Closure Issues*

Two closure scenarios are proposed for the TMF. Scenario 1 assumes the mine will not reopen, the south dam would be breached, and the pond at the south end of the impoundment would be drained. Scenario 2 assumes Cominco will reopen the mine and continue to place tailings into the TMF to an elevation of about 1102 metres.

Once the South Dam is breached in Scenario 1, the flow through the breach will be related to the drainage area upstream. The seepage flow through the tailings will be a small component of the overall flow, and will be influenced by the permeability, the depth and the areal extent of the tailings.

The effect in Scenario 1 would be to lower seepage rates through the South Dams (due to the reduced head), maintain the current seepage rate through the North Dam and expose additional tailings. The latter effect is expected to be insignificant because very little tailings are currently underwater. Seepage out of the covered tailings at the south end of the impoundment is expected to be between 10 to 20 L/min after closure. Assuming that zinc concentrations are not solubility limited (due to the high solubility of zinc sulphate under pH neutral conditions), and that zinc possibly originates by slow oxidation of residual zinc sulphide, Scenario 1 would not result in a significant increase in the zinc loads from the tailings. Zinc concentrations in seepage might increase due to the lower seepage flow.

Scenario 2 is expected to increase seepage flow from the north end tailings to between 30 to 50 mg/L. The seepage rate from the south end is expected to be very similar. For the same reasons noted above, the actual zinc load in the long term would probably not increase because the tailings area exposed to oxidation will not change substantially. However, even if loads did increase by the same factor as the seepage flow rates, the additional proportion contributed to downstream load at MH-16 would be less than 2 percent. A higher calculated contribution would be expected in winter but, as noted previously, the actual load contributed by the mine area is much lower than calculated due to stream flow loss by freezing. The change in loads has an insignificant impact on MH-11 and MH-16 and does not warrant additional engineered measures to address leaching.

4.5 CONCLUSIONS

The bulk of zinc load to False Canyon Creek originates from the MH-4 area (Main Zone and Jewelbox Zones, natural runoff). This load is believed to be a result of stable oxidation of sphalerite in skarn rock on surface. The current load release can be expected to persist but not increase. The Burnick Portal also contributes a significant portion of the load in winter. The increasing zinc concentration in seepage from the North Dam is not significant. The load may increase without generating a significant impact on False Canyon Creek, but loads appear to have stabilized.

The proposed alternative closure scenarios are not expected to have a significant effect on downstream load in False Canyon Creek. Some changes in seepage flow are expected, but the change in load will be negligible in the context of other sources and the basin as a whole. Additional closure measures to address oxidation of the tailings are not needed.

5.0 TERRESTRIAL RESOURCES

5.1 VEGETATION

The Sä Dena Hes mine site is located in the Liard Basin Ecoregion (ESWG, 1995). The site includes boreal forest, subalpine and alpine vegetation zones with treeline at an approximate elevation of 1400 masl. A terrain mapping program consisting of aerial photographic interpretation augmented with field reconnaissance was completed for the IEE. The reader is referred to the IEE, Volume IV, Section 2.1.2 (SRK, 1990) for a discussion of the terrain mapping that was conducted to document generalized terrain features and geomorphic hazards that might affect project facilities. A preliminary vegetation inspection was conducted in July 1999 and forms the basis for the following vegetative description of the site.

Climax vegetation in the boreal forest zone is either white spruce (*Picea glauca*), black spruce (*Picea mariana*), subalpine fir (*Abies lasiocarpa*) or a combination of these species. Black spruce and alpine fir are the most common boreal vegetation communities in the area. Black spruce forest is prevalent on poorly drained bogs and fens such as those in the tailings impoundment area. Open stands of black and white spruce are found on upland slopes. The area around the mill and camp upwards to the treeline is primarily subalpine fir.

Paper birch (*Betula papyrifera*) occurs on moist sites throughout the area. Trembling aspen (*Populus tremuloides*) is found on well-drained south-facing slopes, and balsam poplar (*Populus balsamifera*) colonizes alluvial gravel bars and other moderately well-drained disturbed sites. Lodgepole pine (*Pinus contorta*) forms pure even-age stands in some upland areas on the mine site, presumably following fire. Larch (*Larix laricina*) is found in lowland bogs along the main access road.

Willow (*Salix* spp.), alder (*Alnus crispa*), rose (*Rosa acicularis*) and Labrador tea (*Ledum groenlandicum*) are the common understorey shrubs. Mountain ash (*Sorbus scopulina*) is found in the tailings impoundment area. Ground cover is dominated primarily by kinnikinnick (*Arctostaphylos uva-ursi*), bearberry (*Arctostaphylos rubra*), crowberry (*Empetrum nigrum*),

ligonberry (*Vaccinium vitis-idaea*), bunchberry (*Cornus canadensis*) and toadflax (*Geocaulon lividum*).

Shrub birch (*Betula glandulosa*), along with alpine fir and willows dominate the subalpine zone. Low ericaceous shrubs are common in alpine areas, along with a groundcover of mosses and lichens.

Bluejoint reedgrass (*Calamagrostis canadensis*) is a prominent graminoid in the area, particularly in moist semi-shaded areas. Altai fescue (*Festuca altaica*) is dominant on drier slopes. Fowl bluegrass (*Poa palustris*) prevails in moist open areas. Slender wheatgrass (*Agropyron pauciflorum*), violet wheatgrass (*Agropyron violaceum*) and bearded wheatgrass (*Agropyron subsecundum*) are the primary invaders of disturbed areas.

Legumes are not prominent in the native flora. Elegant milk vetch (*Astragalus eucosmus*) and arctic lupine (*Lupinus arcticus*) are the most common indigenous legumes in the Sä Dena Hes area.

Soils

Genetic materials throughout the mine site area are primarily morainal, fluvial or glaciofluvial. Organics overlying morainal or fluvial material occur in wetlands such as the tailings impoundment areas. Upper alpine zones are bedrock while zones of colluvium occur on the steeper upland slopes.

A layer of silty loam or gravely sandy loam supports white spruce and mixed deciduous forests. These moderately well drained soils are slightly acidic to neutral (pH 6.1 to 7.3) with low to moderate organic matter and with a low level of available nutrients. Wetlands supporting black spruce vegetation have soils of mesic, fibric peat or silty loam. These poorly drained soils are slightly to strongly acidic, have high organic matter and have very little nutrients available. Alpine and subalpine vegetation is found on moderately well drained silty loam or loamy sand. These soils are slightly acid to neutral with low organic matter and with a low level of available nutrients.

5.2 WILDLIFE

The Sä Dena Hes mine site is located within the False Canyon Creek watershed and the mine access road traverses the headwaters of various tributaries of the Tom Creek watershed. The area encompasses several mature mountains with a predominance of boreal forest and limited alpine and sub-alpine terrain. This habitat is capable of supporting various ungulates, large carnivores, other fur-bearers and many bird species. However, species that generally exploit alpine zones are rare due to the limited availability of this habitat in the area.

Wildlife utilization and habitat potential investigation within the Sä Dena Hes Mine project area was undertaken in 1989 to complement similar studies conducted in the area by other agencies. This investigation involved a review of published and unpublished reports on wildlife in the Southeast Yukon, wildlife surveys and trapline catch information, interviews with personnel knowledgeable about the area, and field reconnaissance. Refer to Section 2.4 within the “Mt. Hundere Development Initial Environmental Evaluation, Supporting Document IV, Biophysical Evaluation” (SRK, 1990).

As noted within the IEE, moose are the most prevalent ungulate in the study area, with sightings from the timberline to the valley bottoms. Currently, moose are very infrequent visitors to the project area, and Cominco is not aware of any moose mortalities. The Sä Dena Hes project area also provides good black bear habitat, although only occasionally seen within the vicinity of the mine site itself. Beaver sign has been noted along virtually all watercourses and at all lakes in the study area. An assessment of beaver activity in the area was completed in 1998 (LES, 1998). Cycles of flooding and abandonment attributable to beavers result in ponded wetlands used by many species including waterfowl.

No further wildlife investigations have been completed in the project study area since those reported in the IEE.

6.0 AQUATIC RESOURCES

6.1 FISHERIES

Fisheries monitoring programs have been conducted concurrently with the biological monitoring program as described in their water use licence, every two years since 1992. Baseline fisheries investigations of drainages within the Sä Dena Hes study area were completed by Environmental Sciences Ltd. (ESL) on the False Canyon Creek drainage in June and September of 1989 as a component of the Initial Environmental Evaluation for the Mt. Hundere Development. ESL also conducted fish surveys on the Tom Creek drainage as well as on a tributary to Francis River, where grayling and slimy sculpin were captured. A summary of the results from this investigation are provided in Chapter 2.5 of the report entitled "*Mt. Hundere Development Initial Environmental Evaluation*, Volume IV Biophysical Evaluation of Project Site, (SRK, 1990).

Results from the water use licence fisheries monitoring are summarized below. The reader is referred to the following reports for a detailed discussion of the fisheries investigations.

- *Environmental Assessment of False Canyon Creek, 1992 Study*. Prepared for Curragh Resources. (P.A. Harder & Associates Ltd. 1992).
- *Environmental Monitoring at False Canyon Creek, 1994*. Prepared for Sä Dena Hes Joint Venture. (Laberge Environmental Services and White Mountain Environmental Consulting. 1995).
- *Environmental Monitoring at False Canyon Creek, 1996*. Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services. 1996).
- *Environmental Monitoring at False Canyon Creek, 1998*. Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 1998).

During the study conducted in 1992, fish tissues were analyzed for metals, although this was not a requirement of the licence. The concentrations found in the liver and muscle of Arctic Grayling and Whitefish, and in the whole bodies of sculpins, were similar to concentrations in fish captured in an unaffected watershed (Blind Creek), indicating that there was no effect from the Sä Dena Hes Mine. In 1998, habitat and utilization assessments were also conducted on North Creek upstream and downstream of the North Creek dike and no fish were captured.

A variety of techniques were used during the investigations; electro-shocker (gas and battery operated), minnow trapping, seine netting, gill netting, angling and visual observations. All of the existing fisheries data on the False Canyon Creek drainage have been summarized and are presented in Table 6-1. Locations of fish monitoring stations are provided in Figure 6-1.

Pre- and post-development fish sampling indicate that fish production capabilities in the upper False Canyon Creek drainage are relatively low. The most productive area within the system appears to be the lower reaches of False Canyon Creek near the confluence with the Frances River.

Six species of fish were found within the False Canyon Creek drainage: slimy sculpin (*Cottus cognatus*), Arctic grayling (*Thymallus arcticus*), round whitefish (*Prosopium cylindraceum*), burbot (*Lota lota*), northern pike (*Esox lucius*), and char species (*Salvelinus* sp). Slimy sculpin were the most abundant species captured representing 75% of the total catch, followed by Arctic grayling at 20%.

The sites MH-13 and MH-20 were monitored during each of the five surveys. Only slimy sculpin were captured at MH-13 although several fishing methods were employed. This site is a beaver/wetland complex with low velocity flow. The slimy sculpin population however, continued to be stable and the habitat supported all life history stages of this species.

Arctic grayling and slimy sculpin dominated the catch at MH-20 with incidental occurrences of whitefish and char. This site displays suitable fish habitat with stable banks and gravel substrate, and good riffle/pool ratio.

Fish distribution and catch results collected over the study period, indicate little change in the abundance or species assemblage.

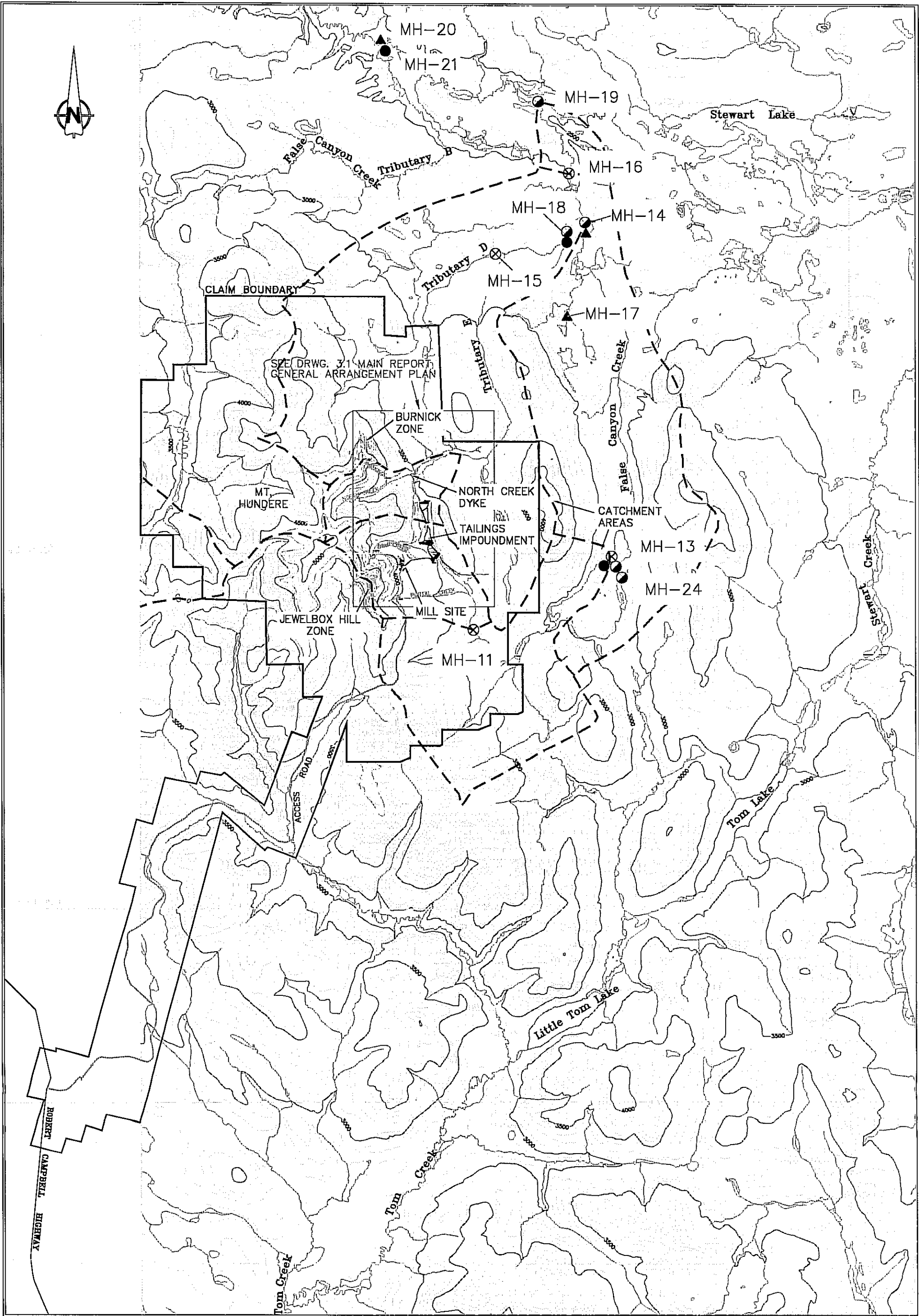
Table 6-1 Summary of Fish Species Captured In the False Canyon Creek Drainage

Species	Year	MH-12	MH-13	MH-14	MH-16	MH-17	MH-19	MH-20	MH-21	FFO1	Total per Species
Slimy Sculpin	1989	-	0	-	-	-	1	12	-	6	146
	1992	0	9	2	-	0	1	1	0	0	
	1994	-	19	-	-	0	-	8	-	-	
	1996	-	18	-	-	0	-	33	-	-	
	1998	-	15	2	0	-	-	19	-	-	
Arctic Grayling	1989	-	0	-	-	-	1	10	-	3	38
	1992	0	0	0	-	0	0	1	0	8	
	1994	-	0	-	-	0	-	7	-	-	
	1996	-	0	-	-	0	-	5	-	-	
	1998	-	0	0	0	-	-	3	-	-	
Whitefish	1989	-	0	-	-	-	0	0	-	0	4
	1992	0	0	0	-	0	0	0	0	1	
	1994	-	0	-	-	0	-	1	-	-	
	1996	-	0	-	-	0	-	0	-	-	
	1998	-	0	0	0	-	-	2	-	-	
Char species	1989	-	0	-	-	-	0	0	-	0	1
	1992	0	0	0	-	0	0	0	0	0	
	1994	-	0	-	-	0	-	1	-	-	
	1996	-	0	-	-	0	-	0	-	-	
	1998	-	0	0	0	-	-	0	-	-	
Burbot	1989	-	0	-	-	-	0	0	-	1	3
	1992	0	0	0	-	0	0	0	0	0	
	1994	-	0	-	-	0	-	0	-	-	
	1996	-	0	-	-	0	-	0	-	-	
	1998	-	0	0	2	-	-	0	-	-	

Species	Year	MH-12	MH-13	MH-14	MH-16	MH-17	MH-19	MH-20	MH-21	FFO1	Total per Species
Pike	1989	-	0	-	-	-	0	0	-	0	1
	1992	0	0	0	-	0	1	0	0	0	
	1994	-	0	-	-	0	-	0	-	-	
	1996	-	0	-	-	0	-	0	-	-	
	1998	-	0	0	0	-	-	0	-	-	
Totals per site:		0	61	4	2	0	4	103	0	19	193

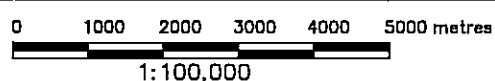
Notes: A dash (-) indicates that that site was not sampled during that year.

FF01 = False Canyon Creek upstream of the confluence with Francis River.



NTS: 105 A/06, 105 A/07
105 A/10, 105 A/11

CONTOUR INTERVAL 100 FEET



NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927



- LEGEND**
- ⊗ WATER MONITORING STATION
 - ▲ FISH MONITORING STATION
 - BENTHIC MONITORING STATION
 - STREAM SEDIMENT SAMPLING SITE

**S&A DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN**

**REGIONAL WATER QUALITY, FISH, BENTHIC+
STREAM SEDIMENT MONITORING STATIONS**

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	REV.
DATE: JULY 29, 1999	PROJ. NO. 1CC005.05	6-1	

6.2 BENTHIC INVERTEBRATES

Two baseline benthic invertebrate investigations were conducted within the Sä Dena Hes study area prior to mine development. In September 1989, ESL collected baseline benthic invertebrates from 23 sites. Samples from only three of these sites were identified and analyzed, and the remaining 20 were archived. A discussion of this study was provided in the report entitled "*Mt. Hundere Development Initial Environmental Evaluation*, Volume IV Biophysical Evaluation of Project Site, (SRK, 1990). In July 1990, Environmental Protection Services (EP) of Whitehorse, Yukon, conducted baseline biological monitoring at ten sites, four of which lie within the False Canyon Creek drainage. Details of this study are reported in the "*Mount Hundere Baseline Study, June 1988 and June 1990*. Data Report No. 94-02. Environmental Protection Branch. 1994

Biological monitoring programs have been conducted according to water licence specifications, every two years since 1992. The reader is referred to the following reports for a detailed discussion of the benthic invertebrate investigations.

- *Environmental Assessment of False Canyon Creek, 1992 Study*. Prepared for Curragh Resources. (P.A. Harder & Associates Ltd., 1992).
- *Environmental Monitoring at False Canyon Creek, 1994*. Prepared for Sä Dena Hes Joint Venture. (Laberge Environmental Services and White Mountain Environmental Consulting. 1995).
- *Environmental Monitoring at False Canyon Creek, 1996*. Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services. 1996).
- *Environmental Monitoring at False Canyon Creek, 1998*. Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 1998).

Results from the benthic invertebrate monitoring studies are summarized below. Biological monitoring station locations are shown in Figure 6-1. Due to a poorly designed monitoring program in regard to site selection, the sites sampled have varied over the years. In water licence number IN90-002, stations MH-13, MH-14, MH-18, MH-19 and MH-21 were to be monitored for benthic invertebrates. In 1992, it was discovered that MH-18 was inaccessible (however ESL managed to sample this site in 1989) and MH-19 was located in a sedge-meadow setting with a sandy mobile substrate, inadequate as a biological monitoring site. These two sites were dropped and MH-20 was monitored in 1992 and thereafter, to coincide with the fisheries site at this location. Site MH-21 was to act as a background site for benthic invertebrate communities as it existed on an unaffected tributary. However, the habitat here prohibited the colonization of healthy communities and was of a degraded nature when compared to the communities at the potentially impacted sites of MH-13, MH-14 and MH-20. In 1996, MH-14 and MH-21 were flooded due to beaver activity and biological monitoring could not be conducted. In 1998, the situation prevailed and monitoring was conducted at MH-16 instead of MH-14, which is only a further two kilometres downstream on False Canyon Creek. In 1998, assessments were also conducted on North Creek upstream and downstream of the North Creek dike.

Triplicate samples were collected at each site using a Surber sampler for all of the surveys. All of the existing benthic data collected in the False Canyon Creek drainage have been summarized and are presented in Table 6-2. Density was calculated for the total number of invertebrates found at each site. Taxonomic richness was determined through enumeration of all of the individual taxonomic groups present at each site as a measure of community diversity. Taxa were grouped according to order, and those orders forming 25% or more of the community were considered dominant. The data has been separated into either tributary sites or False Canyon Creek mainstem sites.

The lowest populations and diversities were recorded at Tributary B, MH-21. The highest populations were generally found at MH-13 and were usually dominated by the Dipteran family, Chironomidae. Site MH-20 exhibited diverse healthy communities with good representation of pollution sensitive species found within the orders Ephemeroptera, Plecoptera and Trichoptera.

Table 6-2 Summary of Benthic Invertebrate Data in the False Canyon Creek Drainage

Site	Year	Density # of organisms/m ²	Taxonomic Richness	Dominant Taxa
Tributary Sites				
Trib B, headwaters	1990	1,091	22	Plecoptera & Ephemeroptera
Trib B, MH-21	1990	129	16	Diptera
	1992	165	12	Plecoptera
	1994	703	24	Plecoptera & Ephemeroptera
Trib D, MH-12	1992	2,372	20	Diptera
Trib E, headwaters	1989	22,354	32	Diptera
Trib E, MH-18	1989	7,743	40	Diptera
Unnamed Trib, MH-17	1996	21,450	65	Ephemeroptera & Diptera
North Cr u/s	1998	7,320	49	Diptera
North Cr d/s	1998	6,211	56	Diptera & Plecoptera
Mainstem Sites				
MH-13	1990	1,087	23	Ephemeroptera
	1992	5,605	25	Diptera
	1994	27,380	37	Ephemeroptera & Diptera
	1996	13,211	57	Diptera
	1998	46,764	30	Diptera
MH-14	1990	865	37	Ephemeroptera
	1992	4,521	27	Diptera
	1994	10,728	37	Ephemeroptera
MH-16	1998	13,470	60	Diptera & Ephemeroptera
MH-19	1989	26,154	38	Diptera
MH-20	1992	1,414	22	Ephemeroptera
	1994	2,583	31	Ephemeroptera & Diptera
	1996	3,358	54	Ephemeroptera & Diptera
	1998	9,200	59	Ephemeroptera & Diptera

The community structure at the sites in the False Canyon Creek drainage appear to be a function of habitat characteristics rather than related to water or stream sediment quality. The communities located at sites with low velocity and substrates composed of fine sediment were usually well represented by Dipterans, whereas communities at sites with swifter currents and clean washed gravels had good representation from Ephemeroptera and Plecoptera (usually subdominant).

Sites MH-13 and MH-20 (the sites closest to and furthest from the reclaim pond respectively) have complete data records to date (water quality, stream sediment quality, fisheries and benthic data) allowing the benthic communities here to serve as monitors to aquatic perturbations in water quality.

Overall, the benthic invertebrate communities within the False Canyon Creek drainage were relatively diverse and had good representation from the major groups of organisms that are usually present in lotic waters.

6.3 STREAM SEDIMENTS

Baseline stream sediment samples were collected by Environmental Protection Services (EP) in 1988 and 1990 (EPS, 1994). Stream sediment samples have been collected concurrently during the biological monitoring program as described in the water licence, every two years since 1992. In 1998 assessments were also conducted on North Creek upstream and downstream of the North Creek dike. All of the existing sediment data have been summarized and are presented in Table 6-3. Stream sediment sample locations are shown in Figure 6-1.

High levels of lead and zinc were found in the 1988 samples collected by EP from a site identified as "headwaters of False Canyon Creek" at 60°32'N by 128°57'W. This site may lay within the vicinity of the ore body. No corresponding licence station exists at this location and samples were only collected in 1988.

Table 6-3 Historic Summary of Metals in Stream Sediments at Sä Dena Hes

Site	Year	Arsenic	Copper	Cadmium	Lead	Zinc
Headwaters of FCC	1988	81	78.2	37.5	11,367	14366
Headwaters of Trib B	1988	13	35.6	2.4	139	254.3
	1990	17	21.0	0.93	101	160.7
MH-12	1992	26	12.9	1.1	38.7	185
MH-13	1990	<20	21.8	1.41	22.5	196.3
(FCC 10 km d/s reclaim pond)	1992	17	21.7	1.2	65.3	256
	1994	11.5	22.8	1.5	47	216
	1996	12	19.2	1.7	27	160.3
	1998	14	20.7	1.2	37	174
MH-14	1990	<16	21.3	1.4	14.2	147
(FCC 20 km d/s reclaim pond)	1992	13	13.4	0.8	21	119
	1994	<10	15.1	0.9	10.7	92.8
MH-16	1998	<8	9.2	0.4	8	72
(FCC 22 km d/s reclaim pond)						
MH-17	1992		6.9	0.7	3	40.1
	1994	<10	6.6	0.5	3	33.6
	1996	<8	7.5	1.6	3	40.9
MH-19	1992	16	6.2	0.1	6	59.3
MH-20	1990	<9	20.9	0.3	10.4	80.2
(FCC 33 km d/s reclaim pond)	1992	13	22.1	<0.1	15	77.7
	1994	<10	20.6	0.5	9	69.3
	1996	9	16.6	1.5	9.3	68.9
	1998	9	18.7	0.3	11	74
MH-21	1990	19	13.7	0.81	10.6	132.7
	1992	12	15.9	0.5	13	103
	1994	<10	21.2	0.8	12.3	106
North Cr u/s North Cr dike	1998	27	19.3	1.2	61	212
North Cr d/s North Cr dike	1998	18	21.0	1.5	121	368

Note: all values are dry weight, ug/g, and are averages of triplicate samples

FCC = False Canyon Creek

A temporal review of the data indicates little fluctuation in concentrations of arsenic, copper or cadmium at each of the sites. For the reference sites MH-17 and MH-21, there was also little change in lead and zinc levels over time. However, zinc values at MH-21 were significantly higher than at the potentially impacted sites of MH-16, MH-19 and MH-20, indicating the presence of natural mineralization at this tributary.

MH-13 lies closest to the reclaim pond and has the highest potential for impacts from the mine. Lead and zinc values were considerably greater in 1992 than during baseline conditions in 1990. These higher values could have been influenced in part by a tailings spill in July 1991. The mine was also operational during this time period. Zinc levels were below baseline values in 1996 and 1998 and lead concentrations approached baseline values in 1996 and 1998.

Subsequent zinc analyses at the downstream sites of MH-14 and MH-20 showed lower concentrations than during the baseline survey.

It would appear that while the mine was operating, effects on sediment metals concentrations were apparent at ten kilometers downstream, but were undetectable beyond that.

7.0 CURRENT LAND USE AND TENURE

This section addresses other projects or activities within the general Sä Dena Hes Mine project area both currently and from recent history. Land use in the area surrounding the Sä Dena Hes Mine property was addressed in the IEE for the project (SRK, 1990). The IEE should be referred to for a detailed discussion of the results of those investigations. Table 7-1 provides a summary of current and historical projects/activities within this area. The information was obtained from a number of government agencies and boards responsible for the issuance of various permit authorizations. Mineral and land tenure resource maps were also obtained from the DIAND Mining Recorder and DIAND Land Resources.

There have been several activities in the area, most of which have been focussed around the Robert Campbell Highway. Yukon Territorial Government and Federal Government departments have also historically conducted various activities within the highway right-of-way, such as right of clearing, maintenance, and geotechnical investigations. There are a few privately held lots along the highway and various First Nation site specific and settlement land claims within the general vicinity of the property area. In addition to the mineral claims held by the Sä Dena Hes Operating Corporation, there are a number of mineral claims held within the area by various parties. Various trapping concessions are held in the project area and actively trapped. Currently trapping and hunting are the primary activities in the project area. Much of the hunting is conducted from the roadways. Various trapping concessions are held in the project area and are summarized in Table 7-1.

The importance of cultural resources such as recreational, traditional, and special uses of land, including hunting and trapping are addressed in the following section. Implementation of closure measures are not expected to interfere with other current land uses in the area.

Table 7-1 List of Previous and Current Activities in the Project Area

Activity Type	Permit Licence Holder	Comments
MAP SHEET 105 A/6		
MINERAL TENURE		
MC Lots. 1-21	Glimmer Resources	Mineral claims designated GMS (expire 01/08/11)
MC Lots. 1-21	Minfocus International Inc.	Mineral claims designated BOMB (expire 99/10/10)
MC Lots 1-32	Pacific Bay Minerals	Mineral claims designated CAM (expire 02/02/26)
MC Lots 13-1583 (various)	Cominco	Mineral claims designated HOLMES (expire 01/12/15)
MC Lots 1-144	McCroy Holdings Ltd.	Mineral claims designated EAGLE (expire 05/08/24)
WATER USE		
LAND USE/Mineral LAND USE		
YA3W436 (expired 96/04/30)	Kaska Forest Resources	Activities related to forestry THA Liard Block
YA5Q925 (closed 97/09/13)	YTG - CTS	Blanket maintenance km 10-50.5 Robert Campbell Hwy.
YA6S187	YTG - CTS - Transportation and Engineering	Geotechnical investigations at various locations between km 55-232 Robert Campbell Hwy.
YA6E255 (closed 98/04/21)	YTG - CTS	Right of Way clearing km 55-232 Robert Campbell Hwy.
YA6S260 (expired 99/01/31)	YTG - CTS - Transportation and Engineering	Geotechnical investigations at various locations between km 34-222 Robert Campbell Hwy.
YA7N301 (closed 98/04/30)	Geological Survey of Canada - Dr. Isa Asudeh	Seismic geological investigations
YA7X296 (closed)	Ivan Johnson	Establish a portable sawmill on the site within a timber operating unit, in the vicinity of km 43 Robert Campbell Hwy.
OTHER		
S-67, S-68, S-168, S-265, S-79	Liard First Nation	Site Specific Lands
Various Trapping Concessions continued from other map sheets (see below)		

Activity Type	Permit Licence Holder	Comments
<u>MAP SHEET 105 A/10</u>		
MINERAL TENURE		
MC Lots 42-46	Sä Dena Hes Operating Corp.	Mineral claims designated JEWEL (expire 99/08/24)
MC Lots 120-308	Sä Dena Hes Operating Corp.	Mineral claims designated HUN (expire 09/03/01)
MC Lots 329-422	Sä Dena Hes Operating Corp.	Mineral claims designated HUN (expire 02/09/06)
MC Lots 1-8	Sä Dena Hes Operating Corp.	Mineral claims designated HAWK (expire 03/08/24)
MC Lots 1-78	Sä Dena Hes Operating Corp.	Mineral claims designated CIMA (expire 09/03/01)
MC Lots 1-12, 40, 41	Sä Dena Hes Operating Corp.	Mineral claims designated MICA (expire 09/03/01)
MC Lots 1-22	Sä Dena Hes Operating Corp.	Mineral claims designated THUNDER (expire 03/08/24)
MC Lots 1-10, 19, 20	Alex Black	Mineral claims designated ECHO (expire 99/10/05)
WATER USE		
IN90-002	Mount Hundere Joint Venture	Original water licence for project was to expire 00/09/15. Licence was amended QZ97-025 by new owner Sä Dena Hes Operating Corp.
QZ97-025	Sä Dena Hes Operating Corp.	
MS97-091 (expires 04/12/31)	Sä Dena Hes Operating Corp.	Type B Water Licence To construct a runoff catchment berm, at km 15.5 of main mine access road
Other		
S-219	Liard First Nation	Site Specific Land
R-15	Liard First Nation	Settlement Land
Registered Trapping Concession #356	Jim Stewart/Andy Szabo	Trapping Concession
<u>MAP SHEET 105 A/07</u>		
MINERAL TENURE		
MC Lots 1-144 (various active)	Sä Dena Hes Operating Corp.	Mineral claims designated GMN (expire 05/10/26)
LAND USE/Mineral LAND USE		
Tom Creek Lookout Site	DIAND - Fire Management	Lookout tower and cabin designated YFS 001
OTHER		
R-15	Liard First Nation	Settlement Lands
Registered Trapping Concession #358	Leo Stewart	Trapping concession
Registered Trapping Concession #359	Alice Brodhagen	Trapping concession

8.0 CULTURAL RESOURCES

The cultural resources of the study area have been previously examined as part of the IEE (SRK, 1990). The results of the Heritage Resource Overview found that the archaeological potential of the study area is low and no zones of high or even moderate potential are encroached by the development. However it is noted in the study recommendations that the area is relatively unknown in terms of heritage resource site distribution and recommends an awareness of the potential for discovery. The reader is referred to Appendix B of Volume III (Socio-economic Evaluation) of the IEE (SRK, 1990) which provides a more complete description of the heritage resource value of the region.

An evaluation in 1990 of current use of the Mount Hundere area by Liard First Nation residents found that primary use of the area was for hunting, fishing, and trapping. No spiritual or special places were identified. The study hypothesized that the impact of the project would not necessarily come from the mine itself, but rather the increased pressure of hunting from both natives and non-natives along the access road. For a more comprehensive description the reader is referred to the aforementioned IEE Volume III Appendix C (SRK, 1990).

Trapping and hunting continue to be the primary activities in the project area. There are several active trapping concessions in the area and the opportunity for hunting access via the Robert Campbell Highway is readily available. The project area is generally part of the Liard First Nation's traditional territory and continues to provide for First Nation's and other subsistence users. Resource usage is expected to continue at existing levels for trapping, hunting, recreational, and subsistence use.

9.0 AIR QUALITY

Past and current air quality for the project area is good. A small fleet of diesel equipment will be in use at the mine and exhaust emissions from the combustion of fossil fuels are mitigated following standard industrial procedures for emission control. Experience operating an underground mine fosters an acute awareness of exhaust emissions. Appropriate control measures are employed to control fugitive dust at the mill site, load-out, mining operations, and from road use.

10.0 STABILITY ANALYSIS

10.1 INTRODUCTION

The following Tailings Management Facility closure scenarios are presented in the Sä Dena Hes closure plan:

- Scenario 1: Close the tailings impoundment based on the current volume and distribution of tailings within the facility (Figure 10-1); or
- Scenario 2: Deposit an additional 1.8 million tonnes of tailings into the impoundment over a period of 4 years (Figure 10-2).

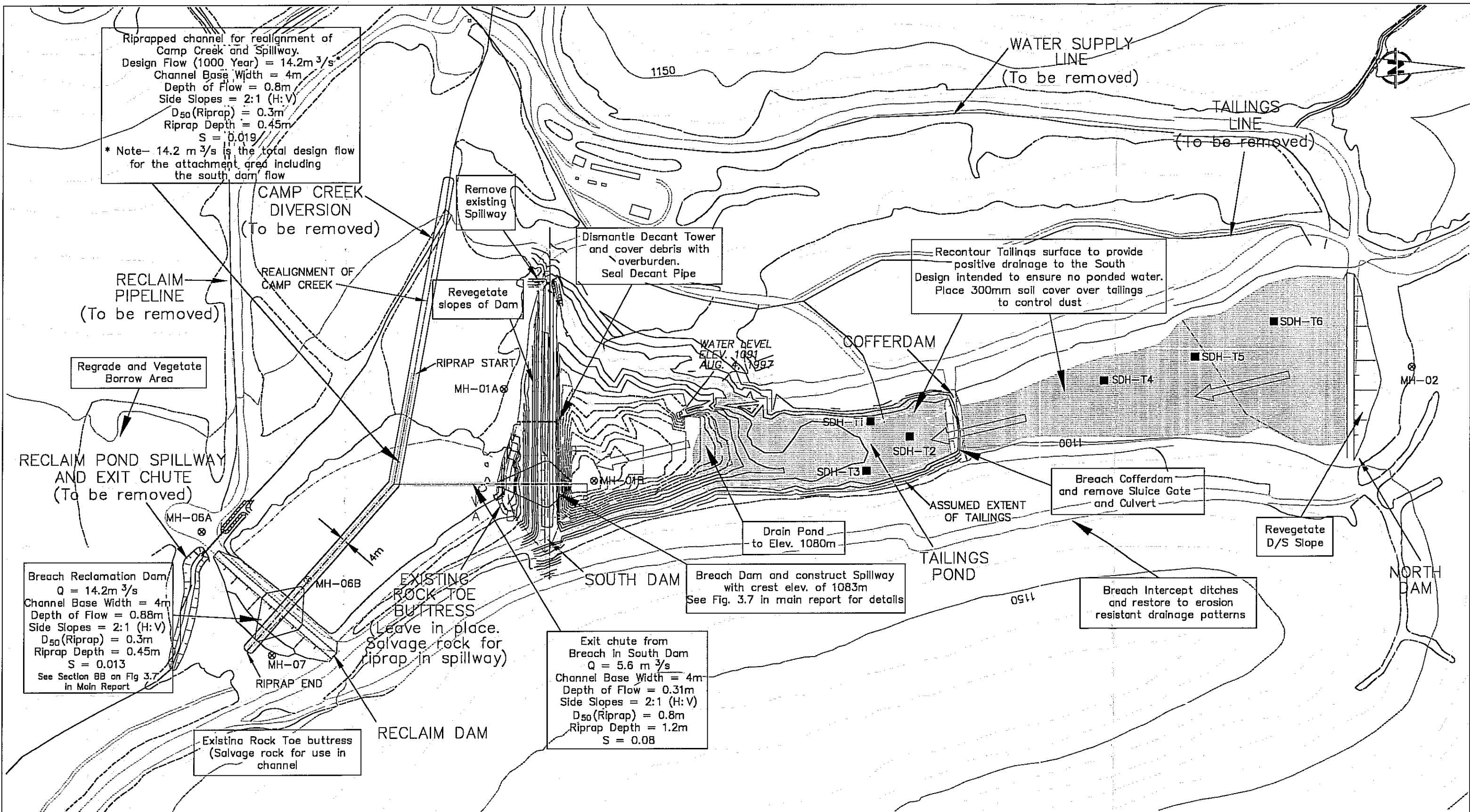
This section discusses the physical stability of the dams at the tailings impoundment in the context of these two closure scenarios.

10.2 GENERAL DESCRIPTION OF THE TAILINGS IMPOUNDMENT

The tailings impoundment occupies a north-south valley segment with an earthfill dam at either end (the North and South Dams, as shown in Figure 10-1). The area between the North and South Dams is about 1100 m long and up to 350 m wide. The small earthfill cofferdam approximately midway between the two dams coincides with the catchment line that separates drainage to the north and south of the impoundment.

The North Dam has a current crest elevation of 1098 m and is about 12 m high. The South Dam currently has a crest elevation of 1096 m and is about 16 m high.

The area of the impoundment is approximately 21 hectares. The total impoundment catchment is 134 hectares.



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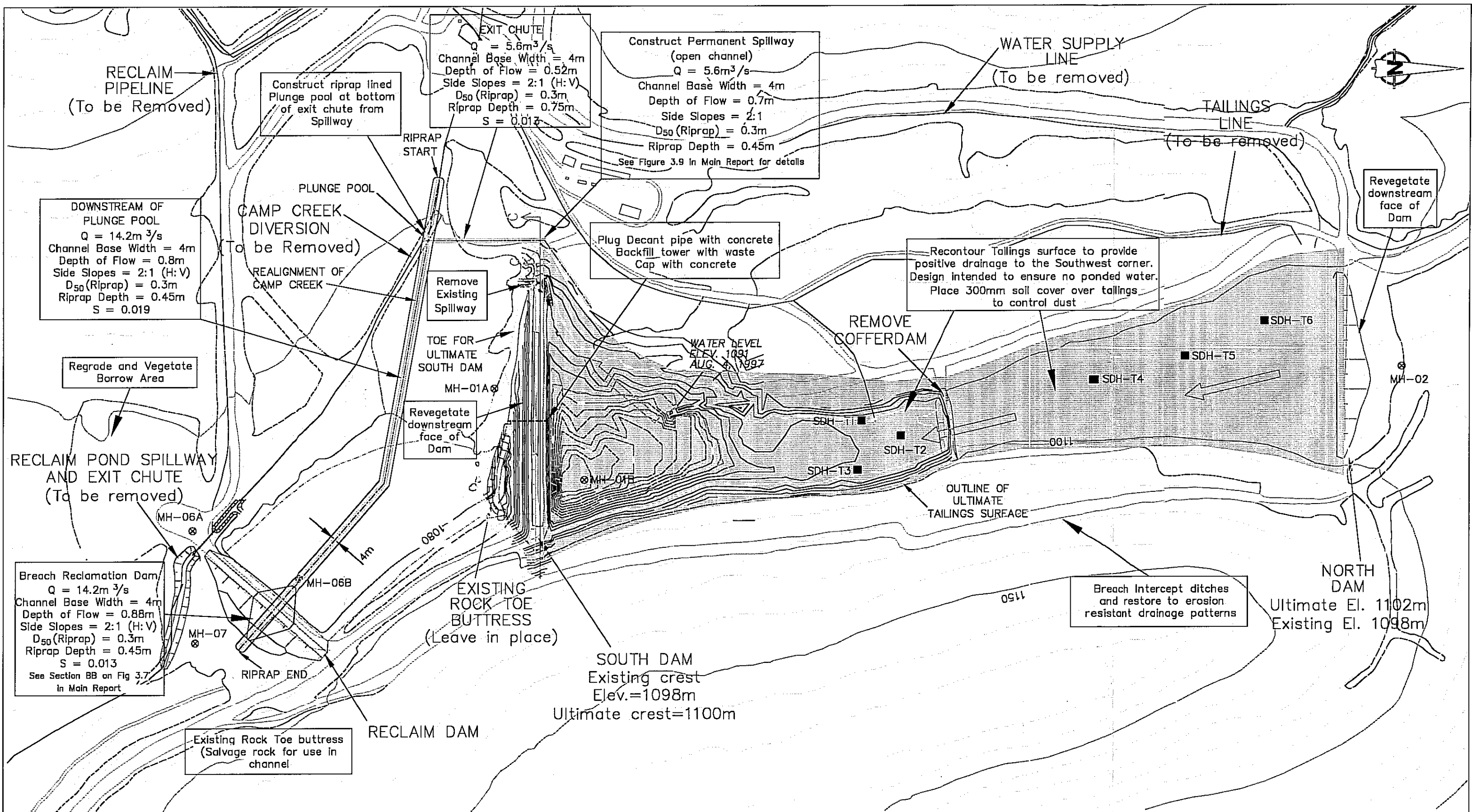
LEGEND

- ⊗ WATER MONITORING STATION
- TAILINGS SAMPLE
- ← SURFACE DRAINAGE

SA DENA HES DETAILED
 DECOMMISSIONING AND RECLAMATION PLAN

TMF CLOSURE MEASURES
 SCENARIO 1

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	10.1	REV.
DATE:	AUGUST 2, 1999	PROJ. NO.	1CC005.05			

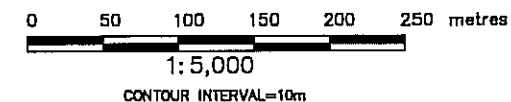


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LEGEND

- ⊗ WATER MONITORING STATION
- TAILINGS SAMPLE
- ← SURFACE DRAINAGE



NOTE:
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

TMF CLOSURE MEASURES
SCENARIO 2

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	REV.
DATE: AUGUST 4, 1999	PROJ. NO. 1CC005.05	10.2	

10.3 CLOSURE SCENARIO 1

10.3.1 General

With Scenario 1, the North Dam will remain at its current elevation and the South Dam will be breached (Figure 10-1). The invert elevation of the breach will be established so as to prevent the escape of tailings and to eliminate or, at least, minimize the impoundment of water.

For Scenario 1, the stability of the North Dam requires evaluation as a closure issue, while that of the South Dam does not.

10.3.2 North Dam Configuration

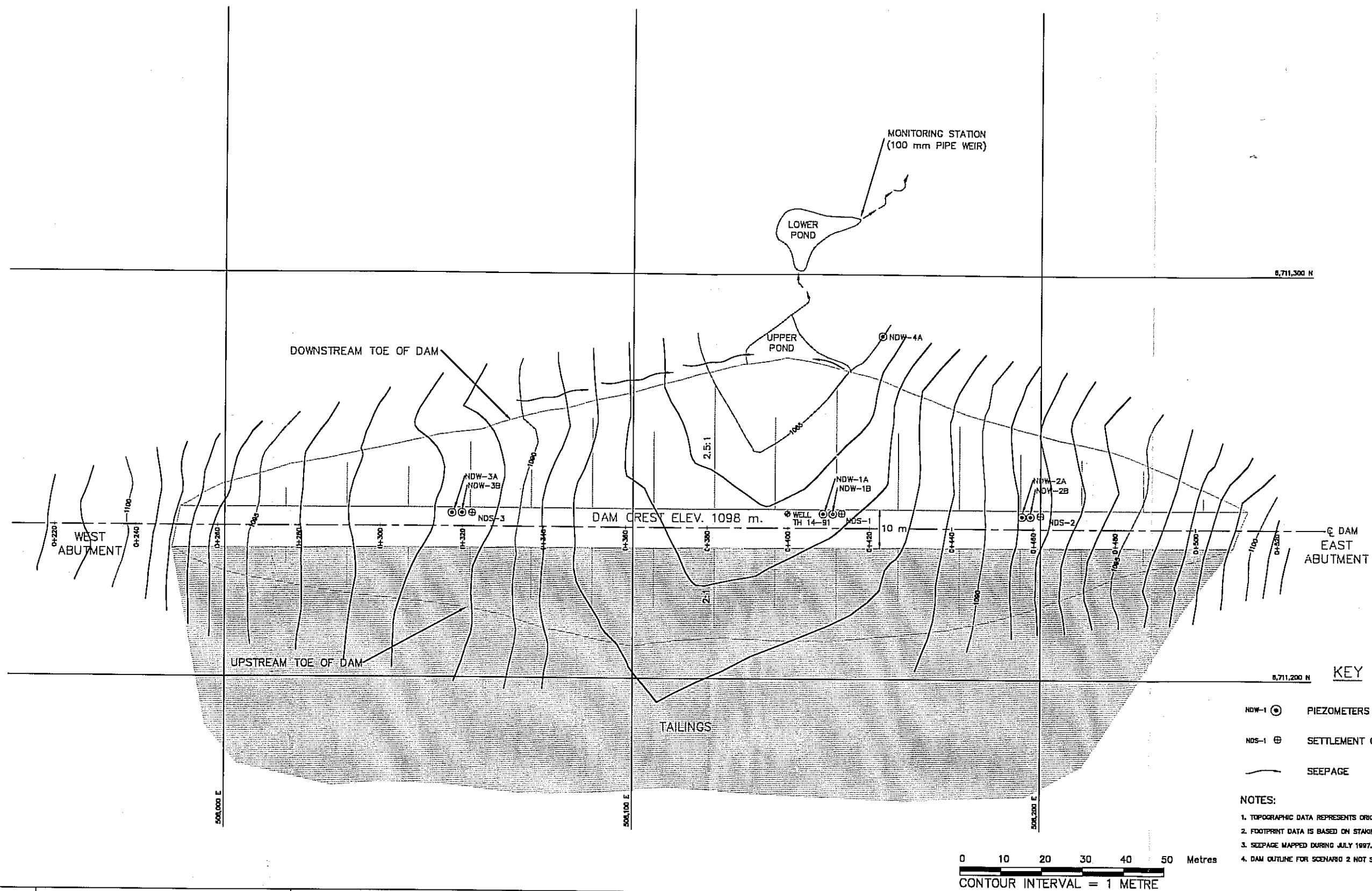
The current crest elevation of the North Dam is 1098 m, which corresponds to a dam height of 12 m relative to the downstream toe (Figures 10-3 and 10-4). It has an upstream slope of 2H:1V (horizontal:vertical) and a downstream slope of 2.5H:1V. In cross-section, the dam consists of three zones: an upstream silty till zone, a central sandy till filter zone and a sand/gravel downstream zone.

10.3.3 Foundation Conditions at the North Dam

The thin cover of organic soils present at the site of the North Dam was removed during initial construction. Foundation conditions, therefore, consist of about 1 to 4 m of till, which grades from a gravelly, silty sand to a sandy, gravelly silt overlying shale bedrock (Figure 10-4).

10.3.4 North Dam Performance

The North Dam was constructed during October and November 1990. Sand boils were observed emanating from the area immediately downstream of the dam in 1991, as water was stored behind the dam in preparation for plant startup. However, tailings were subsequently deposited against the North Dam and the sand boil activity gradually diminished, with no recent evidence of any fines in the seepage.



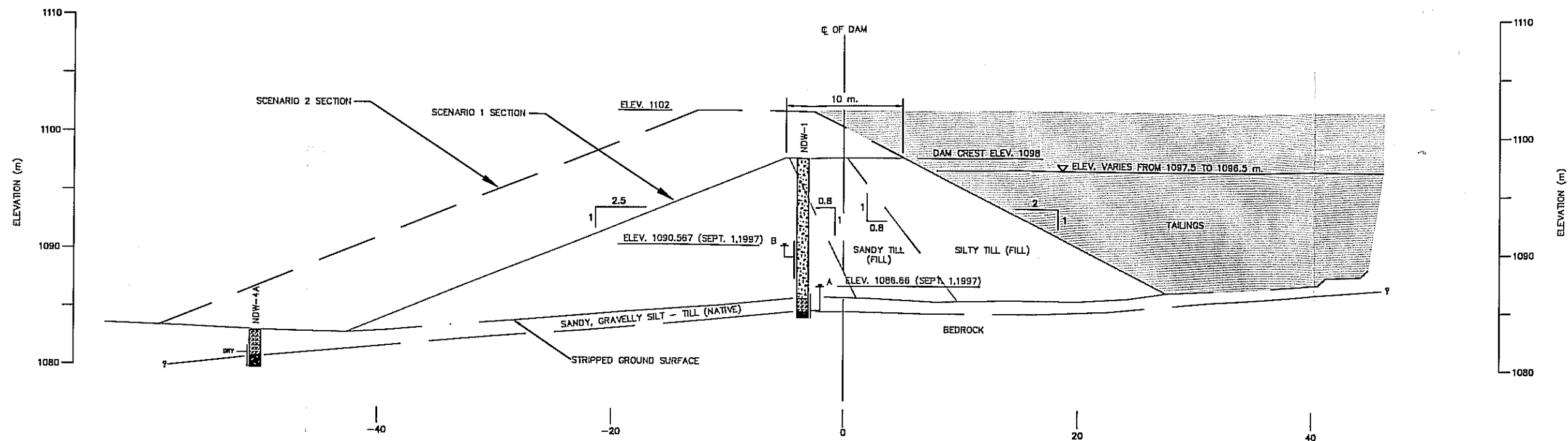
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Sd DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

NORTH DAM
PLAN VIEW OF EXISTING STRUCTURE

DRAWN BY:	MH	CHECKED BY:	CCS	FIGURE NO.	REV.
DATE:	AUG. 6, 1999	PROJ. NO.	1CC005.05	10-3	



NDW-1B			
DATE	T.O.P.	READING	ELEV.
SEPT. 1, 1997	1098.572	8.005	1090.567

KEY

- SANDY TILL (FILL)
- SILTY TILL (FILL)
- SAND & GRAVEL (FILL)
- SILTY SAND (TILL)
- GRAVELLY SILTY SAND (TILL)
- SAND & GRAVEL (NATIVE)
- BEDROCK
- PIEZOMETRIC HEAD FOR FILTER ZONE INDICATED

0 4 8 12 16 20 Metres



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Sä DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

NORTH DAM - SECTION 0+400

DRAWN BY:	MH	CHECKED BY:	CCS	FIGURE NO.	REV.
DATE:	AUG. 6, 1999	PROJ. NO.	1CC005.05	10-4	

Since shutdown, seepage has been observed along the toe of the dam (see Appendix B, Section 3.2). However, most of this seepage originates from groundwater discharge from the hillsides on either side of the valley.

Aside from relatively minor concerns with previous foundation seepage and sand boil activity, the North Dam has experienced no physical stability problems.

10.3.5 North Dam Stability Analysis

As part of the original dam design studies completed in 1990 for the Initial Environmental Evaluation (SRK, 1990), stability analyses were completed using a limit equilibrium slope stability program, PC-SLOPE. The original analyses were done for the South Dam only because it was higher than the North Dam and had a thicker sequence of foundation soils than the North Dam. Therefore, the safety factors computed for the South Dam were expected to be equal to or lower than for the North Dam. The 1990 results were as follows:

Table 10-1 Factor of Safety Results from Original 1990 Design Analyses

Conditions at the South Dam*	Computed Factor of Safety	
	Static Loading	Pseudo-static Loading ($a_{\max} = 0.069g$)
Starter dam, end-of-construction	1.4	
Final dam, long term	1.7	1.4

*Factor of safety at the North Dam will be greater than or equal to that of the South Dam.

The pseudo-static method was used to evaluate dam stability during an earthquake. This method is considered appropriate where neither liquefaction nor major pore pressure buildup is anticipated, which is the case for the dams at Să Dena Hes. The horizontal acceleration used in the pseudo-static analyses was 0.069g. This value was based on the peak horizontal acceleration for the 1:475 year seismic event, 0.055g, multiplied by an amplification factor, 1.25, that accounts for possible amplification of the seismic wave through the foundation soils. A value of 1.25 is conservative for the conditions at the tailings impoundment.

The current factor of safety for the North Dam has been determined using the computer program, SLOPE/W, recent piezometric data and the 1:1000-year seismic event. The results are summarized below and in Figure 10-5.

Table 10-2 Current Factors of Safety, Scenario 1, North Dam

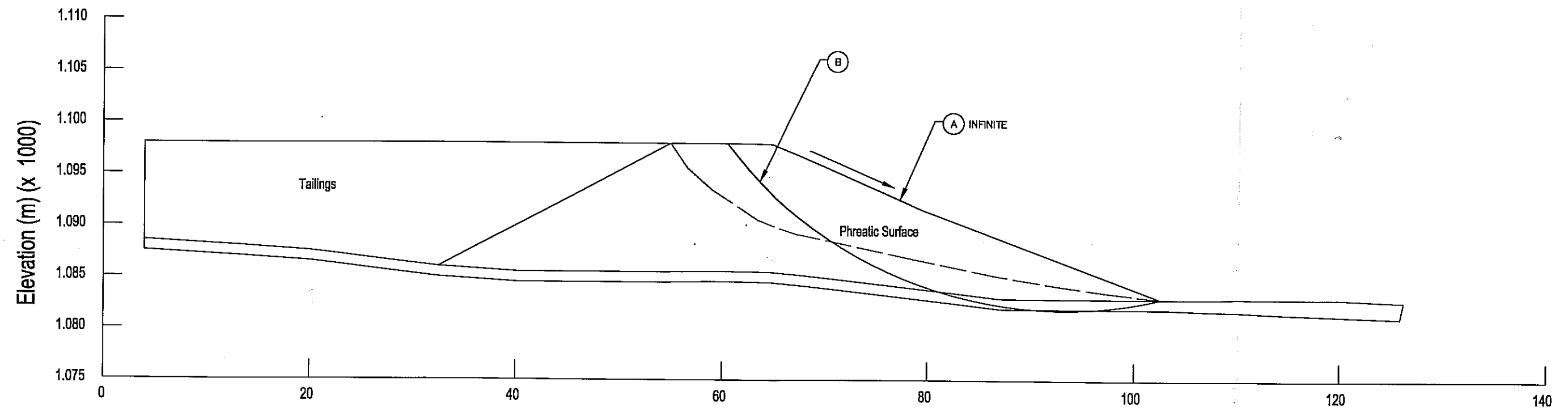
Failure Surface	Description	Factors of Safety (1:1000yr seismic event)	
		Static	Pseudo-Static ($a_{\max}=0.089g$)
1	Slope Face	1.63	1.28
2	Deep	1.83	1.43

In the long term, the phreatic level in the tailings that abut the North Dam will be at or below the cofferdam that separates the drainage catchments for the North and South Dams (i.e. elevation 1098, or less). Piezometric conditions are not likely to be as severe as they have been previously and may well be similar to what they are presently. The safety factors shown in Table 10-2 and Figure 10-5 are, therefore, conservative representations of the long-term conditions at the North Dam.

The peak acceleration used in the analysis was 0.089 g, which corresponds to the 1:1000 year seismic event 0.071g, times as amplification factor of 1.25 to account for the foundation sediments. As failure of the tailings dams does not pose a significant risk to public health and safety after closure, the minimum return period of 1000 years as specified in the water license was adopted in calculating the factors of safety. This is based on the following factors:

- The levels of contaminants are low.
- There is no potential for acid generation.
- The surface area of the impoundment is less than 50 ha.
- After closure there is very low risk to public safety.

This is consistent with the guidelines recommended in the publication “Mine Reclamation in the Northwest Territories and the Yukon”, Indian and Northern Affairs Canada (INAC, 1992).



Material Properties Assumed in Stability Analysis				
Layer	Description	Unit Weight (kN/m ³)	Effective Angle of Friction (?)	Effective Cohesion C' (kPa)
A	Tailings	18.0	25	0
B	Sand & Gravel	20.6	33	0
C	Sandy, Gravelly Silt - Till	20.6	35	0
D	Bedrock	19.5	45	0

Failure Surface	Description	Factors of Safety	
		Static	Pseudo-Static (a _{max} =0.089g)
1	Slope Face	1.63	1.28
2	Deep	1.83	1.43



Sä DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

NORTH DAM
STABILITY ANALYSIS

DRAWN BY: MH	CHECKED BY: CCS	FIGURE NO. 10-5	REV.
DATE: AUG. 9, 1999	PROJ. NO. 1CC005.05		

10.4 CLOSURE SCENARIO 2

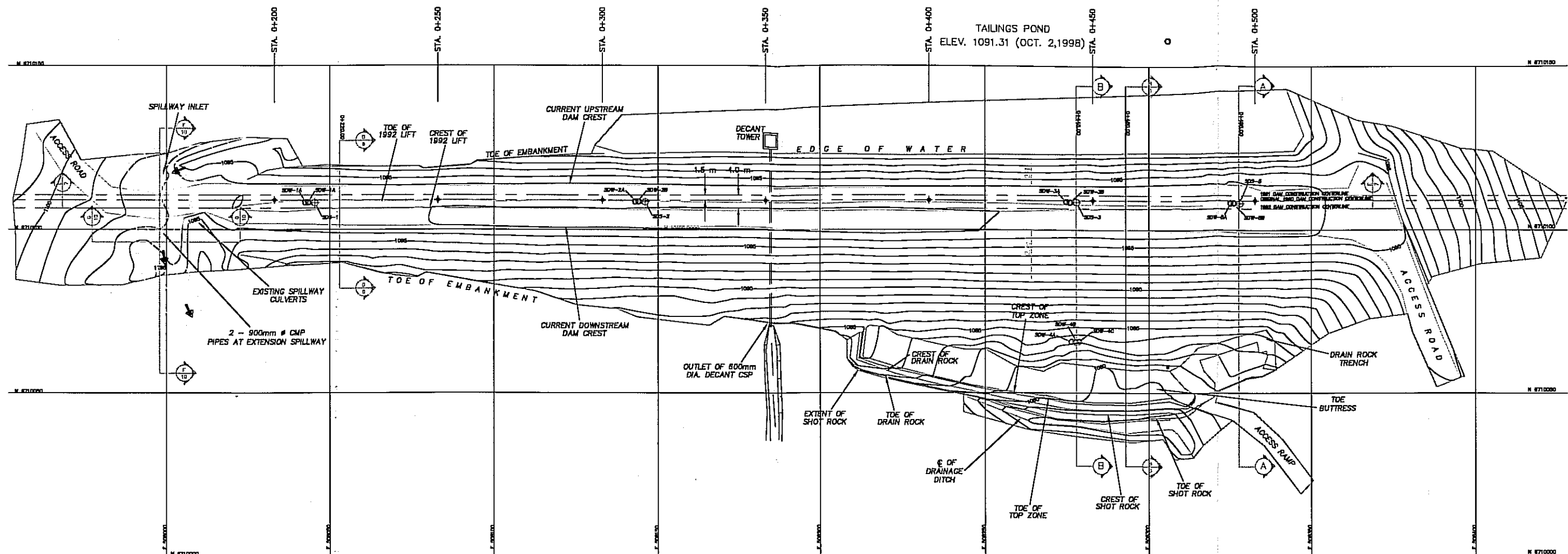
10.4.1 General

Scenario 2 calls for a 4-m raise to the North Dam (Ultimate crest EL.1102 and a 4-m raise to the South Dam (Ultimate crest EL.1100). The tailings will be deposited such that at closure, the pond will be near the west abutment of the South Dam. The invert of the permanent spillway at closure will be established at an elevation that prevents erosion of the tailings, but minimizes the depth of water which ponds on the surface of the impoundments (Figure 10-2).

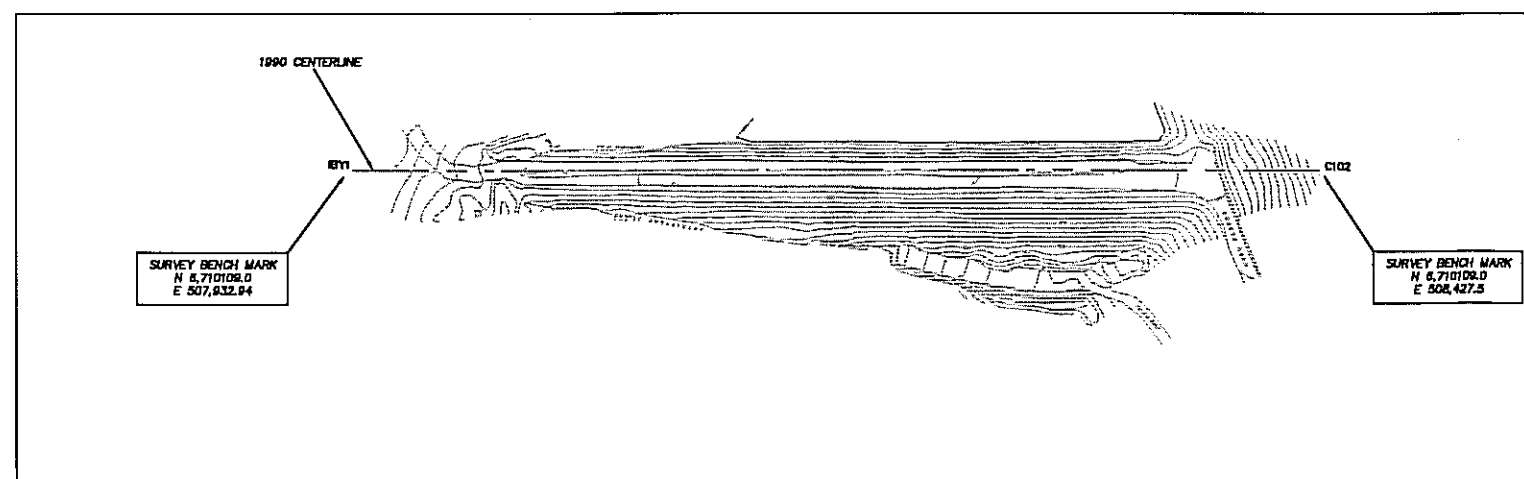
With Scenario 2, the stability of both the North and South Dams must be considered. However, with a 4-m raise of the North Dam, the critical failure surface would be along the downstream slope and therefore, the safety factors at closure are expected to be similar to the values in Table 10-2. Comparatively more severe conditions will coincide with the South Dam as a result of its greater height, thicker foundation sediments and the relatively close proximity of the small residual pond. For these reasons, the stability analyses associated with Scenario 2 address only the South Dam.

10.4.2 South Dam Configuration

The South Dam has a current crest elevation of 1096 to 1097 m, which corresponds to a dam height between 17 and 18 m (Figures 10-6 and 10-7). Further operation would require the dam be raised to elevation 1100 m or a height of 21 m. Its configuration is similar to the North Dam, with a 2H:1V upstream slope, and a 2.5H:1V downstream slope. However, unlike the North Dam, a small stabilizing rock buttress is present at the toe of the South Dam. Two zones grading from upstream silty till through a downstream sandy till make up the dam section, along with a sandy gravel blanket drain. The buttress is comprised of a 1m thick layer of drainrock capped with 2 metres of sand and gravel.



RECLAIM POND
ELEV. 1078.031 (OCT. 2,1998)
MAX. ELEV. 1079.5



LEGEND

- SDW-1A PIEZOMETERS
- ⊕ SDS-1 SETTLEMENT GAUGES

NOTES : 1. SURVEY DATA PROVIDED BY YUKON ENGINEERING SERVICES LTD., OCT. 1997
2. DIMENSIONS IN METRES
3. GRID IS UTM

0 62.5 125 187.5 250 312.5metres
SCALE 1:1250



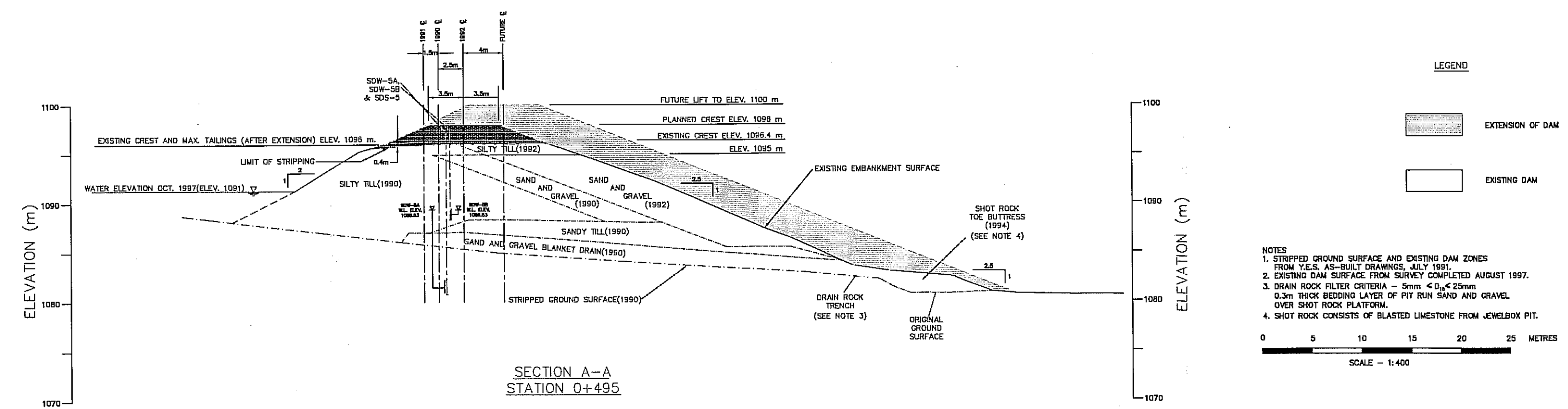
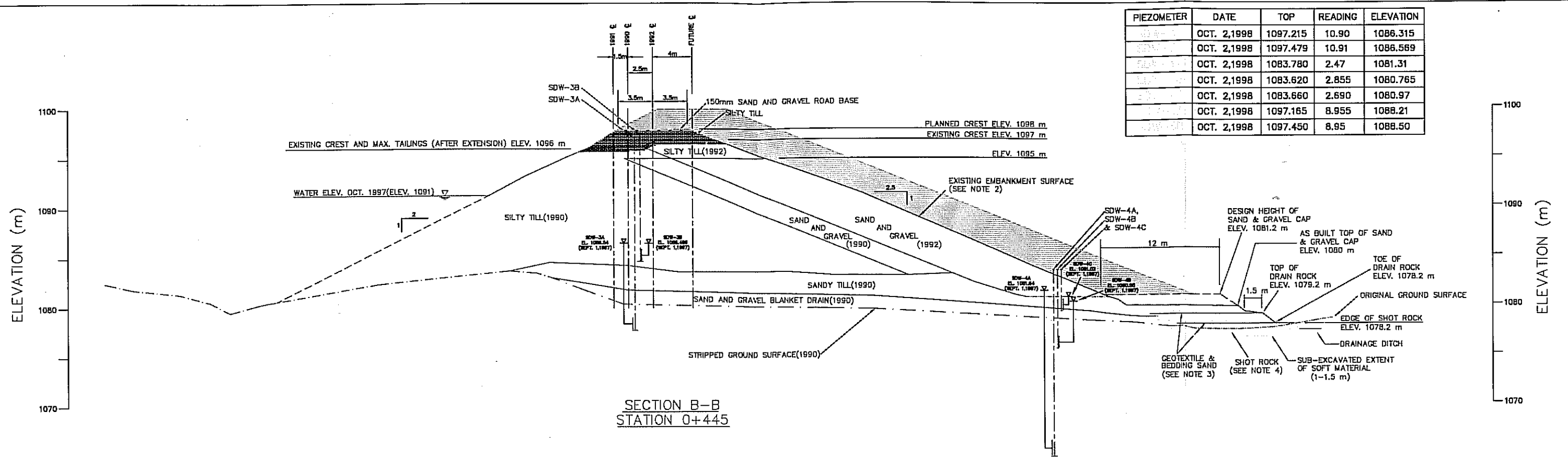
ACCESS MINING CONSULTANTS LTD.

SRK Consulting
Engineers and Scientists

Sä DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

SOUTH DAM
PLAN VIEW OF EXISTING STRUCTURE

DRAWN BY:	MH	CHECKED BY:	CCS	FIGURE NO.	REV.
DATE:	AUG. 6,1999	PROJ. NO.	1CC005.05	10-6	



S& DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

SECTION 0+445 &
0+495 SOUTH DAM

DRAWN BY:	MH	CHECKED BY:	CCS	FIGURE NO.	REV.
DATE:	AUG. 6, 1999	PROJ. NO.	1CC005.05	10-7	

10.4.3 Foundation Conditions at the South Dam

Following removal of the organic soils during dam construction, the foundation conditions at the site of the South Dam typically consist of gravelly, silty sand (till) overlying gravelly sand overlying till overlying bedrock. The total thickness of these deposits is often 4 to 8 m and the interlayer of gravelly sand is usually 1 to 2 m thick. In some areas, especially on the east side of the valley, the gravelly sand is either very thin or absent.

10.4.4 South Dam Performance

The major part of the South Dam was constructed over two construction seasons, in 1990 and 1991. Additional works consisting primarily of an additional lift to the dam crest and a toe buttress were constructed in 1997.

Seepage and sand boils were observed in the area downstream of the dam as water ponded behind the structure during the early stages of operation. In addition, seepage was observed near the east abutment and near the toe in the central portion of the dam.

Over the last five years, piezometric levels have been recorded in the South Dam at piezometers located both along the centreline of the dam and at the toe (Figure 10-6). The records indicate that although the levels in the dam fill are controlled reasonably well by the drainage blanket, elevated levels have been recorded in the piezometers at the toe of the dam (SDW-4A, 4B and 4C) and have demonstrated a sensitivity to water levels in the pond. The well tip of SDW-4A is located within deep gravel zones, which are believed to be hydraulically connected to the water stored in the pond upstream. Although piezometers SDW-4C and 4B are not as sensitive to the pond level as 4A, the levels indicated pore pressures in the drainage blanket and in the underlying shallow gravel zones.

In order to provide a greater safety factor against a rotational failure, Cominco constructed the existing toe buttress along the toe of the South Dam in the fall of 1997 and in the summer of 1998. Details of this work are presented in "Construction Report South Dam (SRK, 1992) and Toe Buttress (SRK, 1997)".

10.4.5 North and South Dam Stability Analysis

The original stability results associated with the dam design studies are included in Section 10.3.5.

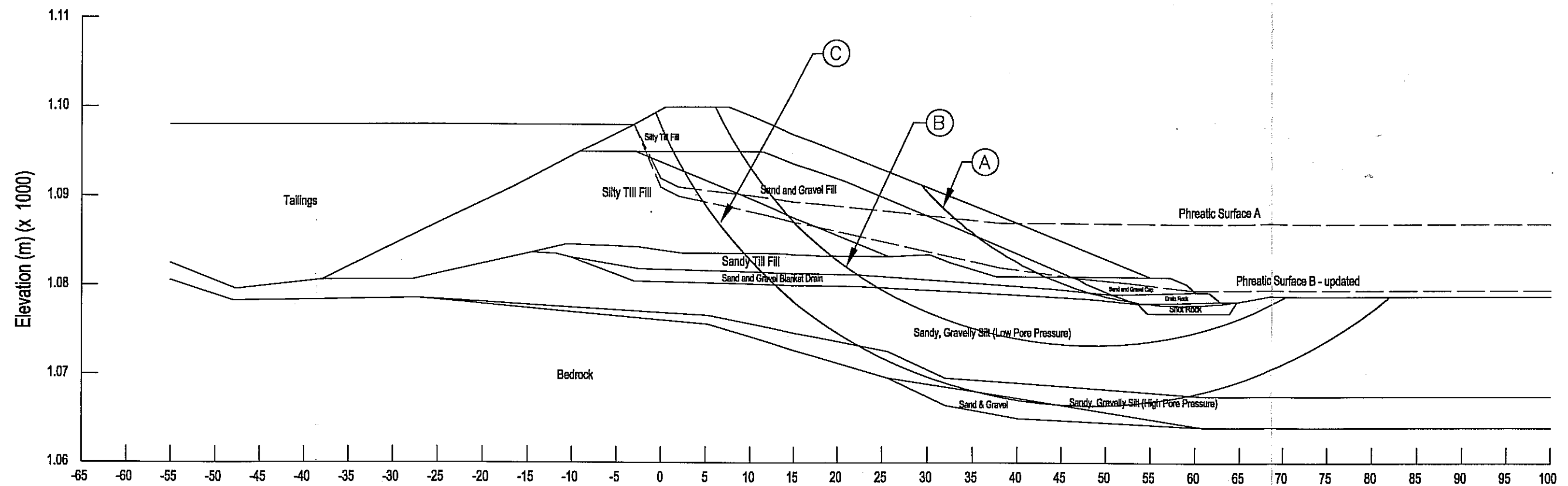
To the extent that the North Dam is raised 4 m, the impact on North Dam stability will be inconsequential as a result of the shallow bedrock foundation. The minimum factor of safety will coincide with that of a sliding failure at the slope face, and will be numerically the same as it was under Scenario 1.

In consideration of the 2-m raise of the South Dam associated with Scenario 2, the long-term stability has been analyzed using the computer program SLOPE/W. The results of these analyses are provided in Figure 10-8 and the following Table 10-3.

Table 10-3 FOS Results, Scenario 2, South Dam

Failure Surface	Description	Factors of Safety (1 in 1000 yr seismic event)	
		Static	Psuedo-Static ($a_{max}=0.089g$)
1	Shallow	1.59	1.24
2	Intermediate	1.71	1.36
3	Deep	1.83	1.39

The 1:1000 year event was used as the basis for the earthquake evaluation for the same reasons it was used at the North Dam (Section 10.3.5). Essentially, the potential impact to the environment and public health and safety are low.



Material Properties Assumed in Stability Analysis					
Layer	Description	Unit Weight (kN/m ³)	Effective Angle of Friction (?)	Effective Cohesion C' (kPa)	Phreatic Surface
A	Tailings	18.0	25	0	B
B	Silty Till	20.6	33	0	B
C	Sand & Gravel	20.6	33	0	B
D	Sandy Till	19.5	33	0	B
E	Sand & Gravel Blanket Drain	19.5	33	0	B
F	Sandy, Gravelly Silt (Low Pore Pressure)	22.0	35	0	B
G	Sandy, Gravelly Silt (High Pore Pressure)	22.0	35	0	A
H	Sand & Gravel	21.6	35	0	A
I	Bedrock	29.4	45	0	A
J	Sand & Gravel Cap	19.5	33	0	B
K	Drain Rock	19.5	35	0	B
L	Shot Rock	20.5	35	0	B

Failure Surface	Description	Factors of Safety	
		Static	Pseudo-Static (a _{max} =0.089g)
1	Shallow	1.59	1.24
2	Intermediate	1.71	1.36
3	Deep	1.83	1.39



S& DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

SOUTH DAM
STABILITY ANALYSIS

DRAWN BY:	MH	CHECKED BY:	CCS	FIGURE NO.	REV.
DATE:	AUG. 9, 1999	PROJ. NO.	1CC005.05	10-8	

10.5 CONCLUSIONS AND RECOMMENDATIONS

10.5.1 Scenario 1

Under Scenario 1, the South Dam would be breached and only the North Dam would be left standing. The North Dam is classed as having a low environmental impact for purposes of closure design and there are no public safety concerns.

The historic performance of the North Dam and recent stability analyses indicate that its critical factor of safety corresponds to a sliding failure along its downstream slope. The long-term factors of safety against such a failure are 1.63 under static loading conditions and 1.28 under pseudo-static conditions corresponding to the 1:1000 year seismic event. These results exceed the minimum safety factors associated with conventional closure criteria. As a result, no additional activities are required for purposes of the North Dam slope stability.

10.5.2 Scenario 2

Under Scenario 2, the North and South Dams will be raised 4 metres. The potential impact of failure of these dams on the environmental and on public health and safety is low.

Even though the North dam would be raised, the critical factor of safety will correspond to a sliding failure along its downstream slope. As such, the minimum factor of safety at the North Dam is the same as for Scenario 1. The results exceed the minimum safety factors associated with conventional closure criteria and, therefore, no additional activities are required for purposes of the North Dam slope stability.

At the South Dam, the historic performance of the dam and recent stability analyses indicate that the critical factor of safety corresponds to a shallow circular failure near its downstream toe. The long-term factors of safety against such a failure are 1.59 under static loading conditions and 1.24 under pseudo-static conditions corresponding to the 1:1000 year event. These results exceed the minimum safety factors associated with conventional closure criteria. As a result, no additional activities are required at closure for purposes of the South Dam slope stability.

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COMINCO LTD.

SÄ DENA HES MINE

DETAILED DECOMMISSIONING & RECLAMATION PLAN

APPENDIX C – WATER QUALITY MONITORING DATA

FEBRUARY 2000

***THIS APPENDIX HAS BEEN UPDATED
PLEASE SEE APPENDIX "D" FOR DETAILS***

Prepared by:





SÄ DENA HES MINE
DETAILED DECOMMISSIONING & RECLAMATION PLAN

Appendix D
JANUARY 2006 UPDATE

Prepared by:



1.0 INTRODUCTION

This document contains updates to the Detailed Decommissioning and Reclamation Plan (“DDRP”, or the “Plan”) for the Sä Dena Hes Mine, Yukon that was originally submitted in February of 2000. These updates are summarized by section in Table A-1.

This Appendix comments on any changes (or lack of changes) to the DDRP in the same order and using the same section numbering system as the DDRP. In this way, any updates to the DDRP are clearly identified for clarity to the reader.

The Sä Dena Hes Mine is owned by a joint venture between Teck Cominco Limited (50% ownership) and Pan Pacific Metal Mining Corp (50% ownership, a wholly owned subsidiary of Korea Zinc.) The Joint Venture purchased the Sä Dena Hes lead/zinc property in March 1994. Teck Cominco is the operator under the joint venture agreement.

Teck Cominco is a primarily Canadian owned, Vancouver-based company that was formed by a merger between Cominco Limited and Teck Corporation that occurred in July 2001. Historical references to Cominco in this report remain accurate, but subsequent to July 2001 any of the tasks, activities and commitments made in the original DDRP or this update are made on behalf of the Sa Dena Hes Operating Corporation by Teck Cominco (the site operator under the terms of the joint venture agreement.)

The Sä Dena Hes Operating Corporation has a Type A Water Use License (QZ99-045, formerly QZ97-025) issued pursuant to the Yukon Waters Act and Regulations for the mine and milling operations. Teck Cominco continues to ensure that all water license obligations are fulfilled on behalf of the Sä Dena Hes Operating Corporation.

Cominco's DDRP for the Sä Dena Hes Mine was submitted in February 2000 towards fulfillment of the requirements of Section 67 of Water License QZ97-025. This update to the February 2000 DDRP is submitted as a requirement of Section 86 of Water License QZ99-045.

Table A-1. Section-Specific Summary Table for Closure Plan Updates

Section Number	Section Heading	Update Comments
1.0	Introduction	This section has been updated to reflect new corporate structure and addresses the requirements for updating the February 2000 DDRP.
1.1	<i>Closure Philosophy</i>	No changes
1.2	<i>Scope of Plan</i>	Updates to this section have been formed based on requirements from the renewal of Water Use License QZ99-045. Table 1-1 has been updated.
1.3	<i>Corporate Background</i>	This section has been updated with new corporate information for Teck Cominco
1.4	<i>Property Location</i>	No changes
1.5	<i>Statutory and Regulatory Responsibilities</i>	This section has been updated to include new licenses and license renewals, and any changes to the regulatory agencies responsible for these. Table 1-2 has been updated to reflect changes to potential approvals/licenses that the site might require under different scenarios.
1.6	<i>Document Organization</i>	This section has been updated to reflect the new structure of this update document
2.0	Mining Activities	
2.1	<i>Mine History</i>	No changes
2.2	<i>Current Status</i>	No changes
2.3	<i>Reopening Plans & Projections</i>	This section has been updated to comment upon Tck Cominco's current projections for re-opening.
2.4	<i>Permanent and Temporary Closure Status</i>	This section has been updated to include brief comments on site temporary closure, with reference to TeckCominco's Temporary Closure Site Status Report as of January 2005.
2.5	<i>Decommissioning and Reclamation Plan Review</i>	This section has been updated to comment upon changes to the timing of required closure plan updates from the renewed Water Use License QZ99-045.
3.0	Detailed Decommissioning & Reclamation Plan	
3.1	<i>Overview</i>	No changes
3.2	<i>Mine Workings</i>	Figure 33 has been updated to reflect changes to decommissioning plans of the mine workings since 2000.
		Reclamation plans and activities regarding the Main Zone 1380 Portal and the Burnick Zone Waste Dump have been updated.
3.3	<i>Tailings Management Facility</i>	Specifics regarding Closure Measures for the Tailings Mangement Facility, namely the South Dam Spillway, have been updated in response to the upgrade of the design flood from 200-yr to 1000-yr in the 2003 Dam Safety Review. Figures 3-6, 3-7, 3-8 and 3-9 have been updated.
3.4	<i>Infrastructure: Buildings, Structures and Services</i>	This section has been updated to include new plans for the construction of a landfill that meets the requirements in Schedule A of the Production License regarding Solid Waste Management.
3.5	<i>Industrial Reagents and Wastes</i>	
3.5.1	<i>Mill Reagents</i>	This section and Table 3-3 have been updated to reflect the latest review of reagents / chemicals on site.
3.5.5	<i>Site Landfill</i>	This section has been updated to include discussion on the proposed construction of a new Site Landfill.
3.6	<i>Land Reclamation and Revegetation</i>	This section has been revised to summarize findings and recommendations from the ongoing Revegetation Test Trials.
4.0	Implementation Schedule	No Changes
5.0	Post Closure Site Management	No Changes
5.1	<i>Organization, Site Access & Security</i>	No Changes
5.2	<i>Supervision and Documentation of Work</i>	No Changes
5.3	<i>Mine Records</i>	No Changes
5.4	<i>Compliance Monitoring and Reporting</i>	This section has been updated to reflect new monitoring schedule requirements in the renewed Water Use License QZ99-045.
6.0	Closure Costs	These costs have been reviewed and updated to reflect inflation, changes to local equipment rates, and updated closure activities.
7.0	Financial Security	
7.1	<i>Water Licence Requirements</i>	This section has been updated to reflect revised closure costs and security requirements in Water Use License QZ99-045
7.2	<i>Updated Financial Security</i>	No changes
7.3	<i>Return of Financial Security</i>	This section has been updated to reflect TeckCominco's intent to follow YG's Reclamation Policy Guidelines for Reclamation and Financial Security.
8.0	REFERENCES	Thi section has been updated to include any new references utilized for the purpose of updating this plan.

Section Number	Section Heading	Update Comments
Appendix A	Cominco Corporate Environmental Policy	This Appendix has been updated to include the Corporate Environmental Policy of TeckCominco
Appendix B	Environmental Baseline Update and Technical Basis for Closure Assumptions	
B 1.0	1.0 Geology and Ore Reserves	No Changes
1.1	1.1 Geology	No Changes
1.2	1.2 Physiography	No Changes
B 2.0	2.0 Climate	
2.1	2.1 Climatological Setting	No Changes
2.2	2.2 Climatological Data Sources	This update refers to the establishment of a weather station at the mill site for the validation of regional climatic estimates.
2.3	2.3 Precip Correction for NWT and Yukon	New precipaiton data from 1998 - 2005 have been analyzed and this section has been updated to address this analysis. Essentially, the new data would not substantively change the 1999 assessment. Figure 1 has been added showing precipitation data from Watson Lake Airport.
2.4	2.4 Precipitation Estimate	This section has been updated based on data from the minesite rain gauge, which has not substantively changed the mean annual precipitation estimate made in the 2000 DDRP.
2.5	2.5 Snowpack estimate	No Changes
2.6	2.6 Temperature Estimate	This section has bene updated to mention the temperature data collection from the mill site weather station. This will be used to reassess the temperature estimate, but is not yet complete.
2.7	2.7 Evaporation Estimate	No Changes
B 3.0	3.0 Water Resources	
3.1	3.1 Surface Water Hydrology	
3.1.2	3.1.2 Available Data	This section has been updated to include analysis of data retrieved from the installation of a automated water level recorder in Camp Creek. Figures 2, 3 and 4 have been added showing Camp Creek hydrographs and corresponding minesite rainfall records where available.
3.1.3	3.1.3 Average Flow Estimates	This section has bene updated to mention that the Camp Creek stage/flow data collection will be used to reassess estimates of mean annual runoff for the minesite, but is not yet complete.
3.1.4	3.1.4 Low Flow Estimates	No Changes
3.1.5	3.1.5 Flood Estimates	Flood Estimates for the site have been updated based upon studies initiated as a result of the 2003 Dam Safety Review, to determine if the TMF and Reclaim Dam have the capacity to deal with a 1000-yr flood event during temporary closure. This analysis determined that the current facilities and the proposed permanent closure designs are adequate and do not require upgrading. New Figures 5 through 9 compare and simulate 1000-yr flood dynamics at the current facilities.
3.2	3.2 Tailings Management Facility Seepage Estimates	This section has been updated based on SRK's November 2000 review of seepage estimates. The original estimates were not altered, and further investigation was not recommended.
3.3	3.3 Water Quality	This section has been updated based on a review of recent water quality data from the site. The original water quality loading estimates did not require revision based on the results of this review.
B 4.0	Geochemistry	
4.3	4.3 Results	This section has been updated based on investigations, soil column attenuation tests, pore water sample collection and surface water sample collection aimed at characterizing the geochemistry and impacts to water quality of discharges at the Burnick 1200, Main Zone 1380, and Jewelbox 1250 portals and numerous North Dam seeps. A new section adressing the geochemistry of mine pool water at the Jewelbox underground workings has also been added (section 4.3.3.4.)
4.4	4.4 Water Quality Predictions	This section has been updated based on SRK's Sa Dena Hes Mine Water Quality and Loading Re-Assessment (January 2005).
B 5.0	5.0 Terrestrial Resources	
5.1	5.1 Vegetation	No Changes
5.2	5.2 Wildlife	No Changes
B 6.0	6.0 Aquatic Resources	
6.1	6.1 Fisheries	This section has been updated to include most recent information from monitoring programs
6.2	6.2 Benthic Invertebrates	This section has been updated to include most recent information from monitoring programs
6.3	6.3 Stream Sediments	This section has been updated to include most recent information from monitoring programs
B 7.0	7.0 Land Use and Tenure	No Changes
B 8.0	8.0 Cultural Resources	No Changes
B 9.0	9.0 Air Quality	No Changes
B 10.0	10.0 Stability Analysis	This section has been updated to reflect the recommendations of the 2003 Dam Safety Review and subsequent ongoing studies.
B 11.0	11.0 References	Thi section has been updated to include any new references utilized for the purpose of updating this appendix.
Appendix C	Water Quality Monitoring Data	This section has been updated to include recent data from ongoing water quality monitoring programs

1.1 CLOSURE PHILOSOPHY

No Change to the February 2000 DDRP.

1.2 SCOPE OF PLAN

The scope of the Sä Dena Hes Mine Decommissioning & Reclamation Plan remains the same as outlined in the 2000 Plan document to include requirements in section 66 of Water License QZ97-025, and subsequently the renewal of this license, QZ99-045. Table 1-1 Global Information List from the Plan has been updated to present a listing of reports and other information sources produced since the February 2000 DDRP that was reviewed in the updating of the Plan.

Section 86 of the current Water License also stipulates that an update to the Decommissioning Plan be submitted within four years of the effective date of the Water License. To be addressed in this Update Document are the following:

1. relevant changes in technology;
2. changes to the Canadian Environmental Quality Guidelines (CCME, 1999);
3. any relevant additional information that has been acquired through site monitoring or studies; and
4. a review of the estimated costs of decommissioning.

Table 1-1 Global Information List

Report Title / Topic	Author	Date
Environmental Monitoring at False Canyon Creek 1998	LES & Can-Nic-A-Nick	Dec. 1998
1999 Annual Report	Cominco	Feb. 2000
1999 Annual Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Dec. 1999
2000 Annual Report	Cominco	Feb. 2001
2000 Geotechnical Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Feb. 2001
2000 Geochemical Studies, Sä Dena Hes Mine	SRK	Nov. 2000
Environmental Monitoring at False Canyon Creek 2000	LES & Can-Nic-A-Nick	Dec. 2000
Land Reclamation and Revegetation Plan. Preliminary Test Program Summary Report, Sä Dena Hes,	Access Mining Consultants Ltd.	Nov. 2000
2001 Annual Report	Teck Cominco	Feb. 2002
2001 Geotechnical Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Dec. 2001
Results Summary of Phase II Revegetation Test Program -2001, Sä Dena Hes. ,	Access Consulting Group	Feb. 2002
2002 Annual Report	Teck Cominco	Feb. 2003
2002 Geotechnical Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Mar. 2003
2002 Geochemical Projects Sä Dena Hes,	SRK	Mar. 2003
Environmental Monitoring at False Canyon Creek 2002	LES & Can-Nic-A-Nick	Nov. 2002
Results Summary of Phase II Revegetation Test Program -2002, Sä Dena Hes. ,	Access Consulting Group	Jan. 2003
2003 Annual Report	Teck Cominco	Feb. 2004
2003 Geotechnical Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Dec. 2003
Sä Dena Hes – 2003 Dam Safety Review	Klohn Crippen	Nov. 2003
Results Summary of Phase II Revegetation Test Program - 2003, Sä Dena Hes. ,	Access Consulting Group	Mar. 2004
Operating, Maintenance and Surveillance Manual, Tailings Management Facility – December 2004	SRK Consulting	Dec, 2004

Report Title / Topic	Author	Date
2004 Annual Report	Teck Cominco	Mar. 2005
2004 Geotechnical Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Feb 2005
Environmental Monitoring at False Canyon Creek 2004	LES & Can-Nic-A-Nick	Nov. 2004
Results Summary of Phase II Revegetation Test Program - 2004, Sä Dena Hes. ,	Access Consulting Group	Mar. 2005
Sä Dena Hes Mine Temporary Closure Site Status Report as of January 2005	Teck Cominco	Jan. 2005

1.3 CORPORATE BACKGROUND

Teck Cominco is a diversified mining, smelting and refining group; a world leader in the production of metallurgical coal and zinc; and a major producer of copper and gold. Teck Cominco is Canada's oldest continually operating mining company and an integrated metal producer. Teck Cominco actively explores for mineral deposits throughout the world with exploration offices numerous countries. The company is active in product and process research in order to enhance the value of the company by developing its intellectual capital.

The company owns or is a significant partner in the following active operations including:

- Highland Valley Copper Mine (British Columbia) – copper / molybdenum
- Antamina Mine (Peru) – copper
- Louvicour (Quebec) – copper / zinc
- Red Dog Mine (Alaska) – zinc / lead
- Pend Oreille Mine (Washington) – zinc / lead
- Williams Mine (Ontario) – gold
- David Bell Mine (Ontario) - gold
- Pogo Mine (Alaska) – gold
- Fording Coal Partnership which operates the following coal mines:
 - o Elkview (British Columbia)
 - o Fording River (British Columbia)
 - o Coal Mountain (British Columbia)

- o Greenhills (British Columbia)
 - o Line Creek (British Columbia)
 - o Cardinal River (Alberta)
- Trail Smelter and Refineries – zinc / lead and other associated metals

In recent years the company has received numerous awards and recognition for their reclamation efforts (see <http://www.Teck Cominco.com/sustainability/awards.htm>).

1.4 PROPERTY LOCATION

No Change to the February 2000 DDRP.

1.5 STATUTORY AND REGULATORY RESPONSIBILITIES

1.5.1. Regulatory Agencies

The Sä Dena Hes mine was constructed in 1991 and operated for a 16-month period between August, 1991 and December, 1992 under Water Use Licence IN90-002. The Sä Dena Hes Operating Corporation purchased the property from Curragh Resources Inc. in March 1994 and the Water Use Licence was subsequently assigned in April 1994. Teck Cominco presently manages the property on behalf of the Sä Dena Hes Operating Corporation.

Water Use Licence IN90-002 was amended by the Sä Dena Hes Operating Corporation in August 1997 to address submission of a decommissioning plan for the site. Amended Water Use Licence (QZ97-025) was issued in March 1998 and required the licensee to submit a Detailed Decommissioning and Reclamation Plan (DDRP) for the site. The licence expiry date remained September 15, 2000.

The company submitted a final DDRP in February 2000 after extensive consultation with various interested parties. A Water Use Licence renewal application was also filed (QZ99-045) in February 2000 to renew and extend the existing licence and this application triggered an environmental assessment (EA) pursuant to the *Canadian Environmental Assessment Act*

(CEAA). Two further amendment requests (QZ00-047) and (QZ00-048) were made to the Water Board to request an extension to the licence expiry date to ensure completion of the CEAA review. In addition, the company also submitted an application for a Quartz Mine Production Licence pursuant to the *Yukon Quartz Mining Act* that also required a CEAA review.

An extensive CEAA screening was completed in June 2001 while the property was still under Temporary Closure and included an assessment of the DDRP. The CEAA screening enabled the issuance of both the Water Use Licence (QZ99-045) and Quartz Mine Production Licence (QML-0004) with specific terms and conditions relating to temporary closure and maintenance of the site.

The 2001 CEAA screening remains substantially accurate with respect to the existing property and care and maintenance activities. No new development activities have been undertaken since the screening and all required care and maintenance activities have been completed by the company. Required licence studies and monitoring programs have been completed and submitted to the Water Board and other regulatory authorities. The results of various studies and monitoring programs have been reviewed and an assessment completed regarding the site's effects on the surrounding environment. Teck Cominco submitted their most recent temporary site closure status report to the Water Board in March 2005 as part of the company's Annual Report.

1.5.2. *Approvals and Licenses*

The project proponent currently holds a Type A Water License QZ99-045, formerly QZ97-025 and IN90-002 for quartz mining, which expires on December 15, 2015. Table 1-2 has been updated to reflect changes since 2000 to the approvals and licenses that may be issued for this project and the associated permitting bodies.

Table 1-2 Summary of Permits and Licenses

Purpose	Permit/Application Name, and/or Act, and/or Program	Responsible Authority/Agency	Contact
Permission to use/discharge water	Water License issued under the <i>Yukon Waters Act</i> .	Yukon Territory Water Board YG Water Resources	Judi White, Manager (867) 456-3980 (Fax) 456-3890 Kevin McDonnell, Chief (867) 667-3145 Fax: 667-3195
Permission to use gravel/sand from a quarry	Application for Quarrying Permit & Quarrying Permit	DIAND - Subject to Territorial Quarrying Regulations; Referenced to a Land Use Permit or Licence of Occupation issued by the Land Use Section	Marjorie Fraser, Supervisor of Lands (867) 667-3241 (Fax) 667-7073
Gas Permit	Gas Permit Application	YG Community Services, Building Safety Branch	Del Young, Gas Inspector (867) 667-5845 (Fax) 393-6249
Sewage disposal	(1) Application for a Permit to Install a Private Sewage Disposal System	YG Environmental Health	1-800-661-0408 local 8391
	(2) Notification of Installation and Undertaking to Maintain a Private Sewage Disposal System		
To install plumbing for the camp	Plumbing Permit Application	YG Community Services, Building Safety Branch	(867) 667-5471 (Fax) 393-6249
Approval to use a low energy radioactive source	Radioisotope License	Atomic Energy Control Board	

Purpose	Permit/Application Name, and/or Act, and/or Program	Responsible Authority/Agency	Contact
Approval to burn refuse	Burning Permit issued April to September under the <i>Yukon Forest Protection Act</i>	YG Community Services, Protective Services	Watson Lake Zone Protection Officer (867) 536-7335 (Fax) 536-7331
Permission to undertake land use activities on mineral claims or leases	Approval of a Notification or Operating Plan issued under the Yukon Quartz Mining Land Use Regulations	YG Energy, Mines and Resources - Minerals Management Branch	Joanne Oberg, Mining Lands Manager (867) 456-3882 (Fax) 667-8601
Transportation of Heavy Equipment	Under the <i>Motor Vehicles Act</i> , an Oversize Permit (\$5.00) is required. If transportation is from outside of Yukon, a Temporary Certificate (\$150) is required. Temporary Certificates are limited to six per year. If transportation is within Yukon, a Freight Vehicle Permit (\$60 + \$3/metric tonne on total gross weight) and a Fuel Permit (\$0.04/km) is required. One pilot car is required for widths over 10'6". for widths of 11'4" or more, two pilot cars are required.	Transport Services Branch, Department of Highways and Public Works, Government of Yukon	Weigh Station (867) 667-5729 (Fax) 393-6048
Transport of Dangerous Goods/ Waste	Certificate and/or Permit for Transport of Dangerous Goods issued under the Transportation of <i>Dangerous Goods Act</i>	Transport Services Branch, Department of Highways and Public Works, Government of Yukon	Motor Vehicle Section (867) 667-3032 (Fax) 393-6048
Confirm Closure Compliance	<i>Yukon Quartz Mining Act</i> , Certificate of Closure	YG Energy, Mines and Resources - Minerals Management Branch	Joanne Oberg, Mining Lands Manager (867) 456-3882 (Fax) 667-8601
Permit for Storage and Handling of Petroleum products and other Hazardous Substances	Storage Tank Regulations <i>Environment Act, Yukon</i>	Dept. of Community Services, Protective Services Branch, Fire Marshal's Office	John Holesworth or Folkie Johnson, Fire Marshal (867) 667-5217 (Fax) 393-6249

Purpose	Permit/Application Name, and/or Act, and/or Program	Responsible Authority/Agency	Contact
Solid Waste (garbage) Management	Solid Waste Regulations, <i>Environment Act, Yukon</i>	Yukon Environmental Programs, Government of Yukon	Janine Kostelnik, Standards and Approvals Section (867) 667-5456 (Fax) 393-6205
Installation, operation, closure, abandonment or renovations to above or underground storage tanks	Storage Tank Regulations, <i>Environment Act, Yukon</i>	Dept. of Community Services, Protective Services Branch, Fire Marshal's Office	Jack Holesworth, Fire Marshal (867) 667-5217 (Fax) 393-6249
Mixing and Dilution, Generation, Handling, Collection, Release or Disposal of Special Hazardous Wastes	Special Waste Permit issued under the Special Waste Regulations of the <i>Environment Act, Yukon</i>	Yukon Environmental Programs, Government of Yukon	Janine Kostelnik, Standards and Approvals Section (867) 667-5456 (Fax) 393-6205
Safe Operation of Mines; Public Safety Upon Closure	<i>Occupational Health and Safety Act</i> and Regulations	Mine Safety Branch, Yukon Workers' Compensation Health & Safety Board	Naresh Prasad, Chief, Mining Engineer (867) 667-3777 Fax: 393-6279

1.6 DOCUMENT ORGANIZATION

As previously mentioned in Section 1.0 Introduction, the main sections of the 2000 DDRP remain unchanged, with the supplemental changes in this update document mirroring the original structure. Please see Table A-1 for a summary of the material updates.

2.0 MINING ACTIVITIES

2.1 MINE HISTORY

No Change to the February 2000 DDRP.

2.2 CURRENT STATUS

No Change to the February 2000 DDRP.

2.3 REOPENING PLANS & PROJECTIONS

In the first quarter of 2005, Teck Cominco conducted a review and updating of the economics of the mine as metal prices were starting to strengthen. At the time the review was completed, it was concluded that metal prices were insufficient to re-commence operations. Assuming metal prices rise sufficiently to make the operations economically viable, it will require investments of both capital and management resources. In 1999, Teck Cominco attempted to restart the mine when metal prices spiked but the higher prices were short lived and dropped before the mine could resume operations. Once metal prices are sufficient to consider re-opening, there must be confidence that they will remain strong for the projected 4-year mine life before a decision to re-open will be made.

2.4 TEMPORARY CLOSURE STATUS

The issues surrounding permanent and temporary closure have been addressed recently in Teck Cominco's document *Temporary Site Closure Status Report as of January 2005*, included in the 2004 Annual Water License Report. Essentially, responsible closure conditions and

1.6 DOCUMENT ORGANIZATION

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2.0 MINING ACTIVITIES

2.1 MINE HISTORY

No Change to the February 2000 DDRP.

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No Change to the February 2000 DDRP.

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In 2005, Teck Cominco conducted a review of the economics of the mine as metal prices were starting to strengthen. At the time the review was completed, it was concluded that metal prices were insufficient to re-commence operations. Prior to reopening the mine, investments of both capital funds and management resources will be required. In 1999, Teck Cominco attempted to restart the mine as a result of higher metal prices. A management team was assembled, a mining contractor engaged, and work underground at the mine was initiated to prepare the Jewelbox deposit for production. However the increase in metal prices was short lived and dropped before the mine could resume production. Once metal prices are sufficient to consider re-opening, there must be confidence that the markets will remain strong for the projected 4-year mine life before a decision to re-open will be made.

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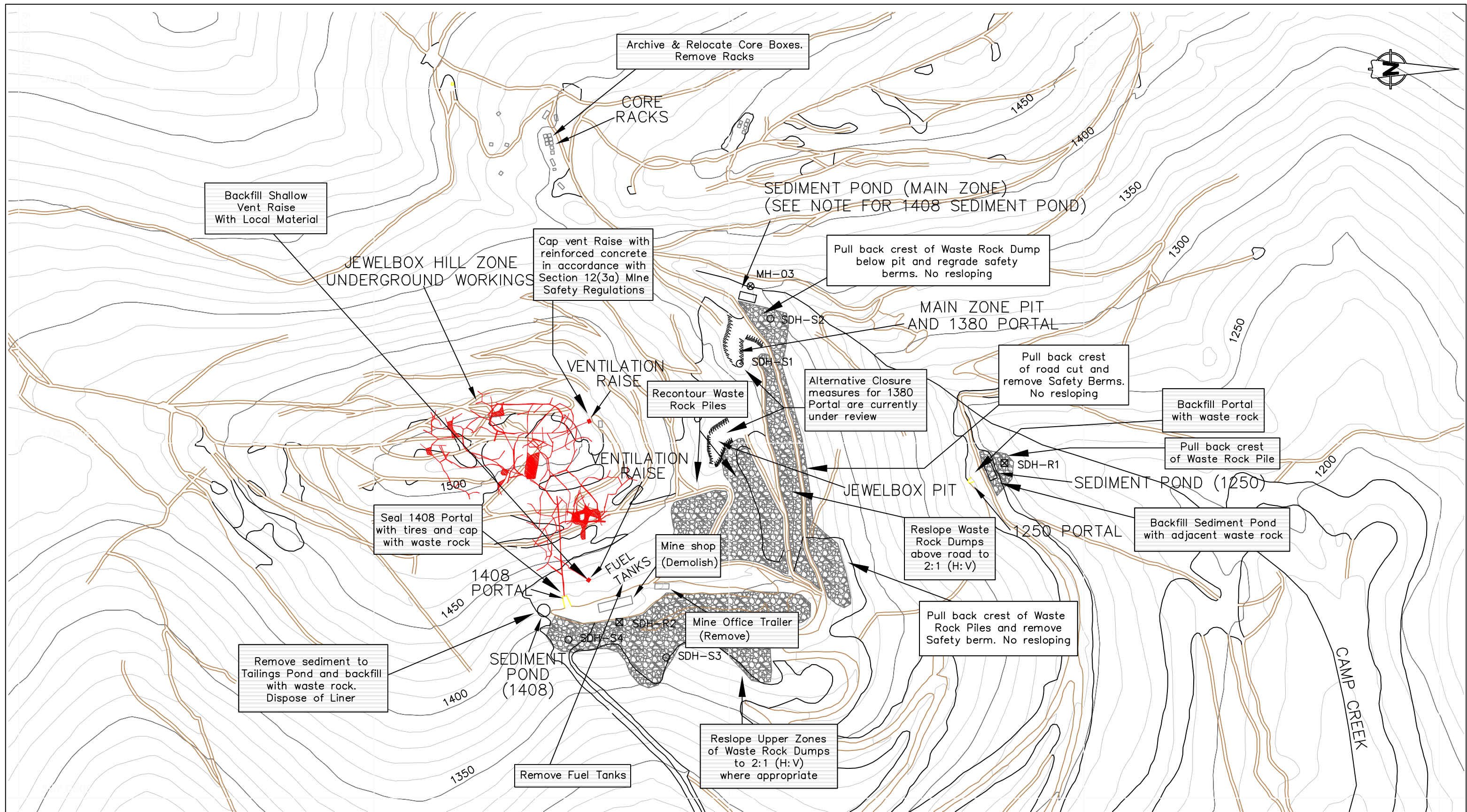
in the 2004 Annual Water License Report. Essentially, responsible closure conditions and strategies have been implemented at the site and have been successful in achieving the objectives of temporary closure set forth in Water Licenses QZ97-025 and QZ99-045. These include activities, studies or monitoring programs in the following areas:

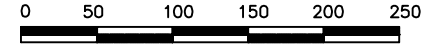
- maintenance of site facilities;
- geotechnical stability;
- geochemistry of surface and ground waters;
- hydrology and climatology; and
- environmental conditions.

These initiatives are discussed in greater depth throughout this update document.

2.5 DECOMMISSIONING AND RECLAMATION PLAN REVIEW

This update represents the first review of the Decommissioning and Reclamation plan at the 5-year mark, as originally proposed in the February 2000 DDRP, and required in Water License QZ99-045. The amended Water License requires that the next update to the DDRP is submitted within two years of the mine resuming operation or by January 26, 2010 if the mine continues in 'Temporary Closure'.



	 	LEGEND  WATER MONITORING STATION  TAILINGS SAMPLE  SURFACE DRAINAGE	 1: 5,000 CONTOUR INTERVAL=10m NOTE: BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983 ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927	SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN			
				JEWELBOX HILL AND MAIN ZONE CLOSURE MEASURES			
				DRAWN BY: MH DATE: Dec. 2005	CHECKED BY: PMH PROJ. NO. 1CC005.05	FIGURE NO. 3-3	REV.

3.2.3.4 *BURNICK ZONE – WASTE DUMP*

This section makes reference to several tension cracks along the crest of the dump and settlement. Since the closure plan was issued in 2000, Teck Cominco re-graded the top of the dump to take the load off the crest. The dump has been monitored over the last 2 to 3 years and no further settlement or slumping has been observed.

3.3 **TAILINGS MANAGEMENT FACILITY**

In the original 2000 closure plan, the discussion indicated that during operations and when the pond water level becomes too high, water is decanted from the Tailings pond to the Reclaim pond through a concrete decant tower located adjacent to the upstream crest of the South Dam. Recently Teck Cominco have replaced the decant system with a siphon arrangement that controls the water level in the tailings pond behind the South Dam. Prior to the onset of winter, the water level in the tailings pond is taken down as far as practical to provide extra storage during the spring runoff.

On page 44 of the DDRP there is reference to the 0.5m discharge pipe through the dam which is connected to the decant tower. As discussed above, there is no discharge of water through this pipe under the current setup. In the 4th paragraph on this page, reference is made to the design capacity of the tailings impoundment emergency spillway. It is currently designed for the 1 in 200 year flood. In the 2003 Dam Safety Review, the consequence category of this dam was revised and as a result the design flood was upgraded to the 1000-year event both under operations, care and maintenance as well as at closure. A detailed discussion on the revised flood hydrology for the site, including the referenced Figures 1 to 9, is provided in the updated Section 3.1.5 of Appendix B – Flood Estimates.

An extract of this discussion is provided as follows:

To examine the effects of storage on flood magnitude it was necessary to use a rainfall/runoff model that simulates the full flood hydrograph and that provides flood routing capabilities. The model selected for this purpose was developed by the U.S. Corps of Engineers and is known as HEC-HMS.

Figure 5 shows the results of applying the HEC-HMS model to the Tailings Management Facility (TMF). The instantaneous peak of the incoming flood hydrograph was estimated to be $5.4 \text{ m}^3/\text{s}$. The combined outflow through the two culverts would peak at $1.6 \text{ m}^3/\text{s}$, or 30% of the incoming flood peak. During passage of the flood, a volume of $53,000 \text{ m}^3$ of water would be temporarily stored within the TMF. The water level in the TMF would peak at an elevation of 1094.9 m , which is roughly at the crown level of the two culverts.

In the 6th paragraph on Page 44, reference is made to the design capacity of the two 1.2 m dia culverts (in Camp Creek at the Reclaim dam). Although there is no requirement to upgrade the design flood from the current 200-year event for these culverts, Teck Cominco reviewed the impact of the 1000-year flood on the culverts. A detailed discussion of the recent hydrological assessment is provided in updated Section 3.1.5 of Appendix B - Flood Estimates. An extract is provided below.

Figure 6 shows the simulated flood hydrology for the two culverts at the road crossing of the Camp Creek Diversion. The instantaneous peak of the hydrograph generated by the Camp Creek catchment would be $12.7 \text{ m}^3/\text{s}$, including outflows from the TMF. The combined outflow through the two culverts at the road crossing would be an estimated $6.0 \text{ m}^3/\text{s}$, or roughly half the peak of the incoming flood. In passing this flood, some $66,000 \text{ m}^3$ of water would be temporarily stored in the Reclaim Pond. Another $36,000 \text{ m}^3$ would be stored in the TMF. The water level would rise to 1081.1 m behind the Reclaim Dam, leaving a freeboard of about 0.9 m below the dam's crest.

3.3.3 CLOSURE ISSUES

In 3rd Paragraph on Page 49, reference is made to passing of the Probable Maximum Flood (PMF) through the current emergency spillway without overtopping the dam. Recent analyses

using the rainfall model and routing the 1000-year storm through two 900 mm culverts indicated that the freeboard below the current 1097 m crest elevation under current conditions would be 2.1m. A review of the PMF under Scenario 2 closure condition for the Tailings Management facility concluded that the peak outflow would be 14.2 m³/s (based on the Rational Method). Given the configuration of the final spillway (see revised Figure 3-9), the PMF would be accommodated without overtopping of the dam.

3.3.4 CLOSURE MEASURES, SCENARIO 1

General closure measures for the Tailings Management Facility are presented in updated Figure 3-6.

3.3.4.6 SOUTH DAM SPILLWAY

As discussed above and in updated Appendix B Section 3.1.5 – Flood Estimates, the 1000-year design flood would have a peak flow of 5.4 m³/s. The configuration of the breach (Scenario 1) has not changed and is shown as Figure 3-7. However it should be noted that the geotextile filter fabric specified beneath riprap has been replaced with native sandy material (as was recommended during the review of the DDRP).

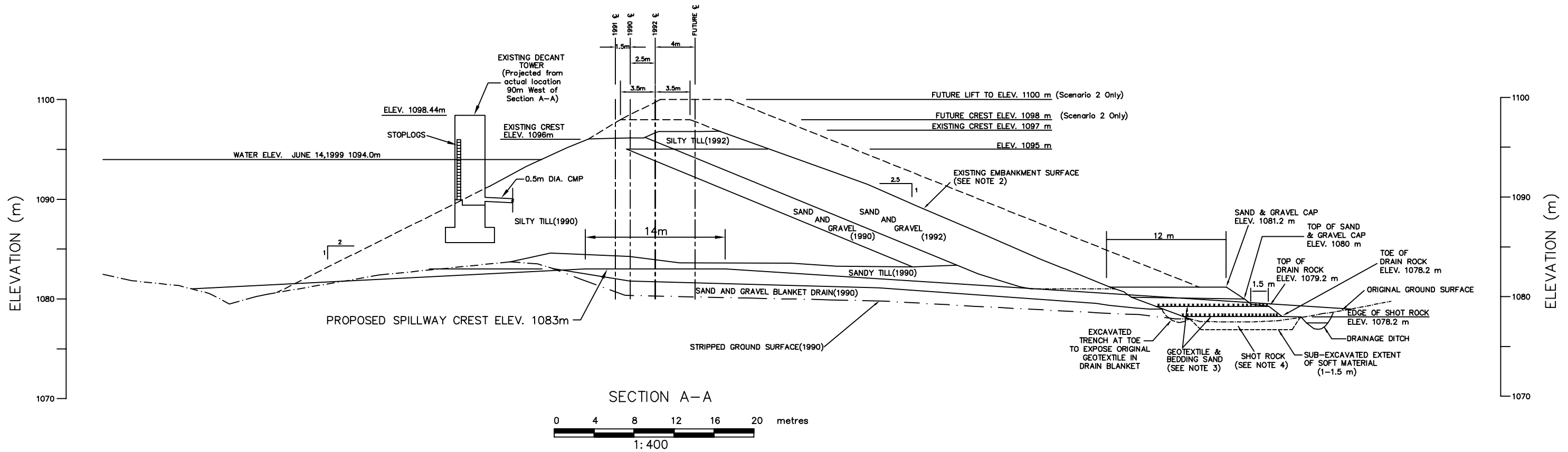
3.3.4.7 RECLAIM POND, SECTION (II) CHANNEL BREACH

As a result of the revised hydrology, the peak flow for the 1000-year design flood has been changed from 14.2 m³/s to 15.6 m³/s.

3.3.5 CLOSURE MEASURES, SCENARIO 2

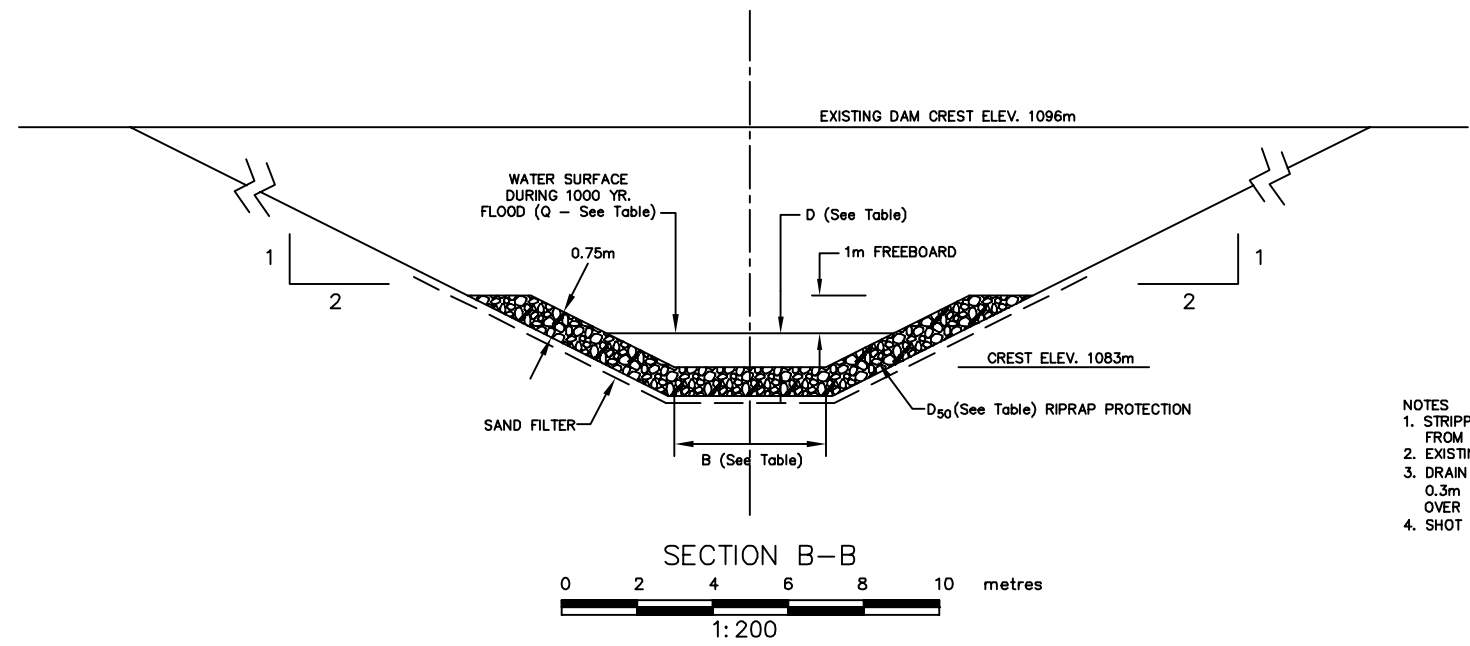
3.3.5.6 SOUTH DAM SPILLWAY

As a result of the revised hydrology, the peak flow for the 1000-year design flood has been changed from 5.6 m³/s to 5.4 m³/s. These changes are reflected on the updated Figures 3-8 and 3-9.



	RECLAIM DAM BREACH CHANNEL	SOUTH DAM SPILLWAY
Q (m ³ /s)	15.6	5.4
B (Crest width)	4m	4m
D (Depth of flow)	0.88m ?	0.75m
D ₅₀ (Riprap)	0.3m	0.3m
Sideslopes	2:1	2:1
Depth of Riprap	0.45m	0.45m
Crest Elevation	N/A	1083m
Channel Slope	0.013	N/A

N/A = Not Applicable



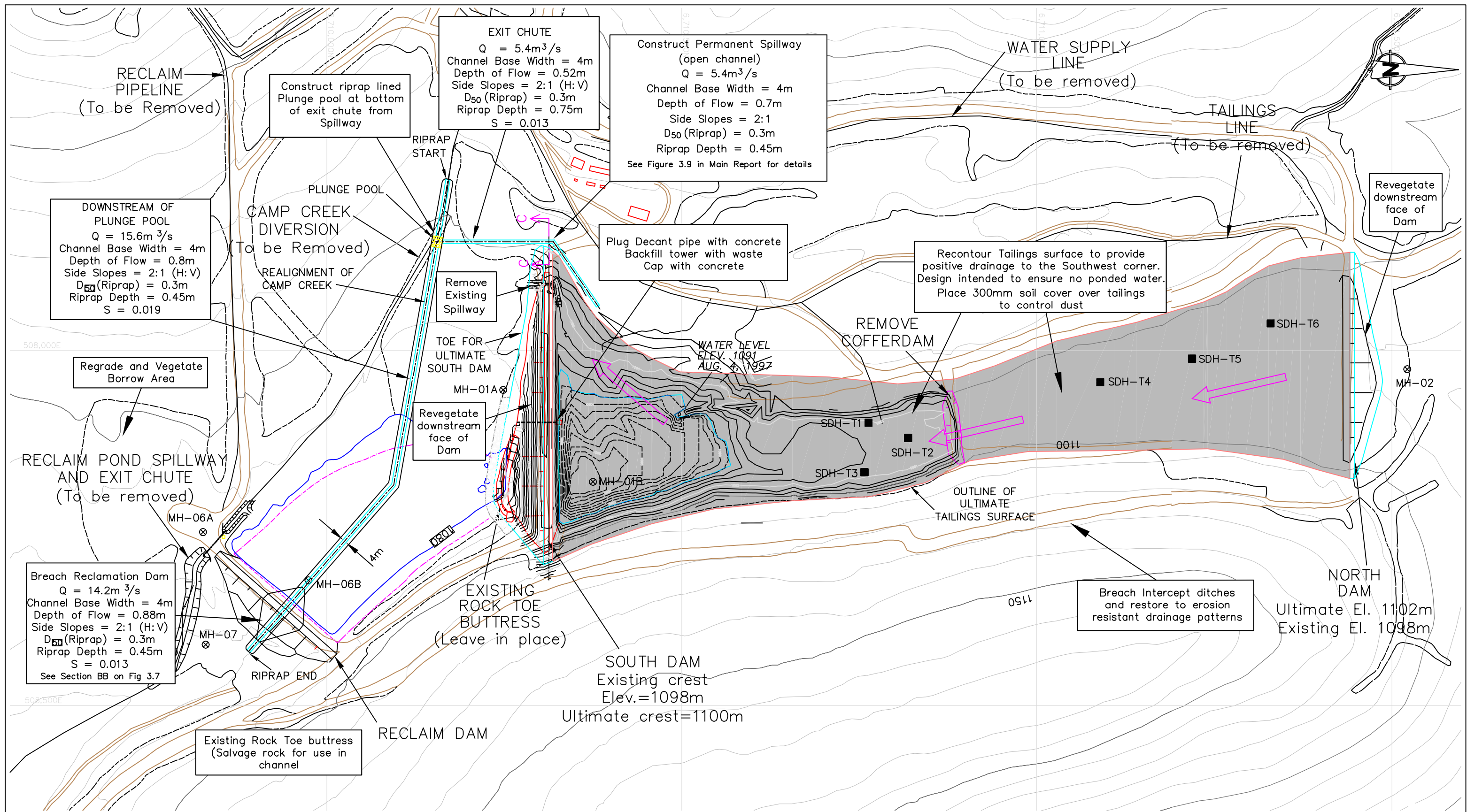
- NOTES**
1. STRIPPED GROUND SURFACE AND EXISTING DAM ZONES FROM Y.E.S. AS-BUILT DRAWINGS, JULY 1991.
 2. EXISTING DAM SURFACE FROM SURVEY COMPLETED AUGUST 1997.
 3. DRAIN ROCK FILTER CRITERIA - $5\text{mm} \leq D_{15} \leq 25\text{mm}$
0.3m THICK BEDDING LAYER OF PIT RUN SAND AND GRAVEL OVER SHOT ROCK PLATFORM.
 4. SHOT ROCK CONSISTS OF BLASTED LIMESTONE FROM JEWELBOX PIT.



SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

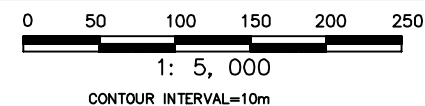
TMF CLOSURE MEASURES – SCENARIO 1
SECTIONS A-A AND B-B

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	REV.
DATE:	Dec. 2005	PROJ. NO.	1CC005.05	3-7	



LEGEND

-  WATER MONITORING STATION
-  TAILINGS SAMPLE
-  SURFACE DRAINAGE

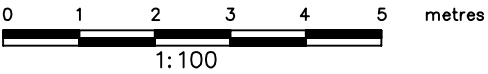
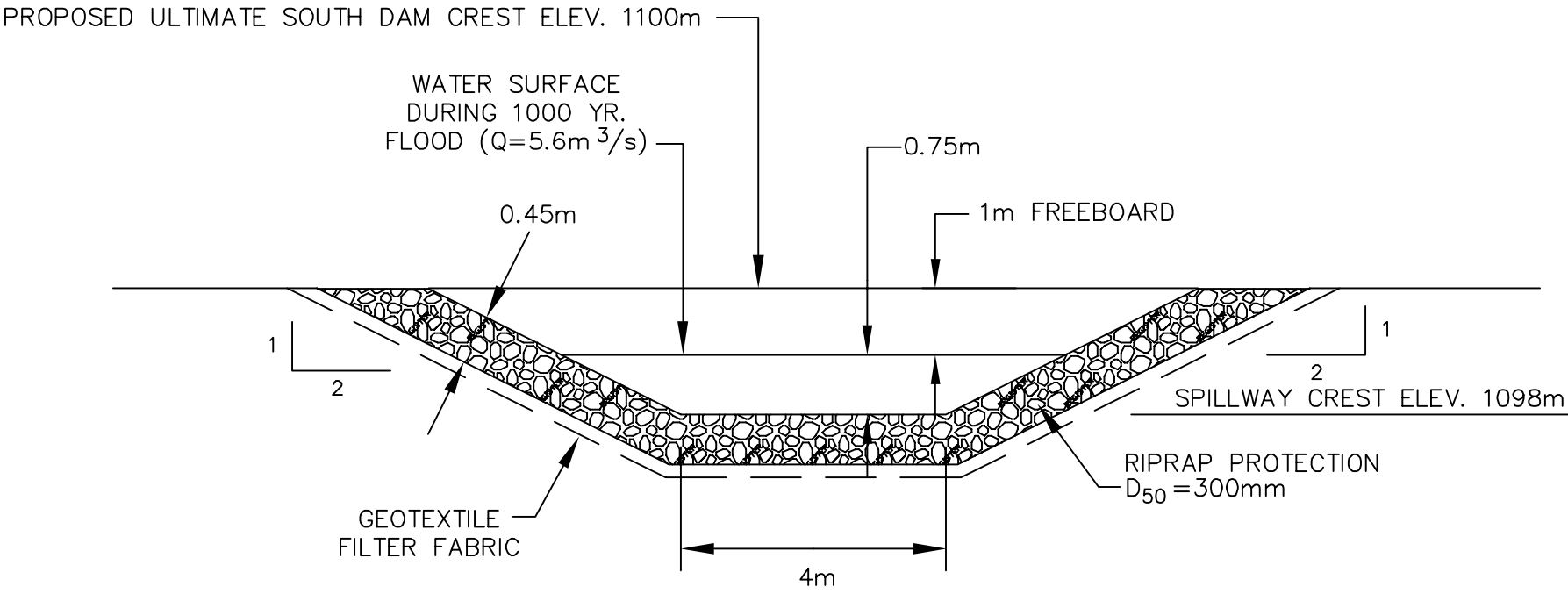


NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

TMF CLOSURE MEASURES SCENARIO 2

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	REV.
DATE:	Dec. 2005	PROJ. NO.	1CC005.05	3-8	



SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

TMF SPILLWAY DETAIL
SECTION C-C – SCENARIO 2

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	REV.
DATE:	Dec. 2005	PROJ. NO.	1CC005.05	3-9	

3.4 INFRASTRUCTURE: BUILDINGS, STRUCTURES AND SERVICES

Teck Cominco will construct an engineered landfill facility for the disposal of non-putrescible waste with no salvage value generated during closure activities. The reader is referred to Section 3.5.2 for a discussion of this facility.

3.5 INDUSTRIAL REAGENTS AND WASTES

3.5.1. *Mill Reagents*

Table 3-3 *Industrial Reagents: Inventory, Storage Location and Closure Methods* has been updated based on the further investigations at the site. Figures 3-13 and 3-14 remain accurate as to the locations of the industrial reagents.

For a more thorough and updated discussion of mill reagents, the reader may review the Sä Dena Hes Mine, Environmental Emergency Response & Procedures Plan. Product utilization forms for each of the reagents including information on historical rates of consumption, tank size, normal warehouse inventory levels and other pertinent information can be found in Appendix A of the aforementioned Environmental Emergency Response & Procedures Plan.

Table 3-3 Industrial Reagents: Inventory, Storage Location, and Closure Measures

Substance	Total Quantity Stored on Site	Storage Location	Closure Measure (refer to note)	Plan View Location #
Lime	50 - 1,000kg bags	Mill basement, lime-mixing area, left from main overhead door.		1
	5 – Containers (8x8x20ft.), 4x100% Full, 1x33% Full	In the Conex containers by the main gate.	1	n/a
Diesel Engine Coolant (Glycol)	5 - 45 IG barrels	Mill basement, right from main overhead door, near entrance.	1	2
		Mill basement, right from main overhead door, near middle of room.		7
Antifreeze / Engine Coolant / Coal De-icer	69 - 45 IG barrels	Mill basement, right from main overhead door, near entrance.	1	2b
		Mill basement, left from main overhead door, at pump boxes.		3
		Mill basement, right from main overhead door, midway along copper sulphate tank.		6
Sodium Cyanide	85 - 100 kg barrels	Mill basement, left from main overhead door, at pump boxes.	1	3
		Mill basement, left from main overhead door midway along grinding aisle.		4
		Mill basement, first reagent encountered in front of main door.		5
		Mill basement, under reagent mixing.		9
Sodium Isopropyl Xanthate (NAX31)	55 - 130 kg barrels	Mill basement, under reagent mixing.	1	8
		Storage shed, opposite main doors at back.		17
Zinc Sulphate	433 - 25 kg barrels	Mill basement, right from main overhead door, near middle of room.	1	10
		Reagent mixing floor, at zinc sulphate mix tank hopper.		14
		Storage shed, back left corner from main doors.		16
Dowfroth 250	4 full and 1 partial 45 IG barrels	Mill basement, under stairway.	1	11
		Reagent mixing floor, by reagent addition pumps.		15
Aerofloat 242	13 - 45 IG barrels	Reagent mixing floor, near reagent mixing pumps.	1	12
		Storage shed, in very back right corner from main doors.		21
Percol 351	13 - 25 kg bags	Reagent mixing floor, opposite stairway access.	1	13
		Storage shed, left front corner from main doors.		22
Copper Sulphate	52 - 45 IG barrels, 100 - 25 kg bags, and 5 - 1 tonne IBC's	Mill basement, tank located on opposite side of basement from main overhead door.	1	Storage Tank
		Mill basement, far right from main overhead door, under dewatering.		16
		Storage shed, left front from main doors.		20
		Storage shed, directly in front of main doors.		23
Methyl Isobutyl Carbinol (MIBC)	37 - 165 kg barrels	Storage shed, back right corner from main doors.	1	18
		Storage shed, back right corner from main doors.		24
Cement	2 - 1tonne pallets	Storage shed, right side from main doors, midway back.	2	19

Note: **1** Use in closure and/or determine economic viability of re-sale and expedite, otherwise ship to other Cominco properties or have removed to appropriate hazardous waste disposal facility (approved under Yukon Environment Act)

2 Sell or donate to a local group.

3.5.5. *Site Landfill*

The 2000 report proposed the use of the existing landfill for the disposal of non-putrescible wastes that have no salvage value, such as lumber and scrap steel. Schedule A – Solid Waste Management of Sä Dena Hes Operating Corporation's Production License QML-0004 requires such a facility to be an "approved engineered landfill area." As such, Teck Cominco is proposing to construct an approved landfill on site to provide for disposal of materials in accordance with the Production License requirements and YG Solid Waste Regulations.

Specifically, the engineered landfill facility will:

- be approved by an inspector prior to any waste disposal;
- be compacted and covered with rock or overburden on a regular basis;
- be maintained to minimize attraction of wildlife and water infiltration; and
- be compacted and capped with a minimum of one meter of low-permeability overburden or soils (and domed and re-vegetated) to retard the infiltration of water on the completion of landfill activities.

3.6 LAND RECLAMATION & REVEGETATION

The 2000 DDRP proposed a land reclamation and revegetation plan and test program with the overall goal of preparing the site for closure so that revegetation efforts would assist in returning the site to a state that existed prior to mining activities. This included proposed seed mixtures and application rates.

The primary objectives of the ongoing test program are to:

- Determine the seed mixtures that will provide short-term soil stability while allowing the natural invasion of local plant species;
- Determine fertilizer applications optimal for sustaining the healthy growth of seeded species without inhibiting colonization by indigenous plant species;

- Investigate methods of encouraging natural plant succession on reclaimed surfaces; and
- Determine potential success rates of revegetation at test plots on different areas of the mine site, in particular the tailings management facility.

Based on the findings from the test plot surveys (2002 to 2005), following are the updated preliminary revegetation grass seed mix recommendations. These recommendations are based on growing success to date, not on metal uptake data, which is still inconclusive.

3.6.1.2 Main Access Road

Violet Wheatgrass	<i>(Agropyron violaceum)</i>
Alpine Bluegrass	<i>(Poa alpina)</i>
Sheep Fescue	<i>(Festuca ovina)</i>
Tufted Hairgrass	<i>(Deschampsia caespitosa)</i>

3.6.1.3 Service and Haul Roads

Violet Wheatgrass	<i>(Agropyron violaceum)</i>
Alpine Bluegrass	<i>Poa alpina)</i>
Tufted Hairgrass	<i>Deschampsia caespitosa)</i>
Ticklegrass	<i>(Agrostis scabra)</i>

3.6.2.1 Tailings Management Facility

Violet Wheatgrass	<i>(Agropyron violaceum)</i>
Tufted Hairgrass	<i>(Deschampsia caespitosa)</i>
Rocky Mountain Fescue	<i>(Festuca saximontana)</i>
Ticklegrass	<i>(Agrostis scabra)</i>
Kentucky Bluegrass	<i>(Poa alpina)</i>
Red Fescue	<i>(Festuca rubra)</i>

3.6.2.5 Camp and Mill Area, Refuse Site, and Borrow Pits

Violet Wheatgrass	(<i>Agropyron violaceum</i>)
Alpine Bluegrass	(<i>Poa alpina</i>)
Sheep Fescue	(<i>Festuca ovina</i>)
Tufted Hairgrass	(<i>Deschampsia caespitosa</i>)

These successful grass species are all northern native species, with the exception of Kentucky Bluegrass and Red Fescue. These two non-native, turf-forming species may be required to help stabilize the mobile fine soils on the TMF.

The northern native legumes seeded on the test plots, however, have so far not been successful – with the exception of a few Bear Root (*Hedysarum*) plants – and are therefore not component to the recommended revegetation mixtures.

The revegetation test plot program is ongoing, in an effort to refine the seed mixture recommendations, determine appropriate seed mix ratios and seed application rates, and further investigate metals uptake potential.

For complete methods and results of the Revegetation Test Program, the reader is referred to Teck Cominco's Annual Water License Reports for the Sä Dena Hes Site for the years 2001 – 2005 inclusive.

4.0 IMPLEMENTATION SCHEDULE

No Change to the February 2000 DDRP.

5.0 POST CLOSURE SITE MANAGEMENT

No Change to the February 2000 DDRP.

5.1 ORGANIZATION, SITE ACCESS & SECURITY

No Change to the February 2000 DDRP.

5.2 SUPERVISION AND DOCUMENTATION OF WORK

No Change to the February 2000 DDRP.

5.3 MINE RECORDS

No Change to the February 2000 DDRP.

5.4 COMPLIANCE MONITORING AND REPORTING

Table 5-2 *Licensed Surveillance Program during Temporary Cessation of Operations* has been updated in accordance with water licensing, specifically a new station - MH-25 (The Main Zone 1380 Portal discharge) has been added to the surveillance schedule. Table 5-3 *Licensed Surveillance Network – Water Quality Monitoring Stations* and Table 5-4 *Environmental Monitoring and Inspection Program – Post Closure* have also been amended to include reference to the new station MH-25. Inclusion of this station in the Post Closure monitoring program is not imposed by licensing, but Teck Cominco proposes its inclusion in the interest of data continuity (but will be redundant if closure includes sealing of the portal with a water tight bulkhead).

Table 5-2 Licensed Surveillance Program During Temporary Cessation of Operations

		Stations																				
		MH-1	MH-2	MH-3	MH-4*	MH-5	MH-6a	MH-6b**	MH-7	MH-8	MH-9	MH-10	MH-11	MH-13	MH-14	MH-16	MH-18	MH-19	MH-20	MH-22	MH-24	MH-25
W A T E R Q U A L I T Y	Water Quality Monitoring																					
	pH (Field)	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Flow Rate	Q	M	M	Q	M	M	Q	M	M	M	M	M/C***	Q	Q	Q	--	--	--	M	--	M
	Temperature	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Conductivity	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Alkalinity	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	pH(Lab)	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Tot. Sus. Solids	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Dissolved Solids	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	ICP Scan - Total	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Ammonia - Total	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Sulphate	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Hardness	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Cyanide - Total	Q	M	--	--	--	M	Q	M	--	--	--	M	Q	Q	Q	--	--	--	--	--	--
	Bioassay - LC50	--	--	--	--	--	Q	Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--
M O P N R I O T G O R A I M N S G	Environmental Monitoring																					
	Benthic Invertebrates	--	--	--	--	--	--	--	--	--	--	--	--	2Y	2Y	--	2Y	2Y	--	--	2Y	--
	Stream Sediments	--	--	--	--	--	--	--	--	--	--	--	--	2Y	2Y	--	2Y	2Y	--	--	2Y	--
	Fish Monitoring	--	--	--	--	--	--	--	--	--	--	--	--	2Y	--	--	2Y	--	2Y	--	2Y	--
	Physical Monitoring																					
	Internal Monitoring (Earthworks)	Monthly internal inspection of all earthworks on site																				
	Annual Geotechnical Inspection	Annual Geotechnical Inspection of all earthworks																				
	Piezometers Monitoring	Monthly piezometric readings from wells located in tailings management facility																				
	Settlement Marker Monitoring	Annual readings taken during geotechnical inspection																				
	Seepage Monitoring	Monthly seepage readings from seepage weirs located in tailings management facility																				

LEGEND: Q = Quarterly M = Monthly 2Y = every second year during September C = Continuous

NOTES: -- Monitoring for this parameter at this station is not required as per water use licence schedule
 * To be monitored as an alternative site to MH-3 only when there is no discharge from the Camp Creek Sediment Pond.
 ** To be monitored as an alternative site to MH-6a only when there is no discharge from the reclaim pond.
 *** Monitor a minimum of monthly or continuous flow recording year round.

Table 5-3 Licensed Surveillance Network – Water Quality Monitoring Sites

MH-1:	Tailings Pond Outflow – discharge from the tailings pond, through the decant tower, to the reclaim pond or if no discharge, the pond water.
MH-2:	Tailings North Dam Seepage – seepage water collected immediately below the downstream face of the north tailings dam.
MH-3:	Camp Creek Pond Outflow – discharge from a sedimentation pond located in upper Camp Creek that drains the Jewelbox Hill 1250 Portal and Main Zone Waste Dump.
MH-4:	Alternate Site – Lower Camp Creek – on Camp Creek located immediately above the West Interceptor Ditch; this is an alternative site to be sample <u>only</u> when there is no discharge from MH-3.
MH-5:	Portal Creek – a small intermittent stream which drains the East face of Jewelbox Hill, immediately below the 1408 portal, to False Canyon Creek; releases discharge from the portal sedimentation pond and water from the Jewelbox Waste Dump.
MH-6a:	Reclaim Pond Outflow – discharge from the reclaim pond through the overflow spillway.
MH-6b:	Reclaim Pond – To be monitored as a alternative to MH-6a only when there is no discharge from the reclaim pond.
MH-7:	Reclaim Pond Seepage – water accumulating within the seepage collection system located immediately below the downstream face of the reclaim dam.
MH-8:	Burnick Creek – a small intermittent drainage south of the Burnick pit and portal sites which will consolidate drainage within a sediment pond from those sites as well as Burnick pit access road runoff; the drainage contributes to the upper end of Tributary E, east fork, of False Canyon Creek.
MH-9:	Burnick West Pond Outflow – discharge from a small sediment pond, which collects drainage from the west and north faces of the Burnick Dump and drains to the upper end of Tributary E, west fork, of False Canyon Creek.
MH-10:	Burnick East Pond Outflow – discharge from a small sediment pond, which collects drainage from the east face of the Burnick Dump, to a branch of Tributary E, west fork, of False Canyon Creek.
MH-11:	Upper False Canyon Creek located one kilometre downstream of the tailing management facility.
MH-12:	Tributary E, east fork – of False Canyon Creek, approximately 2 kilometres downstream of the north tailings dam.
MH-13:	The main channel of False Canyon Creek, approximately 10 kilometres downstream of the reclaim pond.
MH-14:	The main channel of False Canyon Creek, approximately 20 kilometres downstream of the reclaim pond just upstream of the confluence with Tributary E.
MH-15:	Tributary E, west fork, upstream of the confluence with Tributary E, east fork, approximately six kilometres downstream of the North Hill development.
MH-16:	The main channel of False Canyon Creek, downstream of the confluence of Tributary D, approximately 22 kilometres downstream of the reclaim pond.
MH-18:	Lower reaches of Tributary E, approximately one kilometre above the confluence with False Canyon Creek.
MH-19:	The main channel of False Canyon Creek, approximately four kilometres downstream of the Tributary D confluence.
MH-20:	The main channel of False Canyon Creek, approximately 13 kilometres upstream of the mouth and immediately above the Tributary B confluence.
MH-22:	Burnick portal discharge, the end of pipe discharge point into the North Hill Settlement Basin.
MH-23:	North Creek immediately downstream of the impoundment.
MH-24:	The east tributary that joins False Canyon Creek just downstream of MH-13.
MH-25:	The Main Zone 1380 Portal discharge.

Table 5-4 Environmental Monitoring and Inspection Program - Post Closure

		Post Closure Implementation Year			Post Closure Monitoring Year					
		1	2	3	1	2	3	4	5	>6
	Calendar Year	1	2	3	4	5	6	7	8	>9
W A T E R Q U A L I T Y	Water Quality Monitoring Stations *									
	MH-1	Q	Q	Q	Q	Q	Q	A	A	P
	MH-2	M	M	M	Q	Q	Q	A	A	P
	MH-3	M	M	M	--	--	--	--	--	--
	MH-4	Q	Q	Q	Q	Q	Q	A	A	P
	MH-5	M	M	M	Q	Q	Q	A	A	P
	MH-6	M	M	M	--	--	--	--	--	--
	MH-7	M	M	M	--	--	--	--	--	--
	MH-8	M	M	M	--	--	--	--	--	--
	MH-9	M	M	M	--	--	--	--	--	--
	MH-10	M	M	M	--	--	--	--	--	--
	MH-11	M	M	M	Q	Q	Q	A	A	P
	MH-13	Q	Q	Q	Q	Q	Q	A	A	P
	MH-14	Q	Q	Q	Q	Q	Q	A	A	P
	MH-16	Q	Q	Q	--	--	--	--	--	--
	MH-18	--	--	--	A***	--	A***	--	A***	P
	MH-19	--	--	--	A***	--	A***	--	A***	P
	MH-22	M	M	M	Q	Q	Q	A	A	P
	MH-24	--	--	--	A***	--	A***	--	A***	P
	MH-25	M	M	M	--	--	--	--	--	--
M O P E R A T I O N S	Environmental Monitoring **									
	Benthic Invertebrates		2Y		2Y	--	2Y	--	2Y	--
	Stream Sediments		2Y		2Y	--	2Y	--	2Y	--
	Fish Monitoring		2Y		2Y	--	2Y	--	2Y	--
	Physical Monitoring									
	Internal Monitoring (Earthworks)	M	M	M	--	--	--	--	--	--
	Annual Geotechnical Inspection	A	A	A	A	A	A	A	A	P
	Piezometers Monitoring	M	M	M	Q	Q	Q	A	A	P
	Settlement Marker Monitoring	A	A	A	A	A	A	A	A	P
	Seepage Monitoring	M	M	M	Q	Q	Q	A	A	P

LEGEND:

Q = Quarterly; M = Monthly; A = Annually; 2Y = every second year during September; P = Periodic Inspector

NOTES: Post Closure starts after all mining & milling is completed. Post Closure phases include reclamation implementation and long term monitoring.

* Water quality parameters include pH, Flow, Temperature, Conductivity, Alkalinity, Suspended solids, Dissolved solids, ICP scan - Total and Dissolved metals, Ammonia, Sulphate, Hardness and Total cyanide

** Monitoring stations for this program includes MH-13, MH-14, MH-18, MH-19 & MH-24

*** Water Quality monitored annually in conjunction with Environmental Monitoring Programs

6.0 CLOSURE COSTS

The updated estimated costs to implement the Detailed Decommissioning and Reclamation Plan described in this report are presented in updated Tables 6-1 through to 6-10. Table 6-1 presents the summary of cost estimates for various mine components including mine workings, tailings management facility, infrastructure, land reclamation and revegetation and post closure monitoring and maintenance.

As shown in Table 6-1, a closure cost of **\$5,702,432.00** is estimated for current conditions with no mine reopening (Scenario 1). Closure costs for Scenario 2, wherein the mine resumes operation to exhaust the known ore reserves (additional 3.8 years mining), is estimated at **\$6,313,835.00**. Where there is a different cost for closure measures for Scenario 1 or 2, they are presented separately. All costs are in constant 2005 dollars.

Where available, the equipment costs have been updated using current unit rates for equipment providers from Yukon Government's Third Party Equipment Rental Rates Summary for the fiscal year 2005/06. Contractor Unit Rates have been updated to reflect current pricing for these activities. Labor rates, re-vegetation costs and lump sum costs have been increased by 10% to reflect actual inflation (calculated at 9.7% for the Yukon Territory between February 2000 and June 2005.) All costing has been applied to levels of effort in sufficient detail to allow thorough scrutiny by the reader

- Table 6-1 provides a summary of all cost estimates;
- Table 6-2 sets out unit rates used in the calculations;
- Table 6-3 provides closure cost estimates for the existing mine workings (Scenario 1);
- Table 6-4 outlines the additional mine workings closure costs associated with mine reopening (Scenario 2);
- Table 6-5 presents cost estimates for the tailings management facility Scenario 1;
- Table 6-6 estimates costs for the tailings management facility for reopening (Scenario 2);
- Table 6-7 presents the decommissioning cost estimates for site infrastructure. These costs are common to both Scenario 1 and 2;
- Table 6-8 presents cost estimates for land reclamation and revegetation for Scenario 1;

- Tables 6-9 presents cost estimates for land reclamation and revegetation for Scenario 2;
- Table 6-10 outlines costs associated with the site management during closure implementation and presents post closure costs for compliance monitoring and maintenance for the entire projected 8 year post closure monitoring life (These costs are common to both Scenario 1 and 2).

All of the individual mine component cost estimate tables provide the detailed breakdown of the costs to implement each of the main elements of the works as described in the Decommissioning & Reclamation Plan.

Table 6-1 - Estimated Decommissioning Costs, Summary Table

Scenario 1

Item	Description	Cost
1	Mine Workings	\$308,330
2	Tailings Management Facility	\$643,378
3	Infrastructure	\$1,031,785
4	Land Reclamation and Revegetation	\$1,138,574
5	Post Closure Site Management (Including Monitoring & Maintenance)	\$1,836,570
	Sub-total	\$4,958,637
	Contingency Allowance @ 15%	\$743,795
	Total Estimated Scenario 1 Closure Cost	\$5,702,432

Scenario 2

Item	Description	Cost
1	Mine Workings	\$330,230
2	Tailings Management Facility	\$749,815
3	Infrastructure	\$1,031,785
4	Land Reclamation and Revegetation	\$1,541,891
5	Post Closure Site Management (Including Monitoring & Maintenance)	\$1,836,570
	Sub-total	\$5,490,291
	Contingency Allowance @ 15%	\$823,544
	Total Estimated Scenario 2 Closure Cost	\$6,313,835

Table 6-2: Unit Costs

Personnel & Equipment Rates				
Equipment	2000 All found		2005 All found	
	Rates/hr	Rate/mo	Rates/hr	Rate/mo
D9H Dozer	\$180		\$210	
Haul Truck D250E	\$100		\$160	
Tandem Haul Truck	\$65		\$100	
Drill Rig	\$186		\$225	
36" Walk Behind Roller	\$40		\$63	
Cat 235 Excavator	\$186		\$200	
Cat 16H grader	\$108		\$171	
Hammer	\$40		\$63	
988B Loader	\$110		\$170	
Hiab Flatdeck truck	\$30		\$75	
Cat 950 loader	\$75		\$120	
Personal Vehicles		\$2,000		\$2,200
Blaster	\$50		\$55	
Labourer	\$40		\$45	
Tradesman	\$55		\$60	
Site Supervisor	\$80		\$90	
Design Engineer	\$115		\$130	
Project Manager		\$8,800		\$9,700
Camp Labourer		\$3,000		\$3,300
Site Caretaker		\$5,500		\$6,100
Environmental Monitor		\$4,500		\$5,000

Other Materials				
Revegetation Seed Mix	\$8.57	per kg	\$13.00	per kg
Fertilizer	\$0.80	per kg	\$1.00	per kg
Tree Seedlings	\$1,250	per ha (1,000/ha)	not required - natural seedlings on site	
Seed/Fertilizer Application	\$1,325	per ha	\$1,458	per ha
Erosion Control Matting	\$1,000	per linear km (2m mat width)	\$3,000	per linear km (2m mat width)

Contractor Unit Rates & Camp Costs				
Excavation of Soil	\$3.00	cu.m	\$4.50	cu.m
Supply and place Geotextile	\$4.00	sq m	\$5.00	sq m
Haul and place soil cover	\$5.00	cu.m	\$5.00	cu.m
Haul & Place rock cover	\$5.00	cu.m	\$7.00	cu.m
Drill, Blast & Haul Rip Rap	\$10.00	cu.m	\$15.00	cu.m
Place Riprap	\$10.00	cu.m	\$10.00	cu.m
Camp Cost	\$100.00	per day per person	\$110.00	per day per person

Table 6-3: Estimated Decommissioning Costs, Mine Workings Scenario 1

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
1.0	MINE WORKINGS						
1.1	JEWELBOX ZONE						
1.1.1	Jewelbox Zone - 1408 Portal						
	Plug portal with tires	Cat 235 Hoe	hrs	20	\$200	\$4,000	\$4,000
	Place waste rock cap over tires	Cat 235 Hoe	hrs	10	\$200	\$2,000	
		Cat 250E Truck	hrs	10	\$160	\$1,600	\$3,600
	Supply broken rock for drain at base of plug and discharge channel riprap	Cat 235 Hoe	hrs	10	\$200	\$2,000	
		Cat 250E Truck	hrs	20	\$160	\$3,200	\$5,200
	Construct rock drain at base of plug	Cat 235 Hoe	hrs	5	\$180	\$900	\$900
	Supply till to seal discharge channel	Cat 235 Hoe	hrs	4	\$200	\$800	
		Cat 250E Truck	hrs	4	\$160	\$640	\$1,440
	Construct lined open channel for discharge from portal	Cat 235 Hoe	hrs	15	\$200	\$3,000	
		Compactor	hrs	10	\$63	\$630	\$3,630
	Misc. Supplies & Shipping & Mod/Demob of Tire Installation Contractor	Misc.				\$11,000	\$11,000
	Labour to assist with placing tires & cap	Labourer	hrs	40	\$45	\$1,800	\$1,800
	Supervision to design & install tires & cap	Supervision	hrs	40	\$90	\$3,600	\$3,600
	Sub-Total						\$35,170
1.1.2	Jewelbox Zone - 1250 Portal						
	Place waste rock cap in opening	Cat 235 Hoe	hrs	10	\$200	\$2,000	
		Cat 250E Truck	hrs	20	\$160	\$3,200	\$5,200
	Supervision of work	Supervision	hrs.	10	\$90	\$900	\$900
	Sub-Total						\$6,100
1.1.3	Jewelbox Zone - Ventilation Raises						
	Construct Concrete cap over upper vent openings (both upper & lower)	Cat 235 Hoe	hrs	40	\$200	\$8,000	
		Labourer	hrs	40	\$50	\$2,000	
		Supplies	L.S			\$8,250	\$24,500
	Contour Slope around opening	Cat 235 Hoe	hrs	10	\$200	\$2,000	\$2,000
	Design and Site Supervision of Cap	Engineering	hrs	75	\$130	\$9,750	\$9,750
	Sub-Total						\$36,250
1.1.4	Jewelbox Zone - Open Pit						
	Drill and blast highwall	Drill Rig	hrs	20	\$225	\$4,500	
		Blaster	hrs	20	\$55	\$1,100	
		Helper	hrs	20	\$45	\$900	
		Supplies			\$2,750	\$2,750	
	Construct rock filled Spillway	Cat D9H Dozer	hrs	20	\$210	\$4,200	\$13,450
		Cat 235 Hoe	hrs	40	\$200	\$8,000	
		Drill Rig	hrs	20	\$225	\$4,500	
		Blaster	hrs	20	\$55	\$1,100	
		Labourer	hrs	20	\$45	\$900	
		Cat D9H Dozer	hrs	10	\$210	\$2,100	
		Cat 250E Truck	hrs	10	\$160	\$1,600	\$18,200
	Layout and Site Supervision of Spillway	Supervision	hrs	80	\$90	\$7,200	\$7,200
	Sub-Total						\$38,850
1.1.5	Jewelbox Zone - Waste Dumps						
	Reslope Upper Zone of Dump below Portal (1.3ha)	Cat D9H Dozer	hrs	30	\$210	\$6,300	\$6,300
	Reslope Jewelbox pit waste on ridge (1.9 ha)	Cat D9H Dozer	hrs	20	\$210	\$4,200	\$4,200
	Pull Back crest of waste dump and road cut below access road to Main Pit (0.5ha)	Cat 235 Hoe	hrs	30	\$200	\$6,000	\$6,000
	Reslope Jewelbox pit waste dump above road (0.8ha)	Cat D9H Dozer	hrs	30	\$210	\$6,300	\$6,300
	Supervision	Supervision	hrs	55	\$90	\$4,950	\$4,950
	Sub-Total						\$27,750
1.2	MAIN ZONE						
1.2.1	Main Zone - 1380 Portal (see also Main Zone Pit)						
	Plug 1380 Portal with concrete plug	Misc.	L.S			\$50,000	\$50,000
	Sub-Total						\$50,000
1.2.2	Main Zone - Open Pit						
	Drill and blast highwall and cover Portal 1380	Drill Rig	hrs	20	\$225	\$4,500	
		Blaster	hrs	20	\$55	\$1,100	
		Labourer	hrs	20	\$45	\$900	
		Supplies			\$2,750	\$2,750	
		Cat D9H Dozer	hrs	20	\$210	\$4,200	\$13,450
	Sub-Total						\$13,450
1.2.3	Main Zone - Waste Dump						
	Pull Back crest of waste dump below pit (0.3ha)	Cat 235 Hoe	hrs	20	\$200	\$4,000	\$4,000
	Pull Back crest of waste dump below 1250 portal	Cat 235 Hoe	hrs	5	\$200	\$1,000	\$1,000
	Supervision	Supervision	hrs	12	\$90	\$1,080	\$1,080
	Sub-Total						\$6,080
1.3	BURNICK ZONE						
1.3.1	Burnick Zone - 1200 Portal						
	Plug portals with tires	Cat 235 Hoe	hrs	30	\$200	\$6,000	\$6,000
	Supply & Place waste rock cap over tires	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Cat 250E Truck	hrs	40	\$160	\$6,400	\$10,400
	Supply broken rock for drain at base of plug and discharge channel riprap	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Cat 250E Truck	hrs	40	\$160	\$6,400	\$10,400
	Construct rock drain at base of portal plugs	Cat 235 Hoe	hrs	10	\$200	\$2,000	\$2,000
	Supply till to line discharge channel	Cat 235 Hoe	hrs	10	\$200	\$2,000	
		Cat 250E Truck	hrs	20	\$160	\$3,200	\$5,200
	Construct lined open channel for discharge from portal	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Compactor	hrs	10	\$63	\$630	\$4,630
	Misc. Supplies	Misc.				\$5,000	\$5,000
	Labour to assist with placing tires & cap	Labourer	hrs	80	\$45	\$3,600	\$3,600
	Design of rock drain and channel	Engineering	hrs	40	\$130	\$5,200	\$5,200
	Supervision installation of tire plug & rock drain	Supervision	hrs	50	\$90	\$4,500	\$4,500
	Sub-Total						\$56,930
1.3.2	Burnick Zone - 1300 Portal						
	Plug portals with tires	Cat 235 Hoe	hrs	30	\$200	\$6,000	\$6,000
	Supply & Place waste rock cap over tires	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Cat 250E Truck	hrs	40	\$160	\$6,400	\$10,400
	Misc. Supplies					\$5,000	\$5,000
	Labour to assist with tire installation	Labourer	hrs	40	\$45	\$1,800	
	Supervision to design & install tires & cap	Supervision	hrs	20	\$90	\$1,800	\$3,600
	Sub-Total						\$25,000
1.3.3	Burnick Zone - Open Pit						
	Does not exist in Scenario 1					\$0	
	Sub-Total						\$0
1.3.4	Burnick Zone - Waste Dump						
	Reslope Dump below Portal (1.4ha)	Cat D9H Dozer	hrs	50	\$210	\$10,500	\$10,500
	Supervision	Supervision	hrs	25	\$90	\$2,250	\$2,250
	Sub-Total						\$12,750
Total Estimated Cost in Reclaiming Mine Workings							\$308,330

Estimated Decommissioning Costs
Table 6-4: Mine Workings Scenario 2, Additional Costs

No.	Work Item Description	Labour	Units	Quantity	Cost	Cost	Cost
1.0	MINE WORKINGS						
1.1	JEWELBOX ZONE						
1.1.1	Jewelbox Zone - 1408 Portal						
	Plug portal with tires	Cat 235 Hoe	hrs	20	\$200	\$4,000	\$4,000
	Place waste rock cap over tires	Cat 235 Hoe	hrs	10	\$200	\$2,000	\$2,000
		Cat 250E Truck	hrs	10	\$160	\$1,600	\$3,600
	Supply broken rock for drain at base of plug and discharge channel riprap	Cat 235 Hoe	hrs	10	\$200	\$2,000	\$2,000
		Cat 250E Truck	hrs	20	\$160	\$3,200	\$5,200
	Construct rock drain at base of plug	Cat 235 Hoe	hrs	5	\$180	\$900	\$900
	Supply till to seal discharge channel	Cat 235 Hoe	hrs	4	\$200	\$800	
		Cat 250E Truck	hrs	4	\$160	\$640	\$1,440
	Construct lined open channel for discharge from portal	Cat 235 Hoe	hrs	15	\$200	\$3,000	
		Compactor	hrs	10	\$63	\$630	\$3,630
	Misc. Supplies & Shipping & Mod/Demob of Tire Installation Contractor	Misc.				\$10,000	\$10,000
	Labour to assist with placing tires & cap	Labourer	hrs	40	\$45	\$1,800	\$1,800
	Supervision to design & install tires & cap	Supervision	hrs	40	\$90	\$3,600	\$3,600
	Sub-Total						\$34,170
1.1.2	Jewelbox Zone - 1250 Portal						
	Place waste rock cap in opening	Cat 235 Hoe	hrs	10	\$200	\$2,000	
		Cat 250E Truck	hrs	20	\$160	\$3,200	\$5,200
	Supervision of work	Supervision	hrs.	10	\$90	\$900	\$900
	Sub-Total						\$6,100
1.1.3	Jewelbox Zone - Ventilation Raises						
	Construct Concrete cap over upper vent openings (both upper & lower)	Cat 235 Hoe	hrs	40	\$200	\$8,000	
		Labourer	hrs	40	\$50	\$2,000	
		Supplies	L.S			\$8,250	\$24,500
	Contour Slope around opening	Cat 235 Hoe	hrs	10	\$200	\$2,000	\$2,000
	Design and Site Supervision of Cap	Engineering	hrs	75	\$130	\$9,750	\$9,750
	Sub-Total						\$36,250
1.1.4	Jewelbox Zone - Open Pit						
	Drill and blast highwall	Drill Rig	hrs	20	\$225	\$4,500	
		Blaster	hrs	20	\$55	\$1,100	
		Helper	hrs	20	\$45	\$900	
		Supplies			\$2,750	\$2,750	
	Construct rock filled Spillway	Cat D9H Dozer	hrs	20	\$210	\$4,200	\$13,450
		Cat 235 Hoe	hrs	40	\$200	\$8,000	
		Drill Rig	hrs	20	\$225	\$4,500	
		Blaster	hrs	20	\$55	\$1,100	
		Labourer	hrs	20	\$45	\$900	
		Cat D9H Dozer	hrs	10	\$210	\$2,100	
		Cat 250E Truck	hrs	10	\$160	\$1,600	\$18,200
	Layout and Site Supervision of Spillway	Supervision	hrs	80	\$90	\$7,200	\$7,200
	Sub-Total						\$38,850
1.1.5	Jewelbox Zone - Waste Dumps						
	Reslope Upper Zone of Dump below Portal (1.3ha)	Cat D9H Dozer	hrs	60	\$210	\$12,600	\$12,600
	Reslope Jewelbox pit waste on ridge (1.9 ha)	Cat D9H Dozer	hrs	20	\$210	\$4,200	\$4,200
	Pull Back crest of waste dump and road cut below access road to Main Pit (0.5ha)	Cat 235 Hoe	hrs	30	\$200	\$6,000	\$6,000
	Reslope Jewelbox pit waste dump above road (0.8ha)	Cat D9H Dozer	hrs	30	\$210	\$6,300	\$6,300
	Supervision	Supervision	hrs	70	\$90	\$6,300	\$6,300
	Sub-Total						\$35,400
1.2	MAIN ZONE						
1.2.1	Main Zone - 1380 Portal (see also Main Zone Pit)						
	Plug 1380 Portal with concrete plug	Misc.	L.S			\$50,000	\$50,000
	Sub-Total						\$50,000
1.2.2	Main Zone - Open Pit						
	Drill and blast highwall and cover Portal 1380	Drill Rig	hrs	20	\$225	\$4,500	
		Blaster	hrs	20	\$55	\$1,100	
		Labourer	hrs	20	\$45	\$900	
		Supplies			\$2,750	\$2,750	
		Cat D9H Dozer	hrs	20	\$210	\$4,200	\$13,450
	Sub-Total						\$13,450
1.2.3	Main Zone - Waste Dump						
	Pull Back crest of waste dump below pit (0.3ha)	Cat 235 Hoe	hrs	20	\$200	\$4,000	\$4,000
	Pull Back crest of waste dump below 1250 portal	Cat 235 Hoe	hrs	5	\$200	\$1,000	\$1,000
	Supervision	Supervision	hrs	12	\$90	\$1,080	\$1,080
	Sub-Total						\$6,080
1.3	BURNICK ZONE						
1.3.1	Burnick Zone - 1200 Portal						
	Plug portals with tires	Cat 235 Hoe	hrs	30	\$200	\$6,000	\$6,000
	Supply & Place waste rock cap over tires	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Cat 250E Truck	hrs	40	\$160	\$6,400	\$10,400
	Supply broken rock for drain at base of plug and discharge channel riprap	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Cat 250E Truck	hrs	40	\$160	\$6,400	\$10,400
	Construct rock drain at base of portal plugs	Cat 235 Hoe	hrs	10	\$200	\$2,000	\$2,000
	Supply till to line discharge channel	Cat 235 Hoe	hrs	10	\$200	\$2,000	
		Cat 250E Truck	hrs	20	\$160	\$3,200	\$5,200
	Construct lined open channel for discharge from portal	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Compactor	hrs	10	\$63	\$630	\$4,630
	Misc. Supplies	Misc.				\$5,000	\$5,000
	Labour to assist with placing tires & cap	Labourer	hrs	80	\$45	\$3,600	\$3,600
	Design of rock drain and channel	Engineering	hrs	40	\$130	\$5,200	\$5,200
	Supervision installation of tire plug & rock drain	Supervision	hrs	50	\$90	\$4,500	\$4,500
	Sub-Total						\$56,930
1.3.2	Burnick Zone - 1300 Portal						
	Plug portals with tires	Cat 235 Hoe	hrs	30	\$200	\$6,000	\$6,000
	Supply & Place waste rock cap over tires	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Cat 250E Truck	hrs	40	\$160	\$6,400	\$10,400
	Misc. Supplies					\$5,000	\$5,000
	Labour to assist with tire installation	Labourer	hrs	40	\$45	\$1,800	
	Supervision to design & install tires & cap	Supervision	hrs	20	\$90	\$1,800	\$3,600
	Sub-Total						\$25,000
1.3.3	Burnick Zone - Open Pit						
	Drill and blast highwall and cover portals	Drill Rig	hrs	20	\$225	\$4,500	
		Blaster	hrs	20	\$55	\$1,100	
		Labourer	hrs	20	\$45	\$900	
		Supplies			\$2,750	\$2,750	
		Cat D9H Dozer	hrs	20	\$210	\$4,200	
		Supervisor	hrs	20	\$90	\$1,800	\$15,250
	Sub-Total						\$15,250
1.3.4	Burnick Zone - Waste Dump						
	Reslope Dump below Portal (1.4ha)	Cat D9H Dozer	hrs	50	\$210	\$10,500	\$10,500
	Supervision	Supervision	hrs	25	\$90	\$2,250	\$2,250
	Sub-Total						\$12,750
Total Estimated Cost in Reclaiming Mine Workings							\$330,230

Estimated Decommissioning Costs
Table 6-5: Tailings Management Facility, Scenario 1, Closure Costs

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
2.0	TAILINGS MANAGEMENT FACILITY - SENARIO 1						
2.1	South Dam						
2.1.1	Remove Existing Spillway	Cat 235 Hoe	hrs	10	\$200	\$2,000	
		Cat 250E Truck	hrs	20	\$160	\$3,200	\$5,200
2.1.2	Breach Dam	Unit Cost Basis	cu.m	16,300	\$5	\$73,350	\$73,350
2.1.3	Construct Spillway and Exit Channel						
	Excavate Channel	Unit Cost Basis	cu.m	4,125	\$5	\$18,563	
	Supply and Place Geotextile (Spillway and Channel)	Unit Cost Basis	sq.m	4,250	\$5	\$21,250	
	Supply and Place Riprap (Spillway and Channel)	Unit Cost Basis	cu.m	2,625	\$25	\$65,625	
	Design Spillway & Channel	Engineering	hrs	50	\$130	\$6,500	
	Site Supervision Spillway and channel	Supervision	hrs	60	\$90	\$5,400	\$117,338
	Sub-Total						\$195,888
2.2	Decant Tower						
2.2.1	Dismantle Decant Tower and Bury debris	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Hammer	hrs	20	\$63	\$1,260	\$5,260
2.2.2	Specifications/Design Plug for Decant Pipe	Man hours	hrs	24	\$130	\$3,120	\$3,120
2.2.3	Plug Decant Pipe	Labourer	hrs	80	\$45	\$3,600	
		Materials	l.s.			\$5,500	\$9,100
2.2.4	Supervision	Supervision	hrs	40	\$90	\$3,600	\$3,600
	Sub-Total						\$21,080
2.3	Tailings Surface						
2.3.1	Recontour tailings surface (11ha)	Cat D9H Dozer	hrs	100	\$210	\$21,000	\$21,000
2.3.2	Remove Cofferdam and bury culvert	Cat D9H Dozer	hrs	16	\$210	\$3,360	\$3,360
2.3.3	Supervision	Supervision	hrs	50	\$90	\$4,500	\$4,500
	Sub-Total						\$28,860
2.4	Reclaim Dam						
2.4.1	Remove Existing Spillway and exit channel. Regrade	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Cat D9H Dozer	hrs	30	\$210	\$6,300	
		Cat 250E Truck	hrs	40	\$160	\$6,400	\$16,700
2.4.2	Breach Dam	Unit Cost Basis	cu.m	21,800	\$5	\$98,100	\$98,100
2.4.3	Construct Spillway and Exit Channel						
	Supply and Place Geotextile (Spillway and Channel)	Unit Cost Basis	sq.m	1,700	\$5	\$8,500	
	Supply and Place Riprap (Spillway and Channel)	Unit Cost Basis	cu.m	1,050	\$25	\$26,250	
	Design of Spillway and Channel	Engineering	hrs	50	\$130	\$6,500	
	Site Supervision of Spillway and channel	Supervision	hrs	60	\$90	\$5,400	\$46,650
	Sub-Total						\$161,450
2.5	Camp Creek Diversion and restoration						
2.5.1	Breach existing diversion, remove culverts, regrade	Cat 235 Hoe	hrs	40	\$200	\$8,000	
		Cat D9H Dozer	hrs	30	\$210	\$6,300	
		Cat 250E Truck	hrs	20	\$160	\$3,200	\$17,500
2.5.2	Realign Camp Creek and riprap						
	Excavate Channel	Unit Cost Basis	cu.m	9,250	\$5	\$41,625	
	Supply and Place Geotextile (Spillway and Channel)	Unit Cost Basis	sq.m	6,290	\$5	\$31,450	
	Supply and Place Riprap (Spillway and Channel)	Unit Cost Basis	cu.m	3,885	\$25	\$97,125	
	Design of Channel Realignment	Engineering	hrs	40	\$130	\$5,200	
	Site Supervision of channel realignment	Supervision	hrs	60	\$90	\$5,400	\$180,800
	Sub-Total						\$198,300
2.6	Interceptor Ditches						
2.6.1	Breach ditches and recontour	Cat D9H Dozer	hrs	30	\$210	\$6,300	\$6,300
	Sub-Total						\$6,300
2.7	Tailings pipeline (1.9km)						
2.7.1	Remove Pipeline	Cat 235 Hoe	hrs	50	\$200	\$10,000	
		Cat 250E Truck	hrs	50	\$160	\$8,000	
		Labour	hrs	100	\$45	\$4,500	\$22,500
	Sub-Total						\$22,500
2.8	Reclaim pipeline (0.8km)						
2.8.1	Remove Pipeline	Cat 235 Hoe	hrs	20	\$200	\$4,000	
		Cat 250E Truck	hrs	20	\$160	\$3,200	
		Labour	hrs	40	\$45	\$1,800	\$9,000
	Sub-Total						\$9,000
Total Estimated Cost in Reclaiming TMF (Scenario 1)							\$643,378

Estimated Decommissioning Costs
Table 6-6: Tailings Management Facility Scenario 2, Closure Costs

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
2.0	TAILINGS MANAGEMENT FACILITY - SENARIO 2						
2.1	South Dam						
2.1.1	Remove Existing Spillway	Cat 235 Hoe	hrs	10	\$200	\$2,000	\$5,200
		Cat 250E Truck	hrs	20	\$160	\$3,200	
2.1.2	Construct Spillway and Exit and Entrance Channels						\$131,500
	Excavate Channel		cu.m	6,500	\$5	\$29,250	
	Supply and Place Geotextile (Spillway and Channel)		sq.m	4,420	\$5	\$22,100	
	Supply and Place Riprap (Spillway and Channel)		cu.m	2,730	\$25	\$68,250	
	Design Spillway and Channel	Engineering	hrs	50	\$130	\$6,500	
	Site Supervision for Spillway and channel	Supervision	hrs	60	\$90	\$5,400	
2.1.3	Plunge Pool						
	Excavate Channel		cu.m	350	\$5	\$1,575	\$19,585
	Supply and Place Geotextile (Spillway and Channel)		sq.m	300	\$5	\$1,500	
	Supply and Place Riprap (Spillway and Channel)		cu.m	206	\$25	\$5,150	
	Design Pluge Pool & Channel	Engineering	hrs	32	\$130	\$4,160	
	Design and Site Supervision for Spillway and channel	Supervision	hrs	80	\$90	\$7,200	
	Sub-Total						\$156,285
2.2	Decant Tower						
2.2.1	Backfill Decant Tower and break up exposed sections	Cat 235 Hoe	hrs	20	\$200	\$4,000	\$5,260
		Hammer	hrs	20	\$63	\$1,260	
2.2.2	Specifications/Design Plug for Decant Pipe	Engineering	hrs	24	\$130	\$3,120	\$3,120
2.2.3	Plug Decant Pipe	Labourer	hrs	80	\$45	\$3,600	\$9,100
		Material	l.s.			\$5,500	
2.2.4	Supervision	Supervisor	hrs	40	\$90	\$3,600	\$3,600
	Sub-Total						\$21,080
2.3	Tailings Surface						
2.3.1	Recontour tailings surface (11.8 ha)	Cat D9H Dozer	hrs	200	\$210	\$42,000	\$42,000
2.3.2	Remove Cofferdam and bury culvert	Cat D9H Dozer	hrs	5	\$210	\$1,050	\$1,050
2.3.3	Supervision	Supervisor	hrs	100	\$90	\$9,000	\$9,000
	Sub-Total						\$52,050
2.4	Reclaim Dam						
2.4.1	Remove Existing Spillway and exit channel. Regrade	Cat 235 Hoe	hrs	20	\$200	\$4,000	\$16,700
		Cat D9H Dozer	hrs	30	\$210	\$6,300	
2.4.2	Breach Dam	Cat 250E Truck	hrs	40	\$160	\$6,400	\$98,100
2.4.3	Construct Spillway and Exit Channel		cu.m	21,800	\$5	\$98,100	
	Supply and Place Geotextile (Spillway and Channel)		sq.m	1,700	\$5	\$8,500	\$46,650
	Supply and Place Riprap (Spillway and Channel)		cu.m	1,050	\$25	\$26,250	
	Design of Spillway and channel	Engineering	hrs	50	\$130	\$6,500	
	Site Supervision of Spillway and channel	Supervisor	hrs	60	\$90	\$5,400	
	Sub-Total						\$161,450
2.5	Camp Creek Diversion and restoration						
2.5.1	Breach existing diversion, remove culverts, regrade	Cat 235 Hoe	hrs	40	\$200	\$8,000	\$17,500
		Cat D9H Dozer	hrs	30	\$210	\$6,300	
		Cat 250E Truck	hrs	20	\$160	\$3,200	
2.5.2	Realign Camp Creek and riprap						\$303,650
	Excavate Channel		cu.m	15,900	\$5	\$71,550	
	Supply and Place Geotextile (Spillway and Channel)		sq.m	10,800	\$5	\$54,000	
	Supply and Place Riprap (Spillway and Channel)		cu.m	6,700	\$25	\$167,500	
	Design of Spillway and channel	Engineering	hrs	40	\$130	\$5,200	
	Design and Site Supervision of channel	Supervisor	hrs	60	\$90	\$5,400	
	Sub-Total						\$321,150
2.6	Interceptor Ditches						
2.6.1	Breach ditches and recontour	Cat D9H Dozer	hrs	30	\$210	\$6,300	\$6,300
	Sub-Total						\$6,300
2.7	Tailings pipeline (1.9km)						
2.7.1	Remove Pipeline	Cat 235 Hoe	hrs	50	\$200	\$10,000	\$22,500
		Cat 250E Truck	hrs	50	\$160	\$8,000	
		Labour	hrs	100	\$45	\$4,500	
	Sub-Total						\$22,500
2.8	Reclaim pipeline (0.8km)						
2.8.1	Remove Pipeline	Cat 235 Hoe	hrs	20	\$200	\$4,000	\$9,000
		Cat 250E Truck	hrs	20	\$160	\$3,200	
		Labour	hrs	40	\$45	\$1,800	
	Sub-Total						\$9,000
Total Estimated Cost in Reclaiming TMF (Scenario 2)							\$749,815

Estimated Decommissioning Costs							
Table 6-7 Infrastructure: Buildings, Structures and Services Scenario 1 & 2							
Item No.	Work Item Description	Equipment/Labour	Units	Quantity	Unit Cost	Cost	Total Cost
3.0	INFRASTRUCTURE: BUILDINGS, STRUCTURES AND SERVICES						
3.1	Concentrator Buildings (incl. Whse, crusher building, load out)						
	Remove salvageable equipment	General Labour	hrs	704	\$45	\$31,680	
		Trades Labour	hrs	880	\$60	\$52,800	
	Dismantle Building - Manpower	General Labour	hrs	1200	\$45	\$54,000	
	Dismantle Building - Manpower	Trades Labour	hrs	720	\$60	\$43,200	
	Dismantle Building - Equipment	Cat 235	hrs	120	\$200	\$24,000	
	Concrete Demolition	Cat 235	hrs	80	\$200	\$16,000	
		Hammer	hrs	80	\$63	\$5,040	
	Reslope, contour & bury	Cat D9H	hrs	48	\$210	\$10,080	
	Misc. Supplies & Tools	Misc.	I.s.			\$11,000	
	Scrap haul to landfill	Truck D250E	hrs	240	\$160	\$38,400	
	Subtotal:						\$286,200
3.2	Power House and Power Lines						
	Remove salvageable equipment	General Labour	hrs	240	\$45	\$10,800	
		Trades Labour	hrs	240	\$60	\$14,400	
		I.s.				\$27,500	
	Salvage and remove powerline and poles						
	Dismantle Building - Manpower	General Labour	hrs	160	\$45	\$7,200	
		Trades Labour	hrs	80	\$60	\$4,800	
	Dismantle Building - Equipment	Cat 235	hrs	40	\$200	\$8,000	
	Concrete Demolition	Cat 235	hrs	40	\$200	\$8,000	
	Reslope, contour & bury	Cat D9H	hrs	24	\$210	\$5,040	
	Misc. Supplies & Tools	Misc.	I.s.			\$1,650	
	Scrap haul to landfill	Truck D250E	hrs	40	\$160	\$6,400	
	Subtotal:						\$93,790
3.3	Water Supply						
	Remove salvageable equipment - pipeline/pump	General Labour	hrs	48	\$45	\$2,160	
		Trades Labour	hrs	98	\$60	\$5,880	
	Remove pipeline	Truck D250E	hrs	100	\$160	\$16,000	
		Cat 235	hrs	100	\$200	\$20,000	
		General Labour	hrs	200	\$45	\$9,000	
		General Labour	hrs	20	\$45	\$900	
	Dismantle Building - Manpower	Cat 235	hrs	16	\$200	\$3,200	
	Dismantle Building - Equipment						
	Misc. Supplies & Tools	Misc.	I.s.			\$550	
	Reslope, contour & bury	Cat D9H	hrs	16	\$210	\$3,360	
	Subtotal:						\$61,050
3.4	North Creek Dyke						
	Excavate channel	Unit Cost Basis	cu.m	1600	\$5	\$7,200	
	remove culverts	Misc.	I.s.			\$4,400	
	supply rip rap	Unit Cost Basis	cu.m	20	\$10	\$200	
	Subtotal:						\$11,800
3.5	Service Garage						
	Dismantle Building - Manpower	General Labour	hrs	48	\$45	\$2,160	
		Trades Labour	hrs	24	\$60	\$1,440	
	Dismantle Building - Equipment	Cat 235	hrs	10	\$200	\$2,000	
	Concrete Demolition	Cat 235	hrs	10	\$200	\$2,000	
	Reslope, contour & bury	Cat D9H	hrs	8	\$210	\$1,680	
	Misc. Supplies & Tools	Misc.	I.s.			\$550	
	Scrap haul to landfill	Truck D250E	hrs	8	\$160	\$1,280	
	Subtotal:						\$11,110
3.6	Accommodation/Camp Trailers Buildings/Office						
	Remove salvageable equipment	General Labour	hrs	140	\$45	\$6,300	
		Trades Labour	hrs	48	\$60	\$2,880	
	Dismantle Buildings - Manpower	General Labour	hrs	380	\$45	\$17,100	
		Trades Labour	hrs	32	\$60	\$1,920	
	Dismantle Building - Equipment	Cat 235	hrs	20	\$200	\$4,000	
	Remove septic tanks & clean line	Labour	hrs	24	\$45	\$1,080	
	Reslope, contour & bury	Cat D9H	hrs	48	\$210	\$10,080	
	Misc. Supplies & Tools	Misc.	I.s.			\$825	
	Scrap haul to landfill	Truck D250E	hrs	20	\$160	\$3,200	
	Subtotal:						\$47,385
3.7	Explosive Magazine						
	remove from site	Misc.	I.s.			\$2,500	
	Subtotal:						\$2,500
3.8	Miscellaneous Buildings & Structures						
	Remove salvageable equipment	General Labour	hrs	280	\$45	\$12,600	
		Trades Labour	hrs	280	\$60	\$16,800	
	Remove salvageable equipment	Hiab truck	hrs	280	\$75	\$21,000	
	Remove salvageable equipment	Cat 950 loader	hrs	280	\$120	\$33,600	
	Dismantle Building - Manpower	General Labour	hrs	280	\$45	\$12,600	
		Trades Labour	hrs	140	\$60	\$8,400	
	Dismantle Building - Equipment	Cat 235	hrs	40	\$200	\$8,000	
	Concrete Demolition	Cat 235	hrs	40	\$200	\$8,000	
	Reslope, contour & bury	Cat D9H	hrs	80	\$210	\$16,800	
	Misc. Supplies & Tools	Misc.	I.s.			\$2,750	
	Scrap haul to landfill	Truck D250E	hrs	40	\$160	\$6,400	
	Subtotal:						\$146,950
3.9	Industrial Reagents, Fuels & Waste						
	Industrial Reagents	Misc.	I.s.			\$16,500	
	Fuels	Misc.	I.s.			\$11,000	
	Wastes	Misc.	I.s.			\$11,000	
	Subtotal:						\$38,500
3.10	Spill Clean						
	Concentrator haul out	lump sum	I.s.			\$82,500	
	Other Building/Site spill clean up	lump sum	I.s.			\$82,500	
	Subtotal:						\$165,000
3.11	Demolition Overheads						
	Supervision	Supervision	hrs	1000	\$90	\$90,000	
	Mod/Demob	Misc.	I.s.			\$22,000	
	Office/Admin Costs	Misc.	I.s.			\$5,500	
	Subtotal:						\$117,500
3.12	Landfill						
	Design/build new landfill facility	Misc.	I.s.			\$50,000	
	Subtotal:						\$50,000
Total Estimated Cost in Infrastructure: Buildings, Structures and Services							\$1,031,785

Estimated Decommissioning Costs
Table 6-8 Land Reclamation & Revegetation - Scenario 1

Item No.	Work Item Description	Equipment/Labour	Units	Quantity	Unit Cost	Cost	Total Cost
4.0	LAND RECLAMATION & REVEGETATION						
4.1	Roads and Trails						
4.1.1	Exploration Trails						
	stabilize slopes - erosion barriers	Unit Cost Basis	per linear k	4	\$3,000	\$12,000	
	revegetate - seed	Unit Cost Basis	per kg	45.6	\$13.00	\$593	
	revegetate - fertilizer	Unit Cost Basis	per kg	420	\$1.00	\$420	
	application labour	General Labour	hrs	10	\$45.00	\$450	
	Subtotal:						\$13,463
4.1.2	Main Access Road						
	road barrier	Misc.	l.s.			\$3,300	
	culvert excavation	Cat 235	hrs	500	\$200	\$100,000	
	culvert removal	haul truck	hrs	500	\$100	\$50,000	
	scarify	Cat 16H grader	hrs	200	\$171	\$34,200	
	recontour slopes	D9H Dozer	hrs	200	\$210	\$42,000	
	stabilize slopes - erosion barriers	Unit Cost Basis	per linear k	5	\$3,000	\$15,000	
	revegetate - seed	Unit Cost Basis	per kg	2405	\$13.00	\$31,265	
	revegetate - fertilizer	Unit Cost Basis	per kg	14300	\$1.00	\$14,300	
	application cost	Unit Cost Basis	ha	65	\$1,458	\$94,770	
	Subtotal:						\$384,835
4.1.3	Service and Haul Roads within the Minesite						
	road barrier	Misc.	l.s.			\$3,300	
	culvert excavation	Cat 235	hrs	200	\$200	\$40,000	
	culvert removal	haul truck	hrs	200	\$100	\$20,000	
	scarify	Cat 16H grader	hrs	48	\$171	\$8,208	
	recontour slopes	D9H Dozer	hrs	60	\$210	\$12,600	
	stabilize slopes - erosion barriers	Unit Cost Basis	per linear k	3.5	\$3,000	\$10,500	
	revegetate - seed	Unit Cost Basis	per kg	608	\$13.00	\$7,904	
	revegetate - fertilizer	Unit Cost Basis	per kg	5600	\$1.00	\$5,600	
	application cost	Unit Cost Basis	ha	16	\$1,458	\$23,328	
	Subtotal:						\$131,440
4.2	Non-Linear Developments						
4.2.1	Tailings Management Facility						
	Cover installation - rock fill for base in wet areas (25% of 11.8 ha, 1 m depth)	Unit Cost Basis	cu.m	29,500	\$7	\$206,500	
	Cover installation - haul soil and spread (300 mm depth over entire area)	Unit Cost Basis	cu.m	35400	\$5	\$177,000	
	revegetate - seed	Unit Cost Basis	per kg	389.4	\$13.00	\$5,062	
	revegetate - fertilizer	Unit Cost Basis	per kg	4130	\$1.00	\$4,130	
	application cost	Unit Cost Basis	ha	11.8	\$1,458	\$17,204	
	Subtotal:						\$409,897
4.2.2	Reclaim Pond						
	pond clean up	Misc.	l.s.			\$11,000	
	Cover installation - rock fill for base in wet areas (25% of 4 ha, 1 m depth)			10000	\$7	\$70,000	
	Cover installation - haul soil and spread (300mm cover on rock cover area)			3000	\$5	\$15,000	
	revegetate - seed	Unit Cost Basis	per kg	66	\$13.00	\$858	
	revegetate - fertilizer	Unit Cost Basis	per kg	700	\$1.00	\$700	
	application cost	Unit Cost Basis	ha	4	\$1,458	\$5,832	
	Subtotal:						\$103,390
4.2.3	Waste Dumps						
	application labour	General Labour	man hours	16	\$45	\$720	
	Subtotal:						\$720
4.2.4	Sediment Ponds						
	Jewel Box sediment pond - recontour and slope	Cat 235	hrs	12	\$200	\$2,400	
	Main Zone sediment pond - recontour and slope	Cat 235	hrs	6	\$200	\$1,200	
	Sediment Pond solids haul	Truck D250E	hrs	20	\$160	\$3,200	
	Burnick sediment pond - recontour and slope	Cat 235	hrs	10	\$200	\$2,000	
	Burnick sediment revegetate - seed	Unit Cost Basis	per kg	6.6	\$13.00	\$86	
	Burnick sediment revegetate - fertilizer	Unit Cost Basis	per kg	70	\$1.00	\$70	
	application labour	General Labour	man hours	40	\$45	\$1,800	
	Subtotal:						\$10,756
4.2.5	Disturbed Sites (incl. Mill), Refuse Areas and Borrow Pits						
	recontour refuse area	D9H Dozer	hrs	50	\$210	\$10,500	
	bury refuse areas	D9H Dozer	hrs	50	\$210	\$10,500	
	revegetate - seed	Unit Cost Basis	per kg	231	\$13.00	\$3,003	
	revegetate - fertilizer	Unit Cost Basis	per kg	2450	\$1.00	\$2,450	
	application cost	Unit Cost Basis	ha	7	\$1,458	\$10,206	
	Subtotal:						\$36,659
Total Estimated Cost in Land Reclamation and Revegetation							\$1,138,574

Estimated Decommissioning Costs
Table 6-9 Land Reclamation & Revegetation - Scenario 2

Item No.	Work Item Description	Equipment/Labour	Units	Quantity	Unit Cost	Cost	Total Cost
4.0	LAND RECLAMATION & REVEGETATION						
4.1	Roads and Trails						
4.1.1	Exploration Trails						
	stabilize slopes - erosion barriers	unit rate basis	per lineal	4	\$3,000	\$12,000	
	revegetate - seed	unit rate basis	per kg	45.6	\$13.00	\$593	
	revegetate - fertilizer	unit rate basis	per kg	420	\$1.00	\$420	
	application labour	general labour	man hou	10	\$45.00	\$450	
	Subtotal:						\$13,463
4.1.2	Main Access Road						
	road barrier	misc.	l.s.			\$3,300	
	culvert excavation	Cat 235	hrs	500	\$200	\$100,000	
	culvert removal	haul truck	hrs	500	\$100	\$50,000	
	scarify	Cat 16H grader	hrs	200	\$171	\$34,200	
	recontour slopes	D9H Dozer	hrs	200	\$210	\$42,000	
	stabilize slopes - erosion barriers	unit rate basis	per lineal	5	\$3,000	\$15,000	
	revegetate - seed	unit rate basis	per kg	2405	\$13.00	\$31,265	
	revegetate - fertilizer	unit rate basis	per kg	14300	\$1.00	\$14,300	
	aplication cost	unit rate basis	ha	65	\$1,458	\$94,770	
	Subtotal:						\$384,835
4.1.3	Service and Haul Roads within the Minesite						
	road barrier	misc.	l.s.			\$3,300	
	culvert excavation	Cat 235	hrs	200	\$200	\$40,000	
	culvert removal	haul truck	hrs	200	\$100	\$20,000	
	scarify	Cat 16H grader	hrs	48	\$171	\$8,208	
	recontour slopes	D9H Dozer	hrs	60	\$210	\$12,600	
	stabilize slopes - erosion barriers	unit rate basis	per lineal	3.5	\$3,000	\$10,500	
	revegetate - seed	unit rate basis	per kg	608	\$13.00	\$7,904	
	revegetate - fertilizer	unit rate basis	per kg	5600	\$1.00	\$5,600	
	application cost	unit rate basis	ha	16	\$1,458	\$23,328	
	Subtotal:						\$131,440
4.2	Non-Linear Developments						
4.2.1	Tailings Management Facility						
	Cover installation - rock fill for base in wet areas (1 m depth for 25% of 22 ha)	unit rate basis	cu.m	55000	\$7	\$385,000	
	Cover installation - haul soil and spread (300 mm depth for 22 ha)	unit rate basis	cu.m	66000	\$5	\$330,000	
	revegetate - seed	unit rate basis	per kg	726	\$13.00	\$9,438	
	revegetate - fertilizer	unit rate basis	per kg	7700	\$1.00	\$7,700	
	application cost	unit rate basis	ha	22	\$1,458	\$32,076	
	Subtotal:						\$764,214
4.2.2	Reclaim Pond						
	pond clean up	misc.	l.s.			\$60,000	
	Rock fill for soft areas (1 m depth for 25% of 4 ha)	unit rate basis	cu.m	10000	\$7	\$70,000	
	Cover installation (on rock filled areas) - haul soil and spread	unit rate basis	cu.m	3000	\$5	\$15,000	
	revegetate - seed	unit rate basis	per kg	66	\$13.00	\$858	
	revegetate - fertilizer	unit rate basis	per kg	700	\$1.00	\$700	
	application cost	unit rate basis	ha	4	\$1,458	\$5,832	
	Subtotal:						\$152,390
4.2.3	Waste Dumps						
	application labour	general labour	man hou	16	\$45.00	\$720	
	Subtotal:						\$720
4.2.4	Sediment Ponds						
	Jewel Box sediment pond - recontour and slope	Cat 235	hrs	12	\$200	\$2,400	
	Main Zone sediment pond - recontour and slope	Cat 235	hrs	6	\$200	\$1,200	
	Sediment Pond solids haul	Truck D250E	hrs	20	\$160	\$3,200	
	Burnick sediment pond - recontour and slope	Cat 235	hrs	10	\$200	\$2,000	
	Burnick sediment revegetate - seed	unit rate basis	per kg	6.6	\$13.00	\$86	
	Burnick sediment revegetate - fertilizer	unit rate basis	per kg	70	\$1.00	\$70	
	application labour	general labour	man hou	40	\$45.00	\$1,800	
	Subtotal:						\$10,756
4.2.5	Disturbed Sites, Refuse Areas and Borrow Pits						
	recontour refuse area	D9H Dozer	hrs	50	\$210	\$10,500	
	bury refuse areas	D9H Dozer	hrs	50	\$210	\$10,500	
	revegetate - seed	unit rate basis	per kg	231	\$13.00	\$3,003	
	revegetate - fertilizer	unit rate basis	per kg	2450	\$1.00	\$2,450	
	application cost	unit rate basis	ha	7	\$1,458	\$10,206	
	Subtotal:						\$36,659
Total Estimated Cost in Land Reclamation and Revegetation							\$1,541,891

Estimated Decommissioning Costs
Table 6-10 Post Closure Site Management

Item No.	Work Item Description	Equipment/Labour	Units	Quantity	Unit Cost	Cost	Total Cost
5.0	POST CLOSURE SITE MANAGEMENT						
5.1	Organization, Site Access & Security, Overhead Costs						
	Pre-Closure Planning/Organizing	Management	monthly	2	\$9,700	\$19,400	
	Project Manager	Management	monthly	21	\$9,700	\$203,700	
	Camp Cost	Labour	monthly	4500	\$110	\$495,000	
	Site Security, Routine Water Sampling Till end to Year 3 of Post Closure	Labour	monthly	30	\$6,100	\$183,000	
	Pre-Closure Site Environmental Assessment	Contract	l.s.	1		\$82,500	
	Post-Closure Environmental Cleanup Confirmation Assessment	Contract	ls	1		\$55,000	
	Main Access Road Maintenance	Misc.	per year	3	\$55,000	\$165,000	
	Vehicles for Security & Manager	Light trucks	months	51	\$2,200	\$112,200	
	Misc. Office/Supply/Misc. Costs	Misc.	per year	3	\$1,650	\$4,950	
	Subtotal:						\$1,301,350
5.2	Supervision and Documentation of Work						
	Site environmental monitoring, reporting, documentation	Man hours	monthly	15	\$5,000	\$75,000	
	Document Reviews/Storage	Misc.	ls	1		\$5,500	
	Final as built plan	Man hours	hrs	120	\$130	\$15,600	
	Subtotal:						\$96,100
5.3	Compliance Monitoring and Reporting						
	Water Quality Monitoring - During Closure implementation - analytical	Misc.	l.s.			\$64,900	
	Water Quality Monitoring - During Closure implementation - Heli	Misc.	l.s.			\$18,480	
	Water Quality Monitoring - Post Closure - Analytical/Collection	Misc.	l.s.			\$76,560	
	Water Quality Monitoring - Post Closure - Heli/Travel	Misc.	l.s.			\$77,880	
	Geotechnical Inspection - During Closure implementation	Misc.	years	3	\$13,200	\$39,600	
	Geotechnical Inspection - Post closure	Misc.	years	5	\$13,200	\$66,000	
	Biological Monitoring - Professional fees - Closure implementation	Misc.	per event	1	\$11,000	\$11,000	
	Biological Monitoring - Helicopter & Lab Analysis - implementation	Misc.	per event	1	\$6,050	\$6,050	
	Biological Monitoring - Professional fees - Post closure	Misc.	per event	3	\$11,000	\$33,000	
	Biological Monitoring - Helicopter & Lab Analysis - Post closure	Misc.	per event	3	\$6,050	\$18,150	
	Subtotal:						\$411,620
5.4	Post Closure Maintenance						
	Misc. Maintenance work related to the site after closure	Misc.	per year	5	\$5,500	\$ 27,500	
	Subtotal:						\$27,500
Total Estimated Cost in Post Closure Site Management							\$1,836,570

7.0 FINANCIAL SECURITY

7.1 WATER LICENSE REQUIREMENTS

The financial security called for in Water License QZ99-045 is set out in Part B – Security, as follows:

“18. Within 30 days of the effective date of this License, the Licensee shall provide security in addition to that already in place to increase the total amount to five million, thirty-two thousand dollars. (\$5,032,000.) The Licensee shall provide additional security, as follows:

- (a) sixty-six thousand dollars (\$66,000) within thirty (30) days of the start of commercial production,*
- (b) an additional one hundred and forty-four thousand dollars (\$144,000) no less than one year after the start of commercial production;*
- (c) an additional one hundred and forty-three thousand dollars (\$143,000) no less than two years after the start of commercial production; and*
- (d) an additional one hundred and forty thousand dollars (\$140,000) no less than three years after the start of commercial production.*

7.2 UPDATED FINANCIAL SECURITY

No Change to the February 2000 DDRP.

7.3 RETURN OF FINANCIAL SECURITY

It is Teck Cominco's anticipation that the company will follow the Government of Yukon's Reclamation Policy and Guidelines with respect to the return of financial security.

8.0 REFERENCES

Table 1-1, in Section 1, provides a complete list of documents and reports that were reviewed in updating of the February 2000 Detailed Decommissioning and Reclamation Plan for Sä Dena Hes Mine. The following references have been added to the 2000 reference list:

Steffen Robertson and Kirsten (Canada) Inc. (SRK), 2000. “ *Geochemical Studies Sä Dena Hes Mine, November 2000.*” Report 1CC005.06.

Steffen Robertson and Kirsten (Canada) Inc. (SRK), 2002. “ *Geochemical Reports Sä Dena Hes Mine, March 2003.*” Report 1CT008.000.

Steffen Robertson and Kirsten (Canada) Inc. (SRK), “*Sä Dena Hes Mine Water Quality and Loading Re-Assessment. January 2005.*” Report 1CT006.008.

Teck Cominco Ltd. 2001. “*Sä Dena Hes, 2000 Annual Report, Yukon Water Licence QZ97-025.*”

Teck Cominco Ltd. 2002. “*Sä Dena Hes, 2001 Annual Report, Yukon Water Licence QZ97-025.*”

Teck Cominco Ltd. 2003. “*Sä Dena Hes, 2002 Annual Report, Yukon Water Licence QZ99-045.*”

Teck Cominco Ltd. 2003. “*Sä Dena Hes Mine 2003 Dam Safety Review.*” November 2003. Report M09171 A01.500. Prepared by Klohn Crippen Consultants Ltd.

Teck Cominco Ltd. 2004. “*Sä Dena Hes, 2003 Annual Report, Yukon Water Licence QZ99-045.*”

Teck Cominco Ltd., 2004. “*Environmental Emergency Response & Procedures Plan.*” Sä Dena Hes Mine, Yukon Territory. Prepared by Access Consulting Group.

Teck Cominco Ltd. 2005. *“Temporary Closure Site Status Report as of January 2005.”* Sä Dena Hes

Teck Cominco Ltd. 2005. “Sä Dena Hes, 2004 Annual Report, Yukon Water Licence QZ99-045.”

UPDATES TO APPENDIX A – TECK COMINCO CORPORATE ENVIRONMENTAL POLICY

Teck Cominco Limited and its subsidiary and associated companies (“Teck Cominco”) are committed to sound and responsible business practices in every aspect of its activities. Teck Cominco’s operating practices are governed by the principles set out in the company’s Charter of Corporate Responsibility and the standards set out in the company’s Code of Business, Environmental and Health and Safety Practices.

(see <http://www.teckcominco.com/sustainability/>).

Teck Cominco is committed to conducting its activities in a sustainable manner that:

- Generates wealth for the benefit of its shareholders, employees, governments and society at large;
- Creates products that society needs and values;
- Contributes to the well-being of communities directly impacted by our operations; and
- Operates responsibly in protecting the environment, applying fair hiring and employment practices, and reporting fully on all results.

Key excerpts from Teck Cominco’s Code of Business, Environmental, and Health and Safety Practices related to environmental practices are:

- Teck Cominco will conduct its operations in a sound environmental manner, seeking to continually improve its performance and incorporate policies for pollution prevention and waste minimization into its daily action.
- Conduct regular environmental, health, safety and emergency preparedness audits and identify and resolve all shortcomings.
- Continually improve its environmental, health and safety management systems, policies and controls, ensuring that these are fully integrated into each operation’s business plan.
- Include closure and reclamation plans as a critical component of all development projects. Undertake progressive reclamation at operating mines and reclaim dormant sites to ensure long-term protection of the environment.
- Encourage the safe use, reuse and recycling of its products.

- Support and conduct research to improve environmental, health and safety performance at its operations and to enhance its products for the economic, social and environmental benefit of people everywhere.

UPDATES TO APPENDIX B

ENVIRONMENTAL BASELINE UPDATE AND TECHNICAL BASIS FOR CLOSURE ASSUMPTIONS

1.0 GEOLOGY AND ORE RESERVES

No Changes to February 2000 DDRP.

2.0 CLIMATE

2.2 CLIMATOLOGICAL DATA SOURCES

The climate of the minesite was first characterized in 1990 during the permitting stage of the mine development. An update was prepared in 1999 in support of the 2000 DDRP. In both cases, the source of data was exclusively regional climate stations and snow courses. In 2002, Access Mining Consultants established a weather station at the mill site to monitor rainfall intensity, air temperature and humidity. The data collected at this station will be used to validate estimates of climatic parameters made using the regional data.

2.3 Precipitation Correction for NWT and Yukon

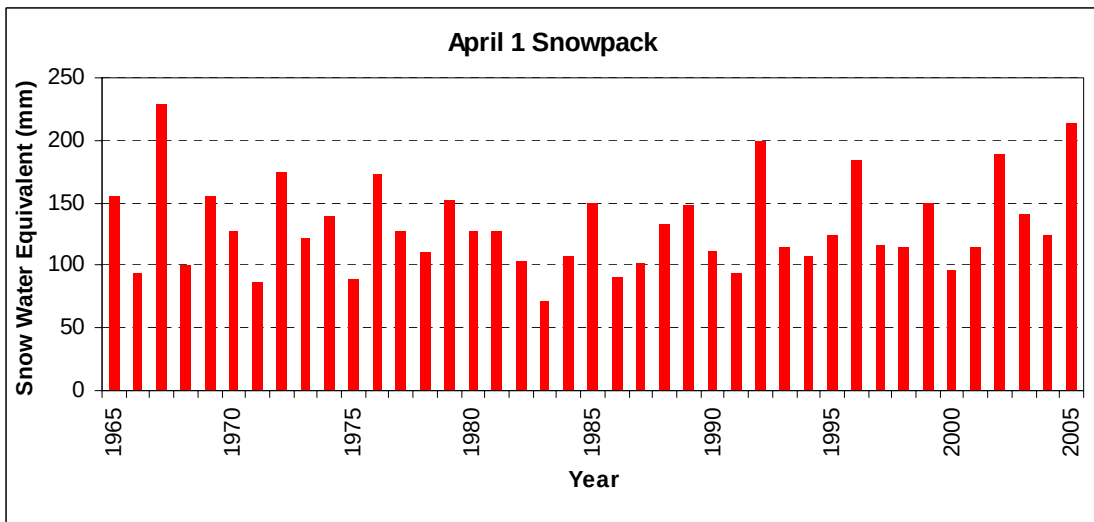
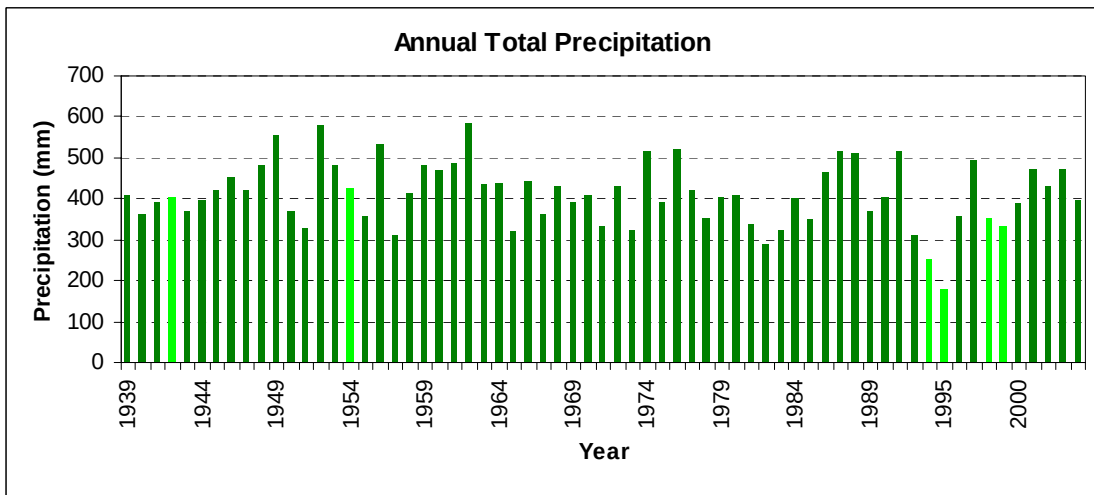
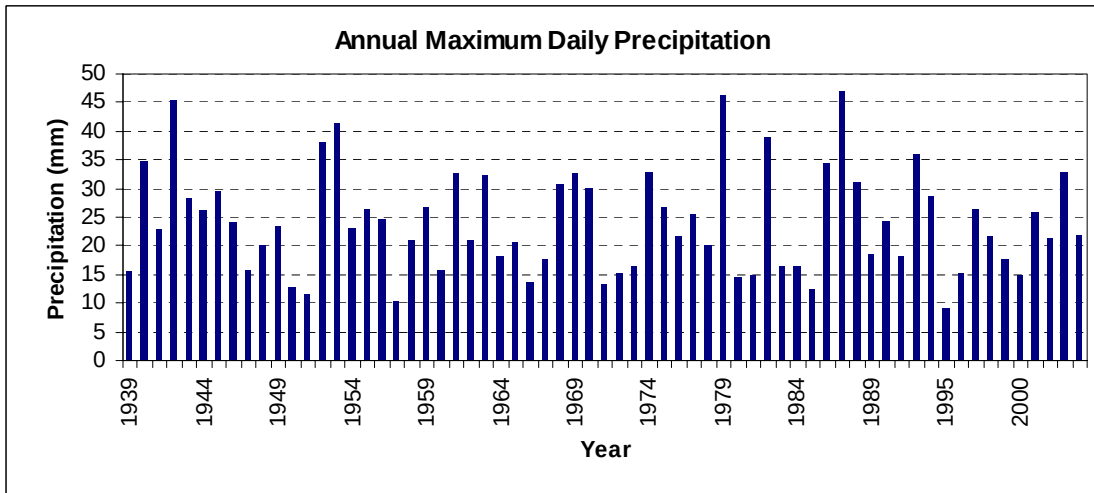
When the climate of the mine was re-assessed in 1999 for the closure plan, the data for the regional stations were available up to about 1997. The available database is now eight years longer. Teck Cominco has reviewed the recent data and updated the plan where applicable.

Figure 1 shows the annual series for three measurements of precipitation at the Watson Lake Airport. The top plot on this figure shows the annual maximum daily precipitation from 1939 to 2004. The middle plot presents the annual total precipitation for the same period. Finally, the

bottom plot presents the water content of the snowpack on April 1 of each year from 1965 to 2005.

Examination of these plots show that no increased trend in precipitation has occurred in the last eight years. Furthermore, the period 1998 to 2005 did not result in any new record highs. The snowpack in 2005 was high but was exceeded by an event in 1967. The maximum daily precipitation in the period January 1998 to September 2005 was 37.2 mm, which is significantly less than the record event of 47 mm that occurred in 1987.

The climate records for Watson Lake Airport suggest the addition of the last eight years worth of data would not substantively change the assessment made of the minesite climate in 1999.



2.4 Precipitation Estimate

The mean annual precipitation (MAP) at the tailings impoundment is estimated to be 690 mm. This is about 1.67 times as much precipitation as measured at the Watson Lake Airport.

The rainfall data collected at the mine site were used as a partial validation of the minesite MAP. The tipping bucket was operated in the summers of 2002 and 2005. No data were collected in the intervening years due to an instrumentation malfunction. A summary of the data collected by the tipping bucket is presented in Table 1, together with the coincidental data measured at the Watson Lake Airport. These data indicate that the mine receives about 1.14 to 1.19 times more precipitation than Watson Lake during the summer months, which is far less than the 1.67 times expected when the annual totals at the two sites are compared.

The small difference between the summer precipitation at the minesite and Watson Lake Airport was expected because orographic effects tend to be less important during warmer weather. To get an indication of the orographic effects in the winter, a comparison was made of snowpack levels between high and low elevation snow courses. Table 2 shows the average water contents of the March 1 and April 1 snowpacks at the Pine Lake Airstrip and the Watson Lake Airport. The former station is located at a similar elevation as the minesite and probably provides a reasonable approximation of the snowpack conditions at the minesite. Figure 2-4 of Appendix B provides evidence to suggest that a regional snow course can be used to accurately approximate conditions at the minesite. This figure shows that there are two other snow courses in the region with similar elevations as the minesite, and both experience comparable, but less, snowpacks than the Pine Lake Airstrip. The snowpack at the Pine Lake Airstrip is some 1.6 to 1.7 times larger than what develops at the Watson Lake Airport.

Taken together, the information provided in Tables 1 and 2 suggest that the adopted estimate of MAP for the minesite may be conservative (i.e., overestimate the true MAP). On an annual basis, the ratio between the minesite and Watson Lake MAPs would be expected to lie intermediate to the multiplier for the summer months (1.14 to 1.19) and the one for the winter months (1.6 to 1.7). Such an intermediate value would be less than the multiplier that has been adopted (i.e., 1.67). To retain some conservatism, no change is proposed to the adopted MAP value for the minesite.

Table 1 Coincidental Precipitation at Minesite and Watson Lake

Period of Overlap	Total Precipitation over Period of Overlap (mm)		Ratio: Minesite to Watson Lake Precipitation
	Minesite	Watson Lake	
June 20 to 30, 2002	3.6	7.5	0.48
July 2002	110.8	119.7	0.93
August 1 to 28, 2002	118.8	77.4	1.53
June 20 to August 28, 2002	233.2	204.6	1.14
May 16 to 31, 2005	50.4	57.5	0.88
June 2005	74	61.8	1.20
July 2005	66	61.8	1.07
August 2005	37.6	31.2	1.21
September 2005	53.4	38.4	1.39
October 1 to 24, 2005	24.6	n/a	n/a
May 17 to September 30, 2005	254.3	213.5	1.19

Table 2 Comparison of Average Snowpacks at Pine Lake Airstrip and Watson Lake

Date of Measurement	Average Snow Water Equivalent (mm)		Ratio: Pine Lake to Watson Lake Snowpack
	Pine Lake Airstrip	Watson Lake Airport	
March 1	198	125	1.58
April 1	224	131	1.72

Note: Averages are for period 1976 to 2005

2.6 Temperature Estimate

The temperature data collected at the mill site weather station will be used to check the estimates of temperature derived from regional data. This analysis is not yet complete.

3.0 WATER RESOURCES

3.1 SURFACE WATER HYDROLOGY

3.1.2 Available Data

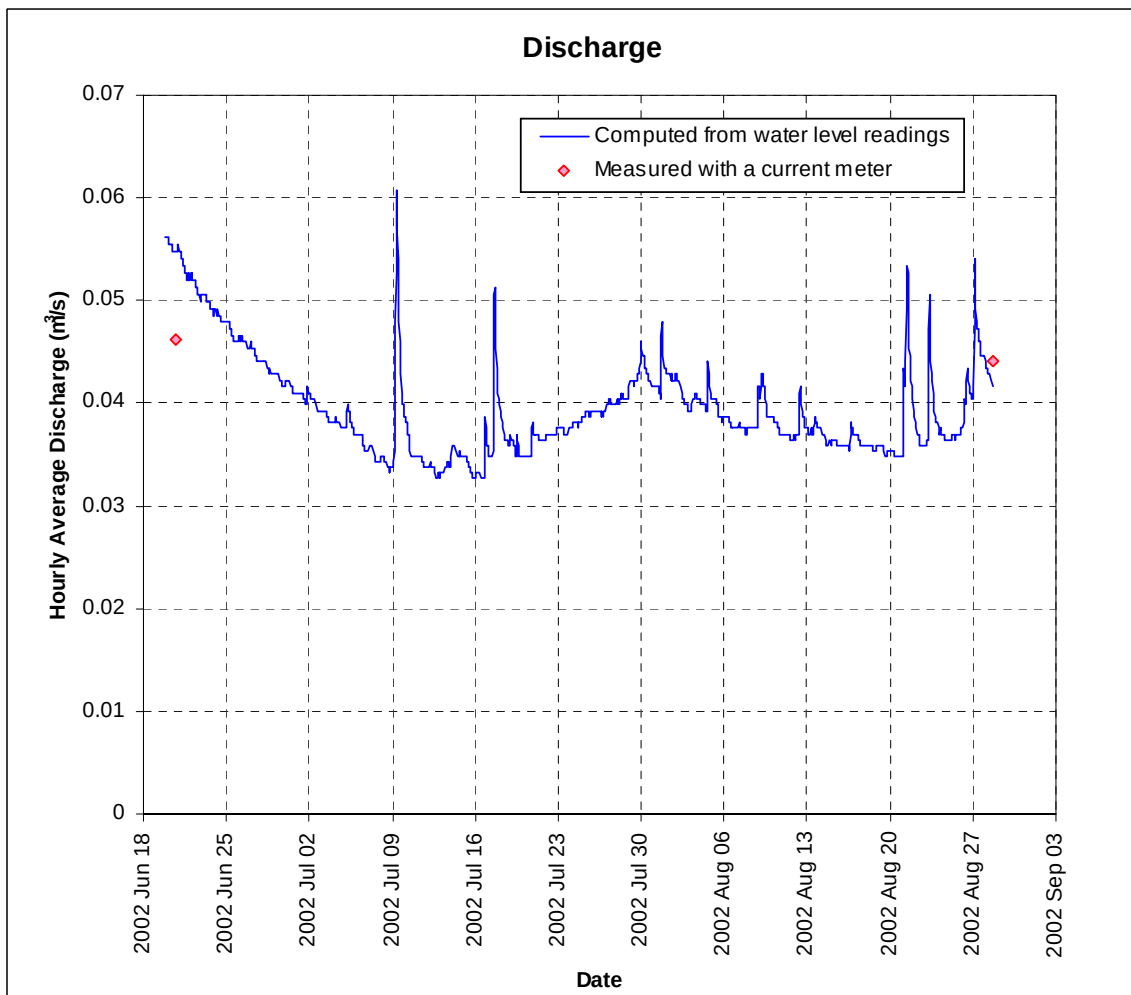
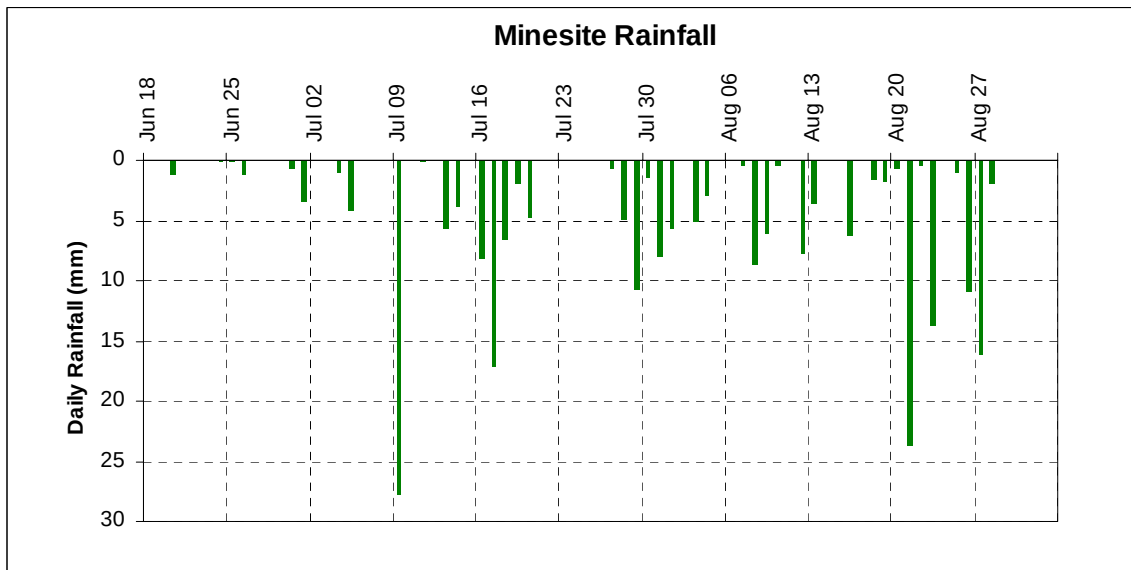
As was done for the climate analysis, the hydrology of the minesite was first characterized in 1990 as part of the mine's permitting studies. The hydrology was then updated in 1999 to support preparation of the 2000 DRP. In both cases, the hydrology was estimated using a mix of site-specific and regional data. At the point of updating the hydrology in 1999, no automated streamflow gauging stations had been operated at the minesite. The site-specific data largely comprised spot measurements made by a current meter.

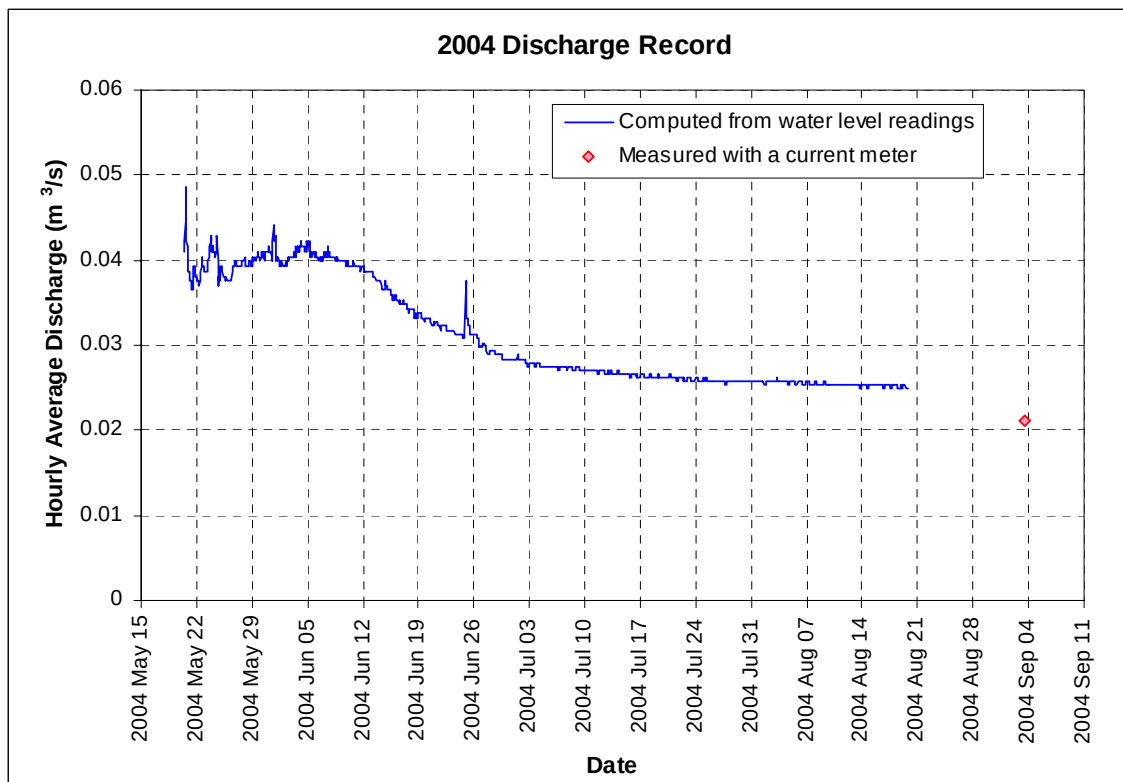
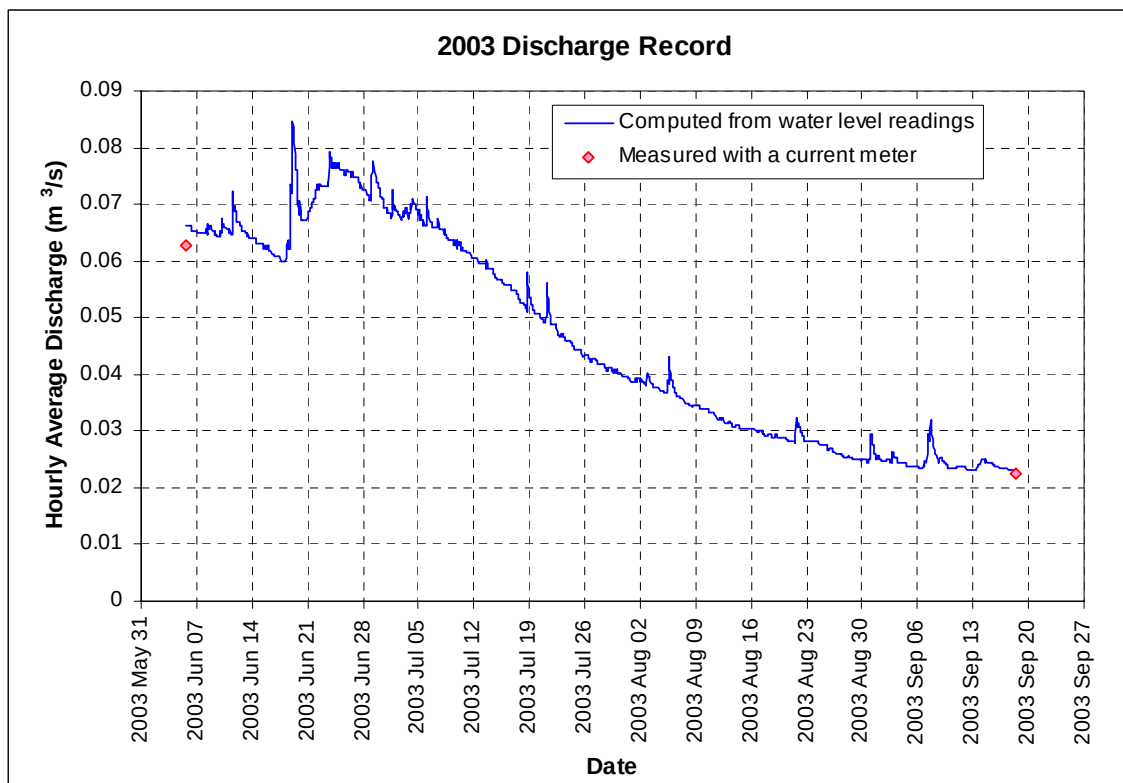
In 2002, Access Mining Consultants established an automated water level recorder in the Camp Creek Diversion upstream of the spillway from the Reclaim Pond. The station has now been operated for four open water seasons. A total of 12 direct flow measurements have been made at the station with a current meter.

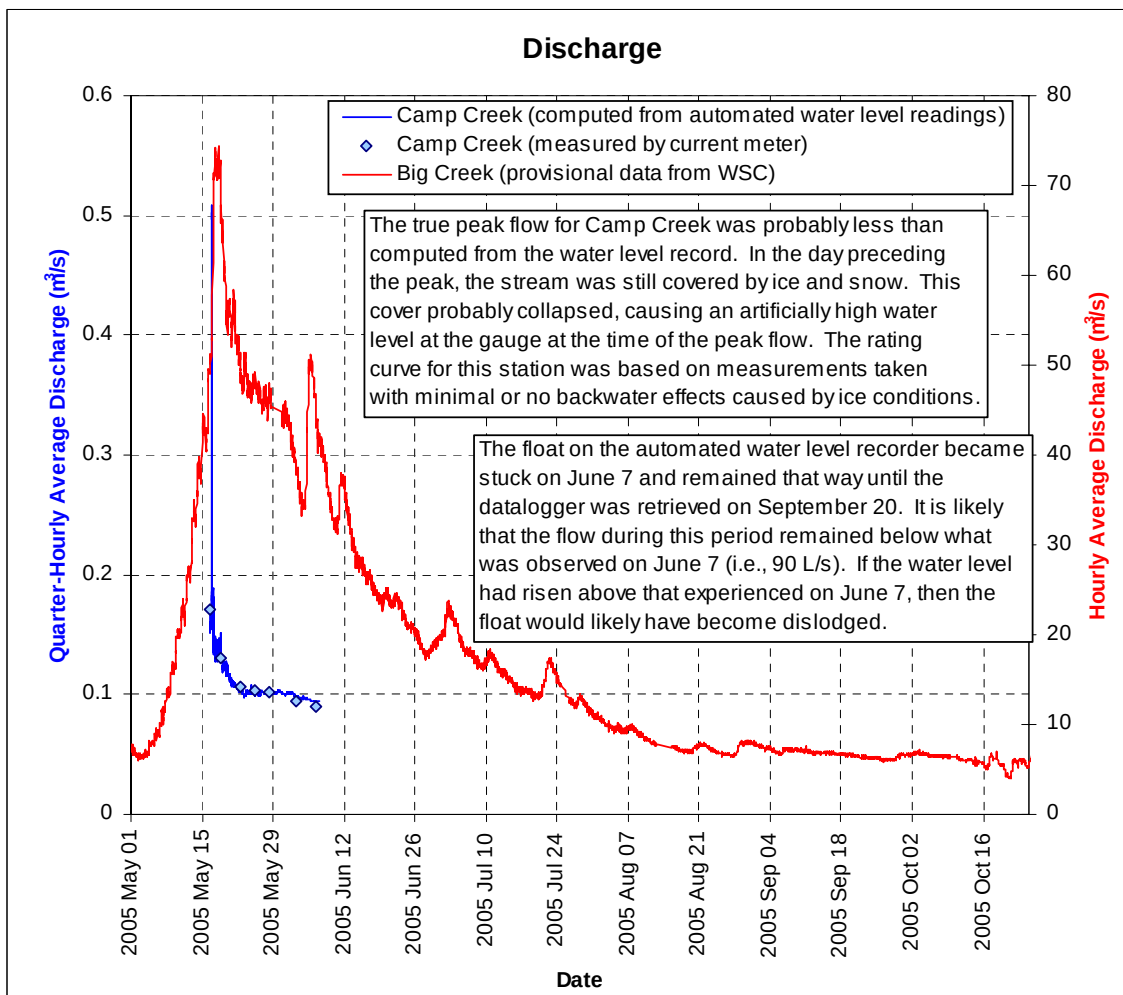
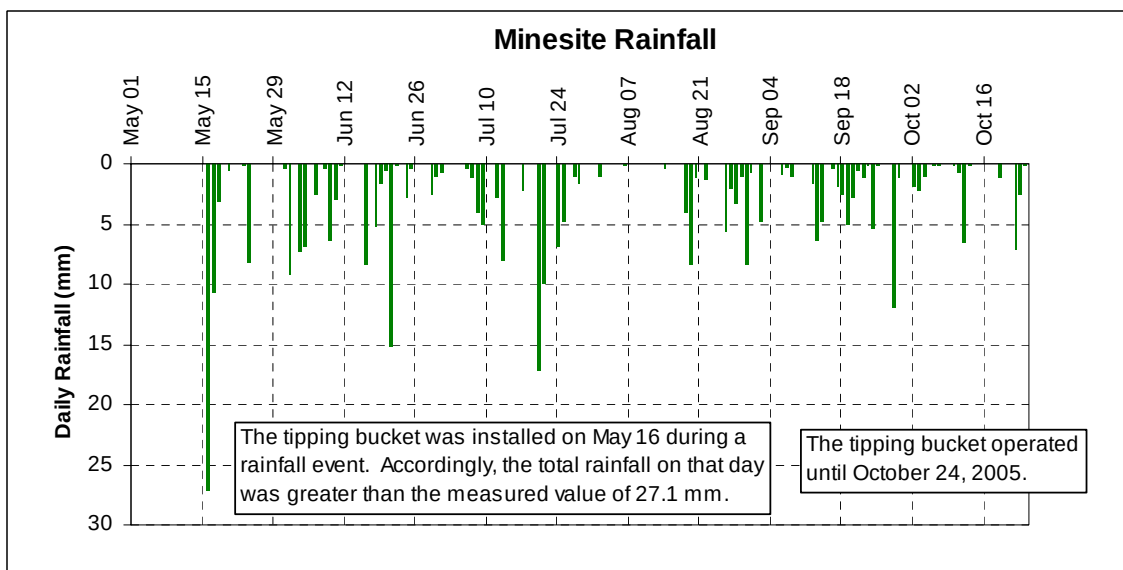
The flows collected at this station from 2002 to 2005 are presented in Figures 2 to 4. The corresponding daily rainfall records collected at the mill site, where available, are also shown on these figures.

The flow hydrographs for Camp Creek have one distinctive feature: they are very subdued. This suggests that the groundwater contribution to streamflow is very large. Large rainfalls (e.g., see July 9, 2002 event on Figure 2) appear to cause only minor increases in flow in Camp Creek. The groundwater-dominated nature of the hydrology may, at least partly, be a result of the limestone geology within the stream's catchment.

The annual peak was probably missed in the first two years of record and may have also been missed in 2004. However, it is very likely that the 2005 peak was measured, as evidenced by the streamflow record of a regional streamflow gauging station (Big Creek). This regional station experienced its annual peak just days after the peak was observed in Camp Creek (see Figure 4).







The 2005 peak flow for Camp Creek is shown on Figure 4 to be about 0.5 m³/s. However, it is strongly suspected that the true discharge was less than this value. On the day preceding the occurrence of the peak, the stream was largely covered by ice and snow. This cover probably collapsed into the stream, temporarily causing an artificially high water level. The shape of the water level record exhibits abrupt increases and decreases in stream depth just prior to and following the apparent peak in discharge, which suggests the stream channel was temporarily dammed by ice and snow. Further discussion of the Camp Creek flow data is given in Section 3.1.5.

3.1.3 Average Flow Estimates

The data collected at the Camp Creek gauging station will be used to check the original estimates of mean annual runoff at the minesite. This analysis is not yet complete.

3.1.5 Flood Estimates

The flood analysis contained in the 2000 DDRP provided design flood estimates for the permanent closure of the Sa Dena Hes mine. For this scenario, it was only necessary to provide estimates of the instantaneous peak of various flood events. Details on the volumes of water associated with these flood events were unimportant because there was no plan to rely on storages to reduce flood size. For example, under permanent closure status, the Reclaim Dam would be breached, thus eliminating any potential flood-reducing benefit of this structure. In addition, the TFM would be provided with an open channel spillway of large capacity, again reducing the potential for any reduction of flood peaks by storage.

As a consequence of the 2003 Dam Safety Review report, Teck Cominco initiated a study to determine whether the TMF and the Reclaim Dam have the capacity to deal with the 1000-year flood during the temporary closure status. A study was conducted to determine if the current spillway at the TMF (comprising two 900 mm culverts) and the road crossing of the Camp Creek Diversion (comprising two 1200 mm culverts) could accommodate the 1000-year flood. In performing the study, it was recognized that storages within the TMF and the Reclaim Pond would probably have to be relied upon to temporarily store a portion of the incoming flood

waters so that the capacities of the culverts would not be exceeded during passage of the extreme flood event.

The flood estimation techniques provided in the 2000 DRP only provide estimates of the instantaneous peak of the flood hydrograph. To examine the effects of storage on flood magnitude it was necessary to turn to a rainfall/runoff model that simulates the full flood hydrograph and that provides flood routing capabilities. The model selected for this purpose was developed by the U.S. Corps of Engineers and is known as HEC-HMS.

Figure 5 shows the results of applying the HEC-HMS model to the TMF. Key assumptions of the modeling are:

- The 1000-year flood would be generated by an intense thunderstorm (1000-year, 24-hour total rainfall = 81 mm) falling on a ripe snowpack that, in the days preceding the storm, was melting at a high rate (20 mm/d);
- The spillway would be comprised of the existing two 900 mm culverts;
- All interceptor ditches around the TMF would fail, allowing the full catchment runoff to enter the impoundment; and
- The culverts would be flowing prior to the arrival of the storm, so that storage below the invert level of the culverts would not be available to store a portion of the incoming flood hydrograph.

The instantaneous peak of the incoming flood hydrograph was estimated to be 5.4 m³/s. The combined outflow through the two culverts would peak at 1.6 m³/s, or 30% of the incoming flood peak. During passage of the flood, a volume of 53,000 m³ of water would be temporarily stored within the TMF. The water level in the TMF would peak at an elevation of 1094.9 m, which is roughly at the crown level of the two culverts.

Figure 6 shows the simulated flood hydrology for the two culverts at the road crossing of the Camp Creek Diversion. Key assumptions of the modeling are:

- The 1000-year flood would be generated by the same conditions outlined above for the TMF;

- The interceptor ditches around the TMF would function in such a way as to maximize the peak flow of water to the Camp Creek Diversion (i.e., the West Interceptor Ditch would survive but one of the East Interceptor Ditches would develop a breach and empty into the Reclaim Pond); and
- The TMF spillway and the Reclaim Pond spillway would both be flowing prior to the arrival of the storm so that storage below the crests of these spillways would not be available to store a portion of the incoming floodwaters.

The instantaneous peak of the hydrograph generated by the Camp Creek catchment would be $12.7 \text{ m}^3/\text{s}$, including outflows from the TMF. The combined outflow through the two culverts at the road crossing would be an estimated $6.0 \text{ m}^3/\text{s}$, or roughly half the peak of the incoming flood. In passing this flood, some $66,000 \text{ m}^3$ of water would be temporarily stored in the Reclaim Pond. Another $36,000 \text{ m}^3$ would be stored in the TMF. The water level would rise to 1081.1 m behind the Reclaim Dam, leaving a freeboard of about 0.9 m below the dam's crest.

In addition to examining the flood hydrology of the mine during the temporary closure status, HEC-HMS was used to provide additional estimates of flood magnitude for the permanent closure status. Figure 7 shows the estimated 1000-year flood that would have to be conveyed by the permanent spillway for the TMF. The situation is identical to the conditions modeled in Figure 5 except it was assumed that no storage attenuation would occur within the TMF. Thus, the peak of the outflow hydrograph is identical to the peak of the inflow hydrograph, or $5.4 \text{ m}^3/\text{s}$.

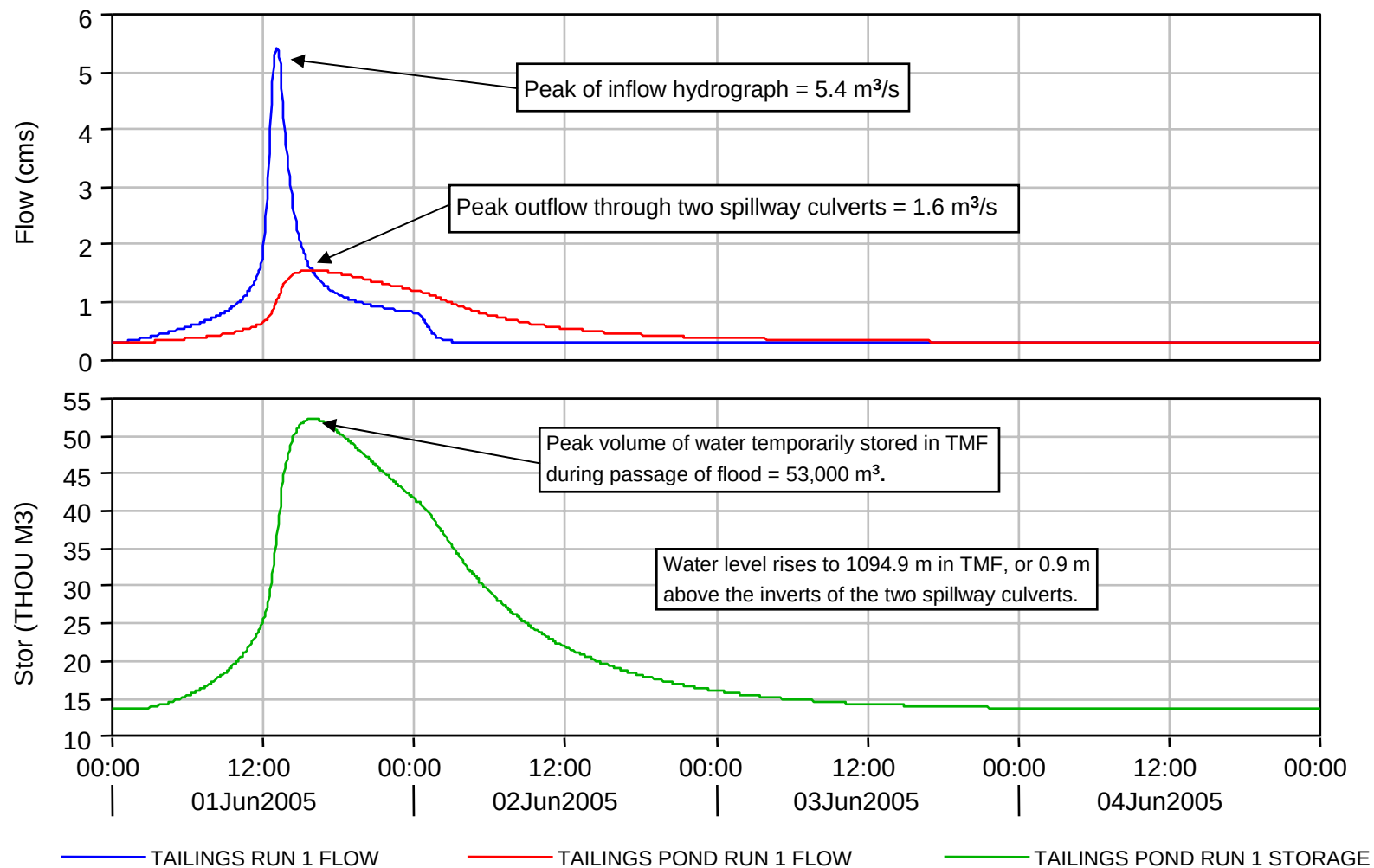
Figure 8 shows the estimated 1000-year flood for the proposed breach in the Reclaim Dam. Without the benefit of storage within either the Reclaim Pond or the TMF, the flood peaks at an estimated $15.6 \text{ m}^3/\text{s}$.

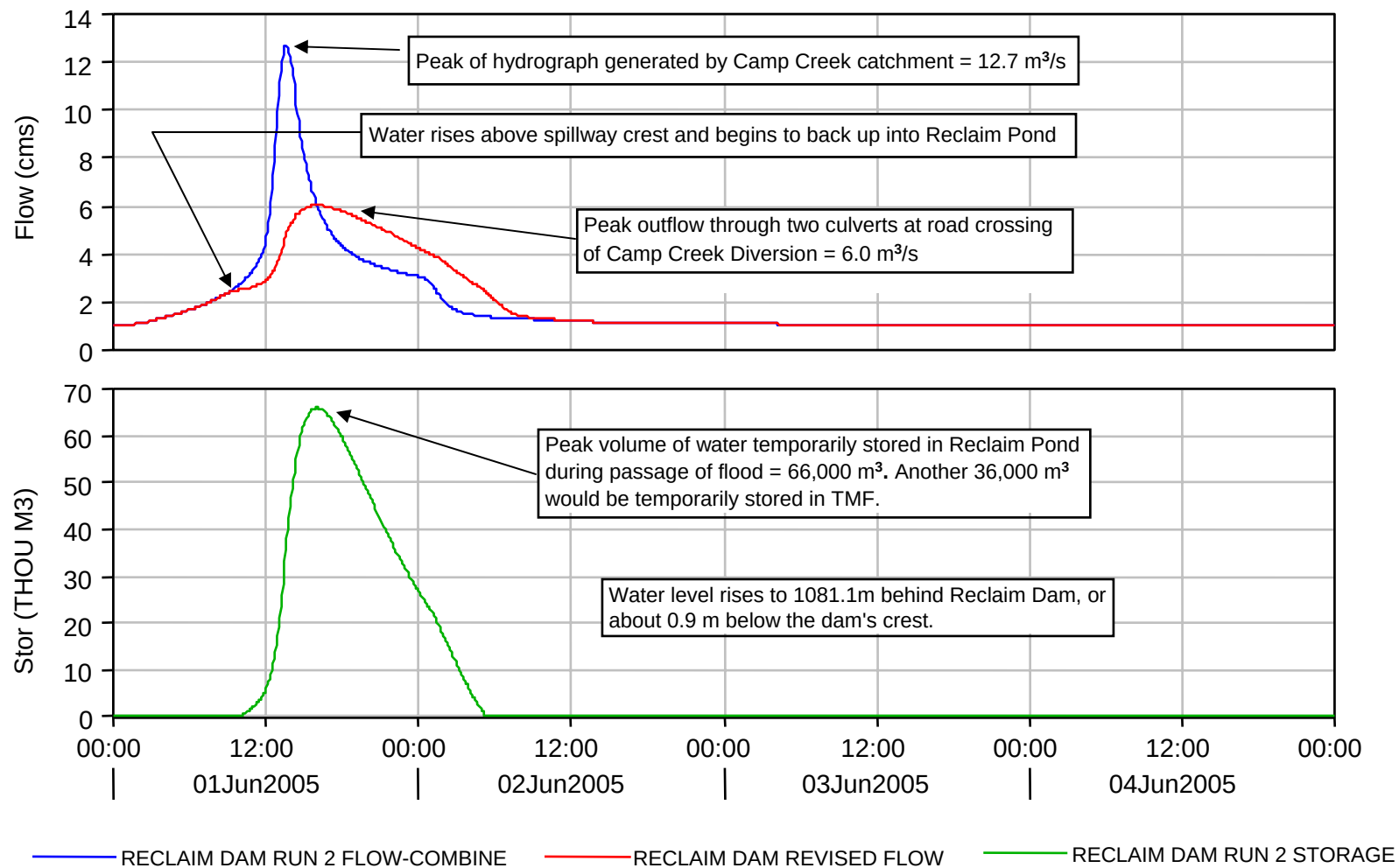
The simulated flood peaks in Figures 5 to 8 were checked for reasonableness by comparing them against maximum observed floods in the Yukon. Figure 9 presents the maximum observed floods at all government-operated streamflow gauging stations within the territory (87 operated by the Water Survey of Canada and 97 by Environment Yukon.) To facilitate comparison of the flood values from the widely different drainage areas, the flood magnitudes have been normalized (i.e., the absolute flood value has been divided by the contributing drainage area). Examination of Figure 9 reveals that none of the floods in the Yukon have attained a unit discharge greater than $1.0 \text{ m}^3/\text{s}/\text{km}^2$.

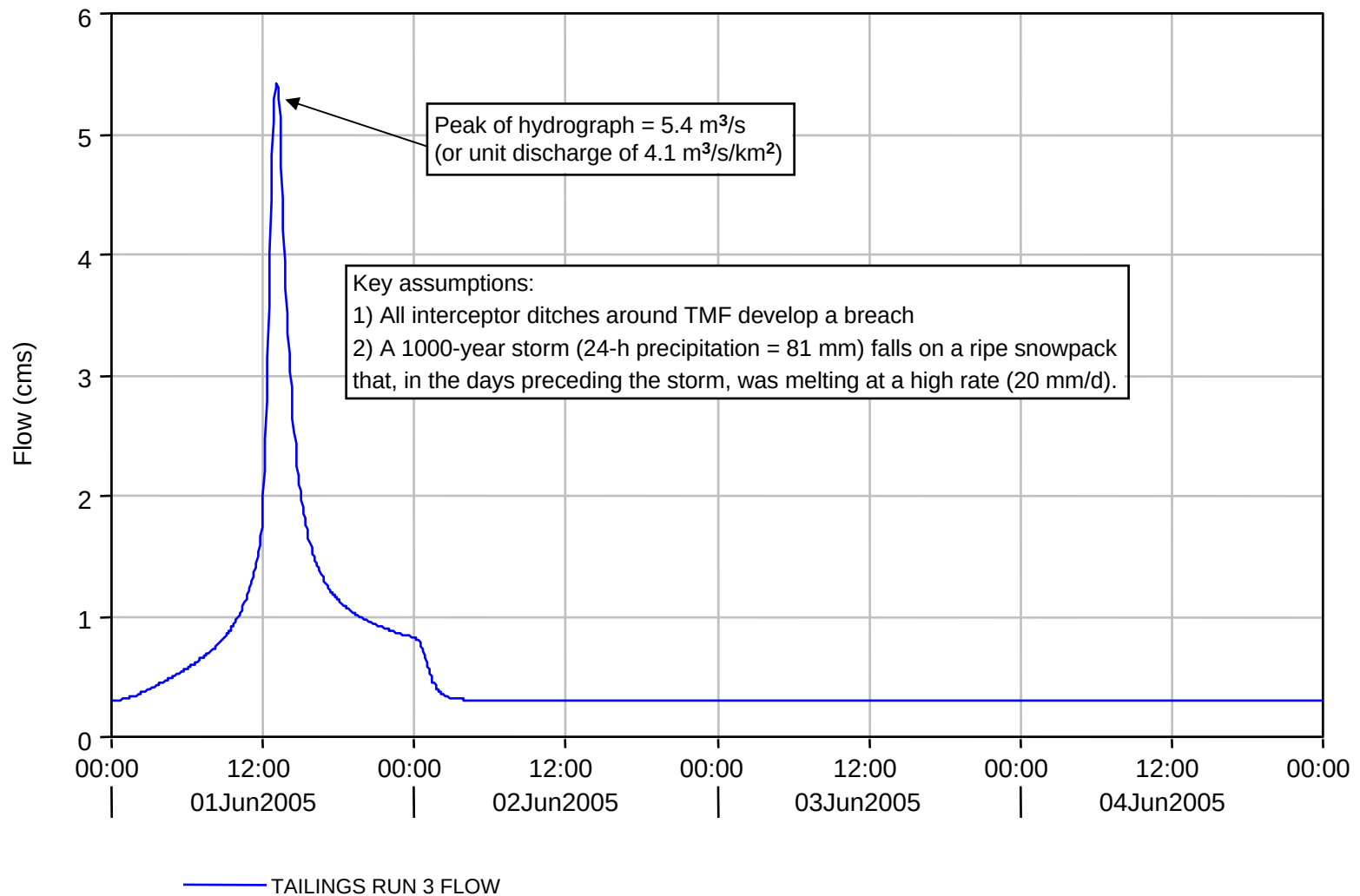
The estimated 1000-year floods for the mine, for both temporary and permanent closure scenarios, all plot above the maximum observed floods in the Yukon. Even the attenuated peaks through the TMF culverts and the Camp Creek culverts are large relative to the floods that have thus far been measured in the territory.

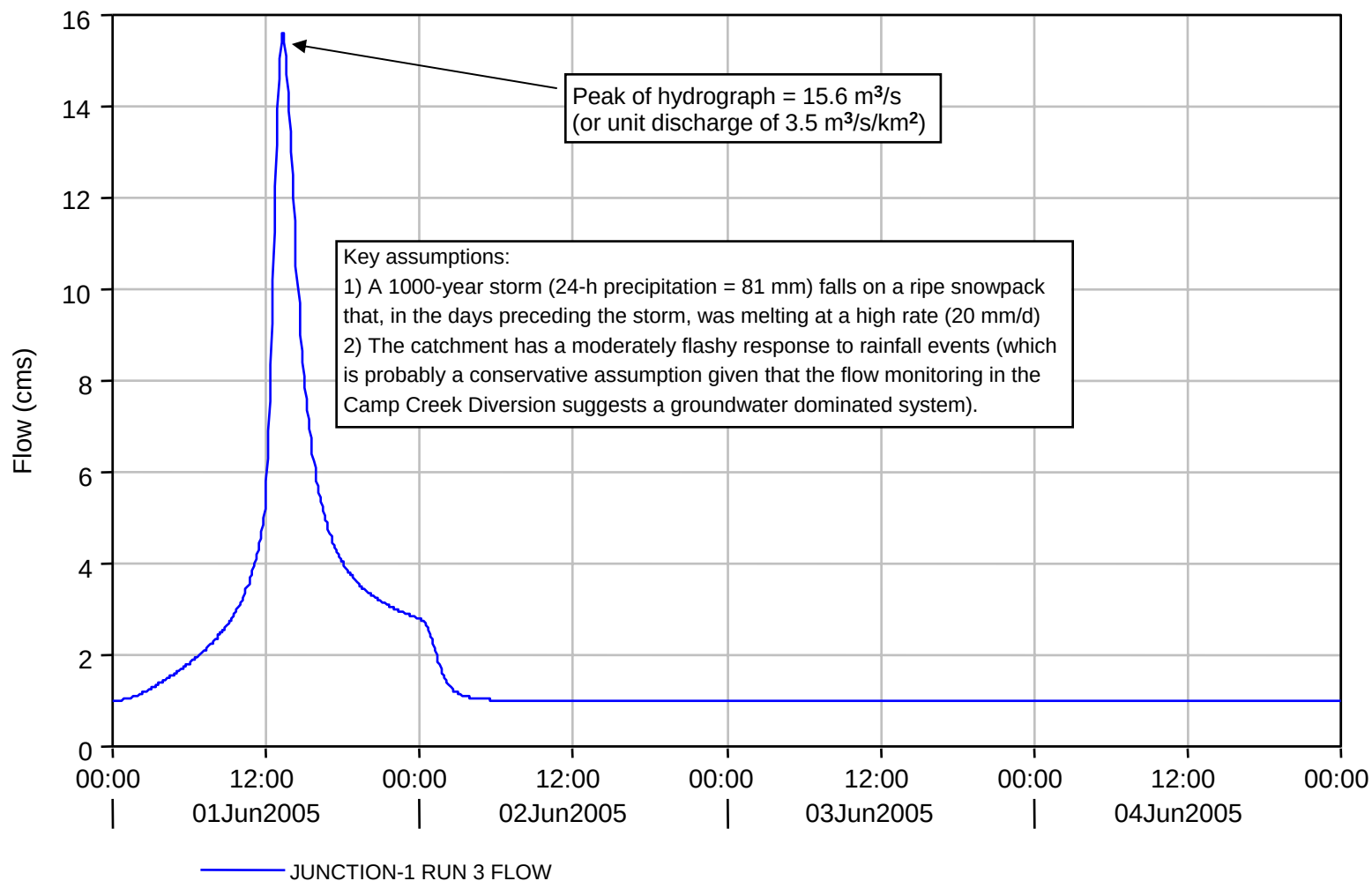
It should be noted that model parameters were selected for HEC-HMS that would generate hydrograph shapes typical of steep, forested catchments. This probably results in an overestimation of the true 1000-year flood peaks that could be generated within the Camp Creek catchment. As discussed in Section 3.5, the flow monitoring station at the minesite has revealed that groundwater contributions to the streamflows of Camp Creek are large. Thus, the 1000-year flood hydrographs for this stream may be substantially more subdued than simulated by the HEC-HMS model. Further monitoring of the flows in Camp Creek may provide enough evidence to allow the estimated flood peaks to eventually be reduced.

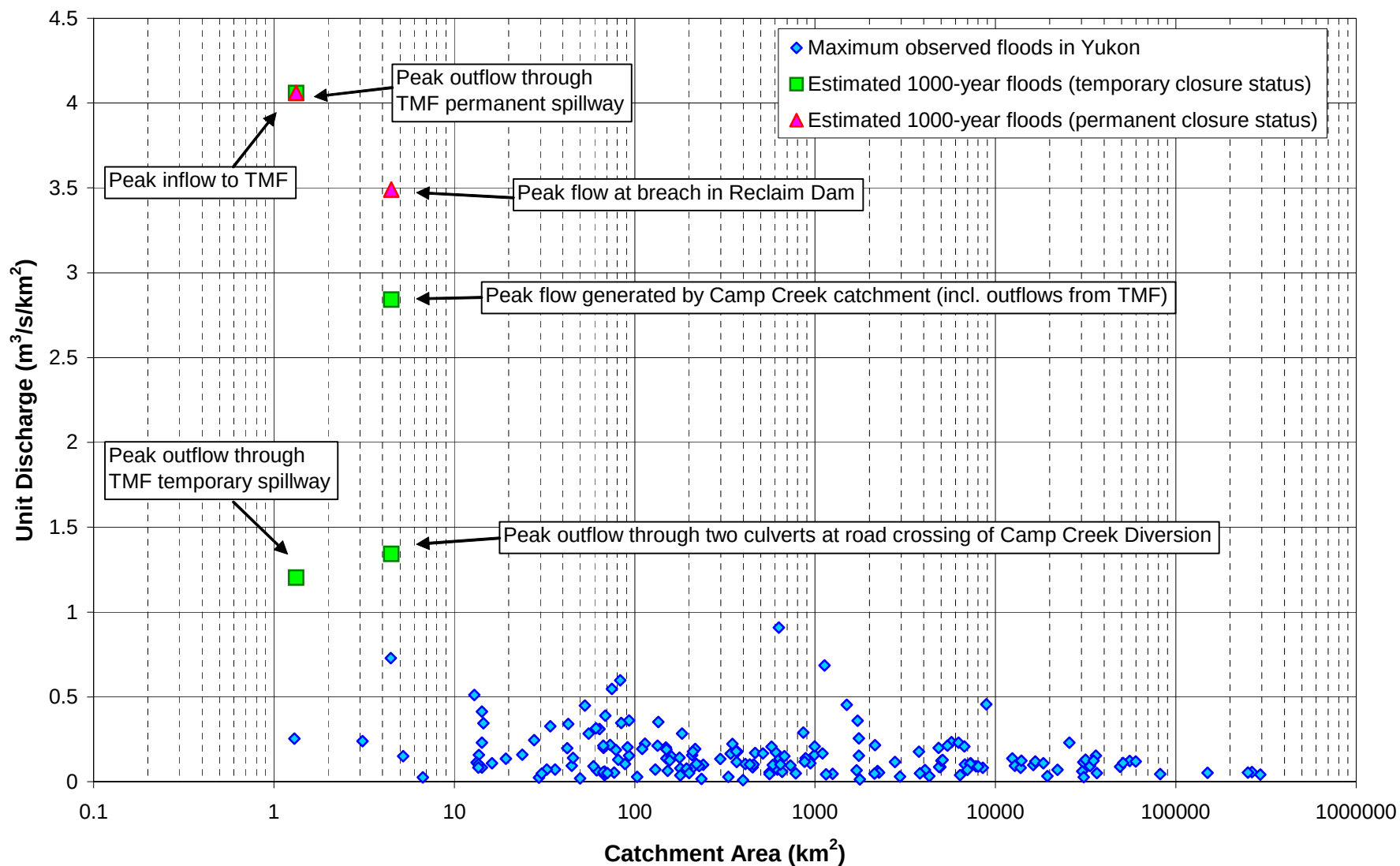
In summary, using the conservative 1000-year flood event, the recent hydrological evaluation confirms that both the current facilities as well as the proposed permanent closure designs (as proposed in the 2000 DDRP) are adequate and do not require upgrading.











3.2 TAILINGS MANAGEMENT FACILITY - SEEPAGE ESTIMATES

In November 2000, SRK submitted to DIAND a review of their seepage estimates from the 2000 DDRP document. They concluded in this memo that:

“On the basis of the above analyses, there is an acceptable margin between the seepage estimate and the threshold levels established using the mass-loading model. We therefore reiterate our opinion that further work to better understand the seepage flows would not be productive.”

3.2 WATER QUALITY

In a report titled *Water Quality and Loading Re-Assessment* issued by SRK in January of 2005, updated water quality monitoring results were reviewed to determine whether significant changes in water chemistry had occurred and how these might affect overall loadings from the site. Based on previous experience, the review was focused on the following parameters:

- sulfate;
- total suspended solids (TSS); and
- total zinc.

Monitoring results indicated that some changes in water chemistry have occurred since the original loading calculation presented in the February 2000 DDRP. The overall conclusions of the loading calculation, however, remain unchanged. In addition, there have been no changes to the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life with respect to monitored surface water parameters in the surveillance network since 2000.

4.0 GEOCHEMISTRY

4.3 RESULTS

4.3.1 *Underground Mine Workings*

4.3.1.1 *Burnick 1200 Portal*

Drainage from the 1200 Portal at the Burnick Zone discharges onto the Burnick Waste Rock Dump and infiltrates the waste rock. The mine water is consistently pH neutral and contains zinc concentrations below 1 mg/L. Based on inspection of the slopes below the discharge, SRK was not able to find emergent seepage corresponding to the mine water. There is no evidence that the zinc load in the drainage is detectable in Camp Creek and SRK concluded that zinc was being attenuated by contact with soil.

To evaluate this hypothesis, SRK performed soil column attenuation tests using mine drainage water as the feed. The soil samples were glacial till type materials from near the portal and alluvium composed of carbonaceous phyllite and granite from further downslope. The glacial till would not transmit water so the test was performed in duplicate with the alluvium. The test demonstrated that zinc concentrations decreased from 0.184 mg/L to 0.001 mg/L when in contact with the soils. Using the results of the testwork, it was concluded that downgradient soils have the potential to significantly attenuate zinc concentrations at the levels observed in the discharge for much longer than 200 years.

The studies confirmed that zinc is passively treated to levels below freshwater aquatic life standards by contact with downgradient soils and that zinc removal will effectively occur in perpetuity.

4.3.4 *Tailings - North Dam*

In 1998, total zinc concentrations at MH-2 (North Dam Seepage) appeared to have leveled off at below 0.45 mg/L after increasing since 1991. In 2004, zinc concentrations had declined to below 0.1 mg/L. During this period, sulphate concentrations generally increased but the trend had flattened in 2004 at near 300 mg/L.

SRK's 2000 assessment of the trends in zinc and sulphate concentrations involved collection of tailings samples, and installation and sampling of eight drive point piezometers in the tailings beaches. In 2002, the piezometers were re-sampled, tailings pore water samples were obtained from the beach in the vicinity of the piezometers, and several seeps along the toe of the North Dam were sampled and analyzed.

The 2000 and 2002 investigations showed that pore water chemistry within the tailings was the result of oxidation of residual sphalerite (producing soluble zinc, cadmium and sulphate) and re-precipitation of zinc, cadmium and sulphate by the formation of zinc and cadmium carbonates, and calcium sulphate. These studies allowed the pore water chemistry to be constrained and used in evaluations of the source of zinc at MH-2. It was predicted based on mixing of pore water and groundwater in ratios indicated by chemically-conservative parameters that zinc concentrations at MH-2 should be about 0.02 mg/L. This concentration was an order-of-magnitude below zinc concentrations typically observed at MH-2. SRK concluded that zinc was being contributed by another source. Windblown tailings were present along the dam face and were identified as a conceivable source. Teck Cominco recovered the tailings and placed a gravel cover on the tailings beach in 2001, which appears to have reversed the trend in zinc concentrations.

SRK concluded that removal of windblown tailings and prevention of additional wind erosion probably contributed to the decrease in zinc concentrations at MH-2.

4.3.3.2 Main Zone - 1380 Portal Drainage

During open water season, water drains from the Main Zone 1380 portal and infiltrates into soils in the dry headwaters of Camp Creek. The drainage was first sampled in 1999 during preparation of the closure plan and found to contain 41 mg/L zinc (dissolved). In 2000, the drainage was monitored to determine the variation in flow and chemistry for two months. While flow decreased following freshet, zinc concentrations were sustained. The zinc load associated with this flow was not detectable in Camp Creek at any time during the summer. Sampling of rock in the portal area showed that zinc is leached from oxidizing exposures and talus containing sphalerite. The source water is probably shallow groundwater but it does not appear to be fed by ponding of water in the small upslope Jewel Box Pit.

SRK concluded that zinc in the drainage is being strongly attenuated by contact with soils between the portal and down gradient springs feeding Camp Creek. To evaluate this hypothesis performed an attenuation test using portal drainage and samples of marble talus. The tests showed very strong attenuation of zinc from 44.9 mg/L to <0.001 mg/L. Cadmium was attenuated to <0.0001 mg/L. Based on measurement of precipitated zinc concentrations in the test, SRK concluded that the attenuation capacity of the soils down gradient of the portal could be exhausted in several years leading to break through of zinc loadings at the Camp Creek springs.

SRK understands that Teck Cominco has evaluated remedial options of the drainage and plans further investigations.

4.3.3.3 Jewel Box Hill Zone - 1250 Portal

This portal accesses a very short adit probably produced by one or two blast rounds. The portal was inspected by SRK and found not to be a source of nearby flowing surface water. Surface water flow in the area originated from the nearby natural slopes. Field measured zinc concentrations were 0.04 mg/L. Therefore, SRK concluded the drainage was not a significant source of zinc loading to Camp Creek.

SRK recommended no further assessment.

4.3.3.4 Jewel Box Hill Zone - Underground Mine Pool

This is a new section, added to this document in response to water licensing requirements and subsequent investigations by Teck Cominco and SRK.

After mining of the Jewel Box underground mine ceased in the early 1990s, the working began to flood. The concern has been raised that the workings could eventually discharge water containing unacceptable levels of zinc. Investigations have evaluated the likelihood of discharge and the zinc concentrations.

The elevation of the lowest portal is 1408 m. In 1997, the flood level was 1350 m (compared to 1340 m in 1992). Teck Cominco completely drained the workings in 1997 in preparation for re-activation of the mine; however, the mine was allowed to re-flood and rose to 1344 m at the time of the June 1999 inspection. When SRK and Teck Cominco accessed the workings in July 2002, the water level was 1349 m. Based on these observations, SRK concluded that the initial flooding rate exceeded 2 m per year but then decreased to 1.6 m per year. The flooding rate indicates that it is unlikely that a discharge would be observed at the 1408 Portal, but if the current rate of water level rise were sustained, discharge would occur in 2037. An underground inspection by Teck Cominco in the fall of 2004 found the water level to still be at 1349m.

Zinc concentrations in the mine pool were increasing slightly and were 2.18 mg/L in 2004, 1.75 mg/L in 2002 and 0.7 mg/L in 1997. The increase was attributed to the effects of weathering and leaching of residual sphalerite ore. SRK predicted that zinc concentrations might increase further and eventually stabilize and decrease, as the workings become a flow through component of the groundwater system.

4.4 WATER QUALITY PREDICTION

4.4.2 Results of Downstream Loading Re-Assessment

As required by Water License QZ99-045, Teck Cominco engaged SRK to update the downstream surface water loading calculations based on new data. For the complete re-assessment, the reader is referred to SRK's *Sä Dena Hes Mine Water Quality and Loading Re-Assessment* in Teck Cominco's *Temporary Site Closure Status Report as of January 2005*.

The downstream loading re-assessment used a dilution model to back-calculate loading and concentrations in background (natural undisturbed) sources using known sources of loadings in the mine-disturbed area. This approach indicates the presence of any unknown sources (shown by high calculated background) and attenuation effects (shown by low or negative calculated background).

The assessment focused on zinc as the main potential contaminant of concern and sulphate as an indicator of mine-related impacts that is not significantly affected by attenuation processes in surface waters. Generally, input data for years 2001, 2002 and 2003 were used. For the previous assessment included in the 2000 DDRP, input data were from 1996, 1997 and 1998.

The re-assessment resulted in reasonable background concentrations for zinc and sulphate comparable to the previous assessment, which indicated that all significant sources are known. Some changes in concentrations and loadings were apparent but these did not result in significant downstream effects in False Canyon Creek because the mine area occupies a relatively small part of the total catchment area.

5.0 TERRESTRIAL RESOURCES

No Changes to February 2000 DDRP.

6.0 AQUATIC RESOURCES

6.1 FISHERIES

Fisheries monitoring programs have continued to be conducted concurrently with the biological monitoring program as described in their water use license, every two years since the last summary in the DDRP in 2000 (2000, 2002 and 2004.)

Updated results from the water use license fisheries monitoring are summarized below. The reader is referred to the following reports for a detailed discussion of the fisheries investigations since the Detailed Reclamation Plan was submitted initially in 2000.

- *Environmental Monitoring at False Canyon Creek, 2000.* Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2000).

- *Environmental Monitoring at False Canyon Creek, 2002.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2002).
- *Environmental Monitoring at False Canyon Creek, 2004.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2004).

All of the existing fisheries data on the False Canyon Creek drainage have been summarized and are presented in Table 6-1. Locations of fish monitoring stations are provided in Figure 6-1.

Four species of fish were found within the False Canyon Creek drainage since 2000: slimy sculpin (*Cottus cognatus*), Arctic grayling (*Thymallus arcticus*), round whitefish (*Prosopium cylindraceum*), and burbot (*Lota lota*.) Slimy sculpin continue to be the most abundant species captured representing 74% of the total catch, followed by Arctic grayling at 23%.

The sites MH-13 and MH-20 were monitored during each of the eight surveys. Only slimy sculpin were captured at MH-13 although several fishing methods were employed. This site is a beaver/wetland complex with low velocity flow. The slimy sculpin population however, continued to be stable and the habitat supported all life history stages of this species.

Arctic grayling and slimy sculpin dominated the catch at MH-20 with incidental occurrences of whitefish and char. This site displays suitable fish habitat with stable banks and gravel substrate, and good riffle/pool ratio.

Fish distribution and catch results collected over the study period continue to indicate little change in the abundance or species assemblage.

Table 6-1. Summary of Fish Species Captured In the False Canyon Creek Drainage – Updated for 2000, 2002, 2004.

Species	Year	MH-12	MH-13	MH-14	MH-16	MH-17	MH-19	MH-20	MH-21	FFO1	Total per Species
Slimy Sculpin	1989	-	0	-	-	-	1	12	-	6	249
	1992	0	9	2	-	0	1	1	0	0	
	1994	-	19	-	-	0	-	8	-	-	
	1996	-	18	-	-	0	-	33	-	-	
	1998	-	15	2	0	-	-	19	-	-	
	2000	-	6	-	6	-	-	4	-	-	
	2002	-	8	-	5	-	-	4	-	-	
	2004	-	25	-	27	-	-	18	-	-	
Arctic Grayling	1989	-	0	-	-	-	1	10	-	3	76
	1992	0	0	0	-	0	0	1	0	8	
	1994	-	0	-	-	0	-	7	-	-	
	1996	-	0	-	-	0	-	5	-	-	
	1998	-	0	0	0	-	-	3	-	-	
	2000	-	0	-	1	-	-	6	-	-	
	2002	-	0	-	4	-	-	12	-	-	
	2004	-	0	-	6	-	-	9	-	-	
Whitefish	1989	-	0	-	-	-	0	0	-	0	8
	1992	0	0	0	-	0	0	0	0	1	
	1994	-	0	-	-	0	-	1	-	-	
	1996	-	0	-	-	0	-	0	-	-	
	1998	-	0	0	0	-	-	2	-	-	
	2000	-	0	-	0	-	-	1	-	-	
	2002	-	0	-	0	-	-	2	-	-	
	2004	-	0	-	0	-	-	1	-	-	
Char species	1989	-	0	-	-	-	0	0	-	0	1
	1992	0	0	0	-	0	0	0	0	0	

Species	Year	MH-12	MH-13	MH-14	MH-16	MH-17	MH-19	MH-20	MH-21	FFO1	Total per Species
	1994	-	0	-	-	0	-	1	-	-	
	1996	-	0	-	-	0	-	0	-	-	
	1998	-	0	0	0	-	-	0	-	-	
	2000	-	0	-	0	-	-	0	-	-	
	2002	-	0	-	0	-	-	0	-	-	
	2004	-	0	-	0	-	-	0	-	-	
Burbot	1989	-	0	-	-	-	0	0	-	1	6
	1992	0	0	0	-	0	0	0	0	0	
	1994	-	0	-	-	0	-	0	-	-	
	1996	-	0	-	-	0	-	0	-	-	
	1998	-	0	0	2	-	-	0	-	-	
	2000	-	0	-	0	-	-	1	-	-	
	2002	-	0	-	1	-	-	1	-	-	
	2004	-	0	-	0	-	-	0	-	-	
Pike	1989	-	0	-	-	-	0	0	-	0	1
	1992	0	0	0	-	0	1	0	0	0	
	1994	-	0	-	-	0	-	0	-	-	
	1996	-	0	-	-	0	-	0	-	-	
	1998	-	0	0	0	-	-	0	-	-	
	2000	-	0	-	0	-	-	0	-	-	
	2002	-	0	-	0	-	-	0	-	-	
	2004	-	0	-	0	-	-	0	-	-	
Totals per site:		0	100	4	52	0	4	162	0	19	337

Notes: A dash (-) indicates that that site was not sampled during that year.

FF01 = False Canyon Creek upstream of the confluence with Francis River.

6.2 BENTHIC INVERTEBRATES

Biological monitoring programs have continued according to water license specifications, every two years since 1992. The reader is referred to the following reports for a detailed discussion of the benthic invertebrate investigations since 2000:

- *Environmental Monitoring at False Canyon Creek, 2000.* Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2000).
- *Environmental Monitoring at False Canyon Creek, 2002.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2002).
- *Environmental Monitoring at False Canyon Creek, 2004.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2004).

Updated results from the benthic invertebrate monitoring studies are summarized below.

Table 6-2. Summary of Benthic Invertebrate Data in the False Canyon Creek Drainage – updated for 2000, 2002, 2004.

Site	Year	Density # of organisms/m ²	Taxonomic Richness	Dominant Taxa
Tributary Sites				
Trib B, headwaters	1990	1,091	22	Plecoptera & Ephemeroptera
Trib B, MH-21	1990	129	16	Diptera
	1992	165	12	Plecoptera
	1994	703	24	Plecoptera & Ephemeroptera
Trib D, MH-12	1992	2,372	20	Diptera
Trib E, headwaters	1989	22,354	32	Diptera
Trib E, MH-18	1989	7,743	40	Diptera
Unnamed Trib, MH-17	1996	21,450	65	Ephemeroptera & Diptera
North Cr u/s	1998	7,320	49	Diptera
North Cr d/s	1998	6,211	56	Diptera & Plecoptera
Mainstem Sites				
MH-13	1990	1,087	23	Ephemeroptera
	1992	5,605	25	Diptera
	1994	27,380	37	Ephemeroptera & Diptera
	1996	13,211	57	Diptera
	1998	46,764	30	Diptera
	2000	6,114	50	Plecoptera & Diptera
	2002	3,660	43	Diptera
	2004	26,153	72	Diptera
MH-14	1990	865	37	Ephemeroptera
	1992	4,521	27	Diptera
	1994	10,728	37	Ephemeroptera
MH-16	1998	13,470	60	Diptera & Ephemeroptera
	2000	12,838	65	Diptera & Ephemeroptera
	2002	20,050	67	Diptera & Ephemeroptera
	2004	21,510	63	Diptera & Ephemeroptera
MH-19	1989	26,154	38	Diptera
MH-20	1992	1,414	22	Ephemeroptera

Site	Year	Density	Taxonomic	Dominant Taxa
	1994	2,583	31	Ephemeroptera & Diptera
	1996	3,358	54	Ephemeroptera & Diptera
	1998	9,200	59	Ephemeroptera & Diptera
	2000	1,478	28	Ephemeroptera & Diptera
	2002	5,709	43	Diptera
	2004	6,648	56	Ephemeroptera & Diptera

Overall, the benthic invertebrate communities within the False Canyon Creek drainage have remained relatively diverse and have had good representation from the major groups of organisms that are usually present in lotic waters. The dominance of the respective communities has remained virtually unchanged over the study period, with Diptera the dominant of co-dominant order at MH13 during every sampling event. Ephemeroptera and/or Diptera have been the dominant orders at MH16 and MH20 over the course of the study period.

6.3 STREAM SEDIMENTS

Stream sediment monitoring has continued according to water license specifications, every two years since 1992. The reader is referred to the following reports for a detailed discussion of the stream sediment investigations since 2000:

- *Environmental Monitoring at False Canyon Creek, 2000.* Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2000).
- *Environmental Monitoring at False Canyon Creek, 2002.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2002).
- *Environmental Monitoring at False Canyon Creek, 2004.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2004).

Updated results from the stream sediment monitoring studies are summarized below.

Table 6-3. Historic Summary of Metals in Stream Sediments at Sä Dena Hes Mine Site.

Site	Year	Arsenic ISQG 5.9 PEL 17.0	Copper ISQG 35.7* PEL 197.0	Cadmium ISQG 0.6 PEL 3.5	Lead ISQG 35.0 PEL 91.3	Zinc ISQG 123 PEL 315
Headwaters of FCC	1988	81	78.2	37.5	11,367	14366
Headwaters of Trib B	1988	13	35.6	2.4	139	254.3
	1990	17	21.0	0.93	101	160.7
MH-12	1992	26	12.9	1.1	38.7	185
MH-13	1990	<20	21.8	1.41	22.5	196.3
(FCC 10 km d/s reclaim pond)	1992	17	21.7	1.2	65.3	256
	1994	11.5	22.8	1.5	47	216
	1996	12	19.2	1.7	27	160.3
	1998	14	20.7	1.2	37	174
	2000	17.3	24.1	2.1	71	266
	2002	8.1	17.8	1.2	24	148
	2004	9.6	23.5	1.3	30	185
MH-14	1990	<16	21.3	1.4	14.2	147
(FCC 20 km d/s reclaim pond)	1992	13	13.4	0.8	21	119
	1994	<10	15.1	0.9	10.7	92.8
MH-16	1998	<8	9.2	0.4	8	72
(FCC 22 km d/s reclaim pond)	2000	11.3	9.8	0.4	8	80
	2002	6.0	13.0	0.8	11	90
	2004	7.8	17.5	1.0	13	118
MH-17	1992		6.9	0.7	3	40.1
	1994	<10	6.6	0.5	3	33.6
	1996	<8	7.5	1.6	3	40.9
MH-19	1992	16	6.2	0.1	6	59.3
MH-20	1990	<9	20.9	0.3	10.4	80.2
(FCC 33 km d/s reclaim pond)	1992	13	22.1	<0.1	15	77.7
	1994	<10	20.6	0.5	9	69.3
	1996	9	16.6	1.5	9.3	68.9
	1998	9	18.7	0.3	11	74
	2000	7.3	23	0.3	13	88
	2002	4.6	16.9	0.3	8	57
	2004	6.1	22.9	0.4	10	78

Site	Year	Arsenic ISQG 5.9 PEL 17.0	Copper ISQG 35.7* PEL 197.0	Cadmium ISQG 0.6 PEL 3.5	Lead ISQG 35.0 PEL 91.3	Zinc ISQG 123 PEL 315
MH-21	1990	19	13.7	0.81	10.6	132.7
	1992	12	15.9	0.5	13	103
	1994	<10	21.2	0.8	12.3	106
North Cr u/s North Cr dike	1998	27	19.3	1.2	61	212
North Cr d/s North Cr dike	1998	18	21.0	1.5	121	368

Notes: all values are dry weight, ug/g, and are averages of triplicate samples

FCC = False Canyon Creek

* This ISQG value has changed since 2000 (raised from 22.7 to 35.9.)

Sediment results were compared to data collected in previous studies in the previously-mentioned annual reports. Arsenic concentrations have consistently surpassed the Interim Sediment Quality Guideline (ISQG) and have approached or exceeded the Probable Effects Level (PEL) at MH13. Concentrations at MH13 have ranged between 17.3 mg/L to 8.1 mg/L since 1990 with the lowest concentrations being measured in the last two monitoring events. The concentrations do not appear to have impacted the aquatic communities.

Copper levels remain well below the ISQG, which has been changed since 2000. As the copper ISQG was raised from 22.7 to 35.9, this is not a significant issue with respect to sediment copper concentrations. Concentrations were very similar at MH13 and downstream at MH20. Levels at MH16, located between these two sites, were significantly lower, but appear to be increasing over time.

Cadmium, lead and zinc concentrations were significantly higher in the sediments at MH13 than downstream at MH16 and MH20. The ISQG for these metals was usually exceeded at MH13, but concentrations were near or below the ISQLG at MH16 and MH20. There appears to be a slight increase in the concentrations of these three metals in the sediments at MH16 over recent years.

In general, the concentrations of the various metals have remained relatively consistent in the sediments at MH20. Concentrations tended to fluctuate more widely in the sediments at MH13 and show signs of gradually increasing in the sediments at MH16.

7.0 CURRENT LAND USE AND TENURE

No Changes to the February 2000 DDRP.

8.0 CULTURAL RESOURCES

No Changes to the February 2000 DDRP.

9.0 AIR QUALITY

No Changes to the February 2000 DDRP.

10.0 STABILITY ANALYSIS

Since the submission of the 2000 DDRP, a Dam Safety Review has been conducted. This review did not identify any stability concerns, however it did recommend that detailed stability calculations be conducted for the Reclaim Dam in its current configuration and piezometric condition. This is being undertaken presently, and the details will be included in the 2005 Geotechnical Inspection Report.

11.0 REFERENCES

The following resources have been utilized in the updating *Appendix B – Environmental Baseline Update and Technical Basis for Closure Assumptions* of the February 2000 DDRP:

Klohn Crippen Consultants Ltd. 2003. *“Sä Dena Hes Mine 2003 Dam Safety Review.”* Prepared for Teck Cominco Metals Ltd.

Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2000. *“Environmental Monitoring at False Canyon Creek, 2000”.* Prepared for Sä Dena Hes Operating Corporation.

Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2002. “*Environmental Monitoring at False Canyon Creek, 2002*”. Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd.

Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2004. “*Environmental Monitoring at False Canyon Creek, 2004*”. Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd.

Steffen Robertson and Kirsten (Canada) Inc. (SRK), “*Sä Dena Hes Mine Water Quality and Loading Re-Assessment. January 2005.*” Report 1CT006.008.

UPDATES TO APPENDIX C

See following pages.

Appendix C

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Sä Dena Hes Mine

Detailed Decommissioning & Reclamation Plan

Appendix C-1

Burnick Portal Discharge Water Quality

Burnick Portal Discharge

Sample Date	06/06/1995	27/07/1993	31/08/1993	08/10/1993	02/11/1993	29/11/1993	29/12/1993	26/01/1994	03/03/1994	28/03/1994	26/04/1994	31/05/1994	28/06/1994	20/07/1994	29/08/1994	26/09/1994	30/10/1994	30/11/1994	29/12/1994	28/01/1995	23/02/1995	02/03/1995	03/04/1995	03/05/1995	06/06/1995	04/07/1995	
Collected By:	DIAND	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	Co.	
Lab No.	5080					93030077	94000214																				
Station	BLANK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	BURNICK	
Physical Parameters																											
pH	5.40	8.30	8.30	8.30	8.10	8.00	8.10	8.00	8.10	8.20	8.30	7.90	8.10	8.10	8.10	7.90	7.90	7.90	7.90	7.60	7.80	7.90	8.20	8.20	7.70	7.95	
pH (in Field)																8.2	7.7	8.6	7.3	7.8	7.9	7.9	8.4	8.2	8.2	8.1	
Conductivity, micro-mho/cm	2	291	299	298	314	319	292	353	322	320	288	222	254	261	292	246	252	303	310	322	372	346	333	319	260	289	
Conductivity (in Field), micro-																											
Total Suspended Solids, mg/L	-5	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	46	< 4	< 4	< 4	< 4	< 4	4	22	33	52	432	54	< 4	< 4	5	2	
Turbidity, NTU		0.3	0.2	0.2	0.2	0.1	0.3	0.7	1.5	0.2	15.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	
Dissolved Suspended Solids, mg/L	104	186	195	182	202	206	222	202	210	218	200	121	127	138	182	145	176		190	238	416	232	167	228	172	120	
Flow, L/min			135.0	128.0	114.0			62.0	45.0	15.0			231.0		77.0	77.0	10.0			90.0	90.0	90.0	90.0	90.0	180.0	104.0	
Temp., degrees Celcius																10.8	6.3		13.8	5.6	8.9	8.9	5.0	17.2	18.1	17.2	
Hardness, CaCO ₃ mg/L																											
Total Hardness, mg/L	-1	157	160	159	163	160	158	161	194	176	183	116	134	139	155	138	150	161	159	168	235	167	184	180	141	152	
LC50																											
Anions																											
Alkalinity, CaCO ₃ mg/L	2	100	107	102	108	110	110	111	112	112	112	82	90	94	105	92	102	110	109	118	145	118	124	126	90	103	
Sulphate (SO ₄), mg/L	-1	41.7	36.1	46.2	48.7	44.2	51.9	40.7	52.0	55.1	54.5	37.7	38.2	34.3	41.5	39.0	38.3	43.3	44.0	47.4	47.7	54.4	48.0	48.8	38.1	38.5	
Nutrients																											
Nitrite Nitrogen (NO ₂), mg/L	-0.050	0.171	0.186	0.194	0.153	0.157	0.131	0.137	0.096	0.102	0.062	0.081	0.029	0.046	0.005	0.012	0.005	0.006	0.005	0.038	2.150	0.455	0.092	0.091	0.128	0.067	
Nitrate Nitrogen (NO ₃), mg/l	-0.200																										
N-NH ₃ , mg/L																											
N-NO ₂ -NO ₃ , mg/L	-0.020	0.410	0.380	0.560	0.350	0.360	0.390	0.430	0.410	0.440	0.470	0.530	0.340														
Total Phosphorus, mg/L	-0.06																										
Cyanide																											
Total Cyanide, mg/L	-0.005		-0.005	0.005	0.005	0.005	0.001	0.001	0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.010	0.003	-0.001	-0.001	-0.001	-0.001	
Cyanide-WAD, mg/L																											
Total Metals																											
Aluminum	-0.010	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	0.180	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	0.360	0.090	0.810	4.840	1.260	0.100	-0.060	0.110	0.044	
Antimony	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	0.020	-0.020	-0.020	-0.006	
Arsenic	-0.02	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.040	-0.040	-0.040	-0.040	-0.040	0.005	
Barium	-0.0006	0.0180	0.0180	0.0180	0.0180	0.0190	0.0180	0.0180	0.0200	0.0240	0.0180	0.0130	0.0150	0.0150	0.0180	0.0150	0.0160	0.0210	0.0180	0.0300	0.0700	0.0400	0.0240	0.0220	0.0170	0.0203	
Beryllium	-0.0002																										
Bismuth																											
Boron																											
Cadmium	-0.0005	0.0007		0.0012	0.0003	0.0004	0.0005	0.0005	0.0006	0.0006	0.0020	0.0008	0.0007	0.0003	0.0005	0.0013	0.0007	0.0024	0.0019	0.0600	0.0150	0.0021	0.0004	0.0005	0.0007	-0.0006	
Calcium	-0.1	50.6	53.0	52.4	53.4	52.3	51.2	52.5	65.1	57.3	60.2	39.2	45.2	46.9	50.7	46.4	49.8	52.6	52.4	51.4	73.0	63.7	59.3	57.7	47.3	37.4	
Chromium	-0.0010																										
Cobalt	-0.001																										
Copper	0.003	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.006	-0.002	-0.002	-0.002	-0.002	-0.002	0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.038	0.008	-0.002	-0.002	-0.002	0.004	-0.001
Iron	0.017	0.190	-0.050	0.090	-0.050	-0.050	-0.050	0.060	0.090	0.120	0.650	0.100	-0.050	-0.050	-0.050	-0.050	-0.050	1.160	0.390	2.470	13.500	1.840	0.200	-0.050	0.220	0.064	
Lead	-0.010	0.007	0.007	0.070	0.003	0.004	0.004	-0.003	0.003	0.005	0.018	0.009	0.003	-0.003	-0.003	0.007	0.003	0.029	0.014	0.060	0.200	0.028	0.005	0.005	0.008	0.003	
Lithium																											
Magnesium	-0.01							7.00	7.70	8.10	7.80	4.30	5.10	5.40	6.80	5.50	6.10	7.30	7.00	7.80	12.80	8.80	8.70	5.60	5.88		
Manganese	-0.0010							0.0280	0.0250	0.0270	0.0570	0.0230	0.0190	0.0170	0.0180	0.0170	0.0160	0.0970	0.0360	0.2030	1.0100	0.1900	0.0630	0.0630	0.0530	0.0380	
Mercury																											
Molybdenum	-0.005	0.010	0.011	0.012	0.012	0.014	0.040	0.013	0.014	0.015	0.014	0.006	0.008	0.007	0.013	0.008	0.011	0.010	0.014	0.011	0.012	0.013	0.019	0.012	0.007	0.011	
Nickel	-0.0010							-0.010	0.030	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	0.020	-0.010	-0.010	-0.010	-0.010	0.004	
Potassium	-0.2							1.00	1.00	1.00	16.00	22.00	20.00	23.00	23.00	24.00	25.00	11.00	24.00	28.10	24.60	27.70	27.60	24.90	21.70	1.11	
Selenium	-0.02	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	0.	

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Sä Dena Hes Mine

Detailed Decommissioning & Reclamation Plan

Appendix C-2

MH-01 Water Quality

(-) Indicates values are less than (below) indicated

Sample Date	24-Mar-92	30-Mar-92	05-Apr-92	15-Apr-92	24-Apr-92	30-Apr-92	05-May-92	06-May-92	12-May-92	21-May-92	27-May-92	02-Jun-92	02-Jun-92	10-Jun-92	16-Jun-92	23-Jun-92	02-Jul-92	09-Jul-92	16-Jul-92	23-Jul-92	28-Jul-92	04-Aug-92	11-Aug-92	18-Aug-92	24-Aug-92	02-Sep-92	
Collected By:	Company	Company	Company	Company	Company	Company	Company	DIAND	Company	Company	Company	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	
Lab No.								2051				2057															
Station	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	
Physical Parameters																											
pH	7.50	7.80	7.20	7.40	7.70	8.80	8.60	7.65	8.50	8.10	7.40	7.40	7.50	7.40	7.60	7.50	7.70	7.70	7.90	7.80	7.90	8.00	7.90	8.10	7.80	7.80	
pH (in Field)								8.8				7.9															
Conductivity, micro-mho/cm	780	810	845	860	885	905	860	953	875	880	610	728	605	640	640	670	660	806	802	814	820	839	826	845	879	891	
Conductivity (in Field), micro-								940				727															
Total Suspended Solids, mg/L	6	-5	-5	-5	-5	-5	-5	-10	-5	5	17	10	6	6	6	8	8	10	8	7	5	5	7	6	2	6	
Turbidity, NTU	1.0	1.0	2.0	2.0	2.0	2.0	4.0		3.0	2.0	18.0		6.0	5.0	5.0	4.0	5.0	2.9	3.4	2.4	1.2	3.4	3.0	2.2	1.4		
Dissolved Suspended Solids, Flow, L/min	582	599	630	656	657	656	695	720	640	615	424	520	478	572	520	573	569	594	598	616	606	460	640	644	664	652	
Temp., degrees Celcius								1.8				4.1						13.1	14.9	13.8	14.1	15.1	13.5	11.6		11.9	
Hardness, CaCO ₃ , mg/L								357				278															
Total Hardness, mg/L	239	258	313	292	286	287	336	360	318	307	255	280	253	268	317	292	314	340	317	344	341	373	380	203	375	460	
LC50																											
Anions																											
Alkalinity, CaCO ₃ , mg/L	64	59	85	47	50	54	64	49	59	57	83	61	62	78	97	85	90	89	88	84	82	n/a	83	n/a	84	84	
Sulphate (SO ₄), mg/L	300.0	336.0	329.0	353.0	358.0	353.0	388.0		366.0	337.0	202.0	240	239.0	260.0	261.0	259.0	290.0	295.0	287.0	310.0	307.0	323.0	316.0	339.0	335.0	317.0	
Nutrients																											
Nitrite Nitrogen (NO ₂), mg/L	1.900	1.500	2.000	1.900	2.700	2.900	3.300	5.460	2.700	2.700	1.400	2.490	1.800	2.400	2.100	2.200	3.200	2.400	2.500	2.810	2.620	2.480	2.400	2.460	2.220	2.590	
Nitrate Nitrogen (NO ₃), mg/l												0.515															
N-NH ₃ , mg/L												1.020															
N-NO ₂ -NO ₃ , mg/L	4.100	4.000	5.600	5.000	4.800	4.200	5.000		4.000	6.800	2.900		4.000	4.500	3.400	4.000	2.400	2.470	2.380	2.450	2.840	3.380	2.950	3.540	3.490	5.260	
Total Phosphorus, mg/L								-0.10				-0.10															
Cyanide																											
Total Cyanide, mg/L	0.213	0.297	0.046	0.015	0.064	0.054	0.117	-0.030	0.082	0.100	0.037	0.040	0.028	0.025	0.027	0.019	0.020	0.027	0.009	0.017	0.008	0.010	0.025	0.013	0.011	0.011	
Cyanide-WAD, mg/L								-0.030				0.040															
Total Metals																											
Aluminum	-0.050	-0.050	-0.050	-0.050	0.190	0.130	1.100	0.140	0.540	0.160	0.580	0.290	-0.050	0.130	-0.050	0.060	0.150	0.070	0.110	0.090	0.080	0.040	0.120		-0.020	-0.020	
Antimony	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.060	-0.020	-0.020	-0.020	-0.060	-0.020	-0.020	-0.020	-0.020	-0.020	-0.015	0.018	-0.015	-0.015	-0.015	-0.015		-0.015	-0.015	
Arsenic	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.06	-0.040	-0.040	-0.040	-0.06	-0.040	-0.040	-0.040	-0.040	-0.040	0.001	0.001	0.001	-0.001	-0.001	0.001		0.001	-0.040	
Barium	0.0210	0.0220	0.0230	0.0100	0.0200	0.0200	0.0200	0.0380	0.0100	0.0100	0.0300	0.0430	0.0200	0.0200	0.0200	0.0100	0.0200	0.0470	0.0600	0.0470	0.0500	0.0530	0.0520		0.0530	0.0540	
Beryllium								-0.0010				-0.0010															
Bismuth																											
Boron								0.050				0.020															
Cadmium	0.0024	0.0019	0.0016	0.0019	0.0009	0.0008	-0.0003	-0.0060	0.0004	-0.0003	0.0004	-0.0060	-0.0003	0.0004	0.0006	-0.0003	-0.0003	0.0005	0.0005	0.0006	0.0006	0.0006	0.0007		0.0008	0.0007	
Calcium	83.3	89.5	112.0	104.0	103.0	105.0	122.0	134.0	116.0	113.0	92.0	102.0	93.3	108.0	116.0	107.0	115.0	131.0	120.0	129.0	128.0	140.0	135.0		140.0	173.0	
Chromium								-0.0060				0.0270															
Cobalt								0.008				0.022															
Copper	0.321	0.282	0.226	0.173	0.165	0.198	0.244	0.294	0.226	0.214	0.149	0.206	0.162	0.162	0.143	0.132	0.100	0.099	0.088	0.066	0.057	0.048	0.043		0.039	0.037	
Iron	0.119	0.089	0.071	0.134	0.075	0.135	0.074	0.248	0.073	0.066	0.651	0.458	0.261	0.295	0.145	0.139	0.176	0.192	0.203	0.226	0.201	0.120	0.247		0.132	0.130	
Lead	0.084	0.078	0.061	0.064	0.075	0.044	0.036	-0.060	0.061	0.058	0.033	0.160	0.063	0.085	0.071	0.042	0.056	0.060	0.080	0.070	0.052	0.040	0.050		0.040	0.070	
Lithium																											
Magnesium								5.50				4.70															
Manganese								0.2660				0.2450															
Mercury																											
Molybdenum	0.034	0.034	0.034	0.042	0.053	0.050	0.050	0.050	0.045	0.035	0.021	0.030	0.025	0.020	0.018	0.019	0.037	0.072	0.078	0.089	0.085	0.096	0.083		0.079	0.087	
Nickel								-0.0200				-0.0200															
Potassium								11.0				12.0															
Selenium	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.06	-0.020	-0.020	-0.020	-0.06	-0.020	-0.020	-0.020	-0.020	-0.020	0.050	0.050	0.040	0.050	0.050	0.040		-0.030	0.060	
Silicon								3.03				2.91															
Silver	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001		-0.001	-0.010	
Sodium	61.90	65.00	66.70	56.80	64.20	59.90	61.40	59.00	56.80	50.60	26.90	36.60	30.50	31.60	32.10	30.40	32.00	29.80	28.70	27.10	26.20	27.40	24.60		24.00	25.70	
Strontium								0.419				0.287															
Sulphur																											
Tellurium																											
Thallium																											
Tin								-0.060				-0.060															
Titanium								-0.0020				0.0220															
Vanadium								-0.010				0.050															
Zinc	0.4840	0.4530	0.3440	0.2290	0.1440	0.1160	0.1000	0.1150	0.0750	0.0720	0.0650	0.0710	0.0680	0.0900	0.0900	0.0790	0.0660	0.0650	n/a	0.0550	0.0580	0.0600	0.0620		0.0620	0.0970	
Dissolved Metals																											
Aluminum	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.430		0.250	0.060	0.060		-0.050	-0.050	-0.050	-0.050	0.090	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020		-0.020	-0.020	
Antimony	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020		-0.020	-0.020	-0.020	-0.020	-0.020	-0.02													

Sample Date Collected By: Lab No. Station	10-Sep-92 Company	17-Sep-92 Company	23-Sep-92 Company	30-Sep-92 Company	07-Oct-92 Company	15-Oct-92 Company	21-Oct-92 Company	27-Oct-92 Company	02-Nov-92 Company	13-Nov-92 Company	19-Nov-92 Company	26-Nov-92 Company	02-Dec-92 Company	09-Dec-92 Company	05-Jan-93 Company	12-Feb-93 Company	31-Mar-93 Company	07-Apr-93 Company	30-Apr-93 Company	18-May-93 Company	30-Jun-93 Company	26-Jul-93 Company	31-Aug-93 Company	08-Oct-93 Company	02-Nov-93 Company
	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01	MH-01
Physical Parameters																									
pH	7.90	7.90	7.80	7.70	7.60	7.70	7.70	7.70	7.60	8.10	8.00	7.90	8.20	7.67	7.90	7.70	7.70	7.70	7.69	7.90	7.80	8.10	8.20	8.20	8.00
pH (in Field)														8.5					7.7						
Conductivity, micro-mho/cm	897	875	910	918	923	986	1040	1070	1080	1120	1120	1080	1070	1040	1050	1010	936	829	810	775	661	495	502	586	655
Conductivity (in Field), micro-mho/cm														1050					820						
Total Suspended Solids, mg/L	6	5	10	8	8	8	13	10	10	32	27	22	9	-10	4	5	5	4	-10	9	11	10	< 4	< 4	4
Turbidity, NTU	2.1	2.2	2.4	4.8	3.6	2.0	5.5	3.5	4.0	35.0	30.0	20.0	5.9	2.8	0.9	1.0	1.5	1.5	6.5	4.9	4.8	2.0	0.8	2.5	
Dissolved Suspended Solids, mg/L	700	654	692	686	700	392	808	767	579	617	401	847	835	810	815	770	696	606	600	468	471	339	412	457	
Flow, U/min														1440.00				300.0	1200.00			1280.0	94.0	-0.1	-0.1
Temp., degrees Celsius														1.9				1.7							
Hardness, CaCO ₃ , mg/L														429				386							
Total Hardness, mg/L	448	429	390	472	463	499	506	526	592	605	425	524	526	430	515	515	452	411	388	437	351	256	259	299	332
LC50																									
Anions																									
Alkalinity, CaCO ₃ , mg/L	81	83	82	83	83	98	83	86	88	80	76	57	42	38	41	62	98	135	132	138	126	117	129	138	139
Sulphate (SO ₄), mg/L	350.0	352.0	363.0		366.0	383.0	445.0	447.0	441.0	476.0	480.0	498.0	481.0	423	402.0	421.0	370.0	293.0	280	288.0	208.0	124.0	146.0	186.0	184.0
Nutrients																									
Nitrite Nitrogen (NO ₂), mg/L	2.610	2.670	2.730	2.620	2.820	2.900	3.280		2.950	3.520	3.380	3.550	3.470	3.250	3.620	3.160	2.730	2.120	2.010	1.760	1.320	0.620	0.548	0.983	1.170
Nitrate Nitrogen (NO ₃), mg/L														0.670				0.197							
N-NH ₃ , mg/L														7.290				1.850							
N-NO ₂ -NO ₃ , mg/L	3.550	3.290	3.660	3.640	3.780	4.210	4.060	4.340	4.900	6.100	5.960	6.370	6.440		6.620	5.150	3.860	1.810		1.440	1.130	0.780	0.470	0.350	0.290
Total Phosphorus, mg/L														-0.10					-0.10						
Cyanide																									
Total Cyanide, mg/L	0.007	0.012	0.013	0.016	0.014	0.013	0.037	0.031	0.037	0.052	0.052	0.090	0.127		0.102	0.054	0.016	0.008	-0.030	0.020	0.011	0.008	0.008	0.007	0.005
Cyanide-WAD, mg/L																			-0.030						
Total Metals																									
Aluminum	-0.020	0.020	0.050	-0.020	0.030	0.030	-0.020	-0.020	0.130	0.250	0.230	0.130	0.020	-0.060	-0.020	0.020	-0.020	-0.060	-0.060	0.110	0.220	0.210	-0.060	-0.060	-0.060
Antimony	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.060	-0.015	0.016	-0.015	-0.020	-0.060	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Arsenic	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.06	-0.040	-0.040	-0.040	-0.040	-0.06	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Barium	0.0490	0.0520	0.0560	0.0630	0.0600	0.0580	0.0630	0.0680	0.0620	0.0520	0.0470	0.0390	0.0380	0.0410	0.0410	0.0650	0.0620	0.0860	0.1000	0.0890	0.0740	0.0550	0.0570	0.0640	0.0680
Beryllium														-0.0010				-0.0010							
Bismuth																									
Boron														0.050					-0.010						
Cadmium	0.0007	0.0006	0.0008	0.0007	0.0007	-0.0005	0.0013	0.0011	0.0014	0.0030	0.0024	0.0009	0.0005	-0.0060	0.0003	0.0010	0.0010	0.0005	-0.0060	0.0003	0.0012	0.0009	0.0009	0.0007	0.0080
Calcium	169.0	161.0	145.0	177.0	173.0	186.0	187.0	193.0	220.0	223.0	154.0	194.0	195.0	180.0	190.0	188.0	166.0	148.0	145.0	159.0		60.2	90.6	106.0	118.0
Chromium														-0.0050				-0.0060							
Cobalt														0.011				-0.006							
Copper	0.030	0.037	0.045	0.059	0.055	0.089	0.112	0.134	0.147	0.108	0.078	0.120	0.147	0.151	0.148	0.121	0.061	0.020	0.013	0.020	0.023	0.003	0.007	0.008	0.009
Iron	0.171	0.193	0.262	0.237	0.199	0.207	0.232	0.187	0.951	2.030	1.900	1.310	0.330	0.110	0.101	0.200	0.196	0.110	0.144	0.350	0.800	0.360	0.140	0.130	0.220
Lead	0.050	0.050	0.060	0.050	0.050	0.280	0.120	0.090	0.640	0.510	0.360	0.190	0.070	0.100	0.100	0.110	0.090	0.050	-0.060	0.009	0.220	0.040	0.040	0.040	0.090
Lithium																									
Magnesium														9.60				11.00							
Manganese														0.2580				0.6560							
Mercury																									
Molybdenum	0.079	0.064	0.064	0.064	0.066	0.063	0.064	0.059	0.054	0.056	0.055	0.055	0.063	0.060	0.059	0.049	0.034	0.025	0.030	0.026	0.018	0.009	0.010	0.013	0.019
Nickel														-0.0200				-0.0200							
Potassium														15.0				8.0							
Selenium	0.040	-0.030	0.030	0.030	0.050	0.040	0.040	0.060	0.050	0.040	0.040	0.050	-0.030	-0.06	-0.030	0.030	-0.030	-0.030	-0.06	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030
Silicon														3.63				4.15							
Silver	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.030	-0.010	-0.030	-0.010	-0.030	-0.030	-0.030	-0.030
Sodium	24.50	29.60	26.30	29.30	28.30	27.00	28.90	24.90	27.10	26.70	25.80	25.60	26.80	23.60	29.00	19.70	14.80	21.50	15.20	12.30	6.90	6.70	9.00	11.80	
Strontium														0.503				0.437							
Sulphur																									
Tellurium																									
Thallium																									
Tin														-0.060				-0.060							
Titanium														0.0040				0.0040							
Vanadium														-0.010				-0.010							
Zinc	0.0830	0.0740	0.0910	0.1060	0.0790	0.0960	0.1580	0.1590	0.1600	0.6540	0.5370	0.2750	0.1320	0.0850	0.0720	0.1990	0.1680	0.1000	0.1100	0.1000	-0.0300	0.0900	0.0600	0.0700	0.1300
Zirconium																									
Dissolved Metals																									
Aluminum	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Antimony	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
Arsenic	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Barium	0.0460	0.0500	0.0570	0.0580	0.0590	0.0590	0.0610	0.0660	0.0580	0.0470	0.0450	0.0370	0.0380	0.0410	0.0270	0.0840	0.0860	0.0910	0.0790	0.0550	0.0280	0.0660	0.0660	0.0630	0.0630
Cadmium	-0.0005	0.0006	-0.0005	0.0005	0.0006	0.0007	0.0015	0.0013	0.0009	-0.0001	0.0008	0.0001	0.0001	-0.0001	0.0007	0.0007									

(-) Indicates values are less than (be

Sample Date	31-May-94	30-Nov-94	29-Dec-94	28-Jan-95	28-Feb-95	16-Mar-95	06-Apr-95	03-May-95	03-Nov-95	01-Dec-95	02-Jan-96	05-Feb-96	04-Mar-96	02-Apr-96	05-May-96	03-Jun-96	04-Jul-96	01-Aug-96	01-Sep-96	01-Oct-96	04-Nov-96	01-Dec-96	05-Jan-97	01-Feb-97	01-Mar-97	01-Apr-97	
Collected By:	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	
Lab No.																											
Station	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	
Physical Parameters																											
pH	7.90	8.10	8.00	7.70	8.10	8.00	7.80	8.00	7.97	7.74	7.55	7.43	7.37	7.33	7.39	7.14	8.18	8.40	8.20	8.30	8.00	8.20	8.00	7.90	7.90	7.80	
pH (in Field)		8.2	7.5	7.8	7.8	7.0	7.0	8.8	7.9	7.7	7.9	8.2	8.1	7.2	7.8	7.8	8.1	8.2	8.2	8.0	8.0	7.9	7.7	6.6	7.2	7.3	
Conductivity, micro-mho/cm	412	498	496	494	466	490	557	50	415	419	440	451	449	491	423	316	353	368	365	373	405	402	411	427	430	437	
Conductivity (in Field), micro-																											
Total Suspended Solids, mg/L	23	< 4	< 4	< 4	< 4	< 4	< 4	< 4	1	2	-1	2	3	5	11	32	9	5	4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	
Turbidity, NTU	20.0																										
Dissolved Suspended Solids, mg/L	211	276	372	364	276	372	342	36	267	280	260	255	300	353	267	173	227	228	256	228	258	250	264	238	210	246	
Flow, L/min	-0.1																					-0.1	-0.1	-0.1	0.1	1.0	
Temp., degrees Celcius		14.4	8.1	1.7	7.8	2.2	14.4	16.7	5.6											2.0	0.5	0.1	0.1	0.1	0.1	1.0	
Hardness, CaCO ₃ , mg/L																											
Total Hardness, mg/L	206	259	265	256	270	297	302	24	217	232	243	238	250	268	233	172	192	197	5	179	212	193	201	239	219	219	
LC50																											
Anions																											
Alkalinity, CaCO ₃ , mg/L	127	163	163	169	170	190	185	22	155	155	159	166	168	181	162	105	128	129	127	129	142	145	148	156	157	156	
Sulphate (SO ₄), mg/L	92.1	93.0	91.0	92.9	99.0	111.0	114.0	3.3	70.3	71.9	76.5	73.5	74.7	81.7	70.7	59.4	59.8	62.5	58.0	58.2	63.4	64.6	65.3	67.5	66.5	63.7	
Nutrients																											
Nitrite Nitrogen (NO ₂), mg/L	0.205	0.103	0.081	0.059	0.066	0.088	0.068	0.030	0.098	0.023	0.012	0.098	0.030	0.022	0.174	0.037	0.084	0.005	-0.005	0.015	-0.005	0.010	0.008	0.010	0.005	-0.005	
Nitrate Nitrogen (NO ₃), mg/l																											
N-NH ₃ , mg/L																											
N-NO ₂ -NO ₃ , mg/L	0.630																										
Total Phosphorus, mg/L											0.007	0.007	0.008	0.007	0.008	0.018	-0.006	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	
Cyanide																											
Total Cyanide, mg/L	0.005	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.001	0.001	0.001	-0.001	-0.001	0.001	-0.001	0.001	
Cyanide-WAD, mg/L																											
Total Metals																											
Aluminum	-0.030	-0.060	-0.060	0.060	-0.060	-0.060	-0.060	-0.060	0.042	0.085	0.024	0.021	0.025	0.020	0.084	0.474	0.498	0.007	-0.006	-0.006	-0.006	-0.060	-0.060	-0.060	-0.060	-0.060	
Antimony	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	
Arsenic	-0.040	0.030	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.004	-0.004	0.015	0.004		-0.004	-0.010	-0.010	-0.010	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	
Barium	0.0410	0.0530	0.0540	-0.0400	0.0570	0.0630	0.0600	0.0080	0.0629	0.0553	-0.0002	0.0560	0.0560	0.0623	0.0756	0.0423	0.0497	0.0380	0.0410	0.0400	0.0450	0.0400	0.0470	0.0510	0.0490	0.0470	
Beryllium											-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	
Bismuth											-0.0007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	
Boron											0.007	0.007	0.007	0.008	0.007	0.004	0.039	0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	
Cadmium	0.0040	0.0008	0.0007	0.0008	0.0007	0.0008	0.0007	0.0003	0.0007	-0.0005	0.0005	0.0006	0.0007	-0.0005	0.0007	0.0041	0.0023	0.0011	0.0010	0.0008	0.0007	0.0006	0.0006	0.0007	0.0007	0.0005	
Calcium	71.9	89.4	91.5	85.0	92.1	101.0	103.0	8.8	77.7	76.6	78.8	81.0	78.8	86.8	76.4	58.3	63.3	67.6	71.0	63.8	72.2	63.4	70.0	81.4	74.8	74.8	
Chromium											-0.0008	-0.0008	-0.0008	-0.0008	-0.0008	0.0014	0.0009	-0.0020	0.0040	0.0050	0.0030	-0.0020	0.0040	-0.0020	0.0020	0.0020	
Cobalt											-0.0007	-0.0007	-0.0007	-0.0007	-0.0007	0.0011	-0.0007	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	
Copper	0.007	-0.002	0.003	0.004	-0.002	-0.002	0.003	-0.002	0.004	0.002	0.005	0.008	0.002	0.006	0.004	0.012	0.006	0.004	0.005	0.005	0.002	0.003	-0.002	0.004	0.003	-0.002	
Iron	0.850	-0.050	-0.050	0.080	-0.050	-0.050	-0.050	-0.050	0.092	0.060	0.056	0.061	0.037	0.054	0.104	1.990	0.705	0.200	0.100	0.120	0.070	0.070	-0.050	0.080	-0.050	-0.050	
Lead	0.180	0.012	0.009	0.006	0.004	0.007	0.005	0.005	0.013	0.010	0.009	0.011	0.005	0.011	0.023	0.405	0.092	0.026	0.017	0.025	0.016	0.015	0.012	0.012	0.007	0.005	
Lithium											0.00560	0.00249	0.00389	0.00377	0.00351	0.00288	0.00267										
Magnesium	6.50	8.70	9.00	8.80	9.70	10.90	10.90	0.30	9.35	9.23	9.34	9.80	9.60	10.90	9.04	5.23	6.56										
Manganese	1.0600	0.3300	0.3470	0.3280	0.3420	0.3800	0.3410	0.0570	0.0446	0.0217	0.0266	0.0470	0.0430	0.0658	0.1020	0.6090	0.3860	0.2310	0.1810	0.1460	0.1360	0.1160	0.1250	0.1390	0.1040	0.0910	
Mercury																											
Molybdenum	-0.004	0.005	0.006	-0.004	-0.004	-0.004	0.007	-0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.002	0.004	-0.004	0.005	-0.004	-0.004	-0.004	-0.004	0.005	0.005	-0.004	
Nickel	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.001	-0.001	0.001	0.001	-0.001	-0.001	-0.001	0.003	0.002	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	
Potassium	22.00	25.00	25.00	22.00	24.00	25.00	26.00	24.00	1.55	1.18	1.48	1.60	1.40	2.00	2.00	1.20	-0.40	1.20	1.30	1.60	1.40	1.60	14.30	1.80	1.40	1.20	
Selenium	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	0.003	-0.003	-0.003	-0.003	-0.003	0.006	-0.003	0.006	-0.003	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	
Silicon											1.51	1.69	1.74	1.98	2.07	3.29	3.16	1.80	1.90	1.60	1.00	1.40	1.50	1.50	1.40	1.40	
Silver	-0.030	-0.030	-0.040	-0.030	-0.030	-0.030	-0.030	-0.030	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	
Sodium	2.40	4.80	3.90	3.80	3.80	4.40	4.50	-0.40	3.70	2.82	2.20	3.35	2.88	3.14	2.99	1.39	2.79	1.40	1.50	1.50	1.70	1.40	1.70	1.90	1.80	1.80	
Strontium											0.326	0.335	0.327	0.367	0.319	0.202	0.247	0.213	0.243	0.214	0.255	0.229	0.259	0.287	0.271	0.265	
Sulphur	26.50	32.50	31.10	30.50	30.60																						

(-) Indicates values are less than (b)

Sample Date	4-Nov-01	5-Jan-02	3-Apr-02	1-Jul-02	1-Oct-02	2-Jan-03	25-Apr-03	16-Jul-03	14-Oct-03	9-Feb-04	9-May-04	6-Aug-04	4-Oct-04	29-Jan-05	6-Jul-05	13-Sep-05
Collected By:	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr
Lab No.																
Station	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B	MH-01B
Physical Parameters																
pH	8.1	8.10	8.20	8.40	8.1	8	8.2	8.3	8.3	8.2	7.7	8.3	8.2	8.1	8.1	7.9
pH (in Field)	8.41	8.21	7.93	8.40	8.32	8.38	8.38	7.92	8.56							
Conductivity, micro-mho/cm											98	306	339	364	336	391
Conductivity (in Field), micro-	394	423	410	331	313	318	524	330	374	387						
Total Suspended Solids, mg/L	<4	<4	5	<4	<4	<4	17	<4	<4	<4	<4	<4	<4	<4	<4	<4
Turbidity, NTU											1.68	0.75	1	0.42	1.3	1.3
Dissolved Suspended Solids,	252	264	254	204	230	246	332	196	222	228	56	190	200	206	222	228
Flow, L/min	u/a	u/a	u/a	u/a	u/a	u/a	u/a	u/a	u/a							
Temp., degrees Celsius	0	-0.3	0	16.1	4.8	-0.2	0.7	11.2	3.1							
Hardness, CaCO ₃ , mg/L	212	233	235	179	216	222	314	180	203	219	50.1	156	262	197	190	210
Total Hardness, mg/L																
LC50																
Anions																
Alkalinity, CaCO ₃ , mg/L	183	196	191	151	178	193	214	150	176	186	44.1	140	158	167	162	172
Sulphate (SO ₄), mg/L	31.8	35.7	32.7	23.4	25.6	27.1	72.7	21.2	24.6	28.5	5.3	22.6	21.5	22.6	20.1	23.8
Nutrients																
Nitrite Nitrogen (NO ₂), mg/L											<0.005	<0.005	<0.005			
Nitrate Nitrogen (NO ₃), mg/l											<0.02	0.02	<0.02			
N-NH ₃ , mg/L	<0.005	0.011	<0.005	<0.005	<0.005	0.033	0.027	<0.005	<0.005	0.025	0.012	0.01	<0.005	0.025	0.04	0.016
N-NO ₂ -NO ₃ , mg/L											<0.02	0.02	<0.02	<0.02	0.02	<0.02
Total Phosphorus, mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cyanide																
Total Cyanide, mg/L	<0.001	<0.001	0.0006	<0.0005	<0.0005	<0.0005	0.0007	<0.0005	<0.0005	0.0014	0.0007	0.0019	<0.0005	<0.0005	0.0005	0.0005
Cyanide-WAD, mg/L																
Total Metals																
Aluminum	<0.02	0.02	<0.02	0.05	0.02	<0.02	<0.02	0.03	<0.02	<0.02	0.06	0.04	0.22	<0.02	0.07	0.11
Antimony	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	0.039	0.042	0.041	0.038	0.040	0.039	0.043	0.037	0.037	0.041	0.012	0.032	0.039	0.036	0.038	0.04
Beryllium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bismuth	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	<0.01	<0.01	<0.01	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.009	<0.008	<0.008	<0.008
Cadmium	0.0003	0.0003	0.0001	0.0002	0.00011	<0.0001	0.0001	0.0002	<0.0001	0.1	<0.0001	0.0001	0.0002	<0.002	0.00027	0.00017
Calcium	71.2	78.5	78.8	59.8	71.5	73.1	84	59.3	66.8	71.8	16.9	51	90.2	64.4	53	67.6
Chromium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Iron	0.033	0.024	0.021	0.089	0.069	0.005	0.036	0.028	0.014	0.006	0.064	0.048	2.39	0.012	0.117	0.179
Lead	0.002	0.0023	0.0014	0.0028	0.0037	0.0007	0.0035	0.0019	0.0014	0.23	0.0012	0.0017	0.0065	<0.03	0.00735	0.00691
Lithium																
Magnesium	8.22	8.94	9.36	7.11	9.02	9.48	25.2	7.66	8.76	9.72	1.92	6.93	8.9	8.69	7.95	9.23
Manganese	0.012	0.013	0.012	0.012	0.117	0.003	0.004	0.01	0.01	0.002	0.003	0.009	0.021	0.004	0.026	0.02
Mercury											<0.00005					
Molybdenum	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005
Nickel	<0.01	<0.01	<0.01	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Potassium	2	<1	1	<1	1	<1	3	<1	1	<1	<1	2	1	<1	1	1
Selenium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Silicon															2.11	2.04
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	1.0	1.1	1.14	0.79	0.99	1	2.77	0.83	0.93	0.95	0.26	0.82	1.55	0.96	0.77	0.95
Strontium	0.254	0.269	0.271	0.212	0.264	0.274	0.384	0.219	0.243	0.279	0.061	0.19	0.252	0.242	0.229	0.254
Sulphur	10.1	11.4	11.8	7.7	8.9	9.1	25.8	8.1	8.5	9.3	1.8	6.8	9.5	8.3	6.8	7.9
Tellurium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			
Thallium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Tin	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Titanium	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Vanadium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	0.1	0.101	0.103	0.046	0.039	0.025	0.035	0.04	0.026	0.031	0.011	0.022	0.054	0.035	0.055	0.03
Zirconium	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Metals																
Aluminum																
Antimony																
Arsenic																
Barium																
Cadmium																
Calcium																
Copper																
Iron																
Lead																
Molybdenum																
Selenium																
Silver																
Sodium																
Zinc																
(-) Indicates values are less than (b)																

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Detailed Decommissioning & Reclamation Plan

Appendix C-3

MH-02 Water Quality

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Sample Date	07-Apr-93	30-Apr-93	18-May-93	30-Jun-93	26-Jul-93	31-Aug-93	08-Oct-93	02-Nov-93	29-Dec-93	26-Jan-94	03-Mar-94	28-Mar-94	26-Apr-94	31-May-94	28-Jun-94	20-Jul-94	21-Jul-94	29-Aug-94	26-Sep-94	30-Oct-94	30-Nov-94	29-Dec-94	28-Jan-95	28-Feb-95	16-Mar-95	06-Apr-95	01-May-95	01-May-95	06-Jun-95
Collected By:	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	DIAND
Lab No.	3009																4102											5073	
Station	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	
Physical Parameters																													
pH	7.57	8.00	8.10	8.10	8.20	8.00	8.00	8.00	8.10	8.10	8.00	8.10	7.80	8.00	7.90	7.90	8.10	8.20	7.90	7.90	8.10	8.10	7.80	8.20	8.00	7.90	7.70	7.70	7.90
pH (in Field)	7.2																7.5		7.8	7.7	7.3	7.5	6.9	7.1	7.2	7.2	7.5	7.5	7.9
Conductivity, micro-mho/cm	856	452	436	754	840	708	858	868	798	675	855	850	723	775	775	787	840	755	699	763	423	844	930	858	910	599	667	667	865
Conductivity (in Field), micro-mho/cm	880																903												924
Total Suspended Solids, mg/L	-10	183	112	69	-4	4	-4	-4	-4	-4	-4	-4	-4	-4	-4	4	13	-4	16	-4	-4	-4	15	10	-4	-4	14	14	-5
Turbidity, NTU	150.0	150.0	55.0	32.0	1.8	3.0	2.8	2.6	1.5	4.8	3.8	2.6	2.3	0.7	3.5														
Dissolved Susspended Solids, mg/L	590	263	217	485	535	527	553	564	590	592	604	610	474	396	439	455	585	560	452	475	624	532	684	588	626	408	494	494	600
Flow, L/min			180.0		43.0	52.0	60.0	51.0	45.0	49.0				180.0	69.2	53.0	30.00	90.0	90.0	43.0	10.0	10.0						48.00	
Temp., degrees Celcius	1.8																11.4		7.4	2.5	0.1	2.8	8.3	11.1	8.9	12.8	13.9	13.9	15.4
Hardness, CaCO ₃ , mg/L	408																												
Total Hardness, mg/L	413	268	219	407	483	418	456	446	437	449	532	483	445	411	457	460	441	435	455	475	501	452	489	485	477	527	395	395	418
LC50																													
Anions																													
Alkalinity, CaCO ₃ , mg/L	370	194	182	358	403	390	407	405	421	432	435	429	391	355	421	409	370	394	352	404	420	421	446	451	452	451	332	332	398
Sulphate (SO ₄), mg/L	128	59.6	52.7	80.0	90.1	91.2	21.1	104.0	102.0	83.7	90.0	100.0	82.3	112.0	95.3	105.0	114	108.0	105.0	114.0	111.0	110.0	94.7	111.0	110.0	116.0	95.8	95.8	142
Nutrients																													
Nitrite Nitrogen (NO ₂), mg/L	0.139	0.061	0.045	0.177	0.087	0.075	0.010	0.124	0.107	0.115	0.133	0.120	0.100	0.127	0.157	0.110	0.120	0.028	0.123	0.132	0.164	0.161	0.131	0.150	0.140	0.145	0.094	0.094	0.140
Nitrate Nitrogen (NO ₃), mg/l	-0.002																-5.000												-2.000
N-NH ₃ , mg/L	0.017																												
N-NO ₂ -NO ₃ , mg/L		0.260	0.040	0.030	0.020	-0.020	1.570	0.030	0.050	0.050	0.030	0.020	0.040	0.070	0.020		-1.000												-0.200
Total Phosphorus, mg/L	-0.10																-0.06												-0.06
Cyanide																													
Total Cyanide, mg/L	-0.030	0.006	0.006	0.009	0.007	0.006	0.005	0.007	0.006	0.006	0.003	0.003	0.002	0.022	0.013	0.007	-0.005	0.002	0.006	0.005	0.002	0.001	-0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.005
Cyanide-WAD, mg/L	-0.030																												
Total Metals																													
Aluminum	0.170	5.710	1.120	2.270	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	0.170	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	0.380	0.380	0.070
Antimony	-0.060	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Arsenic	0.08	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.040	0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.050	0.050	-0.040	-0.040	-0.040	0.050	0.050	-0.02	
Barium	0.1670	0.1530	0.0790	0.1630	0.1400	0.1400	0.1480	0.1360	0.1410	0.1530	0.1520	0.1630	0.1390	0.1350	0.1450	0.1540	0.1510	0.1460	0.1470	0.1460	0.1560	0.1520	0.1550	0.1550	0.1680	0.1760	0.1400	0.1400	0.1570
Beryllium	-0.0010																-0.0002												-0.0002
Bismuth																													
Boron	-0.010																												
Cadmium	-0.0060	0.0008	0.0004	0.0006	0.0003	0.0009	0.0009	0.0003	0.0002	0.0002	0.0002	0.0002	0.0001	0.0008	0.0004	0.0003	-0.0005	0.0002	0.0010	0.0006	0.0005	0.0004	0.0003	0.0003	0.0002	0.0003	0.0005	0.0005	0.0009
Calcium	157.0	89.5	77.9	136.0	160.3	140.0	154.0	152.0	148.0	152.0	183.0	163.0	152.0	142.0	156.0	155.0	147.0	155.0	163.0	172.0	170.0	163.0	167.0	163.0	160.0	179.0	136.0	136.0	140.0
Chromium	-0.0060																-0.0010												-0.0010
Cobalt	-0.006																0.004												0.003
Copper	-0.006	0.012	0.005	0.004	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.004	-0.002	-0.002	-0.002	-0.002	-0.002	0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.015
Iron	0.515	10.500	2.580	3.750	0.430	-0.002	0.540	0.720	0.980	0.840	1.010	0.770	0.590	0.730	0.700	0.632	0.530	0.560	0.750	0.880	0.910	1.100	2.050	1.140	1.350	1.350	0.866	0.866	
Lead	-0.060	0.060	0.090	0.120	0.005	-0.030	0.006	0.004	0.004	0.004	-0.003	0.009	-0.003	0.018	0.012	0.015	0.040	0.004	0.007	0.008	0.005	0.005	0.005	0.004	0.004	0.005	0.027	0.027	0.020
Lithium																													
Magnesium	14.90									16.90	18.20	18.50	16.00	13.70	16.50	17.10	13.90	16.50	16.40	16.60	17.30	17.10	17.40	18.90	18.90	19.50	13.50	13.50	14.70
Manganese	1.8600									2.6000	3.1700	3.1200	2.7800	2.0100	2.9100	2.9300	2.6100	2.3100	2.9400	2.9300	3.3200	3.2100	3.5500	3.5500	3.7200	4.0000	2.7900	2.7900	2.7700
Mercury																													
Molybdenum	-0.010	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	0.004
Nickel	-0.0200									-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	0.0030	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	0.0040
Potassium	-2.0									1.00	1.00	1.00	17.00	22.00	20.00	23.00	0.9	23.00	23.00	23.00	27.00	23.00	21.20	23.20	24.40	24.10	24.10	0.8	
Selenium	-0.06	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.02	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.02
Silicon	4.81																5.01												5.63
Silver	-0.010	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.001
Sodium	48.70	14.00	15.50	29.80	32.80	30.20	32.90	30.60	29.20	33.60	33.50	35.50	29.40	33.00	30.50	32.40	34.70	32.20	33.10	33.60	34.30	32.70	32.50	34.10	33.10	37.30	26.50	26.50	30.50
Strontium	0.639																0.560												0.600
Sulphur										26.30	32.20	30.80	27.60																

NST: No Sample Taken
(-) Indicates values are less than (below)

Sample Date	01-Sep-97	02-Oct-97	07-Nov-97	26-Nov-97	01-Dec-97	04-Jan-98	05-Feb-98	03-Mar-98	04-Apr-98	04-May-98	01-Jun-98	01-Jul-98	02-Aug-98	30-Aug-98	06-Oct-98	10-Oct-98	02-Nov-98	01-Dec-98	4-Jan-99	1-Feb-99	2-Mar-99	2-Apr-99	2-May-99	2-Jun-99	2-Jul-99	5-Aug-99	2-Sep-99	5-Oct-99	3-Nov-99
Collected By:	Company	Company	Company	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	DIAND	Company	Company	Company											
Lab No.				7182		98000548				98016581	98022638	98027986	98036462	98044648	8116	98056635	98062641	98070143											
Station	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02
Physical Parameters																													
pH	8.30	7.90	8.20	7.70	8.20	7.60				7.90	8.10	8.10	8.30	8.00	7.93	8.00	8.00	7.90	8.10	7.80	8.00		7.90	8.20	8.40	8.10	8.10	8.20	8.10
pH (in Field)	7.2	7.6	7.4		6.5	6.82				6.96	7.04	7.33	7.36	7.18	7.8	7.81	7.14	6.6	7.59	7.56	7.48		7.44	7.71	7.64	7.56	7.68	7.78	7.24
Conductivity, micro-mho/cm	982	987	1120	1150	1100	1070				791	1030	986	996		1000	1020	1070	1020	1090	1100	1150		881	769	1010	1030	1020	1060	1080
Conductivity (in Field), micro-mho/cm															1050														
Total Suspended Solids, mg/L	-4	-4	-4	-5	-4	6				-4	-4	-4	-4	4	-5	-4	-4	-4	<4	4	4		<4	<4	<4	<4	<4	<4	<4
Turbidity, NTU																													
Dissolved Susspended Solids, mg/L	674	726	716	772	750	752				522	744	692	658	690	710	730	780	786	822	828	874		644	520	796	836	748	784	858
Flow, L/min	25.0	26.0	17.0		17.0	NST				25	84	33	23	20	24.00	21	19	NST	u/a	u/a	u/a	0	4	200	54	25	18	17	11
Temp, degrees Celcius	16.0	2.0	1.0		1.0	1.0				2.0	10.0	16.0	22.0	15.0	1.4	2.0	1.0	1.0	0	0	0		1	6	15	15	9	3	0
Hardness, CaCO ₃ , mg/L																			608	611	609		479	386	629	558	573	617	648
Total Hardness, mg/L	523	501	475		548	526				391	539	468	528	525		536	589	582											
LC50																													
Anions																													
Alkalinity, CaCO ₃ , mg/L	386	386	414	418	427	425				280	366	394	394	395	410	383	395	430	432	417	425		293	234	362	380	373	365	369
Sulphate (SO ₄), mg/L	184.0	186.0	167.0	246	170.0	188				179	249	183	195	221	240	235	266	246					216	189	303	245	247	271	310
Nutrients																													
Nitrite Nitrogen (NO ₂), mg/L	0.073	0.145	0.178	0.290	0.164	0.174				0.157	0.162	0.032	0.044	0.046	-0.050	0.023	0.155	0.174											
Nitrate Nitrogen (NO ₃), mg/l				-0.050											-0.003														
N-NH ₃ , mg/L																			0.164	0.135	0.131		0.127	0.130	0.045	0.016	0.009	0.030	0.046
N-NO ₂ -NO ₃ , mg/L				0.050											-0.050														
Total Phosphorus, mg/L	-0.040	-0.040	-0.040	-0.06	-0.040	0.22				-0.04	-0.04	-0.04	0.06	-0.04	0.24	-0.04	-0.04	-0.04	<0.04	<0.04	0.04		<0.04	<0.04	0.04	<0.04	0.05	<0.1	<0.1
Cyanide																													
Total Cyanide, mg/L	0.003	0.004	0.003		0.004	0.001				0.001	0.002	0.002	0.001	-0.001	0.006	-0.001	0.002	-0.001	<0.001	<0.001	0.001		0.003	0.003	0.003	0.001	0.001	0.002	0.001
Cyanide-WAD, mg/L																													
Total Metals																													
Aluminum	-0.060	-0.060	-0.060	0.020	-0.060	-0.06	NST	NST	NST	-0.06	-0.06	-0.06	-0.06	-0.06	0.040	-0.06	-0.06	-0.06	<0.06	<0.06	<0.06		<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Antimony	-0.020	-0.020	-0.020	-0.020	-0.020	-0.02				-0.02	0.02	0.02	0.02	-0.02	-0.020	-0.02	0.02	-0.02	<0.02	<0.02	<0.02		0.03	0.02	<0.02	<0.02	<0.02	0.02	0.05
Arsenic	-0.040	-0.040	-0.040	-0.02	-0.040	-0.04				-0.04	-0.04	-0.04	-0.04	-0.04	-0.02	-0.04	-0.04	0.07	<0.04	0.07	0.06		0.04	<0.04	<0.04	0.05	<0.04	<0.04	0.003
Barium	0.1880	0.1730	0.1640	0.1610	0.1570	0.145				0.127	0.152	0.131	0.166	0.155	0.1390	0.150	0.144	0.173	0.152	0.157	0.189		0.132	0.109	0.154	0.126	0.123	0.113	0.123
Beryllium	-0.0010	-0.0010	-0.0010	-0.0002	-0.0010	-0.001				-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	0.0006	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bismuth	-0.020	-0.020	-0.020		0.020	-0.02				-0.02	-0.02	-0.02	-0.02	-0.02		-0.02	0.02	-0.02	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Boron	-0.040	-0.040	-0.040		-0.040	0.33				-0.04	-0.04	-0.040	0.0	0.0		0.0	0.0	0.0	<0.04	<0.04	<0.04		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Cadmium	0.0006	0.0005	0.0006	0.0012	0.0007	0.0007				0.0005	0.0013	0.0010	0.0012	0.0008	0.0012	0.0008	0.0011	-0.0001	0.0002	0.0004	0.0003		0.0006	0.0014	0.0010	0.0005	0.0004	0.0007	0.0006
Calcium	190.0	178.0	182.0	203.0	176.0	180				137	177	160	190	183	161.0	186	193	211	201	210	214		158	148	221	190	196	212	222
Chromium	0.0030	0.0400	0.0080	-0.0010	-0.0020	0.0030				-0.0020	0.0020	0.0020	0.0020	0.0010	0.0050	0.0080	0.0050	0.004	0.005	0.006		0.004	0.004	0.004	0.004	0.003	0.003	0.004	0.006
Cobalt	0.0050	0.0060	0.0080	0.006	-0.0040	-0.0040				-0.0040	0.0040	0.0060	-0.0040	-0.0040	0.003	0.0060	0.0110	0.0050	0.0050	0.0040	0.0040		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Copper	0.002	0.003	0.006	0.006	0.004	-0.002				-0.003	-0.003	-0.003	-0.003	-0.003	0.021	-0.003	0.004	-0.003	<0.003	<0.003	<0.003		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Iron	0.750	0.950	0.870	0.694	0.730	0.57				0.75	0.46	0.54	0.64	0.90	0.957	0.89	0.57	1.05	0.93	1.12	1.17		2.46	0.36	0.37	0.52	0.74	0.48	0.58
Lead	0.005	0.004	0.003	0.012	0.003	-0.003				-0.003	0.005	0.005	0.006	0.010	-0.005	-0.003	-0.003	0.006	0.005	0.005	0.002		0.003	0.014	0.002	0.003	0.006	0.001	<0.001
Lithium																													
Magnesium	20.40	19.10	20.30	17.90	19.40	19.5				12.9	16.0	17.8	19.9	20.7	15.90	20.5	19.8	22.1	21.1	21.6	23.3		15.1	11.4	18.7	20.4	20.2	21.3	22.8
Manganese	3.6100	3.8100	3.8100	4.6400	3.6800	3.64				2.73	3.16	2.63	2.96	2.94	2.9200	3.22	3.32	3.77	3.31	2.88	3.11		2.77	1.81	2.43	1.99	1.94	1.97	1.83
Mercury																													
Molybdenum	-0.004	-0.004	-0.004	-0.005	-0.004	0.009	NST	NST	NST	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	<0.005	<0.005	<0.005		<0.005	<0.005	<0.005	0.005	<0.005	<0.005	<0.005
Nickel	-0.010	-0.010	-0.010	0.0040	-0.010	-0.01				-0.01	-0.01	-0.01	-0.01	-0.01	-0.0020	-0.01	-0.01	-0.01	-0.01	<0.01	<0.01		<0.01	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01
Potassium	1.30	1.80	1.60	1.1	0.90	1.40				1.00	1.20	1.00	1.00	1.10	1.3	1.50	1.50	1.10	0.8	1.2	1.1		1.5	1.1	1.0	0.8	1.0	1.2	1.2
Selenium	-0.030	-0.030	-0.030	-0.02	-0.030	-0.03				-0.03	-0.03	-0.03	-0.03	-0.03	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03		0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Silicon	3.70	1.50	1.90	6.14																									

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Sample Date	29-Jul-02	1-Sep-02	1-Oct-02	3-Nov-02	2-Dec-02	2-Jan-03	1-Feb-03	1-Mar-03	1-Apr-03	2-May-03	1-Jun-03	4-Jul-03	8-Aug-03	4-Sep-03	4-Nov-03	7-Dec-03	6-Jan-04	7-Feb-04	2-Mar-04	11-Apr-04	9-May-04	7-Jun-04	6-Jul-04	6-Aug-04	5-Sep-04	4-Oct-04	29-Jan-05	24-Feb-05	17-Mar-05	18-Apr-05	27-May-05	21-Jun-05		
Collected By:																																		
Lab No.																																		
Station	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02	MH-02		
Physical Parameters																																		
pH	8.20	8.10	8.10		8.10	7.7	8.0	8.0	7.9	8.1	8.1	8.3	8.1	8.2	8.1	8.3	8.2	8.2	8.1	8.1	8.2	8.3	8.3	8.2	8.1		8.1	7.8	8	8	8.1	7.9	8.2	
pH (in Field)	7.87	7.95	7.90		7.83	7.78	7.97	7.88	7.77	7.68	7.97		8.29	8.18	8.78	8.28							8.56	8.48										
Conductivity, micro-mho/cm	1010	961	992		1080	1050	1170	1220	1260	1020	1180	309	390	384	359	342	380	384	392															
Conductivity (in Field), micro-mho/cm																					386	379	405	399	1040		1040	1010	1180	1170	1040	877	673	914
Turbidity, NTU	<4	<4	<4		<4	<4	<4	6	7	<4	<4	<4	<4	<4	<4	<4	10	42	10															
Dissolved Suspended Solids, mg/L	708	736	756		760	802	878	922	988	726	908	196	228	240	236	234	224	220	224	226	222	210	228	782	788		718	856	862	716				
Flow, L/min	37	46	28		13	u/a	u/a	u/a	u/a	8	52			20	28							26	22											
Temp., degrees Celcius	9.7	8.3	1.3		-0.1	0.1	0.3	-0.1	0.1	0.3	13		10.8	11.1	0.1	0.9																		
Hardness, CaCO ₃ , mg/L	557	588	595		607	616	677	680	745	557	677	177		225	216	214	212		205	214	221	213	202	226	219	566	553	581	671		470	400	530	
Total Hardness, mg/L																																		
LC50																																		
Anions																																		
Alkalinity, CaCO ₃ , mg/L	317	323	337		366	384	382	387	378	296	352	149	190	176	181	188	179	182	190	187	184	208	194	338	315	326	354	330	330	229	226	287		
Sulphate (SO ₄), mg/L	255	252	272		304	280	343	361	413	281	391	20.3	18.1	18.8	31.1	23.2	25.2	26.9	26.3	24.6	21.4	15	17.8	291	276	269	302	354	277	257	150	249		
Nutrients																																		
Nitrite Nitrogen (NO ₂), mg/L																						<0.005	<0.005	<0.005	0.005	<0.005	<0.005							
Nitrate Nitrogen (NO ₃), mg/l																						0.02	0.22	0.06	0.03	0.03	0.02							
N-NH ₃ , mg/L	0.040	0.047	0.102		0.099	0.123	0.227	0.220	0.226	0.109	0.126	<0.005	0.005	<0.005	<0.005		<0.005	<0.005	<0.005	0.009	<0.005	<0.005	<0.005	0.099	0.102	0.081	0.177	0.177	0.088	0.109	0.04	0.089		
N-NO ₂ -NO ₃ , mg/L																						0.02	0.22	0.06	0.03	0.03	0.02	0.04	0.06	0.06	0.14	<0.02	<0.02	
Total Phosphorus, mg/L	<0.1	<0.1	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		
Cyanide																																		
Total Cyanide, mg/L	0.0017	0.0019	0.0020		0.0024	0.0018	0.0019	0.0017	0.0016	0.0014	0.0019	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0009	0.0018	<0.0005	0.0005	0.0005	0.0014	0.0029	0.0017	0.0014	0.0013	<0.0005	0.0009	0.001	0.0009	0.0019		
Cyanide-WAD, mg/L																																		
Total Metals																																		
Aluminum	<0.02	<0.02	<0.02		<0.02	<0.02	0.02	0.05	0.05	<0.02	<0.02	0.02	<0.02	0.02	<0.02	0.02	0.34	1.91	0.09	0.03	0.28	<0.02	0.05	0.02	<0.02	<0.02	0.07	0.08	<0.02	<0.02	<0.02	<0.02		
Antimony	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
Arsenic	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
Barium	0.097	0.099	0.104		0.115	0.112	0.123	0.131	0.144	0.125	0.131	0.036	0.047	0.047	0.045	0.045	0.056	0.078	0.05	0.046	0.046	0.045	0.044	0.111	0.104	0.1	0.163	0.122	0.093	0.064	0.087	0.096		
Beryllium	<0.0002	<0.0002	<0.0002		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		
Bismuth	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
Boron	<0.008	0.010	<0.008		<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008		
Cadmium	0.0003	0.0002	0.00023		<0.0001	0.0002	0.0003	0.0005	0.0004	0.0003	0.0004	0.0002	<0.002	<0.0001	<0.002	0.00007	<0.002	0.37	0.00014	<0.002	0.0001	0.00004	<0.0001	0.0002	0.00021	0.0002	<0.002	0.00034	0.00005	0.00004	0.00162	0.00047		
Calcium	188	190	203		205	208	231	232	256	191	235	58.9	76.5	73.9	73.2	72.1	69.9	71.9	75.4	72.7	68.3	76.3	74.2	192	189	198	229	233	192	151	141	184		
Chromium	<0.005	<0.005	0.005		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005			
Cobalt	<0.005	<0.005	<0.005		<0.005	<0.005	<0.005	<0.005	0.007	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		
Copper	<0.005	<0.005	<0.005		<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		
Iron	0.418	0.433	0.600		1.210	1.23	1.53	1.16	1.2	0.77	0.55	0.022	0.014	0.028	0.03	0.043	0.469	2.48	0.11	0.035	0.417	0.005	0.063	0.484	0.468	0.531	0.553	1.55	0.128	0.036	0.322	0.475		
Lead	0.0069	0.0014	0.0005		0.0015	0.0023	0.0046	0.0218	0.018	0.0134	0.0017	0.0013	<0.03	0.0007	<0.03	0.00066	0.05	28.7	0.00308	<0.03	0.0074	0.00047	0.0019	0.0035	0.00241	0.001	<0.03	0.0149	0.00092	0.0022	0.00131	0.00577		
Lithium																																		
Magnesium	21.2	20.2	21.3		23.1	23.5	24.4	24.4	25.6	19.5	21.9	7.2	8.19	7.58	7.59	7.76	7.35	8.3	7.91	7.63	7.61	8.65	8.14	21	19.7	21.1	24	21.8	23.2	25	11.3	17.5		
Manganese	1.84	1.60	2.49		3.39	3.32	3.86	4.17	5.17	4.32	3.26	0.006	0.001	0.002	0.002	0.002	0.015	0.036	0.008	0.005	0.038	0.001	0.006	2.87	2.7	2.53	4.46	3.86	2.13	1.06	1.37	2.38		
Mercury																					<0.00005													
Molybdenum	<0.005	<0.005	<0.005		<0.005	<0.005	<0.005	<0.0																										

Sä Dena Hes Mine

Detailed Decommissioning & Reclamation Plan

Appendix C-4

MH-03 and MH-04 Water Quality

Sample Date	13-Nov-91	05-Jul-91	01-Oct-91	31-Jan-92	26-Feb-92	04-Mar-92	12-Mar-92	18-Mar-92	24-Mar-92	30-Mar-92	05-Apr-92	15-Apr-92	24-Apr-92	30-Apr-92	05-May-92	06-May-92	12-May-92	21-May-92	27-May-92	02-Jun-92	02-Jun-92	10-Jun-92	16-Jun-92
Collected By:	Company	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	DIAND	Company	Company	Company	DIAND	Company	Company	Company
Lab No.	1079															2053				2060			
Station	MH-03	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04
Physical Parameters																							
pH	8.10	8.10	8.10	8.30	8.10	8.20	8.20	8.50	8.20	8.10	8.20	8.30	8.10	8.00	8.10	8.21	8.00	8.10	8.10	8.00	7.90	8.00	7.90
pH (in Field)	8.1															7.7				8.0			
Conductivity, micro-mho/cm	269	237	295	300	320	340	350	320	325	330	345	355	360	340	340	337	350	370	310	306	255	220	203
Conductivity (in Field), micro-mho/cm	159															340				304			
Total Suspended Solids, mg/L	-5	-5	10	2	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5	-10	-5	-5	7	70	215	110	37
Turbidity, NTU	-1		2.0	1.0	-1.0	1.0	-1.0	1.0	-1.0	-1.0	1.0	1.0	1.0	-1.0	-1.0		-1.0	1.0	2.0	30.0	28.0	9.0	
Dissolved Suspended Solids, mg/L		150	160	174	186	184	216	215	225	215	220	231	220	222	217	250	221	212	199	190	198	164	166
Flow, L/min																							
Temp., degrees Celsius		5.3														1.7				1.7			
Hardness, CaCO ₃ , mg/L		137														185				163			
Total Hardness, mg/L		137	143	137	147	134	161	161	162	178	197	163	169	178	178	186	172	167	156	169	177	134	150
LC50																							
Anions																							
Alkalinity, CaCO ₃ , mg/L	142	127	132	134	128	117	121	130	120	141	142	124	133	135	137	140	130	122	131	136	125	129	121
Sulphate (SO ₄), mg/L		7	9.9	8.7	11.7	13.8	15.9	17.2	18.8	19.9	17.5	19.1	19.4	23.2	22.0		20.4	24.1	11.9	11	10.2	7.6	6.0
Nutrients																							
Nitrite Nitrogen (NO ₂), mg/L	0.080	-0.002	-0.050	0.030	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.130	-0.050	0.060	-0.050	0.004	-0.050	-0.050	-0.050	-0.002	-0.050	-0.050	0.070
Nitrate Nitrogen (NO ₃), mg/l	0.08	-0.002																		-0.002			
N-NH ₃ , mg/L		0.068																		2.790			
N-NO ₂ -NO ₃ , mg/L			0.300	0.200	1.300	2.300	3.600	4.600	4.700	5.500	5.300	5.500	5.800	6.800	6.000		5.600	7.000	2.800		2.500	1.200	0.300
Total Phosphorus, mg/L		-0.10														-0.10				-0.10			
Cyanide																							
Total Cyanide, mg/L	-0.005		-0.005	0.003	-0.005	0.009	-0.005	0.012	0.012	-0.005	0.009	-0.005	-0.005										
Cyanide-WAD, mg/L																							
Total Metals																							
Aluminum		-0.060	-0.050	-0.050	-0.050	0.040	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.160	0.100	0.150	0.230	0.150	-0.060	0.150	3.780	2.410	0.510	1.000
Antimony		-0.060	-0.050	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.060	-0.020	-0.020	-0.020	-0.060	-0.020	-0.020	-0.020
Arsenic		-0.06	0.070	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.06	-0.040	-0.040	-0.040	-0.06	-0.040	-0.040	-0.040
Barium		0.0220	0.0160	0.0150	0.0160	0.0160	0.0170	0.0170	0.0160	0.0170	0.0200	-0.0100	-0.0100	-0.0200	0.0200	0.0280	0.0200	-0.0100	0.0200	0.0820	0.0500	0.0200	0.0300
Beryllium		-0.0010														-0.0010				-0.0010			
Bismuth																							
Boron		-0.010														-0.010				-0.010			
Cadmium	0.0005	-0.0060	-0.0003	0.0002	-0.0003	-0.0003	0.0008	0.0004	0.0004	-0.0003	0.0004	0.0012	0.0008	0.0006	0.0006	-0.0060	0.0006	0.0004	0.0006	0.0060	0.0009	0.0006	0.0008
Calcium		50.8	52.0	50.3	53.6	48.6	59.2	58.7	59.0	64.6	71.8	59.6	60.0	63.6	64.5	67.8	61.5	60.2	56.4	63.7	55.7	47.4	49.9
Chromium		-0.0060														-0.0060				0.0090			
Cobalt		-0.006														-0.006				-0.006			
Copper	0.006	0.008	-0.001	0.010	-0.001	-0.001	0.197	0.001	0.003	0.001	0.002	0.002	0.009	0.005	-0.001	-0.006	0.005	0.025	-0.001	-0.006	0.006	0.010	0.006
Iron		0.089	0.021	0.030	0.106	0.032	0.274	0.068	0.072	0.090	0.030	0.061	0.040	0.013	0.004	0.182	-0.003	0.006	0.184	3.220	3.580	0.880	3.360
Lead	0.013	-0.060	-0.004	0.015	0.007	0.010	0.080	0.029	0.013	-0.005	0.007	0.032	0.019	0.028	-0.004	-0.060	0.023	0.038	0.014	-0.060	0.058	0.050	0.110
Lithium		2.60														3.70				3.70			
Magnesium		0.0180														0.0020				0.0450			
Mercury																							
Molybdenum		-0.010	-0.005	0.002	-0.003	0.004	0.035	0.006	-0.003	-0.003	-0.003	0.005	0.006	-0.003	-0.003	-0.010	0.004	-0.003	-0.003	-0.010	-0.003	-0.003	-0.003
Nickel		-0.0200														-0.0200				-0.0200			-0.003
Potassium		-2.0														0.5				-2.0			
Selenium	0.01	-0.06	-0.010	0.010	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.06	-0.020	-0.020	-0.020	-0.06	-0.020	-0.020	-0.020
Silicon		2.91														3.60				9.49			
Silver	0.00	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
Sodium		0.90	0.87	0.80	0.81	3.69	0.68	0.85	0.89	0.92	1.10	1.10	1.80	1.80	3.10	1.00	1.40	1.10	1.50	0.90	0.80	0.70	-0.50
Strontium		0.159														0.200				0.202			
Sulphur																							
Tellurium																							
Thallium																							
Tin		-0.060														-0.060				-0.060			
Titanium		0.0050														0.0120				0.1460			
Vanadium		-0.010														-0.010				0.010			
Zinc	-0.001	0.0530	0.0070	0.0230	0.0080	0.0120	0.1130	0.0300	0.0290	0.0140	0.0140	0.0290	0.0310	0.0170	0.0130	0.0120	0.0210	0.0160	0.0100	0.0290	0.0870	0.0650	0.1530
Zirconium																							
Dissolved Metals																							
Aluminum		-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.130		0.100	-0.050	0.070		-0.050	-0.050	-0.050
Antimony		-0.050	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Arsenic	0.08	-0.050	0.020	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.050		-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Barium		0.0150	0.0140	0.0140	0.0150	0.0160	0.0170	0.0150	0.0170	0.0160	0.0170	-0.0100	-0.0100	-0.0100	-0.0100	-0.0100	-0.0100	0.0200	0.0200	0.0100	-0.0100	-0.0100	-0.0100
Cadmium		-0.0003	0.0002	-0.0003	-0.0003	-0.0003	0.0004	-0.0003	-0.0003	-0.0003	0.0008	0.0007	0.0005	0.0004		-0.0003	-0.0003	-0					
Calcium		50.8	50.0	49.9	49.9	47.8	51.1	56.1	59.9	62.7	70.6	59.3	59.3	63.7	62.7	60.4	60.2	56.2	53.2	45.5	45.8		
Copper		-0.001	0.001	-0.001	-0.001																		

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05-Jan-93	12-Feb-93	31-Mar-93	07-Apr-93	30-Apr-93	18-May-93	30-Jun-93	26-Jul-93	31-Aug-93	08-Oct-93	02-Nov-93	29-Nov-93	29-Dec-93	26-Jan-94	03-Mar-94	28-Mar-94	26-Apr-94	31-May-94	28-Jun-94	20-Jul-94	21-Jul-94	29-Aug-94	26-Sep-94	30-Oct-94	30-Nov-94	29-Dec-94
Company	Company	Company	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	DIAND	Company	Company	Company	Company	Company
MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	
			3010								93030072	94000208								4103					
8.10	8.10	8.40	8.04	8.00	8.20	8.20	8.30	8.20	8.30	8.10	8.10	8.10	8.10	8.10	8.20	7.90	8.10	8.10	8.20	8.30	8.20	8.10	8.00	8.10	8.10
			7.9																	7.6		8.0	8.3	7.5	8.1
311	303	301	303	304	291	286	316	312	325	322	317	313	776	323	310	276	388	265	289	275	306	298	303	276	311
			305																	292					
< 4	< 4	< 4	-10	< 4	884	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	4	4	< 4	4	< 4	4	-5	< 4	9	< 4	11	4
0.3	0.1	0.1		2.6	280.0	173.0	0.3	0.2	0.4	-0.1	0.2	0.8	0.6	1.7	1.0	0.7	0.7	0.2							
182	176	301	180	184	206	173	191	204	194	196	202	216	194	206	266	194	166	147	165	180	186	187	184	204	400
													167.0		196.0	183.0				960.00	182.0				
			14																	4.3		11.1	1.0	15.6	5.0
			156																						
178	163	169	156	187	170	169	184	170	184	176	166	172	167	207	196	183	165	147	156	155	182	178	174	171	168
142	145	147	143	143	137	132	145	148	152	145	150	151	155	160	159	153	150	136	139	130	147	145	151	155	151
14.7	15.1	22.7	12	18.7	15.0	13.0	18.7	17.3	21.1	22.6	19.0	16.5	11.6	12.4	16.6	13.9	11.5	12.0	18.5	15	16.4	27.0	13.4	12.5	12.4
-0.005	0.005	0.005	-0.002	0.011	0.011	0.031	0.009	0.023	0.010	0.009	0.005	0.008	0.006	0.005	0.005	0.011	0.010	0.022	0.016	0.070	0.005	0.006	0.005	0.006	-0.005
			-0.002																	-1.000					
			0.884																						
1.670	1.100	0.850		0.570	1.540	1.110	1.050	0.830	1.570	1.220	0.840	0.700	0.610	0.530	0.530	0.400	0.840	0.580							
			-0.10																	0.800					
																				-0.06					
							0.005																		
-0.020	-0.020	-0.060	-0.060	0.090	8.080	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.010	0.070	0.090	-0.060	0.120	-0.060
-0.015	-0.015	-0.020	-0.060	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
-0.040	-0.040	-0.040	-0.06	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.02	-0.040	-0.040	-0.040	-0.040	-0.040
0.0290	0.0170	0.0180	0.0220	0.0310	0.1580	0.1620	0.0260	0.0260	0.0270	0.0250	0.0260	0.0270	0.0280	0.0310	0.0350	0.0290	0.0240	0.0200	0.0210	0.0184	0.0280	0.0240	0.0230	0.0270	0.0230
			-0.0010																	-0.0002					
			0.010																						
0.0002	0.0001	-0.0001	-0.0060	0.0001	0.0023	0.0003	0.0003	0.0002	0.0003	0.0002	0.0003	0.0003	0.0002	0.0001	0.0002	-0.0001	0.0006	0.0002	0.0002	-0.0005	0.0002	0.0006	0.0002	0.0002	0.0001
66.1	60.9	62.8	61.8	69.6	73.3	63.0	65.9	63.0	67.8	65.3	61.3	63.7	61.5	77.0	72.1	67.7	60.7	54.4	57.9	58.2	67.3	65.8	64.6	63.2	62.2
			-0.0060																	-0.0010					
			-0.006																	-0.001					
0.004	-0.001	-0.002	-0.006	-0.002	0.026	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.004	-0.002	-0.002	0.005	-0.002	-0.002	-0.002	-0.002	0.002	-0.002	-0.002	-0.002	-0.002	-0.002
0.052	0.030	-0.050	-0.006	0.190	12.800	-0.050	0.060	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.120	0.120	-0.050	0.100	0.070	0.070	0.011	0.120	0.220	-0.050	0.210	0.150
-0.003	-0.003	0.009	-0.060	0.018	0.840	-0.003	0.010	0.004	0.008	-0.004	0.019	0.007	0.005	0.005	0.005	0.004	0.008	0.005	0.008	-0.010	0.005	0.011	0.003	0.007	0.006
			3.20										3.20	3.70	4.00	3.40	3.20	2.80	2.80	2.37	3.40	3.30	3.10	3.30	3.00
			-0.0010										0.0090	0.0270	0.0330	0.0170	0.0220	0.0200	0.0170	0.0030	0.0120	0.0080	0.0070	0.0110	0.0080
-0.004	-0.004	-0.004	-0.010	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005	-0.004	-0.004	-0.004	-0.004	-0.004
			-0.0200										-0.010	-0.010	0.020	-0.010	-0.010	-0.010	-0.010	-0.0010	-0.010	-0.010	-0.010	-0.010	-0.010
			-2.0										-1.00	-1.00	1.00	18.00	21.00	22.00	21.00	-0.2	23.00	23.00	24.00	24.00	24.00
-0.030	-0.030	-0.030	-0.06	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.02	-0.030	-0.030	-0.030	-0.030	-0.030
			3.15																	2.70					
-0.010	-0.010	-0.030	-0.010	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.001	-0.030	-0.030	-0.030	-0.030	-0.030
1.04	0.84	0.80	1.00	0.90	1.00	0.80	1.00	0.90	1.10	0.80	0.80	1.00	0.80	1.50	2.20	0.90	0.80	0.90	0.70	0.83	1.00	0.90	0.90	1.00	0.80
			0.186																	0.160					
													3.60	4.20	4.80	4.10	3.70	3.60	4.70	5.00	5.30	8.60	4.50	4.10	3.80
			-0.060																	-0.010					
			-0.0020																	-0.0010					
			-0.010																	-0.002					
0.0130	0.0210	0.0100	-0.0020	0.0200	0.5000	0.0200	0.0200	0.0100	0.0200	0.0600	0.0300	0.0300	0.0400	0.0400	0.0200	0.0100	0.0100	0.0100	0.0600	0.0100	0.0100	0.0600	-0.0100	0.0100	0.0100
-0.020	-0.020	-0.020		-0.020	0.050	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020						
-0.015	-0.015	-0.015		-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015						
-0.040	-0.040	-0.040		-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040						
0.0310	0.0170	0.0180		0.0310	0.0690	0.0170	0.0260	0.0270	0.0250	0.0260	0.0280	0.0280	0.0300	0.0340	0.0280	0.0340	0.0280	0.0230	0.0210						

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05-Jan-97	01-Feb-97	01-Mar-97	01-Apr-97	01-May-97	01-Jun-97	01-Jul-97	01-Aug-97	01-Sep-97	02-Oct-97	07-Nov-97	01-Dec-97	04-Jan-98	05-Feb-98	03-Mar-98	04-Apr-98	04-May-98	26-Aug-98	13-Nov-98	4-Jan-99	2-Apr-99	10-Jul-99	5-Oct-99	2-Feb-00	4-Apr-00	1-Jul-00	1-Nov-00
Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan
MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	98000549	98004351	98007322	98011047	98015582	98044649	98065617	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04	MH-04
8.00	7.80	8.00	8.00	7.20	8.20	8.30	8.20	8.40	8.30	8.30	8.30	8.00	8.10	8.20	8.40	8.10	8.20	7.90	8.1	8.0	8.3	8.3	8.1	8.5	8.2	8.1
6.7	7.3	7.3	7.6	7.4	7.4	7.7	7.6	7.6	7.6	7.2	7.7	7.54	7.51	7.43	7.16	7.27	7.30	7.21	7.92	8.03	8.10	8.28	7.25	7.62	8.30	8.24
311	306	298	310	261	273	274	292	300	295	352	312	307	341	337	341	291	319	337								
6	4	< 4	5	4	33	8	27	< 4	5	< 4	< 4	8	< 4	< 4	< 4	6	5	16	341	332	283	319	234	276	261	315
194	154	174	160	162	174	160	192	148	196	198	182	202	198	158	202	170	190	206	208	188	174	198	196	276	172	192
0.1	0.1	0.1	0.1	1.0	4.0	4.0	3.0	5.0	2.0	0.1	0.1	1.0	0.5		1.0	1.0	5.0	1.0	0.5	0	5	2	0	0	3.5	0
159	176	161	163	136	137	157	165	169	161	153	167	172	172	166	186	156	168	171	182	183	151	185	173	191	154	172
154	155	153	154	132	129	133	140	145	143	148	150	152	162	158	159	138	150	159	162	162	136	149	161	159	137	155
13.3	12.2	12.0	11.4	6.9	7.9	9.6	12.3	10.5	6.5	4.1	5.5	4.6	6.3	4.7	12.7	14.1	16.7	18.5	12.5	11.6	12.6	15.4	11.4	13.1	22.5	14.3
0.058	0.005	0.024	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.006	-0.005	0.005	0.012	0.007	-0.005	-0.005	-0.005	0.005								
																			<0.005	<0.005	0.010	<0.005	0.007	0.020	0.006	<0.005
-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.11	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	<0.04	<0.04	<0.04	<0.1	<0.1	<0.1	<0.1	<0.1
-0.001	-0.001	-0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
-0.060	0.070	-0.060	-0.060	0.710	0.740	0.130	0.060	-0.060	-0.060	-0.060	-0.060	-0.06	-0.06	-0.06	-0.06	0.230	-0.060	0.130	<0.06	0.10	<0.06	<0.06	<0.06	<0.06	<0.02	<0.02
-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	0.030	-0.020	-0.020	-0.020	-0.020	-0.02	0.04	0.02	-0.02	-0.02	-0.02	-0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.090	-0.040	-0.040	-0.040	-0.040	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04
0.0350	0.0410	0.0300	0.0310	0.0450	0.0210	0.0020	0.0300	0.0290	0.0270	0.0260	0.027	0.033	0.033	0.029	0.031	0.033	0.028	0.040	0.031	0.036	0.023	0.026	0.030	0.032	0.021	0.026
-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.001	-0.001	-0.001	-0.001	-0.001	-0.0002	-0.0002	-0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	0.0	-0.04	-0.04	-0.04	-0.04	-0.04	-0.01	-0.01
0.0001	0.0002	0.0001	-0.0001	0.0002	0.0002	0.0002	0.0003	0.0001	0.0001	0.0001	-0.0001	0.0003	-0.0001	0.0001	-0.0001	0.0002	0.0002	0.0003	<0.0001	0.0003	0.0002	0.0003	0.0002	0.0001	0.0002	0.0002
64.5	70.5	61.4	62.9	49.9	54.2	57.1	1.3	68.3	70.2	60.9	57.6	63.9	65.2	63.0	68.1	57.2	64.2	69.1	63.1	66.6	55.6	68.7	63.3	70.3	57.1	63.4
0.0090	-0.0020	-0.0020	0.0030	-0.0020	0.0050	-0.0020	0.0040	-0.0020	0.0040	-0.0020	-0.0020	0.0040	0.0030	0.0020	-0.0020	-0.0020	0.0030	-0.002	0.003	0.002	-0.002	0.003	-0.002	-0.002	-0.005	-0.005
-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005	-0.005
-0.002	-0.002	-0.002	-0.002	-0.002	0.004	-0.002	-0.002	-0.002	0.005	0.004	-0.002	0.002	0.003	-0.002	-0.002	-0.003	-0.003	-0.003	<0.003	0.004	<0.003	<0.003	<0.003	<0.003	<0.005	<0.005
-0.050	0.070	-0.050	0.050	0.730	1.050	0.170	-0.050	0.050	0.090	0.080	-0.050	-0.050	0.170	0.050	-0.050	0.330	-0.050	0.190	0.05	0.28	<0.05	<0.05	<0.05	<0.05	0.017	0.052
-0.003	0.003	-0.003	-0.003	0.005	0.011	0.010	0.006	0.003	0.004	-0.003	0.004	-0.003	-0.003	-0.003	-0.003	0.026	0.005	0.009	<0.001	0.001	0.001	<0.001	0.001	0.001	<0.001	<0.001
3.60	3.90	3.40	3.32	3.02	3.39	2.59	0.43	3.56	3.53	3.30	3.15	3.41	3.84	3.53	3.75	3.43	3.46	7.39	3.62	3.95	2.87	3.38	3.74	8.33	2.88	3.34
0.0070	0.0110	0.0040	0.0050	0.0220	0.0390	0.0110	-0.0020	0.0070	0.0100	0.0050	0.0030	0.0040	0.0080	0.0040	0.0080	0.0120	0.0070	0.0100	0.007	0.011	0.003	0.003	0.004	0.011	<0.001	0.002
-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	0.018	-0.004	-0.004	-0.004	-0.004	0.007	-0.004	-0.004	-0.004	-0.005	-0.005	-0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
0.40	0.70	-0.10	-0.40	0.70	0.50	-0.40	-0.40	-0.40	-0.40	0.80	-0.40	0.60	1.30	0.6	0.40	1.20	-0.50	1.00	<0.5	0.90	0.80	<0.5	<0.5	<0.5	<1	<1
-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
2.50	2.70	2.20	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	1.6	1.8	1.2	2.3	-0.8	1.3	1.9	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.01	<0.01
-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	0.9	1.2	0.8	0.8	0.9	0.9	0.8	0.9
0.90	1.00	0.90	0.90	0.90	1.10	0.90	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.900	1.000	0.600	1.100	0.900	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
0.213	0.224	0.200	0.200	0.162	0.188	0.158	0.031	0.230	0.226	0.203	0.193	0.205	0.212	0.204	0.210	0.190	0.210	0.226	0.203	0.225	0.180	0.195	0.215	0.224	0.181	0.208
4.50	4.60	4.20	4.00	4.00	5.10	4.60	6.50	6.00	5.50	4.70	4.20	4.20	4.000	4.000	4.000	4.600	5.800	6.200	4.6	4.8	4.0	6.4	4.4	4.4	4.7	4.6
-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05
-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	0.070	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
-0.0030	-0.0030	-0.0030	-0.0030	0.0180	0.0250	-0.0030	0.0150	-0.0030	-0.0030																	

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Sä Dena Hes Mine

Detailed Decommissioning & Reclamation Plan

Appendix C-5

MH-05 and MH-06 Water Quality

Page 1 of 10

Sample Date	4-Jun-00	1-Jul-00	1-Aug-00	1-Sep-00	3-Oct-00	13-Nov-00	1-Dec-00	6-Jan-01	1-Feb-01	2-Mar-01	1-Apr-01	2-May-01	3-Jun-01	1-Jul-01	1-Aug-01	1-Sep-01	3-Oct-01	4-Nov-01	1-Dec-01	5-Jan-02	2-Feb-02	3-Mar-02	3-Apr-02	5-May-02
Collected By:	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan
Lab. No.																								
Station	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05	MH-05
Physical Parameters																								
pH	7.40												7.70											
pH (in Field)	8.30												7.86											
Conductivity, micro-mho/cm																								
Conductivity (in Field), micro-	208												322											
Total Suspended Solids, mg/L	109												144											
Turbidity, NTU																								
Dissolved Susspended Solids,	132												204											
Flow, L/min	300	0	0	0	0	0	0						1200											
Temp., degrees Celcius	6.5												2.3											
Hardness, CaCO ₃ , mg/L	103												176											
Total Hardness, mg/L																								
LC50																								
Anions																								
Alkalinity, CaCO ₃ , mg/L	24.0												100											
Sulphate (SO ₄), mg/L	56.1												57											
Nutrients																								
Nitrite Nitrogen (NO ₂), mg/L																								
Nitrate Nitrogen (NO ₃), mg/l																								
N-NH ₃ , mg/L	0.029												<0.005											
N-NO ₂ -NO ₃ , mg/L																								
Total Phosphorus, mg/L	0.6												0.2											
Cyanide																								
Total Cyanide, mg/L	<0.001												<0.001											
Cyanide-WAD, mg/L																								
Total Metals																								
Aluminum	2.43												2.04											
Antimony	<0.05												<0.05											
Arsenic																								
Barium	0.045												0.043											
Beryllium	<0.0002												0.0003											
Bismuth	<0.05												<0.05											
Boron	0.02												<0.01											
Cadmium	0.0178												0.0122											
Calcium	36.1												63.3											
Chromium	0.005												0.006											
Cobalt	<0.005												<0.005											
Copper	0.009												0.009											
Iron	4.91												4.22											
Lead	1.79												2.01											
Lithium																								
Magnesium	3.22												4.3											
Manganese	0.189												0.19											
Mercury																								
Molybdenum	<0.005												<0.005											
Nickel	<0.01												0.01											
Potassium	1.00												1.0											
Selenium	<0.03												<0.03											
Silicon																								
Silver	<0.01												<0.01											
Sodium	0.50												0.7											
Strontium	0.083												0.163											
Sulphur	21.8												18.6											
Tellurium	<0.05												<0.05											
Thallium	<0.03												<0.03											
Tin	<0.02												<0.02											
Titanium	0.107												0.113											
Vanadium	0.014												0.014											
Zinc	2.34												1.98											
Zirconium	<0.005												<0.005											
Dissolved Metals																								
Aluminum		-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.100	0.060	0.130		0.170	0.100	0.090		-0.050	-0.050	-0.050	-0.050	0.080
Antimony		-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Arsenic	0.297	-0.050	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Barium		0.0350	0.0340	0.0320	0.0310	0.0270	0.0280	0.0280	0.0320	0.0300	0.0350	0.0300	0.0300	0.0200	0.0300	0.0300	0.0500	0.0200	0.0400	0.0300	0.0400	0.0400	0.0400	0.0400
Cadmium		0.0020	0.0022	0.0019	0.0013	0.0013	0.0009	0.0015	0.0012	0.0020	0.0022	0.0021	0.0018	0.0010	0.0007	0.0009	0.0014	0.0010	0.0014	0.0012	-0.0003	0.0005	0.0005	0.0005
Calcium		56.0	57.4	68.7	79.2	76.3	79.2	85.6	87.9	80.5	69.0	81.8	88.0	99.8	95.8	96.5	101.0	85.7	84.5	89.7	75.5	87.9	87.9	87.9
Copper		0.229	0.248	0.223	0.167	0.158	0.160	0.153	0.184	0.180	0.229	0.131	0.126	0.110	0.091	0.096	0.055	0.026	0.038	0.025	0.019	0.017	0.017	0.017
Iron		0.094	0.149	0.086	0.087	0.112	0.113	0.037	0.063	0.053	0.100	0.043	0.020	-0.003	-0.003	-0.003	-0.003	0.003	0.004	-0.003	-0.003	0.069	0.069	0.069
Lead		0.073	0.100	0.038	0.020	0.015	0.015	0.033	0.012	0.020	0.039	0.023	0.022	0.017	0.029	0.057	0.027	0.061	0.066	0.026	0.019	0.041	0.041	0.041
Molybdenum		0.034	0.039	0.032	0.029	0.028	0.026	0.016	0.033	0.036	0.036	0.036	0.035	0.032	0.033	0.026	0.026	0.020	0.017	0.009	-0.003	0.006	0.006	0.006
Selenium		-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Silver		-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
Sodium		80.70	77.30	69.60	65.80	58.40	59.30	64.00	68.90	57.60	76.50	64.30	61.90	62.00	56.40	56.70	49.10	39.30	33.60	32.50	16.40	25.20	25.20	25.20
Zinc		0.3920	0.4220	0.3700	0.2830	0.2660	0.2650	0.2720	0.3260	0.3330	0.3680	0.2950	0.2650	0.2110	0.1340	0.1520	0.1290			0.1270	0.1270	0.1150	0.0370	0.0910
(-) Indicates values are less than (f																								

(-) Indicates values are less than 0

(-) Indicates values are less than (1

(-) Indicates values are less than (

(-) Indicates values are less than 0

Sample Date	06-Jun-95	05-Feb-98	02-Jun-92	10-Jul-99	2-Sep-99	13-Jun-02	1-Jul-02	15-Jul-02	29-Jul-02	18-Aug-02	1-Sep-02	17-Sep-02	1-Oct-02	21-Aug-03	21-Jun-05	17-Jul-05	26-Jan-94	03-Mar-94	28-Mar-94	26-Apr-94	28-May-94	31-May-94	03-Jun-94	28-Feb-95	16-Mar-95
Collected By:	DIAND	Company	DIAND	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	Company	Company	Company	Company	Company	Company	Company	Company	Company
Lab. No.	5075	No Sample taken	2062																						
Station	MH-06	MH-06	MH-06A	MH-06A	MH-06A	MH-06A	MH-06A	MH-06A	MH-06A	MH-06A	MH-06A	MH-06A	MH-06A	MH-06A	MH-06A	MH-06A	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	
Physical Parameters																									
pH	8.20		7.50	8.30	8.30	8.50	8.50	8.30	8.30	8.20	8.20	8.10	8.10	8.3	8.2	8.2	7.70	7.80	7.70	7.70	8.20	8.00	6.90		
pH (in Field)	8.3		7.7	8.15	7.79	8.26	8.71	8.41	8.35	8.21	8.38	8.17	8.31												
Conductivity, micro-mho/cm	390		325												276	325	304	668	643	568	390	348	282		
Conductivity (in Field), micro-	418		334	304	344	324	342	317	319	316	311	302	304	345											
Total Suspended Solids, mg/L	10		60	4	<4	6	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	
Turbidity, NTU															2.1	0.6	0.9	2.2	2.0	3.0	0.8				
Dissolved Suspended Solids, Flow, L/min	272		210	182	202	194	204	204	202	182	206	210	200	208	162	226	474	496	482	454	203	171			
Temp., degrees Celcius	11.6		2.4	8	5	15.9	11.7	13.8	11.1	10.5	10.6	8.4	6.0												
Hardness, CaCO ₃ , mg/L			141	159	190	174	184	189	182	193	193	204	204	194	150	180									
Total Hardness, mg/L	191		150														327	406	353	351	214	171			
LC50																							100		
Anions																									
Alkalinity, CaCO ₃ , mg/L	157		88	145.0	159.0	153	162	158	160	166	166	173	175	158	134	156	167	174	178	183	140	120			
Sulphate (SO ₄), mg/L	65		64	14.0	19.9	18.9	19.9	18.4	18.3	18.6	18.3	18.6	18.2	15.1	13.5	17	188.0	187.0	189.0	188.0	74.1	56.2			
Nutrients																									
Nitrite Nitrogen (NO ₂), mg/L	0.050		0.278														0.274	0.180	0.274	0.212	0.039	0.010			
Nitrate Nitrogen (NO ₃), mg/l	-2.000		0.094																						
N-NH ₃ , mg/L			1.860	0.006	0.009	0.007	<0.005	0.006	0.006	0.006	0.009	<0.005	<0.005	0.012	0.009	0.025									
N-NO ₂ -NO ₃ , mg/L	-0.200														<0.02	<0.02	0.200	0.120	0.020	0.030	0.020				
Total Phosphorus, mg/L	0.07		-0.10	<0.04	<0.04	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1									
Cyanide																									
Total Cyanide, mg/L	-0.005		-0.030	<0.001	<0.001	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	0.0007	0.003	0.001	0.004	0.001	-0.001	-0.001			
Cyanide-WAD, mg/L			-0.030																						
Total Metals																									
Aluminum	0.220		6.030	<0.06	<0.06	0.07	0.04	<0.02	<0.02	0.05	<0.02	<0.02	0.03	0.03	0.02	<0.02	-0.060	-0.060	-0.060	-0.060	-0.060	0.160			
Antimony	-0.020		-0.060	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020			
Arsenic	-0.02		-0.06	<0.04	<0.04	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-0.040	-0.040	-0.040	-0.040	-0.040	0.040			
Barium	0.0601		0.1620	0.032	0.045	0.049	0.052	0.053	0.052	0.058	0.056	0.057	0.057	0.055	0.042	0.046	0.0800	0.0820	0.0860	0.0750	0.0510	0.0460			
Beryllium	-0.0002		-0.0010	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002									
Bismuth			<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05									
Boron			-0.010	<0.04	<0.04	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008									
Cadmium	-0.0005		-0.0060	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00003	0.00003	<0.0001	0.00006	0.00006	0.0002	0.0002	0.0002	-0.0001	-0.0001	0.0001			
Calcium	68.4		53.7	67.2	67.0	60.4	63.8	65.5	63.2	66.6	66.8	70.4	70.3	66.2	53.8	62.2	116.0	146.0	125.0	125.0	75.8	60.4			
Chromium	-0.0010		0.0090	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005									
Cobalt	-0.001		-0.006	<0.004	<0.004	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005									
Copper	0.014		0.023	<0.004	<0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	0.004	0.006	0.004	0.002	-0.002			
Iron	0.678		4.350	<0.05	<0.05	0.094	0.036	0.026	0.022	0.053	0.021	0.031	0.045	0.035	0.053	0.037	0.130	0.160	0.310	0.300	0.080	0.350			
Lead	0.030		0.060	0.001	<0.001	0.0011	0.0009	0.0007	0.0008	0.0011	0.0006	0.0007	0.0009	0.0009	0.00198	0.0007	0.008	0.004	0.007	0.003	0.004	0.016			
Lithium																									
Magnesium	6.07		4.80	3.81	5.54	5.69	5.99	6.09	6.39	6.37	6.81	6.80	6.86	4.92	6.37										
Manganese	0.1550		0.1700	0.0060	0.0240	0.024	0.013	0.010	0.010	0.029	0.013	0.028	0.034	0.019	0.015	0.015									
Mercury																									
Molybdenum	-0.005		-0.010	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.004	0.009	0.009	0.006	0.004	-0.004			
Nickel	0.0020		-0.0200	<0.01	<0.01	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008									
Potassium	1.4		5.0	0.60	0.80	1	<1	1	1	1	2	<1	1	1	<1	<1									
Selenium	-0.02		-0.06	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030			
Silicon	2.64		13.40												2.04	2.21									
Silver	-0.001		-0.010	<0.03	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030			
Sodium	5.74		8.30	0.90	1.40	1.18	1.26	1.22	1.20	1.40	1.37	1.34	1.34	1.23	0.66	1.79	13.00	13.80	13.80	12.10	6.00	4.40			
Strontium	0.260		0.177	0.192	0.223	0.213	0.224	0.233	0.228	0.249	0.250	0.258	0.256	0.244	0.187	0.212									
Sulphur	19.90			4.5	7.7	6.3	6.6	6.4	6.3	6.5	6.5	6.7	6.8	6.4	4.8	5.8									
Tellurium			<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05									
Thallium			<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03									
Tin	-0.010		-0.060	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02									
Titanium	-0.0010		0.2870	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003									
Vanadium	0.004		0.020	<0.003	<0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.0													

(-) Indicates values are less than (b)

Sample Date	01-Aug-98	01-Sep-98	01-Oct-98	04-Nov-98	01-Dec-98	05-Jan-97	01-Feb-97	01-Mar-97	01-Apr-97	#####	01-Jun-97	01-Jul-97	01-Aug-97	01-Sep-97	02-Oct-97	07-Nov-97	01-Dec-97	04-Jan-98	05-Feb-98	03-Mar-98	04-Apr-98	#####	26-Aug-98	13-Nov-98	4-Jan-99	2-Apr-99	10-Jul-99	5-Oct-99	2-Feb-00	
Collected By:	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	
Lab. No.																														
Station	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	98000550	98004352	98007323	98011048	98016583	98044650	98065618	MH-06B	MH-06B	MH-06B	MH-06B	MH-06B	
Physical Parameters																														
	pH	8.30	8.20	8.30	8.00	8.20	7.90	7.90	7.60	7.70	7.30	7.90	8.30	8.20	8.40	8.10	8.40	8.10	8.00	7.80	8.00	8.40	7.30	8.30	8.00	8.10	7.70	8.20	8.30	7.90
	pH (in Field)	8.3	8.3	7.7	7.4	7.7	7.8	7.5	7.6	7.2	7.4	7.6	7.8	7.9	7.8	8.1	7.7	7.4	7.26	7.34	6.94	7.54	8.19	6.91	7.36	7.82	7.93	8.07	7.93	7.47
	Conductivity, micro-mho/cm	322	372	390	415	416	440	449	448	468	356	171	261	291	348	367	417	392	596	400	420	417	29	371	398					
	Conductivity (in Field), micro-mho/cm						440																		430	418	280	365	264	
Total Suspended Solids, mg/L	8	< 4	< 4	< 4	< 4	< 4	< 4	< 4	< 4	8	< 4	6	< 4	< 4	< 4	11	5	< 4	4	< 4	< 4	< 4	< 4	< 4	< 4	6	< 4	< 4	< 4	< 4
Turbidity, NTU																														
Dissolved Suspended Solids, mg/L	200	220	224	246	252	280	254	278	252	226	108	144	182	182	266	216	242	396	244	244	252	14	222	236	266	240	174	226	242	
Flow, L/min																														
Temp, degrees Celsius			1.0	0.5	0.1	0.1	0.1	1.0	1.0	1.0	4.0	10.0	15.0	14.0	5.0	1.0	-0.1					1.0	1.0	13.0	1.0	0.5	0	15	4	0
Hardness, CaCO ₃ mg/L																														
Total Hardness, mg/L	180	213	205	216	197	211	250	227	233	176	83	142	158	179	186	179	197	349	196	203	218	12.9	199	200						
LC50																														
Anions																														
	Alkalinity, CaCO ₃ mg/L	141	156	164	175	179	186	194	193	198	152	66	108	123	141	152	156	164	258	165	173	169	13	164	176	188	191	127	167	175
	Sulphate (SO ₄), mg/L	30.0	36.0	37.5	41.0	42.7	44.3	46.2	43.5	42.1	27.9	12.7	25.0	27.2	27.9	28.1	22.4	27.3	53.9	29.3	32.0	42.2	1.9	34.8	40.0	38.8	30.4	23.5	24.0	27.6
Nutrients																														
	Nitrite Nitrogen (NO ₂), mg/L	0.013	0.009	0.063	0.046	0.071	0.095	0.093	0.129	0.101	0.122	-0.005	0.021	-0.005	0.025	0.023	0.072	0.015	0.063	0.053	0.012	0.084	0.012	0.046	0.041					
	Nitrate Nitrogen (NO ₃), mg/L																													
	N-NH ₃ , mg/L																								0.080	0.069	0.012	0.018	<0.005	
	N-NO ₂ -NO ₃ , mg/L																													
Total Phosphorus, mg/L	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.040	-0.040	-0.040	0.050	-0.040	0.07	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	<0.04	<0.04	0.060	<0.1	<0.1	
Cyanide																														
	Total Cyanide, mg/L	-0.001	0.001	0.001	0.001	-0.001	-0.001	0.001	-0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.001	-0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide-WAD, mg/L																														
Total Metals																														
	Aluminum	0.080	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	0.070	0.140	-0.060	-0.060	-0.060	-0.060	-0.06	-0.060	-0.060	-0.060	-0.060	0.130	-0.060	-0.060	<0.06	<0.06	0.06	<0.06	<0.06
Antimony	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	0.02	0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.03	<0.02	<0.02	0.03	0.03
Arsenic	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	0.06	<0.04	<0.04	<0.04	<0.04
Barium	0.0430	0.0490	0.0500	0.0550	0.0510	0.0590	0.0640	0.0650	0.0620	0.0260	0.0360	0.0460	0.0600	0.0590	0.0560	0.0570	0.084	0.054	0.058	0.055	0.006	0.053	0.060	0.051	0.068	0.041	0.049	0.053	0.053	0.053
Beryllium	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.001	-0.001	-0.001	-0.001	-0.0002	-0.0002	-0.0002	-0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bismuth	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.02	<0.02	<0.02	<0.02	<0.02
Boron	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.13	-0.04	-0.04	-0.04	-0.04	-0.04	0.0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Cadmium	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Calcium	61.7	73.9	69.4	76.3	70.8	79.1	89.5	82.2	84.1	66.8	29.2	50.9	55.8	70.0	65.5	68.5	68.7	113.0	70.2	76.2	75.6	4.32	88.1	76.3	82.4	81.3	51.0	66.7	69.2	69.2
Chromium	-0.0020	0.0030	0.0030	0.0030	-0.0020	0.0050	-0.0020	-0.0020	0.0020	-0.0020	0.0020	-0.0020	0.0020	0.0030	0.0020	0.0020	-0.0020	0.0040	0.0030	0.0040	0.0020	-0.0020	0.0020	0.0030	0.004	0.003	0.002	<0.002	0.003	0.003
Cobalt	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	<0.004	<0.004	0.004	<0.004	<0.004
Copper	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.003	0.002	0.004	0.003	0.006	0.005	0.004	0.005	0.003	0.003	-0.002	-0.003	-0.003	-0.003	<0.003	0.005	<0.003	<0.003	<0.003
Iron	0.190	0.050	0.060	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.170	0.230	0.250	0.060	0.080	-0.050	-0.050	0.180	-0.050	-0.050	0.170	-0.050	-0.050	0.05	0.10	<0.05	0.06	<0.05	<0.05
Lead	0.007	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	0.003	0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	<0.001	<0.001	0.001	0.001	<0.001
Lithium																														
Magnesium	5.30	6.60	6.30	6.80	6.50	7.30	8.00	7.80	7.60	6.20	2.60	4.00	5.00	6.40	6.40	6.50	6.60	11.00	6.68	7.33	7.01	0.39	6.60	7.39	8.02	7.36	4.86	6.33	7.22	7.22
Manganese	0.0330	0.0520	0.1340	0.0720	0.0590	0.0280	0.0680	0.1650	0.2730	0.1830	0.0870	0.0200	0.0240	0.0590	0.1430	0.0450	0.0090	0.010	0.025	0.033	0.153	0.070	0.106	0.005	0.020	0.165	0.010	0.058	0.003	0.003
Mercury																														
Molybdenum	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	0.004	-0.004	-0.004	-0.004	-0.004	0.004	-0.004	0.004	-0.004	0.005	-0.004	0.013	-0.004	0.004	-0.004	-0.005	-0.005	-0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium	1.00	1.20	1.40	1.40	1.40	1.50	2.00	1.60	1.40	1.40	1.10	1.10																		

(-) Indicates values are less than (

Sä Dena Hes Mine

Detailed Decommissioning & Reclamation Plan

Appendix C-6

MH-07 Water Quality

Sample Date Collected By:	10-Sep-91 Company	01-Oct-91 Company	13-Nov-91 Company	13-Nov-91 Company	10-Jan-92 Company	16-Jan-92 Company	21-Jan-92 Company	31-Jan-92 Company	31-Jan-92 Company	04-Feb-92 Company	11-Feb-92 Company	04-Mar-92 Company	12-Mar-92 Company	18-Mar-92 Company	24-Mar-92 Company	30-Mar-92 Company	05-Apr-92 Company	15-Apr-92 Company	19-Apr-92 Company	24-Apr-92 Company	27-Apr-92 Company	30-Apr-92 Company	05-May-92 Company
Lab. No.																							
Station	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07
Physical Parameters																							
pH	8.20	7.90	7.90	7.80	8.00	8.00	7.90	8.10	8.30	7.90	8.00	8.10	8.10	8.30	8.00	8.00	8.20	8.00	8.00	8.00	8.10	8.00	7.90
pH (in Field)																							
Conductivity, micro-mho/cm	340	385			211	201	243	209	420	620	650	690	720	635	610	610	620	620	665	625	620	620	600
Conductivity (in Field), micro-																							
Total Suspended Solids, mg/L	71	6	34	33	14	3		3	3	-5	15	9	7	5	33	7	8	7	5	17	9	14	30
Turbidity, NTU	1.0	6.0	18.0	19.0	13.0	2.0	1.0	4.0	2.0	3.0	8.0	5.0	5.0	4.0	17.0	3.0	6.0	7.0	3.0	10.0	5.0	6.0	27.0
Dissolved Suspended Solids, mg/L	237	265			370	375	381	396	261	401	396	431	465	386	426	426	430	420	438	420	412	415	435
Flow, L/min																							
Temp., degrees Celcius																							
Hardness, CaCO ₃ , mg/L																							
Total Hardness, mg/L	212	239			247	246	270	258	204	284	264	257	273	231	239	303	290	273	275	252	266	242	268
LC50																							
Anions																							
Alkalinity, CaCO ₃ , mg/L	195	236	225	228	211	201	243	209	183	235	210	212	214	194	184	229	212	200	223	206	203	184	182
Sulphate (SO ₄), mg/L	8.5	7.1			70.6	83.6	107.0	95.0	27.8	101.0	112.0	124.0	153.0	111.0	136.0	144.0	136.0	142.0	120.0	146.0	128.0	148.0	169.0
Nutrients																							
Nitrite Nitrogen (NO ₂), mg/L	-0.050	-0.050	-0.050	-0.050	0.030	0.070	0.030	0.030	0.030	-0.050	0.080	-0.050	0.100	0.130	0.160	0.150	0.230	0.320	-0.050	0.260	-0.050	0.190	0.250
Nitrate Nitrogen (NO ₃), mg/l																							
N-NH ₃ , mg/L																							
N-NO ₂ -NO ₃ , mg/L		-0.200			0.100	0.250	0.250	0.250	0.300	-0.500	-5.000	-1.000	-1.000	-0.100	-0.500	-1.000	-1.000	-1.000	-1.000	-0.500	-0.500	-0.500	-0.500
Total Phosphorus, mg/L																							
Cyanide																							
Total Cyanide, mg/L	-0.005	-0.005	-0.005	-0.005	0.003	0.003	0.003	0.003	0.013	-0.005	-0.005	0.005	-0.005	-0.005	-0.005	0.006	-0.005	-0.005	-0.005	0.018	-0.005	-0.005	-0.005
Cyanide-WAD, mg/L																							
Total Metals																							
Aluminum	0.180	-0.050			0.130	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.090	-0.050	-0.050	0.390	-0.050	0.010	0.130	-0.050	0.290	0.250	0.200	0.670
Antimony	-0.050	-0.050			0.025	0.025	0.030	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Arsenic	-0.050	0.080			-0.040	-0.040	0.060	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Barium	0.0850	0.0960			0.1680	0.1810	0.1940	0.1740	0.0750	0.1970	0.2020	0.1830	0.1880	0.0800	0.0990	0.0790	0.0910	0.0800	0.1900	0.0900	0.1780	0.0900	0.1200
Beryllium																							
Bismuth																							
Boron																							
Cadmium	0.0005	0.0003	0.0010	0.0009	0.0008	0.0005	0.0006	0.0008	0.0002	0.0006	0.0006	0.0014	0.0014	0.0004	0.0005	0.0012	0.0004	0.0010	0.0014	0.0010	0.0016	0.0005	0.0005
Calcium	68.7	71.2			82.0	81.8	90.6	85.7	66.5	95.2	88.7	85.4	91.4	71.2	73.9	95.2	89.4	84.3	91.2	73.4	83.1	70.6	82.1
Chromium																							
Cobalt																							
Copper	-0.001	-0.001	-0.001	0.003	-0.001	0.001	-0.001	-0.001	-0.001	-0.001	0.008	-0.001	-0.001	0.009	0.024	0.018	0.012	0.015	-0.001	0.036	0.004	0.022	0.005
Iron	0.376	0.884			0.523	0.150	0.118	0.292	0.061	0.168	0.360	0.334	0.190	0.183	1.060	0.277	0.147	0.279	0.114	0.372	6.880	0.263	0.635
Lead	0.182	0.009	0.186	0.191	0.200	0.073	0.080	0.098	0.037	0.083	0.224	0.161	0.117	0.023	0.080	0.143	0.027	0.110	0.115	0.075	0.123	0.038	0.054
Lithium																							
Magnesium																							
Manganese																							
Mercury																							
Molybdenum	-0.005	-0.005			0.007	0.006	0.009	0.002	0.005	0.004	-0.003	-0.003	-0.003	0.006	0.004	0.012	0.006	0.009	-0.003	0.008	-0.003	0.008	0.007
Nickel																							
Potassium																							
Selenium	0.010	-0.010	-0.010	-0.010	-0.020	-0.020	-0.020	-0.020	0.010	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Silicon																							
Silver	-0.010	-0.010	0.005	0.004	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
Sodium	1.73	2.37			17.30	20.60	23.20	24.60	6.00	31.80	32.30	39.40	45.00	37.70	40.10	51.50	48.40	48.40	33.80	52.60	36.00	47.00	45.50
Strontium																							
Sulphur																							
Tellurium																							
Thallium																							
Tin																							
Titanium																							
Vanadium																							
Zinc	0.1310	0.0230	0.1330	0.1350	0.3130	0.1610	0.2090	0.2080	0.0610	0.2140	0.3190	0.3240	0.2470	0.0850	0.1460	0.1270	0.0720	0.0920	0.2170	0.1380	0.2620	0.0920	0.1350
Zirconium																							
Dissolved Metals																							
Aluminum	-0.050	-0.050			-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.180	-0.050	0.100	0.090
Antimony	-0.050	-0.050			0.025	0.025	0.030	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Arsenic	-0.050	0.060	-0.050	0.060	0.030	0.030	0.030	0.010	0.010	-0.050	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Barium	0.0670	0.0920			0.1600	0.1710	0.0220	0.1740	0.0750	0.1900	0.1970	0.1700	0.1870	0.0730	0.0910	0.0780	0.0850	0.0800	0.1670	0.0800	0.1900	0.0800	0.1000
Cadmium	-0.0003	-0.0003			0.0002	0.0002	0.0006	0.0006	0.0002	0.0006	0.0009	0.0013	0.0008	-0.0003	0.0003	0.0006	-0.0003	0.0007	0.0009	0.0008	0.0013	-0.0003	0.0005
Calcium	65.1	71.1			81.3	80.2	90.5	84.7	65.3	93.9	85.6	84.3	91.0	69.9	73.3	84.2	84.0	75.8	89.7	72.5	82.9	70.1	79.6
Copper	-0.001	-0.001			0.001	0.001	0.001	0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.002	0.007	0.002	0.007	-0.001	0.016	-0.001	0.010	-0.001
Iron	0.124	0.018			0.016	0.077	0.110	0.130	0.057	0.160.													

Sample Date	06-May-92	12-May-92	21-May-92	27-May-92	02-Jun-92	02-Jun-92	10-Jun-92	16-Jun-92	23-Jun-92	30-Jun-92	02-Jul-92	09-Jul-92	16-Jul-92	23-Jul-92	28-Jul-92	04-Aug-92	11-Aug-92	18-Aug-92	24-Aug-92	02-Sep-92	10-Sep-92	23-Sep-92	30-Sep-92	07-Oct-92
Collected By:	DIAND	Company	Company	Company	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company
Lab. No.	2055				2063						18966	92014257	92014827	92015766	92016329	92016914	92017600	92018324	92019686					
Station	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07
Physical Parameters																								
pH	8.30	7.90	8.00	8.00	8.10	8.00	8.20	8.00	7.90	8.30	8.30	8.40	8.20	8.20	8.20	8.30	8.20	8.30	8.20	8.20	8.20	8.20	8.10	8.20
pH (in Field)	7.9				7.5																			
Conductivity, micro-mho/cm	662	625	670	375	563	490	520	512	554	590	590	686	890	700	702	700	701	686	700	689	698	700	711	710
Conductivity (in Field), micro-	660				564																			
Total Suspended Solids, mg/L	30	21	47	999	420	369	16	-5	-5	-5	-5	6	8	7	4	4	10	4	-1	5	2	4	5	< 4
Turbidity, NTU		19.0	30.0	280.0		185.0	7.0	4.0	3.0	3.0	3.0	1.2	1.7	0.8	1.5	1.2	2.3	1.6	1.2	0.6	0.8	0.6	1.4	1.5
Dissolved Suspended Solids, mg/L	460	450	430	248	360	353	376	423	431	474	474	474	472	410	474	482	488	360	476	486	488	362	478	480
Flow, L/min	132.00				900.00																			
Temp., degrees Celsius	4.1				3.2							8.3	7.9	5.8	4.4	6.3	6.5	6.2	6.4					
Hardness, CaCO ₃ , mg/L	272				301																			
Total Hardness, mg/L	277	256	267	626	328	357	285	320	280	311	311	306	283	303	284	309	309	292	307	352	353	307	374	362
LC50																								
Anions																								
Alkalinity, CaCO ₃ , mg/L	191	194	189	140	229	233	230	260	220	229	229	219	220	219	217		211		218	221	225	222	222	223
Sulphate (SO ₄), mg/L		156.0	151.0	50.4	70	63.9	74.2	82.4	115.0	163.0	163.0	152.0	150.0	157.0	157.0	165.0	170.0	202.0	175.0	147.0	161.0	154.0	146.0	170.0
Nutrients																								
Nitrite Nitrogen (NO ₂), mg/L	0.438	0.190	0.250	0.210	0.086	0.130	0.180	0.180	0.220	0.260	0.260	0.295	0.345	0.286	0.329	0.179	0.288	0.241	0.175	0.238	0.209	0.219	0.206	0.208
Nitrate Nitrogen (NO ₃), mg/l					0.020																			
N-NH ₃ , mg/L					1.910																			
N-NO ₂ -NO ₃ , mg/L		-0.500	-1.000	0.500		1.600	1.200	-0.500	-0.500	-0.500	-0.050	0.200	0.140	0.140	0.250	0.230	0.600	0.650	0.620	0.250	0.130	0.230	0.130	0.160
Total Phosphorus, mg/L	-0.10				0.40																			
Cyanide																								
Total Cyanide, mg/L	-0.030	-0.005	0.007	0.021	-0.030	-0.005	0.028	-0.005	0.010	-0.005	-0.005	0.028	0.006	-0.005	0.038	-0.005	0.014	0.008	-0.005	-0.005	-0.005	-0.005	0.005	-0.005
Cyanide-WAD, mg/L	-0.030				-0.030																			
Total Metals																								
Aluminum	1.540	0.660	0.770	32.200	13.600	4.630	0.200	-0.050	0.120	0.100	0.100	0.050	0.310	0.070	0.050	0.050	0.070	0.030	0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Antimony	-0.060	-0.020	-0.020	-0.020	-0.060	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
Arsenic	-0.06	-0.040	-0.040	-0.040	0.06	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.001	-0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.040	-0.040	-0.040	-0.040	-0.040
Barium	0.1430	0.1000	0.1000	0.5400	0.3050	0.1500	0.0600	0.1000	0.1000	0.1400	0.1400	0.0140	0.1200	0.1260	0.1220	0.1300	0.1200	0.1180	0.1180	0.1250	0.1200	0.1210	0.1360	0.1330
Beryllium	-0.0010			-0.0010																				
Bismuth																								
Boron	-0.010				0.010																			
Cadmium	-0.0060	0.0008	0.0007	0.0053	0.0060	0.0012	0.0010	0.0009	0.0011	0.0007	0.0007	0.0009	0.0007	0.0007	-0.0005	0.0006	0.0005	0.0007	0.0007	0.0006	-0.0005	0.0007	0.0008	0.0006
Calcium	87.3	76.1	77.4	75.4	86.2	86.2	77.8	91.9	83.6	98.0	98.0	99.3	89.4	96.0	92.9	97.9	97.0	91.2	96.8	115.0	117.0	99.4	123.0	117.0
Chromium	-0.0060				0.0100																			
Cobalt	-0.006				-0.006																			
Copper	0.010	0.005	0.027	0.087	0.017	0.011	-0.001	-0.001	0.006	-0.001	-0.001	0.003	0.002	-0.001	-0.001	-0.001	-0.001	0.001	0.001	-0.001	0.001	0.002	0.003	0.001
Iron	1.410	0.481	1.060	71.800	18.600	11.000	0.355	0.179	0.114	0.045	0.045	0.124	0.140	0.115	0.096	0.107	0.139	1.260	0.096	0.062	0.105	0.063	0.106	0.061
Lead	-0.060	0.056	0.058	0.878	0.250	0.177	0.064	0.066	0.052	0.046	0.046	0.049	0.080	0.080	0.028	0.040	0.080	0.030	0.030	0.023	0.025	0.023	0.022	0.020
Lithium																								
Magnesium	13.40				23.20																			
Manganese	0.1740				0.2260																			
Mercury																								
Molybdenum	-0.010	0.006	-0.003	0.010	-0.010	-0.003	-0.003	-0.003	0.006	-0.003	-0.003	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	0.004	-0.004	-0.004	0.007	-0.004	0.004
Nickel	-0.0200				-0.0200																			
Potassium	1.8				4.0																			
Selenium	-0.06	-0.020	-0.020	-0.020	-0.06	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030
Silicon	5.70				21.80																			
Silver	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.010	-0.010	-0.010	-0.010	-0.010
Sodium	43.50	43.90	40.60	13.90	13.30	15.00	14.70	21.30	26.50	38.30	38.30	35.90	31.90	34.90	33.50	36.90	30.90	30.70	28.70	31.80	30.00	31.40	34.80	33.60
Strontium	0.397				0.352																			
Sulphur																								
Tellurium																								
Thallium																								
Tin	-0.060				-0.060																			
Titanium	0.0660				0.3330																			
Vanadium	-0.010				0.030																			
Zinc	0.1420	0.1100	0.1100	1.3600	0.3660	0.2650	0.0960	0.1460	0.1380	0.1450	0.1450	0.1500	0.1250	0.1210	0.1170	0.1110	0.1300	1.0700	0.1040	0.1160	0.1350	0.1480	0.1650	0.1460
Zirconium																								
Dissolved Metals																								
Aluminum		0.130	-0.050	-0.050		-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Antimony		-0.020	-0.020	-0.020		-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
Arsenic		-0.040	-0.040	-0.040		-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.040	-0.040	-0.040	-0.040	-0.040
Barium		0.0800	0.0700	0.0500		0.0600	0.0600	0.0800	0.0800	0.1400	0.1400	0.1370	0.1200	0.1240	0.1170	0.1290	0.1180	0.1170	0.1210	0.1180	0.1250	0.1440	0.1300	0.1300
Cadmium		0.0007	0.0007	0.0003		0.0003	0.0009	0.0008	0.0007	0.0009	0.0009	0.0009	0.0007	0.0006	-0.0005	0.0005	-0.0005	0.0007						

(-) Indicates values are less than (below

(-) Indicates values are less than (below

Sample Date Collected By Lab. No.	01-Dec-95 Company	02-Jan-96 Company	05-Feb-96 Company	04-Mar-96 Company	02-Apr-96 Company	05-May-96 Company	03-Jun-96 Company	04-Jul-96 Company	01-Aug-96 Company	01-Sep-96 Company	10-Sep-96 DIAND 6066	10-Sep-96 DIAND 6066	10-Sep-96 Company	01-Oct-96 Company	04-Nov-96 Company	01-Dec-96 Company	05-Jan-97 Company	01-Feb-97 Company	01-Mar-97 Company	01-Apr-97 Company	01-May-97 Company	01-Jun-97 Company	01-Jul-97 Company
Station	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07
Physical Parameters																							
pH	7.84	7.87	7.86	7.88	7.95	7.95	7.80	8.02	8.20	8.30	8.30	8.20	8.20	8.30	8.00	8.30	8.20	8.20	8.10	8.10	7.70	8.40	8.40
pH (in Field)	7.6	7.8	7.8	7.8	7.5	7.6	7.6	7.8	8.0	7.8	8.1			7.6	7.3	7.7	7.0	7.7	7.6	7.4	7.2	7.4	7.9
Conductivity, micro-mho/cm	523	530	536	529	535	482	524	517	523	505	470	470	389	503	493	483	486	481	486	504	457	536	539
Conductivity (in Field), micro-mho/cm											515									504	457	536	539
Total Suspended Solids, mg/L	15	23	8	9	-1	7	32	2	< 4	< 4	-5	-5	< 4	< 4	< 4	30	12	5	4	12	< 4	< 4	4
Turbidity, NTU																							
Dissolved Suspended Solids, mg/L	240	325	325	353	353	273	280	320	306	308	314	301	312	286	288	294	294	270	280	294	270	280	266
Flow, L/min	69.0	63.0		66.0	87.0	63.0	300.0	132.0	110.0	109.0				96.0	75.0	75.0	60.0	54.0	49.0	31.0	61.0	127.0	130.0
Temp., degrees Celcius											7.0			3.0	3.0	2.0	0.1	1.0	0.1				
Hardness, CaCO ₃ , mg/L																							
Total Hardness, mg/L	240	291	276	282	278	264	320	284	290		290	273	283	277	259	230	236	267	248	247	226	292	303
LC50																							
Anions																							
Alkalinity, CaCO ₃ , mg/L	237	236	239	240	241	222	262	249	243	241	243	248	241	236	227	226	225	226	227	233	208	268	266
Sulphate (SO ₄), mg/L	49.1	62.0	57.8	56.4	51.4	52.6	33.2	42.4	38.7	35.7	36	36	37.0	35.4	36.8	38.4	38.4	38.2	36.5	33.6	29.1	16.7	25.4
Nutrients																							
Nitrite Nitrogen (NO ₂), mg/L	0.231	0.287	0.329	0.329	0.277	0.353	0.102	0.200	0.153	0.173	0.160	0.160	0.179	0.208	0.200	0.195	0.239	0.218	0.254	0.219	0.165	0.066	0.073
Nitrate Nitrogen (NO ₃), mg/L											-0.003	-0.003											
N-NH ₃ , mg/L																							
N-NO ₂ -NO ₃ , mg/L											0.152	0.155	0.130										
Total Phosphorus, mg/L					-0.006	-0.006	0.007	-0.006	-0.040	-0.040	-0.06	-0.06	-0.040	-0.040	-0.040	0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Cyanide																							
Total Cyanide, mg/L	-0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.001	-0.005	-0.005	0.002	0.001	0.001	-0.001	-0.001	0.001	-0.001	0.001	0.001	0.001	0.001
Cyanide-WAD, mg/L																							
Total Metals																							
Aluminum	0.174	0.277	0.146	0.100	-0.008	0.263	0.354	0.017	-0.060	-0.060	0.020	0.010	-0.060	-0.060	-0.060	0.250	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060
Antimony	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Arsenic	-0.004	0.022	-0.004	0.005	-0.010	-0.010	-0.010	-0.010	-0.040	-0.040	-0.02	-0.02	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Barium	0.0888	0.0922	0.0970	0.0860	0.1070	0.0920	0.0800	0.0950	0.0860	0.0860	0.0909	0.0856	0.0840	0.0800	0.0810	0.0780	0.0750	0.0850	0.0770	0.0720	0.0710	0.0690	0.0640
Beryllium					-0.0005	-0.0005	-0.0005	-0.0005	-0.0010	-0.0010	-0.0002	-0.0002	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010
Bismuth					-0.007	-0.007	-0.007	-0.007	-0.020	-0.020			-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Boron					-0.002	0.005	0.005	0.004	-0.040	-0.040			-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Cadmium	0.0008	0.0011	-0.0005	0.0008	0.0007	0.0009	0.0006	0.0010	0.0007	0.0007	0.0008	0.0009	0.0008	0.0007	0.0007	0.0005	0.0004	0.0005	0.0005	0.0002	0.0009	0.0004	0.0007
Calcium	83.7	92.3	95.4	90.5	92.4	84.3	85.0	87.9	96.2	95.8	95.0	89.7	98.8	88.0	86.6	76.1	79.1	92.9	85.7	88.6	74.4	81.4	89.2
Chromium					-0.0008	-0.0008	0.0010	-0.0008	-0.0020	0.0030	-0.0010	-0.0010	0.0030	0.0030	-0.0020	-0.0020	0.0040	-0.0020	-0.0020	0.0020	0.0040	-0.0020	-0.0020
Cobalt					0.0010	0.0009	-0.0007	-0.0007	-0.0040	-0.0040	-0.001	-0.001	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040
Copper	-0.001	0.002	0.001	0.012	-0.001	-0.001	-0.001	-0.001	-0.002	-0.002	0.003	0.004	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Iron	0.305	0.406	0.271	0.111	0.043	0.266	0.541	0.014	-0.050	-0.050	0.013	0.014	-0.050	-0.050	-0.050	0.500	0.060	0.060	-0.050	0.060	0.070	0.070	0.170
Lead	0.107	0.076	0.034	0.029	0.021	0.018	0.034	0.011	0.013	0.011	0.015	0.012	0.014	0.010	0.010	0.020	0.029	0.040	0.021	0.008	0.025	0.022	0.016
Lithium					0.00377	0.00426	0.00679	0.00447															
Magnesium	10.40	11.00	11.40	11.40	11.40	10.90	18.70	12.60	12.50	12.40	12.50	11.60	12.30	11.30	10.70	10.10	10.20	11.70	11.80	11.90	8.60	19.70	17.10
Manganese	0.3890	0.4080	0.4350	0.4000	0.4130	0.3500	0.2210	0.4340	0.4200	0.4240	0.4320	0.4060	0.4180	0.3660	0.3490	0.2790	0.3410	0.3740	0.3930	0.4060	0.2820	0.1600	0.1670
Mercury																							
Molybdenum	-0.001	-0.001	-0.001	-0.001	-0.001	0.001	-0.001	0.001	-0.004	-0.004	-0.005	-0.005	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
Nickel	-0.001	0.002	0.002	-0.001	0.002	0.001	-0.001	-0.001	-0.010	-0.010	-0.0020	-0.0020	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
Potassium	1.38	1.91	1.80	1.60	2.00	2.20	1.10	-0.40	1.80	1.90	2.2	2.1	9.30	1.70	1.80	1.90	1.40	1.80	1.70	1.70	1.50	1.00	1.40
Selenium	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.030	-0.030	-0.02	-0.02	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030
Silicon					3.70	3.68	3.51	3.78	4.00	4.10	4.98	4.66	3.80	3.60	2.00	2.30	2.50	2.80	2.50	2.20	1.90	1.50	1.50
Silver	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.030	-0.030	-0.001	-0.001	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030
Sodium	8.18	11.50	10.10	8.30	8.45	7.43	5.20	8.98	7.50	7.20	7.78	7.33	7.00	6.60	6.50	5.70	5.80	6.80	6.10	5.60	4.80	3.60	3.20
Strontium					0.382	0.342	0.374	0.380	0.333	0.366	0.375	0.348	0.355	0.313	0.318	0.295	0.301	0.339	0.325	0.324	0.268	0.346	0.299
Sulphur	17.30	19.30	20.30	18.20	18.40	17.70	9.70	14.40	13.60	13.10	13.70	12.70	13.10	12.10	13.40	12.00	11.80	13.60	13.00	12.20	12.10	8.00	10.30
Tellurium					-0.0200	-0.0300	-0.0002	-0.0001	-0.0200	-0.0200			-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200
Thallium					0.008	-0.004	-0.004	-0.004	-0.030	-0.030			-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030
Tin					-0.003	-0.003	-0.003	0.007	-0.020	-0.020	-0.005	-0.005	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Titanium	0.011	0.014	0.0126	0.0045	0.0120	0.0030																	

Sample Date	01-Aug-97	01-Sep-97	02-Oct-97	07-Nov-97	26-Nov-97	01-Dec-97	04-Jan-98	05-Feb-98	03-Mar-98	03-Apr-98	04-May-98	01-Jun-98	01-Jul-98	02-Aug-98	30-Aug-98	06-Oct-98	10-Oct-98	02-Nov-98	01-Dec-98	28-Jun-94	25-Sep-91	25-Sep-91	25-Sep-91	25-Sep-91
Collected By:	Company	Company	Company	Company	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	DIAND	Company	Company	Company	Company	DIAND	DIAND	DIAND	DIAND
Lab. No.	7183	98000551	98004353	98007324	98011049	98016584	98022640	98027987	98036463	98044651	8117	98056636	98062642	98071444	1150	1147	1148	1149	1150	1147	1148	1149	1150	
Station	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	
Physical Parameters																								
pH	8.30	8.50	8.30	8.30	8.10	8.20	7.90	8.10	8.20	8.50	8.10	8.30	8.10	8.40	8.20	8.00	8.20	8.20	8.10	8.10	8.10	8.10	7.80	8.20
pH (in Field)	7.6	7.3	8.1	7.7		7.4	7.35	7.64	7.42	7.30	7.58	7.28	7.72	7.56	7.62	8.1	7.72	6.98	6.40		8.0	8.0	7.6	8.0
Conductivity, micro-mhol/cm	513	511	493	541	500	487	480	489	492	492	349	526	501	401	485	480	483	481	468	574	454	422	395	402
Conductivity (in Field), micro-	513	511	493	541		487									492						278	260	242	249
Total Suspended Solids, mg/L	<4	<4	<4	<4	-5	6	44	7	<4	7	116	<4	<4	<4	<4	-5	<4	<4	16	<4	10	60	-10	10
Turbidity, NTU																								
Dissolved Suspended Solids, mg/L	268	302	336	396	298	42	300	286	280	284	194	308	300	296	296	290	306	280	308	334	280	260	240	250
Flow, L/min	93.0	85.0	79.0	83.0		80.0	80	55	63	45	120	200	200	85	100	85	66.00	67	80	281.0	168.00	300.00	60.00	138.00
Temp., degrees Celsius								1.0		1.0	2.0	6.0	10.0	10.0	9.0	3.7	4.0	3.0	1.0		7.3	7.5	7.2	7.7
Hardness, CaCO ₃ , mg/L																					242	229	204	207
Total Hardness, mg/L	285	276	263	239		257	246	246	249	271	180	296	262	272	263		258	261	248	359	243	237	207	209
LC50																								
Anions																								
Alkalinity, CaCO ₃ , mg/L	248	246	239	233	231	231	224	227	226	224	154	265	240	196	243	246	228	232	228	240	237	216	204	202
Sulphate (SO ₄), mg/L	32.8	24.2	16.8	17.8	34	20.2	22.2	24.0	23.8	37.8	29.1	23.3	29.6	23.1	26.2	36	37.5	33.8	32.5	122.0	6	10	5	12
Nutrients																								
Nitrite Nitrogen (NO ₂), mg/L	0.074	0.117	0.152	0.169	0.170	0.148	0.183	0.218	0.184	0.157	0.058	0.026	0.038	0.083	0.071	-0.050	0.031	0.109	0.170	0.200	-0.002	-0.002	-0.002	0.003
Nitrate Nitrogen (NO ₃), mg/L					-0.050											-0.003					-0.002	-0.002	-0.002	-0.002
N-NH ₃ , mg/L																					-0.002	0.071	-0.002	0.121
N-NO ₂ -NO ₃ , mg/L					0.140											0.140								
Total Phosphorus, mg/L	0.050	-0.040	-0.040	-0.040	-0.06	-0.040	0.1	-0.04	-0.04	-0.04	0.11	-0.04	-0.04	-0.04	-0.04	0.19	-0.04	-0.04	-0.04		-0.10	0.10	-0.10	-0.10
Cyanide																								
Total Cyanide, mg/L	-0.001	0.002	0.002	0.002		0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.010	0.001	-0.001	-0.001	-0.001	-0.030	-0.030	-0.030	-0.030
Cyanide-WAD, mg/L																					-0.030	-0.030	-0.030	-0.030
Total Metals																								
Aluminum	-0.060	-0.060	0.060	-0.060	0.070	0.060	0.14	-0.06	0.07	-0.06	0.67	-0.06	-0.06	-0.06	-0.06	0.040	-0.06	-0.06	0.11	-0.060	0.300	1.860	0.260	0.450
Antimony	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.02	0.03	0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.020	-0.02	-0.02	-0.02	-0.020	-0.060	-0.060	-0.060	-0.060
Arsenic	-0.040	-0.040	-0.040	-0.040	-0.02	-0.040	-0.04	-0.04	-0.04	-0.04	-0.04	0.05	-0.04	-0.04	-0.04	-0.02	-0.04	-0.04	-0.04	-0.040	-0.06	-0.06	-0.06	-0.06
Barium	0.0820	0.0940	0.0950	0.0860	0.0762	0.0830	0.085	0.076	0.078	0.075	0.064	0.060	0.077	0.068	0.080	0.0791	0.086	0.076	0.085	0.0950	0.1390	0.1000	0.1540	0.0390
Beryllium	-0.0010	-0.0010	-0.0010	-0.0010	-0.0002	-0.0010	-0.001	-0.001	-0.001	-0.001	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	0.0004	-0.0002	-0.0002	-0.0002		-0.0010	-0.0010	-0.0010	-0.0010
Bismuth	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.02	-0.02	0.03	-0.02					
Boron	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.1	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	0.0	0.0	0.0	0.0	0.0		-0.010	-0.010	0.010	0.010
Cadmium	0.0007	0.0007	0.0002	0.0006	0.0006	0.0006	0.0012	0.0008	0.0012	0.0007	0.0026	0.0005	0.0010	0.0006	0.0009	0.0017	0.0010	0.0009	-0.0001	0.0005	-0.0060	-0.0060	-0.0060	-0.0060
Calcium	86.8	92.4	88.6	86.7	80.9	85.8	82.5	86.5	88.2	63.6	77.8	81.2	86.9	84.7	77.4	86.6	82.3	88.3	116.0	83.7	70.9	69.9	56.1	
Chromium	0.0020	0.0030	0.0020	0.0030	-0.0010	-0.0020	0.0020	0.0060	0.0040	0.0020	-0.0020	-0.0020	0.0030	0.0030	-0.0020	0.0020	0.0030	-0.0020	-0.0020		-0.0060	0.0100	-0.0060	-0.0060
Cobalt	-0.0040	-0.0040	-0.0040	-0.0040	-0.001	-0.0040	-0.0040	0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.001	-0.0040	-0.0040	-0.0040		-0.006	0.023	0.006	0.006
Copper	0.004	-0.002	0.004	0.005	0.005	-0.002	0.003	0.003	0.007	-0.002	-0.003	-0.003	-0.003	-0.003	-0.003	0.014	-0.003	-0.003	-0.003	-0.002	-0.006	0.010	-0.006	-0.006
Iron	0.160	-0.050	-0.050	-0.050	0.110	0.100	0.230	0.160	0.100	0.100	1.340	-0.050	-0.050	-0.050	-0.050	0.006	-0.050	-0.050	0.140	-0.050	0.415	2.480	0.978	0.512
Lead	0.008	0.010	0.007	0.007	0.009	0.020	0.036	0.015	0.019	-0.003	0.756	0.015	0.012	0.010	0.008	-0.005	0.004	0.007	0.028	0.010	-0.060	0.150	-0.060	-0.060
Lithium																								
Magnesium	14.50	14.00	13.90	12.10	12.20	11.40	11.30	11.10	11.50	11.50	9.26	20.00	13.40	15.30	12.60	10.00	12.20	11.50	12.10		8.60	13.90	7.80	15.90
Manganese	0.2190	0.3060	0.3660	0.3320	0.3120	0.2940	0.376	0.292	0.304	0.303	0.188	0.080	0.153	0.183	0.219	0.2320	0.251	0.237	0.324		0.0480	0.0770	0.5100	0.0080
Mercury																								
Molybdenum	-0.004	-0.004	-0.004	-0.004	-0.005	-0.004	0.006	-0.004	-0.004	-0.004	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.004	-0.010	-0.010	-0.010	-0.010
Nickel	-0.010	-0.010	-0.010	-0.010	-0.0020	-0.010	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.0020	-0.01	-0.01	-0.01	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200
Potassium	1.20	1.70	1.30	2.10	1.6	1.50	2.20	2.50	1.90	1.40	1.50	1.20	2.00	1.40	1.10	1.5	1.70	1.60	1.40		-2.0	-2.0	-2.0	-2.0
Selenium	-0.030	-0.030	-0.030	-0.030	0.03	-0.030	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.02	-0.03	-0.03	-0.030	-0.06	-0.06	-0.06	-0.06
Silicon	2.10	2.30	1.00	1.10	3.52	0.90	1.8	1.9	1.5	2.5	0.8	1.9	1.1	1.1	1.5	3.42	2.2	2.4	2.1	4.71	6.17	4.54	3.28	
Silver	-0.030	-0.030	-0.030	-0.030	-0.001	-0.030	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	0.001	-0.03	-0.03	-0.03	-0.030	-0.010	-0.010	-0.010	-0.010
Sodium	4.80	5.40	5.30	5.30	5.12	5.30	5.70	5.30	5.30	5.50	2.00	2.70	4.10	3.70	4.60	4.16	4.40	4.30	4.90	12.80	1.30	3.10	1.40	4.10
Strontium	0.331	0.362	0.375	0.337	0.309	0.323	0.319	0.310	0.322	0.313	0.211	0.317	0.305	0.334	0.331	0.313	0.335	0.312	0.344		0.308	0.288	0.247	0.268
Sulphur	11.90	11.60	10.20	11.20	11.30	10.60	10.9	11.3	11.9	11.9	9.1	6.70	9.6	7.9										

Sample Date	4-Jan-99	1-Feb-99	2-Mar-99	2-Apr-99	2-May-99	2-Jun-99	2-Jul-99	5-Aug-99	2-Sep-99	5-Oct-99	3-Nov-99	9-Dec-99	4-Jan-00	2-Feb-00	2-Mar-00	4-Apr-00	3-May-00	4-Jun-00	1-Jul-00	1-Aug-00	1-Sep-00	3-Oct-00	13-Nov-00	1-Dec-00	6-Jan-01	1-Feb-01	2-Mar-01
Collected By:																											
Lab. No.																											
Station	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07
Physical Parameters																											
pH	8.20	8.10	8.20	8.10	8.20	8.30	8.40	8.30	8.30	8.40	8.30	8.30	8.10	8.10	8.10	8.60	8.40	8.30	8.20	8.30	8.10	8.40	8.10	8.10	8.10	8.10	8.00
pH (in Field)	7.97	7.84	7.69	7.99	7.58	7.61	7.69	7.68	7.89	8.17	7.52	7.44	7.64	7.29	7.24	7.69	7.67	8.21	8.19	8.20	8.12	8.15	8.15	8.17	8.22	8.27	8.13
Conductivity, micro-mho/cm																											
Conductivity (in Field), micro-	468	515	473	476	428	429	486	473	468	467	455	452	468	374	438	440	424	467	480	484	460	481	465	386	415	458	449
Total Suspended Solids, mg/L	8	11	4	4	9	31	<4	<4	<4	<4	<4	<4	7	4	6	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Turbidity, NTU																											
Dissolved Suspended Solids, mg/L	290	286	278	282	262	252	282	266	274	282	290	266	280	278	274	266	240	264	288	276	266	304	282	270	268	250	262
Flow, L/min	70	78	71	62	96	400	230	166	140	120	105	105	43	80	72	62	92	200	139	150	133	184	133	126	104	92	82
Temp., degrees Celcius	1	1	1	2	3	4	8	8	7	5	1.5	1	0	2	0	1	0	6	6	7	4.5	2.4	1.6	1.9	1.9	2.1	1.7
Hardness, CaCO ₃ , mg/L	251	252	248	265	238	224	301	262	266	277	267	249	261	231	245	266	224	262	262	290	263	284	266	257	241	244	250
Total Hardness, mg/L																											
LC50																											
Anions																											
Alkalinity, CaCO ₃ , mg/L	224	242	228	230	200	214	259	232	235	232	230	222	224	216	224	222	201	233	240	239	232	253	242	237	229	230	230
Sulphate (SO ₄), mg/L	29.7	33.3	31.3	30.0	24.9	15.1	19.5	25.0	21.6	23.1	25.4	22.1	28.7	27.0	26.6	26.4	24.6	13.8	29.9	25.8	28.0	19.5	22.3	21.1	23.2	22.8	22.1
Nutrients																											
Nitrite Nitrogen (NO ₂), mg/L																											
Nitrate Nitrogen (NO ₃), mg/L																											
N-NH ₃ , mg/L	0.160	0.122	0.105	0.117	0.091	0.032	0.022	0.044	0.054	0.086	0.065	0.086	0.115	0.078	0.117	0.122	0.076	0.051	0.056	0.063	0.055	0.067	0.068	0.071	0.050	0.056	0.046
N-NO ₂ -NO ₃ , mg/L																											
Total Phosphorus, mg/L	<0.04	0.04	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Cyanide																											
Total Cyanide, mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Cyanide-WAD, mg/L																											
Total Metals																											
Aluminum	<0.06	0.13	0.07	<0.06	0.17	0.20	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.13	<0.06	<0.06	<0.06	<0.06	0.03	0.02	<0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02
Antimony	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.001	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	0.068	0.075	0.077	0.071	0.065	0.056	0.074	0.085	0.083	0.082	0.078	0.074	0.118	0.070	0.069	0.072	0.057	0.062	0.076	0.084	0.080	0.082	0.081	0.081	0.076	0.073	0.072
Beryllium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bismuth	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	0.0008	0.0008	0.0007	0.0006	0.0008	0.0009	0.0009	0.0009	0.0008	0.0008	0.0006	0.0005	0.0012	0.0007	0.0007	0.0005	0.0005	0.0010	0.0007	0.0009	0.0007	0.0005	0.0008	0.0003	0.0003	0.0003	0.0003
Calcium	76.8	82.9	83.4	86.2	75.3	72.2	89.4	84.6	86.9	92.0	87.6	81.3	89.8	74.8	80.1	87.3	72.4	80.0	82.8	93.1	84.2	86.2	83.8	82.3	77.5	79.3	81.3
Chromium	0.003	0.002	0.004	0.003	<0.002	0.003	0.003	<0.002	0.004	0.0	0.002	<0.002	0.003	0.002	0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007
Cobalt	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005
Copper	0.027	0.007	<0.003	0.004	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006
Iron	4.09	0.20	0.06	0.06	1.08	0.26	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.24	0.09	0.07	<0.05	0.044	<0.005	0.009	0.005	0.028	0.007	0.011	<0.005	0.030	0.025	0.025
Lead	0.046	0.02	0.014	0.009	0.018	0.061	0.009	0.006	0.005	0.004	0.003	0.011	0.121	0.045	0.043	0.015	0.012	0.018	0.007	0.009	0.004	0.005	0.002	0.002	0.004	0.003	0.003
Lithium																											
Magnesium	11.50	11.40	11.90	11.60	9.95	16.60	18.80	12.40	11.90	11.60	11.70	11.10	8.89	10.70	10.90	11.70	10.40	15.20	13.30	14.00	12.90	16.70	13.70	12.60	11.6	11.1	11.4
Manganese	0.29	0.25	0.240	0.23	0.204	0.09	0.16	0.220	0.24	0.26	0.25	0.21	0.369	0.22	0.24	0.25	0.180	0.17	0.18	0.25	0.20	0.25	0.21	0.18	0.133	0.131	0.151
Mercury																											
Molybdenum	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.016	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel	0.13	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Potassium	1.2	1.2	1.6	1.5	1.2	1.2	1.2	0.9	1.8	1.9	1.5	1.0	1.8	1.2	1.0	1.3	1.0	2.0	1.0	1.0	2.0	2.0	2.0	1.0	2	1	1
Selenium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.0							

Sample Date Collected By: Lab. No. Station	1-Apr-01	2-May-01	3-Jun-01	1-Jul-01	1-Aug-01	1-Sep-01	3-Oct-01	4-Nov-01	1-Dec-01	2-Jan-03	1-Feb-03	1-Mar-03	1-Apr-03	2-May-03	1-Jun-03	4-Jul-03	8-Aug-03	4-Sep-03	3-Nov-03	7-Dec-03	6-Jan-04	7-Feb-04	2-Mar-04	11-Apr-04	9-May-04	7-Jun-04	6-Jul-04	6-Aug-04
Physical Parameters	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07	MH-07
pH (in Field)	8.10	8.10	8.00	8.10	8.10	8.10	8.10	8.00	8.00	8.0	8.2	8.1	8.2	8.3	8.2	8.3	8.2	8.3	8.2	8.3	8.3	8.2	8.3	8.2	8.1	8.4	8.4	8.4
Conductivity, micro-mho/cm	8.29	8.24	7.75	8.22	8.23	8.26	8.29	8.21	8.18	8.23	8.2	8.2	8.1	8.1	7.93		8.21	8.23	8.25	8.19				435	387	479	477	464
Conductivity (in Field), micro-mho/cm	458	418	408	449	457	452	470	452	443	342	440	440	441	436	498	485	431	463	453	452	452	448	441					
Total Suspended Solids, mg/L	<4	<4	918	<4	<4	<4	<4	<4	6	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	24	<4	<4	<4	<4	<4	<4	<4
Turbidity, NTU																								1.38	4.67	0.19	0.11	0.11
Dissolved Suspended Solids, mg/L	274	270	250	266	280	270	268	268	254	252	270	276	266	256	304	270	264	264	278	268	260	258	256	254	214	270	274	282
Flow, L/min	75	88	1200	220	200	150	171	150	150	102	96	77	75	105	200		150	85	60									80
Temp, degrees Celsius	1.8	1.8	5.0	6.9	5.4	5.4	4.3	0.4	0.9	0.8	0.9	1.2	1.3	2	8		6.7	8.2	0.9	0.9								
Hardness, CaCO ₃ , mg/L	244	234	301.0	244	248	246	261	256	251	249	250	252	253	236	280	269	243	257	245	252	245	247	245	246	210	268	266	253
Total Hardness, mg/L																												
LC50																												
Anions																												
Alkalinity, CaCO ₃ , mg/L	232	218	217	230	237	235	246	239	234	228	228	232	233	218	289	255	221	225	243	244	237	234	236	228	200	257	245	245
Sulphate (SO ₄), mg/L	22.9	23.8	11.6	19.4	19.6	19.7	22.6	17.8	20.0	18.1	17.3	17.5	16.8	19.2	13.4	12.8	13	12	15.8	13.8	15	15.9	15.9	16	12.8	13.1	14.7	16.4
Nutrients																												
Nitrite Nitrogen (NO ₂), mg/L																									<0.005	<0.005	<0.005	<0.005
Nitrate Nitrogen (NO ₃), mg/L																									<0.02	0.31	0.16	0.14
N-NH ₃ , mg/L	0.034	0.037	<0.005	0.032	0.049	0.018	0.036	0.035	0.043	0.02	0.03	0.023	0.038	0.045	0.016	<0.005	0.013	<0.005	0.031		0.016	0.034	0.022	0.017	0.01	<0.005	<0.005	<0.005
N-NO ₂ -NO ₃ , mg/L																									<0.02	0.31	0.16	0.14
Total Phosphorus, mg/L	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cyanide																												
Total Cyanide, mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0012	0.008	<0.0005	0.0005	<0.0005	0.0013	0.0019
Cyanide-WAD, mg/L																												
Total Metals																												
Aluminum	<0.02	<0.02	9.11	<0.02	<0.02	<0.02	0.02	<0.02	0.03	0.02	0.02	0.03	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	0.14	0.03	0.03	0.03	0.1	<0.02	<0.02	<0.02
Antimony	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	0.071	0.066	0.224	0.083	0.078	0.078	0.081	0.081	0.082	0.076	0.074	0.074	0.069	0.061	0.062	0.075	0.086	0.083	0.073	0.077	0.079	0.074	0.073	0.074	0.059	0.077	0.087	0.087
Beryllium	<0.0002	<0.0002	0.0007	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bismuth	0.11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Cadmium	0.0003	0.0004	0.0013	0.0005	0.0005	0.0006	0.0005	0.0004	0.0004	0.0002	0.0002	0.0003	0.0003	0.0004	0.0003	0.0004	<0.002	0.0004	<0.002	0.00042	<0.002	0.4	0.00005	<0.002	0.0006	0.00044	0.0005	0.0004
Calcium	79.5	76.1	84.7	75.6	78.8	80.8	83.4	82.6	82.1	81.2	81.7	82.4	82.5	75.5	81.1	79.7	78	83.3	79.3	80.9	79.6	80.1	80	80.6	67.1	81.6	85.3	82.6
Chromium	<0.005	<0.005	0.014	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	<0.005	<0.005	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper	<0.005	<0.005	0.024	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Iron	0.013	0.020	20.7	0.016	<0.005	<0.005	0.016	0.012	0.036	0.053	0.036	0.035	0.007	0.031	0.016	0.008	0.005	0.009	0.021	0.068	0.281	0.057	0.04	0.033	0.155	0.007	0.005	0.006
Lead	0.0018	0.003	0.0669	0.0055	0.0028	0.0028	0.0031	0.0020	0.0077	0.0058	0.0051	0.0099	0.0019	0.0037	0.0045	0.0032	<0.03	0.002	<0.03	0.0101	0.03	8.09	0.0128	<0.03	0.0089	0.00293	0.0022	0.0015
Lithium																												
Magnesium	11.1	10.6	21.8	13.3	12.5	10.8	12.7	12.0	11.2	11.2	11.3	11.6	18.9	17.1	11.8	11.9	11.5	12.1	11.2	11.3	11	10.8	10.2	15.5	12.8	11.4		
Manganese	0.136	0.144	0.418	0.307	0.279	0.304	0.315	0.3	0.272	0.131	0.12	0.15	0.142	0.14	0.076	0.167	0.193	0.115	0.18	0.176	0.214	0.153	0.16	0.152	0.121	0.052	0.066	0.066
Mercury																								<0.00005				
Molybdenum	0.042	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008</	

Sä Dena Hes Mine

Detailed Decommissioning & Reclamation Plan

Appendix C-7

MH-08 Water Quality

(-) Indicates values are less than (below) indicated

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Sä Dena Hes Mine

Detailed Decommissioning & Reclamation Plan

Appendix C-8

MH-11 Water Quality

Sample Date Collected By: Lab. No. Station	06-Mar-91 Company	12-Mar-91 Company	19-Mar-91 Company	27-Mar-91 Company	02-Apr-91 Company	09-Apr-91 Company	16-Apr-91 Company	30-Apr-91 Company	07-May-91 Company	28-May-91 Company	04-Jun-91 Company	11-Jun-91 Company	18-Jun-91 Company	25-Jun-91 Company	02-Jul-91 Company	05-Jul-91 DIAND	09-Jul-91 Company	16-Jul-91 Company	26-Jul-91 Company	30-Jul-91 Company	31-Jul-91 Company	04-Aug-91 Company	06-Aug-91 Company	14-Aug-91 Company
	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	1080	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11
Physical Parameters																								
pH	8.10	8.10	7.40	7.80	8.00	8.00	8.00	8.10	8.00	8.00	8.10	8.60	8.30	7.80	8.30	8.20	8.00	8.00	8.00	7.90	8.10	8.20	8.10	8.20
pH (in Field)									7.8							8.3								
Conductivity, micro-mho/cm	310	335	310	335	305	350	333	287	250	275	300	280	310	399	295	367	275	282	300			320	300	300
Conductivity (in Field), micro-									155							230								
Total Suspended Solids, mg/L	-5	-5	-5	-5	102	-5	-5	-5	67	16	7	-5	-5	-5	-5	-5	23	8	-5	999	10	-5	-5	-5
Turbidity, NTU	-1.0	2.0	9.0	2.0	13.0	-1.0	15.0	-1.0	30.0	5.0	2.0	1.0	-1.0	4.0	3.0		22.0	7.0	4.0		2.0	2.0	-1.0	
Dissolved Suspended Solids, Flow, L/min	230	210	213	208	210	204	204	182	184	209	202	183	203	270	214	210	210	214	206	230	220	213	205	226
Temp., degrees Celcius									106.0							7.3								
Hardness, CaCO ₃ , mg/L									5.3							199								
Total Hardness, mg/L	216	188	194	189	197	190	210	176	173	174	181	160	173	271	213	199	213	174	155				188	189
LC50																								
Anions																								
Alkalinity, CaCO ₃ , mg/L	212	190	185	193	190	187	199	168	140	177	170	157	160	246	193	185	185	200	179			185	185	203
Sulphate (SO ₄), mg/L									5.3	6.8	7.3	5.5	5.9	8.4	6.8	18	5.8	5.4	6.1	27.3	6.8	6.8	6.5	6.5
Nutrients																								
Nitrite Nitrogen (NO ₂), mg/L	0.050	-0.050	-0.050	0.130	1.000	0.780	-0.050	-0.050	0.050	-0.050	-0.050	0.250	-0.050	-0.050	-0.050	-0.002	-0.050	-0.050	-0.050	0.210	-0.050	-0.050	-0.050	-0.050
Nitrate Nitrogen (NO ₃), mg/l																-0.002								
N-NH ₃ , mg/L																0.093								
N-NO ₂ -NO ₃ , mg/L	0.100	0.110	0.170	0.120	0.130	0.140	-0.100	0.020	-0.100	0.200	0.200	-0.200	-0.200	-0.200	-0.200		-0.200	-0.200	-0.200	0.600	-0.200	-0.200		
Total Phosphorus, mg/L																-0.10								
Cyanide																								
Total Cyanide, mg/L									0.016							0.030				-0.005	-0.005	-0.008		
Cyanide-WAD, mg/L									0.005							-0.030								
Total Metals																								
Aluminum	-0.050	0.100	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	2.670	0.090	0.090	-0.050	0.080	-0.050	-0.050	-0.060	0.650	-0.050	-0.050	7.580	-0.050	-0.050	-0.050	-0.050
Antimony	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.060	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050
Arsenic	-0.050	0.060	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.06	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.080
Barium	0.0520	0.0450	0.0490	0.0450	0.0480	0.0500	0.0520	0.0480	0.0900	0.0650	0.0700	0.0470	0.0540	0.0730	0.0750	0.0680	0.0870	0.0640	0.0590	0.1900	0.0640	0.0610	0.0660	0.0780
Beryllium																-0.0010								
Bismuth																								
Boron																-0.010								
Cadmium	-0.0003	0.0004	0.0018	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	0.0070	-0.0003	-0.0003	-0.0003	0.0170	-0.0003	-0.0003	-0.0003	-0.0003
Calcium	76.2	66.1	68.6	66.6	68.6	66.5	82.9	60.3	49.8	55.7	57.4	54.1	57.7	92.5	70.0	65.3	68.8	58.2	52.9	58.2	55.9	60.6	61.4	63.4
Chromium																-0.0060								
Cobalt																-0.006								
Copper	-0.001	0.003	0.004	0.010	0.040	-0.001	0.009	0.006	0.008	0.021	0.006	0.005	-0.001	0.001	-0.001	-0.006	-0.001	-0.001	-0.001	0.037	-0.001	-0.001	-0.001	-0.001
Iron	0.041	0.165	0.087	0.077	0.128	0.062	0.064	0.030	2.250	0.188	0.243	0.082	0.229	0.180	0.042	0.182	1.210	0.152	0.146	14.100	0.387	0.093	0.068	0.139
Lead	0.009	0.063	0.006	0.015	0.033	0.024	0.035	0.014	0.037	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.060	-0.004	-0.004	-0.004	2.500	-0.004	0.006	0.017	0.100
Lithium																								
Magnesium																8.40								
Manganese																0.0340								
Mercury																								
Molybdenum	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.006	-0.005	-0.005	-0.005	0.010	-0.005	0.006	-0.005	-0.005	-0.010	-0.005	-0.005	-0.005	0.870	-0.005	-0.005	-0.005	-0.005
Nickel																-0.0200								
Potassium																-2.0								
Selenium	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.06	-0.010	-0.010	0.010	0.040	-0.010	-0.010	-0.010	-0.010
Silicon																3.92								
Silver	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010		-0.010	-0.010	-0.010	-0.010
Sodium	1.20	1.40	1.20	1.40	1.33	1.22	1.21	0.87	3.04	0.90	0.92	0.81	0.79	1.56	0.94	0.90	0.98	0.92	0.91	19.30	1.10	0.94	1.06	1.16
Strontium																0.215								
Sulphur																								
Tellurium																								
Thallium																								
Tin																-0.060								
Titanium																0.0040								
Vanadium																-0.010								
Zinc	0.0170	0.0690	0.1040	-0.0010	0.0520	0.0440	0.0280	0.0120	0.0390	0.0180	0.0980	0.0940	0.2550	0.0210	0.0250	0.0060	-0.0010	0.0050	0.0030	4.7800	0.0300	0.0070	0.0290	0.0280
Zirconium																								
Dissolved Metals																								
Aluminum	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.080	-0.050	-0.050	-0.050	-0.050
Antimony	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050
Arsenic	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050
Barium	0.0430	0.0450	0.0460	0.0370	0.0440	0.0450	0.0430	0.0470	0.0520	0.0560	0.0690	0.0470	0.0530	0.0630	0.0590	0.0630	0.0370	0.0550	0.0600	0.0620	0.0650	0.0620	0.0650	0.0730
Cadmium	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003
Calcium	65.0	66.0	65.1	64.0	62.6	63.8	75.0	55.2	46.8	52.3	55.5	52.7	55.9	89.4	67.1	63.6	56.7	50.8	53.1	55.6	60.7	62.0		
Copper	-0.001	-0.001	-0.001	0.010	-0.001	-0.001	-0.001	0.003	-0.001	-0.001	0.004	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Iron	0.009	0.164	0.006	0.054	0.010	0.064	0.018	-0.005	0.038	0.035	0.044	0.026	0.036	0.110	0.008	0.033	0.009	0.021	0.035	0.014	0.044	0.019		

Sample Date	23-Aug-91	30-Aug-91	06-Sep-91	10-Sep-91	17-Sep-91	25-Sep-91	27-Sep-91	01-Oct-91	09-Oct-91	16-Oct-91	23-Oct-91	28-Oct-91	04-Nov-91	13-Nov-91	18-Nov-91	18-Nov-91	26-Nov-91	09-Dec-91	17-Dec-91	22-Dec-91	10-Jan-92	16-Jan-92	21-Jan-92	04-Feb-92	
Collected By:	Company	Company	Company	Company	Company	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	
Lab. No.						1151																			
Station	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	
Physical Parameters																									
pH	8.20	8.10	8.10	8.40	8.10	8.20	8.10	8.20	8.10	8.00	8.20	8.10	8.10	8.00	8.10	8.00	8.10	8.00	8.70	8.60	8.20	8.20	8.10	8.20	
pH (in Field)						8.2																			
Conductivity, micro-mho/cm	450	270	269	288	300	339	275	300	300	285	300	292						330	380	325	380	400	400	440	
Conductivity (in Field), micro-						203																			
Total Suspended Solids, mg/L	42	5	9	-5	63	40	10	11	6	-5	-5	143	-5	13	36	36	5	5	7	3	3	8		-5	
Turbidity, NTU	50.0	4.0	6.0	1.0	11.0		22.0	3.0	5.0	2.0	1.0	63.0	3.0	5.0	17.0	17.0	3.0	3.0	5.0	2.0	2.0	4.0	2.0	2.0	
Dissolved Suspended Solids,	335	218	204	192	202	220	205	200	204	206	208	210						236	231	240	251	246	246	258	
Flow, L/min						11700.00																			
Temp., degrees Celcius						7.0																			
Hardness, CaCO ₃ , mg/L						187																			
Total Hardness, mg/L	89	180	188	178	175	192	177	184	189	192	196	199						190	200	201	203	203	197	236	
LC50																									
Anions																									
Alkalinity, CaCO ₃ , mg/L	158	176	175	166	158	173	171	177	183	187	180	178	181	194	176	176	211	185	183	183	177	177	181	204	
Sulphate (SO ₄), mg/L	74.8	6.8	6.8	6.3	7.7	8	7.5	7.5	6.4	6.9	7.2	8.0						16.6	15.9	16.8	22.2	22.1	28.6	28.1	
Nutrients																									
Nitrite Nitrogen (NO ₂), mg/L	3.300	-0.050	-0.050	-0.050	-0.050	-0.002	-0.050	-0.050	-0.050	0.090	-0.050	-0.050	-0.050	-0.050	-0.050	0.420	0.450	0.060	0.030	-0.050	-0.050	0.030	0.050	0.050	-0.050
Nitrate Nitrogen (NO ₃), mg/l						-0.002																			
N-NH ₃ , mg/L						0.235																			
N-NO ₂ -NO ₃ , mg/L		-0.200	-0.200				0.220	0.200	0.200	0.300	0.360	0.300						0.430	0.490	0.400	0.530	0.700	0.700	0.400	
Total Phosphorus, mg/L						-0.10																			
Cyanide																									
Total Cyanide, mg/L				-0.005	-0.005	-0.030	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.016	-0.005	-0.005	-0.005	0.003	0.003	0.003	-0.005
Cyanide-WAD, mg/L						-0.030																			
Total Metals																									
Aluminum	0.070	-0.050	-0.050	-0.050	0.310	2.130	0.230	-0.050	0.090	-0.050	-0.050	0.250						-0.050	-0.050	-0.050	-0.050	0.060	-0.050	-0.050	
Antimony	-0.050	-0.050	-0.050	-0.050	-0.050	-0.060	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050						-0.050	-0.050	-0.050	-0.050	0.030	0.030	-0.020	
Arsenic	-0.050	-0.050	-0.050	-0.050	-0.050	-0.06	-0.050	0.080	0.070	0.060	-0.050	0.070						-0.050	-0.050	-0.050	-0.040	-0.040	-0.040	-0.040	
Barium	0.0170	0.0680	0.0630	0.0520	0.0570	0.0980	0.0580	0.0540	0.0620	0.0610	0.0610	0.0800						0.0590	0.0630	0.0650	0.0750	0.0750	0.0850	0.0840	
Beryllium						-0.0010																			
Bismuth																									
Boron						-0.010																			
Cadmium	0.0025	-0.0003	-0.0003	-0.0003	0.0004	-0.0060	0.0004	-0.0003	0.0003	-0.0003	-0.0003	0.0007	-0.0003	0.0005	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	0.0002	0.0002	0.0002	-0.0003	
Calcium	30.7	58.2	61.7	61.1	57.6	63.7	57.6	59.3	61.1	61.2	62.5	63.9						63.1	66.7	66.4	66.4	67.4	62.8	76.1	
Chromium						-0.0060																			
Cobalt						0.015																			
Copper	0.059	-0.001	-0.001	-0.001	0.002	-0.006	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.005	0.004	0.004	-0.001	-0.001	-0.001	-0.001	0.002	-0.001	-0.001	0.016	
Iron	0.400	0.196	0.201	0.113	0.553	2.050	0.468	0.132	0.277	0.105	0.095	0.404	-0.001	0.005	0.004	0.004	-0.001	0.316	0.207	0.101	0.191	0.297	0.205	0.202	
Lead	0.349	0.013	0.017	0.016	0.056	-0.060	0.031	0.014	0.033	0.014	-0.004	0.192	0.008	0.048	0.069	0.074	0.017	0.074	0.044	0.035	0.083	0.221	0.069	0.044	
Lithium																									
Magnesium						7.50																			
Manganese						0.0800																			
Mercury																									
Molybdenum	0.029	-0.005	-0.005	-0.005	-0.005	-0.010	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005						0.006	-0.005	0.007	0.007	0.003	0.009	0.005	
Nickel						-0.0200																			
Potassium						-2.0																			
Selenium	-0.010	-0.010	-0.010	-0.010	-0.010	-0.06	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	0.010	0.010	0.010	
Silicon						7.31																			
Silver		-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.001	0.013	-0.001	-0.001	-0.001	-0.001	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	
Sodium	70.20	0.97	0.99	0.90	0.92	1.00	1.23	1.07	1.08	1.16	1.14	1.28						3.50	3.30	3.30	3.80	4.60	5.90	6.72	
Strontium						0.214																			
Sulphur																									
Tellurium																									
Thallium																									
Tin						-0.060																			
Titanium						0.1000																			
Vanadium						-0.010																			
Zinc	0.5740	0.0170	0.0240	0.0110	0.1050	0.0740	0.0500	0.0280	0.0480	0.0200	-0.0010	0.2410	-0.0010	0.0200	0.0780	0.0810	0.0300	0.0320	0.0230	0.0250	0.0480	0.0690	0.0410	0.0400	
Zirconium																									
Dissolved Metals																									
Aluminum	-0.050	-0.050	-0.050	-0.050	-0.050		0.050	-0.050	-0.050	-0.050	-0.050	-0.050						-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	
Antimony	-0.050	-0.050	-0.050	-0.050	-0.050		-0.050	-0.050	-0.050	-0.050	-0.050	-0.050						-0.050	-0.050	-0.050	-0.050	0.030	0.030	-0.020	
Arsenic	-0.050	-0.050	-0.050	-0.050	-0.050		-0.050	0.050	-0.050	-0.050	-0.050	0.070	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.060	0.030	0.030	0.030	-0.050	
Barium	0.0160	0.0650	0.0620	0.0520	0.0480		0.0530	0.0510	0.0610	0.0610	0.0590	0.0640						0.0570	0.0620	0.0610	0.0750	0.0720	0.8400	0.0840	
Cadmium	0.0023	-0.0003	-0.0003	-0.0003	-0.0003		-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003						-0.0003	-0.0003	-0.0003	0.0002	0.0002	0.0002	-0.0003	
Calcium	30.6	57.8	60.3	57.5	56.9		57.3	59.3	60.4	60.3	60.9	61.9						62.4	66.7	65.9	61.5	65.1	59.9	72.5	
Copper	0.058	-0.001	-0.001	-0.001	-0.001																				

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Sample Date	05-Jan-93	12-Feb-93	31-Mar-93	07-Apr-93	30-Apr-93	18-May-93	30-Jun-93	26-Jul-93	11-Aug-93	08-Oct-93	02-Nov-93	29-Nov-93	29-Dec-93	26-Jan-94	03-Mar-94	28-Mar-94	26-Apr-94	31-May-94	28-Jun-94	20-Jul-94	21-Jul-94	29-Aug-94	26-Sep-94	30-Oct-94
Collected By:	Company	Company	Company	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	DIAND	Company	Company	Company
Lab. No.				3013								93030075	94000212								4107			
Station	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11
Physical Parameters																								
pH	8.30	8.20	8.10	7.99	8.10	8.30	8.00	8.30	8.30	8.30	8.20	8.20	8.20	8.20	8.10	8.20	8.20	8.20	8.20	8.20	8.30	8.30	8.10	8.10
pH (in Field)				7.9																	7.7	8.2	7.8	
Conductivity, micro-mho/cm	550	585	613	613	449	321	465	478	454	465	480	509.0	499.0	621	546	500	403	297	353	345	360	426	359	404
Conductivity (in Field), micro-				618																				
Total Suspended Solids, mg/L	4	< 4	< 4	-10	12	55		4	< 4	< 4	4	< 4	4	< 4	13	< 4	< 4	9	< 4	4	377	< 4	< 4	12
Turbidity, NTU	1.4	0.6	0.4	4.5	18.0	380.0	380.0	1.3	0.4	0.6	0.6	0.5	1.8	0.6	6.0	1.0	0.9	3.0	0.7					
Dissolved Suspended Solids,	358	368	613	410	293	211	316	314	274	314	304	336	350	362	392	392	262	178	189	208	227	270	224	242
Flow, L/min				1740.00					3840.0	2880.0											5580.00			
Temp., degrees Celsius				1.0																	8.5		10.6	7.1
Hardness, CaCO ₃ , mg/L				325																				
Total Hardness, mg/L	290	295	344	326	272	186	252	269	253	255	258	265	264	284	349	306	261	178	204	206	203	249	211	229
LC50																								
Anions																								
Alkalinity, CaCO ₃ , mg/L	206	206	207	205	178	146	159	169	196	194	193	200	197	208	213	212	207	161	172	178	175	198	182	192
Sulphate (SO ₄), mg/L	88.5	102.0	145.0	103	66.8	23.0	88.0	80.9	48.8	55.8	70.0	73.8	72.4	76.0	90.0	113.0	51.4	13.4	20.7	23.6	21	33.8	28.5	25.5
Nutrients																								
Nitrite Nitrogen (NO ₂), mg/L	0.041	0.035	0.028	0.032	0.028	-0.005	0.167	0.081	0.006	0.026	0.013	0.009	0.027	0.014	0.021	0.008	0.022	0.011	0.005	0.024	-0.050	0.005	0.008	0.005
Nitrate Nitrogen (NO ₃), mg/l				0.005																	-2.000			
N-NH ₃ , mg/L				0.250																				
N-NO ₂ -NO ₃ , mg/L	0.680	0.290	0.490		0.190	0.750	0.500	0.520	0.320	0.430	0.330	0.260	0.250	0.170	0.150	0.150	0.120	0.660	0.470		0.500			
Total Phosphorus, mg/L				-0.10																	-0.06			
Cyanide																								
Total Cyanide, mg/L	-0.005	-0.005	0.005	-0.030	0.006	0.007	0.005	0.005	-0.005	0.005	0.005	0.005	0.002	0.001	0.001	0.002	-0.001	-0.001	-0.001	-0.001	-0.005	-0.001	-0.001	-0.001
Cyanide-WAD, mg/L				-0.030																				
Total Metals																								
Aluminum	-0.020	-0.020	-0.060	0.210	0.180	0.930	30.900	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	0.120	-0.060	-0.020	0.150	0.070	-0.060	0.060	-0.060	-0.060	0.100
Antimony	-0.015	-0.015	-0.020	-0.060	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.030
Arsenic	-0.040	-0.040	-0.040	-0.06	-0.040	-0.040	0.070	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.02	-0.040	-0.040	-0.040
Barium	0.1140	0.0910	0.0970	0.1310	0.0800	0.0540	0.4770	0.0710	0.0760	0.0810	0.0780	0.0820	0.0860	0.0950	0.1010	0.1000	0.0770	0.0450	0.0550	0.0550	0.0621	0.0790	0.0610	0.0660
Beryllium				-0.0010																	-0.0002			
Bismuth																								
Boron				-0.010																				
Cadmium	0.0002	-0.0001	0.0001	-0.0060	0.0001	0.0004	0.0040	0.0003	0.0002	0.0002	0.0001	0.0002	0.0002	0.0003	0.0002	0.0002	0.0001	0.0003	0.0001	0.0001	-0.0005	0.0001	0.0008	0.0002
Calcium	96.2	105.0	118.0	115.0	92.0	62.7	99.5	89.5	86.9	86.2	87.1	89.1	88.1	94.6	119.0	102.0	86.4	62.1	70.4	71.4	70.7	84.8	72.4	77.5
Chromium				-0.0060																	-0.0010			
Cobalt				-0.006																	-0.001			
Copper	0.002	-0.001	-0.002	-0.006	-0.002	0.004	0.071	0.004	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.003	-0.002	0.003	-0.002	0.010
Iron	0.144	0.010	0.100	0.120	0.460	1.750	46.100	0.170	0.130	0.130	0.120	0.050	0.110	0.140	0.470	0.200	0.150	0.380	0.160	0.120	0.133	0.160	0.120	0.350
Lead	0.012	0.012	0.007	-0.060	0.015	0.100	1.210	0.013	0.006	0.006	0.006	0.005	0.007	0.007	0.012	0.007	0.005	0.002	0.006	0.007	-0.010	0.005	0.011	0.040
Lithium																								
Magnesium				14.80										11.50	12.70	12.40	11.00	5.70	6.70	6.70	6.33	9.00	7.40	8.50
Manganese				0.1100										0.0850	0.1310	0.0830	0.0680	0.0580	0.0370	0.0440	0.0470	0.0690	0.0470	0.0820
Mercury																								
Molybdenum	-0.004	-0.004	-0.004	-0.010	-0.004	-0.004	0.007	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
Nickel				-0.0200										-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
Potassium	-0.001	-0.001	-0.001	-2.0	-0.001	0.002	0.002	0.001	-0.001	0.002	-0.001	0.002	0.001	1.00	1.00	1.00	17.00	23.00	21.00	21.00	24.00	22.00	24.00	24.00
Selenium	-0.030	-0.030	-0.030	-0.06	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030
Silicon				4.24																	-0.02			
Silver	-0.010	-0.010	-0.030	-0.010	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.001	-0.030	-0.030	-0.030
Sodium	10.80	8.60	9.20	13.00	4.60	1.80	7.20	6.50	4.70	5.30	5.40	6.40	6.50	8.20	9.10	9.00	4.60	1.50	2.50	2.30	2.48	4.00	2.60	3.60
Strontium				0.393																	0.220			
Sulphur														27.10	34.80	29.90	15.70	4.20	6.90	6.90	7.50	11.30	8.30	8.60
Tellurium																								
Thallium																								
Tin				-0.060																	-0.010			
Titanium				0.0050																	0.0030			
Vanadium				-0.010																	-0.002			
Zinc	0.0540	0.0610	0.0400	0.0270	0.0800	0.1600	2.3500	0.0400	0.0200	0.0500	0.0300	0.0600	0.0400	0.0800	0.0900	0.0600	0.0300	0.0400	0.0200	0.0300	0.0160	0.0200	0.0200	0.0600
Zirconium																								
Dissolved Metals																								
Aluminum	-0.020	-0.020	-0.020		-0.020	-0.020	0.060	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020				
Antimony	0.019	0.015	-0.015		-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015				
Arsenic	-0.040	-0.040	-0.040		-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040				
Barium	0.1660	0.0910	0.1000		0.0810	0.0470	0.0770	0.0710	0.0790	0.0720	0.0780	0.0810	0.0890	0.0990	0.1000	0.1010	0.0800	0.0410	0.0520					
Cadmium	0.0001	-0.0001	0.0001		0.0001	0.0002	0.0002	0.0002	0.0002	-0.0001	-0.0001	-0.0001	-0.0001	0.0002	0.									

Sample Date	30-Nov-94	29-Dec-94	28-Jan-95	28-Feb-95	16-Mar-95	03-Apr-95	03-May-95	06-Jun-95	06-Jun-95	04-Jul-95	11-Aug-95	11-Sep-95	17-Oct-95	03-Nov-95	01-Dec-95	02-Jan-96	05-Feb-96	04-Mar-96	02-Apr-96	02-May-96	03-Jun-96	04-Jul-96	01-Aug-96	01-Sep-96
Collected By:	Company	Company	Company	Company	Company	Company	Company	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company
Lab. No.								5078																
Station	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11
Physical Parameters																								
pH	8.10	8.30	8.00	8.20	8.10	8.20	8.10	8.20	7.90	7.97	8.13	8.15	8.08	7.96	7.85	7.91	7.88	7.88	7.99	7.89	7.72	8.13	8.40	8.30
pH (in Field)	8.2	8.3	7.9	7.9	7.9	7.9	7.9	8.2	8.1	7.9	8.0	8.0	8.0	7.9	8.0	8.0	8.0	7.9	7.6	7.6	8.1	8.1	8.1	8.0
Conductivity, micro-mho/cm	425	453	486	459	478	471	344	300	304	367	394	389	397	420	444	460	482	477	482	408	296	345	394	411
Conductivity (in Field), micro-								324																
Total Suspended Solids, mg/L	6	< 4	< 4	< 4	< 4	< 4	4	37	48	20	5	5	4	4	2	1	5	3	-1	4	43	4	< 4	< 4
Turbidity, NTU																								
Dissolved Suspended Solids, Flow, L/min	266	310	292	456	312	266	242	216	198	200	210	250	253	233	247	265	280	307	313	227	160	213	232	244
								10680.00													3889.0	1052.0	5590.0	5947.0
Temp., degrees Celcius	8.9	0.1	3.9	4.7	16.1	11.7	16.7	8.7	18.9	13.9	22.2	15.6	11.1	10.0	-1.1									
Hardness, CaCO ₃ , mg/L																								
Total Hardness, mg/L	233	233	255	265	256	269	200	167	173	209	231	241	223	228	246	257	256	260	256	229	171	190	225	242
LC50																								
Anions																								
Alkalinity, CaCO ₃ , mg/L	199	205	212	216	219	215	179	161	154	184	193	200	195	206	213	215	226	226	227	203	143	173	190	200
Sulphate (SO ₄), mg/L	34.6	39.9	44.2	49.7	50.5	40.7	21.0	12	12.7	13.0	28.5	17.9	27.4	29.7	33.0	36.7	42.2	40.8	37.7	27.1	13.0	15.1	19.1	20.5
Nutrients																								
Nitrite Nitrogen (NO ₂), mg/L	0.016	0.026	0.024	-0.005	0.014	0.021	0.006	0.050	0.020	-0.005	-0.005	-0.005	-0.005	0.006	-0.005	-0.005	-0.005	0.012	-0.005	0.062	-0.005	0.013	-0.005	-0.005
Nitrate Nitrogen (NO ₃), mg/l								-2.000																
N-NH ₃ , mg/L																								
N-NO ₂ -NO ₃ , mg/L								0.300																
Total Phosphorus, mg/L								0.06												-0.006	0.009	0.045	-0.006	-0.040
Cyanide																								
Total Cyanide, mg/L	-0.001	-0.001	-0.001	0.001	-0.001	-0.001	-0.001	0.023	-0.001	0.001	0.001	-0.001	-0.001	-0.001	-0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.001
Cyanide-WAD, mg/L																								
Total Metals																								
Aluminum	0.070	-0.060	0.080	-0.060	-0.060	-0.060	-0.060	0.730	0.420	0.241	0.080	0.087	0.017	0.059	0.075	0.038	0.154	0.034	0.015	0.039	0.579	0.043	-0.060	-0.060
Antimony	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.006	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.020	-0.020	-0.020
Arsenic	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.02	-0.040	0.006	-0.004	-0.004	-0.004	-0.004	0.004	0.005	-0.004	-0.004	-0.010	-0.010	-0.010	-0.040	-0.040	-0.040
Barium	0.0740	0.0770	0.0620	0.0900	0.0920	0.0920	0.0640	0.0672	0.0560	0.0734	0.0753	0.0784	0.0588	0.0934	0.0781	0.0972	0.1100	0.1000	0.1040	0.1120	0.0580	0.0610	0.0680	0.0800
Beryllium																			-0.0005	-0.0005	-0.0005	-0.0010	-0.0010	-0.0010
Bismuth								-0.0002												-0.007	-0.007	-0.007	-0.020	-0.020
Boron																			0.003	-0.002	0.003	-0.002	-0.040	-0.040
Cadmium	0.0002	0.0001	0.0001	0.0002	0.0001	0.0001	0.0003	-0.0005	0.0003	-0.0006	0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0001	-0.0001	-0.0001
Calcium	78.4	77.6	85.7	87.3	94.6	89.6	64.8	54.7	58.4	51.6	74.5	76.1	73.6	80.3	71.5	81.5	87.8	82.5	84.2	54.4	56.1	63.4	75.1	84.4
Chromium								0.0020											-0.0008	-0.0008	0.0015	-0.0008	0.0020	0.0050
Cobalt								-0.001											-0.0007	-0.0007	0.0008	-0.0007	-0.0040	-0.0040
Copper	-0.002	-0.002	0.002	-0.002	-0.002	-0.002	-0.002	0.014	-0.002	0.002	-0.001	-0.001	0.001	-0.001	-0.001	0.003	0.003	-0.001	-0.001	0.002	-0.001	-0.002	-0.002	-0.002
Iron	0.260	0.130	0.150	0.140	-0.050	0.130	0.190	0.968	0.810	0.424	0.129	0.209	0.112	0.118	0.162	0.132	0.362	0.098	0.108	0.320	0.927	0.086	0.080	0.130
Lead	0.007	0.005	0.004	0.004	0.005	-0.003	0.007	0.030	0.026	0.015	0.002	0.005	0.002	0.004	0.004	0.003	0.008	-0.002	0.002	-0.002	0.039	-0.002	-0.003	-0.003
Lithium																				0.00224	0.00111	0.00261	0.00194	
Magnesium	9.10	9.50	10.00	11.30	10.90	11.10	9.30	6.43	6.60	7.33	8.45	8.21	8.30	9.33	8.69	9.78	11.30	10.90	11.00	7.20	5.10	6.40	7.80	9.20
Manganese	0.0810	0.0760	0.0770	0.0730	0.0740	0.0650	0.0520	0.0550	0.0490	0.0481	0.0596		0.0673	0.0738	0.0841	0.0666	0.0730	0.0450	0.0480	0.0250	0.0780	0.0270	0.0420	0.0710
Mercury																								
Molybdenum	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005	-0.004	0.001	0.002	-0.001	-0.001	0.001	-0.001	0.001	0.001	0.002	0.001	0.001	-0.001	0.001	-0.004	-0.004
Nickel	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	0.0020	-0.010	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.010	-0.010
Potassium	23.00	23.00	21.20	23.60	21.70	23.70	22.30	0.6	21.40	0.52	0.55	0.48	0.54	0.57	0.28	0.61	0.70	0.60	0.90	0.90	-0.40	-0.40	0.50	0.70
Selenium	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.02	-0.030	0.006	0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	0.004	-0.003	0.008	-0.003	-0.030	-0.030
Silicon								4.61											4.08	3.82	4.04	3.29	3.00	4.00
Silver	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.001	-0.030	-0.001	-0.001		-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.030	-0.030
Sodium	4.00	4.60	5.00	6.00	5.80	5.90	2.50	1.62	1.40	2.04	3.85	2.91	3.36	4.64	4.00	6.35	6.71	5.42	5.44	1.17	1.37	2.77	2.70	3.30
Strontium								0.190											0.350	0.188	0.199	0.244	0.245	0.297
Sulphur	11.10	12.10	14.40	16.90	16.10	15.90	6.70	3.80	3.80	4.00	8.42	7.25	8.29	10.10	9.76	11.10	15.00	13.00	13.40	2.00	3.70	5.20	6.20	7.60
Tellurium																			-0.0200	-0.0300	-0.0002	-0.0001	-0.0200	-0.0200
Thallium																			-0.004	-0.004	0.006	-0.004	-0.030	-0.030
Tin								-0.010											-0.003	-0.003	-0.003	0.009	-0.020	-0.020
Titanium								0.0060											-0.0004	0.0032	0.0216	0.0012	0.0070	-0.0030
Vanadium								0.004											-0.001	-0.001	0.002	-0.001	-0.003	-0.003
Zinc	0.03																							

Sample Date	10-Sep-96	01-Oct-96	04-Nov-96	02-Dec-96	05-Jan-97	01-Feb-97	01-Mar-97	01-Apr-97	01-May-97	01-Jun-97	01-Jul-97	01-Aug-97	01-Sep-97	02-Oct-97	07-Nov-97	01-Dec-97	05-Jan-98	05-Feb-98	03-Mar-98	03-Apr-98	04-May-98	01-Jun-98	01-Jul-98	02-Aug-98	
Collected By:	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	
Lab. No.	6068																98000552	98004354	98007325	98011050	98016585	98022641	98027988	98036464	
Station	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	MH-11	
Physical Parameters																									
pH	8.30	8.30	8.10	8.30	8.10	8.00	8.10	8.10	7.30	8.30	8.30	8.30	8.50	8.30	8.40	8.20	8.00	8.20	8.20	8.50	8.10	8.20	8.20	8.40	
pH (in Field)	8.4	6.8	8.0	7.0	7.0	7.8	7.8	7.5	7.1	7.4	7.6	7.6	7.8	8.3	7.7	7.6	7.55	7.45	7.19	6.84	7.19	7.74	7.98	7.73	
Conductivity, micro-mho/cm	370	409	419	431	459	449	441	460	313	295	296	351	379	387	452	415	432	438	426	439	327	321	370	403	
Conductivity (in Field), micro-	399																								
Total Suspended Solids, mg/L	-5	4	< 4	4	6	6	< 4	< 4	< 4	17	14	24	5	7	< 4	< 4	13	< 4	< 4	< 4	13	40	< 4	8	
Turbidity, NTU																									
Dissolved Suspended Solids, Flow, L/min	240	224	246	238	284	256	250	250	180	160	154	202	210	242	236	236	270	256	228	252	192	188	216	232	
Temp, degrees Celcius	2760.00	3730.0							4620.0	2611.0							NST	NST	NST	NST	NST	29430	6408	3037	
Hardness, CaCO ₃ , mg/L	5.3	0.5	0.5	2.0	0.1	0.1	0.1	1.0	1.0	3.0	3.0	5.5	8.0	2.0	1.0	-0.1	1.0	1.0				4.0	9.0	10.0	
Total Hardness, mg/L	209	220	224	208	223	247	228	226	161	160	170	136	205	205	198	215	248	225	202	243	176	170	188	225	
LC50																									
Anions																									
Alkalinity, CaCO ₃ , mg/L	209	193	198	209	217	213	210	215	156	144	150	171	183	185	197	202	206	210	187	204	159	150	179	197	
Sulphate (SO ₄), mg/L	18	21.8	22.5	24.5	32.9	30.3	26.9	26.5	10.9	6.8	6.9	9.0	10.5	8.6	7.4	10.5	10.6	13.8	16.4	24.3	12.5	13.9	13.7	16.5	
Nutrients																									
Nitrite Nitrogen (NO ₂), mg/L	-0.050	-0.005	0.007	0.010	0.106	0.007	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.013	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	
Nitrate Nitrogen (NO ₃), mg/l	-0.003																								
N-NH ₃ , mg/L																									
N-NO ₂ -NO ₃ , mg/L	0.188																								
Total Phosphorus, mg/L	-0.06	-0.040	0.050	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.060	-0.040	-0.040	-0.040	-0.040	0.05	-0.04	-0.04	-0.04	0.05	-0.04	-0.04	0.04	
Cyanide																									
Total Cyanide, mg/L	-0.005	0.001	0.001	-0.001	-0.001	-0.001	-0.001	0.001	0.001	0.001	0.001	-0.001	0.002	0.002	0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	
Cyanide-WAD, mg/L																									
Total Metals																									
Aluminum	-0.010	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	0.100	0.220	0.220	0.150	0.080	0.160	-0.060	-0.060	-0.06	-0.06	-0.06	-0.06	0.12	0.12	-0.06	-0.06	
Antimony	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.02	0.02	0.03	-0.02	-0.02	0.02	-0.02	-0.02	
Arsenic	-0.02	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	
Barium	0.0716	0.0740	0.0720	0.0760	0.0890	0.1040	0.0950	0.0950	0.0890	0.0470	0.0430	0.0600	0.0740	0.0800	0.0750	0.0770	0.0870	0.082	0.073	0.081	0.061	0.041	0.060	0.075	
Beryllium	-0.0002	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.001	-0.001	-0.001	-0.001	-0.0002	-0.0002	-0.0002	-0.0002	
Bismuth		-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	
Boron		-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.08	-0.04	-0.04	-0.04	-0.04	-0.04	0.0	0.0	
Cadmium	-0.0005	-0.0001	0.0001	-0.0001	0.0001	0.0002	-0.0001	-0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	-0.0001	-0.0001	0.0003	-0.0001	0.0002	-0.0001	0.0001	0.0001	-0.0001	0.0002	
Calcium	70.2	75.9	74.2	69.9	74.4	86.5	79.0	79.5	53.8	54.1	57.2	65.4	76.5	73.2	72.2	70.1	78.6	75.0	74.8	79.5	56.9	57.1	67.8	76.0	
Chromium	-0.0010	0.0040	-0.0020	-0.0020	0.0030	0.0020	-0.0020	0.0030	-0.0020	0.0040	-0.0020	0.0020	0.0030	0.0030	-0.0020	-0.0020	0.0020	0.0030	0.0040	0.0030	-0.0020	-0.0020	-0.0020	0.002	
Cobalt	-0.001	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	
Copper	0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	0.002	-0.002	0.007	0.003	-0.002	0.002	-0.002	-0.002	-0.002	-0.003	-0.003	-0.003	-0.003	
Iron	0.098	0.150	0.130	0.170	0.100	0.200	0.060	0.070	0.210	0.410	0.440	0.340	0.200	0.340	0.140	0.130	0.17	0.22	0.42	0.10	0.29	0.27	0.07	0.16	
Lead	-0.005	0.004	0.006	0.006	0.010	0.018	0.004	-0.003	0.013	0.012	0.017	0.032	0.010	0.013	0.004	0.004	0.005	0.004	0.004	-0.003	0.014	0.032	0.004	0.007	
Lithium																									
Magnesium	8.05	8.40	8.40	8.70	9.30	10.70	10.40	10.10	7.60	5.20	5.50	6.70	8.00	9.10	8.90	8.90	10.10	9.47	8.01	9.45	8.56	4.88	6.97	8.34	
Manganese	0.0570	0.0650	0.0690	0.0550	0.0720	0.0810	0.0400	0.0320	0.0380	0.0390	0.0360	0.0450	0.0600	0.0840	0.0720	0.0690	0.0810	0.0500	0.0450	0.0510	0.0460	0.0340	0.0300	0.051	
Mercury																									
Molybdenum	-0.005	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005	-0.005	-0.005	-0.005	
Nickel	-0.0020	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	
Potassium	0.7	0.90	0.60	0.50	0.50	1.40	0.80	0.80	1.30	-0.40	0.40	-0.40	0.60	-0.40	0.60	0.50	1.1	1.1	0.9	1.1	1.2	0.6	-0.50	-0.5	
Selenium	-0.02	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	
Silicon	4.22	3.50	2.00	2.20	2.80	3.10	2.80	2.50	2.00	1.70	1.60	2.10	2.30	1.10	1.10	0.90	1.9	2.1	1.6	2.7	0.8	2.2	1.1	1.1	
Silver	-0.001	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	
Sodium	2.87	2.70	2.90	3.00	3.80	4.70	4.10	4.00	2.00	1.20	1.00	1.50	1.90	2.30	2.40	2.60	3.4	3.1	2.8	3.2	1.1	0.9	1.5	1.9	
Strontium	0.264	0.241	0.252	0.261	0.280	0.312	0.297	0.280	0.312	0.297	0.291	0.196	0.188	0.164	0.221	2.660	0.284	0.274	0.261	0.273	0.203	0.184	0.230	0.267	
Sulphur	6.30	7.50		7.70	9.00	10.70	9.80	9.40	5.50	4.10	3.60	4.90	6.00	6.40	6.70	6.80	7.6	7.4	9.0	7.9	4.2	4.2	4.8	5.6	
Tellurium		-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.02	-0.02	-0.0						

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Sä Dena Hes Mine

Detailed Decommissioning & Reclamation Plan

Appendix C-9

MH-12 Water Quality

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Sample Date	01-Jul-97	01-Aug-97	01-Sep-97	02-Oct-97	07-Nov-97	01-Dec-97	05-Feb-98	02-Nov-93	26-Jan-94	03-Mar-94	28-Mar-94	26-Apr-94	31-May-94
Collected By:	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company
Lab. No.							98004355						
Station	MH-12	MH-12	MH-12	MH-12	MH-12	MH-12	MH-12	MH-12B	MH-12B	MH-12B	MH-12B	MH-12B	MH-12B
Physical Parameters													
pH	8.10	8.00	8.30	8.10	8.20	8.00	8.00	8.00	8.00	7.90	7.90	7.90	7.90
pH (in Field)	7.0	7.4	7.0	8.8	7.3	6.3							
Conductivity, micro-mho/cm	250	280	307	306	369	349	372	360	356	401	401	360	222
Conductivity (in Field), micro-													
Total Suspended Solids, mg/L	< 4	< 4	< 4	< 4	< 4	< 4	12	< 4	6	4	< 4	4	5
Turbidity, NTU								0.4	2.0	2.0	1.8	2.5	
Dissolved Suspended Solids,	148	170	164	244	200	198	220	218	240	277	326	324	130
Flow, L/min													
Temp., degrees Celsius	4.0	5.5	7.0	1.0	1.0	-0.1							
Hardness, CaCO ₃ , mg/L													
Total Hardness, mg/L	141	155	170	167	162	180	191	200	227	273	248	127	127
LC50													
Anions													
Alkalinity, CaCO ₃ , mg/L	128	145	157	158	163	173	186	188	219	230	232	227	124
Sulphate (SO ₄), mg/L	3.9	4.2	4.9	3.4	2.9	4.0	4.7	11.4	5.0	5.3	9.8	8.2	5.8
Nutrients													
Nitrite Nitrogen (NO ₂), mg/L	-0.005	-0.005	-0.005	-0.005	0.005	0.019	0.018	0.012	0.032	0.033	0.014	0.012	0.012
Nitrate Nitrogen (NO ₃), mg/l													
N-NH ₃ , mg/L													
N-NO ₂ -NO ₃ , mg/L								0.400	0.060	0.040	0.020	0.020	
Total Phosphorus, mg/L	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.04						
Cyanide													
Total Cyanide, mg/L	0.001	0.001	0.002	0.002	0.001	0.001	0.001	0.005	0.001	0.001	0.001	-0.001	-0.001
Cyanide-WAD, mg/L													
Total Metals													
Aluminum	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	0.07	-0.060	-0.060	-0.060	-0.060	-0.060	0.220
Antimony	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	0.03	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Arsenic	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.04	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Barium	0.0560	0.0040	0.0910	0.0860	0.0850	0.0870	0.104	0.1440	0.1760	0.1890	0.1890	0.0180	0.0980
Beryllium	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.001						
Bismuth	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.02						
Boron	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.04						
Cadmium	-0.0001	0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	0.0002	0.0003	-0.0001	0.0020	0.0001
Calcium	48.0	1.6	64.3	65.5	60.4	58.9	64.6	61.3	68.5	83.9	74.7	80.2	40.5
Chromium	-0.0020	-0.0020	0.0040	0.0030	0.0040	-0.0020	0.0050						
Cobalt	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.0040						
Copper	-0.002	-0.002	-0.002	0.004	0.005	-0.002	0.004	0.003	-0.002	0.003	-0.002	-0.002	-0.002
Iron	0.060	-0.050	0.120	0.120	0.170	0.100	0.430	0.160	0.670	0.790	0.870	0.650	1.630
Lead	-0.003	-0.003	-0.003	0.004	-0.003	-0.003	-0.003	0.010	0.019	0.027	0.003	-0.003	-0.004
Lithium													
Magnesium	5.30	0.40	6.50	7.00	7.20	7.30	8.49		13.60	15.30	15.00	14.60	6.20
Manganese	0.0050	-0.0020	0.0270	0.0150	0.0150	0.0140	0.0180		0.2030	0.2760	0.2430	0.2700	0.0640
Mercury													
Molybdenum	-0.004	0.007	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
Nickel	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.01	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
Potassium	-0.40	-0.40	0.60	-0.40	0.90	-0.40	1.10		1.00	1.00	1.00	16.00	23.00
Selenium	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.03	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030
Silicon	1.60	1.90	2.40	1.00	1.10	0.90	2.2						
Silver	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.03	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030
Sodium	0.60		1.10	1.20	1.20	1.10	1.20	0.90	1.60	1.90	1.50	1.00	0.60
Strontium	0.133	0.038	0.211	0.212	0.198	0.200	0.208						
Sulphur	2.40	3.00	3.50	3.10	3.40	3.30	3.00		5.20	2.20	2.50	1.90	1.80
Tellurium	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.0200	-0.02						
Thallium	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030						
Tin	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.0200						
Titanium	-0.0030	-0.0030	-0.0030	-0.0030	-0.0030	-0.0030	-0.0030						
Vanadium	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003						
Zinc	0.0300	-0.0100	-0.0100	-0.0100	-0.0100	-0.0100	-0.0100	-0.0100	0.0800	0.0800	0.0200	-0.0100	0.0100
Zirconium	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003						
Dissolved Metals													
Aluminum								-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Antimony								-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
Arsenic								-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Barium								0.1460	0.1780	0.1880	0.1900	0.1740	0.0800
Cadmium								0.0001	0.0002	0.0003	-0.0001	-0.0001	-0.0001
Calcium								64.0	70.4	70.0	77.3	71.4	41.6
Copper								-0.001	0.004	0.005	0.005	0.004	0.002
Iron								0.071	0.288	0.196	0.194	0.285	0.078
Lead								0.004	0.015	0.010	0.002	0.003	0.002
Molybdenum								-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
Selenium								-0.030	-0.030	-0.030	-0.030	-0.030	-0.030
Silver								-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
Sodium								0.98	1.65	2.05	1.57	1.16	0.71
Zinc								0.0050	0.0160	0.0310	0.0090	0.0060	0.0050

(C) Indicates values are less than (bet

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Detailed Decommissioning & Reclamation Plan

Appendix C-10

MH-13 and MH-14 Water Quality

Sample Date	07-May-91	30-Jul-91	31-Jul-91	01-Oct-91	01-Oct-91	26-Feb-92	30-Jun-92	26-Aug-92	25-Nov-92	06-Apr-93	30-Jun-93	30-Oct-93	29-Jan-94	30-Apr-94	20-Jul-94	11-Nov-94	19-Jan-95	20-Apr-95	26-Jul-95	17-Oct-95	12-Jan-96	18-Apr-96	19-Jul-96	09-Oct-96
Collected By:	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company
Lab. No.								92019322																
Station	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	MH-13	
Physical Parameters																								
pH	8.00	7.00	8.10	8.10	8.20	8.00	8.10	8.50	8.20	8.10	8.20	8.20	8.00	8.20	8.20	8.10	8.00	8.20	8.00	7.98	7.50	7.84	8.00	8.30
pH (in Field)	7.9															8.0	6.7	7.2	8.0	8.2	6.5	7.1	7.7	
Conductivity, micro-mho/cm	212			259		370	205		397	440	369	392	477	321	357	374	409	341	349	395	377	416	340	381
Conductivity (in Field), micro-mho/cm	110																							
Total Suspended Solids, mg/L	20	-5	-5	-5	-5	-5	30	2	< 4	< 4	7	< 4	< 4	7	< 4	4	< 4	< 4	2	1	36	7	-1	< 4
Turbidity, NTU	10.0			2.0	1.0	2.0	19.0		1.3	0.4	0.9	0.8												
Dissolved Susspended Solids, mg/L	149	111	210	177		231	155		223	265	223	236	286	226	204	218	254	226	220	267	205	247	233	192
Flow, L/min	447.0							14833.3																
Temp., degrees Celcius	0.4							9.0																
Hardness, CaCO3, mg/L																13.3	6.1	11.7	18.9					1.0
Total Hardness, mg/L	140			159		197	125	194	217	238	211	215	234	184	205	208	221	226	203	224	215	239	194	201
LC50																								
Anions																								
Alkalinity, CaCO3, mg/L	120			154	171	178	109	183	197	206	170	189	213	164	187	192	214	210	184	208	194	219	177	192
Sulphate (SO4), mg/L	4.5	1.7	6.7	6.1		14.9	9.8	14.5	22.6	47.3	26.8	23.2	27.5	20.5	13.4	12.0	16.5	18.5	11.5	14.5	16.0	16.2	19.8	11.1
Nutrients																								
Nitrite Nitrogen (NO2), mg/L	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.050	0.015	0.005	0.006	0.014	0.014	0.016	0.016	0.015	0.018	0.052	-0.005	-0.005	0.021	-0.005	0.123	-0.005	0.007
Nitrate Nitrogen (NO3), mg/l																								
N-NH3, mg/L																								
N-NO2-NO3, mg/L	-0.100	-0.200	-0.200	-0.200		0.200	0.200		0.250	0.200	0.170	0.420												
Total Phosphorus, mg/L																						0.013	0.017	-0.040
Cyanide																								
Total Cyanide, mg/L	0.052	-0.005	-0.005	-0.005	-0.005	-0.005	0.023			0.005	0.006	0.005	0.001	-0.001	-0.001	-0.001	-0.010	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.001
Cyanide-WAD, mg/L	0.020	-0.005																						
Total Metals																								
Aluminum	0.900	0.710	-0.050	-0.050		-0.050	0.460	-0.020	-0.020	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	0.060	-0.060	0.046	0.020	0.272	0.031	0.054	-0.060
Antimony	-0.050	-0.050	-0.050	-0.050		-0.020	-0.020	-0.015	-0.015	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.005	-0.005	-0.005	-0.005	-0.005	0.020
Arsenic	-0.050	-0.050	-0.050	0.070		-0.040	-0.040	-0.001	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.004	-0.004	-0.004	-0.010	0.010	-0.040
Barium	0.1350	0.0400	0.1210	0.1010		0.1370	0.0800	0.1270	0.1290	0.1360	0.1240	0.1200	0.1420	0.1080	0.1200	0.1180	0.1220	0.1350	0.1370	0.1230	0.1660	0.1710	0.1340	0.1270
Beryllium																						-0.0005	-0.0005	-0.0010
Bismuth																						-0.007	-0.007	-0.020
Boron																						-0.002	-0.002	-0.040
Cadmium	-0.0003	-0.0003	0.0016	-0.0003	-0.0003	-0.0003	-0.0003	-0.0005	-0.0001	-0.0001	-0.0001	0.0001	0.0001	0.0001	-0.0001	0.0001	-0.0001	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0005	-0.0001
Calcium	39.3	13.8	53.3	51.1		53.6	35.8	57.8	65.1	71.1	62.7	64.0	68.9	55.5	63.1	63.0	66.3	65.8	54.0	64.3	67.0	67.4	56.9	62.2
Chromium																						-0.0008	-0.0008	0.0030
Cobalt																						-0.0007	-0.0007	-0.0040
Copper	0.004	-0.001	-0.001	-0.001	-0.001	-0.001	0.005	-0.001	-0.001	-0.002	0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001	0.001	-0.001	-0.001	0.001	-0.002
Iron	1.850	0.443	0.174	0.326		0.207	0.791	0.181	0.231	0.120	0.150	0.170	0.200	0.520	0.200	0.200	0.250	0.310	0.225	0.261	0.646	0.348	0.306	0.260
Lead	-0.004	-0.004	0.011	0.005	0.004	0.014	0.034	0.002	0.006	0.040	0.007	0.003	0.007	0.003	-0.003	0.003	-0.003	-0.003	-0.002	0.003	-0.002	0.002	0.003	-0.003
Lithium																						0.00186	0.00163	
Magnesium													15.00	11.10	11.40	12.40		14.90	11.30	13.70	14.90	15.50	11.60	13.20
Manganese													0.0150	0.0250	0.0100	0.0130		0.0160	0.0100	0.0184	0.0337	0.0260	0.0140	0.0140
Mercury																								
Molybdenum	-0.005	-0.005	-0.005	-0.005		0.003	-0.003	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	0.008	-0.001	-0.001	-0.001	0.002	0.003	-0.004
Nickel													-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.001	-0.001	-0.001	-0.001	0.001	-0.010
Potassium													1.00	25.00	22.00	24.00		22.60	0.30	0.50	0.59	-0.40	2.50	0.60
Selenium	-0.010	-0.010	-0.010	-0.010	-0.010	-0.020	-0.020	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.003	-0.003	-0.003	-0.003	0.008	-0.030
Silicon																						3.47	2.80	2.80
Silver	-0.010			-0.010	-0.001	-0.010	-0.010	-0.0005	-0.010	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.001	-0.001	-0.001	-0.001	-0.001	-0.030
Sodium	0.94	1.90	1.81	0.88		2.92	1.60	1.66	2.16	2.50	2.70	2.00	2.60	2.00	1.30	1.50	1.70	2.00	2.07	1.97	2.00	2.13	1.52	1.40
Strontium																						0.231	0.204	0.190
Sulphur													8.40	5.80	3.50	4.10		5.60	2.60	4.00	5.13	5.50	3.30	3.80
Tellurium																						-0.0300		-0.0200
Thallium																						-0.004	0.010	-0.030
Tin																						-0.003	-0.003	-0.020
Titanium																						-0.0004	0.0005	-0.0030
Vanadium																						-0.001	-0.001	-0.003
Zinc	0.0270	-0.0010	0.0200	0.0050	0.0070	0.0050	0.0310	0.0040	0.0050	0.0200	0.0100	-0.0100	0.0200	-0.0100	0.0500	-0.0100	0.1200	0.0100	-0.0010	-0.0005	-0.0005	0.0020	0.0110	0.0100
Zirconium																						-0.001	-0.001	-0.003
Dissolved Metals																								
Aluminum	-0.050	-0.050	-0.050	-0.050		-0.050	-0.050	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020
Antimony	-0.050	-0.050	-0.050	-0.050		-0.020	-0.020	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
Arsenic	-0.050	-0.050	-0.050	-0.050	-0.050	-0.040	-0.040	-0.001	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.004	-0.004	-0.004	-0.010	0.010	-0.040
Barium	0.0870																							

(-) Indicates values are less than (below)

(-) Indicates values are less than (below)

Sample Date	26-Jul-95	17-Oct-95	02-Jan-96	18-Apr-96	19-Jul-96	09-Oct-96	14-Jan-97	08-Apr-97	03-Jul-97	10-Oct-97	16-Jan-98	26-Apr-98	25-Aug-98	13-Nov-98	11-Jan-99	13-Apr-99	12-Aug-99	18-Oct-99	3-Feb-00	7-Apr-00	21-Jul-00	2-Nov-00	31-Jan-01	2-Apr-01	21-Jul-01	2-Nov-01	1-Feb-02	16-Apr-02	
Collected By:	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	Company	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	
Lab. No.																													
Station	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	
Physical Parameters																													
pH	8.00	8.02	7.63	8.09		8.20	7.70	7.80	8.40	8.10	8.30	8.00	8.40	7.90	8.10	7.90	8.20	8.10	7.90	8.50	8.40	8.10	8.10	7.90	8.10	7.90	7.90	8.20	
pH (in Field)	8.0	8.8		7.0		7.3	7.3	6.8	7.7	7.7	7.45	6.39	7.85	6.75	7.83	7.00	7.26	7.95	7.21	7.68	8.14	8.01	7.99	8.03	8.16	8.11	8.20	8.13	
Conductivity, micro-mho/cm	364	402	566	395		386	397	397	317	408	656	329		400															
Conductivity (in Field), micro-mho/cm															423	405	378	381	349	391	367	385	404	408	363	392	398	392	
Total Suspended Solids, mg/L	2	-1	40	3		8	< 4	< 4	6	< 4	6	8	< 4	< 4	4.0	7.0	5.0	6.0	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	
Turbidity, NTU																													
Dissolved Suspended Solids, mg/L	213	240	320	233		192	182	226	176	220	388	200		226	232	220	208	228	240	222	204	228	208	228	194	238	212	230	
Flow, L/min																													
Temp., degrees Celcius	19.5					2.0						2.0	8.9	1.0	0.5	0.0	11.0	2.0	0.0	0.0	12.2	0.0	0.0	0.0	14.3	-0.1	0.2	1.0	
Hardness, CaCO ₃ , mg/L															228	225	207	217	226	238	205	216	209	208	199	211	220	210	
Total Hardness, mg/L	214	229	336	223		208	216	213	187	202	374	163	218	218															
LC50																													
Anions																													
Alkalinity, CaCO ₃ , mg/L	194	214	305	210		195	205	207	169	205	348	165	203	210	218	209	196	195	210	208	189	205	213	214	191	209	217	209	
Sulphate (SO ₄), mg/L	12.3	14.5	23.6	11.5		9.5	11.4	11.1	5.0	3.7	11.6	8.7	8.8	9.2	9.3	10.3	6.7	8.6	8.7	10.6	7.9	8.8	9.8	9.9	7.5	8.9	10.2	10.5	
Nutrients																													
Nitrite Nitrogen (NO ₂), mg/L	-0.005	-0.005	-0.005	-0.005		0.009	-0.005	0.009	0.010	-0.005	0.017	-0.005	0.005	-0.005															
Nitrate Nitrogen (NO ₃), mg/l																													
N-NH ₃ , mg/L															0.018	<0.005	<0.005	<0.005	<0.005	0.005	0.313	<0.005	0.015	<0.005	0.027	0.027	0.017	0.023	
N-NO ₂ -NO ₃ , mg/L																													
Total Phosphorus, mg/L				0.007		-0.040	0.500	0.700	-0.400	-0.400	-0.040	0.050	-0.040	-0.040	0.04	0.06	0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Cyanide																													
Total Cyanide, mg/L	-0.001	-0.001	-0.001	-0.001		0.001	-0.001	0.001	0.001	0.002	0.003	-0.001		-0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.0005	
Cyanide-WAD, mg/L																													
Total Metals																													
Aluminum	0.040	0.014	-0.008	0.017		-0.060	-0.060	-0.060	0.100	-0.060	-0.06	-0.06	-0.06	-0.06	<0.06	<0.06	0.10	<0.06	<0.06	<0.06	0.07	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	
Antimony	-0.005	-0.005	-0.005	-0.005		-0.020	-0.020	-0.020	-0.020	-0.020	0.04	-0.02	-0.020	-0.020	<0.02	<0.02	0.03	<0.02	0.03	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Arsenic	0.006	-0.004	-0.004	-0.010		-0.040	-0.040	-0.040	-0.040	-0.040	-0.04	-0.04	-0.04	-0.04	<0.04	<0.04	<0.04	<0.04	0.05	<0.04	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Barium	0.1640	0.1550	0.2860	0.1900		0.1550	0.1940	0.1480	0.1160	0.1580	0.276	0.139	0.174	0.178	0.181	0.176	0.168	0.161	0.178	0.187	0.151	0.151	0.159	0.168	0.154	0.148	0.169	0.158	
Beryllium				-0.0005		-0.0010	-0.0010	-0.0010	-0.0010	-0.0010	-0.001	<0.000	0.000	0.000	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	
Bismuth				-0.007		-0.020	-0.020	-0.020	-0.020	-0.020	-0.02	-0.02	-0.02	-0.02	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
Boron				-0.002		-0.040	-0.040	-0.040	-0.040	-0.040	0.0	0.0	0.0	0.0	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	
Cadmium	-0.0005	-0.0005	-0.0005	-0.0005		-0.0001	-0.0001	-0.0001	-0.0001	-0.0020	0.0	0.0	0.0	0.0	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Calcium	56.1	65.8	95.9	63.7		62.8	68.7	64.2	53.8	59.5	104.0	49.6	61.5	67.9	63.1	64.4	60.6	62.1	63.7	68.4	61.0	62.6	60.2	58.9	58.8	61.0	63.4	60.6	
Chromium				0.0009		-0.0020	-0.0020	-0.0020	-0.0020	0.0020	0.0030	-0.0020	-0.0020	0.0030	<0.002	0.002	0.006	<0.002	0.004	<0.002	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Cobalt				-0.0007		-0.0040	-0.0040	-0.0040	-0.0040	-0.0040	-0.004	-0.004	-0.0040	-0.0040	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Copper	-0.001	-0.001	-0.001	-0.001		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003	-0.003	-0.003	<0.003	<0.003	0.007	<0.003	<0.003	<0.003	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Iron	0.160	0.174	0.099	0.131		0.220	0.160	0.150	0.250	0.180	0.110	0.370	0.250	0.240	0.27	0.26	0.69	0.25	0.320	0.270	0.329	0.141	0.273	0.265	0.167	0.260	0.226	0.185	
Lead	-0.002	-0.002	-0.002	-0.002		-0.003	-0.003	-0.003	-0.003	-0.003	0.00	0.00	0.03	0.00	<0.001	<0.001	<0.001	0.001	0.009	<0.001	<0.001	0.002	0.0009	0.0004	<0.0005	0.0009	<0.0005	<0.0005	
Lithium				0.00188																									
Magnesium	12.40	14.70	28.70	13.90		14.10	16.60	15.60	10.20	14.60	32.5	12.1	15.0	16.3	16.1	15.3	13.6	15.1	15.8	16.3	12.8	14.6	14.3	14.7	12.7	14.2	15.1	14.2	
Manganese	0.0100	0.0111	0.0128	0.0070		0.0200	0.0180	0.0100	0.0110	0.0170	0.0350	0.0220	0.0220	0.0250	0.027	0.023	0.042	0.013	0.029	0.020	0.015	0.006	0.024	0.019	0.015	0.018	0.021	0.015	
Mercury																													
Molybdenum	-0.001	-0.001	0.001	0.002		-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005	-0.005	-0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Nickel	-0.001	-0.001	-0.001	0.006		-0.010	-0.010	-0.010	-0.010	-0.010	-0.01	-0.01	-0.01	-0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Potassium	0.40	0.60	1.09	-0.40		-0.40	0.50	0.70	-0.40	-0.40	1.8	1.0	-0.5	1.0	<0.5	0.8	1.1	<0.5	1.0	<0.5	2.0	<1	<1	<1	<1	<1	<1	<1	
Selenium	-0.003	-0.003	-0.003	-0.003		-0.030	-0.030	-0.030	-0.030	-0.030	-0.03	-0.03	-0.03	-0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	
Silicon				3.46		3.00																							

MH-13 and MH-14

Sample Date	25-Jul-02	15-Nov-02	12-Jan-03	25-Apr-03	15-Jul-03	14-Oct-03	8-Feb-04	9-May-04	10-Aug-04	4-Oct-04	6-Jul-05	4-Sep-05
Collected By:	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan		Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr
Lab. No.												
Station	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14	MH-14
Physical Parameters												
pH	8.20	8.10	8.2	8.1	8.2	8.1	8.1	8	8.3	8.2	8	8
pH (in Field)	7.92	8.11	8.18	8.24	7.97	8.39						
Conductivity, micro-mho/cm								256	393	391	371	388
Conductivity (in Field), micro-mho/cm	335	383	357	353	355	403	387					
Total Suspended Solids, mg/L	<4	<4	<4	17	<4	7	<4	<4	<4	<4	<4	<4
Turbidity, NTU								1.55	1.78	0.87	0.3	0.2
Dissolved Suspended Solids, mg/L	176	228	222	202	204	224	220	130	232	224	220	212
Flow, L/min			u/a	u/a	u/a	u/a						
Temp., degrees Celsius	11.2	0.1	-0.2	1.9	16.8	1.3						
Hardness, CaCO ₃ , mg/L	200	208	216	192	201	229	219	132	214	222	210	220
Total Hardness, mg/L												
LC50												
Anions												
Alkalinity, CaCO ₃ , mg/L	190	201	214	183	188	218	210	132	211	209	199	209
Sulphate (SO ₄), mg/L	5.9	11.0	8.8	8.9	6.4	5.8	7	5.4	7.3	7.3	5.6	7.3
Nutrients												
Nitrite Nitrogen (NO ₂), mg/L								<0.005	0.005	<0.005		
Nitrate Nitrogen (NO ₃), mg/l								<0.02	0.03	0.03		
N-NH ₃ , mg/L	<0.005	0.010	0.016	<0.005	<0.005	<0.005	0.007	<0.005	0.015	<0.005	<0.005	<0.005
N-NO ₂ -NO ₃ , mg/L								<0.02	0.03	0.03	0.06	0.08
Total Phosphorus, mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cyanide												
Total Cyanide, mg/L	<0.0005	0.0007	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	<0.0005	0.0019	<0.0005	<0.0005	<0.0005
Cyanide-WAD, mg/L												
Total Metals												
Aluminum	<0.02	<0.02	<0.02	0.04	<0.02	0.06	<0.02	0.06	0.07	0.02	0.03	<0.02
Antimony	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	0.161	0.145	0.166	0.148	0.161	0.162	0.173	0.102	0.17	0.169	0.153	0.174
Beryllium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bismuth	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Cadmium	<0.0001	0.16	<0.0001	<0.0001	<0.0001	<0.0001	0.05	<0.0001	<0.0001	<0.0001	0.00003	0.00006
Calcium	58.5	60.5	61.6	55.1	59.1	67.4	62.5	38.8	62.2	64.3	60.7	65.2
Chromium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Iron	0.116	0.169	0.222	0.393	0.213	0.235	0.212	0.55	0.378	0.201	0.114	0.059
Lead	0.0011	0.5300	<0.0005	<0.0005	0.001	0.0016	0.88	<0.0005	0.0044	<0.0005	0.00022	0.00631
Lithium												
Magnesium	13.0	13.8	15.1	13.2	13	14.8	15.4	8.57	14.2	14.9	14.1	14.8
Manganese	0.005	0.013	0.016	0.019	0.017	0.041	0.008	0.034	0.026	0.01	0.002	<0.001
Mercury								<0.00005				
Molybdenum	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Potassium	<1	<1	<1	<1	<1	<1	<1	<1	1	<1	<1	<1
Selenium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Silicon											3.26	3.34
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	1.01	1.37	1.51	1.32	1.2	1.1	1.06	0.93	1.51	1.34	1.25	1.18
Strontium	0.190	0.208	0.227	0.195	0.212	0.2	0.212	0.137	0.218	0.217	0.189	0.202
Sulphur	1.9	3.1	3.2	3.3	2.3	1.6	2.4	1.8	2.3	2.6	2.1	2.5
Tellurium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
Thallium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Tin	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Titanium	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Vanadium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	<0.005	<0.005	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.019
Zirconium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Metals												
Aluminum												
Antimony												
Arsenic												
Barium												
Cadmium												
Calcium												
Copper												
Iron												
Lead												
Molybdenum												
Selenium												
Silver												
Sodium												
Zinc												
(-) Indicates values are less than (below) :												

Sä Dena Hes Mine

Detailed Decommissioning & Reclamation Plan

Appendix C-11

MH-15 to MH-22 Water Quality

Sample Date Collected By:	07-May-91 Company	01-Oct-91 Company	01-Oct-91 Company	26-Feb-92 Company	25-Nov-92 Company	07-May-91 Company	30-Jul-91 Company	30-Jul-91 Company	30-Jul-91 Company	31-Jul-91 Company	01-Oct-91 Company	26-Feb-92 Company	30-Jun-92 Company	26-Aug-92 Company 92019324	25-Nov-92 Company	06-Apr-93 Company	30-Jun-93 Company	30-Oct-93 Company	29-Jan-94 Company	30-Apr-94 Company	20-Jul-94 Company	11-Nov-94 Company	19-Jan-95 Company	20-Apr-95 Company	26-Jul-95 Company
Lab. No.																									
Station	MH-15	MH-15	MH-15	MH-15	MH-15	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	
Physical Parameters																									
pH	8.00	8.20	8.20	7.90	8.20	8.10	8.20	8.10	8.20	8.20	8.10	8.10	8.50	8.30	8.30	8.40	8.20	8.20	8.30	8.30	8.10	8.10	8.30	8.10	
pH (in Field)	7.8					8.0														8.2	8.1	7.6	8.1	8.3	
Conductivity, micro-mho/cm	222	300	300	340	370	235				300	370	221		395	395	354	394	389	315	362	388	395	361	369	
Conductivity (in Field), micro-mho/cm	132					145																			
Total Suspended Solids, mg/L	5	-5	-5	-5	< 4	10	-5	-5	-5	-5	-5	54	2	< 4	< 4	< 4	< 4	< 4	5	< 4	< 4	< 4	5	3	
Turbidity, NTU	1.0	-1.0	-1.0	2.0	1.3	3.0				-1.0	2.0	15.0		0.8	0.3	0.6	0.8								
Dissolved Suspended Solids, mg/L	160	208	206	220	207	195	210	210	205	207	252	188		255	231	208	226	242	226	211	222	242	230	247	
Flow, L/min	198.0					2019.0																			
Temp., degrees Celcius	3.3					3.5															1.4	6.1	9.4	21.1	
Hardness, CaCO ₃ , mg/L																									
Total Hardness, mg/L	145	191	190	191	207	155				193	189	140	206	221	218	208	218	203	179	203	219	214	224	220	
LC50																									
Anions																									
Alkalinity, CaCO ₃ , mg/L	120	171	173	175	198	130				191	197	119	198	208	209	183	204	214	172	197	206	213	209	200	
Sulphate (SO ₄), mg/L	3.2	5.4	5.2	5.1	8.6	5.2	6.6	6.6	6.8	6.8	8.0	7.6	12.5	15.2	30.9	11.9	18.6	9.8	8.8	9.1	8.3	3.7	10.7	10.0	
Nutrients																									
Nitrite Nitrogen (NO ₂), mg/L	-0.050	-0.050	-0.050	-0.050	0.014	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	0.022	0.005	0.007	0.034	0.009	0.012	0.009	0.021	-0.005	0.014	-0.005	-0.005	
Nitrate Nitrogen (NO ₃), mg/l																									
N-NH ₃ , mg/L																									
N-NO ₂ -NO ₃ , mg/L	-0.100	-0.200	-0.200	0.100	0.050	-0.100	-0.200	-0.200	-0.200	-0.200	-0.100	0.100		0.110	0.150	0.040	0.070								
Total Phosphorus, mg/L																									
Cyanide																									
Total Cyanide, mg/L	0.050	-0.005	-0.005	-0.005		0.022	-0.005	-0.005	-0.005	-0.005	-0.005	0.034			0.005	0.005	0.007	0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	
Cyanide-WAD, mg/L	0.010					-0.005	-0.005	-0.005																	
Total Metals																									
Aluminum	1.140	-0.050	-0.050	-0.050	-0.020	0.320	0.680	0.760	-0.050	-0.050	-0.050	0.170	0.030	-0.020	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	-0.060	0.080	0.046	
Antimony	-0.050	-0.050	-0.050	-0.020	-0.015	-0.050	-0.050	-0.050	-0.050	-0.050	-0.020	-0.020		-0.015	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.030	-0.020	-0.020	-0.005	
Arsenic	-0.050	0.060	0.070	-0.040	-0.040	0.050	-0.050	-0.050	-0.050	-0.050	0.060	-0.040	-0.040	-0.001	-0.040	-0.040	-0.060	-0.060	-0.040	-0.040	0.040	-0.040	-0.040	0.005	
Barium	0.1210	0.1390	0.1420	0.1540	0.1480	0.1310	0.1300	0.1100	0.1350	0.1370	0.1570	0.0900	0.1480	0.1520	0.1490	0.1400	0.1420	0.1420	0.1220	0.1420	-0.0200	0.1480	0.1580	0.1660	
Beryllium																									
Bismuth																									
Boron																									
Cadmium	-0.0003	-0.0003	-0.0003	-0.0003	-0.0001	-0.0003	-0.0003	-0.0003	0.0009	-0.0003	-0.0003	-0.0003	-0.0005	-0.0001	-0.0001	0.0042	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0005	
Calcium	40.9	54.3	51.1	50.8	63.2	44.2	51.8	48.0	52.5	54.3	54.0	37.5	59.6	64.9	64.0	62.0	63.7	60.1	52.3	60.1	64.3	62.6	65.6	57.1	
Chromium																									
Cobalt																									
Copper	0.004	-0.001	-0.001	-0.001	-0.001	0.004	-0.001	-0.004	0.007	-0.001	-0.001	0.003	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001	
Iron	0.446	0.121	0.122	0.226	0.191	0.505	0.109	0.109	0.131	0.116	0.160	0.933	0.175	0.127	0.080	0.120	0.140	0.140	0.430	0.140	0.140	0.160	0.390	0.153	
Lead	-0.004	-0.004	-0.004	0.007	0.006	-0.004	-0.004	-0.004	-0.004	-0.004	0.010	0.032	0.001	-0.003		0.004	0.004	-0.003	-0.003	0.006	-0.003	-0.003	-0.003	-0.002	
Lithium																									
Magnesium																		14.30	11.80	12.80	14.10		14.70	13.20	
Manganese																		0.0080	0.0200	0.0100	0.0070		0.0200	0.0090	
Mercury																									
Molybdenum	-0.005	-0.005	-0.005	0.004	-0.004	-0.005	-0.005	-0.005	0.008	-0.005	-0.003	-0.003	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.001	
Nickel																		-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.001	
Potassium																		-1.00	20.00	20.00	24.00		23.70	0.40	
Selenium	-0.010	-0.010	-0.010	-0.020	-0.030	-0.010	-0.010	-0.010	-0.010	-0.010	-0.020	-0.020	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.030	-0.003	
Silicon																									
Silver	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.0005	-0.010	-0.030	-0.030	-0.030	-0.030	-0.040	-0.040	-0.030	-0.030	-0.030	-0.001	
Sodium	3.63	1.00	0.96	1.02	0.99	1.50	2.40	2.70	0.64	1.19	1.38	-0.50	1.38	1.43	1.20	1.40	1.30	1.30	1.00	1.20	1.40	1.40	1.60	2.11	
Strontium																									
Sulphur																		3.10	2.20	2.60	2.90		2.90	2.10	
Tellurium																									
Thallium																									
Tin																									
Titanium																									
Vanadium																									
Zinc	0.0340	0.0040	0.0040	-0.0010	-0.0020	0.0110	-0.0010	-0.0010	0.0080	0.0040	0.0010	0.0260	-0.0020	-0.0020	0.0100	0.0100	0.0100	0.0100	-0.0100	0.0400	-0.0100	0.0700	0.0100	-0.0010	
Zirconium																									
Dissolved Metals																									
Aluminum	-0.050	-0.050	-0.050	-0.050	-0.020	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.050	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	-0.020	
Antimony	-0.050	-0.050	-0.050	-0.020	-0.015	-0.050	-0.050	-0.050	-0.050	-0.050	-0.020	-0.020		-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	
Arsenic	-0.050	0.050	0.060	-0.040	-0.040	-0.050	-0.050	-0.050	-0.050	-0.050	0.060	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040	0.005	
Barium	0.1100	0.1360	0.1360	0.1480	0.1470	0.1110	0.1300	0.1200	0.1450	0.1330	0.1600	0.0400	0.1470	0.1480	0.1530	0.1380	0.0750	-0.0003	-0.0003	-0.0003	-0.0003	-0.0001	-0.0001	-0.0001	
Cadmium	-0.0003	-0.0003	-0.0003	-0.0003	-0.0001	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0005	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001						

NST: No sample taken
(-) Indicates values are less than (below)

Sample Date Collected By:	2-Nov-01	1-Feb-02	16-Apr-02	25-Jul-02	15-Nov-02	12-Jan-03	25-Apr-03	15-Jul-03	14-Oct-03	8-Feb-04	9-May-04	10-Aug-04	4-Oct-04	6-Jul-05	4-Sep-05	07-May-91	01-Oct-91	03-Jun-92	26-Aug-92	07-May-91	30-Jul-91	31-Jul-91	01-Oct-91	26-Feb-92	26-Aug-92	
Station	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-16	MH-17	MH-17	MH-17	MH-17	MH-19	MH-19	MH-19	MH-19	MH-19	MH-19	
Physical Parameters																										
pH	8.10	8.00	8.30	8.30	8.10	8.3	8.2	8.3	8.3	8.3	8.1	8.4	8.3	8.2	8.2	8.10	8.10	8.10	8.40	8.10	8.20	8.20	8.20	8.10	8.40	
pH (in Field)	8.56	8.45	8.39	8.38	8.31	8.17	8.33	8.36	8.42							7.5	7.9									
Conductivity, micro-mho/cm											291	386	377	354	371	385	380	380					300	360		
Conductivity (in Field), micro-mho/cm	392	406	391	336	390	362	377	353	378	394						230	237									
Total Suspended Solids, mg/L	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	10	<4	<4	<4	<4	5	5	6	14	11	5	20	5	5	3	
Turbidity, NTU											3.49	0.9	0.67	1.2	0.9	-1.0	-1.0	1.0		3.0	-5	20	-5	2.0		
Dissolved Suspended Solids, mg/L	228	218	212	190	258	234	212	198	208	224	154	226	222	216	210	233	252	287		209	250	210	205	229		
Flow, L/min						u/a	u/a	u/a	u/a							21.0			4333.0							
Temp., degrees Celcius	-0.2	-0.3	0.5	11.9	-0.2	-0.3	1.2	13.1	0.7							3.8			11.0	3.9					108333.0	
Hardness, CaCO ₃ , mg/L	214	226	219	204	219	214	208	199	215	224	156	212	246	200	220				233.0							
Total Hardness, mg/L																215	235	235		145			195	161		
LC50																									197	
Anions																										
Alkalinity, CaCO ₃ , mg/L	207	222	213	191	208	220	197	187	201	214	151	210	203	192	202	200	216	219	221	130			179	172	197	
Sulphate (SO ₄), mg/L	8.0	8.5	10.1	6.5	9.8	8.3	7.7	6.2	7.3	8.1	5.4	6.4	7.2	6.1	6.9	11.6	14.6	13.5	20.2	5.0	6.0	6.5	6.9	7.2	13.5	
Nutrients																										
Nitrite Nitrogen (NO ₂), mg/L											<0.005	<0.005	<0.005			-0.050	-0.050	-0.050	0.014	-0.050	-0.050	-0.050	-0.050	-0.050	0.011	
Nitrate Nitrogen (NO ₃), mg/l											<0.02	<0.02	<0.02													
N-NH ₃ , mg/L	0.012	0.006	<0.005	<0.005	0.005	0.009	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005											
N-NO ₂ -NO ₃ , mg/L											<0.02	<0.02	<0.02	<0.02	<0.02	-0.100	-0.200	0.100		-0.100	-0.200	-0.200	-0.200	-0.100		
Total Phosphorus, mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1											
Cyanide																										
Total Cyanide, mg/L	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0006	0.0005	0.002	<0.0005	<0.0005	<0.0005	0.008	-0.005	0.015		0.010	-0.005	-0.005	-0.005	-0.005		
Cyanide-WAD, mg/L																0.008				-0.005	-0.005					
Total Metals																										
Aluminum	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.12	0.02	0.08	0.04	<0.02	0.050	-0.050	-0.050	0.020	1.570	0.840	-0.050	-0.050	-0.050	0.030	
Antimony	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-0.050	-0.050	-0.020		-0.050	-0.050	-0.050	-0.050	-0.020	-0.015	
Arsenic	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-0.050	-0.050	-0.040	-0.001	-0.050	-0.050	-0.050	0.070	-0.040	0.000	
Barium	0.144	0.175	0.166	0.162	0.155	0.166	0.164	0.164	0.155	0.185	0.132	0.175	0.166	0.168	0.168	0.164	0.2010	0.2110	0.1700	0.2040	0.1240	0.1300	0.1470	0.1390	0.1700	0.1500
Beryllium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002											
Bismuth	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05								
Boron	<0.01	<0.01	<0.01	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.009	0.008	<0.008								
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001	0.29	<0.0001	<0.0001	<0.0001	<0.0001	0.02	<0.0001	<0.0001	<0.0001	<0.0001	0.00004	0.00002	-0.0003	-0.0003	-0.0003	-0.0005	-0.0003	-0.0003	0.0013	-0.0003	-0.0003	-0.0005
Calcium	61.7	65.1	63.4	59.4	63.3	60.8	59.4	58.1	62.1	64.1	44.5	61.4	74.1	60.3	63.2	56.9	59.3	61.9	60.8	38.9	54.8	49.4	54.7	49.6	56.6	
Chromium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005								
Cobalt	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005								
Copper	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-0.001	-0.001	-0.001	-0.001	0.001	0.002	0.005	
Iron	0.135	0.141	0.147	0.172	0.122	0.15	0.214	0.153	0.13	0.13	0.640	0.156	1.1	0.237	0.175	0.019	-0.005	0.006	0.039	0.522	0.161	0.719	0.129	0.284	0.188	
Lead	<0.0005	<0.0005	<0.0005	<0.0005	0.12	<0.0005	<0.0005	<0.0005	0.0006	0.1	0.0009	0.0014	<0.0005	0.00124	0.00437	-0.004	-0.004	0.017		-0.004	-0.004	0.006	-0.004	0.019	0.002	
Lithium																										
Magnesium	14.5	15.4	14.7	13.5	14.8	15	14.6	13.2	14.5	15.5	10.9	14.3	14.8	13.1	14.3											
Manganese	0.009	0.013	0.010	0.014	0.007	0.01	0.01	0.013	0.007	0.009	0.04	0.01	0.011	0.02	0.012											
Mercury											<0.00005															
Molybdenum	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-0.005	0.006	-0.003	-0.004	-0.005	0.007	-0.005	
Nickel	<0.01	<0.01	<0.01	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008							-0.004	
Potassium	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1											
Selenium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	-0.010	0.010	-0.020	-0.030	-0.010	-0.010	-0.010	-0.010	
Silicon																2.86	2.92									
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010	-0.001	
Sodium	1.2	1.30	1.36	1.04	1.27	1.33	1.27	1.1	1.27	1.3	0.94	1.38	1.56	1.1	1.32	1.55	1.41	1.20	1.28	3.83	4.00	1.68	1.77	1.44	1.24	
Strontium	0.200	0.213	0.200	0.199	0.200	0.206	0.196	0.202	0.2	0.223	0.143															

Sample Date	#####	01-Oct-91	01-Oct-91	30-Jul-91	31-Jul-91	25-Aug-92	01-Oct-91	01-Oct-91	25-Aug-92	21-Jul-94	06-Jun-95	05-Jan-98	05-Feb-98	03-Mar-98	04-Apr-98	#####	01-Jun-98	01-Jul-98	02-Aug-98	30-Aug-98	06-Oct-98	10-Oct-98	02-Nov-98	01-Dec-98	4-Jan-99	1-Feb-99	2-Mar-99	2-Apr-99	2-May-99	
Collected By:	Company	Company	Company	Company	Company	Company	Company	Company	Company	DIAND	DIAND	Company	Company	Company	Company	Company	Company	Company	Company	Company	DIAND	Company	Company	Company	Company	RFlanagan	RFlanagan	RFlanagan	RFlanagan	
Lab. No.						92019327				4106	5077						98022642	98027989	98036465	98044653	8119	98056638	98062644	98070146						
Station	MH-20	MH-20	MH-20	MH-20	MH-20	MH-20	MH-21	MH-21	MH-21	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	
Physical Parameters																														
pH	7.80	8.20	8.20	8.10	8.10	8.40	8.30	8.30	8.40	8.20	8.10						8.00	7.90	8.20	8.20	8.09	8.10	8.00	7.90						
pH (in Field)	7.7									7.6	8.3						7.25	7.16	6.69	7.17	8.3	8.3	7.59	6.18						
Conductivity, micro-mho/cm	173						300	300		245	250						220	273	310	303	300	313	318	321						
Conductivity (in Field), micro-mho/cm	110									260	273																			
Total Suspended Solids, mg/L	11	-5	-5	-5	-5	2	-5	-5	4	-5	-5						13	< 4	6	< 4	-5	< 4	< 4	< 4						
Turbidity, NTU	4.0	-1.0	-1.0				-1.0	-1.0																						
Dissolved Susspended Solids, mg/L	123			135	130		196	198		312	175						132	168	190	196	185	200	196	212						
Flow, L/min						200000.0			88333.0	96.00	180.00						800	136	66	35	18.00	19	18	15						
Temp., degrees Celcius	3.9					10.0				7.0	4.6						3.0	4.0	3.0	3.0	1.5	1.5	1.0							
Hardness, CaCO ₃ , mg/L																														
Total Hardness, mg/L	110					153	183	181	192	131	123						106	134	159	157		157	162	159						
LC50																														
Anions																														
Alkalinity, CaCO ₃ , mg/L	93	173	171			149	172	171	186	87	96						76.4	94.6	103.0	104.0	117	105.0	104.0	105.0						
Sulphate (SO ₄), mg/L	4.8			5.2	5.8	11.7	9.6	9.6	16.3	34	39						27.7	37.6	39.7	45.1	45	46.3	54.4	51.2						
Nutrients																														
Nitrite Nitrogen (NO ₂), mg/L	-0.050	-0.050	-0.050	-0.050	-0.050	0.012	-0.050	-0.050	0.014	0.110	0.140						0.419	0.380	0.208	0.063	-0.050	-0.005	-0.005	-0.005						
Nitrate Nitrogen (NO ₃), mg/l										-1.000	-2.000										0.007									
N-NH ₃ , mg/L																														
N-NO ₂ -NO ₃ , mg/L	-0.100			-0.200	-0.200		-0.200	-0.200		0.300	0.400										1.160									
Total Phosphorus, mg/L										-0.06	-0.06						0.04	-0.04	0.04	-0.04	0.16	-0.04	-0.04	-0.04						
Cyanide																														
Total Cyanide, mg/L	-0.005	-0.005	-0.005	-0.005	-0.005		-0.005	-0.005									-0.001	-0.001	-0.001	-0.001		-0.001	-0.001	-0.001						
Cyanide-WAD, mg/L	-0.005			-0.005																										
Total Metals																														
Aluminum	0.270			0.750	-0.050	0.020	-0.050	-0.050	0.050	0.020	0.080	NST	NST	NST	NST	NST	0.12	-0.06	-0.06	-0.06	0.050	-0.06	-0.06	-0.06						
Antimony	-0.050			-0.050	-0.050	-0.015	-0.050	-0.050	-0.015	-0.020	-0.020						0.02	-0.02	-0.02	-0.02	-0.020	-0.02	-0.02	-0.02						
Arsenic	-0.050			-0.050	-0.050	-0.001	-0.050	-0.050	-0.001	-0.02	-0.02						0.04	-0.04	-0.04	-0.04	-0.02	-0.04	-0.04	-0.04						
Barium	0.0940			0.0800	0.0830	0.1150	0.1030	0.1060	0.1190	0.0166	0.0177						0.0170	0.0200	0.0210	0.0190	0.0206	0.0220	0.0210	0.0230						
Beryllium										-0.0002	-0.0002						0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002						
Bismuth																	0.02	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02						
Boron																	0.1	-0.040	0.0	0.0		0.0	0.0	0.0						
Cadmium	-0.0003	-0.0003	-0.0003	-0.0003	0.0006	-0.0005	-0.0003	-0.0003	-0.0005	0.0005	0.0008						0.0008	0.0007	0.0009	0.0008	0.0015	0.0011	0.0015	0.0012						
Calcium	31.3			30.7	28.0	43.9	50.9	50.6	54.3	44.2	40.6						35.6	46.6	51.8	47.1	46.9	50.8	50.4	55.0						
Chromium										-0.0010	-0.0010						0.002	0.003	-0.0020	-0.0020	-0.0010	0.003	0.002	-0.002						
Cobalt										-0.001	-0.001						0.0040	-0.0040	-0.0040	-0.0040	-0.001	-0.0040	-0.0040	-0.0040						
Copper	0.003	-0.001	-0.001	-0.001	0.001	-0.001	-0.001	-0.001	-0.001	-0.002	0.010						0.003	-0.003	-0.003	-0.003	0.012	0.004	-0.003	-0.003						
Iron	0.702			0.115	0.116	0.153	0.052	0.047	0.130	0.059	0.217						0.42	0.06	0.07	-0.05	0.016	-0.05	0.06	-0.05						
Lead	-0.004	-0.004	-0.004	-0.004	-0.004	0.002	0.007	0.008	0.001	-0.010	-0.010						0.005	0.004	-0.003	-0.003	-0.005	-0.003	-0.003	-0.003						
Lithium																														
Magnesium										4.87	4.94						4.07	5.97	6.89	6.53	6.05	7.30	7.10	7.78						
Manganese										0.0180	0.0500						0.045	0.029	0.025	0.015	0.0110	0.011	0.009	0.007						
Mercury																														
Molybdenum	-0.005			-0.005	-0.005	0.004	0.005	0.005	-0.004	0.010	0.007	NST	NST	NST	NST	NST	0.006	0.014	0.015	0.013	0.010	0.018	0.017	0.016						
Nickel										0.1890	0.0030						0.01	-0.01	-0.01	-0.01	0.0040	-0.01	-0.01	0.01						
Potassium										0.6	0.9						0.9	1.3	1.0	0.7	0.7	1.2	1.2	1.0						
Selenium	-0.010	-0.010	-0.010	-0.010	-0.010	-0.030	0.010	-0.010	-0.030	-0.02	-0.02						0.03	-0.03	-0.03	-0.03	-0.02	-0.03	0.03	0.03						
Silicon										5.40	5.87						3.1	1.4	1.5	1.8	4.83	2.9	3.1	2.5						
Silver	-0.010	-0.001	-0.001			-0.0005	-0.0100	-0.0100	-0.0005	-0.0010	-0.001						0.03	-0.03	-0.03	-0.03	-0.001	-0.03	-0.03	-0.03						
Sodium	1.11			2.50	1.57	1.29	0.98	0.98	0.92	1.10	1.22						1.1	1.0	1.1	1.0	1.00	1.1	1.1	1.3						
Strontium										0.260	0.260						0.183	0.246	0.278	0.272	0.302	0.312	0.308	0.355						
Sulphur										11.60	11.90						8.8	12.7	13.6	13.5	14.70	15.4	15.6	17.2						
Tellurium																	0.02	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02						
Thallium																	0.03	-0.030	-0.030	-0.0300		-0.0300	-0.0300	-0.0300						
Tin										-0.010	-0.010						0.02	-0.0200	-0.0200	-0.0200	-0.005	-0.0200	-0.0200	-0.0200						
Titanium										0.0010	-0.0010						0.003	-0.0030	-0.003	-0.003	0.0030	-0.003	-0.003	-0.003						
Vanadium										-0.002	0.003						0.003	-0.003	-0.003	-0.003	-0.002	-0.003	-0.003	-0.003						
Zinc	0.0150	0.0040	0.0040	-0.0010	0.0100	0.0020	0.0060	0.0050	0.0050	0.1590	0.1840			</																

Sample Date	2-Jun-99	2-Jul-99	5-Aug-99	2-Sep-99	5-Oct-99	3-Nov-99	9-Dec-99	4-Jan-00	2-Feb-00	2-Mar-00	4-Apr-00	3-May-00	4-Jun-00	1-Jul-00	1-Aug-00	1-Sep-00	3-Oct-00	13-Nov-00	1-Dec-00	6-Jan-01	1-Feb-01	2-Mar-01	1-Apr-01	2-May-01	3-Jun-01	6-Jun-01	1-Jul-01	1-Aug-01	1-Sep-01		
Collected By:	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan	RFlanagan		
Lab. No.																															
Station	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22		
Physical Parameters																															
	pH	8.10	8.10	8.20	8.30	8.30	8.10	7.90					8.10	8.30	8.20	8.10	8.20	7.80	7.90	7.70	8.00					7.50	7.80	8.10	8.10	8.20	
	pH (in Field)	7.92	8.14	8.02	8.24	8.29	7.61	7.59					8.43	8.36	8.40	8.40	8.41	8.18	8.19	7.90	8.38					8.49	7.89	8.46	8.49	8.54	
	Conductivity, micro-mho/cm																														
	Conductivity (in Field), micro-mho/cm	316	227	276	292	302	302	262					289	221	249	245	247	268	283	285	316					220	239	237	264	277	
	Total Suspended Solids, mg/L	5	<4	<4	<4	<4	<4	<4						8	<4	<4	<4	<4	<4	<4	<4					11	202	<4	<4	<4	
	Turbidity, NTU																														
	Dissolved Susspended Solids, mg/L	188	132	142	182	194	210	165						162	152	162	176	182	182	176	188	176				158	140	154	172	182	
	Flow, L/min	150	600	100	54	30	19	11	0	0	0	0	0	200	428	240	171	171	54	39	27	17				98	245	300	158	57	
	Temp., degrees Celcius	0	4	3	3	2	0	0						0.0	2.0	2.3	1.8	1.3	0.9	0	0	0				0	4	1.7	2.1	2	
Hardness, CaCO ₃ , mg/L	163	130	149	156	166	166	165						149	120	153	143	138	164	153	145	152				124	153	122	136	143		
Total Hardness, mg/L																															
LC50																															
Anions																															
	Alkalinity, CaCO ₃ , mg/L	98.5	84.4	99.9	105	104	106	108						89	88	98	95	96	105	108	107	108				86	85	89	96	105	
Sulphate (SO ₄), mg/L	51.3	27.8	38.9	37.8	39.8	47.1	47.9						38.8	34.9	37.6	41.0	38.1	42.9	44.1	46.1	46.9				34.7	30.2	29.4	34.6	41.2		
Nutrients																															
	Nitrite Nitrogen (NO ₂), mg/L																														
	Nitrate Nitrogen (NO ₃), mg/l																														
	N-NH ₃ , mg/L	0.014	0.027	0.008	<0.005	<0.005	0.005	<0.005						0.069	0.030	0.008	<0.005	<0.005	<0.005	<0.005	<0.005	0.019				<0.005	0.035	<0.005	<0.005	<0.005	
	N-NO ₂ -NO ₃ , mg/L																														
Total Phosphorus, mg/L	<0.04	<0.04	<0.04	<0.04	<0.1	<0.1	<0.1						0.5	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1				0.1	0.2	<0.1	<0.1	<0.1		
Cyanide																															
	Total Cyanide, mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001						<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	0.001	
Cyanide-WAD, mg/L																															
Total Metals																															
	Aluminum	0.09	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06						0.18	<0.02	0.04	0.03	<0.02	0.04	0.03	0.03	<0.02					0.32	1.65	0.03	0.03	<0.02
	Antimony	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02						<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	<0.05	<0.05	<0.05	<0.05	
	Arsenic	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04						<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	<0.05	<0.05	<0.05	<0.05	
	Barium	0.022	0.017	0.019	0.019	0.019	0.020	0.021						0.020	0.015	0.018	0.017	0.016	0.019	0.018	0.018	0.018				0.019	0.032	0.018	0.016	0.016	
	Beryllium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002						<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002				0.0002	0.0005	<0.0002	<0.0002	<0.0002	
	Bismuth	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02						<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	<0.05	0.08	<0.05	<0.05	
	Boron	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04						0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01	<0.01	0.01	<0.01	<0.01	
	Cadmium	0.0018	0.0013	0.0014	0.0014	0.0016	0.0018	0.0019						0.0024	0.0013	0.0015	0.0015	0.0014	0.0014	0.0015	0.0016	0.0018				0.0025	0.0057	0.0014	0.0016	0.0017	
	Calcium	55.7	43.9	48.8	51.4	55.0	54.6	53.8						49.2	40.2	51.1	47.3	45.3	53.9	50.6	47.3	49.9				41.8	50.8	40.4	45.2	47.5	
	Chromium	<0.002	<0.002	<0.002	<0.002	0.004	0.002	0.002						<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				<0.005	<0.005	<0.005	<0.005	<0.005	
	Cobalt	<0.004	<0.004	<0.004	<0.004	0.005	<0.004	<0.004						<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				<0.005	0.006	<0.005	<0.005	<0.005	
	Copper	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003						<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				<0.005	<0.005	<0.005	<0.005	<0.005	
	Iron	0.19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05						0.285	0.028	0.033	0.013	0.011	0.126	0.059	<0.005	0.018				0.586	2.740	0.021	<0.005	<0.005	
	Lead	0.005	0.001	0.001	<0.001	<0.001	<0.001	<0.001						0.010	0.001	0.001	0.001	0.001	0.001	0.001	0.0009	0.0014				0.0093	0.0850	0.0008	0.0010	0.0007	
	Lithium																														
	Magnesium	7.36	5.01	6.49	6.81	6.95	7.29	7.40						6.36	4.84	6.25	6.15	5.94	7.08	6.56	6.64	6.71				4.84	6.41	5.09	5.70	5.95	
	Manganese	0.020	0.015	0.013	0.007	0.004	0.003	0.002						0.024	0.010	0.010	0.008	0.009	0.006	0.006	0.002	0.002				0.029	0.230	0.007	0.007	0.003	
	Mercury																														
	Molybdenum	0.014	<0.005	0.014	0.009	0.014	0.017	0.022						0.010	0.011	0.012	0.015	0.013	0.013	0.006	0.014	0.019				0.007	0.008	0.030	0.010	0.008	
	Nickel	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01						<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01	0.01	<0.01	<0.01	<0.01	
	Potassium	0.9	<0.5	0.8	<0.5	1.3	1.1	0.6						<1	<1	<1	2.0	<1	<1	<1	2	1				<1	1	<1	<1	<1	<1
	Selenium	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03						<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	<0.03	<0.03	<0.03	<0.03	
	Silicon																														

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MH-15 to MH-22

Sample Date	6-Jan-04	7-Jun-04	6-Jul-04	6-Aug-04	5-Sep-04	4-Oct-04	27-May-05	21-Jun-05	10-Aug-05	13-Sep-05	11-Oct-05
Collected By:		Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr
Lab. No.											
Station	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22	MH-22
Physical Parameters											
pH	8.0	8.2	8.3	8.3	8.2	8.1	7.3	7.8	7.9	7.6	8.1
pH (in Field)			8.38	8.36							
Conductivity, micro-mho/cm		235	274	290	294	288	224	228	274	286	291
Conductivity (in Field), micro-mho/cm	297										
Total Suspended Solids, mg/L	5	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Turbidity, NTU		0.49	0.33	0.25	0.13	0.23	2.1	0.5	0.4	0.2	0.3
Dissolved Suspended Solids, mg/L	190	188	164	180	180	178	148	134	176	168	170
Flow, L/min			82	70							
Temp., degrees Celsius											
Hardness, CaCO ₃ , mg/L	153	113	139	143	147	162	130	120	150	160	150
Total Hardness, mg/L											
LC50											
Anions											
Alkalinity, CaCO ₃ , mg/L	107	86.7	98.4	107	106	102	85.6	87.9	103	104	105
Sulphate (SO ₄), mg/L	43.2	24.9	33.1	41.8	38.8	39.7	29.7	27	34.1	39.3	40.3
Nutrients											
Nitrite Nitrogen (NO ₂), mg/L		<0.005	<0.005	<0.005	<0.005	<0.005					
Nitrate Nitrogen (NO ₃), mg/l		0.29	0.25	0.22	0.21	0.21					
N-NH ₃ , mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
N-NO ₂ -NO ₃ , mg/L		0.29	0.25	0.22	0.21	0.21	0.3	0.21	0.21	0.19	0.17
Total Phosphorus, mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cyanide											
Total Cyanide, mg/L	<0.0005	<0.0005	0.0011	0.0019	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cyanide-WAD, mg/L											
Total Metals											
Aluminum	0.2	0.02	<0.02	<0.02	<0.02	0.03	0.16	0.02	<0.02	<0.02	<0.02
Antimony	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	0.019	0.014	0.015	0.016	0.017	0.017	0.016	0.014	0.015	0.018	0.016
Beryllium	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bismuth	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Cadmium	0.003	0.00166	0.002	0.0022	0.00221	0.0023	0.00197	0.00175	0.00206	0.00236	0.00239
Calcium	50	37.5	45.8	47.1	48.3	54.2	43	40.5	48.2	52.1	50.8
Chromium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Iron	0.285	0.036	0.008	0.007	0.007	0.324	0.262	0.022	0.005	0.005	<0.005
Lead	<0.03	0.00097	0.0007	0.0006	0.00065	0.0007	0.00465	0.00097	0.00045	0.00043	0.00043
Lithium											
Magnesium	6.79	4.67	5.87	6.27	6.4	6.51	5.1	4.83	6.11	6.84	6.47
Manganese	0.015	0.007	0.003	0.002	0.001	0.003	0.021	0.005	0.001	<0.001	<0.001
Mercury											
Molybdenum	0.011	0.011	0.009	0.009	0.015	0.01	0.01	0.007	0.01	0.011	0.011
Nickel	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Potassium	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	<1
Selenium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Silicon							4.81	4.04	4.2	4.43	4.44
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	0.95	0.79	0.96	0.94	0.86	1.04	4.57	0.72	1.04	0.92	0.84
Strontium	0.253	0.179	0.214	0.22	0.236	0.258	0.209	0.178	0.214	0.244	0.24
Sulphur	14.3	8.6	11.3	12.1	13	14.2	13.9	8.8	11.8	13.4	13.3
Tellurium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05					
Thallium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Tin	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Titanium	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.004	<0.003	<0.003	<0.003	<0.003
Vanadium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	0.573	0.222	0.326	0.401	0.437	0.478	0.319	0.212	0.382	0.444	0.441
Zirconium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Metals											
Aluminum											
Antimony											
Arsenic											
Barium											
Cadmium											
Calcium											
Copper											
Iron											
Lead											
Molybdenum											
Selenium											
Silver											
Sodium											
Zinc											
NST: No sample taken											
(-) Indicates values are less than (below)											

Sä Dena Hes Mine

Detailed Decommissioning & Reclamation Plan

Appendix C-12

MH-25 Water Quality

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Sample Date	4-Sep-03	3-Nov-03	7-Dec-03	7-Jun-04	6-Jul-04	10-Aug-04	5-Sep-04	21-Jun-05	10-Aug-05	13-Sep-05
Collected By:	RFlanagan	RFlanagan	RFlanagan	Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr	Brian Curr
Lab. No.										
Station	MH-25	MH-25	MH-25	MH-25	MH-25	MH-25	MH-25	MH-25	MH-25	MH-25
Physical Parameters										
pH	7			7.4	7.4	7.3	7.4	6.5	6.6	6.5
pH (in Field)	8.03				8	7.88				
Conductivity, micro-mho/cm				407	629	741	739	474	560	650
Conductivity (in Field), micro-mho/cm	937									
Total Suspended Solids, mg/L	26			23	22	15	13	9	16	<4
Turbidity, NTU				4.89	11.4	8.06	0.8	2.9	10.1	0.8
Dissolved Suspended Solids, mg/L	778			354	476	596	568	372	442	492
Flow, L/min	19				19	18				
Temp., degrees Celsius	2.5									
Hardness, CaCO ₃ , mg/L	454			155	269	326	328	210	250	300
Total Hardness, mg/L										
LC50										
Anions										
Alkalinity, CaCO ₃ , mg/L	32.1			33.2	30	33.6	44.6	31.9	44.7	43.2
Sulphate (SO ₄), mg/L	471			158	292	383	336	203	221	309
Nutrients										
Nitrite Nitrogen (NO ₂), mg/L				<0.005	0.015	0.02	0.029			
Nitrate Nitrogen (NO ₃), mg/L				0.44	0.44	0.58	0.76			
N-NH ₃ , mg/L	0.01			<0.005	<0.005	0.014	0.023	0.008	0.015	0.011
N-NO ₂ -NO ₃ , mg/L				0.44	0.45	0.6	0.79	0.33	0.63	0.77
Total Phosphorus, mg/L	0.1			<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cyanide										
Total Cyanide, mg/L	<0.0005			0.0007	0.0019	0.0009	0.0008	<0.0005	0.0005	<0.0005
Cyanide-WAD, mg/L										
Total Metals										
Aluminum	0.45			0.3	0.44	0.27	0.2	0.11	0.29	0.1
Antimony	<0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic	<0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	0.02			0.013	0.014	0.016	0.015	0.014	0.015	0.014
Beryllium	<0.0002			<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Bismuth	<0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	<0.008			<0.008	<0.008	<0.008	0.008	<0.008	<0.008	<0.008
Cadmium	0.523			0.302	0.379	0.459	0.439	0.368	0.352	0.431
Calcium	175			58.2	103	125	126	78.5	93.8	114
Chromium	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	0.007			0.009	<0.005	0.005	0.011	0.005	0.005	<0.005
Copper	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Iron	1.27			1.05	0.968	1.03	0.372	0.523	0.652	0.334
Lead	0.549			0.744	0.309	0.552	0.402	0.927	0.365	0.378
Lithium										
Magnesium	4.14			2.34	2.97	3.48	3.15	2.43	2.86	3.11
Manganese	1.81			0.266	0.189	0.742	1.39	0.21	0.316	0.669
Mercury										
Molybdenum	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nickel	0.008			<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Potassium	<1			<1	<1	<1	1	<1	<1	<1
Selenium	<0.03			<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Silicon								3.55	4.38	4.37
Silver	<0.01			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	0.87			0.38	0.64	0.7	0.58	0.42	0.76	0.67
Strontium	0.161			0.056	0.092	0.111	0.111	0.072	0.08	0.102
Sulphur	161			51.2	90	113	114	67.8	79.6	100
Tellurium	<0.05			<0.05	<0.05	<0.05	<0.05			
Thallium	<0.03			<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Tin	<0.02			<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Titanium	<0.003			<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Vanadium	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	65.9			32.8	40.9	50.5	55	36.7	45.1	49
Zirconium	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Dissolved Metals										
Aluminum										
Antimony										
Arsenic										
Barium										
Cadmium										
Calcium										
Copper										
Iron										
Lead										
Molybdenum										
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