

# WHITEHORSE COPPER MINE SITE

## DECOMMISSIONING PLAN

### SPILLWAYS AND DISCHARGE CHANNELS

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24 JULY 1992

File 90-149

WHITEHORSE COPPER MINE SITE  
DECOMMISSIONING PLAN  
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## 1.0 INTRODUCTION

A conceptual decommissioning plan for the Whitehorse Copper Mine site was outlined in the Gadsby Consultants Ltd. report dated November 1991. The report discussed the objectives for decommissioning the mine site, and described the work that would be carried out. The conceptual decommissioning plan was submitted to the Mr. J.A. Polyck, DIAND in November 1991.

Since the conceptual plan was submitted, detailed engineering analyses and design alternatives have been carried out for the spillways and discharge channels required to decommission the mine site.

This memorandum provides a brief discussion of the earthworks, and the design parameters selected to meet the decommissioning objectives for the site.

## 2.0 DECOMMISSIONING WORK

The objectives of the decommissioning plan are:

- to protect public health and safety;
- to alleviate or eliminate environmental damage; and
- wherever practicable, allow a productive return of the land to its original condition, or an acceptable alternative.

Detailed studies have been carried out on the mine site from 1983 to October 1991. The purpose of these studies has been to evaluate the long-term aspects of physical and chemical stability of the site. The results of these studies were presented in the November 1991 report.

An additional set of surface water samples was taken in May 1992; a report summarizing the results from this 1992 survey was submitted to DIAND in June 1992

The conclusions from the studies indicate that:

- The mine site is chemically stable. The tailings and mined rock are not acid generating, and the surface water meets CCREM drinking water quality guidelines, with the exception of manganese (4 locations) and dissolved solids (3 locations); and
- The earth dam structures in the tailing impoundments and the Little Chief Rockpile are considered physically stable for both static and earthquake forces.

## 2.1 Decommissioning Activities

Decommissioning work at the site is primarily associated with the development of spillways and drainage channels to pass the flood flows through the tailing impoundment system, and the prevention of dust being blown off the Old Pond tailings impoundment surface. In addition, plugging and grouting of the decant pipes in the A and B impoundments will be required.

The work will include:

### Old Pond

- Constructing rock-lined spillways 6 & 7, to carry surface drainage from the Old Pond into the A Valley and Crater Lake drainages;
- Contouring the surface of the Old Pond to direct surface drainage into spillways 6 & 7; any depressions and areas where ponding occurs will be backfilled;
- Spreading a thin layer of sand and gravel/fine rock, nominally 3" thick, over portions of the contoured tailing area to provide a dust prevention cover; and
- Plugging and or removing the decant pipes.

The Old Pond Area is sub-divided into four sub-areas. It is proposed that the small internal dykes be

removed, leaving only the 1976 Pipeline Berm. The sand and gravel material in the small dykes would be used for site grading and covering the tailings.

#### **A Dam/Valley**

- Constructing a rock-lined discharge channel between the A and B Valleys; and
- Plugging and grouting the decant pipes.

#### **B Dam/Valley**

- Constructing a rock-lined spillway through the right abutment;
- Placing an inverted filter of selected rock fill downstream of the left abutment, to prevent seepage erosion; and
- Plugging and grouting the decant pipes.

#### **Mined Rock Piles**

- Flattening and contouring the north face of the Little Chief Rock Pile; and
- Removing the Underground Rock Pile for general site grading and contouring work

### **2.1 Flood Hydrology and Routing**

Flood hydrology and routing the tailings impoundment system is discussed in section 5.6.10 of the Conceptual Decommissioning Plan report. The values shown in Table I were developed for designing and planning the spillways and drainage channels.

### **2.2 Design Considerations and Construction Materials**

The following factors have been taken into consideration in developing the spillway designs:

- The work should be kept as simple and as practicable as possible;

- Durable materials, not subject to weathering, and readily available on the site; should be used; and
- The facilities should be as maintenance free as possible.

Materials available on site consist of well-graded sands and gravels, (max. size about 6 ins) and the mined rock from the open pit operations, (max. size approx. 36ins).

## 2.3 Design Details

A general layout plan for the decommissioning earthworks is shown on drawing 90-149-18. Details for the specific spillways and discharge channels are shown on drawings 90-149-19 to 22, and discussed below.

### 2.2.1 Old Pond Spillways #6 & 7

Details are shown on drawings 90-149-19 and 20.

Both spillways will be rock lined, have a minimum base width of 20 feet and side slopes no steeper than 5 horizontal to 1 vertical. The spillway gradient through the embankments will be no steeper than 2%.

For spillway #6, twenty-four inch minus (24) well graded rock will be used to withstand the velocity during the probable maximum flood, which is calculated to be 8 fps or less. The downstream apron of Spillway #6 will have a gradient of between 8 to 10%, and the 24 inch size rock is likely to be eroded at floods greater than the 1000 year event. Larger size rock, if readily available, will be used in this apron section to improve the resistance against flood events greater than the 1000 year event. The rock layer will be placed upon a 18 inch thick filter layer of sand and gravel.

For spillway #7, 12 inch minus well graded rock will be used to withstand the velocity during the probable maximum flood, which is calculated to be 5 fps. The downstream apron will be constructed from 24 inch minus rock, to withstand the calculated velocity of 7 fps during the probable maximum flood.

In the downstream aprons for both of the spillways, rock groynes will be placed on the outside of the aprons to direct the flood flows; the positions of the groynes will be established in the field.

### 2.2.2 A/B Valley Discharge Channel

Details are shown on drawing 90-149-21.

The cross section will be similar to that for the #6 and #7 Spillways, The channel will be constructed to an invert elevation of 2501 feet, and zero gradient. The maximum velocity for the PMF at 2% gradient is calculated at 7 fps; The channel will be lined with a 24 inch layer of 18 inch minus rock, underlain by an 18 inch layer of sand and gravel. The outfall will be constructed from 36 inch minus rock, about the largest size available on site.

### 2.2.3 B Dam Spillway

Details are shown on drawing 90-149-22.

The B Dam Spillway will be the final spillway in the tailings impoundment system. The spillway will be a rock-lined open channel excavated in the sands and gravels of the right abutment to the B Dam. The spillway will have a total length of about 500 feet. The spillway channel will have a base width of 20 feet and side slopes of 2 horizontal to 1 vertical. The initial invert level on the upstream side of the B Dam will be 2492 feet. The gradient through the right abutment will be 0.5%, over a distance of approximately 360 feet. Water will be discharged into the environment, over the rock apron placed on the existing natural slope, about 500 feet distance from the B Dam.

The calculated flow for the PMF is 800 cfs; and the water velocity in the main channel will about 6 fps. The spillway channel will be lined with an 18 inch layer of 12 inch minus rock fill, placed directly upon the sands and gravels in the right abutment. At the discharge apron, the critical water velocity at the outfall edge is calculated to be 16 fps, which would require a rock size about 72 inches ( $D_{50} = 36$  inches) to prevent erosion; these large rocks are not available on the site. For the 1000 year flood event, the water velocity at the outfall edge is calculated to be 12 fps, which would require a maximum rock size of about 48 inches ( $D_{50} = 24$  inches); it is expected that rocks of this size can be selected from the rock piles.

From the above, the rock-lined main spillway channel, over the 0.5% gradient section, is not expected to be eroded during the PMF. The outfall apron will be protected with rock, using selected materials generally greater than 48 inches, and larger if available. It is expected that the outfall apron will resist the 1000 year flood event.

Sand and gravel materials from the excavation will be used to cover a portion of the tailings in the Old Pond Area, or disposed of on site.

#### 2.2.4 B Dam Left Abutment Downstream Slope Protection

Details are shown on drawing 90-149-22.

Gulleying in the upper portion of the natural sand and gravel slope is being caused by natural seepage from a lake, about 600 feet east, and 15 feet above the crest of the B Dam. A layer of 18 inch minus selected rock fill, about 10 feet thick, will be placed over approximately a 150 foot width of the slope.

Respectfully submitted



John W. Gadsby P.Eng



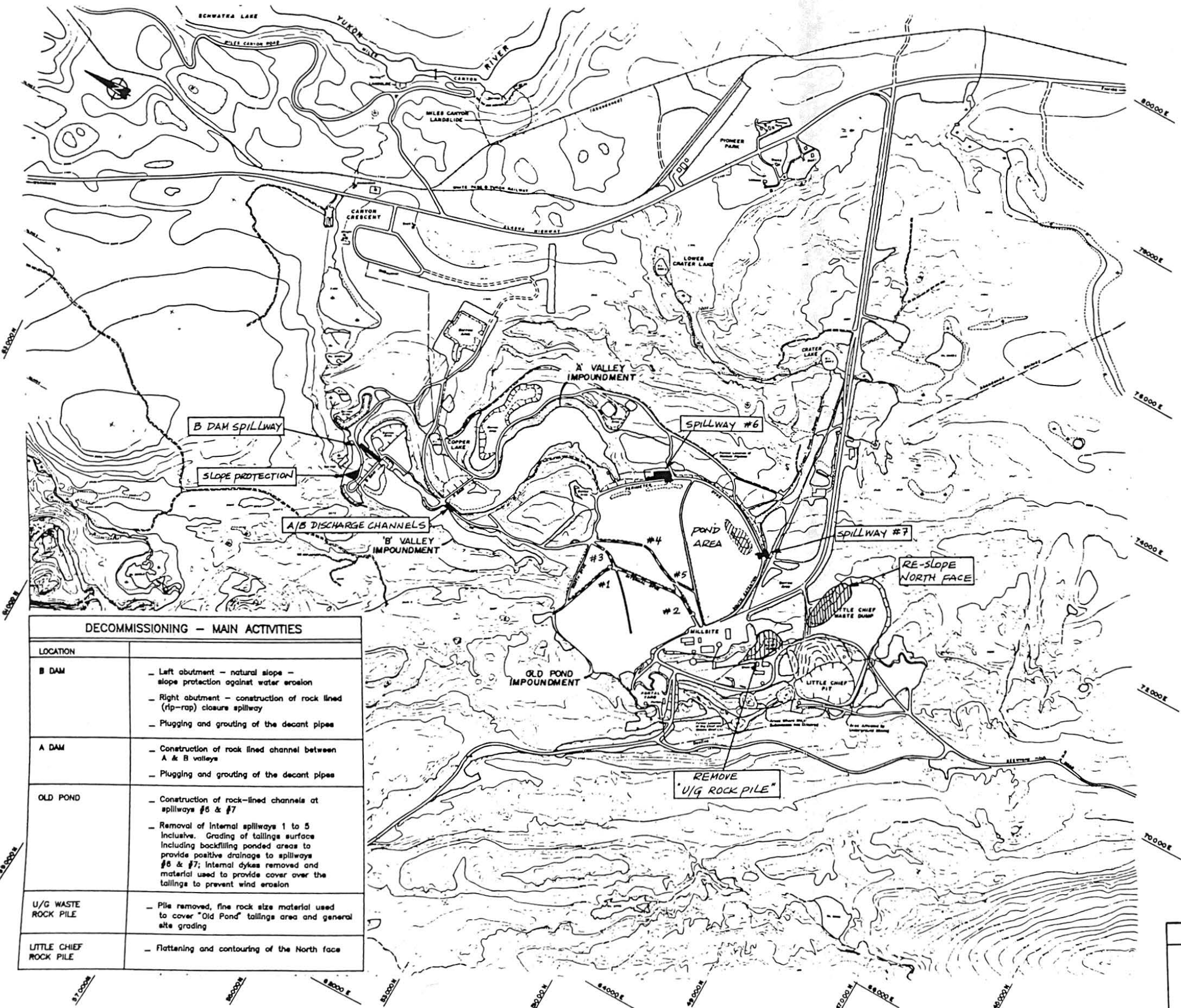
Adrian G. Chantler P.Eng.



Spill-way	Flood Event	Flood Flow cfs	Channel Grad.	Water Depth ft.	Vel. fps	D <sub>50</sub> rock size ins.
Old Pond #6 20 ft wide 5:1 side slopes	PMF	745	2%	2.7	8	10
			10%	1.8	14	40
	1000 year	264	2%	1.6	6.	6
			10%	1.0	10.	24
Old Pond #7 20 ft wide 5:1 side slopes	PMF	137	2%	1.1	5	5
			5%	0.9	7	10
A/B Dis. Channel 12 ft wide; 5:1 side slopes	PMF	332	2%	2.2	7	8
B Dam Spill-way Invert @ 2492ft	PMF	800	0.5%	5.6	6	5
			Outfall edge	3.1	16	36
	1000 year	321	0.5%	3.5	5	3
			Outfall edge	1.8	12	24

**TABLE I  
CLOSURE SPILLWAYS  
PRINCIPAL DESIGN PARAMETERS**

(Ref: Erosion and Sediment Control; United States Environmental Protection Agency, publication 625/3 -76-006).



**LEGEND:**

**GENERAL FEATURES**

- Permanent Stream
- Intermittent Stream
- Open Channel
- Spring or Seepage
- Permanent Lake or Pond
- Fen or Muskeg
- Areas Subject to Seasonal and/or Ephemeral Flooding
- House and Well
- Access Road
- Crest of Slope
- Edge of Clearing

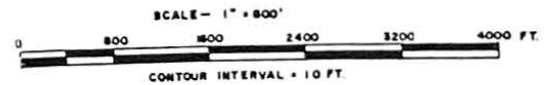
**REFERENCE DRAWINGS:**

- N.T.S. Topography - Whitehorse (1:25,000)  
Part of 105 D/11h, 11g & 10e (1968)
- "Valerie - Arctic Chief - Topography" - New Imperial Mines Ltd.  
Drwg. No. D-11-1 (Undated)
- "Plan of Tailings Area" - Whitehorse Copper Mines (1973)
- Airphotos 24074 (Sept. '67) and 127955 (June '80) -  
Pacific Survey Corporation.

**NOTES:**

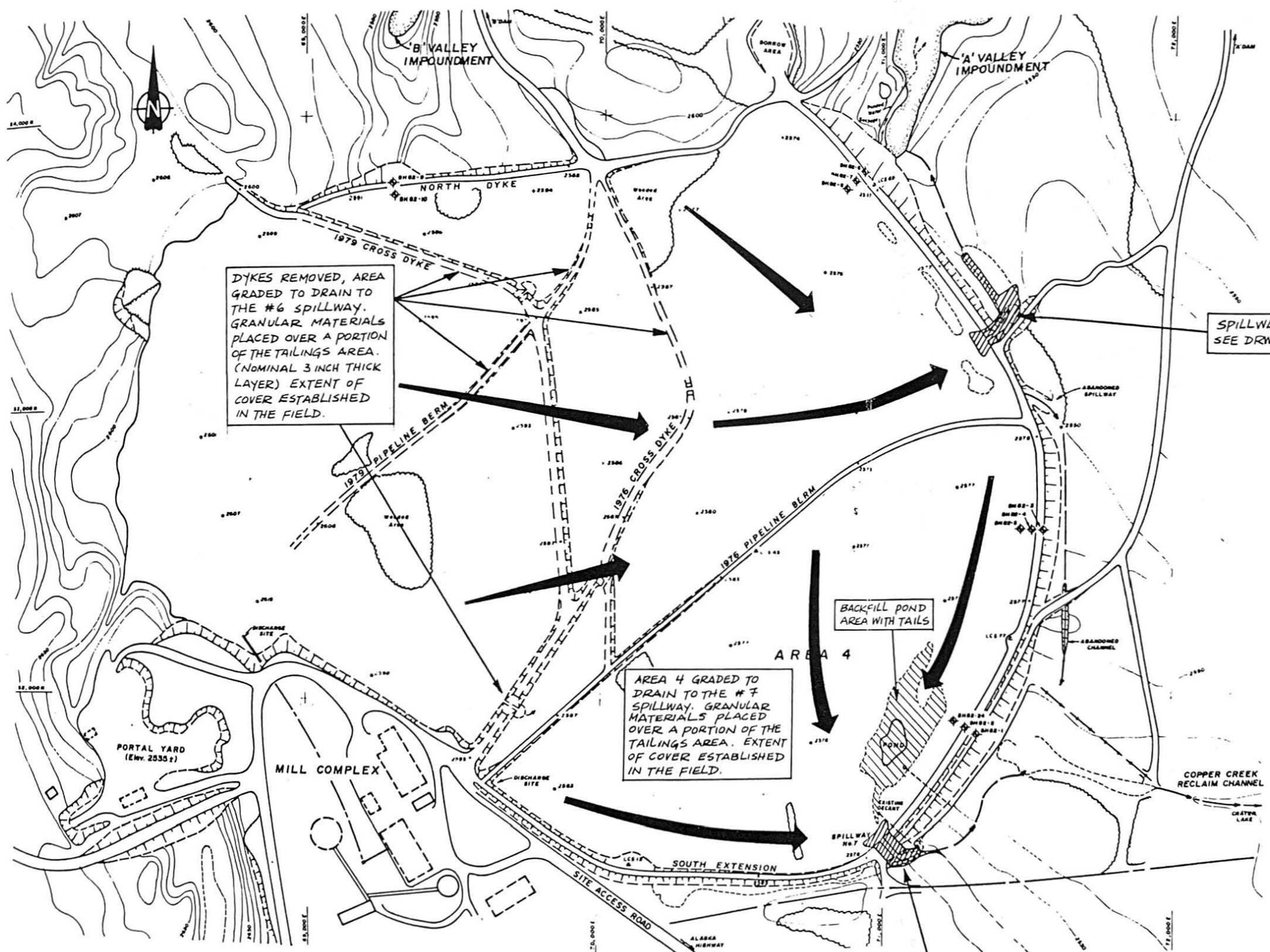
- 1) Topographic information has been compiled from various sources. Contours in northern and eastern areas are approximate only.
- 2) Planimetric detail has been compiled from uncontrolled airphoto enlargements. Various features have been omitted for clarity.
- 3) Drawing depicts conditions as of June 1987. Various abandonment work has already been completed.

SITE PLAN ADOPTED FROM DRAWINGS SUPPLIED BY THOMPSON GEOTECHNICAL CONSULTANTS LTD.



DECOMMISSIONING - MAIN ACTIVITIES	
LOCATION	
B DAM	<ul style="list-style-type: none"> <li>- Left abutment - natural slope - slope protection against water erosion</li> <li>- Right abutment - construction of rock lined (rip-rap) closure spillway</li> <li>- Plugging and grouting of the decant pipes</li> </ul>
A DAM	<ul style="list-style-type: none"> <li>- Construction of rock lined channel between A &amp; B valleys</li> <li>- Plugging and grouting of the decant pipes</li> </ul>
OLD POND	<ul style="list-style-type: none"> <li>- Construction of rock-lined channels at spillways #6 &amp; #7</li> <li>- Removal of internal spillways 1 to 5 inclusive. Grading of tailings surface including backfilling ponded areas to provide positive drainage to spillways #6 &amp; #7; Internal dykes removed and material used to provide cover over the tailings to prevent wind erosion</li> </ul>
U/G WASTE ROCK PILE	<ul style="list-style-type: none"> <li>- Pile removed, fine rock size material used to cover "Old Pond" tailings area and general site grading</li> </ul>
LITTLE CHIEF ROCK PILE	<ul style="list-style-type: none"> <li>- Flattening and contouring of the North face</li> </ul>

HUDSON BAY MINING & SMELTING CO. LTD.		DATE
WHITEHORSE COPPER MINE SITE		JULY 1992
SITE PLAN		PROJ. NO.
DECOMMISSIONING EARTHWORKS		90-149
		APPROVED
		NO.
GADSBY CONSULTANTS LTD. IN ASSOCIATION WITH STEVEN ROBERTSON & PARTNERS		18



DYKES REMOVED, AREA GRADED TO DRAIN TO THE #6 SPILLWAY. GRANULAR MATERIALS PLACED OVER A PORTION OF THE TAILINGS AREA. (NOMINAL 3 INCH THICK LAYER) EXTENT OF COVER ESTABLISHED IN THE FIELD.

AREA 4 GRADED TO DRAIN TO THE #7 SPILLWAY. GRANULAR MATERIALS PLACED OVER A PORTION OF THE TAILINGS AREA. EXTENT OF COVER ESTABLISHED IN THE FIELD.

SPILLWAY #6  
SEE DRWG. No. 20

SPILLWAY #7  
SEE DRWG. No. 20

**LEGEND:**

- Crest of Slope
- Toe of Slope
- Open Channel - Drainage Swale
- Areas Subject to Seasonal and/or Ephemeral Flooding
- Edge of Clearing
- Location of Borehole/Instrumentation
- Spot Elevations - Oct. '81
- Spot Elevations - May '82
- Spot Elevations - Aug. '82

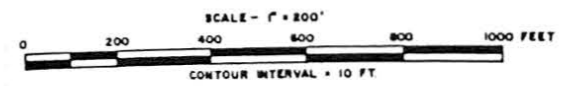
**REFERENCE DRWGS:**

- Old Pond Storage Area - Thompson Geotechnical - Aug. '82
- Valeria - Arctic Chief Topography - New Imperial Mines Drwg No. D-11-1 (undated).
- Airtphotos 129754 & 129755 - Pacific Survey Corp. - June '80.

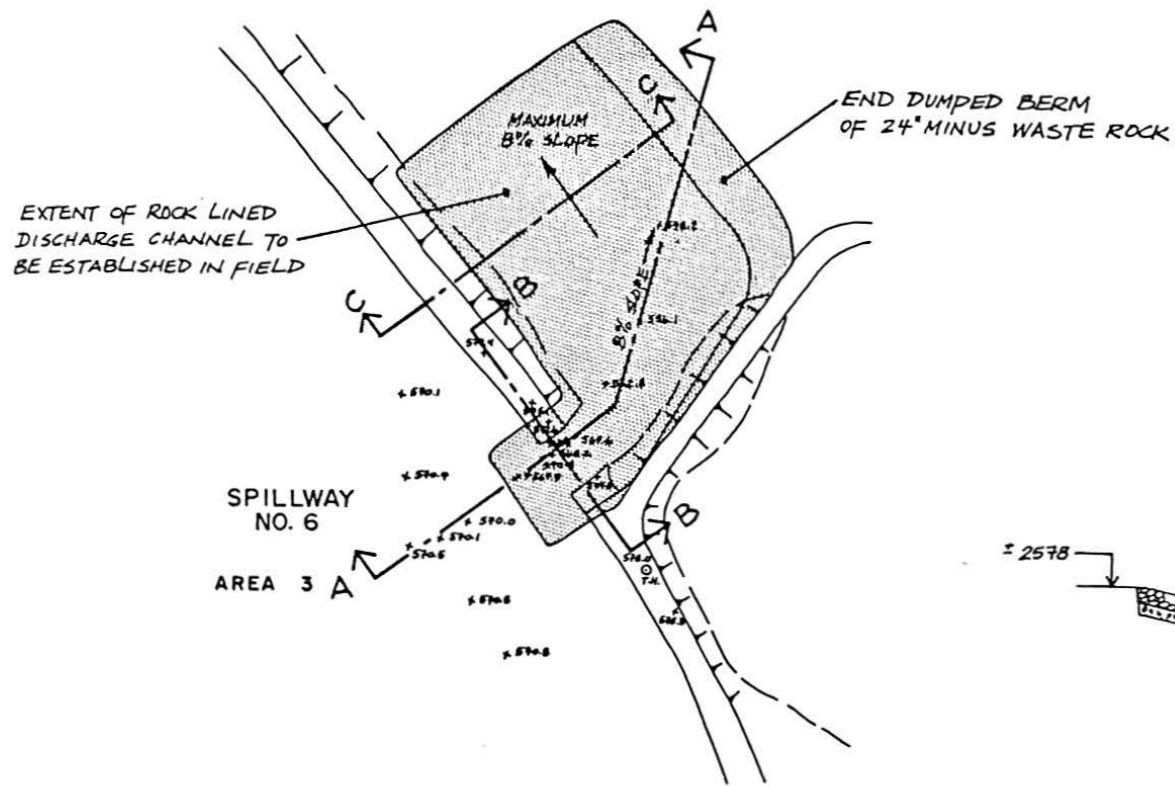
**NOTES:**

- 1) Drawing has been compiled from various data. Topographic and planimetric detail is approximate only.
- 2) Spot elevations have been defined from surface surveys as noted in legend. Minor deposition and/or settlement has occurred in various areas since surveys were completed.
- 3) Sections A-A to E-E shown on Figure 11.

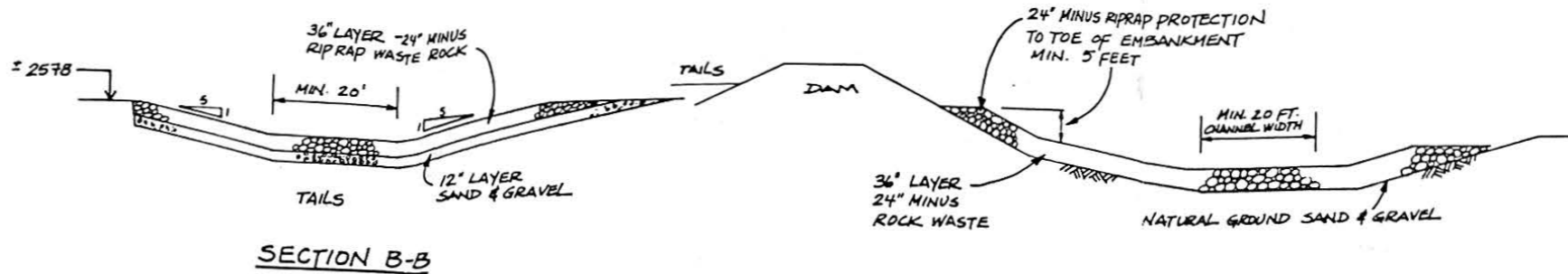
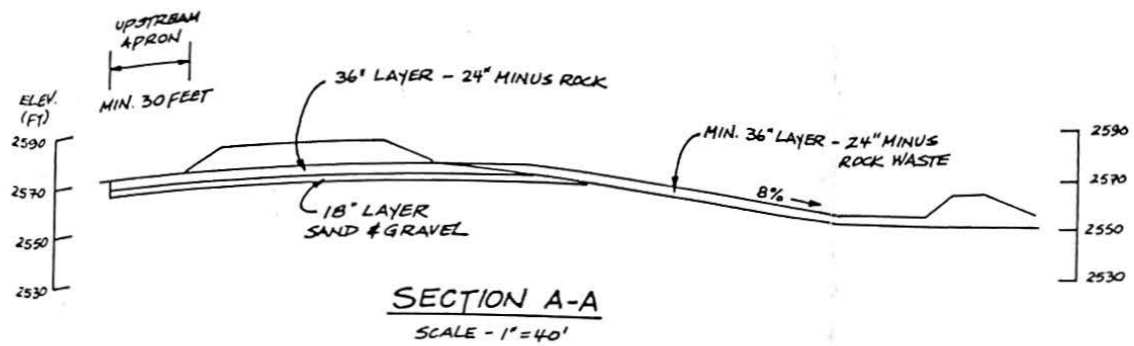
PLAN ADOPTED FROM DRAWINGS SUPPLIED BY THOMPSON GEOTECHNICAL CONSULTANTS LTD.



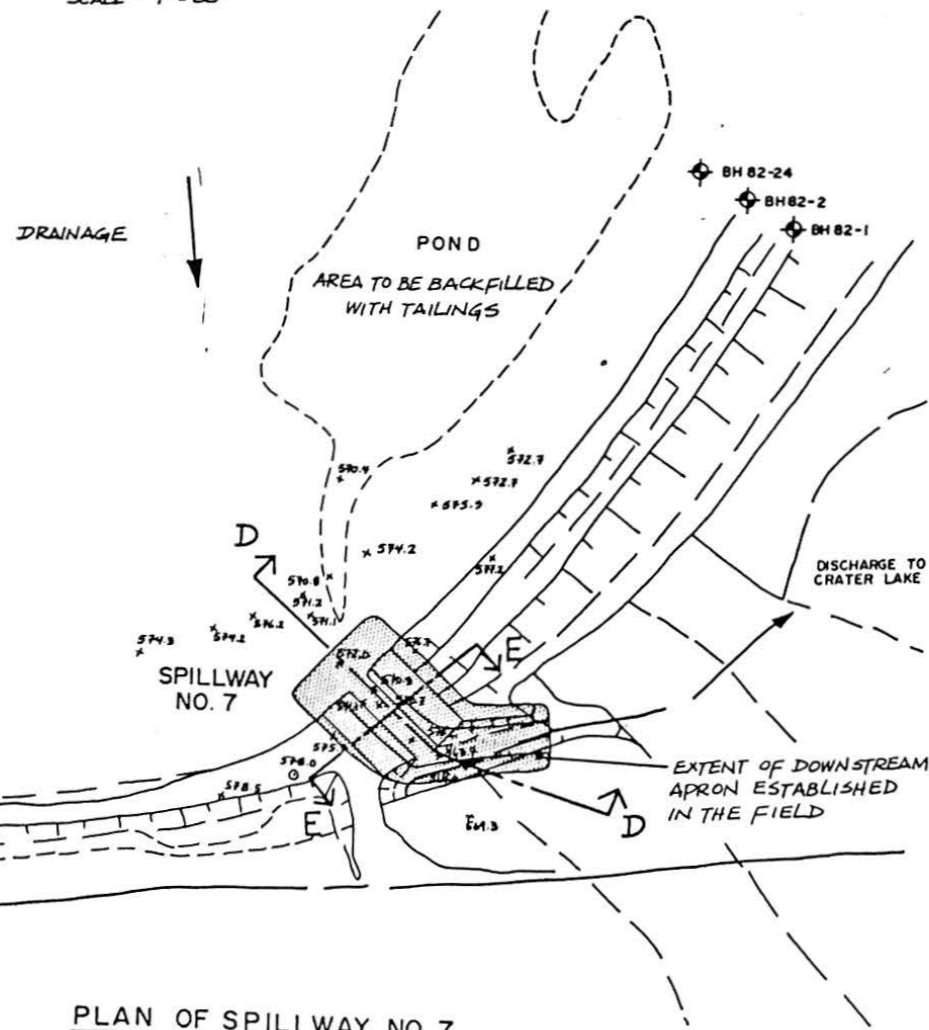
HUDSON BAY MINING & SMELTING CO. LTD.		DATE	JULY 1992
WHITEHORSE COPPER MINE SITE		PROJ. NO.	90-149
"OLD POND" IMPOUNDMENT AREA DECOMMISSIONING EARTHWORKS		APPROVED	
GADSBY CONSULTANTS LTD IN ASSOCIATION WITH STEFFEN ROBERTSON & KIRSTEN		NO.	19



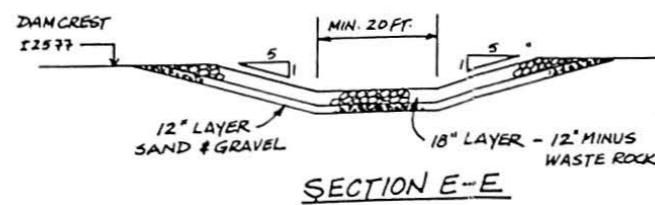
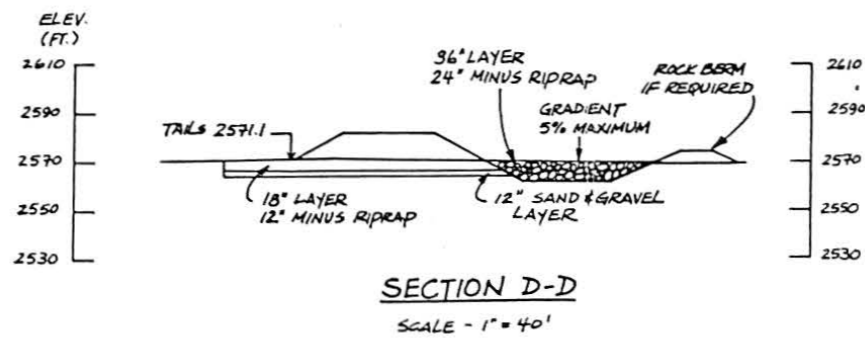
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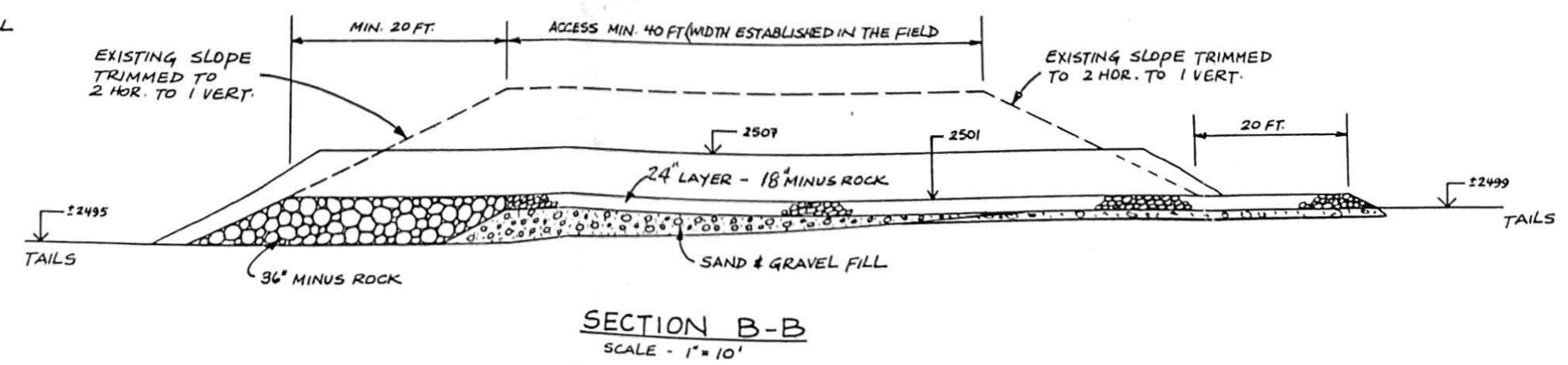
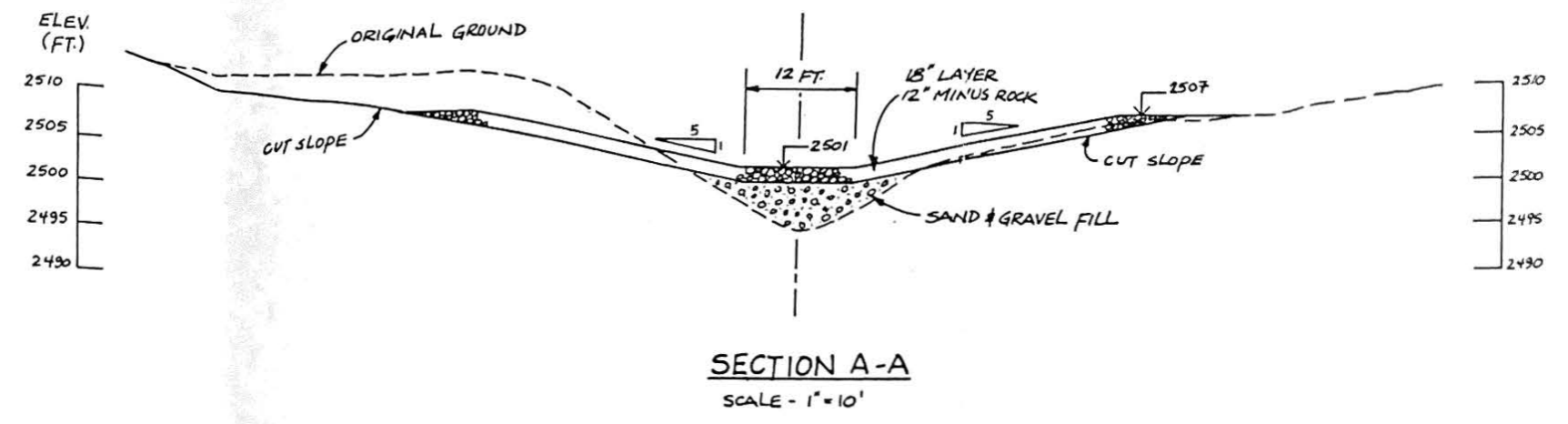
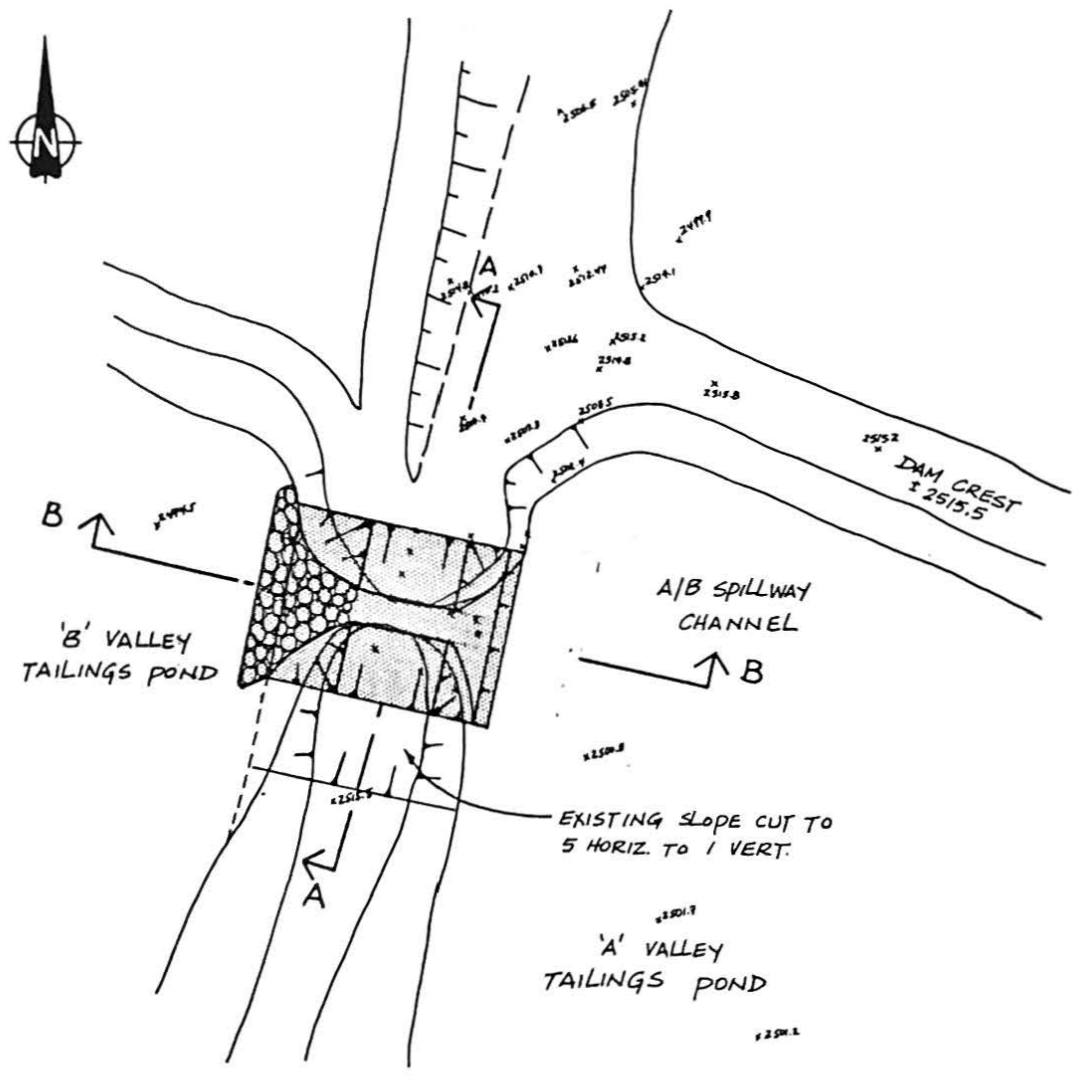
SECTION C-C



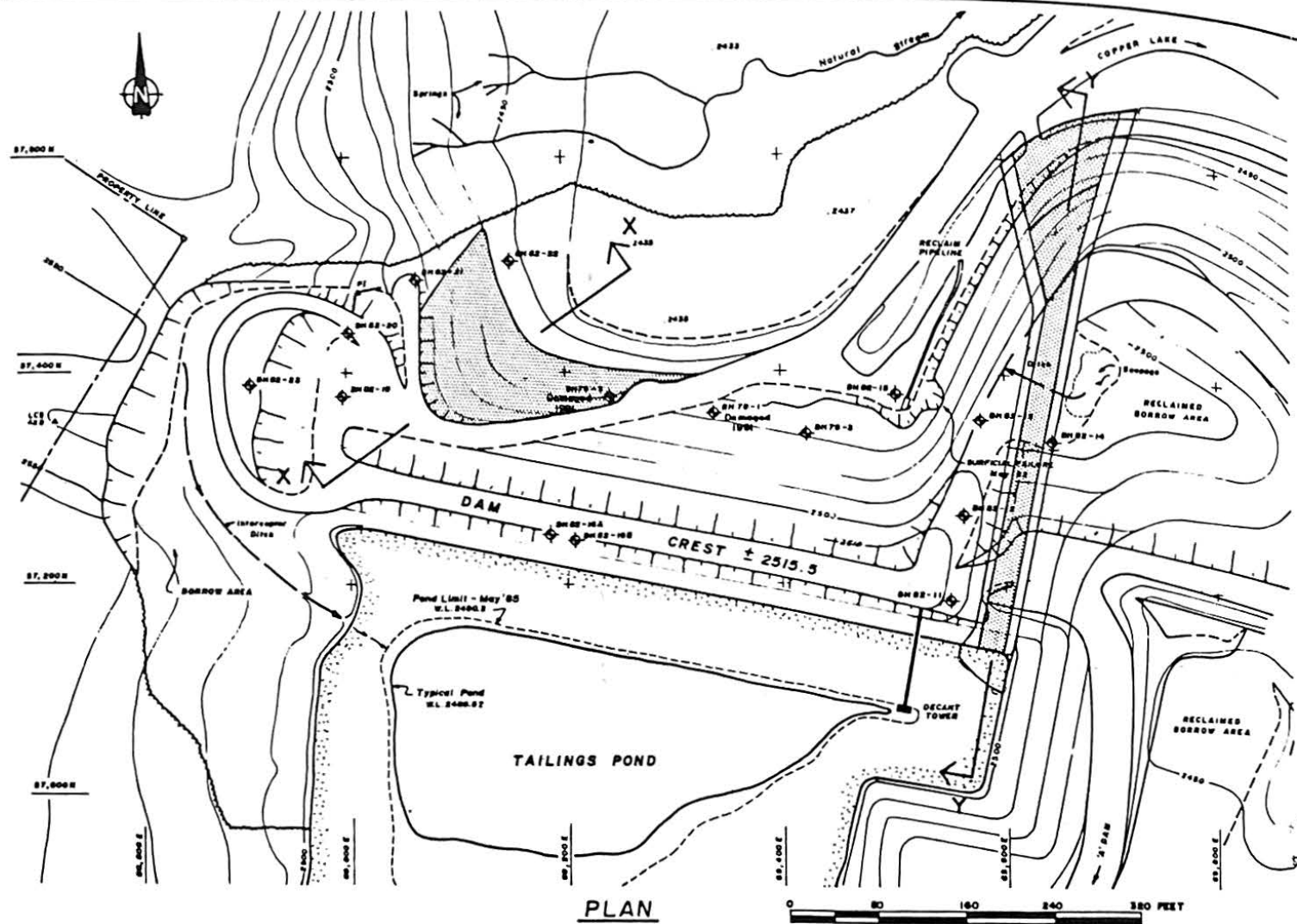
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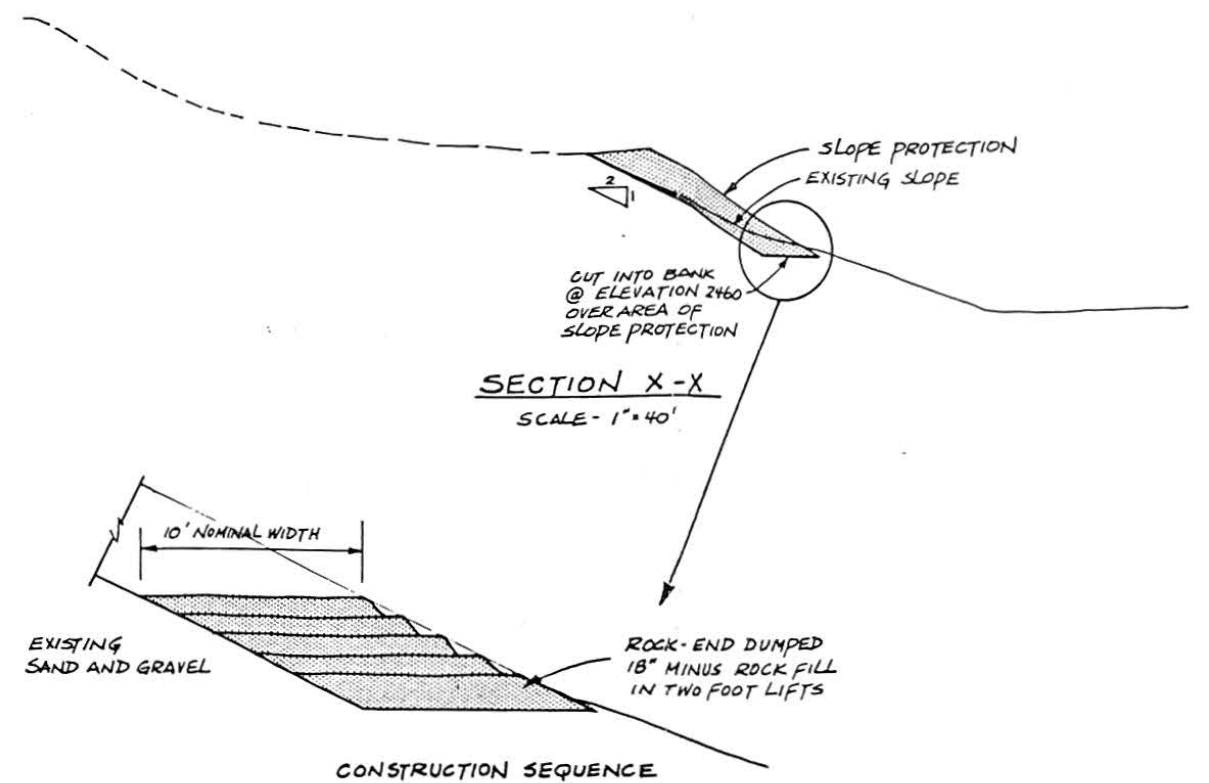
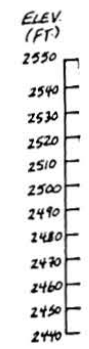
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"OLD POND" - SPILLWAYS 6 & 7		PROJ. NO.
DECOMMISSIONING EARTHWORKS		90-149
		APPROVED
		NO.
GADSBY CONSULTANTS LTD. IN ASSOCIATION WITH STEFFEN ROBERTSON & KIRSTEN		20



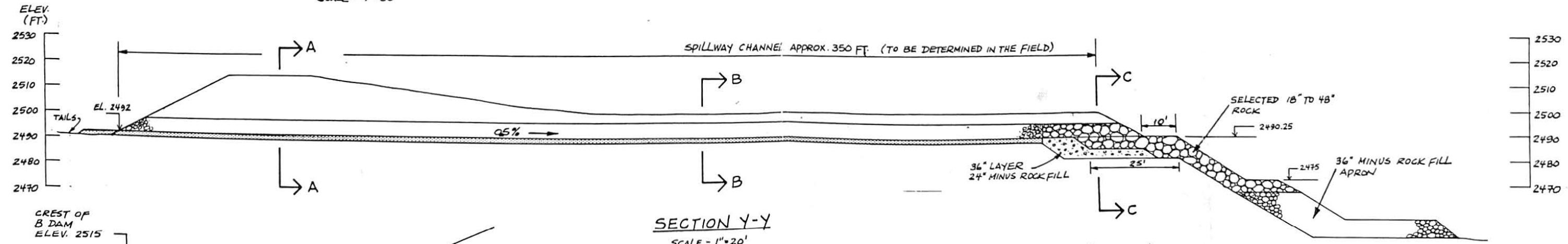
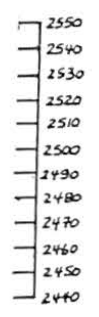
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A/B SPILLWAY CHANNEL		PROJ NO
DECOMMISSIONING EARTHWORKS		90-149
GADSBY CONSULTANTS LTD. IN ASSOCIATION WITH STEFFEN ROBERTSON & KIRSTEN		APPROVED
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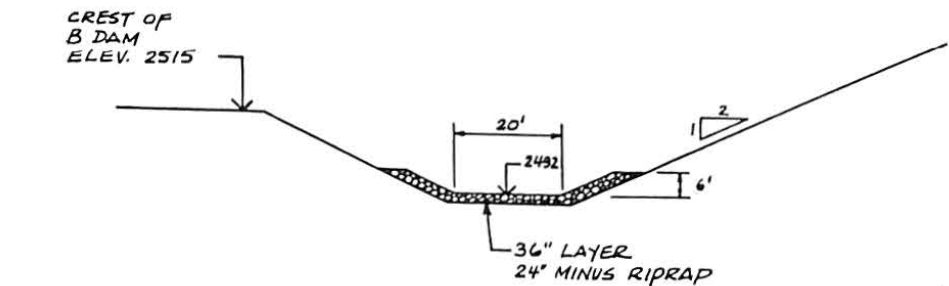
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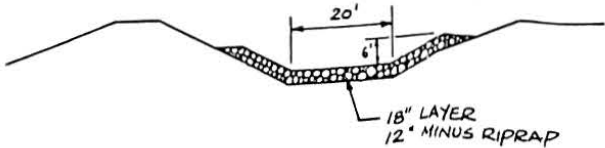
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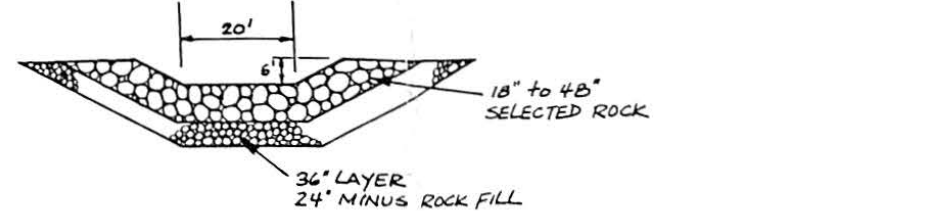
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SECTION A-A



SECTION B-B



SECTION C-C

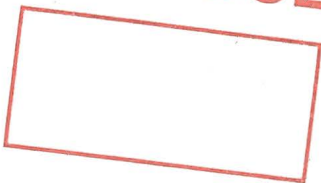
HUDSON BAY MINING & SMELTING CO. LTD.		DATE JULY 1992
* WHITEHORSE COPPER MINE SITE		PROJ. NO. 90-149
B DAM SLOPE PROTECTION & EROSION DECOMMISSIONING EARTHWORKS		APPROVED
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