

**Golder Associates Ltd.**

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October 11, 2007

06-1413-024.6000

Canadian Zinc Corporation  
Suite 1710, 650 West Georgia Street  
Vancouver, B.C. V6B 4N9

Attention: Mr. David Harpley, Environmental Coordinator

**RE: FLOOD EROSION PROTECTION – PRAIRIE CREEK MINE, NT**

Dear David:

Canadian Zinc Corporation (CZC) requested that Golder Associates (Golder) carry out an inspection of the flood protection dikes and related facility at the Prairie Creek Mine.

The Prairie Creek Mine is located in the Nahanni-Butte area of southwestern Northwest Territories. The mine site is located at approximately a latitude of 61°33' North and a longitude of 124°48' West.

The mine site construction was completed in the early 1980s. The mine site layout is shown on Figure 1.

**Description of Flood Protection Facility**

The flood protection dikes and facility at the Prairie Creek mine consists of the Water Holding Pond (originally constructed as a tailings impoundment facility) and the flood protection dike or berm.

The tailings impoundment facility was constructed in 1981. The impoundment has not received tailings since the facility was completed. Currently, water has impounded within the reservoir. The facility is now called the Water Holding Pond. The impoundment consists of:



- 
- A 'three-sided' dam constructed in the Prairie Creek floodplain, built against the north wall of the creek valley ('backslope'). Material for embankment construction was excavated from the back slope of the pond or from within the impounded area.
  - A geomembrane (Hypalon) liner was placed on the upstream (inside) face of the eastern half of the southern embankment, and also on the backslope area. The Hypalon liner along the backslope ruptured during 1983 and has since been completely removed, except any liner that was underwater at the time of removal.
  - The downstream (outside) toe of the embankment, adjacent to Prairie Creek, is lined with rip rap as flood or erosion protection.
  - An in situ, apparently continuous clay stratum that underlies the impoundment area, acts as a low-permeability containment at the bottom of the impoundment.

The flood protection berm is approximately 6 m wide, 5 m high and 700 m long. The berm is tied into the holding pond embankment and was constructed to prevent the mine site from flooding in the event that a flood occurs on Prairie Creek.

### Observations

Mr. Dave Caughill, P.Eng., of Golder carried out an inspection of the flood erosion protection portions of the embankments around the Water Holding Pond and flood protection berm in August 2007. The erosion protection was inspected for signs of possible movement of the rip rap particles, or for erosion of the downstream face of the embankment.

The embankment and berm were also inspected for signs of instability.

The following key observations were made regarding the flood erosion protection of the embankment and berm:

- The riprap is partially eroded in an area near the centre of the Water Holding Pond embankment, along an outside bend in Prairie Creek, as was observed in 2006. The area eroded is approximately 40 m long. The amount of erosion did not appear significantly different from that reported in 2006.
- There is an area approximately 30 m long near along the erosion protection berm, downstream from where it is connected to the Water Holding Pond, where there is little to no rip rap. This area is on a slight inside bend in the creek and thus, there appears to be little erosion from the creek, at least at lower to moderate flows.
- No other significant surface erosion was observed on the slopes of the embankments.

- No cracking or evidence of instability related to the embankment or berm was observed. Some sloughing of surficial material along the centre of the flood protection berm was noted, along the creek side of the berm, above the rip rap.
- The rip rap along the downstream toe of the embankments, along Prairie Creek, appears to be generally intact, and does not appear to have been overtopped or eroded. Previous documentation indicates that a streamflow event with a return period of approximately 20 years would be necessary before any damage to the rip rap would be observed (see Reference 1).

### Conclusions

The erosion protection embankment and berm were observed to be intact and functioning as intended. No signs of significant instability were noted. There are two areas where the rip rap is either missing or is beginning to erode and are recommended for repair, as noted below.

### Recommendations

It is recommended that additional rip rap be placed in the two areas where it appears eroded or is lacking. This should be completed before the water level is raised in the pond.

It is recommended that the flood erosion protection on the downstream side of the Water Holding Pond embankments be inspected weekly during the high-flow periods (spring, summer, and fall) by mine personnel. Any deterioration or erosion should be repaired as quickly as possible. If there is a significant storm event, the erosion protection should be inspected immediately following the event.

Additionally, we recommend that the flood erosion protection be inspected annually by a qualified geotechnical engineer. Preferably, the inspection should take place immediately following the spring thaw period, or after the (typically) highest annual flows have subsided.

It is also recommended that prior to raising the pond level that the rip rap be raised to an elevation sufficient to protect the embankment against a streamflow event with a return period of 100 years. It is also noted that if the pond was to contain tailings at closure, then the rip rap will need to be raised to protect against a streamflow event with a return period of 200 years.

Canadian Zinc Corporation  
Mr. David Harpley


-4-

October 11, 2007  
06-1413-024.6000


We trust that this letter presents the information required. Please call the undersigned if you have any questions or concerns.

Yours very truly,

**GOLDER ASSOCIATES LTD.**



Dave Caughill, P.Eng.  
Associate, Geotechnical Engineer



John Hull, P.Eng.  
Principal, Mining Group

DLC/JAH/map/jg

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PERMIT TO PRACTICE GOLDER ASSOCIATES LTD.	
Signature	<i>Dave Caughill</i>
Date	<i>Oct 11, 2007</i>
PERMIT NUMBER: P 428 The Association of Professional Engineers, Geologists and Geophysicists of the NWT / NU	

## **REFERENCES**

1. Letter dated August 16, 2001, to Canadian Zinc Corporation, Mr. J. Peter Campbell, Vice President, Project Affairs, from BGC Engineering Inc.,  
Re: Prairie Creek Mine Tailings Impoundment Facility, NT GNWT-RWED and DIAND Information Requests.





June 7, 2006

Sarah Baines  
Regulatory Officer  
Mackenzie Valley Land and Water Board  
7<sup>th</sup> Floor-4910 50<sup>th</sup> Avenue,  
Yellowknife, NT  
X1A 2P6

Dear Ms. Baines:

**RE: Repairs to Bulk Fuel Storage Facilities, MV2001L2-0003**

I refer to your letter dated January 11, 2006 which lists repairs for specific tanks which must be made before the respective tank may be used. As requested, Canadian Zinc (CZN) with this letter is providing details of repairs that have been completed and are scheduled.

Steel plugs have been inserted in all valves, including the water drain valves, for all four tanks. The water drain valve in Tank 2 was removed and resealed. The two minor pinhole weeps in Tank 1 are scheduled to be welded shut today.

Bids have been received for painting the tanks. CZN intends to award a contract to paint Tank 1 in the next few days. The painting is expected to occur in late July-early August when weather conditions should be most favourable. CZN will consolidate the existing diesel fuel inventory into Tank 1 and use that tank only for the time being.

We will notify you when the scheduled repairs have been completed, and keep you apprised of our activities in connection with the Bulk Fuel Storage Facilities in general.

If you have any questions, please contact us at 604-688-2001

Yours truly,  
CANADIAN ZINC CORPORATION

A handwritten signature in black ink, appearing to read 'D. Harpley', is written over a horizontal line.

David P. Harpley, P. Geo.  
Environmental Coordinator

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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

January 11, 2006

File: MV2001L2-0003

*SB*

Mr. Alan Taylor  
COO and VP Exploration  
Canadian Zinc Corporation  
Suite 1710, 650 West Georgia Street  
VANCOUVER, BC V6B 4N9

Fax: (604) 688-2043

Dear Mr. Taylor:

**Board Approval: Bulk Fuel Storage Facilities Condition Inspection Report**

The Mackenzie Valley Land and Water Board (the Board) met on January 11, 2006 to deliberate on the aforementioned report required under part D, item 9 of Water Licence MV2001L2-0003. The Board hereby considers the requirements of part D, item 9 fulfilled and approves the Bulk Fuel Storage Facilities Condition Inspection Report with the following conditions:

1. Prior to the use of any diesel tank in conjunction with the licensed undertakings, Canadian Zinc Corporation (CZN) shall carry out the recommendations for the specific tank(s) made in the report and summarized in the table below. CZN shall notify the Board in writing of any work completed on the tank(s).

DIESEL TANK 1	DIESEL TANK 2	DIESEL TANK 3	DIESEL TANK 4
<ul style="list-style-type: none"><li>• Tank requires painting</li><li>• Shall weld two minor pinhole weeps in bottom</li><li>• Install steel plugs in all valves, including the water drain valves</li></ul>	<ul style="list-style-type: none"><li>• Tank requires painting</li><li>• Water drain valve needs to be removed and resealed</li><li>• Install steel plugs in all valves, including the water drain valves</li></ul>	<ul style="list-style-type: none"><li>• Tank requires painting</li><li>• Install steel plugs in all valves, including the water drain valves</li></ul>	<ul style="list-style-type: none"><li>• The tank base requires reconstruction 6" high and containment area graded toward sump to ensure proper drainage</li><li>• Tank requires painting</li><li>• Install steel plugs in all valves, including the water drain valves</li></ul>

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2. The use of the gasoline storage tanks is prohibited unless upgraded according to the recommendations in the Fuel Storage Inspection Report. CZN shall notify the Board in writing of any upgrades to the gasoline storage tanks.

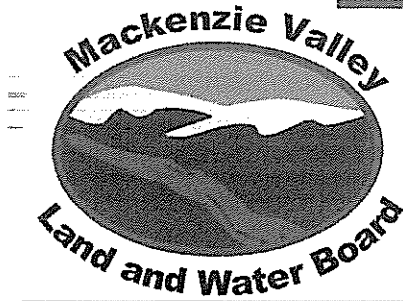
If you have any questions, please contact Sarah Baines at (867) 766-7457 or by email at [sbaines@mvlwb.com](mailto:sbaines@mvlwb.com).

Yours sincerely,



Todd Burlingame  
Chair

Copied to: Dave Harpley, Canadian Zinc Corporation (Fax: (604) 594-3855)  
Distribution List



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## STAFF REPORT

<b>Company:</b> Canadian Zinc Corporation (CZN)	
<b>Location:</b> Prairie Creek Mine	<b>Application:</b> MV2001L2-0003
<b>Date Prepared:</b> December 29, 2005	<b>Meeting Date:</b> January 11, 2006
<b>Subject:</b> Report approval – Condition Inspection Report for the Bulk Fuel Storage Facilities	

### 1. Purpose/Report Summary

The purpose of this report is to present to the Board for approval the Condition Inspection Report for the Bulk Fuel Storage Facilities at the Prairie Creek Mine (Fuel Storage Inspection Report) as submitted by the Canadian Zinc Corporation (CZN).

### 2. Background

The Bulk Fuel Storage Facilities, otherwise known as the Tank Farm Facility, consist of 4 – 1700 m<sup>3</sup> diesel tanks and 2 – 55 m<sup>3</sup> gasoline tanks surrounded by earth berms. Associated with the tanks is a Fuel Resupply and Dispensing Yard which consists of the following components:

- Diesel fuel/gasoline pump house
- Diesel fuel/gasoline loading rack and gasoline dispenser
- Truck unloading manifolds with spill preventers
- Truck fuelling apron

Under part D, item 9 of Water Licence MV2001L2-0003, CZN is required to have the integrity and capacity of the Bulk Fuel Storage Facilities certified by an engineer. Part D, item 9 reads as follows:

*The Licensee shall submit to the Board for approval a geotechnical assessment carried out by a qualified Geotechnical Engineer certifying the integrity and capacity of the Tank Farm Facility and associated containment structures before it may be*

*used in conjunction with the licensed undertakings. This assessment shall certify that the capacity of the containment structures associated with the Tank Farm Facility is 10% greater than the volume of the largest container placed therein.*

On April 29, 2005 the Board approved the Geotechnical Site Reconnaissance Report which contained an evaluation of the condition of the earthworks portion of the Bulk Fuel Storage Facilities and the capacity of the bermed area. In order to fulfill the remaining requirements of part D, item 9, CZN contracted Roosdahl Engineering Enterprises (Roosdahl) to inspect the Bulk Fuel Storage Facilities, including the tanks.

The results of the Roosdahl inspection are summarized in the Fuel Storage Inspection Report, which was received by this office on December 16, 2005. The Fuel Storage Inspection Report is the focus of this staff report.

### **3. Discussion**

Larrie Roosdahl, the person who carried out the inspection of the Bulk Fuel Storage Facilities, is a professional engineer and a certified American Petroleum Institute (API) 653 tank inspector (Inspector #21606). Roosdahl offices are located in Yellowknife and Calgary.

Mr. Roosdahl carried out the inspection to confirm that the Bulk Fuel Storage Facilities comply with all requirements of the applicable codes and standards: Canadian Council of Ministers of the Environment (CCME) Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products; the National Fire Code; the Canadian Electrical Code; American Petroleum Institute; Underwriters' Laboratories of Canada; and Canadian Standards Association.

The conclusions reached by Roosdahl are (see page 11 in the report):

- *The diesel fuel bulk fuel storage and dispensing facilities have been designed and constructed to meet all the requirements of the National Fire Code; the Canadian Electrical Code; and American Petroleum Institute, Underwriters' Laboratories of Canada (ULC) and Canadian Standards Association (CSA) Codes and Standards and, based on this in-service inspection, the facilities are considered to be safe and environmentally secure for continued operation.*
- *The Canadian Council of Ministers of the Environment (CCME), Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products, is based on the design and construction of facilities to the above codes and standards,*

thus the facilities also meet the intent of the CCME Environmental Code of Practice.

- Based on this in-service inspection, the structural integrity of the diesel fuel bulk storage and dispensing facilities is considered to be good and suitable for commissioning and future use.
- The gasoline dispensing facility is also considered to be suitable for commissioning and future use. However, the gasoline storage tanks will need to be replaced and the gasoline storage compound will need to be upgraded, before it is suitable for use.

Roosdahl also recommends that prior to full scale mining; the diesel tanks should undergo an API 653 Out-of-Service internal inspection.

#### 4. Comments

The Fuel Storage Inspection Report contained recommendations for upgrades/maintenance to each of the four diesel tanks, that when completed would certify the tanks for continued diesel fuel service. Regular maintenance and inspection of the tanks is required. The following is a summary table of the upgrades/maintenance recommendations:

DIESEL TANK 1	DIESEL TANK 2	DIESEL TANK 3	DIESEL TANK 4
<ul style="list-style-type: none"> <li>• Tank requires painting</li> <li>• Shell weld two minor pinhole weeps in bottom</li> <li>• Install steel plugs in all valves, including the water drain valves</li> </ul>	<ul style="list-style-type: none"> <li>• Tank requires painting</li> <li>• Water drain valve needs to be removed and resealed</li> <li>• Install steel plugs in all valves, including the water drain valves</li> </ul>	<ul style="list-style-type: none"> <li>• Tank requires painting</li> <li>• Install steel plugs in all valves, including the water drain valves</li> </ul>	<ul style="list-style-type: none"> <li>• The tank base requires reconstruction 6" high and containment area graded toward sump to ensure proper drainage</li> <li>• Tank requires painting</li> <li>• Install steel plugs in all valves, including the water drain valves</li> </ul>

#### 5. Review comments

The Fuel Storage Inspection Report was not distributed for review as the report is signed by a professional engineer who is a certified tank inspector.

**6. Security**

Not applicable.

**7. Conclusion**

The Fuel Storage Inspection Report satisfies the requirements of part D, item 9 of Water Licence MV2001L2-0003.

**8. Recommendation**

Generally, I recommend that the Board approve the Fuel Storage Inspection Report and consider the requirements of part D, item 9 of Water Licence MV2001L2-0003 fulfilled.

Specifically, I recommend the following:

- a) The Board require that CZN complete the upgrade and maintenance recommendations outlined in the summary table provided under the Comments section of this staff report prior to using the diesel tanks for activities licensed under Water Licence MV2001L2-0003.
- b) The Board prohibit the use of the gasoline storage tanks unless upgraded according to the recommendations in the Fuel Storage inspection Report, or equivalent.
- c) The Board reiterate in its decision letter to CZN Roosdahl's recommendation that the diesel tanks undergo an API 653 Out-of-Service internal inspection prior to the start-up of full production mining.

**9. Attachments**

- CZN's cover letter for the Fuel Storage Inspection Report
- Roosdahl's Fuel Storage Inspection Report

**Respectfully submitted,**



**Sarah Baines  
Regulatory Officer**



**CANADIAN ZINC**  
CORPORATION

December 16, 2005

Attention: Ms. Sarah Baines, Regulatory Officer  
Mackenzie Valley Land and Water Board  
PO Box 2130  
7<sup>th</sup> Floor – 4910 50<sup>th</sup> Ave.  
Yellowknife, NT  
X1A 2P6

Mackenzie Valley Land  
& Water Board

File

DEC 20 2005

Application # MV200112-0003

Copied To PLMISBIReg

Dear Ms. Baines:

**Re: Response to Condition Part D Section 9, Water License MV200112-0003**

Condition Part D, Section 9 of Water License MV200112-0003 is stated as follows:

*"9. The Licensee shall submit to the Board for approval a geotechnical assessment carried out by a qualified Geotechnical Engineer certifying the integrity and capacity of the Tank Farm Facility and associated containment structures before it may be used in conjunction with the licensed undertakings. This assessment shall certify that the capacity of the containment structures associated with the Tank Farm Facility is 10% greater than the volume of the largest container placed therein."*

There are two separate aspects to this condition the latter one being a requirement to assess the capacity of the containment structures, this report was submitted August 6, 2004 and approved by your Board April 29, 2005. To fulfill the remainder of Condition 9, relating to the integrity of the Tank Farm, Canadian Zinc Corporation contracted Roosdahl Engineering Enterprises, a very well know and respected northern engineering company, to conduct the assessment of the tank farm at Prairie Creek in 2005. The Roosdahl inspection concluded *"the diesel fuel bulk fuel storage facilities and dispensing facilities have been designed and constructed to meet all the requirements of the National Fire Code; the Canadian Electrical Code; and American Petroleum Institute (API), Underwriters' Laboratories of Canada (ULC) and Canadian Standards Association (CSA) Codes and Standards, and were found to be in good condition, safe and environmentally secure for continued operation."* A copy of Roosdahls' cover letter and report are attached with this email letter and the same is being forwarded to you in hard copy by courier post.

Should you have any questions or require any additional information please feel free to contact Mr. Larrie Roosdahl (867) 873-6731 or myself at your convenience.

Yours very truly,  
**CANADIAN ZINC CORPORATION**

Alan B. Taylor  
COO & V P Exploration

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**Mr. Alan B. Taylor**

**Chief Operating Officer**

Canadian Zinc Corporation  
Suite #1710 – 650 West Georgia Street  
PO Box 11644, Vancouver, BC, V6B 4N9  
Fax (604) 688-2043

**Dear Mr. Taylor:**

**Condition Inspection Report Summary  
Bulk Fuel Storage Facilities  
Canadian Zinc Corporation Mine  
Prairie Creek, NT**

The attached report is based on a condition inspection and API 653 In-Service Inspections of the Canadian Zinc Corporation, Bulk Fuel Storage Facilities at Prairie Creek, NT, conducted on July 21 – 22, 2005.

The Canadian Zinc Corporation Mine is a base metal mine developed and constructed in the early 1980's. The mine was never operated. Due to a sharp drop in the price of silver the mine construction was shut down and the equipment was mothballed until the metal prices recovered. The time has come to now advance the project to production at the earliest opportunity to take advantage of the growing metal markets. As part of this project initiation, an inspection of the bulk fuel storage facilities is required to fulfill a condition in *Section 7* of the *Class B Water License MV2001L2-0003*, issued by the Mackenzie Valley Land and Water Board (MVLWB), to confirm the structural integrity of the facilities and that they comply with the current Codes and Standards.

A detailed condition inspection of the bulk fuel storage facility and individual In-Service API 653 tank inspections of the fuel storage tanks were carried out, to ensure that they meet all the requirements of the applicable Codes and Standards to ensure that the facility is safe and environmentally secure for continued operation.

A set of Prairie Creek Mine Reference Documents were received from Canadian Zinc Corporation (CZC), including copies of the following mine fuel storage system drawings:

- |   |  |
|---|--|
| • Canadian Zinc Corporation, Drawing, dated April, 2005                                 | Fuel Storage Area, As Built Diagram                            |
| • KILBORN, Drawing No. 150-17-001 Rev.04, dated Nov. 19, 1981                           | Prairie Creek, Fuel Oil Storage Tank Farm, General Arrangement |
| • KILBORN, Drawing No. 100-17-016 Rev.02 dated March 16, 1982                           | Prairie Creek, Fuel Storage and Gasolene Storage, P&ID Diagram |
| • Cadillac Explorations – Golder Associates, Drawing 802-1073, Fig.10, dated Sept, 1980 | Fuel Tank Farm Spill Control Works                             |

**Yellowknife Office**

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The Bulk Fuel Storage and Distribution Facilities at the Prairie Creek mine site include the following:

1. A Diesel Fuel Storage Compound, containing four diesel fuel storage tanks with a combined storage capacity of 6 800 m<sup>3</sup>.
2. A Gasoline Storage Compound containing two gasoline storage tanks with a combined storage capacity of 110 m<sup>3</sup>.
3. A Fuel Resupply and Dispensing Yard area with the following facilities:
  - Diesel Fuel/Gasoline Pump House
  - Diesel Fuel/Gasoline Loading Rack and Gasoline Dispenser
  - Truck Unloading Manifolds with spill preventers
  - Truck Fuelling Apron

The storage compound is constructed with a 1' thick impervious clay seal, protected by a 3' thick sand and gravel cover. Inspection of the containment area shows by a relatively high tide mark on the tanks and on the dike, that the clay seal is effective. The survey elevations and diked Fuel Oil Containment volume calculations, shown on CZC Dwg., dated April, 2005, that the required containment capacity of the largest tank plus 10% of the capacity of the other tanks (2 212 m<sup>3</sup>) can be adequately contained by the dike, as constructed.

The diesel fuel storage tanks have all been fabricated, erected and are labeled to API Standard 650. An API 653 In-Service inspection was conducted on each of the tanks, and the tanks are considered to have good structural integrity and are in very good condition. The tanks are not painted and are rusted, but approximately 50% of the mill scale is still intact. There is no significant metal loss.

The gasoline tanks are 55 m<sup>3</sup> vertical riveted steel tanks. They have suffered significant damage and do not have API or ULC name plates. These tanks have not been used and are not considered to be suitable for service as gasoline storage tanks. They will be replaced with new double wall skid mounted, ULC labeled horizontal tanks located on the existing regraded gasoline storage compound.

All fuels will be brought in by tanker trucks over the winter road during the months of January through March. Supplies will be marshaled at Fort Nelson and transported approximately 300 km north on the Liard Highway, to the Liard River crossing, which is 30 km northeast of Nahanni Butte. From there, the winter road originally built by Cadillac Exploration, will be re-opened to traverse 160 km west to the mine site.

Properly equipped and serviced tanker trucks belonging to the fuel suppliers will be used to transport the fuel. Spill contingency plans for transporting the fuel will be in place, by the fuel suppliers, and will be approved by the Department of Environment and Natural Resources of the Government of the Northwest Territories.

The diked fuel storage compounds and fuel transfer pump house are set up to handle, P-40 diesel fuel and gasoline. As discussed above, diesel fuel is stored in the diesel fuel storage compound, in four 14.94 m (49') diameter x 9.75 m (32') high vertical steel

welded tanks, each with a capacity of 1 700 m<sup>3</sup>, designed and erected to API 650 Standards. Diesel fuel is to be dispensed through the pump house, a meter and an overhead loading rack.

Gasoline is to be stored in two new 54 000 litre (12 000 gallon) double wall, skid mounted ULC labeled horizontal tanks located in the existing regraded gasoline storage compound. Gasoline will be dispensed through a Gas Boy Dispenser Cabinet and ¾" fueling hose.

The tanker truck resupply and fuel dispensing area in front of the Pump House and Loading Platform, is provided with a concrete vehicle loading apron, approximately 4 m wide x 36.7 m long. The apron includes a pad around the Loading Platform and drain channels to a sump located on each end of the Pump House to contain any spillage that may occur on the fuelling apron. Spill preventers are provided at each resupply manifold to further minimize and fuel spillage during fuelling operations. The apron and spill containment systems are in excellent condition.

The Pump House is an insulated metal clad steel frame building approximately 4 500 mm (15') x 6 700 mm (22') x 2 400 mm (8') high with a peaked roof and a concrete floor. The building is provided with explosion proof wiring, lights and fire alarm system. Fire extinguishers (20 lb. dry chemical) are provided in the Pump House and at the resupply manifold locations.

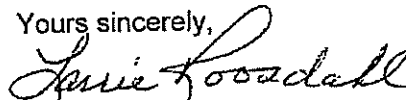
The pumps are mounted on concrete pads and include two 3" x 2" pumps for double diesel fuel tanker truck unloading. The pumps are also piped for mine vehicle fuelling.

There is also a 3" x 2" gasoline tanker truck unloading pump. Gasoline dispensing is by gravity through a Gas Boy dispenser pump.

The piping within the diesel fuel storage compound is insulated 6" schedule 40 pipe with 6' x 150# flanges and 6" x 150# steel gate valves. Each tank is separated by a 3 way Nordstrom plug valve, to allow control of diesel fuel from resupply and vehicle loading operations and to mine operations.

Based on this in-service inspection, it is evident that the diesel fuel bulk fuel storage facilities and dispensing facilities have been designed and constructed to meet all the requirements of the *National Fire Code*; the *Canadian Electrical Code*; and *American Petroleum Institute (API)*, *Underwriters' Laboratories of Canada (ULC)* and *Canadian Standards Association (CSA)* Codes and Standards, and were found to be in good condition, safe and environmentally secure for continued operation.

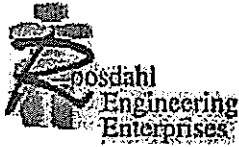
Yours sincerely,



Larrie Roosdahl, P. Eng.

Senior Engineer

Certified API 653 Tank Inspector #21606



REPORT  
PREPARED FOR  
CANADIAN ZINC CORPORATION

PRAIRIE CREEK MINE, NT

**BULK FUEL STORAGE FACILITIES  
CONDITION INSPECTION REPORT**

PRAIRIE CREEK MINE, NT

Project No. 05-CZ-03

Inspected by:  
Roosdahl Engineering Enterprises  
July 21-22, 2005

**Yellowknife Office**

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Bulk Fuel Storage Facility Condition Inspection  
Canadian Zinc Corporation  
Prairie Creek Mine, NT

## List of Appendices

Appendix I	Drawings
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Bulk Fuel Storage Facility Condition Inspection  
Canadian Zinc Corporation  
Prairie Creek Mine, NT

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CANADIAN ZINC CORPORATION  
Prairie Creek Mine, NT

Bulk Fuel Storage Facility  
Condition Inspection  
July 21-22, 2005

## 1.0 Background

The Canadian Zinc Corporation Mine is a base metal mine developed and constructed in the early 1980's. The mine was never operated. Due to a sharp drop in the price of silver the mine construction was shut down and the equipment was mothballed until the metal prices recovered. The time has come to now advance the project to production at the earliest opportunity to take advantage of the growing metal markets. As part of this project initiation, an inspection of the bulk fuel storage facilities is required to fulfill a condition in *Section 7* of the *Class B Water License MV2001L2-0003*, issued by the Mackenzie Valley Land and Water Board (MVLWB), to confirm the structural integrity of the facilities and that they comply with the current Codes and Standards.

Roosdahl Engineering Enterprises was appointed the engineer, to conduct a detailed condition inspection of the tank farm and to conduct individual In-Service API 653 tank inspections of the bulk fuel storage tanks. The facility was inspected to ensure that it meets all the requirements of the *Canadian Council of Ministers of the Environment (CCME), Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products*; the *National Fire Code*; the *Canadian Electrical Code*; and *American Petroleum Institute (API), Underwriters' Laboratories of Canada (ULC) and Canadian Standards Association (CSA) Codes and Standards* to ensure that the facility is safe and environmentally secure for continued operation. The tanks were inspected by a qualified API 653 Above Ground Tank Inspector.

A condition inspection of the Fuel Storage Facilities at the Prairie Creek Mine Site, NT, was carried out by Larrie Roosdahl, P.Eng., on July 21-22, 2005, in response to a request, by Canadian Zinc Corporation.

## 1.1 Location

The Prairie Creek Mine, is located in the Northwest Territories at 61° 34' N, 124° 49' W. The Prairie Creek Mine site is located approximately 600 air km (230 air miles) N of Fort Nelson, BC. The elevation at Prairie Creek Mine, at the airstrip, is approximately 3,000' (915m) above sea level. The Prairie Creek Mine site located in the Nahanni watershed, at the junction of Harrison Creek and Prairie Creek, on a low gravel beach in a mountainous area enclosed on two sides by high hills.

Transportation, in the past, for fuel and heavy equipment was completed on a winter road.

## 1.2 Climate

The average climate conditions at Prairie Creek (based on Nahhani Butte statistics) are as follows:

	<u>Temperatures:</u>	<u>Mean</u>
July:	Mean high	25.6° C
	Mean low	12.2° C
January:	Mean high	-23.0° C
	Mean low	-32.7° C
<u>Precipitation:</u>		
	Rainfall	381.0 mm
	Snowfall	1 549.0 mm
	Total Precipitation	533.0 mm

## 2.0 Prairie Creek Mine Bulk Fuel Storage Facilities

A set of Prairie Creek Mine Reference Documents were received from Canadian Zinc Corporation (CZC), including copies of the following mine fuel storage system drawings:

Canadian Zinc Corporation, Drawing, dated April, 2005	Fuel Storage Area, As Built Diagram
KILBORN, Drawing No. 150-17-001 Rev.04, dated Nov. 19, 1981	Prairie Creek, Fuel Oil Storage Tank Farm, General Arrangement
KILBORN, Drawing No. 100-17-016 Rev.02 dated March 16, 1982	Prairie Creek, Fuel Storage and Gasolene Storage, P&ID Diagram
Cadillac Explorations – Golder Associates, Drawing 802-1073, Fig.10, dated Sept, 1980	Fuel Tank Farm Spill Control Works

Copies of these Reference Documents are provided in Appendix I, for reference.

The Bulk Fuel Storage and Distribution Facilities at the Prairie Creek mine site include the following:

1. A Diesel Fuel Storage Compound, as shown in Photos #1, #2 and #4 containing the following diesel fuel storage tanks:

• Diesel Fuel Storage Tank 1	1 700 m <sup>3</sup>	(10 700 BBL)
• Diesel Fuel Storage Tank 2	1 700 m <sup>3</sup>	(10 700 BBL)

- Diesel Fuel Storage Tank 3      1 700 m3      (10 700 BBL)
- Diesel Fuel Storage Tank 4      1 700 m3      (10 700 BBL)
- Total Diesel Fuel Capacity      6 800 m3

2. A Gasoline Storage Compound containing the following gasoline storage tanks:

- Gasoline Storage Tank 5      55 m3      (350 BBL)
- Gasoline Storage Tank 6      55 m3      (350 BBL)
- Total Gasoline Capacity      110 m3

3. A Fuel Resupply and Dispensing Yard area, as shown in Photo #3, with the following facilities:

- Diesel Fuel/Gasoline Pump House
- Diesel Fuel/Gasoline Loading Rack and Gasoline Dispenser
- Truck Unloading Manifolds with spill preventers
- Truck Fuelling Apron

## 2.1 Diesel Fuel Storage Compound

2.1.1 As shown on Drawings: CZC, Dwg., dated April, 2005 and Cadillac Explorations – Golder Associates Dwg. 802-1073, Fig.10, the storage compound is constructed with a 1' thick impervious clay seal, protected by a 3' thick sand and gravel cover. Inspection of the containment area shows by a relatively high tide mark on the tanks and on the dike, see Photo #2, that the clay seal is effective.

2.1.2 The survey elevations and diked Fuel Oil Containment volume calculations, shown on CZC Dwg., dated April, 2005, show that the required containment capacity of the largest tank plus 10% of the capacity of the other tanks (2 212 m3) can be adequately contained by the dike, as constructed.

2.1.3 The diked containment is graded to a sump located in the southwest corner, where the water is tested before being pumped out.

2.1.4 The tanks are not painted and are rusted although approximately 50% of the mill scale is still intact. There is no significant metal loss. The tanks have all been fabricated and erected to API Standard 650. An API 653 In-Service inspection was conducted on each of the tanks. The tabulated results are provided in Appendix II

The tanks are considered to have good structural integrity and are in very good condition. To meet the new Federal Guidelines, the tanks



will need to have an API 653 Out-of-Service, internal inspection conducted, prior to mine start-up

2.1.4.1 Diesel Fuel Tank 1 Name Plate Data

Gem Steel Enterprises Ltd.  
Edmonton, Alberta

Type: Fuel Storage Serial Number: 81-112-3  
Work Order No: 112 Date: API 650  
Design Specific Gravity: 0.88 Corrosion Allowance: None  
Diameter: 49' 0" Height: 32' 0" Material: C40.21 38T  
Shell: .250 .188 Floor: .250 Roof: .188  
Customer: Cadillac Exp. Ltd.

Comments:

The tank is located on a raised, compacted granular foundation pad and shows no signs of settlement. The tank is level and plumb.

The tank is equipped with:

- a ladder, with a safety hoop and roof handrails
- an aluminum level gauge board – Reading: 11' 6"
- a 30" shell manway
- a flanged 6" x 16" flush clean-out
- a 6" inlet/outlet flanged nozzle, with 6" x 150 WCB steel gate valve, with 3" flanged heat tape coil
- two spare 6" flanged nozzles, one with 6" x 150 WCB steel gate valve and one with a blind flange
- a 2" Shand & Jurs water drain valve
- a 24" roof manway
- a flanged 8" Clay & Bailey gauge hatch
- a 8" gooseneck vent
- heavy duty grounding cable

2.1.4.2 Diesel Fuel Tank 2 Name Plate Data:

Gem Steel Enterprises Ltd.  
Edmonton, Alberta

Type: Fuel Storage Serial Number: 81-112-1  
Work Order No: 112 Date: API 650  
Design Specific Gravity: 0.88 Corrosion Allowance: None  
Diameter: 49' 0" Height: 32' 0" Material: C40.21 38T  
Shell: .250 .188 Floor: .250 Roof: .188  
Customer: Cadillac Exp. Ltd.

Bulk Fuel Storage Facility Condition Inspection  
Canadian Zinc Corporation  
Prairie Creek Mine, NT

6

Comments:

The tank is located on a raised, compacted granular foundation pad and shows no signs of settlement. The tank is level and plumb.

The tank is equipped with

- a ladder, with a safety hoop and roof handrails
- an aluminum level gauge board – Reading: 3' 6"
- a 30" shell manway
- a flanged 6" x 16" flush clean-out
- a 6" inlet/outlet flanged nozzle, with 6" x 150 WCB steel gate valve, with 3" flanged heat tape coil
- a spare 6" flanged nozzle with a blind flange and a 4" flanged nozzle with a 4" x 150 WCB steel gate valve
- a 2" Shand & Jurs water drain valve
- a 24" roof manway
- a flanged 8" Clay & Bailey gauge hatch
- a 8" gooseneck vent
- heavy duty grounding cable

2.1.4.3

Diesel Fuel Tank 3 Name Plate Data:

Gem Steel Enterprises Ltd.  
Edmonton, Alberta

Type: Fuel Storage	Serial Number: 81-112-2		
Work Order No: 112	Date: API 650		
Design Specific Gravity: 0.88	Corrosion Allowance: None		
Diameter: 49' 0"	Height: 32' 0"	Material: C40.21 38T	
Shell: .250	.188	Floor: .250	Roof: .188
Customer: Cadillac Exp. Ltd.			

Comments:

The tank is located on a raised, compacted granular foundation pad and shows no signs of settlement. The tank is level and plumb.

The tank is equipped with:

- a ladder, with a safety hoop and roof handrails
- an aluminum level gauge board – Reading: 4' 0"
- a 30" shell manway
- a flanged 6" x 16" flush clean-out

- a 6" inlet/outlet flanged nozzle, with 6" x 150 WCB steel gate valve, with 3" flanged heat tape coil
- a spare 6" flanged nozzle with a blind flange and a 4" flanged nozzle with a 4" x 150 WCB steel gate valve
- a 2" Shand & Jurs water drain valve
- a 24" roof manway
- a flanged 8" Clay & Bailey gauge hatch
- a 8" gooseneck vent
- heavy duty grounding cable

2.1.4.4 Diesel Fuel Tank 4 Name Plate Data:

API STANDARD 650

Appendix:	Year Completed: 82
Nominal Diameter: 49	Nominal Height: 32
Nominal Capacity: 10700	Design Liquid Level:
Fabricated By: Bird Oil Equipment Ltd.	
Erected By: Bird Oil Equipment Ltd.	

Comments:

The tank is located on a raised, compacted granular foundation pad and shows no signs of settlement. The tank is level and plumb.

The tank is equipped with:

- a ladder, with a safety hoop and roof handrails
- an aluminum level gauge board – Reading: 6' 6"
- a 30" shell manway
- a flanged 6" x 16" flush clean-out
- a 6" inlet/outlet flanged nozzle, with 6" x 150 WCB steel gate valve, with 3" flanged heat tape coil
- a spare 6" flanged nozzle with a blind flange and a 4" flanged nozzle with a 4" x 150 WCB steel gate valve
- a 2" Shand & Jurs water drain valve
- a 20" roof manway
- a flanged 8" Clay & Bailey gauge hatch
- a 8" gooseneck vent
- heavy duty grounding cable

2.2 Gasoline Storage Compound

2.2.1 As shown on Drawing: CZC, Dwg., dated April, 2005, the diked containment area is located in the southwest corner of the storage

compound. However, inspection of the containment area shows no signs that there has been any contained water, indicating that the clay seal is not effective. A new impervious liner will be needed, if a single wall tank is to be used for gasoline storage in this section of the compound.

2.2.2

The tanks are approximately 12' diameter x 20' high, riveted steel tanks. They have suffered significant damage being installed in the compound and do not have API or ULC name plates. These tanks have not been used and are not considered to be suitable for service as gasoline storage tanks. They will be replaced with new double wall skid mounted horizontal tanks located on the existing regraded gasoline storage compound.

### 2.3| Fuel Resupply and Dispensing|

2.3.1

The details of the fuel storage compounds, fuel pump house, loading platform, piping, resupply manifolds, with spill preventers, and concrete truck apron are shown on CZC Dwg., dated April 2005 and KILBORN, Dwg. No. 150-17-001 Rev.04, dated November 19, 1981. The Process and Instrumentation Diagram for the fuel systems is provided in KILBORN, Dwg. No. 100-17-016 Rev.02, dated March 16, 1982. The drawings are provided in Appendix I, for reference.

2.3.2

Essentially all fuels will be brought in by tanker trucks over the winter road during the months of January through March. Supplies will be marshaled at Fort Nelson and transported approximately 300 km north on the Liard Highway, to the Liard River crossing, which is 30 km northeast of Nahanni Butte. From there, the winter road, originally built by Cadillac Exploration, will be re-opened to traverse 160 km west to the mine site.

2.3.3

The following number of vehicle trips is expected to be required to deliver the fuel for mine operations:

- 17 trips/week for diesel fuel
- 2 trips /week for propane and
- 3 trips/season for gasoline.

Properly equipped and serviced tanker trucks belonging to the fuel suppliers will be used to transport the fuel. Spill contingency plans for transporting the fuel will be in place, by the fuel suppliers, and will be approved by the Department of Environment and Natural Resources of the Government of the Northwest Territories.

such that movement between checkpoints is strictly controlled to prevent accidents.

- 2.3.4 The diked fuel storage compounds and fuel transfer pump house are set up to handle, P-40 diesel fuel and gasoline. As discussed above, diesel fuel is stored in the diesel fuel storage compound, in four 49' diameter x 32' high vertical steel welded tanks, designed and erected to API 650 Standards. Diesel fuel is to be dispensed through the pump house, a meter and an overhead loading rack.
- 2.3.5 Gasoline is to be stored in two new 54 000 litre (12 000 gallon) double wall, skid mounted horizontal tanks located on the existing regraded gasoline storage compound. Gasoline will be dispensed through a Gas Boy Dispenser Cabinet and 3/4" fueling hose.
- 2.3.6 The tanker truck resupply and fuel dispensing area, in front of the Pump House and Loading Platform, shown in Photo #3, is provided with a concrete vehicle loading apron, approximately 4 m wide x 36.7 m long. The apron includes a pad around the Loading Platform, see Photo #7, and drain channels to a sump located on each end of the Pump House to contain any spillage that may occur on the fuelling apron. Spill preventers are provided at each resupply manifold to further minimize and fuel spillage during fuelling operations. The apron and spill containment systems are in excellent condition.
- 2.3.7 The Pumhouse, shown in Photo #3, is an insulated metal clad steel frame building approximately 4 500 mm (15') x 6 700 mm (22') x 2 400 mm (8') high with a peaked roof and a concrete floor. The building is provided with explosion proof wiring, lights and fire alarm system. Fire extinguishers (20 lb. dry chemical) are provided in the Pump House and at the resupply manifold locations.

The pumps are mounted on concrete pads and include two 3" x 2" pumps for double diesel fuel tanker truck unloading. The pumps, shown in Photo #5, are also piped for mine vehicle fuelling.

There is also a 3" x 2" gasoline tanker truck unloading pump, shown in Photo #6. Gasoline dispensing is by gravity through a Gas Boy dispenser pump, shown in Photo #7.

Each meter piping run has a set of strainers and block valves. The details of the strainers, meters and valves are shown on CZC Dwg., dated April 2005 and KILBORN, Dwg. No. 150-17-001 Rev.04, dated November 19, 1981. The Process and Instrumentation Diagram for the

fuel systems is provided in KILBORN, Dwg. No. 100-17-016 Rev.02, dated March 16, 1982. The drawings are provided in Appendix I, for reference.

2.3.8 The piping within the diesel fuel storage compound, shown in Photo #2, is insulated 6" schedule 40 pipe with 6" x 150# flanges and 6" x 150# steel gate valves. Electric heat tracing is provided for winter operations, if P-40 diesel fuel is supplied. Each tank is separated by a 3 way Nordstrom plug valve, to allow control of diesel fuel from resupply and vehicle loading operations and to mine operations.

## 2.4 Conclusions

2.4.1 It is evident that the diesel fuel bulk fuel storage and dispensing facilities have been designed and constructed to meet all the requirements of the *National Fire Code*; the *Canadian Electrical Code*; and *American Petroleum Institute (API)*, *Underwriters' Laboratories of Canada (ULC)* and *Canadian Standards Association (CSA)* Codes and Standards and, based on this in-service inspection, the facilities are considered to be safe and environmentally secure for continued operation.

2.4.2 The *Canadian Council of Ministers of the Environment (CCME)*, *Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products*, is based on the design and construction of facilities to the above codes and standards, thus the facilities also meet the intent of the CCME Environmental Code of Practice.

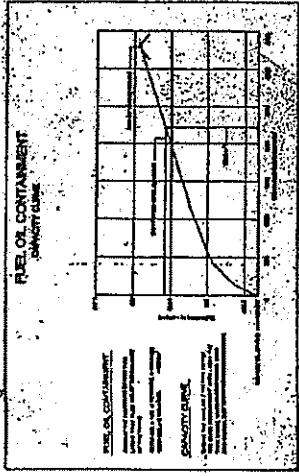
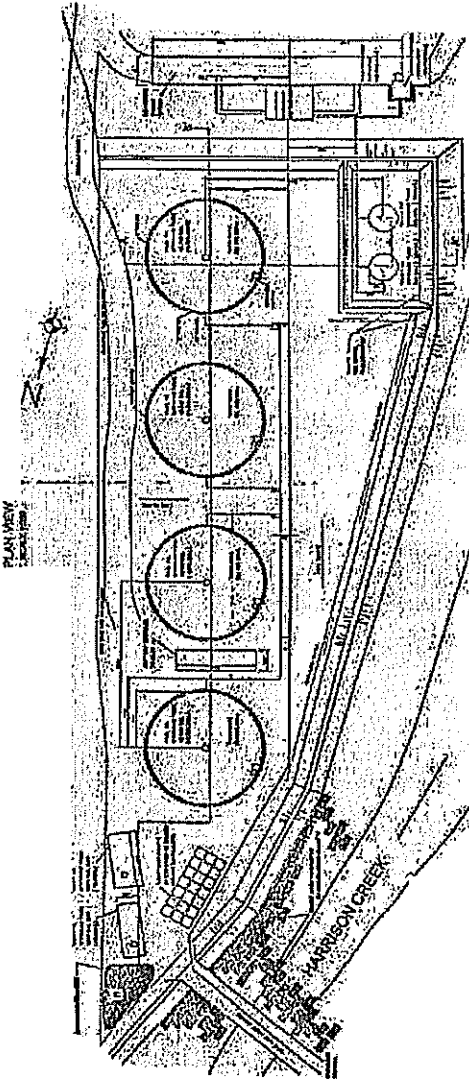
2.4.3 Based on this in-service inspection, the structural integrity of the diesel fuel bulk storage and dispensing facilities is considered to be good and suitable for commissioning and future use.

2.4.4 The gasoline dispensing facility is also considered to be suitable for commissioning and future use. However, the gasoline storage tanks will need to be replaced and the gasoline storage compound will need to be upgraded, before it is suitable for use.

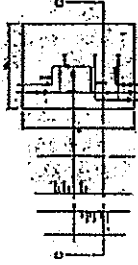
# Appendix I

## Drawings:

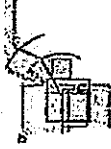
- Canadian Zinc Corporation, Drawing: Fuel Storage Area, As Built Diagram  
dated April, 2005
- KILBORN, Drawing No. 150-17-001 Rev.04, Prairie Creek, Fuel Oil Storage  
dated Nov. 19, 1981 Tank Farm, General Arrangement
- KILBORN, Drawing No. 100-17-016 Rev.02 Prairie Creek, Fuel Storage and  
dated March 16, 1982 Gasolene Storage, P&ID Diagram
- Cadillac Explorations – Golder Associates, Fuel Tank Farm Spill Control Works  
Drawing 802-1073, Fig.10, dated Sept, 1980



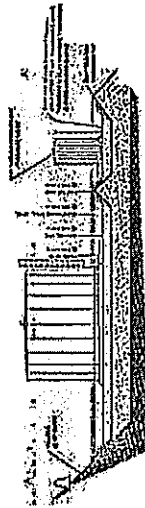
PUMP HOUSE LAYOUT  
SCALE 1:200



LOADING PLATFORM LAYOUT  
SCALE 1:200



SECTION A-A'  
SCALE 1:200



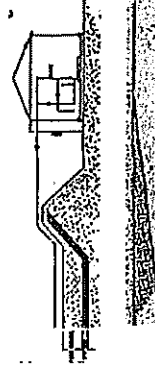
PUMP DETAIL  
SCALE 1:200



TANK PAD DETAIL  
SCALE 1:200



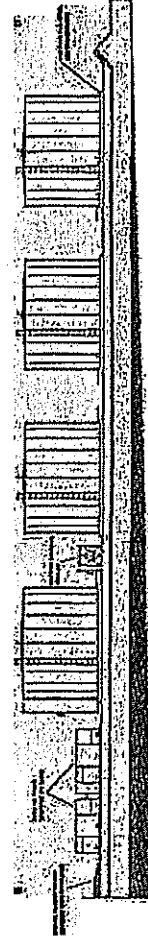
SECTION C-C'  
SCALE 1:400



SECTION D-D'  
SCALE 1:400

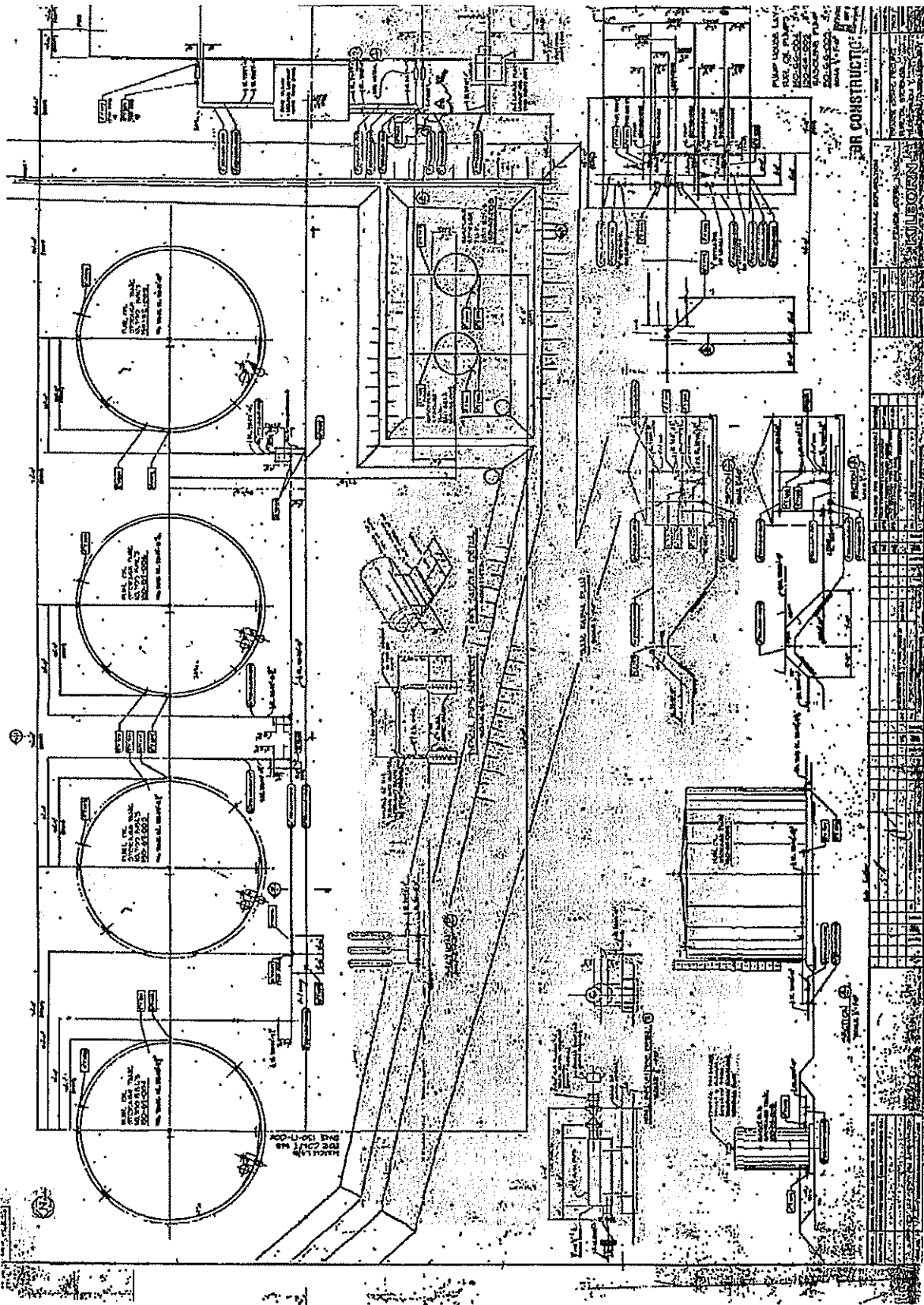


SECTION B-B'  
SCALE 1:200



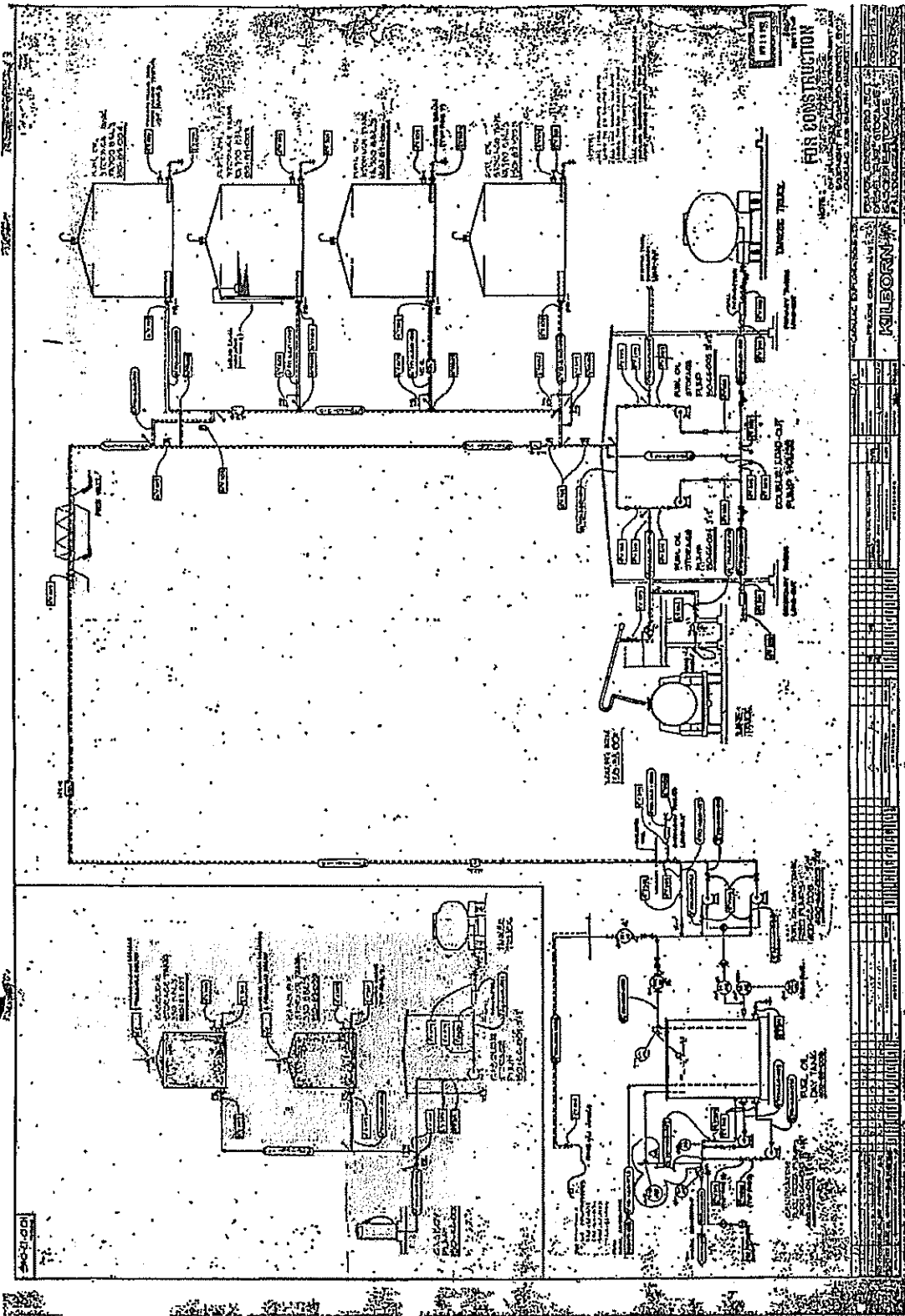
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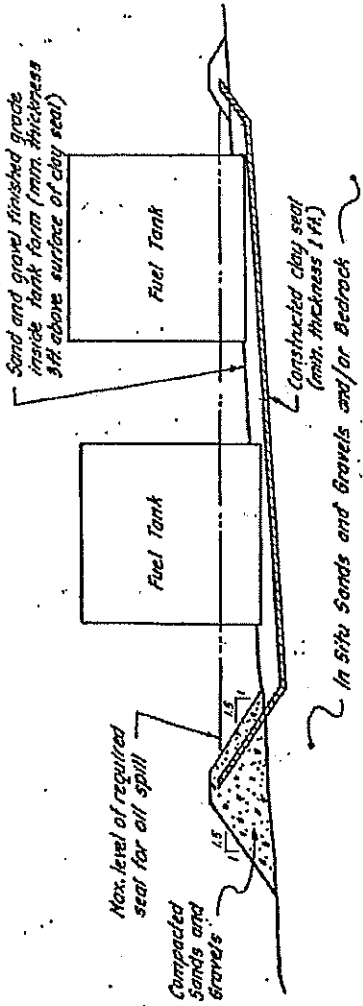




FOR CONSTRUCTION

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Note: Clay seal also required beneath fuel tanks.

Fig. 10a) SCHEMATIC SECTION OF TANK FARM AND CLAY SEAL SPILL PROTECTION WHERE FOUNDATION SOILS CONSIST OF PERVIOUS MEDIA

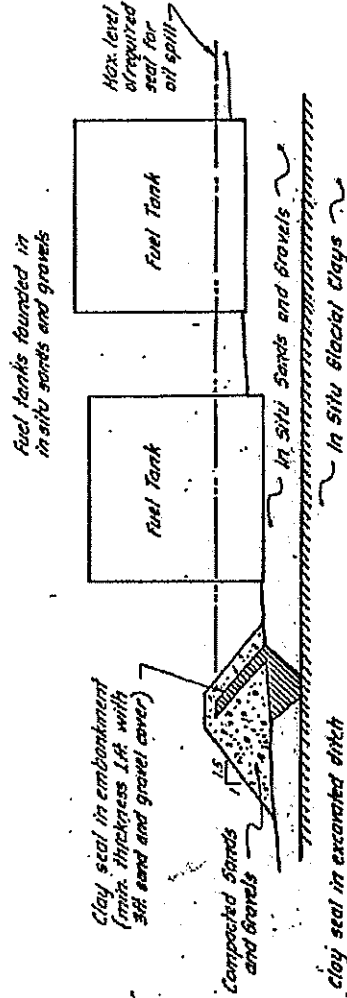


Fig. 10b) SCHEMATIC SECTION OF TANK FARM AND FUEL SPILL PROTECTION FOR CASE WHERE IMPERVIOUS IN SITU CLAY EXISTS WITHIN EASY ACCESS FROM GROUND SURFACE

Cadillac Explorations Ltd. Northwest Territories	
Golder Associates	
<b>FUEL TANK FARM SPILL CONTROL WORKS</b>	
Drawn	S.H.
Date	SEPT. 1980
Reviewed	GHZ
Project No. 902-1073 LEQ	

# Appendix II

## API Standard 653 Tank In-Service Inspection Checklists

- Tank 1      API Standard 653 Tank External Inspection Checklist
- Tank 2      API Standard 653 Tank External Inspection Checklist
- Tank 3      API Standard 653 Tank External Inspection Checklist
- Tank 4      API Standard 653 Tank External Inspection Checklist

Appendix II:  
API Standard 653 Tank External Inspection Checklist  
Canadian Zinc Corporation Bulk Fuel Storage Facility, Prairie Creek, NT

Owner: Canadian Zinc Corp.  
 Tank: #1 Diesel Fuel Tank Capacity: 1 700 m<sup>3</sup> (14.94 mm ID x 9.75 mm high)  
 Date of Inspection: 22-Jul-05 Year Built: 1981

Item	Description	Okay	Comments
<b>C.1.1</b>	<b>Foundation</b>		
	a. Check the foundation levelness and bottom flange elevations.	X	
	b. Inspect for cavities under foundation and vegetation at the tank base.	X	
	c. Check that runoff rainwater drains away from the tank base.	X	
	d. Check for settlement around the perimeter of the tank and bulging of the shell.	X	
	e. Check for sand crown or evidence of rock under tank base.		n/a
<b>C.1.2</b>	<b>Site Drainage and Housekeeping</b>		
	a. Inspect site for drainage away from the tank base and associated piping.	X	
	b. Check operating condition of the dike sump and sump pump.	X	
	c. Inspect site for vegetation, debris and combustible materials around the tank.	X	
	d. Inspect fire fighting equipment.	X	
<b>C.1.3</b>	<b>Tank Shell</b>		
	a. Visually inspect for paint failure, pitting and corrosion.	X	*2
	b. Inspect shell and welds for leaks and defects, particularly vertical weld seams.	X	
	c. Clean off bottom flange area and inspect for corrosion and weld defects.	X	*3
	d. Inspect bottom to shell weld and tank support.	X	
	e. Inspect wind girder for signs of stress.		n/a
<b>C.1.4</b>	<b>Shell Appurtenances</b>		
<b>C.1.4.1</b>	<b>Manways and Nozzles</b>		
	a. Inspect welds for corrosion and leakage at nozzles, manways & reinforcing pads.	X	
	b. Identify type of shell nozzles, valves and equipment.	X	*4
	c. Inspect nozzle valves for packing leaks and damaged flange faces.	X	*4
	d. Check that valves have thermal pressure relief back to the tanks.	X	
	e. Check that the piping has flexible connectors and record condition.	n/a	*5
	f. Inspect shell plates for corrosion, dimpling at nozzles and other defects.	X	
	g. Inspect to ensure gaskets are fire-safe and for flange leaks at gaskets & bolting.	X	
<b>C.1.4.2</b>	<b>Tank Piping Manifolds</b>		
	a. Inspect manifold piping, flanges and valves for signs of leakage.	X	
	b. Check for adequate thermal pressure relief of piping to the tank.	X	
	c. Check that the piping has flexible connectors and record condition.		n/a
	d. Check sample or other connections for leaks, valve operation & security plugs.	X	
	e. Check for adequate static electricity bonding and grounding.		*7
	f. Check welds on shell mounted reinforcing clips.	X	
<b>C.1.4.3</b>	<b>Water Drain Valves</b>		
	a. Inspect water drain valve for cracks or signs of leakage.	X	
	b. Check that the valve operates properly, is lockable and has a security plug.	X	*5
<b>Comments Details:</b>			
*1	Tank is equipped with a gooseneck vent, which acts as a painters post.		
*2	Tanks have not been painted, some mill scale still remaining after minimal general corrosion. The tanks need painting.		
*3	Two minor pinhole weeps in bottom to shell weld, will need to be repaired before being put back into operation.		
*4	All tank valves are 6" x 150# flanged steel gate valves, complete with internal pressure relief fittings; no evident stress or leakage.		
*5	Steel plugs need to be installed in all valves, including the water drain valves.		
*6	Piping is provided with expansion offsets.		
*7	The tanks have static electricity grounding, but no bonding over flanges and valves.		
*8	42" high x 7" long angle iron handrails at roof equipment.		

Appendix II		Page 2 of 2	
API Standard 653 Tank External Inspection Checklist			
Canadian Zinc Corporation Bulk Fuel Storage Facility, Prairie Creek, NT			
Owner: Canadian Zinc Corp.			
Tank #1		Capacity: 1,700 m <sup>3</sup> (14,94 mm ID x 9,75 mm high)	
Date of Inspection: 22-Jul-05		Year Built: 1981	
Item	Description	Okay	Comments
<b>C.1.4.4</b>	<b>Autogauge System</b>		
a.	Inspect autogauge tape & roof connections		n/a
b.	Inspect autogauge head for damage and bump for indication of good operation		n/a
c.	Check high level alarm		n/a
d.	Inspect condition of board and legibility of board type gauges	X	
e.	Check freedom of movement of marker & float	X	
<b>C.1.5</b>	<b>Roof</b>		
a.	For safety, hammer test & check roof near the edge for severe corrosion & thinning	X	
b.	Visually inspect the roof plates and seams for paint failures, pitting, holes etc.	X	*2
<b>C.1.6</b>	<b>Roof Appurtenances</b>		
<b>C.1.6.1</b>	<b>Inspection and Light Hatches</b>		
a.	Inspect the hatches for corrosion, paint failures, holes and cover seal	X	*2
b.	On loose covers, check for a safety chain in good condition		n/a
c.	On hatches over 30 inches across, check for safety rods		n/a
d.	Inspect the condition of the gaskets on hatch covers	X	
<b>C.1.6.2</b>	<b>Breathers and Vents</b>		
a.	Inspect and service the breather		*1
b.	Inspect screens on vents and breathers	X	
<b>C.1.6.3</b>	<b>Emergency P/V Hatches</b>		
a.	Inspect and service emergency & pressure/vacuum hatches		n/a
<b>C.1.6.4</b>	<b>Gauge Hatch</b>		
a.	Inspect gauge (sample) hatch for corrosion	X	
b.	Inspect the condition of the seals on hatch covers	X	
c.	Check that the cover operates properly and is lockable	X	
d.	For tanks lined with a protective coating, check coating condition		n/a
<b>C.1.6.5</b>	<b>Fixed Roof Scaffold Support</b>		
a.	Inspect the painters post for corrosion, wear and structural soundness	X	*1
<b>C.1.7</b>	<b>Access Structures</b>		
<b>C.1.7.1</b>	<b>Handrails</b>		
a.	Identify and report type (steel pipe, square tube, angle) & size of handrails	X	*8
b.	Inspect for pitting and holes, paint failure	X	*2
c.	Inspect attachment welds, cold joints and sharp edges on the handrails	X	
d.	Inspect safety hoop ladder for corrosion, functioning and length	X	
<b>C.1.7.2</b>	<b>Platform Frame</b>		
a.	Inspect frame for corrosion and paint failure		n/a
b.	Check reinforcing pads & attachment of frame to supports		n/a
c.	Inspect the surface that deck plate or grating rests on, for thinning and holes		n/a
d.	Check that flat-surface junctures		n/a
<b>Comments Details:</b>			
<p>Note: With the above corrections, Tank #1 is hereby certified for continued diesel fuel service, with regular maintenance and inspection. A full Out-of-Service API 653 tank inspection of Tank #1 will be required before the mine is put into operation.</p>			

Appendix II			
API Standard 653 Tank External Inspection Checklist			
Canadian Zinc Corporation Bulk Fuel Storage Facility, Prairie Creek, NT			
Owner: Canadian Zinc Corp.			
Tank: #2 Diesel Fuel Tank Capacity: 1 700 m <sup>3</sup> (14.94 mm ID x 9.75 mm high)			
Date of Inspection: 22-Jul-05 Year Built: 1981			
Item	Description	Okay	Comments
<b>C.1.1</b>	<b>Foundation</b>	x	
	a. Check the foundation levelness and bottom flange elevations	x	
	b. Inspect for cavities under foundation and vegetation at the tank base	x	
	c. Check that runoff rainwater drains away from the tank base	x	
	d. Check for settlement around the perimeter of the tank and bulging of the shell	x	
	e. Check for sand crown or evidence of rock under tank base		n/a
<b>C.1.2</b>	<b>Site Drainage and Housekeeping</b>		
	a. Inspect site for drainage away from the tank base and associated piping	x	
	b. Check operating condition of the dike sump and sump pump	x	
	c. Inspect site for vegetation, debris and combustible materials around the tank	x	
	d. Inspect fire fighting equipment	x	
<b>C.1.3</b>	<b>Tank Shell</b>		
	a. Visually inspect for paint failure, pitting and corrosion		*2
	b. Inspect shell and welds for leaks and defects, particularly vertical weld seams	x	
	c. Clean off bottom flange area and inspect for corrosion and weld defects	x	
	d. Inspect bottom to shell weld and tank support	x	
	e. Inspect wind girder for signs of stress		n/a
<b>C.1.4</b>	<b>Shell Appurtenances</b>		
<b>C.1.4.1</b>	<b>Manways and Nozzles</b>		
	a. Inspect welds for corrosion and leakage at nozzles, manways & reinforcing pads	x	
	b. Identify type of shell nozzles, valves and equipment	x	*4
	c. Inspect nozzle valves for packing leaks and damaged flange faces	x	*4
	d. Check that valves have thermal pressure relief back to the tanks	x	
	e. Check that the piping has flexible connectors and record condition	n/a	*6
	f. Inspect shell plates for corrosion, dimpling at nozzles and other defects	x	
	g. Inspect to ensure gaskets are fire-safe and for flange leaks at gaskets & bolting	x	
<b>C.1.4.2</b>	<b>Tank Piping Manifolds</b>		
	a. Inspect manifold piping, flanges and valves for signs of leakage	x	
	b. Check for adequate thermal pressure relief of piping to the tank	x	
	c. Check that the piping has flexible connectors and record condition		n/a
	d. Check sample or other connections for leaks, valve operation & security plugs	x	
	e. Check for adequate static electricity bonding and grounding		*7
	f. Check welds on shell mounted reinforcing clips	x	
<b>C.1.4.3</b>	<b>Water Drain Valves</b>		
	a. Inspect water drain valve for cracks or signs of leakage	x	*3
	b. Check that the valve operates properly, is lockable and has a security plug	x	*5
<b>Comments/Details</b>			
*1	Tank is equipped with a gooseneck vent, which acts as a painters post.		
*2	Tanks have not been painted, 60 - 70% of the mill scale still remaining after minimal general corrosion. The tanks need painting.		
*3	Minor weep at water drain valve threaded connection. Valve needs to be removed and resealed.		
*4	All tank valves are 6" x 150# flanged steel gate valves, complete with internal pressure relief fittings, no evident stress or leakage.		
*5	Steel plugs need to be installed in all valves, including the water drain valves.		
*6	Piping is provided with expansion offsets.		
*7	The tanks have static electricity grounding, but no bonding over flanges and valves.		
*8	42" high x 7' long angle iron handrails at roof equipment		

Appendix II			
API Standard 653 Tank External Inspection Checklist			Page 2 of 2
Canadian Zinc Corporation Bulk Fuel Storage Facility, Prairie Creek, NT			
Owner: Canadian Zinc Corp.			
Tank: #2		Diesel Fuel Tank	Capacity: 1 700 m <sup>3</sup> (14.94 mm ID x 9.75 mm high)
Date of Inspection: 22-Jul-05		Year Built: 1981	
Item	Description	Okay	Comments
C.1.4.4	Autogauge System	x	
	a. Inspect autogauge tape & roof connections		n/a
	b. Inspect autogauge head for damage and bump for indication of good operation		n/a
	c. Check high level alarm		n/a
	d. Inspect condition of board and legibility of board type gauges	x	
	e. Check freedom of movement of marker & float	x	
C.1.5	Roof		
	a. For safety, hammer test & check roof near the edge for severe corrosion & thinning	x	
	b. Visually inspect the roof plates and seams for paint failures, pitting, holes etc.	x	*2
C.1.6	Roof Appurtenances		
	Inspection and Light Hatches		
	a. Inspect the hatches for corrosion, paint failures, holes and cover seal	x	*2
	b. On loose covers, check for a safety chain in good condition		n/a
	c. On hatches over 30 inches across, check for safety rods		n/a
	d. Inspect the condition of the gaskets on hatch covers	x	
C.1.6.2	Breathers and Vents		
	a. Inspect and service the breather		*1
	b. Inspect screens on vents and breathers	x	
C.1.6.3	Emergency P/V Hatches		
	a. Inspect and service emergency & pressure/vacuum hatches		n/a
C.1.6.4	Gauge Hatch		
	a. Inspect gauge (sample) hatch for corrosion	x	
	b. Inspect the condition of the seals on hatch covers	x	
	c. Check that the cover operates properly and is lockable	x	
	d. For tanks lined with a protective coating, check coating condition		n/a
C.1.6.5	Fixed Roof Scaffold Support		
	a. Inspect the painters post for corrosion, wear and structural soundness	x	*1
C.1.7	Access Structures		
C.1.7.1	Handrails		
	a. Identify and report type (steel pipe, square tube, angle) & size of handrails	x	*8
	b. Inspect for pitting and holes, paint failure	x	*2
	c. Inspect attachment welds, cold joints and sharp edges on the handrails	x	
	d. Inspect safety hoop ladder for corrosion, functioning and length	x	
C.1.7.2	Platform Frame		
	a. Inspect frame for corrosion and paint failure	n/a	
	b. Check reinforcing pads & attachment of frame to supports	n/a	
	c. Inspect the surface that deck plate or grating rests on, for thinning and holes	n/a	
	d. Check that flat-surface junctures	n/a	
Comments Details			
<p>Note: With the above corrections, Tank #2 is hereby certified for continued diesel fuel service, with regular maintenance and inspection. A full Out-of Service API 653 tank inspection of Tank #2 will be required before the mine is put into operation.</p>			



Appendix II			
API Standard 653 Tank External Inspection Checklist			Page 1 of 2
Canadian Zinc Corporation Bulk Fuel Storage Facility, Prairie Creek, NT			
Owner: Canadian Zinc Corp.			
Tank #: #3 Diesel Fuel Tank Capacity: 1700 m <sup>3</sup> (14.94 mm ID x 9.75 mm high)			
Date of Inspection: 22-Jul-05 Year Built: 1981			
Item	Description	Okay	Comments
<b>C.1.1</b>	<b>Foundation</b>		
a.	Check the foundation levelness and bottom flange elevations.	X	
b.	Inspect for cavities under foundation and vegetation at the tank base.	X	
c.	Check that runoff rainwater drains away from the tank base.	X	
d.	Check for settlement around the perimeter of the tank and bulging of the shell.	X	
e.	Check for sand crown or evidence of rock under tank base.		n/a
<b>C.1.2</b>	<b>Site Drainage and Housekeeping</b>		
a.	Inspect site for drainage away from the tank base and associated piping.	X	
b.	Check operating condition of the dike sump and sump pump.	X	
c.	Inspect site for vegetation, debris and combustible materials around the tanks.	X	
d.	Inspect fire fighting equipment.	X	
<b>C.1.3</b>	<b>Tank Shell</b>		
a.	Visually inspect for paint failure, pitting and corrosion.		*2
b.	Inspect shell and welds for leaks and defects, particularly vertical weld seams.	X	
c.	Clean off bottom flange area and inspect for corrosion and weld defects.	X	
d.	Inspect bottom to shell weld and tank support.	X	
e.	Inspect wind girder for signs of stress.		n/a
<b>C.1.4</b>	<b>Shell Appurtenances</b>		
<b>C.1.4.1</b>	<b>Manways and Nozzles</b>		
a.	Inspect welds for corrosion and leakage at nozzles, manways & reinforcing pads.	X	
b.	Identify type of shell nozzles, valves and equipment.	X	*4
c.	Inspect nozzle valves for packing leaks and damaged flange faces.	X	*4
d.	Check that valves have thermal pressure relief back to the tanks.	X	
e.	Check that the piping has flexible connectors and record condition.	n/a	*5
f.	Inspect shell plates for corrosion, dimpling at nozzles and other defects.	X	
g.	Inspect to ensure gaskets are fire-safe and for flange leaks at gaskets & bolting.	X	
<b>C.1.4.2</b>	<b>Tank Piping Manifolds</b>		
a.	Inspect manifold piping, flanges and valves for signs of leakage.	X	
b.	Check for adequate thermal pressure relief of piping to the tank.	X	
c.	Check that the piping has flexible connectors and record condition.		n/a
d.	Check sample or other connections for leaks, valve operation & security plugs.	X	
e.	Check for adequate static electricity bonding and grounding.		*3
f.	Check welds on shell mounted reinforcing clips.	X	
<b>C.1.4.3</b>	<b>Water Drain Valves</b>		
a.	Inspect water drain valve for cracks or signs of leakage.	X	
b.	Check that the valve operates properly, is lockable and has a security plug.	X	*5
<b>Comments Details</b>			
*1	Tank is equipped with a gooseneck vent, which acts as a painters post.		
*2	Tanks have not been painted, some of the mill scale still remaining after minimal general corrosion. The tanks need painting.		
*3	The tanks have static electricity grounding, but no bonding over flanges and valves.		
*4	All tank valves are 6" x 150# flanged steel gate valves, complete with internal pressure relief fittings, no evident stress or leakage.		
*5	Steel plugs need to be installed in all valves, including the water drain valves.		
*6	Piping is provided with expansion offsets.		
*7	42" high x 7" long angle iron handrails at roof equipment.		

Appendix II		Page 2 of 2	
API Standard 653 Tank External Inspection Checklist			
Canadian Zinc Corporation Bulk Fuel Storage Facility, Prairie Creek, NT			
Owner: Canadian Zinc Corp.			
Tank: #3		Capacity: 1 700 m <sup>3</sup> (14.94 mm ID x 9.75 mm high)	
Date of Inspection: 22-Jul-05		Year Built: 1981	
Item	Description	OKay	Comments
<b>C.1.4.4</b>	<b>Autogauge System</b>		
a.	Inspect autogauge tape & roof connections		n/a
b.	Inspect autogauge head for damage and bump for indication of good operation		n/a
c.	Check high level alarm		n/a
d.	Inspect condition of board and legibility of board type gauges	X	
e.	Check freedom of movement of marker & float	X	
<b>C.1.5</b>	<b>Roof</b>		
a.	For safety, hammer test & check roof near the edge for severe corrosion & thinning	X	
b.	Visually inspect the roof plates and seams for paint failures, pitting, holes etc.	X	*2
<b>C.1.6</b>	<b>Roof Appurtenances</b>		
<b>C.1.6.1</b>	<b>Inspection and Light Hatches</b>		
a.	Inspect the hatches for corrosion, paint failures, holes and cover seal	X	*2
b.	On loose covers, check for a safety chain in good condition		n/a
c.	On hatches over 30 inches across, check for safety rods		n/a
d.	Inspect the condition of the gaskets on hatch covers	X	
<b>C.1.6.2</b>	<b>Breathers and Vents</b>		
a.	Inspect and service the breather		*1
b.	Inspect screens on vents and breathers	X	
<b>C.1.6.3</b>	<b>Emergency P/V Hatches</b>		
a.	Inspect and service emergency & pressure/vacuum hatches		n/a
<b>C.1.6.4</b>	<b>Gauge Hatch</b>		
a.	Inspect gauge (sample) hatch for corrosion	X	
b.	Inspect the condition of the seals on hatch covers	X	
c.	Check that the cover operates properly and is lockable	X	
d.	For tanks lined with a protective coating, check coating condition		n/a
<b>C.1.6.5</b>	<b>Fixed Roof Scaffold Support</b>		
a.	Inspect the painters post for corrosion, wear and structural soundness	X	*1
<b>C.1.7</b>	<b>Access Structures</b>		
<b>C.1.7.1</b>	<b>Handrails</b>		
a.	Identify and report type (steel pipe, square tube, angle) & size of handrails	X	*7
b.	Inspect for pitting and holes, paint failure	X	*2
c.	Inspect attachment welds, cold joints and sharp edges on the handrails	X	
d.	Inspect safety hoop ladder for corrosion, functioning and length	X	
<b>C.1.7.2</b>	<b>Platform Frame</b>		
a.	Inspect frame for corrosion and paint failure		n/a
b.	Check reinforcing pads & attachment of frame to supports		n/a
c.	Inspect the surface that deck plate or grating rests on, for thinning and holes		n/a
d.	Check that flat surface junctures		n/a
<b>Comments Details:</b>			
<p>Note: With the above corrections, Tank #3 is hereby certified for continued diesel fuel service, with regular maintenance and inspection.</p> <p>A full Out-of-Service API 653 tank inspection of Tank #3 will be required before the mine is put into operation.</p>			

Appendix II			
API Standard 653 Tank External Inspection Checklist			Page 1 of 2
Canadian Zinc Corporation Bulk Fuel Storage Facility, Prairie Creek, NT			
Owner: Canadian Zinc Corp.			
Tank #: #4 Diesel Fuel Tank Capacity: 1,700 m <sup>3</sup> (14.94 mm ID x 9.75 mm high)			
Date of Inspection: 22-Jul-05 Year Built: 1981			
Item	Description	Okay	Comments
<b>C.1.1</b>	<b>Foundation</b>		
a.	Check the foundation levelness and bottom flange elevations	X	
b.	Inspect for cavities under foundation and vegetation at the tank base	X	
c.	Check that runoff rainwater drains away from the tank base	X	
d.	Check for settlement around the perimeter of the tank and bulging of the shell		*1
e.	Check for sand crown or evidence of rock under tank base		n/a
<b>C.1.2</b>	<b>Site Drainage and Housekeeping</b>		
a.	Inspect site for drainage away from the tank base and associated piping	X	*1
b.	Check operating condition of the dike sump and sump pump	X	
c.	Inspect site for vegetation, debris and combustible materials around the tank	X	
d.	Inspect fire fighting equipment	X	
<b>C.1.3</b>	<b>Tank Shell</b>		
a.	Visually inspect for paint failure, pitting and corrosion		*2
b.	Inspect shell and welds for leaks and defects, particularly vertical weld seams	X	
c.	Clean off bottom flange area and inspect for corrosion and weld defects	X	*1
d.	Inspect bottom to shell weld and tank support		n/a
e.	Inspect wind girder for signs of stress		n/a
<b>C.1.4</b>	<b>Shell Appurtenances</b>		
<b>C.1.4.1</b>	<b>Manways and Nozzles</b>		
a.	Inspect welds for corrosion and leakage at nozzles, manways & reinforcing pads	X	
b.	Identify type of shell nozzles, valves and equipment	X	*4
c.	Inspect nozzle valves for packing leaks and damaged flange faces	X	*4
d.	Check that valves have thermal pressure relief back to the tanks	X	
e.	Check that the piping has flexible connectors and record condition	n/a	*8
f.	Inspect shell plates for corrosion, dimpling at nozzles and other defects	X	
g.	Inspect to ensure gaskets are fire-safe and for flange leaks at gaskets & bolting	X	
<b>C.1.4.2</b>	<b>Tank Piping Manifolds</b>		
a.	Inspect manifold piping, flanges and valves for signs of leakage	X	
b.	Check for adequate thermal pressure relief of piping to the tank	X	
c.	Check that the piping has flexible connectors and record condition		n/a
d.	Check sample on other connections for leaks, valve operation & security plugs	X	
e.	Check for adequate static electricity bonding and grounding		*3
f.	Check welds on shell mounted reinforcing clips	X	
<b>C.1.4.3</b>	<b>Water Drain Valves</b>		
a.	Inspect water drain valve for cracks or signs of leakage	X	
b.	Check that the valve operates properly, is lockable and has a security plug	X	*5
<b>Comments Details</b>			
*1	Sediment has settled around the tank base. The tank base needs to be reconstructed 6" high and the containment area graded toward the sump to ensure proper drainage.		
*2	Tanks have not been painted, some of the mill scale still remaining after minimal general corrosion. The tanks need painting.		
*3	The tanks have static electricity grounding, but no bonding over flanges and valves.		
*4	All tank valves are 6" x 150# flanged steel gate valves, complete with internal pressure relief fittings, no evident stress or leakage.		
*5	Steel plugs need to be installed in all valves, including the water drain valves.		
*6	Piping is provided with expansion offsets.		

API Standard 653 Tank External Inspection Checklist  
 Canadian Zinc Corporation Bulk Fuel Storage Facility, Prairie Creek, NT

Owner: Canadian Zinc Corp.  
 Tank: #4 Diesel Fuel Tank Capacity: 1 700 m<sup>3</sup> (14.94 mm ID x 9.75 mm high)  
 Date of Inspection: 22-Jul-05 Year Built: 1981

Item	Description	Okay	Comments
<b>C.1.4.4</b>	<b>Autogauge System</b>		
a.	Inspect autogauge tape & roof connections		n/a
b.	Inspect autogauge head for damage and bump for indication of good operation		n/a
c.	Check high level alarm	X	n/a
d.	Inspect condition of board and legibility of board type gauges	X	*9
e.	Check freedom of movement of marker & float	X	*9
<b>C.1.5</b>	<b>Roof</b>		
a.	For safety, hammer test & check roof near the edge for severe corrosion & thinning	X	
b.	Visually inspect the roof plates and seams for paint failures, pitting, holes etc.	X	*2
<b>C.1.6</b>	<b>Roof Appurtenances</b>		
<b>C.1.6.1</b>	<b>Inspection and Light Hatches</b>		
a.	Inspect the hatches for corrosion, paint failures, holes and cover seal	X	*2
b.	On loose covers, check for a safety chain in good condition		n/a
c.	On hatches over 30 inches across, check for safety rods		n/a
d.	Inspect the condition of the gaskets on hatch covers	X	
<b>C.1.6.2</b>	<b>Breathers and Vents</b>		
a.	Inspect and service the breather	X	*7
b.	Inspect screens on vents and breathers		
<b>C.1.6.3</b>	<b>Emergency P/V Hatches</b>		
a.	Inspect and service emergency & pressure/vacuum hatches		n/a
<b>C.1.6.4</b>	<b>Gauge Hatch</b>		
a.	Inspect gauge (sample) hatch for corrosion	X	
b.	Inspect the condition of the seals on hatch covers	X	
c.	Check that the cover operates properly and is lockable	X	n/a
d.	For tanks lined with a protective coating, check coating condition		
<b>C.1.6.5</b>	<b>Fixed Roof Scaffold Support</b>		
a.	Inspect the painters post for corrosion, wear and structural soundness	X	*7
<b>C.1.7</b>	<b>Access Structures</b>		
<b>C.1.7.1</b>	<b>Handrails</b>		
a.	Identify and report type (steel pipe, square tube, angle) & size of handrails	X	*3
b.	Inspect for pitting and holes, paint failure	X	*2
c.	Inspect attachment welds, cold joints and sharp edges on the handrails	X	
d.	Inspect safety hoop ladder for corrosion, functioning and length	X	
<b>C.1.7.2</b>	<b>Platform Frame</b>		
a.	Inspect frame for corrosion and paint failure		n/a
b.	Check reinforcing pads & attachment of frame to supports		n/a
c.	Inspect the surface that deck plate or grating rests on, for thinning and holes		n/a
d.	Check that flat surface junctures		n/a

Comments Details

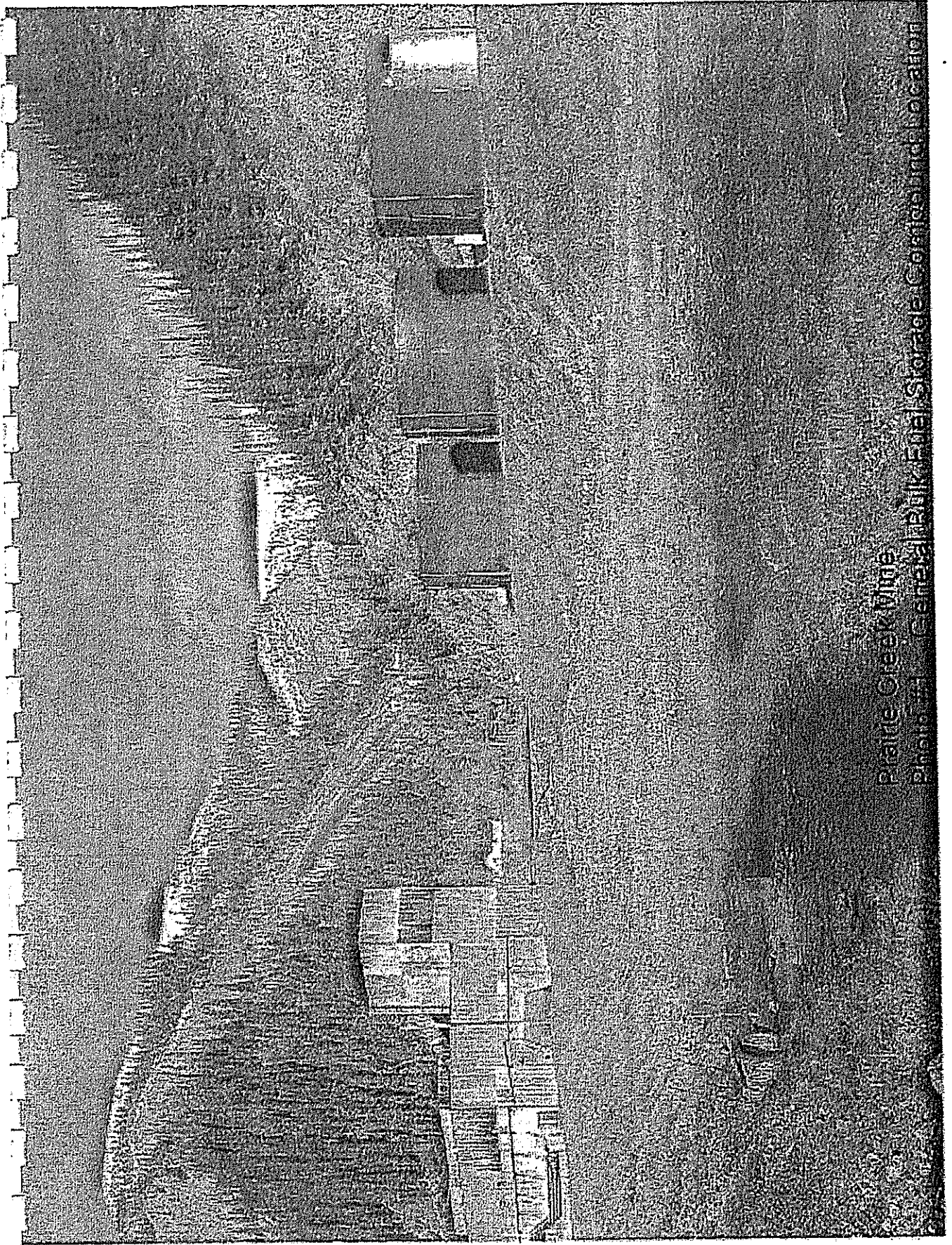
\*7 Tank is equipped with a gooseneck vent, which acts as a painters post.  
 \*8 42" high x 7' long angle iron handrails at roof equipment.  
 \*9 The gauge head and marker is dislodged from the board and needs to be repaired.

Note: With the above corrections, Tank #4 is hereby certified for continued diesel fuel service, with regular maintenance and inspection.  
 A full Out-of-Service API 653 tank inspection of Tank #4 will be required before the mine is put into operation.

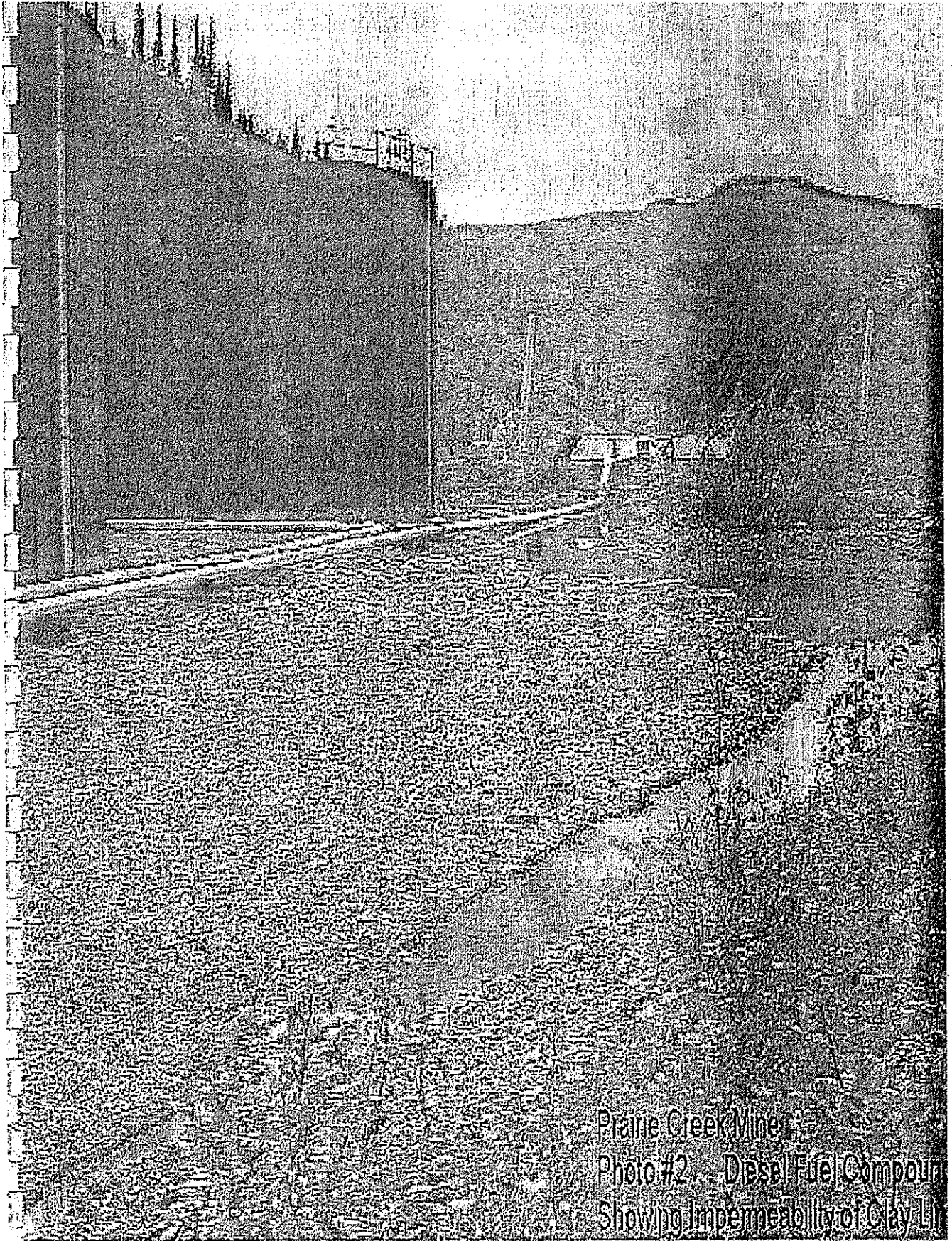
# Appendix III

## Photos

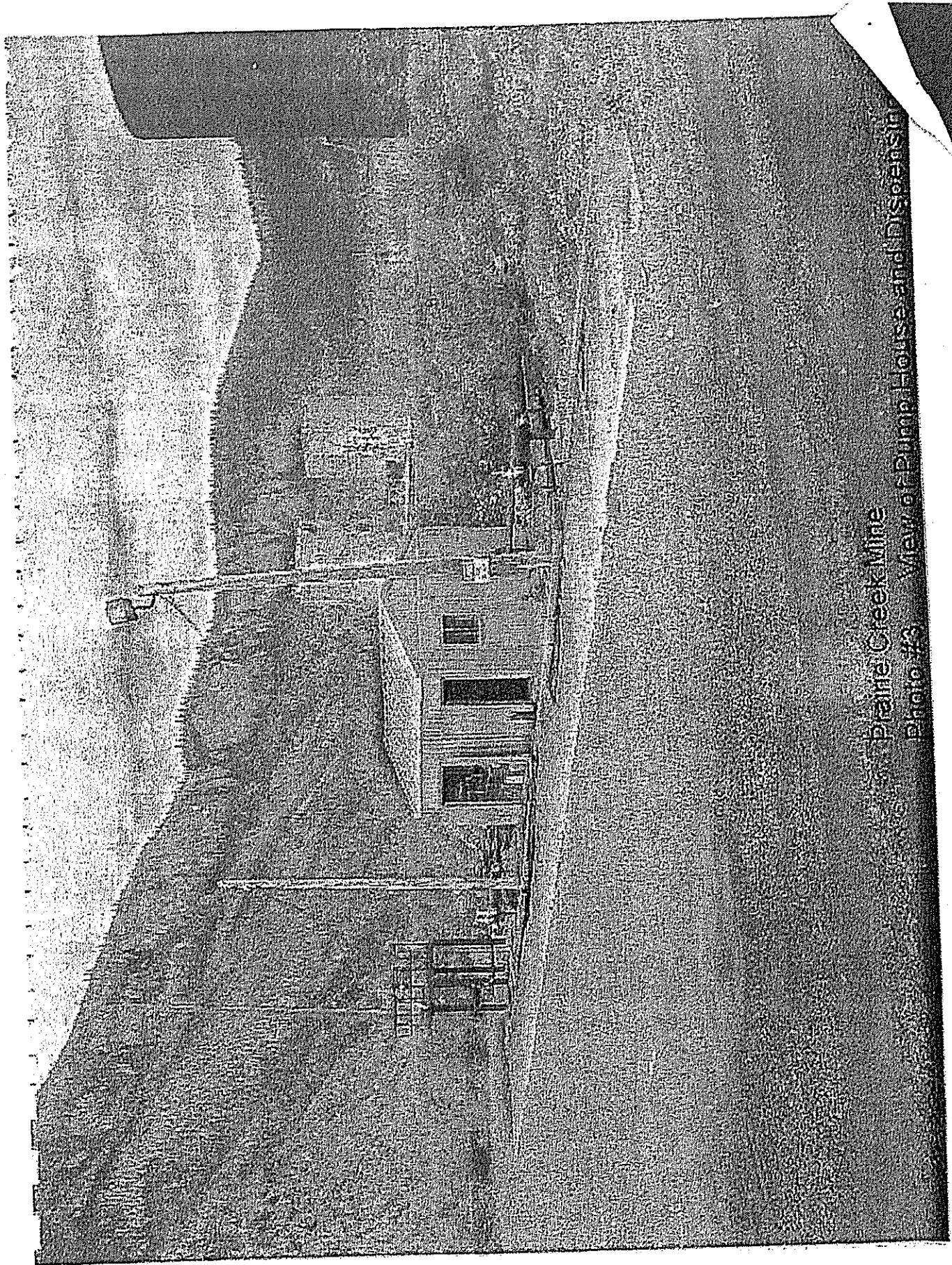
- Photo #1| General Bulk Fuel Storage Compound Location
- Photo #2 Diesel Fuel Compound  
Showing Impermeability of Clay Liner
- Photo #3 View of Pump House and Dispensing Area
- Photo #4 North Side of Diesel fuel Compound  
Showing Diesel Fuel Tanks
- Photo #5| Diesel Fuel Piping in the Pump House
- Photo #6| Gasoline Piping in the Pump House
- Photo #7| Loading Rack Area



Pratt Creek Mine  
Photo #1 - General Pit - Fuel Storage Corridor Location

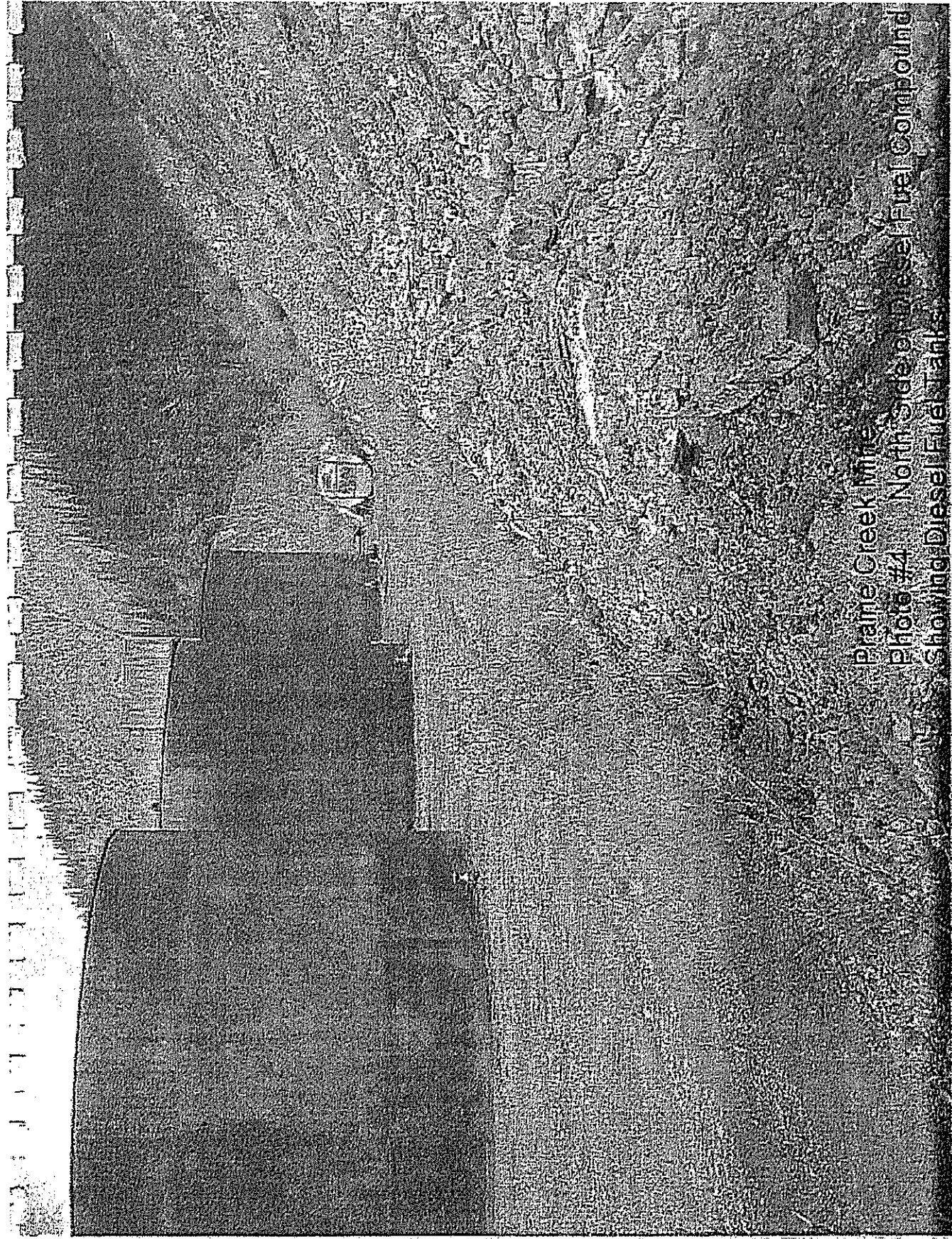


Prairie Creek Mine  
Photo #2. Diesel Fuel Compound  
Showing Impermeability of Clay Liner

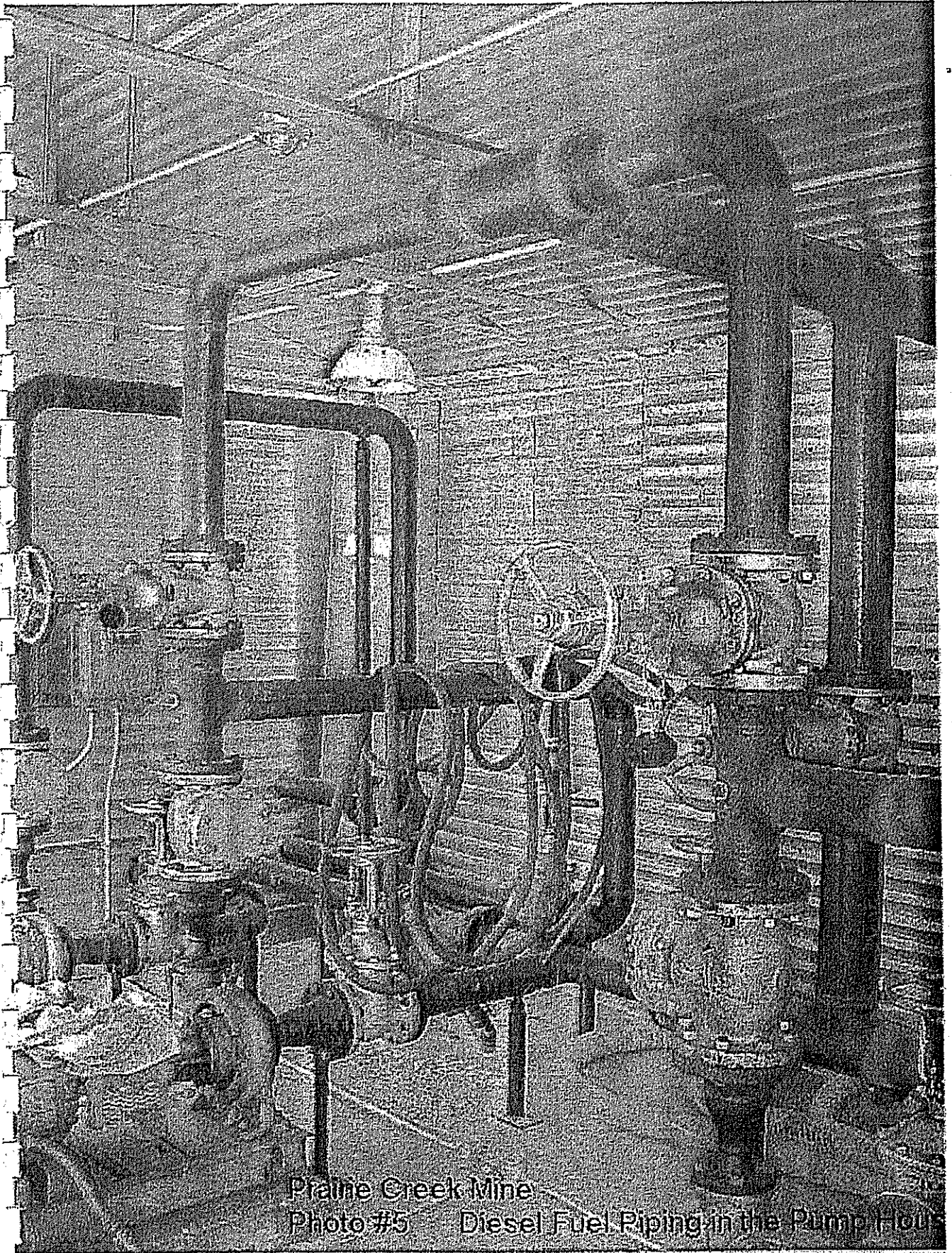


Prairie Creek Mine  
Photo #3 View of Pump House and Dispensing

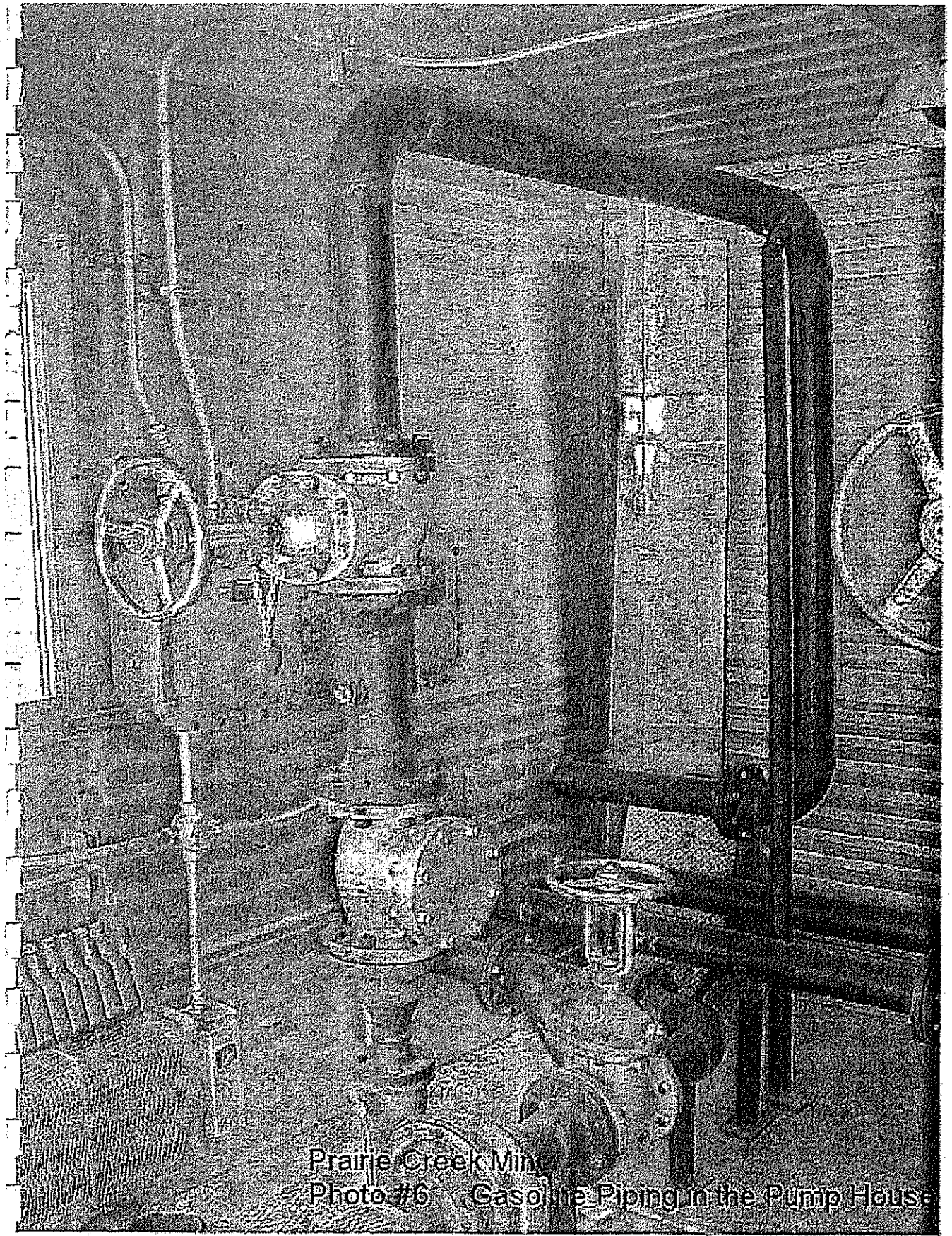




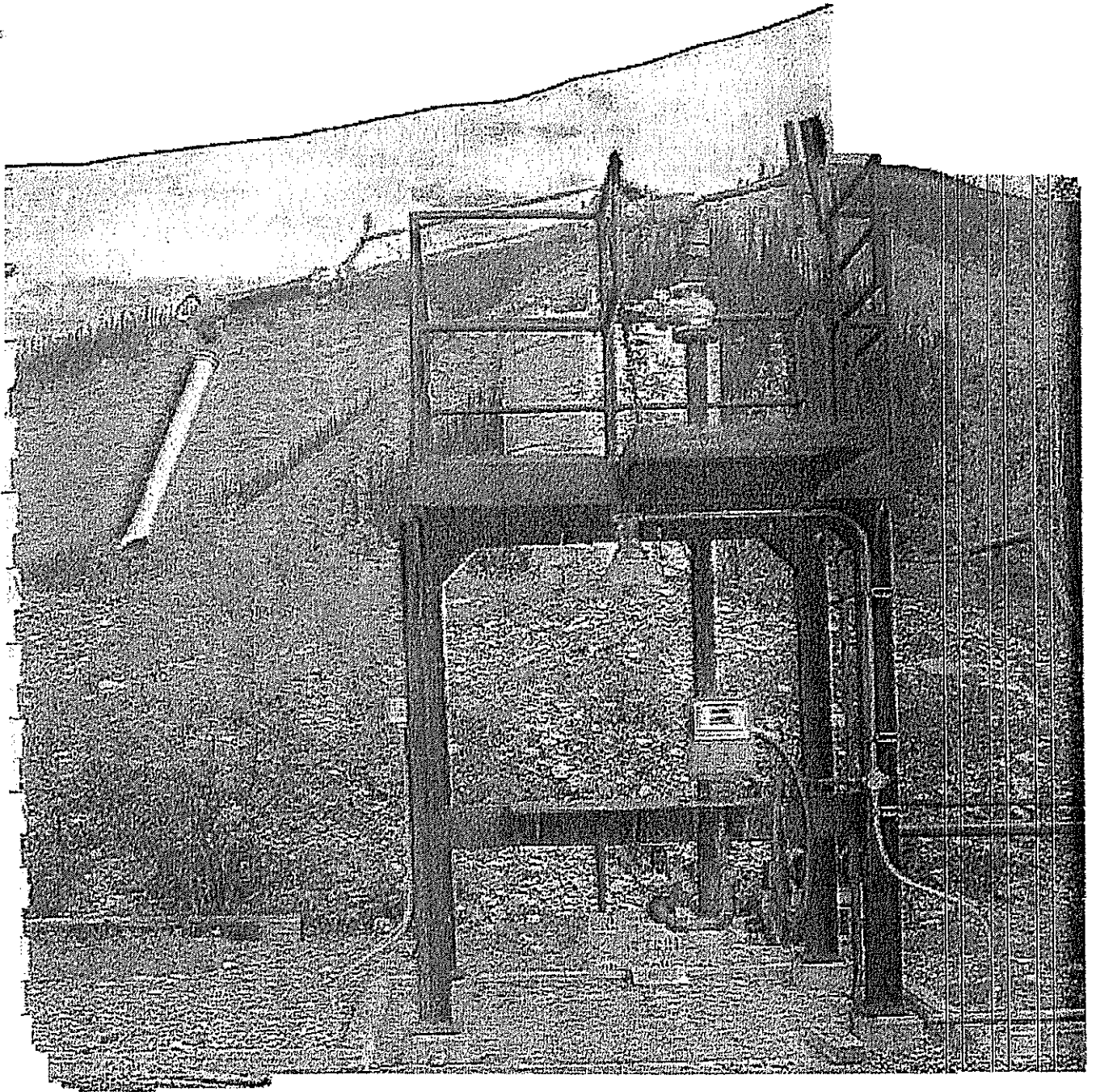
Prairie Creek Mine  
Photo #74 North Side of Diesel Fuel Compound  
Showing Diesel Fuel Tanks



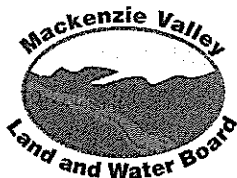
Prairie Creek Mine  
Photo #5 Diesel Fuel Piping in the Pump House



Prairie Creek Mine  
Photo #6 Gasoline Piping in the Pump House



Prairie Creek Mine  
Photo #7 Loading Rack Area



**Mackenzie Valley Land and Water Board**

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April 29, 2005

File: MV2001L2-0003

Mr. David Harpley, Environmental Coordinator  
Canadian Zinc Corporation  
Suite 1202-700 West Pender Street  
VANCOUVER, BC V6C 1G8

Fax: (604) 594-3855

Dear Mr. Harpley:

**Board Approval: Geotechnical Site Reconnaissance Report, Prairie Creek Mine**

The Mackenzie Valley Land and Water Board (the Board) has reviewed the aforementioned report submitted to satisfy the requirements Part D, Items 1 and 9 of Water Licence MV2001L2-0003 (the Licence). The Board hereby approves the Geotechnical Site Reconnaissance Report dated August 6, 2004. As a condition of this approval, the Canadian Zinc Corporation (CZN) must implement all recommendations for on-going operations made by EBA Engineering Consultants Inc. in the aforementioned report:

- Clear emergent vegetation from the top and inside slope of the containment berms surrounding the Tank Farm Facility.
- Pump runoff water from inside the bermed area promptly in the spring and in accordance with Part D, Items 10 and 11 in the Licence.
- Develop a plan to remove and dispose of waste oil products currently stored with the Tank Farm Facility in accordance with Conditions 26 and 27 in Land Use Permit MV2001C0023.
- Conduct annual monitoring of the Flood Protection Work in accordance with Part B, Item 10 of the Licence.

The Board thanks CZN for their commitment to have the 1.7 million litre fuel tanks located within the Tank Farm Facility inspected during the summer of 2005 by an appropriately qualified engineer. The report detailing the results of the inspection shall be submitted to the Board for approval no later than 60 days following the inspection. If CZN does not fulfill this commitment, the Board will proceed to amend the Licence to require the tank inspection done.

If you have any questions, contact Sarah Baines, Regulatory Officer, at (867) 766-7457 or email [sbaines@mvlwb.com](mailto:sbaines@mvlwb.com).

Sincerely,

A handwritten signature in black ink, appearing to read "T. Burlingame".

Todd Burlingame  
Chair

Copied to: Alan Taylor, Canadian Zinc Corporation (Fax: 604-688-2043)  
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FILE NUMBER: MV2001L2-0003

Date: Tuesday, May 03, 2005

To: Mr. David Harpley, Environmental Coordinator

Organization: Canadian Zinc Corporation

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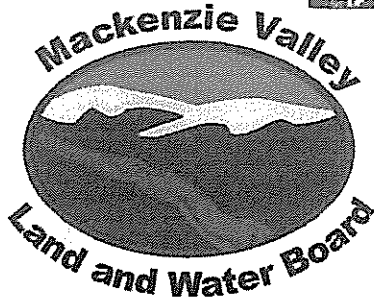
Board Approval Geotechnical Site Reconnaissance Report  
 Prairie Creek Mine

- Enclosures
- As requested
- For your information
- For your comment
- For your approval

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**Staff Report**

<b>Company:</b> Canadian Zinc Corporation (CZN)	
<b>Location:</b> Prairie Creek Mine	<b>Application:</b> MV2001L2-0003
<b>Date Prepared:</b> April 4, 2005	<b>Meeting Date:</b> April 12, 2005
<b>Subject:</b> Plan approval – Prairie Creek Geotechnical Site Reconnaissance Report (Flood Protection Work and Tank Farm Facility)	

**1. Purpose/Report Summary**

The purpose of this staff report is to present to the Board for review and approval the Prairie Creek Geotechnical Site Reconnaissance Report (Geotechnical Report) submitted by Canadian Zinc Corporation (CZN).

This Geotechnical Report is made up of two sections: the geotechnical evaluation of the Flood Protection Work (required under Part D, Item 1) and the geotechnical evaluation of the Tank Farm Facility (required under Part D, Item 9).

During the review of the Geotechnical Report, the Board will have to decide on the interpretation of the word "certify" and if the Geotechnical Report satisfies the requirement for a "certification" of the integrity of the berm/dyke work and the capacity of the bermed area surrounding the Tank Farm by a Geotechnical Engineer.

The review of the Flood Protection Work section of the Geotechnical Report specifically will require a decision on the appropriate standard for evaluating the Flood Protection Work (i.e. the flood magnitude and freeboard).

## 2. Background

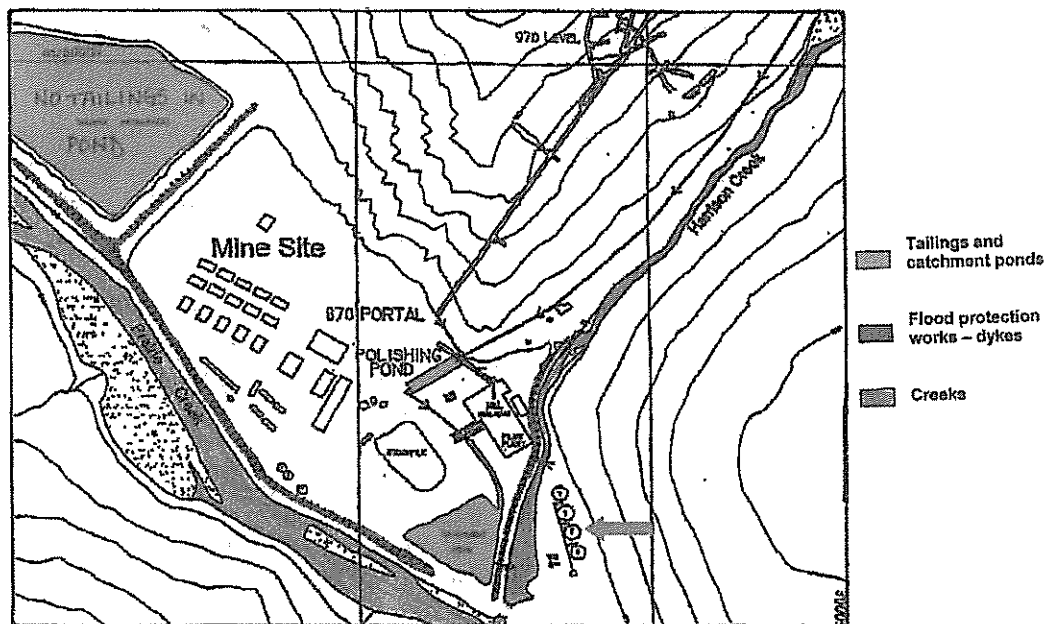
### Flood Protection Work

The geotechnical evaluation of the Flood Protection Work at the site is required under the second half of Part D, Item 1:

*The Licensee shall submit to the Board for approval within six (6) months of the issuance of the licence updated Probable Maximum Flood Calculations for flood elevations using at least the data available from 1975 to 1990, including data from the weather station at the Virginia Falls hydrometric gauge. In addition to these calculations a description of the adequacy of the current Flood Protection Work shall be submitted with recommendations from a qualified Geotechnical Engineer for any improvements or modifications to be implemented upon approval by the Board.*

The geotechnical evaluation of the Flood Protection Work at the Prairie Creek Mine site as shown in green in Figure 1 below was conducted by EBA Engineering Consultants Inc. (EBA). The standard that EBA considered most appropriate for assessing the Flood Protection Work was the 200 year flood estimate presented in the *Probable Maximum Flood Profile Report (PMFPR)* that the Board approved at the March 23, 2005, Board meeting.

**Figure 1: Flood Protection Works at the Prairie Creek Mine Site**



### Tank Farm Facility

The Tank Farm Facility consists of 4 – 1.7 million litre tanks surrounded by a berm that is at least 0.76 metres high. The berms consist of compacted silt, sand and gravel and, according to the 1980 comprehensive environmental evaluation completed by Ker, Priestman and Associates Ltd. (Ker Priestman Report), the entire facility is underlain by in-situ glacial clays. The location of the



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Tank Farm Facility in relation to the rest of the infrastructure at the Prairie Creek Mine is indicated by a red arrow on Figure 1 above.

The requirement under Part D, Item 9 in the licence for a geotechnical evaluation of the Tank Farm Facility stems from a recommendation in the MVEIRB *Report of Environmental Assessment* approved by the Minister of INAC. Part D, Item 9 reads as follows:

*The Licensee shall submit to the Board for approval a geotechnical assessment carried out by a qualified Geotechnical Engineer certifying the integrity and capacity of the Tank Farm Facility and associated containment structures before it may be used in conjunction with the licensed undertakings. This assessment shall certify that the capacity of the containment structures associated with the Tank Farm Facility is 10% greater than the volume of the largest container placed herein.*

### **Chronology**

**March 19, 2004:** Receipt of the Probable Maximum Flood Profile Report (PMFPR) with estimates for the 100 year, 200 year, 500 year and 10,000 year flood. The PMFPR was produced by HAY and Company Consultants Inc. (HAYCO).

**March 22, 2004:** PMFPR distributed for review. Comment deadline was May 7, 2004.

**May 4, 2004:** Comment deadline for Water Resources Division, INAC was extended to May 21, 2004.

**June 8, 2004:** Letter requesting more information sent to CZN. Response deadline was August 13, 2004.

**July 22, 2004:** Receipt of the Probable Maximum Flood Profile Report Follow-up (PMFPR Follow-up) produced by HAYCO. This was submitted by CZN in response to the June 8, 2004, letter from Board staff.

**August 4, 2004:** PMFPR Follow-up distributed for review. Comment deadline was August 31, 2004.

**August 6, 2004:** Receipt of the Prairie Creek Geotechnical Site Reconnaissance Report (Geotechnical Report). Within the public registry documents, this report is also known as the PMFPR Follow-up Addendum Report with Tank Farm Assessment.

**August 16, 2004:** Distribution of the Geotechnical Report. Comment deadline for the Flood Protection Work section was August 31, 2004, and the comment deadline for Tank Farm Facility section was September 10, 2004.

**August 20, 2004:** Parks Canada indicates to Board staff that they have a copy of the Ker Priestman Report which contains details on and drawings of the Flood Protection Work and Tank Farm Facility at Prairie Creek. Board staff requests a copy.

**September 27, 2004:** Letter distributed to CZN and the reviewers stating that the review process of the PMFPR will be stalled until the Ker Priestman Report was received.

**October 5, 2004:** Comment deadline for Water Resources, INAC on the Geotechnical Report extended to October 22, 2004.

**October 6, 2004:** INAC Inspector confirms that he finds the methods for storing hazardous materials within the bermed area surrounding the Tank Farm acceptable.

**October 8, 2004:** Letter requesting a response to review comments on the Geotechnical Report sent to CZN. Response deadline was November 19, 2004.

**October 15, 2004:** Receipt of the Ker Priestman Report from Parks Canada.

**November 9, 2004:** Board staff requests clarification from Environment Canada on calculating flood levels for Prairie Creek. Response from Environment Canada received same day.

**November 22, 2004:** Receipt of the response made by CZN to reviewer comments on the Geotechnical Report. The response consisted of a letter-report from EBA and a letter from CZN.

**March 9, 2005 and March 23, 2005:** PMFPR and PMFPR Follow-up presented to the Board for review and approval. The Geotechnical Report was not submitted for approval at these Board meetings because the geotechnical evaluation of the Flood Protection Work was dependent on the Board approval of the calculations presented in the PMFPR.

### 3. Discussion

The central concern relating to both sections of the Geotechnical Report is whether or not the letter-reports submitted by EBA represent "certifications" of the integrity of the Flood Protection Work and berms on site and the capacity of the bermed area surrounding the Tank Farm Facility. This concern was raised by Parks Canada, CPAWS-NWT, DCFN and Water Resources Division of INAC.

In response to this concern, EBA resubmitted the Geotechnical Report with the professional stamp of Don Hayley, the professional engineer responsible for the geotechnical evaluation of the Flood Protection Work and Tank Farm Facility. Don Hayley also submitted a letter dated November 12, 2004, explaining that the term "certify" is actually not used in the practice of engineering because:

*"...it could imply that the Engineer provides an all-encompassing guarantee or warranty. This could be interpreted to mean that the Engineer is held liable for any adverse consequences suffered by anyone who relies on the structure. This is not the case and no experienced Professional Engineer can provide such a warranty. That would extend the liability of Professional Engineers far beyond what is required of a professional under common law. The law defines the standard of care that Professional Engineers must exercise when conducting our professional practice. Professional Engineers accept responsibility for their professional opinions, their*

*designs and their participation in monitoring construction activities related to those designs.*

*Absolute certifications are also uninsurable. They are assumptions of liability under contract that are excluded from coverage under every policy of professional liability insurance underwritten in Canada. That makes it difficult to understand how the public interest is served by a requirement that deprives Professional Engineers of the financial capacity under their insurance to respond in the event of a failure."*

Another facet of the meaning of "certify" is the project scope for which the Flood Protection Work and Tank Farm Facility were assessed. In this particular case, EBA conducted the geotechnical assessments to a level that, in their professional opinion, was appropriate for the scope of the water licence, that is, for advanced exploration activities. EBA also took into consideration the fact that there are no tailings in the Tailings Pond and that under the current water licence the Tailings Pond is not to be used. EBA was careful to point out that the conclusions in their Geotechnical Report may need to be re-examined if the scope of the project changes or the use of the Tailings Pond changes. The Board will have to decide if they find this approach used by EBA appropriate or if the geotechnical assessment should be conducted according to a different scope.

The following is a discussion of points relating specifically to the individual sections in the Geotechnical Report.

### **Flood Protection Work**

- The condition requiring a geotechnical assessment of the Flood Protection Works does not specify the largest flood magnitude that the Flood Protection Works should withstand (i.e. the standard). EBA recommended that the 200-year flood be used as the standard because:
  - ♦ the scope of the licenced undertaking is limited to exploration activities only;
  - ♦ there are no tailings in the Tailings Pond (the licence stipulates that the Tailings Pond cannot be used at all in conjunction with the licenced undertakings); and
  - ♦ the 200 year flood is in line with the standards used in other provinces (Alberta uses the 100 year flood and BC uses the 200 year flood + freeboard of up to 0.6 metres) as the standard for river Flood Protection Works).

EBA concluded that the Flood Protection Works meet the 200 year flood standard with a 0.5 metre freeboard. DCFN recommends that the Flood Protection Works withstand the worst case scenario while the Water Resources Division stated that using the probable maximum flood may be overly conservative. Water Resources did not specify what they consider to

be an appropriate standard but they recommended that if the 200 year flood is used, then a freeboard greater than 0.5 metres should be required.

- EBA noted that there is one short section on the dyke adjacent to the Tailings Pond where the surface riprap seems thinner on the upper slope and that there is a short section of dyke downstream from the Tailings Pond where there is no riprap. EBA did not consider these observations to be significant because there are no tailings in the Tailings Pond and because the area without riprap does not experience high velocity water flows. Overall, EBA reports that the "geotechnical condition of the structures at the Prairie Creek Site are satisfactory for the exploration activities included under Water Licence MV2001L2-0003".

EBA was also careful to point out that if the use of the Tailings Pond changes at some point in the future, the Flood Protection Works will have to be reassessed. If CZN proposes to use the Tailings Pond in the future, the licence will have to be amended and as part of the amendment, the Board can require CZN to have the geotechnical assessment of the Flood Protection Works redone.

- Parks Canada has concerns about the cyanide and PCB stores located downstream from the main camp. Board staff discussed the storage of these materials with the Inspector and he is satisfied with how these chemicals are stored. The chemicals are stored up on the hillside well above Prairie Creek and Harrison Creek (at elevations much greater than the dyke work on site). Photographs of the storage area are attached to this staff report.

### **Tank Farm Facility**

- The background material relating to the recommendation made in the MVEIRB Report of Environmental Assessment for "an engineering certification as to the suitability of the Tank Farm Facility" clearly indicates that the tanks themselves need to be inspected by a qualified engineer registered to practice in the NWT. However, the condition in the water licence requiring the engineering assessment of the Tank Farm Facility specifies that the assessment is to be done by a Geotechnical Engineer. As EBA pointed out, a Geotechnical Engineer cannot inspect the tanks themselves, only the earthworks surrounding the tanks (as has been done by EBA). In other words, the licence does not fully reflect the requirements of the recommendation made in the *Report of Environmental Assessment* because the licence does not require an inspection of the tanks themselves

Board staff has approached CZN requesting that CZN have the tanks inspected by an appropriate Engineer registered in the NWT. CZN has confirmed in writing via an email dated April 5, 2005, that they will voluntarily have the tanks inspected.

- All reviewers who submitted comments on the Tank Farm Facility section in the Geotechnical Report questioned why EBA did not conduct permeability tests on the sediments making up the berm. EBA reported that the "site observations made under a sustained head of 70 mm have more relevance than small scale permeability testing carried out on site or in the laboratory".
- The reviewers were also concerned that the berms are not impermeable because they are made up of silt, sand and gravel. EBA responded that compacted silty sands with gravels can achieve a permeability of  $10^{-6}$  cm/sec if properly placed and compacted.
- The licence also requires that the bermed enclosure surrounding the Tank Farm have a volume that is 10% greater than the largest fuel container placed inside the berm. EBA has confirmed that the bermed enclosure can contain 1870 m<sup>3</sup> of fuel not including the footprint of the fuel tanks, which is 10% greater than 1700 m<sup>3</sup>, the volume of the largest tank.

Overall, EBA has concluded in the Geotechnical Report stamped by a professional engineer that the "bermed enclosure is in excellent condition for service in support of the exploration activities planned under the water licence."

#### 4. Comments

In the Geotechnical Report, EBA made recommendations for on going operations (*the red italics are comments made by Board staff*):

##### **Flood Protection Works**

- Annual monitoring of the dykes should be carried out. *Part B, Item 10 of the licence requires that all Flood Protection Work, including riprap be inspected annually by a geotechnical engineer.*

##### **Tank Farm Facility**

- Clear emergent vegetation from the top and inside slope of the containment dykes. *Vegetation has already been cleared from the berms and CZN has committed to do this regularly.*
- Pump runoff water from the facility promptly in the spring. *According to the Inspector, CZN already does this following sampling for the parameters specified in the licence (Metals, TSS and TPH if water is to be decanted to a creek and TPH for water decanted to any location, including the ground surface).*
- Develop a plan to remove and dispose of waste oil products currently stored within the facility. *The LUP associated with this licence (MV2001C0023) requires that CZN incinerate or remove from site all combustible waste petroleum products (Condition 26) and that CZN dispose of all other toxic substances in a manner approved by the Board (Condition 27). A plan to*

*remove and dispose of waste oil products in a high temperature burner is currently being considered by CZN.*

## 5. Review Comments

### **Flood Protection Works**

- Parks Canada, CPAWS-NWT, DCFN and Water Resources Division of INAC submitted comments on the Flood Protection Works
- The above-mentioned reviewers did not consider the Geotechnical Report to be a "certification" of the adequacy of the Flood Protection Work. See the Discussion section of this Staff Report for further details.
- DCFN states that Board must adopt the Precautionary Principle with regards to all Flood Protection Work on site and that the Flood Protection Work must be designed to withstand the worst case scenario.
- Water Resources Division states that requiring the Flood Protection Work to withstand the probable maximum flood may be overly conservative if regular inspections of the dykes take place and sufficient resources are available on site to handle emergencies. If the 200 year flood is adopted as the standard, the Water Resources Division recommends that a freeboard greater than 0.5 metres be required.
- All reviewers support the repair of the section with thinner riprap adjacent to the Tailings Pond and the addition of riprap to the section downstream of the Tailings Pond.

### **Tank Farm Facility**

- Parks Canada, CPAWS-NWT, DCFN and Water Resources Division of INAC submitted comments on the Tank Farm Facility
- All above mentioned reviewers state that the tanks themselves must be inspected. Please see the Discussion section of this Staff Report for further details.
- All above mentioned reviewers questioned why permeability tests on the berm materials were not conducted, especially since the berm materials consist of silts, sands and gravels. Please see the Discussion section of this Staff Report for further details.

Please see the attached Comment Summary Tables for full list of comments made by reviewers.

## 6. Security

Not applicable.

## 7. Conclusion

The water licence requires that a Geotechnical Engineer "certify" the integrity and capacity of the Flood Protection Work and Tank Farm Facility. Don Hayley, a Professional Engineer registered in the NWT, has provided reasoning as to why interpreting the word "certify" to mean an all-encompassing guarantee or warranty is not appropriate when referring to "certification" by a Professional Engineer. Mr. Hayley has accepted professional responsibility for his statements and conclusions made in the Geotechnical Report and associated letters by both signing and stamping the Report.

### Flood Protection Work

EBA considers the 200 year flood + 0.5 metre freeboard to be an appropriate standard for evaluating the adequacy of the Flood Protection Work on site because "there are no significant environmental consequences should a portion of the dyke erode (i.e. there are no tailings in the Tailings Pond). This is a reasonable conclusion, especially since other provinces use the 200 year or smaller flood as the standard. BC requires a freeboard allowance of up to 0.6 metres; therefore, the 0.5 metre freeboard recommended by EBA is within the range required in other jurisdictions.

The reviewers provided vague and somewhat opposing comments on what they consider to be an appropriate standard. DCFN recommends that the Flood Protection Work withstand the worst case scenario whereas Water Resources Division states that the PMF may be too conservative. Water Resources Division does not recommend an actual standard but rather that a more conservative freeboard than 0.5 metres should be required if the 200 year flood is adopted as the standard.

The reviewers do agree that the thin riprap on the dyke adjacent to the Tailings Pond should be repaired and riprap should be added to the section of the dyke downstream from the Tailings Pond that is not reinforced with riprap. EBA does not consider this work necessary because there are no tailings in the Tailings Pond and because the section without riprap does not experience high velocity flows (and so is not as susceptible to erosion).

### Tank Farm Facility

EBA used did not observe any seepage through or sloughing of the berms surrounding the Tank Farm despite the retention of water inside the berm with a head greater than 70 mm. EBA used these observations to conclude that the soil underlying the Tank Farm and the berms surrounding the Tank Farm are sufficiently impervious to contain a fuel spill if one were to occur. The reviewers were sceptical of this conclusion because no permeability tests on the berm and

underlying sediments were conducted. EBA reported that the observations made on site are more relevant than small scale permeability tests.

## **8. Recommendations**

Specifically, I make the following recommendations:

- The comments made by EBA regarding the meaning of "certify" and its application in the engineering field should be accepted: "certify" cannot be interpreted to mean an all-encompassing guarantee.
- The 200 year flood + 0.5 metre standard proposed by EBA should be used as the standard for the Flood Protection Work.
- If CZN ever proposes to use the Tailings Pond, the geotechnical evaluation of the Flood Protection Work should be redone.
- The capacity requirement for the bermed enclosure around the Tank Farm should be considered satisfied because the bermed enclosure has a volume that is 10% greater than the largest container inside the berm.
- The conclusion that the bermed enclosure around the Tank Farm is sufficiently imperviousness to contain a fuel spill should be accepted.
- CZN should be required to implement all recommendations made by EBA in the Geotechnical Report.

Overall, the Geotechnical Report should be approved by the Board and the requirements of Part D, Items 1 and 9 considered fully satisfied. If CZN does not fulfill their commitment to have the tanks in the Tank Farm Facility inspected during the 2005 spring/summer season and the results of that inspection submitted to the Board, the Board should proceed to amend Part D, Item 9 to require the tank inspection done.

## **9. Attachments**

- Comment Summary Table – Geotechnical Evaluation of the Flood Protection Works
- Comment Summary Table – Geotechnical Evaluation of the Tank Farm Facility
- Prairie Creek Mine Probable Maximum Flood Profile Report
- Probable Maximum Flood Profile Report Follow-up
- Prairie Creek Geotechnical Site Reconnaissance Report
- November 22, 2004 response made by CZN to reviewer comments on the Geotechnical Report
- Figure 10 from the Ker Priestman Report: Fuel Tank Farm Spill Control Works



- Figure 18 from the Ker Priestman Report: Cross sections showing dyke elevations
- 3 photographs of the Tank Farm Facility
- 3 photographs of the storage area for cyanide and PCB (referred to in the Comment Summary Table – Flood Protection Works)

**Respectfully submitted,**



Sarah Baines  
**Regulatory Officer**

**Comment Summary Table**  
**Geotechnical Evaluation of the Flood Protection Work at the Prairie Creek Mine Site**

Reviewing Agency, Date Comments Received	Comments	Mitigation Measures
<p>Parks Canada, August 12, 2004</p>	<p>1. One important factor in the Ker Priestman Report that must be emphasized is that the freeboard available along the dyke was based on adding height to the dyke at the time the report was written. It is essential that the dyke crest elevation be confirmed to ensure that the dyke will in fact provide the necessary elevation to provide flood protection.</p> <p>2. Comments provided by DFO and DIAND following a site visit indicated visible erosion of the berm for the Tailings Pond by the river. This needs to be considered, since the amount of freeboard available would be further reduced at this point and the integrity of the Tailings Pond may be seriously compromised by this erosion, particularly in flood conditions.</p>	<p>1. The Ker Priestman Report was completed in 1980 and is a comprehensive environmental evaluation of the Prairie Creek Mine. It includes details on the flood protection works at the site.</p> <p>Board staff cross referenced the dyke crest elevations (DCE) used in the HAYCO Report with those presented in the Ker Priestman Report. The HAYCO DCE are equivalent to the DCE for the dykes existing at the time the Ker Priestman Report was written. Therefore, if the DCE were raised after 1980, dyke freeboard is greater than that that presented in the HAYCO Report.</p> <p>2. EBA Engineering Consultants Ltd. (EBA) recognized that "there is one short section near the bend where the surface riprap seems thinner on the upper slope, suggesting some localized movement." EBA concluded that the "geotechnical condition of the earthwork structures at the Prairie Creek Site are considered satisfactory for the exploration activities included under Water Licence MV2001L2-0003" (it must be remembered that there are no tailings in the Tailings Pond and the dykes were constructed over 23 years ago).</p> <p>EBA recommends that annual monitoring</p>

		<p>of the dykes be conducted and CZN has committed to doing this. Part B, item 10 requires that all flood protection work, including the riprap be inspected by a geotechnical engineer annually.</p> <p>The Board has the option of requiring CZN to repair the riprap.</p>
<p>Canadian Parks and Wilderness Society – NWT Chapter (CPAW-NWT), September 10, 2004</p>	<ol style="list-style-type: none"> <li>1. It is not certain why an engineering stamp was not provided on the report submitted. As such, CPAWS-NWT is requesting that the document be reviewed by an independent certified engineer to confirm the approach and the conclusions.</li> <li>2. From a non-engineer's perspective, it would have been useful to have plain language definitions of the parameters used in the HEC-RAS program and overall site diagrams of the various 200-year water level scenarios.</li> </ol>	<ol style="list-style-type: none"> <li>1. EBA has resubmitted the report stamped by Don Hayley, P.Eng. See the Discussion section of the Staff Report for further details.</li> <li>2. Noted. According to HAYCO and EBA, the dykes are of sufficient elevation to contain the 200 year flood. As such, the creek boundary during the 200 year flood would be that of the dyke.</li> </ol>
<p>Deh Cho First Nations (DCFN), September 10, 2004</p>	<ol style="list-style-type: none"> <li>1. Given the location of the Prairie Creek Mine site within an active floodplain and an area of seismic activity, we must stress to the Board that the highest possible standards should apply to ensure that the flood protection structures are structurally sound along their entire length, and designed to deal with the worst case scenario. Given the continued level of uncertainty regarding the flood history at the mine site, we can only conclude that the Board must adopt the Precautionary Principle with regards to all earthworks structures, floodworks, and associated infrastructure at the site.</li> <li>2. As the environmental integrity of the Nahanni Watershed is of the utmost importance to the DCFN, we are very concerned with the following statement contained in the EBA section of the August 5, 2004 Report: "Considering that there are no significant environmental consequences should a portion of the dyke erode, it is a realistic approach to risk management to conclude that the dyke and riprap</li> </ol>	<ol style="list-style-type: none"> <li>1. Presented to the Board. According to HAYCO and EBA, the current flood protection work at the site can withstand the 200 year flood with a minimum of 0.5 metre freeboard. The Board has the option of requiring CZN to raise the DCE of the dykes to the elevation of any flood magnitude the Board deems appropriate.</li> <li>2. Presented to the Board. Under Part D, Item 7 of the licence, CZN is required to submit a geotechnical assessment of the Polishing Pond to ensure that its design capacity and integrity are sufficient. This geotechnical assessment will be submitted to the Board after the Polishing Pond is constructed.</li> </ol>

<p>are fully serviceable in their current condition for current exploration operations."</p> <p>Firstly, the DCFN remind the Board that the MVEIRB concluded that "because of the proximity of the Polishing Pond to Harrison Creek and Prairie Creek, its stability is an important issue. A failure at this site would in the MVEIRB's opinion likely result in a significant adverse impact on the environment." The DCFN note that a failure involving the Polishing Pond includes the potential for the Polishing Pond to exceed its capacity. This possibility has also been acknowledged by CZN.</p> <p>Secondly, the dyke and riprap are designed to prevent flooding of the mine site from high water flows and flood events, yet are also designed to prevent potentially contaminated mine site surface water from entering nearby waterways, due to unforeseen failure of mine site equipment and infrastructure. Therefore, the structural integrity of the dyke and riprap are of the utmost importance along its entire length. The DCFN recommend that in the absence of additional data that a precautionary approach to risk management would be more appropriate in these circumstances, and that CZN be required to undertake measures to ensure that the dyke and riprap can withstand the more conservative calculations provided in the HAYCO report dated March 10, 2004.</p>	<p>According to HAYCO and EBA, the current flood protection work at the site can withstand the 200 year flood with a minimum of 0.5 metre freeboard. The Board has the option of requiring CZN to raise the DCE of the dykes to the elevation of any flood magnitude the Board deems appropriate.</p> <p>Part B, Item 10 requires that all flood protection work, including the riprap be inspected by a geotechnical engineer annually.</p>
<p>3. Part D, Item 1 specifies that "a description of the adequacy of the current flood protection work shall be submitted with recommendations from a qualified Geotechnical Engineer." With all due respect to the two authors of the report, DCFN request that the Board clarify that Adrian Chantler of HAYCO and Don Hayley of EBA are professional engineers registered with the Association of Professional Engineers of the Northwest Territories and whose principal field of specialization is the design and construction of earthworks in a permafrost</p>	<p>3. Don Hayley, P. Eng., FEIC, has submitted a letter with his signature and professional stamp that states he has been licensed to practice by NAPEGG for 20 years and that EBA has had a permit to practice from NAPEGG since 1979. He also states that his expertise is in earthworks design and construction.</p>

<p>Parks Canada, September 10, 2004</p>	<p>environment.</p> <p>1. The serviceability of the dyke and riprap is based solely on site observations and the fact that no remediation work has been done in the past 23 years. This information is certainly not indicative of the integrity and capacity of the Tailings Pond. The author then goes on to state areas where remediation work should be conducted (i.e. at a bend where the riprap is thinner and downstream from the tailings embankment where the riprap has never been completed). The author also discusses the movement of material on the inside slope of the tailings embankment. How do these deficiencies affect the integrity and capacity of the pond? The opinions presented do not meet the requirements for a geotechnical assessment and certification for integrity and capacity by a qualified Geotechnical engineer as required by Part D, Item 7 of the water licence.</p> <p>2. Contrary to the statement by the author that his conclusion will need to be re-examined when a plan for future use of the pond is presented to the MVLWB, the water licence clearly states in Part D, Item 7 that a geotechnical assessment of the Polishing Pond and related water treatment facilities</p>
	<p>1. The water licence does not require the integrity and capacity of the Tailings Pond to be certified because the licence stipulates that the Tailings Pond is not to be used in conjunction with the licensed undertakings.</p> <p>The HAYCO and EBA Reports covered by this Staff Report are not meant to satisfy Part D, Item 7; the report required under Part D, Item 7 is to be submitted to the Board after the Polishing Pond is constructed.</p> <p>The author does not state that remediation work should be conducted but rather that the "geotechnical condition of the earthwork structures at the Prairie Creek Site are considered satisfactory for the exploration activities included under Water Licence MV2001L2-0003" and that if the use of the Tailings Pond changes in the future, the flood protections works should be reassessed.</p> <p>EBA recommends that annual monitoring of the dykes be conducted and CZN has committed to doing this. Part B, Item 10 requires that all flood protection work, including the riprap be inspected by a geotechnical engineer annually.</p> <p>The Board has the option of requiring CZN to repair the riprap.</p> <p>2. The Tailings Pond and the Polishing Pond are two separate structures and must not be confused. The statement made by EBA about the report conclusions needing to be re-examined if the future use of the pond changes refers to the Tailings Pond, not</p>

	<p>is required before they may be used in conjunction with the licensed undertakings and should be undertaken at this time.</p>	<p>the Polishing Pond. According to the licence, the Tailings Pond is not to be used at all in conjunction with the licensed undertakings.</p> <p>Parks Canada is correct in stating that under Part D, Item 7 of the licence, CZN is required to submit a geotechnical assessment of the Polishing Pond. However, the EBA Report addressed by this Staff Report was submitted to satisfy different conditions, Part D, items 1 and 9. The geotechnical assessment of the Polishing Pond required under Part D, item 7 is to be submitted to the Board for approval after the construction of the Polishing Pond is complete.</p>
<p>Parks Canada, September 21, 2004</p>	<p>1. The discussion in the flood profile report was limited to impacts to the Tailings Pond. Another area of serious concern is the cyanide and PCB storage area, which is located in a flood plain on a gravel surface in an area, which does not appear to be bermed. Any accidental releases of chemicals, either as a result of flooding or from inadequate storage practices, could result in significant impacts to the ecological integrity of Nahanni National park, which is located downstream of the chemical storage area. The current storage area poses an unacceptable risk and should be addressed in the shortest delay possible.</p>	<p>1. Under Part B, item 9 of the licence, CZN must store these substances in a manner that protects them from the 'elements', to the satisfaction of the Inspector. The Inspector has provided written notice that these chemicals are stored in an acceptable manner.</p> <p>The chemicals are stored high up on the hillside at an elevation above Prairie Creek that is greater than the crest elevations of the on site dykes. Photographs of the chemical stores are attached to this Staff Report.</p>
<p>Water Resources Division, INAC, October 21, 2004</p>	<p>1. In the absence of a Probable Maximum Flood calculation, the "extreme flood with a return period in the order of 10,000 years" calculation was considered. The outcome of the two approaches resulted in a flood water surface profile below the crest of the dyke in all but one of the cross sections, where the crest elevation was about 0.3 metres too low. If a freeboard limit is considered, the water</p>	<p>1. Presented to the Board, EBA reported that to be in line with the standards used in other provinces, the 200 year flood be used as the standard rather than the 10,000 year flood or probable maximum flood. EBA reports that the flood protection work at the site can withstand the 200 year flood with a 0.5 metre</p>

	<p>surface profile (the freeboard limit + 0.3 m) too high, and therefore, the dyke crest elevation is (freeboard limit + 0.3 m) too low.</p> <p>2. Observations that the dyke and riprap has not needed remediation work during the past 23 years following construction is encouraging. Of concern is the short section near the bend where there is evidence of some localized surface movement. This area should be repaired and any potential for surface movement into the future along the length of the dyke should be eliminated. The short section of the dyke downstream from the tailings embankment where the riprap is not complete should also be repaired if the area presents a risk into the future.</p> <p>3. The report supports the belief that the dyke does not need to be engineered for a probable maximum flood (PMF) event because the Tailings Pond is not to be used as part of the licensed undertakings. A PMF design may be overly conservative if regular inspections of the dyke structure take place and sufficient personnel and equipment are on site for unforeseeable emergencies; however, this is what is required in the current water licence.</p> <p>4. A freeboard of at least 0.5 metres was determined for the 200-year flood calculations. If this design standard is to be adopted, the freeboard limit should</p>	<p>freeboard.</p> <p>2. The Board has the option of requiring CZN to repair the localized erosion and to add riprap to the short section downstream from the Tailings Pond. EBA reports though that the section without riprap may not need riprap because that section is not subject to high water velocities. EBA also concludes that the "geotechnical condition of the earthwork structures at the Prairie Creek Site are considered satisfactory for the exploration activities included under Water Licence MV2001L2-0003".</p> <p>Part B, Item 10 requires that all flood protection work, including the riprap be inspected by a geotechnical engineer annually.</p> <p>3. The water licence does not specify that the flood protection work must withstand the probable maximum flood. Rather, the licence requires that in addition to the probable maximum flood calculations, CZN submit a geotechnical assessment of the adequacy of the flood protection work with recommendations from a qualified Geotechnical Engineer for any improvements or modifications to be implemented upon approval by the Board. HAYCO and EBA recommend that the 200 year flood be used as the standard but the Board can decide to what flood magnitude the dykes should be evaluated.</p> <p>4. Presented to the Board.</p>
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be more conservative.

5. The report states that, considering the scope of the exploration project, the dyke and riprap are fully serviceable in their current condition but that this conclusion will need to be re-examined if the Tailings Pond is to be used in the future. The conditions applying to waste disposal would be easier to evaluate if the future use of the Tailings Pond was known (the current water licence states that the tailings containment area is not to be used with the licensed undertakings - is this the assumption that should be used to evaluate the concerns on site into the future? Otherwise these structures will have to be re-examined if the use of the Tailings Pond changes).

6. One recommendation from the report is to remove the exposed liner from the original Tailings Pond. How would this affect seepage into Prairie Creek? Would creek water levels rise, altering the flood water surface profile?

5. The water licence stipulates that the Tailings Pond is not to be used at all in conjunction with the licensed undertakings. If CZN proposes to use the Tailings Pond in the future, the licence will have to be amended. As part of the amendment, the Board can require CZN to reassess the flood protection work using a different flood magnitude standard.

6. The liner is already not intact (sections of the liner have been removed over the past few years for use around this mine site). There are no tailings in the Tailings Pond and sampling of the water in the Tailings Pond confirms that water quality is good (according to the inspector the water is essentially rainwater). Based on this evidence, any seepage reaching Prairie Creek from the Tailings Pond will not have a significant environmental impact.

CZN, in consultation with EBA, reports that:

- Removal of the liner would have no affect on seepage to Prairie Creek since slope drainage would still report to the Tailings Pond, as it does now, and be subject to the containment controls in the Tailings Pond already in place.
- Creek water levels would not rise and the flood water surface profile would not be altered.



	7. The other recommendation to monitor the condition of the dykes annually is a great recommendation as a minimum.	7. Presented to the Board.
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**Comment Summary Table**  
**Geotechnical Evaluation of the Tank Farm Facility at the Prairie Creek Mine Site**

Reviewing Agency, Date Comments Received	Comments	Mitigation Measure
<p>Deh Cho First Nations, September 7, 2004</p>	<p>1. Section 6.4.3.3 of the MVEIRB Report of Environmental Assessment states:</p> <p><i>The Review Board finds that there is notable concern about how the Tank Farm Facility is being managed, and in particular, the integrity of the tanks themselves. The Review Board finds the concerns legitimate given the location of the tanks (adjacent to Harrison Creek and Prairie Creek) and the noticeable staining around the base of the tanks as observed during the site visit. The Review Board decided that the petroleum tank facility is part of the scope of development. The Review Board also appreciates CZN's assertion that the subject Tank Farm Facility would not be altered by the proposed developments. The Review Board also appreciated CZN's assertions that existing care-and-maintenance requirements are laid out in CZN's lease with the Government of Canada. However, the developer refused to file the lease on the Public Registry and has not advised the Review Board of any terms and conditions in the lease which would deal with this concern. The Review Board has no evidence about these mitigation requirements. Therefore, the Review Board concludes that a qualified engineer certified to practice in the NWT should inspect the tank farm before it is used in these developments. That report should certify the tanks are safe and environmentally acceptable before they are used in the developments.</i></p> <p>2. The Tank Farm Report does not appear to be a Geotechnical Certification, as required by the water licence. The Report appears only to contain the opinion</p>	<p>1. Presented to the Board.</p> <p>2. EBA resubmitted the report with the professional stamp of Don Hayley, P.Eng., the principle engineer</p>

<p>and comments from an Engineer. The Report does not appear to have certified the integrity and capacity of the Tank Farm Facility, nor the associated containment structures (the tanks).</p> <p>3. The geotechnical certification must also certify the integrity and the capacity of the associated containment structures, i.e. the tanks. EBA appears to have misinterpreted the requirements of Part D, Item 1 of the licence as demonstrated by the statement in the report: "an engineering opinion is also required...on the integrity and capacity of the containment structures surrounding the fuel storage tank farm". As evidenced by the quote from the MVEIRB Report of Environmental Assessment, the Review Board is referring to the tanks themselves when referencing containment structures.</p>	<p>overseeing the project. See the Discussion section of the Staff Report for further details.</p> <p>3. The condition requires that a geotechnical assessment of the Tank Farm Facility and associated containment structures be carried out by a Geotechnical Engineer. EBA's interpretation of the licence requirement was that it applied to the soil berm for spill containment because a specific field of practice (geotechnical engineering) was designated. EBA explains that geotechnical engineers are graduate Civil Engineers with specializations in soil mechanics and foundation engineering. Geotechnical engineers do not have the appropriate expertise to offer an opinion on the adequacy of the mechanical components of the fuel storage system (i.e. the tanks).</p> <p>The Report of Environmental Assessment does refer to the need for an assessment of the tanks as well as the surrounding berm.</p> <p>The Board will have to decide on the appropriate interpretation of the licence.</p>
<p>4. The DCFN request that the Board require CZN to comply with the licence and provide a positive Geotechnical Certification, complete with an Engineer's Seal from a qualified Geotechnical Engineer. Should CZN fail to provide a positive certification of both the integrity and capacity of the entire Tank Farm Facility, including the</p>	<p>4. EBA has resubmitted the report with the professional stamp of Don Hayley, P.Eng. Please see the Discussion section of the Staff Report for further details.</p>

<p>berm and the tanks, then the DCFN further request that CZN be required to upgrade the entire Tank Farm Facility so that it does pass a positive certification and is in conformity with current Federal and Territorial legislation before the Tank Farm may be used in conjunction with the licensed undertakings.</p>	<p>5. The DCFN refer the Board to Land Use Permit N1995C0373 held by San Andreas Corporation for exploration diamond drilling. Under Part 31(1)(k) Petroleum Fuel Storage, the Permittee was required to adhere to the following conditions:</p> <p>29. The Permittee shall construct a dyke around each stationary fuel container or group of stationary fuel containers where any one container has a capacity exceeding 4,000 litres.</p> <p>30. The Permittee shall line the dyke and area enclosed by the dyke with a type of plastic film liner approved by the Engineer.</p> <p>31. The volume of the dyked area shall be 10% greater than the capacity of the largest fuel container placed herein.</p> <p>32. The Permittee shall ensure that the dyke and the area enclosed by the dyke shall be <u>impermeable</u> to petroleum products at all times.</p> <p>Given the assertion provided in the CZN Tank Farm Facility Report that the berm is unlined, it appears that CZN may never have complied with the above conditions of this previous land use permit.</p>	<p>5. The permit referenced in the comment has been closed and the Board cannot retroactively deal with this possible non-compliance issue.</p>
<p>6. EBA submitted a report stamped by a professional engineer that states that the "bermed enclosure is in excellent condition for service in support of the exploration activities planned under the water licence."</p> <p>The stamped report from EBA states that the site observations (for seepage</p>	<p>6. Of utmost concern to the DCFN is the integrity of the Tank Farm Facility berm. The berm must be impermeable and not allow the passage of any fluids to the surrounding lands and waters. Particularly troubling is the assertion in the Report that "soil, silt and sand are sufficiently impervious to contain fuel if a spill were to occur. This design was common practice at the time of construction...dyke soils are sufficiently impervious to contain water without identifiable seepage."</p>	<p>6. EBA submitted a report stamped by a professional engineer that states that the "bermed enclosure is in excellent condition for service in support of the exploration activities planned under the water licence."</p> <p>The stamped report from EBA states that the site observations (for seepage</p>

	<p>These statements appear to rely on the observations at the time of inspection that no fluids were visibly leaking from the Tank Farm berm. The DCFN find this to be completely unreliable and unsatisfactory test of the impermeable nature of the berm. Firstly, by their very nature, soils, silt and sand are not impervious materials. Secondly, the Report has provided no physical evidence, nor has the author conducted any scientific tests whatsoever to support these claims. Thirdly, seepage through the Tank Farm berm may be undetectable by the naked human eye, and may require soils sampling and other physical tests, as appropriate to the circumstances.</p> <p>7. DCFN finds it inconsequential that "this design was common practice at the time of construction." The Licensee has acquired this licence in present day, under present day legislation, laws, and standards. CZN is also undertaking these developments in present day and therefore must comply with the laws and standards of the day. To allow otherwise could result in absurd situations where developers could utilize whatever aged and decrepit equipment and infrastructure they wanted, simply on the illogical grounds that it was "common practice" at some point in history. DCFN highly doubts that this is the scenario that is intended in the legislation.</p> <p>8. The DCFN do not find that CZN has fulfilled Part D, Item 9 of the licence. As noted in the environmental assessment, there is visible hydrocarbon staining on the fuel tanks, and the impervious nature of the berm remains uncertain. This requirement of the water licence is very clear and very important, and the environmental impacts should there be a fuel leak, battery malfunction, oil spill or other accident within an unlined Tank Farm Facility with unproven tanks are equally so. The DCFN urge the Board to require that a proper Geotechnical Certification be provided, and that the highest, current</p>	<p>or discharge) made under a sustained head of 70 cm have more relevance than small scale permeability testing that might be carried out either on site or in a laboratory.</p> <p>EBA also states that the berm materials can offer greater protection than a membrane liner and that the substantial thickness of soil of low permeability comprising the embankment will limit potential seepage loss and provide the time necessary to recover any spilled product.</p> <p>7. Presented to the Board.</p> <p>8. Presented to the Board. CZN reports that the hydrocarbon staining is a result of oil barrels that were previously stored inside the berm around the fuel tanks rather than from leaks from the tanks themselves. These oil barrels have been cleaned up and other containers of hazardous materials are stored inside an enclosed trailer within the berm. The Inspector is satisfied with the</p>
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MVLWB Board Meeting

	<p>standards be applied with which to assess the suitability of the Tank Farm Facility.</p>	<p>management of the Tank Farm Facility and the storage of hazardous materials within the Tank Farm Facility.</p>
<p>Canadian Parks and Wilderness Society – NWT Chapter, September 10, 2004</p>	<p>1. The report notes that other waste products including used motor oil, grease, and batteries are being stored within the fuel tank bermed area. The design purpose of the berm is to retain fuel from the tanks located in the berm. It is unclear in the report if a DIAND Inspector has approved the storage of these hazardous materials at this location. If it is approved, the report should document this approval. If it is not approved, CPAWS-NWT recommends that a plan be developed to eliminate storage of hazardous materials within the fuel berm or would set maximum time limits of hazardous waste storage. Regardless if there is approval for the storage of these hazardous materials in the bermed area, the MVLWB should consider adding additional parameters (such as lead, nickel, cadmium, and PAHs) to the water licence. Water within the bermed area should be tested for these parameters prior to being decanted to the receiving environment.</p>	<p>1. The inspector has provided written confirmation that he is satisfied with the storage of hazardous materials within the Tank Farm Facility (as required by Part B, Item 9).</p> <p>Under the LUP associated with this licence (MV2001C0023), Conditions 26 and 27 require that:</p> <ul style="list-style-type: none"> <li>• CZN incinerate or remove from site all combustible waste petroleum products</li> <li>• CZN dispose of all other toxic substances in a manner approved of by the Board</li> </ul> <p>CZN already has to test for the parameters suggested by CPAWS-NWT (TPH was recommended during the licensing process rather than PAH for measuring hydrocarbons). Part D, Item 10 requires CZN to test for total petroleum hydrocarbons prior to decanting water from inside the bermed area. Part D, Item 5 requires CZN to test any water decanted to Prairie Creek, Harrison Creek or the Catchment Pond for lead, nickel and cadmium. The Board can reiterate these requirements in their decision letter to CZN to ensure there is no misunderstanding of what is required of the company.</p>
	<p>2. EBA notes that "the soils comprising the dykes are sufficiently impervious to contain fuel if a spill were to</p>	<p>2. The stamped report from EBA states that the site observations (for seepage</p>

	<p>occur. The design was common practice at the time of construction." EBA also notes that the perimeter dykes were made up of silt, sand, and gravel. A test pit was dug within the bermed area to 30 cm and determined that there was no liner present. However, the report does not state the composition of the soil in the area beneath and surrounding the fuel tanks, inside the perimeter dykes/berms. CPAWS-NWT recommends that a soil texture or particle size test be conducted on samples collected from at least four locations at varying depths within the bermed area to provide additional information on the underlying soil permeability.</p> <p>3. From EBA's calculations, the current fuel tank berm would have the ability to retain 110% of one tank farm at a maximum level plus the spring freshet. Considerations for fuel (or potential fuel leaks and spills) in the other tanks were not included and would appear to exceed berm capacity. Should the proponent wish to store additional fuel in the tanks, the MVLWB should identify that the maximum fuel levels in the tanks should not exceed the available storage capacity of the berm.</p> <p>EBA does not provide a reference for the "110% requirement" as identified in the last sentence on page 2 of the report. CPAWS-NWT requests that the reference be provided. The consultant should also confirm that they have reviewed and determined the applicability of the following 3 documents: 1) Registration of Storage Tank Systems for Petroleum Products and Allied Petroleum Products on Federal Lands Regulations; 2) Technical Guidelines for Aboveground Storage Tank Systems Containing Petroleum Products; and 3) CCME PN 1148 Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products.</p> <p>Additionally, Environment Canada completed consultations on the proposed 'Storage Tanks Systems for Petroleum and Allied Petroleum Products Regulations' in September 2003. Environment Canada has plans to</p>	<p>or discharge) made under a sustained head of 70 cm have more relevance than small scale permeability testing that might be carried out either on site or in a laboratory. EBA also states that compacted silty sands with gravels can achieve a permeability of <math>10^{-6}</math> cm/sec if properly placed and compacted.</p> <p>3. The licence requires that the bermed area have a volume that is 10% greater than the largest container within the bermed area, not a volume equivalent to the combined storage capacity of all the fuel tanks. (The reference is the largest container within the fuel berm, which is a 1.7 million litre diesel fuel tank).</p> <p>The water licence requires that CZN follow all other applicable legislation, therefore, CZN must comply with the three documents listed in the comment. CZN was provided with these comments.</p>
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<p>publish the draft regulations in the Canada Gazette, Part I, during the Spring of 2005. There will be a subsequent 60 day comment period and then a final regulation will be published few months later. Although the proponent is not currently required to meet the proposed regulations, due diligence should be exercised in reviewing the draft regulations to become aware of possible future requirements.</p>	<p>4. The proponent should confirm the three recommendations made by the consultant (on page 3 of the report) will be undertaken. These should be included in the A&amp;R Plan, Annual SNP Reporting and other applicable documents.</p>	<p>4. CZN has committed to carrying out the recommendations made on page 3 of the report. The Board can state in their decision letter to the company that CZN must carry out the recommendations made in the report.</p>
<p>1. EBA submitted a report stamped by a professional engineer that states that the "bermed enclosure is in excellent condition for service in support of the exploration activities planned under the water licence." EBA also states that the berm materials can offer greater protection than a membrane liner and that the substantial thickness of soil of low permeability comprising the embankment will limit potential seepage loss and provide the time necessary to recover any spilled product.</p> <p>The licence requires that CZN comply with all other applicable legislation.</p>	<p>1. Paragraph 2 on page 1 states: "A geotechnical engineering opinion is also required under condition Part D, Item 9 on the integrity and capacity of the containment structures surrounding the fuel storage tank farm." This statement in no way reflects the requirements of Part D, Item 9 of the licence, which requires a "geotechnical assessment carried out by a qualified Geotechnical Engineer certifying the integrity and capacity of the Tank Farm Facility and associated containment structures before it may be used in conjunction with the licensed undertakings." A certification of integrity and capacity is not an opinion; the legal requirement is to provide a certification, which should be based on a technical assessment of the impermeability of the containment barrier. Data on the permeability of both the perimeter dyke and the floor of the bermed area should be provided to meet the licence requirements. The Canadian Council of Ministers of the Environment Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products recommends a sustained permeability to water of less than <math>1 \times 10^6</math> cm/s under a hydraulic head of 3 metres.</p>	<p>1. EBA submitted a report stamped by a professional engineer that states that the "bermed enclosure is in excellent condition for service in support of the exploration activities planned under the water licence." EBA also states that the berm materials can offer greater protection than a membrane liner and that the substantial thickness of soil of low permeability comprising the embankment will limit potential seepage loss and provide the time necessary to recover any spilled product.</p> <p>The licence requires that CZN comply with all other applicable legislation.</p>
	<p>2. Paragraph 1, page 2: The statement that there is not possibility of fuel re-supply until the winter road is opened</p>	<p>2. Presented to the Board.</p>



	<p>is misleading; other alternatives are available although the company may not wish to consider these.</p> <p>3. Middle of page 2: It is speculative for the author to state that the "soils comprising the dykes are sufficiently impervious to contain fuel if a spill were to occur" with no recent permeability tests or technical information to support this claim. Although this design was common practice at the time of construction, using silt/sand/gravel for a liner is not acceptable by current standards for impermeable barriers.</p> <p>4. Third paragraph, page 2: It is evident that the growth of willows and shrubs on the outside and inside slopes and on top of the dyke will eventually weaken the integrity of the containment structure, although it may not be evident until the dyke is submitted to pressure form containment. This points again to the requirement to have a structure tested and certified for integrity. A visual assessment is not adequate to provide assurance that the dyke has retained its integrity.</p> <p>5. Fourth paragraph, page 2: The current standard for testing as noted above is a 3-metre (3000 mm) head. The author states that the dykes were effectively</p>	<p>3. EBA submitted a report stamped by a professional engineer that states that the "bermed enclosure is in excellent condition for service in support of the exploration activities planned under the water licence."</p> <p>EBA also states that the berm materials can offer greater protection than a membrane liner and that the substantial thickness of soil of low permeability comprising the embankment will limit potential seepage loss and provide the time necessary to recover any spilled product.</p> <p>The stamped report from EBA states that the site observations (for seepage or discharge) made under a sustained head of 70 cm have more relevance than small scale permeability testing that might be carried out either on site or in a laboratory.</p> <p>4. CZN has already removed all vegetation on the berms and dykes and has committed to continue doing so. The Board can stipulate that CZN must continually remove all vegetation from the berms and dykes in their decision letter to CZN.</p> <p>5. EBA submitted a report stamped by a professional engineer that states that the "bermed enclosure is in excellent</p>
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	<p>retaining water with a head of 70 mm. This is not indicative that the dyke can meet current standards.</p> <p>6. First paragraph, page 3: Again, the statement that the dykes are "sufficiently impervious to contain water" is speculative and not supported by testing or technical information.</p>	<p>condition for service in support of the exploration activities planned under the water licence."</p> <p>6. The stamped report from EBA states that the site observations (for seepage or discharge) made under a sustained head of 70 cm have more relevance than small scale permeability testing that might be carried out either on site or in a laboratory. EBA also states that compacted silty sands with gravels can achieve a permeability of <math>10^{-6}</math> cm/sec if properly placed and compacted.</p>
<p>Water Resources Division, October 21, 2004</p>	<p>1. The licence states that the Tank Farm Facility and associated containment structures must be assessed and approved by the Board before it may be used in conjunction with the licensed undertakings. The report states that fuel for the on-going exploration program is obtained directly from within the tank farm and that other waste products are stored in the bermed area. Has the Board given its approval for this, or is CZN in non-compliance with their water licence?</p> <p>2. The integrity and capacity of the Tank Farm Facility, according to the report, meet the criteria outlined in the water licence. Has this been certified by a qualified Geotechnical Engineer, or is this simply an opinion?</p> <p>3. Of concern are issues relating to the three recommendations presented. The first recommendation is to clear emergent vegetation from the containment dykes. Is this vegetation promoting seepage from the bermed containment area? Will the vegetation have to be managed continuously into the future to maintain dyke integrity? The report states that the soils comprising the</p>	<p>1. The Inspector is satisfied with the management of the Tank Farm Facility and the storage of hazardous materials within the bermed area (as required by Part B, Item 9).</p> <p>Fuel in the Tank Farm Facility is being used to carry out the diamond drilling permitted by LUP MV2001C0022.</p> <p>2. Don Hayley, P.Eng., of EBA signed and stamped the report with his professional stamp. Please see the Discussion section of the Staff Report for further details.</p> <p>3. CZN has already removed all vegetation on the berms and dykes and has committed to continue doing so. The Board can stipulate that CZN must continually remove all vegetation from the berms and dykes in their decision letter to CZN.</p>

	<p>dykes are sufficiently impervious to contain fuel if a spill were to occur. Have detailed studies been done to prove this? Has the entire containment area been examined for permeability (i.e. for water depths greater than 70 mm, and the bottom of the containment area)? No evidence of seepage was found at the site. Was this solely based on a visual inspection?</p> <p>4. The second recommendation is to pump runoff water from the facility in the spring. Again, will this have to be done every year so long as the structure is in place? Water testing will have to be done to ensure that this water is suitable for discharge to the creek, and contingency plans (i.e. water treatment plans) must be identified for water that is not suitable for direct discharge. Water testing parameters should detect all the potential contaminants originating from items stored within the bermed area.</p> <p>5. The third recommendation is to develop a plan to remove and dispose of waste oil products currently stored within the facility.</p>	<p>The stamped report from EBA states that the site observations (for seepage or discharge) made under a sustained head of 70 cm have more relevance than small scale permeability testing that might be carried out either on site or in a laboratory. EBA also states that compacted silty sands with gravels can achieve a permeability of 10<sup>-6</sup> cm/sec if properly placed and compacted.</p> <p>4. The recommendation will have to be followed for the duration of the licence. Water within the bermed area must be sampled for TPH (Part D, Item 10) prior to decanting and any water discharged to Prairie Creek, Harrison Creek or the Catchment Pond must be sampled for the parameters listed under Part D, Item 5. These requirements can be reiterated in the Board's decision letter to CZN.</p> <p>5. CZN has committed to carrying out the recommendations made on page 3 of the report, including investigating the possibility of incinerating used oil and other appropriate materials.</p> <p>Under the LUP associated with this licence (MV2001C0023), Conditions 26 and 27 require that:</p> <ul style="list-style-type: none"> <li>• CZN incinerate or remove from site all combustible waste petroleum products</li> <li>• CZN dispose of all other toxic substances in a manner approved of by the Board</li> </ul>
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	<p>6. Part D, Item 11 of the licence requires the company to notify the Inspector at least 10 days prior to the decant of the Tank Farm Facility. Treatment options must be identified before discharge to Prairie Creek or Harrison Creek.</p>	<p>The Board can state in their decision letter to the company that CZN must carry out the recommendations made in the report.</p> <p>6. CZN can be required to include treatment options for water within the bermed area around the Tank Farm that does not meet criteria in the Effluent Treatment Options Plan required under Part D, Item 6.</p>
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November 19, 2004

Mackenzie Valley Land and Water Board  
PO Box 2130  
7<sup>th</sup> Floor – 4910 50<sup>th</sup> Ave.  
Yellowknife, NT  
X1A 2P6

Attention Ms. Sarah Baines, Regulatory Officer

**Re: Response to Reviewer Comments – Tank Farm Section of the Prairie Creek Project  
Geotechnical Site Reconnaissance Report : MV2001L2-0003**

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Dear Ms. Baines:

In reply to your letter of October 8, 2004, enclosing Reviewer comments, from Parks Canada, CPAWS and Deh Cho First Nations, on the Tank Farm section of the Prairie Creek Project Geotechnical Site Reconnaissance Report prepared by EBA Engineering Consultants, Canadian Zinc Corporation (CZN) is pleased to provide this response.

CZN referred all Reviewer comments on the methodology, content, form, standard and quality of the EBA Report to EBA. Attached is a response letter from EBA dated November 12, 2004 which addresses the issues raised. We are also sending you, via courier, an original reissued copy of the EBA Report which has been embossed with an engineer's certification stamp. An electronic copy of the report is also attached via email.

These issues, and EBA's response, are summarized as follows:

- Reviewers were concerned that EBA's Report did not constitute a certification of the integrity and capacity of the Tank Farm Facility. EBA have addressed that point in their response letter dated November 12, 2004.
- Reviewers commented that the EBA Report did not address the integrity of the tanks themselves. This is not a requirement of the Water Licence. The Licence calls for "a geotechnical assessment .... of the Tank Farm Facility and associated containment structures. Shall certify that the capacity of the containment structures associated with the Tank Farm Facility is 10% greater than the volume of the largest container placed therein." [see definition of Tank Farm Facility] . The Licence requires a "geotechnical assessment". EBA have explained that a geotechnical engineer is not qualified to comment on the tanks themselves. This is not what the Licence requires and no geotechnical engineer is qualified to do this.

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EBA did confirm that the containment structure is adequate to retain 110% of the volume of the largest tank (container).

- Reviewers commented that tests were not undertaken to confirm the low permeability of the containment soils. EBA have replied that, in effect, the ponding of spring snow melt over an extended dry period in excess of one month without an apparent reduction in water levels constitutes a containment-wide permeability test which is more relevant than small scale permeability testing.
- Reviewers noted that the EBA Report did not bear an engineer's seal or stamp. EBA has reissued their Report with an engineer's stamp.

There are some other points that were raised by Reviewers that are not addresses in EBA's response. CZN's response to the remaining points is given below.

The safety, suitability and integrity of the Tank Farm Facility is of utmost importance to CZN. EBA have confirmed the suitability of the Tank Farm in their report dated August 5, 2004 and again in their letter dated November 12, 2004 where they confirm that the bermed enclosure is in excellent condition for service in support of the activities planned under the Licence. A plastic film liner is not a requirement of the Water Licence, or any other Licence issued to CZN by the Water Board. The reference to LUP N95C373 pertaining to Petroleum Fuel Storage was in context to a Diamond Drill Exploration program and the establishment of any stationary fuel containers in relation to that specific program. The reference was not specific to the Tank Farm (?), and is not retroactive to the established minesite infrastructure. This was understood by all agencies at that time, and final clearance and closure of LUP N95C373 was received September 22, 1998.

During the summer of 2004 CZN carried out various maintenance and repairs to the Tank Farm Facility (including removal of brush, maintenance of the containment berm, and further consolidation of used oil drums). Material within the berm was cleared away from the base of the tanks, the tanks were inspected and no evidence of staining or leaks was found. The Tank Farm Facility, including the tanks, was inspected on a daily basis over the period May 8 to October 8, 2004. Measurements were taken daily/weekly and, after adjusting for fuel used, no evidence of leakage was detected. The visible hydrocarbon staining on the fuel tanks is a result of minor historical seepage from a few small containers placed in the containment prior to the San Andreas/Canadian Zinc period of tenure. Snowmelt and rainwater that accumulated in the containment caused residual hydrocarbon material to float and stain the tanks. Consequently, any old residue found within the containment is immediately cleaned up by CZN. The seepage and staining occurred wholly within the contained and bermed area. The Tank Farm has been properly maintained and is not "aged and decrepit equipment and infrastructure". The Tank Farm has operated safely and effectively for decades and there is no reason to believe that it will not continue to do so. Based on these facts and the history of the Tank Farm Facility, it is CZN's opinion that the Tank Farm Facility is being managed appropriately and effectively, and that it can be concluded that there is presently minimal risk of tank failure, minimal risk of containment failure even if tank failure occurred, and therefore minimal risk to the environment in terms of the Tank Farm Facility.

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During the summer period 2004 the Prairie Creek site was the subject of 6 inspections by various Inspectors and Government agencies, including 2 inspections of the Tank Farm Facility by DIAND inspectors. No problems with the Tank Farm Facility were identified or reported on any of these inspections.

The storage of some hazardous waste (waste oil, grease, batteries) in the containment area has been approved by the DIAND Inspector. The oil is contained in 205 litre sealed drums and the grease is in sealed pails. All of it is stored under thick tarps to protect it from the elements. [The few remaining batteries on site are inside a transport trailer inside of the berm and are therefore also protected from the elements.] CZN is reviewing various options for the safe disposal of the waste oil, but until a suitable option has been developed and approved, or until the waste oil is removed from site, the containment is considered the best location for storage.

The three recommendations in the EBA Report for on-going operations have been actively addressed and will be acted upon on an on-going basis. Vegetation has been cleared from the top and inside the berm area, runoff water will be pumped off in the spring only after the standard procedure of water analysis and notification of the proper authorities, per Section 10 and 11 of Water License MV2001L2-000, has been completed. A plan to remove and dispose of waste oil products in a high temperature burner is currently being considered.

Should you have any questions or require any additional information please feel free to contact me at your convenience.

Yours very truly,

**CANADIAN ZINC CORPORATION**

Alan B. Taylor  
COO & V P Exploration

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# **EBA Engineering Consultants Ltd.**

Creating and Delivering Better Solutions

November 12, 2004

EBA File: 1740078

Canadian Zinc Corporation  
Suite 1202  
700 West Pender Street  
Vancouver B.C. Canada V6C 1G8

Attention: Mr. Alan B. Taylor,  
Vice President, Exploration

**Subject: Comments on EBA Report of August 5, 2004**

I have reviewed the letter from Ms. Sarah Baines of the Mackenzie Valley Land and Water Board (MVLWB), dated October 8, 2004. Letters from three agencies who reviewed EBA's report were also attached. The EBA report following my site reconnaissance trip provided our assessment of the condition and ability of the secondary containment system surrounding the tank farm to fulfill its function in the event of a fuel spill, as directed under Part D-9 of the Water License. There were three general issues raised by the reviewers. I have provided further comments on these issues in the following.

**1. How we interpret "certification of the integrity and capacity of the tank farm" as specifically directed under Part D-9 of the Water License**

The EBA report of August 5 offers our professional opinion on the capability of the bermed enclosure surrounding the tank farm to provide short-term contingency storage of spilled fuel, up to 110 percent of the largest single tank. This containment volume criterion is set out in section D-9.

It seems that the reviewers of our report have a more rigorous interpretation of what constitutes certification by a professional engineer. The term "certify" is not used in our practice because it could imply that the Engineer provides an all-encompassing guarantee or warranty. This could be interpreted to mean that the Engineer is held liable for any adverse consequences suffered by anyone who relies on the structure. This is not the case and no experienced Professional Engineer can provide such a warranty. That would extend our liability far beyond what is required of a professional under common law. The law defines the "standard of care" that we must exercise when conducting our professional practice. We accept responsibility for our professional opinions, our designs and our participation in monitoring construction activities related to those designs.

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Absolute "certifications" are also uninsurable. They are assumptions of liability under contract that are excluded from coverage under every policy of professional liability insurance underwritten in Canada. That makes it difficult to understand how the public interest is served by a requirement that deprives us of the financial capacity under our insurance to respond in the event of a failure.

We encourage the Water Board to apply the usual professional interpretation to requirements that include the terminology "certification" of structures by a Professional Engineer. I have been working for many years on projects controlled by MVLWB licenses. My interpretation of what is required for the Prairie Creek License was consistent with our normal practice for annual dam inspections that we undertake for a number of clients in Northwest Territories.

## **2. The Scope of Services Provided in our Report of August 5, 2004**

Part D-9 of the water license makes specific reference to those activities to be conducted by a "Geotechnical Engineer". A geotechnical engineer is a graduate Civil Engineer with specialization, usually at the post-graduate degree level, in Soil Mechanics and Foundation Engineering. Our expertise is in earthworks design and construction. We do not have appropriate expertise to offer an opinion on the adequacy of the mechanical components of the fuel storage system. Our interpretation of the Water License requirement was that it applied to the soil berm for spill containment because a specific field of practice (geotechnical engineering) was designated.

At the time of the site reconnaissance, there was substantial water from spring runoff still ponded within the bermed enclosure. The water depth in the low part of the facility was about 70 cm. The site personnel for Canadian Zinc indicated that the water level had not changed for at least a month. In my opinion, this offered a reasonable opportunity to examine the berms with a sustained water head and carefully check for seepage or discharge. My conclusion was that there was no discernable seepage loss nor was there any evidence of past seepage from the enclosure. This site observation has more relevance than small-scale permeability testing that might be carried out either on site or in a laboratory.

The samples from the shallow test pit were described as silty-sand with some gravel. This material can offer greater protection than a membrane liner. It is not unrealistic to expect to achieve a permeability of  $10^{-6}$  cm/sec within the dyke materials when they are properly placed and compacted. Moreover, the substantial thickness of soil of low permeability comprising the embankment will limit potential seepage loss and provide the time necessary to recover any



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spilled product. It is my assessment that the bermed enclosure is in excellent condition for service in support of the exploration activities planned under the water license.

### 3. Lack of a Professional Stamp on the EBA Document.

One of the reviewers expressed concern that my professional stamp was not present on the letter-report. It is common practice in our firm to stamp drawings issued for construction and extensive reports. This report fell into the grey zone of a letter-report and probably should have had my stamp on it. I have no concerns about reissuing the report with my professional stamp.

I became a Professional Engineer in 1968 and am currently registered in 5 provinces or Territories. Almost all my professional activities have been in NT/NU and Yukon as well as other circumpolar regions of the world (Alaska, Russia and Norway). I have been licensed to practice by NAPEGG for about 20 years and EBA has had a permit to practice since NAPEGG was formed in 1979. We are currently the largest engineering firm practicing geotechnical engineering from a base within Northwest Territories.

I trust these comments are helpful. I would be pleased to meet with the Water Board Staff to further explore the concerns we have expressed here regarding the limitations with respect to our capacity to "certify" structures as a specific requirement of the water license. In that regard, I believe I speak for all Professional Engineers, not just EBA.

Yours truly,  
EBA Engineering Consultants Ltd.



D.W. Hayley, P.Eng., FEIC  
Principal Engineer  
(Direct Line: (250) 767-9033)  
(e-mail: [dhayley@eba.ca](mailto:dhayley@eba.ca))

cc: Dave Harpley, Canadian Zinc  
R. Hoos, EBA





# **EBA Engineering Consultants Ltd.**

Creating and Delivering Better Solutions

August 5, 2004

EBA File: 1740078

Canadian Zinc Corporation  
Suite 1202-700 West Pender Street  
Vancouver, B.C.  
V5C 1G8

Attention: Alan B. Taylor  
VP Exploration

**Re: Prairie Creek Project Geotechnical Site Reconnaissance Report**

Dear Mr. Taylor:

The undersigned was at Canadian Zinc Corporation's Prairie Creek Site near Ft. Simpson NT from June 9-11, 2004, for the purpose of examining the condition of certain earthwork structures. In particular, detailed observations were undertaken at the fuel storage tank farm and of the riprap protecting the dyke from erosion by Prairie Creek. These observations and the comments provided in this letter-report are intended to address conditions in Water License MV2001L2-0003 of the Mackenzie Valley land and Water Board.

Part D of the Water License applying to waste disposal require an opinion from the Geotechnical Engineer on the adequacy of the current flood protection works along with any applicable recommendations (D1). A geotechnical engineering opinion is also required under condition D-9 on the integrity and capacity of the containment structures surrounding the fuel storage tank farm. This letter provides my comments on those facilities as Canadian Zinc Corporation's Project Geotechnical Engineer as defined in the Water License.

## **1.0 PRAIRIE CREEK TANK FARM**

A tank farm comprising four steel tanks each with a total volume of 10,700 bbls (1700 m<sup>3</sup>) was constructed inside a bermed enclosure at the site in the 1980's. Fuel was transported over a

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winter road in service only for construction purposes. It is understood that current fuel reserves on site in the tanks are equivalent to about 3/4 of one tank but it is distributed among several tanks. There is currently no road access to the site and therefore no possibility of fuel re-supply until such time as a permit is granted to reopen the winter road.

The tank farm is separated from the other mine facilities site by Harrison Creek, a small tributary of Prairie Creek. It is accessed by a road over a culvert and by a structural steel pipe bridge that also provides foot access. The locations of these facilities are shown in Photo 1. There is a concrete apron and truck loading facility at the south end of the tank farm that has never been commissioned and is not used. Fuel for the on-going exploration program is obtained directly from within the tank farm. Other waste products including used motor oil, grease and batteries are stored within the confines of the bermed area.

The perimeter dykes were constructed from compacted silt, sand and gravel that appear to be of mixed colluvial and alluvial origin, as shown in Photo 2 (1792). An as-built drawing of the containment was not available. A shallow test pit was dug in the deepest corner to investigate if a membrane liner was present. There was no liner found within 30 cm of the surface and it is assumed that one was not placed. The soils comprising the dykes are sufficiently impervious to contain fuel if a spill were to occur. This design was common practice at the time of construction.

The dykes appear to be in excellent condition, there were no cracks or sloughing of the slopes or surface erosion. Young willow trees and other shrubs had encroached on the outside slopes, the top of the dykes and in some cases on the inside slopes. At the time of the inspection, there was water occupying the south half of the facility. The water was runoff from the past winter snow. It is understood that the water contained inside the tank farm is currently being tested by a certified laboratory and subject to compliance with water license criteria will be released to the downstream receiving environment.

The outside toe of the dyke slope on the edge of Harrison Creek was carefully checked for any signs of seepage of the water from the enclosure. No evidence of seepage or surface sloughing was found. The dykes were effectively retaining water with a head greater than 70 mm at the time of the inspection.

A simple tape and hand level survey was conducted to provide a check on available storage capacity within the dyked enclosure. The available enclosed surface area for spill storage was estimated at 2,778 m<sup>2</sup>, excluding the footprint of the four tanks. Each tank can contain up to 1,700 m<sup>3</sup> of fuel. The requirement for contingency short-term storage within the dyked enclosure is to store 110 % of one tank or 1,870 m<sup>3</sup>. The necessary minimum dyke height to provide the

contingency storage is 1,870/2,778 or 0.67 m. At the time of the inspection the depth from the top of the berm to the water level within the enclosure was measured at several places considered to represent the minimum containment height and the available height (above water) was found to be 0.76 m. Therefore the dyked enclosure meets the storage requirement even with the annual spring freshet water in place. The freshet water was estimated to consume 20 % of the total storage volume of the enclosure at the time of the assessment. After the water is removed the available storage volume is approximately 50 % greater than the volume of one tank.

The dyked enclosure is considered satisfactory for the tank farm operation. The containment is not lined but the dyke soils are sufficiently impervious to contain water without identifiable seepage. The available storage volume exceeds the criteria of 110 % of the largest tank.

Recommendations for on-going operations are as follows:

- Clear emergent vegetation from the top and inside slope of the containment dykes.
- Pump runoff water from the facility promptly in spring.
- Develop a plan to remove and dispose of waste oil products currently stored within the facility.

## 2.0 FLOOD PROTECTION FACILITIES

The mine site is situated on the floodplain of Prairie Creek within the confines of a narrow steep-sided valley. The original development divided the available area into a tailings pond and mine infrastructure that includes a process plant, camp and maintenance facilities. Construction of the various facilities was about 95% complete at the time the development was terminated in the early 1980's.

The enclosed area designated for tailings disposal is currently a shallow pond of clean snowmelt and runoff water. The layout is illustrated in Photo 3. A dyke was constructed in 1981 to protect Prairie Creek from contamination by process water that could leach from the prospective tailings pond. The dyke was designed to prevent the creek from overflowing its banks into the pond or plant site during periods of peak flow. It was constructed of alluvial and colluvial gravel from the floodplain and the mountain slope and was armoured on the slope exposed to Prairie Creek with cobbles and boulders (riprap) to prevent erosion during periods of high flow. The elevation of the erosion protection riprap was set above the estimated water level for a computed 'maximum possible flood'.

No design details or as-built drawings were available from which to judge the thickness, particle size and quality control procedures exercised during construction. The serviceability of the dyke and riprap for its current use has been judged based on site observations and the knowledge that it has not needed remediation work during the 23 years following construction.

The entire length of the riprap berm was examined on foot during the site visit. Photos 4 to 6 show the location and condition of the riprap. The twigs in Photo 5 probably represent the maximum elevation of high flood during the service life of the dyke. The following observations were made during inspection.

- There is no indication that the riprap, installed in 1981, has ever been overtopped.
- The rock size varies from about 100 mm to greater than 1,000 mm, with an estimated median size of 200 to 250 mm.
- Larger boulders have been added at the bend in the channel where the dyke is most susceptible to erosion.
- The gravel slopes supporting the riprap (2H to 1V) are stable with no evidence of sloughing or cracking.
- There is one short section near the bend where the surface riprap seems thinner on the upper slope, suggesting some localized surface movement.
- There is no indication of sediment loss from the riprap slope to the stream.
- There is a short section of dyke downstream from the tailings embankment where it appears the riprap was not completed during the construction period. That section is not in a zone subject to high water velocities.

I have examined the estimation of "probable maximum flood" prepared by Dr. Adrian Chantler of Hay and Company as documented in his letter to you of June 25, 2004. It is my view, that the dyke as it is currently used (without an operational tailings pond) does not need to be engineered for such an extreme event. I have discussed this with Dr. Chantler and his estimate of Prairie Creek water velocities suggest that it would take a runoff event with a return period of approximately 20 years before damage to the riprap could begin to occur.

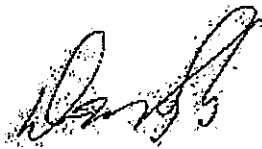
Considering that there are no significant environmental consequences should a portion of the dyke erode, it is a realistic approach to risk management to conclude that the dyke and riprap are fully serviceable in their current condition for current exploration operations. This conclusion will need to be re-examined when a plan for future use of the pond, originally designated for tailings disposal, is presented for Water Board consideration, or when a full site reclamation and abandonment plan is developed. At that time, the failure consequences will change and the requirement for long-term stability of the riprap will require a more detailed re-evaluation.

A detailed assessment of the condition of the slopes within the original tailings pond was carried out in 2000 by BGC Engineering. Their report examines long term stability of the inside slopes of the dyke where movement has occurred in the past. They provide a plan for remediation of the slopes that is appropriate if the pond were to be used as originally designed. The conditions observed in the field during this inspection are consistent with those reported by BGC Engineering. There is no indication of further deterioration of the slopes or further movement. The overall slopes surrounding the pond are considered stable for site operations covered under the current Water License. Removal of the exposed hypalon liner from the inside face of the slope would be advantageous as it seems the liner has in the past impeded drainage and may have been a contributing factor to slope movements.

In conclusion, the geotechnical condition of the earthwork structures at the Prairie Creek Site are considered satisfactory for the exploration activities included under Water License MV2001L2-0003. Annual monitoring of the condition of the dykes is recommended.

Respectfully submitted,

EBA Engineering Consultants Ltd.



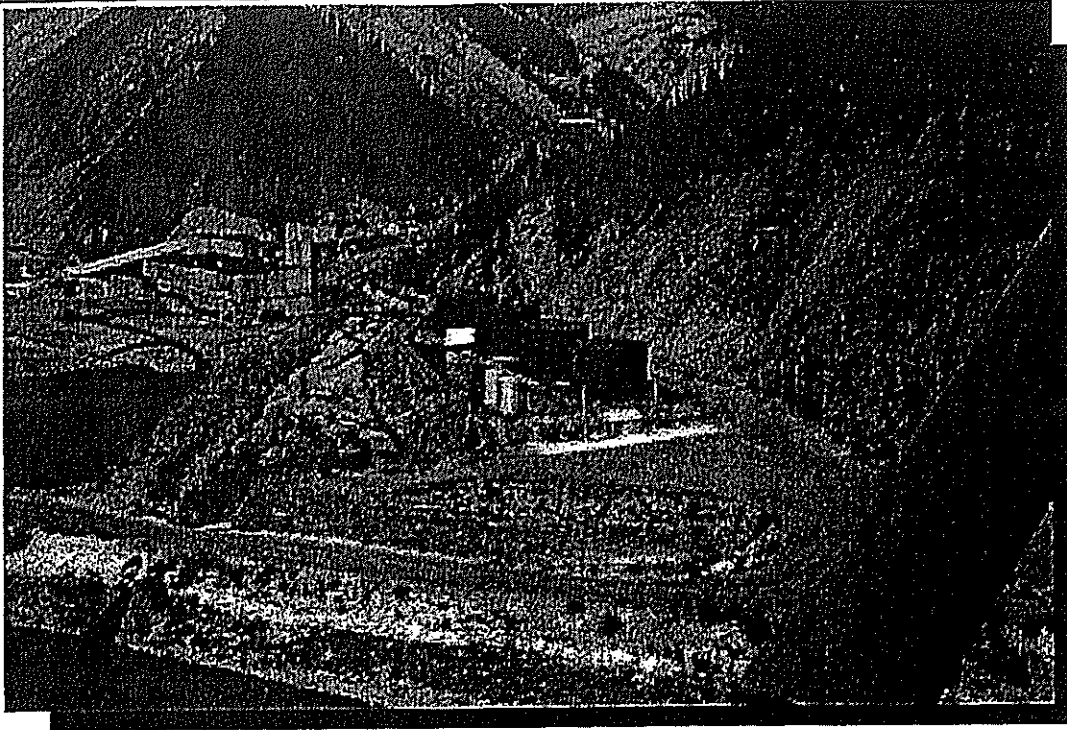
Don W. Hayley P.Eng  
Principal Engineer

Attachment: Photos

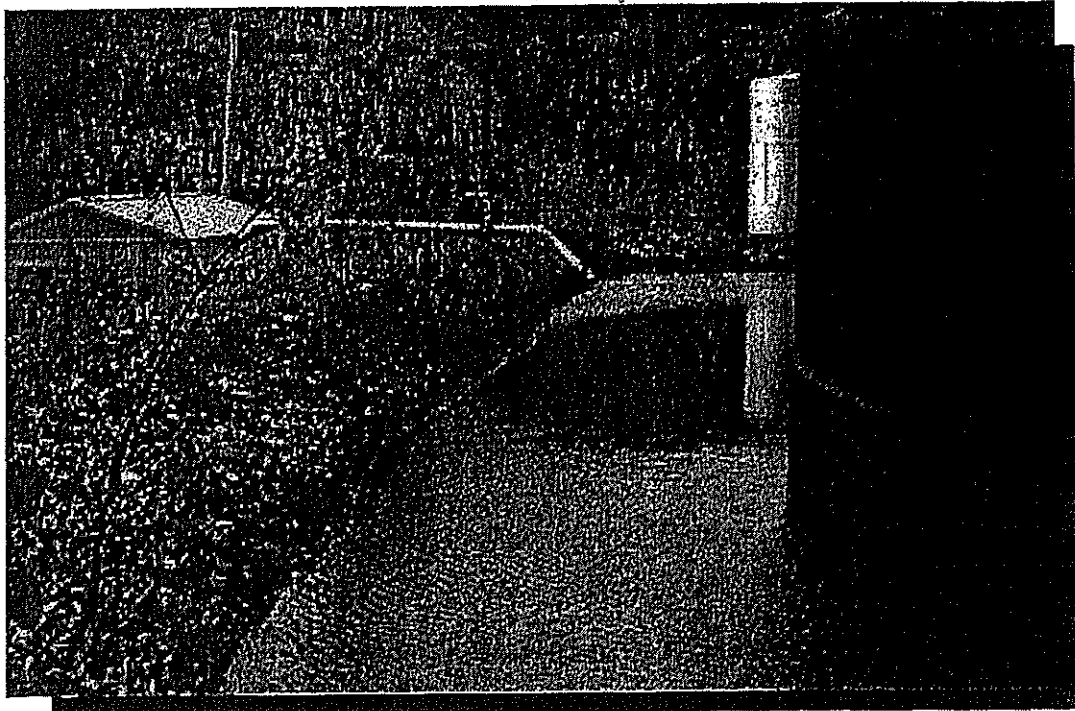
c.c. R. Hoos, M.Sc. R.P. Bio.  
A. Chantler P.Eng

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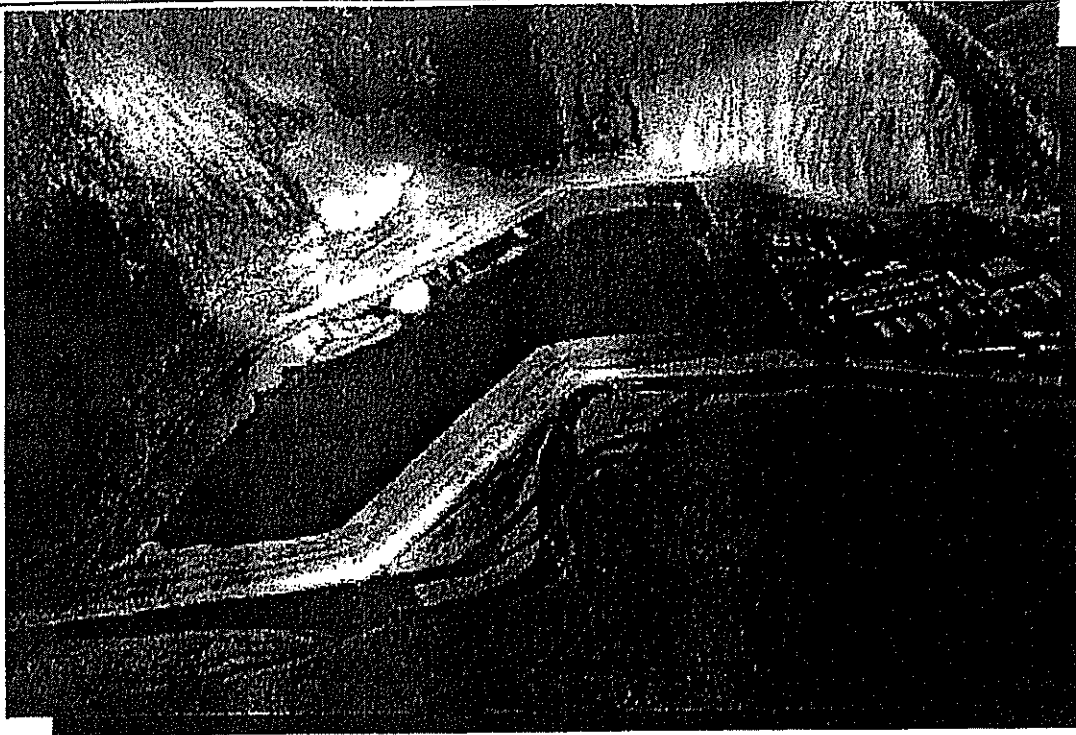




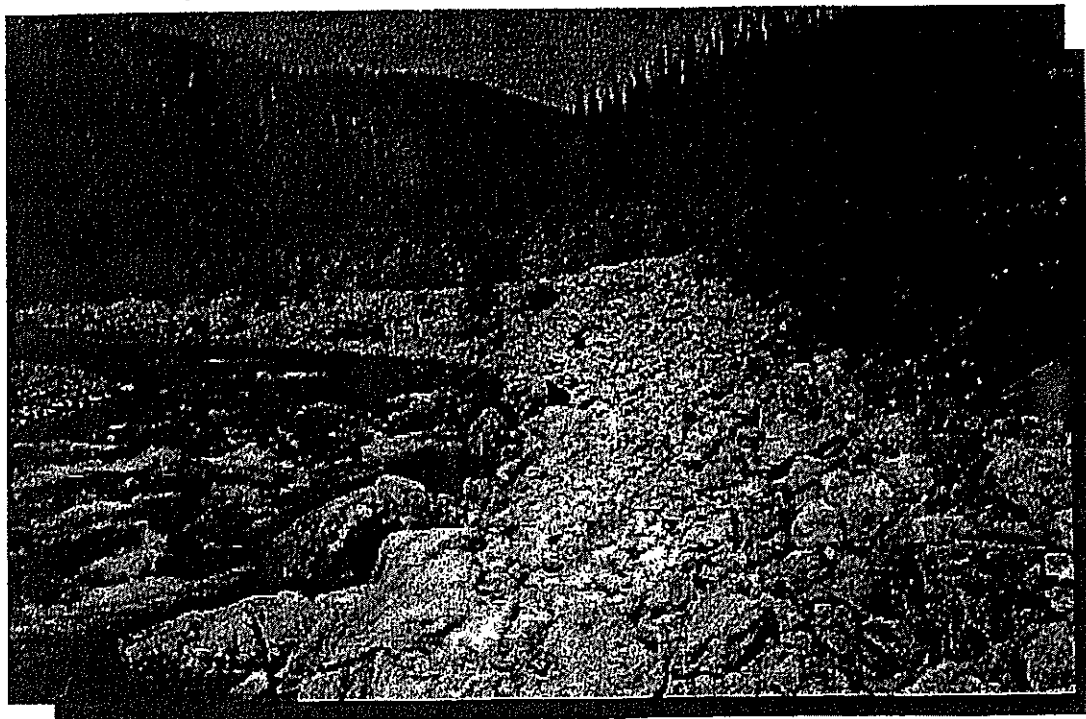
**Photo 1**  
Location of Fuel Tank Farm at Prairie Creek



**Photo 2**  
Perimeter Dyke Surrounding Fuel Tank Farm



**Photo 3**  
Layout of the Prairie Creek Project Tailings Pond (no tailings in pond)



**Photo 4**  
Riprap Berm Along Prairie Creek Below Tailings Pond



**Photo 5**  
Composition of Riprap Berm Material



**Photo 6**  
Cobble and Boulder Material Characteristic of Riprap Berm



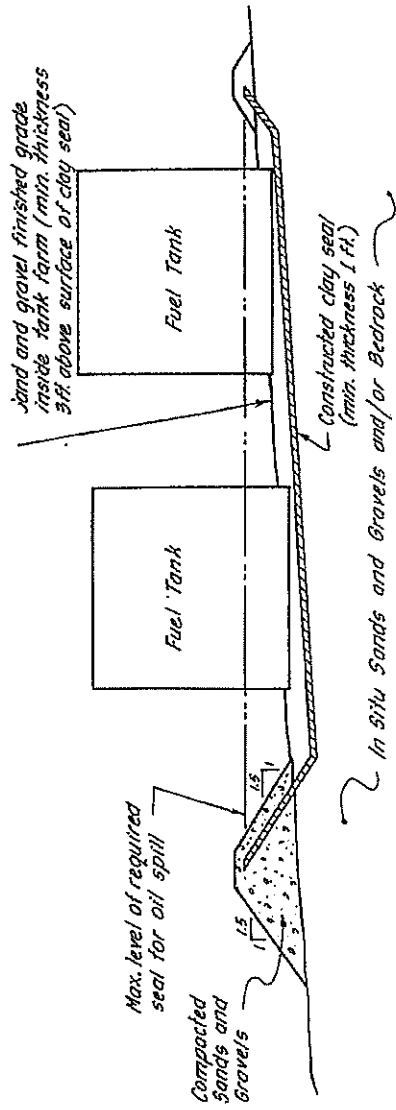


Fig. 10 a) SCHEMATIC SECTION OF TANK FARM AND CLAY SEAL SPILL PROTECTION WHERE FOUNDATION SOILS CONSIST OF PERVIOUS MEDIA

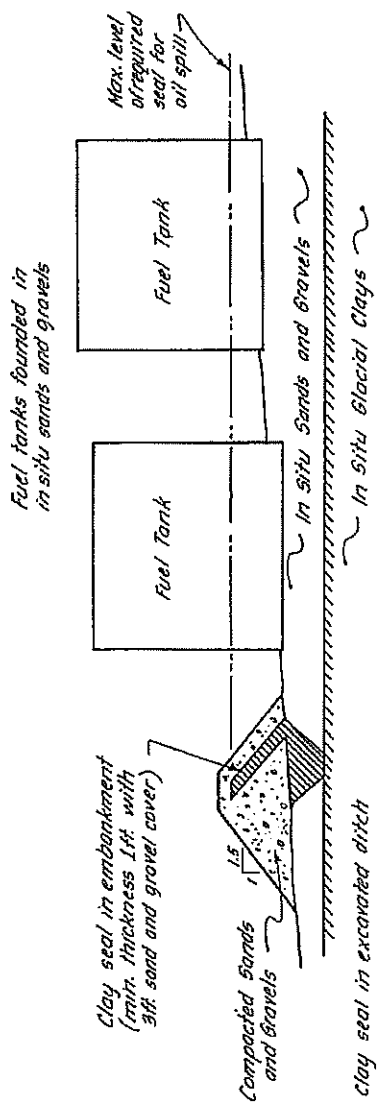
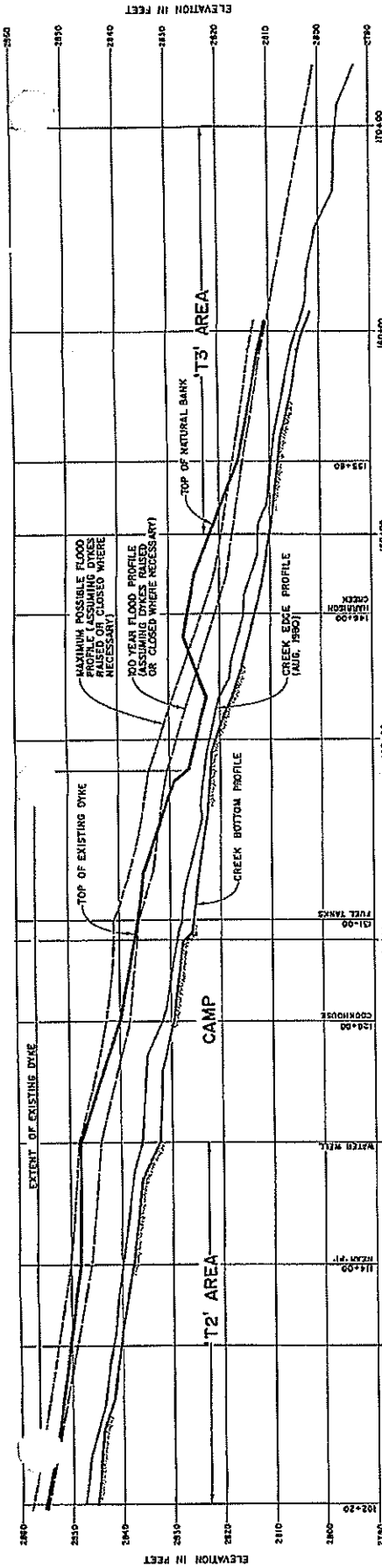


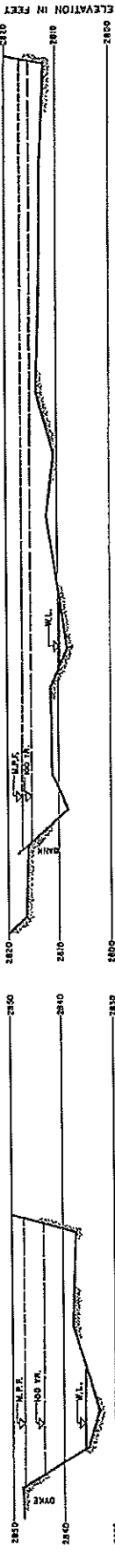
Fig. 10 b) SCHEMATIC SECTION OF TANK FARM AND FUEL SPILL PROTECTION FOR CASE WHERE IMPERVIOUS IN SITU CLAY EXISTS WITHIN EASY ACCESS FROM GROUND SURFACE

Cadillac Explorations Ltd, Northwest Territories	
Golder Associates	
<b>FUEL TANK FARM SPILL CONTROL WORKS</b>	
Drawn	S.H.
001*	SEPT. 1980
Reviewed	SEP
Project No. 802-1073	
Fig. 10	



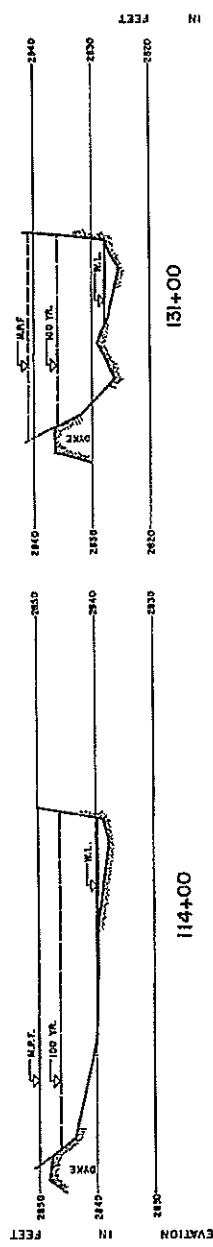
PROFILE - PRAIRIE CREEK

HORIZONTAL SCALE 1" = 200'



126+00

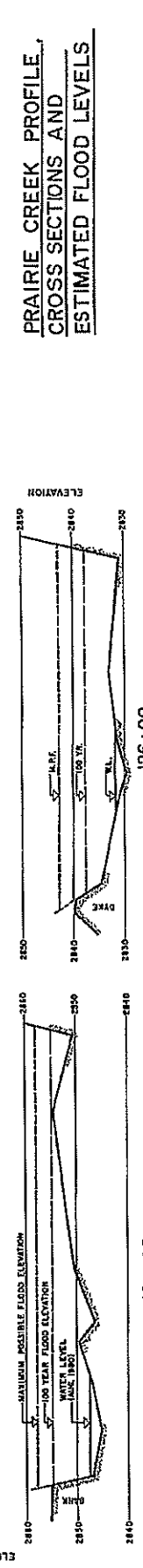
153+60



102+20

114+00

131+00



126+00

CROSS SECTIONS

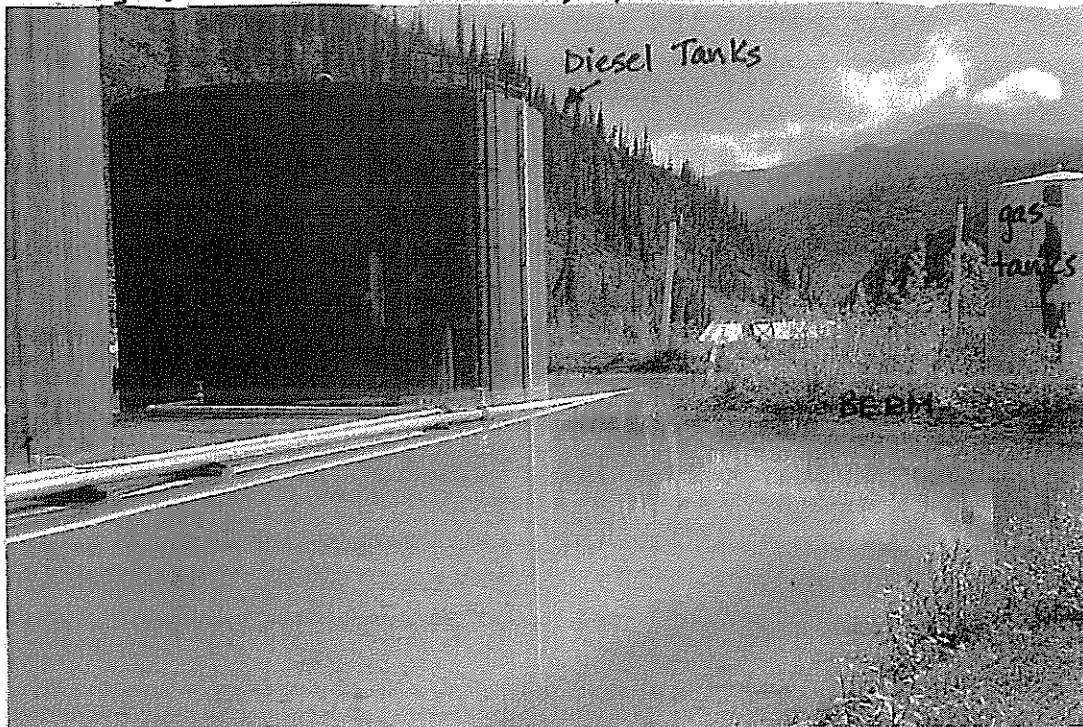
HORIZONTAL SCALE 1" = 150'

PRAIRIE CREEK PROFILE,  
CROSS SECTIONS AND  
ESTIMATED FLOOD LEVELS

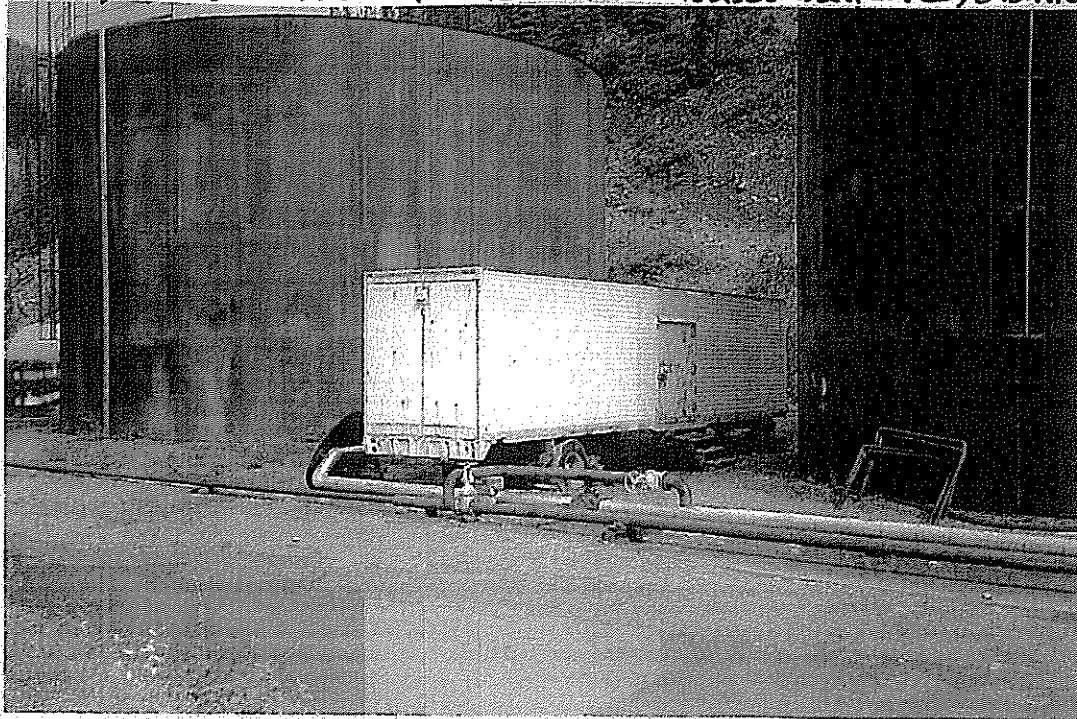
FIGURE 18

PER. PRIESTMAN & ASSOCIATES LTD.

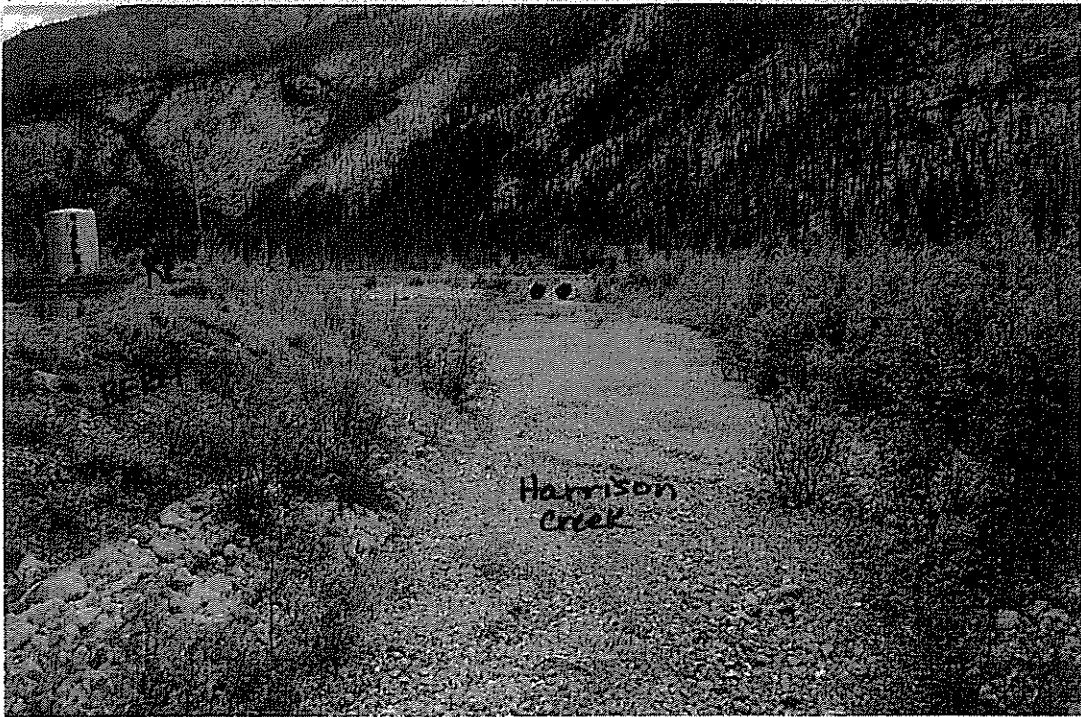
Photograph #1: Tank Farm Facility with ponded water



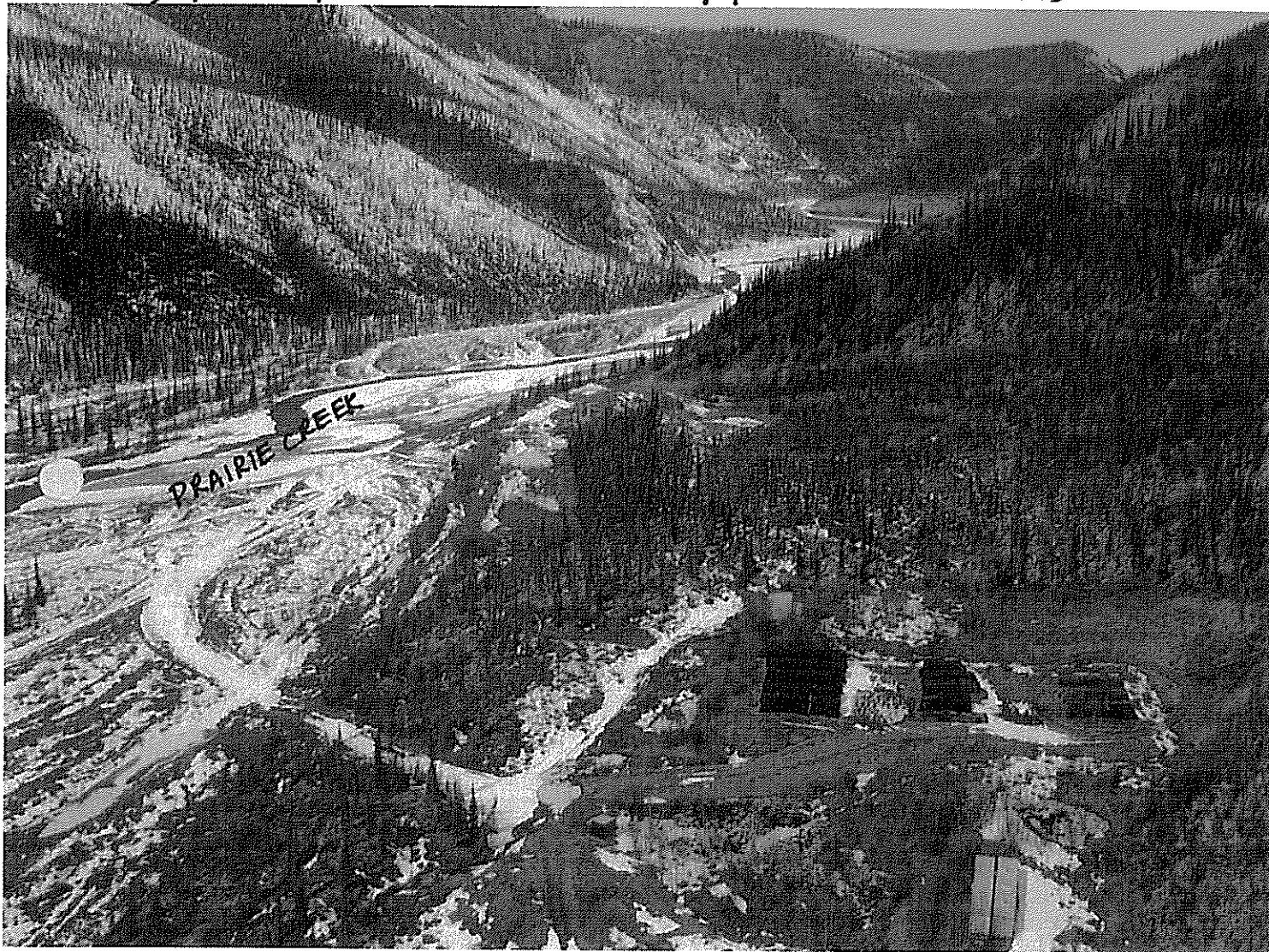
Photograph #2: Trailer inside bermed area surrounding the Tank Farm Facility. The trailer houses batteries, chemicals etc.



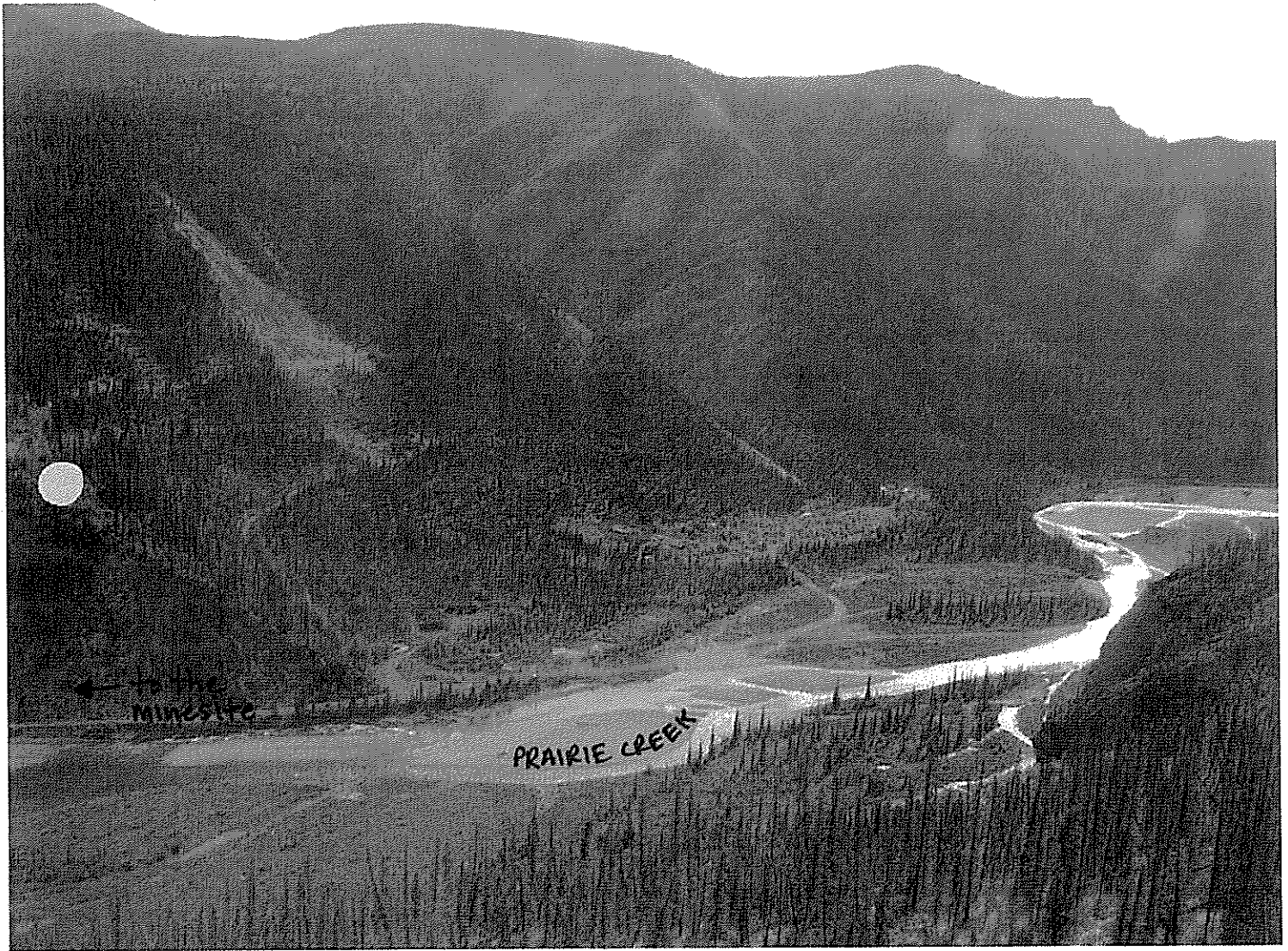
Photograph # 3: The berm between Harrison Creek and the Tank Farm Facility is on the left side of the photo.



Photograph #1 of the chemical stores (cyanide circled in red)



Photograph #2 of the chemical stores (cyanide circled in red)



Photograph #3 of the chemical stores (cyanide circled in red)



