Teck Metals Ltd.
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Teck

August 22, 2017

Kierney Leach
Technical Regulatory Specialist
Mackenzie Valley Land and Water Board
7th Floor – 4922 48th Street
PO Box 2130
Yellowknife, NT X1A 2P6

Dear Ms. Leach:

Re: Pine Point Tailings Impoundment Area – Renewal of Water Licence MV2006L2-0013

Introduction

The Pine Point mine was operated by Comino from 1964 to 1988 and produced 70 million tons of ore, with grades of 2.9% lead and 6.8% zinc. In July 2001, Cominco and Teck merged. Since the merger, Teck has managed the site. The project has operated under a water licence since 1975. The existing Type B Water Licence (MV2006L2-0013) expires in October 2017.

The following letter provides an overview of the closure and post-closure activities completed to date and a summary of Teck's requested changes to the Surveillance Network Program (SNP) of the renewed Type B Water Licence. A detailed Water Licence renewal application to continue post closure management of the closed Pine Point mine is appended to this letter for your review.

Closure (1988 to 1993)

The Closure and Reclamation Plan originally called an "Abandonment and Restoration Plan" was issued and subsequently approved in June 1987. When the Pine Point mine closed in 1988, the Plan was implemented immediately. The Plan was updated in 1990 and 1991 during reclamation activities.

As part of the Closure and Reclamation activities, the tailings impoundment was covered with an approximately 150 mm thick layer of sand and gravel during the summers of 1990 and 1991 to stabilize the surface and prevent dust; an estimated 1250 acres, or 86% of the pond, was covered. The 1991 update of the Closure and Reclamation Plan identified effluent quality and long-term stability of dykes and decant structures as the remaining issues to be addressed.

Following implementation of the closure and reclamation activities in accordance with the 1991 Plan, surface leases were surrendered back to the Crown during the mid to late 1990s, with the exception of one surface lease (#85B/16-9-9), which encompasses the tailings impoundment (Figure 2 of the Water License Renewal Form). This retained surface lease allows Teck to continue to manage the tailings impoundment and treat ponded water. All mining claims were surrendered back to the Crown.

Post-Closure Period (1993 to present)

A public hearing was held for the original water licence on January 16, 1974 and the second public hearing was held on November 6, 1992. The water licence was determined to be a Type “B” Licence pursuant to Schedule V of the Northwest Territories Water Regulations, effective June 15, 1993. This licence allows Teck to occasionally discharge “wastes” from the tailings impoundment as required during the open water season; the “waste” is water from precipitation and snowmelt that falls within the impoundment area and then ponds at the north end of the facility where it is treated prior to discharge to the environment.

The existing SNP sample locations that were monitored during operations have been maintained through closure and into post-closure. These include one sample of tailings water before treatment, one sample of tailings water after treatment, and seven downstream stations between the impoundment and Great Slake Lake (Figure 2 of the Water License Renewal Form).

In 2006 a Stakeholder Engagement Plan was developed and implemented (Appendix B of the 2017 Stakeholder Engagement Plan), to support an *Update to the Closure and Reclamation Plan (Restoration and Abandonment Plan – 2006)* (Attachment 11 of the Mining Industry Questionnaire) and ultimately a Water Licence renewal for 2007 to 2017. The 2006 plan clarified that the primary issue associated with effluent quality is dissolved zinc in the pond water, which exceeds the permit limits and requires treatment prior to discharge. This water has been treated for each of the 10 years of the existing post-closure water licence (MV2006L2-0013) as well as every year since mining ended. A temporary water treatment plant is mobilized to the north end of the impoundment at the beginning of the open water season, and adds lime to the pond water as it flows into a serpentine settling channel. The facility typically operates for 3 to 6 weeks each summer.

For each of the last 10 years in accordance with the conditions of the existing post-closure water licence, the treated water has been sampled daily during treatment and the SNP sample stations have been monitored once every fall and once every second spring. All monitoring results are reported to the MVLWB in an annual report, as well as directly to DKFN as per the Stakeholder Engagement Plan associated with the water licence.

All parameters, with the exception of total zinc, meet the licence limits in the tailings pond prior to treatment. Graphs for pH (measured in the laboratory), total copper, total lead, and total zinc in the tailings pond are shown below in Figures 1, 2, 3, and 4 with the licence limits for comparison.

Figure 1: pH (Laboratory) in Tailings Pond Water, Pre-Treatment

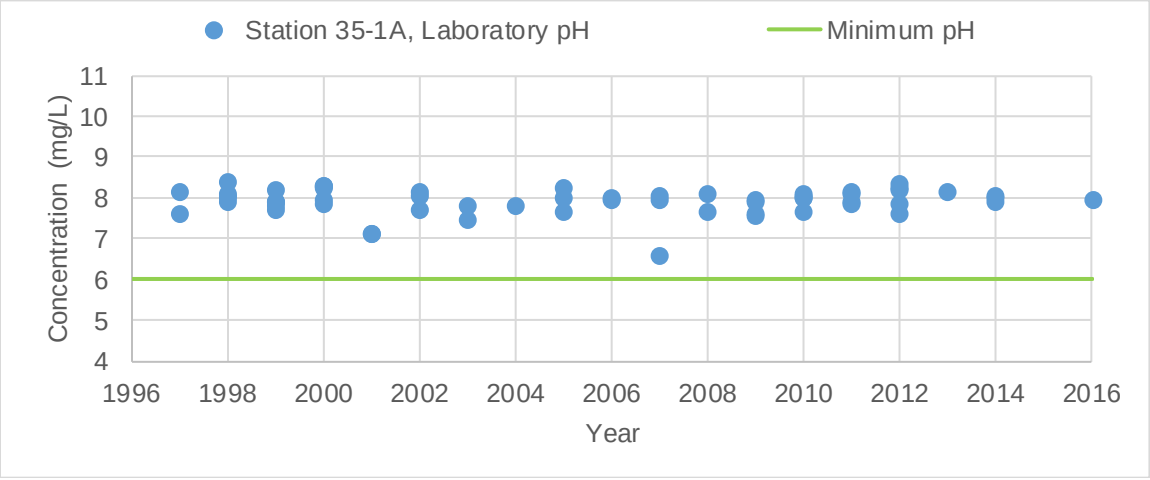


Figure 2: Total Copper in Tailings Pond Water, Pre-Treatment

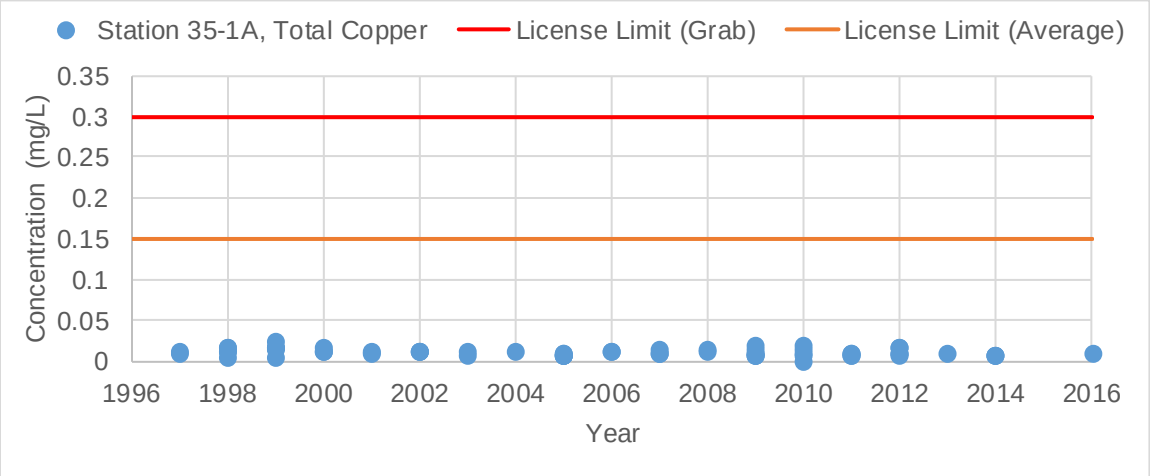


Figure 3: Total Lead in Tailings Pond Water, Pre-Treatment

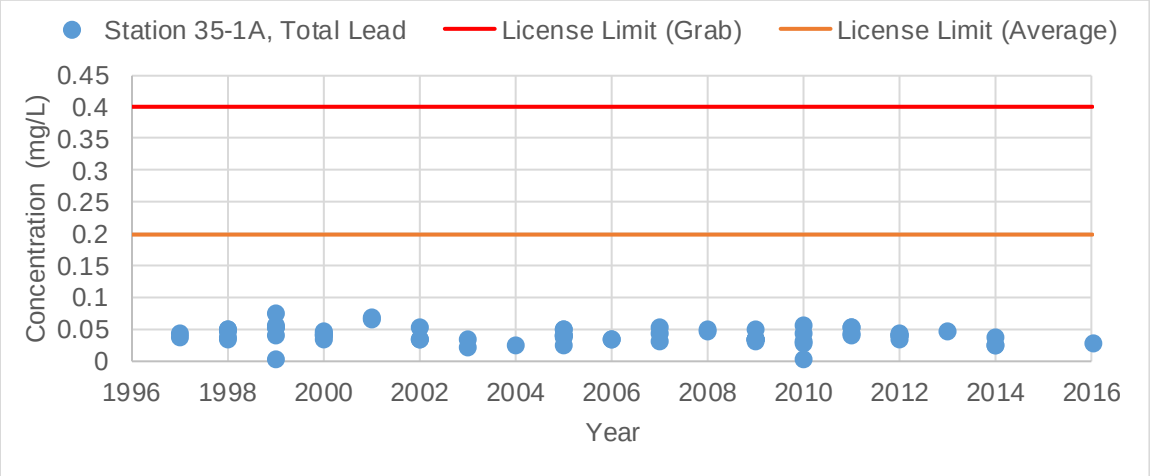
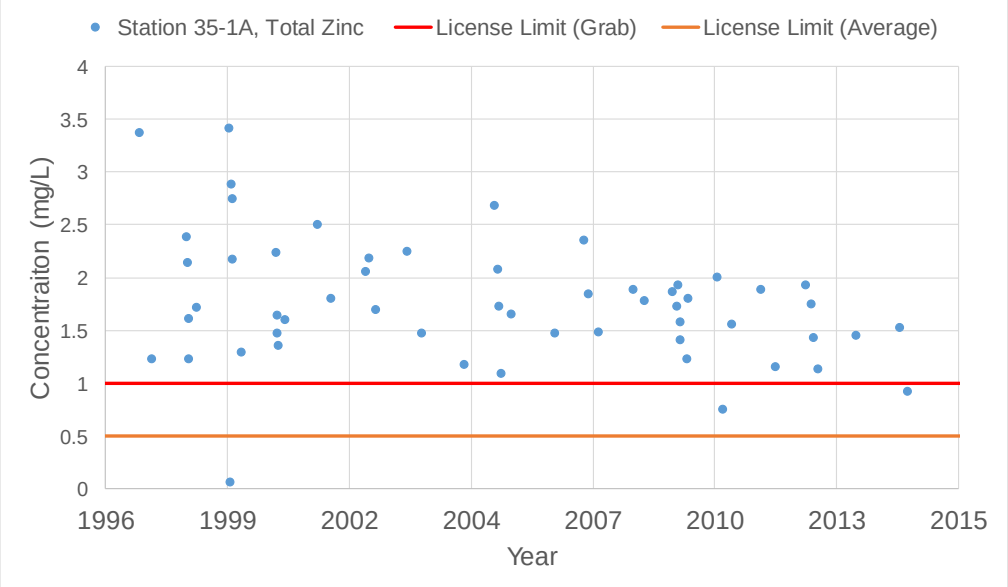
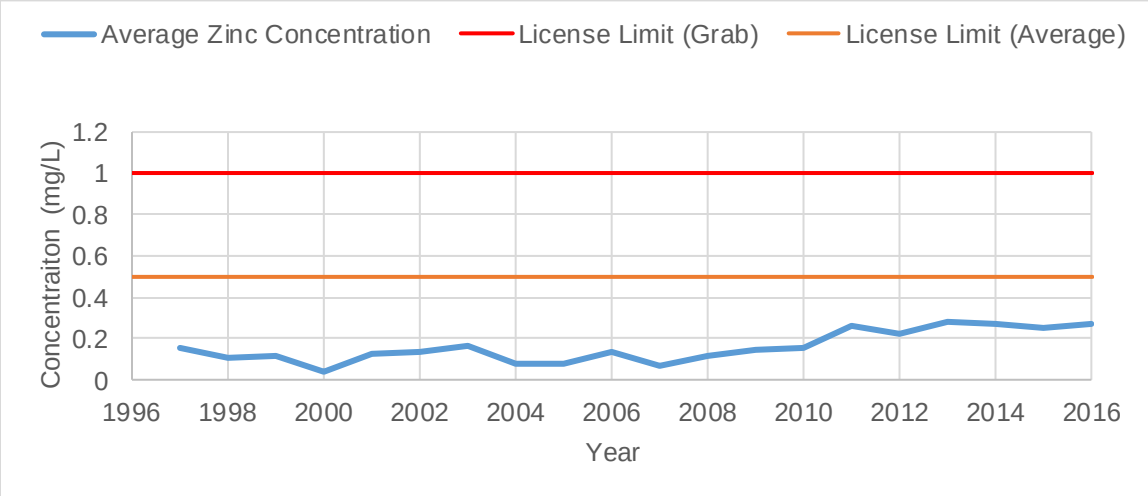


Figure 4: Total Zinc in Tailings Pond Water, Pre-Treatment



Concentrations of total zinc have been declining in the tailings pond water, but still exceed licence limits and require treatment. The lime treatment approach is effective at reducing zinc concentrations to well below the licence limits (Figure 5, showing average treated concentrations each year), and in the receiving environment, zinc concentrations are consistent with Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the protection of Aquatic Life (CCME Guidelines).

Figure 5: Average Annual Treated Zinc Concentrations at Station 35-1B



During the previous licence period (2007 – 2017), a limited number of maintenance activities were required on the cover and containment structures:

- Routine removal of vegetation from containment structures;
- Concrete cut-off walls were installed in the spillway in September 2012;
- Monitoring and as-needed periodic repairs to address surface erosion on downstream segments of the North and West Dykes and wave-induced erosion on the upstream face of the North Dyke

In addition to the annual dam safety inspections, a Dam Safety Review was completed in 2014. The facility and water treatment activities are also subject to an annual inspection by either the Federal or Territorial government. The 2011 annual inspection report noted that the switch was made from a decant structure to siphon lines to discharge treated water. The 2014 annual inspection report requested that SNP station signs be erected at all sampling locations, which was identified as a deficiency. No other significant environmental issues were identified.

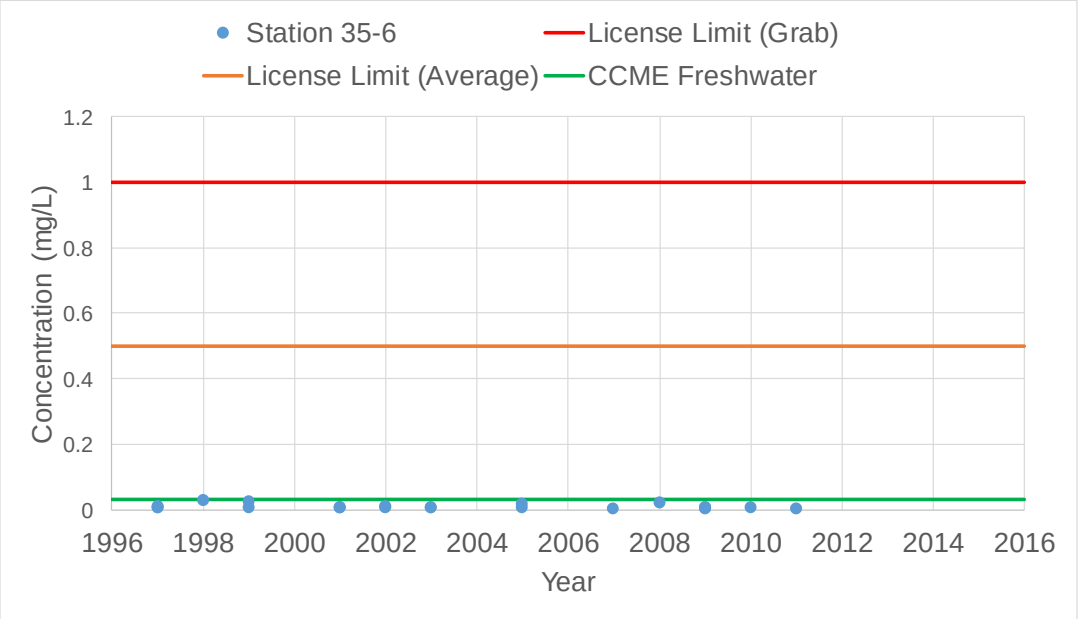
In summary, Teck has operated in compliance with the conditions of the Water Licence throughout its entire term.

Licence Renewal (2017 – 2027)

Teck is requesting a 10-year renewal of the Type B Water Licence to continue the post-closure monitoring of both the tailings containment area as well as the surface water that ponds within the facility.

There are two changes that Teck is requesting. The first is the removal of SNP Station 35-6, which has been dry since 2011 (Figure 6). When there is water at Station 35-6, it is well below both the licence limits and CCME guidelines. Station 35-6 is an unnecessary cost to Teck because it can only be accessed by helicopter, but does not provide any relevant information.

Figure 6: Total Zinc Concentrations at Station 35-6



The second change that Teck is requesting is a decrease in the frequency of laboratory analysis of treated discharge. Currently, the water treatment operators use an on-site Hach kit to make any necessary operational changes to optimize treatment. In addition, samples are collected daily for laboratory analysis, these samples are shipped off site for analysis at an accredited Laboratory. The daily laboratory data does not add value and does not improve treatment efficiency. Given the consistency in the treated water quality and the reliability of the on-site Hach kit measurements throughout the previous 10-year licence period, Teck is requesting that the frequency of samples analyzed at the laboratory be reduced from daily to weekly samples in order to confirm the measurements of the on-site Hach kit.

In support of this post-closure licence renewal, a Stakeholder Engagement Plan was developed and implemented, an Operations, Maintenance and Surveillance Manual which conforms to the Canadian Dam Association Guidelines was prepared (Operations and Maintenance Plan), a Spill Contingency Plan and a Water Treatment Manual were updated. All of these documents are attached to this post-closure licence renewal. A summary of the Stakeholder Engagement Plan is provided in Table 1.

Table 1: Engagement Plan Summary

Stakeholder Group	Form of Engagement	Date
Dehcho First Nation Northwest Territories Metis Nation NWT Treaty 8 Tribal Council Akaitcho Screening Committee Deninu K'ue First Nation Fort Resolution Metis Council Fort Resolution Settlement Corporation K'atl'Odeeche First Nation Mayor of Hay River Hay River Metis Government Council West Point First Nation Salt River First Nation Darnley Bay Resources Limited	Written Notification	May 25, 2017
Deninu K'ue First Nation Chief and Council	Face to face meeting in Fort Resolution	July 11, 2017

Stakeholder Group	Form of Engagement	Date
Members of Deninu K'ue First Nation Members of Fort Resolution Metis Council Residents of Fort Resolution Settlement Corporation General Public	Public Meeting in the community of Fort Resolution	July 11, 2017
Mayor and Council of the Town of Hay River	Presentation at a locally televised Town Council Meeting	July 11, 2017
K'atl'Odeeche First Nation Chief and Director of Lands, Resources, and Negotiations	Face to face meeting at K'atl'Odeeche First Nation Reserve	July 12, 2017
MVLWB staff	Face to face meeting in MVLWB Yellowknife office	July 13, 2017
Government of the Northwest Territories Environment and Natural Resources staff	Face to face meeting with staff in Yellowknife office	July 13, 2017

Conclusions

Attached to this cover letter please find the following documentation for your review:

- Written acknowledgement from MVLWB of Teck's name change
- Application for a Renewal of Licence, including:
  - Draft Application Form
  - Site location
  - 1:50,000 Site Plan
  - List of studies undertaken
- Mining Industry Questionnaire, including but not limited to:
  - Closure and Reclamation Plan (2006 Restoration and Abandonment Plan)
  - Operations and Maintenance Plan (Operations, Maintenance and Surveillance Manual)
  - Water Treatment Manual
  - Correspondence related to environmental review screening
  - Public Engagement Plan and a record of all engagements
  - Spill Contingency Plan

I respectfully ask that you contact Mark Liskowich of SRK Consulting (Canada) Inc., who is assisting Teck, with your review comments. Mark can be reached at (306) 955 4799 or by email at mliskowich@srk.com.

We thank you for taking the time to consider this matter and look forward to the renewal of the former Pine Point mine Type B Water Licence.

Sincerely,

Michelle Unger, B.Sc., Manager, Environmental Compliance
Teck

Mackenzie Valley Land and Water Board
7th Floor - 4922 48th Street
P.O. Box 2130
YELLOWKNIFE NT X1A 2P6
Phone (867) 669-0506
FAX (867) 873-6610

August 3, 2017 File: MV2006L2-0013

Ms. Michelle Unger
Manager, Environmental Compliance
Teck Metals Ltd.
Bag 2000
Kimberley BC V1A 3E1 Email: Michelle.Unger@teck.com

Dear Ms. Unger:

Water Licence - Name Change
Teck Metals Ltd.

The Mackenzie Valley Land and Water Board (the Board) acknowledges receipt of your submission on May 30, 2017 regarding your company's name change. To reflect this change, the Board has updated Water Licence MV2006L2-0013, as issued to Teck Cominco Metals Ltd., to Teck Metals Ltd.

Enclosed is a new cover page and an updated Water Licence for your file which reflects this name change. These documents will be posted to our Public Registry.

If you have any questions or concerns, please contact Kierney Leach at (867) 766-7470 or kleach@mvlwb.com.

Yours sincerely,

Mavis Cli-Michaud
MVLWB Chair

Copied to: Distribution List

Attached: Water Licence MV2006L2-0013

MACKENZIE VALLEY LAND AND WATER BOARD
WATER LICENSE

Pursuant to the *Mackenzie Valley Resource Management Act* and Regulations, the Mackenzie Valley Land and Water Board, hereinafter referred to as the Board, hereby grants to:

Teck Metals Ltd.
(Licensee)

of Bag 2000, Kimberley, British Columbia V1A 3E1
(Mailing Address)

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

License Number:	MV2006L2-0013
License Type:	B
Water Management Area:	Northwest Territories 01
Location:	60°53'41.3"N and 114°25'30.7"W (Formerly known as Pine Point NT)
Purpose:	MONITORING OF WATER IN AND ADJACENT TO THE TAILINGS CONTAINMENT AREA, AND DISPOSAL OF WASTES FROM THE TAILINGS POND
Description:	Mining and Milling
Quantity of water **not to be exceeded**:	Zero (0)
Effective Date of License:	October 29, 2007
Expiry Date of License:	October 28, 2017

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

MACKENZIE VALLEY LAND AND WATER BOARD

Mavis Cli-Michaud, Chair **Amanda Gauthier, Witness**

PART A: SCOPE AND DEFINITIONS

1. **Scope**

a) This License allows for the monitoring of water in and adjacent to the Tailings Containment Area, and disposal of wastes from the tailings pond at 60°53'41.3"N and 114°25'30.7"W, formerly known as Pine Point, Northwest Territories.

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

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

2. **Definitions**

In this License: **MV2006L2-0013**

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

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

"Average Concentration" means the discrete average of four consecutive analytical results, or if less than four analytical results collected during a batch decant, and as submitted to the Board in accordance with the sampling and analysis requirements specified in the "Surveillance Network Program";

"Board" means the Mackenzie Valley Land and Water Board established under Part 4 of the *Mackenzie Valley Resource Management Act*;

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

"Licensee" means the holder of this License;

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

"Tailings Containment Area" comprises the tailings containment basin and the engineered structures designed to contain tailings as described in Golder Associates Pine Point Tailing Dyke Extension 1987 North Portion of Tailings Area Drawing Number GA-1150-10 and South Portion of Tailings Area Drawing Number GA-1150-11;

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

PART B: GENERAL CONDITIONS

1. Prior to the disposal of waste, the Licensee shall have posted and shall maintain a security deposit in the amount of $100,000 pursuant to Section 17(1) of the *Act* and Section 12 of the Regulations. The security deposit shall be maintained until such time as it is fully or in part refunded by the Minister pursuant to Section 17 of the *Act*. This clause shall survive the expiry of this License.

2. The Licensee shall file an Annual Report with the Board not later than March 31st of the year following the calendar year reported which shall contain the following information:

   (a) tabular summaries of all data generated under the "Surveillance Network Program";

   (b) any revisions to the approved Contingency Plan;

   (c) any revisions to the approved Abandonment and Restoration Plan;

   (d) a description of any restoration or reclamation work carried out;

   (e) results of any studies associated with restoration and reclamation;

   (f) a report on any inspection of the Tailings Containment Area pursuant to Part C, Item 1 (i);

   (g) a summary of modifications and/or major maintenance work carried out on the waste disposal systems and all associated structures;

   (h) a list of unauthorized discharges;

   (i) any other details waste disposal requested by the Board by November 1st of the year being reported;

3. The Licensee shall comply with the “Surveillance Network Program” annexed to this License, and any amendment to the said “Surveillance Network Program” as may be made from time to time, pursuant to the conditions of this License.

4. The “Surveillance Network Program” and compliance dates specified in the License may be modified at the discretion of the Board.

5. The Licensee shall, within sixty (60) days of the issuance of this License, post the necessary signs, where possible, to identify the stations of the “Surveillance Network Program”. All postings shall be located and maintained to the satisfaction of an Inspector.

PART C: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Tailings Containment Area shall be constructed, operated and maintained to engineering standards such that:

   a) the solids fraction of the Mill Tailings shall be permanently contained within the Tailings Containment Area;

   b) seepage from the Tailings Containment Area is minimized;

   c) any seepage which does not meet the effluent quality limits specified in Part C, Item 2 that occurs is collected and immediately returned to the Tailings Containment Area;

   d) a freeboard limit of 1.0 metre shall be maintained at all times;

   e) the rate of waste discharge is at all times controlled and measured;

   f) erosion of constructed facilities is rectified immediately;

   g) inspections of the tailings dams shall be carried out after spring freshet, once during the summer period, and again prior to freeze-up in the fall. Records of these inspections shall be kept for review upon the request of an Inspector.

   h) more frequent inspections shall be performed at the request of an Inspector;

   i) an inspection of the Tailings Containment Area shall be carried out at least every five years in the summer by a qualified geotechnical engineer registered in the Northwest Territories. The engineer’s report shall be submitted to the Board within sixty (60) days of the inspection, including a covering letter from the Licensee outlining an implementation plan to respond to the engineer’s recommendations.

j) at the same time as the geotechnical engineer's report of the inspection is submitted under Part C, Item 1(i), above, the Licensee shall provide to the Board in writing, a schedule as to when all geotechnical recommendations from the report will be carried out.

2. All wastes discharged by the Licensee from the Tailings Containment Area shall meet the following effluent quality requirements:

PARAMETERS	MAXIMUM AVERAGE CONCENTRATION	MAXIMUM CONCENTRATION OF ANY GRAB SAMPLE
Total Arsenic	0.50 mg/L	1.00 mg/L
Total Copper	0.15 mg/L	0.30 mg/L
Cyanide	0.10 mg/L	0.20 mg/L
Total Lead	0.20 mg/L	0.40 mg/L
Total Zinc	0.50 mg/L	1.00 mg/L
Suspended Solids	25.00 mg/L	50.00 mg/L
Ammonia (as N)	2.00 mg/L	4.00 mg/L

The Waste discharged shall have a pH greater than six (6), and no waste discharged shall contain floating solids, or visible sheen of oil and grease.

3. The Licensee shall notify an Inspector of any planned discharge of waste from the Tailings Containment Area at least seven (7) days prior to such discharge occurring.

PART D: CONDITIONS APPLYING TO MODIFICATIONS

1. The Licensee may, without written approval from the Board, carry out modifications to the Waste Disposal Facilities provided that such modifications are consistent with the terms of this License and the following requirements are met:

   a) the Licensee has notified the Board in writing of such proposed modifications at least sixty (60) days prior to beginning the modifications;

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

   c) the Board has not, during the sixty (60) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and

   d) the Board has not rejected the proposed modifications.

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

3. The Licensee shall provide to the Board as-built plans and drawings of the modifications referred to in this License within ninety (90) days of completion of the modifications.

PART E: CONDITIONS APPLYING TO CONTINGENCY PLANNING

1. The General Contingency Plan as submitted with the water license renewal application dated December 19, 2006 will come into effect as of the Effective Date of this License.

2. The Contingency Plan shall be reviewed annually by the Licensee and revised as necessary to reflect changes in activities and technology. The proposed revisions shall be submitted to the Board for approval.

3. The Licensee shall revise the Contingency Plan referred to in Part F, Item 1 within three (3) months of receipt of any concerns expressed by the Board.

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

    a) employ the appropriate contingency plan;

    b) report the incident immediately via the 24 Hour NWT Spill Report Line. Currently the number is (867) 920-8130; and

    c) submit to an Inspector, a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART F: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

1. The Licensee shall continue to implement the Abandonment and Restoration Plan approved by the Board during the previous Licensing periods.

2. The Licensee shall revise the Abandonment and Restoration Plan referred to in Part G, Item 1 within three (3) months of receipt of any concerns expressed by the Board.

3. The Licensee shall complete the restoration work as outlined in the plan, or as subsequent revisions are approved by the Board.

4. The Licensee shall review the Abandonment and Restoration Plan annually and shall modify the Plan as necessary to reflect changes in operation, technology, and results of reclamation and/or other studies. The proposed modifications shall be submitted to the Board for approval.

5. The Licensee shall provide updates of all abandonment and restoration activities under Part B, Item 2 above, by March 31st of each year.

6. Compliance with the Abandonment and Restoration Plan specified in this License shall not limit the legal liability of the Licensee, other than liability arising by operation of this *Act.*

MACKENZIE VALLEY LAND AND WATER BOARD

Mavis Cli-Michaud, Chair

Amanda Gauthier, Witness

LICENSEE: Teck Metals Ltd.

LICENCE NUMBER: MV2006L2-0013

EFFECTIVE DATE OF LICENCE: October 29, 2007

EFFECTIVE DATE OF SURVEILLANCE NETWORK PROGRAM (SNP): October 29, 2007

SURVEILLANCE NETWORK PROGRAM

A. Location of Surveillance Stations

Station Number	Description
35-1	Tailings area discharge at the decant structure. (60°53’41.3"N/114°25’30.7"W).
35-1A	Containment Pond (60°53’41.3"N/114°25’30.7"W).
35-1B	Post-Treatment Effluent Discharge (60°53’41.3"N/114°25’30.7"W).
35-4	Muskeg surface water due north of tailings area decant structures 2.5 miles from Great Slave Lake. (60°54’41.8"N/114°26’17.2"W).
35-5	Muskeg surface water 1 mile south of Great Slave Lake and 2 miles west of Station number 35-3. (60°54’27.7"N/114°27’30.4"W).
35-6	Muskeg surface water 1.5 miles due south of Station number 35-5. (60°55’26.6"N/114°28’25.4"W).
35-9	Great Slave Lake 1.5 miles southwest of Presquile Point. (60°55’35.0"N/114°36’04.1"W).

35-10	Great Slave Lake 3 miles east of Presquile Point. (60°57’00.2"N/114°27’56.6"W).
35-12	Muskeg surface water 3 miles north of tailings area decant structures, 0.5 mile south of Great Slave Lake shoreline. (60°57’02.1"N/114°25’06.6"W).
35-13	Muskeg surface water 2.5 miles east of Station Number 35-9 and 0.5 mile south of Great Slave Lake shoreline. (60°55’59.1"N/114°31’59.0"W).

B. Sampling and Analysis Requirements

1. The tailings area discharge at Station 35-1 shall be sampled daily during discharge and analysed for the following parameters:

Total Copper	pH
Total Lead	Suspended Solids
Total Zinc	

2. The waters of Great Slave Lake, the swamp and muskeg area adjacent to the Tailings Containment Area shall be sampled once during the spring of 2007, and every two years thereafter, at the following station numbers: 35-1, 35-4, 35-5, 35-6, 35-9, 35-10, 35-12, and 35-13. If water is to be discharged from the Tailings Containment Area in any given year, waters at these stations shall be sampled in the Fall following the discharge. Samples shall be analyzed for the following parameters:

Total Copper	pH
Total Lead	Total Zinc

3. Water in the Tailings Containment Area shall be sampled three times a year (spring, summer, and fall), during periods of open water and analysed for the following parameters:

Total Zinc	Total Lead
Total Copper	

4. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of "Standards Methods for the Examination of Water and Wastewater", or by such other methods approved by an Analyst.

5. All analyses shall be performed in a laboratory approved by an Analyst. The Licensee shall annually review the approved Quality Assurance/Quality Control Plan and modify the plan as necessary. Proposed modifications shall be submitted to an Analyst for approval.

6. The plan referred to in Part B, Item 5, shall be implemented as approved by an Analyst.

C. Other Requirements

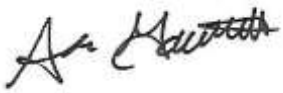
1. The daily and annual quantity of (treated) waste water discharged from Surveillance Network
   Program Station Number 35-1 shall be measured and recorded in cubic metres.

2. The water level of the holding pond within the Tailings Containment Area shall be recorded three times a year, (spring, summer, and fall), in conjunction with sampling referred to in Part B, Item 3 during periods of open water.

D. Reports

1. The Licensee shall, unless otherwise requested by an Inspector, include all of the data and information required by the "Surveillance Network Program" including the results of the approved quality assurance/quality control program in the Licensee's Annual Report, which Report shall be submitted to the Board on or before March 31st of the year following the calendar year being reported.

Mackenzie Valley Land and Water Board



Mavis Cli-Michaud, Chair | **Amanda Gauthier, Witness**

Mackenzie Valley Land and Water Board
7th Floor - 4910 50th Avenue
P.O. Box 2130
YELLOWKNIFE NT X1A 2P6
Phone (867) 669-0506
FAX (867) 873-6610

APPLICATION FOR A NEW WATER LICENCE, AMENDMENT OF LICENCE, OR RENEWAL OF LICENCE.

Application/Licence No: (amendment or renewal only) MV2006L2-0013

1. Name and Mailing Address of Applicant

Teck Metals Ltd.
Bag 2000
Kimberley, BC V1A 3E1
Telephone: 250-427-8405
Fax: 250-427-8451

2. Address of Head Office in Canada if Incorporate

Teck Metals Ltd.
600-200 Burrard Street
Vancouver, BC V6C 3L9
Telephone: 604-687-1117
Fax: 604-687-6100

3. Location of Undertaking (describe and attach a map, indicating watercourses and location of any proposed waste deposits).

Latitude 60°53'41.3" N Longitude 114°25'30.7" W

4. Description of Undertaking (describe and attach plans)

Discharge of effluent from the tailings pond, from time to time, during the open-water season. Effluent is the result of accumulation of natural precipitation in the pond.

5. Type of Undertaking.

1.	Industrial		5.	Agriculture	
2.	Mining and Milling	X	6.	Conservation	
3.	Municipal		7.	Recreation	
4.	Power		8.	Miscellaneous	

6. Water Use

To obtain water		Flood control	
To cross a watercourse		To divert water	
To modify the bed or bank of a watercourse		To alter the flow of, or store water	

Other (describe): No water use required. License is for collection, treatment and water discharge only.

7. Quantity of water involved (litres per second, litres per day or cubic meters per year), including both quantity to be used and quantity to be returned to source.

Under the existing water license approximately 10,000 m3 of water is treated and released daily over a period of three to six weeks each summer with a total volume of approximately 300,000 m3 per year.

8. Waste deposited (quantity, quality, treatment and disposal)

A Waste Management Plan for the proposed activities is to be developed in accordance with the Board's *Guidelines for Developing a Waste Management Plan* (accessible at www.mvlwb.com) and submitted as an attachment to the application form. A template for this Plan is provided in the Guidelines. Applications for a municipal licence do not need to include a Waste Management Plan as this information is required under the Operation and Maintenance Plan.

In addition, applicants are referred to the Board's *Water and Effluent Quality Management Policy* (accessible at www.mvlwb.com) to understand the Board's approach to managing the deposit of waste into the receiving environment through enforceable terms and conditions set in water licences.

Water will be treated with lime and settled to remove zinc prior to discharge to the environment. Quality of discharge will comply with current license Effluent Quality Criteria. Water quantity discharged varies, but

The Water Treatment Manual (attachment 3 of the Mining Industry Questionnaire) provides a detailed list of equipment located and used at the site during the treatment season. Essentially there are two portable diesel

9. Other persons or properties affected by this Undertaking (give name, mailing address and location). Attach a list if necessary.

Proponent has initiated consultation with respect to the renewal with neighbouring communities, First Nation and Metis groups. See Attachment 17 of the Mining Questionnaire for a complete record of the Stakeholder

10. Predicted environmental impacts of Undertaking and proposed mitigation.

As part of the response to this section, a spill contingency plan for the proposed activities is to be developed in accordance with INAC's *Guidelines for Spill Contingency Planning, April 2007*. (accessible at http://www.ainc-inac.gc.ca/ai/scr/nt/pdf/SCP-EUD-eng.pdf). This plan is to be submitted as an attachment to the application form.

No environmental impacts predicted, based upon 10 years of post closure monitoring data. A spill Cor

11. Contractors and sub-contractors (names, addresses and functions). Attach a list if necessary.

Two water treatment plant operators have a full time presence on site for a three to six week period th

12. Studies undertaken to date. Attach a list if necessary.

Various studies undertaken by proponent since 1989. List attached.

13. Proposed time schedule.

Start date: October 29, 2017 Completion date: October 28, 2027

Name (print): Michelle Unger Signature: 

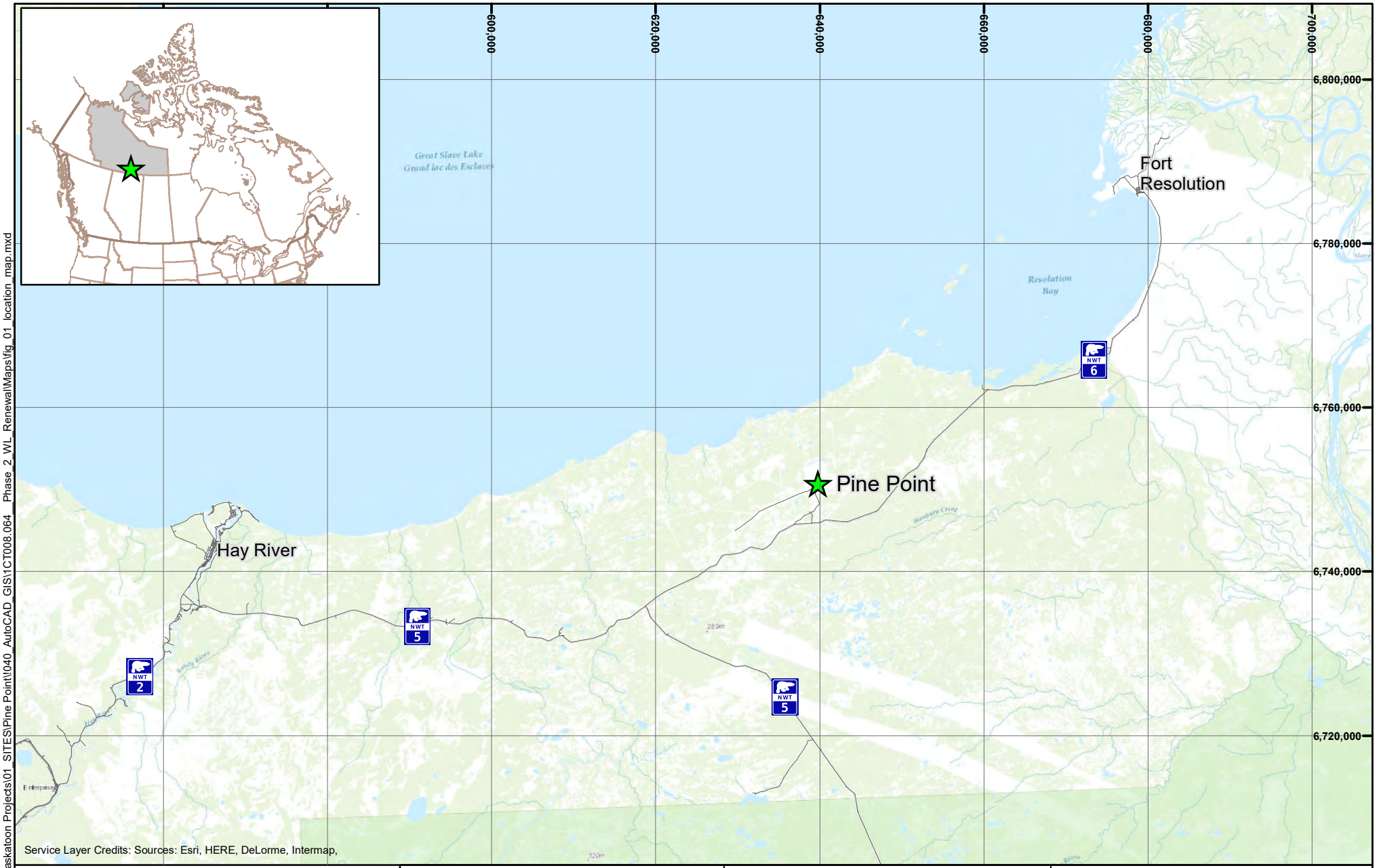
Title (print): Manager, Environmental Cc Date: August 22, 2017

Please make all cheques payable to "Receiver General of Canada"

FOR OFFICE USE ONLY

Application Fee Amount: $_____ **Receipt No:** _____

Water Use Deposit Amount: $_____ **Receipt No:** _____



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srk consulting

Job No: 1CT008.064

Filename: fig_01_location_map

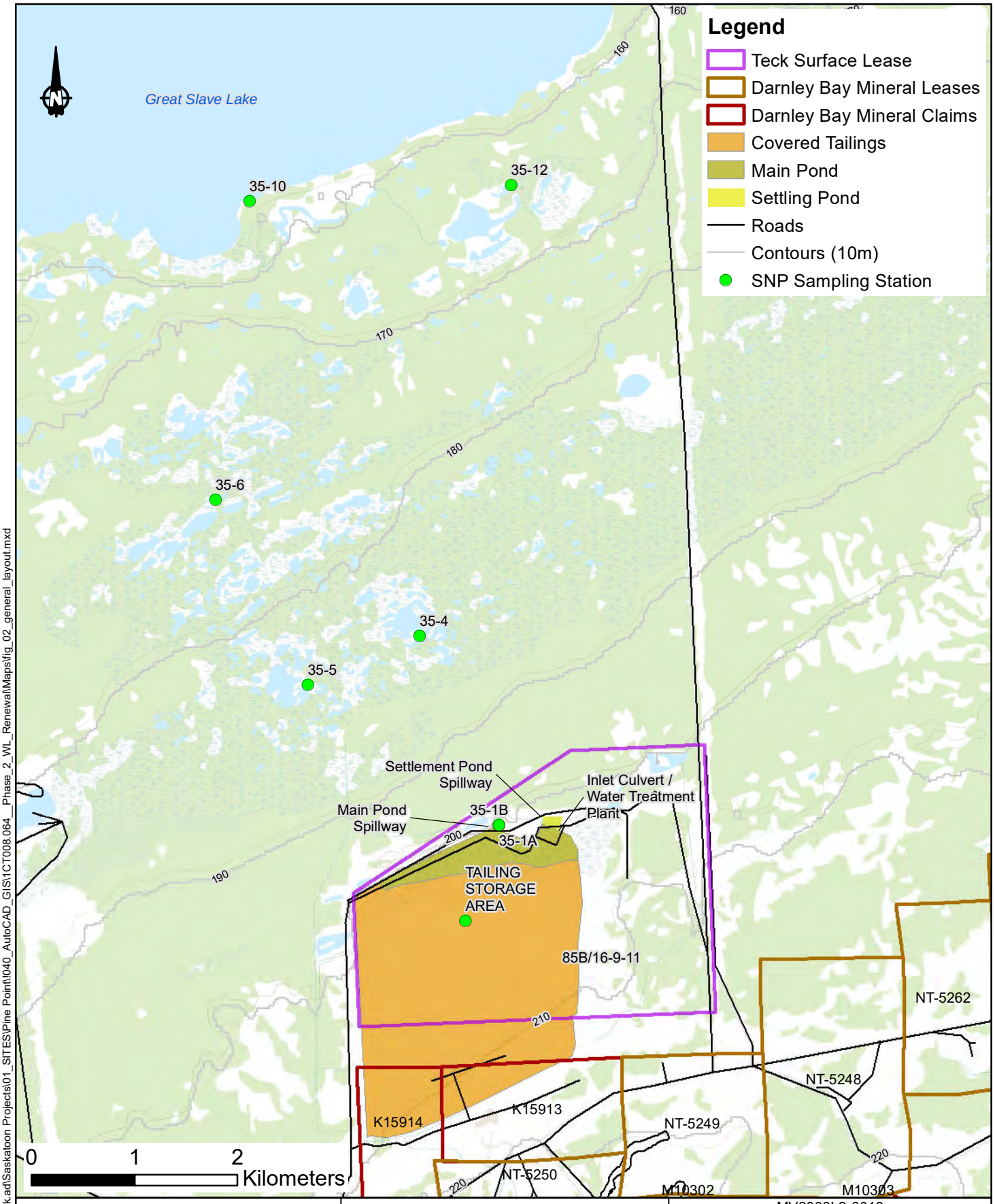
Teck

PINE POINT, NT

MV2006L2-0013
Application for Water Licence Renewal

Pine Point
Tailing Impoundment Area Location

Date:	Approved:	Figure:
May 2017	AL	1



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srk consulting

Teck

MV2006L2-0013
Application for Water Licence Renewal

Pine Point
Tailing Impoundment Area Site Plan

Job No: 1CT008.064

Filename: fig_02_general_layout

PINE POINT, NT

Date:	Approved:	Figure:
May 2017	AL	2

Report Title	Company	Date	Year
1988 Assessment Program - Pine Point Tailings Impoundment	Cominco Engineering Services	May	1989
Mined-Land Reclamation Research Progress Report 1989	Cominco (R. Gardiner)		1989
1989 Assessment Program - Pine Point Tailings Impoundment	Cominco Engineering Services	March	1990
Leachability of Metals in Tailings from Pine Point Mine	Cominco Reclamation Research (R. Gardiner)	November	1990
Abandonment & Restoration Plan - Millsite & Tailings Containment Areas	Cominco Ltd.	December	1990
1990 Assessment Program - Pine Point Tailings Impoundment	Cominco Engineering Services	March	1991
Abandonment & Restoration Assessment Report for Pine Point Operations, NT	H*GCL Mid-Atlantic Regional Office under the direction of L. Manuel (Cominco)	August	1992
Pine Point Tailings - Metal Leaching Potential and Discharge Water Quality - Research Report No. 92PR05	Cominco Research (D.J. McKay & R.T. Gardiner)		1992
Treatment and Discharge of Pine Point Tailings Pond Water (1994) - Research Report No. 94PR49	Cominco Research (S.J. Walden)	December	1994
Treatment and Discharge of Pine Point Tailings Pond Water Project II (1995) - Research Report No. 95PR48	Cominco Research (S.J. Walden)	10-Nov	1995
Interim Report on Geochemical And Hydrogeological Investigations of the Tailings Pond at Pine Point, NWT	Golder Associates Ltd.	18-Jun	1996
Gravity Flow Treatment (1996) of Pine Point Tailings Pond Water - Research Report No. 96PR48	Cominco Research (S.J. Walden)	19-Sep	1996
Geochemical, Mineralogical and Hydrogeological Investigations of the Tailings Pond at Pine Point, NWT	Golder Associates Ltd.	2-Dec	1996
Report on Summary of Geochemical, mineralogical and Hydrogeological Investigations of the Tailings Pond at Pine Point, NWT	Golder Associates Ltd.	14-Mar	1997
Fort Resolution Fish Monitoring Program (1992-1993): Concentration of Metals and Trace Elements in Muscle and Liver Fish Collected from Great Slave Lake, Fort Resolution Area, NWT - FINAL REPORT (prepared for Department of Indian Affairs & Northern Development)	Caroline Lafontaine, Yellowknife	November	1997
1998 Annual Water Licence Report - Water Licence N1L2-0035	Teck Cominco	March	1998
Metal Studies of water, sediments and fish from the Resolution Bay area of Great Slave Lake: Studies related to the decommissioned Pine Point Mine	National Hydrology Research Institute, Saskatchewan & Freshwater Institute, Manitoba	15-Jul	1998

Report Title	Company	Date	Year
1999 Annual Water Licence Report - Water Licence N1L2-0035	Teck Cominco	March	2000
2000 Geotechnical Inspection	Golder Associates Ltd.	13-Jul	2000
2000 Annual Water Licence Report - Water Licence N1L2-0035	Teck Cominco	March	2001
2001 Annual Water Licence Report - Water Licence N1L2-0035	Teck Cominco	March	2002
2002 Geotechnical Inspection Report - Water Licence N1L2-0035	Golder Associates Ltd.	October	2002
2002 Annual Water Licence Report - Water Licence N1L2-0035	Teck Cominco	March	2003
2003 Annual Water Licence Report - Water Licence N1L2-0035	Teck Cominco	March	2004
2004 Geotechnical Inspection Report - Water Licence N1L2-0035	Golder Associates Ltd.	October	2004
2004 Annual Water Licence Report - Water Licence N1L2-0035	Teck Cominco	March	2005
2005 Geotechnical Inspection Report - Water Licence N1L2-0035	Golder Associates Ltd.	October	2005
2005 Annual Water Licence Report - Water Licence N1L2-0035	Teck Cominco	March	2006
Submission to Mackenzie Valley Land and Water Board in Support of the Renewal of Water Licence N1L2-0035, Pine Point, Northwest Territories	EBA Engineering Consultants Ltd.	December	2006
Pine Point Mine - Review of Tailings Discharge Monitoring Data	SRK Consulting	December	2006
Pine Point Mine Tailings Impoundment Area - Contingency Manual	Teck Cominco		2006
2006 Annual Water Licence Report - Water Licence N1L2-0035	Teck Cominco	March	2007
2007 Annual Water Licence Report & 2007 Geotechnical Inspection Report	Teck Cominco & Golder	31-Mar	2008
Pine Point Mine Water Treatment Program - Operating Equipment Manuals	Teck Cominco		2008
2008 Geotechnical Inspection, Pine Point Tailings Dyke, Pine Point, NT	Golder Associates Ltd.	3-Mar	2009
Operation, Maintenance & Surveillance Manual for the Tailings Impoundment Area, Pine Point Mine, NT	Golder Associates Ltd.	19-Mar	2009
2008 Annual Water Licence Report - Water Licence MV2006L2-0013	Teck	31-Mar	2009
2009 Geotechnical Inspection Pine Point Tailings Dyke	Golder Associates Ltd.	January	2010
Pine Point Mine Tailings Impoundment Area - Water Treatment Manual (REVISED 2010)	Teck	February	2010

Report Title	Company	Date	Year
2009 Annual Water Licence Report - Water Licence MV2006L2-0013	Teck	February	2010
2010 Dam Safety Review, Tailings Impoundment Area, Pine Point Mine, Northwest Territories	SRK Consulting	July	2010
2010 Geotechnical Inspection, Pine Point Tailings Dyke, Pine Point, NT	Golder Associates Ltd.	March	2011
2010 Annual Water Licence Report - Water Licence MV2006L2-0013	Teck	March	2011
Polaris 2011/Pine Point 2011 - Curtis Kidd's photos	Curtis Kidd	December	2011
2011 Geotechnical Inspection , Pine Point Tailings Dyke, Pine Point, NT	Golder Associates Ltd.	March	2012
2011 Annual water Licence Report MV2006L2-0013	Teck	March	2012
2012 Annual Water Licence Report MV2006L2-0013	Teck	March	2013
2012 Geotechnical Inspection Pine Point Tailings Dyke	Golder Associates Ltd.	March	2013
2013 Annual Water Licence Report MV2006L2-0013	Teck	March	2014
2013 Geotechnical Inspection Pine Point Tailings Dyke	Golder Associates Ltd.	March	2014
2014 Annual Water Licence Report MV2006L2-0013	Teck	March	2015
2014 Geotechnical Inspection Pine Point Tailings Dyke	Golder Associates Ltd.	March	2015
2015 Annual Water Licence Report MV2006L2-0013	Teck	March	2016
2015 Geotechnical Inspection Pine Point Tailings Dyke	Golder Associates Ltd.	March	2016
2016 Annual Water Licence Report MV2006L2-0013	Teck	March	2017
2016 Geotechnical Inspection Pine Point Tailings Dyke	Golder Associates Ltd.	February	2017

Mining Industry Questionnaire to Accompany Water Licence Applications to the Mackenzie Valley Land and Water Board

Mackenzie Valley Land and Water Board
7th Floor - 4910 50th Avenue
P.O. Box 2130
YELLOWKNIFE NT X1A 2P6
Phone (867) 669-0506
FAX (867) 873-6610

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Regulating the use of land and waters and the deposit of waste, and enabling residents to participate in the management of resources to provide optimum benefit to the residents of the settlement areas and of the Mackenzie Valley and to all Canadians.

October 2003

The purpose of this questionnaire is to solicit supplemental information from an Applicant to support his/her application for a water licence (or renewal). It is anticipated that the completion of this questionnaire will reduce delays arising from the Board's having to solicit additional information after an application has already been submitted. This information will also be useful during the pre-screening of your application, which must be undertaken prior to development and approval of a water licence to determine if the project needs to be referred to the Environmental Impact Review Board.

The Applicant should complete the questionnaire to the best of his/her ability, recognizing that some questions may not be relevant to the project under consideration. For questions that do not relate to his/her operation, the Applicant is requested to indicate "N/A" (Not Applicable).

If any questions arise while completing the questionnaire, the Applicant may wish to contact the Mackenzie Valley Land and Water Board at (867) 669-0506.

Table of Contents **Page**

Please Print Or Type Your Responses

NOTES:

If space is insufficient for any of the responses on this questionnaire, use the back of the sheet or an attachment.

A number of sections in the questionnaire solicit information on water quality and waste management which must be provided in accordance with specific policies and guidelines: the Board's *Water and Effluent Quality Management Policy*; the Board's *Guidelines for Developing a Waste Management Plan*; and INAC's *Guidelines for Spill Contingency Planning*. The Board's policies and guidelines are accessible at www.mvlwb.com or by calling the Board. INAC's *Guidelines for Spill Contingency Planning* are available at http://www.ainc-inac.gc.ca/ai/scr/nt/pdf/SCP-EUD-eng.pdf). Please provide separate plans and/or reports to address these information requirements as part of the completed application package. Reference the relevant title(s) of the plans and/or reports in the body of the questionnaire.

SECTION 1 – GENERAL

Date: August 22, 2017

1.1 Applicant **Teck Metals Ltd.** **250-427-8405**
company, corporation, owner) **(telephone no.)**
Bag 2000, Kimberley, BC V1A 3E1
(postal address)

Property name: **Pine Point Tailings Impoundment Area**

Closest community: **Fort Resolution, NT**

Latitude/Longitude: **60˚53'16"N 114˚25'12"W**

1.2 Environmental contact: **Dana Haggar** **250-427-8413**
(name) **(telephone no.)**
Site Manager
(title)

1.3 Indicate the status of the mine and/or mill on the date of application. (check the appropriate space)

	Mine	Mill
Design		
Under construction		
In operation		
Suspended		
Abandoned		

Questionnaire provided options not applicable (NA)

The mine and mill site have been closed and the areas reclaimed. The status of the tailings containment area is **post-closure** management and maintenance of containment structures and seasonal water treatment.

1.4 If a change in the status of the mine or mill is expected, indicate the nature and anticipated date of such change.

NA

1.5 Indicate the present (or proposed) mine/mill operating schedule.

NA. The Cover letter and License renewal form provide details on actual physical presence at the site, which is limited to three geotechnical inspections per summer (3 days), water treatment (approximately 3 to 6 weeks per summer) and SNP sampling approximately 1 day per summer.

	Mine	Mill
hours per day	_____	_____
days per week	_____	_____
weeks per year	_____	_____
shift periods	_____	_____
number of employees	_____	_____

1.6 Attach a detailed map, drawn to scale, showing the relative locations of the (proposed) mine, mill, water treatment facilities, sewage and solid waste facilities, and tailings areas. The plan should include the water intake and pumphouse, fuel and chemical storage facilities, any existing and proposed concentrate, ore and waste rock storage piles, any existing and proposed drainage controls, piping distribution systems, gas, electric and water utility route locations, and transportation access routes around the site. The map also should include elevation contours, water bodies, and an indication of drainage patterns for the area.

See Attachment #2, Pine Point Tailings Impoundment Area Site Plan as well as Attachment 19 GIS Shape files.

1.7 If applicable, provide a brief history of property development which took place before the present company gained control of the site. Include shafts, adits, mills (give rated capacity, etc.), waste dumps, chemical storage areas, tailings disposal areas, and effluent discharge locations. Make references to the detailed map.

There has been no change of ownership of the site. Teck Metals Ltd. is the holder of the surface land lease that hosts the tailings impoundment area. The property was developed by its predecessor, Cominco Ltd in the 1960s. In July 2001, Teck Corporation and Cominco Ltd. merged to form a new company, the company became Teck Cominco Metals Ltd. in June 2009, Teck Cominco Metals Ltd. changed its name to Teck Metals Ltd. See cover letter to this renewal submission for further detail.

1.8 Give a short description of the proposed or current freshwater intake facility, the type and operating capacity of the pumps used, and the intake screen size.

NA. No freshwater use required. Potable water for the water treatment operators is sourced in Hay River.

1.9 At the rate of intended water usage for operations, explain water balance inputs and outputs in terms of estimated maximum draw down and recharge capability of the river or lake from which fresh water will be drawn.

NA.

1.10 Will any work be done that penetrates regions of permafrost?

Yes _____ No X

1.11 If "Yes" above, is the permafrost continuous or discontinuous?

1.12 Were (or will) any old workings or water bodies (be) dewatered in order to bring the present property into production?

Yes _____ No X

1.13 If "Yes" above, indicate the name of the water body, the total volume of water to be discharged, and the chemical characteristics of that water.

NA.

Water body _____

Total volume _____ m^3

Receiving watercourse _____

Dewatering flow rate into above _____ m^3/sec

Chemical characteristics of discharge:

T/Pb	_____	mg/L	Total cyanide	_____	mg/L
T/Cu	_____	mg/L	Total ammonia	_____	mg/L
T/Al	_____	mg/L	Suspended solids	_____	mg/L
T/Hg	_____	mg/L	Specific conductivity	_____	uhmo/cm
T/Zn	_____	mg/L	pH	_____	
T/Cd	_____	mg/L	Oil and grease	_____	mg/L
T/As	_____	mg/L			
T/Ni	_____	mg/L			
T/Mn	_____	mg/L			

(Sampling locations should be clearly identified and described on maps and drawings.)

1.14 Was (or will) the above discharge (be) treated chemically?

NA.

Yes _____ No _____

If "Yes" above, describe the applied treatment.

SECTION 2 -- GEOLOGY AND MINERALOGY

2.1 Physiography: Provide an analysis and interpretation of the geologic and hydrologic environment in the immediate vicinity of the mine or plant. The investigation should extend from ground surface downward to the base of the glacial drift. Include large scale topographic map(s) covering the area where the mine, mill, and waste disposal basin are (or are to be) located. The map(s) should provide information on groundwater patterns and permafrost variations in the area.

The Laurentide Ice Sheet has deposited till over the bedrock. After the retreat of the ice sheet, the area was inundated by glacial Lake McConnell, which winnowed the till surface and deposited thin (<2 m) beach and littoral glaciolacustrine sediments at the site (Rice, et. al. 2013).

The TIA is located to the north of the former Pine Point mill site on terrain which slopes downwards towards the northwest. The terrain slopes gently for about 13 km towards Great Slave Lake from an approximate elevation of 230 m at the former mill site to an approximate lake elevation of 160 m.

The topography of the area is illustrated on the Pine Point Tailings Impoundment Area Site Plan (Attachment #2). The groundwater table at the site is relatively high and is known to be generally within 1.0 to 2.0 m below the existing ground surface (SRK 2016).

Pine Point is situated within the discontinuous sporadic permafrost zone (Heginbottom 1989 and Johnston 1981), and as a result the glacial till is often locally frozen (Golder, 1981). Permafrost was encountered in the foundation exposed during one of the raises of the West Dyke (SRK 2016). The discontinuous permafrost pattern below the TIA is unknown.

2.2 Briefly describe the physical nature of the orebody, including known dimensions and approximate shape.

NA

2.3 Briefly describe the country rock in the general vicinity of the ore body (from the surface to the ore body).

The orebodies are hosted within middle Devonian carbonates which are located in, or are in close proximity to, the dolomitized Presqu'ile barrier complex. The barrier complex is a reef-like complex that acts as the transition between the shallow marine sediments to the south and the deep marine sediments to the north. To the west of the site lies the foothills belt of the Cordilleran Orogen and to the east is the Precambrian Shield. The orebodies are predominately positioned along weakened bedrock planes associated with the Great Slave Lake Shear Zone, with the primary control of the orebody being karstification (Rice, et. al. 2013).

2.4 Provide a geological description of the *ore minerals* of the deposit. (If possible include the percentage of metals.)

The primary ore minerals were galena and sphalerite.

2.5 Describe the geochemical tests which have been (or will be) performed on tailings solids and different geological units of ore, country rock, and waste rock to determine their relative acid generation and contaminant leaching potential. Outline methods used (or to be used) and provide test results in an attached report (i.e., static, kinetic tests).

The geochemical tests conducted to characterize the tailings involved chemical acid production tests on two tailings samples. The tests determined there was no potential for acid generation. The test results are attached (Attachment # 3).

2.6 Estimate the percentage of sulphides in the orebody:

NA

pyrite _____

pyrrhotite _____

pyrite/pyrrhotite mixture _____

arsenopyrite _____

SECTION 3 -- THE MINE

3.1 Indicate the type of mining method to be used on the property.

NA

Open pit _____

Underground _____

Strip mining _____

Other mining activity? Explain.

The mine operated by Teck Metals Ltd. predecessor is closed and reclaimed.

3.2 Outline any possible operational changes and when they might occur (i.e., open pit to underground).

NA

3.3 Describe the type(s) of explosives to be used in mining operations.

NA

3.4 Indicate the number of shafts or other openings that are presently on the property. Signify whether or not the openings are presently in use: (submit measurements in metres)

NA. This Water Licence application applies only to the Tailings Impoundment Area. Mineral leases hosting all other components of the historic operation were released back to the Crown following the success completion of the approved Closure and Reclamation Plan in the late 1990s.

Shaft (name or number)	Present depth	Proposed depth

Adit (name or number)	Present depth	Proposed depth

Open pit (name) _____

Present surface length _____

Maximum future surface length _____

Present surface width _____

Maximum future surface width _____

Present depth _____

Maximum future Depth _____

Open Pit

Waste rock dump _____
(name)

Area occupied _____ hectares

Height _____

3.5 Are any entrances to shafts, adits, etc. below groundwater level?

NA

3.6 Are permafrost conditions expected?

NA

Yes _____ No _____

3.7 Indicate the expected life of the mine.

NA. Mine is closed.

3.8 Indicate the *present average* rate of production from all ore sources on the property.

0 tonnes ore/day

3.9 Indicate the *expected maximum* rate of production form all ore sources on the property.

0 tonnes ore/day

3.10 Outline all water usage in the mine, indicating the source and volume of water for each use.

NA

	Source	**Use**	**Volume (m^3/day)**
1.			
2.			
3.			
4.			

3.11 Indicate the volume of natural groundwater presently gaining access to the mine workings.

NA

_____ m^3/day

3.12 Outline methods used (planned) underground to decrease mine water flow. (i.e., recycling)

NA

3.13 Indicate the average daily volume of water to be discharged *from the mine* during normal operations.

NA

_____ m^3/day

3.14 If a mill will be operating on the property in conjunction with mining, will all mine water (underground, open pit, etc.) be directed to the mill for reuse?

NA

3.15 If not, indicate the proposed point and volume of discharge for the mine water.

NA

Point of discharge _____

Volume of discharge _____ m^3/day

3.16 What are the chemical and physical characteristics of the preceding mine water?

T/Cu	_____	mg/L	Total ammonia	_____	mg/L
T/Pb	_____	mg/L	Suspended solids	_____	mg/L
T/Zn	_____	mg/L	Specific conductivity	_____	uhmo/cm
T/Ag	_____	mg/L	pH	_____	
T/Mn	_____	mg/L	Oil and grease	_____	mg/L
T/As	_____	mg/L			
T/Hg	_____	mg/L	Other		
T/Cr	_____	mg/L	_____		
T/Cd	_____	mg/L	_____		
T/Ni	_____	mg/L	_____		
T/Fe	_____	mg/L	_____		

3.17 Are there any treatment plans for mine water and will any chemicals be used in such treatment? Explain.

NA

SECTION 4 -- THE MILL

4.1 Attach a copy of the (proposed) mill flow sheet. Indicate the points of addition of all the various reagents (chemicals) that are (or will be) used.

NA. This Water Licence application applies only to the Tailings Impoundment Area.

4.2 If milling is in progress on the property at the present time, indicate the rate of milling.

NA.

_____ not applicable (check) OR _____ tonnes/day

4.3 What is the present (or proposed) maximum capacity of the mill?

NA.

_____ tonnes/day

4.4 List the types and quantities of all reagents used in the mill process (in kg/tonne ore milled).

NA.

Reagent	**Kg/tonne ore milled**

4.5 Is the (proposed) milling circuit based on autogenous grinding?

NA.

Yes _____ No _____ Partially _____

4.6 Indicate the amount(s) of concentrate(s) produced in the mill.

NA.

_____ kg/day _____ kg/day

_____ kg/day _____ kg/day

4.7 Will fresh water undergo treatment prior to use in the mill process? Explain.

NA.

4.8 Indicate all uses of water in the mill. Include the quantity and source of the water for each use.

NA.

	Use	Source	Volume (m^3/day)
i.			
ii.			
iii.			
iv.			
v.			
vi.			
vii.			
viii			
ix.			
x.			

4.9 Indicate the total volume of water discharged from the mill.

NA.

_____ m^3/day

4.10 Of the preceding volume, what quantity is (will be) recycled to other areas on the property (mine, mill, etc.)? Indicate location of use and quantity.

NA.

Location		
		m^3/day
		m^3/day
		m^3/day

4.11 Based on yearly production, indicate the average quantity of tailings (dry weight) discharged from the mill.

NA.

_____ tonnes/day

4.12 What is the average liquid solid ratio of tailings leaving the mill?

NA.

By weight _____ : _____ By volume _____ : _____
liquid : solid liquid : solid

4.13 If applicable, identify any chemical treatment applied to the liquid phase before being discharged to the tailings area. (Attach flow sheet if available.)

NA.

4.14 Based on present production or bench test results, describe the chemical and physical characteristics of liquid mill wastes directed to the tailings area.

NA.

T/Cu	_____	mg/L	Total ammonia	_____	mg/L
T/Pb	_____	mg/L	Suspended solids	_____	mg/L
T/Zn	_____	mg/L	Specific conductivity	_____	uhmo/cm
T/Ag	_____	mg/L	pH	_____	
T/Mn	_____	mg/L	Alkalinity	_____	$CaCo_3$/L
T/Ni	_____	mg/L	Hardness	_____	mg/L
T/Fe	_____	g/L	Total cyanide	_____	mg/L
T/Hg	_____	mg/L	Oil and grease	_____	mg/L
T/As	_____	mg/L			
T/Cd	_____	mg/L			
T/Cr	_____	mg/L			
T/Al	_____	mg/L			

4.15 Provide a geochemical description of the solid fraction of the tailings.

NA.

Cu	_____	mg/g	Al	_____	mg/g
Pb	_____	mg/g	Fe	_____	mg/g
Zn	_____	mg/g	Hg	_____	mg/g
Ag	_____	mg/g	Ni	_____	mg/g
Mn	_____	mg/g	As	_____	mg/g
Cr	_____	mg/g	CN	_____	mg/g
Cd	_____	mg/g			

4.16 Identify the current source of power production.

The water treatment plan is powered by a 5 KW Honda EX5DCC9 Diesel with two 30 amp/120 volt receptacles and one 18.8 amp/240 volt receptacle. The fuel supply for the generators is a 400L truck mounted slip tank.

4.17 Other properties (or will the mill be handling any in the future)?

NA.

4.18 If so, specify ore characteristics and describe any mill processes which will change as a result.

NA.

4.19 If tailings are being recovered in the mill or elsewhere for use as backfill (etc.) in the mine (etc.), indicate the quantity of solid tails (tonnes/day) recovered from the mill process.

NA.

4.20 Will exits be bermed to prevent spills from escaping the mill?

NA.

4.21 Will all sumps for process tanks have the required 110% holding capacity of the largest tank?

NA.

Section 5 -- The Tailings Area

5.1 Is the tailings containment area (being) designed for total containment?

Yes

5.2 Attach detailed scale plan drawings of the proposed (or present) tailings area. The drawings must include the following:

(a) Details of pond size and elevation;

(b) Precise details of all retaining structures (length, width, height, materials of construction, etc.);

(c) Details of the drainage basin, and existing and proposed drainage modifications;

(d) Details of all decant, siphon mechanisms etc, including water treatment plant facilities;

(e) The plan for tailings deposition and final tailings configuration;

(f) Details with regard to the direction and route followed by the flow of wastes and/or waste waters from the area; and

(g) Indications of the distance to nearby major watercourses.

Note: Individual detailed large scale drawings of any facility (dam, decant system, ditch, dike, water treatment plant, etc.) (to be) constructed *must* be attached. Specific details with regard to the methods of construction, materials (to be) used, etc., are required.

The TCA occupies terrain that slopes gently (i.e. at an average gradient of less than 1%) towards the northwest. Great Slave Lake, the nearest major waterbody, is located approximately 6.5 km to the northwest. As shown in Attachment #4, Tailings Impoundment Area, an earthfilled perimeter dyke, which retains the tailings and any ponded water, extends fully along the north and west sides (North Dyke and West Dyke) and along most of the south side (South Dyke) of the facility. Due to the local topography, only a small portion of the east side of the TCA requires a dyke (East Dyke) to retain small pools of water in low spots if the pond level approaches the maximum allowable level. The total length of the dyke system is about 8.5 km and the maximum height is about 11 m at the northwest corner (Golder, 2012).

Except for the pond immediately adjacent to the North Dyke (Main Pond) and the abutting small polishing pond (Settling Pond), the entire tailings surface has been covered with locally borrowed alluvial gravel to prevent wind erosion of the tailings. A thin layer of waste rock has been placed over the gravel cover in one small area adjacent to several standpipe piezometers located near one of the two high points on of the impoundment. It is believed the waste rock was placed to provide access to the piezometers (SRK, 2010).The Settling Pond Dyke is an internal dyke and is needed solely for purposes of water treatment which occurs on a batch basis for about 4 to 6 weeks each summer. The Main Pond and Settling Pond are connected by a steel culvert located at the southeast corner of the Settling Pond Dyke (Attachment #5, Settling Pond Plan View).

In 2012, the stoplogs were replaced with concrete headwalls installed at both spillways (Attachment #6, Details of Upgraded Spillways). The elevation at which water discharges over the headwalls at the spillway entrance is understood to be 202.5 m, 1.0 m below the minimum crest elevation along the perimeter dykes. However, as discussed in Section 4.2, there is some uncertainty regarding the elevations at the tops of these two walls. The Main Pond Spillway invert is normally dry, whereas treated water is annually piped over the Treatment Spillway to the environment in conjunction with the water treatment campaign.

Detailed plans of the constructed tailings area are attached. The basic layout of the earthfilled

perimeter dyke, the internal Settling Pond Dyke and treatment plant is provided in Attachment #7 (Aerial Photos of Tailings Impoundment Area). The topography of the tailings surface is shown in Attachment #4 (Tailings Pond Impoundment Area). Typical cross-sections through the West and North Dykes are shown in Attachments #8 and #9. The cross-sections indicate these dykes consist of two zones, an upstream zone consisting of stiff, clayey silt and a downstream zone consisting of sand and gravel. Although not reflected in Attachments #8 and #9, a layer of sand and gravel was subsequently added to portions of the upstream face of these dykes for erosion protection (SRK 2016).

The crest of the North Dyke was regraded and widened to about 7.3 m in conjunction with the placement of 6-inch minus gravel along about 750 m of the upstream face of the North Dyke in 2008, per Attachment #10 (Overview of North Tailings Impoundment Area) The gravel was added to protect the clayey silt in the upstream zone from erosion that had occurred due to prolonged wave action. The serpentine channel in the Settling Pond was also cleaned out to remove sludge, in order to deepen the channel and increase retention time.

5.3 Explain your choice of location for the tailings pond design by rationalizing rejection of other options. Consider the following criteria in your comparisons: subsurface strata permeability, abandonment of tailings, recycling/reclaiming waters, and assessment of runoff into basins. Attach a brief summation.

NA

5.4 The total area for the existing tailings basin is 700 **hectares and for any proposed tailings area is _____ hectares.**

5.5 The *average* depth of the tailings basin is unknown **metres.**

5.6 Indicate the total capacity for the *existing* tailings area by using water balance and stage volume calculations and curves. (Attach a description of inputs and outputs along with volume calculations).

The TIA is currently closed, and is not receiving any more tailings. Water ponds in a main pond on the north side of the facility. This pond has an operational capacity of 790,660 m^3, corresponding to a water level of 201.8 m. The dyke crest (at 203.5 m) corresponds to a storage capacity of 2,550,300 m^3. Figure 1 below presents the storage capacity of the pond with elevation. The storage in Figure 1 is based on a survey completed in 2008. It does not include the northeast corner of the TIA and is conservative.

The pond receives runoff from the surrounding catchment, which has an area of approximately 9 km^2. Outputs from the pond include infiltration, evaporation, and discharge to the environment. The water from the pond is treated prior to discharge. The average annual precipitation is 565 mm, the average annual evaporation is 524 mm, and the average annual discharge for 2012-2014 was 236,000 m^3.

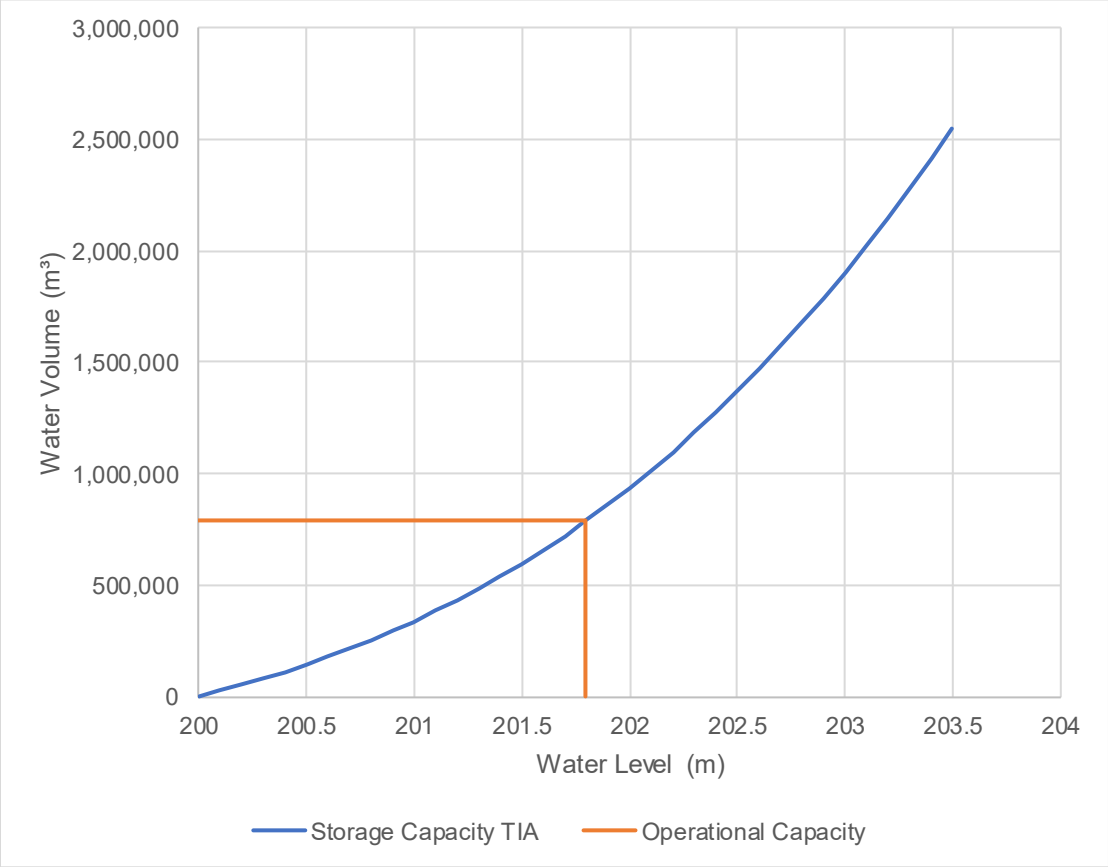


Figure 1 Storage Capacity of TIA

5.7 Indicate the total capacity for any *proposed* tailings area by using water balance and stage volume calculations and curves. (Attach a description of inputs and outputs along with volume calculations).

NA. No additional tails to be added.

5.8 Will the *present* tailings area contain the entire production from the mine mill complex for the life of the project?

NA

5.9 If "No" above, or if production output increases tailings volumes, indicate what plans have been made for future tailings disposal on the property.

NA

5.10 Has any land in the immediate area been identified as native or Crown land or withdrawn pending Native Claim Settlement?

The TIA is located on Commissioner's Land. The area is within the Traditional Lands of the Deninu Kué First Nation who are part of the Akaitcho Treaty 8 Tribal Corporation. Treaty 8 land, resource and self-government negotiations are still being negotiated.

5.11 Do the tailings area and all related treatment facilities lie on company held claims?

Teck Metals Ltd. is the holder of the surface land lease N.W.T. lease No. 85 B/16-9-11. This lease encompasses the tailings impoundment area to allow for the on-going management of the tailings facility. After the mine closed and as reclamation activities were completed in accordance with the approved Closure and Reclamation Plan (Restoration and Abandonment Plan), the surface leases were surrendered back to the Crown (mid to late 1990's). The company has also surrendered all mining claims in the area.

5.12 If not, indicate mine claim boundaries (and owners) on tailings area plan map (see Q.58). Also, attach a copy of all pertinent agreements signed with the owners of the claims not held by the company.

There are no active mine claims within the TIA. Two mineral claims (KD15914 D2, K15913 D1) and a mineral lease (NT-5249) are adjacent to the south side of the surface lease as shown on the Pine Point Tailings Impoundment Area Site Plan (Attachment #2). These are held by Darnley Bay Resources.

5.13 Will the proposed tailings area engulf or otherwise disturb any existing watercourse?

Yes _____ No X

5.14 If "Yes", attach all pertinent details (name of watercourse, present average flow, direction of flow, proposed diversions, etc.).

NA

5.15 If any natural watercourse will gain access to the proposed tailings area, what methods will be used to decrease the amount of runoff water entering the containment area? Indicate the volume of water which will enter the tailings area from the source(s) in question and attach all pertinent details of proposed diversions.

	Name of source	Volume (m^3/day)
1.		
2.		
3.		
4.		

Nature of Diversion(s):

NA. The only water entering the TIA is from precipitation as described in response to question 5.6.

5.16 Indicate on the tailings area plan drawing (see Q.61) all sources of seepage presently encountered in the vicinity of the tailings area, the volume of each seepage flow (m^3/day), and the direction of each flow.

There has been no seepage observed below the Main Pond Spillway since 2012. In 2011 seepage was observed below the Polishing Pond Spillway. Monitoring of these location continues to occur in conjunction with site inspections. The spillway locations are shown on the Pine Point Tailings Impoundment Area Site Plan (Attachment #2).

5.17 Are the seepage flows from the property presently being treated chemically? If so, describe how.

No seepage flows are being treated.

5.18 If not, explain.

NA

5.19 Please attach a conceptual Abandonment and Restoration Plan for all tailings areas being developed. Describe the measures that have been (or will be) taken to contain and stabilize the tailings area(s) against leaching and seepage after operations on the property cease.

The last remaining long-term objective of the Pine Point Abandonment and Restoration Plan is to leave the tailings pond in a stable condition which will allow any precipitation runoff to flow unimpeded from the area whilst maintaining a quality suitable for discharge.

The December 1990 report *Abandonment and Restoration Plan Millsite and Tailings Containment Area Cominco Ltd, - Pine Point Operations* underwent minor revisions dated December 18, 1991. In December 2006 an *Update to Restoration and Abandonment Plan,*

Tailings Impoundment Area was issued. As Lease #85B/16-9-9 is the only surface land tenure that Teck Metals Ltd. continues to hold at the site, the update to the Restoration and Abandonment Plan is directed to issues associated with this lease area only. The 2006 update is included as Attachment #11.

Since the development of the original plan, the ongoing treatment of tailings-pond water prior to release and the regular inspections and maintenance of the tailings impoundment dams have been conducted as proposed. The ultimate closure concepts for the tailings facility, once pond-water quality permits, remain unchanged from those in the original plans. At the point in time where water quality of the pond approaches acceptable levels, final detailed planning and engineering required for the permanent abandonment of the tailings area will be completed and submitted to the MVLWB for its consideration and approval prior to being implemented.

In this post closure license period, Teck Metals Ltd. will continue diligently to manage the tailings impoundment area by inspecting and maintain the integrity of the containment structures in accordance with the Operations and Maintenance Plan (Attachment #12), monitoring water quality levels of the pond within the impoundment area, treat the pond water prior to discharging it and regular monitoring of the receiving environment in accordance with the renewed Water License requirements as well as the Water Treatment Manual (Attachment #13 and the Contingency Plan (Attachment #18).

The TIA is considered to be in the Closure-Active Care phase of mine life (Golder 2016), based on regular monitoring of the dykes and regular treatment and release of water from the facility. Should the TIA move to the Closure-Passive Care phase, in which the system is considered stable with no water treatment or management of the pond, such that water may be passively released from the system, the design criteria for the dam would be updated (Attachment #12, Operations and Maintenance Plan (*Operation, Maintenance and Surveillance Manual for Pine Point Tailings Impoundment Area))*.

5.20 Describe the proposed or present operation, maintenance, and monitoring of the tailings area.

The actions undertake at the site are described in the attached Operations and Maintenance Plan (*Operation, Maintenance and Surveillance Manual for Pine Point Tailings Impoundment Area* (Attachment #12).) In summary the facilities containment structures undergo three inspections each summer by a qualified geotechnical engineer as well as a 10 year Dam Safety review in accordance with the Canadian Dam Safety Guidelines.

SECTION 6 -- WATER TREATMENT

6.1 Describe the methods of chemical treatment that are presently being used and/or will be used to control the quality of the tailings effluent. Attach engineering drawings where applicable and a process flow chart. If a pilot test has been conducted, please attach description of methodology and results.

The water treatment system consists of lime treatment and settling. Further details are provided in the attached *Water Treatment Manual* (2017) (Attachment #13). A process flow chart is attached as Attachment #14. The serpentine settling pond is illustrated Attachment #5, Settling Pond Plan View.

6.2 List the names of chemicals to be used in the water treatment process.

Hydrated lime

6.3 What is the proposed or present *average* rate of effluent treatment of the plant (if applicable)?

12.5 m^3/min, approximately 10,000 m^3/day or approximately 300,000 m^3/year, during a three to six week treatment season each summer.

6.4 What is the proposed or present *maximum* effluent treatment capacity of the plant (if applicable)?

Approximately 12.5 m^3/min

6.5 Will treated effluent be discharged directly to a natural water body or will polishing or settling ponds be employed? Describe location, control structures, and process of water retention and transfer. Attach any relevant design drawings.

The treated effluent flows via gravitation through a serpentine channel to promote settlement of solids prior to discharge. Details are provided in the attached *Water Treatment Manual* (Attachment #13).

6.6 Name the first major watercourse the discharge flow enters after it leaves the area of company operations.

Following discharge the treated water meanders through a muskeg area for approximately 13 kilometres prior to entering Great Slave Lake.

6.7 In terms of rate of effluent release and volume and flushing rate of the receiving watercourse, estimate the extent of the mixing zone within the receiving waters and where background levels of constituents for that watercourse will be attained.

The effluent is released into a dry channel on land and allowed to infiltrate prior to mixing with receiving waters.

6.8 Describe the present (proposed from pilot tests) chemical and physical characteristics of the tailings effluent (decant).

In 2016 the discharge water quality had the following ranges:

T/Cu	0.004 - 0.009 mg/L	Total ammonia	<0.025 mg/L as N
T/Pb	0.0025 - 0.0063 mg/L	Suspended solids	4 – 78 mg/L
T/Zn	0.233 - 0.428 mg/L	Specific conductivity	µhmo/cm
T/Ag	<0.00001 mg/L	Alkalinity	25 – 33 mg/L as $CaCO_3$
T/Mn	0.008 - 0.01 mg/L	Hardness	269 – 274 mg/L as $CaCO_3$
T/Ni	0.0009 - 0.0013 mg/L	pH	7.63 - 10.1
T/Fe	<0.05 mg/L	Total cyanide	mg/L
D/Hg	<0.000005 mg/L		
T/Cr	<0.0005 - 0.0005 mg/L	**Other**	
T/Cd	0.0002 - 0.00024 mg/L	Electrical Conductivity	541 – 544 µS/cm

T/As	<0.0002 mg/L	Weak Acid Dissociable Cyanide	<0.004 mg/L

SECTION 7 -- ENVIRONMENTAL MONITORING PROGRAM

7.1 Has any baseline data been collected for the main water bodies in the area prior to development?

Yes _____ No X

7.2 If "Yes", include all data gathered on the physical, biotic and chemical characteristics at each sampling location. Identify sampling locations on a map.

The Surveillance Network Program sampling stations are shown on the Pine Point Tailings Impoundment Area Site Plan (Attachment #2). The GIS Shape files for these locations is provided in Attachment #19.

7.3 Provide an inventory of hazardous materials on the property and storage locations (attach separate map)

There are no hazardous materials on site expect during the water treatment period. During the 3 to 6 weeks of water treatment the following hazardous materials, as listed in the *Contingency Plan, Pine Point Mine Tailings Impoundment Area,* are utilized:

Substance	Volumes	Storage location
Cyclohexanone	120 mL	Lab trailer
pH buffer 4, 7, & 10	4 L each	Lab trailer
Gasoline	300 L	Tidy tank in operator's vehicle
Diesel	500 L	Tidy tank in operator's vehicle
Zincover5	300 pouches	Lab trailer
Hydrated Lime	30 tonnes	Silo

7.4 Attach the present or proposed contingency plan which describes course of action, mitigative measures, and equipment available for use in the event of system failures and spills of hazardous materials.

The Contingency Plan is found in Attachment #18 and as Appendix C of the Operations and Maintenance Plan (*Operation, Maintenance and Surveillance Manual for Pine Point Tailings Impoundment Area* (see Attachment #12)).

7.5 Provide a brief overview of the conceptual abandonment and restoration plan for the site.

In June 1987, the Pine Point Mine Restoration and Abandonment Plan was issued and subsequently approved. The plan was implemented immediately upon closure of the mine in 1988. Updates to the plan were issued in 1990 and again in 1991 as reclamation work neared completion. By October 1991 the only outstanding work (other than related to the tailings impoundment facility) was the removal of three large concrete bins, two residential houses, and the dump site to be filled. Subsequently, this work was completed.

As reclamation activities were completed, in accordance with the approved Closure and Reclamation Plan (Restoration and Abandonment Plan), the surface leases were surrendered back to the Crown (mid to late 1990's). Currently only one surface land lease (#85B/16-9-9) continues to be held by Teck Metals Ltd. (formerly Teck Cominco Metals Ltd. and Cominco Ltd.). This lease encompasses the tailings impoundment area to allow for the on-going management of the tailings facility.

In December 2006 an Update to Closure and Reclamation Plan (2006 Restoration and Abandonment Plan, Tailings Impoundment Area) was issued and subsequently approved by the MVLWB. As Lease #85B/16-9-9 is the only surface land tenure that Teck continues to hold

at the site, the update to the Restoration and Abandonment Plan is directed to issues associated with this lease area. The 2006 update is included as Attachment #11.

The last remaining long-term objective of the Pine Point Abandonment and Restoration Plan is to leave the tailings pond in a stable condition which will allow any precipitation runoff to flow unimpeded from the area whilst maintaining a quality suitable for discharge. At the point in time where water quality of the pond approaches acceptable levels, final detailed planning and engineering required for the permanent abandonment of the tailings area will be completed and submitted to the MVLWB for its consideration and approval prior to being implemented.

In this interim period, Teck Metals Ltd. will continue diligently to manage the tailings impoundment area by inspecting and maintaining the integrity of the dam, monitoring water quality and levels of the pond within the impoundment area, treating the pond water prior to discharging it and regular monitoring of the receiving environment.

SECTION 8 – PRE-SCREENING

In addition to providing sufficient technical and related information for licensing to proceed, applicants must provide adequate descriptive information to ensure that an initial pre-screening decision can be made prior to a project's proceeding for regulatory approvals.

Your application and other project details, such as this questionnaire, will be sent out for review by local aboriginal, as well as, territorial and federal government agencies. Their comments (e.g., regarding the significance of project impacts) are considered before a decision is made to allow the project to proceed.

8.1 Has this project ever undergone an initial environmental review, including previous owners?

Yes X By whom/when Government of Canada, Federal Environmental Assessment Office, June 1990

No _____ Unknown _____

Attached is a letter from Minister of Indian and Northern Development dated May 28, 1993 (Attachment #15) that concludes:

"A screening of the water use application pursuant to the *Environmental Assessment and Review Process Guidelines Order* was completed and I am satisfied that any potentially adverse environmental and related social effects that may be caused by the project are insignificant or mitigable with known technology."

8.2 Has any baseline data collection and evaluation been undertaken with respect to the various biophysical components of the environment potentially affected by the project (e.g., wildlife, soils, air quality), in addition to water related information requested in this questionnaire?

Yes _____ No _____ Unknown _____X

8.3 Has any meteorological data been collected at or near the site? (e.g., precipitation, evaporation, snow, wind)

Yes _____X No _____

8.4 If "Yes", please include data and attach copies of reports or cite titles, authors and dates.

Meteorological data is included in Section 2.4 of the Operations and Maintenance Plan (*Operation, Maintenance and Surveillance Manual for Pine Point Tailings Impoundment Area* (see Attachment #12)).

8.5 If "No", are such studies being planned? Briefly describe the proposals.

8.6 Has authorization been obtained or sought form the Department of Fisheries and Oceans for dewatering or using any water bodies for containment of waste?

NA

8.7 Please attach an outline briefly describing any options or alternatives considered or rejected for the various mine components outlined in this questionnaire (e.g., mill site, water supply sources, locations for ore and waste piles).

The Closure and Reclamation Plan (Restoration and Abandonment plan) was initially completed and approved in 1987. Research was conducted with respect to the water treatment process including testing sodium hydroxide. The process was abandoned due to the high physical risks associated using concentrated caustic soda.

It was initially envisaged that water effluent quality should improve overtime however concentrations of zinc in the tailings pond still exceed the Water Licence as such water must be treated prior to discharge to the environment. Conventional lime addition has continued to produce water that meets or exceeds the Water License discharge limits. Other water treatment technologies have not been further investigated.

8.8 Has a socio-economic impact assessment or evaluation of this project been undertaken? (This would include a review of any public concerns, land, water and cultural uses of the area, implications of land claims, compensation, local employment opportunities, etc.)

Yes X No _____ Unknown _____

8.9 If "Yes", please describe the proposal briefly.

Attached is a letter from Minister of Indian and Northern Development dated May 28, 1993 (Attachment #15) that concludes:

"A screening of the water use application pursuant to the *Environmental Assessment and Review Process Guidelines Order* was completed and I am satisfied that any potentially adverse environmental and related social effects that may be caused by the project are insignificant or mitigable with known technology."

Attached is a letter from the Regional Director General, Northwest Territories Region, Indian and Northern Affairs Canada dated October 25, 2007 (Attachment #16) that states:

"… it is INAC's view that the Crown's duty to consult, if it does arise in this case, has been met and that the water licence should be renewed by the MVLWB to prevent a potentially negative impact on the environment and the DKFN's treaty rights."

A Pine Point Stakeholder Engagement Plan has been created following the guidance provided in the MVLWB *Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits* (2013, updated 2014). Stakeholder engagement for this water license renewal consisted of written notifications, meetings with designated leadership groups and community members. Further details are provided in the Stakeholder Engagement Plan attached as Attachment #17.

SECTION 9 -- LIST OF ATTACHMENTS

	Reference to Question #	Title	Number of pages
1.	2.1, 5.2	Technical References	1
2.	1.6, 2.1, 5.12, 5.16, 7.2	Pine Point Tailings Impoundment Area Site Plan	1
3.	2.5	Geochemical Tests	2
4.	5.2	Tailing Pond Impoundment Area	1
5.	5.2, 6.1	Settling Pond Plan View	1
6.	5.2	Details of Upgraded Spillways	1
7.	5.2	Aerial Photos of Tailings Impoundment Area	1
8.	5.2	West Dyke Sections	1
9.	5.2	North Dyke Sections	1
10.	5.2	Overview of North Tailings Impoundment Area	1
11.	5.19, 7.5	Update to Restoration and Abandonment Plan Tailing Impoundment Area December, 2006	5
12.	5.19, 5.20, 7.4, 8.4	Operations and Maintenance Plan (Operation Maintenance and Surveillance Manual for Pine Point Tailings Impoundment Area)	103
13.	6.1, 6.5	Water Treatment Manual	171
14.	6.1	Process Flow Chart	1
15.	8.1, 8.9	1993 Letter from Minister of Indian and Northern Development	
16.	8.9	2007 Letter from Regional Director General Northwest Territories, Indian and Northern Affairs Canada	5
17.	8.9	Stakeholder Engagement Plan	25
18.	5.19, 7.3, 7.4	Spill Contingency Plan	14
19.	Board Advise	Reclaim Model	29
20.	1.6, 7.6	GIS Shape Files	

Attachment 1 – Technical References

Technical References

Golder Associates (1981). *Geotechnical Investigation Stability of Tailings Dyke Pine Point Mines, N.W.T..* Report prepared for Cominco Ltd, November 1981. Project No. 812-116

Golder Associates (2012). *2011 Geotechnical Inspection, Pine Point Tailings Dyke, Pine Point, NT.* Submitted to Teck Metals Ltd., March 2012. Project No. 1114270013-005.

Heginbottom, J.A. (1989). *A Survey of Geomorphic Processes in Canada. Quaternary Geology of Canada and Greenland*; by Fulton, RJ (ed); Geological Survey of Canada, Geology Series no.1, 1989; p.576-577, doi:10.4095/131636

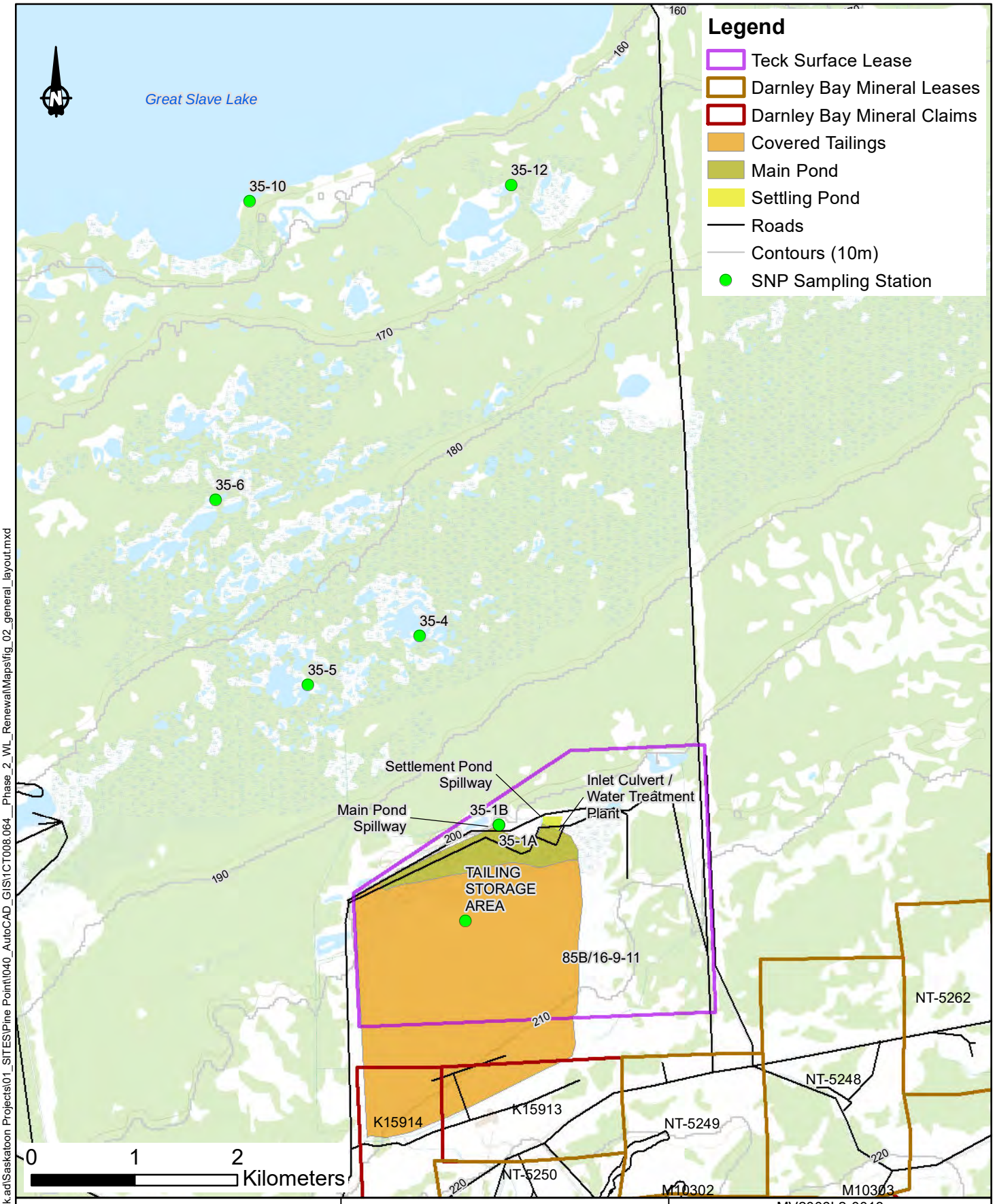
Johnston, G.H., (1981). *Permafrost: Engineering Design and Construction*. National Research Council Canada. Associate Committee on Geotehcnial Research. 1981

Rice, J.M., Paulen, R.C., Menzies, J.M., McClenaghan, M.B, and Oviatt, N.M. (2013*). Glacial stratigraphy of the Pine Point Pb-Zn mine site, Northwest Territories*; Geological Survey of Canada, Current Research 2013-5, 14 p. doi:10.4095/292184

SRK Consulting (Canada) Inc. (2010). *2010 Dam Safety Review Pine Point Tailings Impoundment Pine Point Mine, Northwest Territories*. July 2010.

SRK Consulting (Canada) Inc. (2016). *2014 Dam Safety Review Pine Point Tailings Impoundment Pine Point, Northwest Territories*. March 2016.

Attachment 2 – Pine Point Tailings Impoundment Area Site Plan



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srk consulting

Teck

MV2006L2-0013
Application for Water Licence Renewal

Pine Point
Tailing Impoundment Area Site Plan

Job No: 1CT008.064

Filename: fig_02_general_layout

PINE POINT, NT

Date:	Approved:	Figure:
May 2017	AL	2

Attachment 3 – Geochemical Tests

BC RESEARCH

3650 Wesbrook Mall,
Vancouver, B.C.,
Canada V6S 2L2
Phone (604) 224-4331
Cable RESEARCHBC
Telex 04-507748

October 13, 1987
Our File: 4-07-425

Mr. R. Jones
Cominco Limited
Pine Point Operations
Pine Point
North West Territories
X0E 0W0

Dear Mr. Jones:

Tabulated results of chemical acid production potential tests on the two tailing samples submitted are attached.

Both materials have a massive excess of reactive alkalinity (mainly carbonate, as indicated by rapid effervescence during acid addition), and neither sample has any potential whatever for acid generation. I would consider confirmation testing to be entirely superfluous for either of these materials.

I have enlcosed a copy of the test procuedure for your file.

I trust this brief report is satisfactory; if you have any questions, please contact me.

Yours sincerely,

B.C.RESEARCH

R. O. McElroy
Group Leader
Extractive Metallurgy
Industrial Chemistry Division

ROM/md
Enc.

rec'd Oct 16/87
REJ

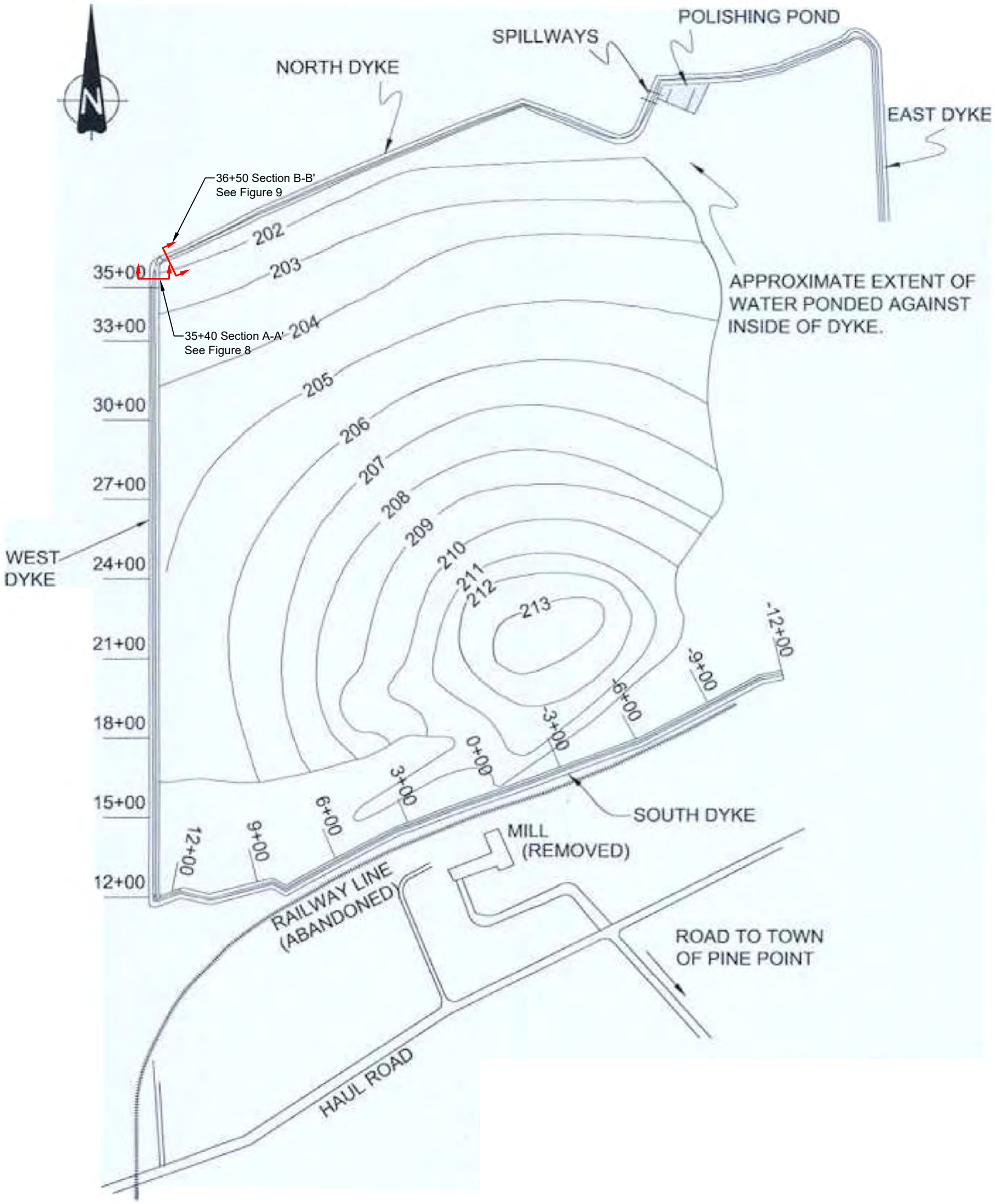
TABLE

RESULTS OF CHEMICAL ACID PRODUCTION POTENTIAL TESTS ON TAILING SAMPLES SUBMITTED BY PINE POINT MINES LIMITED

SAMPLE CODE	TOTAL SULPHUR (Wt%)	POTENTIAL ACID (Kg/T)	SLURRY pH	ACID CONSUMPTION (Kg/T)	POTENTIAL ACID PRODUCER
"Fine"	2.26	96.2	8.4	833*	No
"Coarse"	2.68	82	8.5	704*	No

*Strong effervescence on acid addition indicates reactive carbonates.

Attachment 4 – Tailing Pond Impoundment Area



NOTES

Contour Interval: 1m

REFERENCES

1. Golder Associates, Dec. 2004.
2. Cominco Ltd. drawings number P5A, 132, and 133, dated 18 Dec. 1980.

0 200 400 600 800 1000

Scale in Metres

srk consulting

Teck

MV2006L2-0013
Application for Water Licence Renewal

Tailings Impoundment Area

SRK JOB NO.: 1CT008.064

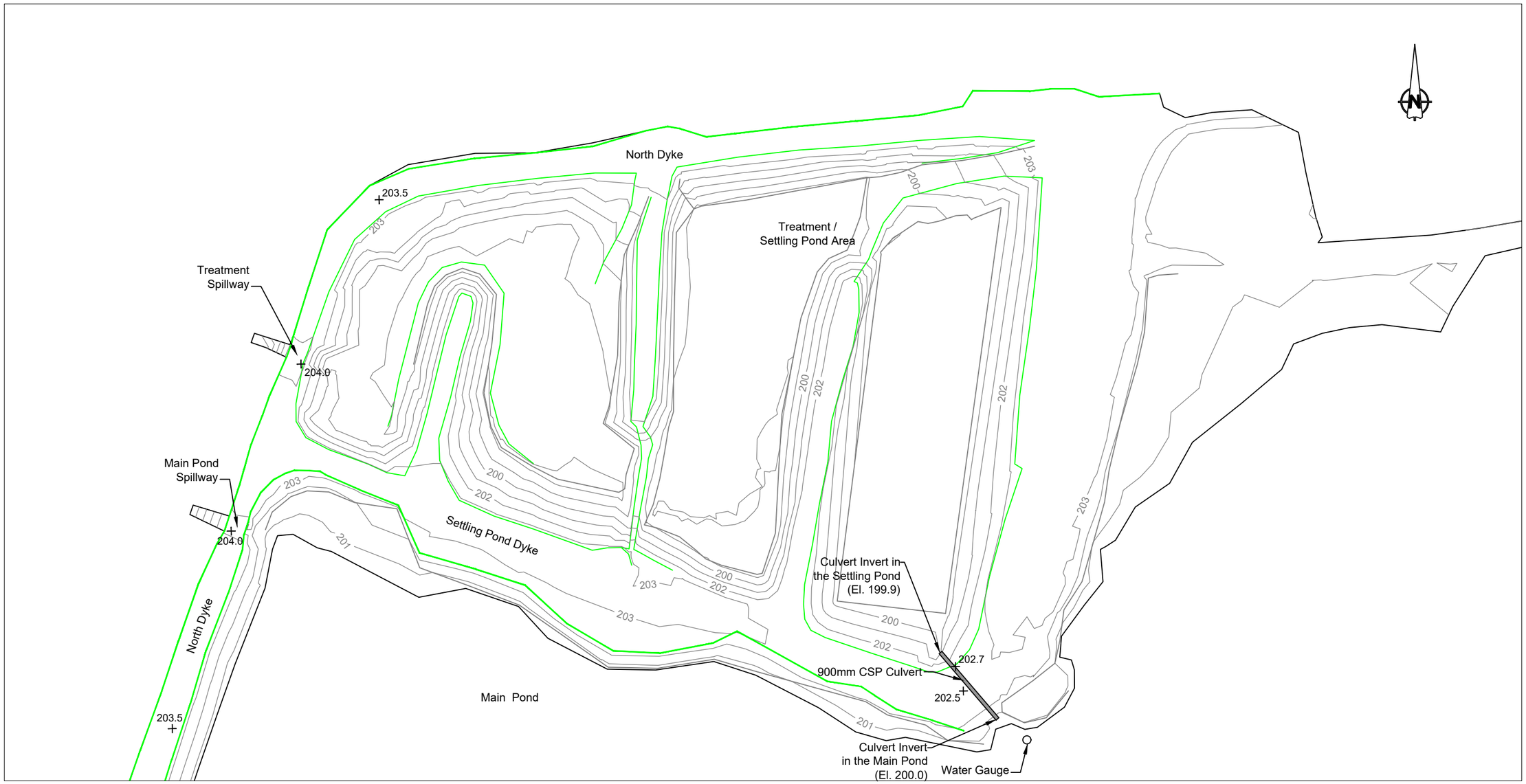
FILE NAME: PinePoint_2017_WL_renewal_Figure_2_6_7.dwg

PINE POINT, NT

DATE:	APPROVED:	FIGURE:
May 2017	AL	4

\\SSK-SVR03.ssk.na.srk.ad\Saskatoon Projects\01_SITES\Pine Point\1CT008.064_Phase_2_WL_Renewal\040_AutoCAD\PinePoint_2017_WL_renewal_Figure_2_6_7.dwg

Attachment 5 – Settling Pond Plan View



SETTLING POND PLAN VIEW

0 10 20 30 40 50

Scale in Metres

NOTE

Contour interval 1m.

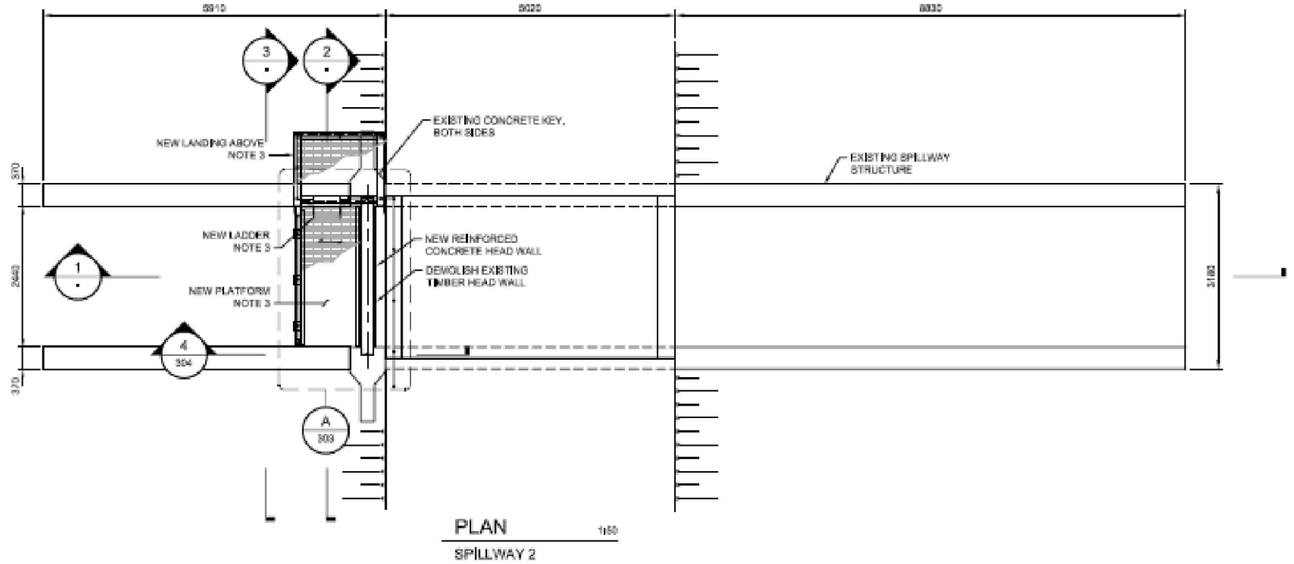
REFERENCE

1. Base drawings provided by Teck Cominco
2. Base Drawings by Maskwa Engineering Ltd.
   October 2007, "Teck Cominco Tailings Containment Dyke Slope Repair".
   December 2008, " Pine Point Tailings Impoundment Area 2008 Slope Repair"

srk consulting	Teck	MV2006L2-0013 Application for Water Licence Renewal
SRK JOB NO.: 1CT008.064 FILE NAME: PinePoint_2017_WL_renewal_Figure_3_4_8.dwg	PINE POINT, NT	Settling Pond Plan View DATE: May 2017 | APPROVED: AL | FIGURE: 5

\\SSK-SVR2.ask.ca.srk.ad\Saskatoon Projects\01_SITES\Pine Point\1CT008.064_Phase_2_WL_Renewal\1040_AutoCAD\PinePoint_2017_WL_renewal_Figure_3_4_8.dwg

Attachment 6 – Details of Upgraded Spillways

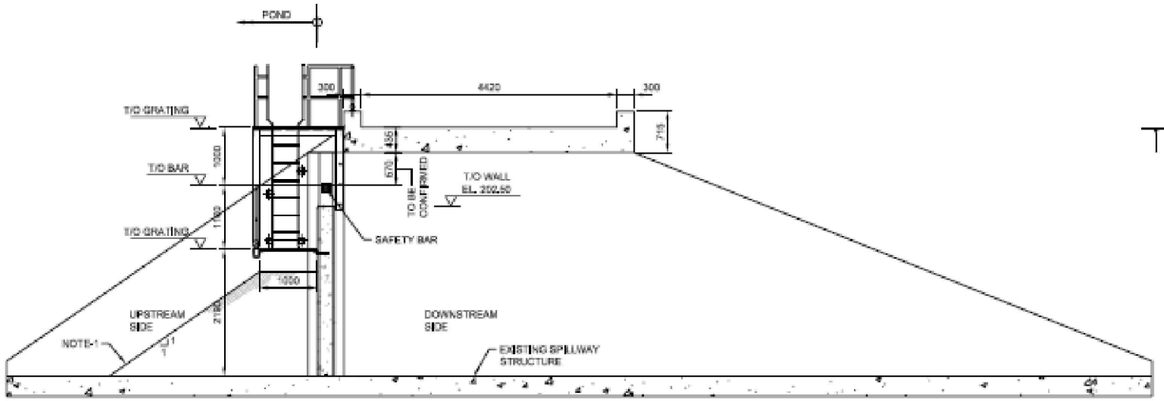


PLAN 1:50

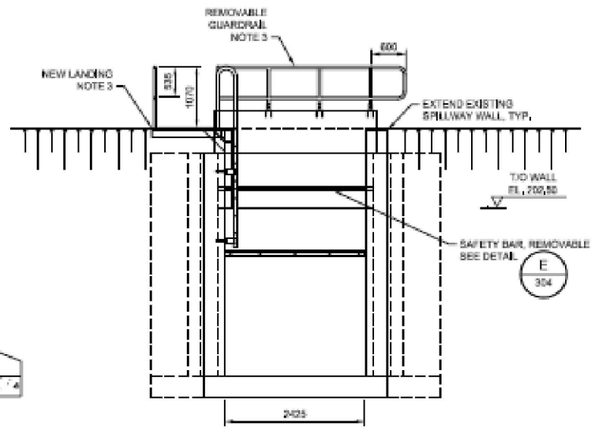
SPILLWAY 2

NOTES:

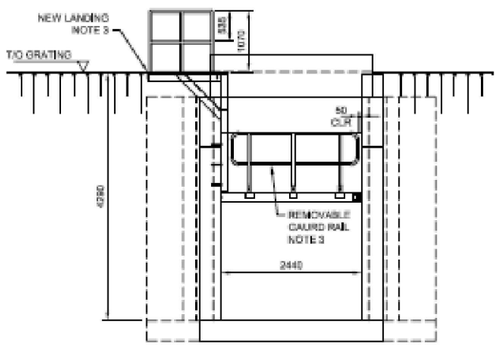
1. CLAY BUFFER AS APPROVED BY OWNER & ENGINEER. TO BE PLACED AFTER 28 DAYS OF CONCRETE CASTING.
2. DIMENSIONS ARE BASED ON RECORD DRAWINGS PROVIDED BY OWNER.
3. WALKWAY, GUARDRAILS AND LADDERS ONLY REQUIRED FOR SPILLWAY AT SERPENTINE CHANNEL DIKE. THESE ITEMS NOT REQUIRED FOR THE MAIN POND SPILLWAY.



1 SECTION 1:20



2 SECTION 1:50



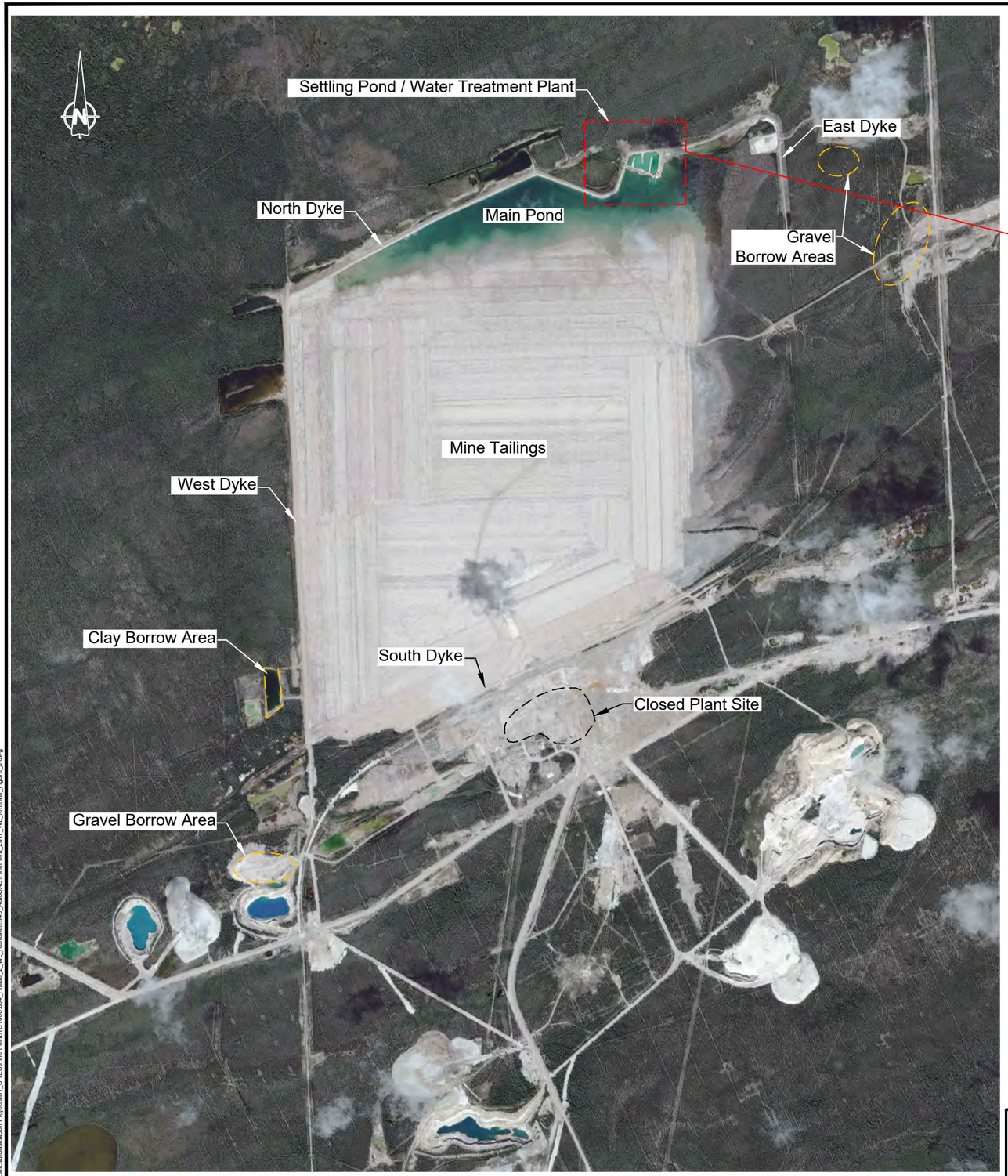
3 SECTION 1:50

REFERENCE

The as-built details of the upgraded spillways were provided to Teck by Associated Engineer in 2014

srk consulting	Teck	MV2006L2-0013 Application for Water Licence Renewal
SRK JOB NO.: 1CT008.064 FILE NAME: PinePoint_2017_WL_renewal_Figure_3_4_8.dwg	PINE POINT, NT	Details of Upgraded Spillways
		DATE: May 2017 | APPROVED: AL | FIGURE: 6

Attachment 7 – Aerial Photos of Tailings Impoundment Area



0 200 400 600 800 1000
Scale in Metres

Site Overview

Settling Pond/Water Treatment Plant

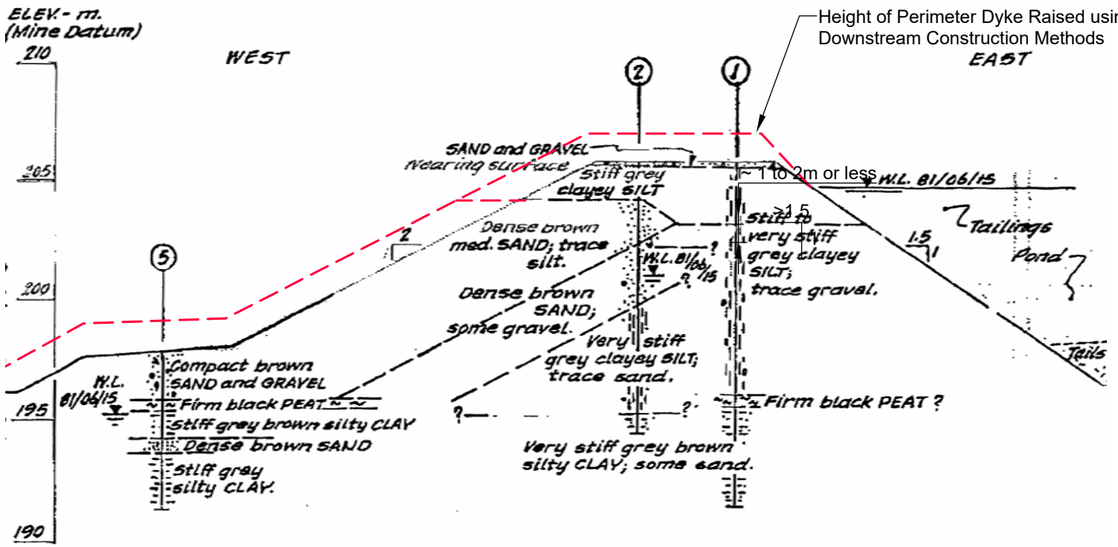
0 30 60 90 120 150
Scale in Metres

REFERENCE

Orthophoto provided by Teck-Cominco.
Orthophoto date July 2006.

srk consulting	Teck	MV2006L2-0013 Application for Water Licence Renewal
SRK JOB NO.: 1CT008.064 FILE NAME: PinePoint_2017_WL_renewal_Figure_5.dwg	PINE POINT, NT	Aerial Photos of Tailings Impoundment Area
		DATE: May 2017 · APPROVED: AL · FIGURE: 7

Attachment 8 – West Dyke Sections

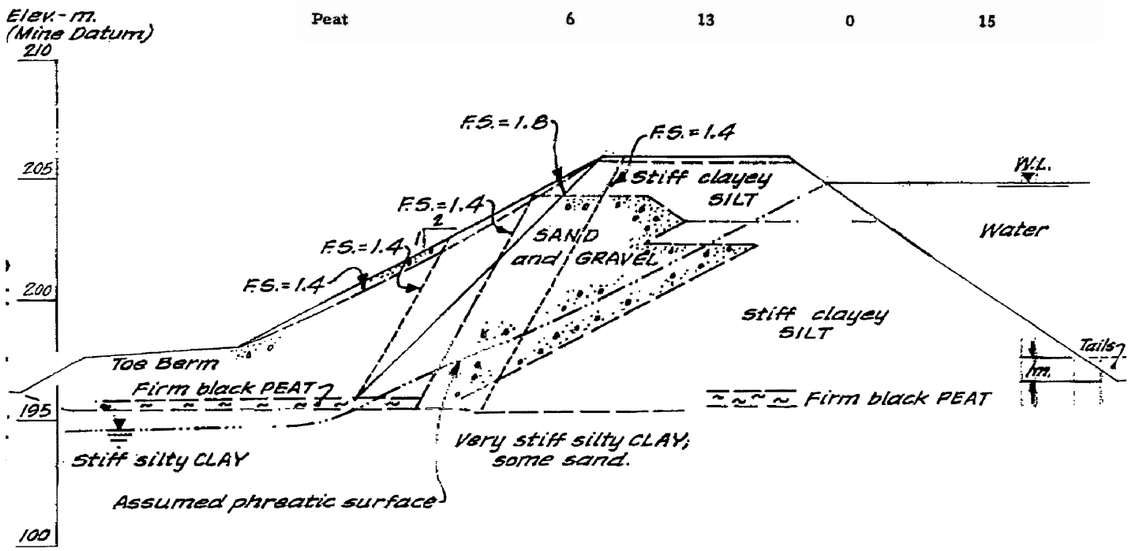


SECTION A-A'
Station 35+40 - West Dyke

SCALE 1:250

LEGEND:
(5) Location o

NOTES:
1. For location of Section, see Fig. 2.
2. Section partially inferred from construction records.
3. Black peat removed from under toe berm of west dyke south of Sta. 35+00.



SECTION A-A'
Station 35+40 - West Dyke

SCALE 1:250

NOTE:
1.) Failure planes assumed to pass along the peat layer.
2.) Factor of Safety increases in area of 1981 construction as peat removed from under downstream toe berm.

Soil Parameters Used in Stability Analysis

Material	Unit Weights Moist kN/m³	Unit Weights Saturated kN/m³	Effective Strength Parameters Cohesion (c) kN/m²	Effective Strength Parameters Friction Angle (Degrees)
Tailings Slimes		16	0	0
Original Dyke (pre 1976)	20	22	14	32
Foundation				
a) Stiff silty clay	20	22	24	18
b) Sand and gravel	20	22	0	35
Dyke Fill				
a) Clayey silt	20	22	7	30
b) Sand and gravel	19	19	0	35
c) Sand	19	19	0	35
Peat	6	13	0	15

STABILITY ANALYSIS
TYPICAL FAILURE PLANES ANALYZED

NOTES

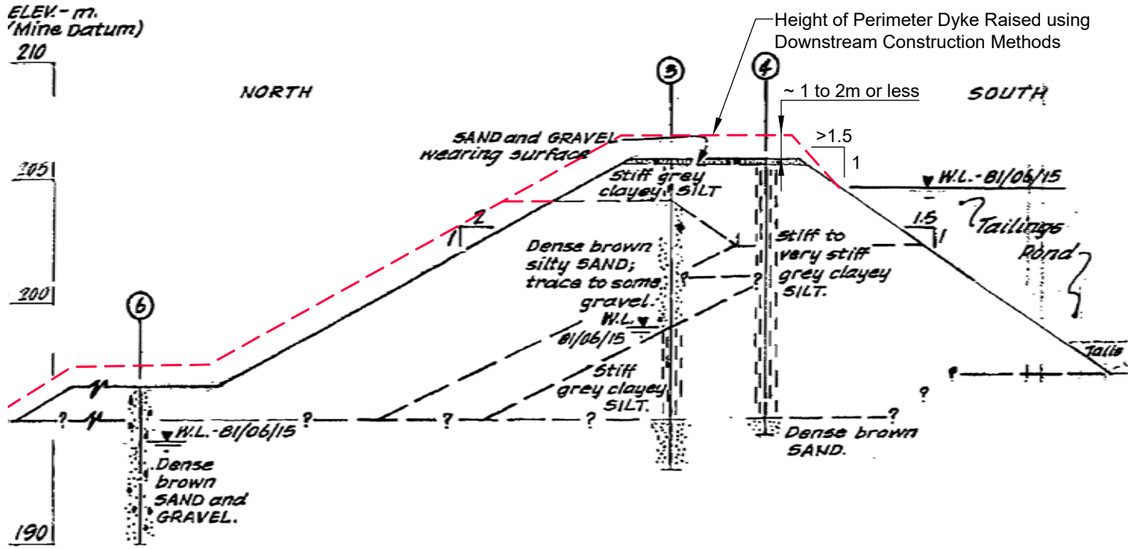
1. Sections are referenced to old mine datum instead of geodetic datum.
2. Height of the perimeter dyke was initially raised in1987 to provide additional tailings storage (dashed red line).
3. No seismic or zero gravitational acceleration modeled.

REFERENCE

Base Sections by Golder Associates, July 1981.

srk consulting	Teck	MV2006L2-0013 Application for Water Licence Renewal
SRK JOB NO.: 1CT008.064 FILE NAME: PinePoint_2017_WL_renewal_Figure_2_6_7.dwg	PINE POINT, NT	West Dyke Sections DATE: May 2017 · APPROVED: AL · FIGURE: 6

Attachment 9 – North Dyke Sections



SECTION B-B'
Station 36+50 - North Dyke

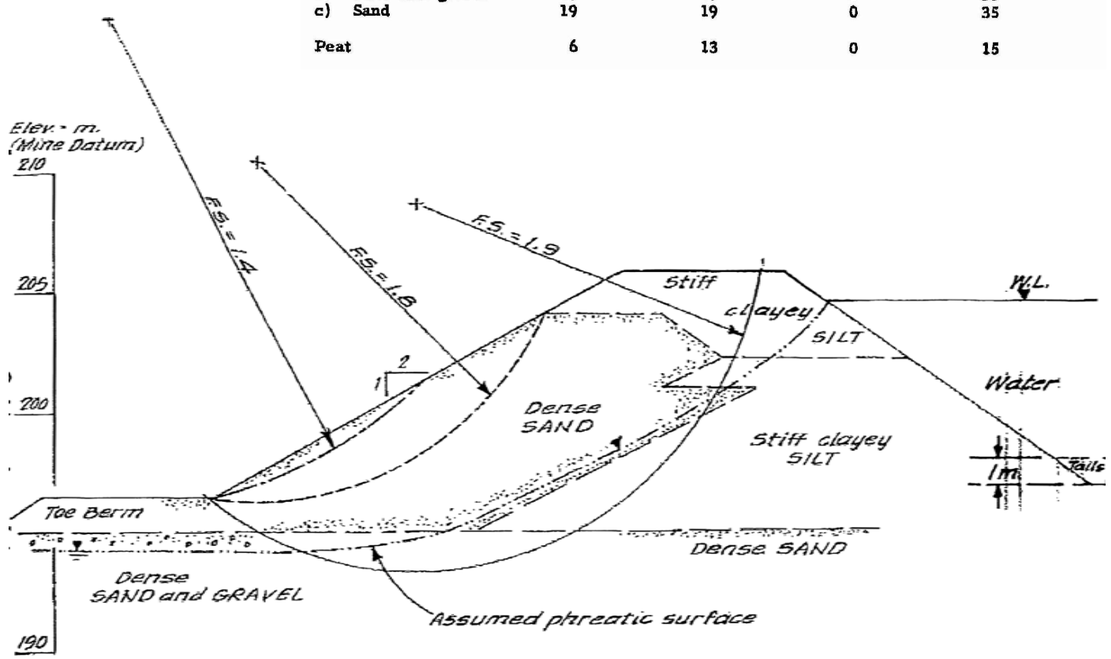
SCALE 1:250

LEGEND:
(6) Location of Borehole.

NOTES:
1) For location of Section, see Fig. 2.
2) Section partially inferred from construction records.

Soil Parameters Used in Stability Analysis

Material	Unit Weights Moist kN/m³	Unit Weights Saturated kN/m³	Effective Strength Parameters Cohesion (c) kN/m²	Effective Strength Parameters Friction Angle (Degrees)
Tailings Slimes		16	0	0
Original Dyke (pre 1976)	20	22	14	32
Foundation				
a) Stiff silty clay	20	22	24	18
b) Sand and gravel	20	22	0	35
Dyke Fill				
a) Clayey silt	20	22	7	30
b) Sand and gravel	19	19	0	35
c) Sand	19	19	0	35
Peat	6	13	0	15



SECTION B-B'
Station 36+50 - North Dyke

SCALE 1:250

STABILITY ANALYSIS
TYPICAL FAILURE PLANES ANALYZED

NOTES

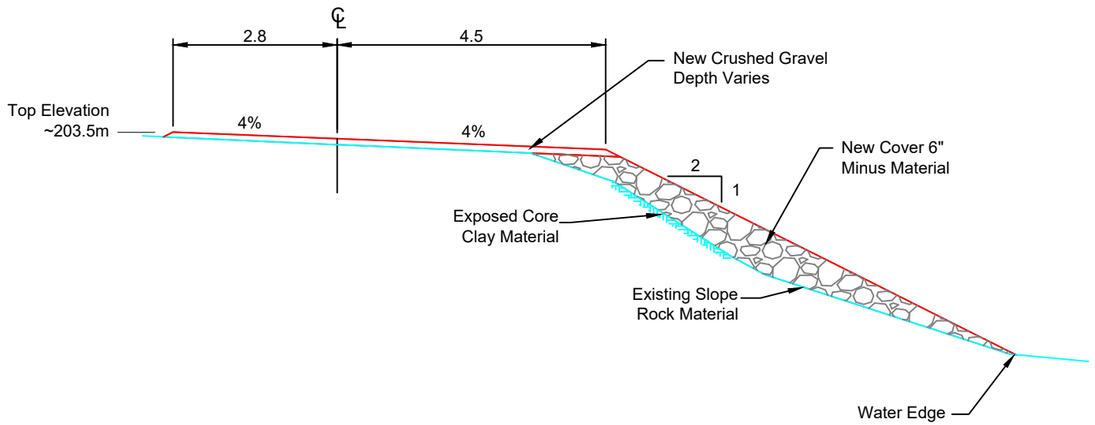
1. Sections are referenced to old mine datum instead of geodetic datum.
2. Height of the perimeter dyke was initially raised in1987 to provide additional tailings storage (dashed red line).
3. No seismic or zero gravitational acceleration modeled.

REFERENCE

Base Sections by Golder Associates, July 1981.

srk consulting	Teck	MV2006L2-0013 Application for Water Licence Renewal
SRK JOB NO.: 1CT008.064 FILE NAME: PinePoint_2017_WL_renewal_Figure_2_6_7.dwg	PINE POINT, NT	North Dyke Sections DATE: May 2017 · APPROVED: AL · FIGURE: 9

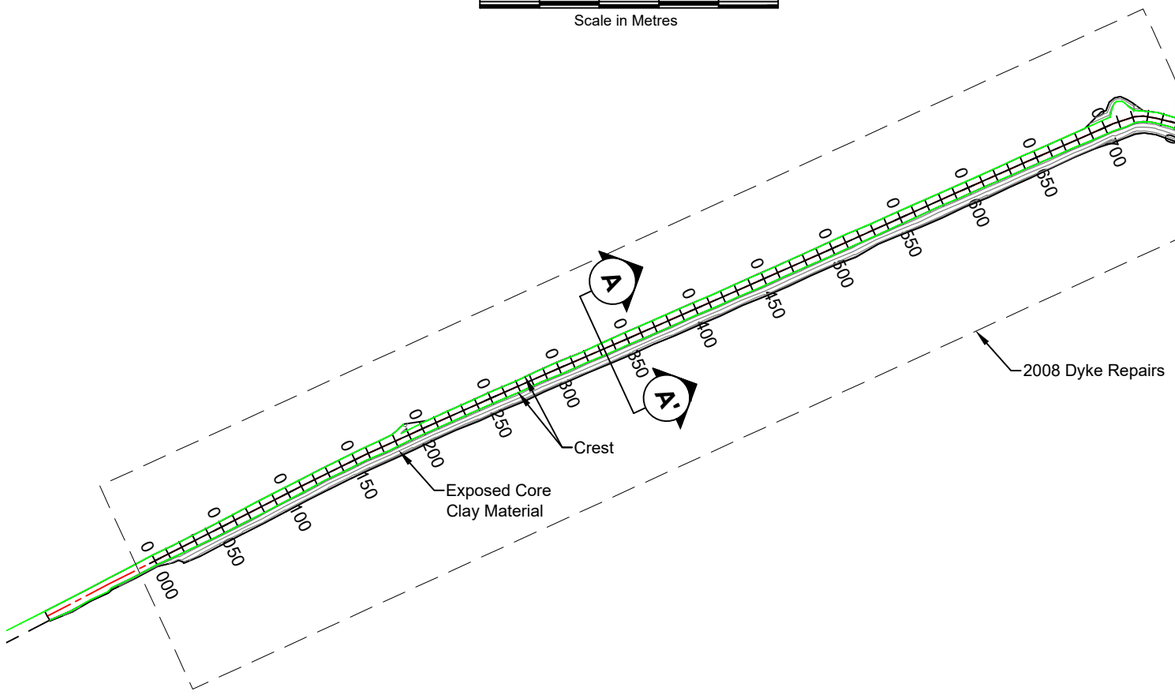
Attachment 10 – Overview of North Tailings Impoundment Area

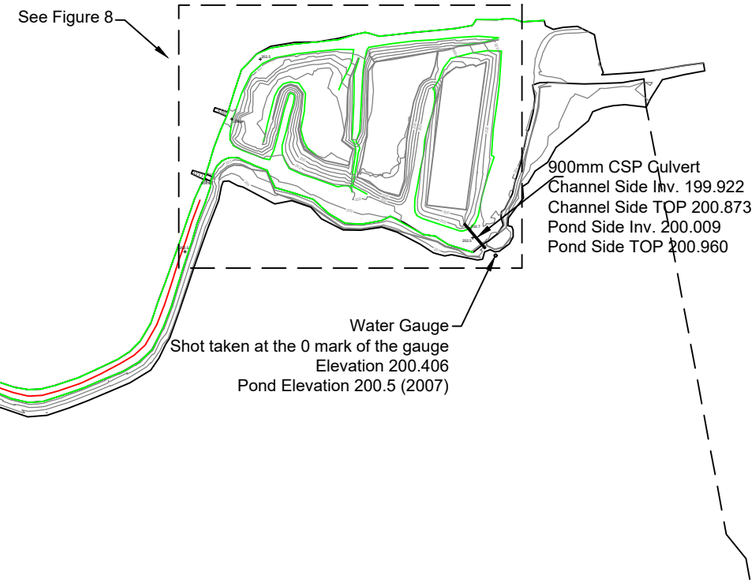


A TYPICAL CROSS SECTION OF DYKE REPAIRS

0 1 2 3 4 5

Scale in Metres





REFERENCE

1. Base drawings provided by Teck Cominco
2. Base Drawings by Maskwa Engineering Ltd.
   December 2008, " Pine Point Tailings Impoundment Area 2008 Slope Repair"

0 40 80 120 160 200

Scale in Metres

srk consulting	Teck	MV2006L2-0013 Application for Water Licence Renewal
SRK JOB NO.: 1CT008.064 FILE NAME: PinePoint_2017_WL_renewal_Figure_3_4_8.dwg	PINE POINT, NT	Overview of North Tailings Impoundment Area
		DATE: May 2017 / APPROVED: AL / FIGURE: 10

Attachment 11 – Closure and Reclamation Plan (Update to Restoration and Abandonment Plan Tailing Impoundment Area December, 2006)

PINE POINT MINE

Closure and Reclamation Plan

(UPDATE TO

RESTORATION AND ABANDONMENT PLAN

TAILING IMPOUNDMENT AREA

DECEMBER, 2006)

teckcominco

1. INTRODUCTION

The Pine Point Mine was a large lead/zinc open pit mining operation located in southern North West Territories approximately 100 km east of Hay River as shown in Figure 1. The deposit was first staked in 1898 by prospectors going to the Klondike to search for gold. Exploration of the site proceeded in stages and it was not until 1961 that agreement to develop of the property was reached. Pine Point Mines (initially 78% owned by Cominco Ltd.) constructed the mine and production started in 1964. The mine operated for over 20 years with all major activity ending in the spring of 1988. During the life of the mine approximately 70 million tons of ore grading 2.9% lead and 6.8% zinc were mined.

In June of 1987, the Restoration and Abandonment Plan was issued and subsequently approved. The plan was implemented immediately upon closure of the mine in 1988. Updates to the plan were issued in 1990 and again in 1991 as reclamation work neared completion. By October 1991 the only outstanding work (other than related to the tailings impoundment facility) was the removal of three large concrete bins, two residential houses, and the dump site to be filled. Subsequently, this work was completed.

To enable the mine to be developed, Pine Point Mines acquired the surface rights from the Crown for the town site area, the areas required for mining and processing facilities, and for the tailing impoundment area. After the mine closed and as reclamation activities were completed in accordance with the Restoration and Abandonment Plan, the surface leases were surrendered back to the Crown (mid to late 1990's). Currently only one surface land lease (#85B/16-9-9) continues to be held by Teck Cominco Metals Ltd. (formerly Cominco Ltd.). This lease encompasses the tailings impoundment area to allow for the on-going management of the tailings facility. As Lease #85B/16-9-9 is the only surface land tenure that Teck Cominco continues to hold at the site, the update to the Restoration and Abandonment Plan is directed to issues associated with this lease area.

2. TAILINGS IMPOUNDMENT AREA

The 1991 update of the Restoration and Abandonment Plan identified two remaining issues to be dealt with in the tailings impoundment area:

1. Effluent quality
2. Long-term stability of dykes and decant structures

The tailings impoundment area covers an area of approximately 2.5 by 2.8 km in plan and contains about 54 million tonnes of tailings. The primary mineral in the tailings is dolomite with lesser amounts of calcite. These minerals are accompanied by low-percentage to trace quantities of pyrite, marcasite, sphalerite, galena, muscovite and quartz. The impoundment is situated to the north of the former millsite on terrain which slopes very gently towards the northwest. The perimeter dyke contains the tailings and pond water extends fully along the north and west side of the disposal area and partially along the higher south and east sides as shown in Figure 2. The pond water originates from precipitation that falls within the tailings impoundment area. The total length of the perimeter dykes is approximately 8.5 km and the maximum height of these dykes is about 11m at the northwest corner of the impoundment. The tailings range in thickness from 14m near the discharge point to 5.3m near the tailings pond at the north end of the impoundment. Prior to 1993, a 150mm nominal thickness of sand and gravel were place over most of the exposed tailings surface to mitigate dust plume generation.

2.1. Effluent Quality

The principle issue with effluent quality is the concentration of dissolved zinc in the pond water. Concentrations of zinc in the tailings pond water exceed the permit levels specified in the Water Licence so that the water must be treated prior to discharge to the environment. The zinc concentration was initially believed to be the result of residual dissolved material created in the acid leach circuit that was used to treat the zinc concentrate while the mill was in operation. The first few years after the mine closed, the concentration of zinc decreased significantly, but this trend did not continue. Subsequently, field investigations of the tailings that confirmed that it was the carbonate minerals in the tailings and not the residual materials from the acid leach circuit that were controlling the zinc concentration in the pore waters. In the past 10 years there has been no apparent trend of either increasing or decreasing zinc concentrations in the tailings pond waters (SRK letter report 'Pine Point Mine – Review of Tailings Discharge Monitoring Data', December 14, 2006). As long as zinc concentrations in the pond water exceed Water Licence permit levels, treatment of the water during the annual discharge period will be required.

The treatment method used is to inject a lime/water mixture into the pond water as it flows into a serpentine settling channel (which is located within the tailings impoundment area). As the water flows through the channel, the pH of the water is increased by the lime and zinc is precipitated out of solution and settles out of the water column. At the end of the settling channel, the water is discharged from the tailings impoundment. The water discharged is compliant with the requirements of the Water Licence for all parameters including metals concentrations, pH, and turbidity.

Prior to 2006, Teck Cominco rented the equipment used to conduct the water treatment process. In 2006 Teck Cominco purchased new equipment for the treatment process to have better control of the equipment being used; to ensure the equipment being used is reliable; and to be able to modify the equipment to refine the treatment process.

Teck Cominco is committed to continue monitoring water quality as required in the Water Licence and will continue to conduct an annual water treatment program until the pond water within the tailings impoundment meets Water Licence criteria and can be discharged without treatment.

2.2. Tailings Impoundment Dyke Stability

Management of the tailings impoundment area will consist of two phases, the first being the on-going management of the facility as long as the pond water requires treatment on an annual basis prior to being released, and the second stage will occur once the pond water is compliant and no longer requires treatment prior to being released.

2.2.1. Prior to Tailings Pond Water Being Compliant for Untreated Discharge

As long as water within the tailings impoundment area exceeds Water Licence permit conditions, the water will continue to be impounded within the facility prior to treatment and discharge. Under these conditions, there is always water stored within the impoundment area which requires that the tailings dykes are maintained in good condition. Currently, the tailings dykes are inspected in the spring after snow melts, during the summer, and again in the fall to verify that they are in good condition. The current Water Licence requires that a formal inspection by a geotechnical engineer is done every second summer to have an expert examination

of the dam condition and to identify potential maintenance requirements to keep the dam in good condition.

Teck Cominco has internal policies regarding the management of tailings facilities that includes:

- The development and regular review of an Operating, Maintenance, and Surveillance (OMS) manual for the facility. This manual is currently under development for this facility by Golder Associates and will be completed prior to the 2007 summer open water season.
- A periodic dam safety review. To conduct a dam safety review, an independent geotechnical engineer reviews the physical conditions of the dyke, the stability design calculations of the dyke, and the adequacy and compliance of the program specified in the OMS manual. A dam safety review is currently underway (by SRK Engineering Consultants) and will be completed in 2007 prior to the summer open water season.

These tools are intended to supplement the geotechnical inspections to ensure that the long-term integrity and safety of the tailings dykes are maintained.

2.2.2. Subsequent to the Tailings Pond Water Becoming Compliant for Untreated Discharge

Once monitoring of the tailings pond waters confirm that water quality is consistently compliant with effluent discharge requirements (without being treated), then the long term, permanent closure of the tailings facility will proceed. Final closure of the tailings facility will include the construction of a permanent spillway through the north dyke to eliminate the pond of water within the tailings impoundment area and to allow rainwater and snowmelt to flow from the impoundment area unimpeded. The final spillway and approaches will be designed to ensure that water does not pond against the dykes and that the spillway is capable of handling major flood events.

During normal operation, tailings impoundment dykes were constructed with a 1.5H to 1.0V upstream slope and a 2.0H to 1.0V downstream slope. In addition, crest widths were maintained between four and six meters to handle large equipment traffic.

Prior to final abandonment, Teck Cominco proposes to ensure long-term stability of the dykes by reducing slope erosion by recontouring the dykes to reduce the slope angle. It is envision that the maximum slopes on the downstream side of the dykes will be reduced to 3.0H to 1.0V. To achieve this, the dykes will be recontoured such that the crests are cut down to a minimum of 0.5 metres from the tailings surface. At this time there will no longer be a pond within the impoundment area. As the dykes will no longer be retaining water the requirement for a 1.0 m freeboard will not be applicable. Reducing the slope gradient of the recontoured dykes will also enhance revegetation of the slopes. This will further increase the long-term stability.

A geotechnical firm experienced in the design of tailings impoundment abandonment will be retained to provide the detailed designs. The designs will be submitted to the Water Board for review and approval prior to implementation at an appropriate future date.

Attachment 12 – Operations and Maintenance Plan (Operation Maintenance and Surveillance Manual for Pine Point Tailings Impoundment Area)

The single most important factor in the prevention of incidents is a positive attitude towards safety. Before any task commences, make it a habit to assess the hazards so they can be mitigated and/or controlled. It only takes one at-risk behaviour to result in a serious incident.

Any employee who is asked to participate in an unfamiliar work process must inform his/her supervisor of such before proceeding. Necessary training will then be provided.

OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL FOR PINE POINT TAILINGS IMPOUNDMENT AREA

The review protocol for the Operation, Maintenance and Surveillance (OMS) Manual is shown in Table A-1.

Table A-1: Operation, Maintenance and Surveillance Manual Review Protocol

	Name	Company	Position	Signature	Date
Prepared by	Bjorn Weeks	Golder Associates Ltd.	Engineer of Record		22-FEB-17
Reviewed by	Dana Haggar	Teck Resources Limited	Site Manager		
Approved by	Kathleen Willman	Teck Resources Limited	Manager Engineering and Remediation		

RECORD OF REVISIONS

The OMS Manual should be reviewed on an annual basis and following any significant changes at the site to assess the validity of the content under the prevailing conditions at the time of the review. Revisions to the manual should be undertaken within a reasonable timeframe (within six months) of changes, should updates to the content be required. The version history of the OMS Manual is shown in Table A-2. The last revision of the OMS Manual supersedes all previous versions.

Table A-2: Operation, Maintenance and Surveillance Manual Revision Summary

Revision Number	Details of Revision	Date of Issue	Comment
2017 Version 0	Updated Document by Golder	22 February 2017	■ Update of consequence class for north and west dykes from low to significant. ■ Freeboard calculation updated to include up rush ■ Climate information from 2009 to 2016 updated. ■ Formatted to comply with Teck Guideline (Teck 2014)
2009 Version 0	Updated Document by Golder	19 March 2009	

Table of Contents

TABLES

PLATES

FIGURES

APPENDICES

1.0 ROLES AND RESPONSIBILITIES

1.1 Formally Assigned

The roles and responsibilities of personnel formally assigned roles in the operation, maintenance, and surveillance of the Pine Point Tailings Impoundment Area (TIA) are defined in Table 1-1.

Table 1-1: Individuals Responsible

Role	Name	Company	Responsibilities	Phone #
Site Manager	Dana Haggar	Teck Resources Limited	complete routine and event-driven/special inspections as outline by surveillance	Office: 1-250-427-8413 Mobile: 250-602-9361
Alternative Contact	Michelle Unger	Teck Resources Limited	contact in the event that site manager cannot be reached	Office: 1-250-427-8422 Mobile: 250-432-5264
Local Consultant	Clell Crook	Maskwa Engineering Limited	assist with routine and event-driven/special maintenance as outlined by maintenance	Office: 1-867-874-2207 Mobile: 867-874-4401
Manager, Engineering and Remediation	Kathleen Willman	Teck Resources Limited	be available for consultation	Office: 1-250-427-8401 Mobile: 1-250-432-9563
Engineer of Record (EoR)	Bjorn Weeks	Golder Associates Ltd.	be available for consultation, complete annual dam safety inspection and submittal, participate in dam safety reviews and risk assessments	Office: 1-604-297-4647 Mobile: 1-604-679-9079

1.2 Organization Chart

An organization chart identifying the individuals indicated in Table 1-1 and their chain of command is presented in Plate 1. Key internal staff (Teck) and external advisors are included.

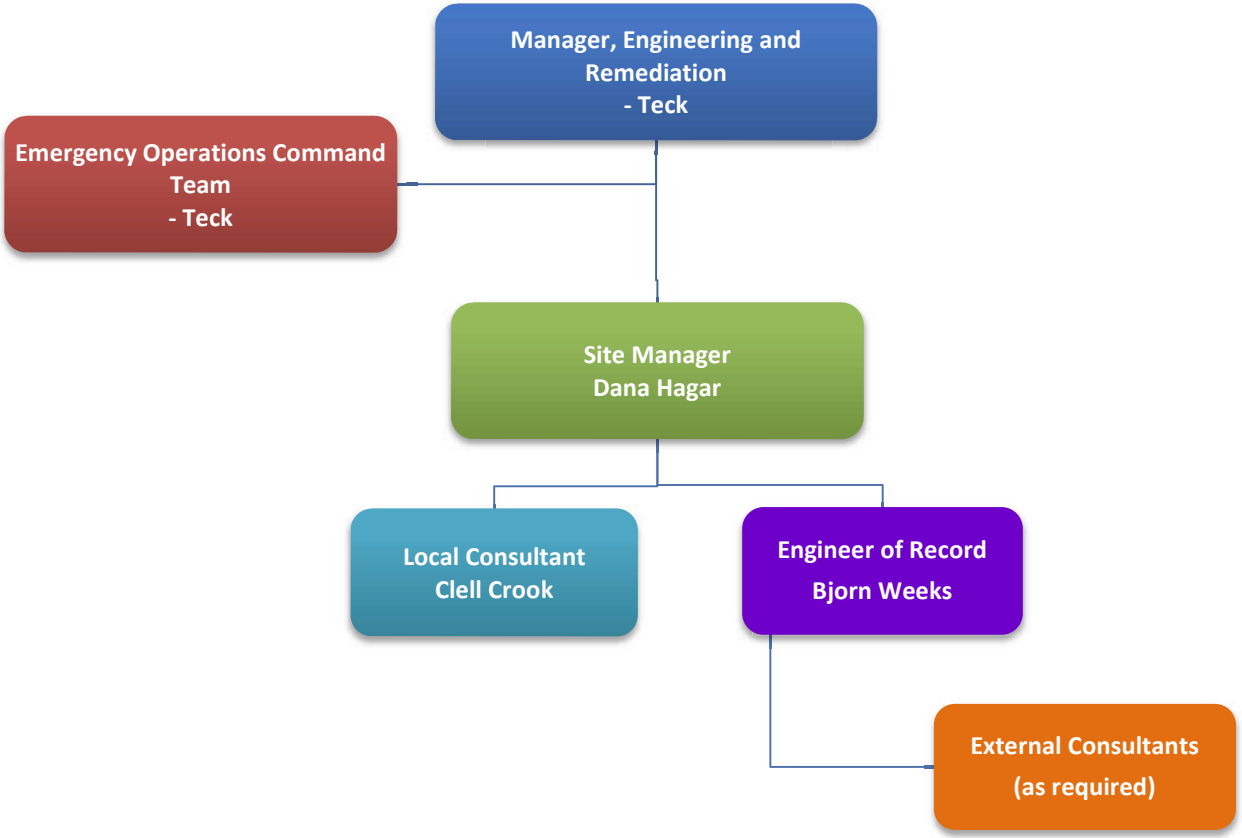


Plate 1: Pine Point TIA Chain of Command

1.3 Responsibilities and Requirements for Competency and Training

Summarizes the minimum knowledge, competency, and training requirements for personnel involved in the operation, maintenance, and surveillance of the Pine Point TIA.

Table 1-2: Required Proficiencies and Training

Roles	Minimum Knowledge and Competency Requirements	Training
Site manager	■ awareness of the responsibilities related to the dykes, their safety, and applicable regulations ■ an understanding of the significance of hazard and risk ■ detailed understanding of Emergency Preparedness and Response Plan (EPRP) in relation to the Pine Point TIA ■ detailed understanding of regulatory requirements for various regulatory bodies in relation to Dam Safety Inspections (DSIs) and Dam Safety Reviews (DSRs)	■ OMS Manual ■ EPRP ■ existing DSI reports ■ existing DSR reports
Caretaker	■ detailed understanding of dam safety regulatory responsibilities ■ detailed understanding of Pine Point TIA operations, maintenance, and surveillance procedures in relation to OMS Manual ■ detailed understanding of EPRP in relation to the Pine Point TIA ■ understanding of dam design principles and construction techniques ■ understanding of abnormal and non-compliance conditions and protocol	■ OMS Manual ■ EPRP
Engineer of Record	■ experience commensurate with the consequence classification and complexity of the facility ■ registration as Professional Engineer in the Northwest Territories ■ detailed understanding of dam safety regulatory responsibilities ■ detailed understanding of design, construction history, as well as applicable standards, criteria, and guidelines	■ OMS Manual ■ EPRP
Teck employees	■ understanding of contents of the OMS Manual ■ knowledge of specific risks as they apply to work areas in and around the pond	■ OMS Manual
Contractors	■ knowledge of specific risks as they apply to work areas in and around the pond	
External consultants	■ experience with specific role relevant to the Pine Point TIA	■ OMS Manual ■ EPRP

OMS = Operation, Maintenance, and Surveillance; EPRP = Emergency Preparedness and Response Plan; DSI = dam safety inspection; DSR = Dam Safety Review; TIA = tailings impoundment area.

1.4 Responsibilities for Managing Change

There are no procedures in place for making changes to the design or operating plans since Pine Point TIA is closed and non-operational.

The OMS Manual and all associated documents shall be kept current with appropriate practices and procedures and, at minimum, be reviewed annually by the required personnel (Table A-1). The site manager will be responsible for ensuring that any changes imposed on the facility or within management are reflected in the OMS Manual, approved, and distributed accordingly.

2.0 FACILITY DESCRIPTION

2.1 Facility Overview

The TIA covers an area approximately 2.5 by 2.8 km in plan, or roughly 700 hectares, and contains approximately 60 million tonnes of zinc-lead tailings. The Pine Point site location is shown in Figure 1. A sketch and plan showing the layout of the TIA are presented in Figure 2. The mine ceased operations in 1988 and the mill buildings and tailings conveyor (trestle) were subsequently dismantled and removed. The only remaining mining installation at the site is the closed TIA.

The TIA is located to the north of the former Pine Point mill site on terrain that slopes gently downward towards the northwest. As a result of this topography the earthfill perimeter dyke system, which retains the tailings and any ponded water, extends fully along the north and west sides of the disposal area, but is required along only a portion of the south and east sides. The facility is described in more detail in Section 2.5, and its construction history is summarized in Section 2.8.

2.1.1 Water and Infrastructure Elevation Benchmarks

A summary of the elevations and benchmarks at the Pine Point ITA are presented in Table 2-1 and Plate 2. These elevations are adopted for determining water management operations at the site.

Table 2-1: Water and Infrastructure Elevations

Levels	Elevation (m)	Comment
Dyke Crest	203.5	Minimum crest elevation on the dyke.
Top of Spillway	202.5	Top and bottom of the concrete wall spillway at the outlet of the polishing pond.
Base of Spillway	199.2	
Culvert Invert Level in Main Pond	200.0	Culvert levels on the Main and Polishing Pond sides of the culvert.
Culvert Invert Level in Polishing Pond	199.9	
Alert Water Level	201.6	The site manager should be informed immediately, and water treatment should start as early as practicable. A site inspection should take place two weeks after the initial alert level was observation.
Maximum Operating Water Level	201.8	The maximum operating pond elevation. Actions to reduce the water level within the pond should commence as a matter of urgency.

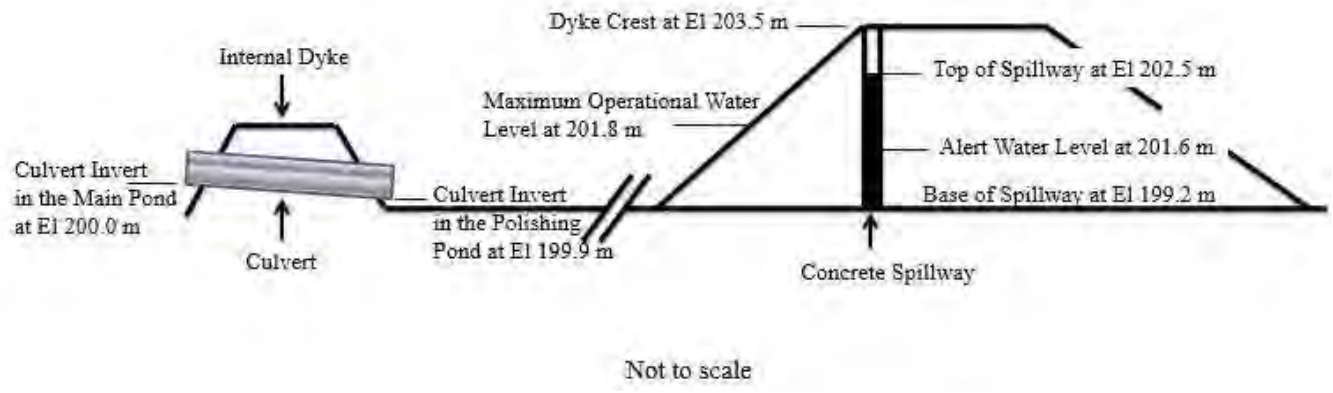


Plate 2: Water and Infrastructure Elevations

2.2 Regulatory Requirements

Applicable codes, guidelines, and regulations governing the Pine Point TIA are listed below:

- Canadian Dam Association (CDA) Dam Safety Guidelines (CDA 2013).
- Application of Dam Safety Guidelines to Mining Dams bulletins (CDA 2014).
- Mining Association of Canada Guidelines (MAC 2011).
- The Type B Water Licence (MV2006L2-0013) issued to Teck Cominco for the Pine Point site by the Mackenzie Valley Land and Water Board (MVLWB 2007) is valid from 29 October 2007 to 28 October 2017. In April, Teck Cominco changed its names to Teck Resources Ltd. (Teck). A copy of this licence is presented in Appendix D.

2.3 Site Reference Data

2.3.1 Grid System and Maps

Pine Point uses UTM NAD 83 Zone 11 map grid. Figure 1 shows the site location map in UTM coordinate system.

2.3.2 Weather

Measurements of temperature, precipitation, snow on the ground, and wind are available from weather stations in the vicinity of Pine Point (Table 2-2). Measurements of temperature and precipitation are also available at Pine Point sporadically from 1953 to 1954 and 1965, and then on a more consistent basis during mining operations from 1975 to 1988. Lake evaporation estimates are sporadically available for Yellowknife (1966 to 1996) and Fort Smith (1966 to 2003), as well as on a continual basis for Pocket Lake from 1994 to 2007 (DIAND 2007).

Table 2-2: Regional Weather Stations

Name[a]	Environment Canada Station Number	Latitude	Longitude	Elevation[c] (m)	Approximate Distance from Site (km)	Period of Record Employed
Pine Point	2203101	60.87° N	114.37° W	224	0	1953 to 1954, 1965, 1975 to 1988
Hay River	2202400	60.84° N	115.78° W	165	75	1953 to 2016
Fort Resolution	2202000	61.18° N	113.69° W	160	50	1953 to 2016
Fort Smith	2202196	60.00° N	111.93° W	183	170	1953 to 2016
Pocket Lake[2(b)]	NA	62.50° N	114.38° W	NA	180	1994 to 2007
Yellowknife[2(c)]	2204100	62.47° N	114.45° W	206	180	1966 to 1996

Notes:

(a) See Figure 1 for the location of the stations. Pocket Lake is immediately east of Yellowknife.

(b) Pocket Lake and Yellowknife stations are used only to describe evaporation. Pocket Lake station is operated by the Department of Indian and Northern Development (DIAND 2007).

(c) Approximate elevation of site is 200.0 m.

NA = not available.

Climate measurements at Pine Point correlate well with measurements from the Hay River, Fort Resolution, and Fort Smith weather stations. These stations are affected by the same climatic patterns as Pine Point but have different absolute values due to the distance between sites. A summary of the correlations are presented in Table 2-3 for coinciding observations from different stations on a monthly basis. The square of the correlation coefficients (R^2 values) for temperature are approximately equal to 1. Correlations for rainfall, snowfall, and snow on the ground between Pine Point and the other stations are considered satisfactory for establishing long term data series trends.

Table 2-3: Squared Correlation between Regional Weather Stations

Variable	Squared Correlation between Pine Point and:		
	Hay River	Fort Resolution	Fort Smith
Monthly mean temperature	0.995	0.994	0.994
Monthly rainfall	0.761	0.671	0.581
Monthly snowfall	0.615	0.558	0.554
Monthly snow on the ground	0.494	0.790[a]	0.465

(a) Only three months of coinciding data were available to assess the correlation between stations.

Continuous, long-term time series for temperature and precipitation were estimated for Pine Point based on the available data. These data have been used in the water balance and flood modelling to assist with surface water management of the facility. Data from Pine Point have been used, where available, with data gaps filled with adjusted regional weather station data. Data from Hay River were used preferentially, due to the higher correlation coefficient values with Pine Point. Where Hay River data were not available, data from Fort Resolution and Fort Smith, respectively, were used as secondary and tertiary data sources to complete the data series.

Data from nearby stations, used to fill data gaps, were adjusted based on the differences between coinciding data for Pine Point and the regional weather stations. A constant value was added to regional temperature data, while a weighting factor was applied to regional rainfall and snowfall data (Table 2-4). Precipitation values were also adjusted for "under-catch" factors, which account for:

- wind under-catch and evaporation based on the type of rain gauge used
- gauge-specific wetting losses for individual rain events
- snowfall based on ruler measurements for the period of record to minimize potential discontinuities associated with the introduction of the shielded Nipher snow gauge in the mid-1960s
- snow density corrections based on concurrent ruler and Nipher snow measurements
- quantification of trace snowfall events

Assessments of meteorological records in the Canadian north (Metcalfe et al. 1993) concluded that precipitation amounts are underestimated due to these under-catch factors. Adjustments for the correction of precipitation amounts were proposed by Mekis and Hogg (1999) and applied to northern weather stations. Table 2-4 lists the under-catch factors applied to the weather stations.

Table 2-4: Adjustments to Climate Data

Station	Constant Adjustment on Temperature	Rainfall		Snowfall	
		Weighing Factor	Under-Catch Factor	Weighing Factor	Under-Catch Factor
Pine Point	0.00	1.00	1.12	1.00	1.31
Hay River	+0.02	1.06	1.12	1.82	1.31
Fort Resolution	-0.78	0.80	1.10	0.94	1.13
Fort Smith	-0.12	1.03	1.30	1.30	1.03

Hay River station has the most complete record of snow on the ground. As such, these observations were used without adjustment to describe this climate variable at Pine Point. Linear interpolation between existing data was used to fill gaps in the record.

Hourly wind observations at Hay River were selected and assessed, as it is the closest of the regional weather stations.

The lake evaporation record was the most complete at Fort Smith, and consequently this station was used as the prime source of data for this climate variable at Pine Point. Gaps in the record were filled with data from Yellowknife station from 1966 to 1996 and from Pocket Lake from 1997 and 2007. A factor of 1.075 was applied to data from Fort Smith and of 0.93 to data from Yellowknife and Pocket Lake (these stations are within 10 km of each other). These factors were needed to account for the observed spatial variability between Fort Smith, Yellowknife and Pine Point.

2.3.3 Subsoil Characteristics

The TIA dykes are founded on glacial deposits. The site geology indicates the TIA dykes are underlain by very stiff silty clay with isolated pockets of gravel. Along parts of the dyke alignment, local pockets of peat were encountered. These were not removed in the initial construction phase, but were removed during subsequent dyke crest raises.

2.3.4 Instrumentation

There is no geotechnical instrumentation (piezometers, inclinometers or settlement gauges) in the dykes at the Pine Point TIA. The only monitoring device is a water level gauge at the culvert from the north dyke to the polishing pond.

2.3.5 Surface Water Sampling

A Type B Water Licence was issued by MVLWB to Teck for the Pine Point site (licence number MV2006L2-0013, Appendix D). The licence details a water sampling program (i.e., Surveillance Network Program) that must be implemented for the monitoring of water quality parameter concentrations in the TIA, discharges from the TIA, and at selected locations in the receiving aquatic environment. This sampling program is applicable to both the regulatory requirement of the water licence and the operation, maintenance and surveillance program for the TIA. Data are managed by Teck and submitted as part of the annual report by 31 March of every year to MVLWB.

2.4 Site Conditions

2.4.1 Topography

The TIA is located to the north of the former Pine Point mill site on terrain which slopes downward towards the northwest. The terrain slopes gently for about 13 km towards Great Slave Lake from an approximate elevation of 230 m at the former mill site to an approximate lake elevation of 160 m. Topographic maps (85B15 and 85B16) indicate that the region around the site can be characterized as low gradient terrain.

2.4.2 Geology

The site is situated in a region that lies between the Cordilleran Orogen to the west and the Precambrian Shield to the east and consists of sedimentary strata. Ordovician to Devonian sediments overlay Archean crystalline rocks and Proterozoic sediments (Giroux 2001). Surficial material is composed of a layer of glacial till, gravel, sand, and clay (Fulton 1989; Giroux 2001).

2.4.3 Vegetation and Wildlife

The vegetation in the region is typical of the Taiga Plains Ecozone (Great Slave Lake Plain), where the land cover is composed predominately of wetlands and bog-fen vegetation such as dwarf black spruce, Labrador tea, ericaceous shrubs, and mosses (EC 2005). Jack pine and willows were also observed in the region of the site (Giroux 2001).

Moose, black bear, and deer are rarely observed in the region. The site is south of caribou migration routes and northwest of wood buffalo habitats (Giroux 2001).

2.4.4 Temperature

The long-term monthly temperature range adopted for the site is presented in Table 2-5. July and January are the warmest and coldest months, with mean temperatures of 16.2°C and -23.4°C respectively. Mean monthly temperatures below 0°C are consistently observed from October to April.

Table 2-5: Monthly Temperature Means, Minimums and Maximums

Month	Monthly Minimum (°C)	Monthly Mean (°C)	Monthly Maximum (°C)
January	-28.1	-23.4	-18.7
February	-25.5	-20.0	-14.3
March	-20.3	-14.2	-7.9
April	-8.4	-2.8	3.0
May	0.9	6.4	11.9
June	7.4	13.1	18.7
July	10.9	16.2	21.4
August	8.8	14.0	19.1
September	3.3	7.9	12.5
October	-4.2	-0.4	3.3
November	-16.7	-12.7	-8.6
December	-24.4	-19.9	-15.4
Annual	-28.1	-2.9	21.4

Note: Values derived from site data from 1953 to 2016, with data gaps filled with data from regional weather stations (Hay River, Fort Resolution, and Fort Smith).

2.4.5 Precipitation and Snow on the Ground

The monthly precipitation and snow on the ground averages are presented in Table 2-6. The total average amount of precipitation calculated for the site is 565.0 mm, of which 59% is snowfall (333.2 mm as equivalent rainfall) and 41% is rainfall (231.8 mm). The total average effective precipitation is 461.7 mm, once snow cover loss, due to sublimation and wind redistribution, is accounted for. The snow cover loss at Pine Point (103.3 mm as equivalent rainfall) is estimated to be approximately 31% of the total average snowfall (333.2 mm), which is within the range observed in the Canadian northern regions (Marsh et al. 1994; Pomeroy et al. 1997). The maximum amount of snow on the ground occurs in March and is estimated to be 477.0 mm (as snow). Snowfalls are consistently expected from October to April, and are present in smaller amounts in May, June, and September.

Table 2-6: Monthly Precipitation and Snow on the Ground Averages

Month	Rainfall (mm)	Snowfall (Water Equivalent, mm)[a]		Total Precipitation (mm)[b]		Snow on the Ground (mm)[c]
		Exclusive of Snow Loss[b]	Inclusive of Snow Loss[b]	Exclusive of Snow Loss[b]	Inclusive of Snow Loss[b]	
January	0.2	47.2	32.6	47.4	32.8	401.0
February	0.1	38.7	26.7	38.8	26.8	472.0
March	0.2	37.4	25.8	37.7	26.1	477.0
April	4.1	23.9	16.5	28.0	20.6	213.0
May	21.5	7.6	5.2	29.1	26.7	9.0
June	32.0	0.2	0.1	32.2	32.2	0.0
July	55.4	0.0	0.0	55.4	55.4	0.0
August	59.3	0.0	0.0	59.3	59.3	0.0
September	43.8	4.1	2.8	47.9	46.6	1.0
October	13.7	43.6	30.1	57.3	43.8	33.0
November	0.9	79.2	54.6	80.1	55.5	171.0
December	0.7	51.3	35.4	51.9	36.0	297.0
Annual[d, e]	231.8	333.2	229.9	565.0	461.7	477.0

(a) The water equivalent of snow assumed based on a relative density of 10% for snowfall.

(b) Snow loss accounts for the depletion of snowfall due to sublimation and snow redistribution.

(c) Snow on the ground observations at Hay River available from 1955 to 2016. The values in the table reflect the amount of snow on the ground at the end of the month (as mm of snow).

(d) The annual value for rainfall, snowfall, and total precipitation are the cumulative for of all the months. The annual value for snow on the ground is the maximum monthly mean.

(e) Annual values do not sum exactly due to rounding.

2.4.6 Wind

The average yearly maximum hourly wind in all principal directions, from 1953 to 2016, is presented in Table 2-7. Hourly wind observations at Hay River were used in the assessment of possible wave heights within the TIA, as this was the station closest to Pine Point with the required data.

Table 2-7: Average Yearly Maximum Hourly Wind in All Principal Directions

Direction [(a)]	Wind Speed [(b)] (km/h)
North	42.0
Northeast	37.7
East	37.0
Southeast	36.1
South	39.8
Southwest	38.2
West	44.7
Northwest	50.6

(a) The wind direction indicates the direction from which the wind is blowing.

(b) Values based on data from Hay River from 1953 to 2016.

2.4.7 Evaporation

The average total annual lake evaporation is estimated to be 524 mm. Evaporation occurs from May to September, and the estimated average lake evaporation for these months is presented in Table 2-8. The evaporation values are based on data from 1966 to 2007, and were derived for Pine Point based on data from the surrounding regional weather stations.

Table 2-8: Estimated Average Monthly Lake Evaporation

Month	Monthly Evaporation (mm)	Percentage of Total Evaporation (%)
May	110	21
June	132	25
July	132	25
August	100	19
September	50	10
Total	524	100

Note: Values derived from climate parameters measured at regional weather stations (Fort Smith, Yellowknife, and Pocket Lake).

2.4.8 Permafrost

Pine Point falls within the discontinuous sporadic permafrost zone (Johnston 1981; Heginbottom 1989). Permafrost exists where the ground is at or below 0°C for at least two years continuously. Discontinuous permafrost results when permafrost is present only in certain areas and covers less than 90% of the ground area. Less than 50% coverage of permafrost is called discontinuous sporadic permafrost (NRCC 1988). Site-specific data on the presence or extent of permafrost within the TIA or under the dykes are not available.

2.4.9 Seismicity

According to the 2010 National Building Code of Canada seismic hazard calculator (NRC 2011), peak ground acceleration (PGA) for the Pine Point site is:

- 0.019 g for the 1-in-1,000-year event (5% probability of exceedance in 50 years)
- 0.036 g for the 1-in-2,475-year event (2% probability of exceedance in 50 years)

Seismic hazard in the region of Pine Point mine is ranked as low (NRC 2008).

It is understood that major Precambrian faults run along the East Arm of Great Slave Lake and controlled the distribution of ore bodies which facilitated the discovery of lead-zinc deposits at Pine Point. These lines of weakness in the bedrock, where karstification, dolomitization, and mineralization occurred, are called the Precambrian McDonald–Great Slave Lake fault system (Hannigan 2008).

2.5 Facility Components

2.5.1 Access Roads

The Pine Point property is approximately 800 km north of Edmonton, Alberta, and approximately 10 km south of Great Slave Lake. Access to the site from Hay River is via a 90 km paved road, which is on Crown land. The old haul roads on site mostly remain serviceable and are accessible using light vehicles, skidoos, tractors, and other all-terrain vehicles (Giroux 2001).

2.5.2 Tailings Impoundment Area

The TIA covers an area approximately 2.5 by 2.8 km in plan, or roughly 700 hectares, and contains about 60 million tonnes of zinc-lead tailings. A sketch and plan showing the layout of the TIA are presented in Figure 2.

The TIA is located to the north of the former Pine Point mill site on terrain that slopes gently downward towards the northwest. As a result of this topography the earthfill perimeter dyke system, which retains the tailings and any ponded water, extends fully along the north and west sides of the disposal area, but is required along only a portion of the south and east sides.

The main pond, where surface water runoff accumulates at present, covers the north end of the TIA and its extent varies depending on water elevation.

2.5.3 Dykes

The total length of the dyke system is approximately 8.5 km with a maximum height of approximately 15 m at the northwest corner. The south dyke varies in height from 0 m at the southeast corner of the TIA to 4 m at the southwest corner. The west dyke connects to the south dyke and has a maximum height at the northwest corner of the TIA of 15 m. The north dyke extends from the west dyke to the east dyke, and includes the perimeter dyke enclosing the polishing pond. The north dyke varies from 15 m in height at the connection with the west dyke to 1.0 m in height at the northeast corner of the TIA.

The 1.0 m dyke height continues on the east dyke until the natural ground surface rises above the dyke crest elevation. The east dyke is approximately 200 m long.

Ponded water is typically present on the north side of the TIA, with the pond in contact with the north dyke. Typical sections of the west and north dykes are shown in Figures 3 and 4 respectively. The dam classifications of the dykes are summarized in Section 2.7.1.

A culvert, through the north dyke, connects the main pond and the polishing pond, which is located on the north side of the impoundment. The culvert is fitted with a gate valve which can be used to control the flow from the main pond to the polishing pond.

2.5.4 Polishing Pond

The polishing pond is enclosed by the north dyke and an internal dyke within the TIA, and is used to treat contact water prior to release to the environment. The water exits the facility, after treatment, via a spillway. The spillway consists of a concrete culvert with an internal concrete wall, which acts as a weir to control the elevation at which water exits the facility. Syphons are also situated in the spillway to facilitate the removal of treated water from the polishing pond but are not typically active at other times.

2.6 Regulatory Compliance Points

The Pine Point mine is permitted under Type B Water Licence MV2006L2-0013, a copy of which is presented in Appendix D, which was issued to Teck Cominco by MVLWB (2007). As a requirement of Water Licence MV2006L2-0013, an annual report must be submitted by March 31 of each year. The annual report must include all of the data and information required by the Surveillance Network Program described in the water licence (Section 4.0).

The CDA (2013) Dam Safety Guidelines recommends that a Dam Safety Review (DSR) be conducted once every 10 years for embankments/dykes with a “Significant” dam classification, such as the west and north TIA dykes (Section 2.7.1). The last DSR was conducted in 2010 and included the south, west, and north dykes (SRK 2010).

The next DSR for these dykes should therefore be scheduled for 2020.

2.7 Basis of Design and Design Criteria

2.7.1 Dam Consequence Classification

The TIA is considered to be in the Closure–Active Care phase of mine life (Golder 2016), based on regular monitoring of the dykes and regular treatment and release of water from the facility. The design criteria for the dam therefore follow the CDA (2013) dam classification (Table 2-9).

Table 2-9: Dam Classification in Terms of Consequences of Failure

Dam Class	Population at Risk[a]	Incremental Losses		
		Loss of Life [b]	Environmental and Cultural Values	Infrastructure and Economics
Low	none	0	minimal short term loss; no long term loss	low economic losses; area contains limited infrastructure or service
Significant	temporary only	unspecified	no significant loss or deterioration of fish or wildlife habitat; loss of marginal habitat only; restoration or compensation in kind highly possible	losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	permanent	10 or fewer	significant loss or deterioration of important fish or wildlife habitat; restoration or compensation in kind highly possible	high economic losses affecting infrastructure, public transport, and commercial facilities
Very High	permanent	100 or fewer	significant loss or deterioration of critical fish or wildlife habitat; restoration or compensation in kind possible but impractical	very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances)
Extreme	permanent	more than 100	major loss of critical fish or wildlife habitat; restoration or compensation in kind impossible	extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances)

Source: CDA (2013), Table 2-1

(a) Definition for population at risk:

None – There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary – People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).

Permanent – The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

(b) Implications for loss of life:

Unspecified – The appropriate level of safety required a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

Should the TIA move to the Closure–Passive Care phase, in which the system is considered stable with no water treatment or management of the pond, such that water may be passively released from the system, the design criteria for the dam should be revised based on recommendations by CDA (2014) and Teck (2014).

The dykes at the site are classified as Low to Significant based on the CDA (2013) guidelines. Only the north dyke retains water at any time. The south and west dykes retain only tailings, while the east dyke does not retain water or tailings (it is required only for freeboard). The criteria for classification are evaluated as follows:

- **Population at risk**—None. There is no known permanent population at risk downstream of the site.
- **Loss of life**—There is no possibility of loss of life other than through unforeseeable misadventure.
- **Environmental and cultural values**—A dyke failure would impact the local environment. There is a possibility of minimal short-term loss or deterioration of wildlife habitat as a result of a failure of the south and east dykes. Failure of the north or west dykes present a higher risk due to the impoundment of water, but failure would not lead to a significant loss or deterioration of important wildlife habitat or areas of cultural significance; restoration or compensation for impacts is considered highly possible.
- **Infrastructure and economics**—None. There is no development or infrastructure downstream of the TIA.

Table 2-10: Dam Failure Consequence Classification for the Tailings Impoundment Area Dykes

Dam	Dam Class	Population at Risk	Consequences of Failure		
			Loss of Life	Environment and Cultural Values	Infrastructure and Economics
North Dyke	Significant	none	low to none	low to significant	low to none
East Dyke	Low	none	low to none	low	low to none
West Dyke	Significant	none	low to none	low to significant	low to none
South Dyke	Low	none	low to none	low	low to none

Note: The class assigned to a dam is the highest rank determined among the four attributes (i.e., population at risk, loss of life, environmental and cultural values, and infrastructure and economics).

2.7.2 Design Criteria

The design criteria related to floods and seismic and static stability based on the CDA (2013) guidelines are summarized in Table 2-11:

Table 2-11: Minimum Design Criteria for Pine Point Dykes

Dykes	Dam Class	Annual Exceedance Probability – Floods	Annual Exceedance Probability – Earthquakes	Factors of Safety			
				Static		Pseudo-static	Post-earthquake
				Long Term	Full or Partial Drawdown		
North and west	Significant	between 1/100 and 1/1,000	between 1/100 and 1/1,000	1.5	1.2 to 1.3	1.0	1.2 to 1.3
South and east	Low	1/100	1/100	1.5	1.2 to 1.3	1.0	1.2 to 1.3

Note: Design criteria based on CDA 2013.

CDA (2013) provides two calculations for freeboard; the most critical of the two cases sets the minimum freeboard to be adopted:

- no overtopping by 95% of the waves caused by the most critical wind with a return period of 1,000 years with the pond at its maximum normal operating elevation; or
- no overtopping by 95% of the waves caused by the most critical wind with a return period of 10 years (for Significant consequence structures), with the pond at the maximum level during the passage of the inflow design flood (IDF)

2.7.3 Flood Design

2.7.3.1 Original Design Intent

The original design documents for the dykes are not available.

2.7.3.2 Existing Conditions and Current Design Status

2.7.3.2.1 Storage Capacity of the Tailings Impoundment Area

The storage capacity of the TIA was derived from a topographic survey conducted in November 2008 (Maskwa 2008a). The topographic survey did not include the northeast corner and as such the derived storage capacity represents a conservative estimate, due to underestimation of the impoundment area. Table 2-12 provides the derived storage capacity as a function of water elevation within the TIA.

The ponding volume in Table 2-12 starts at elevation 200.0 m, which corresponds to the upstream, main pond side of the culvert connecting the main pond to the polishing pond (Maskwa 2008b). The ponding volume stops at elevation 203.5 m which corresponds to the minimum elevation of the north dyke.

Table 2-12: Storage Capacity of the Tailings Impoundment Area

Water Elevation (m)	Pond Volume (m^3)
200.0	0
200.1	24,801
200.2	51,504
200.3	80,109
200.4	110,617
200.5	143,028
200.6	177,341
200.7	213,766
200.8	252,512
200.9	293,580
201.0	336,969
201.1	383,021
201.2	432,078
201.3	484,138
201.4	539,203
201.5	597,271
201.6	658,344
201.7	722,711
201.8	790,660
201.9	862,193
202.0	937,308
202.1	1,016,129
202.2	1,098,777
202.3	1,185,251
202.4	1,275,554
202.5	1,369,683
202.6	1,467,639
202.7	1,569,705
202.8	1,676,162
202.9	1,787,010
203.0	1,902,249
203.1	2,022,129
203.2	2,146,897
203.3	2,276,554
203.4	2,411,099
203.5	2,550,328

2.7.3.2.2 Flood Capacity

This section assesses the capacity of the TIA to operate under the following three scenarios:

- extreme daily rainfall occurring when infiltration is possible due to unfrozen/unsaturated soil conditions (likely from June to October)
- extreme daily rainfall occurring when infiltration is negligible due to frozen/saturated soil conditions (possible from April to May)
- extreme annual total precipitation

Events of extreme annual total precipitation and daily rainfall were estimated based on a frequency analysis using the derived precipitation data for Pine Point from 1953 to 2016. The resulting events for representative return periods are given in Table 2-13.

Table 2-13: Extreme Precipitation Events

Return Period (years)	Extreme Daily Rainfall (mm)	Extreme Annual Total Precipitation (mm)[(a)]
2	31	458
10	53	610
50	74	707
100	84	742
200	94	775
500	107	815
1,000[(b)]	**117**	**844**

(a) The amounts of cumulative snowfall and total precipitation account for the depletion of snowfall due to sublimation and snow redistribution.

(b) Design criteria, inflow design flood.

2.7.3.2.2.1 Extreme Annual Daily Rainfall

Flood routing analyses were completed using the Puls method (Watt et al. 1989), to confirm that the TIA can contain the 1-in-100-year and 1-in-1,000-year flood events. These flood events correspond to the lower and upper bound IDF range recommended by CDA (2013) for dams with Significant consequence classifications. (Table 2-11). Flood routing analyses were completed for the 1-in-100-year and 1-in-1,000-year flood events for both unfrozen/unsaturated and frozen/saturated soil conditions.

The following assumptions were used in the flood routing analyses:

- The water elevation in the TIA at the start of the storm is 201.6 m, which corresponds to the maximum observed water level in the TIA before treatment from 1998 to 2016 (Table 6-2).

- The lowest elevation of the internal dyke separating the main pond in the TIA and the polishing pond is assumed to be 202.5 m.
- The polishing pond spillway is assumed to be a broad-crested weir with a width of 2.44 m (Maskwa 2007) and an elevation of 202.5 m.

The results of the flood routing analyses indicate that the water level in the TIA would reach:

- 202.1 m during a 1-in-100-year storm assuming unfrozen/unsaturated soil conditions
- 202.6 m during a 1-in-100-year storm assuming frozen/saturated soil conditions
- 202.4 m during a 1-in-1,000-year storm assuming unfrozen/unsaturated soil conditions
- 202.8 m during a 1-in-1,000-year storm assuming frozen/saturated soil conditions

The predicted water levels are all below the dyke crest elevation of 203.5 m, which indicates that the flood events recommended by CDA (2013), for dams with Significant consequence classifications (Table 2-11), can be contained when the pre-storm water level in the TIA is equal to or lower than 201.6 m.

The flood routing analyses predicted that the polishing pond would discharge into the environment if the soil was frozen/saturated during a 1-in-100-year and 1-in-1,000-year storm, with water levels above the spillway elevation (202.5 m) but below the dyke crest (203.5). This is considered an acceptable management practice during storm events to prevent overtopping of the dyke.

A “YES” in Table 2-14 and Table 2-15 indicate when discharge is likely to occur during storm events with different return periods, for both unfrozen/unsaturated and frozen/saturated ground conditions, based on the pre-storm water level within the TIA.

A “NO” in Table 2-14 and Table 2-15 implies that no discharge through the TIA spillway is expected. A “YES” indicates that discharge through the TIA spillway is expected.

The estimated amount of runoff from unfrozen/unsaturated ground conditions was calculated using the Soil Conservation Service runoff equation and curve numbers (Rawls et al. 1993). A curve number of 81 was selected for unfrozen/unsaturated ground conditions. This was based on the assumption that the catchment consists of 7 km^2 of bare soil (tailings) and 2 km^2 of grassland (area adjacent to tailings). For the frozen/saturated ground scenario, no curve number was selected as infiltration is not assumed to occur in this scenario.

Table 2-14: Tailings Impoundment Area Discharge as a Function of Rainfall Events and Pond Elevations (unfrozen/unsaturated ground)

Return Period (years)	Effective Daily Rainfall (mm)	Rainfall Volume (m^3)	Exceedance of the Spillway Invert Level (202.5 m) Given a Rainfall Event and a Water Elevation (m) in the TIA at the Start of the Event of:										
			200.0	200.9	201.0	201.2	201.5	201.6	201.7	201.9	202.1	202.3	202.5
2	5	40,975	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
10	17	151,423	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
50	32	287,237	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
100	39	353,517	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
200	47	424,462	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
500	58	525,418	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
1,000[(a)]	**67**	**607,238**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**YES**	**YES**	**YES**	**YES**

(a) Design criteria.

Notes: A "NO' implies that no discharge through the TIA spillway is expected. A "YES" indicates that discharge through the TIA spillway is expected.

TIA = tailings impoundment area.

Table 2-15: Tailings Impoundment Area Discharge as a Function of Rainfall Events and Pond Elevations (frozen/saturated ground)

Return Period (years)	Effective Daily Rainfall (mm)	Rainfall Volume (m^3)	Exceedance of the Spillway Invert Level (202.5 m) Given a Rainfall Event and a Water Elevation (m) in the TIA at the Start of the Event of:										
			200.0	200.9	201.0	201.2	201.5	201.6	201.7	201.9	202.1	202.3	202.5
2	31	277,369	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
10	53	477,792	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
50	74	668,774	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
100	84	753,904	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
200	94	841,633	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES
500	107	962,201	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
1,000[(a)]	**117**	**1,057,237**	**NO**	**NO**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**

(a) Design criteria.

Notes: A "NO' implies that no discharge through the TIA spillway is expected. A "YES" indicates that discharge through the TIA spillway is expected.

TIA = tailings impoundment area.

The results indicate that discharge is not expected to occur for storms with return periods of up to the 1-in-1,000-years if the water elevation at the start of the storm is:

- Lower or equal to 200.9 m for both unfrozen/unsaturated and frozen/saturated ground conditions.
- At the previously observed maximum TIA water level before treatment (201.6 m) if the ground is unfrozen/unsaturated. Discharge from the TIA is likely to occur if the water level before the storm is at the previously observed maximum water level (201.6 m) and the soil is frozen/saturated.

2.7.3.2.2.2 Extreme Annual Total Precipitation

A flood capacity analysis of the TIA was completed for extreme annual total precipitation events. Table 2-16 indicates the estimated volume of water that the TIA will need to store during extreme annual total precipitation events.

The flood capacity analysis was based on the following:

- The extreme total annual precipitation in Table 2-13.
- The total losses (evaporation, evapotranspiration, and infiltration) are based on the relationship derived in Section 3.5.3 between total precipitation (i.e., rainfall plus snowfall) and total losses. The relationship indicates that ninety-five percent of the total precipitation is lost from the TIA due to total losses.
- A watershed area of approximately 9 km^2.
- The elevation-volume storage capacity relationship of the TIA, Table 2-12, which is based on the November 2008 topographic survey (Maskwa 2008a). The survey did not include the northeast corner of the TIA, and therefore the storage capacity represents a conservative estimate due to underestimation of the impoundment area.

Table 2-16: Flood Capacity Analysis for Extreme Annual Total Precipitation Events

Return Period (years)	Total Annual Precipitation (mm)	Total Annual Losses[(b)] (mm)	Net Annual Precipitation[(c)] (mm)	Net Annual Precipitation Volume[(d)] (m^3)
2	458	437	21	185,902
10	610	582	28	247,599
50	707	675	32	286,971
100	742	709	33	301,178
200	775	740	35	314,573
500	815	778	37	330,809
1,000[(a)]	**844**	**806**	**38**	**342,580**

(a) Design criteria.

(b) Total Annual Losses includes evaporation, evapotranspiration and infiltration.

(c) Net Annual Precipitation is Total Annual Precipitation minus Total Annual Losses.

(d) Net Annual Precipitation Volume is Net Annual Precipitation multiplied by a watershed area of 9 km^2.

When the net precipitation volumes in Table 2-16 are compared with the storage capacity of the TIA (Table 2-12), the results indicate that the TIA has sufficient capacity to store extreme annual total precipitation events with a return period as high as 1,000 years.

2.7.3.2.3 Freeboard

CDA (2013) recommends that the height of the freeboard be sufficiently high enough to prevent overtopping by 95% of the waves caused by the most critical wind in the following two scenarios:

- Scenario 1: Wind return period of 1,000 years with the pond at its maximum normal operating elevation; or
- Scenario 2: Wind return period of 10 years (for Significant consequence structures), with the pond at the maximum level during the passage of the IDF.

The total wave uprush (wind setup plus wave run-up) on the upstream face of the dykes is a function of wind speed and fetch length (i.e., the length of water over which a given wind blows) as formulated by USACE (2006). The hourly wind speeds for the relevant return period were determined through frequency analysis using the wind data from the Hay River station from 1953 to 2016 and are presented in Table 2-17.

Table 2-17: Extreme Hourly Wind Events

Return Period (years)	Wind Directions[a] and Wind Speed (km/h)							
	North	Northeast	East	Southeast	South	Southwest	West	Northwest
2	39.9	37.9	37.1	35.5	39.3	37.8	44.8	51.0
10[b]	**55.4**	**45.0**	**44.0**	**44.7**	**47.4**	**47.2**	**51.5**	**61.1**
50	70.6	48.2	47.5	51.5	53.2	53.2	55.4	66.7
100	77.7	49.1	48.4	54.3	55.5	55.1	56.7	68.6
200	85.1	49.8	49.2	56.9	57.6	56.9	57.9	70.3
500	95.5	50.5	50.1	60.3	60.4	58.9	59.4	72.3
1,000[c]	**104.0**	**50.9**	**50.5**	**62.8**	**62.5**	**60.1**	**60.4**	**73.6**

(a) The wind direction indicates the direction from which the wind is blowing.

(b) Design Criteria for Scenario 2

(c) Design Criteria for Scenario 1

Winds blowing from the north and northwest direction would generate wave movement away from the dikes and were therefore not considered in the assessment of uprush. Wave uprush was estimated for all other directions. The combination of the wind speed and fetch length that resulted in the highest wave uprush is generated by winds blowing from the east.

The input parameters for the two scenarios mentioned above and for an east wind direction were as follows:

- Scenario 1:
  - an operational pond elevation of 201.6 m, which corresponds to the maximum observed TIA pond level before treatment from 1998 to 2016 (Table 6-2)
  - fetch length of 1,700 m for the east wind (50.5 km/h)
- Scenario 2:
  - maximum water level at the passage of the IDF of 202.8 m, which is based on the results of the flood routing for the 1-in-1,000-year flood event when there are frozen/saturated ground conditions (Section 2.7.3.2.2) and the pond was already at a maximum operational level of 201.6
  - fetch lengths of 2,000 m for the southwest wind (44.0 km/h)

The estimated wave uprush heights and corresponding elevations are provided in Table 2-18.

Table 2-18: Wave Uprush Heights and Elevations

Scenario	Wind Return Period (years)	Pond Elevation (m)	East Wind	
			Wave Uprush Height (m)	Wave Uprush Elevation (m)
1	1,000	201.6[(a)]	0.53	202.13
2	10	202.8[(b)]	0.52	203.32

(a) 201.6 is the maximum observed TIA pond level before treatment from 1994 to 2016.

(b) 202.8 m is the maximum pond elevation during the 1-in-1,000-year flood event, assuming frozen/saturated ground conditions and the TIA pond at 201.6 m at the beginning of the storm.

TIA = tailings impoundment area.

Based on the results of the assessment, the following levels have been set:

- an alert level of 201.6 m
- a maximum operational pond level of 201.8 m

The alert level is the elevation at which the site manager should be informed immediately, and water treatment should start as early as practicable. A site inspection should take place two weeks after the initial alert level observation. The maximum operational pond level the maximum level at which the pond level is in compliance with all CDA guidelines for the provision of freeboard to prevent overtopping. At this level, the pond should be able to sustain the 1-in-1,000-year flood event when there are frozen/saturated ground conditions as well as a 1 in 10 year wind without overtopping. At higher levels, there would be a risk of overtopping of the dyke under this combination of circumstances. Once the pond level reaches the maximum operation level actions to reduce the water level within the pond should commence immediately.

2.7.4 Seismic and Static Stability

2.7.4.1 Foundation Conditions

There is no known documentation of site investigation that may have been conducted prior to construction of the dykes. Conditions have been inferred from the site geology, which indicates the TIA dykes are underlain by very stiff silty clay with isolated pockets of gravel. Soil units under the clay and gravel are unknown. Along parts of the dyke alignment, local pockets of peat were encountered during construction. These were not removed in the initial construction phase, but were removed during subsequent dyke crest raises.

2.7.4.2 Embankment Fill Materials

The initial perimeter dyke was developed with silt-clay and without a downstream gravel blanket. The clay material for the dyke construction was obtained from borrow pits to the west of the TIA (these pits are now flooded). The sand and gravel needed for the dyke extensions were obtained from borrow pits to the southwest or east of the TIA.

The available information suggests that:

- The north and west dykes were developed with a clay zone on the pond side to act as a low permeability zone, and a downstream shell was built with sand and gravel to maintain a low phreatic surface through the dykes. Dyke raises for the north and west dykes were constructed using downstream construction methods and included a downstream gravel toe zone which was overlain at the top of the dyke section by a 1 to 2 m thick layer of local silt or silty clay. Typical sections of the west and north dyke are shown in Figures 3 and 4 respectively.
- A very limited clay zone was developed on the pond side of the south dyke, with the bulk of the dyke developed with sand and gravel. The south dyke was not designed or built to retain water, only tailings.
- The east dyke was not developed with a clay upstream or pond side low permeable zone.

2.7.4.3 Original Design Intent

Original design documents for the dykes are not available.

2.7.4.4 Existing Conditions and Current Design Status

The 1981 stability review indicated that:

- The north dyke had a global static stability Factor of Safety of 1.8 because of the existing toe berm. The dyke was noted to have a Factor of Safety of 1.4 for a shallow slumping failure of the upper surface of the downstream slope, but this was not deemed to represent a critical surface, provided any slumping of the slope was repaired.
- The west dyke had a global static stability Factor of Safety of 1.4 with no toe berm. The subsequent dyke raise included a toe berm which raised the static Factor of Safety to 1.5.

The 1981 stability review did not calculate a seismic Factor of Safety against failure for the dykes as the 1980 Building Code specified a very low seismic risk for the site. As part of the 2010 DSR (SRK 2010), an independent slope stability analysis was completed for the north and west dykes under pseudo-static conditions. This analyse used a horizontal PGA of 0.059 g, based on the 2005 National Building Code seismic hazard calculator (NRC 2005) for the 1-in-2,475-year event. The analysis indicated:

- Upstream and downstream Factors of Safety of 1.3 for the north dyke.
- Upstream and downstream Factors of Safety of 1.3 and 1.1 respectively for the west dyke, assuming there is no peat beneath the west dyke. The Factors of Safety reduce to 1.1 and 0.9 if a 0.3 m thick layer of peat beneath the dyke is assumed.

The National Building Code has been updated since the 2010 DSR, and the 2010 National Building Code seismic hazard calculator (NRC 2011) indicates a PGA for this site of 0.019 g for the 1-in-1,000-year event (5% probability of exceedance in 50 years), and 0.036 g for the 1-in-2,475-year event (2% probability of exceedance in 50 years). These revised values are lower than the PGA used in the 2010 DSR, and therefore a higher Factor of Safety for pseudo-static analysis can be expected. This should be confirmed as part of the next DSR in 2020.

2.7.5 Geometry

2.7.5.1 Original Design Intent

Original design documents for the dykes are not available.

2.7.5.2 Existing Conditions and Current Design Status

The geometry of the dykes is summarized in Table 2-19. Typical sections of the west dyke and north dyke are shown in Figures 3 and 4 respectively.

Table 2-19: Tailings Impoundment Area Current Dyke Geometry

Dyke	Downstream Slopes	Upstream Slopes	Crest Width (m)	Embankment Height (m)
North	2 horizontal to 1 vertical	2 horizontal to 1 vertical	4 to 5	1 to 15
West	2 horizontal to 1 vertical	steeper than 2 horizontal to 1 vertical, but are now buried or supported by tailings	4 to 5	4 to 15
South	2 horizontal to 1 vertical	1.5 horizontal to 1 vertical	generally 3.5 m wide with several narrower sections	0 to 4
East	unknown	unknown	unknown	up to 1

2.7.6 Dam Breach and Inundation Study

No dam breach and inundation study has been completed for the Pine Point TIA.

2.7.7 Design Criteria Summary

Table 2-20 summarizes the design criteria for the TIA.

Table 2-20: Tailings Impoundment Area Closure–Active Care and Design Criteria

Design Feature	Criteria	Source	Original Assessment	Updated Assessment	Meets Criteria	Comments
Dam safety inspection	required to be completed annually	CDA (2013, 2014)	NA	in progress	Y	
Dam Safety Review	required to be completed every 10 years	CDA (2013, 2014)	NA	SRK 2010	Y	
Emergency Preparedness and Response Plan	NA	CDA (2013, 2014)	NA	in progress	Y	
OMS Manual	NA	CDA (2013, 2014)	NA	OMS Manual (2017)	Y	
Freeboard	two calculations for freeboard with the more critical of the two cases setting the minimum freeboard	CDA (2013, 2014)	NA	OMS Manual (2017)	Y	
Inflow design flood	between 1/100 and 1/1,000 year return period	CDA (2013, 2014)	NA	OMS Manual (2017)	Y	
Earthquake design ground motion	between 1/100 and 1/1,000 year return period	CDA (2013, 2014)	NA	SRK 2010	Y	PGA of 0.056 g used, which is higher than the updated 2010 NBCC PGA for 1-in-1,000-year event of 0.019 g.
Factory of Safety	long term static – 1.5	CDA (2013, 2014)	NA	SRK 2010	Y	post-earthquake condition not analysed
	pseudo-static – 1.0	CDA (2013, 2014)	NA	SRK 2010	Y	
	post-earthquake – 1.2	CDA (2013, 2014)	NA	required	out of date	

OMS = operation, maintenance and surveillance; PGA = peak horizontal ground acceleration; NA = not available; NBCC = National Building Code of Canada.

2.8 Construction History

Mine construction started in 1962 and mining operations in 1964. The initial perimeter dyke was developed with silt-clay and without a downstream gravel blanket. The clay material for the dyke construction was obtained from borrow pits to the west of the TIA (these pits are now flooded). The sand and gravel needed for dyke raising were obtained from borrow pits to the southwest or east of the TIA. The tailings dykes were raised and extended in several stages during the life of the mine as required to contain the increasing volume of mill tailings. The last three crest level increases to the dykes were as follows:

- **1976**—The crest of the north dyke was raised to elevation 203.5 m above mean sea level or some 2.1 m above the previous crest. Also, the dyke was extended eastward to the northeast corner of the pond. Construction of a segment of the east dyke was also carried out.
- **1981**—During the summer of 1981, the west and south dykes were raised and the south dyke extended eastwards.
- **1987**—The height of the perimeter dykes was again raised in July and August 1987 to provide additional tailings storage. Fill was added to the south, west, and a portion of the north dyke at this time. The increase in height of the dyke was generally 1 m or less.

2.9 Training Requirements

Teck site inspectors are required to have completed the following training courses:

- Inspection & Maintenance of Dams, Dam Safety Guidelines, Province of British Columbia Waste Management Branch, Version 2, March 2011.

2.10 Documentation and Document Control

Teck has set up procedures for the retention of information. Once a document has been revised, the version number is updated, at which time the revised procedure is flagged as necessary training to all applicable employees.

Historical reports on the Pine Point TIA and reports from external consultants conducting work on the Pine Point TIA are kept by Teck at its administrative office and electronically on its server in Kimberley, BC, as follows.

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3.0 OPERATIONS

3.1 Objectives

The objective of this section is to define operating standards and procedures in accordance with design criteria, regulatory requirements, company policies, and best operating practices.

3.2 Tailings Transport and Deposition

Pine Point is a closed site, and there is no ongoing tailings transport and deposition.

3.3 Equipment Operating Instructions

Pine Point is a closed site, and equipment operations at Pine Point only relate to water management at the TIA. Refer to Section 3.5 for surface water management operating instructions.

3.4 Dam and Impoundment Raising

Pine Point is a closed site, and no raises to the dam are undertaken or planned at this time.

3.5 Surface Water Management and Water Balance

3.5.1 Water Release

The following operational practices should be applied to the TIA:

- The polishing pond should be operated as instructed in the Water Treatment Manual (Teck Cominco 2008) when water treatment is implemented. The applicability of this document should be reviewed on a regular basis and updated if required. The release of treated water must be controlled to maximize retention time in the polishing pond, which will allow the reaction of constituents such as zinc in the water with the lime solution employed in the treatment process.
- Water treatment should proceed until no water can be conveyed through the culvert between the main and polishing ponds by gravity flow, which would occur when water elevation reaches elevation 200.0 m.
- Visits to site for general inspections (Section 4.3.1) should be made at least three times per year during the open water period, namely during spring (April to May), summer (June to August), and fall (September to October) to determine compliance with the alert level (201.6 m) and maximum operational water level (201.8 m).
- A general inspection should also be undertaken after extreme weather events as noted by the monitoring program (Section 4.3.8). If water elevation is observed at or above the alert level (201.6 m) during any visit, the site manager should be informed immediately and water treatment should start as early as practicable. Another inspection should be scheduled two weeks later. If water elevation is observed below 201.6 m, water treatment should be initiated in July, per standard operating practice.
- Instructions provided in the Contingency Manual (Appendix C) should be followed in the event of the discharge of untreated water.

A flow chart diagram summarizing the operational and climate monitoring practices for water releases, and a diagram of infrastructure elevation benchmarks is attached in Appendix A.

3.5.2 Water Treatment

The Water Treatment Manual (Teck Cominco 2008) must be consulted for details of operational practices for water treatment. Only a brief description of these practices is given in this section.

Water treatment on site consists of a lime solution, prepared in a slurry tank, which is fed with a peristaltic pump to the water flowing in the culvert connecting the main pond to the polishing pond. The amount of lime used is estimated from the historical records of treated water discharge and the water elevation in the TIA. Historical consumption of lime indicates that an average amount of 0.17 kg of lime should be used for every 1 m^3 of released water.

During the water treatment period, the following tasks are undertaken daily:

- Activate power to the treatment facility.
- Prepare the lime solution in the slurry tank by mixing lime and water to achieve a slurry density of 17% solids.
- Generate a water flow in the polishing pond by opening the culvert.
- Feed the lime solution to the water in the culvert by activating the peristaltic pump.
- Adjust the pump speed to achieve a desired pH in the water of 10.9 (see Teck Cominco 2008, Appendix E5, for table of pump speed versus water flow).
- At the end of the day, stop the flow (i.e., close the culvert and spillway gate) and turn off the power to the treatment facility.

The constituents in the water, such as zinc, precipitate out to form solids that settle to the bottom of the polishing pond under low velocity (high retention time). These solids form a sludge which is dredged periodically to preserve the capacity, and therefore the retention time, of the polishing pond. The dredged material is removed from the polishing pond and placed within the TIA footprint.

3.5.3 Water Balance

The water balance for the TIA describes the yearly amount of water released from the facility as the sum of rainfall and snowfall, minus sublimation and snow redistribution, evaporation and evapotranspiration, and infiltration. An annual water balance was performed for the TIA (Table 3-1), from 1993 to 2016, to estimate total losses from evaporation, evapotranspiration, and infiltration. The following assumptions were considered in the water balance:

- Rainfall and snowfall are based on derived precipitations for Pine Point from 1993 to 2016.
- Sublimation and snow redistribution reduces snowfall values by 31%.
- Infiltration occurs over the whole watershed area, which includes the TIA.

- The effects of evaporation, evapotranspiration and infiltration are combined into a single term called total losses.
- Evaporation only occurs in the main pond, which constitutes only a small percentage of the total watershed area of the TIA. Evapotranspiration affects the remaining area of the watershed (i.e., land area). Estimation of the respective amount of evapotranspiration and infiltration cannot be supported with direct observations, however, a previous study concluded that evapotranspiration is greater than precipitation at the location of Pine Point mine (Golder 1996).
- The documented volume of water released (Table 6-2) was converted into an equivalent water depth for use in this water balance. This was calculated by dividing the documented volume of water released by the watershed area of the TIA (approximately 9 km^2). The equivalent water depth is termed Net Water Released in Table 3-1.

Table 3-1: Water Balance in the Main Pond

Year	Rainfall (mm)	Snowfall [(a)] (mm)	Total Losses [(b)] (mm)	Net Water Released (mm)
1993/4	158	201	314	45
1994/5	108	253	278	83
1995/6	168	115	252	31
1996/7	344	142	468	18
1997/8	275	145	401	19
1998/9	336	184	498	22
1999/0	201	118	310	9
2000/1	252	249	463	38
2001/2	392	282	634	40
2002/3	223	213	409	27
2003/4	174	244	396	22
2004/5	226	274	491	9
2005/6	283	201	457	27
2006/7	272	332	590	14
2007/8	198	380	562	16
2008/9	364	463	801	26
2009/10	220	427	620	27
2010/11	325	354	658	21
2011/12	168	508	649	27
2012/13	223	673	869	27
2013/14	195	321	491	25
2014/15	250	295	537	8
2015/16	354	342	660	36

(a) The snowfall amounts in the table are adjusted to account for sublimation and snow redistribution.

(b) Total losses consist of the effects of evaporation, evapotranspiration and infiltration.

The water balance results (Table 3-1) indicate that water had been released every year since 1993, and that there is a strong linear relationship between the values of total precipitation (i.e., rainfall plus snowfall) and total losses (Plate 3). The square of the correlation coefficient (R^2 value, or the coefficient of determination) for these two variables is 0.987 (Plate 3). This relationship indicates that 95% of total precipitation is removed from the basin as total losses. Consequently, the water released from the TIA constitutes approximately 5% of the total precipitation.

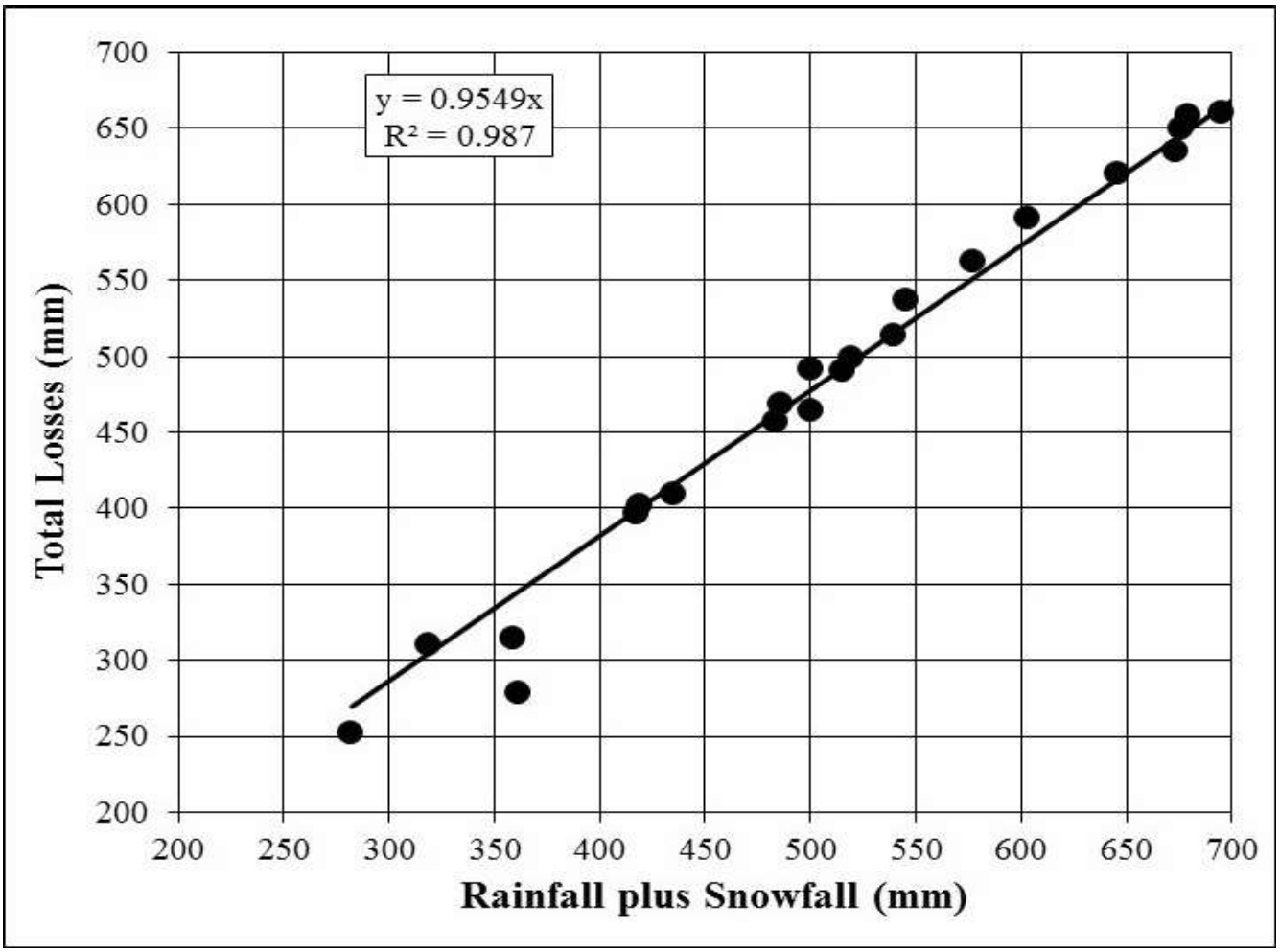

Plate 3: Relation between Total Losses and Total Precipitation (rainfall plus snowfall)

3.6 Environmental Protection

Refer to section 3.5.1 and 3.5.2 for surface water release and treatment operating instructions.

3.7 Safety and Security

The site currently does not have access restriction. It is a remote site, which historically has had little unauthorized access.

3.8 Change Management

The site manager will be responsible for ensuring that any changes at the facility or within management is reflected in the OMS Manual and subsequently reviewed, approved, and distributed accordingly.

3.9 Documentation

The OMS Manual and all associated documents shall be kept current with appropriate practices and procedures and at minimum, reviewed annually by the required personnel (Table A-1).

3.10 Reporting

Records of yearly water releases, lime consumption for water treatment, and water elevations in the main pond at the start and end of the treatment phase are to be kept.

4.0 SURVEILLANCE

4.1 Objectives

A surveillance program is implemented to assess the current performance of a facility relative to its intended design parameters.

The objective of the surveillance program is to provide confirmation of the adequate performance of the facility, including containment, stability, and operational function by observing, measuring, and recording data relative to potential failure modes.

4.2 Surveillance Parameters

4.2.1 Identify Potential Failure Modes

The following represent the different failure modes applicable to the Pine Point TIA:

- overtopping
- instability
- piping

4.2.2 Visual Parameters

Table 4-1 outlines the different failure modes applicable to the Pine Point TIA and visual observations which may indicate potential failure.

Table 4-1: Failure Modes and Identification

Failure Mode	Conditions to Identify Potential Failure Mode
Overtopping	■ water elevation ■ meteorological event
Instability	■ cracking ■ settlement ■ bulging ■ seepage ■ erosion ■ seismic event
Piping	■ seepage ■ wet spots downstream of dam toe ■ sinkholes, depressions

4.2.3 Instrumentation Installation Details

There is no geotechnical instrumentation (piezometers, inclinometers or settlement gauges) in the dykes at the Pine Point mine.

A water level gauge is present at the culvert from the north dyke to the polishing pond, for the monitoring of pond water levels.

4.2.4 Instrumentation Parameters and Thresholds

Details of the operation benchmark and warning elevations for the water level gauge, present at the culvert from the north dyke to the polishing pond, are presented in Section2.1.1.

4.2.5 Sampling and Testing Location Details

The Type B Water Licence issued by MVLWB to Teck for the Pine Point site (licence number MV2006L2-0013, Appendix D) details a water sampling program (i.e., Surveillance Network Program) that must be implemented. Reference should be made to the Water Licence for the details of sampling and testing locations.

4.2.6 Sampling and Testing Parameters and Thresholds

The Type B Water Licence issued by MVLWB to Teck for the Pine Point site (licence number MV2006L2-0013, Appendix D) details a water sampling program (i.e., Surveillance Network Program) that must be implemented. Reference should be made to the Water Licence for the details of sampling and testing locations.

4.3 Surveillance Procedures

4.3.1 Defined Frequency, Schedule, and Procedures

A program of regular periodic surveillance is required to ensure that the TIA is performing adequately and that any problems are detected so that the necessary corrective actions can be implemented in a timely manner. Site inspections will be conducted as per the following frequencies:

- General inspections of the TIA are to occur each spring (April to May), summer (June to August), and fall (September to October).
- Geotechnical inspections of the dykes are to be arranged each summer; and following any extreme weather or seismic events (i.e., extreme wind, rainfall or earthquakes).
- DSRs are to be conducted every 10 years.

The general inspections are the responsibility of any personal visiting the site. The general inspection in spring (April to May) is to be scheduled no later than two weeks after a period of two weeks with air temperatures above 0°C, and no later than 31 May of each year, ideally prior to or during the spring freshet period. The site is also to be inspected during the summer, and prior to start of the winter period to gauge the water management needs.

The geotechnical inspections are the responsibility of the geotechnical specialist, and a geotechnical inspection is to be conducted at least once a year.

An independent DSR should be undertaken by an external consultant or third party.

The site manager is responsible for the implementation of all visits conduced on site.

4.3.2 Visual Monitoring

General inspection forms are attached in Appendix B. The general inspections involve a brief assessment of the TIA and should cover the tasks noted below:

- observation of compliance with the main pond alert level (201.6 m) and maximum operational pond level (201.8 m)
- general characterization of the dyke crests
- observation of any evidence of significant slope instability, sloughing or slides
- observation and recording of deterioration and damage to the access roads to confirm yearly site access; deterioration or damage to the access roads include:
  - any indications of instability (e.g., potholes, slumping, or cracks) in the road or the supporting fills below the road; and
  - any accumulations of debris or other materials on the road or paths.

If seepage is observed through the dykes, the seepage should be inspected. If the seepage flow is “clear,” small local collection ditches and/or retention pools should be developed to allow monitoring of the flows to the existing surface water management system. If the seepage flow is “cloudy,” the geotechnical specialist or EoR should be informed and a site visit arranged. In addition, measures should be started to develop and construct a gravel filter zone in the area of the seepage to minimize the loss of dyke material. These water management actions would be built on the downstream side of the dykes at the site of the seepages.

The geotechnical inspections of the dyke should provide an assessment of both the upstream and downstream faces of the TIA dykes. The tasks for the upstream slope inspection entail observations of:

- any water ponding against the face
- any indication of cracking on the face
- any distortion or displacement of the face

The tasks for the downstream slope inspection include observing the following:

- any indication of cracking of the dam fill
- any areas of local subsidence of the dam fill
- any areas of water ponding
- any areas of accumulation of fines or other unsuitable materials
- any areas of vegetation growth

4.3.3 Survey and Bathymetry

A topographic survey of the tailings facility at the location of the main pond will be made every 10 years or if observations during previous site visits indicate significant changes in the topography of the TIA. The survey will be used to recalibrate the water storage capacity of the main pond and include a check on the north dyke crest elevations.

The last survey of the Pine Point TIA was completed in November 2008 (Maskwa 2008a). No bathymetry has been completed for the TIA.

4.3.4 Instrumentation Measurements

The water level at the gauge will be recorded during each site inspection and as per standard procedure during the water treatment period (Teck Cominco 2008). The most accurate water elevations would be obtained when no flow is conveyed through the culvert or spillways. It is therefore preferable that the culvert gate valve be shut when a water level is recorded.

4.3.5 Sampling and Testing

The Type B Water Licence issued by MVLWB to Teck for the Pine Point site (licence number MV2006L2-0013, Appendix D) is valid from 29 October 2007 to 28 October 2017. The licence details a water sampling program (i.e., Surveillance Network Program) that must be implemented for the monitoring of water quality parameter concentrations in the TIA, discharges from the TIA and at select locations in the receiving aquatic environment. This sampling program is applicable to both the regulatory requirement of the water licence and the operation, maintenance and surveillance program for the TIA.

Sample collection, preservation, and analyses should be conducted in accordance with methods prescribed in the most up to date edition of *Standard Methods for the Examination of Water and Wastewater* (APHA 2012), or equivalent. The site manager is responsible for selecting an approved laboratory where the samples will be analyzed. The site manager is also responsible for reviewing the quality assurance and quality control (QA/QC) plan for the laboratory and planning for a QA/QC procedure (i.e., collecting split and blank samples) within the sampling program for Pine Point. The sampling program, laboratory selection, and QA/QC must be accepted by an analyst from MVLWB.

The water management/treatment operator is responsible of conducting the water sampling program. As a support to that program, this person must also undertake the following tasks:

- record the daily and annual volume of water discharged from the polishing pond to the aquatic environment
- record the water level in the main pond three times a year in conjunction with the water samples performed in the TIA (spring, summer, and fall)

4.3.6 Weather Stations

Reference should be made to Table 2-2 (Section 2.3.2) for a list of weather stations near Pine Point.

Observations of air temperature, rainfall and snowfall are available publicly for Hay River. These observations can be obtained from Environment Canada (https://www.canada.ca/en/services/environment/weather.html). Hourly and daily temperature as well as daily precipitation records are available for download in Excel compatible files (i.e., CSV files). The data should be compiled and processed by the site manager or an assigned member of their staff. The processing should include applying the rainfall and snowfall weighting and under-catch factors that are identified in Table 2-4 to the data from Hay River to determine precipitation at Pine Point. All the downloaded data should be summarized each year by the site manager or designate to determine the cumulative or total precipitation on a yearly basis at the TIA. The information will assist in determining trends to assist with the oversight of the water management system. At present, these data are reviewed annually and reported as part of the annual DSI.

In anticipation of extreme events, the site manager should subscribe to the Weather Network weather alert service (http://www.theweathernetwork.com/) or similar, and check the Environment Canada website for public weather alerts (http://weather.gc.ca/warnings/index_e.html) on a regular basis.

Rainfall data at Hay River should be collected from Environment Canada following any heavy rainfall warning issued between April and September. Environment Canada defines heavy rainfall as 7 mm per hour or more.

If total rainfall during any five days exceeds 50 mm, which is equivalent to a 10-year daily rainfall event (Table 2-13), an inspection should be scheduled as soon as practical. This procedure is included in the flow chart diagram showing operational and climate monitoring practices for water releases in Appendix A.

4.3.7 Triggers for Change of Operations

The Pine Point TIA is not in operation.

Ongoing surveillance is intended to detect any unusual conditions that could signify potential issues with the site, as described in Section 4.2 of this document. If any unusual conditions are observed, the site manger must be informed immediately. Depending on the nature and severity of the condition observed, the EoR may be contacted or the EPRP may be initiated. The decision to execute the EPRP shall only be made once an incident exists (i.e., possible failure or failure of a dyke) and there is a serious risk to facilities and/or downstream stakeholders.

4.3.8 Event-Driven Procedures

In addition to the routine and periodic inspections, special inspections may be required during (if possible) and after unusual or significant seismic or climatic events. Significant climatic events include heavy rainfall and spring freshet floods.

Teck staff should carry out the special inspections after significant events, and the EoR should be notified. If there are any concerns with areas of the dyke, then the site manager would arrange to bring in the EoR for further inspections and review.

4.3.9 Data Collection, Analysis, and Documentation

Inspection reports and water quality results are maintained by Teck at its administrative office, and electronically on its server, in Kimberley, BC.

4.3.10 Periodic Inspections and Review

4.3.10.1 Annual Dam Safety Inspection

A comprehensive review of the Pine Point TIA and its management should be undertaken annually by the EoR or designate. This review shall be submitted to MVLWB.

The inspection shall consist of a geotechnical assessment of the conditions of the dykes, spillways, and would typically be conducted following the freshet period.

Inspection reports are stored by Teck at its administrative office, and electronically on its server, in Kimberley, BC.

4.3.10.2 Dam Safety Review

The Canadian Dam Association Dam Safety Guidelines (CDA 2013) recommends that a DSR be conducted once every 10 years for embankments/dykes with a 'Significant' dam classification, such as the west and north TIA dykes. The last DSR was conducted in 2010 (SRK 2010). The next DSR for these dykes is therefore scheduled for 2020.

All dam safety review reports are stored by Teck at its administrative office, and electronically on its server, in Kimberley, BC.

5.0 MAINTENANCE

5.1 Objectives

Facility maintenance is important to the safe operation of the TIA and the effective management of the ponded water. It is the responsibility of the site manager to ensure that the TIA is properly maintained.

The objectives of the maintenance program are to:

- identify and describe critical parts of the facility
- address routine, predictive/preventative, and event-driven maintenance
- address operating and surveillance observations for all components of the facility

5.2 Inventory of Components Requiring Maintenance

The following components of the Pine Point TIA may require maintenance over the facility's lifetime:

- access
- dykes
- culverts
- spillways

5.3 Maintenance Schedule and Triggers

The TIA should be subject to a regular maintenance program.

The site manager for Pine Point should have sufficient personnel or access to a contractor in close proximity to the site to perform necessary repairs to the TIA infrastructure. These repairs would be planned tasks to address issues identified during the regular inspections (Section 4.3.1) or inspections due to extreme weather or reported sudden change in TIA conditions.

Contractors in Hay River who have experience with earthworks and who could be contacted are:

- Carter Industries Ltd., 40 Studney Drive, phone: 867-874-6574
- Rowe's Construction, 25 Studney Drive, phone: 867-874-3243

5.4 Maintenance Parameters

There are no maintenance parameters.

5.5 Routine and Preventative Maintenance

5.5.1 Access

The access road to the site of the TIA is on Crown land; however, any observed road deterioration or damage during site visits should be recorded. If it is noted that it is necessary to carry out a maintenance program, this will require coordination with MVLWB to confirm access to the TIA site. The maintenance program may normally include regrading of the gravel site access roads as needed. It is not anticipated that extensive work would be required.

5.5.2 Dykes

Maintenance work required on the dyke structures to control seepage and erosion should be carried out as needed and comprise the following activities:

- Regrade dyke crests and replace granular road surfacing material to maintain crest design profiles.
- Replace and regrade fill materials lost on the downstream face and road surface (such as may be eroded by rainfall runoff).
- Replace and regrade fill materials lost on the pond side slope and regrade the adjacent road.

  Ongoing removal of vegetation is required to protect dyke integrity, in particular to prevent the growth of larger trees and the damage to the dykes that could occur in the event of treefall. Any tree on the dykes with a trunk diameter greater than 100 mm should be cut within 50 mm of the ground surface. Any vegetation on the north and west dykes with a trunk/stem diameter larger than 20 mm should be cut to within 50 mm of the ground surface. If herbicide is to be used to control vegetation, all trees with a diameter greater than 20 mm are to be cut off within 50 mm of the ground surface prior to herbicide application.

5.5.3 Culvert

The conveying capacity of the culvert connecting the main pond to the polishing pond must be maintained. The culvert should be kept clean of any blockages from soil material or vegetation. The valve should also be maintained in an operable condition.

5.5.4 Spillway

In order to maintain the efficiency of the spillway, the following activities should be undertaken:

- The conveying capacity of the spillway must be maintained. The spillway should be kept clean of any blockages from soil material or vegetation.
- A reserve of clay should be on site to fill the clay plug at the spillway, if needed, to minimize seepage.

5.6 Event-Driven Maintenance

After a special inspection due to an event-driven inspection, event-driven maintenance may be required. The maintenance should be completed as soon as possible.

5.7 Documentation

Maintenance records and summaries are maintained by Teck at its administrative office and electronically on its server in Kimberley, BC.

6.0 REPORTING AND COMMUNICATION

6.1 Communications

Contacts for the Pine Point operation are listed in Table 6-1.

Table 6-1: Pine Point Contacts

Name	Contact Number
Dana Haggar (site manager)	Office: 250-427-8413 Mobile: 250-602-9361
Michelle Unger (alternate)	Office: 250-427-8422 Mobile: 250-432-5264

6.2 Operations Reporting

Records of yearly water releases, lime consumption for water treatment, and water elevations in the main pond at the start and end of water releases are to be kept. The totals from 1994 to 2016 are provided in Table 6-2.

Table 6-2: Lime Consumption and Water Levels at the Tailings Impoundment Area

Year	Lime Consumption (tonnes)	Volume of Water Releases (m^3)	Water Level in the TIA at the Start of Water Releases (m)	Water Level in the TIA at the End of Water Releases (m)
1994	17.0	410,000	NA	NA
1995	65.0	748,000	NA	NA
1996	44.0	274,000	NA	NA
1997	NA	164,164	NA	NA
1998	NA	162,661	202.0	200.3
1999	NA	196,381	201.2	200.5
2000	NA	86,917	200.7	200.4
2001	95.0	336,648	201.6	200.3
2002	89.9	359,173	201.6	200.6
2003	66.5	237,494	201.3	200.3
2004	43.0	197,931	201.1	200.3
2005	23.0	86,457	200.8	200.4
2006	46.0	244,791	201.3	200.3
2007	29.0	122,374	201.0	200.3
2008	27.1	139,000	201.1	200.5
2009	50.5	240,000	201.4	200.4
2010	42.2	237,700	201.4	200.4
2011	25.8	190,000	201.2	200.4
2012	20.0	240,617	201.1	200.3

Year	Lime Consumption (tonnes)	Volume of Water Releases (m^3)	Water Level in the TIA at the Start of Water Releases (m)	Water Level in the TIA at the End of Water Releases (m)
2013	20.0	240,486	201.1	200.4
2014	20.0	226,954	201.1	200.3
2015	12.0	79,088	201.0	200.4
2016	28.0	320,124	201.4	200.4

TIA = tailings impoundment area; NA = not available.

6.3 Surveillance Reporting

Surveillance reporting must be completed as follows:

- three times a year (spring, summer, and fall) for general inspections
- annually for the geotechnical DSI
- every 10 years for a DSR
- any time a special inspection due to extreme weather is carried out

A list of the general inspections from 1990 to 2016 are shown in Table 6-3.

Table 6-3: List of General Inspections

Year	Month
1990	May
1992	May
1994	June
1996	June
1998	June
2000	July
2002	July
2004	July
2005	July
2006	July
2007	July & October
2008	August
2009	May & October
2010	May, July & October
2011	May, July & October
2012	May, August & October

Year	Month
2013	May, July & October
2014	May, July & October
2015	May, July & October
2016	May, July & October

It is the responsibility of:

- any personnel visiting the site to report (i.e., letter or electronic mail) to the site manager within a day any observed issues that require immediate maintenance or repair
- any personnel visiting the site to report (i.e., letter or electronic mail) to the site manager within one week any other observed issues that require maintenance or repair
- the geotechnical specialist to prepare a memorandum for each geotechnical inspection, describing the observation made during the visits on site
- the water management/treatment operator to prepare summary tables summarizing water volume discharged to the aquatic environment and transferred to the polishing pond from the TIA, water level in the TIA, volume of lime used, and water quality sampling results

Observations made during general and geotechnical inspections must be catalogued in field books. Photocopies of the used pages of the field books should be made for safekeeping. Copies of field notes or field books should be stored at the project office location when not in use.

As a requirement of the water licence (MVLWB 2007; Appendix D), an annual report must be submitted by 31 March of every year. The reports must include all of the data and information required by the Surveillance Network Program described in the water licence (Section 4.3). It is the responsibility of the site manager to prepare these annual reports, which would include the summary tables prepared by the water management/treatment operator. The Pine Point site manager is responsible to submit copies to MVLWB and any other agencies. The site manager would also prepare quarterly activity reports for Teck.

The site manager is also responsible for the preparation of the DSR report, which must be produced every 10 years. The content of the report should meet the requirements provided in the latest Dam Safety Guidelines published by the Canadian Dam Association, Currently CDA 2013.

Hard copies of all documents produced in the reporting process are to be stored at the project safe keeping location. All electronic documents are to be saved on a safe computer or network drive. All documents will be retained for a period of time defined in Teck 2014.

6.4 Maintenance Reporting

It is the responsibility of the water management/treatment operator to maintain and keep updated an electronic database cataloguing all quantitative data collected on site, including:

- water volume discharged to the aquatic environment from the polishing pond
- water level in the TIA
- quantity (in tonnes) of lime used
- water quality sampling results

The database should be saved on a network drive. All documents will be retained for the period of time defined in Teck 2014.

Maintenance records and summaries must be completed immediately after works are carried out and maintained on Teck's Kimberley, BC server.

6.5 Annual Operation, Maintenance and Surveillance Manual Review and Update

Revisions to the OMS Manual are made, as and when required, by re-issuing a complete section, table, or appendix so that the outdated section, table, or appendix can be removed and replaced. The official electronic copy of the OMS Manual is also updated at the same time and will be the primary reference document.

The version history of the OMS Manual is shown in Table 6-4. The last revision of the OMS Manual supersedes all previous versions.

Table 6-4: Operation, Maintenance and Surveillance Manual Revision Summary

Revision Number	Details of Revision	Date of Issue	Comment
2017 Version 0	Updated Document by Golder	20 February 2017	■ Change of consequence class for north and west dykes from low to significant. ■ Freeboard calculation updated to include up rush ■ Climate information from 2009 to 2016 updated. ■ Formatted to comply with Teck Guideline (Teck 2014)
2009 Version 0	Updated Document by Golder	19 March 2009	

The personnel responsible for the review of the OMS Manual is shown in Table 6-5.

Table 6-5: Operation, Maintenance and Surveillance Manual Review Protocol

Name	Company	Position
Bjorn Weeks	Golder Associates Ltd.	Engineer of Record
Dana Haggar	Teck Resources Limited	Site Manager
Kathleen Willman	Teck Resources Limited	Manager, Engineering and Remediation

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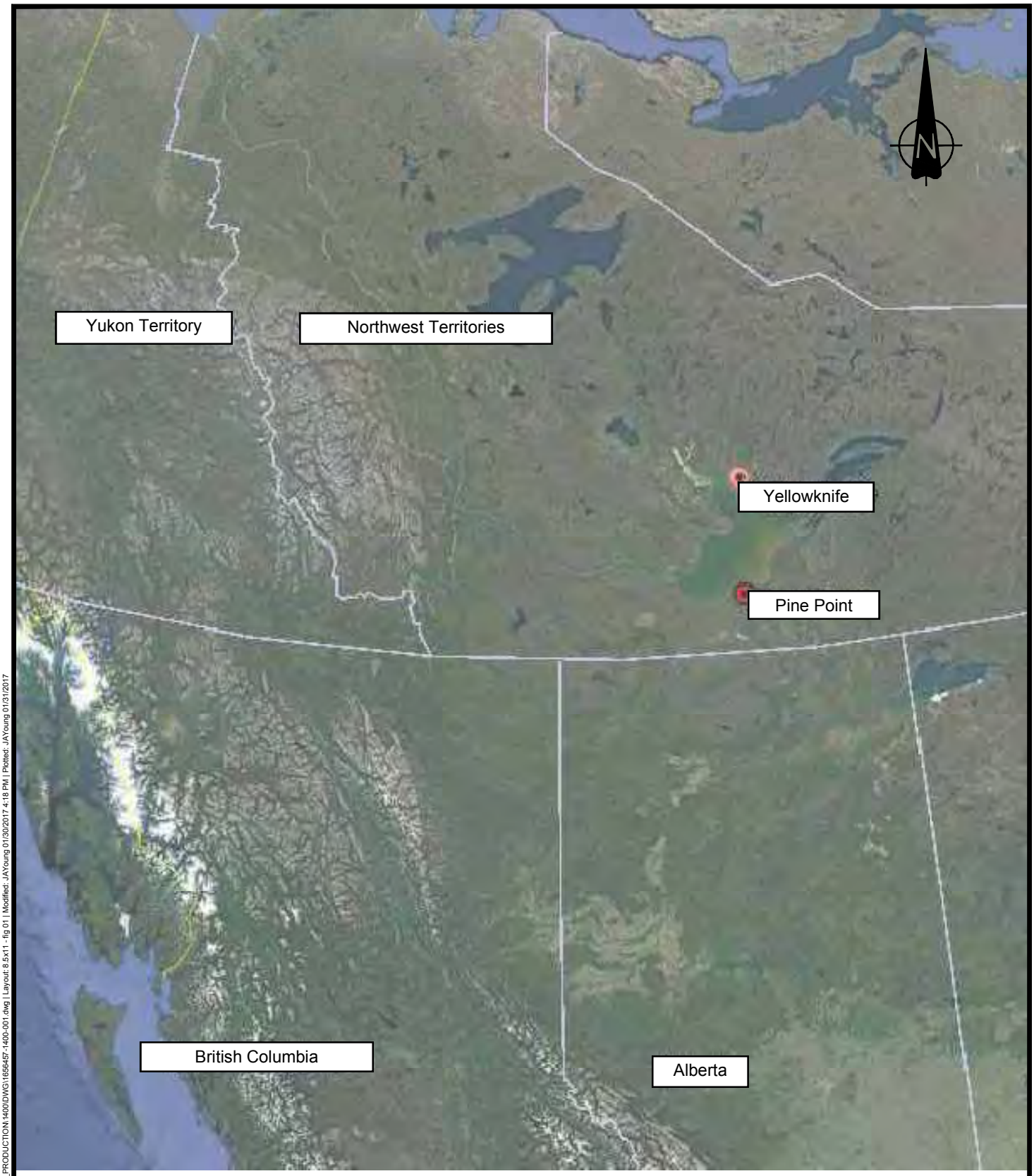


PROJECT

TECK
PINE POINT, NT

TITLE

GENERAL LOCATION OF PINE POINT MINE SITE

Golder Associates

PROJECT No.		1656451	FILE No.	1656457-1400-001
DESIGN	MS	2017-01-31	SCALE	NTS
CADD	JY	2017-01-31		
CHECK	MW	2017-02-20		
REVIEW	BW	2017-02-20		

FIGURE 1

Meters
0 100 200 400 600 800 1,000

PROJECT
TECK
PINE POINT, NT

TITLE
TAILINGS IMPOUNDEMENT AREA

REFERENCE

BASE PLAN PROVIDED BY TECK COMINCO
CAD FILE: PINE_POINT_01.MXD
DATED: OCTOBER 14, 2006

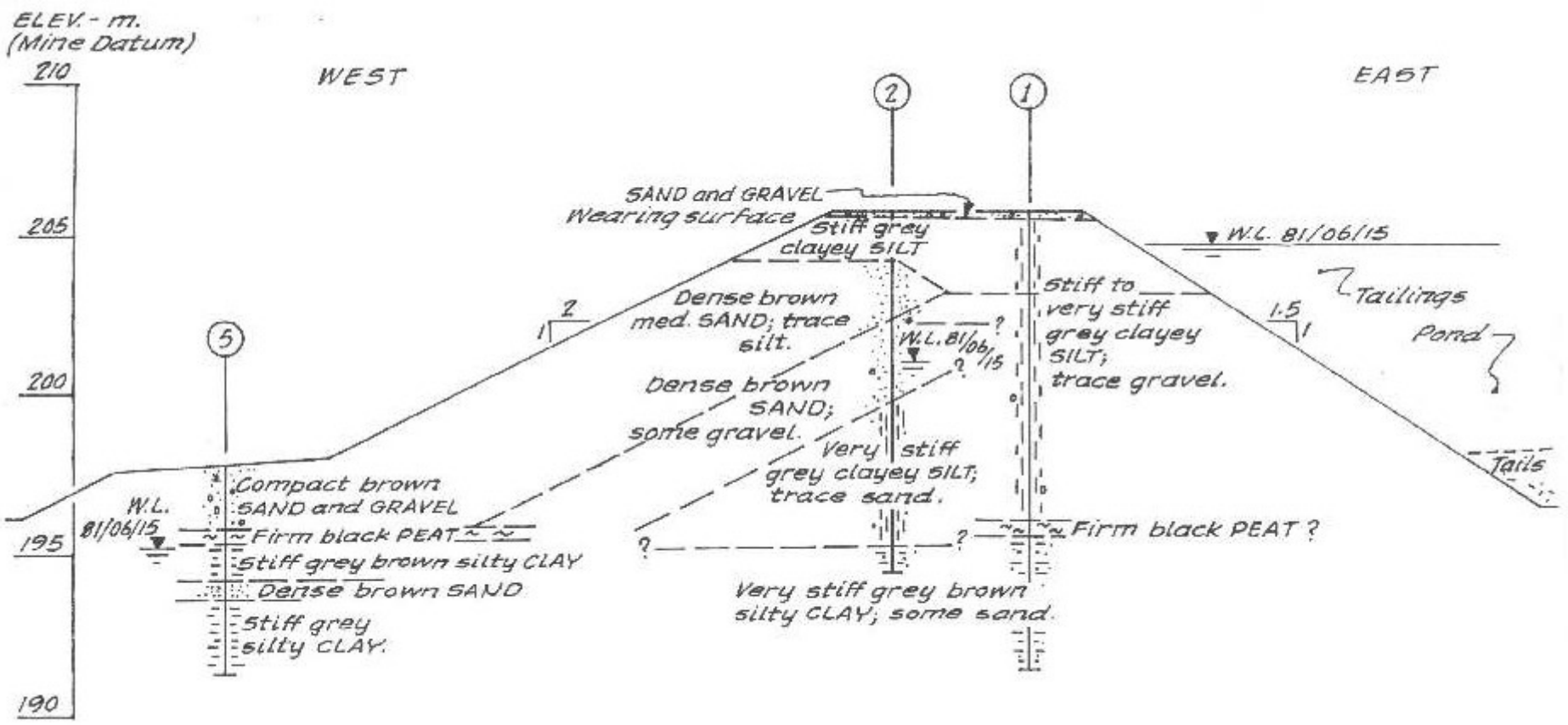
Golder Associates

PROJECT No.		1656457	FILE No.		1656457-1400-001
DESIGN	JH	30JAN09	SCALE	AS SHOWN	REV.
CADD	GG	30JAN09			
CHECK	MW	20FEB17			
REVIEW	BW	20FEB17			

FIGURE 2

DRAWING DATE: 04-Feb-09 COREL FILE: N:\Bur-Graphics\Projects\20071141\3\07-1413-0068\Drafting\4000\FIGURE 2.cdr

DRAWING DATE: 04-Feb-09 COREL FILE: N:\Bur-Graphics\Projects\2007\1413\07-1413-0068\Drafting\4000\FIGURE 3_4.cdr



SCALE 1 : 200

LEGEND

(2) Location of Borehole

NOTE

1. Section partially inferred from construction records.
2. Black peat removed from under toe berm of west dyke south of Sta. 35+00.

PROJECT

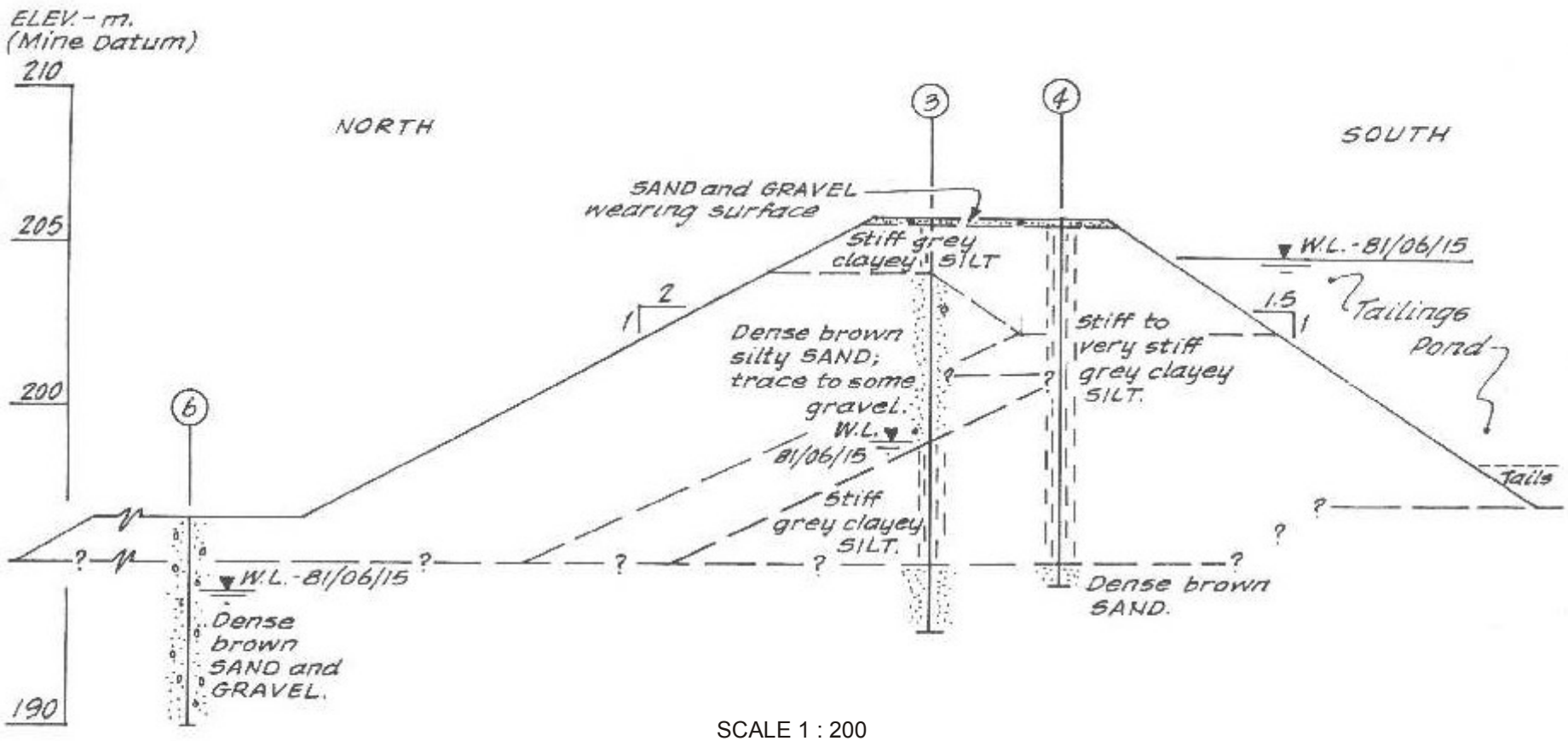
TECK
PINE POINT, NT

TITLE

TYPICAL SECTION
WEST DYKE

Golder Associates

PROJECT No.		1656457	FILE No.		1656457-1400-001
DESIGN	JH	07OCT08	SCALE		REV.
CADD	SS	07OCT08	**FIGURE 3**		
CHECK	JH	07OCT08			
REVIEW	BW	20FEB17			



SCALE 1 : 200

LEGEND

(6) Location of Borehole

NOTE

1. Section partially inferred from construction records.

PROJECT

TECK
PINE POINT, NT

TITLE

TYPICAL SECTION
NORTH DYKE

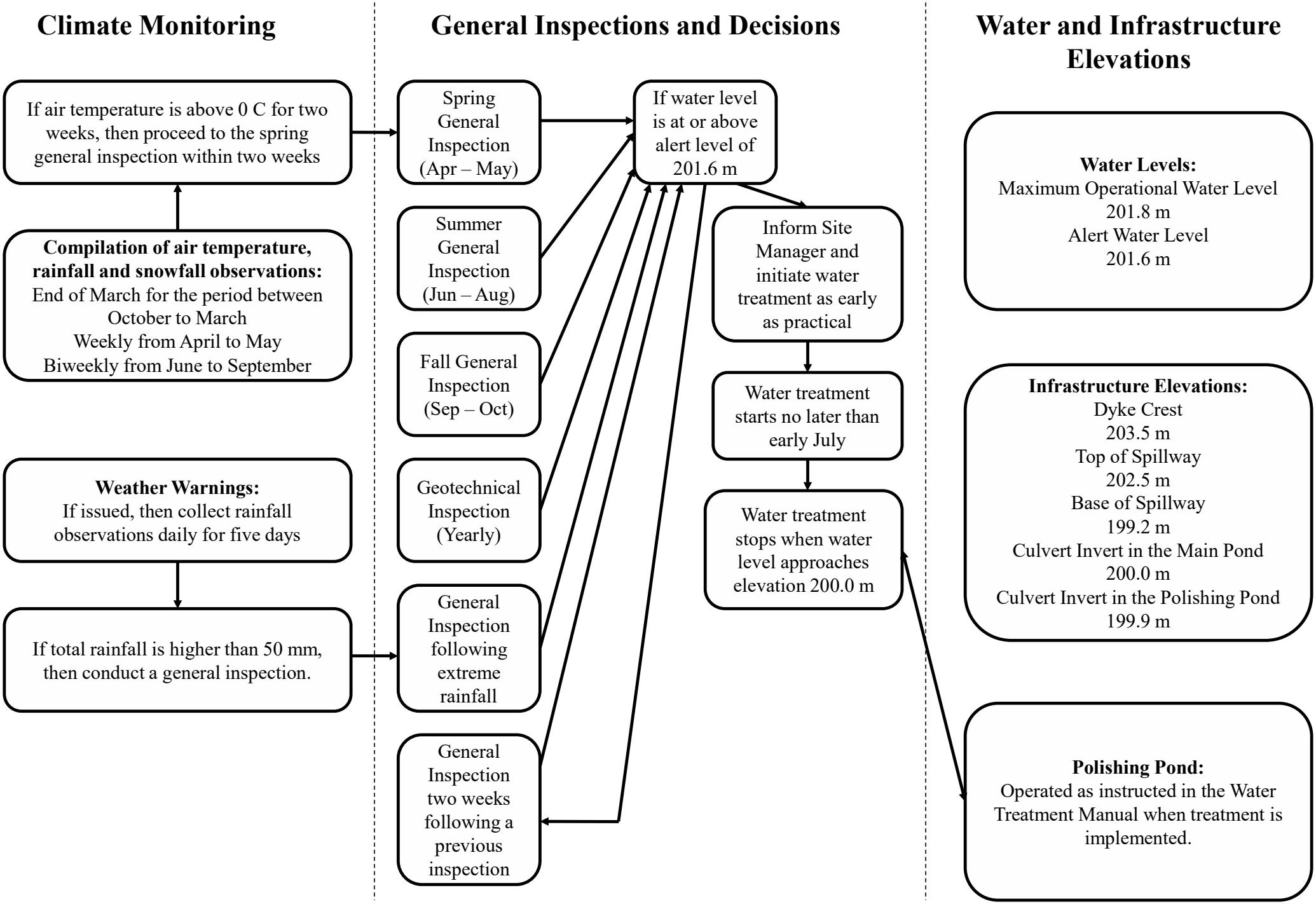
Golder Associates

PROJECT No.		1656457	FILE No.		1656457-1400-001
DESIGN	JH	07OCT08	SCALE		REV.
CADD	SS	07OCT08	**FIGURE 4**		
CHECK	JH	07OCT08			
REVIEW	BW	20FEB17			

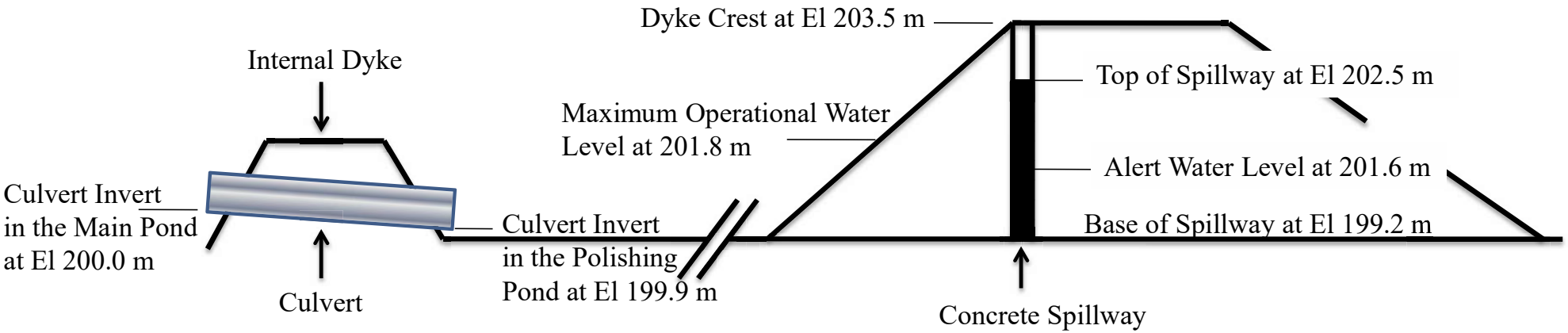
APPENDIX A

Flowchart Diagram of Operational and Climate Monitoring Practices for Water Releases

Operational and Climate Monitoring Practices for Water Releases



Water and Infrastructure Elevations



Not to scale

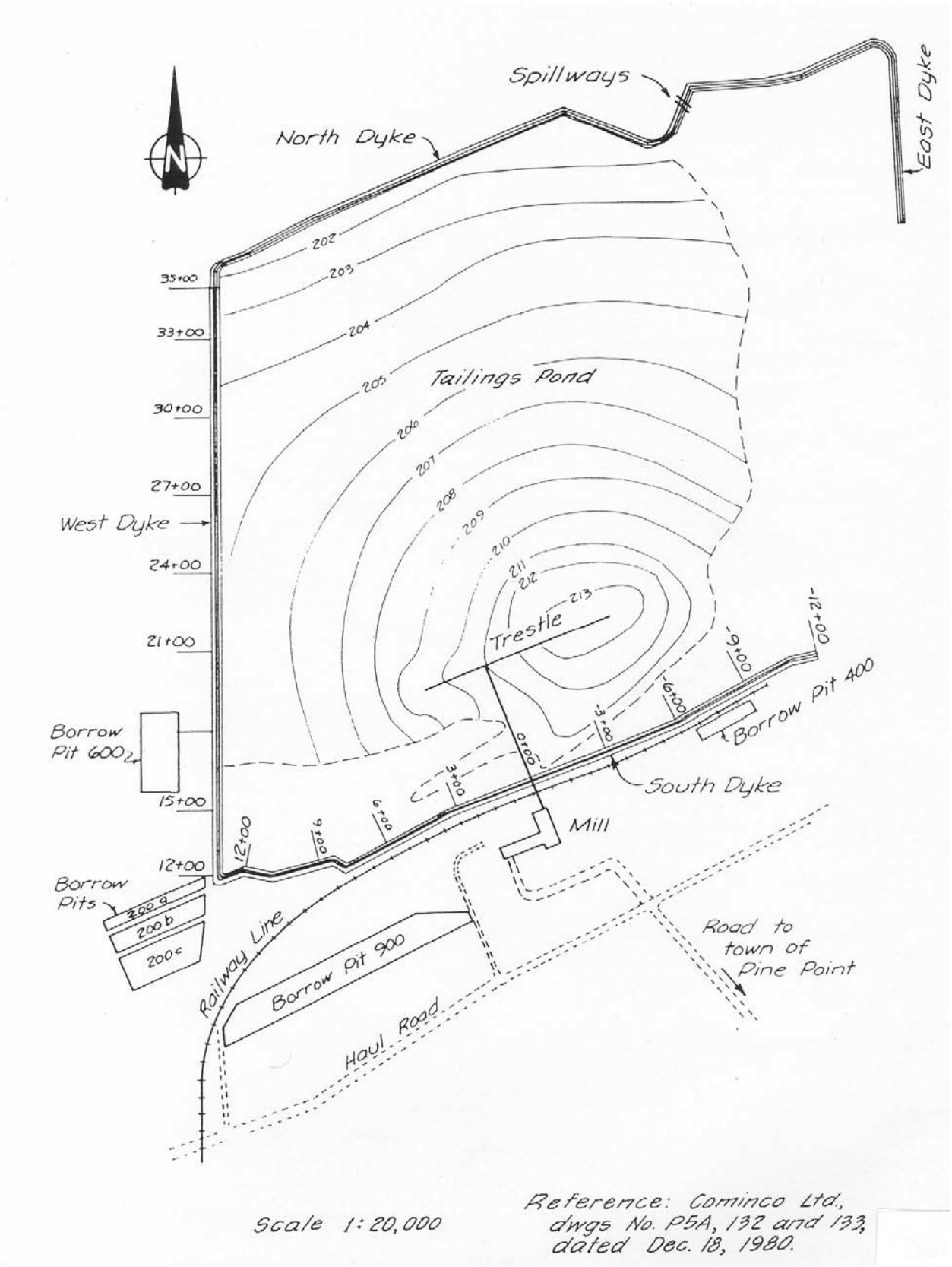
APPENDIX B

Inspection Form

Tailings Impoundment Inspection Form
Pine Point Tailings Impoundment

Date:		Inspected By:
Weather:		
Tailings Pond Information:		
Pond Elevation:		Operating Limits:
Crest Elevation: -note for each area.		Freeboard:
Dyke Inspection Check List (✓ = checked and no problems; x = not checked)		
Check: Upstream Slope of Dyke, Crest and Downstream Slope of Dyke		
South Dyke	**Checked**	**Comment**
Ponded Water		
Erosion		
Settlement/Depressions		
Cracks/Movement		
Debris: on upstream side.		
Vegetation		
Other – (photos)		
Notes:		Water ponded on outside.
West Dyke		
Ponded Water		Water is or is not at dam.
Erosion		Downstream Slope.
Settlement/Depressions (on dam crest)		
Sinkholes		In front of dam
Cracks/Movement		
Debris		
Vegetation		
Other – (photos)		
Notes:		Seepage at north end.

North Dyke	**Checked**	**Comment**
Ponded Water		GPS Coordinates: - where on north side
Erosion		Upstream slope - Downstream slope -
Settlement/Depressions		
Sinkholes		Pond side
Cracks/Movement		Dam Crest
Debris		
Vegetation		
Main Pond Spillway		
Treatment Spillway		
Other – (photos)		
Notes:		
East Dyke		
Ponded Water		
Erosion		
Settlement/Depressions		
Sinkholes		
Cracks/Movement		
Debris		
Vegetation		
Other – (photos)		
Notes:		Water ponded at dyke -


Spillways
East Dyke
North Dyke
N
202
203
204
205
Tailings Pond
206
207
208
209
210
211
212
213
Trestle
35+00
33+00
30+00
27+00
West Dyke
24+00
21+00
15+00
12+00
-12+00
-9+00
-6+00
-3+00
0+00
3+00
6+00
9+00
12+00
Borrow Pit 600
Borrow Pit 400
South Dyke
Mill
Borrow Pits
200a
200b
200c
Railway Line
Borrow Pit 900
Haul Road
Road to town of Pine Point
Scale 1:20,000
Reference: Cominco Ltd., dwgs No. P5A, 132 and 133, dated Dec. 18, 1980.

Tailings Impoundment Inspection
Explanation of Details

Ponded Water:

Look for pools of water against the inside or outside slopes of the Dyke structure. The pooled water is a potential source of water to erode the dyke and therefore the presence of any water must be recorded. Ideally the GPS location should be noted in the comments area.

Another aspect of pooled water is that it may be a source of seepage water at the outside toe of the dyke therefore where pooled water is observed look for increased seepage at the toe. The presence of water at the dyke face can be an indication of increased water levels within the dyke which can decrease Dyke stability.

Erosion:

The presence of small rills, up to 0.3m deep, on the downstream face of the dyke are normal and of no concern. If the rills start eroding into channels greater than 0.3 m and are cutting into the crest more than 0.5 m then the rills must be filled to prevent further progress.

Erosion can also be caused by wave action on the pooled water. Erosion has been occurring on the inside slope of the North Dyke and will soon require placement of material to armor the dyke face. Erosion into the till core must be prevented therefore any excessive erosion must be reported. Ideally record the GPS location so the area can be found on future inspections.

Settlement/Depressions:

Settlement or depressions in the crest or slopes indicate groundwater erosion of the interior of the dyke. Look for any visible seepage at the toe of the dyke. This is a very serious problem and it must be investigated by a professional.

Ideally record the GPS location so the depression can be easily found.

Sinkholes:

Sinkholes are localized deep depressions and are another indication of interior erosion of the dyke. This is a very serious problem and it must be investigated by a professional.

Ideally record the GPS location so the depression can be easily found.

Cracks/Movement:

Cracks accompanied by movement are an indication of a dyke failure and material would probably be seen flowing from the toe of the dyke. This is a very serious situation which must be reported immediately and be investigated by a professional. Ideally record the GPS location so the area can be easily found.

Debris:

Accumulation of debris on the dyke can prevent inspection of the dyke and should be removed.

Vegetation:

Small vegetation on the slopes of the dykes is good to minimize surface erosion. Larger vegetation hinders inspections of the dyke and can damage the dyke if root systems penetrate the till core or large root systems are ripped out by the wind. Therefore any trees on the dyke slopes over 1" diameter should be removed.

Photos:

A log of photos should be maintained.
Locations of key photos should be noted so future photos are taken from the same spot of area looking at the same feature.

APPENDIX C

Contingency Plan, Pine Point Mine Tailings Impoundment Area

Pine Point Mine Tailings Impoundment Area

Contingency Manual

2017

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

1.0 PURPOSE & OBJECTIVES

The purpose of this contingency manual is to minimize health hazards and adverse environmental effects caused by spills, as well as to comply with the Canadian Environmental Protection Act, *Environmental Emergency Regulations*.

This document outlines contingency measures and response strategies for spills of potentially hazardous substances in the Pine Point Tailings area, which may adversely affect the environment, and/or human health and safety. Rapid deployment of emergency personnel and equipment to a spill will both protect the health and safety of employees and public as well as minimize potential effects to the environment.

All Teck Resources Limited (Teck) employees and Contractors working at the Pine Point Mine Tailings Impoundment Area (TIA) should be familiar with this document. New employees and contractors will be introduced to the plan as part of their orientation. Personnel will understand the potentially hazardous situations that spills can create to the health and safety of workers and the environment. They will understand their responsibilities as workers to prevent, identify, report, and appropriately deal with a spill. This document will be available for viewing by all workers. The company will advise workers of revisions or changes to the plan.

The objectives of the manual are:

- To identify potentially hazardous materials located on site.
- To identify spill prevention measures.
- To identify and describe spill response and emergency response measures in the case of an incident.
- To establish a high order of preparedness in the event that a spill occurs.
- To ensure an orderly and timely decision-making, response and reporting process.

2.0 SITE DESCRIPTION

Figure 1 provides a general location map for Pine Point, Figure 2 depicts an area overview of the Tailings Pond area.

The mine operated from the early 1960's until the spring of 1988. Lead/zinc ore from the open pits was trucked to the plant site where it was treated to separate and recover the lead and zinc minerals into two concentrates. Recovery of the minerals was accomplished using a flotation process. The mineral concentrates were generally shipped by rail as they were produced. In the final years of operation stockpiles of concentrate were built to the east and west of the plant site. The tailings from the treatment plant were discharged into the tailings pond located north of the plant site. The processing plant was shut down permanently in the spring of 1988. After shutdown the stockpiles of concentrate were shipped until they were depleted. The site was prepared for abandonment by following the approved Abandonment & Restoration Plan.

The TIA is the only remaining area under lease where annual water treatment and discharge will occur until treatment is no longer required.

Figure 1: General Location Map

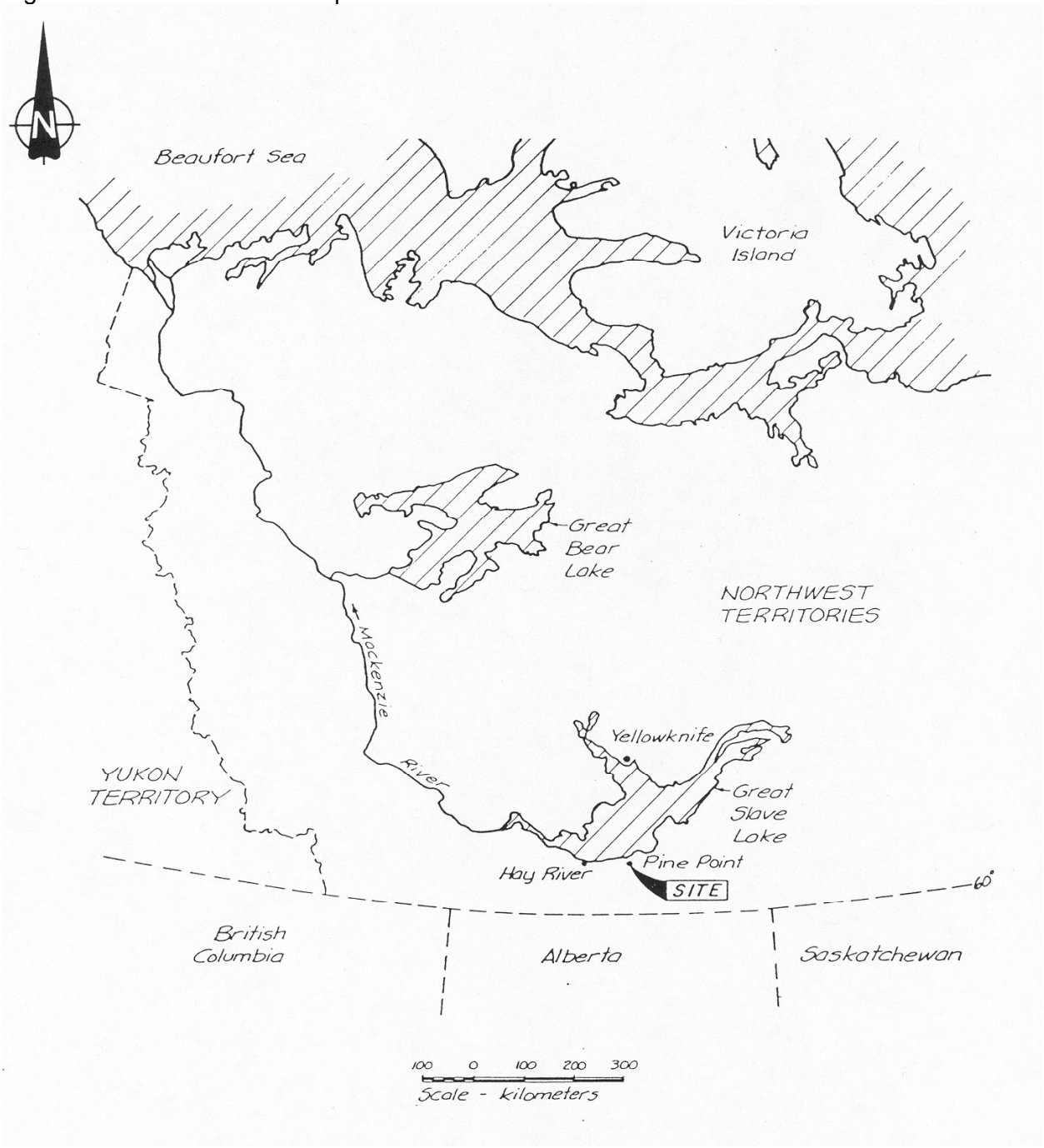
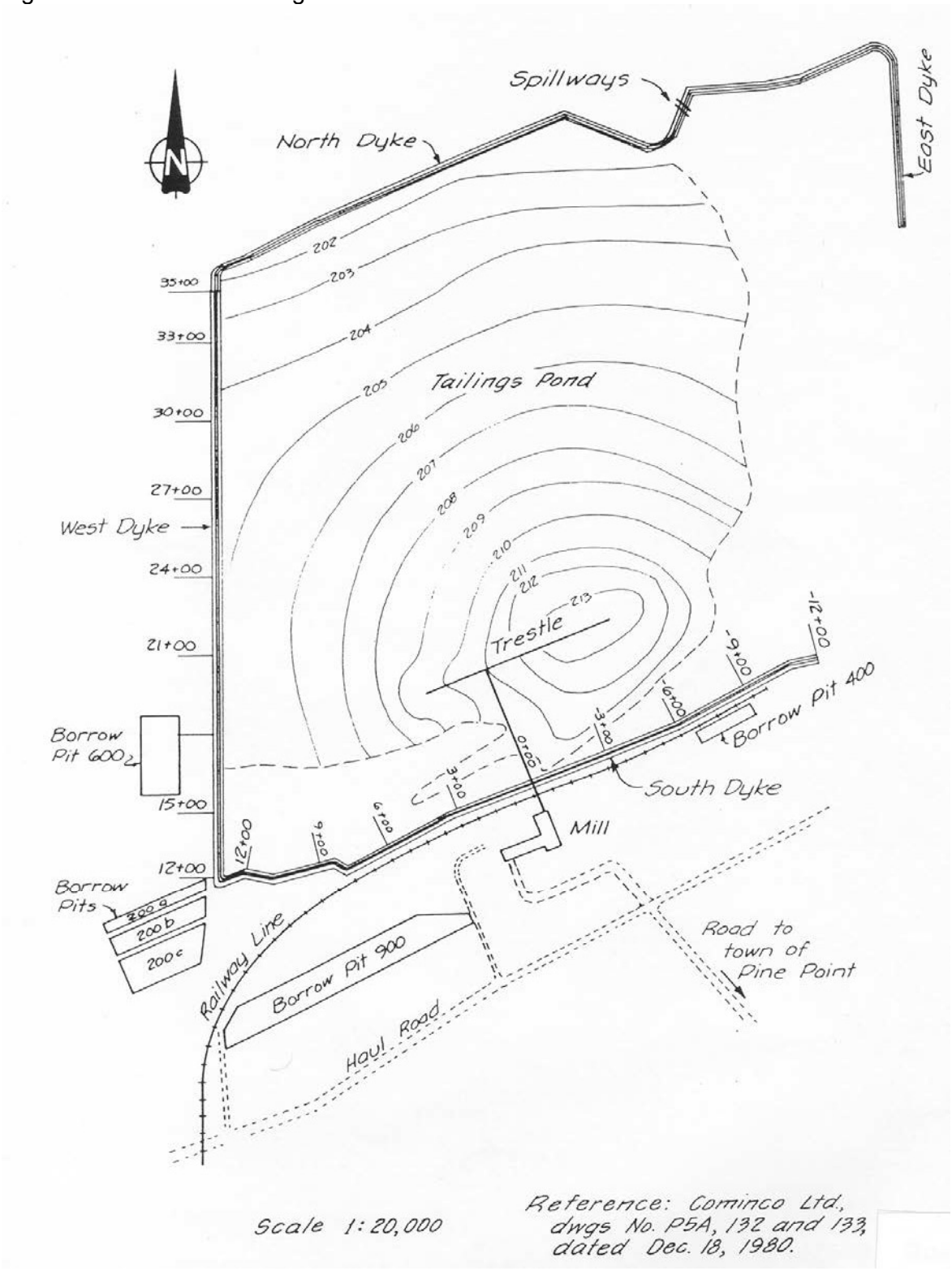


Figure 2: Overview of Tailings Pond Area



3.0 TECK RESOURCE LIMITED'S COMMITMENT TO THE ENVIRONMENT

Teck is committed to advancing environmental protection and providing safe working conditions for employees and contractors. The company recognizes the need to maintain and improve environmental quality on its property. The prevention of deleterious substances from operations entering and impacting the environment is imperative to the Company's long-term future in Canada.

Teck will take an active and aggressive role in minimizing the impact of its operations on the environment by utilizing appropriate technologies and effective management strategies. The company believes that it has a responsibility to develop resources productively and efficiently by applying technologies in a manner that is environmentally responsible.

4.0 GENERAL SPILL CONTINGENCY PLAN

4.1 RESPONSE ORGANIZATION

The mine remains permanently closed and therefore there are no personnel on-site except during the summer water treatment period. There are no Hazardous Materials on the site except during the water treatment period. The only possible spills, other than during the water treatment period, would be related to the TIA dykes. In the event of an incident the Site Manager is responsible for coordinating activities.

As the Incident Commander, the Site Manager is responsible for:

- Overall command and control of an incident.
- Establishing response objectives and strategies.
- Providing information to authorities regarding reportable incidents.
- Scheduling meetings to update the response plan.

During the water treatment period, there will be personnel on-site with Hazardous Materials, in relatively small volumes, under their control. In the event of a spill, the personnel would react immediately to a spill and contact the Site Manager.

4.2 REPORTABLE SPILLS

A spill in excess of the following thresholds is considered a spill under the N.W.T. Spill Contingency Planning and Reporting Regulations (N.W.T. Reg. 068-93), pursuant to the Environment Protection Act. In these regulations "Federal Regulations" means the amended Transportation of Dangerous Goods Regulations (International Harmonization Update, 2016) SOR/2016-95.

Table 1: Reportable Spill Quantity of Dangerous Goods

Substance Spilled	Severe Marine Pollutant	TDG Code	Reportable Quantity
Explosives of Class 1 as defined in section 3.9 of the Federal Regulations.		1	Any amount
Flammable gases, of Division 1 of Class 2 as defined in section 3.11 (a) of the Federal Regulations.	**Gasoline**	2.1	Any amount of gas from a container larger than 100L, or where the spill results from equipment failure, error or deliberate action or inaction.
Non-flammable gases of Division 2 of Class 2 as defined in section 3.11 (d) of the Federal Regulations.		2.2	Any amount of gas from a container larger than 100L, or where the spill results from equipment failure, error or deliberate action or inaction.
Poisonous gases of Division 3 of Class 2 as defined in section 3.11(b) of the Federal Regulations.		2.3	Any amount
Corrosive gases of Division 4 of Class 2 as defined in section 3.11 (c) of the Federal Regulations.		2.4	Any amount
Flammable liquids of Class 3 as defined in section 3.12 of the Federal Regulations.	**Diesel**	3	200L (Any amount if spilled into a watercourse)
Flammable solids of Class 4 as defined in section 3.15 of the Federal Regulations.		4	25 kg
Products or substances that are oxidizing substances of Division 1 of Class 5 as defined in sections 3.17(a) and 3.18(a) of the Federal Regulations.		5.1	50 kg or 50 L
Products or substances that are organic compounds that contain the bivalent "-0-0-"structure of Division 2 of Class 5 as defined in sections 3.17 (b) and 3.18 (b) of the Federal Regulations.		5.2	1 kg or 1L
Products or substances that are poisons of Division 1 of Class 6 as defined in sections 3.19 (a) to (e) and 3.20 (a) of the Federal Regulations.		6.1	5 kg or 5 L
Organisms that are infectious or that are reasonable believed to be infectious and the toxins of these organisms as defined in sections 3.19(f) and 3.20(b) of the Federal Regulations.		6.2	Any amount
Radioactive materials of Class 7 as defined by section 3.24 of the Federal Regulations.		7	Any discharge or a radiation level exceeding 10 mSv/h at the package surface and 200 mSv/h at 1 m from the package surface.
Products or substances of Class 8 as defined by section 3.24 of the Federal Regulations.		8	5 kg or 5 L
Miscellaneous products or substances of Division 1 of Class 9 as defined by sections 3.27 (1) and 2 (a) of the Federal Regulations.		9	50 kg or 50 L

TDG = Transportation of Dangerous Goods.

4.3 DISCOVERY AND RESPONSE TO SPILLS

The following provides a general response to any spill upon initial discovery. Refer to Appendices A and B for more specific information including spill response procedures and MSDS documents for the particular substances located at the mine site.

Appendix B – **Gasoline**

Appendix C – **Diesel**

FIRST PERSON TO OBSERVE THE SPILL:

Ensure personal and worker safety, if you cannot identify the spilled substance consider it dangerous.

If personnel are injured

- Call for medical help, attend to injured person, and administer first aid if safe to do so.

If Safe

- Stop all sources of ignition and stop or reduce the source flow of the spill.
- Shut off all valves.
- Shut off all electrical power.
- Initiate containment.
- Put down adsorbent pads and berm spill area, if possible.
- Do not enter confined spaces.
- Do not expose self to fire hazard.
- Complete the spill report form and report the spill.

If Unsafe

- Initiate evacuation (upgrade or upwind) – move to safe area.
- Notify Site Manager.
- Isolate area and deny entry until qualified response personnel arrive.
- Deny access to all unauthorized personnel.
- Complete the spill report form and report the spill.
- Update Site Manager on spill status.

4.4 TAILINGS DYKE FAILURE

Risk

The risks to the TIA dykes potentially include:

- Release untreated water if water levels exceed specific elevations, or
- Release water and tailings if one of the dykes were to be breached.

Due to the remote location of the TIA, the release of water and/or tailings are not a significant risk to human health or safety. There are no dwellings close to the area and only rarely are individuals present close enough to the dykes that a sudden release of tailings or water would represent a risk. Release of the tailings pond effluent and tailings would have minimal environmental impact in the short term and in the longer term mitigation strategies (such as relocating tailings back into the TIA and reconstructing the dykes could be implemented).

Prevention

The tailing dykes that partially surround the TIA are inspected three times a year in compliance with the Water License. These are completed in spring summer and fall. At a minimum of once every year, the summer inspection is conducted by a qualified geotechnical engineer.

The Operation, Maintenance and Surveillance (OMS) Manual recommends that the water level in the pond be maintained at or less than the maximum operational water level so that in the event of a high wind, waves on the pond will not overtop and erode the crest of the dykes.

To maintain the pond level at or below the maximum operational water level (201.8 m), the pond level is inspected during the spring, summer and fall inspections. If the water level is at or above the alert level of 201.6 m, the site manager is informed and the water is treated and released as early as practical. Water treatment stops when water level approaches elevation 200.0 m.

Accidental Release of Contents

Potential risks to the dykes could occur due to the following events:

1. **Event:** Erosion from wave action on the face of the dykes or from precipitation. If erosion were to become extreme, the potential to weaken the dyke to the point of failure is possible.
   Actions: Identification of this condition should be undertaken during one of the three annual inspections of the dam. If significant erosion is noted, or if a full or partial dyke breach were to be the result, the Site Manager must be contacted and informed of the situation. The Site Manager will then contact the geotechnical consultant to conduct a formal inspection of the dam and to make recommendations as to whether repairs to the dyke are required as well as specify the details of the repairs. Identified source materials for any repairs and a list of contractors are detailed in the OMS Manual. If any release of tailings were to have occurred, they would need to be moved back into the impoundment area upon completion of repairs.

2. **Event:** Water levels in the pond exceed the height of the spillway.

   Response: In the event that water treatment was not carried out, the pond level could be relatively high going into the fall season. It is possible that prior to the next season's normal treatment period, the elevation of the pond could exceed the elevation of the spillway invert and effluent from the pond be discharged in the spring during freshet. Upon discovery of this, the Site Manager must be contacted and a treatment program initiated so that the water level in the pond could be lowered to or below the maximum operational level as defined in the OMS Manual.

3. **Event:** An earthquake causes structural damage to the dam.

   Response: If there is an earthquake in excess of magnitude 5 within 100 kilometers, the Site Manager is notified by the federal government. The Site Manager will immediately contact a geotechnical engineer to undertake a dam inspection; and if this cannot be done in a timely fashion the Site Manager will have another person with geotechnical experience make an interim inspection of the facility. Recommendations from the geotechnical engineer would be acted upon and dyke repairs initiated. Identified source materials for any repairs and a list of contractors are detailed in the OMS Manual. Any tailings released would need to be returned to the impoundment after dyke repairs were completed. The Site Manager is responsible for coordinating repairs using identified material sources.

With any of the above accidental releases, the volumes and concentrations of zinc in the water discharged would exceed the permit limits. Therefore the spill line would need to be contacted and the spill reported.

4.5 COMMUNICATION: SPILL REPORTING

4.5.1 Teck Resources Limited's Reporting and Contact Information

Spills with quantities greater than those shown in section 4.2 must be immediately reported to the Site Manager. If the Site Manager is unavailable, contact Teck's designated alternate, as detailed in Table 2.

If the on-site person is unable to make direct contact with the Site Manager or designated alternate they shall report the incident to the N.W.T. 24 Hour Spill Report Line at 1-867-920-8130.

If possible contact the local Resource Management Officer, Olivia Villebrun, at 867-872-2558 and inform her of the situation.

Table 2: Contact Details for Site Manager and Alternate

Site Manager: Dana Haggar	
Office Tel.	250-427-8413
Cell	250-602-9361
Alternate #1: Michelle Unger	
Office Tel.	250-427-8422
Cell	250-432-5264

If the Site Manager deems that the spill has exceeded the reporting threshold for the spilled substance, Teck's Head Office in Vancouver and the appropriate government agencies will be notified. The government procedure is outlined in the following section, "External Notification".

4.5.2 External Notification

All spills of petroleum products or other hazardous materials exceeding the appropriate threshold must be reported. The Site Manager is responsible for all external reporting. Although several government agencies at the federal, territorial and municipal levels may ultimately be involved, only one government contact is required to be made by the Site Manager or his designate for mine site spills. Affected Agencies will be contacted at:

Northwest Territory 24 HOUR SPILL REPORT LINE

Telephone: 1-867-920-8130

This is a 24 Hour telephone number to Environment Canada. They will notify all other concerned agencies when necessary. The following information shall be conveyed to the affected agencies through the 24 Hour Spill Report Line. This information is to be documented on the "Spill Reporting Form" provided in Appendix A-1.

The reporting person must give as much of the following information as possible:

a) Date and time of spill.

b) Location of spill as follows:
Pine Point Tailings Area 100 km by road east of Hay River, 10 km south of Great Slave Lake.

c) Direction the spill is moving.

d) Name and phone number of a contact person close to the spill location.

e) Type of contaminant spilled and quantity spilled.

f) Cause of spill.

g) Whether spill is continuing or has stopped.

h) Description of existing containment.

i) Action taken to contain, recover, clean up and dispose of spilled contaminant.

j) Name, address and phone number of person reporting spill.

k) Name of owner or person in charge, management or control of contaminants at time of spill.

A list of typical spill response equipment is provided in Appendix A-2.

4.5.3 External Technical Advice - CANUTEC

The Canadian Transport Emergency Center (CANUTEC), a branch of Transport Canada, can also be contacted for 24-hour technical advice on Dangerous Goods, as needed. The CANUTEC – help line for dangerous goods is 1-888-226-8832 or 613-996-6666.

REFERENCES

Canutec. 2016. *Dangerous Goods Initial Emergency Response Guide 2016*. Minister of Supply and Services Canada 2016, Ottawa, Canada.

Government of Canada, Environment Canada. 1999. *Canadian Environmental Protection Act, (1999).*

Government of Canada, Environment Canada. 2003. *Environmental Emergency Regulations (2003).*

Government of Northwest Territories. *Spill Contingency Planning and Reporting Regulations N.W.T. Reg. 068-93*, *Environmental Protection Act (1988).*

APPENDIX D

Mackenzie Valley Land and Water Board Type B Water Licence. Licence Number MV2006L2-0013

Mackenzie Valley Land and Water Board
7th Floor - 4910 50th Avenue • P.O. Box 2130
YELLOWKNIFE, NT X1A 2P6
Phone (867) 669-0506 • FAX (867) 873-6610

October 26, 2007 File: MV2006L2-0013

Mr. Bruce Donald
Teck Cominco Metals Ltd.
Bag 2000
KIMBERLEY BC V1A 3E1 Fax: (250) 427-8451

Dear Mr. Donald:

ISSUANCE OF A TYPE "B" WATER LICENSE

Attached is Water License No. MV2006L2-0013 granted by the Mackenzie Valley Land and Water Board (MVLWB) in accordance with the *Northwest Territories Waters Act.* A copy of this License has been filed in the Public Registry at the office of the MVLWB. The MVLWB approved Water License MV2006L2-0013 for a period of ten (10) years commencing October 29, 2007 and expiring October 28, 2017.

Please read all conditions carefully and note that as per Water License condition Part B: Item 1, a security deposit in the amount of $100,000.00 shall be posted with the Minister and copied to the Board prior to the start of the operation pursuant to Section 17 of the *Northwest Territories Waters Act.* Please submit payment of the security, made out to the Receiver General of Canada, to the MVLWB office.

Attached are general procedures for the administration of licenses in the Northwest Territories. The MVLWB requests that you review these and address any questions to the Boards office.

Please be advised that this letter, with attached procedures, all inspection reports, and correspondence related thereto, are part of the Public Registry, and are intended to keep all interested parties informed of the manner in which the License requirements are being met. All Public Registry material will be considered if an amendment to the Permit is requested.

The full cooperation of Teck Cominco Ltd. is anticipated and appreciated.

Yours sincerely,

Willard Hagen
Interim Chair

Attachments

Copied to: Darnell McCurdy, South Mackenzie District, INAC,
Kathleen Racher, Water Resources Division, IANC
Kathleen Graham, Regulatory Officer, MVLWB

MACKENZIE VALLEY LAND AND WATER BOARD
WATER LICENSE

Pursuant to the *Mackenzie Valley Resource Management Act* and Regulations, the Mackenzie Valley Land and Water Board, hereinafter referred to as the Board, hereby grants to:

Teck Cominco Metals Ltd.
(Licensee)

of 600-200 Burrard Street, Vancouver, British Columbia V6C 3L7
(Mailing Address)

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

License Number:	MV2006L2-0013
License Type:	B
Water Management Area:	Northwest Territories 01
Location:	60°53'41.3"N and 114°25'30.7"W (Formerly known as Pine Point NT)
Purpose:	MONITORING OF WATER IN AND ADJACENT TO THE TAILINGS CONTAINMENT AREA, AND DISPOSAL OF WASTES FROM THE TAILINGS POND
Description:	Mining and Milling
Quantity of water **not to be exceeded**:	Zero (0)
Effective Date of License:	October 29, 2007
Expiry Date of License:	October 28, 2017

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

MACKENZIE VALLEY LAND AND WATER BOARD

Witness **Chair**

PART A: SCOPE AND DEFINITIONS

1. Scope

a) This License allows for the monitoring of water in and adjacent to the Tailings Containment Area, and disposal of wastes from the tailings pond at 60°53'41.3"N and 114°25'30.7"W, formerly known as Pine Point, Northwest Territories.

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

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

2. Definitions

In this License: **MV2006L2-0013**

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

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

"**Average Concentration**" means the discrete average of four consecutive analytical results, or if less than four analytical results collected during a batch decant, and as submitted to the Board in accordance with the sampling and analysis requirements specified in the "Surveillance Network Program";

"**Board**" means the Mackenzie Valley Land and Water Board established under Part 4 of the *Mackenzie Valley Resource Management Act*;;

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

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

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

"**Tailings Containment Area**" comprises the tailings containment basin and the engineered structures designed to contain tailings as described in Golder Associates Pine Point Tailing Dyke Extension 1987 North Portion of Tailings Area Drawing Number GA-1150-10 and South Portion of Tailings Area Drawing Number GA-1150-11;

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

PART B: GENERAL CONDITIONS

1. Prior to the disposal of waste, the Licensee shall have posted and shall maintain a security deposit in the amount of $100,000 pursuant to Section 17(1) of the *Act* and Section 12 of the Regulations. The security deposit shall be maintained until such time as it is fully or in part refunded by the Minister pursuant to Section 17 of the *Act.* This clause shall survive the expiry of this License.

2. The Licensee shall file an Annual Report with the Board not later than March 31st of the year following the calendar year reported which shall contain the following information:

   (a) tabular summaries of all data generated under the "Surveillance Network Program";

   (b) any revisions to the approved Contingency Plan;

   (c) any revisions to the approved Abandonment and Restoration Plan;

   (d) a description of any restoration or reclamation work carried out;

   (e) results of any studies associated with restoration and reclamation;

   (f) a report on any inspection of the Tailings Containment Area pursuant to Part C, Item 1 (i);

   (g) a summary of modifications and/or major maintenance work carried out on the waste disposal systems and all associated structures;

   (h) a list of unauthorized discharges;

   (i) any other details waste disposal requested by the Board by November 1st of the year being reported;

3. The Licensee shall comply with the "Surveillance Network Program" annexed to

this License, and any amendment to the said "Surveillance Network Program" as may be made from time to time, pursuant to the conditions of this License.

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

5. The Licensee shall, within sixty (60) days of the issuance of this License, post the necessary signs, where possible, to identify the stations of the "Surveillance Network Program". All postings shall be located and maintained to the satisfaction of an Inspector.

PART C: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Tailings Containment Area shall be constructed, operated and maintained to engineering standards such that:

   a) the solids fraction of the Mill Tailings shall be permanently contained within the Tailings Containment Area;

   b) seepage from the Tailings Containment Area is minimized;

   c) any seepage which does not meet the effluent quality limits specified in Part C, Item 2 that occurs is collected and immediately returned to the Tailings Containment Area;

   d) a freeboard limit of 1.0 metre shall be maintained at all times;

   e) the rate of waste discharge is at all times controlled and measured;

   f) erosion of constructed facilities is rectified immediately;

   g) inspections of the tailings dams shall be carried out after spring freshet, once during the summer period, and again prior to freeze-up in the fall. Records of these inspections shall be kept for review upon the request of an Inspector.

   h) more frequent inspections shall be performed at the request of an Inspector;

   i) an inspection of the Tailings Containment Area shall be carried out at least every five years in the summer by a qualified geotechnical engineer registered in the Northwest Territories. The engineer's report shall be submitted to the Board within sixty (60) days of the inspection, including a covering letter from the Licensee outlining an implementation plan to respond to the engineer's recommendations.

j) at the same time as the geotechnical engineer's report of the inspection is submitted under Part C, Item 1(i), above, the Licensee shall provide to the Board in writing, a schedule as to when all geotechnical recommendations from the report will be carried out.

2. All wastes discharged by the Licensee from the Tailings Containment Area shall meet the following effluent quality requirements:

PARAMETERS	MAXIMUM AVERAGE CONCENTRATION	MAXIMUM CONCENTRATION OF ANY GRAB SAMPLE
Total Arsenic	0.50 mg/L	1.00 mg/L
Total Copper	0.15 mg/L	0.30 mg/L
Cyanide	0.10 mg/L	0.20 mg/L
Total Lead	0.20 mg/L	0.40 mg/L
Total Zinc	0.50 mg/L	1.00 mg/L
Suspended Solids	25.00 mg/L	50.00 mg/L
Ammonia (as N)	2.00 mg/L	4.00 mg/L

The Waste discharged shall have a pH greater than six (6), and no waste discharged shall contain floating solids, or visible sheen of oil and grease.

3. The Licensee shall notify an Inspector of any planned discharge of waste from the Tailings Containment Area at least seven (7) days prior to such discharge occurring.

PART D: CONDITIONS APPLYING TO MODIFICATIONS

1. The Licensee may, without written approval from the Board, carry out modifications to the Waste Disposal Facilities provided that such modifications are consistent with the terms of this License and the following requirements are met:

   a) the Licensee has notified the Board in writing of such proposed modifications at least sixty (60) days prior to beginning the modifications;

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

   c) the Board has not, during the sixty (60) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and

   d) the Board has not rejected the proposed modifications.

2. Modifications for which all of the conditions referred to in Part E, Item 1 have not

been met, may be carried out only with written approval from the Board.

3. The Licensee shall provide to the Board as-built plans and drawings of the modifications referred to in this License within ninety (90) days of completion of the modifications.

PART E: CONDITIONS APPLYING TO CONTINGENCY PLANNING

1. The General Contingency Plan as submitted with the water license renewal application dated December 19, 2006 will come into effect as of the Effective Date of this License.

2. The Contingency Plan shall be reviewed annually by the Licensee and revised as necessary to reflect changes in activities and technology. The proposed revisions shall be submitted to the Board for approval.

3. The Licensee shall revise the Contingency Plan referred to in Part F, Item 1 within three (3) months of receipt of any concerns expressed by the Board.

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

   a) employ the appropriate contingency plan;

   b) report the incident immediately via the 24 Hour NWT Spill Report Line. Currently the number is (867) 920-8130; and

   c) submit to an Inspector, a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART F: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

1. The Licensee shall continue to implement the Abandonment and Restoration Plan approved by the Board during the previous Licensing periods.

2. The Licensee shall revise the Abandonment and Restoration Plan referred to in Part G, Item 1 within three (3) months of receipt of any concerns expressed by the Board.

3. The Licensee shall complete the restoration work as outlined in the plan, or as subsequent revisions are approved by the Board.

4. The Licensee shall review the Abandonment and Restoration Plan annually and shall modify the Plan as necessary to reflect changes in operation, technology, and results of reclamation and/or other studies. The proposed modifications shall be submitted to the Board for approval.

5. The Licensee shall provide updates of all abandonment and restoration activities under Part B, Item 2 above, by March 31st of each year.

6. Compliance with the Abandonment and Restoration Plan specified in this License shall not limit the legal liability of the Licensee, other than liability arising by operation of this *Act*.

MACKENZIE VALLEY LAND AND WATER BOARD

Witness **Chair**

LICENSEE:	Teck Cominco Ltd.
LICENSE NUMBER:	MV2006L2-0013
EFFECTIVE DATE OF LICENSE:	October 29, 2007
EFFECTIVE DATE OF SURVEILLANCE NETWORK PROGRAM (SNP):	October 29, 2007

SURVEILLANCE NETWORK PROGRAM

A. Location of Surveillance Stations

Station Number	Description
35-1	Tailings area discharge at the decant structure. (60°53'41.3"N/114°25'30.7"W).
35-1A	Containment Pond (60°53'41.3"N/114°25'30.7"W).
35-1B	Post-Treatment Effluent Discharge (60°53'41.3"N/114°25'30.7"W).
35-4	Muskeg surface water due north of tailings area decant structures 2½ miles from Great Slave Lake. (60°54'41.8"N/114°26'17.2"W)
35-5	Muskeg surface water 1 mile south of Great Slave Lake and 2 miles west of Station number 35-3. (60°54'27.7"N/114°27'30.4"W)
35-6	Muskeg surface water 1½ miles due south of Station number 35-5. (60°55'26.9"N/114°28'25.4"W)
35-9	Great Slave Lake 1½ miles southwest of Presquile Point. (60°55'35.0"N/114°36'04.1"W)
35-10	Great Slave Lake 3 miles east of Presquile Point. (60°57'00.2"N/114°27'56.6"W)

35-12	Muskeg surface water 3 miles north of tailings area decant structures, ½ mile south of Great Slave Lake shoreline. (60°57'02.1"N/114°25'06.6"W)
35-13	Muskeg surface water 2½ miles east of Station Number 35-9 and ½ mile south of Great Slave Lake shoreline. (60°55'59.1"N/114°31'59.0"W)

B. Sampling and Analysis Requirements

1. The tailings area discharge at Station 35-1 shall be sampled daily during discharge and analysed for the following parameters:

Total Copper	pH
Total Lead	Suspended Solids
Total Zinc	

2. The waters of Great Slave Lake, the swamp and muskeg area adjacent to the Tailings Containment Area shall be sampled once during the spring of 2007, and every two years thereafter, at the following station numbers: 35-1, 35-4, 35-5, 35-6, 35-9, 35-10, 35-12, and 35-13. If water is to be discharged from the Tailings Containment Area in any given year, waters at these stations shall be sampled in the Fall following the discharge. Samples shall be analyzed for the following parameters:

Total Copper	pH
Total Lead	Total Zinc

3. Water in the Tailings Containment Area shall be sampled three times a year (spring, summer, and fall), during periods of open water and analysed for the following parameters:

Total Zinc	Total Lead
Total Copper	

4. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of "Standards Methods for the Examination of Water and Wastewater", or by such other methods approved by an Analyst.

5. All analyses shall be performed in a laboratory approved by an Analyst. The Licensee shall annually review the approved Quality Assurance/Quality Control Plan and modify the plan as necessary. Proposed modifications shall be submitted to an Analyst for approval.

7. The plan referred to in Part B, Item 6, shall be implemented as approved by an Analyst.

C. Other Requirements

1. The daily and annual quantity of (treated) waste water discharged from Surveillance Network Program Station Number 35-1 shall be measured and recorded in cubic metres.

2. The water level of the holding pond within the Tailings Containment Area shall be recorded three times a year, (spring, summer, and fall), in conjunction with sampling referred to in Part B, Item 3 during periods of open water.

D. Reports

1. The Licensee shall, unless otherwise requested by an Inspector, include all of the data and information required by the "Surveillance Network Program" including the results of the approved quality assurance/quality control program in the Licensee's Annual Report, which Report shall be submitted to the Board on or before March 31st of the year following the calendar year being reported.

MACKENZIE VALLEY LAND AND WATER BOARD

Witness **Chair**

Mackenzie Valley Land and Water Board
7th Floor - 4910 50th Avenue
P.O. Box 2130
YELLOWKNIFE NT X1A 2P6
Phone (867) 669-0506
FAX (867) 873-6610

FILE NUMBER: MV2006L2 – 0013

Date: November 2, 2007

To: Mr. Bruce Donald

Organization: Teck Cominco Metals Ltd.

Fax Number: (250) 427-8451

Copied To: Darnell McCurdy, SMD, INAC
Kathleen Racher, WRD, INAC

From: Elaine Briere for Kathleen Graham, Regulatory Officer

Number of pages including cover 13

Remarks:

Issuance of Type "B" Water License

☒ Enclosures

☐ As requested

☒ For your information

☐ For your comment

☐ For your approval

Delivered by	**Date**
☐ Mail	
☐ Courier	
☐ Hand Delivered	
☒ Fax	November 2, 2007

Job number : 289 *** SEND SUCCESSFUL ***

Mackenzie Valley Land and Water Board
7th Floor - 4910 50th Avenue
P.O. Box 2130
YELLOWKNIFE NT X1A 2P6
Phone (867) 669-0506
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Delivered by	Date
☐ Mail	
☐ Courier	
☐ Hand Delivered	
☒ Fax	November 2, 2007

Group Send Report

Page : 001
Date & Time: 02-Nov-2007 08:40am
Line 1 : +8678736610
Line 2 :
Machine ID : MVLWB

Job number : 289

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Number of pages : 013

Start time : 02-Nov 08:34am

End time : 02-Nov 08:40am

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One touch numbers

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58	6692716

Fax numbers

☎12504278451

Unsuccessful nbrs. Pages sent

Attachment 13 – Water Treatment Manual

Teck

Pine Point Mine Tailings Impoundment Area

Water Treatment Manual

Revised April 2017

Table of Contents:

List of Appendices

1. Introduction

The Tailings Impoundment Area is leased from the NWT Government and is the last operational area left from the former Pine Point Mine. The Tailings Area has been covered to prevent dust migration and to assist in establishing a vegetation cover.

Water accumulates in the pond every spring from snowmelt and rainfall. The water is elevated in Zinc, Lead and Copper and cannot be released to the environment without treatment. Therefore every summer the accumulated water is treated and the water level in the pond is dropped to a minimum level.

The water treatment plant is a simple lime treatment system that consists of: a lime silo, trailer mounted pump/blower unit, lime slurry tank, jet mixer, water pump and a trailer mounted laboratory. Most of the equipment is stored in Hay River through the winter and is assembled for the operating period.

The treatment process is usually started in late June and runs for 4 -6 weeks or whatever is required to bring the pond level down. The operating personnel stay on the site and make trips to Hay River to deliver samples as necessary.

2. Location

2.1. Site Location

The Pine Point Location is shown in Figure 1.

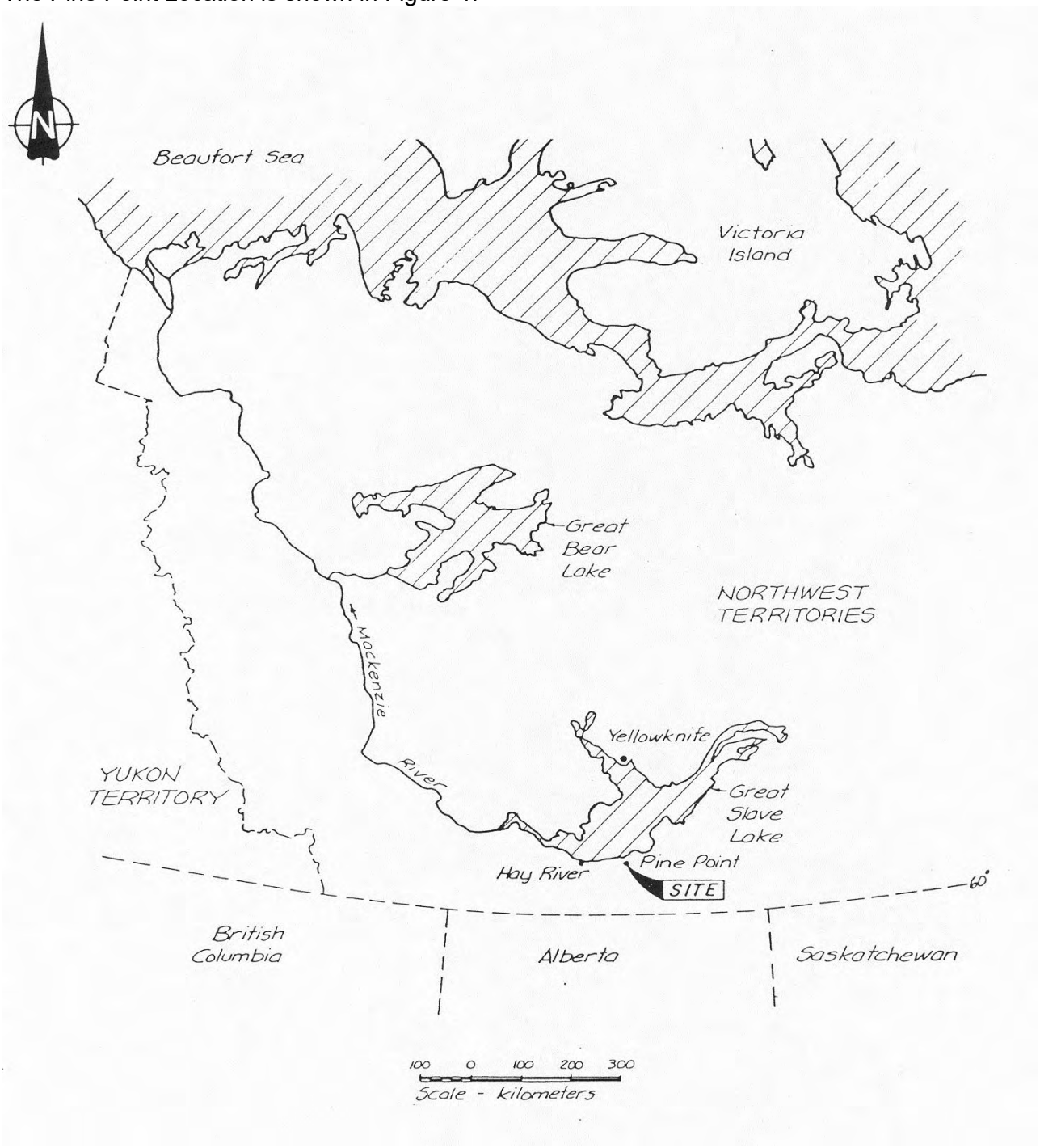


Figure 1: Site Location

2.2. Tailings Pond Impoundment

Pine Point Tailings Impoundment July 2006

The Tailings Impoundment is approximately 2.5 km by 2.8 km and contains about 60 million tons of tailings. Surface runoff covers the north end of the impoundment and the extent of the water is dependent on the water elevation. Modeling of the pond volumes/elevation and runoff done for the Operating, Maintenance and Surveillance Manual (OM&S) determined the key pond elevations as shown in the following figure.

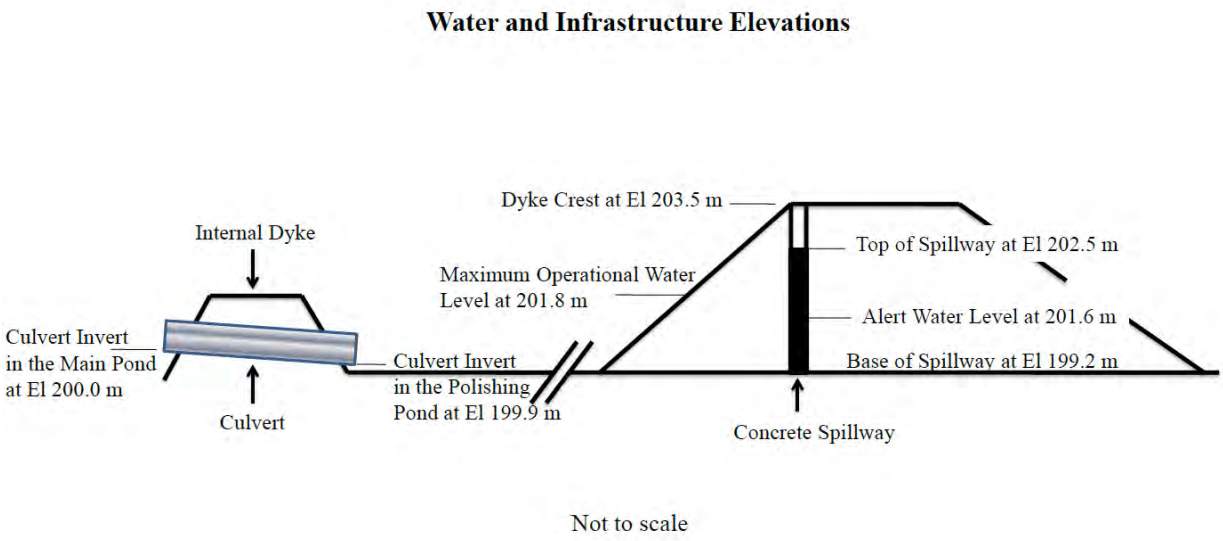
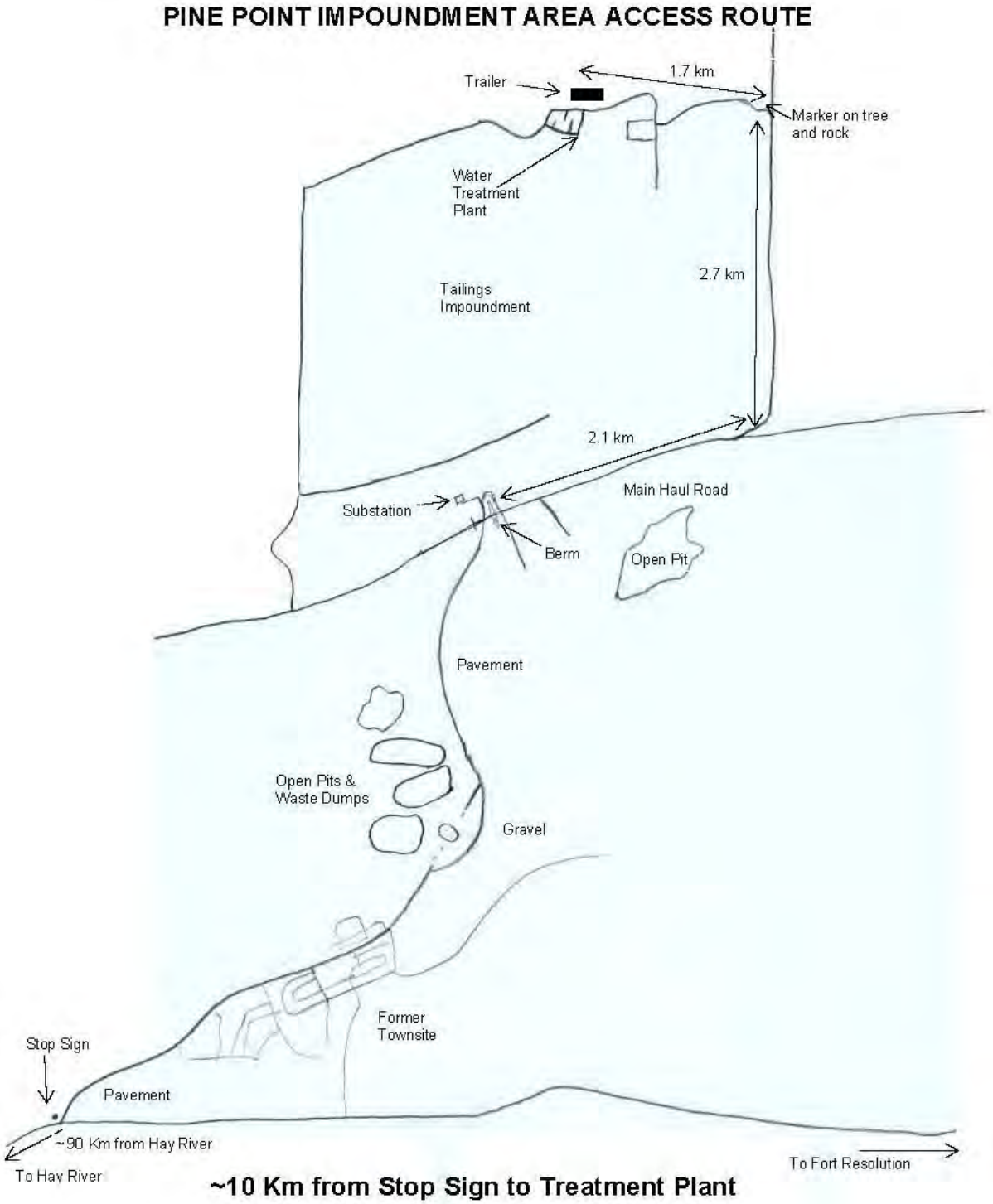


Figure 2: Critical Water and Infrastructure Elevations

2.3. Access Route



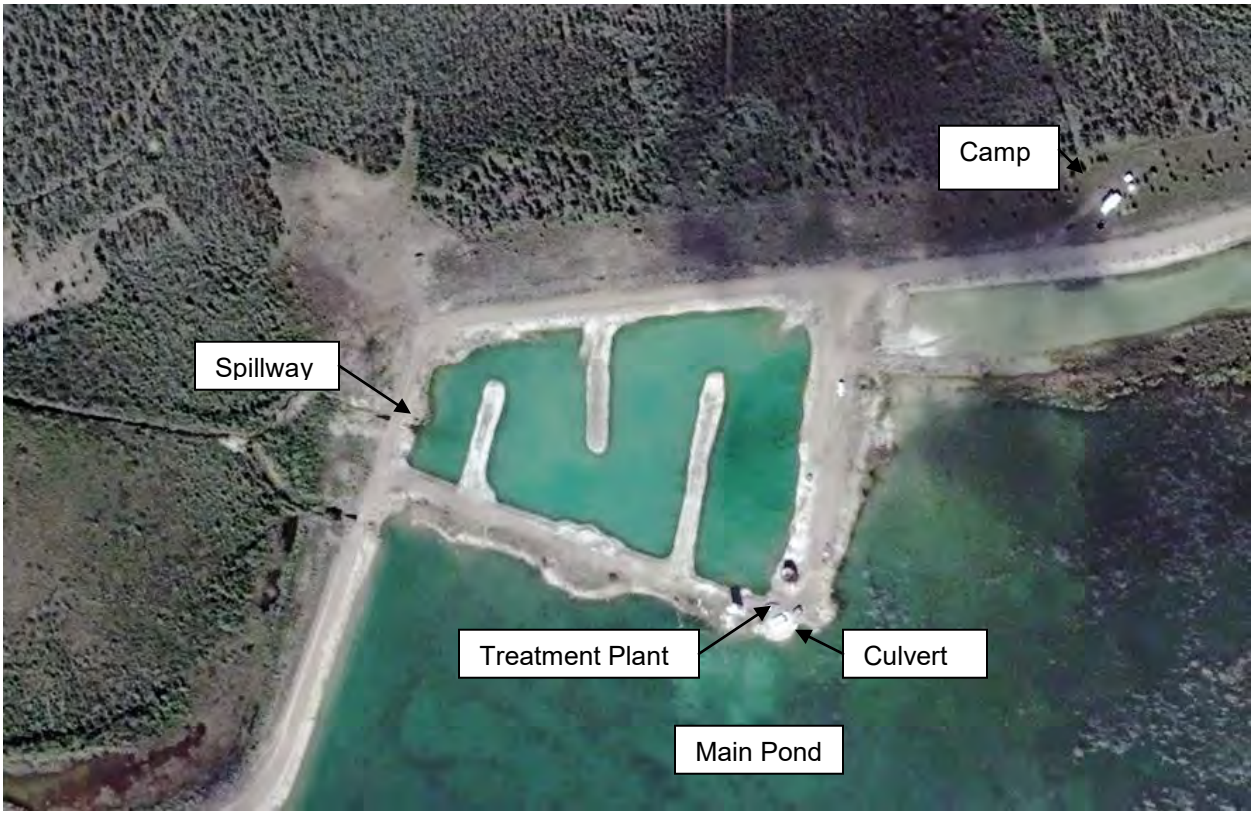
3. Process Description:

The water treatment process is a basic lime precipitation method to remove metals from the water by precipitating them out as metal hydroxides. Hydrated lime is slurried to about 18% solids by weight and then is metered into a culvert and mixed into the water. The culvert allows water from the main pond to flow into the serpentine settling channel before discharging into the swamp at the treatment spillway. After the lime is added into the culvert air is used to mix the lime along with a twelve foot static mixer installed inside the culvert to promote uniform mixing of the water and lime before discharging into the serpentine channel.

An excess of lime is used to raise the pH to 9.5 – 10.0 to ensure that the metals will precipitate out quickly. With deepening of the channel in 2012 lower pH's, 9.5-10.0, can be used while maintaining flow rates. If the water and lime slurry were treated in a large agitated tank then lower pH levels could be used and lime consumption could be drastically reduced.

4. System Overview:

The treatment system is a gravity flow process from the main pond through the serpentine channel to the discharge spillway located at the end of the serpentine channel. The flow through the channel is controlled by five siphons in the discharge spillway.
The serpentine channel is connected to the Main Pond by a culvert that is equipped with a gate valve to isolate the channel from the Main Pond.



Overview of Serpentine Channel

The Treatment Plant Equipment is located near the culvert and the Lime Silo and Lime Slurry Tank are left on site at all times. The lime silo is a gravity flow bin with gate and an auger located on the bottom to feed lime into the jet mixer. The lime pump and air blower are mounted on a trailer as is the Laboratory. The lime pump is used for circulating lime through the slurry tank and mixing the lime. The blower is used to agitate the lime slurry tank and to mix the lime and water in the culvert. Other equipment includes: 5 KW generator, jet mixer, water pump, peristaltic pumps, diesel fuel tank, fuel pump and laboratory equipment.

5. Environment

5.1. Teck Resources Limited Safety and Health Policy

Teck Resources Limited

Teck is Canada's largest diversified resource company, committed to responsible mining and mineral development with major business units focused on copper, steelmaking coal, zinc and energy. We also have teams committed to exploration, project development and technological innovation. While our operations are predominantly located in Canada, the U.S., Chile and Peru, our activity footprint is global.

Health and Safety Policy

Safety is a core value of our company and we believe all incidents that could cause serious harm to our employees and contractors are preventable.

We are responsible for providing a safe workplace, effectively managing workplace risk and are committed to providing leadership and resources for managing health and safety. We will ensure that all employees and contractors have the knowledge and ability to safely perform their duties. We will identify and manage occupational health and hygiene exposures for the protection of longer term health. We will strive for continual improvement and hold ourselves accountable through verification and reporting of our performance.

We expect all employees and contractors to be leaders in health and safety through identification of hazards and the elimination and control of high potential risk. We all share in the responsibility for our safety and that of our co-workers.

Working together we can eliminate fatalities and serious injuries in the workplace; we will accept nothing less. Everyone has the right to a safe and healthy workplace.

Everyone Going Home Safe and Healthy Every Day

Donald R. Lindsay
President and CEO

September 2014

Teck

Water Licence MV2006L2-0013

Under the water licence issued by the Northwest Territories Water board the following requirements are applicable to the Water Treatment process.

Part C: 1d) The Tailings Containment Area operated and maintained such that “a freeboard limit of 1.0 metre shall be maintained at all times”

Part C: 1e) “The rate of waste discharge is at all times controlled and measured”

Part C: 2 “All wastes discharged by the Licensee from the Tailings Containment Area shall meet the following effluent quality requirements:”

Parameters	Maximum Average Concentration	Maximum Concentration of any Grab Sample
Total Arsenic	0.50 mg/L	1.00 mg/L
Total Copper	0.15 mg/L	0.30 mg/L
Cyanide	0.10 mg/L	0.20 mg/L
Total Lead	0.20 mg/L	0.40 mg/L
Total Zinc	0.50 mg/L	1.00 mg/L
Suspended Solids	25.00 mg/L	50.00 mg/L
Ammonia	2.00 mg/L	4.00 mg/L

“The Waste discharged shall have a pH greater than six (6) and no waste discharged shall contain floating solids, or visible sheen of oil and grease.”

Part C: 3 “The Licensee shall notify an Inspector of any planned discharge of waste from the Tailings Containment Area at least seven (7) days prior to such discharge occurring.”

SNP Part B 1. “ The tailings area discharge at Station number 35-1 shall be sampled daily during discharge and analysed for the following parameters:”

Total Copper	pH
Total Lead	Suspended Solids
Total Zinc	

SNP Part C 1. “The daily and annual quantity of treated waste water discharged from Surveillance Network Program Station Number 35-1 shall be measured and recorded in cubic meters.”

SNP Part B 3. “Water in the Tailings Containment Area shall be sampled three times a year (spring, summer, and fall), during periods of open water and analyzed for the following parameters:

Total Zinc	Total Copper
Total Lead	

SNP Part C 2. " The water level of the holding pond within the Tailings Containment Area shall be recorded three times a year, (spring , summer, and fall), in conjunction with sampling referred to in Part B, Item 3 during periods of open water."

5.2. Response Organization

The mine remains permanently closed and therefore there are no personnel on-site except during the summer water treatment activity. Outside of the water treatment period no Hazardous Materials are on the site, therefore the only foreseeable incidents for other reasons would be related to the Tailings Dam structures. In the event of an incident the Site Manager is responsible for coordinating activities.

As the Incident Commander, the Site Manager is responsible for:

- Overall command and control of an incident;
- Establishing response objectives and strategies;
- Providing information to authorities regarding reportable incidents; and
- Scheduling meetings to update the response plan.

When personnel are on-site during the Water Treatment Period there will be a few Hazardous Materials, in relatively small volumes, under their control and therefore they would react immediately to a spill and contact the Site Manager.

5.3. Reportable Spills

A spill in excess of the following thresholds is considered a spill under the N.W.T. *Spill Contingency Planning and Reporting Regulations* (N.W.T. Reg. 068-93), pursuant to the Environment Protection Act. In these regulations "Federal Regulations" means the *Transportation of Dangerous Goods Regulations including Amendment SOR/2016-95* (Canada).

Substance Spilled	PP Substance	TDG Code	Reportable Quantity
Explosives of Class 1		1	Any amount
Flammable gases, of Division 1 of Class 2.	**Gasoline**	2.1	Any amount of gas from a container larger than 100L, or where the spill results from equipment failure, error or deliberate action or inaction.
Non-flammable gases of Division 2 of Class 2		2.2	Any amount of gas from a container larger than 100L, or where the spill results from equipment failure, error or deliberate action or inaction.
Poisonous gases of Division 3 of Class 2		2.3	Any amount
Corrosive gases of Division 4 of Class 2		2.4	Any amount
Flammable liquids of Class 3	**Diesel**	3.1/3.2 /3.3	>100L
Flammable solids of Class 4		4	>25 kg
Products or substances that are oxidizing substances of Division 1 of Class 5		5.1	>50 kg or 50 L
Products or substances that are organic compounds that contain the bivalent "-0-0-" structure of Division 2 of Class 5		5.2	>1 kg or 1L
Products or substances that are poisons of Division 1 of Class 6		6.1	>5 kg or 5 L
Organisms that are infectious or that are reasonable believed to be infectious and the toxins of these organisms		6.2	Any amount
Radioactive materials of Class 7		7	Any discharge or a radiation level exceeding 10 mSv/h at the package surface and 200 mSv/h at 1 m from the package surface.
Corrosive products or substances of Class 8 as defined		8	5 kg or 5 L
Miscellaneous products or substances (environmental hazardous substances intended for disposal), excluding PCB mixtures.		9.0	> 1 kg or 1 L
PCB mixtures of 5 or more parts per million		9.0	> 0.5 kg or 0.5 L
Polluting Substance (Discharge Weir flow)		None	200 L
Reported releases or potential releases of any size that: • are near or in an open water body; • are near or in a designated sensitive environment or habitat;		None	Any amount

Substance Spilled	PP Substance	TDG Code	Reportable Quantity
• Pose an imminent threat to human health or safety; or • Pose an imminent threat to a listed species at risk or its critical habitat			

NOTE: Any exceedance of the effluent discharge permit where more than 200L is discharged is considered a spill to the environment and must be reported.

5.4. Discovery and Response to Spills

The following provides a general response to any spill upon initial discovery. Refer to Appendices A and B for more specific information including spill response procedures and MSDS documents for the particular substances located at the mine site.

Appendix B2 - **Diesel**

Appendix B3 – **Gasoline**

FIRST PERSON TO OBSERVE THE SPILL:

Ensure personal and worker safety, if you cannot identify the spilled substance consider it dangerous.

If personnel are injured

- Call for medical help, attend to injured person, and administer first aid if safe to do so.

If Safe

- Stop all sources of ignition and stop or reduce the source flow of the spill
- Shut off all valves
- Shut off all electrical power
- Initiate containment
- Put down adsorbent pads and berm spill area, if possible
- Do not enter confined spaces
- Do not expose self to fire hazard
- Complete the spill report form and report the spill

If Unsafe

- Initiate evacuation (upgrade or upwind) – move to safe area
- Notify Site Manager
- Report the following as per requirements in Section 5.7
- Isolate area and deny entry until qualified response personnel arrive
- Deny access to all unauthorized personnel
- Complete the spill report form and report the spill
- Update Site Manager on spill status

Permit Exceedance: If the permit criteria are exceeded for the water quality in the weir discharge then the treatment process must be stopped. The spill must be reported. The channel must then be sprayed or the solids allowed to settle and operation can be re-started slowly when all the parameters are again within permit.

5.5. Communication: Spill Reporting

5.5.1. Teck Metals Ltd Reporting and Contact Information

Spills, quantities greater than shown in section 5.4, must be immediately reported to the Site Manager (SM), Dana Haggar. If the SM is unavailable, contact Manager, Environmental Compliance, Michelle Unger, or Environmental Specialist Jeff Rees.

If the on-site person is unable to make direct contact with the SM or designated alternates they shall report the incident to the N.W.T. 24 Hour Spill Report Line at 1-867-920-8130.

If possible contact the local Water Resources Officer, Wendy Bidwell 867-872-6421 and inform her of the situation.

Teck – Communications Contact Information

Dana Haggar, Manager, PP (SM)

Kimberley Office Tel.	250-427-8413
Cell	250-602-9361

Alternate #1: Michelle Unger, Manager, Environmental Compliance

Kimberley Office Tel.	250-427-8422
Cell	250-432-5264

Alternate #2: Jeff Rees, Environmental Specialist

Kimberley Office Tel.	250-427-8421
Cell	250-432-9476

If the SM deems that the spill has exceeded the reporting threshold for the spilled substance, Teck's Head Office in Vancouver and the appropriate government agencies will be notified. The government procedure is outlined in the following section, "External Notification".

5.6. External Notification

All spills of petroleum products or other hazardous materials exceeding the appropriate threshold must be reported. The SM is responsible for all external reporting. Although several government agencies at the federal, territorial and municipal levels may ultimately be involved, only one government contact is required to be made by the SM or his designate for mine site spills. Affected Agencies will be contacted at:

Northwest Territory 24 HOUR SPILL REPORT LINE

Telephone: 1-867-920-8130

This is a 24 Hour telephone number to Environment Canada. They will notify all other concerned agencies when necessary. The following information shall be conveyed to the affected agencies through the 24 Hour Spill Report Line. This information is to be documented on the "Spill Reporting Form" provided in Appendix A-1.

The reporting person must give as much of the following information as possible:

A) Report Date and time

B) Occurrence Date and time of spill

C) Water Licence Number: N1L2-0035

D) Location of Spill:
Pine Point Tailings Area 100 km by road east of Hay River, 10 km south of Great Slave Lake

E) Latitude: Station 35-1 60°53'41.3"N Longitude: Station 35-1 114°25'30.7"W

F) Responsible Party name and address

G) If Contractor involved name and address

H) Product spilled, quantity spilled, UN number, Second product spilled (if applicable)

I) Spill source, cause and area of contamination in square meters

J) Factors affecting spill or recovery, describe assistance required, hazards to persons, property or equipment.

K) Additional information, comments actions taken to contain, recover or dispose of spilled product and contaminated materials

L) name, position, employer, location calling from and phone number of person reporting spill

M) name, position, employer, location and phone number of alternate contact person (site Manager)

A list of typical spill response equipment is provided in Appendix A-2.

5.7. External Technical Advice – CANUTEC

The Canadian Transport Emergency Center (CANUTEC), a branch of Transport Canada, can also be contacted for 24-hour technical advice on Dangerous Goods, as needed. The CANUTEC – help line for dangerous goods is **0 (613) 996-6666** (collect).

5.8. Spill Incident Investigation

Upon resolution and completion of clean-up of a spill and investigation must be performed into the incident. The objective of the Investigation is to prevent a re-occurrence of an incident. The Incident Investigation Report form in Appendix C8 must be completed and approved by the Site Manager and action taken to prevent a re-occurrence.

6. Safety

There are several substances on site that must be used with care; hydrated lime, diesel fuel, gasoline and laboratory reagents.

6.1. High Calcium Hydrated Lime

Hydrated Lime causes burns.

PRECAUTIONS: Avoid contact with eyes. Avoid prolonged contact with skin. Do not breath dust.

FIRST AID: Wash skin with soap and water. In case of contact with eyes, wash with running water for at least 30 minutes and obtain medical attention. For inhalation of dust remove to fresh air, give artificial respiration if necessary and obtain medical attention. If swallowed give one to two glasses of water or milk. **DO NOT INDUCE VOMITING**, obtain medical attention immediately.

For more details see MSDS in Appendix B1.

6.2. Diesel Fuel

Diesel Fuel is a flammable liquid and care should be taken when handling it.

PRECAUTIONS: It is recommended safety goggles, chemical resistant overalls and chemically impervious gloves be used when handling diesel fuel.

For more details see MSDS in Appendix B2.

6.3. Gasoline

Gasoline is a very flammable liquid and care should be taken when handling it.

PRECAUTIONS: It is recommended safety goggles, chemical resistant overalls and chemically impervious gloves be used when handling diesel fuel. Use outside where there is good ventilation.

For more details see MSDS in Appendix B3.

6.4. Laboratory Chemicals

6.4.1. Hydrochloric Acid

Hydrochloric Acid is a very corrosive liquid and a higher concentrations produces vapours that should not be breathed.

PRECAUTIONS: Use in a well ventilated area. Wear goggles and shield, Lab coat & apron and proper gloves.

For more details see MSDS in Appendix B4.

6.4.2. Cyclohexanone

Cyclohexane is a combustible liquid and vapours must be avoided.

PRECAUTIONS: Use in a well ventilated area. Wear goggles and shield, Lab coat & apron and proper gloves. Do not breath mist/vapour.

For more details see MSDS in Appendix B5.

6.4.3. ZincoVer 5, Zinc Reagent Powder Pillows (contains Potassium cyanide)

The Zinc Reagent Powder Pillows contain potassium cyanide which may be fatal if swallowed.

PRECAUTIONS: Use in a well ventilated area. Avoid contact with eyes, skin and clothing. Wear goggles and shield, Lab coat & apron and proper gloves. Have an eyewash station nearby.

For more details see MSDS in Appendix B5.

6.4.4. Nitric Acid

Nitric Acid is a strong oxidizer and can cause severe eye and skin burns. Do not inhale fumes.

PRECAUTIONS: Use in a well ventilated area. Do not breath vapours. Avoid contact with eyes, skin and clothing. Wear goggles and shield, Lab coat & apron and proper gloves.

For more details see MSDS in Appendix B6.

6.4.5. Buffer Solutions

PRECAUTIONS: Buffer Solutions are irritants and should be used with caution. Use in a well ventilated area. Wear goggles and shield, Lab coat & apron and proper gloves.

For more details see MSDS in Appendix B6.

6.5. Eyewash Stations

All eye wash stations should be checked regularly and any defect corrected immediately. The purpose of eye wash stations is to flush lime or chemicals from your eyes.

LOCATIONS: 1: On side of Lime Silo
2: End wall in the Laboratory trailer

6.6. Fire Extinguisher Locations

There are two ABC fire extinguishers available to use on small fires.

LOCATIONS: 1: On Pump/Blower trailer
2: Inside the door of the Laboratory trailer

Note: Fire Extinguishers are to be checked at the start of each operating period.

6.7. Safety Incident Investigation

In the event of any safety incident related to personnel or equipment an Incident Investigation must be performed. The objective of the investigation is to prevent a re-occurrence of the incident. The Incident Investigation Report in Appendix C8 must be completed and submitted to the Site Manager.

7. Major Process Equipment Description & Operation

7.1. Lime Silo

Description:

The Lime Silo was bought from Wheatland Bins in early 2006 and was installed onto a concrete pad at the beginning of July 2006. The bin is a Model WB1417-55 14' in diameter and 33' high with a capacity of 3,381 ft^3. Depending on the bulk density of the hydrated lime the bin will hold a minimum of 45 metric tonnes (in 2006 one truck load with a capacity of 2,200 ft^3 hauled 30 tonnes). The bin is bolted to a concrete pad.

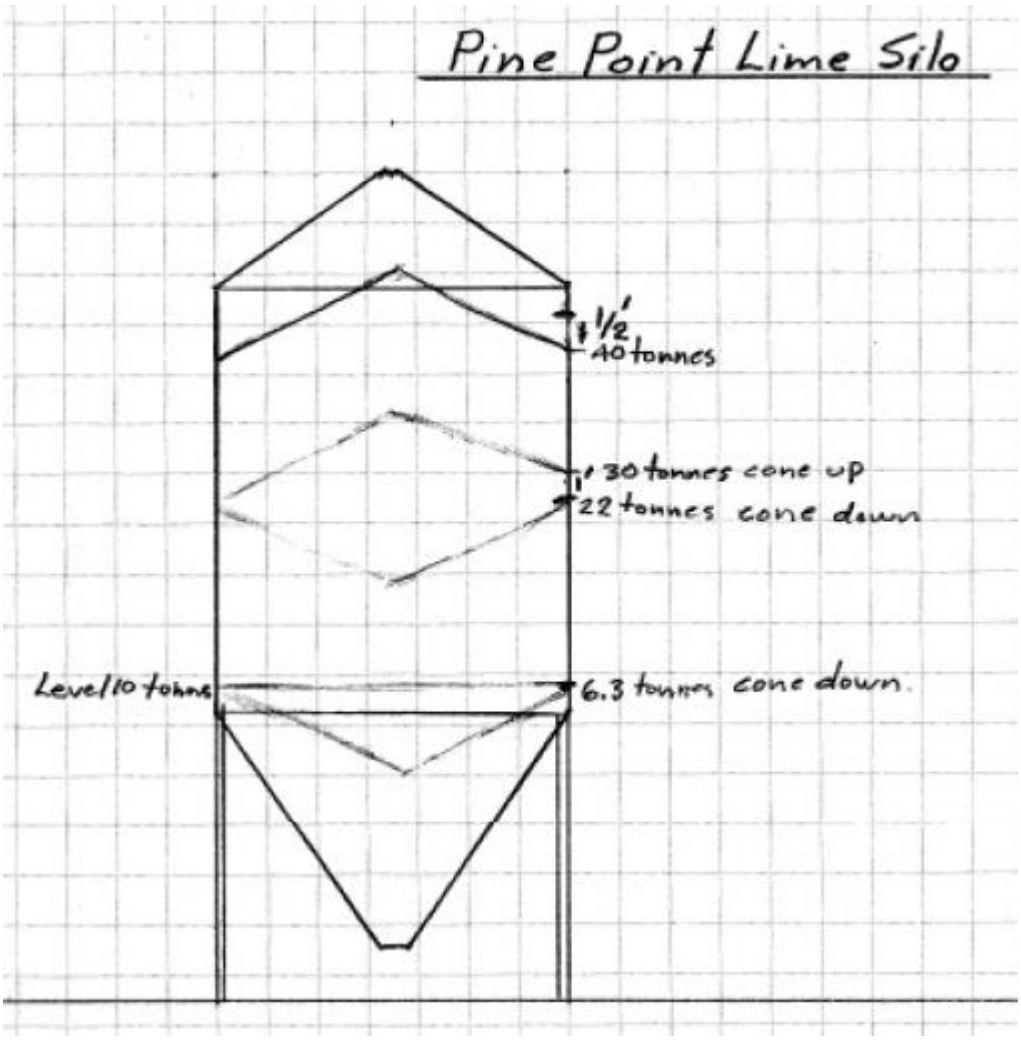
The bin is non pressurized with a 4.5" fill tube with a 4" male camlock connector, running to the top of the bin. There is a 6" vent line from the top to 4' above ground level. A ladder goes up the side of the side of the bin to access the top. On the bottom of the silo there is a manway hatch and a pokehole to clear any blockages. Around the lower part of the bin there are 8 fluidizer air jets to assist with the lime flow when required. The air jets are connected to the air blower by a 1" line. On the bottom of the bin there is a crank operated "knife gate" that can be used to control the lime flow to the auger. The 4" x 12' auger is mounted at a 20° angle and is powered by a 2 HP motor. The auger is used to feed the Hydrated Lime into the Jet Mixer. When installing the Auger be sure the joints are sealed well to prevent leakage.

There are three bin level indicators on the cylindrical part of the silo:

Top indicator ~2,976 ft^3 if lime is level = 40 tonnes of lime
Middle indicator ~1,821 ft^3 if lime is level = 25 tonnes of lime
Bottom indicator ~ 667 ft^3 if lime is level = 10 tonnes of lime

Normally the bin is first filled so the lime will be heaped up in the center and when the lime is being drawn down then the lime is low in the middle. Therefore:

- If 40 tonnes of lime were unloaded into the silo the level would be 1.5' below the top indicator
- If 30 tonnes of lime were unloaded into the silo the level would be 1' above the middle indicator
- When the lime is being drawn down then when the middle indicator goes off then there will be about 22 tonnes of lime remaining
- When the lime is being drawn down then when the bottom indicator goes off then there will be about 6.3 tonnes of lime remaining



Start-up/ Shutdown:

At the end of each operating period the lower part of the ladder, auger, hoses and the hand crank are removed to minimize vandalism. Also all the hatches are chained and locked. Therefore at the start of the operating period these components must be re-installed before the silo is filled with lime.

Lime Silo, Auger and Jet Mixer July 2007

7.2. Lime Pump/ Blower Unit

Description:

The Lime Pump/ Blower Unit is a trailer mounted unit consisting of a diesel engine directly driving the air blower and a clutch to drive the lime pump. The unit was constructed by Frontier Power Products in Calgary.

The engine is a John Deere 4045T turbocharged diesel engine (4.5 liter) with SAE 4-10 housing/flywheel. The unit is rated at 87 Hp (7.4 KW) @ 2,100 rpm continuous.

Mounted on the engine drive is a Twin Disc 10-5 clutch assembly to connect to the lime pump.

The Lime pump is a Berkley B4JRMBH frame mounted pump rated at 900 US gpm @60 psi.

The air blower is a Gardner Denver Sutorbilt 5MVP blower rated for 353 cfm @9 psi.

There is also a 60 gallon fuel tank mounted under the engine.

Preparation:

Locate the trailer unit between the lime Slurry tank and the Lime Silo. Ensure the pump is lower than the full slurry level in the Lime Slurry tank and then level the unit. Block it up to ensure the trailer is stable.

Place a sheet of plastic under the unit to ensure no hydrocarbons are spilled on the ground.

Engine Operation:

Before operating check all the fluid levels and ensure the clutch is disengaged.

To start the engine hold the start button in, turn the key to START while holding the button in, release the button once the engine is running, let the engine warm up and then increase to the desired rpm.

Review the John Deere Operators Manual for detailed instructions on how to start and operate the engine. Also review the Twin Disc manual for the clutch operation.

Blower Operation:

The blower is directly driven by belts from the engine and the other than belt tension and lubrication the blower is easy to operate. The operating pressure is controlled by the number of disks on the pressure relief arrangement and need not be adjusted.

Review the Sutorbilt manual before operating.

Pump Operation:

Ensure the intake and discharge lines are connected and the intake valve is open. With the pump located below the slurry level in the Lime Slurry Tank the pump will be self priming.

Note: Due to the problem with the exhaust height interfering with storing in the shipping container and problems with the valves the priming capability has been disabled.
Priming: To prime the pump open the ½" line on the pump casing. Engage the clutch and close the flapper on the engine exhaust assembly. Hold the flapper closed until liquid exhausts out the exhaust assembly. Immediately close the valve on the ½" line (this prevents liquid in the engine exhaust manifold).

Once the pump is running adjust the engine rpm to give the volume and pressure desired.

Adjusting the gland: The pump gland (pump shaft seal) should be adjusted to allow a slow drip of slurry through it. When the flow through the gland increases the packing can be

tightened. If the packing is tightened too much then the face of the packing burns and it will be impossible to prevent leaking.

Running low pump volumes at high engine rpm will result in the pump being back pressured and can result in high slurry leakage through the gland. To prevent the pump from being back pressured two 3” discharge lines should be operated at all times.

Lime Pump/Blower Unit July 2007

The discharge manifold has four valved ports: three for 3” lines and one for 2” fire hose. Two of the 3” lines connect to the two headers on the Lime Slurry Tank and one 3” hose connects to the Jet Mixer. The fire hose is used for spraying the channel, disposing of excess lime and is connected to the Jet Mixer for mixing lime.

7.3. Lime Slurry Tank

The lime slurry tank is a 21,800 liter rectangular tank that is continuously circulated and agitated to keep lime in suspension. The lime slurry is circulated through the lime pump which discharges the slurry from two headers into the upper side of the tank and the pump is feed from an outlet located at one end near the bottom of the tank.

The tank is agitated by 7 air lances that are distributed around the tank. It is important that the lances are not located too close to the tank outlet otherwise air gets into the pump and it stops pumping. Lime builds up on the lances resulting in the need to clean them every few days and before start-up.

Lime Slurry Tank: Discharge Line from Jet Mixer and Suction Line to the Lime Pump

In 2007 a second header was installed to reduce the pump back pressure when mixing lime.

Lime Slurry Tank: New 2007 discharge header and air lances

Lime Slurry Tank: New discharge header and air lines to the lances

7.4. Jet Mixer

The Jet Mixer is used to mix the lime by contacting the dry lime with a high speed jet of water. The Jet Mixer was purchased from Crown Industries in Calgary and it came with several jets. The Mixer consists of a hopper that drops the lime onto jet of water in the mixing bowl. There is a 3” line that feeds in a rectangular nozzle that emits a flat spray of water at high speed. The lime slurry exits out a 4” discharge line that drops the slurry into the Lime Slurry Tank. There is also a 2” line with a deflector plate that helps to push the lime slurry up into the Lime Slurry Tank.

When operating the jet mixer it is important to have the 2” line operating along with a second 3” line to prevent the lime pump from getting back pressured and leaking excessively from the gland. The other alternative is to operate the engine at a lower rpm when mixing the lime.

7.5. Peristaltic Pumps

There are three Masterflex peristaltic metering pumps, one or two running and a spare, that feed the lime down a vertical pipe into the culvert where it is mixed with the water to be treated. Each pump is connected to a variable speed drive and they are all hooked up to the generator.

The peristaltic pumps are mounted in a plywood box with the suction lines dropping into the Lime Slurry Tank and the discharge lines going to the bottom of the pipe in the culvert. The discharge point is in the water to prevent plugging of the vertical pipe.

Peristaltic Pumps set up inside the protective stand July 2006

7.6. Water Pump

Daily a 2” gasoline water pump is used to fill the Lime Slurry Tank with water from the main pond before mixing the next batch of lime.

7.7. Generator

The generator is a 5 KW Honda EX5DCC9 Diesel with two 30amp/120 volt receptacles and one 18.8amp/240 volt receptacle. The generator will run about 18 hours on a tank of fuel. Before starting ensure the power switch is in the OFF position, start the generator, let it warm up and then turn the power switch ON. Review the Honda Owner's manual before operating.

7.8. Laboratory

The Laboratory is mounted on a trailer and is positioned on the other side of the culvert from the Lime Slurry Tank. The trailer is levelled and blocked up before use. Inside there is a work bench for the pH meter, Hach meter and scale and on the other side is some shelving for storage and tools.

8. Laboratory Procedures

8.1. PH Meters

We have 3 pH meters. Every morning the pH meters must be calibrated with 4.00, 7.00 and 10.00 ph buffers (see MSDS Appendix B8).

1. Pour a known PH buffer standard solution into a clean, dry container. Power on the meter and it automatically enters into the measurement mode. Select PH mode by pressing MODE key.

2. Dip both PH electrode and temperature probe into the buffer solution. Swirl gently and wait for reading to stabilize. (approx 30 seconds depending on electrode's condition)

3. Press CAL key to enter PH calibration mode. A "CA" displays momentarily and the display shows the current uncalibrated reading flashing.

4. To abort or cancel calibration without accepting new value, pres CAL key. The meter then reverts to PH measurement mode.

5. To proceed with calibration, allow reading to stabilize. The meter automatically recognizes PH 4.01, 7.00, or 10.01 buffers. Press ENTER key to confirm calibration and the LCD displays "CO" momentarily. The meter reverts to measurement mode.

6. For 2 or 3 point calibration, repeat step 3 with other PH buffer values of 4.01 7.0 and 10.01 for higher accuracy.

After closing down everything at night, the PH meter probes are briefly put into 10% hydrochloric acid (see MSDS Appendix B4) and distilled water in order to clean off the build-up of lime.

8.2. Hach DR 100 Colorimeter

A Hach test is done to measure the amount of zinc that is in the water. Hach Company is the manufacturer of the Hach DR 100 Colorimeter, Model 41100-20 that is the Zincon Method with a range of 0-1.5, 0-3.0 mg/L.

Samples are taken in 3 - 500ml bottles at the discharge weir. Each bottle is rinsed in the water 3 times, try not to disturb anything, filled to the top and placed into a Tupperware carrier (so not to change the temperature). The samples are taken back to the lab and in one bottle we put the pH probe in and get a temperature reading, then a ph reading. According to “background lab work”, the target ph at the weir is 9.5 – 10.0. After this we dump the sample down the drain. Another bottle is used for the zinc test and the third is for the turbidity measurement.

1. Fill a clean 25mL mixing cylinder to the 20 mL mark with the water to be tested.

2. Add the contents of one ZincoVer Reagent Powder Pillow. Note: There is a 4 year shelf life so be sure the reagent is not dated. WARNING: This reagent contains cyanide and is extremely poisonous if taken internally or if the fumes are inhaled (see MSDS Appendix B6). Stopper the cylinder and invert repeatedly until all particles are dissolved (this takes longer usually when the water is cooler).

3. Fill a clean 2.5cm sample cell to the 10mL mark with the treated sample, leaving 10mL in the mixing cylinder. Cap the sample cell.

4. Using the calibrated dropper, add 0.50mL of cyclohexanone (see MSDS Appendix B5) to the sample in the mixing cylinder. Stopper and shake for 30 seconds. Allow at least six minutes for the color to develop fully, but do not wait more that 15 minutes.

5. Open the light shield and turn the Right Set control fully clockwise. Place the 1cm cell holder into the Left Set position of the sample well. Press down firmly to seat it into place. Close the light shield.

6. While holding the ON button down, adjust the Left Set control to align the meter needle with the arrow at the far left of the scale arc. Remove the cell holder.

7. Place the sample cell without cyclohexanone into the sample well. Press down firmly to seat it into place. Close the light shield. While holding the ON button down, adjust the Right Set control for a meter reading of zero mg/L.

8. Fill a clean 2.5cm sample cell to the 10mL mark with the solution in the mixing cylinder and place it into the sample well. Press down firmly to seat it into place. Close the light shield. While holding the ON button down, allow the meter reading to stabilize, then read and record the mg/L zinc from the 0-1.5mg/L scale.

Empty the samples into the Cyanide Waste Container rinsing with distilled water 3 times, as well as the calibrated dropper and the mixing cylinder. When this container is close to being full, it is dumped into the lake (1A). After the contract, all batteries are removed from the Hach Colorimeters & PH meters.

8.3. Turbidity Meter (LaMotte 2020)

Turbidity measurements are taken at the same time that zinc concentration is checked at the weir. The third sample bottle in the above procedure is used for the tubidity measurement.

The turbidity meter should normally be calibrated in the 0 -10 NTU range.

Calibrate:

1. Turn Meter **ON**
2. Select **MEASURE, press */OK**
3. Rinse Tube labelled B and Fill with the **BLANK** Standard
4. Dry the tube, keep for future use (Step 3 can then be skipped the next time).
5. Place the Blank tube into the meter, close the cover and **press */OK** to scan the Blank
6. Rinse Tube labelled 10 and Fill with NTU 10 standard.
7. Dry the tube, keep for future use (Step 6 can then be skipped the next time).
8. Place the 10 standard into the meter, close the cover and **press */OK** to scan the sample
9. Press ➘ and then **press */OK** to select calibrate
10. Change the highlighted digits one at a time using ➘or ➚ to match the standard concentration. **Press */OK** to accept a digit and move to the next digit.
11. When the display matches the standard, **press */OK** to select **SET**
12. **Press */OK** to proceed to turbidity analysis or turn the meter **OFF**.

Analysis (with calibrated meter):

1. Turn Meter **ON**
2. Select **MEASURE, press */OK**
3. Insert the **BLANK** Standard from above.
4. **press */OK** to scan the Blank
5. Rinse Tube and fill with the sample
6. Dry the tube, place in the meter and close the cover
7. **press */OK** to scan the sample
8. Record the turbidity result
9. Turn the meter **OFF**

If a sample is much higher than 10 NTU the meter may indicate that the value is out of range. When this happens carefully dilute the sample by half and measure again. Be sure to double the measured value.

Note that NTU does not necessarily correlate directly to TSS, therefore it is important to compare the turbidity meter result to the lab result on the daily sample to develop a correlation.

A Model 3150 Insite IG Suspended Solids meter is also used to cross check for TSS.

8.4. Lime Slurry Density

The Lime Slurry is mixed to 18% solids and a 500 ml cylinder is used to determine the slurry density. The 500 cc cylinder is zeroed on the scale and then the weight of 500 ml of slurry should be 557 gm. See Table in Appendix E2. Note that in the past a rough calculation was used for determining the %Solids and that the target slurry weight for 500 ml remains unchanged.

9. Spring Preparation

9.1. Purchase Orders

Purchase orders for equipment and supplies are set up in the Spring by Teck office personnel. Below is a list of typical PO's:

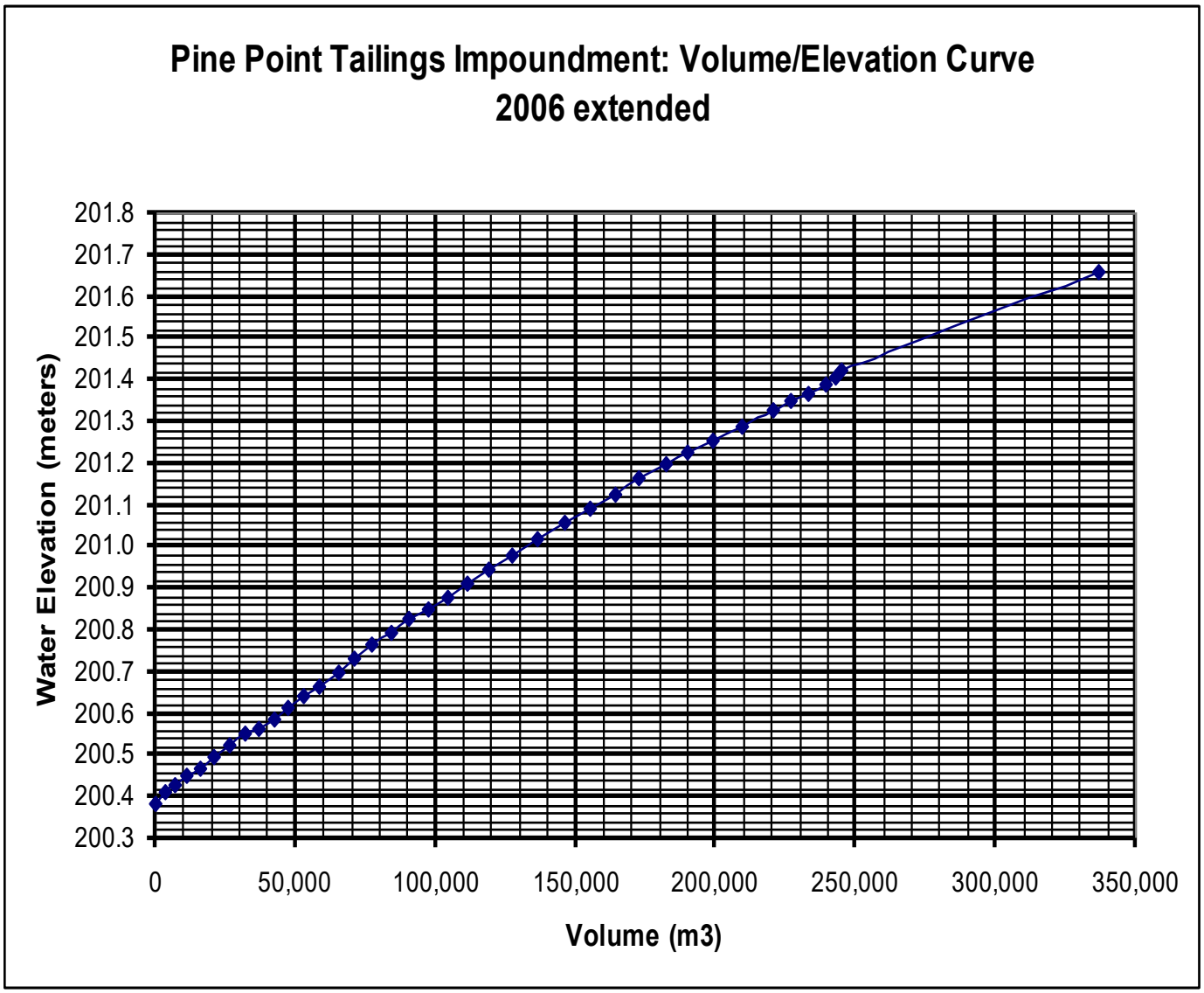
1	Cobb Enterprises	Annual water treatment program
2	ALS	Laboratory analysis
3	Exova	Water quality analysis
4	Rowe's Construction	Miscellaneous equipment rental
5	Buffalo Air Express	Freight for water samples
6	The Northwest Company	Food purchases for caretakers
7	Midnight Petroleum	Fuel for mine site and vehicles
8	SMS Limited	Rental storage unit
9	Golder Associates	Engineer's Geotechnical Inspection
10	Network Innovations	Rental OR Purchase of Sat Phone
11	Summit Helicopters	Air service for fall water sampling
12	Maskwa Engineering	Technician for fall water sampling
13	Kingland Freightliner	Miscellaneous parts
14	Northern Metalic Sales	Miscellaneous Supplies
15	Graymont Western Canada	Hydrated Lime
16	Westcan bulk carriers	Hydrated Lime Delivery
17	Fisher Scientific	Lab Chemicals and supplies

9.2. Insurance for Trailers

There are two trailer units, Laboratory and Pump/Blower Unit, that must be insured each year and the insurance papers must be passed onto the contractor. Teck personnel will renew the insurance annually.

9.3. Estimating Lime Requirements

Before Start-up the lime requirements must be estimated in order to set Purchase Order Quantities and schedule lime deliveries. The lime requirement is estimated by knowing the water level in the Main Pond ahead of the scheduled start-up and estimating the pond volume from the following Chart. The estimated volume is then multiplied by an assumed lime consumption of 0.2 Kg/m^3 to give the estimated lime consumption in Kg. Divide the number of Kg by 1,000 to get the estimated lime consumption in metric tonnes.



10. Start-up

10.1. Water Samples

Upon arrival at the site water samples should be taken from the Main Pond and the Channel and sent for analysis as soon as possible. The results can then be used as a check to ensure the field analysis is good. The results from the channel sample are used to determine if spraying the channel is required before starting treatment.

10.2. Tailings Impoundment Inspection

Soon after arrival the Tailings Impoundment should be inspected and the inspection form (Appendix C3) completed. If there are any obvious issues then the site manager must be contacted immediately.

10.3. Daily Spot Checks

An “inReach” devise has been provided to the Water Treatment contractor to provide Daily contact with the site manager to ensure the safety of the personal on site. As part of the contract the operators are required to check in daily.

10.4. Plant Assembly

To prepare for start-up all the equipment stored in Hay River must be moved out to the site and then organized and assembled. Some wood, the air lances and assorted materials are stored in the bush near the end of the East Dyke. The Lab trailer unit is positioned near the culvert and Lime Slurry Tank. The Pump/Blower Unit is parked between the Lime Silo and the Lime Slurry Tank. The trailers are levelled and blocked up.

Check that the Fire Extinguishers are charged and not expired. Place one fire extinguisher on the Pump/Blower trailer and one inside the door of the Laboratory trailer.

Place the Spill Kit beside the Laboratory Trailer.

The Lime Slurry Tank is cleaned out to prevent plugging of the Jet Mixer.

The Lime Auger is installed and the silo re-assembled; ladder, air lines, hand crank for knife gate and power to the auger motor.

The Jet mixer is positioned under the auger discharge spout and the plastic chute is connected to the auger spout. The top area of the mixer is shrouded in with a couple of pieces of plywood to minimize dusting.

Hoses are connected to the equipment: 4” Intake hose from the Lime Slurry Tank to the pump inlet, 3” Discharge hose from the pump discharge header to the Jet Mixer, 2” fire hose from the discharge header to the Jet Mixer, 4” Discharge hose from the Jet Mixer to the

Lime Slurry Tank, 3” Discharge hose from the pump discharge header to the Lime Slurry Tank.

Air hoses are connected from the Blower header to the lime silo, the Air Lance header and the culvert.

The generator is located between the Lab Trailer and camp to enable power to be supplied to the Treatment Plant Equipment and the camp.

The peristaltic pumps are set up near the culvert and are plugged into the generator.

Power is provided into the laboratory trailer in order to operate the Lab equipment

The water pump is set up beside the Main Pond below the Lime Slurry Tank so that the pumping distance is minimized.

At the discharge weir the level indicating float assembly is set up for easy weir measuring.

10.5. Spraying the Channel

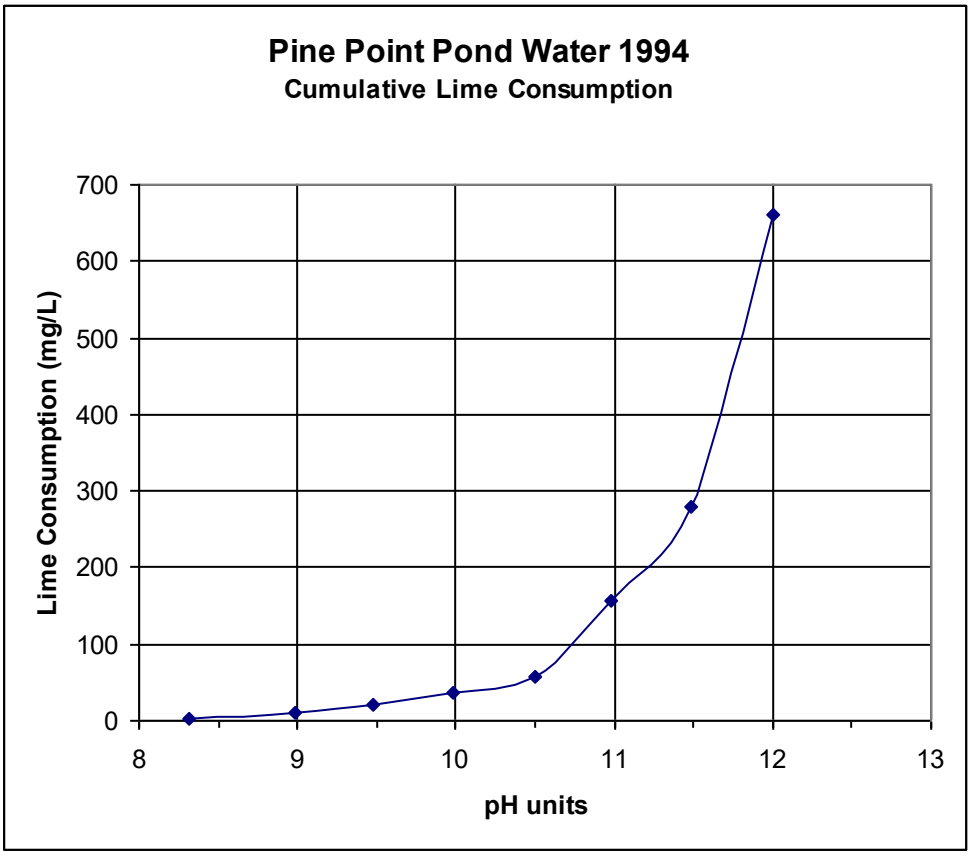
Before starting the process a batch of lime must be mixed and then the serpentine channel must be sprayed with lime. The water be below the permit but in quality but it is good practice to treat this water first. The channel is sprayed using 2” fire hoses and a nozzle to spray lime over the whole length of the channel. Enough lime should be added to raise the pH over 9.5. The lime should be allowed to settle for at least 12 hours or over night. Note that the lime slurry must continue to be recycled back to the Lime Slurry Tank to prevent over pressuring the lime pump. After spraying the channel clean the hoses out with water and leave in place in case the channel needs to be sprayed in an emergency.

11. Operating Strategy

The water treatment process must treat the water from the Tailings Impoundment by precipitating out metals by using lime. The sludge produced in the treated water is settled out in the serpentine channel. The treated water is released to the environment at the spillway and must meet the water quality criteria in the permit.

The pH control is critical to staying within the effluent permit. In 1994 Research in Trail performed some lab tests to determine the optimum operating pH. Increasing pH resulted in lower zinc concentrations and that the pH should be above 10 to ensure the zinc concentration is within the permit. When the pH goes higher than 11 the zinc concentration starts increasing again therefore the operating pH should be between 10 and 11.

Increasing the pH increases lime consumption and over pH 10.5 the amount of lime required to achieve the desired pH increases exponentially. To minimize the cost of lime the closer the pH is to 10.5 the better.



Years of operating experience have shown that operating at a high pH, 10.9-11.0, is required to ensure that the effluent meets the permit with the normal target at 10.95. The pH required is dependent on the flow rate through the culvert and how deep the water is in the serpentine channel. The higher the flow rate the shorter the settling time is in the channel. Therefore the deeper the water is in the channel (highest at start-up) the greater the flow rate can be. In 2008 the channel was deepened which results in higher retention time and

slower flowrates through the channel throughout the treatment period. The deepened channel enables lower operating pH.

The daily starting and shutdown procedures must ensure that at all times lime is being added when there is flow through the culvert. Untreated water entering the serpentine channel will result in higher metal levels at the siphons.

12. Daily Duties

12.1. Summary of Daily Routine

1. Generally start up in the morning at 7:00 AM and start shutting down at 7:00 PM.
2. Start the generator, ensure power switch is off before starting and once it is warm then turn the power switch on.
3. Start pump/blower unit; hold the start button in, turn the key to START while holding the button in, once the engine is running release the button, let the engine warm up at 1,000 rpm.
4. Install air lances in the lime slurry tank while the engine is warming up.
5. Engage the lime pump, prime if necessary, and then increase the engine rpm to 1600-1700.
6. Mix lime to increase the slurry density to 17% solids (note: formerly 10% solids but there was an error in the calculation so the weight of the 500cc cylinder remains unchanged at 557gm). See procedure below.
7. Read the water level in the main pond.
8. Open the culvert.
9. Start the lime metering pump to the culvert.
10. Take a grab sample at the siphons and run on the Hach Meter and LaMotte Meter.
11. Start the 5 siphons if water is compliant flows will be automatically read by the data logger
12. Adjust the peristaltic pump speed to give the desired pH
13. Between 10:00 and noon take a grab sample to ship to the lab and at the same time run it on the Hach meter and LaMotte Meter for comparison.
14. Check the combined flows on the data logger.
15. Ship the grab sample to the lab
16. Around 5:00 PM take another grab sample at the siphons and run on the Hach Meter and LaMotte Meter.
17. Record flow at the data logger
18. At 7:00 PM start shutting down. Close the each siphon line.
19. Close the culvert.
20. Reverse the direction on the lime metering pumps to flush them and then turn them off (note: if the water level in the channel is too low then use a bucket of water to flush the lines) .
21. Reduce the engine speed to 1000 rpm on the pump/blower unit.
22. Remove the air lances from the lime slurry tank and allow them to be blown out.
23. Turn off the pump/blower unit.
24. Fill the Lime Slurry Tank with water using the gas powered water pump. Fill to 1 ½ feet from the top to avoid spillage when the bubblers are running and the lime is added.
25. Fuel the pump/blower unit and generator.
26. Lubricate pump and other equipment as required.
27. Read the water level in the main pond
28. Complete Daily Report
29. Close up the lab.

12.2. Mixing Lime

Lime is mixed every morning before starting up the treatment process. Water is added the Lime Slurry Tank the night before and the lime concentration must be increased back to 18% solids by weight. The density of the lime slurry is determined by filling a 500 ml cylinder with slurry and weighing it on the lab scale. Note: in the past a rough calculation was used to estimate the percent solids and the weight of 557 gm for 500 ml of slurry remains unchanged.

The lime is mixed by feed dry lime from the lime silo into the jet mixer to contact the lime with a high speed jet of water. The slurry then flows into the Lime Slurry Tank and then pumped back into the jet mixer. Lime is added until the density is correct.

1. Open the 3 “ valve on the lime pump header to feed the inlet of the jet mixer
2. Open the 2” valve on the lime pump header to feed second jet on the mixer to assist pushing the lime slurry into the lime slurry tank.
3. Start the auger from the lime silo.
4. Control the flow of lime from the silo to the jet mixer with the crank operated knife gate.
5. If the lime stops flowing into the auger then use the air fluidizers on the bottom of the silo to loosen up the lime. Be sure the knife gate is closed when doing this.
6. Check the density of the slurry and continue to add lime until 17% solids by weight is achieved.
7. Close the 2” valve to the Jet Mixer.
8. Close the 3” valve to the Jet Mixer.
9. Connect the 3” hose to the 4” discharge hose using the adapter.
10. Run to 3” lines to circulate the lime while minimizing the back pressure on the pump.

12.3. Flow monitoring

The flow is calculated using Fisher Scientific flow meters attached to each of the 5 siphon lines and is continuous monitored by a data logger. The total flow for the day is recorded on the Daily Operating Log and the record for the cumulative volumes treated.

12.4. Pond Level

The water level in the Main Pond is measured in the morning and evening using the staff gauge mounted on the culvert. The level is recorded on the Daily Operating Log. The gauge indicates the depth of water relative to mean sea level. The reference elevation is marked on the valve assembly and is 201.001m. The gauge must be read carefully using the marks which are varying lengths and shapes. Note that the bottom of the bars are even numbers and the top of the bars are odd numbers and the new gauge has these marked. Examine the chart in Appendix E4 to understand how to read the depth gauge.

Metric Depth Gauge on Culvert Valve, May 2010

Metric Depth Gauge in the Main Pond, July 2007

12.5. pH Monitoring

The pH is measured frequently, at least every hour, at the discharge of the culvert (35-1E) and the flow from the peristaltic pumps is watched to ensure the pH remains in the target range. At high water levels the pH probe is lowered down a plastic pipe so that it measures the water exiting the culvert before it mixes with the water in the channel.

The pH should also be checked at the weir (35-1B) when samples are taken, 3 times a day. Normally the pH will drop about 0.2-0.3 pH units from the culvert to the weir.

When starting up the pump speed on the peristaltic pumps can be set to give the approximate target pH based on the estimated flow see table in Appendix E5.

If difficulties are encountered sampling at intermediary points in the channel may be required. The following diagram identifies the various sample points.

Pine Point Sampling Points

35-1 A Main Pond at weir
35-1 B Settling Pond at weir
35-1 C Settling Pond at mid point
35-1 D Settling Pond at first point
35-1 E Settling Pond near end of culvert

12.6. Zinc Concentration Monitoring

The zinc concentration is at the discharge weir is measured with the Hach meter at least 3 time a day; ~7:15 AM, ~11:00 AM, and ~5:00 PM. Measurements are taken more frequently when the zinc concentration is higher than normal. The zinc concentration is recorded on the Daily Operating Log.

If it is found that the zinc concentration is increasing measures must be taken to prevent the permit form being exceeded. If the zinc concentration is approaching 0.5 mg/L Normally the first action would be to reduce the flow rate and then increase pH if it is lower than normal. The objective is to take action to prevent a spill. Therefore when the zinc concentration reaches 0.5 mg/L the process should be shutdown and the channel sprayed.

If the zinc concentration exceeds the permit, 1 mg/L in a grab sample, then the process must be shutdown. The spill report must be completed and the reporting procedures completed. The channel is then sprayed, time allowed for solids settlement and once the zinc concentration has dropped the process can be re-started.

12.7. TSS Monitoring

The turbidity should be monitored whenever samples are taken or when there are solids visibly in suspension near the end of the serpentine channel. The turbidity is measured in National Turbidity Units (NTU) which are roughly correlated to total suspended solids (mg/L). The relationship between NTU and TSS will need to be developed for the site by comparing Laboratory data with the meter. Therefore measure the turbidity at the same time the Daily Lab Sample is taken and record it on the Daily Operating Log.

12.8. Start-up, Daily and Weekly Water Samples

Before start-up the permit requires a sample from the Main Pond, 35-1A, be submitted for analysis (same as Daily sample).

A water grab sample is done between 10:00am and 12:00pm that is sent to Exova out of Edmonton, AB. Each sample consists of two Bottles, one (250 ml) for metals (Zinc/Copper/Lead) and the other (500ml) for general parameters (PH & TSS). The metals bottle gets preserved by adding a vial of Nitric Acid (see MSDS Appendix B7). A Chain of Custody form (example in Appendix C4) is completed one copy is retained and the remainder go with the sample. The samples are kept in the fridge in the lab until they are ready to be put into a cooler with a frozen ice pack and newspaper.

Grab samples are not shipped on Saturday and Sunday but samples are taken and stored in the fridge until after the Monday's grab, and then all 3 Daily Samples are shipped. The samples are sent via Buffalo Air Express daily (actually by overnight truck).

The coolers & ice packs are supplied by Exova. The lab must be contacted to let them know how many are required and they send them to Hay River via Buffalo Air Express.

Once a week a Weekly sample is taken and is analyzed for additional parameters. Total and Dissolved metal scans are done along with ammonia, TSS and cyanide. There are 5 bottles to be filled; 250 ml for Dissolved metals, 250 ml for Total metals, 250 ml Nutrient (Ammonia-N) preserved with sulphuric acid, small cyanide bottle preserved with sodium hydroxide NaOH and a 500 ml Routine for pH and TSS. The Chain of Custody is completed with the additional parameters (example Appendix C5).

Note: When a Weekly Sample is taken it is not required to take a Daily Sample.

When samples are taken the Sample Shipment Log (Appendix C6) must be updated. When analytical results are received from the lab the Commercial Lab Assays form and Lab and Field Assays form (Appendix C7) must be updated. The results should be compared to the Hach meter for Zn and to the Turbidity Meter for TSS to ensure the field meters are close.

12.9. Daily Report

The Daily Operating Log must be completed. Record ph (at culvert and data logger), and flow, lime flow, Hach readings, Turbidity readings and when samples are taken. Complete all the other boxes in the report. In particular record any unusual events that impacted the treatment process during the day. For example equipment failures, high winds, etc.

Update the Treated Water Discharge Volume report daily.

12.10. Equipment Lubrication and Maintenance

Generator:
Change oil every 100 hours with 15w40 oil. Clean oil filter every 200 hours and check air filer. Change or clean fuel filter. Check water level in battery. Remove battery when storing generator.

Pump/Blower Unit:
Engine: Oil change every 500 hours. Check the Air filters and fuel filters every 500 hours.
Lime Pump: Grease every day after shut down. Check the packing throughout the day and adjust it so there is a small drip. Change the packing as needed.
Clutch: Grease clutch every day after shut down (minimum 50 hours).
Blower: Grease every 500 hours. Change Oil every 3000 to 4000 hours.

13. Shutdown

13.1. Emptying the Lime Silo

The water treatment will end either when the Main Pond level is at 3.6' or the lime runs out. If the process is stopped and there is still lime in the silo then it is mixed and then discharged into the Main pond. All the fire hoses are connected together and strung out on the dyke and the lime slurry is poured into the pond. The lime must be dumped as far away from the culvert as possible. Ideally the lime should flow into the deepest part of the pool so that wind action won't stir up the lime.

13.2. Cleaning Lime Pump and Hoses

Before dismantling the lime hoses flush the pump and lines using the 2" water pump to prevent build-up and plugging next year.

13.3. Winterizing and Storage of Equipment

Remove valves and flow meter equipment from siphons. Return data logger to Kimberley for downloading and servicing. The siphon lines remain in place.

When the water treatment is complete the equipment is dismantled and stored in Hay River. The auger and lower part of ladder are removed from the lime silo and the hatches locked.

At the end of the contract all equipment that has a build up of lime gets cleaned with water & 10% acid. Everything on site is cleaned. All wood and the burning barrel is driven to our stash close by (near the end of the road on the East Dyke). The silo is rinsed out and locked up.

The engine on the Pump/Blower unit is winterized at a local shop before storing in a shipping container at South Mackenzie Storage.

The Lab trailer is stored beside the two containers at South Mackenzie Storage.

All the smaller equipment such as the generator, water pump, hoses, lime auger, Jet mixer, electrical cables etc. are stored in the second shipping container.

Teck

Pine Point Mine Tailings Impoundment Area

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APPENDIX A

A1: Spill Reporting Form

A2: List of Typical Spill Response Equipment

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR	REPORT TIME	☐ ORIGINAL SPILL REPORT, OR ☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	REPORT NUMBER ____-_____
B	OCCURRENCE DATE: MONTH – DAY – YEAR	OCCURRENCE TIME		
C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)		
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN		
E	LATITUDE DEGREES MINUTES SECONDS	LONGITUDE DEGREES MINUTES SECONDS		
F	RESPONSIBLE PARTY OR VESSEL NAME	RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION		
G	ANY CONTRACTOR INVOLVED	CONTRACTOR ADDRESS OR OFFICE LOCATION		
H	PRODUCT SPILLED	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER	
	SECOND PRODUCT SPILLED (IF APPLICABLE)	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER	
I	SPILL SOURCE	SPILL CAUSE	AREA OF CONTAMINATION IN SQUARE METRES	
J	FACTORS AFFECTING SPILL OR RECOVERY	DESCRIBE ANY ASSISTANCE REQUIRED	HAZARDS TO PERSONS, PROPERTY OR EQUIPMENT	
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS			

L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY	POSITION STATION OPERATOR	EMPLOYER	LOCATION CALLED YELLOWKNIFE, NT	REPORT LINE NUMBER (867) 920-8130

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ INAC ☐ NEB ☐ TC	SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN	FILE STATUS ☐ OPEN ☐ CLOSED

AGENCY	CONTACT NAME	CONTACT TIME	REMARKS
LEAD AGENCY			
FIRST SUPPORT AGENCY			
SECOND SUPPORT AGENCY			
THIRD SUPPORT AGENCY			

A2: List of Typical Response Equipment

- **Absorbents** (For Petroleum Hydrocarbon (Fuels, Lubricants, and Solvents) and Wastewater)
  - Booms
  - Sheets
  - Towels
  - Absorbent granules

- **Contaminated Soils Recovery Tools**
  - Shovels
  - Picks
  - Excavators
  - Loaders
  - Trucks

- **Liquid Recovery Tools**
  - Pumps
  - Containers
  - Vacuum/Eductor Truck

- **Fire Suppression Equipment**
  - Fire Extinguishers for different material types

- **Personal Safety Equipment**
  - Protective Clothing
  - Eye Protection
  - Breathing Apparatus

Note to Plan User:

This is by no means an exhaustive list of materials and tools that can be assembled and used for spill response.

More information on spill response equipment and equipment suppliers can be found on the Internet. Supplies of this sort of equipment and material can also be found in Hay River, Fort Smith or Yellowknife and other communities in the Northwest Territories.

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APPENDIX B1

MSDS FOR HYDRATED LIME

GRAYMONT

MATERIAL SAFETY DATA SHEET

SECTION I - CHEMICAL PRODUCT AND COMPANY INFORMATION

Product Name: **HIGH CALCIUM HYDRATED LIME**	**WHMIS – CLASSIFICATION: D2A / D2B: MATERIALS CAUSING OTHER TOXIC EFFECTS E: CORROSIVE MATERIAL**

MANUFACTURER'S AND SUPPLIER'S NAME:

GRAYMONT (NB) INC	4634, Route 880, Havelock, New Brunswick, E4Z 5K8.
GRAYMONT (QC) INC.	25, rue De Lauzon, Boucherville (Québec), J4B 1E7.
GRAYMONT (PA) INC.	965, East College avenue, Pleasant Gap, PA 16823
GRAYMONT (WESTERN CANADA) INC.	190 – 3025, 12 Street N.E., Calgary, Alberta, T2E 7J2
GRAYMONT (WESTERN US) INC.	3950 South, 700 East, Suite 301, Salt Lake City, Utah 84107

EMERGENCY TEL. No.: (613) 996 – 6666 CANUTEC (Canada) (800) 424 – 9300 CHEMTREC (US)

Chemical Name	Chemical Family	Chemical Formula
Calcium hydroxide	**Alkaline earth hydroxide**	**Complex mixture - mostly $Ca(OH)_2$**
Molecular Weight	Trade Name and Synonyms	Material Use
$Ca(OH)_2$ = 74.096	**Hydrated Lime, Lime, Slaked lime, Lime Putty, Lime Slurry, Milk of Lime, Calcium Hydroxide**	**Neutralization, Flocculation, Stabilization, absorption**

SECTION II - COMPOSITION AND INFORMATION ON INGREDIENTS

Hazardous Ingredients	Approximate Concentration (% by weight)	C.A.S. Number	Exposure limits (mg/m^3)					
			OSHA PEL	ACGIH TLV	RSST VEMP	MSHA PEL (Note 2)	NIOSH REL	NIOSH IDLH
(Complex Mixture)	**(% by weight)**		**(TWA) 8/40h**	**(TWA) 8/40h**	**(TWA) 8/40h**	**(TWA) 8/40h**	**(TWA) 10/40h**	
Calcium hydroxide	**92 to 100**	**1305-62-0**	**15 (tot dust) 5 resp dust**	**5**	**5**	**5**	**5**	**N/A**
Crystalline Silica, Quartz	**0.1 to 1**	**14808-60-7**	**10/(%SiO_2)+2 respirable silica dust**	**0.025 respirable silica dust**	**0.1 respirable silica dust**	**10/(%SiO_2)+2 respirable silica dust**	**0.05 respirable free silica**	**50**
Crystalline Silica, Quartz	**0 to 0.1 (Note 1)**	**14808-60-7**	**10/(%SiO2)+2 respirable silica dust**	**0.025 respirable silica dust**	**0.1 respirable silica dust**	**10/(%SiO2)+2 (respirable silica dust)**	**0.05 respirable free silica**	**50**

(**Note 1**): Concentration of crystalline silica in a series of lime products will vary from source to source. It was not detected on some samples (< 0.1% w/w). Therefore two ranges are being disclosed. **(Note 2)**: ACGIH TLV Version 1973 has been adopted by the Mine Safety Health Administration (MSHA) as the regulatory Exposure Standard.

SECTION III - PHYSICAL AND CHEMICAL DATA

Physical State Gas ☐ Liquid ☐ Solid ☑	Odor and Appearance **Slight earthy odor – Fine white powder**		Odor Threshold (p.p.m.) **Not applicable**	Specific Gravity **2.3 – 2.4**
Vapor Pressure (mm) **Not applicable**	Vapor Density (Air = 1) **Not applicable**	Evaporation Rate **Not applicable**	Boiling Point (°C) **Not applicable**	Melting Point (°C) **Not applicable**
Solubility in Water (20°C) **0.165g/100g Sat.soln**	Volatiles (% by volume) **Not applicable**	pH (25 °C) **Sat. soln $Ca(OH)_2$ 12.45**	Bulk Density (kg/m^3) **320 - 690**	Coefficient of water/oil distribution **Not applicable**

SECTION IV - FIRE OR EXPLOSION HAZARD DATA

Flammability

Yes ☐ No ☑ If yes, under which conditions?

Extinguishing Media

Calcium Hydroxide does not burn. Use extinguishing media appropriate to surrounding fire conditions.

Special Fire Fighting Procedures

Not applicable

Flash point (°C) and Method	Upper flammable limit (% by volume)	Lower flammable limit (% by volume)
Not applicable	**Not applicable**	**Not applicable**
Auto Ignition Temperature (°C)	TDG Flammability Classification	Hazardous Combustion Products
Not applicable	**Non-flammable**	**None**

Dangerous Combustion Products **None**

EXPLOSION DATA

Sensitivity to Chemical Impact	Rate of Burning	Explosive Power	Sensitivity to Static Discharge
Not applicable	**Not applicable**	**Not applicable**	**Not applicable**

SECTION V - REACTIVITY DATA

Chemical Stability		
Yes ☐ No ☑	If no, under which conditions?	**Absorbs carbon dioxide in the air to form calcium carbonate.**
Incompatibility to other substances		
Yes ☑ No ☐	If so, which ones?	**Boron tri-fluoride, chlorine tri-fluoride, ethanol, fluorine, hydrogen fluoride, phosphorus pentoxide; and acids (violent reaction with generating heat and possible explosion in confined area).**
Reactivity		
Yes ☑ No ☐	If so, under which conditions?	**Reacts violently with strong acids. Reacts chemically with acids and many other compounds and chemical elements to form calcium based compounds. Explosive when mixed with nitro organic compounds.**
Hazardous Decomposition Products		**Thermal decomposition at 540°C will produce calcium oxide and water.**
Hazardous Polymerization Products		**Will not occur.**

SECTION VI - TOXICOLOGICAL PROPERTIES

Route of Entry

☑ Skin Contact	☐ Skin Absorption	☑ Eye Contact	☑ Acute Inhalation	☐ Chronic Inhalation	☑ Ingestion

Effects of Acute Exposure to Product

Skin	**Severe irritation of mucous and skin, removes natural skin oils.**
Eyes	**Severe eye irritation, intense watering of the eyes, possible lesions, possible blindness when exposed for prolonged period. Eye-Rabbit-10mg/ 24 h – Severe.**
Inhalation	**If inhaled in form of dust, irritation of breathing passages, cough, sneezing.**
Ingestion	**If ingested: pain, vomiting blood, diarrhea, collapse, drop in blood pressure (indicates perforation of esophagus or stomach).**

Effects of Chronic Exposure to Product:

Contact dermatitis. Following repeated or prolonged contact, this product can cause redness, desquamation and fissures. This product may contain trace amounts of crystalline silica. Excessive inhalation of respirable crystalline silica dust may result in respiratory disease, including silicosis, pneumoconiosis and pulmonary fibrosis.

LD_{50} of Product (Specify Species and Route)	Irritancy of Product	Exposure limits of Product
(Food grade $Ca(OH)_2$: 7340mg/kg) (Rats, ingestion)	**Severe to moist tissues**	**Unavailable**
LC_{50} of Product (Specify Species)	Sensitization to Product	Synergistic materials
Unavailable	**None**	**None reported**

SECTION VI - TOXICOLOGICAL PROPERTIES (Cont'd)

☑ Carcinogenicity ☐ Reproductive effects ☐ Tératogenicity ☐ Mutagenicity

Calcium Hydroxide is not listed as a carcinogen by ACGIH, MSHA, OSHA, NTP or IARC. It may, however, contain trace amounts of Crystalline Silica listed carcinogens by these organizations.

Crystalline Silica, which inhaled in the form of quartz or crystobalite from occupational sources, is classified by IARC as (Group 1) carcinogenic to humans.

Silica, crystalline (Airborne particles of respirable size) is regulated under California's Safe Drinking Water and Toxic Enforcement Act of 1986. (Proposition 65).

NIOSH considers crystalline silica to be potential occupational carcinogen as defined by the OSHA carcinogen policy [29 CFR 1990].

NTP lists respirable Crystalline Silica as known to be human carcinogens based on sufficient evidence of carcinogenicity in humans.

ACGIH lists respirable Crystalline Silica (quartz) as suspected human carcinogen (A-2).

RSST lists respirable Crystalline Silica (quartz) as suspected human carcinogen.

SECTION VII - PREVENTIVE MEASURES

Personal Protective Equipment (PPE) **Wear clean, dry gloves, full length pants over boots, long sleeved shirt buttoned at the neck, head protection and approved eye protection selected for the working conditions.**

Gloves (Specify)	Respiratory (Specify)	Eyes (Specify)	Footwear (Specify)
Gauntlets Cuff style	**NIOSH approved (N/R/P95) dust respirator**	**Tight fitting goggles with side shields. Do not wear contact lenses when handling this chemical.**	**Resistant to caustics**

Clothing (Specify)	Other (Specify)
Fully covering skin	**Evaluate degree of exposure and use PPE if necessary. After handling lime, employees must shower. If exposed daily, use oil, Vaseline, silicone base creme etc. to protect exposed skin, particularly neck, face and wrists.**

Engineering Controls (e.g. ventilation, enclosed process, specify)

Enclose dust sources; use exhaust ventilation (dust collector) at handling points, keep levels below Max. Concentration Permitted.

Leak and Spill Procedure

Limit access to trained personnel. Use industrial vacuums for large spills. Ventilate area.

SECTION VII - PREVENTIVE MEASURES (Cont'd)

Waste Disposal

Transport to disposal area or bury. Review Federal, Provincial and local Environmental regulations.

Handling Procedures and Equipment

Avoid skin and eye contact. Minimize dust generation. Wear protective goggles and in cases of insufficient ventilation, use anti-dust mask. An eye wash station and safety shower should be readily available where this material or its water dispersions are used. Contact lenses should not be worn when working with this chemical.

Storage Requirements

Keep tightly closed containers in a cool, dry and well-ventilated area, away from acids. Keep out of reach of children.

Special Shipment Information

Calcium Hydroxide is neither regulated by the Transportation of Dangerous Goods (TDG) Regulations (Canada) nor by the Hazardous Materials Regulations (USA).

SECTION VIII - FIRST AID MEASURES

Skin

Carefully and gently brush the contaminated body surfaces in order to remove all traces of lime. Use a brush, cloth or gloves. Remove all lime-contaminated clothing. Rinse contaminated area with lukewarm water for 15 to 20 minutes. Consult a physician if exposed area is large or if irritation persists.

Eyes

Immediately rinse contaminated eye(s) with gently running lukewarm water (saline solution is preferred) for 15 to 20 minutes. In the case of an embedded particle in the eye, or chemical burn, as assessed by first aid trained personnel, contact a physician.

Inhalation

Move source of dust or move victim to fresh air. Obtain medical attention immediately. If victim does not breathe, give artificial respiration.

Ingestion

If victim is conscious, give 300 ml (10 oz) of water, followed by diluted vinegar (1 part vinegar, 2 parts water) or fruit juice to neutralize the alkali. Do not induce vomiting. Contact a physician immediately.

General Advise

Consult a physician for all exposures except minor instances of inhalation.

SECTION IX - REGULATORY INFORMATION

Superfund Amendments and Reauthorization Act of 1986 (SARA Title III). / The Emergency Planning and "Community Right-to-Know" Act (EPCRA). / Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). / Resource Conservation and Recovery Act (**RCRA**).

Component Calcium Hydroxide has been reviewed against the following regulatory listings:

- **SARA Section 302 – Emergency Planning Notification. Extremely Hazardous Substances (EHS) List and Threshold Planning Quantity (TPQ). (40 CFR, Part 355, Section 30) : Not listed.**
- **SARA Section 304 – Emergency Release Notification. Extremely Hazardous Substances (EHS) and Reportable Quantity (RQ) List. (40 CFR, Part 355, Section 40) : Not listed.**
- **SARA Section 311/312 – Hazard Categories (40 CFR, Part 370) : This product is regulated under CFR 1910.1200 (OSHA Hazard Communication) as Immediate (Acute) Health Hazards – Irritant.**
- **SARA Section 313 – Toxics Release Inventory (TRI). Toxic Chemical List (40 CFR, Part 372). Not listed.**
- **CERCLA – Hazardous Substance (40 CFR, Part 302): Not listed in Table 302.4.**
- **RCRA – Hazardous Waste Number (40 CFR, Part 261, Subpart D): Not listed.**
- **RCRA – Hazardous Waste Classification (40 CFR, Part 261, Subpart C): Not classified.**

CWA 311. - Clean Water Act List of Hazardous Substances.

Calcium Hydroxide has been withdrawn from the Clean Water Act (CWA) list of hazardous substances. (11/13/79) (44FR65400)

California Proposition 65.

Component Calcium Hydroxide does not appear on the above regulatory listing. This product may contain small amounts of crystalline silica. Silica, crystalline (Airborne particles of respirable size) is regulated under California's Safe Drinking Water and Toxic Enforcement Act of 1986. (Proposition 65)

Transportation - Hazardous Materials Regulations (USA) & Transportation of Dangerous Goods (TDG) Regulations (Can).

Calcium Hydroxide does not appear on the above regulatory listings

Toxic Substances Control Act (TSCA).

All naturally occurring components of this product are automatically included in the USEPA TSCA Inventory List per 40 CFR 710.4 (b). All other components are one the USEPA TSCA Inventory List. Calcium Hydroxide is exempt from reporting under the inventory update rule.

Canadian Environmental Protection Act (CEPA) – Substances Lists (DSL/NDSL).

Calcium Hydroxide appears on the Domestic Substances List (DSL).

ANSI/NSF 60 - Drinking Water Treatment Additives.

Hydrated Lime has been investigated with respect to elements identified by EPA as toxic and it has been classified for use in direct contact with drinking water. (in accordance with Standard ANSI/NSF 60). For a list of classified products, refer to Underwriters Laboratories Inc.'s Online Certifications Directory.

FDA - U.S. Food and Drug Administration, Department of Health and Human Services.

Calcium Hydroxide has been determined as "Generally Recognized As Safe" (GRAS) by FDA. See 21CFR184.1205. (CFR Title 21 Part 184 - - Direct food substances affirmed as generally recognized as safe).

SECTION X - OTHER INFORMATION

Hazardous Materials Identification System (U.S.)

National Fire Protection Association (U.S.)

WHMIS – Classification:

"E" Corrosive Materials.

Symbol:

WHMIS – Classification:

"D2A" and "D2B" Materials causing other toxic effects.

Symbol:

Additional Information/Comments:

The technical data contained herein is given as information only and is believed to be reliable. GRAYMONT makes no guarantee of results and assumes no obligation or liability in connection therewith.

Sources Used:

NFPA, NLA, TDG, CSST, RSST, (LSRO-FASEB), Hazardous Products Act, Environment Canada, Enviroguide, OSHA, ACGIH, IARC, NIOSH, CFR, NTP, HSDB, EPA SRS, Chemistry and Technology of Lime and Limestone (John Wiley and Sons, Inc.), Lime and Limestone (WILEY-VCH).

SECTION XI - PREPARATION INFORMATION

Prepared by:	Telephone number:	Date :
GRAYMONT (QC) INC. **Technical Services**	**(450) 449-2262**	**April 2006**

An electronic version of this MSDS is available at: www.graymont.com under the PRODUCTS section.

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APPENDIX B2

SPECIFIC SPILL INFORMATION AND RESPONSE FOR DIESEL (MSDS INCLUDED)

Diesel

CAS# 68334-30-5

Other Names: Diesel fuel, diesel oil, fuel oil.

Physical Traits: Clear colorless or dyed liquid.

Special Precautions:

- Combustible/flammable liquid.
- May contain PAHs that may be carcinogenic.
- Generally regarded as being of low toxicity unless exposure is repeated and/or prolonged.
- Skin and respiratory tract irritant.

Incompatible Materials:

- Strong acids
- Oxidizing agents
- Halogens

Personal Protective Equipment / Response Equipment

Level D

Coveralls (disposable); gloves and boots made from neoprene or butyl rubber; safety glasses or goggles; hardhat. Additional equipment at discretion of Incident Commander.

Cleanup Procedures and Options:

- Keep unprotected personnel upwind of spill.
- Stop spill at the source, contain in smallest possible area.
- Protect waterways.

If on land and it is safe to do so:

1. Stop or reduce discharge if safe to do so by plugging, righting, adjusting valves or other suitable method.
2. Contain spill by diking with earth, snow or ice or other barrier, possible trenching or creating a lined sump down gradient from the spill source.
3. Ensure that you have reported the spill.
4. Remove fuel from containment area with pumps, vacuum equipment and place in drums or empty storage tanks, “TIDY” tanks or bladders.
5. Absorb residual liquid on natural or synthetic absorbents (e.g. 3M products).
6. Remove contaminated soils in the spill to an appropriate disposal site if spill site is located near water supply or stream/river course or for aesthetic reasons.
7. Dispose of contaminated fuel by recycling or incineration. In site, incineration may be possible if permission granted from environmental and forestry officials.

If in water and if safe to do so:

1. Stop, or reduce discharge if safe to do so by plugging, righting, adjusting valves, or other suitable method. This material floats on water and is toxic to aquatic life in low concentrations.
2. If possible, contain discharge by booming using commercial boom material, logs or other material at hand.
3. If in rapidly flowing water, direct to quieter backwater using booms to deflect material.
4. Ensure that you have reported the spill.
5. Remove from water by skimming, using absorbents, and collect in suitable container (tanks, drums, plastic lined depression in ground or snow).
6. Dispose by recycling or incineration, if conditions are suitable and regulatory authorities grant permission.

If on snow and it is safe to do so:

1. Stop, or reduce discharge if safe to do so by plugging, righting, adjusting valves, or other suitable method.
2. Compact the snow around the perimeter of the spill area.
3. Construct and compact snow dams.
4. Locate the low point of the spill area, then clear channels in the snow to allow material not absorbed to flow into the low area.
5. Once collected in the low area, shovel the spilled material into containers or pick it up with mobile heavy equipment, then transport it to an approved disposal or recovery site.

Material Safety Data Sheet

Trade Name: DIESEL FUEL **Manufacturer:** ESSO - IMPERIAL OIL

MSDS Code: 00826 **Type of Chemical:** GAS

Notes:

1. PRODUCT INFORMATION

Product identifier: MIDDLE DISTILLATE
ESSO MARINE GAS OIL (DYED OR CLEAR)
ESSO RAILROAD DIESEL (DYED OR CLEAR)
HEATING OIL (DYED OR CLEAR)
DIESEL (DYED OR CLEAR)
DIESEL QUALITY FURNACE FUEL (DYED OR CLEAR)
DIESEL QUALITY HEATING OIL (DYED OR CLEAR)
ESSO DIESEL (DYED OR CLEAR)
ESSO DIESEL QUALITY COMMERCIAL FUEL (DYED OR CLEAR)
ESSO DIESEL QUALITY FURNACE FUEL
ESSO DIESEL QUALITY HEATING OIL
ESSO FURNACE FUEL (DYED OR CLEAR)
ESSO HEATING OIL (DYED OR CLEAR)
ESSO MARINE DIESEL FUEL (DYED OR CLEAR)
ESSO RAILROAD DIESEL FUEL #3 (DYED OR CLEAR)
ESSO TOBACCO CURING OIL
FUEL OIL 75
FUEL OIL 76
DIESEL MARINE (DYED OR CLEAR)
DIESEL MARINE GAS OIL (DYED OR CLEAR)
FURNACE (DYED OR CLEAR)
DIESEL MARINE – POUR DEPRESSED (DYED OR CLEAR)
NO.2 FUEL OIL
NAVAL FUEL OIL 3-GP – 11M (DYED)
ESSO DIESEL FUEL LS
DIESEL LOW SULPHUR (DYED OR CLEAR)
NO. 2 FUEL OIL FOR EXPORT
DIESEL FOR EXPORT (DYED OR CLEAR)
FURNACE TOBACCO CURING OIL
DIESEL NAVAL 3GP-11 (DYED OR CLEAR)
DIESEL NAVAL 3GP – 15 (DYED OR CLEAR)
DIESEL LOW SULPHUR RAIL (DYED OR CLEAR)
DIESEL LOW SULPHUR DYED EP
DIESEL RAIL (DYED OR CLEAR)
DIESEL RAIL #3 (DYED OR CLEAR)
DIESEL RAIL #3 (DYED OR CLEAR)
DIESEL LOW SULPHUR <032> (DYED OR CLEAR)
FURNACE URBAN (DYED OR CLEAR)
DIESEL (032) (DYED OR CLEAR)
DIESEL LOW SULPHUR (EXP DYED)
FURNACE FUEL <032> DYED

DIESEL LOW SULPHUR
MARINE GAS OIL

Application and use:
Multi-purpose fuel
Product description:
A complex mixture of aliphatic, olefinic, naphthenic and aromatic hydrocarbons.

REGULATORY CLASSIFICATION

WHMIS:
Class B, Division 3: Combustible Liquids
Class D, Division 2: Subdivision B: Toxic Material

CEPA: CANADIAN ENVIRONMENTAL PROTECTION ACT
All components of this product are either on the Domestic Substances List (DSL) or are exempt.

TDG INFORMATION(RAIL/ROAD):
Shipping Name: FUEL OIL
Class: 3
Packing Group: III
PIN Number: UN1202

Please be aware that other regulations may apply.

TELEPHONE NUMBERS MANUFACTURER / SUPPLIER:
EMERGENCY 24 HOUR: (519) 339-2145 IMPERIAL OIL
TECHNICAL INFO: (800) 268-3183 Products Division
111 St. Clair Avenue West
Toronto, Ontario
M5W 1K3
(416) 968-4441

2. REGULATED COMPONENTS

The following components are defined in accordance with sub-paragraph 13(a)(I) or (iv) or paragraph 14(a) of the Hazardous Products Act:
NAME % CAS #
Fuel Oil No. 2 >99.9 v/v 68476-30-2

3. TYPICAL PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid
Specific gravity: 0.820 to 0.900 at 15 deg C
Viscosity: 1.30 cSt at 40 deg C
Vapour density: 4
Boiling point: 150 to 370 deg C
Evaporation rate: <1 (1=n-butylacetate)
Solubility in water: negligible
Freezing/pour point: -4 deg C –39 (range)
Odour Threshold: not available
Vapour Pressure: 4 kPa at 38 deg C
Appearance/odour: white or pale yellow liquid, petroleum odour.

4. HEALTH HAZARD INFORMATION

NATURE OF HAZARD

INHALATION:
Negligible hazard at normal temperatures (up to 38 deg C).
High vapour concentrations are irritating to the eyes, nose, throat and lungs.
May cause headaches and dizziness. May be anesthetic and may cause other central nervous system effects. Avoid breathing vapours or mists.

EYE CONTACT:
Slightly irritating, but will not injure eye tissue.

SKIN CONTACT:
Low toxicity, irritating.

INGESTION:
Low toxicity.
Small amounts of this liquid drawn into the lungs from swallowing or vomiting may cause severe health effects (e.g. bronchopneumonia or pulmonary edema)

CHRONIC:
Lifetime skin painting tests indicate that materials of similar composition have produced skin cancer in experimental animals. The relationship of these results to humans has not been fully established.

ACUTE TOXICITY DATA:
Based on animal testing data from similar materials and products, the acute toxicity of this product is expected to be:
ORAL: LD50 > 5000 mg/kg (RAT)
DERMAL: LD50 > 2000 mg/kg (RABBIT)
INHALATION: LC50 > 2500 mg/m3 (RAT)

OCCUPATIONAL EXPOSURE LIMIT:
Manufacturer recommends: 100 ppm based on composition
Local regulated limits may vary.

5. FIRST AID MEASURES

INHALATION:
In emergency situations use proper respiratory protection to immediately remove the affected victim from exposure. Administer artificial respiration if breathing has stopped. Keep at rest. Call for prompt medical attention.

EYE CONTACT:
Flush eyes with large amounts of water until irritation subsides. If irritation persists, get medical attention.

SKIN CONTACT:
Immediately flush with large amounts of water. Use soap if available. Remove contaminated clothing, including shoes, after flushing has begun. If irritation persists, seek medical attention.

INGESTION:
DO NOT induce vomiting since it is important that no amount of the material should enter the lungs (aspiration). Keep at rest. Get prompt medical attention.

6. PREVENTITIVE AND CORRECTIVE MEASURES

PERSONAL PROTECTION:
The selection of personal protective equipment varies, depending upon conditions of use. In open systems where contact is likely, wear safety goggles, chemical resistant overalls, and chemically impervious gloves.
Where concentrations in air may exceed the occupational exposure limits given in Section 4 and where engineering, work practices or other means of exposure reduction are not adequate, approved respirators may be necessary to prevent overexposure by inhalation.

ENGINEERING CONTROLS:
The use of local exhaust ventilation is recommended to control emissions near the source. Laboratory samples should be handled in a fumehood. Provide mechanical ventilation of confined spaces.

HANDLING, STORAGE AND SHIPPING:
Keep containers closed. Handle and open containers with care. Store in a cool, well ventilated place away from incompatible materials. In keeping with good personal hygiene practices, wash hands thoroughly after handling the material.
Do not handle or store near an open flame, sources of heat, or sources of ignition.
Material will accumulate static charges which may cause a spark. Static charge build-up could become an ignition source. Use proper relaxation and grounding procedures.
Empty containers may contain product residue. Do not pressurize, cut, heat, or weld empty containers. Do not reuse empty containers without commercial cleaning or reconditioning.

LAND SPILL:
Eliminate source of ignition. Keep public away. Prevent additional discharge of material, if possible to do so without hazard. Prevent spills from entering sewers, water courses or low areas. Contain spilled liquid with sand or earth. Do not use combustible materials such as sawdust. Recover by pumping (use an explosion proof motor or hand pump), or by using a suitable absorbent.
Consult an expert on disposal of recovered material. Ensure disposal in compliance with government requirements and ensure conformity to local disposal regulations. Notify the appropriate authorities immediately. Take all additional action necessary to prevent and remedy the adverse effects of the spill.

WATER SPILL:
Remove from surface by skimming or with suitable absorbents, if allowed by local authorities and environmental agencies, sinking and / or suitable dispersants may be used in unconfined waters. Consult an expert on disposal of recovered material. Ensure disposal in compliance with government requirements and ensure conformity to local disposal regulations. Notify the appropriate authorities immediately. Take all additional action necessary to prevent and remedy the adverse effects of the spill.

7. FIRE AND EXPLOSION HAZARD

Flashpoint and method: >40 deg C PMCT ASTM D93
Autoignition: NA Flammable Limits: LEL: 0.7% UEL: 6.5%

GENERAL HAZARDS:
Combustible liquid: may form combustible mixtures at or above the flash point.
Toxic gases will form upon combustion.
Static Discharge: material may accumulate static charges which may cause a fire.

FIRE FIGHTING:
Use water spray to cool fire exposed surfaces and to protect personnel.
Shut off fuel to fire.
Use foam, dry chemical or water spray to extinguish fire.

Respiratory and eye protection required for fire fighting personnel.
Avoid spraying water directly into storage containers due to danger f boilover.
A self contained breathing apparatus (SCBA) should be used for all indoor fires and any significant outdoor fires. For small outdoor fires, which may easily be extinguished with a portable fire extinguisher, use of an SCBA may not be required.

HAZARDOUS COMBUSTION PRODUCTS:
Smoke, carbon monoxide, carbon dioxide and traces of oxides of sulphur.

8. REACTIVITY DATA

STABILITY: This product is stable. Hazardous polymerization will not occur.

INCOMPATIBLE MATERIALS AND CONDITIONS TO AVOID: strong oxidizing agents.

HAZARDOUS DECOMPOSITION: None.

9. NOTES

All components of this product are listed on the US TSCA inventory.
Three year WHMIS review.
This MSDS has been revised in Section 3.

10. PREPARATION

Prepared by: Lubricants & Specialties
IMPERIAL OIL
Products Division
111 St. Clair Avenue West
Toronto, Ontario
M5W 1K3
(800) 268-3183

CAUTION:
The information contained herein relates only to this product or material and may not be valid when used in combination with any other product or material or in any process. If the product is not to be used for a purpose or under conditions which are normal or reasonably forseeable. This information cannot be relied upon as complete or applicable. For greater certainty. Uses other than those described in Section 1 must be reviewed with the supplier. The information herein is based on the information available at he indicated date of preparation. This MSDS is for the use of Imperial Oil customers and their employees and agents only. Any further distribution of this MSDS by Imperial Oil customers is prohibited without the written consent of Imperial Oil.

Teck

Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX B3

SPECIFIC SPILL INFORMATION AND RESPONSE FOR GASOLINE (MSDS INCLUDED)

Gasoline

CAS# 86290-81-5

Other Names: Gasoline of all grades.

Physical Traits: Clear or coloured liquid with a strong hydrocarbon odour.

Special Precautions:

- Combustible/flammable liquid.
- Moderately toxic by inhalation, avoid prolonged exposure to fumes.
- Harmful or fatal if swallowed.

Incompatible Materials:

- Incompatible or can react with strong oxidizers.

Personal Protective Equipment / Response Equipment

Impermeable protective gloves (i.e.) nitrile) should be worn during routine handling of gasoline. Respiratory protection is not normally required, however, if working in enclosed areas or at high temperatures, conditions may warrant NIOSH approved respiratory equipment. If splashing is likely a face shield and goggles should be worn. Standard work clothing is sufficient when handling gasoline, as long as fastidious cleanliness practices are employed.

Cleanup Procedures and Options:

- Keep unprotected personnel upwind of spill.
- Stop spill at the source, contain in smallest possible area.
- Protect waterways.

If on land and it is safe to do so:

1. Stop, or reduce discharge if safe to do so by plugging, righting, adjusting valves or other suitable method.
2. Contain spill by diking with earth, snow and ice or other barrier, possible trenching or creating a lined sump down gradient from the spill source.
3. Ensure that you have reported the spill.
4. Remove fuel from containment area with pumps, vacuum equipment and place in appropriate containers. Ensure equipment intrinsically safe (does not have a source of ignition/spark).
5. Absorb residual liquid on natural or synthetic absorbents (e.g. 3M products).
6. Remove contaminated soils in the spill site to an appropriate disposal site if spill located near water supply or stream/river course or for aesthetic reasons.
7. Dispose of contaminated fuel by recycling or incineration. In situ, incineration may be possible if permission granted from environmental and forestry officials contacted through the Emergency Spill Response Line.

If in water and if safe to do so:

1. Stop or reduce discharge if safe to do so by plugging, righting, adjusting valves, or other suitable method. This material floats on water and is harmful to aquatic life.
2. If possible, contain discharge by booming using commercial boom material, logs, or other material at hand.
3. If in rapidly flowing water, direct to quieter backwater using booms to deflect material.
4. Ensure that you have reported the spill.
5. Remove from water by skimming, using absorbents, and collect in suitable container (tanks, drums, plastic lined depression in ground or snow).

NOTE: IN THE EVENT MATERIAL IS SPILLED DURING VERY WARM WEATHER AND THERE IS DANGER OF FIRE DUE TO FUMES, DO NOT ATTEMPT TO CONTAIN PRODUCT ON WATER. ALLOW PRODUCT TO DISPERSE AND EVAPORATE.

6. Dispose absorbents by recycling or incineration if conditions are suitable and after consultation with environmental authorities and/or forestry officials contacted through the Emergency Spill Response Line.

If on snow and it is safe to do so:

1. Stop, or reduce discharge if safe to do so by plugging, righting, adjusting valves, or other suitable method.
2. Compact the snow around the perimeter of the spill area.
3. Construct and compact snow dams.
4. Locate the low point of the spill area, then clear channels in the snow to allow material not absorbed to flow into the low area.
5. Once collected in the low area, shovel the spilled material into containers or pick it up with mobile heavy equipment, then transport it to an approved disposal or recovery site.

Material Safety Data Sheet

Trade Name: GASOLINE, UNLEADED **Manufacturer:** ESSO - IMPERIAL OIL

MSDS Code: 08522 **Type of Chemical:** GAS

Notes:
Material Safety Data Sheets

MSDS Number: 08522

1. PRODUCT INFORMATION

Product Identifier: UNLEADED GASOLINE
REGULAR UNLEADED
MIDGRADE UNLEADED
ESSO SUPER PREMIUM UNLEADED
PREMIUM UNLEADED
ESSO REGULAR UNLEADED
ESSO MIDGRADE UNLEADED
ESSO EXTRA MIDGRADE UNLEADED
ESSO PREMIUM UNLEADED
EXXON MIDGRADE UNLEADED
EXXON PREMIUM UNLEADED
INDOLENE GASOLINE
EXXON REGULAR UNLEADED
PREMIUM GASOLINE
ESSO EXTRA MIDGRADE GASOLINE
MIDGRADE GASOLINE
GASOLINE REGULAR UNLEADED
GASOLINE MIDGRADE UNLEADED MUL89 (DYED OR CLEAR)
GASOLINE REGULAR UNLEADED RUL87 (DYED OR CLEAR)
GASOLINE PREMIUM UNLEADED PUL91 (DYED OR CLEAR)
GASOLINE PREMIUM UNLEADED PUL92 (DYED OR CLEAR)
GASOLINE PREMIUM UNLEADED SUL94
SUPERSUPREME 94 PREMIUM UNLEADED GASOLINE-MTBE
GASOLINE MIDGRADE UNLEADED MUL89 (P91/R87)
GASOLINE MIDGRADE UNLEADED MUL89 DCA (P92/R87)
REGULAR UNLEADED
MIDGRADE UNLEADED
ESSO SUPER PREMIUM UNLEADED
PREMIUM UNLEADED
ESSO REGULAR UNLEADED
ESSO MIDGRADE UNLEADED
ESSO EXTRA MIDGRADE UNLEADED
ESSO PREMIUM UNLEADED

EXXON MIDGRADE UNLEADED
EXXON PREMIUM UNLEADED
INDOLENE GASOLINE
EXXON REGULAR UNLEADED
PREMIUM GASOLINE
ESSO EXTRA MIDGRADE GASOLINE
MIDGRADE GASOLINE
GASOLINE REGULAR UNLEADED
GASOLINE MIDGRADE UNLEADED MUL89 (DYED OR CLEAR)
GASOLINE REGULAR UNLEADED RUL87 (DYED OR CLEAR)
GASOLINE PREMIUM UNLEADED PUL91 (DYED OR CLEAR)
GASOLINE PREMIUM UNLEADED PUL92 (DYED OR CLEAR)
GASOLINE PREMIUM UNLEADED SUL94
SUPERSUPREME 94 PREMIUM UNLEADED GASOLINE-MTBE
GASOLINE MIDGRADE UNLEADED MUL89 (P91/R87)
GASOLINE MIDGRADE UNLEADED MUL89 DCA (P92/R87)

Application and Use:
Motor gasoline fuel, for use in internal combustion engines only

Product Description:

A mixture of aliphatic and aromatic hydrocarbons and additives.

REGULATORY CLASSIFICATION

WHMIS:
Class D, Division 2, Subdivision A: Very Toxic Material.
Class B, Division 2: Flammable Liquids.

CEPA: CANADIAN ENVIRONMENTAL PROTECTION ACT
All components of this product are either on the Domestic Substances List (DSL) or are exempt.

TDG INFORMATION (RAIL/ROAD):

Shipping Name: Gasoline
Class: 3
Packing Group: II
PIN Number: UN1203
Marine Pollutant:P

Please be aware that other regulations may apply.

TELEPHONE NUMBERS MANUFACTURER/SUPPLIER:

Emergency 24 hr. (519) 339-2145 IMPERIAL OIL
Technical Info. (800) 268-3183 Products Division
111 St Clair Avenue West
Toronto, Ontario
M5W 1K3

(416) 968-4441

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2. REGULATED COMPONENTS

The following components are defined in accordance with sub-paragraph 13(a) (i) to (iv) or paragraph 14(a) of the Hazardous Products Act:

NAME % CAS #

Gasoline >99 V/V 8006-61-9 LD50>18ml/kg,orl,rat
LD50> 5ml/kg,skn,rbt

Methyl T-Butyl Ether 0-15 V/V 1634-04-4 LD50:3.9g/Kg,ing,rat
LD50:>10g/Kg,skn,rbt
LC50:142Mg/L,inh,rat

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3. TYPICAL PHYSICAL & CHEMICAL PROPERTIES

Physical State: Liquid
Specific gravity: not available
Viscosity: 0.80 cSt at 20 deg C
Vapour Density: 3.2
Boiling Point: 35 to 210 deg C
Evaporation rate: >10 (1= n-butylacetate)
Solubility in water: negligible
Freezing/Pour Point: -60 deg C less than
Odour Threshold: not available
Vapour Pressure: 76 kPa to 103 kPa at 38 deg C
Density: 0.73 g/cc at 15 deg C
Appearance/odour: Naturally occurring water white or pale yellow; may be dyed a variety of colours for tax or other purposes; petroleum odour.

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4. HEALTH HAZARD INFORMATION

NATURE OF HAZARD

INHALATION:

High vapour concentrations are irritating to the eyes, nose, throat and lungs; may cause headaches and dizziness; may be anesthetic and may cause other central nervous system effects.
Avoid breathing vapours or mists.

EYE CONTACT:

Slightly irritating, but will not injure eye tissue.

SKIN CONTACT:

Low toxicity.
Frequent or prolonged contact may irritate the skin and cause a skin rash (dermatitis).

INGESTION:

Low toxicity.
Small amounts of this liquid drawn into the lungs from swallowing or vomiting may cause severe health effects (e.g. bronchopneumonia or pulmonary edema).

CHRONIC:

The International Agency for Research on Cancer (IARC) has evaluated gasoline and found it to be a possible human carcinogen.
Contains benzene. Human health studies (epidemiology) indicate that prolonged and/or repeated overexposures to benzene may cause damage to the blood producing system and serious blood disorders, including leukemia.
Animal tests suggest that prolonged and/or repeated overexposures to benzene may damage the embryo/fetus. The relationship of these animal studies to humans has not been fully established.
Contains n-hexane. Prolonged and/or repeated exposures may cause damage to the peripheral nervous system (e.g. fingers, feet, arms etc.).
Methyl Tertiary Butyl Ether (MTBE) was tested for carcinogenicity, neurotoxicity, chronic, reproductive and developmental toxicity. The NOEL for all endpoints evaluated in three animal species was 400 ppm or greater. An increase in kidney tumors/damage and liver tumors was observed in animals exposed to high concentrations of MTBE. Some embryo/fetal toxicity and birth defects were observed in the offspring of pregnant mice exposed to maternally toxic doses of MTBE, however the offspring of exposed pregnant rabbits were unaffected. The significance of the animal findings at high exposures are not believed to be directly related to potential human health hazards in the workplace.

ACUTE TOXICITY DATA:

Based on animal testing data from similar materials and products, the acute toxicity of this product is expected to be:
Oral : LD50 > 18 ml/kg (Rat)
Dermal : LD50 > 5 ml/kg (Rabbit)

OCCUPATIONAL EXPOSURE LIMIT:

Manufacturer Recommends:
For gasoline, 300 mg/m3.
For Methyl-tert-Butyl Ether, 25 ppm (90 mg/m3) 8-hour TWA and 75 ppm (270 mg/m3) 15-minute STEL.

ACGIH recommends:
For Gasoline, ACGIH recommends a TWA of 300 ppm (890 mg/m3) and

categorizes it as an animal carcinogen.
For n-Hexane (skin), 50 ppm (176 mg/m3).
For Benzene, ACGIH recommends a TWA of 0.5 ppm (1.6 mg/m3), (skin), and categorizes it as a confirmed human carcinogen.
For Methyl-tert-Butyl Ether, ACGIH recommends a TLV of 40 ppm (144 mg/m3) an categorizes it as an animal carcinogen.

Local regulated limits may vary.

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5. FIRST AID MEASURES

INHALATION:

In emergency situations use proper respiratory protection to immediately remove the affected victim from exposure. Administer artificial respiration if breathing has stopped. Keep at rest. Call for prompt medical attention.

EYE CONTACT:

Flush eyes with large amounts of water until irritation subsides. If irritation persists, get medical attention.

SKIN CONTACT:

Flush with large amounts of water. Use soap if available.
Remove severely contaminated clothing (including shoes) and launder before reuse.
If irritation persists, seek medical attention.

INGESTION:

DO NOT induce vomiting since it is important that no amount of the material should enter the lungs (aspiration). Keep at rest. Get prompt medical attention.

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6. PREVENTIVE AND CORRECTIVE MEASURES

PERSONAL PROTECTION:

The selection of personal protective equipment varies, depending upon conditions of use.
In open systems where contact is likely, wear safety goggles, chemical-resistant overalls, and chemically impervious gloves.
Where only incidental contact is likely, wear safety glasses with side shields. No other special precautions are necessary provided skin/eye contact is avoided.
Where concentrations in air may exceed the occupational exposure limits given in Section 4 and where engineering, work practices or other means

of exposure reduction are not adequate, approved respirators may be necessary to prevent overexposure by inhalation.

ENGINEERING CONTROLS:

The use of local exhaust ventilation is recommended to control emissions near the source. Laboratory samples should be handled in a fumehood. Provide mechanical ventilation of confined spaces.
Use explosion-proof ventilation equipment.

HANDLING, STORAGE AND SHIPPING:

Keep containers closed. Handle and open containers with care.
In keeping with good personal hygiene practices, wash hands thoroughly after handling the material.

Store and load at normal (up to 38 deg C) temperature and at atmospheric pressure.
Material will accumulate static charges which may cause a spark. Static charge build-up could become an ignition source. Use proper relaxation and grounding procedures.
For personnel entry into confined spaces (i.e. bulk storage tanks) a proper confined space entry procedure must be followed including ventilation and testing of tank atmosphere.
Empty containers may contain product residue. Do not pressurize cut, heat, or weld empty containers. Do not reuse empty containers without commercial cleaning or reconditioning.

LAND SPILL:

Eliminate source of ignition. Keep public away. Prevent additional discharge of material, if possible to do so without hazard.
Vapours or dust may be harmful or fatal. Warn occupants of downwind areas.
Prevent spills from entering sewers, watercourses or low areas. Contain spilled liquid with sand or earth. Do not use combustible materials such as sawdust.
Recover by pumping (use an explosion proof motor or hand pump), or by using a suitable absorbent.
Consult an expert on disposal of recovered material. Ensure disposal in compliance with government requirements and ensure conformity to local disposal regulations. Notify the appropriate authorities immediately.
Take all additional action necessary to prevent and remedy the adverse effects of the spill.

WATER SPILL:

Eliminate all sources of ignition. Vapours or dust may be harmful or fatal. Warn occupants and shipping in downwind areas.
Consult an expert on disposal of recovered material. Ensure disposal in compliance with government requirements and ensure conformity to local disposal regulations. Notify the appropriate authorities immediately.
Take all additional action necessary to prevent and remedy the adverse effects of the spill.

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7. FIRE AND EXPLOSION HAZARD

Flashpoint and method: -40 deg C COC D92 less than/moins de

Autoignition: NA Flammable Limits: LEL: 1.4% UEL: 7.6%

GENERAL HAZARDS:

Extremely flammable; material will readily ignite at normal temperatures.
Flammable Liquid; may release vapours that form flammable mixtures at or above the flash point.
Toxic gases will form upon combustion.
Static Discharge; material may accumulate static charges which may cause a fire.

FIRE FIGHTING:

Use water spray to cool fire exposed surfaces and to protect personnel.
Shut off fuel to fire if possible to do so without hazard. If a leak or spill has not ignited use water spray to disperse the vapours.
Either allow fire to burn out under controlled conditions or extinguish with foam or dry chemical. Try to cover liquid spills with foam.
Respiratory and eye protection required for fire fighting personnel.
Avoid spraying water directly into storage containers due to danger of boilover.
A self-contained breathing apparatus (SCBA) should be used for all indoor fires and any significant outdoor fires. For small outdoor fires, which may easily be extinguished with a portable fire extinguisher, use of an SCBA may not be required.

HAZARDOUS COMBUSTION PRODUCTS:

Smoke, carbon monoxide, carbon dioxide under thermal decomposition.

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8. REACTIVITY DATA

STABILITY:

This product is stable. Hazardous polymerization will not occur.

INCOMPATIBLE MATERIALS AND CONDITIONS TO AVOID:

Strong oxidizing agents

HAZARDOUS DECOMPOSITION:

none

9. NOTES

All components of this product are listed on the U.S. TSCA inventory.

10. PREPARATION

Prepared by: Lubricants & Specialties
IMPERIAL OIL
Products Division
111 St Clair Avenue West
Toronto, Ontario
M5W 1K3
(800) 268-3183

Teck

Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX B4

MSDS FOR 10% HYDROCHLORIC ACID

MSDS Number: **H3886** * * * * * *Effective Date:* ***02/16/06*** * * * * * *Supercedes:* ***05/07/03***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS | J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

HYDROCHLORIC ACID (10%-33%)

1. Product Identification

Synonyms: This MSDS applies to the concentrated standard used to make laboratory solutions and any solution that contains more than 10% but less than 33% Hydrochloric acid. For diluted product, see MSDS for Hydrochloric Acid (less than 10%).
CAS No.: 7647-01-0
Molecular Weight: 36.46
Chemical Formula: HCl in H2O
Product Codes:
J.T. Baker: 0323, 0327, 0365, 4654, 4657, 5618, 5619
Mallinckrodt: 2608, 2625, H151, H168, V035

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrogen Chloride	7647-01-0	10 - 33%	Yes
Water	7732-18-5	67 - 90%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.
Ingestion:
Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea, and in severe cases, death.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. May react with metals or heat to release flammable hydrogen gas.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Water or water spray. Neutralize with soda ash or slaked lime.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

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7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

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8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Hydrochloric acid:
- OSHA Permissible Exposure Limit (PEL):
5 ppm (Ceiling)
- ACGIH Threshold Limit Value (TLV):
2 ppm (Ceiling), A4 Not classifiable as a human carcinogen

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.

Odor:
Pungent odor.
Solubility:
Infinitely soluble.
Density:
1.05 @ 15C (59F)
pH:
For HCL solutions: 0.1 (1.0 N), 1.1 (0.1 N), 2.02 (0.01 N)
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
101 - 103C (214 - 217F)
Melting Point:
No information found.
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A strong mineral acid, concentrated hydrochloric acid is highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.
Conditions to Avoid:
Heat, direct sunlight.

---

11. Toxicological Information

Hydrochloric acid: Inhalation rat LC50: 3124 ppm/1H; Oral rabbit LD50: 900 mg/kg. Investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Hydrogen Chloride (7647-01-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.
Environmental Toxicity:
This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 200L

International (Water, I.M.O.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 200L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Hydrogen Chloride (7647-01-0)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Hydrogen Chloride (7647-01-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Hydrogen Chloride (7647-01-0)	5000	500*	Yes	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Hydrogen Chloride (7647-01-0)	5000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2R
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Avoid breathing vapor or mist.
Keep container closed.
Use with adequate ventilation.

Wash thoroughly after handling.

Label First Aid:

If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

****

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Teck

Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX B5

MSDS FOR CYCLOHEXANE

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00188

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Cyclohexanone
Catalog Number: 1403332

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00188
Chemical Name: Cyclohexanone
CAS No.: 108-941
Chemical Formula: $C_6H_{10}O$
Chemical Family: Ketones
Hazard: Combustible. Causes severe eye irritation. Experimental mutagen.
Date of MSDS Preparation:
Day: 22
Month: 09
Year: 2004

2. COMPOSITION / INFORMATION ON INGREDIENTS

Cyclohexanone
CAS No.: 108-94-1
TSCA CAS Number: 108-941
Percent Range: 100.0
Percent Range Units: weight / weight
LD50: Oral rat LD_{50} = 1535 mg/kg; Oral mouse LD_{50} = 1400 mg/kg; Oral rat LD_{50} = 1620 mg/kg; Oral rat LD_{50} = 1840 mg/kg.
LC50: Inhalation rat LC_{50} = 8000 ppm/4 hrs; Inhalation human TCLo = 75 ppm -nose, eye respiratory irritation.
TLV: 25 ppm - skin
PEL: 25 ppm - skin
Hazard: Combustible. Causes severe eye irritation. Experimental mutagen.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, colorless liquid
Odor: Peppermint
HARMFUL IF ABSORBED THROUGH SKIN CAUSES EYE IRRITATION MAY CAUSE SKIN AND RESPIRATORY TRACT IRRITATION

COMBUSTIBLE LIQUID AND VAPOR

HMIS:
Health: 1
Flammability: 2
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 1

Flammability: 2
Reactivity: 0
Symbol: Not applicable

Potential Health Effects:

Eye Contact: Causes severe irritation

Skin Contact: Causes mild irritation

Skin Absorption: Harmful if absorbed through the skin Effects similar to those of inhalation

Target Organs: Kidneys Liver

Ingestion: May cause: central nervous system depression diarrhea dizziness drowsiness headache loss of coordination nausea vomiting weakness

Target Organs: Liver Kidneys

Inhalation: May cause: respiratory tract irritation nausea, vomiting diarrhea headache dizziness weakness incoordination central nervous system depression drowsiness loss of consciousness

Target Organs: Liver Kidneys

Medical Conditions Aggravated: Pre-existing: Kidney conditions Liver conditions

Chronic Effects: Chronic overexposure may cause liver damage kidney damage

Cancer / Reproductive Toxicity Information:

O.S.H.A. Listed: No

IARC Group 3: Non-classifiable
Cyclohexanone
NTP Listed: No

Additional Cancer / Reproductive Toxicity Information: Contains: an experimental mutagen.

Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.

Skin Contact (First Aid): Wash skin with soap and plenty of water. Remove contaminated clothing. Call physician immediately.

Ingestion (First Aid): Do not induce vomiting. Give 1-2 glasses of water. Never give anything by mouth to an unconscious person. Call physician immediately.

Inhalation: Remove to fresh air. Give artificial respiration if necessary. Call physician.

5. FIRE FIGHTING MEASURES

Flammable Properties: Combustible Liquid Vapors can travel to a source of ignition and flash back.

Flash Point: 44°C (111°F)

Method: Closed cup

Flammability Limits:

Lower Explosion Limits: 1.1 %

Upper Explosion Limits: 8.1 %

Autoignition Temperature: 420°C (788°F)

Hazardous Combustion Products: Toxic fumes of: carbon monoxide, carbon dioxide.

Fire / Explosion Hazards: Combustible liquid Do not expose to flames. Do not expose to sparks or other ignition sources. May react violently with: aldehydes strong acids strong bases strong oxidizers strong reducers

Static Discharge: None reported.

Mechanical Impact: None reported

Extinguishing Media: Carbon dioxide Dry chemical. Alcohol foam.

Fire Fighting Instruction: Containers can build up pressure if exposed to heat. As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear. Evacuate area and fight fire from a safe distance.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:

Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.

Containment Technique: Releases of this material may contaminate the environment. Remove all combustible material from spill area. Remove all ignition and spark-creating sources from the spill area. Cover spilled liquid with a

commercially available flammable liquid sorbent such as vapor barrier blanket or activated carbon to avoid evolution of fumes. Vapors may travel to a source of ignition and flash back. May be ignited by: heat, sparks, or flames. Material will float on water creating a fire hazard. Dike the material to create a barrier to combustibles.
Clean-up Technique: Eliminate all sources of ignition. Do not breathe the fumes. Cover with an inert material, such as sand. Use only non-sparking tools. Sweep up material. Incinerate material at an E.P.A. approved hazardous waste facility. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate local area (15 foot radius or as directed by your facility's emergency response plan) when: any quantity is spilled. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Product is regulated as RCRA hazardous waste.
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: 127

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin clothing Do not breathe mist or vapors. Wash thoroughly after handling. Use with adequate ventilation. Maintain general industrial hygiene practices when using this product.
Storage: Store between 10° and 25°C. Protect from: heat light Keep away from: acids alkalies oxidizers reducers
Flammability Class: Class II

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Use a fume hood to avoid exposure to dust, mist or vapor. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves lab coat
Inhalation Protection: laboratory fume hood
Precautionary Measures: Avoid contact with: eyes skin clothing Do not breathe: mist/vapor Wash thoroughly after handling. Use with adequate ventilation. Protect from: heat light Keep away from: acids/acid fumes alkalies oxidizers reducers
TLV: 25 ppm - skin
PEL: 25 ppm - skin

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, colorless liquid
Physical State: Liquid
Molecular Weight: 98.14 g/mol
Odor: Peppermint
pH: Not determined
Vapor Pressure: 136 mm at 100°C
Vapor Density (air = 1): 3.4
Boiling Point: 155.6°C (312.1°F)
Melting Point: Not applicable
Specific Gravity (water = 1): 0.948
Evaporation Rate (water = 1): Not determined
Volatile Organic Compounds Content: 100 %
Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Slightly soluble
Acid: Not determined
Other: Soluble in most organic solvents
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Contact with heat, sparks, open flames or other ignition sources. Exposure to light.

Reactivity / Incompatibility: Incompatible with: acids alkalies oxidizers reducers
Hazardous Decomposition: Heating to decomposition releases toxic fumes of carbon monoxide and carbon dioxide.
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: Oral rat LD_{50} = 1535 mg/kg; Oral mouse LD_{50} = 1400 mg/kg; Oral rat LD_{50} = 1620 mg/kg; Oral rat LD_{50} = 1840 mg/kg.
LC50: Inhalation rat LC_{50} = 8000 ppm/4 hrs; Inhalation human TCLo = 75 ppm -nose, eye respiratory irritation.
Dermal Toxicity Data: Skin rabbit LD_{50} = 948 mg/kg.
Skin and Eye Irritation Data: Skin irritation rabbit: 500 mg = MILD; Eye irritation rabbit: 20 mg = SEVERE; Eye irritation rabbit: 250 µg/24 hrs = SEVERE.
Mutation Data: Cytogenetic analysis in human leukocytes @ 100 µmol/l; Cytogenetic analysis in human lymphocytes @ 5 µg/l; Sister chromatid exchange in hamster ovary @ 7500 µl/l; Mutation in mammalian somatic cells in hamster ovary @ 7500 µl/l.
Reproductive Effects Data: Inhalation rat (female) TCLo = 105 mg/m³/4 hrs (Fertility: pre-implantation mortality); Oral mouse (female) TDLo = 11 g/kg (Effects on newborn: growth statistics).
Ingredient Toxicological Data: --
Not applicable

12. ECOLOGICAL INFORMATION

Product Ecological Information: Aquatic toxicity: Golden ides LC50 = 536 mg/l/48 hrs; No inhibition of bacteria in effluent if properly introduced into acclimated biological treatment facility.

Ingredient Ecological Information: --
Not applicable

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: D001
Special Instructions (Disposal): Incinerate material at an E.P.A. approved hazardous waste facility.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Cyclohexanone
--
DOT Hazard Class: 3
DOT Subsidiary Risk: NA
DOT ID Number: UN1915
DOT Packing Group: III
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Cyclohexanone
--
ICAO Hazard Class: 3
ICAO Subsidiary Risk: NA
ICAO ID Number: UN1915
ICAO Packing Group: III
I.M.O.:
I.M.O. Proper Shipping Name: Cyclohexanone
--
I.M.O. Hazard Class: 3
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: UN1915
I.M.O. Packing Group: III

Additional Information: This product may be shipped as part of a chemical kit composed of various compatible dangerous goods for analytical or testing purposes. This kit would have the following classification: Proper Shipping Name: Chemical Kit Hazard Class: 9 UN Number 3316

15. REGULATORY INFORMATION

U.S. Federal Regulations:

O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)

E.P.A.:

S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard Delayed (Chronic) Health Hazard Fire Hazard

S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

--

302 (EHS) TPQ (40 CFR 355): Not applicable

304 CERCLA RQ (40 CFR 302.4): Cyclohexanone 5000 lbs.

304 EHS RQ (40 CFR 355): Not applicable

Clean Water Act (40 CFR 116.4): Not applicable

RCRA: Contains RCRA regulated substances. See Section 13, EPA Waste ID Number.

C.P.S.C.: Not applicable

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): Not applicable

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: TSCA Listed: Yes

TSCA CAS Number: 108-941

16. OTHER INFORMATION

Intended Use: Laboratory Reagent

References: CCINFO MSDS/FTSS. Canadian Centre for Occupational Health and Safety. Hamilton, Ontario Canada: 30 June 1993. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991. NIOSH Registry of Toxic Effects of Chemical Substances, 1985-86. Cincinnati: U.S. Department of Health and Human Services, April, 1987. Patty, Frank A. Industrial Hygiene and Toxicology, 3rd Revised Edition. Volume 2. New York: A Wiley-Interscience Publication, 1981. Technical Judgment. Sax, N. Irving. Dangerous Properties of Industrial Materials, 7th Ed. New York: Van Nostrand Reinhold Co., 1989. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. The Merck Index, 11th Ed. Rahway, New Jersey: Merck and Co., Inc., 1989. Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). IARC Monographs on the Evaluation of the Carcinogenic Risks to Humans. World Health Organization (Volumes 1-42) Supplement 7. France: 1987. List of Dangerous Substances Classified in Annex I of the EEC Directive (67/548) - Classification, Packaging and Labeling of Dangerous Substances, Amended July 1992. Sixth Annual Report on Carcinogens, 1991. U.S. Department of Health and Human Services. Rockville, MD: Technical Resources, Inc. 1991. Vendor Information. EU Occupational Exposure Limits On Line.

Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

Teck

Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX B6

MSDS FOR ZINCOVER5, ZINC REAGENT POWDER PILLOWS

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00048

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: ZincoVer ® 5 Zinc Reagent Powder Pillows
Catalog Number: 1403268

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00048
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Toxic.
Date of MSDS Preparation:
Day: 06
Month: October
Year: 2006

2. COMPOSITION / INFORMATION ON INGREDIENTS

Potassium Borate
CAS No.: 1332-77-0
TSCA CAS Number: 1332-77-0
Percent Range: 50.0 - 60.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 3690 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

Other component
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: 0.01 - 0.1
Percent Range Units: weight / weight
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Boron Oxide
CAS No.: 1303-86-2
TSCA CAS Number: 1303-86-2
Percent Range: 15.0 - 25.0
Percent Range Units: weight / weight
LD50: Oral mouse LD50 = 3163 mg/kg
LC50: None reported
TLV: 10 mg/m³

PEL: 15 mg/m³
Hazard: May cause irritation.

Sodium Ascorbate
CAS No.: 134-03-2
TSCA CAS Number: 134-032
Percent Range: 20.0 - 30.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

Potassium Cyanide
CAS No.: 151-50-8
TSCA CAS Number: 151-508
Percent Range: 1.0 - 10.0
Percent Range Units: weight / weight
LD50: Oral human LD Lo = 2.857 mg/kg; Oral rat LD_{50} = 5 mg/kg; Ocular rabbit LD_{50} = 7.87 mg/kg.
LC50: None reported
TLV: 5 mg/m³ (skin)
PEL: 5 mg/m³ (skin)
Hazard: Fast-acting poison.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Purple
Odor: Not determined
MAY BE FATAL IF SWALLOWED HARMFUL IF INHALED OR ABSORBED THROUGH SKIN MAY CAUSE EYE AND RESPIRATORY TRACT IRRITATION

CONTACT WITH ACIDS FORMS TOXIC FUMES
Emergency response to cyanide exposure should be planned and practiced prior to work with cyanides. First responders should start treatment and get medical attention immediately. Antidote: break an amyl nitrite pearl in cloth and hold lightly under nose for 15 seconds. Repeat 5 times at 15 second intervals. Transport to hospital immediately. Note to Physician: Have a cyanide first aid kit available. If patient has not responded to amyl nitrite, inject intraveneously 10 ml of a 3% solution of sodium nitrite at a rate not greater than 2.5 - 5 ml/min. Follow directly with 50 ml of a 25 % solution of sodium thiosulfate at the same rate by the same route. Keep patient under observation. If signs of poisoning persist or reappear, repeat nitrite and thiosulfate injections 1 hour later in one-half the original doses.

HMIS:
Health: 3
Flammability: 0
Reactivity: 1
Protective Equipment: X - See protective equipment, Section 8.

NFPA:
Health: 3
Flammability: 0
Reactivity: 1
Symbol: Not applicable

Potential Health Effects:
Eye Contact: May cause irritiation
Skin Contact: May cause irritiation
Skin Absorption: Harmful if absorbed through the skin
Target Organs: Brain
Ingestion: May be rapidly fatal. May cause: gastrointestinal irritation confusion irregular heartbeat
Target Organs: Brain
Inhalation: May cause: irritation of nose and throat irregular heartbeat confusion
Target Organs: Brain
Medical Conditions Aggravated: Pre-existing: Respiratory conditions Skin conditions

Chronic Effects: Chronic overexposure may cause brain damage
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: Contains: an experimental mutagen. an experimental teratogen.
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with soap and plenty of water for 15 minutes. Remove contaminated clothing. Call physician immediately.
Ingestion (First Aid): Break an amyl nitrite pearl in cloth and hold lightly under nose for 15 seconds. Repeat every five minutes. Administer artificial respiration with 100% oxygen. Transport to hospital immediately.
Inhalation: Break an amyl nitrite pearl in cloth and hold lightly under nose for 15 seconds. Repeat 5 times at 15 second intervals. Transport to hospital immediately.

5. FIRE FIGHTING MEASURES

Flammable Properties: Combustion generates toxic fumes. Dusts at sufficient concentrations can form explosive mixtures with air.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: Toxic fumes of: cyanide compounds nitrogen oxides. potassium oxides boron compounds
Fire / Explosion Hazards: High concentrations of dust may form an explosive mixture with air.
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Alkali dry chemical. Do NOT use carbon dioxide.
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear. Evacuate area and fight fire from a safe distance. Water runoff can cause environmental damage. Dike and collect water used to fight fire.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Releases of this material may contaminate the environment. Stop spilled material from being released to the environment.
Clean-up Technique: Carefully mist spill with bleach until saturated. Scoop up slurry into a large beaker. Oxidize spilled material with a 50% excess of bleach containing at least 5% sodium hypochlorite. Allow to react for 24 hours in a fume hood. Flush reacted material to the drain with a large excess of water. Decontaminate area with bleach solution.
Evacuation Procedure: Evacuate local area (15 foot radius or as directed by your facility's emergency response plan) when: any quantity is spilled. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Mixture contains a component which is regulated as hazardous waste. Mixture contains a component which is regulated as a hazardous air pollutant. Mixture contains a component which is regulated as a water pollutant.
304 EHS RQ (40 CFR 355): Potassium Cyanide 10 lbs
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes skin clothing Do not breathe dust. Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Protect from: moisture Keep away from: acids
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Have an eyewash station nearby. Use a fume hood to avoid exposure to dust, mist or vapor. Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves lab coat
Inhalation Protection: laboratory fume hood
Precautionary Measures: Avoid contact with: eyes skin clothing Do not breathe: dust Wash thoroughly after handling. Keep away from: acids/acid fumes Protect from: moisture
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Purple
Physical State: Solid
Molecular Weight: Not applicable
Odor: Not determined
pH: of 5% solution = 8.7
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable
Boiling Point: Not applicable
Melting Point: 155°C 311°F
Specific Gravity (water = 1): 1.83
Evaporation Rate (water = 1): Not applicable
Volatile Organic Compounds Content: Not determined
Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Soluble
Acid: Generates HCN
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Excess moisture Heating to decomposition.
Reactivity / Incompatibility: Incompatible with: acids
Hazardous Decomposition: Toxic fumes of: cyanide boron compounds nitrogen oxides potassium oxide Contact with acids/acid fumes releases toxic cyanide gas.
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: Oral rat LD_{50} = 383 mg/kg
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported

Reproductive Effects Data: None reported
Ingredient Toxicological Data: Boron Oxide: Oral mouse LD_{50} = 3163 mg/kg, Potassium Cyanide: Oral human LDLo = 2.857 mg/kg, Oral rat LD_{50} = 5mg/kg, Potassium Borate: Oral rat LD_{50} = 3690 mg/kg

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product.
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: D003
Special Instructions (Disposal): Dispose of material in an E.P.A. approved hazardous waste facility.
Empty Containers: Rinse three times with an appropriate solvent. Rinsate from empty containers may contain sufficient product to require disposal as hazardous waste. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: This product may be shipped as part of a chemical kit composed of various compatible dangerous goods for analytical or testing purposes. This kit would have the following classification:
Proper Shipping Name: Chemical Kit Hazard Class: 9 UN Number 3316.
ALSO NOTE: If the National Competent Authority declares this product an environmental hazard by Special Provision 909 (IMDG) and Special Provision A97 (IATA) the classification may be UN3077 or UN3082.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard Delayed (Chronic) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product contains a chemical(s) subject to the reporting requirements of Section 313 of Title III of SARA.

Potassium Cyanide

302 (EHS) TPQ (40 CFR 355): Potassium Cyanide - RQ 100 lbs.

304 CERCLA RQ (40 CFR 302.4): Potassium cyanide 10 lbs.

304 EHS RQ (40 CFR 355): Potassium Cyanide 10 lbs

Clean Water Act (40 CFR 116.4): Potassium cyanide - RQ 10 lbs.

RCRA: Contains RCRA regulated substances. See Section 13, EPA Waste ID Number.

C.P.S.C.: Not applicable

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): Not applicable

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).

TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Determination of zinc

References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. CCINFO RTECS. Canadian Centre for Occupational Health and Safety. Hamilton, Ontario Canada: 30 June 1993. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991. In-house information. Technical Judgment. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992.

Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

Teck

Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX B7

MSDS FOR NITRIC ACID

Material Safety Data Sheet

Creation Date 12-Mar-2009 **Revision Date** 30-Jun-2009 **Revision Number** 2

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name **Nitric acid (65 - 70%)**

Cat No. **A198C-212, A200-212, A200-212LC, A200-500, A200-500LC, A200-612GAL, A200C-212, A200S-212, A200S-212LC, A200S-500, A200SI-212, A467-1, A467-2, A467-250, A467-500, A483-212, A509-212, A509-212LC, A509-500, A509-SK212, A509-SK212LC**

Synonyms Azotic acid; Engraver's acid; Aqua fortis

Recommended Use Laboratory chemicals

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 703-527-3887

2. HAZARDS IDENTIFICATION

DANGER!

Emergency Overview

Oxidizer: Contact with combustible/organic material may cause fire. Causes severe burns by all exposure routes. May cause pulmonary edema.

Appearance Clear Colorless, Light yellow **Physical State** Liquid **odor** strong Acrid

Target Organs Eyes, Respiratory system, Skin, Teeth, Kidney, Gastrointestinal tract (GI)

Potential Health Effects

Acute Effects
Principle Routes of Exposure

Eyes	Causes severe burns. May cause blindness or permanent eye damage.
Skin	Causes severe burns. May be harmful in contact with skin.
Inhalation	Causes severe burns. May cause pulmonary edema. May be harmful if inhaled.
Ingestion	Ingestion causes burns of the upper digestive and respiratory tract. May be harmful if swallowed.

Chronic Effects Chronic exposure to corrosive fumes/gases may cause erosion of the teeth followed by jaw necrosis. Bronchial irritation with chronic cough and frequent attacks of pneumonia are common. Gastrointestinal disturbances may also be seen. May cause adverse kidney effects. Experiments have shown reproductive toxicity effects on laboratory animals.

See Section 11 for additional Toxicological information.

Aggravated Medical Conditions Preexisting eye disorders. Skin disorders.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Haz/Non-haz

Component	CAS-No	Weight %
Nitric acid	7697-37-2	65 - 70
Water	7732-18-5	30 - 35

4. FIRST AID MEASURES

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Immediate medical attention is required.

Ingestion Do not induce vomiting. Call a physician or Poison Control Center immediately.

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flash Point Not applicable
Method No information available.

Autoignition Temperature No information available.

Explosion Limits
Upper No data available
Lower No data available

Suitable Extinguishing Media Substance is nonflammable; use agent most appropriate to extinguish surrounding fire..

Unsuitable Extinguishing Media No information available.

Hazardous Combustion Products No information available.

Sensitivity to mechanical impact No information available.
Sensitivity to static discharge No information available.

Specific Hazards Arising from the Chemical
Oxidizer: Contact with combustible/organic material may cause fire. Corrosive Material. Causes severe burns by all exposure routes. Thermal decomposition can lead to release of irritating gases and vapors.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear

NFPA **Health** 4 **Flammability** 0 **Instability** 0 **Physical hazards** OX

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Wear self-contained breathing apparatus and protective suit. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing.

Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable and closed containers for disposal. Keep away from clothing and other combustible materials.

7. HANDLING AND STORAGE

Handling Use only under a chemical fume hood. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Keep away from clothing and other combustible materials. Do not breathe vapors/dust. Do not ingest. Contents under pressure.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Do not store near combustible materials. Corrosives area.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location.

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Nitric acid	TWA: 2 ppm STEL: 4 ppm	(Vacated) TWA: 2 ppm (Vacated) TWA: 5 mg/m^3 (Vacated) STEL: 10 mg/m^3 (Vacated) STEL: 4 ppm TWA: 2 ppm TWA: 5 mg/m^3	IDLH: 25 ppm TWA: 2 ppm TWA: 5 mg/m^3 STEL: 10 mg/m^3 STEL: 4 ppm

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Nitric acid	TWA: 2 ppm TWA: 5.2 mg/m^3 STEL: 10 mg/m^3 STEL: 4 ppm	TWA: 2 ppm TWA: 5 mg/m^3 STEL: 10 mg/m^3 STEL: 4 ppm	TWA: 2 ppm TWA: 5 mg/m^3 STEL: 10 mg/m^3 STEL: 4 ppm

NIOSH IDLH: *Immediately Dangerous to Life or Health*

Personal Protective Equipment

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Appearance	Clear Colorless, Light yellow
odor	strong Acrid
Odor Threshold	No information available.
pH	1.0 (0.1M)
Vapor Pressure	0.94 kPa (20°C)
Vapor Density	No information available.
Viscosity	No information available.
Boiling Point/Range	120.5°C / 248.9°F
Melting Point/Range	-41°C / -41.8°F
Decomposition temperature °C	No information available.
Flash Point	Not applicable
Evaporation Rate	No information available.
Specific Gravity	1.40
Solubility	No information available.
log Pow	No data available
Molecular Weight	63.02
Molecular Formula	HNO3

10. STABILITY AND REACTIVITY

Stability	Oxidizer: Contact with combustible/organic material may cause fire.
Conditions to Avoid	Incompatible products. Combustible material. Excess heat.
Incompatible Materials	Strong bases, Reducing agents, Organic materials, Aldehydes, Alcohols, Cyanides, Metals, Powdered metals, Ammonia
Hazardous Decomposition Products	Nitrogen oxides (NOx)
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions .	None under normal processing..

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Nitric acid	Not listed	Not listed	130 mg/m^3 (Rat) 4 h 7 mg/L (Rat) 1 h
Water	90 mL/kg (Rat)	Not listed	Not listed

Irritation Causes severe burns by all exposure routes

Toxicologically Synergistic Products No information available.

Chronic Toxicity

Carcinogenicity There are no known carcinogenic chemicals in this product

Sensitization No information available.

Mutagenic Effects No information available.

Reproductive Effects Experiments have shown reproductive toxicity effects on laboratory animals.

Developmental Effects No information available.

Teratogenicity Teratogenic effects have occurred in experimental animals..

Other Adverse Effects See actual entry in RTECS for complete information.

Endocrine Disruptor Information No information available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Do not empty into drains.

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available

Mobility .

Component	log Pow
Nitric acid	-2.3

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. TRANSPORT INFORMATION

DOT

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

TDG

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

IATA

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

IMDG/IMO

UN-No	UN2031
Proper Shipping Name	NITRIC ACID
Hazard Class	8
Subsidiary Hazard Class	5.1
Packing Group	II

15. REGULATORY INFORMATION

All of the components in the product are on the following Inventory lists:

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	CHINA	KECL
Nitric acid	X	X	-	231-714-2	-		X	X	X	X	KE-25911 X
Water	X	X	-	231-791-2	-		X	-	X	X	KE-35400 X

Legend:
X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Nitric acid	7697-37-2	65 - 70	1.0

SARA 311/312 Hazardous Categorization

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Nitric acid	X	1000 lb	-	-

Clean Air Act
Not applicable

OSHA

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Nitric acid	-	TQ: 500 lb

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Nitric acid	1000 lb	1000 lb

California Proposition 65
This product does not contain any Proposition 65 chemicals.

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Nitric acid	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security

This product contains the following DHS chemicals:

Component	DHS Chemical Facility Anti-Terrorism Standard
Nitric acid	2000 lb STQ

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
C Oxidizing materials
E Corrosive material

16. OTHER INFORMATION

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Tel: (412) 490-8929

Creation Date 12-Mar-2009

Print Date 30-Jun-2009

Revision Summary "***", and red text indicates revision

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of MSDS

Teck

Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX B8

MSDS FOR pH BUFFER SOLUTIONS (pH 4, 7 & 10)

Material Safety Data Sheet

Creation Date 28-Jan-2010 **Revision Date** 28-Jan-2010 **Revision Number** 1

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name **Buffer Solution, pH 4.00, Color-Coded Red**

Cat No. **SB101-4; SB101-20; SB101-500**

Synonyms (Certified)

Recommended Use Laboratory chemicals

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 703-527-3887

2. HAZARDS IDENTIFICATION

CAUTION!

Emergency Overview

Contains a known or suspected carcinogen. May cause eye, skin, and respiratory tract irritation . The toxicological properties have not been fully investigated.

Appearance Red **Physical State** Liquid **odor** odorless

Target Organs None known.

Potential Health Effects

Acute Effects

Principle Routes of Exposure

Eyes	May cause irritation.
Skin	May cause irritation. May be harmful in contact with skin.
Inhalation	May cause irritation of respiratory tract. May be harmful if inhaled.
Ingestion	May be harmful if swallowed. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

Chronic Effects Contains a known or suspected carcinogen.

See Section 11 for additional Toxicological information.

Aggravated Medical Conditions No information available.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Haz/Non-haz

Component	CAS-No	Weight %
Water	7732-18-5	98.91
1,2-Benzenedicarboxylic acid, monopotassium salt	877-24-7	1.0
Formaldehyde	50-00-0	0.05
Fluorescein, 2',4',5',7'-tetraiodo, disodium salt	16423-68-0	0.02
Methyl alcohol	67-56-1	0.02

4. FIRST AID MEASURES

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Get medical attention immediately if symptoms occur.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Get medical attention immediately if symptoms occur.

Ingestion Do not induce vomiting. Obtain medical attention.

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flash Point Not applicable
Method No information available.

Autoignition Temperature No information available.

Explosion Limits
Upper No data available
Lower No data available

Suitable Extinguishing Media Substance is nonflammable; use agent most appropriate to extinguish surrounding fire..

Unsuitable Extinguishing Media No information available.

Hazardous Combustion Products No information available.

Sensitivity to mechanical impact No information available.
Sensitivity to static discharge No information available.

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear

NFPA **Health** 1 **Flammability** 0 **Instability** 0 **Physical hazards** N/A

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Use personal protective equipment. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.

Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable and closed containers for disposal.

7. HANDLING AND STORAGE

Handling Wear personal protective equipment. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing. Do not breathe vapors or spray mist.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Formaldehyde	Ceiling: 0.3 ppm	(Vacated) TWA: 3 ppm (Vacated) STEL: 10 ppm (Vacated) Ceiling: 5 ppm TWA: 0.75 ppm STEL: 2 ppm	IDLH: 20 ppm TWA: 0.016 ppm Ceiling: 0.1 ppm
Methyl alcohol	TWA: 200 ppm STEL: 250 ppm Skin	(Vacated) TWA: 200 ppm (Vacated) TWA: 260 mg/m^3 (Vacated) STEL: 325 mg/m^3 (Vacated) STEL: 250 ppm Skin TWA: 200 ppm TWA: 260 mg/m^3	IDLH: 6000 ppm TWA: 200 ppm TWA: 260 mg/m^3 STEL: 250 ppm STEL: 325 mg/m^3

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Formaldehyde	Ceiling: 3 mg/m^3 Ceiling: 2 ppm	Peak: 3 mg/m^3 Peak: 2 ppm	STEL: 1.0 ppm CEV: 1.5 ppm

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Methyl alcohol	TWA: 200 ppm TWA: 262 mg/m^3 STEL: 328 mg/m^3 STEL: 250 ppm Skin	TWA: 200 ppm TWA: 260 mg/m^3 STEL: 250 ppm STEL: 310 mg/m^3	TWA: 200 ppm TWA: 260 mg/m^3 STEL: 325 mg/m^3 STEL: 250 ppm Skin

NIOSH IDLH: *Immediately Dangerous to Life or Health*

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Appearance	Red
odor	odorless
Odor Threshold	No information available.
pH	4.0
Vapor Pressure	No information available.
Vapor Density	0.7 (Water = 1.0)
Viscosity	No information available.
Boiling Point/Range	100°C / 212°F
Melting Point/Range	0°C / 32°F
Decomposition temperature °C	No information available.
Flash Point	Not applicable
Evaporation Rate	> 1.0 (Ether = 1.0)
Specific Gravity	1.0
Solubility	Soluble in water
log Pow	No data available

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Conditions to Avoid	Excess heat.
Incompatible Materials	None known
Hazardous Decomposition Products	Thermal decomposition can lead to release of irritating gases and vapors
Hazardous Polymerization	Hazardous polymerization does not occur
Hazardous Reactions .	None under normal processing.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information No acute toxicity information is available for this product

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Water	90 mL/kg (Rat)	Not listed	Not listed
1,2-Benzenedicarboxylic acid, monopotassium salt	3200 mg/kg (Rat)	Not listed	Not listed
Formaldehyde	500 mg/kg (Rat)	Not listed	0.578 mg/L (Rat) 4 h
Fluorescein, 2',4',5',7'-tetraiodo, disodium salt	1840 mg/kg (Rat)	Not listed	Not listed
Methyl alcohol	5628 mg/kg (Rat)	15800 mg/kg (Rabbit)	64000 ppm (Rat) 4 h 83.2 mg/L (Rat) 4 h

Irritation No information available.

Toxicologically Synergistic Products No information available.

Chronic Toxicity

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	ACGIH	IARC	NTP	OSHA	Mexico
Formaldehyde	A2	Group 1	Reasonably Anticipated	X	Not listed

ACGIH: (American Conference of Governmental Industrial Hygienists)
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)
IARC: (International Agency for Research on Cancer)
IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

Sensitization No information available.

Mutagenic Effects No information available.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

Other Adverse Effects The toxicological properties have not been fully investigated.. See actual entry in RTECS for complete information.

Endocrine Disruptor Information No information available

12. ECOLOGICAL INFORMATION

Ecotoxicity

.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Formaldehyde	Not listed	Not listed	Not listed	EC50 96 h 20 mg/L EC50 48 h 2 mg/L EC50 96 h 20 mg/L
Methyl alcohol	Not listed	Not listed	EC50 = 39000 mg/L 25 min EC50 = 40000 mg/L 15 min EC50 = 43000 mg/L 5 min	Not listed

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available

Mobility .

Component	log Pow
Formaldehyde	0.35
Methyl alcohol	-0.74

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Formaldehyde - 50-00-0	U122	-
Methyl alcohol - 67-56-1	U154	-

14. TRANSPORT INFORMATION

DOT Not regulated

TDG Not regulated

IATA Not regulated

IMDG/IMO Not regulated

15. REGULATORY INFORMATION

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	CHINA	KECL
Water	X	X	-	231-791-2	-		X	-	X	X	KE-35400 X
1,2-Benzenedicarboxylic acid, monopotassium salt	X	X	-	212-889-4	-		X	X	X	X	KE-02310 X
Formaldehyde	X	X	-	200-001-8	-		X	X	X	X	KE-17074 X
Fluorescein, 2',4',5',7'-tetraiodo, disodium salt	X	X	-	240-474-8	-		X	X	X	X	KE-10872 X
Methyl alcohol	X	X	-	200-659-6	-		X	X	X	X	KE-23193 X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Formaldehyde	50-00-0	0.05	0.1
Methyl alcohol	67-56-1	0.02	1.0

SARA 311/312 Hazardous Categorization

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Formaldehyde	X	100 lb	-	-

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Formaldehyde	X		-
Methyl alcohol	X		-

OSHA

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Formaldehyde	0.5 ppm Action Level 0.75 ppm TWA 2 ppm STEL	TQ: 1000 lb

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Formaldehyde	100 lb	100 lb
Methyl alcohol	5000 lb	-

California Proposition 65
This product contains the following Proposition 65 chemicals:

Component	CAS-No	California Prop. 65	Prop 65 NSRL
Formaldehyde	50-00-0	Carcinogen	40 µg/day

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Formaldehyde	X	X	X	X	X
Methyl alcohol	X	X	X	X	X

U.S. Department of Transportation
Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product contains the following DHS chemicals:

Component	DHS Chemical Facility Anti-Terrorism Standard
Formaldehyde	11250 lb STQ (solution)

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
Non-controlled

16. OTHER INFORMATION

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Tel: (412) 490-8929

Creation Date 28-Jan-2010

Print Date 28-Jan-2010

Revision Summary "***", and red text indicates revision

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of MSDS

Material Safety Data Sheet

Creation Date 09-Dec-2009 **Revision Date** 09-Dec-2009 **Revision Number** 1

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name **Buffer Solution, pH 7.00, Color-Coded Yellow**

Cat No. **SB107-4; SB107-20; SB107-500**

Synonyms None.

Recommended Use Laboratory chemicals

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 703-527-3887

2. HAZARDS IDENTIFICATION

CAUTION!

Emergency Overview

May cause eye, skin, and respiratory tract irritation . Low hazard for usual industrial or commercial handling.

Appearance Yellow **Physical State** Liquid **Odor** odorless

Target Organs None known.

Potential Health Effects

Acute Effects
Principle Routes of Exposure

Eyes	May cause irritation.
Skin	May cause irritation. Low hazard for usual industrial or commercial handling.
Inhalation	May cause irritation of respiratory tract. Low hazard for usual industrial or commercial handling.
Ingestion	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. Low hazard for usual industrial or commercial handling.

Chronic Effects None known.

See Section 11 for additional Toxicological information.

Aggravated Medical Conditions No information available.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Haz/Non-haz

Component	CAS-No	Weight %
Water	7732-18-5	99.18
Dihydrogen potassium phosphate	7778-77-0	0.7
Sodium hydroxide	1310-73-2	0.1
FD&C yellow No. 5	1934-21-0	0.0 - 0.02

4. FIRST AID MEASURES

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Get medical attention immediately if symptoms occur.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Get medical attention immediately if symptoms occur.

Ingestion Do not induce vomiting. Obtain medical attention.

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flash Point Not applicable
Method No information available.

Autoignition Temperature No information available.
Explosion Limits
Upper No data available
Lower No data available

Suitable Extinguishing Media Substance is nonflammable; use agent most appropriate to extinguish surrounding fire..

Unsuitable Extinguishing Media No information available.

Hazardous Combustion Products No information available.

Sensitivity to mechanical impact No information available.
Sensitivity to static discharge No information available.

Specific Hazards Arising from the Chemical
None known.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear

NFPA **Health** 1 **Flammability** 0 **Instability** 0 **Physical hazards** N/A

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Use personal protective equipment. Avoid contact with skin, eyes and clothing.

Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable and closed containers for disposal.

7. HANDLING AND STORAGE

Handling Handle in accordance with good industrial hygiene and safety practice. Wear personal protective equipment. Avoid contact with skin, eyes and clothing. Avoid ingestion and inhalation.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Sodium hydroxide	Ceiling: 2 mg/m^3	(Vacated) Ceiling: 2 mg/m^3 TWA: 2 mg/m^3	IDLH: 10 mg/m^3 Ceiling: 2 mg/m^3

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Sodium hydroxide	Ceiling: 2 mg/m^3	Peak: 2 mg/m^3	CEV: 2 mg/m^3

NIOSH IDLH: *Immediately Dangerous to Life or Health*

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Appearance	Yellow
Odor	odorless
Odor Threshold	No information available.
pH	7.00@ 25°C
Vapor Pressure	760 mmHg @ 20 °C
Vapor Density	No information available.
Viscosity	No information available.
Boiling Point/Range	100°C / 212°F

9. PHYSICAL AND CHEMICAL PROPERTIES

Melting Point/Range	0°C / 32°F
Decomposition temperature °C	No information available.
Flash Point	Not applicable
Evaporation Rate	No information available.
Specific Gravity	1.0
Solubility	Soluble in water
log Pow	No data available

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Conditions to Avoid	None known.
Incompatible Materials	None known
Hazardous Decomposition Products	None known
Hazardous Polymerization	Hazardous polymerization does not occur
Hazardous Reactions .	None under normal processing.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information No acute toxicity information is available for this product

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Water	90 mL/kg (Rat)	Not listed	Not listed
Dihydrogen potassium phosphate	1700 mg/kg (Mouse)	4640 mg/kg (Rabbit)	Not listed
Sodium hydroxide	Not listed	1350 mg/kg (Rabbit)	Not listed
FD&C yellow No. 5	12750 mg/kg (Mouse)	Not listed	Not listed

Irritation No information available.

Toxicologically Synergistic Products No information available.

Chronic Toxicity

Carcinogenicity There are no known carcinogenic chemicals in this product

Sensitization No information available.

Mutagenic Effects No information available.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

Other Adverse Effects The toxicological properties have not been fully investigated.. See actual entry in RTECS for complete information.

Endocrine Disruptor Information No information available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Do not empty into drains.

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available

Mobility No information available

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification

14. TRANSPORT INFORMATION

DOT Not regulated

TDG Not regulated

IATA Not regulated

IMDG/IMO Not regulated

15. REGULATORY INFORMATION

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	CHINA	KECL

15. REGULATORY INFORMATION											
Water	X	X	-	231-791-2	-		X	-	X	X	KE-35400 X
Dihydrogen potassium phosphate	X	X	-	231-913-4	-		X	X	X	X	KE-28622 X
Sodium hydroxide	X	X	-	215-185-5	-		X	X	X	X	KE-31487 X
FD&C yellow No. 5	X	X	-	217-699-5	-		X	X	X	X	KE-06857 X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313
Not applicable

SARA 311/312 Hazardous Categorization

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Sodium hydroxide	X	1000 lb	-	-

Clean Air Act
Not applicable

OSHA
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Sodium hydroxide	1000 lb	-

California Proposition 65
This product does not contain any Proposition 65 chemicals.

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Sodium hydroxide	X	X	X	-	X

U.S. Department of Transportation
Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
Non-controlled

16. OTHER INFORMATION

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Tel: (412) 490-8929

Creation Date 09-Dec-2009

Print Date 09-Dec-2009

Revision Summary "***", and red text indicates revision

Disclaimer

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End of MSDS

Material Safety Data Sheet

Creation Date 28-Jan-2010 **Revision Date** 28-Jan-2010 **Revision Number** 1

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name **Buffer Solution, pH 10.00, Color-Coded Blue**

Cat No. **SB115-4; SB115-20; SB115-500**

Synonyms (Certified)

Recommended Use Laboratory chemicals

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 703-527-3887

2. HAZARDS IDENTIFICATION

CAUTION!

Emergency Overview

May cause eye, skin, and respiratory tract irritation . The toxicological properties have not been fully investigated.

Appearance Blue **Physical State** Liquid **odor** odorless

Target Organs None known.

Potential Health Effects

Acute Effects
Principle Routes of Exposure

Eyes	May cause irritation
Skin	May cause irritation
Inhalation	May cause irritation of respiratory tract
Ingestion	Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea

Chronic Effects None known.

See Section 11 for additional Toxicological information.

Aggravated Medical Conditions No information available.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Haz/Non-haz

Component	CAS-No	Weight %
Water	7732-18-5	97.78
Ethylenediaminetetraacetic acid, disodium salt dihydrate	6381-92-6	1.0
Potassium carbonate	584-08-7	0.6
Boron potassium oxide (B4K2O7)	1332-77-0	0.4
Potassium hydroxide	1310-58-3	0.2

4. FIRST AID MEASURES

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Get medical attention immediately if symptoms occur.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Get medical attention immediately if symptoms occur.

Ingestion Do not induce vomiting. Obtain medical attention.

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flash Point No information available.
Method No information available.

Autoignition Temperature No information available.

Explosion Limits
Upper No data available
Lower No data available

Suitable Extinguishing Media Substance is nonflammable; use agent most appropriate to extinguish surrounding fire..

Unsuitable Extinguishing Media No information available.

Hazardous Combustion Products No information available.

Sensitivity to mechanical impact No information available.
Sensitivity to static discharge No information available.

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear

NFPA **Health** 1 **Flammability** 0 **Instability** 0 **Physical hazards** N/A

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Use personal protective equipment. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.

Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable and closed containers for disposal.

7. HANDLING AND STORAGE

Handling Wear personal protective equipment. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing. Do not breathe vapors or spray mist.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Potassium hydroxide	Ceiling: 2 mg/m^3	(Vacated) Ceiling: 2 mg/m^3	Ceiling: 2 mg/m^3

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Potassium hydroxide	Ceiling: 2 mg/m^3		CEV: 2 mg/m^3

NIOSH IDLH: *Immediately Dangerous to Life or Health*

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Appearance	Blue
odor	odorless
Odor Threshold	No information available.
pH	10.0

9. PHYSICAL AND CHEMICAL PROPERTIES

Vapor Pressure	No information available.
Vapor Density	No information available.
Viscosity	No information available.
Boiling Point/Range	100°C / 212°F
Melting Point/Range	0°C / 32°F
Decomposition temperature °C	No information available.
Flash Point	No information available.
Evaporation Rate	> 1 (Water = 1.0)
Specific Gravity	1.013 @ 25°C
Solubility	Soluble in water
log Pow	No data available

10. STABILITY AND REACTIVITY

Stability	Stable under normal conditions.
Conditions to Avoid	Excess heat.
Incompatible Materials	None known
Hazardous Decomposition Products	Thermal decomposition can lead to release of irritating gases and vapors
Hazardous Polymerization	Hazardous polymerization does not occur
Hazardous Reactions .	None under normal processing.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

Product Information No acute toxicity information is available for this product

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Water	90 mL/kg (Rat)	Not listed	Not listed
Potassium carbonate	1870 mg/kg (Rat)	1.87 mg/kg (Rat)	Not listed
Potassium hydroxide	214 mg/kg (Rat)	Not listed	Not listed

Irritation No information available.

Toxicologically Synergistic Products No information available.

Chronic Toxicity

Carcinogenicity There are no known carcinogenic chemicals in this product

Sensitization	No information available.
Mutagenic Effects	No information available.
Reproductive Effects	No information available.
Developmental Effects	No information available.
Teratogenicity	No information available.
Other Adverse Effects	The toxicological properties have not been fully investigated.. See actual entry in RTECS for complete information.
Endocrine Disruptor Information	No information available

12. ECOLOGICAL INFORMATION

Ecotoxicity

Do not empty into drains.

Persistence and Degradability	No information available
Bioaccumulation/ Accumulation	No information available
Mobility	.

Component	log Pow
Potassium hydroxide	0.65 0.83

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods	Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification

14. TRANSPORT INFORMATION

DOT	Not regulated
TDG	Not regulated
IATA	Not regulated
IMDG/IMO	Not regulated

14. TRANSPORT INFORMATION

15. REGULATORY INFORMATION

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	CHINA	KECL
Water	X	X	-	231-791-2	-		X	-	X	X	KE-35400 X
Ethylenediaminetetraacetic acid, disodium salt dihydrate	-	X	-	-	-		X	X	X	X	-
Potassium carbonate	X	X	-	209-529-3	-		X	X	X	X	KE-29083 X
Boron potassium oxide (B4K2O7)	X	X	-	215-575-5	-		X	-	X	X	KE-12187 X
Potassium hydroxide	X	X	-	215-181-3	-		X	X	X	X	KE-29139 X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313
Not applicable

SARA 311/312 Hazardous Categorization

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Potassium hydroxide	X	1000 lb	-	-

Clean Air Act
Not applicable

OSHA
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Potassium hydroxide	1000 lb	-

California Proposition 65
This product does not contain any Proposition 65 chemicals.

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Potassium hydroxide	X	X	X	-	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
Non-controlled

16. OTHER INFORMATION

Prepared By	Regulatory Affairs Thermo Fisher Scientific Tel: (412) 490-8929
Creation Date	28-Jan-2010
Print Date	28-Jan-2010
Revision Summary	"***", and red text indicates revision

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End of MSDS

Teck

Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX C1

DAILY OPERATING LOG

Pine Point Water Treatment Year:
NWT Licence Site 35-1
Daily Operating Log

Date: Operator: Sample Tech:

Time	Culvert (1E) pH	Weir (1B) pH	Weir Head inches	Weir Flowrate m^3/min	Lime Flow L/min	Samp. Taken ✓	Hach Zn mg/L	Turb NTU	Remarks
6: am									
6: am									
7: am									
7: am									
8: am									
8: am									
9: am									
9: am									
10: am									
10: am									
11: am									
11: am									
12: am									
12: am									
1: pm									
1: pm									
2: pm									
2: pm									
3: pm									
3: pm									
4: pm									
4: pm									
5: pm									
5: pm									
6: pm									
6: pm									
7: pm									
7: pm									
8: pm									
8: pm									

Water Temp (°C) at Weir: (35-1B)	am:		Weather:	pm:
	pm:		Air Temp.:	pm:
			Wind:	pm:
Lime Slurry Strength (%)				
Main Pond Height (m) (35-1A)	am: pm:		Height change since last day (m):	
Volume Discharged Today (m^3)				

Comments:

Teck

Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX C2

TREATED WATER DISCHARGE VOLUMES

Pine Point Water Treatment
NWT Licence Site 35-1
Treated Water Discharge Volumes

Year:

Operating Date	Daily Discharge Volume (cubic metres)	Total Cumulative Discharge Volume (cubic metres)	Pond Elevaton (meters)

Note: Pond Elevation is reported at the end of the day.

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Pine Point MineTailings Impoundment Area

Water Treatment Manual

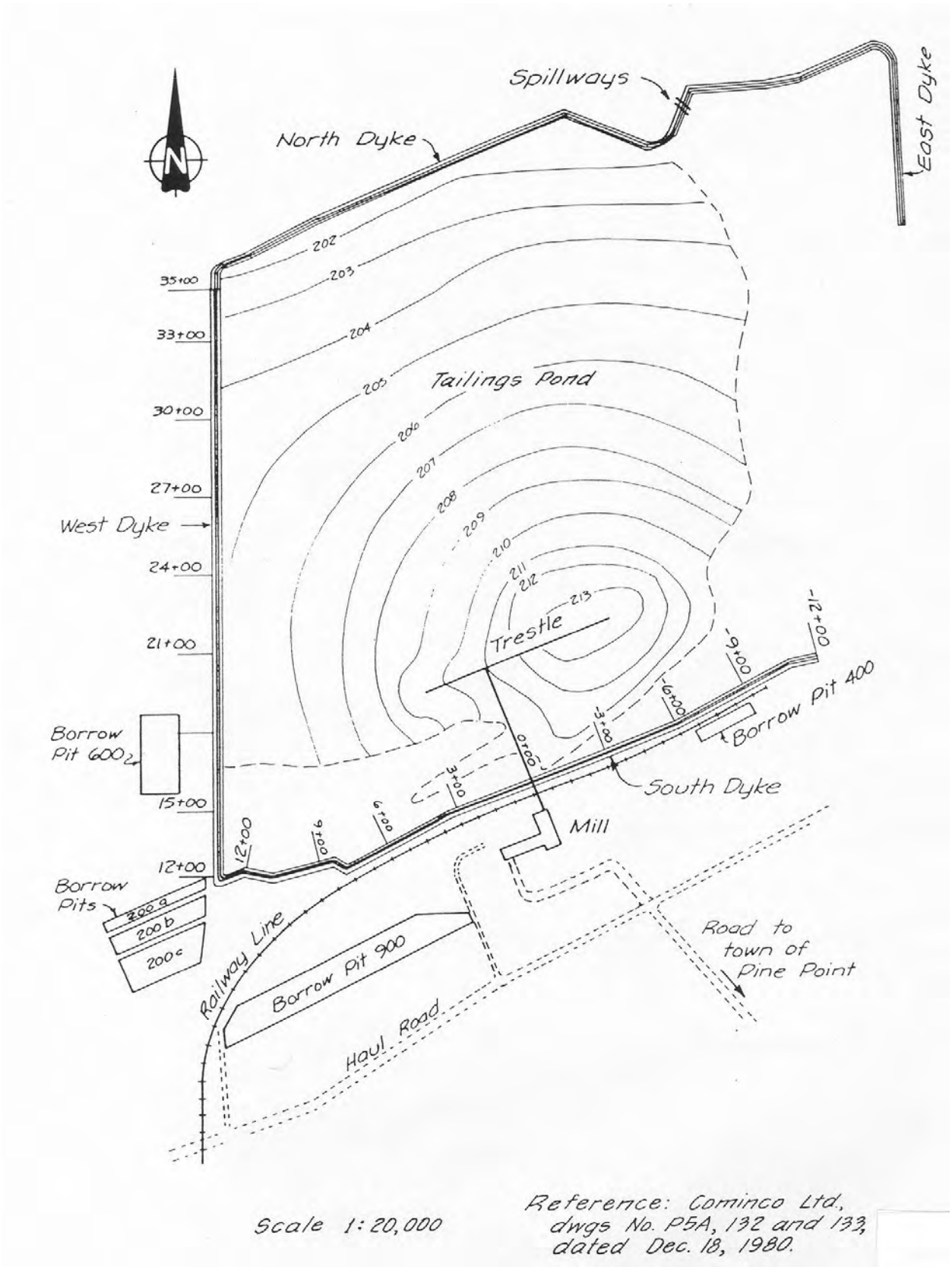
APPENDIX C3

DAM INSPECTION REPORT

Teck Metals Ltd
Tailings Impoundment Inspection Form
Pine Point Tailings Impoundment

Date:		Inspected By:
Weather:		
Tailings Pond Information:		
Pond Elevation:		Operating Limits:
Crest Elevation:		Freeboard: (Minimum 1m)
Dyke Inspection Check List (✓ = checked and no problems; Blank = not checked)		
Check: Upstream Slope of Dyke, Crest and Downstream Slope of Dyke		
South Dyke	**Checked**	**Comment**
Ponded Water		Where? GPS Coord.:
Erosion		
Settlement/Depressions		
Sinkholes		
Cracks/Movement		
Debris		
Vegetation		
Other		
West Dyke		
Ponded Water		
Erosion		
Settlement/Depressions		
Sinkholes		
Cracks/Movement		
Debris		
Vegetation		
Other		

North Dyke	**Checked**	**Comment**
Ponded Water		Where? GPS Coord.:
Erosion		
Settlement/Depressions		
Sinkholes		
Cracks/Movement		
Debris		
Vegetation		
Main Pond Spillway		
Treatment Spillway		
Other		
East Dyke		
Ponded Water		
Erosion		
Settlement/Depressions		
Sinkholes		
Cracks/Movement		
Debris		
Vegetation		
Other		


Spillways
East Dyke
North Dyke
N
202
203
204
205
Tailings Pond
206
207
208
209
210
211
212
213
Trestle
35+00
33+00
30+00
27+00
West Dyke
24+00
21+00
15+00
12+00
-12+00
-9+00
-6+00
-3+00
0+00
3+00
6+00
9+00
12+00
Borrow Pit 600
Borrow Pit 400
South Dyke
Mill
Borrow Pits
200a
200b
200c
Railway Line
Borrow Pit 900
Haul Road
Road to town of Pine Point
Scale 1:20,000
Reference: Cominco Ltd., dwgs No. P5A, 132 and 133, dated Dec. 18, 1980.

Tailings Impoundment Inspection
Explanation of Details

Ponded Water: Look for pools of water against the inside or outside slopes of the Dyke structure. The pooled water is a potential source of water to erode the dyke and therefore the presence of any water must be recorded and ideally the GPS location should be noted in the comments area. Another aspect of pooled water is that it may be a source of seepage water at the outside toe of the dyke therefore where pooled water is observed look for increased seepage at the toe. The presence of water at the dyke face can be an indication of increased water levels within the dyke which can decrease Dyke stability.

Erosion: The presence of small rills, up to 0.3m deep, on the faces of the dyke are normal and of no concern. If the rills start eroding into channels greater than 0.3 m and are cutting into the crest more than 0.5 m then the rills must be filled to prevent further progress.

Erosion can also be caused by wave action on the pooled water. Erosion has been occurring on the inside slope of the North Dyke and will soon require placement of material to armor the dyke face. Erosion into the till core must be prevented therefore any excessive erosion must be reported. Ideally record the GPS location so the area can be easily found.

Settlement/Depressions: Settlement or depressions in the crest or slopes indicate groundwater erosion of the interior of the dyke. Look for any visible seepage at the toe of the dyke. This is a very serious problem and it must be investigated by a professional. Ideally record the GPS location so the depression can be easily found.

Sinkholes: Sinkholes are localized deep depressions and are another indication of interior erosion of the dyke. This is a very serious problem and it must be investigated by a professional. Ideally record the GPS location so the depression can be easily found.

Cracks/Movement: Cracks accompanied by movement are an indication of a dyke failure and material would probably be seen flowing from the toe of the dyke. This is a very serious situation which must be reported immediately and be investigated by a professional. Ideally record the GPS location so the area can be easily found.

Debris: Accumulation of debris on the dyke can prevent inspection of the dyke and should be removed.

Vegetation: Small vegetation on the slopes of the dykes is good to minimize surface erosion. Larger vegetation hinders inspections of the dyke and can damage the dyke if root systems penetrate the till core or large root systems are ripped out by the wind. Therefore any trees on the dyke slopes over 1” diameter should be removed.

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Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX C4

DAILY CHAIN OF CUSTODY

Control Number

Environmental Sample Information Sheet

NOTE Proper completion of this form is required in order to proceed with analysis

See reverse for contacting your nearest Norwest location and proper sampling protoc

Billing Address		**Report To:**	**Copy of Report To:**		**Copy of invoice:**	
Company:	Teck Cominco Limited		Company:		**Mail invoice to this**	
Address:	Bag 2000 Kimberley, BC V1A 3E1	**QA/QC Report** x	Address:		**address for approval**	
Attention:	Bruce Donald	**Report Result:**	Attention:	Cathy Korn	Chantale van Dieren	**Report Result:**
Phone:	(250) 427-8405	Fax	Phone:	(250) 448-4988	(250) 427-8412	Fax
Fax:	(250) 427-8451	Mail x	Fax:			Mail
Cell:		Courier	Cell:			Courier
Email:	bruce.donald@teckcominco.com	Email x	Email:	chantale.vandieren@teckcominco.com		Email x

Information to be included on Report and Invoice

Project ID:

Project Name:

Project Location: **Pine Point 2007**

Legal Location: **NT**

PO#: **7365**

Proj. Acct. Code:

Agreement ID: **53796**

RUSH **Please contact the laboratory to confirm rush dates and times before submitting samples.**

Upon filling out this section, client accepts that surcharges will be attached to this analysis

Required on: all analyses **or** as indicated ☐ **or** ☐

Date required:___ **ASAP**

Signature:_____

Norwest Authorization:_____

Sample Custody (Please Print)

Sampled by: **Cathy Korn** Date

Company Signature

Relinquished by: **Cathy name the shipper**

Company Date

Waybill number: **Cathy put this in**

Received by:

Company Date

Processed by:

Norwest Labs Date

Special Instructions/Comments

Daily Sampling

	Sample Identification	Location	Depth	Date/Time Sampled	Matrix	Sampling Method	Number of Containers ↓	Zinc (Zn)	Copper (Cu)	Lead (Pb)	TSS	pH									
								Enter tests above (check off relevant samples below)													
1	351B01DDMMYR	35-1B	-				2	✓	✓	✓	✓	✓									
2																					
3																					
4																					
5			-																		
6			-																		
7			-																		
8			-																		
9			-																		
10			-																		
11			-																		
12			-																		
13			-																		
14			-																		

NOTE: All hazardous samples must be labeled according to WHMIS guidelines

Page ___ of ___

Accredited by the Standards Council of Canada for specific tests

##

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Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX C5

WEEKLY CHAIN OF CUSTODY

Control Number

NORWEST LABS
"Your Lab Next Door"

Environmental Sample Information Sheet

NOTE Proper completion of this form is required in order to proceed with analysis

See reverse for contacting your nearest Norwest location and proper sampling protoc

Billing Address		**Report To:**	**Copy of Report To:**		**Copy of invoice:**
Company:	Teck Cominco Limited		Company:		**Mail invoice to this**
Address:	Bag 2000 Kimberley, BC V1A 3E1	**QA/QC Report** [x]	Address:		**address for approval** [ ]
Attention:	Bruce Donald	**Report Result:**	Attention:	Cathy Korn	**Report Result:**
Phone:	(250) 427-8405	Fax [ ]	Phone:		Fax [ ]
Fax:	(250) 427-8451	Mail [x]	Fax:		Mail [ ]
Cell:		Courier [ ]	Cell:		Courier [ ]
Email:	bruce.donald@teckcominco.com	Email [x]	Email:	chantale.vandieren@teckcominco.com	Email [x]

Information to be included on Report and Invoice

Project ID:
Project Name:
Project Location: **Pine Point 2006**
Legal Location: **NT**
PO#: **7091**
Proj. Acct. Code:
Agreement ID:

RUSH **Please contact the laboratory to confirm rush dates and times before submitting samples.**

Upon filling out this section, client accepts that surcharges will be attached to this analysis

Required on: all analyses **or** as indicated [ ] **or** [x]

Date required:___ **ASAP**

Signature:_____

Norwest Authorization:_____

Sample Custody (Please Print)

Sampled by: **Cathy Korn** Date

Company Signature

Relinquished by: **Cathy name the shipper**

Company Date

Waybill number: **Cathy put this in**

Received by:

Company Date

Processed by:

Norwest Labs Date

Special Instructions/Comments

Only Total Metals and Routine Analysis needed on 100% RUSH
Everything else is normal turnaround

Weekly Sampling (one day per week)

	Sample Identification	Location	Depth	Date/Time Sampled	Matrix	Sampling Method	Number of Containers ↓	W-10	Total Metals (MS-ICP)	Dissolved Metals (MS-ICP)	Nutrients	TSS	Cyanide (Weak Acid)								
								Enter tests above (check off relevant samples below)													
1	351B01DDMMYR	35-1B	-				5	✓	✓	✓	✓	✓	✓								
2																					
3																					
4			-																		
5			-																		
6			-																		
7			-																		
8			-																		
9			-																		
10			-																		
11			-																		
12			-																		
13			-																		
14			-																		

NOTE: All hazardous samples must be labeled according to WHMIS guidelines

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Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX C6

SAMPLE SHIPMENT LOG

Pine Point Water Treatment **Year:**
NWT License Site 35-1
Sample Shipment Log

Shipping Number	Sample Number	Sampling Date	Shipping Date	Results Received Date	Comments

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Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX C7

COMMERCIAL LAB ASSAYS AND COMPARISON

Pine Point Water Treatment **Year:**
NWT License Site 35-1
Commercial Lab Assays

Shipment Number	Sampling Date	Sampling Site	Assays (Total mg/L) Zinc	Lead	Copper	TSS (mg/L)	pH	Comments

Pine Point Water Treatment Year:
Drainage Water Assays (Field & Lab)

Date	Sample Time	Sample Station	Shipping Sample Number	Field pH	Field TSS NTU	Field Zn (mg/l)	Lab pH	Lab TSS (mg/l)	Lab Zn (mg/l)

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Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX C8

INCIDENT INVESTIGATION REPORT

Teck Metals Ltd. – Legacy Properties Group

Incident/Accident Investigation Report

SUPERVISOR FILLING OUT FORM: _____

OHSC REPRESENTATIVE:

Mine Site:	Date of Occurrence:	Time: AM PM
Exact Location:	Date Reported:	Time: AM PM

Injury/Illness Incident	
Person Involved:	Present at Investigation ☐ Yes ☐ No
Type of Injury – Illness – Body Part – L or R	
Object / Equipment / Substance / Action Causing Injury/Illness	
Person with most control of Item above:	Name of Supervisor Notified:
Witnesses Name (s):	Interviewed? ☐ Yes ☐ No

Equipment/Property Damage
Property Damaged:
Nature of Damage:
Estimated Costs:
Object / Equipment / Substance Inflicting Damage
Person with most control of item above:

Environmental Incident	
Reported to Government: ☐ Yes ☐ No If Yes Date & Time: Reported to Supervisor - Name: Date & Time: Name of Person reporting the spill: Nearest water body or stream affected:	Substance Spilled: Quantity Spilled:
Action taken to contain, recover, clean up and dispose of contaminant:	

Description of Incident: Consider: Dimensions, Weight, Direction, Conditions, Circumstances. Location, Body Movement or Position, Safety Equipment, Simple Diagram or photograph if helpful

Conditions at time of Incident:

Cause (s): Why did this accident/incident happen?

Teck Metals Ltd. – Legacy Properties Group

Incident/Accident Investigation Report

TO BE FILLED OUT DURING/AFTER THE INVESTIGATION:

CONFIRMATION – CAUSE/CIRCUMSTANCE (Agreement with supervisor):

ACTIONS TO PREVENT RECURRENCE	PERSON RESPONSIBLE	TARGET DATE	DATE COMPLETED

POTENTIAL CONSEQUENCES	Catastrophic	Critical/Major	Serious/Marginal	Minor/Marginal	
PROBABILITY OF RECURRENCE	Frequent	Probable	Occasional	Remote	Improbable
RISK	High	Medium	Low		

Circle one in each of first 2 categories – RISK is then determined from chart below

REFERENCE:

SEVERITY	ILLNESS/INJURY	FINANCIAL IMPACT	ENVIRONMENTAL IMPACT	IMPACT TO IMAGE
Catastrophic	Fatality	>$5M	Major liquid release impacting water	Provincial/National
Critical/Major	Serious injury/illness	$1M - $5M	Major liquid release – not impacting water	Regional Attention
Serious/Marginal	Recordable injury	$50K - $1M	Liquid release on site – greater than 200 Liters	Local Attention
Minor/Marginal	Minor injury	<$50K	Small liquid release – less than 200 Liters	None

PROBABILITY OF RECURRENCE	DEFINITION	VALUE
Frequent	Likely to occur repeatedly	3 in 10
Probable	Likely to occur several times	3 in 100
Occasional	Likely to occur sometime	3 in 1,000
Remote	Not likely to occur, but possible	3 in 10,000
Improbable	Almost zero probability	3 in 100,000

RISK ASSESSMENT:

SEVERITY	PROBABILITY	Frequent	Probable	Occasional	Remote	Improbable
	Catastrophic	High	High	High	Medium	Low
	Critical/Major	High	High	Medium	Low	Low
	Serious/Marginal	High	Medium	Low	Low	Low
	Minor/Minimal	Medium	Low	Low	Low	Low

Teck Metals Ltd. – Legacy Properties Group

Incident/Accident Investigation Report

HIGH RISK	**Unacceptable for long term, immediate corrective action required to reduce risk**
MEDIUM RISK	**Undesirable condition, corrective action to be taken as soon as practical**
LOW RISK	**Acceptable condition, no further action required for existing conditions only – any procedural violations noted must be reviewed/addressed with crews**

Supervisor's Name: (print)	
Supervisor's Signature:	**Date:**
Manager's Signature:	**Date:**
OHSC REPRESENTATIVE Signature:	**Date:**

INCIDENT/ACCIDENT INVESTIGATION - PROCEDURE

SIGN OFF

Employee acknowledges that he/she has read and understood the above procedure:

Employee Name:	Signature:	Date:
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
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_____	_____	_____
_____	_____	_____

NOTES:

_____

_____

_____

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Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX D1

EQUIPMENT LIST

Pine Point Water Treatment Equipment List

Mar. 2007

Equipment	Model	Serial No.	Date Purchased	Other Details
Lime Silo, UFA Wheatland Bin	WB1417-55	20060518026	Feb. 2006	14' Diameter, 33' High, 3,381 ft^3, 6" Auger boot at 20°
Westfield Auger	UT-04-04		Feb. 2006	6" diameter, 16' long, 2 HP 110 V single phase motor
Solimar fluidizers	4500 Series		Feb. 2006	8 low pressure fluidizers <10 psi
John Deere Diesel Engine, Frontier Power Products	4045TF270 B	PE4045147767 5	Apr. 2006	4.5 Liter, 7.4 KW at 2500 rpm Oil Filter RE504836 Fuel Filter R 60 T
Twin Disc Clutch	4-11256	1V0405	Apr. 2006	Clutch 10-5, Housing Size 4
Berkley 4" Pump	B4JRMBH		Apr. 2006	Frame mounted pump, 900 USGPM @60 psi
Sutorbilt 5MVP Blower	GAEMPA	S195202	Apr. 2006	353 cfm @9psi
Jet Mixer Crown Energy Tech.			Nov. 2005	Mixing Bowl DMA1467 Hopper DMA 1468 Jet #30 DMA1085
Honda Generator	EX5DCC9		June 2005	The Power Factor, 5KW, Diesel
Water Pump 2" Subaru Robin	PKX201		June 2005	Renown Industries, 4.5 HP gasoline
Water Pump 2" Yamaha			?	gasoline
Mico Fuel Pump			June 2005	Renown Industries, with power head, 30' discharge hose, 24" standpipe
Hoses (Hose Headquarters)				
4" Suction Hose	G1341-400		June 2006	Two 17' Suction Hoses, 1 male and 1 female end.
4" Discharge Hose	G374-400		June 2006	Four 15' Discharge Hoses, 1 male and 1 female end
3" Discharge Hose	G374-300		June 2006	Seven 15' high pressure, discharge hoses, 1 male end and 1 female end
2" Fire Hose				
Various Stainless Steel Camlock Couplings	G65SSC G65SSE		June 2006	Female and Male hose shank couplers
Masterflex Pumps				
pH meters				3 meters
Scale				
Hach Meter	41100-20			Hach DR 100 Colorimeter, Zincon 0-1.5, 0-3.0 mg/L
La Motte Turbidimeter	2020e	PN-26858 SN-ME12396	Feb. 2007	Fisher Scientific

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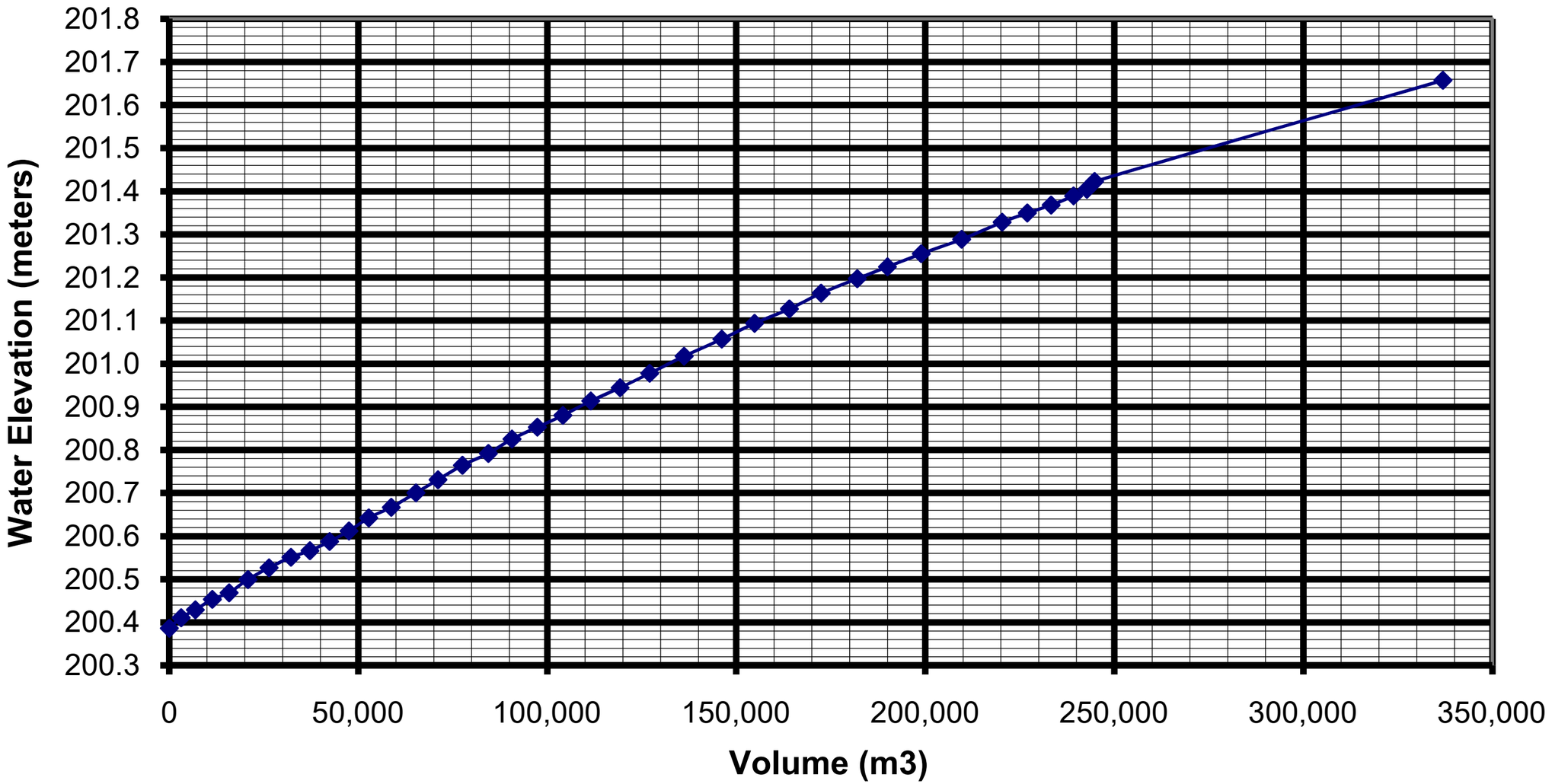
Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX E1

PINE POINT TAILINGS IMPOUNDMENT VOLUME/ELEVATION CURVE

Pine Point Tailings Impoundment: Volume/Elevation Curve
2006 extended



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Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX E2

LIME SLURRY %SOLIDS

Lime Slurry: Percent Solids

Lime Slurry weight percent solids $P = \frac{\text{Weight of Lime}}{\text{Weight of Slurry}} \times 100$

Weight of Slurry = Weight of Water + Weight of Lime

Volume of Slurry = Weight of Water + Weight of Lime/SG of lime
Specific Gravity of Lime = 2.5

Normally the slurry weight is measured using a 500 cc cylinder

500 = Ww + Wl/2.5 at 10% solids Ww = 9Wl 0.1 = Wl/(Ww + Wl)
500 = 9Wl + 0.4Wl Ww + Wl = 10Wl
Wl = 500/9.4 = 53.19 gm
Ww = 9 x 53.19 = 478.7 gm
Weight of Slurry = 478.7 + 53.2 = 531.9 gm

Weight %	Wl gm	Ww gm	Weight of Slurry gm
10	53	479	532
10.5	56	478	534
11	59	476	535
11.5	62	475	537
12	65	474	539
12.5	68	473	541
13	70	472	542
13.5	73	471	544
14	76	469	546
14.5	79	468	548
15	82	467	549
15.5	85	466	551
16	88	465	553
16.5	92	463	555
17	**95**	**462**	**557**
17.5	98	461	559
18	101	460	561
18.5	104	458	562
19	107	457	564
19.5	110	456	566
20	114	455	568

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Pine Point MineTailings Impoundment Area

Water Treatment Manual

APPENDIX E3

ESTIMATED LIME ADDITION RATES

Estimated Lime Addition Rates

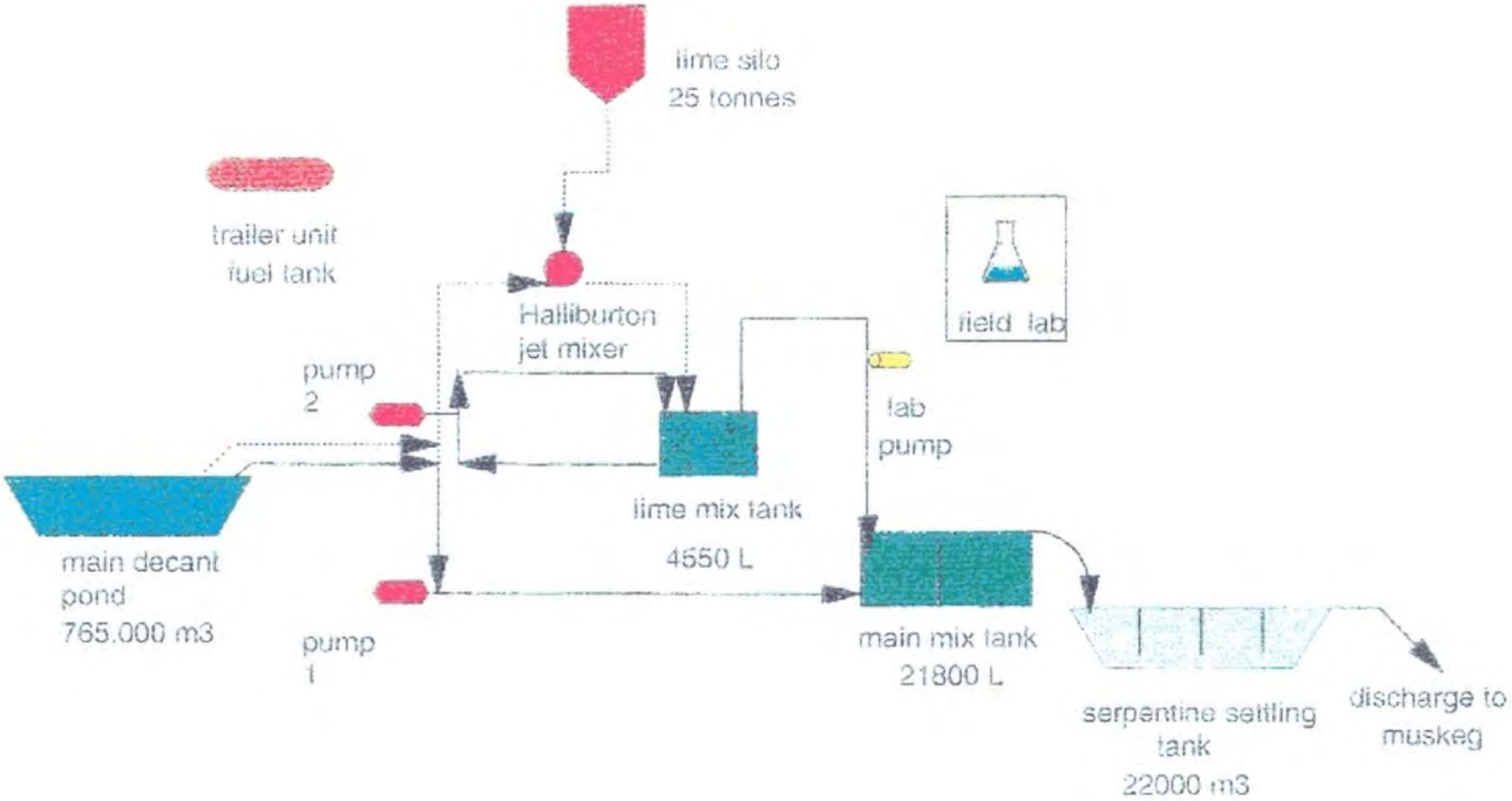
For a target pH of 10.9 - 11

Lime Slurry at 17% solids by weight (190 gm/l of lime)

Target Lime addition rate of 0.188 gm/l of Pond Water

Discharge Weir inches	Water Flow m3/min	Lime Flow L/min
2	3.08	3.05
2 1/4	3.68	3.64
2 1/2	4.30	4.26
2 3/4	4.97	4.92
3	5.66	5.60
3 1/4	6.38	6.31
3 1/2	7.13	7.05
3 3/4	7.91	7.83
4	8.71	8.62
4 1/4	9.54	9.44
4 1/2	10.40	10.29
4 3/4	11.27	11.15
5	12.17	12.04
5 1/4	13.10	12.96
5 1/2	14.05	13.90
5 3/4	15.01	14.85
6	16.00	15.83
6 1/4	17.01	16.83
6 1/2	18.05	17.86
6 3/4	19.10	18.90
7	20.17	19.96
7 1/4	21.26	21.04
7 1/2	22.37	22.13
7 3/4	23.49	23.24
8	24.64	24.38
8 1/4	25.80	25.53
8 1/2	26.99	26.71
8 3/4	28.19	27.89
9	29.40	29.09
9 1/4	30.64	30.32
9 1/2	31.89	31.55
9 3/4	33.15	32.80
10	34.44	34.08
10 1/4	35.73	35.35
10 1/2	37.05	36.66
10 3/4	38.38	37.98
11	39.73	39.31

Attachment 14 – Process Flow Chart



srk consulting

Job No: 1CT008.064

Filename: fig_07_process_flow_chart

Teck

PINE POINT, NT

MV2006L2-0013 Water License Renewal

Water Treatment Flow Chart

Date:	Approved:	Figure:
May 2017	AL	14

Attachment 15 – 1993 Letter from Minister of Indian and Northern Development

Minister of Indian Affairs
and Northern Development

CANADA

Ministre des Affaires
indiennes et du Nord canadien

COPY
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Controller
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1
orig.

MAY 2 8 1993
MAI

Mr. Dave Nickerson
Chairman
Northwest Territories Water Board
P.O. Box 1500
YELLOWKNIFE NT X1A 2R3

Dear Mr. Nickerson:

I am pleased to forward the enclosed water licence renewal N1L3-0035 (two originals) for Cominco Ltd. at Pine Point, N.W.T. I have approved the licence as recommended by the Board.

A screening of the water use application pursuant to the *Environmental Assessment and Review Process Guidelines Order* was completed and I am satisfied that any potentially adverse environmental and related social effects that may be caused by the project are insignificant or mitigable with known technology.

Again, thank you for your co-operation.

Yours sincerely,

Tom Siddon, P.C., M.P.

Encl.

Northwest Territories
Water Board
JUN 01 93
Yellowknife, N.W.T.

Attachment 16 – 2007 Letter from Regional Director General Northwest Territories, Indian and Northern Affairs Canada

Indian and Northern Affairs Canada / Affaires indiennes et du Nord Canada

FACSIMILE TRANSMITTAL
TRANSMISSION PAR TÉLÉCOPIEUR

Number of pages including this page / Nombre de pages incluant cette page: 5

Date: 2007-10-25

FROM - DE

Name - Nom	Position title - Titre du poste
Trish Merrithew-Mercredi	Regional Director General
Directorate - Direction	**Branch - Direction générale**
INAC	Executive

Room - Pièce	Facsimile no. - N° de télécopieur	Telephone no. - N° de téléphone
	(867) 669-2703	(867) 669-2507

TO - À

Name - Nom

Wanda Anderson
Executive Director
Mackenzie Valley Land & Water Board
Box 2130 Yellowknife NT X1A 2P6

Facsimile no. - No de télécopieur	Telephone no. - N° de téléphone
(867) 873-6610	(867) 669-0506

Attached is letter dated October 25, 2007. Original to follow in the mail.

cc:
Deninu Kué First Nation, Chief Norn and Council – 867-394-5122
Teck Cominco Ltd., Bruce Donald, Reclamation Manager – 250-427-8451
Akaitcho IMA Implementation Office, Stephen Ellis – 867-370-3209

Canada

Indian and Northern Affairs Canada / Affaires indiennes et du Nord Canada

Box 1500
Yellowknife NT X1A 2R3

Your file: MV2006L2-0013
Our file: CIDM# 170062

Your file Votre référence

Our file Notre référence

October 25, 2007

Ms. Wanda Anderson
Executive Director
Mackenzie Valley Land and Water Board
Box 2130
Yellowknife NT X1A 2P6

Dear Ms. Anderson:

I am writing in response to Mr. James Boraski's letter of September 19, 2007, in which he asked me for an update on Crown consultation in relation to the Teck Comino water licence renewal application (#MV2006L2-0013). Specifically, INAC has conducted a preliminary assessment to determine if the legal duty to consult with Aboriginal peoples arose in this case, and if so, has it been met.

Please find attached the letter the INAC staff sent to the Deninu Kué' First Nation. The Chair of the Mackenzie Valley Land and Water Board (MVLWB) was copied on this letter yesterday. As the letter states, based on our preliminary assessment, it is INAC's view that the Crown's duty to consult, if it does arise in this case, has been met and that the water licence should be renewed by the MVLWB to prevent a potentially negative impact on the environment and the DKFN's treaty rights. That said, we understand that the DKFN may have further questions and concerns about the water licence renewal in the Pine Point area. Therefore, we commit to working together with the DKFN and Teck Cominco to encourage a dialogue about the company's activities.

Please note that the decision by INAC to perform a preliminary assessment in this case does not preclude any future decision on defined roles and responsibilities regarding the Crown's duty to consult when assertions of potential adverse impacts on established or potential Aboriginal and treaty rights are raised by Aboriginal groups.

INAC appreciates your consideration of this matter.

Sincerely,

for

Trish Merrithew-Mercredi
Regional Director General
Northwest Territories

Cc:
Deninu Kué First Nation, Chief Norn and Council – 867-394-5122
Teck Cominco Ltd., Bruce Donald, Reclamation Manager – 250-427-8451
Akaitcho IMA Implementation Office, Stephen Ellis – 867-370-3209

Encl.

Indian and Northern Affairs Canada / Affaires indiennes et du Nord Canada
Box 1500
Yellowknife NT X1A 2R3

Your file Votre référence

October 24, 2007

Our file Notre référence

Rosy Bjornson
IMA Coordinator
Deninu Kué First Nation
P.O. Box 1899
Fort Resolution, NT X0E 0M0
Via email : imadeneguri@hotmail.com

Dear Ms. Bjornson:

Indian and Northern Affairs Canada (INAC) has conducted a preliminary assessment of the Deninu Kué First Nation's ("DKFN") assertion that the Crown has not consulted with respect to the application by Teck Cominco Ltd. to renew its water licence (#MV2006L2-0013). This assessment has focussed on determining what the potential adverse impact of renewing this water licence may have on the DKFN's established or potential Aboriginal and treaty rights.

In the case of the Teck Cominco water licence application, the company has requested a renewal of an existing licence in order to treat and then discharge effluent that has accumulated due to natural precipitation and run-off in an existing tailings pond at its Pine Point property. No new water use is being proposed. In assessing this situation, INAC looked at the potential for this continued activity to adversely impact the DKFN's established treaty rights such as hunting, trapping and fishing. INAC has coniuded that if this water licence is **not** renewed, there will be a much greater chance that a negative impact would occur. That is to say, if Teck Cominco can no longer treat the effluent being discharged from the existing tailings pond because its water licence is not renewed, that effluent could potentially have an adverse impact on water quality in the area, which in turn, could adversely impact the DKFN's treaty right to fish.

As you are aware, INAC-NWT Region's interim approach to Crown consultation builds upon the processes set out in the *Mackenzie Valley Resource Management Act*, while at the same time taking into account any negotiated arrangements such as the Akaitcho Territory Dene First Nations Interim Measures Agreement ("IMA"). The DKFN and the Akaitcho Pre-Screening Board were sent copies of the Teck Cominco's water licence renewal application by the

Mackenzie Valley Land and Water Board, and as per the IMA, in order to consult and solicit comments about the DKFN's concerns about the proposed renewal. The DKFN did not use this opportunity to provide comments as to how the proposed renewal could adversely impact its established or potential Aboriginal or treaty rights. Furthermore, Teck Comino has made a number of attempts to explain the application and to meet with the DKFN. The DKFN has not availed itself of these opportunities, except to say that the whole community would meet with Teck Cominco if the company paid the DKFN meeting costs and fees that the company deemed to be excessive.

On the balance of interest, INAC feels that the Crown's duty to consult, if it does arise in this case, has been met and that the water licence should be renewed to prevent a potentially negative impact on the environment and the DKFN's treaty rights. That said, we understand that the DKFN may have questions and concerns about the water licence renewal in the Pine Point area. Therefore, we commit to working together with the DKFN and Teck Cominco to encourage a dialogue about the company's activities.

As you know from our previous correspondence with the DKFN and with the Akaitcho Dene First Nations, INAC is committed to ensuring that the Crown's duty to consult, and where appropriate accommodate, is met. To that end, we want to continue our discussions with the DKFN and all the Akaitcho Dene First Nations about how we can move forward with INAC-NWT Region's interim approach to consultation, with specific focus on linking this approach to the provisions and accommodations made in the IMA. We would like to continue to meet with you on this important matter and are currently awaiting a response from Paul Boucher, Akaitcho Community Negotiator, to determine when our next meeting on this topic will occur.

I will look forward to our continued work together.

Yours truly,

Julie Jackson
Senior Policy Advisor
Northwest Territories Region

Cc:
Chief Bill Norn and Councillors, Deninu Kué First Nation – 867-394-5122
Stephen Ellis, Akaitcho IMA Implementation Office – 867-370-3209
Willard Hagen, Interim Chair, MVLWB – 867-873-6610
Paul Boucher, Akaitcho Community Negotiator – via email
John Klassen, Chief Federal Negotiator – via email
Bruce Donald, Reclamation manager, Teck Cominco, via email