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REPORT TO

COMINCO LTD.

RE

HB TAILINGS DAM NEAR SALMO, B.C.

LJM

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INTRODUCTION

This report presents the results of an investigation of the existing HB Tailings Dam south of Salmo, B.C., together with an assessment of its stability. An assessment is also made of the suitability of the existing dam to impound tailings that would be generated in the event that Cominco decide to put the HB mine and concentrator back into operation. The investigation and this report were authorized by Cominco Purchase Order HB2 dated June 1, 1972.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

1) The water level in the existing tailings pond can be raised to elevation 2502; 3 ft. below the crest of the existing HB Tailings Dam.

2) Normal water surface in the tailings pond should be maintained at a level not higher than elevation 2502 to assure that adequate freeboard is maintained.

3) The results of stability analyses indicate that the existing embankment has an adequate factor of safety with respect to a shearing failure of the downstream slope.

4) The foundation soils on which the HB Tailings Dam has been constructed consist of dense glacial till. These glacial till soils exhibit high shear strength characteristics, and are relatively incompressible. They provide unyielding foundation support for the tailings dam, and preclude the possibility of a shearing failure through the foundation.

5) In the event that Cominco decide to raise the crest of the existing tailings dam, this should be done by placing additional fill on the crest, and on the downstream fill slope. A drainage blanket consisting of clean, well-graded sand and gravel should be provided adjacent to the existing downstream fill slope prior to placement of new fill.

PROCEDURE

The HB Tailings Dam was inspected by the writer in company with Mr. G. Shoblom of Cominco Ltd. on May 24th and 25, 1972. At the time of this inspection, the existing borrow pits at the east and west abutments of the dam were examined to gain an appreciation of the nature and type of soils that had been used in its construction.

Two test pits were excavated into the existing embankment fill. Test pit no. 1, located on the crest of the tailings dam was excavated to a depth of 4 1/2 ft. using a small backhoe. Owing to difficulty of access, test pit no. 2, located at the toe of the fill slope was excavated by hand. Representative samples of soil from test pits 1 and 2 were retained for laboratory testing.

A 20 ft. long section of perforated pipe was installed in a drilled hole on the centreline of the dam crest to permit measurement of the phreatic water surface within the section.

Representative samples of the embankment fill materials were subjected to grain size analysis to determine the particle size distribution of the fill material. Two typical grain size curves are shown on Fig. 5. Samples of the no. 4 minus fraction of the material were subjected to laboratory shear strength tests to evaluate the shear strength parameters of the soils used in the construction of the embankment (see Fig. 6). A ground survey by Mr. H. Dixon of Cominco Ltd. established the configuration of the existing downstream fill slope.

Using the data collected in the course of the field and laboratory investigations, stability analyses were performed to assess the factor safety of the dam with respect to potential shearing failure through the embankment.

HB TAILINGS DAM

The HB Tailings Dam is located approximately four miles south of Salmo, B.C. (see Fig. 1). The dam was originally constructed in 1955 for retention and storage of tailings produced at the HB Mine, which operated from 1955 to 1966. The mining operations were suspended in 1966.

The crest of the HB Tailings Dam is approximately 650 ft. long, and is curved in the upstream direction. The maximum height of the dam is of the order of 50 to 60 ft. above the original ground surface. Contours on the downstream face of the tailings dam, together with three typcial cross sections are shown on Fig. 2. Photographs of the tailings dam are shown on Figs. 3 and 4.

The HB Tailings Dam is equipped with two decant outlets to pass water from the upstream to the downstream side of the structure. Each decant consists of a timber tower on the upstream side of the dam, with a 24 in. diameter steel corrugated pipe passing through the embankment from the upstream to the downstream side of the dam. The present inlet elevation at the easterly decant tower is 2496.3, while the inlet elevation at the westerly decant tower is 2499.6. The east decant tower passes normal flows which enter the tailings dam, while the west decant tower would serve as an emergency outlet in the event that the capacity of the east decant were exceeded.

The HB tailings dam is an earthfill embankment constructed of materials borrowed from the east and west abutments. We understand that the borrow materials were excavated and transported to the section by bulldozers. Compaction within the section was achieved by the traffic of the construction equipment used to spread and place the fill.

The materials used in construction of the dam consist of silty sand and gravel with scattered cobbles and small boulders. Most of the available borrow materials have now been removed from the east abutment. The limited amount of material which remains on the east abutment consists predominantly of slightly silty fine to medium sand. The materials from the west borrow pit consist of a well graded heterogeneous mixture of silt, sand, gravel, cobbles and boulders (glacial till). The materials incorporated within the west half of the dam contain more stone than those within the east half, reflecting the higher stone content of the borrow materials that were available from the west abutment.

The crest of the dam was raised periodically during the period 1955 to 1966 as the tailings storage requirements increased. The crest of the dam was raised by the downstream method of construction, i.e. additional fill was placed on the crest and on the downstream slope of the dam.

We understand that the original dam was constructed with an earthfilled timber crib retaining wall at the downstream toe. Subsequent to construction of this retaining wall, a flat earth fill supporting berm has been constructed on its downstream side, and the crib has been covered over. Prior to placement of this stabilizing fill, several concrete pipe drains were installed at the downstream toe of the dam. The outlets of some of these drains were seen during the site inspection on May 25th.

FOUNDATION SOILS

Soil exposures at the downstream toe of the dam were examined during the May 24th - 25th inspection. The in situ soils exposed at the downstream toe of the HB Tailings Dam consist of dense glacial till composed of a heterogeneous assortment of silt, sand, gravel and occasional small cobbles. The material is very dense, and exhibits high shearing strength characteristics. These materials are capable of providing foundation support for the structure without any danger of shearing failure or significant settlement under the weight of the embankment fill.

EMBANKMENT STABILITY

Direct shear tests on representative samples of the embankment fill show that the fill material has an angle of internal friction of approximately 35 1/2° with 0 cohesion. The flat toe berm below elevation 2470 on the downstream side of the dam provides a high degree of stability to the structure, and precludes the possibility of a deep seated shearing failure within the embankment. This toe berm reduces the effective height of the embankment to approximately 35 ft.

The stability of the existing embankment between elevation 2470 and the present crest at elevation 2505 is governed by the gradient of the downstream fill slope between these elevations, the shear strength characteristics of the embankment fill, and the position of the phreatic surface within the section. The approximate position of the phreatic surface for a tailings pond level at elevation 2503 is shown on section BB, Fig. 2. The phreatic surface shown on Section BB is based on the water level measurement in the observation well installed at Section AA on the centreline of the dam, a water level at elevation 2503 on the upstream face, and the approximate position of the drains on the downstream side of the buried timber crib.

The stability analyses indicate that the minimum factor of safety of the embankment, for potential failure surfaces which intersect the upstream slope at or below the crest is 1.3. The factor of safety is considered adequate, although it is near the lower limit of the range considered acceptable by conventional engineering practice.

SAFETY AGAINST OVERTOPPING

The size of the catchment area surrounding the HB Tailings Pond is approximately 480 acres. The approximate boundaries of the catchment area are indicated on Fig. 1. The closest station at which long term percipitation records have been maintained is Nelson, B.C., which is approximately 26 miles north of the HB Tailings Dam. The long term percipitation records at Nelson indicate a maximum rainfall of 2.6 in. in 24 hrs. Assuming a runoff coefficient of 0.8, a rainfall of 2.6 inches in 24 hours over an area of 430 acres would result in an average runoff rate of approximately 40 cu.ft./sec. The two 24 in. diameter decant pipes are capable of passing between 50 and 60 cu.ft./sec. Thus, the existing decant system at the HB Tailings Dam is considered to have sufficient capacity to pass the maximum anticipated flow into the tailings pond. We therefore conclude, that the existing outlet capacity is adequate, and that the structure would not be over topped during the maximum anticipated runoff.

SEEPAGE

Based on examination of the ground surface at the downstream toe of the existing dam, the total leakage was estimated to be of the order of 5 to 10 gallons per minute. If the water surface in the pond is raised from its present level to elevation 2502, the rate of seepage will increase only slightly. Examination at points where drains exit on the downstream slope indicated that the existing drains are not carrying soil particles. The existing drains appeared to be operating satisfactorily.

SURFACE EROSION

The presence of cobbles and gravel within the embankment fill affords a degree of erosion protection on the downstream face of the existing embankment. Examination of the dam indicates that no significant surface erosion has occurred on the downstream fill slope during the six year interval 1966 to 1972. Also, there is no evidence that wave action in the tailings pond has resulted in any significant deterioration of the upstream fill slope. The performance of the existing structure indicates that the dam has adequate protection against surface erosion.

In conclusion, our analyses and studies indicate that the existing HB Tailings Dam will perform satisfactorily after the water level in the tailings pond has been raised to elevation 2502. If during operation, it is decided that the crest of the dam should be raised to provide a greater depth of water for clarification of the tailings effluent, the crest of the dam should be raised by placing additional fill on the crest, and on the downstream fill slope. To assure that the phreatic surface within the section does not rise above the level of the existing downstream fill slope, a layer of free draining granular fill should be placed adjacent to the existing downstream slope, as illustrated on Fig. 7. The fill placed on the crest and on the downstream slope should be spread in horizontal layers not exceeding 12 in. thickness, and each layer should be compacted to a minimum density equivalent to 95 percent of maximum dry density as determined by the Standard Proctor Compaction Test prior to placement of each succeeding layer.

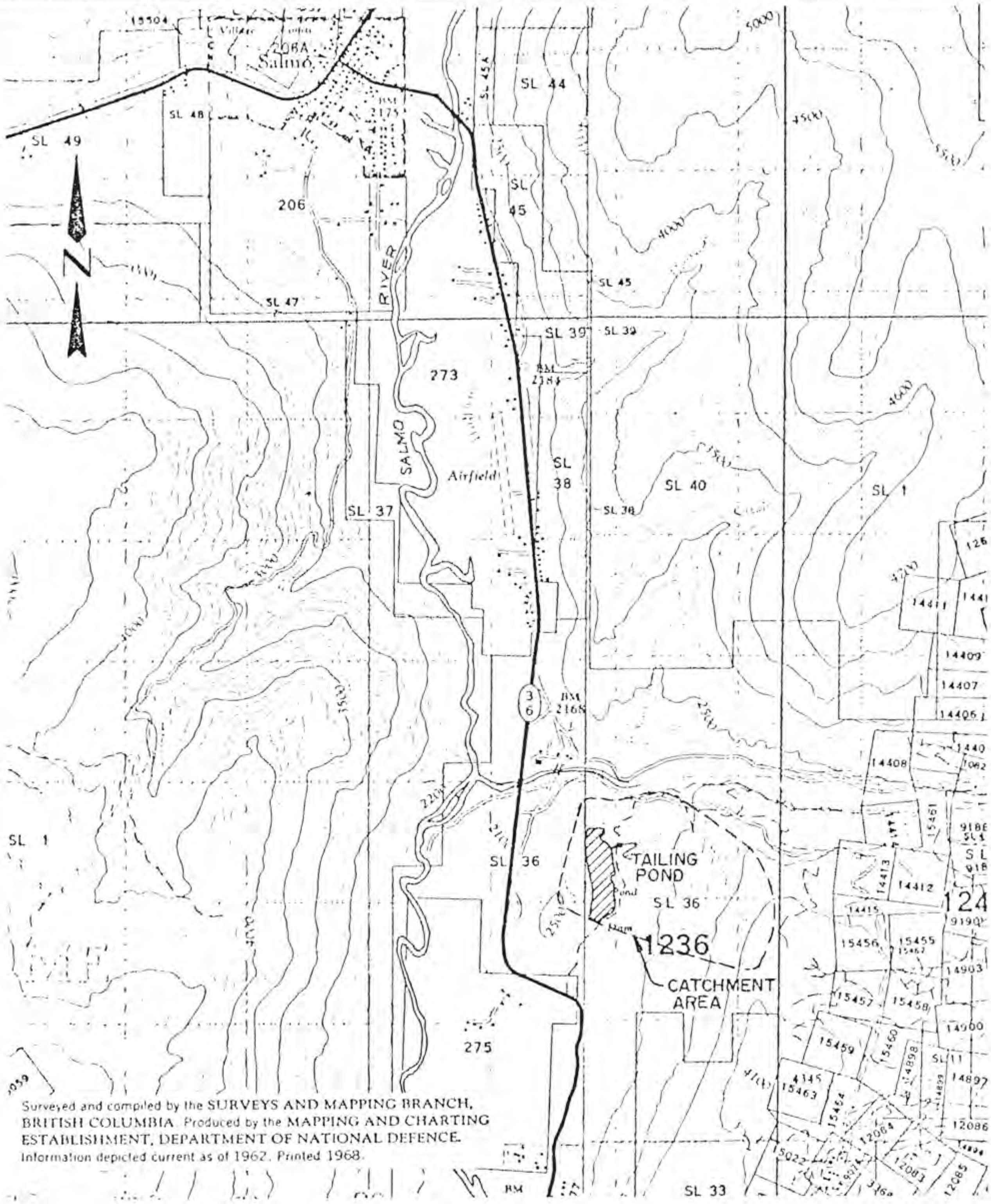
GOLDER BRAWNER & ASSOCIATES LTD.

David B. Campbell

DBC/sm D.B. Campbell, P. Eng.

LOCATION PLAN

FIGURE 1



SCALE 1:50,000 ÉCHELLE

Miles 1 0 1 2 3 Miles

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Made
Chkd.
Appd.

PROJECT No. 1210

SITE PHOTOGRAPHS

FIGURE 3

*HB Tailings Dam-
Looking toward
west abutment.
Note west
abutment
borrow pit to
left of centre.*

*HB Tailings Dam-
Looking toward
east abutment.
East abutment
borrow pit is
located beyond
east abutment.*

GOLDER, BRAWNER & ASSOCIATES

Made L.R.T.
Chkd.
Appd.

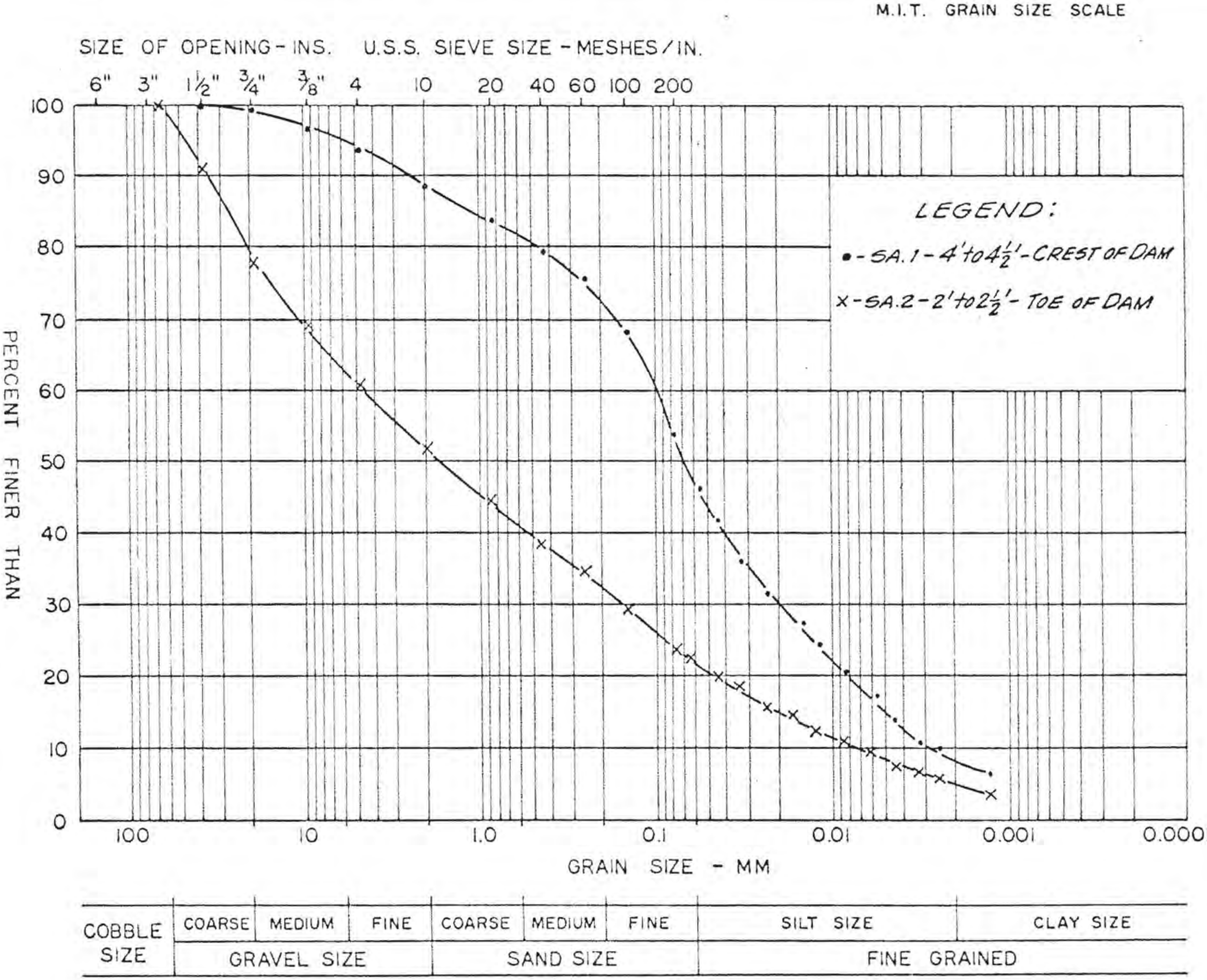
SITE PHOTOGRAPH

FIGURE 4

View of downstream face of H B Tailings Dam. Flume at far side of toe berm carries discharge from east decant tower.

GRAIN SIZE DISTRIBUTION

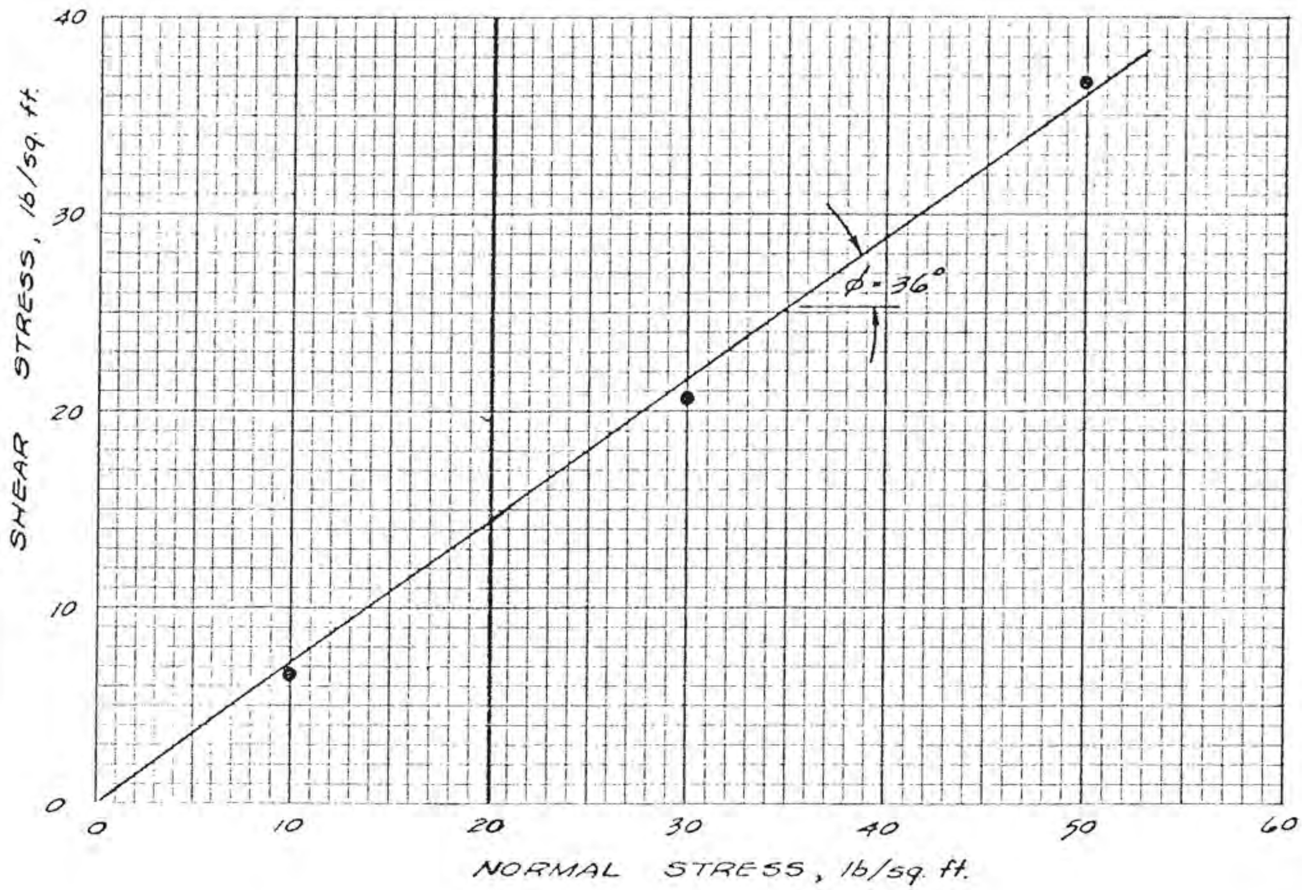
FIGURE 5



GOLDER, BRAWNER & ASSOCIATES

DIRECT SHEAR TEST RESULT
H. B. TAILINGS DAM

FIGURE 6

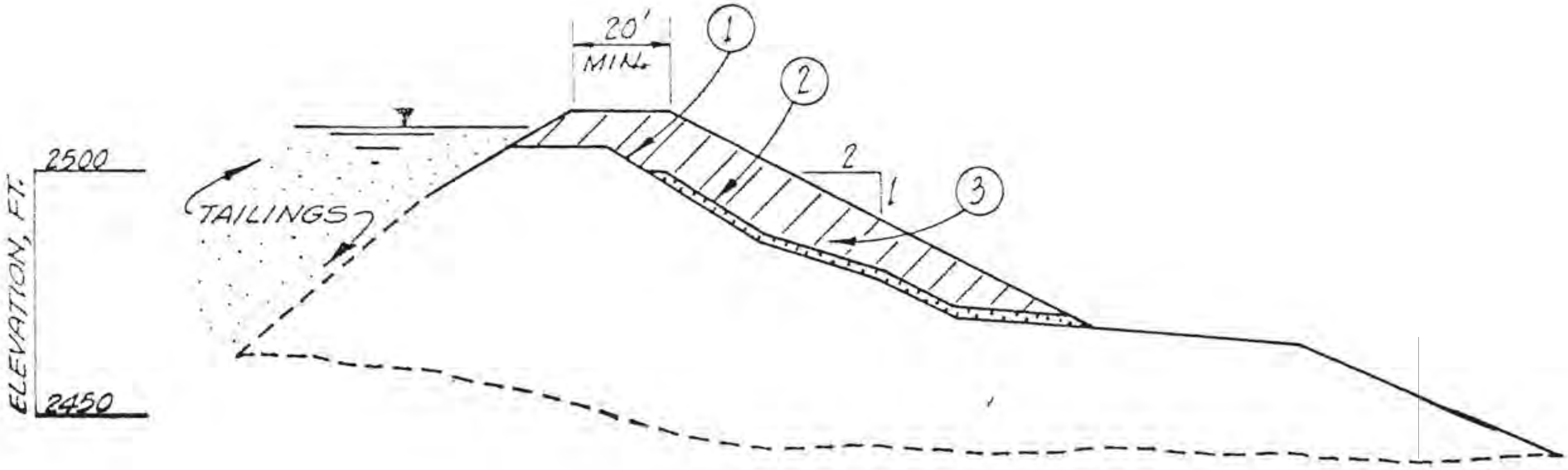


RESULTS OF DIRECT SHEAR TEST ON MINUS # 4 FRACTION OF MATERIAL FROM TEST PIT #2. MATERIAL PLACED IN SHEAR BOX AT DENSITY OF 106 lb/cu. ft., THEN SATURATED. RATE OF STRAIN 0.01 in/min.

Drawn A.F.
Approved BL
Date JUNE '72

GOLDER, BRAWNER & ASSOCIATES

METHOD OF RAISING DAM CREST LEVEL



SCALE: 1 IN. TO 50 FT. VERT. & HOR.

(1) EXISTING DOWNSTREAM FILL SLOPE.

(2) LAYER OF CLEAN FREE-DRAINING SAND AND GRAVEL MINIMUM THICKNESS 18".

(3) NEW FILL - PLACED IN UNIFORM LAYERS OF 12" MAXIMUM THICKNESS. COMPACT EACH LAYER TO A MINIMUM DENSITY EQUIVALENT TO 95% MAXIMUM DRY DENSITY AS DETERMINED BY STANDARD PROCTOR COMPACTION TEST.

FIGURE 7

GOLDER, BRAWNER & ASSOCIATES

Drawn
Approved
Date

Specification No. HBO.005-1

COMINCO LTD.

H.B. MINE TAILINGS DIKE EXTENSION

INSTRUCTIONS TO TENDERERS

FORM OF TENDER

SCHEDULE OF QUANTITIES & UNIT PRICES

FORM OF CONTRACT AGREEMENT

GENERAL CONDITIONS OF CONTRACT

SPECIFICATION

DRAWINGS

Prepared by

COMINCO LTD.

June 1974

GRIT
1649

COMINCO LTD.

H.B. MINE TAILINGS DIKE EXTENSION

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	Form of Tender
	Schedule of Quantities and Unit Prices
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	General Conditions of Contract
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	- Section 2 - Earthwork

SPECIFICATION

SECTION 2

EARTHWORK

2-01 SCOPE

The work covered in this section includes all earthwork, clearing and development of borrow pits, establishment and maintenance of access and haulroads, dewatering and extending of the decant discharge culvert necessary for the fulfillment of the contract.

2-02 GENERAL ARRANGEMENTS

All excavation, fill placing and other construction work shall be completed to the lines, elevations and sections shown on the drawings or as directed by the Engineer.

Fill material shall be obtained from borrow areas suggested in Section 1 and as approved by the Engineer.

2-03 CLEARING

The work to be done under this Clause shall comprise the supply of all labour, material and plant and the performance of all work necessary for clearing of the site as shown on the drawings, as required by the Engineer and as specified herein.

Clearing shall consist of cutting and disposing of all trees, shrubs, brush, debris and all other perishable materials, including fallen trees and logs within the areas to be cleared.

All trees, shrubs and brush shall be cut to within 2' above the ground surface. The organic cover of topsoil on the ground surface shall be left intact, except where excavation is required as stated in these documents.

All vegetation and debris resulting from clearing operations regardless of size, shall be removed from the areas cleared, and shall be disposed of by the following methods, upon written approval of the Engineer.

(a) Combustible materials may be piled and burned on open fires as specified herein. Material to be disposed of in this way shall be completely burned so that it is all reduced to ashes.

(b) Materials obtained from clearing which cannot be burned may be placed in nearby disposal areas as directed by the Engineer. The material placed in disposal areas shall be crushed with a tractor or other heavy equipment to a thickness of not more than 5 feet.

2-03 CLEARING (Cont'd)

The Contractor shall be responsible for any damage done by fire resulting from the work under this item and shall at no time leave a fire unattended until it is fully extinguished. All burning shall be done in strict conformance with the rules and regulations of local, provincial, and federal agencies and it shall be the responsibility of Contractor to obtain all burning permits.

Sufficient equipment shall be ready and available together with a sufficient force of men to control burning operations at any time.

Measurement for payment for clearing will be made of the number of acres cleared in accordance with these specifications, measured to the nearest 1/10 acre as the projection onto a horizontal plane.

Payment for clearing will be made at the unit price per acre bid in the Schedule of Quantities and Unit Prices.

2-04 FOUNDATION PREPARATION

The work to be done under this item shall comprise the supply of all labour, material and plant for the performance of all work necessary for the preparation of the foundations for the dike as shown on the drawings, as specified herein and as required by the Engineer.

Foundation preparation shall be scheduled such that the appropriate fill material may be placed shortly thereafter. No fill material shall be placed on any part of the foundation area until each part of the foundation has been approved by the Engineer.

Foundation preparation shall include the removal of any coarse rock or boulders that are laying where construction is to take place. The coarse rock and boulders shall be removed to ensure a good contact between the new and the existing work. The coarse rock may be removed by bulldozing the rock off the crest and down the downstream slope so that the remaining rock protruding above the general surface is not larger than 6 inches in size.

If necessary, the Engineer may require that the foundation surface be moistened or dried prior to compaction, and scarified, moistened or dried prior to placing of the fill material to create a satisfactory bond between the foundation and the fill materials.

The foundation surface shall be compacted by four complete passes of compaction equipment as specified herein. Pockets of poor or unsuitable materials, which during this operation cannot be satis-

2-04 FOUNDATION PREPARATION (Cont'd)

factorily compacted, shall be excavated to the limits ordered by the Engineer.
Unsuitable materials excavated and disposed of when ordered by the Engineer shall be measured by cross-sectioning the area to be excavated before and after removal. Payment will be made at the unit price bid for "Unsuitable Material" in the Schedule of Quantities and Unit Prices.

Foundations soils which become soft due to inadequate control of surface or subsurface water, or for any other reason become unacceptable due to the Contractor's operations, shall be removed and replaced with fill material and compacted as specified herein at no additional expense to the Owner.

The placing of fill will not be permitted on foundation soils which are frozen. The removal of any frozen foundation soils shall be accomplished at no additional expense to the Owner.

Measurement for payment for the preparation of the foundations will be made of the actual prepared surface area, projected onto a horizontal plane, measured in square yards, prepared as specified herein, with no allowance made for irregularities.

Payment for the preparation of the foundation soil complete in every respect and as specified herein, will be made at the unit price per square yard bid in the Schedule of Quantities and Unit Prices.

2-05 FILTER ZONE

2-05 (a) Scope of Work

The work to be carried out under this item shall comprise the supply of all labour, material, plant, equipment, fuel and the performance of all work necessary to prepare, develop, excavate, load, haul, rehandle if necessary, place, compact, upgrade the existing haul road, maintain, leave in good condition and any other operations necessary to carry out the work as required by the Engineer.

2.05 (b) Fill Material

This material is a clean sand and gravel or clean gravel and cobbles, the gradation of which lies within the shaded envelope shown on Figure 1. Material in this size range is available about $1\frac{1}{2}$ miles from the dike.

All fill shall be free of organic materials, roots, and other perishable materials. No fill material shall contain ice or snow, or shall be placed in a frozen condition.

Cobbles and boulders larger than 9" shall be removed from all fill prior to compaction.

2.05 (c) Borrow Operations

Fill materials shall be obtained from the borrow areas as indicated in the Tender Documents and as approved by the Engineer. Approval by the Engineer of a source of fill material shall not be construed as constituting approval of all materials to be taken from that source.

The Contractor shall conduct his operations in borrow areas in such a manner which shall ensure that the maximum possible volume of suitable construction material may be obtained. Measures shall be taken to ensure adequate drainage of water from the borrow areas so that the borrow material is obtained at a water content suitable for compaction and so that the borrow operations are not affected adversely. Ponding and infiltration of water shall be prevented.

Some of the material in the borrow areas may be frozen. The Contractor shall conduct his operations in such a manner to ensure that the frozen material shall be thawed prior to placement in the dikes. To meet this requirement the Contractor shall open and work as large an area of the borrow areas practical, and shall rip, scarify, disc, harrow or use any other similar means to expose the frozen material to permit thawing.

The detailed planning of the operation of the borrow area shall be the responsibility of the Contractor and shall be subject to the approval of the Engineer.

EARTHWORK

2-05 (c) Borrow Operations (cont'd.)

Prior to commencement of the work, the Contractor shall submit for approval by the Engineer, a plan showing the details of his proposed methods and the sequence and schedule of operations to be followed for the utilization of the borrow area to obtain the required fill material. During construction the plan shall be reviewed and modified as required. A copy of the modified plan and schedule shall be provided for the Engineer's approval prior to implementation of any changes.

Unsuitable material shall be disposed of as directed by the Engineer and graded off to present a reasonably uniform appearance.

The Contractor shall be responsible at all times for the safe operation of the borrow area. All slopes left permanently exposed shall be approved by the Engineer.

2-05-(d) Haul Roads

Approval by the Engineer of any proposed haul roads shall be obtained before commencing construction of the haul roads.

All haul roads built and maintained by the Contractor shall be available, without charge, for use by the Engineer and by others authorized by the Engineer, and at completion of the Contract, shall become the property of the Owner.

2-05 (e) Compaction Equipment

The Filter Zone shall be compacted with a grid-roller towed by a suitable tractor. The grid-roller shall be a Hyster Model D with concrete ballast weighing approximately 13 tons, or an alternative approved by the Engineer.

Power tampers for compaction near structures shall weigh not less than 200 pounds and shall have a ramming foot area not exceeding 80 square inches. The rammer shall be capable of delivering at least 200 foot pounds of compacting energy per blow.

2-05 (f) Placing and Compacting

No fill material shall be placed in any section of the dike until the foundation soil for that section has been suitably prepared according to the requirements of these specifications.

2-05 (f) Placing and Compacting (cont'd.)

The placing of fill material shall be directed at obtaining a stable and a reasonably homogeneous fill. The fill material shall be spread in approximately horizontal layers of uniform thickness by bulldozers or other approved means. If necessary, discing, harrowing, or other approved means shall be employed to break up the material and to blend it before compaction.

The thickness of fill layers shall not exceed twelve inches before compaction.

Four passes of the compaction equipment shall be made over each layer before a succeeding layer is placed.

No separate payment will be made for compaction.

The fill shall be placed in such a way that the top surface of any section, along the axis of the dike, shall remain approximately level. During spreading and compaction, a slope towards the downstream toe shall be maintained on the fill surface providing a transverse grade not exceeding ten percent so that water from precipitation will drain. In order that the effect of precipitation on placed fill be minimized, the surface shall be rolled smooth, and adequate drainage shall be provided prior to periods of precipitation when operations must be suspended.

The elevation of the filter blanket shall be so maintained that it is no more than four feet higher than the adjacent Common Fill. Care shall be maintained so that the mixing of the Filter Zone and Common Fill is not allowed to take place. Each zone shall be kept clearly separate.

All openings through the dike for construction purposes shall be subject to the Engineer's approval. The slope of openings left through dikes and at the end of any unfinished section shall not be steeper than four horizontal to one vertical.

The water content of the fill prior to and during compaction shall be distributed uniformly throughout each layer. The water content shall be within the range required to obtain the specified soil density during compaction.

Overbuilding or under building shall be remedied at the Contractors expense to the satisfaction of the Engineer.

2-05 (g) Measurement and Payment for "Filter Zone" and "Overhaul - Filter Zone"

The unit price tendered for "Filter Zone" shall include all costs to complete the work as described under paragraph 2-05 (a), and as detailed elsewhere in the Tender Documents. A free-haul distance of 2 miles is to be included in the tender price for the Item "Filter Zone"

The unit of measure is the cubic yard and is the volume measure in place on the dike by cross-sectioning before and after the placement and compaction of the filter zone.

All measurements for payment purposes shall be carried out by a survey crew as laid out in paragraph 2-08. Measurement will be made to the theoretical neat lines where a zone is built to or beyond the theoretical neat line. Measurement will be made to the actual surface where the surface of a zone is not built out to the theoretical neat line. Payment for all work carried out under this Section and completed in all respects will be the product of the volume measured and the unit price tendered for "Filter Zone".

An overhaul unit price for hauling beyond the 2 mile free-haul limit is to be tendered under the Item "Overhaul-Filter Zone". The tendered price is to include for all additional costs incurred for the haul and return of haulage vehicles. The unit of measure is the cubic yard-station. This unit is the product of the volume of materials moved and the distance beyond the free-haul limit measured in one direction in stations. One station is one hundred feet.

2-06 SELECT IMPERVIOUS AND COMMON FILL

2-06 (a) Scope of Work

The work to be carried out under this item shall comprise the supply of all labour, material and plant, fuel and the performance of all work necessary to prepare and maintain borrow areas and haul roads, rip, excavate, load, transport, dump, spread and compact fill material for the tailings dikes as shown on the drawings, as required by the Engineer and as specified herein.

2-06 (b) Fill Material

Select impervious fill shall be a glacial till, well graded with a maximum size of 9 inches and with at least 20% finer than the No. 200 U.S. Standard sieve size.

2-06 (b) Fill Material (cont'd.)

Common fill shall be a glacial till, well graded with a maximum size of 9 inches.

Both select impervious fill and common fill must be of a gradation and moisture content that allows them to be placed and adequately compacted as specified herein.

All fill shall be free of organic materials, roots, and other perishable materials. No fill material shall contain ice or snow, or shall be placed in a frozen condition.

Cobbles and boulders larger than 9 inches shall be removed from all fill prior to compaction.

2-06 (c) Borrow Areas

Fill material shall be obtained from the Borrow Areas near the east and west abutments of the existing dike and as approved by the Engineer. Approval by the Engineer of a source of fill material shall not be construed as constituting approval of all materials to be taken from that source.

2-06 (d) Borrow Operations

The Contractor shall conduct his operations in borrow areas in such a manner which shall ensure that the maximum possible volume of suitable construction material may be obtained. Measures shall be taken to ensure adequate drainage of water from the borrow areas so that the borrow material is obtained at a water content suitable for compaction and so that the borrow operations are not affected adversely. Ponding and infiltration of water shall be prevented.

Some of the material in the borrow areas may be frozen. The Contractor shall conduct his operations in such a manner to ensure that the frozen material shall be thawed prior to placement in the dikes. To meet this requirement the Contractor shall open and work as large an area of the borrow area as practical, and shall rip, scarify, disc, harrow or use any other similar means to expose the frozen material to permit thawing.

The detailed planning of the operation of the borrow area shall be the responsibility of the Contractor and shall be subject to the approval of the Engineer.

Prior to commencement of the work, the Contractor shall submit for approval by the Engineer, a plan showing the details of his

2-06 (d) Borrow Operations (cont'd.)

proposed methods and the sequence and schedule of operations to be followed for the utilization of the borrow area to obtain the required fill material. During construction the plan shall be reviewed and modified as required. A copy of the modified plan and schedule shall be provided for the Engineer's approval prior to implementation of any changes.

The Contractor shall be responsible at all times for the safe operation of the borrow area. All slopes left permanently exposed shall be approved by the Engineer.

Unsuitable materials shall be removed and placed in disposal areas as directed by the Engineer. The disposal area and pile shall be kept neatly graded for appearance, drainage and stability.

2-06 (e) Haul Roads

Approval by the Engineer of any proposed haul roads shall be obtained before commencing construction of the haul roads.

All haul roads built and maintained by the Contractor shall be available, without charge, for use by the Engineer and by others authorized by the Engineer, and at completion of the Contract, shall become the property of the Owner.

2-06 (f) Compaction Equipment

The filter zone shall be compacted with a grid-roller towed by a suitable tractor. The grid-roller shall be a Hyster Model D with concrete balast weighing approximately 13 tons or an alternative approved by the Engineer.

Power tampers for compaction near structures shall weigh not less than 200 pounds and shall have a ramming foot area not exceeding 80 square inches. The rammer shall be capable of delivering at least 200 foot pounds of compacting energy per blow.

2-06 (g) Placing and Compacting

No fill material shall be placed in any section of the dike until the foundation soil for that section has been suitably prepared according to the requirements of these specifications.

The placing of fill material shall be directed at obtaining a stable and a reasonably homogeneous fill. The fill material

2-06 (g) Placing and Compacting (cont'd.)

shall be spread in approximately horizontal layers of uniform thickness by bulldozers or other approved means. If necessary, discing, harrowing, or other approved means shall be employed to break up the material and to blend it before compaction.

The thickness of fill layers shall not exceed twelve inhces before compaction.

The fill shall be placed in such a way that the top surface of any section, along the axis of the dike, shall remain approximately level. During spreading and compaction, a slope towards the downstream toe shall be maintained on the fill surface providing a transverse grade not exceeding ten percent so that water from precipitation will drain. In order that the effect of precipitation on placed fill be minimized, the surface shall be rolled smooth, and adequate drainage shall be provided prior to periods of precipitation when operations must be suspended.

Each zone shall be kept clearly separate by a small difference in elevation.

If the impervious fill material is too dry or too wet, water shall be added or removed by working the fill with a harrow, scarifier or other approved equipment until the water is uniformly distributed and satisfies the requirements of these specifications. Any conditioning of the fill material that may be required to obtain fill with a water content within the required range may be undertaken in the borrow area or after placement in the layer.

Each layer of fill shall be compacted by at least four complete coverages of the compaction equipment as specified in paragraph 2-06 (f). Additional coverages with the compaction equipment shall be made if necessary to ensure both the select impervious and the common fill materials are compacted to a dry density at least equal to 95% of the laboratory maximum dry density as determined from the Product compaction tests as specified in ASTM D698.

The surface of the existing dike, against which the select impervious fill or common fill is to be placed, is to be bladed and scarified and then blended in with the new materials to create a homogeneous fill free of any unconformity.

2-06 (g) Placing and Compacting (cont'd.)

The fill within any zone shall be effectively bladed and mixed so as to create a homogeneous gradation. Care shall betaken to avoid building horizontal layers into the dike that are of a gradation differing largely from the adjacent layers.

If, in the opinion of the Engineer, the surface of the prepared foundation, or the rolled surface of any layer of the fill is too dry or too smooth to bond properly with the layer of material to be placed thereon, it shall be moistened and worked with a harrow, scarifier, or other suitable equipment, in an approved manner and to a sufficient depth to provide a satisfactory bonding surface, before the succeeding layer of material is placed.

If, in the opinion of the Engineer, the surface of the prepared foundation, or the rolled surface of any layer of the fill is too wet for proper compaction of the layer of fill material to be placed thereon, it shall be removed and allowed to dry, or worked with harrow, disc, or other suitable equipment, to reduce the moisture content to the required amount; then it shall be recompacted before the succeeding layer of fill is placed thereon.

Ruts in the surface of any layer shall be graded level and recompacted to the approval of the Engineer.

Any and all materials not approved as fill which accumulate on the surface of any layer or prepared foundation, shall be removed by the Contractor before placing the succeeding layer.

Final acceptance of the fill material will only be made after the material has been placed, spread and compacted in place. Rejection by the Engineer of fill material may be made in the borrow area, in the transporting vehicle, or in place. The Contractor shall co-operate with the Engineer to ensure that only acceptable fill material will be hauled from the borrow area to the work.

Particular care shall be taken to ensure that the compaction requirements are satisfied in areas of fill adjacent to any structure. Compaction adjacent to the structures shall be carried out carefully and thoroughly utilizing approved power tampers where necessary to ensure that the material is tightly compacted at the boundaries of the structure. The thickness of these fill layers compacted by power tampers shall not exceed four inches before compaction. No cobbles or pebbles large than two inches in size will be permitted in the fill material within one foot of structures. Fill shall be placed and compacted against the structures only during daylight hours, unless adequate lighting is provided to the satisfaction of the Engineer.

2-06 (g) Placing and Compacting (cont'd.)

Any layer or layers which, in the opinion of the Engineer, have suffered a reduction in density after compaction due to the action of frost, rain or for any other reason, shall be removed by the Contractor at no additional compensation, before placing operations are resumed.

Fill shall not be placed in a frozen condition and shall not be placed on a surface which is frozen or on which there is any snow or ice. Placing of fill in freezing weather shall not be permitted except when approved by the Engineer, and when proper measures are taken to prevent freezing of the material.

No separate payment will be made for compaction, or work entailed to adjust the moisture content or removal and disposal of materials rejected after being placed on the dike. All openings through the dike for construction purposes shall be subject to the Engineer's approval. The slope of openings left through dikes and at the end of any unfinished section shall not be steeper than four horizontal to one vertical.

Overbuilding or underbuilding shall be remedied at the Contractor's expense to the satisfaction of the Engineer.

2-06 (h) Measurement and Payment for "Select Impervious and Common Fill"

The unit price tendered for "Select Impervious and Common Fill" shall include all costs to complete the work described in this Section 2-06, and as detailed elsewhere in the Tender Documents. A free-haul distance of 2500 feet is to be included in the tender price for the Item "Select Impervious and Common Fill".

The unit of measure is the cubic yard and is the volume measured in place on the dike by cross-sectioning before and after the placement and compaction of the fill.

All measurements for payment purposes shall be carried out by a combined survey crew as laid out in paragraph 2-08. Measurement will be made to the theoretical neat lines where a zone is built to or beyond the theoretical neat line. Measurement will be made to the actual surface where the surface of a zone is not built out to the theoretical neat line.

An overhaul unit price for hauling beyond the 2500 feet free-board limit is to be tendered under the Item "Overhaul - Select Impervious and Common Fill". The tendered price is to include for all additional costs incurred for the haul and

2-06 (h) Measurement and Payment for "Select Impervious and Common Fill (cont'd)

return of haulage vehicles. The unit of measure is the cubic yard-station. This unit is the product of the volume of materials moved and the distance beyond the free-haul limit measured in one direction in stations. One station is one hundred feet.

Payment for all work carried out under this Section and completed in all respects will be the product of the volume measured and the unit price tendered for "Select Impervious and Common Fill".

2-06 (i) Measurement and Payment for Unsuitable Materials

The unit price tendered for "Unsuitable Materials" shall include all costs to complete the work as described in this Section and as detailed elsewhere in the Tender Documents. No overhaul will be paid on this item.

The unit of measure is the cubic yard and the volume for payment purposes is measured by cross-sectioning the area to be excavated before removal and after removal.

Only material designated as "Unsuitable Material" by the Engineer and removed and disposed to his satisfaction will be paid for.

All measurements for payment purposes shall be carried out by a Combined Survey Crew as laid out in paragraph 2-08.

2-07 DECANT OUTLET

2-07 (a) Scope of the Work

The Contractor shall remove the existing wood flume; purchase, have delivered and handle the pipe; haul, place, and compact bedding and backfill material; install and connect the pipe; backfill and compact and carry out all other works necessary to extend the east decant culvert. The cost of all labour, materials, plant, equipment, fuel and other items necessary shall be included in the unit price tendered for "Decant Outlet" in the Schedule of Quantities and Unit Prices.

The Owner will arrange to divert the flow through the emergency decant during the period of alterations to the east decant. The Owner will connect the wood flume to the finished culvert.

The Contractor is to co-operate with the Owner's forces and to keep the work necessary to rebuild the flume to a minimum.

2-07 (b) Materials

The decant pipe shall be 24" diameter, 12 gauge, standard 2 oz. galvanized corrugated (2 2/3" x 1/2") pipe. Connections shall be by bands supplied and installed to the instructions of the manufacturer.

The bedding and backfill material shall be a clean coarse sand with a maximum size of 3/4". Not more than 15% by weight shall pass the No. 200 U.S. Standard sieve.

2-07 (c) Installation

The culvert shall be installed to the manufacturers recommendations. A bed of sand 18" thick shall be laid and compacted in layers not exceeding 4" thick, each layer being tamped to 95% of maximum density as established by ASTM D698. A bed shaped to the outside of the pipe and sloped to the correct grade shall be scraped from this bed to a depth of 6". The pipe shall be laid in this trench, connected to the existing pipe, and backfill placed on each side of the pipe in 4" layers and tamped to 95% of maximum density. The backfill shall be continued in this manner until 18" has been placed on top of the pipe. Care shall be taken to save the culvert from damage by the passage of vehicles.

The tamper shall be as specified in paragraph 2-05 (e).

2-07 (d) Measurement and Payment of "Decant Outlet"

The unit price tendered for "Decant Outlet" shall include all costs to cover the work as described in this Section and as detailed elsewhere in the Tender Documents.

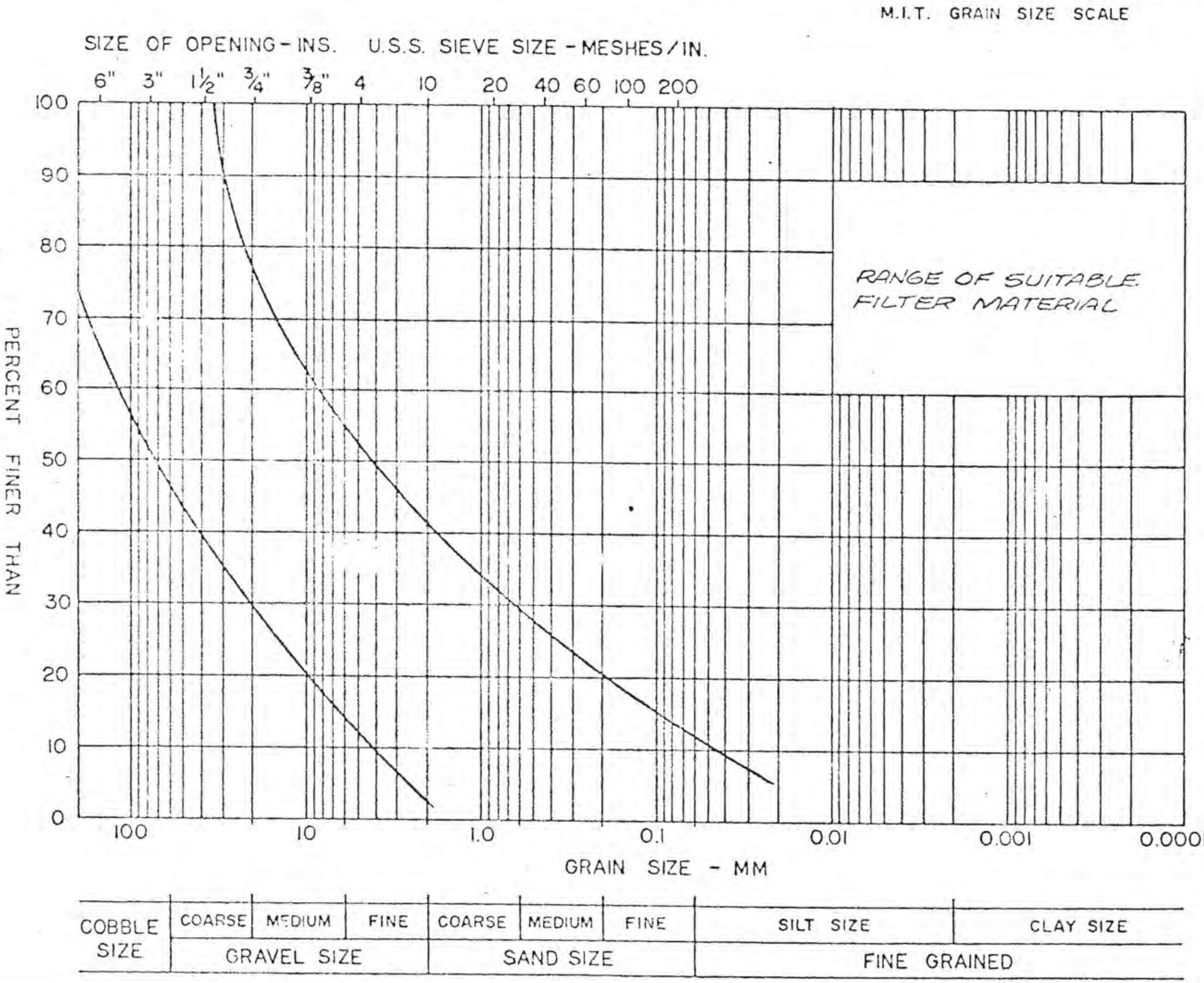
The payment for the work shall be the product of the length of culvert installed from centre of joint to end and the unit price tendered in the Schedule of Measurement and Unit Prices.

2-08 COMBINED SURVEY CREW

Survey control, layout and measurements of all work performed are to be carried out by a combined Survey Crew supplied by the Owner and under the jurisdiction of the Engineer. The Contractor shall assign one or more members of his staff to serve on the crew at the expense of the Contractor. The representative supplied by the Contractor to the survey crew shall satisfy the Contractor as to the accuracy of the survey work. In case of conflict over measurements the Engineer and the Contractor shall exhaust all means of arriving at a satisfactory agreement before applying the arbitration clause referred to in the General Conditions.

The Contractor shall employ a grade foreman to bring up slope stakes and to ensure the work is kept to the correct slopes.

GOLDER, BRAWNER & ASSOCIATES



GRAIN SIZE DISTRIBUTION

FIGURE 1

Golder Brawner Associates

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REPORT TO
COMINCO LTD.
ON
SITE INVESTIGATION AT EXISTING
H.B. MINES TAILINGS POND

SALMO B.C.

Distribution:

4 copies - Cominco Ltd.
Trail, British Columbia

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January 2, 1974

Cominco Ltd.,
Engineering Dept.,
Trail, B.C.

ATTENTION: Mr. D. Boyle

Re: Site Investigation at Existing
H.B. Mines Tailings Pond, Salmo, B.C.

Dear Sir:

As requested by your Purchase Order No. HB 15017 dated October 26, 1973, and in accordance with our proposal of September 20, 1973, we have carried out a detailed drilling program at the above site. The purpose of this investigation was to determine the condition of the existing dyke and foundation soils to enable a detailed stability analysis to be carried out. This report is further to our report No. V 72109 of June, 1973.

FIELD INVESTIGATION

Three boreholes were drilled at the site between October 29, 1973 and November 1, 1973 using a truck-mounted rotary drill rig. These boreholes were drilled to depths varying from 45 to 85 ft. and extended approximately 20 ft. into bedrock. One borehole was drilled from the crest and two boreholes from the lower slope of the existing tailings dyke as shown on Fig. 1. Stan-

dard split spoon samples were obtained of the overburden and wash samples of drill cuttings were obtained of the bedrock. All samples were identified in the field and returned to our laboratory for classification and testing.

Perforated plastic standpipes were installed in the open boreholes to enable groundwater levels to be monitored.

SITE CONDITIONS

The existing tailings pond is located approximately 4 miles south of Salmo, B.C. The tailings dyke is located at the southern end of a valley and has been constructed 50 to 60 ft. high using borrow fill obtained from the abutment slopes. Contours of the downstream face of the dyke together with a typical cross section are shown on Fig. 1.

The borehole results indicate that the dyke is generally comprised of soft to firm brown sandy silt containing varying amounts of medium to coarse sand and fine gravel. Standard penetration test results gave average 'N' values of the order of 10 blows/ft. indicating a loose to compact state of relative density.

Examination of the overburden samples enabled an approximate estimate of the location of original ground surface beneath the dyke fill. The approximate location of the existing ground surface is shown on Fig. 2. In borehole 1, the natural ground surface was estimated to be located approximately 59 ft. below the crest of the dyke. Underlying the fill, a 4 ft. thick stratum of very dense silty till was identified overlying a 5 ft. thick layer of hard desiccated silt. Bedrock was encountered at approximately 68 ft. below the crest of the dyke.

In borehole 2, the original ground surface was estimated as being located approximately 27 ft. below the dyke fill surface. The boreholes en-

countered a 7 ft. thick stratum of soft to firm silt beneath the fill. Underlying the silt, a 2 ft. thick layer of sand and gravel was identified overlying bedrock.

In borehole 3, the original ground surface was estimated to be located approximately 20 ft. below the fill. The borehole encountered a 3 ft. thick stratum of dense silty till beneath the dyke fill. Underlying the silt, a 3 ft. thick layer of sand and gravel was identified overlying bedrock.

More detailed descriptions of the soil conditions are given on the Record of Boreholes. A cross section showing the inferred soil stratigraphy is shown on Fig. 2.

GROUNDWATER CONDITIONS

The standpipes installed in the boreholes were monitored for approximately 4 weeks after installation to enable the water levels to stabilize. From the recorded water levels, we have inferred the phreatic surface in the dyke to be located as shown on Figure 2.

Inspection of the dam during the period of the drilling program indicated that seepage was occurring near the toe of the upper slope of the dam and at each abutment. Soft saturated soil was observed at several locations in the middle slope of the dam and very soft saturated soil was encountered at the east abutment.

This seepage and degree of saturation was not observed at the time of the original site investigation in May 1972. The occurrance of seepage above the phreatic line as inferred from the standpipe levels is believed to be caused by local variations in the permeability of the dam material. The location of the phreatic line is expected to vary somewhat across the dam.

DYKE STABILITY

The investigation has indicated that the existing dyke has been constructed essentially with silty soils which have been placed in a loose condition. The design parameters used in our previous calculations are considered to be still applicable although the phreatic surface assumed in our original report appears to have been somewhat lower than now exists. This present condition may be a result of a change in ponded water level upstream. Stability calculations for the present condition indicate a safety factor against a shearing type failure of the order of 1.3 which is considered adequate.

It is understood that it is proposed to eventually raise the pond water level to a maximum elevation of 2502 ft. behind the existing dam. As the pond water level is raised, the phreatic surface will also rise. Stability calculations for these future conditions indicate a factor of safety against a shearing type failure of the order of 1.1 which is lower than is normally acceptable. To increase the dyke stability, it is recommended that a berm be constructed on the downstream section of the dam as shown on Fig. 3. Provision of this berm will increase the factor of safety to approximately 1.3 which is adequate.

SEEPAGE

At present, seepage is occurring at the intersection of the upper and middle slope of the dyke and at the abutments. Examination of this seepage during the drilling program indicated that the flow was clear and did not appear to be carrying any soil particles. However, the dyke is essentially homogeneous and has been constructed with silty soils which are most susceptible to internal backward erosion. The potential for this type of erosion will increase as the ponded water level is raised. To provide protection against internal backward

erosion, filter material should be placed on the downstream slope of the dyke. This can be accomplished by constructing the previously recommended stability berm (Figure 3) of a suitable filter material which satisfies the gradation requirements shown on Figure 4. It is possible that mine waste rock will be suitable.

The berm should be adequately compacted to provide the required strength for support of possible future dyke extensions, yet should not be over-compacted so as to reduce its permeability. Generally, if heavy equipment is available and if the gradation of the filter material tends to be towards the coarser fraction of the range shown on Figure 4, satisfactory compaction without excessive reduction in permeability will be achieved by spreading the material in 16 in. lifts using a heavy crawler tractor.

We would be pleased to provide more specific construction details when the gradation of material and type of construction equipment are known.

To accommodate the seepage at the abutment, a filter blanket should be placed at these locations as shown on Fig. 3. This blanket should consist of similar filter material to that described above and should have a minimum thickness of 2 ft. This filter material should also be placed as described above.

It is pointed out that the specification given above for the filter material is critical if the filter blanket is to perform satisfactorily. As a result, we recommend, that when potential sources of material have been established, that we review the suitability of the material. In addition during raising of the ponded water level to elevation 2502, we recommend that the dyke be inspected by a member of our staff to ensure that the filter blanket is performing as desired.

At the time of the drilling, examination of the upper face of the dyke indicated that some surface erosion had occurred due to water ponding on the crest of the dyke and flowing downstream. It is recommended that these slopes be renovated by using granular material. In addition some surface grading should be carried out on the crest of the dyke to prevent ponding of rain water. During this work the crest could be sloped inwards towards the pond in order to direct run-off in that direction.

FUTURE DYKE EXTENSION

If the height of the existing dyke and pond level are increased in the future to elevations 2511 ft. and 2508 ft. respectively, the crest of the dyke should be raised by placing additional fill on the crest and on the downstream slope. In addition, the filter material recommended above should be extended as shown on Fig. 5 to a maximum elevation of 2500 ft. The additional filter material should be placed as previously recommended while the fill material should be placed in horizontal lifts of 12 inch maximum and compacted to at least 95 per cent of Standard Proctor Density.

We trust that this is the information you require. We would be pleased to discuss the report in more detail should you desire.

Yours very truly,

GOLDER BRAWNER & ASSOCIATES LTD.

R.M. Wilson, P.Eng.

H.H. Hawson, P.Eng.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA H. HAWSON

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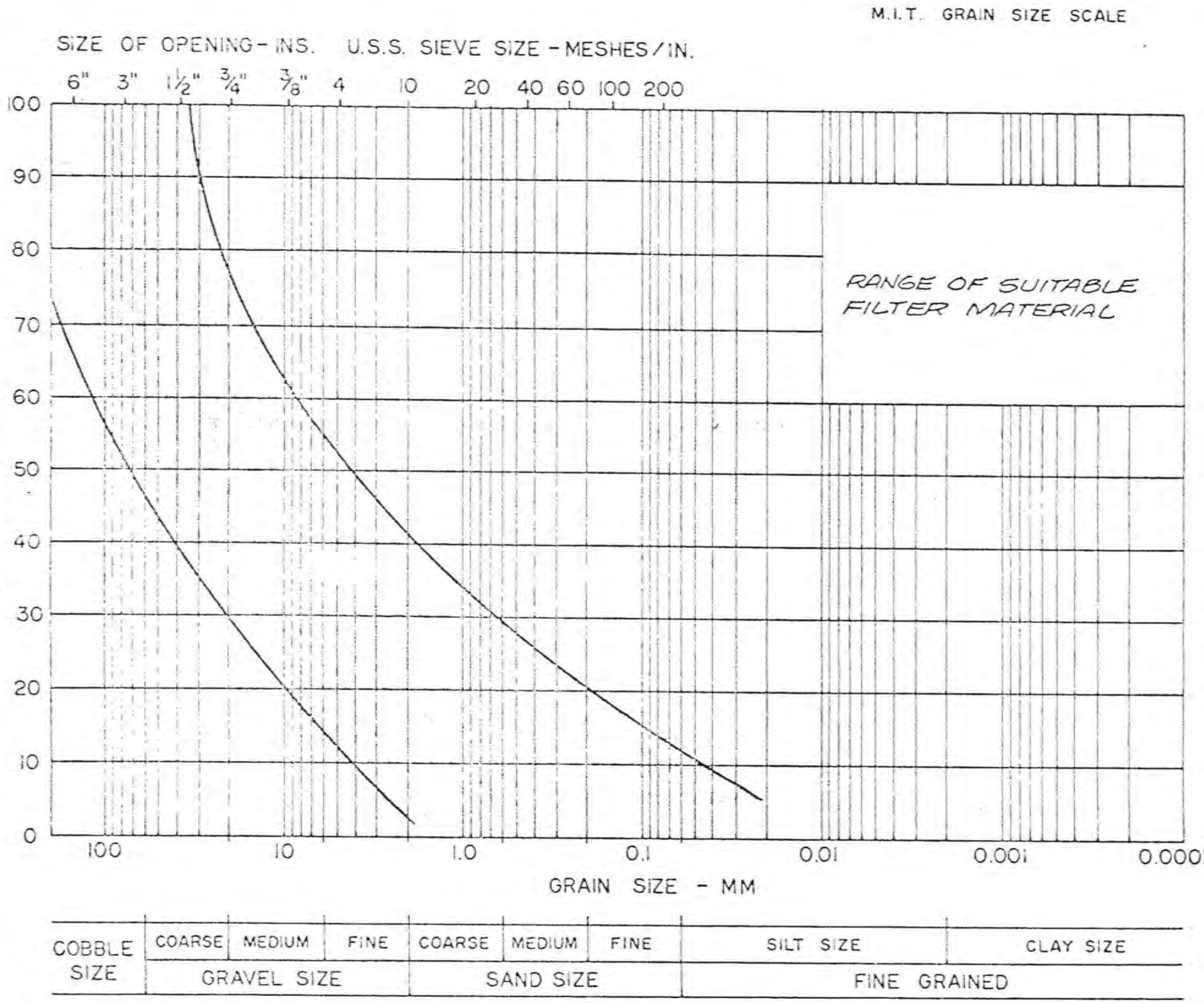


GRAIN SIZE DISTRIBUTION

FIGURE 4

SPECIFICATIONS

Section 1 - General Provisions

Section 2 - Miscellaneous Works

Section 3 - Structures

Section 4 - Drainage Pipe

Section 5 - Block Existing Decants

SPECIFICATION

SECTION 1

GENERAL PROVISIONS

1-01 LOCATION

The site of the H.B. Mine Tailing Dam is located four and one half miles south of Salmo, B.C., one half mile south of Sheep Creek and about one mile east of Provincial Highway No. 3.

1-02 ACCESS TO SITE

Access to the site is by two lane gravel public road towards the Canex Mine from Highway No. 3 immediately south of Sheep Creek. An unimproved single lane bush road starting three quarters of a mile north of Highway No. 3 leads one mile south to the tailing dike.

1-03 SCOPE OF THE WORK

Except as otherwise specified, the work described in this specification comprises the furnishing of labour, materials, transportation, tools, equipment, supplies, supervision, and all other things necessary for the construction of the H.B. Mine Tailing Dam Spillway.

The works are broken down generally into the following sections and reference is made to the appropriate section for details.

1. Build a cofferdam around the new spillway structure (Section 2)
2. Realign the access road (Section 2)
3. Excavate inside the cofferdam for the spillway structure, construct and backfill the structure (Section 3).
4. Excavate for the manhole, construct and backfill (Section 3).
5. Excavate for the culvert, construct and backfill (Section 4).
6. Remove the cofferdam (Section 2).
7. Plug the existing decants (Section 5).

1-04 STORAGE

The Contractor shall, to the approval of the Engineer, erect within his working areas, buildings and other facilities necessary for the safe storage of materials and equipment

GENERAL PROVISIONS

1-05 CONTRACTOR'S CAMP

Contractor shall be responsible for supplying his own accommodation.

1-06 UTILITIES

The Contractor shall, to the approval of the Engineer, make all necessary arrangements for the supply of water needed for all purposes at the site.

The Contractor shall be responsible for the provision of all necessary lighting and power for the works.

1-07 COMMUNICATIONS

The Contractor shall be responsible for providing his own communication.

1-08 SEWAGE DISPOSAL AND SANITATION

The Contractor shall, to the approval of the Engineer, provide and maintain adequate toilet facilities at the site and no pollution shall result from these installations.

1-09 FIRE PRECAUTIONS

The Contractor shall provide all necessary precautions against fire and shall rigidly comply with all laws, rules and regulations relating thereto.

In the event of fire the Contractor will be required to fight the fire to the full limit of his available manpower and equipment.

1-10 DECANT WATER

The Contractor is advised that water from the tailing pond is decanted beneath the dike. It shall be the responsibility of the Contractor to select a method of construction that will in no way impair the current rate of discharge until the final diversion is made through the new works.

1-11 ESCAPE OF TAILING FROM TAILING POND

The Contractor is advised of the potential danger of an escape of fluid tailing through the works under construction and all efforts are to be exerted to obviate such an occurrence.

GENERAL PROVISIONS

1-12 AVAILABILITY OF BUILDING MATERIALS

It is proposed to use impervious soil from the existing borrow pit at the east abutment and granular soils will come from the existing borrow pit located approximately one quarter mile east of the turn-off to the dam on the Canex Road.

1-13 SURVEYS

A control survey and a benchmark in the site area will be provided by Cominco Ltd. Layout work, batterboards, slope stakes etc. will be the responsibility of the Contractor.

Where a cross-section for payment purposes is required, a combined crew of Owner's and Contractor's personnel shall be used. The Contractor shall provide 24 hours notice to the Engineer for such surveys.

1-14 ACCESS AND HAUL ROADS

The Contractor will have free use of the access and haul roads around the site area. It will be his responsibility to maintain the roads and leave them in their original condition.

Particular care shall be taken to keep open all drainage ditches and culverts.

The passage of vehicles across the top of the dam when the surface is damp, thereby causing ruts, is to be avoided. Any ruts created shall be graded over immediately to shed surface water.

Additional access or haul roads that the Contractor may require shall be constructed by the Contractor at no expense to the Owner after approval by the Engineer. The area shall be maintained in a neatly graded to drain condition

1-15 DISTURBANCE OF THE EXISTING DAM

Any disturbance of any part of the existing dam structure and surroundings by the Contractor shall be repaired to the original specifications at no cost to the Owner.

1-16 DEWATERING

All construction work shall be carried out in dry ground conditions and the Contractor shall supply, install, operate and maintain necessary pumping equipment at no cost to the Owner.

1-17 EXCAVATION - COMMON

The excavation for structures and drainage pipe shall be kept to a minimum width compatible with the use of power compaction equipment.

The trench shall be dug so that the pipe can be laid to the alignment and depth required, and it shall be excavated only so far in advance of the pipe laying as safety, weather conditions, and traffic requirements permit. The trench shall be so braced and drained that the workmen may work therein safely and efficiently. The discharge of the trench dewatering pumps shall be conducted to natural drainage channels or drainage pipes.

The width of the trench at the bottom shall be such as to permit the pipe to be laid and jointed properly and backfill to be placed and compacted properly. Trenches shall be of such extra width, when required, as will permit for convenient placing of timber supports, sheeting and bracing, and handling of specials.

When the bottom of a trench is found to be unstable or unsuitable below the depth of normal bedding, the Contractor shall excavate and remove such material to the width and depth required to establish a firm, stable base. The subgrade shall be replaced by backfilling with granular material as specified. This material shall be compacted in 3-inch layers by hand or mechanical equipment to provide thoroughly consolidated pipe base.

Additional compensation shall be allowed for this work when, in the opinion of the Engineer, it is necessitated by the existence of unsatisfactory soil conditions. No compensation will be allowed when these conditions have resulted from the acts, neglects, or delays on the part of the Contractor or when working in a trench excavated in rock.

During compacting operations care must be taken to backfill equally on each side of the pipe or structure to prevent movement or warping.

Compaction must be carried out to either the spring-line or original ground level, whichever is higher.

The cost of borrowing, hauling, backfilling and compaction is to be included in the specific structure or drain pipe pay item and no extra payment will be considered.

The cost of common excavation and shoring is to be included in the specific structure or drain pipe item and no extra payment will be considered except as indicated above.

1-18 EXCAVATION - ROCK

No blasting is allowed in the vicinity of the dam. All rock excavation must be carried out by jackhammer or wedging and barring.

The only rock excavation contemplated is at the foundation to the spillway structure. This will be to provide a level base on sound rock as judgedby the Engineer. Measurement will be by the cubic yard as determined by surveyed cross-sections, and the cost to the Owner shall be at the price stipulated in the Schedule of Prices.

Boulders larger than 1 cubic yard in volume, if encountered, will be paid by the same method.

Additional rock excavation encountered elsewhere in the trenching or manhole will be treated as Extra Work.

1-19 EARTH FILLS

The Contractor is hereby cautioned that the earth fills forming the present tailing dam have been carefully laid using specified grain sizes, slopes, water contents and compaction.

Excavation through the dike will require similar material to be replaced. If the material removed is too wet to achieve the required compaction, it will have to be replaced with dry material.

Scope of Work

The work shall include the supply of all labour, material and plant, fuel and the performance of all work necessary to prepare and maintain borrow areas and haul roads, rip, excavate, load, transport, dump spread and compact fill material used as backfill in the various parts of the works.

Fill Material

Select impervious fill shall be a glacial till, well graded with a maximum size of 6 inches and with at least 20% finer than the No. 200 U.S. Standard sieve size.

Common fill shall be a glacial till, well graded with a maximum size of 6 inches.

Both select impervious fill and common fill must be of a gradation and moisture content that allows them to be placed and adequately compacted as specified herein.

1-19 EARTH FILLS (continued)

Fill Material (cont'd)

Filter material or granular material shall be a well graded clean sand and gravel with not more than 15% passing a No. 200 sieve.

Cobbles and boulders larger than 6" shall be removed from the fill.

The minimum thickness of bedding shall be eight (8) inches. Bedding material for the drainage pipe where it passes through the impervious zone of the drain shall be of impervious material.

Bedding material for the remainder of the length of drainage pipe shall be granular material as specified above.

No bedding or backfill against the pipe shall be larger than 3/4" in size.

All fill shall be free of organic materials, roots, and other perishable materials. No fill material shall contain ice or snow, or shall be placed in a frozen condition.

Compaction

Backfill in trenches or around structures shall be placed in layers not exceeding 6" in thickness when loose.

Backfill other than in trenches or around structures shall be placed in layers not exceeding 9" in thickness when loose.

Compaction in all cases shall be not less than 95% of the laboratory maximum dry density as determined by the Proctor Compaction test as specified in ASTM D698.

If the impervious fill material is too dry or too wet, water shall be added or removed by working the fill with a harrow, scarifier or other approved equipment until the water is uniformly distributed and satisfies the requirements of these specifications.

Particular care shall be taken to ensure that the compaction requirements are satisfied in areas of fill adjacent to any structure. Compaction adjacent to the structures shall be carried out carefully and thoroughly utilizing approved power tampers where necessary to ensure that the material is tightly compacted at the boundaries of the structure. Fill shall be placed and compacted against the structures only during daylight hours, unless adequate lighting is provided to the satisfaction of the Engineer.

1-19 EARTH FILLS (continued)

Compaction

Any layer or layers which, in the opinion of the Engineer, have suffered a reduction in density after compaction due to the action of frost, rain or for any other reason, shall be removed by the Contractor at no additional compensation, before placing operations are resumed.

Fill shall not be placed in a frozen condition and shall not be placed on a surface which is frozen or on which there is any snow or ice. Placing of fill in freezing weather shall not be permitted except when approved by the Engineer, and when proper measures are taken to prevent freezing of the material.

Borrow Areas

The Contractor shall conduct his operations in borrow areas in such a manner which shall ensure that the maximum possible volume of suitable construction material may be obtained. Measures shall be taken to ensure adequate drainage of water from the borrow areas so that the borrow material is obtained at a water content suitable for compaction and so that the borrow operations are not affected adversely. Ponding of water shall be prevented.

Some of the material in the borrow areas may be frozen. The Contractor shall conduct his operations in such a manner to ensure that the frozen material shall be thawed prior to placement in the dikes. To meet this requirement the Contractor shall open and work as large an area of the borrow area as practical, and shall rip, scarify, disc, harrow or use any other similar means to expose the frozen material to permit thawing.

The detailed planning of the operation of the borrow area shall be the responsibility of the Contractor and shall be subject to the approval of the Engineer.

Unsuitable material shall be disposed of as directed by the Engineer and graded off to present a reasonably uniform appearance.

The Contractor shall be responsible at all times for the safe operation of the borrow area. All slopes left permanently exposed shall be approved by the Engineer.

DETAILED PROVISIONS

1-20 CLEARING

The work to be done under this clause shall comprise the supply of all labour,material and plant and the performance of all work necessary for clearing of the site as shown on the drawings, as required by the Engineer and as specified herein.

Clearing shall consist of cutting and disposing of all trees, shrubs, brush, debris and all other perishable materials, including fallen trees and logs within the areas to be cleared.

All trees, shrubs and brush shall be cut to within 2" above the ground surface. The organic cover of topsoil on the ground surface shall be left intact, except where excavation is required as stated in these documents.

All vegetation and debris resulting from clearing operations regardless of size, shall be removed from the areas cleared, and shall be disposed of by the following methods, upon written approval of the Engineer.

(a) Combustible materials may be piled and burned on open fires as specified herein. Material to be disposed of in this way shall be completely burned so that it is all reduced to ashes.

(b) Materials obtained from clearing which cannot be burned may be placed in nearby disposal areas as directed by the Engineer. The material placed in disposal areas shall be crushed with a tractor or other heavy equipment to a thickness of not more than 5 feet.

The Contractor shall be responsible for any damage done by fire resulting from the work under this item and shall at no time leave a fire unattended until it is fully extinguished. All burning shall be done in strict conformance with the rules and regulations of local, provincial, and federal agencies and it shall be the responsibility of Contractor to obtain all burning permits.

Sufficient equipment shall be ready and available together with a sufficient force of men to control burning operations at any time.

There will be no separate payment for clearing and the cost of clearing is to be included in the price of installation of the drainage pipe.

GENERAL PROVISIONS

1-21 CONCRETE

All concrete work shall conform to the standards specified in the current edition of CSA A23.1 "Concrete Materials and Methods of Concrete Construction".

Concrete shall be supplied by a ready-mix concrete company which is satisfactory to the Engineer. Otherwise the proposed method of production and the mix design shall be submitted to the Engineer for approval.

Care shall be taken to avoid excessive mix time due to the remoteness of the site.

Concrete aggregate shall have a maximum size of 3/4".

The required strength of concrete is specified in the appropriate section.

1-22 CONCRETE FILL

The work in this paragraph shall conform to all conditions specified in paragraph 1-21, except that the maximum size of aggregate shall be 1-1/2".

Payment for this item shall include for all costs to supply, deliver and place the concrete.

Measurement of the volume placed shall be calculated from cross-sections.

Payment will be at the contract unit price stated in the Schedule of Prices.

1-23 DRAINAGE PIPE

The drainage pipe shall be corrugated steel pipe to Specification No. 501-74 of the Corrugated Steel Pipe Institute.

The size shall be 36 inch diameter, 12 gauge (0.109") galvanized with 2 oz. zinc per square foot, 2-2/3" x 1/2" corrugations, Helcor Lokseam construction with a neoprene cord seal. The ends shall be end-rolled (Armco or similar) to accept corrugated bands. Rev. 2

Coupling shall be 2 piece corrugated bands with angles 24" width, neoprene gaskets 12" wide by 1/4" thick shall be installed between the coupling and the culvert. A heavy bead of caulking compound, specified below, shall be applied to the culvert side of the neoprene gasket.

The caulking compound shall be thiocaulk (polysulphide-architectural grade) by Steelcote Manufacturing Ltd., and shall be applied in accordance with their specifications.

1-24 MISCELLANEOUS METALWORK

The Contractor is to detail, fabricate, deliver, install and paint all steelwork shown on the drawings.

Steelwork embedded in concrete shall be unpainted.

The finish for all other metals is as follows:

Blastclean all surfaces to SSPC-SP6 Commercial Blast Degree

Prime coat - 1 coat of Bapco Ethyl Silicate Zinc Rich Primer, at the rate of 315 square feet per gallon to produce a dry film thickness of 2.5 mils.

Finish coats - for parts submerged or inside the structures:

2 coats of grey Bapco Arocoat High Build at 115 square feet per gallon (10 mil dry film thickness per coat).

- for other parts:

2 coats of grey Bapco Paralite Enamel High Build at 160 square feet/gallon (4 mils dry thickness per coat).

The cost of work carried out in this paragraph is to be included in the cost of the structures and no separate payment will be made.

1-25 ADDITIONAL DRAINAGE PIPE

In the event that it is necessary to increase by a small amount the length of the 36" diameter drainage pipe, payment shall be made for the supply, delivery and installation at the Contract Unit Price stated in the Schedule of Prices.

Excavation, backfill and compaction required for the additional drainage pipe shall be paid for at the Contract Unit Price stated in the Schedule of Prices.

The measurement shall be established from cross-sections taken at the discharge end of the drainage pipe.

SPECIFICATION

SECTION 2

MISCELLANEOUS WORKS

2-01 SCOPE

The work included in this section includes the installation and removal of the cofferdam, realignment of the access road, relocation of the 8" diameter culvert.

2-02 GENERAL ARRANGEMENTS

All excavation, placement of fill and other construction work shall be completed to the lines and grades as shown on the drawings or as directed by the Engineer.

2-03 COFFERDAM

The Contractor shall build and remove on the completion of construction of the complete spillway facilities a cofferdam as shown on the drawings and as described herein.

Alternative designs of the cofferdam will be considered by the Engineer, but the Contractor must obtain approval in writing from the Engineer before starting construction of any alternative arrangement.

The Contractor will be held fully responsible to construct and maintain the effectiveness of the cofferdam.

The cofferdam shall have a minimum top width of twelve (12) feet with side slopes of 2:1 and a minimum freeboard of three feet above the current pond water level shall be maintained.

Foundation preparation for the construction of the cofferdam shall consist of the systematic squeezing out of tailings by the placement of the impervious soil.

The cofferdam shall be constructed of impervious soil, compacted, as described in Clause 1-19, to achieve a watertight structure.

After the completion of the spillway and drainage pipe and after returning the dike to its original condition and before blocking the existing decant systems, the cofferdam shall be removed in entirety, and the excavated material placed neatly in a local disposal area as designated by the Engineer.

MISCELLANEOUS WORKS

2-03 COFFERDAM (continued)

Payment for the cofferdam shall be the lump sum stated in the Schedule of Prices and shall include all work necessary to construct, maintain, dewater and remove the cofferdam and to realign the access road and relocate the culvert.

2-04 REALIGNMENT OF THE ACCESS ROAD

The access road is to be moved about 10 feet to the east to by-pass the new spillway structure to maintain access onto the top of the dam.

The material to be used shall be common earth compacted as specified in Section 1-19.

The present culvert beneath the road will also have to be moved to accommodate the 10 foot realignment.

There is no separate payment for the realignment of the road and the cost is to be included in the cost of the cofferdam.

SPECIFICATIONS

SECTION 3

STRUCTURES

3-01 SCOPE

The work included in this section includes the common excavation, drilling for and installation of rock anchors, construction and removal of all temporary works, supply and installation and vibration of all concrete to the strengths as specified, testing of cylinders, supply and installation of all embedded and non-embedded metal work, painting of metalwork, supply and installation of precast concrete members, concrete curing and backfilling to provide a completed structure as shown on the drawings.

3-02 SPILLWAY STRUCTURE

The structure shall be constructed as shown on the drawings and to the standards specified in paragraph 1-21.

Particular care shall be taken with the alignment of the stop-log guide and the accuracy of forming the pre-cast stoplogs to provide an accurate fit.

The strength of concrete shall be 3,000 p.si. at 28 days.

The structure shall be founded on sound bedrock. Payment for excavation to bedrock is included in this pay item.

Rock excavation will be paid for at the "Rock Excavation" contract unit price per cubic yard as explained in paragraph 1-18.

Fill concrete to elevation 2511.5 will be paid for at the "Concrete Fill" contract unit price as explained in paragraph 1-22. Rev. 2

The strength of the concrete fill shall be 2,000 p.s.i. at 28 days.

The cost of all other work necessary to complete the spillway structure is to be included in the sum stated for "spillway structure" in the Schedule of Prices.

3-03 MANHOLE

The structure shall be constructed as shown on the drawings and to the standards specified in paragraph 1-21.

The strength of concrete shall be 3,000 p.s.i. at 28 days.

Payment shall be the sum stated for "manhole" in the Schedule of Prices".

SPECIFICATION

SECTION 4

DRAINAGE PIPE

4-01 SCOPE

The work included in this section is supply, delivery and installation of the drainage pipe, clearing, excavation, shoring, dewatering, supply and placement of bedding, backfill, compaction and all other operations necessary to complete the works as indicated on the drawings.

4-02 REFERENCES

The drainage pipe and connections shall be as specified in paragraph 1-23.

Excavation is covered in paragraph 1-17 and backfill in paragraph 1-19.

4-03 GENERAL

The pipe shall be laid to the grades shown on the drawings.

Care shall be exercised to avoid damage to the pipe in handling and placing and damaged galvanizing shall be repaired to the Engineer's satisfaction.

4-04 PRESSURE TEST

The Contractor's attention is drawn to the fact all joints must be watertight, particularly between the spillway structure and the manhole.

A pressure test shall be conducted on the spillway to manhole section before backfilling, to ensure the watertightness of the system.

No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{\text{ND x the square root of P}}{1850}$$

in which L = the allowable leakage in U.S. gallons an hour

N = the number of joints in the test section

D = the nominal diameter of the pipe in inches

P = 10 p.s.i.

4-04 PRESSURE TEST - continued

Leakage is defined as the quantity of water which must be added to the test section to maintain the specified test pressure after the pipe has been filled with water and the air expelled.

Should any test disclose leakage greater than that specified above, the Contractor shall, at his own expense, locate and repair the defect.

4-05 SEEPAGE CUT-OFF RING

An annular ring 48" in diameter x 1/4" thick shall be welded around the culvert to provide a seepage cut-off. It shall be located in the centre of the impervious zone.

All metal must be painted as specified in paragraph 1-24.

4-06 PAYMENT

Payment for work carried out under this section will be paid for at the contract stipulated sum in the Schedule of Prices.

SPECIFICATIONS

SECTION 5

BLOCK EXISTING DECANTS

The Contractor is to supply all labour, equipment and supplies to block off the east and west decants.

The decants consist of built-up wooden towers about 50 feet high extending down from the water surface to the original ground level.

A 24" diameter culvert connects from the base of each decant tower and exits from the fill at the downstream toe of the dam.

After the spillway and drainage pipe are completed and backfilled and the cofferdam removed, it is necessary to permanently plug off both decants.

This is most easily achieved by blocking off the culverts near the base of the tower and pumping the culverts full of concrete.

A suggested method of operation will be to raise the top of the decants until they are clear of the water thereby considerably reducing the flow down the tower.

By lowering burlap bags filled with dry mix to the bottom of the tower, a plug will be formed. The tower will gradually fill with seepage water and the pond water will escape through the new spillway structure.

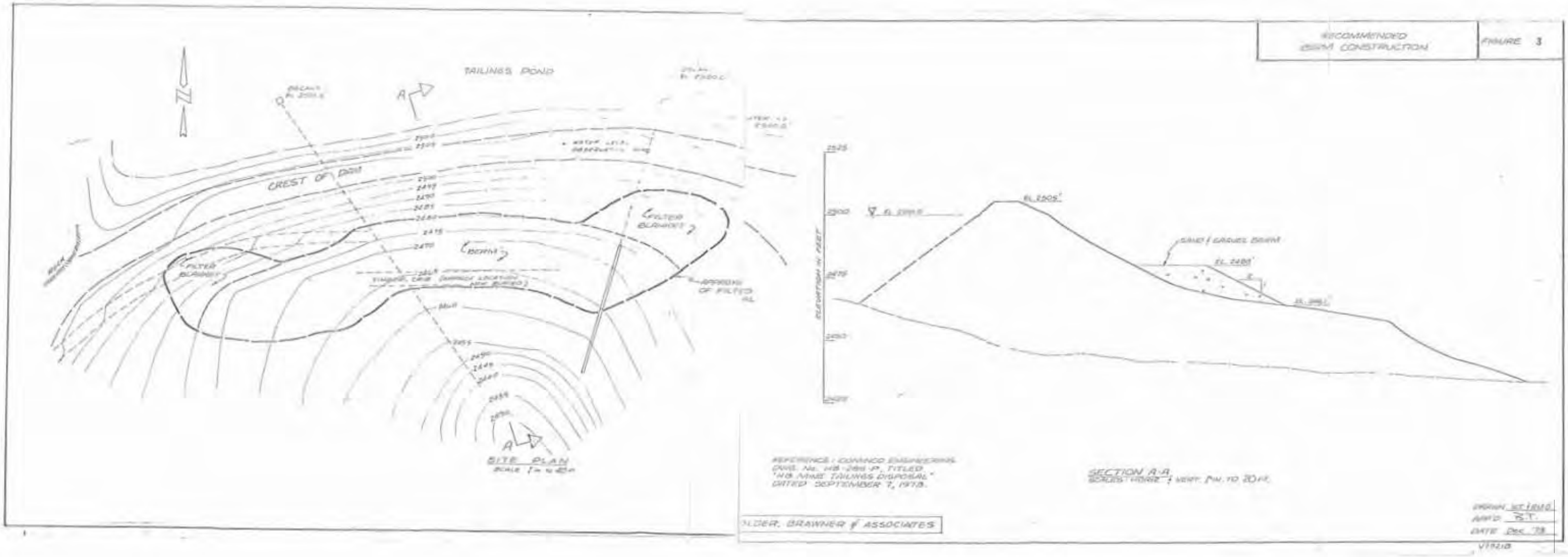
Depending on the degree of blockage attained, it may be necessary to add additional bags of dry concrete.

When an effective seal has been accomplished, it will be necessary to fill the culverts with 2,000 p.s.i. concrete.

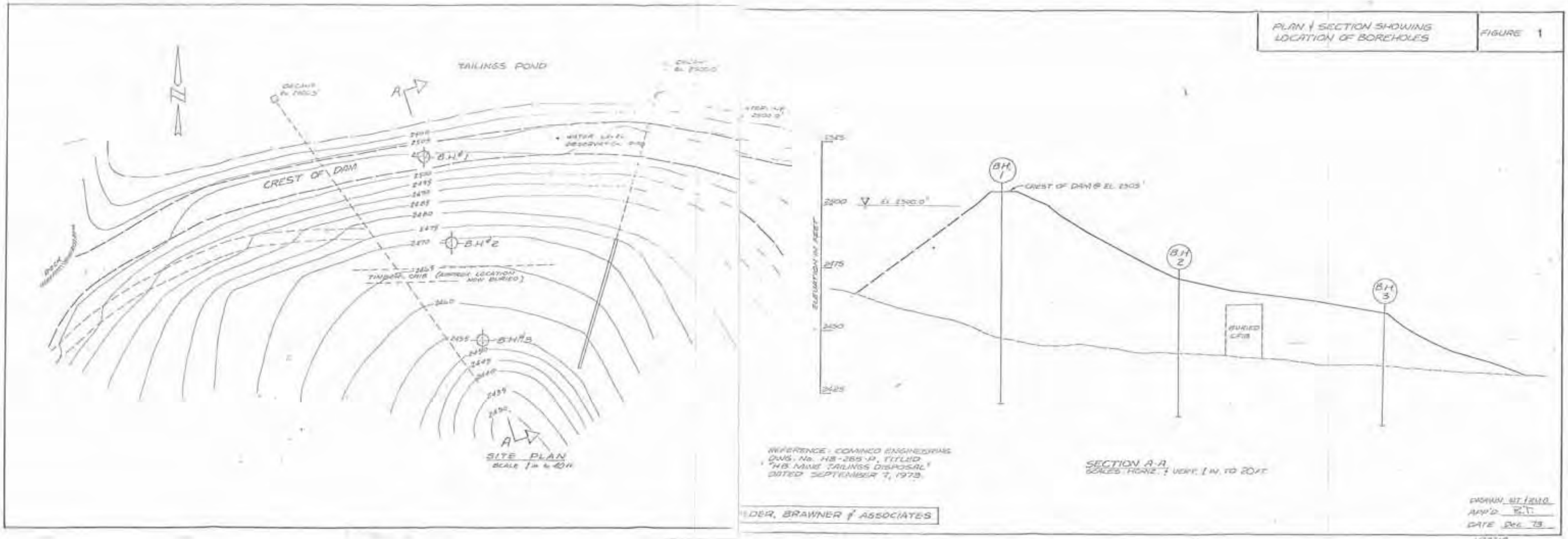
By welding a plate with a threaded nipple to the end of the culvert, a concrete pump can be connected and the culvert pumped full of grout.

Alternative methods of blocking the culverts will be considered but must receive written approval of the Engineer before the work is commenced.

Payment for the above work will be at the Contract Unit Price stated in the Schedule of Prices.

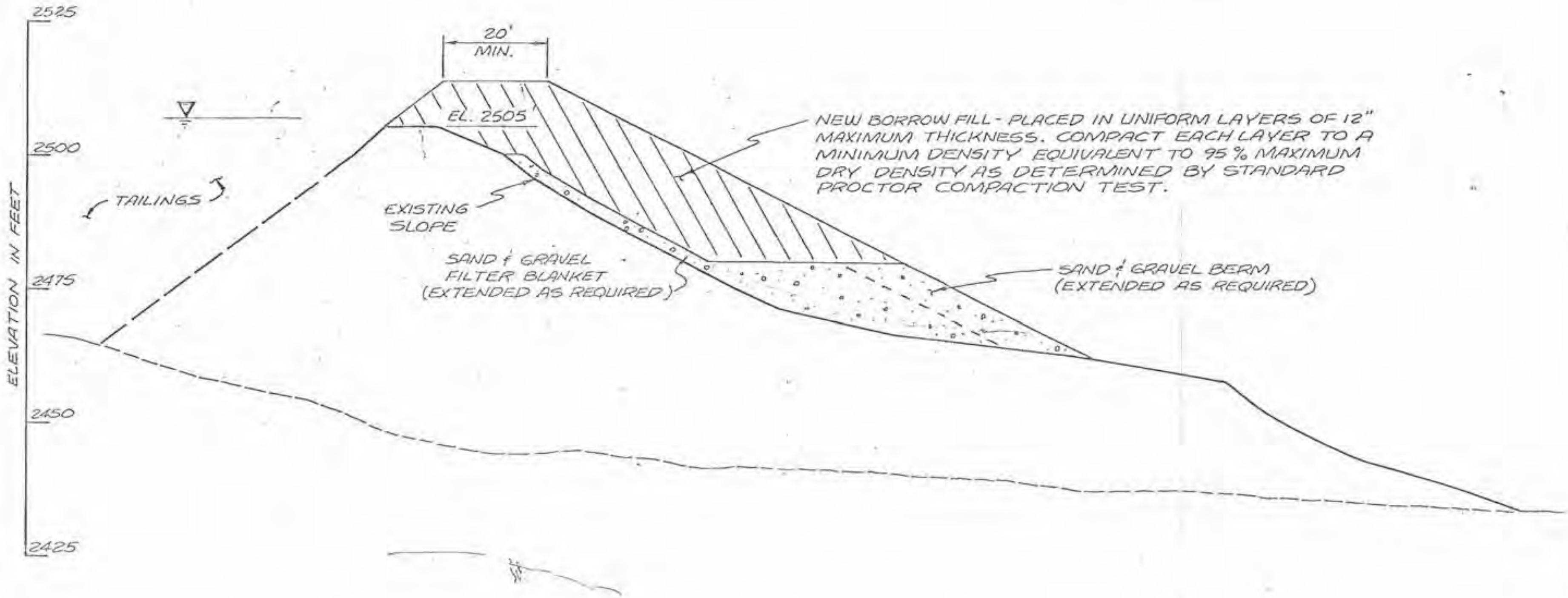


RECOMMENDED
BERM CONSTRUCTION
FIGURE 3
TAILINGS POND
CREST OF DAM
SITE PLAN
EL. 2505'
SAND / GRAVEL BERM
EL. 2485'
ELEVATION IN FEET
2525
2500
2475
2450
2425
REFERENCE: CONWACO ENGINEERING
DWG. No. HB-286-P, TITLED
"H.B. MINE TAILINGS DISPOSAL"
DATED SEPTEMBER 7, 1978.
SECTION A-A
GOLDER, BRAWNER & ASSOCIATES
DATE DEC. '78
V19218



PLAN & SECTION SHOWING
LOCATION OF BOREHOLES
FIGURE 1
TAILINGS POND
CREST OF DAM
B.H.#1
B.H.#2
B.H.#3
SITE PLAN
B.H. 1
B.H. 2
B.H. 3
CREST OF DAM @ EL. 2505'
ELEVATION IN FEET
BURIED CRIB
REFERENCE: COMINCO ENGINEERING
DWG. No. HB-265-P, TITLED
"HB MINE TAILINGS DISPOSAL"
DATED SEPTEMBER 7, 1973.
SECTION A-A
SCALES: HORIZ. & VERT. 1 IN. TO 20 FT.
DRAWN
APP'D R.T.
DATE DEC. '73
LDER, BRAWNER & ASSOCIATES

SECTION SHOWING RECOMMENDED METHOD OF RAISING EXISTING DAM	FIGURE 5

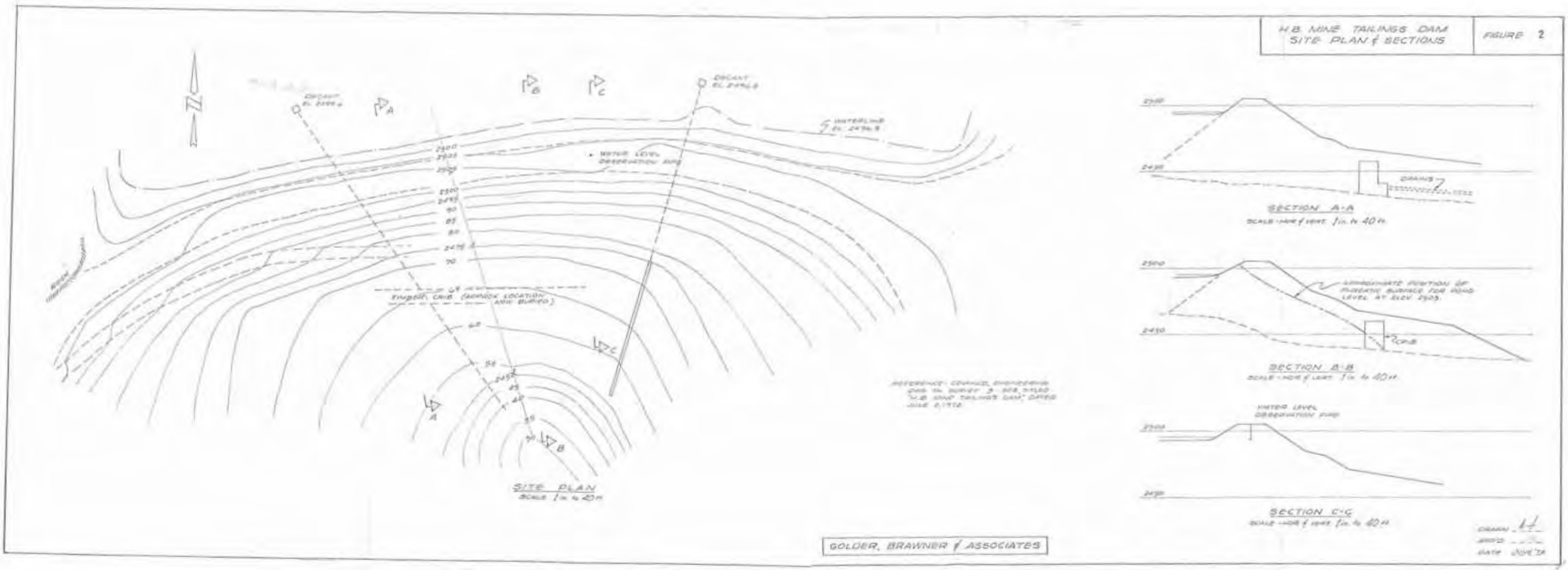


REFERENCE: COMINCO ENGINEERING DWG. No. HB-285-P, TITLED "H.B. MINE TAILINGS DISPOSAL" DATED SEPTEMBER 7, 1973.

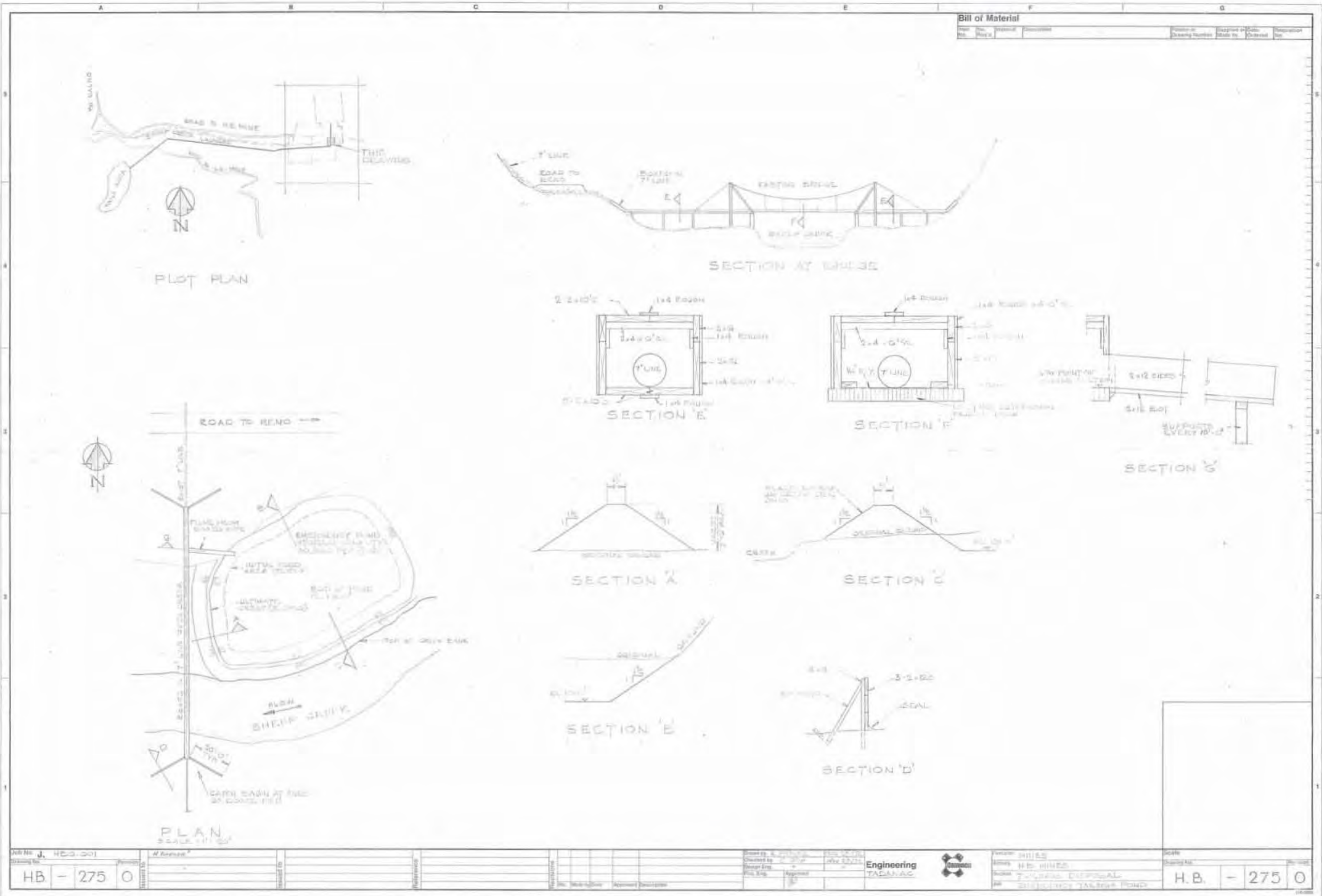
SECTION A-A
SCALES: HORIZ. & VERT. 1 IN. TO 20 FT.

DRAWN RMO
APP'D. B.T.
DATE Dec. '73.

V73218



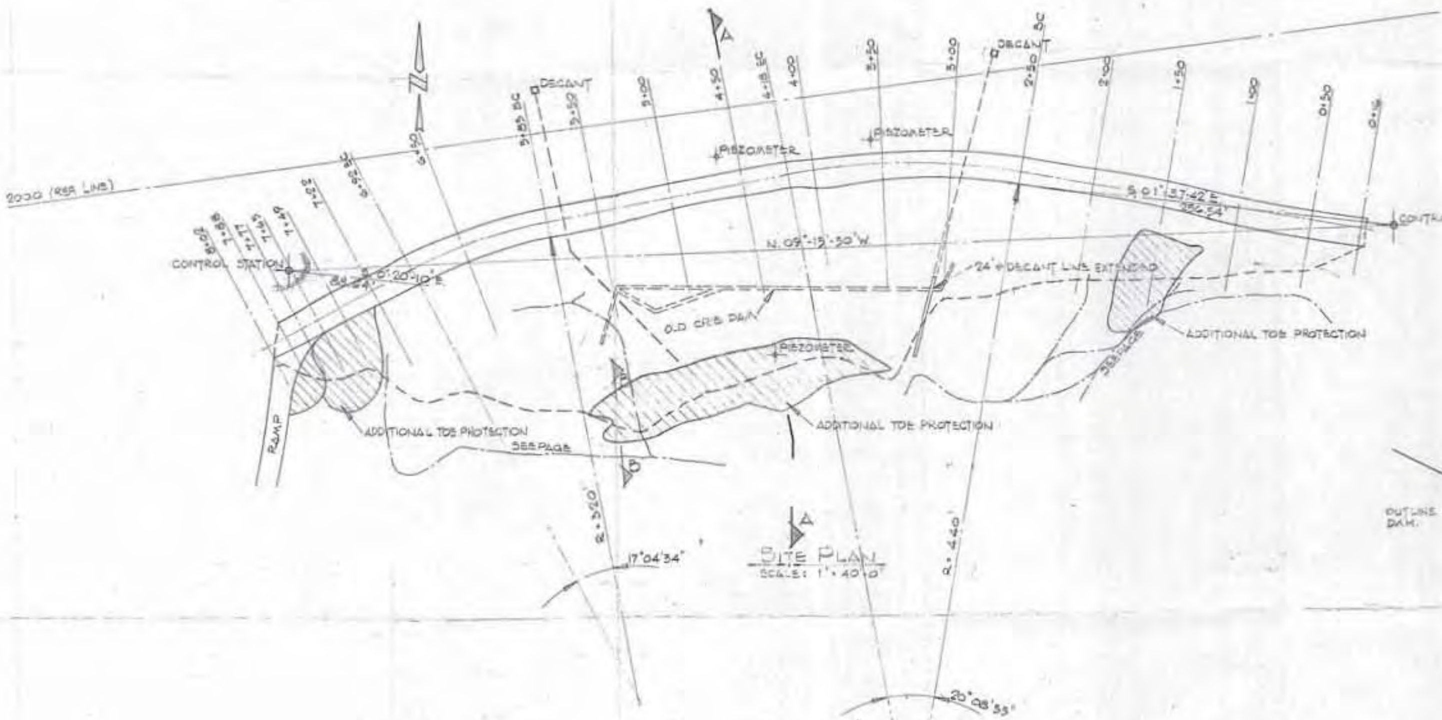
H.B. MINE TAILINGS DAM
SITE PLAN & SECTIONS
FIGURE 2
SECTION A-A
SECTION B-B
SECTION C-C
SITE PLAN
GOLDER, BRAWNER & ASSOCIATES



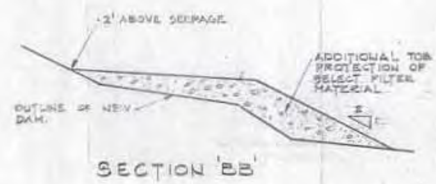
Bill of Material
ROAD TO RENO
THIS DRAWING
PLOT PLAN
SECTION AT BRIDGE
SECTION 'E'
SECTION 'F'
SECTION 'G'
SECTION 'A'
SECTION 'C'
SECTION 'B'
SECTION 'D'
SHEEP CREEK
PLAN
Engineering
TADANAC
HB - 275 0
H.B. - 275 0

Bill of Material

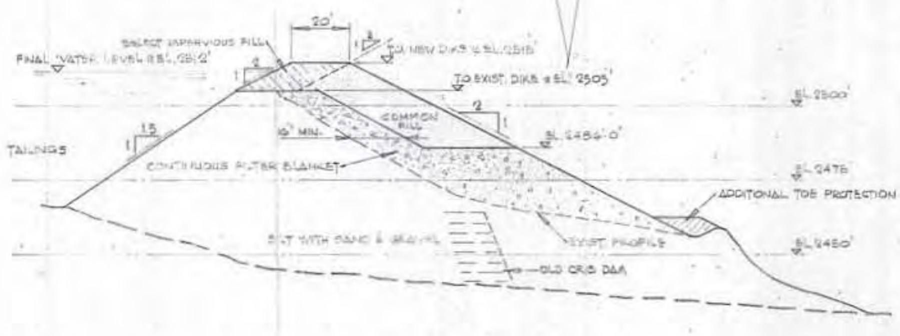
Item No.	No. Req'd	Material	Description	Pattern or Drawing Number	Supplied or Made by	Date Ordered	Requisition No.



SITE PLAN
SCALE: 1" = 40'-0"



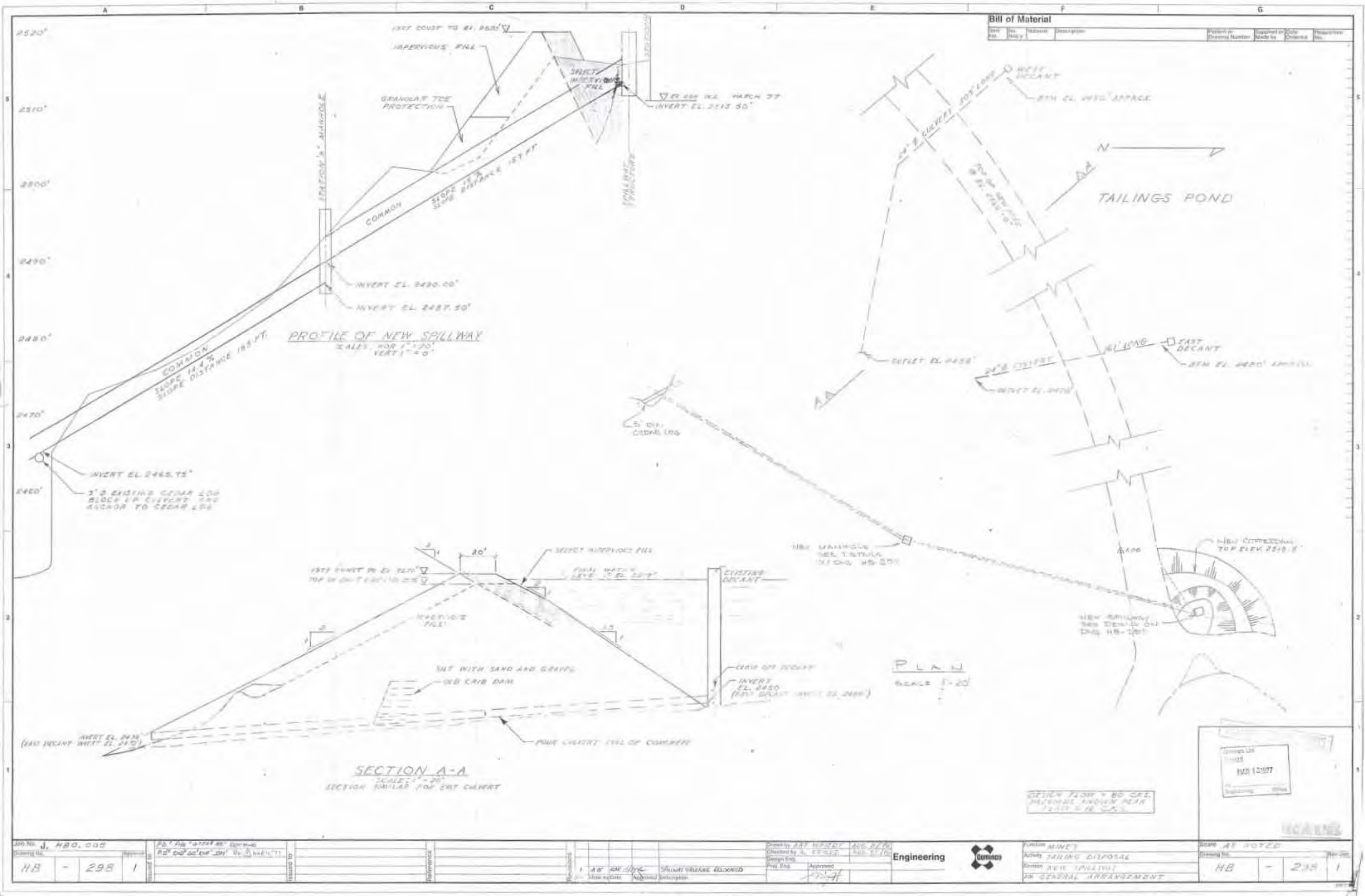
SECTION 'BB'



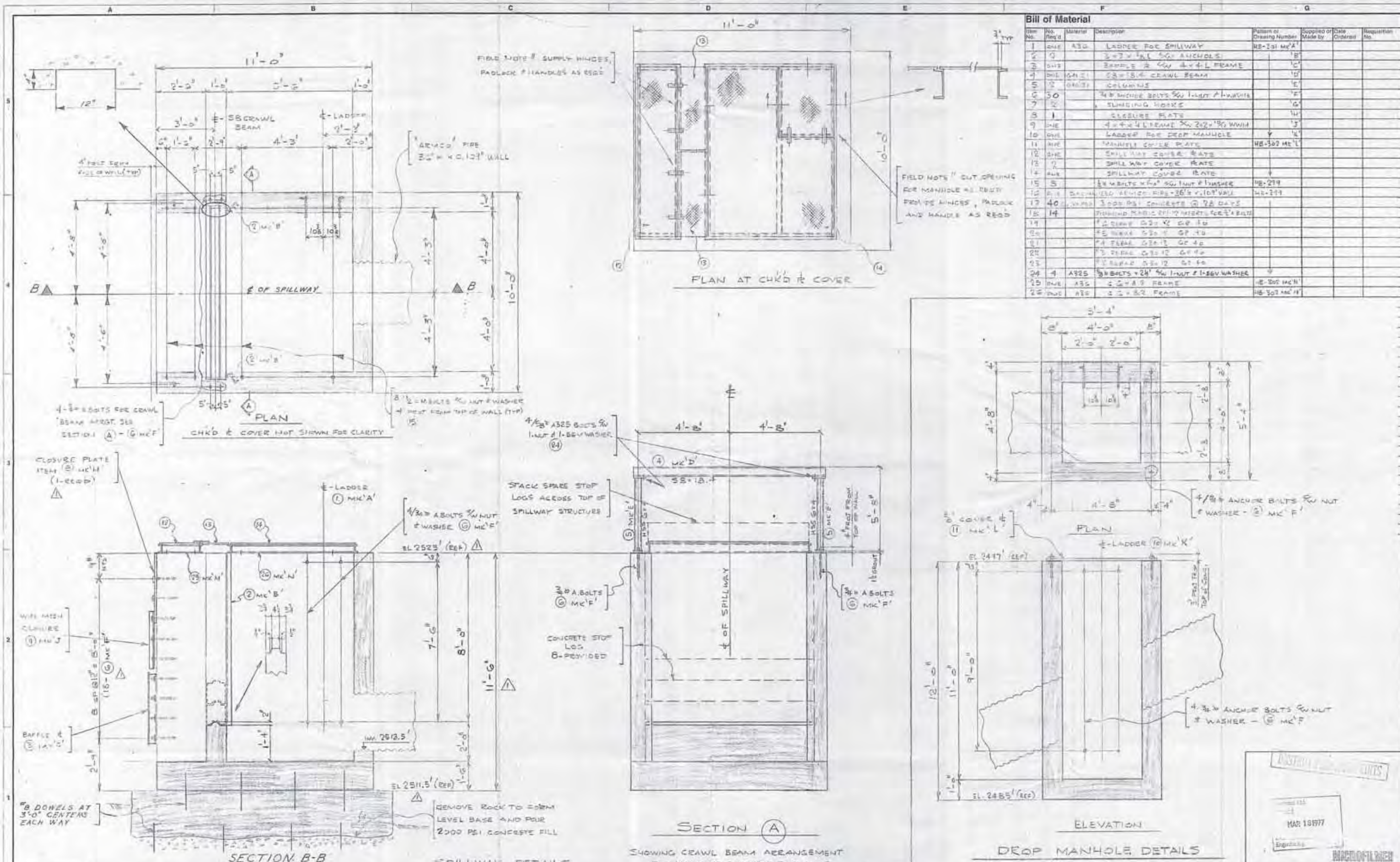
SECTION 'A-A'
SCALE: 1" = 20'-0"

KEY PLAN
SCALE 1" = 4000 FT.

Job No. J. HB0.005	P JSW' C.B.' REB' JUNE 19/74	HB-285 EXIST. DIKE	Drawn by G.SWEAT JUNE 17/74	Function MINES
Drawing No. HB – 289 Revision 0	0 JSW' EWB REB' FEB 28/76	HB-263-2 ARRANGEMENT (1963)	Checked by	Activity H.B. MINE
	Issued to	Reference	Design Eng.	Section TAILINGS DISPOSAL
		Revisions: No. Made by Date Approved Description	Proj. Eng. Approved	Job DIKE EXTENSION - AS BUILT
			Engineering TRAIL	Scale AS NOTED
				Drawing No. HB – 289 Revision 0



Bill of Material
PROFILE OF NEW SPILLWAY
TAILINGS POND
N
COMMON
INVERT EL. 2480.00'
INVERT EL. 2487.50'
INVERT EL. 2465.75'
GRANULAR TOE PROTECTION
IMPERVIOUS FILL
SELECT IMPERVIOUS FILL
SPILLWAY STRUCTURE
WEST DECANT
EAST DECANT
5' DIA. CEDAR LOG
NEW MANHOLE
NEW SPILLWAY
PLAN
SCALE 1"=20'
SECTION A-A
SILT WITH SAND AND GRAVEL
IMPERVIOUS FILL
EXISTING DECANT
2520'
2510'
2500'
2490'
2480'
2470'
2460'
Job No. J. HBO. 005
HB - 298 1
Engineering
Cominco
MINES
TAILING DISPOSAL
NEW SPILLWAY
GENERAL ARRANGEMENT
AS NOTED
HB - 298 1



Bill of Material

Item No.	No. Req'd	Material	Description	Pattern or Drawing Number	Supplied or Made by	Date Ordered	Requisition No.
1	ONE	A36	LADDER FOR SPILLWAY	HB-301 MK'A'			
2	9		3×3×¼ L SG ANCHORS	'B'			
3	ONE		BAFFLE ℄ C/W 4×4 L FRAME	'C'			
4	ONE	G40.21	S8×18.4 CRAWL BEAM	'D'			
5	2	G40.21	COLUMNS	'E'			
6	30		¾ ⌀ ANCHOR BOLTS C/W 1-NUT & 1-WASHER	'F'			
7	2		SLINGING HOOKS	'G'			
8	1		CLOSURE PLATE	'H'			
9	ONE		4×4×¼ L FRAME C/W 2×2×10/10 WWM	'J'			
10	ONE		LADDER FOR DROP MANHOLE	'K'			
11	ONE		MANHOLE COVER PLATE	HB-302 MK 'L'			
12	ONE		SPILLWAY COVER PLATE				
13	2		SPILLWAY COVER PLATE				
14	ONE		SPILLWAY COVER PLATE				
15	5		½ ⌀ M.BOLTS × [illegible] C/W 1 NUT & 1 WASHER	HB-299			
16	[illegible]	GALVANIZED	ARMCO PIPE - 36'6 × .109" WALL	HB-299			
17	40	[illegible]	3000 PSI CONCRETE @ 28 DAYS				
18	14		[illegible] INSERTS FOR ¾ ⌀ BOLTS				
19			#6 REBAR G30.12 GR 40				
20			#5 REBAR G30.12 GR 40				
21			#4 REBAR G30.12 GR 40				
22			#3 REBAR G30.12 GR 40				
23			#2 REBAR G30.12 GR 40				
24	4	A325	⅝ ⌀ BOLTS × 2¼" C/W 1-NUT & 1-BEV WASHER				
25	ONE	A36	[illegible] FRAME	HB-302 MK'N'			
26	ONE	A36	[illegible] FRAME	HB-302 MK'N'			

Job No. J. HB0.007
Drawing No. HB — 299 Revision 1

Reference: HB 299 CONCRETE DETAILS

Revisions: 1 FS 15-3-77 SPILLWAY ELEV REVISED

Drawn by FRED SHERLOCK AUG 13-76
Checked by K FRICKE AUG 25/76
Design Eng.
Proj. Eng. Approved

Engineering TRAIL BC

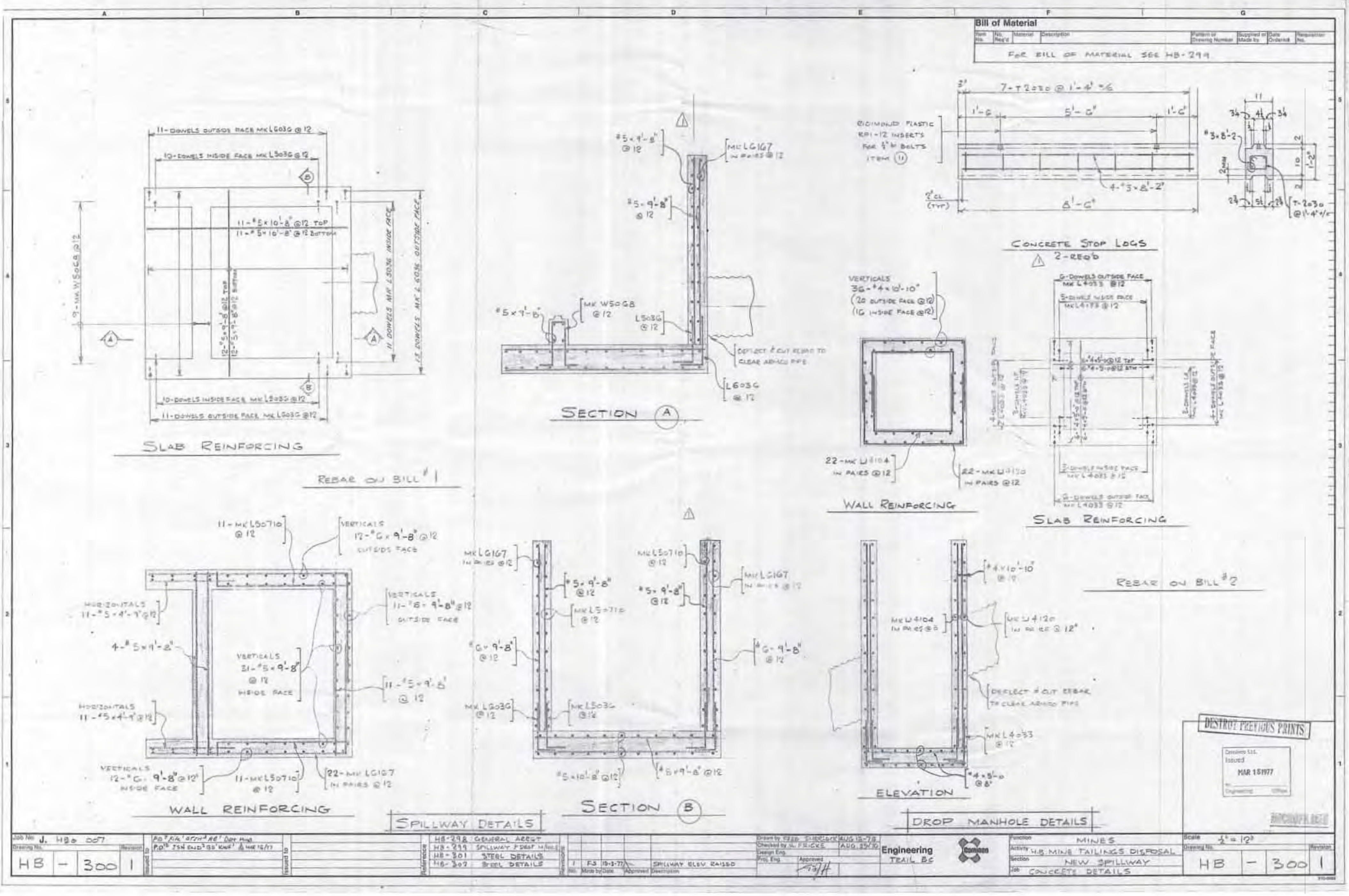
Cominco

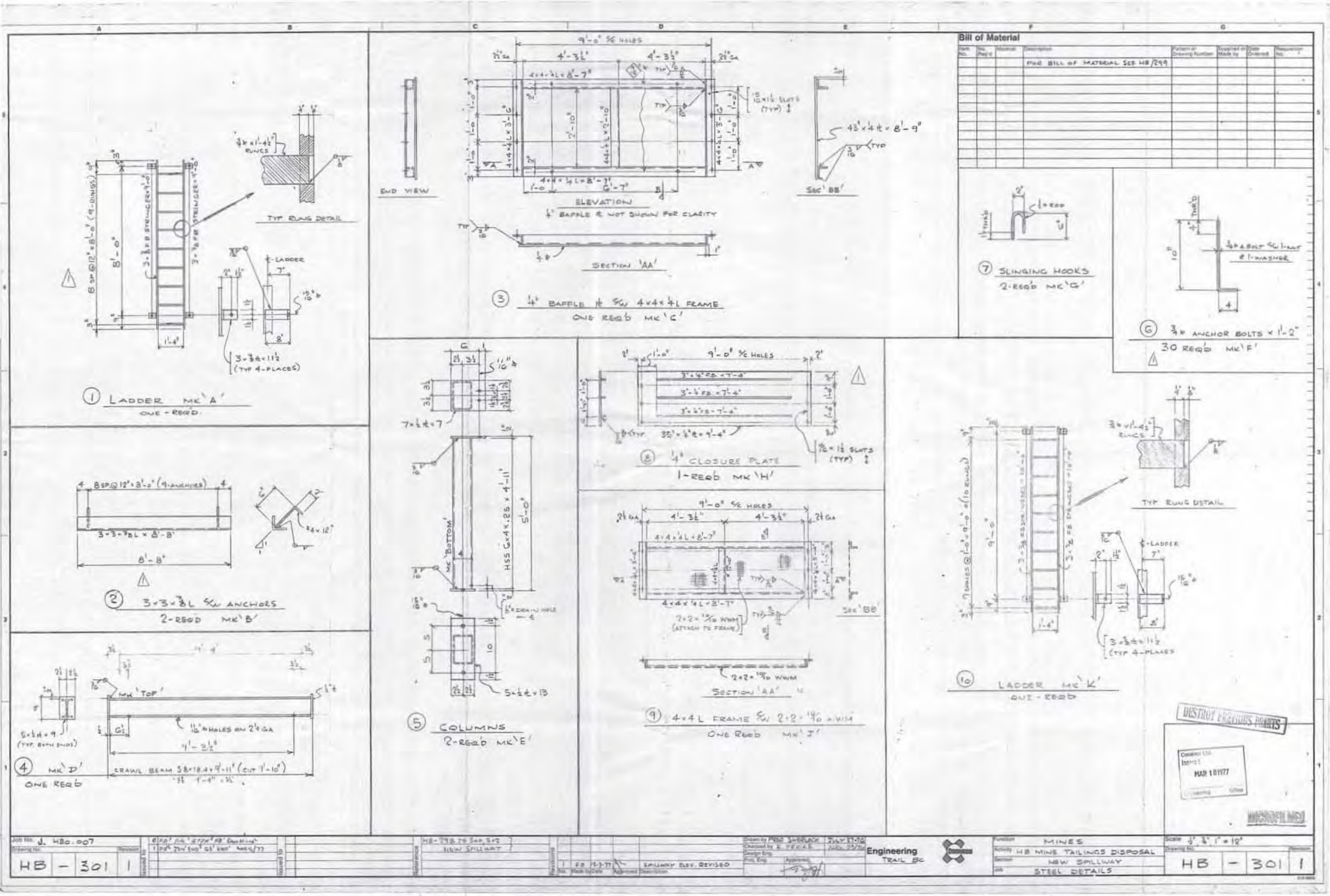
Function: MINES
Activity: HB MINE TAILINGS DISPOSAL
Section: NEW SPILLWAY
Job: SPILLWAY & DROP MANHOLE ARRANGEMENT

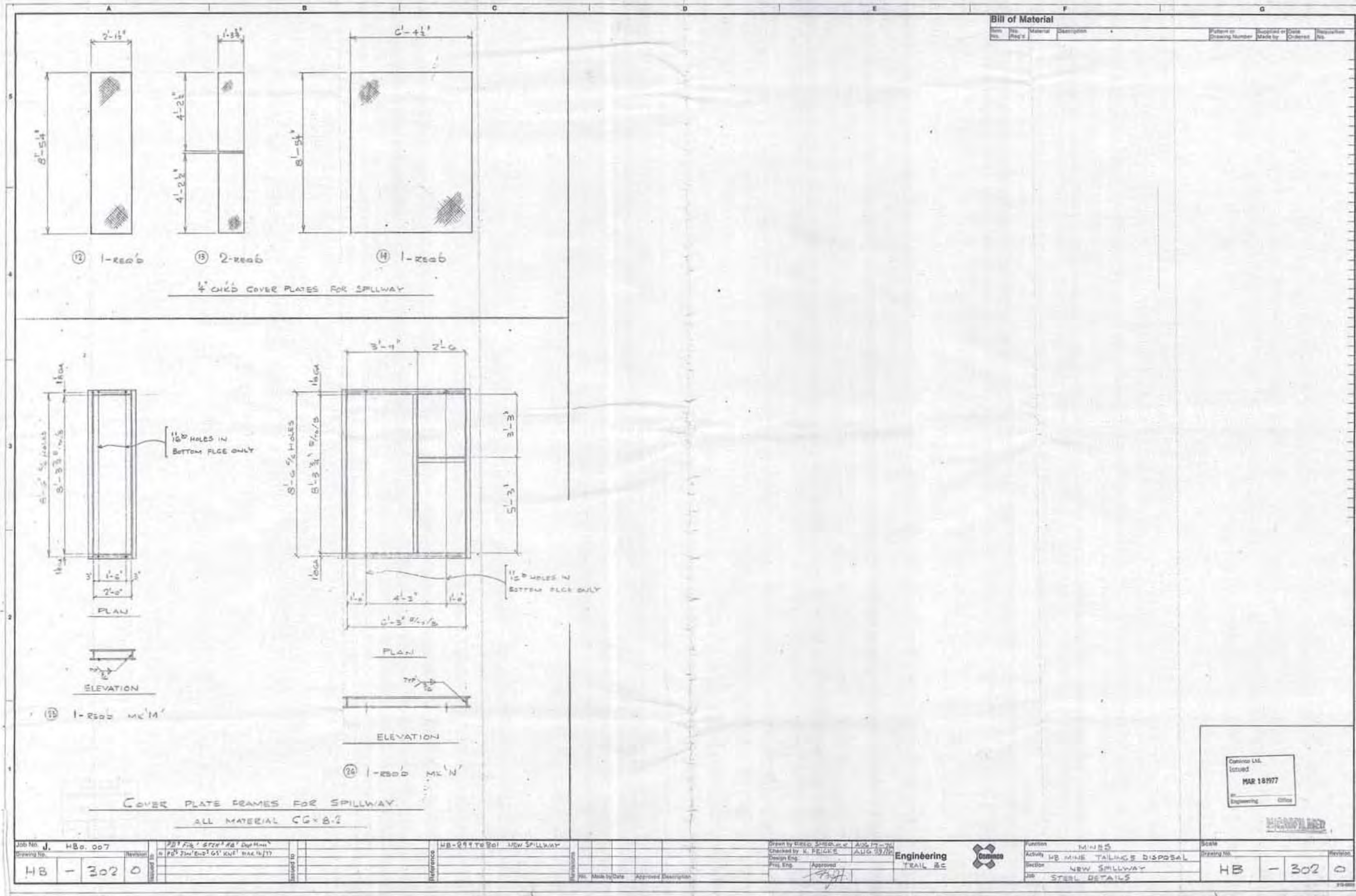
Scale ½" = 1'0"
Drawing No. HB — 299 Revision 1

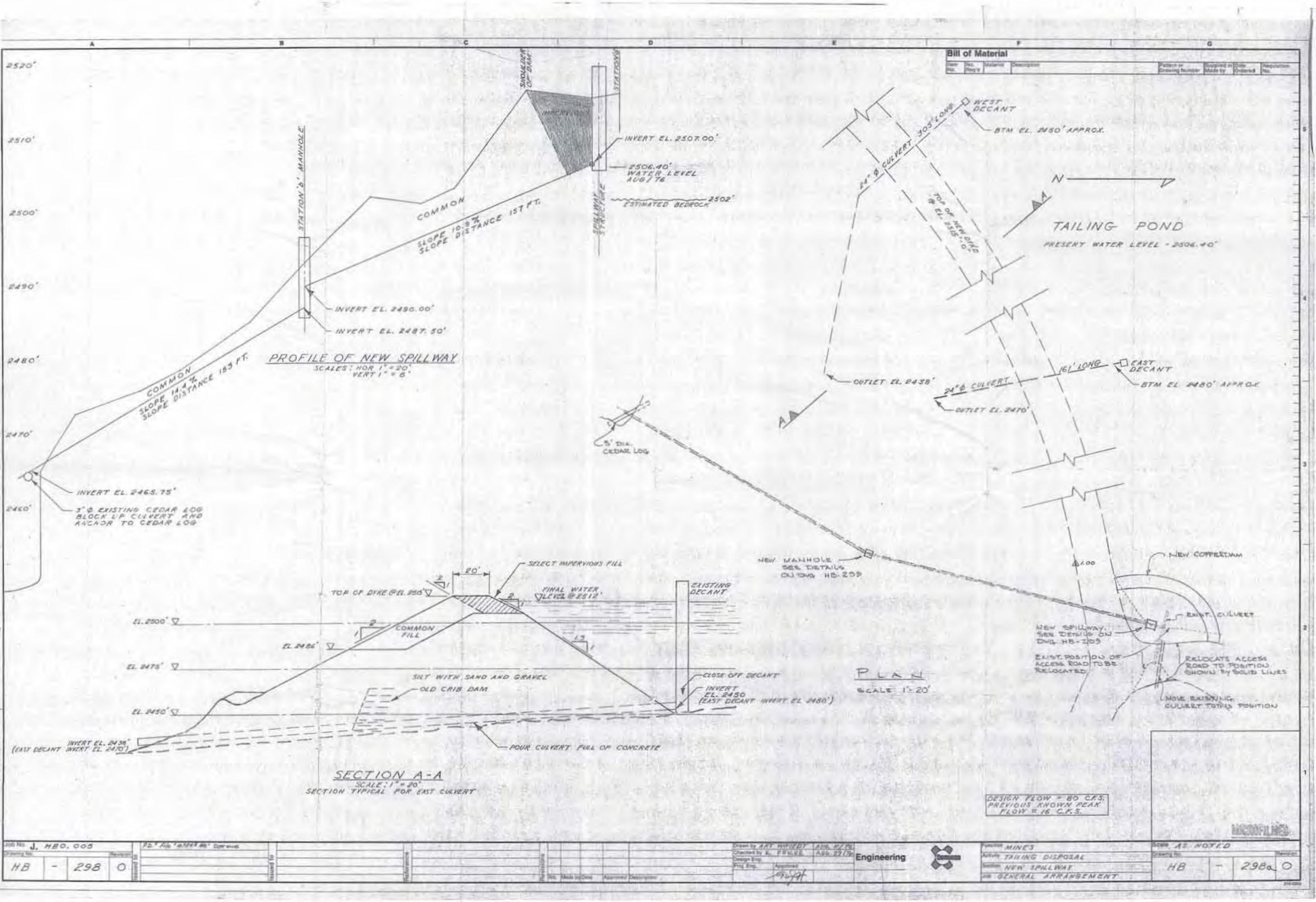
MAR 18 1977

MICROFILMED

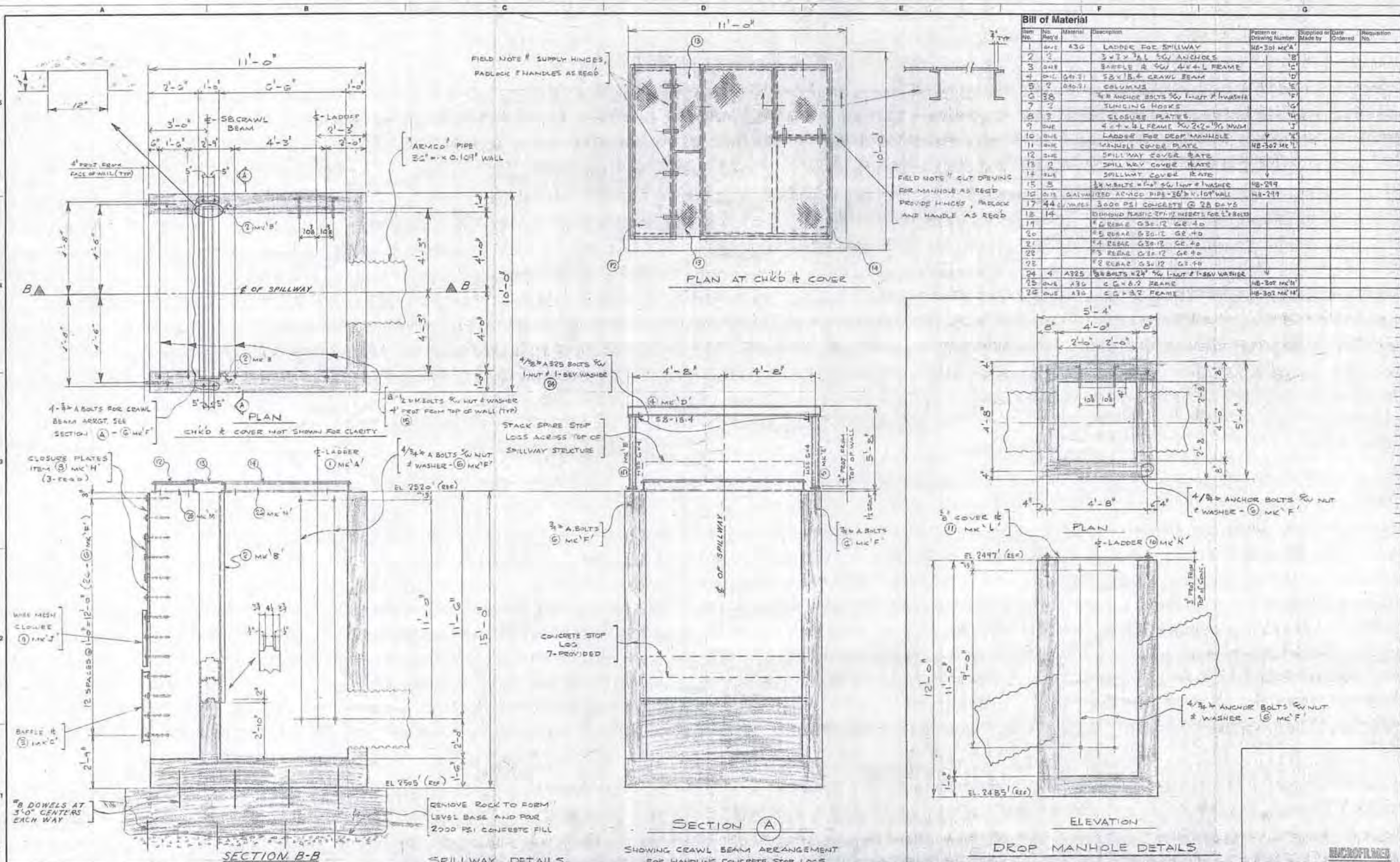

Bill of Material
FOR BILL OF MATERIAL SEE HB-299
SLAB REINFORCING
SECTION A
REBAR ON BILL #1
CONCRETE STOP LOGS
2-REQ'D
WALL REINFORCING
SLAB REINFORCING
REBAR ON BILL #2
WALL REINFORCING
SECTION B
ELEVATION
SPILLWAY DETAILS
DROP MANHOLE DETAILS
DESTROY PREVIOUS PRINTS
MAR 15 1977
Engineering
TRAIL BC
MINES
H.B. MINE TAILINGS DISPOSAL
NEW SPILLWAY
CONCRETE DETAILS
HB - 300 1


Bill of Material
FOR BILL OF MATERIAL SEE HB/299
① LADDER MK 'A'
ONE - REQ'D
TYP RUNG DETAIL
② 3×3×3/8 L S/W ANCHORS
2-REQ'D MK 'B'
③ 1/4" BAFFLE ℞ S/W 4×4×1/4 L FRAME
ONE REQ'D MK 'C'
ELEVATION
1/4" BAFFLE ℞ NOT SHOWN FOR CLARITY
END VIEW
SECTION 'AA'
SEC' BB'
④ MK 'D'
ONE REQ'D
CRAWL BEAM S8×18.4×9'-11" (CUT 7'-10")
⑤ COLUMNS
2-REQ'D MK 'E'
HSS 6×4×.25 × 4'-11"
⑥ 3/4 ⌀ ANCHOR BOLTS × 1'-2"
30 REQ'D MK 'F'
⑦ SLINGING HOOKS
2-REQ'D MK 'G'
⑧ 1/4" CLOSURE PLATE
1-REQ'D MK 'H'
⑨ 4×4 L FRAME S/W 2×2×10/10 WWM
ONE REQ'D MK 'J'
SECTION 'AA'
⑩ LADDER MK 'K'
ONE - REQ'D
TYP RUNG DETAIL
DESTROY PREVIOUS PRINTS
MAR 18 1977
MICROFILMED
J. HB0.007
HB - 301 1
HB-298 TO 300, 302 NEW SPILLWAY
SPILLWAY ELEV. REVISED
Engineering
TRAIL BC
MINES
HB MINE TAILINGS DISPOSAL
NEW SPILLWAY
STEEL DETAILS
HB - 301 1


Bill of Material
⑫ 1-REQ'D
⑬ 2-REQ'D
⑭ 1-REQ'D
¼" CHK'D COVER PLATES FOR SPILLWAY
11/16" ⌀ HOLES IN BOTTOM FLGE ONLY
PLAN
ELEVATION
⑮ 1-REQ'D MK'M'
PLAN
ELEVATION
㉔ 1-REQ'D MK'N'
COVER PLATE FRAMES FOR SPILLWAY
ALL MATERIAL C6×8.2
Cominco Ltd. Issued MAR 18 1977 Engineering Office
MICROFILMED
Job No. J. HBo. 007
Drawing No. HB – 302 Revision 0
HB-299 TO 301 NEW SPILLWAY
Drawn by REED SHERLOCK AUG 17-76
Checked by K. FEICKE AUG 19/76
Engineering TRAIL BC
Cominco
Function MINES
Activity HB MINE TAILINGS DISPOSAL
Section NEW SPILLWAY
Job STEEL DETAILS
Drawing No. HB – 302 Revision 0



PROFILE OF NEW SPILLWAY
SCALES: HOR 1" = 20' VERT 1" = 5'
COMMON
SLOPE 10.9% SLOPE DISTANCE 157 FT.
SLOPE 14.4% SLOPE DISTANCE 153 FT.
STATION '2' MANHOLE
SHOULDER OF DAM
IMPERVIOUS
SPILLWAY STRUCTURE
INVERT EL. 2507.00'
2506.40' WATER LEVEL AUG/76
ESTIMATED BEDROCK 2502'
INVERT EL. 2490.00'
INVERT EL. 2487.50'
INVERT EL. 2465.75'
3' Ø EXISTING CEDAR LOG BLOCK UP CULVERT AND ANCHOR TO CEDAR LOG
Bill of Material
WEST DECANT
BTM EL. 2450' APPROX.
24" Ø CULVERT 305' LONG
TOP OF NEW DIKE @ EL. 2515'-0"
N
TAILING POND
PRESENT WATER LEVEL - 2506.40'
OUTLET EL. 2438'
161' LONG
24" Ø CULVERT
EAST DECANT
BTM EL. 2480' APPROX.
OUTLET EL. 2470'
A
5' DIA. CEDAR LOG
NEW MANHOLE SEE DETAILS ON DWG. HB-299
NEW COFFERDAM
EXIST. CULVERT
NEW SPILLWAY SEE DETAILS ON DWG. HB-299
EXIST. POSITION OF ACCESS ROAD TO BE RELOCATED
RELOCATE ACCESS ROAD TO POSITION SHOWN BY SOLID LINES
MOVE EXISTING CULVERT TO THIS POSITION
PLAN
SCALE: 1" = 20'
SELECT IMPERVIOUS FILL
20'
TOP OF DYKE @ EL. 2515'
FINAL WATER LEVEL @ 2512'
EXISTING DECANT
EL. 2500'
COMMON FILL
EL. 2486'
EL. 2475'
SILT WITH SAND AND GRAVEL
OLD CRIB DAM
CLOSE OFF DECANT
INVERT EL. 2450 (EAST DECANT INVERT EL. 2480')
EL. 2450'
INVERT EL. 2438' (EAST DECANT INVERT EL. 2470')
POUR CULVERT FULL OF CONCRETE
SECTION A-A
SCALE: 1" = 20'
SECTION TYPICAL FOR EAST CULVERT
DESIGN FLOW = 80 C.F.S. PREVIOUS KNOWN PEAK FLOW = 16 C.F.S.
MICROFILMED
Job No. J. HBO. 005
HB - 298 0
Drawn by ART WRIGHT
Checked by K. FRUKE
Engineering
MINES
TAILING DISPOSAL
NEW SPILLWAY
GENERAL ARRANGEMENT
Scale AS NOTED
HB - 298a 0

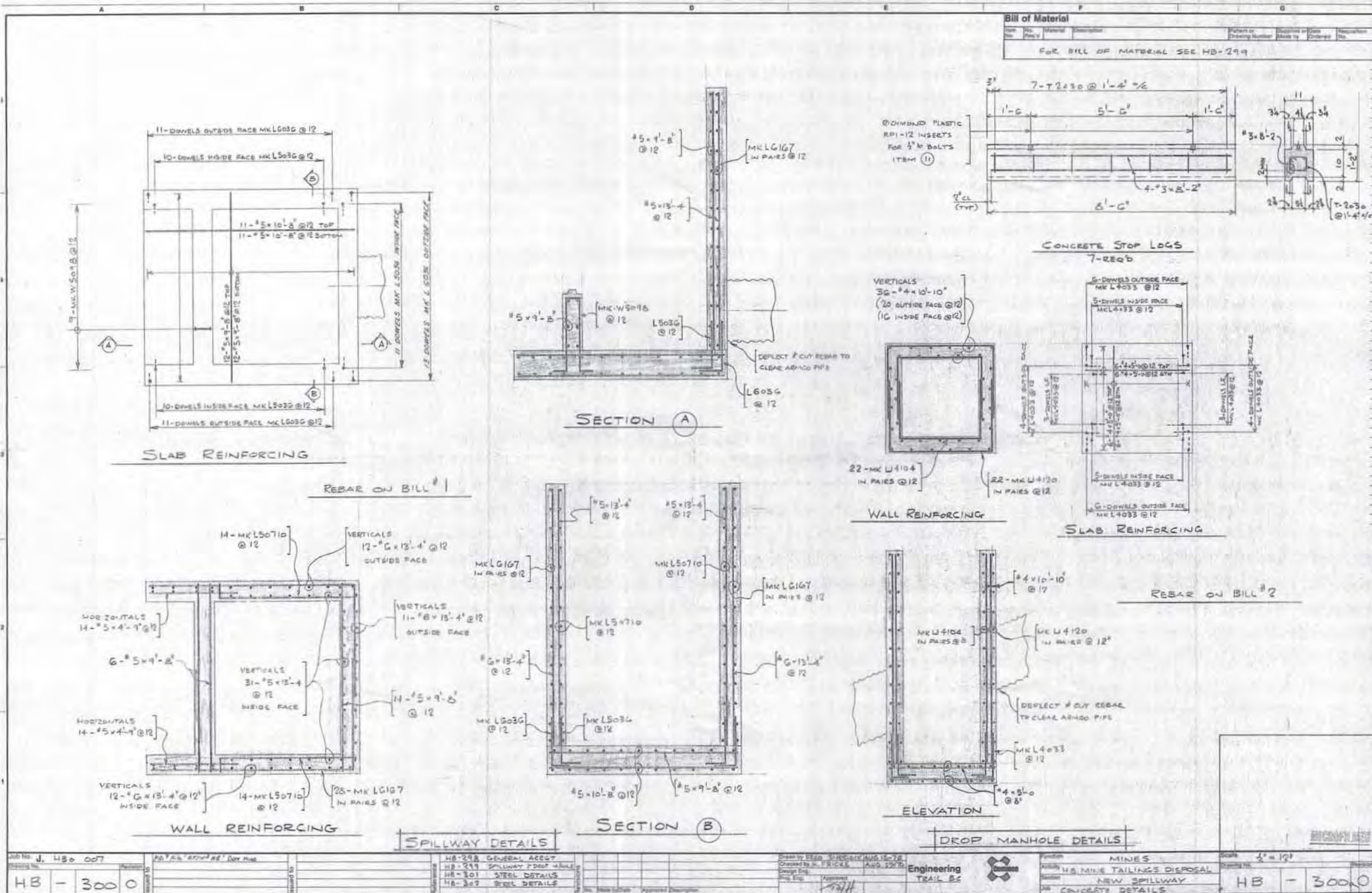


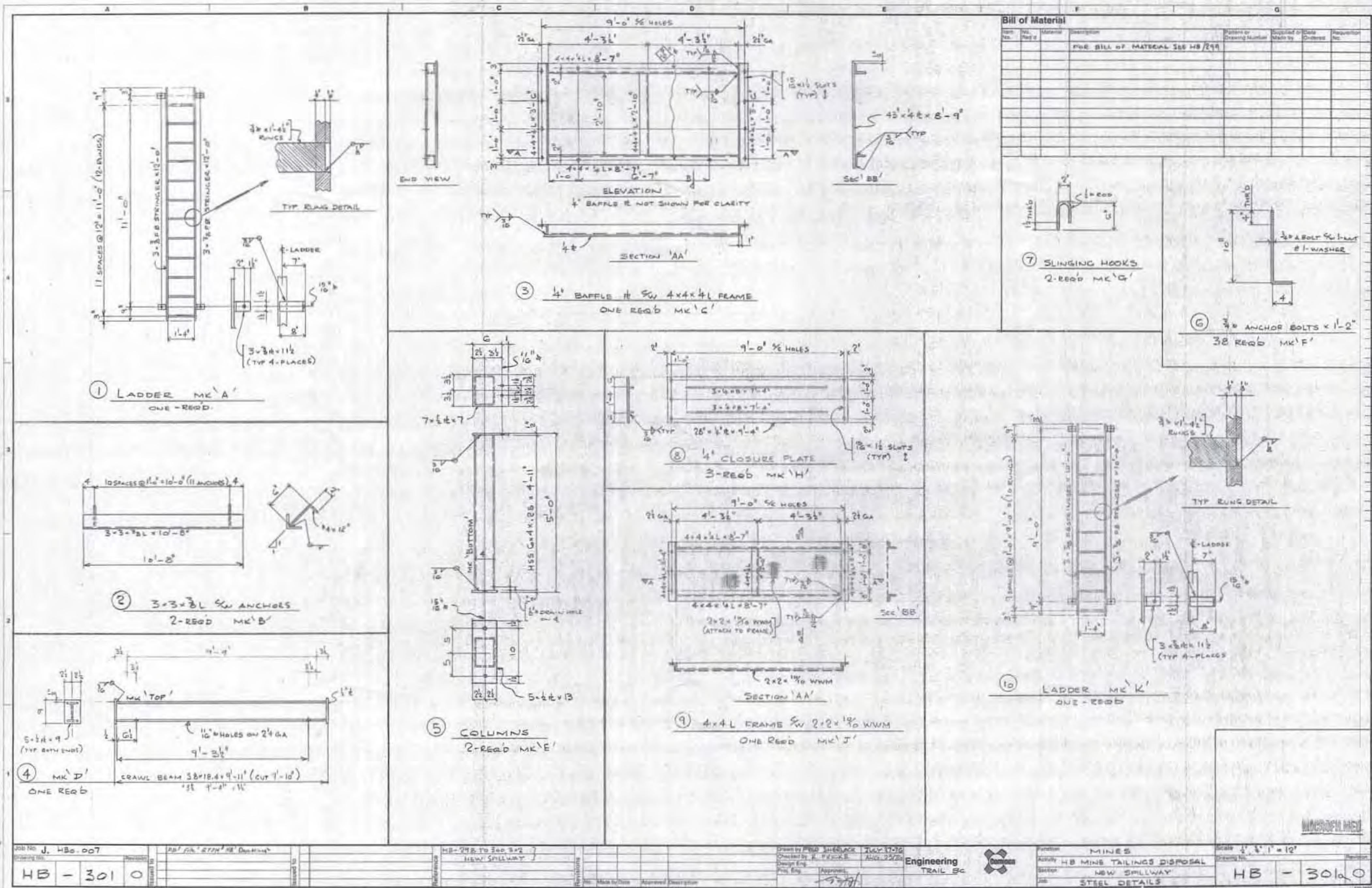
Bill of Material

Item No.	No. Req'd	Material	Description	Pattern or Drawing Number	Supplied or Made by	Date Ordered	Requisition No.
1	ONE	A36	LADDER FOR SPILLWAY	HB-301 MK'A'			
2	2		3×3×¼ L S/W ANCHORS	'B'			
3	ONE		BAFFLE ℞ S/W 4×4 L FRAME	'C'			
4	ONE	G40.21	S8×18.4 CRAWL BEAM	'D'			
5	2	G40.21	COLUMNS	'E'			
6	38		¾ ⌀ ANCHOR BOLTS S/W 1-NUT & 1-WASHER	'F'			
7	2		SLINGING HOOKS	'G'			
8	3		CLOSURE PLATES	'H'			
9	ONE		4×4×¼ L FRAME S/W 2×2-10/10 WWM	'J'			
10	ONE		LADDER FOR DROP MANHOLE	'K'			
11	ONE		MANHOLE COVER PLATE	HB-302 MK'L'			
12	ONE		SPILLWAY COVER PLATE				
13	2		SPILLWAY COVER PLATE				
14	ONE		SPILLWAY COVER PLATE				
15	8		⅞ ⌀ M.BOLTS × 1'-0" S/W 1 NUT & 1 WASHER	HB-299			
16	ONE	GALVANIZED	ARMCO PIPE-36" ⌀ × .109" WALL	HB-299			
17	44	CU. YARDS	3000 PSI CONCRETE @ 28 DAYS				
18	14		DIAMOND PLASTIC SPLIT INSERTS FOR ½" ⌀ BOLTS				
19			#6 REBAR G30.12 GR 40				
20			#5 REBAR G30.12 GR 40				
21			#4 REBAR G30.12 GR 40				
22			#3 REBAR G30.12 GR 40				
23			#2 REBAR G30.12 GR 40				
24	4	A325	⅝ ⌀ BOLTS × 2½" S/W 1-NUT & 1-BEV WASHER				
25	ONE	A36	C6×8.2 FRAME	HB-302 MK'M'			
26	ONE	A36	C6×8.2 FRAME	HB-302 MK'N'			

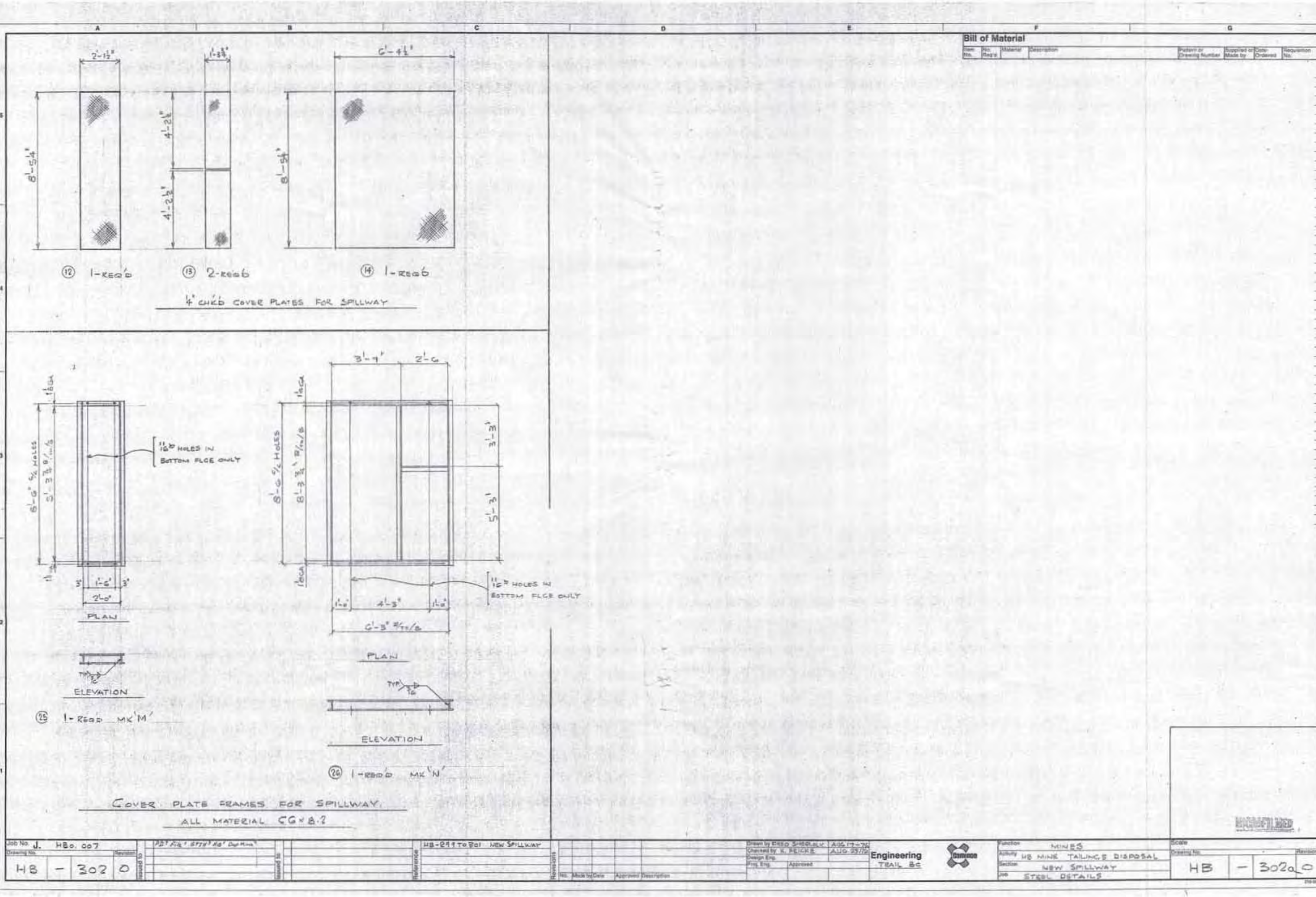
Job No.	J. HB0.007
Drawing No.	HB – 299 0
Reference	FD' FILE' GTTH' HB' DORMING; HB 299 CONCRETE DETAILS
Drawn by	FRED SHERLOCK AUG 13-76
Checked by	K. FRICKE AUG 25/76
	Engineering TRAIL BC
Function	MINES
Activity	HB MINE TAILINGS DISPOSAL
Section	NEW SPILLWAY
Job	SPILLWAY & DROP MANHOLE ARRANGEMENT
Scale	½" = 1'0"
Drawing No.	HB – 299
Revision	0

MICROFILMED


Bill of Material
FOR BILL OF MATERIAL SEE HB-299
SLAB REINFORCING
REBAR ON BILL #1
SECTION A
WALL REINFORCING
SECTION B
SPILLWAY DETAILS
CONCRETE STOP LOGS
7-REQ'D
WALL REINFORCING
SLAB REINFORCING
REBAR ON BILL #2
ELEVATION
DROP MANHOLE DETAILS
Engineering
TRAIL BC
MINES
H.B. MINE TAILINGS DISPOSAL
NEW SPILLWAY
CONCRETE DETAILS
HB - 300 0

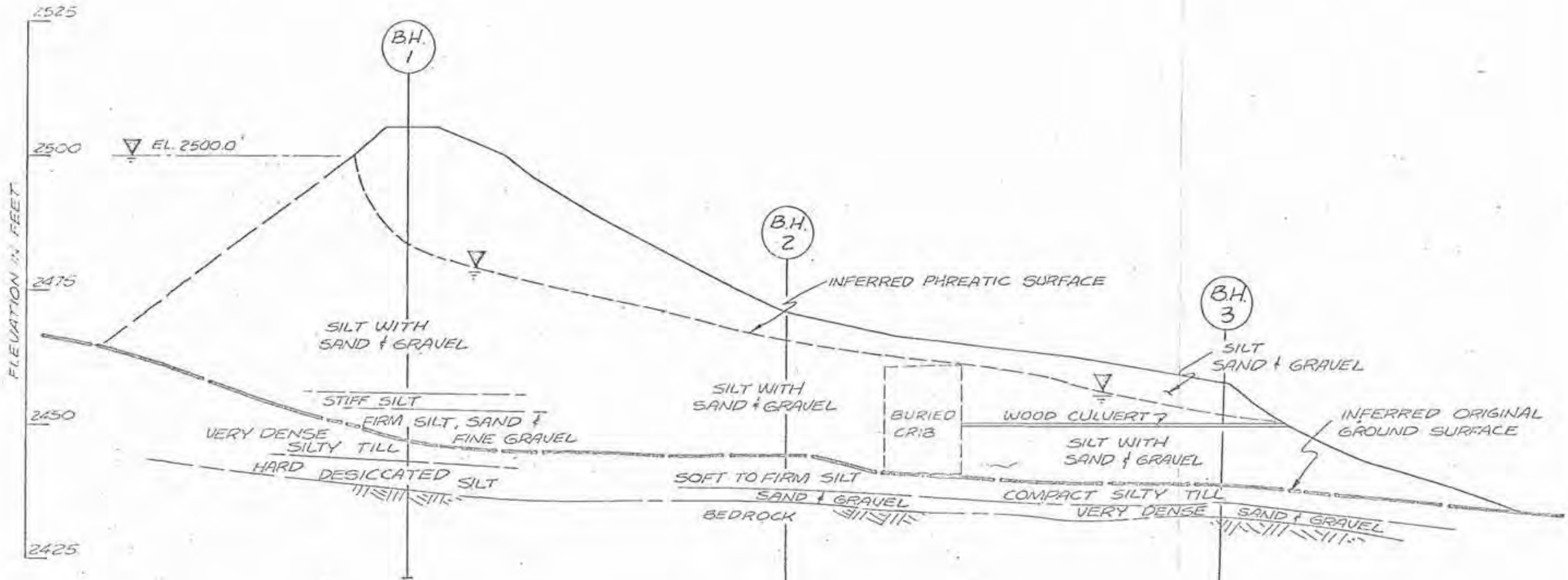


Bill of Material
FOR BILL OF MATERIAL SEE HB/299
① LADDER MK 'A'
ONE - REQ'D.
TYP. RUNG DETAIL
② 3×3×3/8L S/W ANCHORS
2-REQ'D MK 'B'
③ 1/4" BAFFLE PL S/W 4×4×1/4L FRAME
ONE REQ'D MK 'C'
ELEVATION
1/4" BAFFLE PL NOT SHOWN FOR CLARITY
SECTION 'AA'
END VIEW
SEC 'BB'
④ MK 'D'
ONE REQ'D
CRAWL BEAM S8×18.4×9'-11" (CUT 9'-10")
⑤ COLUMNS
2-REQ'D MK 'E'
⑥ 3/4" ANCHOR BOLTS × 1'-2"
38 REQ'D MK 'F'
⑦ SLINGING HOOKS
2-REQ'D MK 'G'
⑧ 1/4" CLOSURE PLATE
3-REQ'D MK 'H'
⑨ 4×4L FRAME S/W 2×2×13/10 WWM
ONE REQ'D MK 'J'
⑩ LADDER MK 'K'
ONE - REQ'D
Job No. J. HB0.007
Drawing No. HB - 301 0
HB - 298 TO 300, 302
NEW SPILLWAY
Engineering
TRAIL BC
MINES
HB MINE TAILINGS DISPOSAL
NEW SPILLWAY
STEEL DETAILS
HB - 301 0


Bill of Material
Item No. | No. Req'd | Material | Description | Pattern or Drawing Number | Supplied or Made by | Date Ordered | Requisition No.
2'-1½"
1'-3¾"
6'-4½"
8'-5¼"
4'-2⅝"
4'-2⅝"
8'-5¼"
(12) 1-REQ'D
(13) 2-REQ'D
(14) 1-REQ'D
¼" CHK'D COVER PLATES FOR SPILLWAY
1/16" HOLES IN BOTTOM FLGE ONLY
6'-6" 9/16 HOLES
5'-3⅞"
3" 1'-6" 3"
2'-0"
PLAN
ELEVATION
(25) 1-REQ'D MK'M'
3'-4" 2'-6"
8'-6" 9/16 HOLES
3'-3"
5'-3"
1/16" HOLES IN BOTTOM FLGE ONLY
1'-0" 4'-3" 1'-0"
6'-3"
PLAN
TYP
ELEVATION
(26) 1-REQ'D MK'N'
COVER PLATE FRAMES FOR SPILLWAY
ALL MATERIAL C6×8.2
Job No. J. HBo. 007
HB-299 TO 301 NEW SPILLWAY
Drawn by D. SHEPLAK AUG 17-76
Checked by K. REICKS AUG 25/76
Engineering
TRAIL BC
Function MINES
Activity HB MINE TAILINGS DISPOSAL
Section NEW SPILLWAY
Job STEEL DETAILS
Drawing No. HB — 302 0
MICROFILMED

CROSS SECTION A-A SHOWING INFERRED SOIL STRATIGRAPHY & PHREATIC SURFACE

FIGURE 2



REFERENCE: COMINCO ENGINEERING DWG. No. HB-285-P, TITLED "HB MINE TAILINGS DISPOSAL" DATED SEPTEMBER 7, 1973.

SECTION A-A

SCALES: HORIZ. & VERT. 1 IN. TO 20 FT.

GOLDER, BRAWNER & ASSOCIATES

DRAWN RMO
APP'D B.T.
DATE Dec. '73

V73218

PROJECT No. V73218

RECORD OF BOREHOLE 2

LOCATION See Figure 1 BORING DATE NOVEMBER 1, 1973 DATUM TAKEN FROM COMINCO DRAWING NO. HB-285-P

BOREHOLE TYPE ROTARY-TRICONE BOREHOLE DIAMETER 4 IN.

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT LB. DROP INCHES

ELEVN. / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	BLOWS/FT.	ELEVATION SCALE
2465.0 / 0.0'	GR. SURFACE.				
	SOFT BROWN SANDY SILT WITH MED. & COARSE SAND & GRAVEL TO 1½" DIA. OFTEN TILL LIKE.	1	2" D.O.	10	2460
		2	2" D.O.	8	
		3	2" D.O.	13	2450
		4	2" D.O.	4	
2438.6' / 26.4'	WOOD	5	2" D.O.	20	2440
27.0'	SOFT TO FIRM STRATIFIED BROWN & GREY SILT WITH OCC. GRAVEL TO 1½" DIA.	6	2" D.O.		
2431.0 / 34.0' / 2429.0	SAND & GRAVEL.				2430
36.0'	BEDROCK.	7	W.S.		
		8	W.S.		2420
		9	W.S.		
		10	W.S.		
2410.0 / 55.0'	END OF HOLE.				2410

DYNAMIC PENETRATION RESISTANCE BLOWS/FT.

SHEAR STRENGTH C_u, LB./SQ.FT.

COEFFICIENT OF PERMEABILITY k, CM./SEC.

WATER CONTENT, PERCENT W_P W W_L

ADDITIONAL LAB. TESTING

STANDPIPE INSTALLATION

W.L. 5.5' NOV. 23, 1973

Percent axial strain at failure

VERTICAL SCALE 1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

2

DRAWN RMO

CHECKED

GB-11

PROJECT No. V73218

RECORD OF BOREHOLE 3

LOCATION See Figure 1 BORING DATE NOVEMBER 1, 1973 DATUM TAKEN FROM COMINCO DRAWING NO. HB-285-P

BOREHOLE TYPE ROTARY-TRICONE BOREHOLE DIAMETER 4 IN.

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT - LB DROP - INCHES

ELEVN. DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	BLOWS/FT.	ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FT. / SHEAR STRENGTH C_u, LB./SQ.FT	COEFFICIENT OF PERMEABILITY k, CM./SEC. / WATER CONTENT, PERCENT W_P W W_L	ADDITIONAL LAB. TESTING	STANDPIPE INSTALLATION
2455.0	GR. SURFACE.									
0.0'	VARIABLE DENSITY BROWN & GREY SILT, SAND & GRAVEL		1	2" D.O.	>50	2450				W.L. 6.0' NOV 23, 1973
2448.0 7.0'	WOODEN CULVERT									
8.0'	VARIABLE DENSITY BROWN & GREY SILT WITH MED. & COARSE SAND & FINE GRAVEL.		2	2" D.O.	>100					
			3	2" D.O.	15	2440				
2435.0 20.0'	COMPACT BROWN & GREY SILT, SAND & GRAVEL (TILL)		4	2" D.O.	37					
2432.0 23.0'			5	2" D.O.	>100	2430				
2429.0 26.0'	VERY DENSE SAND & GRAVEL		6	W.S						
	BEDROCK.					2420				
			7	W.S						
2410.0 45.0'	END OF HOLE.					2410				

15-○-5 Percent axial strain at failure
10

VERTICAL SCALE
1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

3

DRAWN RMC
CHECKED

PROJECT No. V73218

RECORD OF BOREHOLE 1

LOCATION See Figure 1 BORING DATE OCTOBER 29, 30, 1973 DATUM TAKEN FROM COMINCO DRAWING NO. HB-285-P

BOREHOLE TYPE ROTARY - TRICONE BOREHOLE DIAMETER 4 IN.

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT — LB. DROP — INCHES

ELEV. / DEPTH	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	BLOWS / FT.	ELEVATION SCALE	STANDPIPE INSTALLATION
2505.0 / 0.0'	GR. SURFACE.					
	SOFT TO FIRM NON-PLASTIC BROWN SANDY SILT WITH SOME MED. & COARSE SAND & FINE GRAVEL.	1	2" D.O.	11	2500	
		2	2" D.O.	4		
		3	2" D.O.	14	2490	
		4	2" D.O.	5		
		5	2" D.O.	15	2480	W.L. 23.0' NOV. 23, 1973
		6	2" D.O.			
		7	2" D.O.	13	2470	
		8	2" D.O.	13		
		9	2" D.O.	23	2460	
2455.0 / 50.0'	STIFF STRATIFIED GREY & BROWN CLAYEY SILT WITH A TRACE OF MED. SAND.	10	2" D.O.	37		
2452.0 / 53.0'		11	2" D.O.	24	2450	
2446.0 / 59.0'	FIRM BROWN & DARK BROWN SILT WITH SOME MED. & COARSE SAND, FINE GRAVEL & ORGANICS.	12	2" D.O.	>100		
2442.0 / 63.0'		13	2" D.O.	>100	2440	
2437.0 / 68.0'	VERY DENSE DARK GREY SILT, SAND & GRAVEL TO 1" DIA. (TILL).					
	VERY DENSE BLACK FRIABLE DESICCATED SILT WITH THIN PYRITE LENSES & ROUNDED GRAVEL TO 1½" DIA.	14	WS		2430	
		15	WS			
	BEDROCK.	16	WS			
2420.0 / 85.0'	END OF HOLE.				2420	

DYNAMIC PENETRATION RESISTANCE BLOWS / FT.

SHEAR STRENGTH C_u, LB./SQ.FT.

COEFFICIENT OF PERMEABILITY k, CM./SEC.

WATER CONTENT, PERCENT W_P W W_L

ADDITIONAL LAB. TESTING

ε Percent axial strain at failure

VERTICAL SCALE 1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

1

DRAWN RMO

Pages 1 through 7 redacted for the following reasons:
- -
Not Responsive

1981

File HB.
0500032

M-85

EXHIBIT 'C'

DAVID MINERALS LTD.

Tailings Disposal Scheme

HB Mill, Salmo, B.C.

Return to:
Victoria
OFFICE
Box 91-1956-32

KLOHN LEONOFF
CONSULTING ENGINEERS

PROJECT:	HB Mill Tailings Disposal Scheme
LOCATION:	Salmo, B.C.
CLIENT:	David Minerals Ltd.
OUR FILE:	VA 2869 November 27, 1981

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APPENDIX

I - LOGS OF BOREHOLES DRILLED BY GOLDER ASSOCIATES IN 1973

LIST OF DRAWINGS

A-2869-1	-	SITE LOCATION
B-2869-2	-	LOCATION OF TAILINGS DISPOSAL POND
B-2869-3	-	PLAN OF EXISTING TAILINGS POND
D-2869-4	-	PLAN AND SECTION OF EXISTING DAM
B-2869-5	-	SCHEMATIC PROFILE OF TAILINGS POND
B-2869-6	-	STABILITY ANALYSIS OF DAM
A-2869-7	-	WATER BALANCE

1. INTRODUCTION AND SUMMARY

Klohn Leonoff Ltd. was requested by David Minerals Ltd. to investigate the feasibility of using the existing tailings pond at the HB Mill for the deposition of about one million tons of tailings. This report has been prepared for submission to the Nelson Branch of the B.C. Ministry of Energy, Mines and Petroleum Resources so that a permit can be obtained by David Minerals to operate the pond.

The HB Tailings Dam is located approximately four miles south of Salmo, B.C. (Drawings A-2869-1 and B-2869-2). The dam was originally built by Cominco in 1955 using a timber crib over which borrow materials from the west end of the pond were placed. The dam was raised in this manner to a height of about 40 ft. In 1964, a portion of the timber crib failed and moved about 10 to 15 ft. Drains were placed and toe protection was provided to stabilize the failure. Construction of the dam raising continued by the downstream method until operations were suspended in 1967. We understand that there was no independent geotechnical control of dam construction until 1973. In 1973, Golder Associates drilled three holes, one in the crest and two in the downstream portion of the dam. They encountered relatively soft material (as low as four blows per foot) in two holes. They recommended measures to reduce the phreatic surface within the dam, which were implemented. Subsequently, Golder Associates supervised the construction of dam raisings in 1975 and 1977. The operations at the HB Mill were suspended by Cominco in 1978.

The tailings dam is located at the southern end of a valley and has been constructed about 75 to 80 ft high using borrow materials. The tailings were deposited at the back of the pond, about 2900 ft from the crest of the dam and clarified water ponded against the upstream face of the dam (Drawing B-2869-3). Initially, two timber

decant towers were used in conjunction with two 24-inch diameter steel pipes to pass water from the upstream to the downstream side of the dam. In 1977, these decant towers were filled with concrete and replaced with a new spillway and drop manhole arrangement (Drawing D-2869-4).

Dr. Rajaram of Klohn Leonoff visited the damsite on September 23, 1981. Discussions were held with Mr. Newman of Cominco Engineering to obtain details of the tailings dam operation during the period 1955 to 1978. A profile of the tailings pond from the tailings flume to the dam crest was obtained from Mr. Newman and from Mr. Girdler of David Minerals. A schematic profile of the tailings pond is presented in Drawing B-2869-5. Assuming that tailings will be deposited uniformly on the existing tailings surface, a curve relating tons of tailings to elevation was developed. Approximately 790,000 tons of tailings can be deposited in the existing pond and dam. The dam will have to be raised by about 6 ft before the anticipated one million tons of tailings are deposited.

Klohn Leonoff will assess the condition of the existing dam by conducting a program of field investigation and laboratory analysis. Based on the results of this investigation, specifications for the dam raising will be provided.

The hydrology of the site was briefly analyzed to determine the water balance in the pond. It was concluded that the present spillway, which we understand is designed for a peak flow of 80 cu ft per second, is adequate to handle the runoff from a 200 year flood.

A seismic risk analysis of the site indicated that the acceleration amplitude with return periods of 100 years is 0.015 g (1.5 percent gravity). Since this figure indicates that the site has very low seismic risk, a static stability analysis was performed. The

analysis indicates that the dam has a minimum factor of safety against a shearing type failure of 1.7.

This report details the condition of the existing dam and describes the physical and hydrologic setting of the tailings pond, the tailings disposal scheme, and final abandonment of the pond.

2. DESCRIPTION OF EXISTING TAILINGS POND AND DAM

The existing tailings pond is located approximately four miles south of Salmo, B.C. A plan of the pond area showing the contours of the tailings surface is presented on Drawing B-2869-3. The tailings dam is located at the southern end of a valley and has been constructed about 75 to 80 ft high using borrow material obtained from the abutment slopes. The dam is about 800 ft long and the pond occupies an area of about 67 acres. A plan and section through the dam are presented on Drawing D-2869-4.

2.1 Cominco's Operating History

Cominco operated the tailings pond during the period 1955 through 1978. The tailings pond was used during 1955 through 1967, and subsequently during the period 1974 through 1978. The crest of the dam was raised periodically during these years to accommodate the increasing volumes of tailings. These dam raisings were performed using the downstream method of construction, i.e., additional fill was placed on the crest and the downstream slope of the dam. It is our understanding that the dam construction during the years 1955 through 1967 was not performed under independent geotechnical control.

When the dam was initially constructed in 1955, a timber crib structure was used. This crib was covered with borrow material obtained from the west end of the pond. The dam was raised in this manner to a height of about 40 ft. In 1964, a portion of the

timber crib failed and moved about 10 to 15 ft. Drains were placed and toe protection was provided to stabilize this failure. Construction of the dam raising continued by the downstream method until operations were suspended in 1967.

Before Cominco re-opened the HB Mill in 1974, Golder Associates investigated the stability of the tailings dam in 1972 and 1973. They drilled three holes, one on the crest and two on the downstream portion of the dam. They encountered soft materials (as low as four blows per foot) in two of the three holes. They recommended that a filter blanket be placed on the downstream slope of the dam to reduce the phreatic surface and improve dam stability. This was implemented in 1974. Two subsequent dam raisings in 1975 and 1977 were supervised by Golder Associates (personal communication, Newman, 1981). Cominco has been monitoring the water levels in the dam since the installation of piezometers in 1973. These observations indicate that the phreatic surface within the dam has not changed since Cominco shut down their operation in 1978.

2.2 Geotechnical Aspects of Dam Construction

Cominco re-opened the HB Mine and Mill in 1973. In 1972 and 1973, Golder Associates of Vancouver investigated the stability of the tailings dam. In 1973, three boreholes were drilled to depths varying from 45 to 85 ft and extended approximately 20 ft into bedrock. One borehole was drilled from the crest and two boreholes from the downstream slope of the existing tailings dam. Logs of the boreholes obtained by Golder Associates are presented in Appendix I. Samples were obtained for laboratory testing, and perforated plastic standpipes were installed in the boreholes to monitor groundwater levels. A plan and section of the dam, showing the location of these boreholes, is presented on Drawing D-2869-4.

A review of Golder Associates reports dated June 1972 and January 1974, and discussions with Mr. Newman of Cominco reveal the following about the tailings dam:

- The dam is generally comprised of brown sandy silt containing varying amounts of medium to coarse sand and fine gravel.
- There are zones of soft material in the fills placed before 1967 (as low as four blows per foot).
- A timber crib was used during the initial construction of the dam, and a portion of this crib failed in 1964 and moved about 10 to 15 ft.
- The foundation material under the fill consists of bedrock overlain by 6 to 8 ft of dense silty till with minor amounts of sand and gravel.
- The fill material has an angle of internal friction of approximately 35 1/2 degrees with zero cohesion, as determined by Golder Associates' laboratory tests.
- The factor of safety against a shearing type failure is of the order of 1.3. Since this analysis was completed by Golder Associates in 1973, the phreatic surface has been lowered and so the present factor of safety is considered to be greater than this figure.
- The dam has adequate protection against surface erosion.

Golder Associates recommended that if the ponded water level is raised, the dam should be raised using a filter blanket to maintain the phreatic surface below the level of the existing downstream fill slope. The specifications for the 1975 and 1977 dam raisings were prepared by Cominco on the basis of the Golder reports, and we

understand that the construction was supervised by Golder Associates. A review of the piezometer readings through July 1981 indicates that the phreatic surface has been relatively constant, since Cominco shut down in 1978.

2.3 Spillway

Prior to 1977, two timber decant towers were used in conjunction with two 24-inch diameter steel pipes to pass water from the upstream to the downstream side of the dam. Due to operating and maintenance problems with this system, Cominco filled these structures with concrete and installed a new spillway and drop manhole structure (Drawing D-2869-4). This structure is equipped with a 36-inch diameter steel pipe, and we understand was designed to pass a maximum flow of 80 cu ft per second (35,900 USGPM).

3. TAILINGS DISPOSAL SITE

The tailings disposal area is situated in a natural basin covering about 67 acres in the Salmo Provincial Forest. It is to the east of Provincial Highway 3 and the Salmo River, about four miles south of Salmo, B.C. (Drawing B-2869-2). To the east and west of the pond are heavily treed slopes consisting of 80 to 90% of evergreens. The dam is situated at the southern end of the basin.

3.1 Hydrological Setting

Dr. McCreath of Klohn Leonoff, obtained data on snowcourse, streamflow, and precipitation from measuring stations at Creston, Nelson, Trail, and Edgren Creek. From analysis of the data, the average annual precipitation at the site is 31.5 inches, and the average annual evaporation is 16.7 inches. The average annual runoff from a catchment area of about 445 acres to the east of the tailings pond is about 14.5 inches. The water balance for the pond was calculated using these estimates for precipitation, evaporation, and runoff.

The peak 200 year flood inflow into the pond is estimated to be in the order of 120 to 150 cu ft per second (cfs). About 30 to 50% of this inflow can be temporarily stored in the pond since a flood surcharge of 2 ft has been assumed in computing the volume-elevation curve. Thus, the existing spillway, which we understand has been designed for a discharge of 80 cfs, can handle the 200 year flood estimated for the site.

4. TAILINGS DISPOSAL SCHEME

4.1 Existing Capacity of the Pond

The tailings pond has been operated since 1955 with the tailings being deposited at the upstream end of the tailings pond and the dam being raised as necessary by the downstream method of construction using borrow materials. Klohn Leonoff recommends that this method of tailings disposal be continued by David Minerals Ltd. In an effort to estimate the present capacity of the tailings pond, and the extent of dam raising necessary to store the anticipated 1,000,000 tons of tailings, a curve relating the tons of tailings to the elevation of the dam crest was developed (Drawing B-2869-5).

A schematic profile of the existing tailings surface is presented on Drawing B-2869-5. The water level in the pond is 5 ft below the dam crest, and the depth of the ponded water on the upstream side of the dam is 9 ft. The tailings should be discharged in layers over the existing tailings surface. In June 1984, after about 790,000 tons of tailings have been deposited, the ponded water capacity and flood surcharge provision will be reduced to a minimum. At that point, the dam will have to be raised by about 6 ft before additional tailings can be deposited. During operation of the tailings pond, the elevations of the tailings should be monitored to ensure that the schematic profile presented on Drawing B-2869-5 is maintained. The depth from the crest of the slimes

surface on the upstream side of the dam should be maintained as depicted in the tons of tailings versus elevation curve.

4.2 Tailings Dam Raising

The tons of tailings versus elevation curve indicates that the dam crest has to be raised prior to June 1984. Klohn Leonoff recommends that before the dam raising is undertaken, a program of field investigation should be conducted to assess the condition of the upstream portion of the dam. The upstream portion of the dam contains some soft zones, and also has a timber crib buried within it.

During the 1982 field season, two to three boreholes should be drilled to assess the condition of the upstream side. Soil samples should be obtained for conducting laboratory tests. Based on the results of the field and laboratory testing program, Klohn Leonoff will develop detailed specifications for the dam raising.

A stability analysis of the dam was performed using the parameters presented in Drawing B-2869-6. A preliminary profile of the dam raised by 6 ft was used to perform the analysis. A seismic risk analysis of the site indicated that the acceleration amplitude with return periods of 100 years is 0.015 g (1.5% gravity). Since this represents a very low seismic risk, a static stability analysis was performed. The minimum factor of safety for the dam was found to be 1.7.

4.3 Water Balance

The hydrological data given in Section 3.1 of this report was utilized to compute the water balance for the tailings pond (Drawing A-2869-7). Using a production rate of 900 tons per day, a tailings pulp density of 30%, and no recycling of the water, the tailings

transport water required is 350 USGPM. Of this amount about 50 USGPM remains within the voids of the tailings. The runoff and precipitation into the pond is estimated to be 335 USGPM. Assuming that 40 USGPM are lost due to evaporation and seepage, the average amount of daily flow out of the spillway is 595 USGPM. This represents an average dilution factor of about two for the tailings water. During periods of heavy runoff and precipitation, this factor could be much higher.

4.4 Permanent Spillway

On final abandonment of the pond, a permanent spillway should be constructed at the east abutment of the dam. This should be an open-channel spillway which will safely pass flood water from the upstream to the downstream side of the dam. The design of this spillway is beyond the scope of the present study.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

1. The existing tailings dam has a capacity of approximately 790,000 tons.

2. The tailings should be discharged from the northern end of the pond, in layers over the existing tailings surface. The depth from the crest of the slimes surface on the upstream side of the dam should be maintained at a minimum of about 8 ft.

3. The dam crest should be raised by about 6 ft during the 1983 field season to accommodate the anticipated one million tons of tailings.

5.2 Recommendations

1. The condition of the existing dam, especially the upstream portion, should be investigated during the 1982 field season. Based on this investigation, plans and specifications for the 1983 dam raising should be prepared.

2. Piezometric levels in the dam should be monitored on a monthly basis.

3. The tailings surface elevation should be monitored to ensure that the schematic profile presented in this report is maintained. Any significant variations in this profile will affect the tailings storage capacity.

KLOHN LEONOFF LTD.

V Rajaram

V. RAJARAM, Ph.D., P.E.
Senior Division Engineer

Mark Olsen

MARK T. OLSEN, P.Eng.
Staff Consultant

VR/MTO/jas

APPENDIX I

LOGS OF BOREHOLES DRILLED BY GOLDER ASSOCIATES IN 1973

	BEDROCK.	8	W.S	2420	
		9	W.S		
10.0		10	W.S	2410	
5.0	END OF HOLE.				

15 0 5 10 Percent axial strain at failure

VERTICAL SCALE
1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

2

DRAWN RMO
CHECKED

2432.0 23.0	SAND & GRAVEL (TILL)				
2429.0 26.0	VERY DENSE SAND & GRAVEL	5	2" D.O	>100	2430
		6	W.S		
	BEDROCK.				2420
		7	W.S		
2410.0 45.0	END OF HOLE.				2410

15 ○ 5 0 10 Percent axial strain at failure

VERTICAL SCALE
1 INCH TO 10 FEET

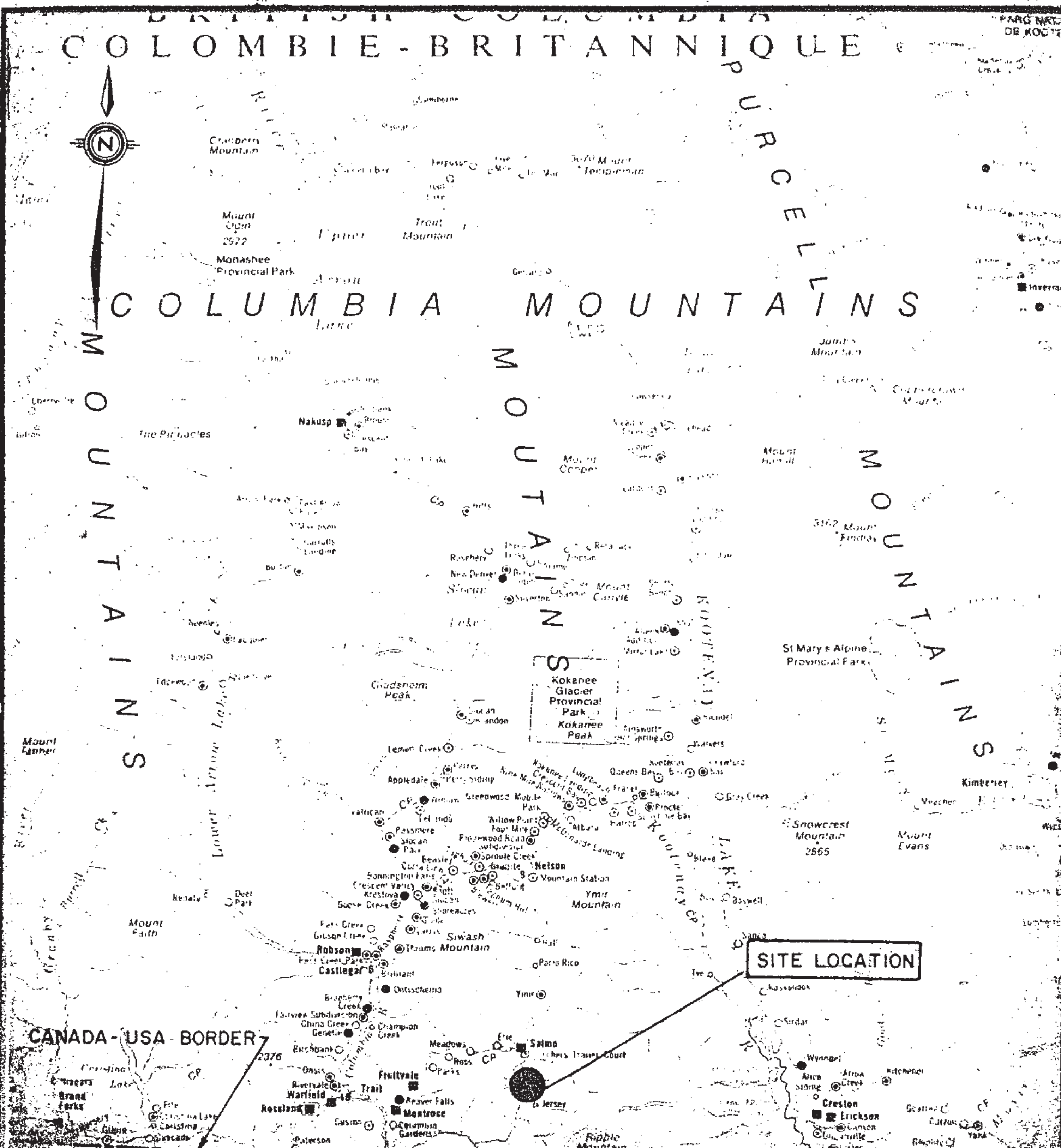
GOLDER, BRAWNER & ASSOCIATES

3

DRAWN RMD
CHECKED

LIST OF DRAWINGS

A-2869-1	-	SITE LOCATION
B-2869-2	-	LOCATION OF TAILINGS DISPOSAL POND
B-2869-3	-	PLAN OF EXISTING TAILINGS POND
D-2869-4	-	PLAN AND SECTION OF EXISTING DAM
B-2869-5	-	SCHEMATIC PROFILE OF TAILINGS POND
B-2869-6	-	STABILITY ANALYSIS OF DAM
A-2869-7	-	WATER BALANCE



AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL

REF.: CANADA GAZETTEER ATLAS 1980

SCALE 1 : 1 000 000

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT: HB MILL TAILINGS DISPOSAL

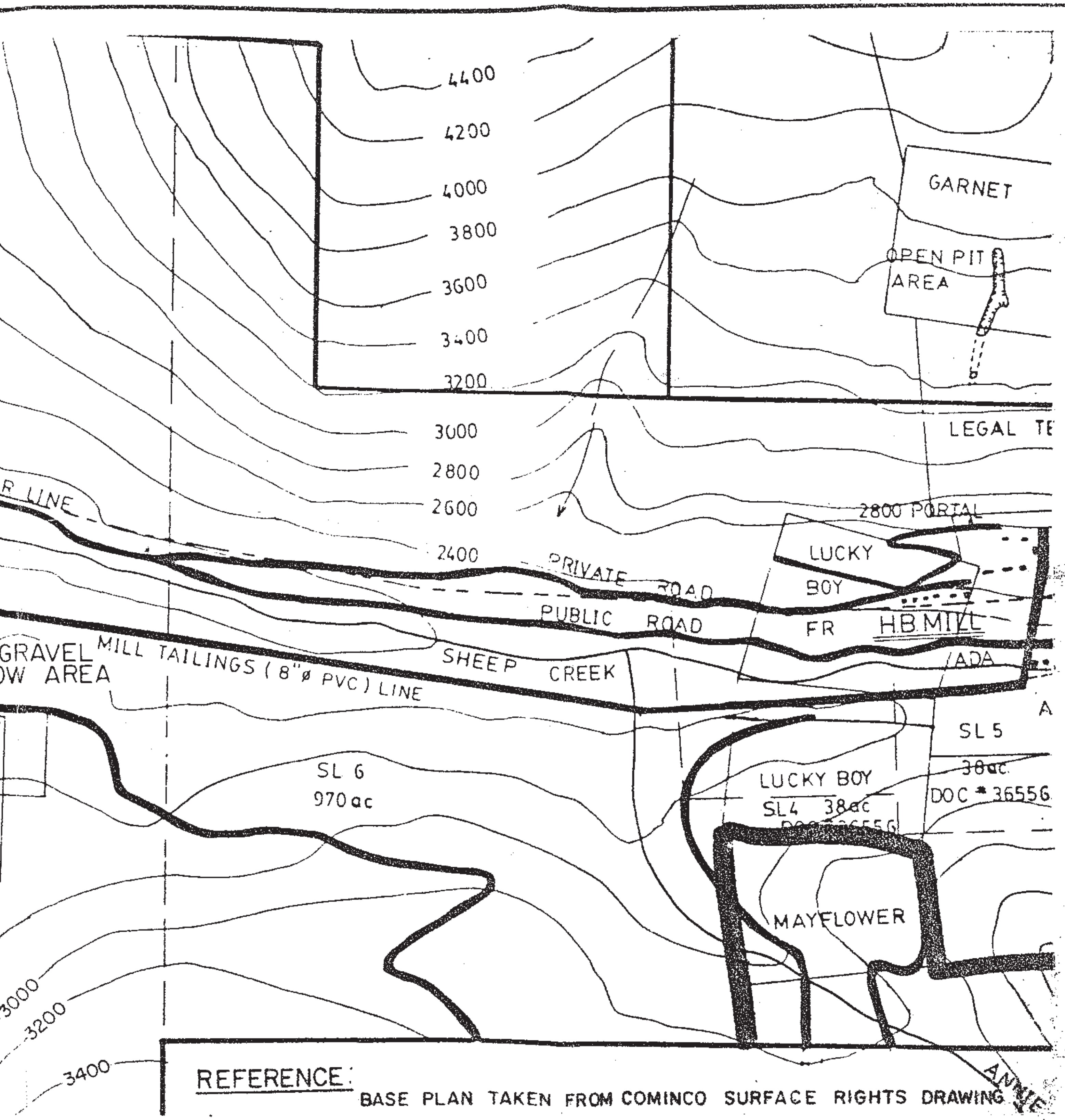
TITLE: SITE LOCATION

CLIENT: DAVID MINERALS LTD.

DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
NOV. 27, 1981	VA 2869	A-2869-1	

APPROVED

NCI-455-KL



REFERENCE: BASE PLAN TAKEN FROM COMINCO SURFACE RIGHTS DRAWING

TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981

SCALE 1" = 1000'

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

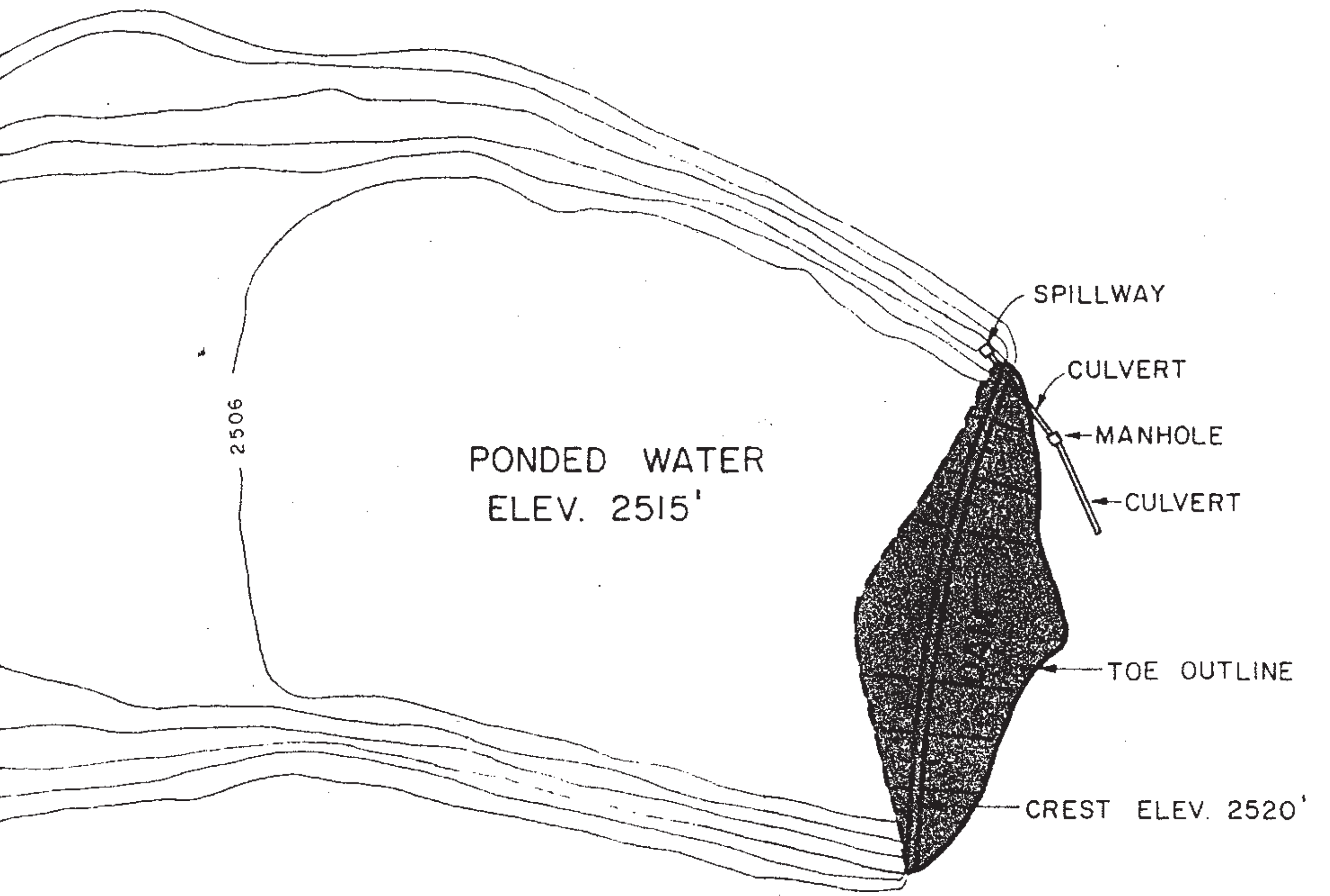
CLIENT: DAVID MINERALS LTD

PROJECT: HB MILL TAILING DISPOSAL

TITLE: LOCATION OF TAILINGS POND

DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
NOV. 27, 1981	VA 2869	B-2869-2	

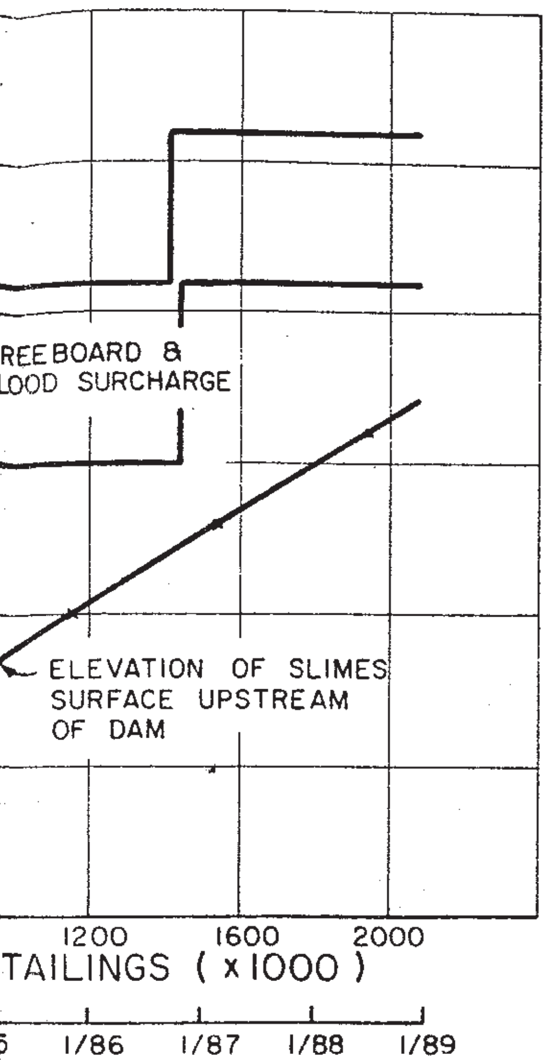
APPROVED [signature]



TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981

SCALE 1" = 300'

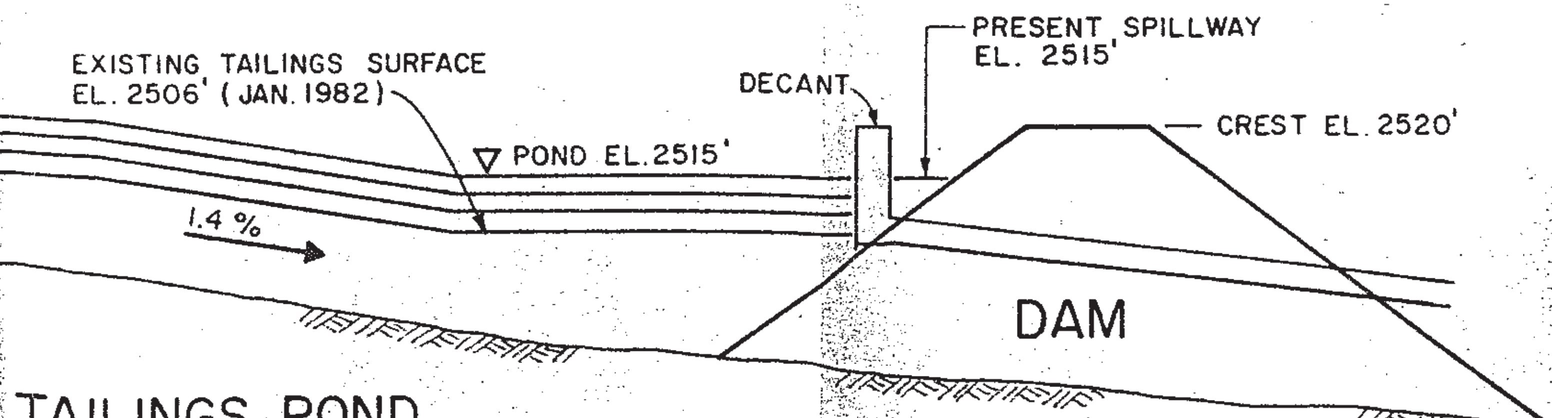
KLOHN LEONOFF LTD. CONSULTING ENGINEERS	PROJECT: HB MILL TAILINGS DISPOSAL
	TITLE: TAILINGS SURFACE CONTOURS
CLIENT: DAVID MINERALS LTD.	DATE OF ISSUE: NOV. 27, 1981 / APPROVED / PROJECT No.: VA 2869 / DWG. No.: B-2869-3 / REV.



AILINGS vs ELEVATION

NOTES

1. TAILINGS PRODUCTION RATE OF 300,000 TONS / YEAR.
2. SLOPE OF TAILINGS NEAR POND IS EXAGGERATED. PROFILE DRAWN FROM DATA GIVEN BY MR. NEWMAN OF COMINCO.



TAILINGS POND

TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981

SCALE N. T. S.

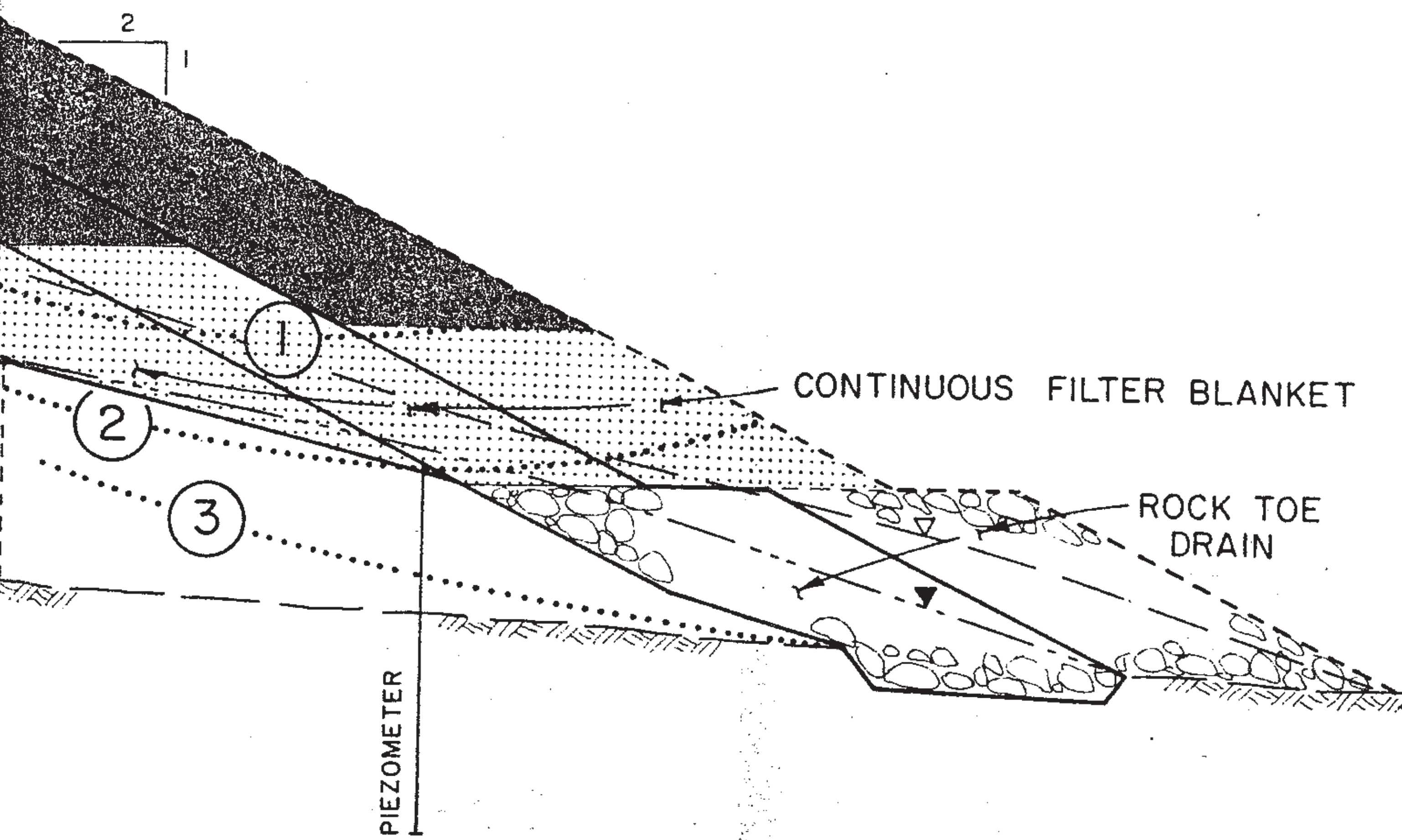
KLOHN LEONOFF LTD. CONSULTING ENGINEERS	PROJECT: HB MILL TAILINGS DISPOSAL			
	TITLE: SCHEMATIC PROFILE OF TAILINGS POND			
CLIENT: DAVID MINERALS LTD.	DATE OF ISSUE: NOV. 27, 1981; APPROVED:	PROJECT No.: VA 2869	DWG. No.: B-2869-5	REV.

ASSUMPTIONS AND RESULTS OF ANALYSIS

CIRCLE	DRY DENSITY γd (lbs/cu. ft.)	FRICTION ANGLE ϕ' (degrees)	FACTOR OF SAFETY
1	110	35	2.20
2	115	36.5	2.23
3	115	36.5	1.77
4	110	30	1.69
5	110	25	1.71

L

FILL



TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981

SCALE 1" = 20'

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT: HB MILL TAILINGS DISPOSAL

TITLE: STABILITY ANALYSIS

CLIENT: DAVID MINERALS LTD.

DATE OF ISSUE: NOV. 27, 1981

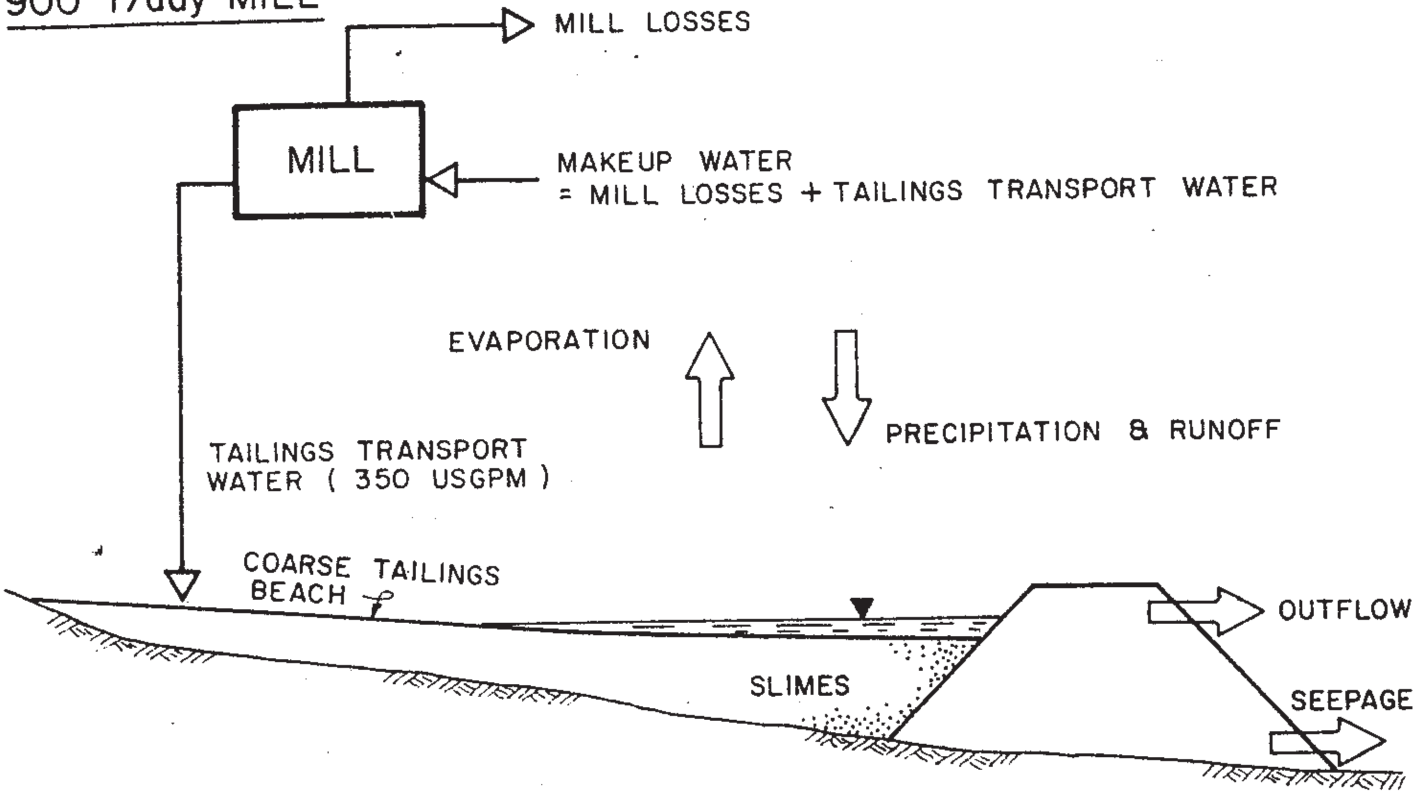
APPROVED:

PROJECT No. VA 2869

DWG. No. B-2869-6

REV.

900 T/day MILL



WATER BALANCE	
INPUT (USGPM)	OUTPUT (USGPM)
350 gpm (TAILINGS WATER) 335 gpm (PRECIP. & RUNOFF)	50 gpm (VOIDS WATER) 20 gpm (EVAPORATION) 20 gpm (SEEPAGE) 595 gpm (OUTFLOW)
685 gpm (TOTAL)	685 gpm (TOTAL)

SCALE NTS

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT: HB MILL TAILINGS DISPOSAL

TITLE: WATER BALANCE

CLIENT: DAVID MINERALS LTD.

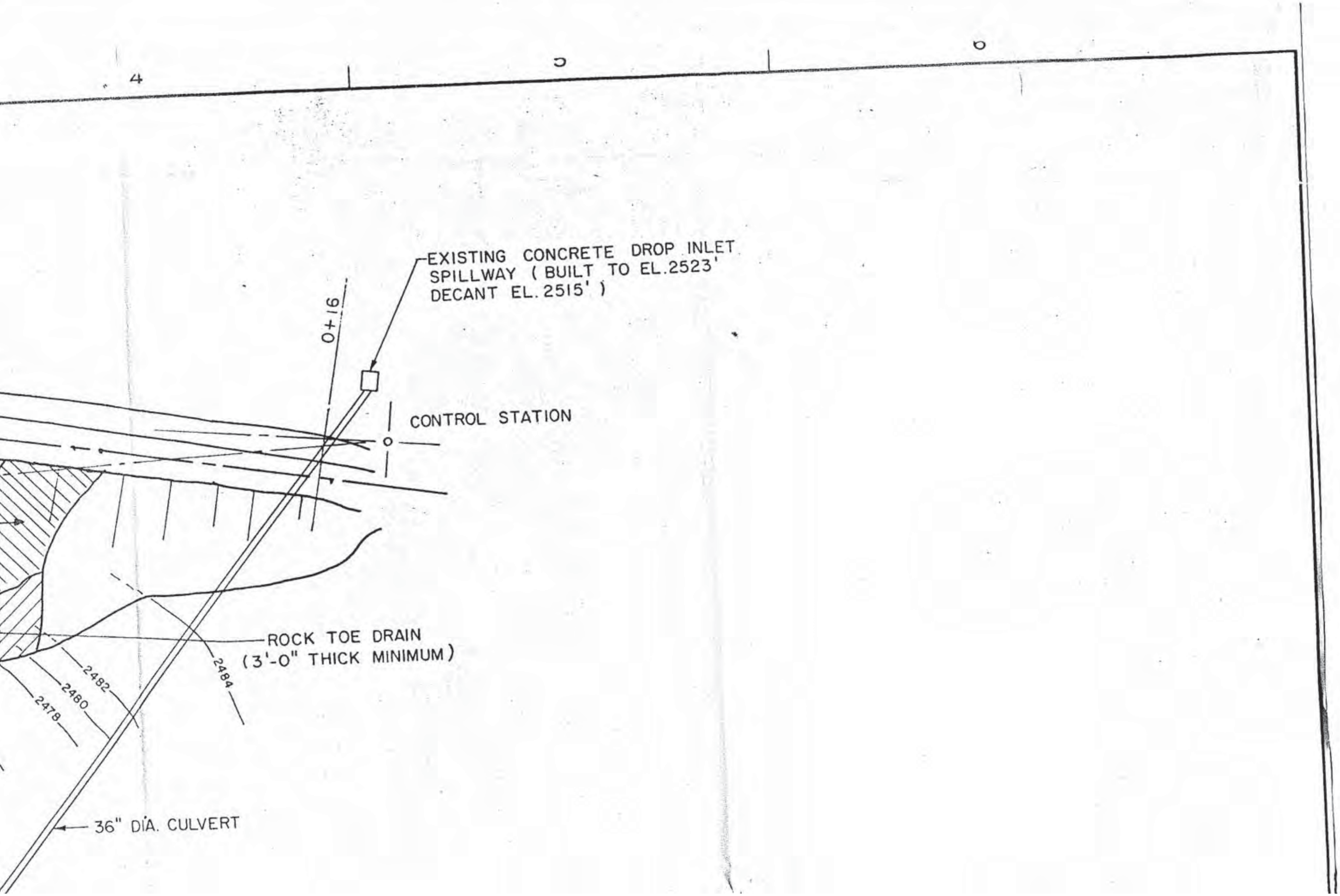
DATE OF ISSUE: NOV. 27, 1981

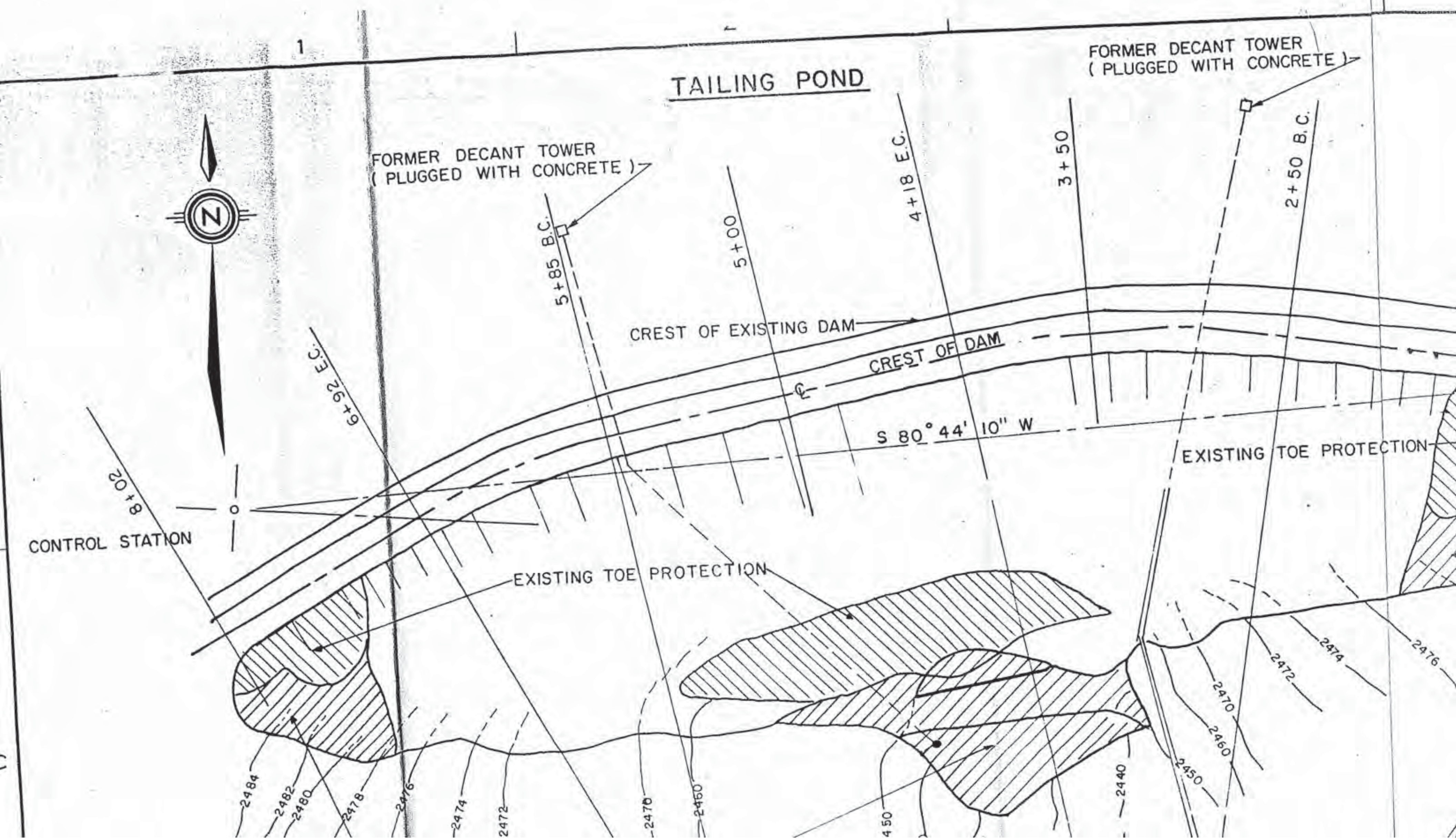
APPROVED:

PROJECT No.: VA 2869

DWG. No.: A-2869-7

REV.:


4
5
6
EXISTING CONCRETE DROP INLET SPILLWAY (BUILT TO EL.2523' DECANT EL. 2515')
0+16
CONTROL STATION
ROCK TOE DRAIN (3'-0" THICK MINIMUM)
2484
2482
2480
2478
36" DIA. CULVERT



TAILING POND
FORMER DECANT TOWER
(PLUGGED WITH CONCRETE)
FORMER DECANT TOWER
(PLUGGED WITH CONCRETE)
5+85 B.C.
5+00
4+18 E.C.
3+50
2+50 B.C.
6+92 E.C.
8+02
CREST OF EXISTING DAM
CREST OF DAM
S 80° 44' 10" W
EXISTING TOE PROTECTION
EXISTING TOE PROTECTION
CONTROL STATION
2484
2482
2480
2478
2476
2474
2472
2470
2450
2440
2460

REFERENCE

DRAWING SUPPLIED BY COMINCO ENGINEERING,
DWG. NO. HB 304 DATED FEBRUARY 7, 1977.

0'

ROCK TOE DRAIN

OVE ORGANIC OVERBURDEN

TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981

REV.	DATE	REVISION DETAILS

SCALE: AS SHOWN

DESIGN	DRAWN	DATE	SCALES
COMINCO	S.S.	OCT., 1981	AS SHOWN

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

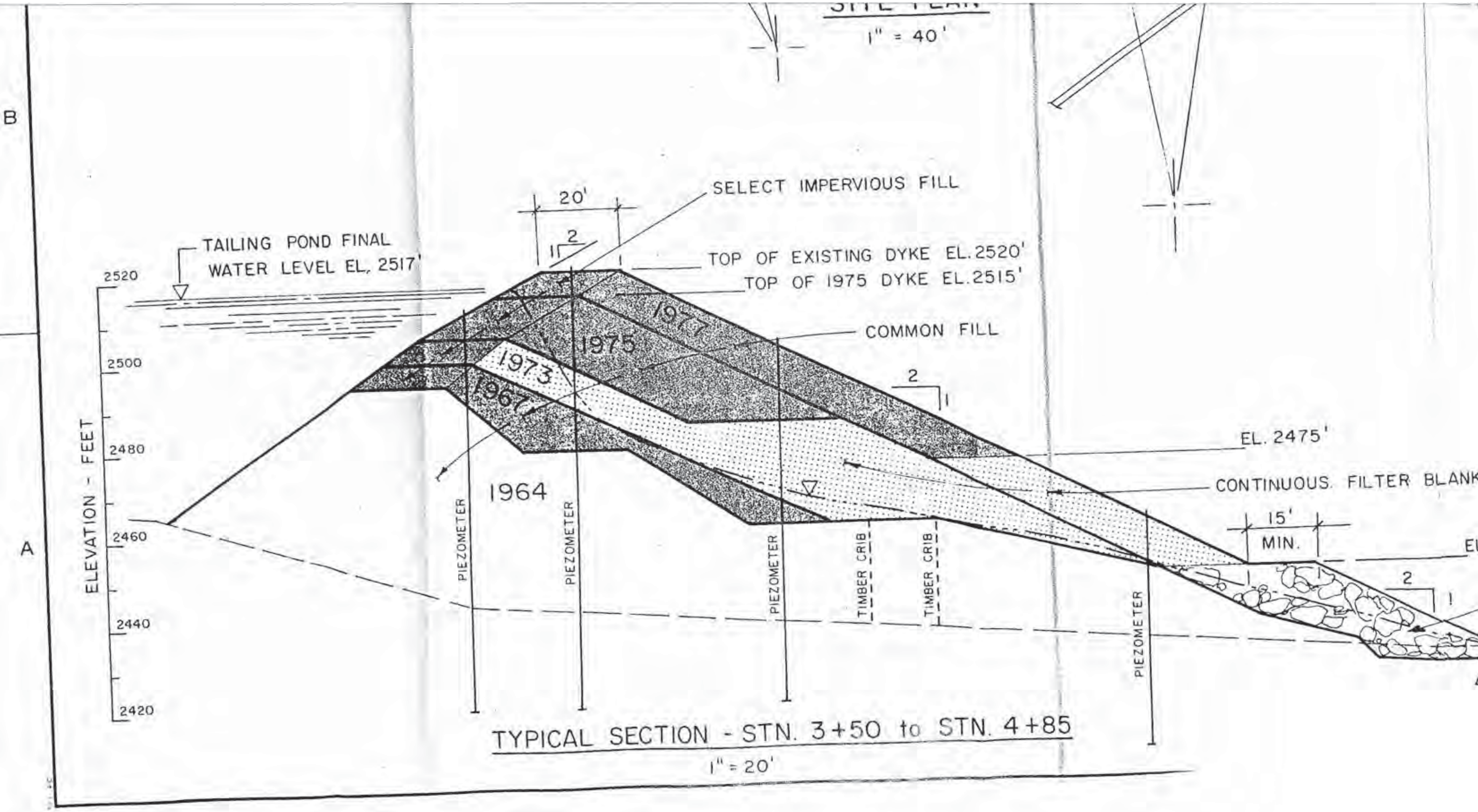
PROJECT: HB MILL TAILINGS DISPOSAL

TITLE: PLAN AND SECTION OF EXISTING DAM

CLIENT: DAVID MINERALS LTD.

DATE OF ISSUE	PROJECT No	DWG. No.	REV.
NOV. 27, 1981	VA 2869	D-2869-4	

APPROVED



TYPICAL SECTION - STN. 3+50 to STN. 4+85

1" = 20'

Pages 35 through 37 redacted for the following reasons:
- -
Not Responsive

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

REPORT OF INSPECTOR OF MINES

(Issued pursuant to section 4 of the Mines Act)

CRUSHING AND CONCENTRATING WORKS

Name of concentrator, etc. H. B. Concentrator
Locality Salmo/Sheep Creek Area

Owner or operator (David Minerals)
Manager (Receiver Manager) Thorne, Ernst & Whitney

Superintendent None at present Property idle
Address 2500 Board of Trade Tower 1177 West Hastings Street Vancouver, B. C. V6E 2L9

Number employed 1 (caretaker)

Method of concentration followed Not Operating

Reagents used

Persons Contacted

Company Representatives
Jeff Belza (Caretaker)

Worker Representatives

The caretaker reports that the property is inspected daily.

CONCENTRATOR AREA

This property is acquiring an unkempt, unattended appearance with the development of scrap strewn about, also barrels, one full of xanthate pellets. This barrel shall be moved inside the mill building out of the elements and behind a locked door.

Cyanide was not found on the property, the caretaker informing such was moved to the Ainsworth Mill prior to shut-down.

One of the reagents mixing tanks appeared to be approx. 1/3 full but could not be easily opened for an inspection. A report as to the contents of this tank is requested pursuant to the Mines Act Section 5 re possible dangerous conditions.

MINE ADIT AREA

The mine portal area is also becoming littered with various scrap. The mine portal is open for easy access. All mine entrances shall be checked and shall be securely fenced, or sealed, to prevent inadventent access as per Mines Act Section 14 requirements.

TAILINGS POND

Due to a low water level, the pond was not discharging via the overflow structure. Free board was estimated at 10 feet. The activity of a very small spring at the toe of the downstream slope at the junction of the rock fill continues to be present. The dam appears stable.

M. A. Mellor MAMellor
Inspector of Mines

310 Ward Street, Nelson, B. C. V1L 5S4
(Address)

Date of inspection October 23, 1986
cc

file HB. Min

[redacted] s.22

August 11, 1997

Hon. Corky Evans M.L.A.
402 Baker St.
#204
Nelson BC
V1L 4H8

Dear Corky Evans:

I would like to bring to your attention an issue concerning property [redacted] s.22 situated eight kilometres south of Salmo. [redacted] s.22 s.22 s.22 We have attached a map depicting the properties and relevant terrain details.

As shown on the map a drainage ditch passes through Blocks 3, 4, and Parcel "A" of Block 5. This ditch was constructed across the property in the early 1950's to accomodate flow from a tailings pond created behind an earth fill dam in the draw above the remainder of Block 5.

It has been brought to our attention that during the period of spring runoff when water flows through this ditch that the water has been contaminated by seepage from the RDCK (Regional District of Central Kootenay) landfill into the tailings pond. We understand that when the seepage is contained by the tailings pond that the tailings acts as a filter for the contaminated material. This is not the case during the runoff period and the discharge flows down across our property and into the Salmo river.

A further problem is the control and timing of the release of the runoff flow from the tailings pond. This spring the flow began while the ditch was still filled with snow. The water flowed down over top of the snow till it reached the plowed driveway leading to the house, barn, and outbuildings on the farm. The water travelled along the driveway entering the house, flooding the barn and outbuildings, stranding our cattle, ruining stored hay, and flooding farm machinery. This required us, at some expense, to rent a bulldozer and excavator to redirect the flow.

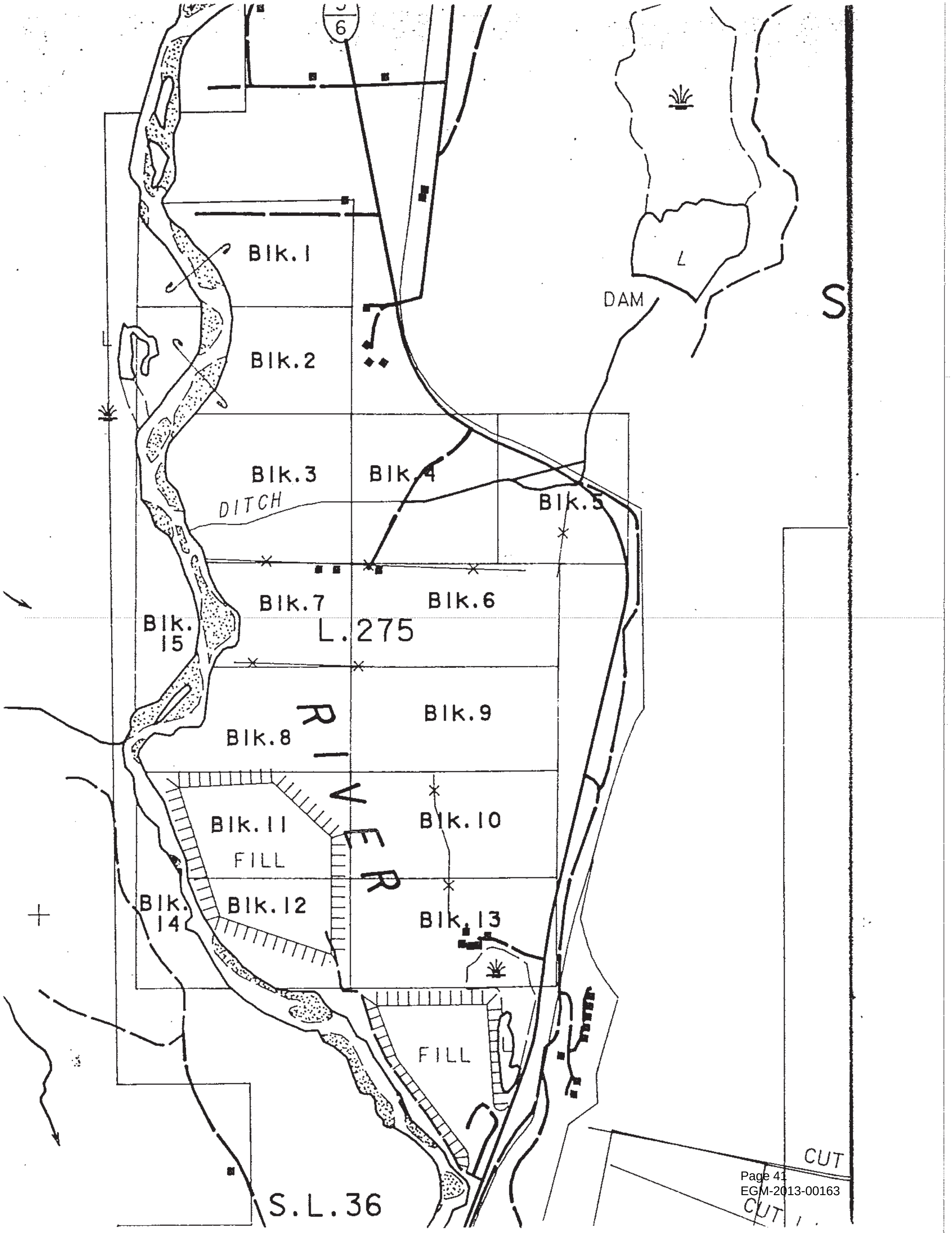
[redacted]

We have the health and safety of [redacted] to consider. [redacted] It is deeply upsetting to think the Salmo river where we fish and play is also affected by this problem. In giving some thought to our initial actions regarding this matter, we are requesting through yourself an investigation into the contamination of spring runoff flowing though our land from the RDCK landfill. Secondly, should the information provided us be proven accurate through this investigation, it would be prudent to deal with the containment, control, and routing of runoff in a timely manner to ensure the protection of [redacted] and the Salmo river from further contamination. In any case, considering the events of this spring in regards to the flooding that occured, the control and routing of this flow must be dealt with.

We look forward to working towards a solution to this problem with the various agencies involved.

[redacted]

cc: RDCK Waste Management
Environment and Lands,
Pollution Prevention Branch
Ministry of Mines


6
Blk.1
Blk.2
Blk.3
Blk.4
Blk.5
Blk.6
Blk.7
Blk.8
Blk.9
Blk.10
Blk.11
Blk.12
Blk.13
Blk.14
Blk.15
L
L
DAM
S
DITCH
L.275
RIVER
FILL
FILL
CUT
CUT
S.L.36

WHALE/CRANBROOK

BRITISH COLUMBIA

October 30, 1997
File: 18040-02-07/HB/01
x M-85

Mr. Walter Kuit
Manager, Environmental Affairs
Cominco Ltd.
200 Burrard Street
Vancouver, BC V6C 3L7

MINISTRY OF EMPLOYMENT & INVESTMENT
NOV 6 1997
FILE

Nu-Dawn Resources Inc.
102 Piper Crescent
Nanaimo, BC V9T 3G3

Dear Sir/Madam(s):

Re: HB Mine Tailings Impoundment, Salmo, B.C.

According to our records the HB Mine near Salmo, B.C. is permitted under Mines Act Permit M-85 to Cominco, while mineral title and fee simple land is owned by Nu-Dawn Resources. Geotechnical inspections of the tailings impoundment were performed by the Mines Branch in April 1993 and June 1997. Attached you will find copies of these inspection reports.

On July 22, 1977 the Acting Chief Inspector of Mines approved construction of a spillway at the dam by letter addressed to Mr. J.S. Newman, P.Eng., Civil Engineer for Cominco. The spillway was never installed.

In summary, site conditions at HB Mine tailings impoundment have deteriorated and pose public safety and environmental hazards. The main concerns are that the impoundment was never decommissioned with a permanent spillway on closure and the current decant structure is deteriorating; the intake channel and structure are filling with debris and the discharge flume and channel on the downstream face are in need of repair. The integrity of the dam itself appears to be satisfactory except that there should be more freeboard. Overtopping and breaching of the dam or regressive erosion at the decant outlet is considered a distinct possibility in the foreseeable future.

.../2

Ministry of Employment and Investment

Regional Operations,
Health and Safety Branch
Energy and Minerals Division

Mailing Address:
PO Box 9320 Stn Prov Govt
Victoria BC V8W 9N3
Telephone: (250) 952-0462
Facsimile: (250) 952-0481

Location:
5th Floor, 1810 Blanshard Street
Victoria

BRITISH COLUMBIA

Province of British Columbia
Ministry of Employment and Investment

ENERGY AND MINERALS DIVISION

REPORT OF GEOTECHNICAL INSPECTOR

(Issued pursuant to Section 15 of the Mines Act)

Name of Property:	HB Mine	File: 18040-02-07/HB/01
Location:	Salmo	
Mine Manager:	n/a	
Company: Address:	Cominco and Nu-Dawn as per cover letter	
Persons Contacted:	n/a	
Type of Mining:	Closed, u/g, base metal	
Date of Inspection:	June 10, 1997	

An inspection of the tailings impoundment was conducted in the company of Art O'Bryan. The previous geotechnical inspection was April 29, 1993. The following areas in particular were noted:

The upstream dam face (Photo 1) is in good condition with no evidence of effects from wave action. The dam crest and downstream slope (Photo 2) are also in good condition with no evidence of cracks, settlement, slumps or erosion. Vegetation cover (mainly grasses and legumes) is healthy and thick and an alder has started on the upstream face at waterline.

The downstream toe is wet in the same areas as observed in 1993 and the toe drains appear to be functioning satisfactorily. The grouted CMP (old decant outlet) near the central toe of the dam is dry and not showing any signs of leakage inside or outside of the pipe.

The operating decant or water control structure is structurally sound. However the inlet channel to the decant is completely full if cattails and the alders are much larger. Compare Photo 3 (April 29, 1993) and Photo 4 (June 10, 1997). The log at the entrance to the channel is still in place. However the concrete water level control beams have not been removed from inside the structure as ordered in my 1993 inspection, although I note that the wooden support posts for the upper beam appear to have been replaced with steel pipe. Note that the same number of concrete beams are resting on top of the control structure in both photos.

F.ᵥince of British Columbia
Ministry of Energy, Mines and Petroleum Resources 18040-02-07/HB/01

ok to file

Report of Inspector of Mines
(Issued pursuant to Section 15 of the Mines Act)

GEOTECHNICAL - EIM

Name of Mine: HB Mine

Locality: Salmo, B.C.

Owner or Operator: Nor-Quest Resources Ltd.

Address: 102 Piper Crescent Nanaimo, B.C. V9T 3G3

Manager: Mr. Raynerd Carson

Areas Inspected: Tailings Dam

Persons Contacted

Management: No one available.

The mine manager shall complete the right hand column noting specific corrective actions taken, or to be taken by a specified date, and return a copy to the Inspector within 15 days of receiving the report.

Inspection Report	Manager's Response of Action Taken
1. Crest good, no settlement.	
2. Upstream slope good, beach/ wave action/ erosion minimal.	
3. Downstream slope covered with grass and alder, wet zones at toe and several seeps, but no seeps were obvious on downstream slope face. Stability looks good; no sloughs, settlements, toe drains operating.	
4. Piezometer standpipe near toe at centre of dam is dry to a depth of approx. (plumbed with small stone) 45-50 feet. Check Fig. 1 from Golder Brawner 74 report (Feb. 12, 1979 Rep# E/74/124) assume it to be BH 2 which is drawn at about 50 foot depth on the section so assume piezo is dry.	

Copies To:

Tim Eaton, P. Eng.
Geotechnical Manager

Tim Eaton
Signature - Inspector

105-525 Superior St. Victoria, B.C., V8V 1X4
Address

Signature - Manager

Date of Inspection: April 29, 1993

Dated: ______________, 19____

PHOTO 1

PHOTO 2

PHOTO 3

PHOTO 4

PHOTO 5

PHOTO 6

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Parliament Buildings
Victoria
British Columbia
V8V 1X4

Rm. 105 - 525 Superior Street, Victoria, B.C. V8V 1X4

MINISTRY OF ENERGY, MINES
AND PETROLEUM RESOURCES
FERNIE, B.C.
NOV 05 1987
FILE
SUBJECT

October 16, 1987

File: 18040-02-07

Nor-Quest Resources Ltd.
Box 369
Salmo, B.C.
VOG 1ZO

Attention: Mr. Greg Carriere, Project Manager

Dear Sir:

Re: H.B. Mill Project

Attached is my inspection report for the geotechnical inspection of the tailings dam conducted September 28th. Please post a copy in the usual, conspicuous location. You should also forward a copy to your corporation headquarters.

As I had said during my inspection the white plastic sleeve of the piezometer could not be located; it will be useful when you submit your engineering report for approval of recomissioning. You will also need to sound the pond and present the results of the sounding survey along with the engineering report in order to recomission this pond. You would be wise to undertake the sounding survey and the restoration of the piezometer as soon as possible.

The placing of the coarse material on the upstream face can probably be delayed until next year, for I am not likely to conduct my next inspection until Autumn of 1988.

Yours truly,

R.T. Martin, P.Eng.,
Sr. Geotechnical Inspector

RTM:blh
Attachments:

cc: A.W. Whale, Fernie
R.A. Fyles, Victoria

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

REPORT OF INSPECTOR OF MINES

(Issued pursuant to section 4 of the *Mines Act*, 1980)

GEOTECHNICAL INSPECTION

Name of Mine .... H.B. MILL

District and Location .... District no.5, Nelson, near Salmo

Owner or Agent .... Nor-Quest Resources Limited

Designated Manager .... Greg Carriere

Date of Inspection .... September 28, 1987

Person(s) attending .... A. Whale, Inspector of Mines & Res. Eng.)
) E.M.P.R.
T. Martin, Sr. Geotechncial Inspector)

G. Carriere, Manager

Part inspected .... Tailings dam

Remarks:

Sunny, warm, calm.

The usual springs at the junction of the downstream face and both the west abutment and the rock toe berm still exist, but they were severely reduced by the prolonged dry conditions this year. The piezometer on the toe berm seems to have been snapped off. Relocate and restore it if possible.

Freeboard was adequate, but undercutting of the upstream face of the dam is becoming significant. Place coarse gravel and cobble-sized protection over the affected area before my next inspection.

G. Carriere reported

Although no overflow was occurring at the time, the overflow had obviously been functioning this year. However, one stoplog was jammed in the guides. Remove the jammed log to allow free overflow. Check overflow occasionally during periods of high runoff.

7/4 McDonald

H.B. Mine 85

Environment Canada | Environnement Canada

Environmental Protection | Protection de l'Environnement

4th Floor, Kapilano 100, Park Royal,
West Vancouver, B.C. V7T 1A2

April 20, 1978

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd APR 24 1978

Your file Votre référence

Our file Notre référence
4780-37/C685-2

Mr. R. Wyka,
Mine Manager,
Cominco Ltd.,
H.B. Mine,
Salmo, B.C. VOC 1Z0

Dear Mr. Wyka:

Re: Effluent Quality Survey, October, 1977

As you are aware, during the period from October 4-6, 1977, the Environmental Protection Service conducted a study to determine the quality of the Cominco H.B. mine tailings pond decant. Samples were collected for chemical and bioassay analyses. We have enclosed for your information and records a copy of the results obtained.

A review of the data indicated that the decanted effluent is in compliance with the effluent quality requirements of our "Metal Mining Liquid Effluent Guidelines" for all parameters except fish toxicity. Based on the available data we are unable to determine the component or components of the effluent contributing to the toxicity.

Under normal circumstances, we would be concerned about the discharge of toxic effluent to the Salmo River and would be endeavouring to have this problem resolved. However, noting that the effluent is only marginally toxic and that your mine will be shutting down in September 1978, we are willing to live with the existing situation until the specified closure date.

With respect to site reclamation following mine closure, we have made arrangements with the Ministry of Mines and Petroleum Resources to obtain from that agency a copy of your plans for reclamation when submitted. Following our review of the plans, we will be providing comments as required to that Ministry for incorporation in their agreement with your Company.

...2

04-1002 (06/75)

If you have any questions or comments with respect to the enclosed data, please feel free to contact Mr. J. Villamere or Mr. G. Trasolini (telephone number 666-6711) of my staff.

Yours truly,

ORIGINAL SIGNED BY
B. A. HESKIN
A SIGNÉ L'ORIGINAL

B. A. Heskin, P. Eng.,
Regional Director General, Pacific Region,
Environmental Protection Service,
Department of Fisheries and the Environment

Encl.

cc: Mr. W.N. Venables, P. Eng.,
Director, Pollution Control Branch,
Water Resources Administration,
Ministry of the Environment,
Parliament Buildings,
Victoria, B. C. V8V 4S5.

Mr. J. McDonald,
Senior Reclamation Inspector,
Ministry of Mines and Petroleum Resources,
1837 Fort Street,
Victoria, B.C. V8R 1J6

COMINCO H.B. MINE

TAILINGS POND DECANT

COMPOSITE SAMPLE RESULTS

October 4 - 6, 1977

A. CHEMICAL ANALYSES

PARAMETER		DAY 1	DAY 2	DAY 3
As (T)	mg/l	0.004	0.004	0.005
Cd (T)	mg/l	<0.01	<0.01	<0.01
Cd (D)	mg/l	<0.01	<0.01	<0.01
Cu (T)	mg/l	0.02	0.02	0.01
Cu (D)	mg/l	<0.01	<0.01	<0.01
Hg (T)	µg/l	<0.2	<0.2	<0.2
Ni (T)	mg/l	<0.05	<0.05	<0.05
Ni (D)	mg/l	<0.05	<0.05	<0.05
Pb (T)	mg/l	0.1	<0.1	0.1
Pb (D)	mg/l	0.03	0.04	0.04
Zn (T)	mg/l	0.09	0.08	0.08
Zn (D)	mg/l	0.05	0.07	0.07
N.F.R.	mg/l	<5	<5	<5
pH		7.5	7.6	7.5

B. TOXICITY DETERMINATION

	DAY 1	DAY 3
LC_{50} (96 hour)	56%	73%

COMINCO H.B. MINE

TAILINGS POND DECANT

GRAB SAMPLE RESULTS

October 5, 1977.

PARAMETER			
As	(T)	mg/l	0.004
Cd	(T)	mg/l	<0.01
Cd	(D)	mg/l	<0.01
Cu	(T)	mg/l	0.01
Cu	(D)	mg/l	<0.01
Hg	(T)	µg/l	<0.2
Ni	(T)	mg/l	<0.05
Ni	(D)	mg/l	<0.05
Pb	(T)	mg/l	0.1
Pb	(D)	mg/l	0.03
Zn	(T)	mg/l	0.09
Zn	(D)	mg/l	0.04
N.F.R.		mg/l	<5
pH			7.5

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Tel: 354-6125 Fax: 354-6120

Office address:
403 Vernon Street
Nelson, B.C. V1L 4E6
Telephone: (604) 354-6125
Mailing address:
310 Ward Street
Nelson, B.C. V1L 5S4

File: 18080-02-02 - H.B. MINE

May 27, 1994

Mr. R. Carson
Nu-Dawn Resources
102 Piper Crescent
Nanaimo, B.C.
V9T 3G3

Dear Mr. Carson:

Re: Inspection - May 25, 1994

Enclosed are two copies of my Inspection Report for the above-noted date.

Would you kindly fill in the second copy in the appropriate areas responding to the Inspector's comments, sign and date the first page and initial the subsequent page(s).

Please return the copy with your comments to me at the address shown on the report. Thank you for your cooperation in this matter.

Yours very truly,

D. Roach

D. Roach
Inspector of Mines

DR/sb

Encls.

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

Report of Inspector of Mines
(Issued pursuant to Section 15 of the Mines Act)

MINERAL EXPLORATION

Name of Mine: H.B. MINE

Locality: Salmo, B.C.

Owner or Operator: Nu-Dawn Resources

Address: 102 Piper Crescent
Nanaimo, B.C. V9T 3G3

Manager: R. Carson

Areas Inspected: Sheep Creek Transformers

Persons Contacted

Management: J. Wadsworth, Acting Mine Manager, Salmo Division

OHS Committee:

Workers:

A copy has been forwarded to the Joint Occupational Health and Safety Committee and/or the union. The mine manager shall complete the right hand column noting specific corrective actions taken, or to be taken by a specified date, and return a copy to the Inspector within 15 days of receiving the report. Further, he shall post a copy to the bulletin board.

Inspection Report	Manager's Response of Action Taken
The existence of four transformers, of probable 40 year vintage, perched across two poles near Sheep Creek was brough to EMPR's attention by E. Stockerl, MOE. Nu-Dawn Resources shall develop and implement on approval, a plan to safely remove, securely store, test and if required, suitably dispose of these four transformers. The plan shall be submitted to E. Stockerl, MOE with a copy to S. Wuschke, District Manager, LMPB, no later than June 13, 1994. This plan shall include the expected dates when this work is to take place.	

Copies To: MH&S Fernie, E. Stockerl, MOE, Jim Wadsworth

Signatures D. Roach

Dennis Roach
Inspector of Mines

Inspector

310 Ward St., Nelson, B.C. V1L 5S4
Address

Manager

Date of Inspection: May 25, 1994

Dated: ____________, 19____

WHALE/CRANBROOK

BRITISH COLUMBIA

October 30, 1997
File: 18040-02-07/HB/01
x M-85

Mr. Walter Kuit
Manager, Environmental Affairs
Cominco Ltd.
200 Burrard Street
Vancouver, BC V6C 3L7

MINISTRY OF EMPLOYMENT & INVESTMENT
NOV 6 1997
FILE

Nu-Dawn Resources Inc.
102 Piper Crescent
Nanaimo, BC V9T 3G3

Dear Sir/Madam(s):

Re: HB Mine Tailings Impoundment, Salmo, B.C.

According to our records the HB Mine near Salmo, B.C. is permitted under Mines Act Permit M-85 to Cominco, while mineral title and fee simple land is owned by Nu-Dawn Resources. Geotechnical inspections of the tailings impoundment were performed by the Mines Branch in April 1993 and June 1997. Attached you will find copies of these inspection reports.

On July 22, 1977 the Acting Chief Inspector of Mines approved construction of a spillway at the dam by letter addressed to Mr. J.S. Newman, P.Eng., Civil Engineer for Cominco. The spillway was never installed.

In summary, site conditions at HB Mine tailings impoundment have deteriorated and pose public safety and environmental hazards. The main concerns are that the impoundment was never decommissioned with a permanent spillway on closure and the current decant structure is deteriorating; the intake channel and structure are filling with debris and the discharge flume and channel on the downstream face are in need of repair. The integrity of the dam itself appears to be satisfactory except that there should be more freeboard. Overtopping and breaching of the dam or regressive erosion at the decant outlet is considered a distinct possibility in the foreseeable future.

.../2

Ministry of Employment and Investment

Regional Operations,
Health and Safety Branch
Energy and Minerals Division

Mailing Address:
PO Box 9320 Stn Prov Govt
Victoria BC V8W 9N3
Telephone: (250) 952-0462
Facsimile: (250) 952-0481

Location:
5th Floor, 1810 Blanshard Street
Victoria

While it is unusual to have different entities as Permittee and Owner, you both have obligations to make the tailings impoundment safe, remove the hazard(s) and decommission the tailings site so the Mines Branch can close its file on the tailings impoundment. I must add that there are other safety concerns at the mill building which our health and safety inspectors will review next year after another safety inspection. Ultimately, Mines Branch wants to close all its files on the site and you should proceed with this in mind.

If you have any questions please do not hesitate to call me at (250) 952-0485 in Victoria. I would appreciate a response from you on this matter before the end of January 1998, with a plan to take appropriate action in the summer of 1998.

Yours sincerely,

Tim Eaton

Tim Eaton, P.Eng.
Manager, Geotechnical Engineering

TE/tl

cc: Ricci Berdusco
Andrew Whale

Attachments

BRITISH COLUMBIA

Province of British Columbia
Ministry of Employment and Investment

ENERGY AND MINERALS DIVISION

REPORT OF GEOTECHNICAL INSPECTOR

(Issued pursuant to Section 15 of the Mines Act)

Name of Property: HB Mine File: 18040-02-07/HB/01

Location: Salmo

Mine Manager: n/a

Company: Cominco and Nu-Dawn
Address: as per cover letter

Persons Contacted: n/a

Type of Mining: Closed, u/g, base metal

Date of Inspection: June 10, 1997

An inspection of the tailings impoundment was conducted in the company of Art O'Bryan. The previous geotechnical inspection was April 29, 1993. The following areas in particular were noted:

The upstream dam face (Photo 1) is in good condition with no evidence of effects from wave action. The dam crest and downstream slope (Photo 2) are also in good condition with no evidence of cracks, settlement, slumps or erosion. Vegetation cover (mainly grasses and legumes) is healthy and thick and an alder has started on the upstream face at waterline.

The downstream toe is wet in the same areas as observed in 1993 and the toe drains appear to be functioning satisfactorily. The grouted CMP (old decant outlet) near the central toe of the dam is dry and not showing any signs of leakage inside or outside of the pipe.

The operating decant or water control structure is structurally sound. However the inlet channel to the decant is completely full if cattails and the alders are much larger. Compare Photo 3 (April 29, 1993) and Photo 4 (June 10, 1997). The log at the entrance to the channel is still in place. However the concrete water level control beams have not been removed from inside the structure as ordered in my 1993 inspection, although I note that the wooden support posts for the upper beam appear to have been replaced with steel pipe. Note that the same number of concrete beams are resting on top of the control structure in both photos.

A 900 mm CMP conducts water from the decant control structure to a drop structure (manhole) part way through the dam and another CMP from the drop structure to the downstream dam toe. The drop structure has had the steel cover secured so that we could not inspect inside and the steel plate has been removed from inside as ordered in my 1993 inspection.

The downstream outlet for the decant structure has had some minor improvements made to it, compare Photo 5 (April 29, 1993) and Photo 6 (June 10, 1997). The steel and fibreglass plume has been realigned and now carries the discharge water from the outlet CMP and discharges it into the drainage natural plunge pool, about seven metres away. However this outlet structure needs repair.

Discussion

The current arrangements at the dam require monitoring and maintenance to ensure satisfactory long term operation. The existing decant structure will eventually plug with debris with a potential dam breach the end result. The flume in the downstream outlet for the decant will topple out of place again in the near future. Discharge water will gradually erode and undermine the toe of the dam in this area.

As stated in my 1993 inspection report this tailings facility must be permanently decommissioned. An engineered spillway and outlet channel need to be designed and installed for the 1:200 year 24 hour flood or combination flood and freshet, whichever is determine to be the bigger event. Static stability must have a minimum factor of safety of 1.5 and seismic stability reviewed to satisfy the 1:475 year probabilistic event. In the event stability is inadequate the pond level should be further lowered by the new spillway to reduce risk and improve stability. If necessary the entire pond should be permanently drained from the impoundment by the spillway/outlet structure.

Tim Eaton

Tim Eaton, P.Eng.
Manager Geotechnical Engineering

Date: October 30, 1997

Pr...ince of British Columbia
Ministry of Energy, Mines and Petroleum Resources

18040-02-07/HB/01
ok to file

Report of Inspector of Mines

(Issued pursuant to Section 15 of the Mines Act)

GEOTECHNICAL - EIM

Name of Mine: HB Mine

Locality: Salmo, B.C.

Owner or Operator: Nor-Quest Resources Ltd.

Address: 102 Piper Crescent Nanaimo, B.C. V9T 3G3

Manager: Mr. Raynerd Carson

Areas Inspected: Tailings Dam

Persons Contacted

Management: No one available.

The mine manager shall complete the right hand column noting specific corrective actions taken, or to be taken by a specified date, and return a copy to the Inspector within 15 days of receiving the report.

Inspection Report	Manager's Response of Action Taken
1. Crest good, no settlement.	
2. Upstream slope good, beach/ wave action/ erosion minimal.	
3. Downstream slope covered with grass and alder, wet zones at toe and several seeps, but no seeps were obvious on downstream slope face. Stability looks good; no sloughs, settlements, toe drains operating.	
4. Piezometer standpipe near toe at centre of dam is dry to a depth of approx. (plumbed with small stone) 45-50 feet. Check Fig. 1 from Golder Brawner 74 report (Feb. 12, 1979 Rep# E/74/124) assume it to be BH 2 which is drawn at about 50 foot depth on the section so assume piezo is dry.	

Copies To:

Tim Eaton, P. Eng.
Geotechnical Manager

105-525 Superior St. Victoria, B.C., V8V 1X4
Address

Tim Eaton
Signature - Inspector

Signature - Manager

Date of Inspection: April 29, 1993

Dated: ____________, 19____

Inspection Report	Manager's Response of Action Taken
5. Decant structure at E end looks structurally sound, flow not impeded but bullrushes growing at inlet are being drawn into structure. Large log at entrance to outlet ditch is okay and prevents other debris from passing. Inside the decant well there are 2 concrete outlet water level control beams. One is raised approx. 18" and supported entirely by 2"x2"x4" on end which are rotting. This must be removed as soon as possible. The lower beam sits on the bottom and should be removed to create additional free board between dam crest to panel level.	
6. Drop structure looks sound but water has flowed out of the MH as evidenced by recent erosion and flattened grass around the MH . A 1/4" steel plate inside the MH must be removed as soon as possible. It is fastened by rusting bolts to the concrete and will block the outlet when it falls.	
7. The downstream decant outlet requires maintenance. A steel and fibreglass flume has partially collapsed and should be removed. There is some resulting erosion. The channel below the outlet should be armoured along a 15 m. stretch with rock larger than 300 m in diameter.	
8. Surface runoff shall be diverted from the crest of the dam, E end.	
9. <u>For abandonment</u>, this facility requires a geotechnical inspection (annual report) and assessment of long term stability and capacity to accommodate 1:200 year 24 hour flood through a spillway structure. Recommendations shall be made in this report by a registered B.C. geotechnical engineer. Flood precipitation data shall be reviewed at this time. Seismic stability shall be reviewed for the 1:475 year. event.	

Date of Inspection: ______________________ Initials: LC (signature) ______ Inspector ______ Manager

PHOTO 1

PHOTO 2

PHOTO 3

PHOTO 4

PHOTO 5

PHOTO 6

Nor-Quest Resources Ltd.
Kootenay Division: Box 369, Salmo, B.C., Canada, V0G 1Z0
Telephone (604) 357-2440

MINISTRY OF ENERGY, MINES
AND PETROLEUM RESOURCES
FERNIE, B.C.
APR 22 1988
FILE
SUBJECT

April 13, 1988

Andrew Whale P.Eng.,
Inspector of Mines and Resident Engineer
310 Ward St.,
Nelson, B.C.,
V1L 5S4

MINISTRY OF ENERGY, MINES & PETROLEUM RESOURCES
REC'D OCT 19 1988
NELSON, B.C.

MINISTRY OF ENERGY, MINES & PETROLEUM RESOURCES.
REC'D APR 20 1988
NELSON, B.C.

RE: Tailings Pond Registration

Dear Sir;

Please find enclosed a completed copy of your "Questionnaire for Register of Tailings Dams in B.C."

Our H.B. Concentrator has been dormant for the past several years and as such, there has been no appreciable changes to the H.B. Tailings Dam and impoundment areas. We are, however, planning to proceed with our renovations and bring the facility to production capability during the summer of 1988. The actual production date has not been set and will depend upon the timely revival of the existing production permits as well as securing a reliable source of feed. The ore may be obtained from our own outside properties and/or from custom milling clients and since the details of these sources have not yet been formally defined, the preliminary mill circuits and intended throughputs are now only speculative. This information will be provided to your office as it becomes available.

We have recently conducted a survey of the tailings pond in order to assess the current capacity and future possibilities of this facility. Calculations and stability analysis are being carried out by Klohn Leonoff Consulting Engineers of Vancouver and once the final report is completed, I will forward a copy to your office for distribution.

Should you have any questions, please contact me at our Sheep Creek office.

Sincerely
Nor-Quest Resources Ltd.

G. Carriere P.Eng.
Division Manager

QUESTIONNAIRE FOR REGISTER OF TAILINGS DAMS IN B.C.

1. Designation:

(a) Operation (Mine) H.B. Mill

(b) Name of major impoundment (other than (a)) as above

(c) Name of major dam, if any (no., location etc.) H.B. Tailings Dam

(d) Owner or Operator Nor-Quest Resources Ltd.

(e) Engineer(s) or design firm Cominco Eng., Golder & Assoc.

2. Vicinity of operation:

(a) Nearest town Salmo, B.C.

(b) Drainage where major dam located Salmo River

3. Type of emplacement ("X"):

(a) Fluid discharge X of tailings:

(i) into gulley or valley X
(ii) into sidehill containment ______
(iii) into containment ringed by dykes ______
(iv) into bowl or excavation ______

(b) Dry stacked tailings ______:

(i) along a gulley ______
(ii) along a ridge or terrace ______
(iii) on a sidehill ______
(iv) in a pile ______

4. Water management or control ("X"):

(a) Active emplacement ______
(Underline appropriate control methods: none, recirculation, decanting, spillways, runoff interception, stream diversion, infiltration, other.)

(b) Inactive emplacement X (on Standby)
(Underline applicable control methods: none, tower drain, spillway, diversion, reclaimed surface, other.)

5. Impounded area up to the emergency discharge or spilling level (hectare):

(a) present 20.68 ha, (b) ultimate 28.47 ha

6. Storage capacity, including pond up to spillway (millions of cu. metres)

(a) current 0.45 (avail), (b) planned 1.59 (avail)

7. Year that dam:

(a) started 1955, (b) finished or expected completion ?

8. Maximum height of dam above ground in metres:

(a) currently 24.1m, (b) approved 28.7m

9. Crest length of dam or dyke in kilometres:

(a) present 0.244 km, (b) eventual 0.26 km

10. Foundations of dam ("X"):

(a) Deposits: bedrock X till ____ lacustrine ____ fluvial ____

(b) Material type (rock, gravel, sand, silt, clay, peat) sandy-silt/gravel

(c) Characteristics (strong, weak, pervious, etc.) strong

11. Method of dam construction ("X"):

(a) Upstream ____:

i) mechanical raising ____
ii) hydraulic lifts ____

(b) Centreline or conventional ____:

(i) zoned fill ____
(ii) random ____

(c) Downstream ____: X

(i) horizontal lifts ____
(ii) inclined segments X

(d) Combined ____

12. Other pertinent details (abandoned, damaged, eroded, reworked, etc.):

tailings impoundment is being maintained on a standby basis until a suitable ore source has been located

DATE April 11, 1988 SIGNATURE

BRITISH COLUMBIA

Ph: (250) 952-0475

June 17, 1997

File: M-85
14675-35-04

Mr. B. Baldigara
Secretary, Assistant Administrator
Regional District of Central Kootenay
601 Vernon Street
Nelson, B.C.
V1L 4E9

Dear Mr. Baldigara:

Re: H.B. Mine Tailings Impoundment

I have been asked to reply to your May 15, 1997 letter to Andrew Whale, Regional Manager, Ministry of Employment and Investment, regarding possible future liabilities associated with the H.B. tailings impoundment.

Status of Permits Covering the Tailings Impoundment

The mine is regulated under the Mines Act.

The mine, including the tailings impoundment, is covered by Permit M-85 issued to Cominco Ltd. (copy attached). However, they sold this property to David Minerals who subsequently went bankrupt, and the last record we have of an owner is Nu-Dawn Resources.

Over the years, in spite of numerous attempts to get the new owner to assume the responsibilities of the permit, Cominco still remains the permittee.

Cominco carried out considerable research in the early 1970's to determine the feasibility of establishing vegetation directly on the tailings material, and to determine the metal uptake in plants. That information is stored off-site and I do not have that information immediately available. I don't recall any major issues, however.

I could not find a closure plan and I don't believe that one was ever filed.

...2

Dam Safety

I have included Part 9 of our Health, Safety and Reclamation Code for Mines in British Columbia (Code). The owner and permittee have not satisified the requirements of part 9.2.4, 9.3.2 and 9.3.5 The obligations in this regard should be discussed with Tim Eaton, P.Eng., Manager, Geotechnical Engineering. At present there are no significiant dam safety issues, however some work is required.

Should the Regional District purchase this property, the tailings impoundment would still be regarded as part of a mine, albeit a closed mine, and regulated under the Mines Act. As such, there would still be requirements for maintenance, periodic inspections and monitoring. These requirements would likely not be onerous, however.

Contamination Level of the Liquid and Solid in the Tailings

This a potential concern especially in relation to the new Contaminated Sites Provisions of the Waste Management Act. Our own internal review several years ago made a preliminary assessment of acid rock drainage potential of these tailings and it was felt that the abundance of limestone which hosted this ore deposit was likely sufficient to prevent sulphide oxidation, and acid mine drainage from occurring. This needs to be confirmed through samples of tailings and seepage from the impoundment. If there is any metal release, it will be associated with neutral to alkaline drainage.

If you have any further questions or concerns, please do not hesitate to call either myself (250) 952-0470 or Tim Eaton (250) 952-0485.

Yours very truly,

Carol Howell

for John C. Errington, Ph.D., P.Ag.
Manager, Reclamation and Permitting

JCE:ch
Encl.

cc: Andrew Whale, Cranbrook
Tim Eaton
Fred Hermann

let-hb

I N T E R O F F I C E   M E M O R A N D U M

Created: 06-Aug-1997 01:51pm PDT
Sent: 06-Aug-1997 02:13pm PDT
From: Steve Wuschke of EI
SWUSCHKE
Title.
Dept: Employment & Investment
Tel No: 426-1655

TO: Tim Eaton of EI (TEATON)

Subject: HB Tailings Dam - Discharge

Greetings

A land owner [redacted] s.22 just called. Apparently the drainage from the decants / overflows goes into a ditch constructed in about 1950, to carrry away excess water. There were no easements or records that the land owner knows about for the ditch.

The land owner said that the dich overflowed and caused property damage and [redacted] s.22

The land owner [redacted] s.22 would like the ditch to be removed and the drainage to be rerouted to a natural drainage route. Apparently the natural drainage was not able to handle the volumes of water when the mill was in operation.

I have not been to the site and don't know the hydraulic works associated with the dam structure. So perhaps you could provide me with some advise on this matter.

Land owner is: [redacted] s.22 s.22

I suggested to the land owner that he should contact the Tailings pond owner which is NuDawn(?) and Cominco who may still have the permit. I don't know who is responsible for the tailings.

Thanks: Steve W.

MEMORANDUM

TO The Hon. L. Nimsick,
Minister,
Dept. of Mines & Petroleum Res.

FROM THE

DEPARTMENT OF MINES
AND PETROLEUM RESOURCES

VICTORIA, B.C., March 5, 1973

WHEN REPLYING PLEASE REFER
TO FILE No.

Re: Section 11, Mines Regulation Act.
Cominco Ltd., H.B. Mine, Salmo, B.C.

The Advisory Committee on Reclamation, consisting of three representatives of the Department of Lands, Forests, and Water Resources, one from the Department of Recreation and Conservation, (the representative of the Department of Agriculture was unable to attend but submitted a covering memorandum), the Inspector of Mines - Reclamation, and with myself as Chairman, has studied the report submitted by Cominco Ltd., H.B. Mine, as appended hereto. The Committee has approved the report, with the additions and amendments as listed below.

A notice of the filing of the Cominco Ltd. H.B. Mine reclamation report as required by subsection 4 of Section 11 of the Act was published, for one insertion only, in the B.C. Gazette on Thursday, February 8, 1973, and in the Nelson Daily News and the Trail Times on Thursday, February 8, 1973.

The report is submitted for your approval, under subsection 5 of Section 11 of the Act, with the following additions and amendments:

1. That topsoil and overburden soil stripped from the surface shall be conserved, as feasible, for possible useage in the reclamation of disturbed areas.

2. That investigations and research be carried out covering:
(a) the location, stability, and erosion control of waste dumps, tailing ponds, and stockpiles;
(b) the protection of watercourses, as applicable;
(c) the reclamation of disturbed areas;
all to the satisfaction of the Chief Inspector of Mines.

3. That upon completion of the programme in (2) above, a plan and report describing in detail the reclamation and protection of the disturbed areas be submitted to the Chief Inspector of Mines for approval.

4. That the permit be valid for a period of five (5) years, or until approval of the report in (3) above, whichever is the sooner: the permit to be renewable upon application and upon evidence of satisfactory performance.

5. The total acreage to be disturbed during the planned life of the operation is 76.4 acres. Cost of reclamation is estimated at $100 per acre. A bond in the amount of $10,000 is recommended.

Approved Leo Nimsick

J.W. Peck, P.Eng.,
Chief Inspector of Mines.

JWP:sl
encl.

COMINCO LTD.

H.B. MINE - SALMO, B.C.

Application for Permit Authorizing Surface Work

I. INTRODUCTION

The H.B. Mine and concentrator is situated about seven miles south-east of the village of Salmo, B.C. on the North side of the Sheep Creek valley.

The property which was originally staked by Horton and Benson (hence H.B.) about 1907 was purchased by Cominco Ltd. in 1927. Intermittent work was carried out until 1946. Later, an extensive diamond drilling program was undertaken followed by underground exploration.

With sufficient ore outlined, construction of a 1000 ton/day concentrator was started in April of 1952 and completed in the spring of 1953. Due to unfavourable metal prices, operation did not commence until May, 1955 and was suspended in 1966. The mine is scheduled to resume production in early 1973.

The current head office address of Cominco Ltd. is 1199 West Pender Street, Vancouver 1, B.C.

II. PRODUCTION PROGRAM

General

It is planned to treat up to 1200 tons of ore per day from an underground source, thereby producing separate lead and zinc concentrates which will be shipped to Cominco-owned smelters in Trail.

With current ore reserves it is expected that the mine will operate for 3 1/2 years.

Nature of Mining and Milling Operations

(a) Geology

The main mineralization at the H.B. Mine consists of several zinc-lead sulphide ore bodies localized in the Reeves limestone member of the lower Hiab group of lower Cambrian age. The Reeves limestone has been thickened by folding to several times its original thickness. It has increased from an original thickness of 40' - 70' to a maximum of 700'. This bulge in the limestone member plunges 20° south and the ore bodies maintain their relative position in the lime band with a similar plunge. The main ore body, the No. 1 zone, is steeply dipping and varies from a depth of 400' in the northern section near 3500 level to about 10' at its southern tip where it reaches to within 200 ft. of the surface. Several other ore zones lie just to the west and below the crest of the No. 1 ore zone. The Garnet zone ore body, however, lies approximately 600' to the west of the main ore body and extends to the surface.

The chief economic constituents of the ore body are lead and zinc occurring as marmatite and galena in a gangue of talc, tremolite, limestone and dolomite. There are also considerable iron sulphides in the form of pyrite and pyrrhotite.

(b) Mining

The ore bodies will be mined from underground by both longhole and open stoping methods with a minimum of pillars remaining. No disturbance of the surface area is expected except for the Garnet Zone which will be extracted through to the surface. The final dimensions of the breakthrough will be about 1000' long by 70' wide by a maximum of 200' deep.

Access to the mine is through two main openings. The portal of the main entrance, the 2800 level haulageway, is situated about 300' above Sheep Creek and provides access from the main surface buildings. Most of the personnel and supplies are carried underground on this level and all the ore and waste is trammed out.

The 3500 level portal is located about 200' above Aspen Creek and provides access to the upper reaches of the No. 1 zone and to the hoist-room for the service shaft. Some material and a few personnel enter the mine through this opening. A third access of lesser importance, the 3300 portal, is located about the 2800 level portal and on the same slope.

Underground, the only ore tramming that is done is on the 2800 level. This is done by a Ruston-Hornsby diesel locomotive pulling eleven 6-ton cars from various areas and dumping at the coarse ore bin located on surface about 340' east of the portal. All other ore and waste movement underground is effected by 20 to 60 H.P. air or electric slushers and by gravity through a system of ore passes down to the 2800 level.

The waste produced underground is generally a limestone or dolomite with sizes ranging from 1/2 inch to 24 inches. A portion of this waste is disposed of underground into accessible mined out stopes and the remainder is removed to surface via the 2800 level portal. On surface, a waste dump has been established east of the coarse ore bin, along the hillside and extending about 500 feet along the hill and 150 feet down the slope. The resulting talus slope rests at an angle of repose of about 40° and is about 200 ft. across, from the toe to the side of the hill.

There is also an established waste dump below the 3500 level portal that may be used in future to dispose of waste from planned development of an ore body north of the service shaft and extending above the 3500 level. The expected annual waste production is about 6000 tons.

(c) Milling

Milling of the H.B. ore is straightforward with production of separate lead and zinc concentrates. Open-circuit primary and secondary crushing is followed by open-circuit rod milling and closed circuit ball milling. The talc and tremolite which are readily floatable are floated out first to avoid contamination of the lead concentrate. This is followed by lead rougher flotation and zinc rougher flotation. The final concentrates, about 100 tons/day, are thickened, filtered and then shipped to the smelters. The talc concentrate joins the zinc rougher tails and goes to waste.

The mill waste, about 1100 tons per day of solids, flows by gravity to a surge box, some 30 feet below the mill level, from where it crosses the Sheep Creek Valley through a "U-tube". The tailings drop 180 feet down the north arm of the "U-tube" to the creek level and go up the south arm some 120 feet where it discharges to a wooden flume. The "U-tube" is of 7" wood stave pipe and approximately 750 feet in length.

The wooden flume, of which 100% has been rebuilt, carries the tailings some 2 1/2 miles to the west to a settling pond. The tailings pond is a small depression about 1/2 mile wide by 3/4 mile long, ringed on three sides by steeply dipping hillsides and an earth fill dam on the fourth. Clear overflow is handled by a 30 inch culvert pipe through the dam with a vertical intake of 3 x 12 timber cribbing. The cribbing as well as the earth fill dam is raised as required. The clear decant water is discharged from the culvert into a ditch and flows by gravity to the Salmon River. It is estimated that the tailings area will increase in area from about 60 acres to 69 acres in the 3 1/2 years of project operation.

(d) Disturbed Land Area

Land area disturbed by mining and milling activity is summarized.

2800 level waste dump	2.2 acres
3500 level waste dump	0.2 acres
Tailings disposal pond	60.0 acres
Buildings and Service area	10.0 acres
Roads	4.0 acres
	76.4

III. NATURE AND PRESENT USE OF LAND

The Sheep Creek valley is bounded on the north and south by steep mountain slopes. Relief in the area of the mine extends from 2500 to over 5500 feet. Elevation of the tailings pond is 2200 feet.

The valley is situated in the Western larch subzone of the Interior Western Hemlock biogeoclimatic zone which is characterized by total annual precipitation in the range 22-35"[1]. Zonal soils include orthic ferro-humic podzol developed on shallow glacial deposits over bedrock.

Land on the south facing mountain slope surrounding the mine complex includes areas of productive and non-productive woodland[2]. Immature stands of trembling aspen, lodgepole pine and Douglas fir occupy medium quality productive sites[3]. Fire destroyed forest cover over part of the area in 1905 and in 1925. The tailings pond occupies a depression bounded on the west by unproductive land (rock) and by productive woodland in other directions[2]. Productive woodland has a cover of immature western larch with minor Douglas fir, lodgepole pine and white pine on medium quality sites[3]. Fire destroyed forest cover on part of the area in 1925.

Land surrounding the mine and tailings pond has been classified with respect to physical capability for use by agriculture, forestry, recreation, big game and waterfowl[2]. Classification was based on data from surveys conducted under the Canada Land Inventory program. Physical capability of land at the H.B. Mine for each use group listed is summarized.

1. Agriculture

(a) Mine: land has severe limitations for agricultural use due to adverse topography, shallowness to bedrock and climate. 80% of land possesses no capability for arable culture or permanent pasture. 20% is capable only of producing perennial forage crops. Improvement practices are not feasible.

(b) Tailings pond: land has severe limitations for agricultural use due to adverse topography, stoniness and climate. 40% of land possesses no capability for arable culture or permanent pasture. 60% is capable only of producing perennial forage crops. Improvement practices are considered feasible.

2. Forestry

(a) Mine: land has moderate to severe limitations to growth of commercial forest. Growth limiting factors include restriction of rooting zone by bedrock and soil moisture deficiency. A small area has severe limitations which preclude growth of commercial forests.

(b) Tailings pond: land has slight (60%) to moderate (40%) limitations to growth of commercial forest. Growth may be limited by restriction of rooting zone by bedrock and soil moisture deficiency.

3. Recreation

(a) Mine and tailings pond: land lacks natural capability and significant features to rate higher than low capability for outdoor recreation, but has natural capability to engender and sustain low annual use based on dispersed activities such as hiking, nature study or for aesthetic appreciation. Land possesses continuous streams in upland areas and vegetation possessing recreational value.

4. Ungulates

(a) Mine and tailings pond: land classed as winter range of moderately high capability for deer and moose. Productivity may be reduced in some years due to excessive snow depth that reduces mobility of ungulates and availability of food plants.

5. Waterfowl

(a) Mine and tailings pond: capability for production of waterfowl is negligible or nonexistent due to adverse topography.

IV. RECLAMATION PROGRAM

Land disturbance at the H.B. Mine will be kept to a minimum by utilizing existing waste rock and tailings disposal areas. Upon completion of mining operations, disturbed areas will be reclaimed to an appearance and use compatible with surrounding areas.

Currently in British Columbia mined land reclamation practices are not well established nor are conditions limiting plant growth on mine and mill waste well defined. To provide basic information for preparation of a reclamation program for the H.B. Mine, a research program is proposed. The general research approach is summarized:

1. characterize the nature of mine and mill waste by field inspection, sampling and analysis of chemical and physical properties which influence growth,

2. evaluate the suitability of mine and mill waste as a growth medium for plants using laboratory and growth chamber techniques,

3. when areas of mine and mill waste become final, initiate field investigations to determine physical treatments, plant species, planting techniques, fertilizer requirements and soil amendments necessary to establish and maintain suitable plant cover on waste disposal areas.

V. REFERENCES

(1) Krajina, V.J., 1969, Ecology of Forest Trees in British Columbia In Ecology of Western North America, Vol. 2, No. 1. Published by the Department of Botany, University of British Columbia.

(2) Canada Land Inventory, Land capability analysis sector maps of Salmo area for agriculture, forestry, recreaction, ungulates, waterfowl and present land use. B.C. Map Librarian, B.C. Dept. of Agriculture, Victoria.

and Canada Land Inventory: Objectives, Scope and Organization: Report No. 1, 1970. Dept. of Regional Economic Expansion, Queen's Printer, Ottawa.

(3) Forest Cover Map: Salmo PSYU, 1962. Surveys Division, B.C. Forest Service, Victoria, B.C.

RTG:car
January 5, 1973

Pages 80 through 287 redacted for the following reasons:
- -
Not Responsive

Cominco Ltd./H. B. Mine, Salmo, British Columbia, Canada, V0G 1Z0/Tel. (604) 357-2276

Mines

Mr. J. D. McDonald
Senior Reclamation Inspector
Department of Mines and Petroleum Resources
1835 Fort St.
Victoria, B.C. V84 IJ6

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd JAN 29 1976

January 27, 1976

Dear Mr. McDonald:

Enclosed is our Progress Report on Land Reclamation at our H.B. Operations.

Yours sincerely,

for.
H. G. Barker
Superintendent

HGB:mfl

Enclosure

Mined-Land Reclamation at Cominco Ltd.

H.B. Operations

Salmo, B.C.

Progress Report 1975

R.T. Gardiner, P.Ag.
Reclamation Agronomist

J.E. Stathers
Assistant Reclamation Agronomist

Cominco Ltd.
Trail, B.C.

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Mined-Land Reclamation at Cominco Ltd.

H.B. Operations

Progress Report 1975

1. Introduction

The general approach to reclamation of disturbed land surfaces at H.B. Operations is to improve growth conditions on waste disposal and other disturbed land areas and to encourage succession of native vegetation. Establishment and maintenance of an initial vegetative cover of grass and legume species will accelerate soil formation, control erosion, provide forage for wildlife, and improve the aesthetic appearance of disturbed land surfaces.

2. Mining Program

Land areas disturbed at H.B. Operations were described in "Application for Permit Authorizing Surface Work - Cominco Ltd., H.B. Operations, January, 1973", and the "Mined-Land Reclamation Research Report 1974"(1,2). Mining operations in 1975 conformed to the plans outlined in the original permit application. During 1975 construction of access roads to surface diamond drilling sites disturbed 0.7 acres. Land disturbed in construction of the lift to the tailings dam was inspected by Mr. Art O'Brien, Reclamation Inspector, on October 7, 1975. Improvement of drainage along the access road has been completed as suggested. Revegetation of the borrow pit will be carried out when more definite information related to future construction of the tailings dam and further disturbance to the borrow pit area is available.

The nature and extent of land surfaces disturbed to the end of 1975 are summarized in Table 1.

3. Reclamation Research

3.1 Suitability of H.B. Tailings as a Liming Material

The feasibility of using calcareous H.B. tailings as a liming material for neutralization of acidic mill waste at Sullivan Operations has been investigated since 1973(3). Mixing H.B. tailings at 25% by weight with oxidized iron and siliceous tailings reduced salt concentrations and maintained the pH within a range tolerated by most plant species for a period of 20 weeks in growth chamber studies.

The cost of commercial liming materials varies with purity (content of magnesium and heavy metals), degree of fineness or particle size, and calcium carbonate equivalence or neutralizing capacity. In 1975 a study was carried out to determine the suitability of calcareous tailings from three Cominco Ltd. operations as liming materials (unpublished report by Stathers and Gardiner, 1975). H.B. tailings has a particle size and calcium carbonate equivalence (the major factors affecting rate of neutralization in an acid medium) comparable to agricultural grade dolomitic limestone. The total lead and zinc content of H.B. tailings is high relative to agricultural grade dolomitic limestone (Table 2).

3.2 Climatic Conditions During 1975

A summary of weather data recorded during 1975 at the B.C. Forest Service weather station located approximately 10 miles north-west of the H.B. mine is presented (Table 3). Precipitation during the 1975 growing season (May through September) was 283.2 mm. The period May through September 1975, had a mean monthly temperature of 13.9°C. The frost free period was 101 days, occurring between June 9 and September 18.

4. Operational Reclamation

In April 1974, approximately 2 hectares of road cut embankments were hydroseeded in an attempt to reduce surface creep and erosion(2). Maintenance fertilizer the equivalent of 66 Kgm/ha was applied to hydroseeded areas on April 29, 1975. Subjective evaluation of vegetative growth in September, 1975 indicated that where adequate plant populations had established plant growth was vigorous. Limitations to plant growth appeared to be caused by instability of steeply sloping embankments and soil moisture deficiency, rather than nutrient deficiency. On steeply sloping road cuts constructed through coarse-textured material vegetative cover was sparse. On gradually sloping embankments composed of finer-textured material, and seepage sites, vegetative cover was satisfactory.

5. Proposed Research and Operational Reclamation Programs for 1976

Reclamation research investigations planned for H.B. Operations during 1976 will include:

a) establishment of field experiments on shallow tailings deposited adjacent the tailings pipeline

b) continuation of growth chamber studies to determine cultural techniques and plant species for revegetation of tailings and tailings slimes.

6. References

(1) Barker, H.G., 1973. Application for permit authorizing surface work - Cominco Ltd., H.B. Operations, Submitted to Senior Inspector of Mines, Reclamation, Dept. of Mines and Petroleum Resources, Parliament Buildings, Victoria.

(2) Gardiner, R.T., 1975. Mined-Land Reclamation Research at H.B. Operations, Progress Report 1974, Submitted to Senior Reclamation Inspector, Dept. of Mines and Petroleum Resources, Parliament Buildings, Victoria, January 31, 1975.

(3) Gardiner, R.T., 1975. Mined-Land Reclamation Research at Sullivan Operations, Progress Report 1974, Submitted to Senior Reclamation Inspector, Dept. of Mines and Petroleum Resources, Parliament Buildings, Victoria, January 31, 1975.

7. List of Tables

Table 1: Disturbed Land at H.B. Operations

Table 2: Characterization of H.B. Tailings as a Liming Material

Table 3: Weather Summary for 1975.

Table 1: Disturbed Land at H.B. Operations

Nature of Disturbance		Area (Hectares)
Waste rock dumps:	2800 level	0.9
	3500 level	0.1
Open pit		2.4
Tailings impoundment		24.8
Buildings and service area		1.6
Roads		2.3
		34

Table 2: Characterization of H.B. Tailings as a Liming Material

Property		H.B. Tailings	Agricultural Dolomitic Limestone
Particle Distribution (%)			
mesh size	-4	100	100
	-8	100	100
	-20	99.4	87.5
	-40	98.3	80.5
	-60	98.0	62.5
	-80	96.7	42.3
	-100	94.6	26.8
$CaCO_3$ Equivalence (%)		84	87
Total Pb content (ppm)		445	80
Total Zn content (ppm)		3000	225

Table 3:

Weather Summary for the Year: 1975

Station: B.C. Forest Service, Salmo, B.C.

Month	Temperature °C					Precipitation		
	Means			Extremes		Rain	Snow	Total[1]
	Max	Min	Mean	Max	Min	mm	cm	mm
Jan	-2.3	-11.3	-6.8	4.4	-23.3	5.59	111.51	117.09
Feb	1.4	-10.7	-4.6	7.2	-23.3	25.40	86.61	112.01
Mar	5.3	-5.5	-0.1	8.3	-13.9	205.99	25.91	231.90
Apr	11.8	-3.3	4.2	20.0	-12.8	36.30	-	36.30
May	18.8	0.7	9.7	28.3	-7.2	38.10	-	38.10
Jun	21.1	6.0	13.5	28.9	0	71.88	-	71.88
Jul	28.4	10.6	19.5	37.7	1.7	69.34	-	69.34
Aug	23.1	7.9	15.5	31.1	3.9	94.74	-	94.74
Sep	23.1	3.5	11.6	27.8	-0.6	9.14	-	9.14
Oct	9.6	1.5	5.6	25.0	-5.6	143.00	5.59	148.59
Nov	4.1	-5.4	-1.0	16.7	-13.3	83.30	-	83.30
Dec	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

[1] In rainfall equivalents: 1 cm snow = 1 mm rain

Mean annual temperature: n.a.
Mean monthly temperature: January -6.8°C
Mean monthly temperature: July 19.5°C
- Months above 10°C: 4
- Months below 0°C: 4
- Months above 4.5°C: 6

Frost free days (period): June 9 - Sept. 18 (101 days)
Total annual precipitation: n.a.
Annual snowfall: n.a.
Season occurrence of ppt:
- Wet season n.a.
- Wettest month n.a.
- Dryest season n.a.
- Dryest month Sept. (9.14 mm)

0500032

Province of British Columbia
Ministry of Employment and Investment

ENERGY AND MINERALS DIVISION

REPORT OF GEOTECHNICAL INSPECTOR

(Issued pursuant to Section 15 of the Mines Act)

Name of Property: HB Mine Tailing Pond File: 18040-02-07/HB

Location: near Salmo, B.C.

Mine Manager: ~~n/a~~ unknown Vancouver??

Company: Cominco ?? Nu Dawn
Address: ???

Persons Contacted: n/a

Type of Mining: Closed, u/g, base metal

Date of Inspection: June 10, 1997

An inspection of the tailings impoundment was conducted in the company of Art O'Bryan. The previous geotechnical inspection was April 29, 1993. The following areas in particular were noted:

The upstream dam face (Photo 1) is in good condition with no evidence of effects from wave action. The dam crest and downstream slope (Photo 2) are also in good condition with no evidence of cracks, settlement, slumps or erosion. Vegetation cover (mainly grasses and legumes) is healthy and thick and an alder has started on the upstream face at waterline.

?

The downstream toe is wet in the same areas as observed in 1993 and the toe drains appear to be functioning satisfactorily. The grouted CMP (old decant outlet) near the central toe of the dam is dry and not showing any signs of leakage inside or outside of the pipe.

The operating decant or water level control structure is structurally sound. However the inlet channel to the decant is completely full if cattails and the alders are much larger. Compare Photo 3 (April 29, 1993) and Photo 4 (June 10, 1997). The log at the entrance to the channel is still in place. However the concrete water level control beams have not been removed from inside the structure as ordered in my 1993 inspection, although I note that the wooden support posts for the upper beam appear to have been replaced with steel pipe. Note that the same number of concrete beams are resting on top of the control structure in both photos.

A 900 mm CMP conducts water from the decant control structure to a drop structure (manhole) partway throught the dam and another CMP from the drop structure to the downstream dam toe. The drop structure has had the steel cover secured so that we could not inspect inside and the steel plate has been removed from inside as ordered in my 1993 inspection. ? how if can not see inside

The downstream outlet for the decant structure has had some minor improvements made to it, compare Photo 5 (April 29, 1993) and Photo 6 (June 10, 1997). The steel and fibreglass plume has been realigned and now carries the discharge water from the outlet CMP and discharges it into the drainage natural plunge pool, about seven metres away.

permit no ??

Discussion

In coming letter to Cominco??

Cominco is still the Permittee and was the last owner/operator. The acting Chief Inspector approved the construction of a spillway July 22, 1977 by Cominco.

The current arrangements at the dam require monitoring and maintenance to ensure satisfactory long term operation. Without maintenance the current decant structure will eventually plug with debris with a potential dam breach the end result.

such as approved in 77?

As stated in my 1993 inspection report this tailings facility must be permanently decommissioned. An engineered spillway and outlet channel need to be designed and installed for the 1:200 year 24 hour flood or combination flood and freshet. Static stability must have a minimum factor of safety of 1.5 and seismic stability reviewed to satisfy the 1:475 year probabilistic event. In the event stability is inadequate the pond level should be further lowered by the new spillway to reduce risk and improve stability. If necessary the entire pond should be permanently drained from the impoudment by the spillway structure.

need a review of design

Date: June 18. 1997

Tim Eaton, P. Eng.
Manager Geotechnical Engineering

Signature - Manager

Date:

Written response is required by the Mine Manager 15 days after receiving this report

cc: Andrew Whale (~~2 copies~~), Art O'Bryan

ART O'BRYAN
FYI

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

Report of Inspector of Mines
(Issued pursuant to Section 15 of the Mines Act)

file copy

GEOTECHNICAL - EIM

Name of Mine: HB Mine

Locality: Salmo, B.C.

Owner or Operator: Nor-Quest Resources Ltd.

Address: 102 Piper Crescent Nanaimo, B.C. V9T 3G3

Manager: Mr. Raynerd Carson

Areas Inspected: Tailings Dam

Persons Contacted

Management:No one available.

The mine manager shall complete the right hand column noting specific corrective actions taken, or to be taken by a specified date, and return a copy to the Inspector within 15 days of receiving the report.

Inspection Report	Manager's Response of Action Taken
1. Crest good, no settlement.	
2. Upstream slope good, beach/ wave action/ erosion minimal.	
3. Downstream slope covered with grass and alder, wet zones at toe and several seeps, but no seeps were obvious on downstream slope face. Stability looks good; no sloughs, settlements, toe drains operating.	
4. Piezometer standpipe near toe at centre of dam is dry to a depth of approx. (plumbed with small stone) 45-50 feet. Check Fig. 1 from Golder Brawner 74 report (Feb. 12, 1979 Rep# E/74/124) assume it to be BH 2 which is drawn at about 50 foot depth on the section so assume piezo is dry.	

Copies To:

Tim Eaton, P. Eng.
Geotechnical Manager

Tim Eaton
Signature - Inspector

105-525 Superior St. Victoria, B.C., V8V 1X4
Address

Signature - Manager

Date of Inspection: April 29, 1993

Dated: ______________, 19____

Inspection Report	Manager's Response of Action Taken
5. Decant structure at E end looks structurally sound, flow not impeded but bullrushes growing at inlet are being drawn into structure. Large log at entrance to outlet ditch is okay and prevents other debris from passing. Inside the decant well there are 2 concrete outlet water level control beams. One is raised approx. 18" and supported entirely by 2"x2"x4" on end which are rotting. This must be removed as soon as possible. The lower beam sits on the bottom and should be removed to create additional free board between dam crest to panel level.	
6. Drop structure looks sound but water has flowed out of the MH as evidenced by recent erosion and flattened grass around the MH . A 1/4" steel plate inside the MH must be removed as soon as possible. It is fastened by rusting bolts to the concrete and will block the outlet when it falls.	
7. The downstream decant outlet requires maintenance. A steel and fibreglass flume has partially collapsed and should be removed. There is some resulting erosion. The channel below the outlet should be armoured along a 15 m. stretch with rock larger than 300 m in diameter.	
8. Surface runoff shall be diverted from the crest of the dam, E end.	
9. <u>For abandonment</u>, this facility requires a geotechnical inspection (annual report) and assessment of long term stability and capacity to accommodate 1:200 year 24 hour flood through a spillway structure. Recommendations shall be made in this report by a registered B.C. geotechnical engineer. Flood precipitation data shall be reviewed at this time. Seismic stability shall be reviewed for the 1:475 year. event.	

Date of Inspection: ______________ Initials: LC Inspector ______ Manager ______

Golder Brawner Associates

CONSULTING GEOTECHNICAL ENGINEERS

REPORT TO
COMINCO LTD.
ON
SITE INVESTIGATION AT EXISTING
H.B. MINES TAILINGS POND

SALMO B.C.

Distribution:

4 copies - Cominco Ltd.
Trail, British Columbia

2 copies - Golder Brawner & Associates Ltd.
Vancouver, British Columbia

January, 1974 V 73218

Golder Brawner Associates

CONSULTING GEOTECHNICAL ENGINEERS

E/74/124

February 12, 1974

Cominco Ltd.,
Engineering Dept.,
Trail, B.C.

ATTENTION: Mr. D. Boyle, P.Eng.

RE: H.B. Tailings Dam
Salmo, B.C.

Dear Sir:

Enclosed please find 4 copies of amended text and drawings for our January, 1974 report on the above project. Also included are 3 complete copies of the amended report.

Yours very truly,

GOLDER BRAWNER & ASSOCIATES LTD.

B. Thompson, P.Eng.

B. Thompson

BT/jm
V73218

Encl.

GOLDER, BRAWNER & ASSOCIATES LTD., 224 WEST 8th AVE., VANCOUVER, B.C., V5Y 1N5 CANADA • PHONE: (604) 879-9266 • TELEX: 04-508800

Golder Brawner Associates

CONSULTING GEOTECHNICAL ENGINEERS

January 2, 1974

Cominco Ltd.,
Engineering Dept.,
Trail, B.C.

ATTENTION: Mr. D. Boyle

Re: Site Investigation at Existing
H.B. Mines Tailings Pond, Salmo, B.C.

Dear Sir:

As requested by your Purchase Order No. HB 15017 dated October 26, 1973, and in accordance with our proposal of September 20, 1973, we have carried out a detailed drilling program at the above site. The purpose of this investigation was to determine the condition of the existing dyke and foundation soils to enable a detailed stability analysis to be carried out. This report is further to our report No. V 72109 of June, 1973.

FIELD INVESTIGATION

Three boreholes were drilled at the site between October 29, 1973 and November 1, 1973 using a truck-mounted rotary drill rig. These boreholes were drilled to depths varying from 45 to 85 ft. and extended approximately 20 ft. into bedrock. One borehole was drilled from the crest and two boreholes from the lower slope of the existing tailings dyke as shown on Fig. 1. Stan-

GOLDER, BRAWNER & ASSOCIATES LTD., 224 WEST 8th AVE., VANCOUVER, B.C., V5Y 1N5 CANADA • PHONE: (604) 879-9266 • TELEX: 04-508800

dard split spoon samples were obtained of the overburden and wash samples of drill cuttings were obtained of the bedrock. All samples were identified in the field and returned to our laboratory for classification and testing.

Perforated plastic standpipes were installed in the open boreholes to enable groundwater levels to be monitored.

SITE CONDITIONS

The existing tailings pond is located approximately 4 miles south of Salmo, B.C. The tailings dyke is located at the southern end of a valley and has been constructed 50 to 60 ft. high using borrow fill obtained from the abutment slopes. Contours of the downstream face of the dyke together with a typical cross section are shown on Fig. 1.

The borehole results indicate that the dyke is generally comprised of soft to firm brown sandy silt containing varying amounts of medium to coarse sand and fine gravel. Standard penetration test results gave average 'N' values of the order of 10 blows/ft. indicating a loose to compact state of relative density.

Examination of the overburden samples enabled an approximate estimate of the location of original ground surface beneath the dyke fill. The approximate location of the existing ground surface is shown on Fig. 2. In borehole 1, the natural ground surface was estimated to be located approximately 59 ft. below the crest of the dyke. Underlying the fill, a 4 ft. thick stratum of very dense silty till was identified overlying a 5 ft. thick layer of hard desiccated silt. Bedrock was encountered at approximately 68 ft. below the crest of the dyke.

In borehole 2, the original ground surface was estimated as being located approximately 27 ft. below the dyke fill surface. The boreholes en-

countered a 7 ft. thick stratum of soft to firm silt beneath the fill. Underlying the silt, a 2 ft. thick layer of sand and gravel was identified overlying bedrock.

In borehole 3, the original ground surface was estimated to be located approximately 20 ft. below the fill. The borehole encountered a 3 ft. thick stratum of dense silty till beneath the dyke fill. Underlying the silt, a 3 ft. thick layer of sand and gravel was identified overlying bedrock.

More detailed descriptions of the soil conditions are given on the Record of Boreholes. A cross section showing the inferred soil stratigraphy is shown on Fig. 2.

GROUNDWATER CONDITIONS

The standpipes installed in the boreholes were monitored for approximately 4 weeks after installation to enable the water levels to stabilize. From the recorded water levels, we have inferred the phreatic surface in the dyke to be located as shown on Figure 2.

Inspection of the dam during the period of the drilling program indicated that seepage was occurring near the toe of the upper slope of the dam and at each abutment. Soft saturated soil was observed at several locations in the middle slope of the dam and very soft saturated soil was encountered at the east abutment.

This seepage and degree of saturation was not observed at the time of the original site investigation in May 1972. The occurrance of seepage above the phreatic line as inferred from the standpipe levels is believed to be caused by local variations in the permeability of the dam material. The location of the phreatic line is expected to vary somewhat across the dam.

DYKE STABILITY

The investigation has indicated that the existing dyke has been constructed essentially with silty soils which have been placed in a loose condition. The design parameters used in our previous calculations are considered to be still applicable although the phreatic surface assumed in our original report appears to have been somewhat lower than now exists. This present condition may be a result of a change in ponded water level upstream. Stability calculations for the present condition indicate a safety factor against a shearing type failure of the order of 1.3 which is considered adequate.

It is understood that it is proposed to eventually raise the pond water level to a maximum elevation of 2502 ft. behind the existing dam. As the pond water level is raised, the phreatic surface will also rise. Stability calculations for these future conditions indicate a factor of safety against a shearing type failure of the order of 1.1 which is lower than is normally acceptable. To increase the dyke stability, it is recommended that a berm be constructed on the downstream section of the dam as shown on Fig. 3. Provision of this berm will increase the factor of safety to approximately 1.3 which is adequate.

SEEPAGE

At present, seepage is occurring at the intersection of the upper and middle slope of the dyke and at the abutments. Examination of this seepage during the drilling program indicated that the flow was clear and did not appear to be carrying any soil particles. However, the dyke is essentially homogeneous and has been constructed with silty soils which are most susceptible to internal backward erosion. The potential for this type of erosion will increase as the ponded water level is raised. To provide protection against internal backward

erosion, filter material should be placed on the downstream slope of the dyke. This can be accomplished by constructing the previously recommended stability berm (Figure 3) of a suitable filter material which satisfies the gradation requirements shown on Figure 4. It is possible that mine waste rock will be suitable.

The berm should be adequately compacted to provide the required strength for support of possible future dyke extensions, yet should not be over-compacted so as to reduce its permeability. Generally, if heavy equipment is available and if the gradation of the filter material tends to be towards the coarser fraction of the range shown on Figure 4, satisfactory compaction without excessive reduction in permeability will be achieved by spreading the material in 16 in. lifts using a heavy crawler tractor.

We would be pleased to provide more specific construction details when the gradation of material and type of construction equipment are known.

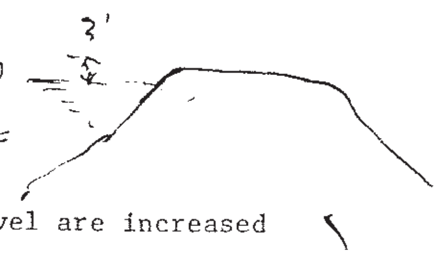
To accommodate the seepage at the abutment, a filter blanket should be placed at these locations as shown on Fig. 3. This blanket should consist of similar filter material to that described above and should have a minimum thickness of 2 ft. This filter material should also be placed as described above.

It is pointed out that the specification given above for the filter material is critical if the filter blanket is to perform satisfactorily. As a result, we recommend, that when potential sources of material have been established, that we review the suitability of the material. In addition during raising of the ponded water level to elevation 2502, we recommend that the dyke be inspected by a member of our staff to ensure that the filter blanket is performing as desired.

At the time of the drilling, examination of the upper face of the dyke indicated that some surface erosion had occurred due to water ponding on the crest of the dyke and flowing downstream. It is recommended that these slopes be renovated by using granular material. In addition some surface grading should be carried out on the crest of the dyke to prevent ponding of rain water. During this work the crest could be sloped inwards towards the pond in order to direct run-off in that direction.

FUTURE DYKE EXTENSION

3' diff



If the height of the existing dyke and pond level are increased in the future to elevations 2511 ft. and 2508 ft. respectively, the crest of the dyke should be raised by placing additional fill on the crest and on the downstream slope. In addition, the filter material recommended above should be extended as shown on Fig. 5 to a maximum elevation of 2500 ft. The additional filter material should be placed as previously recommended while the fill material should be placed in horizontal lifts of 12 inch maximum and compacted to at least 95 per cent of Standard Proctor Density.

We trust that this is the information you require. We would be pleased to discuss the report in more detail should you desire.

Yours very truly,

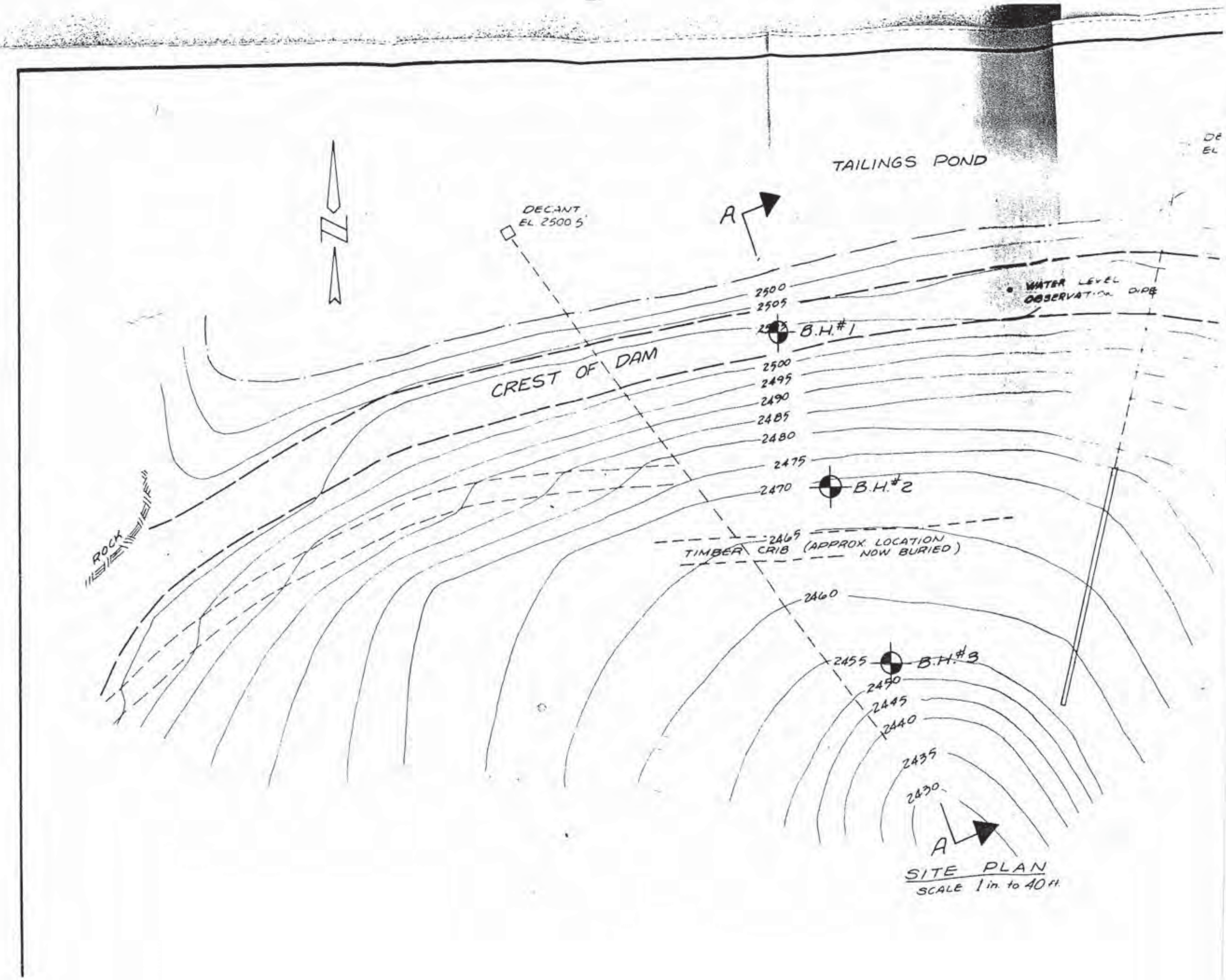
GOLDER BRAWNER & ASSOCIATES LTD.

R.M. Wilson, P.Eng.

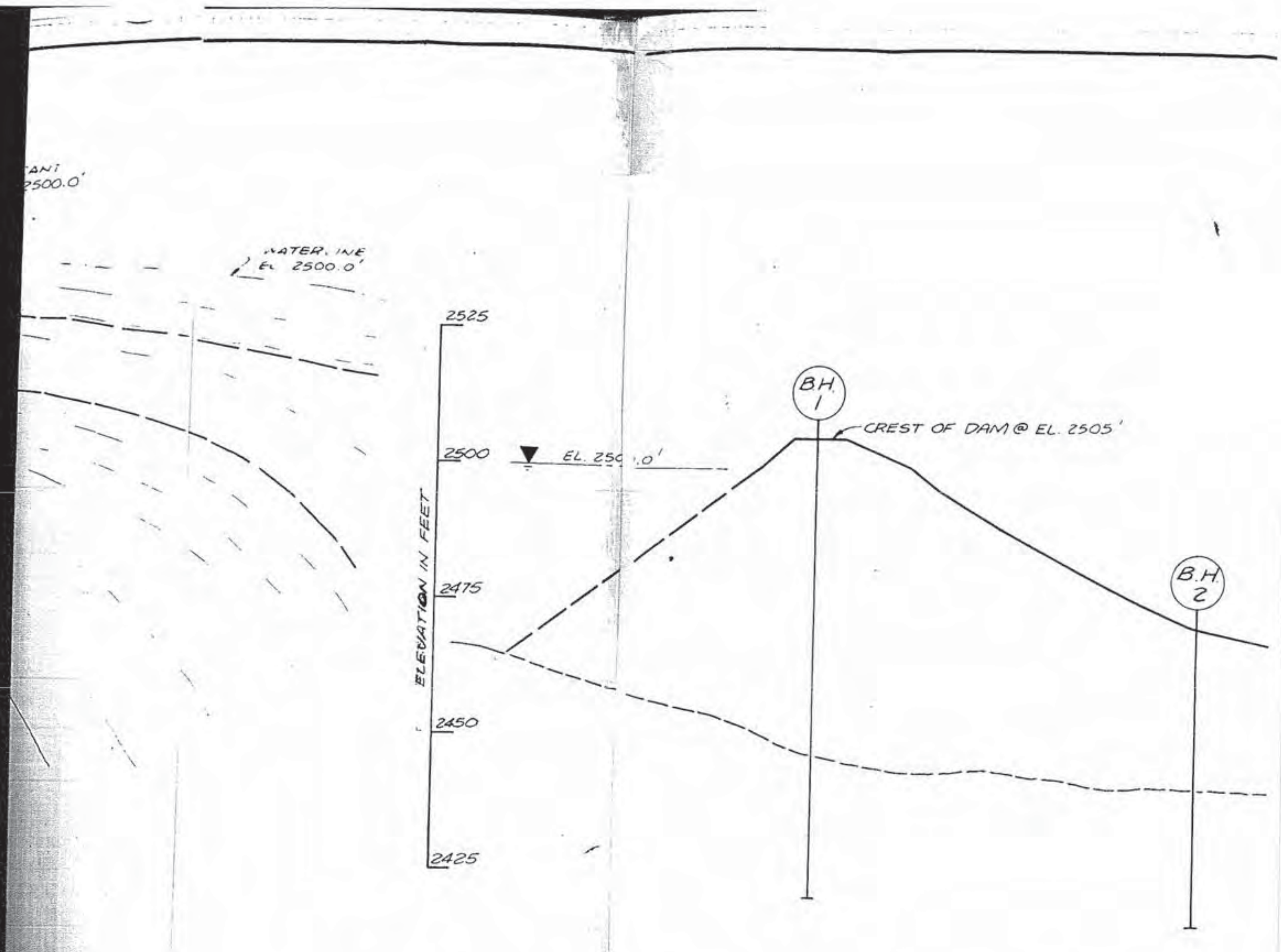
H.H. Hawson, P.Eng.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA H.H. HAWSON

RMW/HHH/sm
V73218



SITE PLAN
SCALE 1 in. to 40 ft.



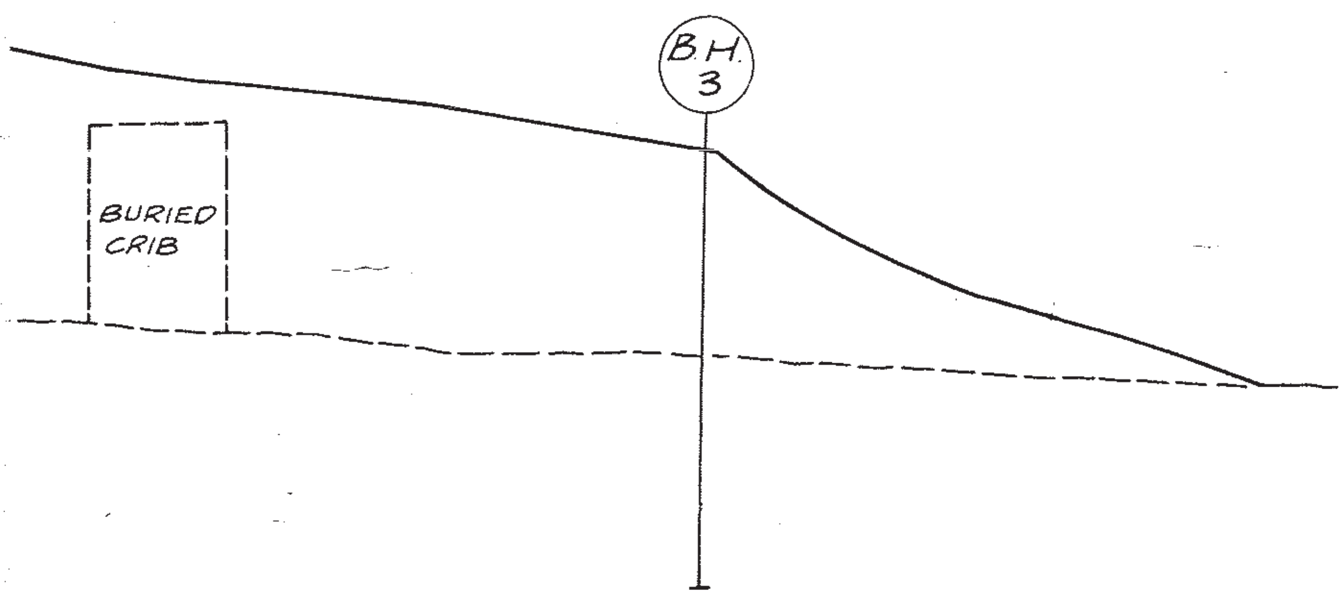
REFERENCE: COMINCO ENG EERING
DWG. No. HB-285-P, TITL D
"H.B. MINE TAILINGS DISPO AL"
DATED SEPTEMBER 7, 19 3.

SECTION A-A
SCALES: HORIZ. & VERT. 1"

GOLDER, BRAWNER & ASSOCIA ES

PLAN & SECTION SHOWING LOCATION OF BOREHOLES

FIGURE 1



1 IN. TO 20 FT.

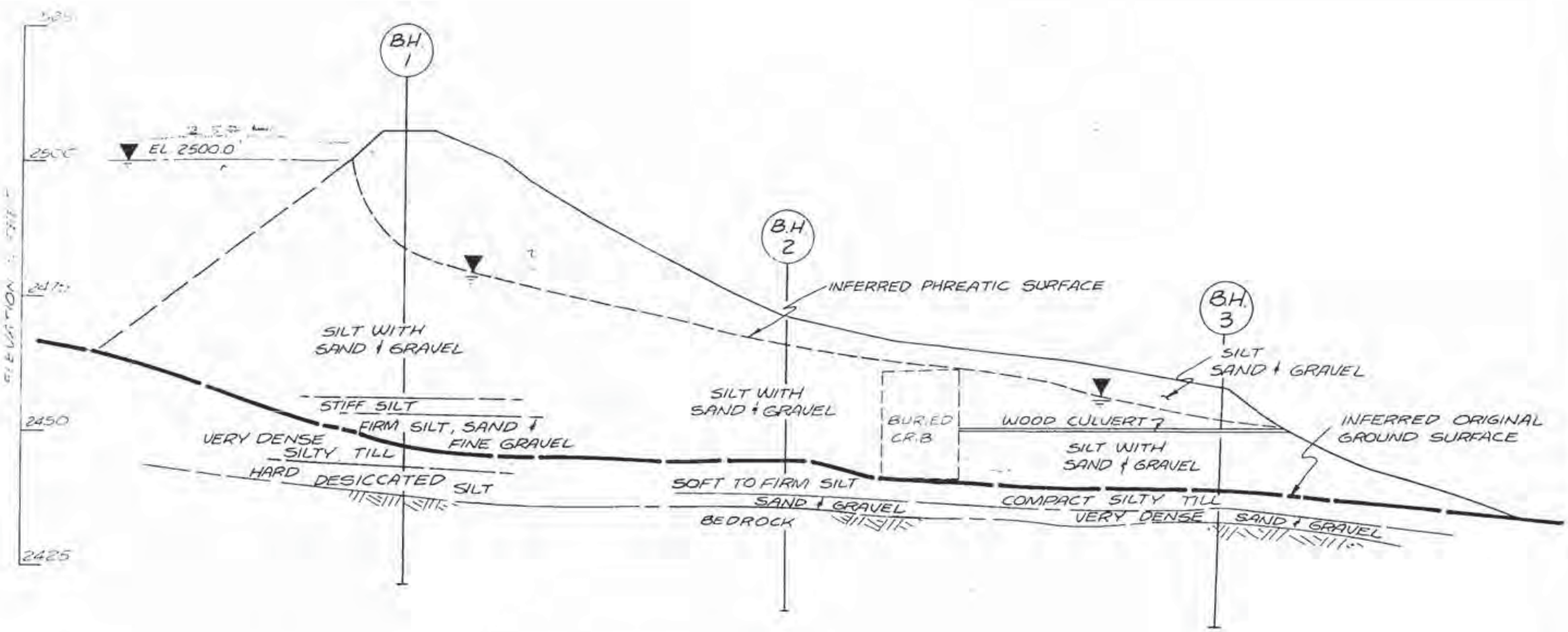
DRAWN W.T. & R.M.O.

APP'D. B.T.

DATE Dec. '73.

CROSS SECTION A-A SHOWING INFERRED SOIL STRATIGRAPHY & PHREATIC SURFACE

FIGURE 2



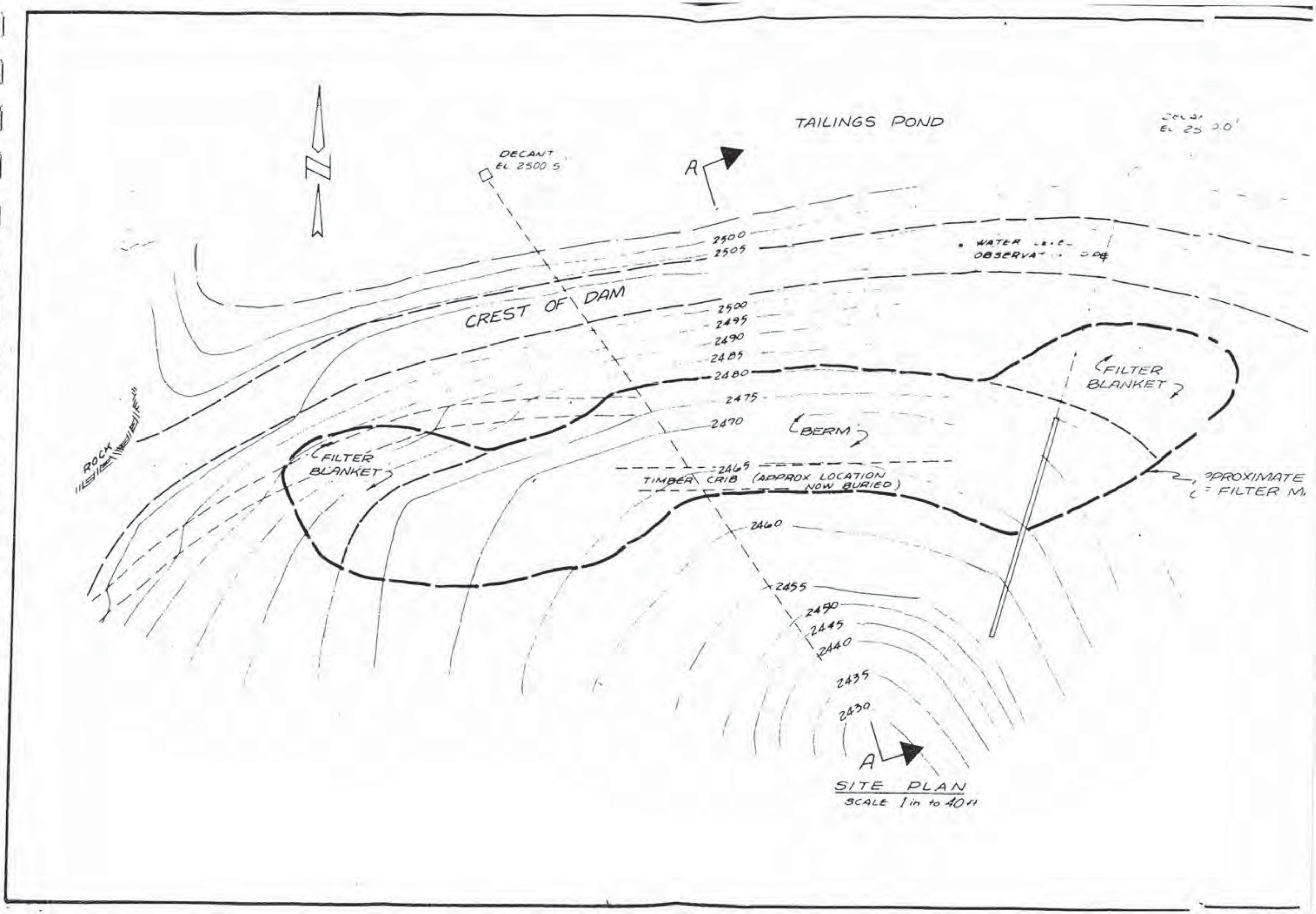
REFERENCE: COMINCO ENGINEERING DWG. No. HB-285-P, TITLED "HB MINE TAILINGS DISPOSAL" DATED SEPTEMBER 7, 1973.

SECTION A-A
SCALES: HORIZ. & VERT. 1 IN. TO 20 FT.

GOLDER, BRAWNER & ASSOCIATES

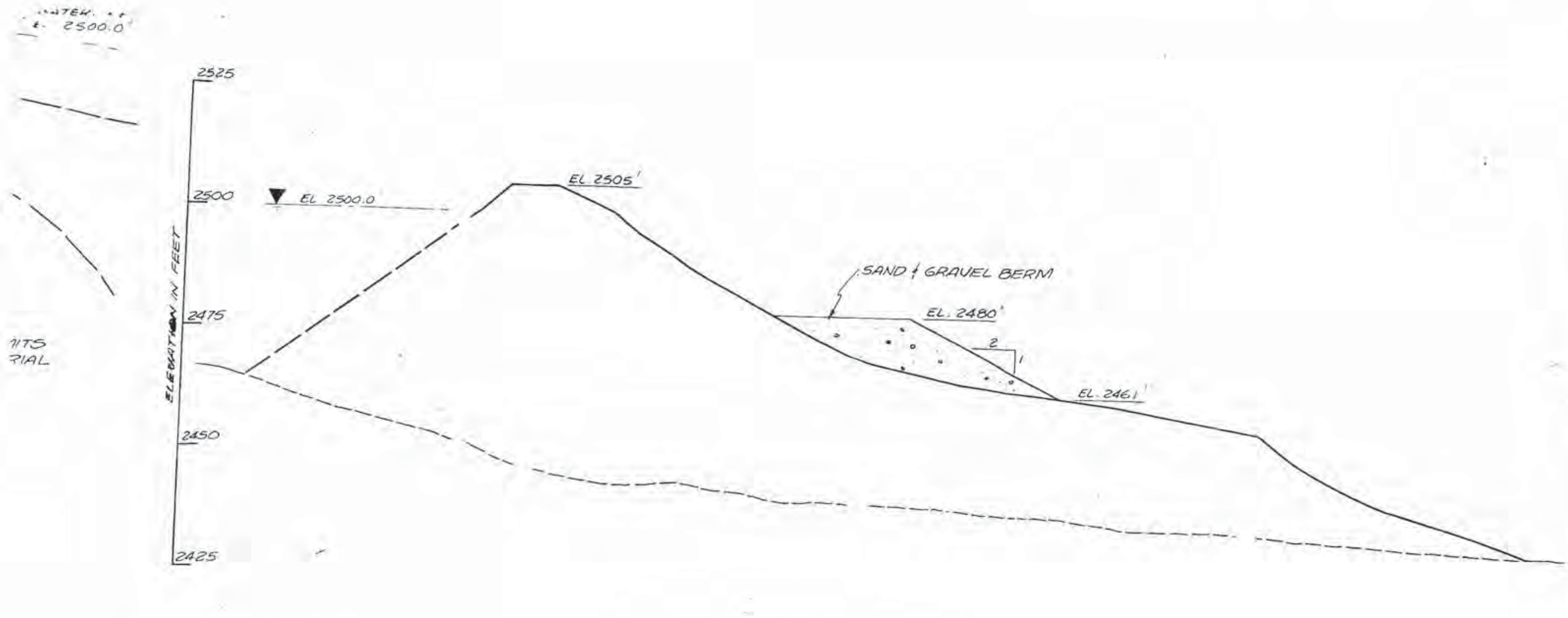
DRAWN RMO
APP'D B.T.
DATE Dec. '73.

V73218


TAILINGS POND
DECANT
EL 2500.5
A
2500
2505
WATER
CREST OF DAM
2500
2495
2490
2485
2480
2475
2470
FILTER BLANKET
BERM
FILTER BLANKET
ROCK
2465
TIMBER CRIB (APPROX LOCATION NOW BURIED)
2460
2455
2450
2445
2440
2435
2430
A
SITE PLAN
SCALE 1 in to 40 ft

RECOMMENDED BERM CONSTRUCTION

FIGURE 3



REFERENCE: COMINCO ENGINEERING DWG. No. HB-285-P, TITLED "H.B. MINE TAILINGS DISPOSAL" DATED SEPTEMBER 7, 1973.

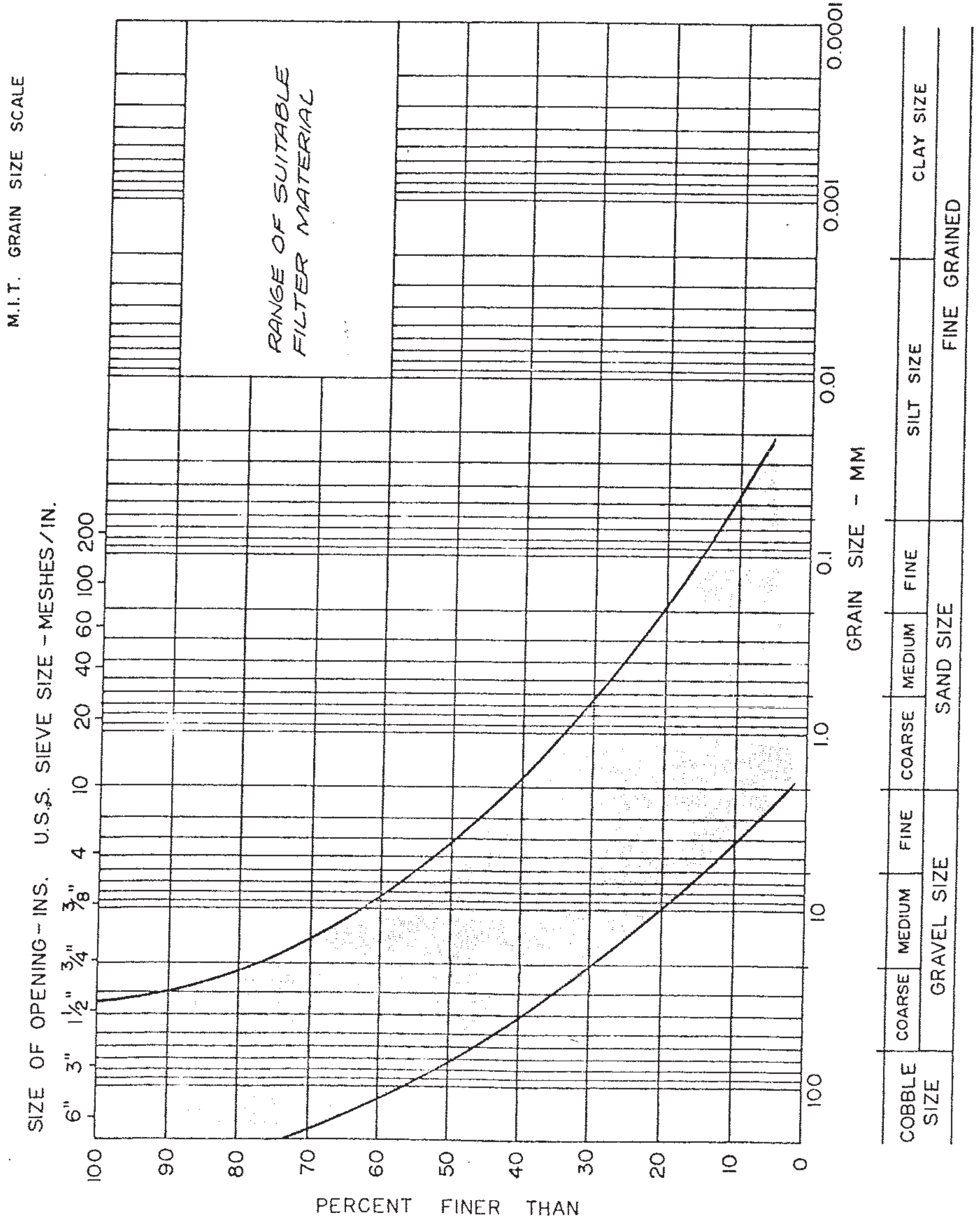
SECTION A-A
SCALES: HORIZ & VERT. 1 IN. TO 20 FT.

GOLDER, BRAWNER & ASSOCIATES

DRAWN WT & RMO.
APP'D. B.T.
DATE Dec '73

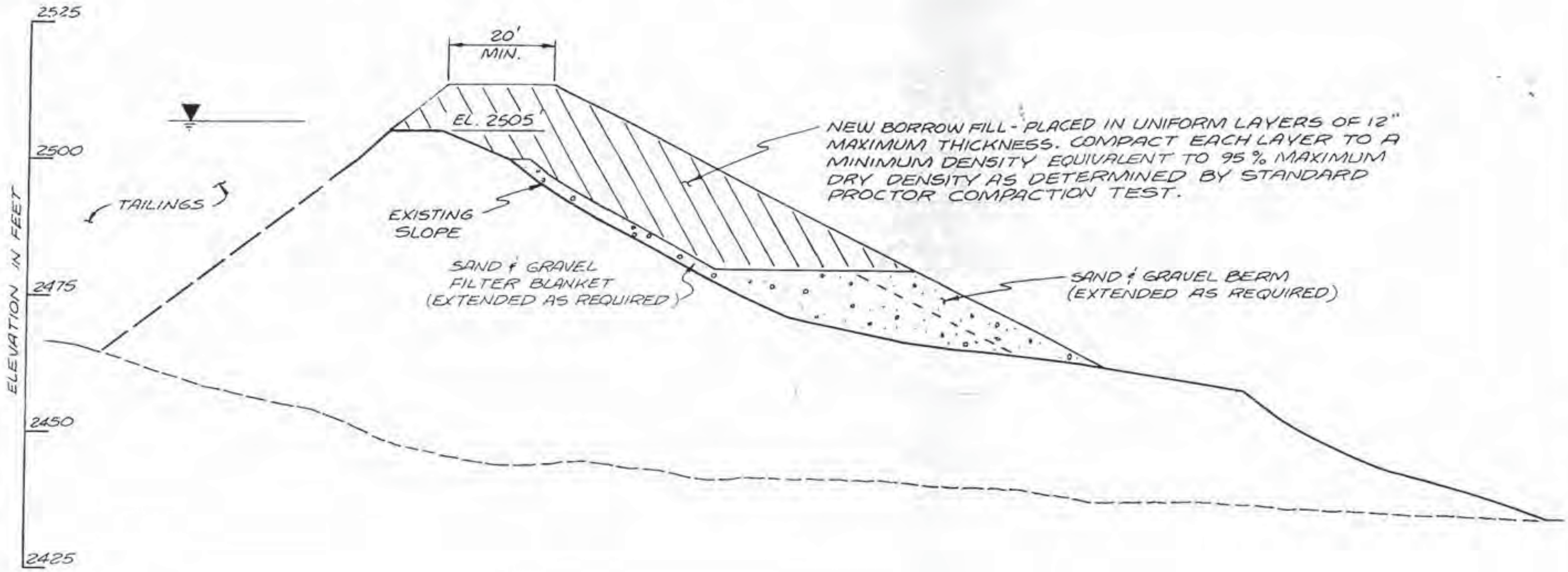
GRAIN SIZE DISTRIBUTION

FIGURE 4



GOLDER, BRAWNER & ASSOCIATES

SECTION SHOWING RECOMMENDED METHOD OF RAISING EXISTING DAM | FIGURE 5



REFERENCE: COMINCO ENGINEERING DWG. No. HB-285-P, TITLED "H.B. MINE TAILINGS DISPOSAL" DATED SEPTEMBER 7, 1973.

SECTION A-A
SCALES: HORIZ. & VERT. 1 IN. TO 20 FT.

DRAWN RM
APP'D. B.T
DATE Dec.

V7371B

PROJECT No. V73218

RECORD OF BOREHOLE 1

LOCATION See Figure 1

BORING DATE OCTOBER 29, 30, 1973

DATUM TAKEN FROM COMINCO DRAWING NO. HB 285 P

BOREHOLE TYPE ROTARY TRICONE

BOREHOLE DIAMETER 4 IN.

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES

PEN. TEST HAMMER WEIGHT — LB DROP — INCHES

SOIL PROFILE: ELEVN. / DEPTH	SOIL PROFILE: DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS / FT.	ELEVATION SCALE
505.0 / 0.0'	GR. SURFACE.					
	SOFT TO FIRM NON-PLASTIC BROWN SANDY SILT WITH SOME MED. & COARSE SAND & FINE GRAVEL.		1	2" D.O.	11	2500
			2	2" D.O.	4	
			3	2" D.O.	14	2490
			4	2" D.O.	5	
			5	2" D.O.	15	2480
			6	2" D.O.		
			7	2" D.O.	13	2470
			8	2" D.O.	13	
			9	2" D.O.	23	2460
55.0 / 0.0'	STIFF STRATIFIED GREY & BROWN CLAYEY SILT WITH A TRACE OF MED. SAND.		10	2" D.O.	37	
52.0 / 0'			11	2" D.O.	24	2450
6.0 / 0'	FIRM BROWN & DARK BROWN SILT WITH SOME MED. & COARSE SAND, FINE GRAVEL & ORGANICS.		12	2" D.O.	>100	
2.0 / 0'	VERY DENSE DARK GREY SILT, SAND & GRAVEL TO 1" DIA. (TILL).		13	2" D.O.	>100	2440
2.0 / 3'	VERY DENSE BLACK FRIABLE DESICCATED SILT WITH THIN PYRITE LENSES & ROUNDED GRAVEL TO 1½" DIA.		14	WS		
			15	WS		2430
	BEDROCK.		16	WS		
0.0 / 0'	END OF HOLE.					2420

DYNAMIC PENETRATION RESISTANCE BLOWS / FT.

SHEAR STRENGTH C_u, LB./SQ.FT.

COEFFICIENT OF PERMEABILITY k, CM / SEC.

WATER CONTENT, PERCENT W_P W W_L

ADDITIONAL LAB. TESTING

STANDPIPE INSTALLATION

W.L. 23.0' NOV. 23, 1973

15 ◇ 3 Percent axial strain at failure 10

VERTICAL SCALE
1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

1

DRAWN
CHECKED

PROJECT No. V73218

RECORD OF BOREHOLE 2

LOCATION See Figure 1 BORING DATE NOVEMBER 1, 1973 DATUM TAKEN FROM COMINCO DRAWING NO. HB 285 P

BOREHOLE TYPE ROTARY TRICONE BOREHOLE DIAMETER 4 IN.

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT LB DROP INCHES

SOIL PROFILE – DESCRIPTION	SAMPLES – NUMBER	TYPE	BLOWS/FT.	ELEVATION SCALE	STANDPIPE INSTALLATION
GR. SURFACE.					
SOFT BROWN SANDY SILT WITH MED. & COARSE SAND & GRAVEL TO 1½" DIA. OFTEN TILL LIKE.	1	2" DO	10	2460	W.L. 5.5' NOV 23, 1973
	2	2" DO	8		
	3	2" DO	13	2450	
	4	2" DO	4		
WOOD	5	2" DO	20	2440	
SOFT TO FIRM STRATIFIED BROWN & GREY SILT WITH OCC. GRAVEL TO 1½" DIA.	6	2" DO			
SAND & GRAVEL.				2430	
BEDROCK.	7	WS			
	8	WS		2420	
	9	WS			
	10	WS			
END OF HOLE.				2410	

DYNAMIC PENETRATION RESISTANCE BLOWS/FT

SHEAR STRENGTH C_u, LB./SQ.FT

COEFFICIENT OF PERMEABILITY k, CM./SEC.

WATER CONTENT, PERCENT W_P W W_L

ADDITIONAL LAB. TESTING

15 10 5 Percent axial strain at failure

VERTICAL SCALE 1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

2

DRAWN
CHECKED

PROJECT No. V73218

RECORD OF BOREHOLE 3

LOCATION See Figure 1

BORING DATE NOVEMBER 1, 1973

DATUM TAKEN FROM COMINCO DRAWING NO. HB-285-P

BOREHOLE TYPE ROTARY-TRICONE

BOREHOLE DIAMETER 4 IN.

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES

PEN. TEST HAMMER WEIGHT – LB DROP – INCHES

ELEVN DEPTH	DESCRIPTION (SOIL PROFILE)	STRAT PLOT	SAMPLE NUMBER	TYPE	BLOWS/FT.	ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FT / SHEAR STRENGTH C_u, LB/SQ.FT	COEFFICIENT OF PERMEABILITY k, CM./SEC. / WATER CONTENT, PERCENT W_P W W_L	ADDITIONAL LAB TESTING	STANDPIPE INSTALLATION
2455.0 / 0.0'	GR SURFACE									
	VARIABLE DENSITY BROWN & GREY SILT SAND & GRAVEL		1	2" DO	>50	2450				
2448.0 / 7.0'	WOODEN CULVERT									W.L. 6.0' NOV 23, 1973
8.0	VARIABLE DENSITY BROWN & GREY SILT WITH MED. & COARSE SAND & FINE GRAVEL		2	2" DO	>100					
			3	2" DO	15	2440				
2435.0 / 20.0'	COMPACT BROWN & GREY SILT, SAND & GRAVEL (TILL)		4	2" DO	37					
2432.0 / 23.0'										
2429.0 / 26.0'	VERY DENSE SAND & GRAVEL		5	2" DO	>100	2430				
			6	WS						
	BEDROCK.					2420				
			7	WS						
2410.0 / 45.0'	END OF HOLE.					2410				

15 -○- 5 (10) Percent axial strain at failure

VERTICAL SCALE
1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

DRAWN
CHECKED

DAVID MINERALS LTD.

Tailings Disposal Scheme

HB Mill, Salmo, B.C.

KLOHN LEONOFF
CONSULTING ENGINEERS

14745-20

PROJECT: HB Mill Tailings Disposal Scheme

LOCATION: Salmo, B.C.

CLIENT: David Minerals Ltd.

OUR FILE: VA 2869 November 27, 1981

VA 2869 November 27, 1981

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APPENDIX

I - LOGS OF BOREHOLES DRILLED BY GOLDER ASSOCIATES IN 1973

LIST OF DRAWINGS

A-2869-1	-	SITE LOCATION
B-2869-2	-	LOCATION OF TAILINGS DISPOSAL POND
B-2869-3	-	PLAN OF EXISTING TAILINGS POND
D-2869-4	-	PLAN AND SECTION OF EXISTING DAM
B-2869-5	-	SCHEMATIC PROFILE OF TAILINGS POND
B-2869-6	-	STABILITY ANALYSIS OF DAM
A-2869-7	-	WATER BALANCE

VA 2869

November 27, 1981

1. INTRODUCTION AND SUMMARY

Klohn Leonoff Ltd. was requested by David Minerals Ltd. to investigate the feasibility of using the existing tailings pond at the HB Mill for the deposition of about one million tons of tailings. This report has been prepared for submission to the Nelson Branch of the B.C. Ministry of Energy, Mines and Petroleum Resources so that a permit can be obtained by David Minerals to operate the pond.

The HB Tailings Dam is located approximately four miles south of Salmo, B.C. (Drawings A-2869-1 and B-2869-2). The dam was originally built by Cominco in 1955 using a timber crib over which borrow materials from the west end of the pond were placed. The dam was raised in this manner to a height of about 40 ft. In 1964, a portion of the timber crib failed and moved about 10 to 15 ft. Drains were placed and toe protection was provided to stabilize the failure. Construction of the dam raising continued by the downstream method until operations were suspended in 1967. We understand that there was no independent geotechnical control of dam construction until 1973. In 1973, Golder Associates drilled three holes, one in the crest and two in the downstream portion of the dam. They encountered relatively soft material (as low as four blows per foot) in two holes. They recommended measures to reduce the phreatic surface within the dam, which were implemented. Subsequently, Golder Associates supervised the construction of dam raisings in 1975 and 1977. The operations at the HB Mill were suspended by Cominco in 1978.

The tailings dam is located at the southern end of a valley and has been constructed about 75 to 80 ft high using borrow materials. The tailings were deposited at the back of the pond, about 2900 ft from the crest of the dam and clarified water ponded against the upstream face of the dam (Drawing B-2869-3). Initially, two timber

What is nature of the proposed tailings? Has Waste Management permitted the new process?

What about 1:200 probability earthquake?

decant towers were used in conjunction with two 24-inch diameter steel pipes to pass water from the upstream to the downstream side of the dam. In 1977, these decant towers were filled with concrete and replaced with a new spillway and drop manhole arrangement (Drawing D-2869-4).

Dr. Rajaram of Klohn Leonoff visited the damsite on September 23, 1981. Discussions were held with Mr. Newman of Cominco Engineering to obtain details of the tailings dam operation during the period 1955 to 1978. A profile of the tailings pond from the tailings flume to the dam crest was obtained from Mr. Newman and from Mr. Girdler of David Minerals. A schematic profile of the tailings pond is presented in Drawing B-2869-5. Assuming that tailings will be deposited uniformly on the existing tailings surface, a curve relating tons of tailings to elevation was developed. Approximately 790,000 tons of tailings can be deposited in the existing pond and dam. The dam will have to be raised by about 6 ft before the anticipated one million tons of tailings are deposited.

Klohn Leonoff will assess the condition of the existing dam by conducting a program of field investigation and laboratory analysis. Based on the results of this investigation, specifications for the dam raising will be provided.

The hydrology of the site was briefly analyzed to determine the water balance in the pond. It was concluded that the present spillway, which we understand is designed for a peak flow of 80 cu ft per second, is adequate to handle the runoff from a 200 year flood.

A seismic risk analysis of the site indicated that the acceleration amplitude with return periods of 100 years is 0.015 g (1.5 percent gravity). Since this figure indicates that the site has very low seismic risk, a static stability analysis was performed. The

analysis indicates that the dam has a minimum factor of safety against a shearing type failure of 1.7.

This report details the condition of the existing dam and describes the physical and hydrologic setting of the tailings pond, the tailings disposal scheme, and final abandonment of the pond.

2. DESCRIPTION OF EXISTING TAILINGS POND AND DAM

The existing tailings pond is located approximately four miles south of Salmo, B.C. A plan of the pond area showing the contours of the tailings surface is presented on Drawing B-2869-3. The tailings dam is located at the southern end of a valley and has been constructed about 75 to 80 ft high using borrow material obtained from the abutment slopes. The dam is about 800 ft long and the pond occupies an area of about 67 acres. A plan and section through the dam are presented on Drawing D-2869-4.

2.1 Cominco's Operating History

Cominco operated the tailings pond during the period 1955 through 1978. The tailings pond was used during 1955 through 1967, and subsequently during the period 1974 through 1978. The crest of the dam was raised periodically during these years to accommodate the increasing volumes of tailings. These dam raisings were performed using the downstream method of construction, i.e., additional fill was placed on the crest and the downstream slope of the dam. It is our understanding that the dam construction during the years 1955 through 1967 was not performed under independent geotechnical control.

When the dam was initially constructed in 1955, a timber crib structure was used. This crib was covered with borrow material obtained from the west end of the pond. The dam was raised in this manner to a height of about 40 ft. In 1964, a portion of the

timber crib failed and moved about 10 to 15 ft. Drains were placed and toe protection was provided to stabilize this failure. Construction of the dam raising continued by the downstream method until operations were suspended in 1967.

Before Cominco re-opened the HB Mill in 1974, Golder Associates investigated the stability of the tailings dam in 1972 and 1973. They drilled three holes, one on the crest and two on the downstream portion of the dam. They encountered soft materials (as low as four blows per foot) in two of the three holes. They recommended that a filter blanket be placed on the downstream slope of the dam to reduce the phreatic surface and improve dam stability. This was implemented in 1974. Two subsequent dam raisings in 1975 and 1977 were supervised by Golder Associates (personal communication, Newman, 1981). Cominco has been monitoring the water levels in the dam since the installation of piezometers in 1973. These observations indicate that the phreatic surface within the dam has not changed since Cominco shut down their operation in 1978.

2.2 Geotechnical Aspects of Dam Construction

Cominco re-opened the HB Mine and Mill in 1973. In 1972 and 1973, Golder Associates of Vancouver investigated the stability of the tailings dam. In 1973, three boreholes were drilled to depths varying from 45 to 85 ft and extended approximately 20 ft into bedrock. One borehole was drilled from the crest and two boreholes from the downstream slope of the existing tailings dam. Logs of the boreholes obtained by Golder Associates are presented in Appendix I. Samples were obtained for laboratory testing, and perforated plastic standpipes were installed in the boreholes to monitor groundwater levels. A plan and section of the dam, showing the location of these boreholes, is presented on Drawing D-2869-4.

A review of Golder Associates reports dated June 1972 and January 1974, and discussions with Mr. Newman of Cominco reveal the following about the tailings dam:

- The dam is generally comprised of brown sandy silt containing varying amounts of medium to coarse sand and fine gravel.
- There are zones of soft material in the fills placed before 1967 (as low as four blows per foot).
- A timber crib was used during the initial construction of the dam, and a portion of this crib failed in 1964 and moved about 10 to 15 ft.
- The foundation material under the fill consists of bedrock overlain by 6 to 8 ft of dense silty till with minor amounts of sand and gravel.
- The fill material has an angle of internal friction of approximately 35 1/2 degrees with zero cohesion, as determined by Golder Associates' laboratory tests.
- The factor of safety against a shearing type failure is of the order of 1.3. Since this analysis was completed by Golder Associates in 1973, the phreatic surface has been lowered and so the present factor of safety is considered to be greater than this figure.
- The dam has adequate protection against surface erosion.

Golder Associates recommended that if the ponded water level is raised, the dam should be raised using a filter blanket to maintain the phreatic surface below the level of the existing downstream fill slope. The specifications for the 1975 and 1977 dam raisings were prepared by Cominco on the basis of the Golder reports, and we

understand that the construction was supervised by Golder Associates. A review of the piezometer readings through July 1981 indicates that the phreatic surface has been relatively constant, since Cominco shut down in 1978.

2.3 Spillway

Prior to 1977, two timber decant towers were used in conjunction with two 24-inch diameter steel pipes to pass water from the upstream to the downstream side of the dam. Due to operating and maintenance problems with this system, Cominco filled these structures with concrete and installed a new spillway and drop manhole structure (Drawing D-2869-4). This structure is equipped with a 36-inch diameter steel pipe, and we understand was designed to pass a maximum flow of 80 cu ft per second (35,900 USGPM).

3. TAILINGS DISPOSAL SITE

The tailings disposal area is situated in a natural basin covering about 67 acres in the Salmo Provincial Forest. It is to the east of Provincial Highway 3 and the Salmo River, about four miles south of Salmo, B.C. (Drawing B-2869-2). To the east and west of the pond are heavily treed slopes consisting of 80 to 90% of evergreens. The dam is situated at the southern end of the basin.

3.1 Hydrological Setting

Dr. McCreath of Klohn Leonoff, obtained data on snowcourse, streamflow, and precipitation from measuring stations at Creston, Nelson, Trail, and Edgren Creek. From analysis of the data, the average annual precipitation at the site is 31.5 inches, and the average annual evaporation is 16.7 inches. The average annual runoff from a catchment area of about 445 acres to the east of the tailings pond is about 14.5 inches. The water balance for the pond was calculated using these estimates for precipitation, evaporation, and runoff.

The peak 200 year flood inflow into the pond is estimated to be in the order of 120 to 150 cu ft per second (cfs). About 30 to 50% of this inflow can be temporarily stored in the pond since a flood surcharge of 2 ft has been assumed in computing the volume-elevation curve. Thus, the existing spillway, which we understand has been designed for a discharge of 80 cfs, can handle the 200 year flood estimated for the site.

4. TAILINGS DISPOSAL SCHEME

4.1 Existing Capacity of the Pond

The tailings pond has been operated since 1955 with the tailings being deposited at the upstream end of the tailings pond and the dam being raised as necessary by the downstream method of construction using borrow materials. Klohn Leonoff recommends that this method of tailings disposal be continued by David Minerals Ltd. In an effort to estimate the present capacity of the tailings pond, and the extent of dam raising necessary to store the anticipated 1,000,000 tons of tailings, a curve relating the tons of tailings to the elevation of the dam crest was developed (Drawing B-2869-5).

A schematic profile of the existing tailings surface is presented on Drawing B-2869-5. The water level in the pond is 5 ft below the dam crest, and the depth of the ponded water on the upstream side of the dam is 9 ft. The tailings should be discharged in layers over the existing tailings surface. In June 1984, after about 790,000 tons of tailings have been deposited, the ponded water capacity and flood surcharge provision will be reduced to a minimum. At that point, the dam will have to be raised by about 6 ft before additional tailings can be deposited. During operation of the tailings pond, the elevations of the tailings should be monitored to ensure that the schematic profile presented on Drawing B-2869-5 is maintained. The depth from the crest of the slimes

surface on the upstream side of the dam should be maintained as depicted in the tons of tailings versus elevation curve.

4.2 Tailings Dam Raising

The tons of tailings versus elevation curve indicates that the dam crest has to be raised prior to June 1984. Klohn Leonoff recommends that before the dam raising is undertaken, a program of field investigation should be conducted to assess the condition of the upstream portion of the dam. The upstream portion of the dam contains some soft zones, and also has a timber crib buried within it.

During the 1982 field season, two to three boreholes should be drilled to assess the condition of the upstream side. Soil samples should be obtained for conducting laboratory tests. Based on the results of the field and laboratory testing program, Klohn Leonoff will develop detailed specifications for the dam raising.

A stability analysis of the dam was performed using the parameters presented in Drawing B-2869-6. A preliminary profile of the dam raised by 6 ft was used to perform the analysis. A seismic risk analysis of the site indicated that the acceleration amplitude with return periods of 100 years is 0.015 g (1.5% gravity). Since this represents a very low seismic risk, a static stability analysis was performed. The minimum factor of safety for the dam was found to be 1.7.

4.3 Water Balance

The hydrological data given in Section 3.1 of this report was utilized to compute the water balance for the tailings pond (Drawing A-2869-7). Using a production rate of 900 tons per day, a tailings pulp density of 30%, and no recycling of the water, the tailings

What about the mine water that is being piped to the tailings pond.

transport water required is 350 USGPM. Of this amount about 50 USGPM remains within the voids of the tailings. The runoff and precipitation into the pond is estimated to be 335 USGPM. Assuming that 40 USGPM are lost due to evaporation and seepage, the average amount of daily flow out of the spillway is 595 USGPM. This represents an average dilution factor of about two for the tailings water. During periods of heavy runoff and precipitation, this factor could be much higher.

4.4 Permanent Spillway

On final abandonment of the pond, a permanent spillway should be constructed at the east abutment of the dam. This should be an open-channel spillway which will safely pass flood water from the upstream to the downstream side of the dam. The design of this spillway is beyond the scope of the present study.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

1. The existing tailings dam has a capacity of approximately 790,000 tons.

2. The tailings should be discharged from the northern end of the pond, in layers over the existing tailings surface. The depth from the crest of the slimes surface on the upstream side of the dam should be maintained at a minimum of about 8 ft.

3. The dam crest should be raised by about 6 ft during the 1983 field season to accommodate the anticipated one million tons of tailings.

5.2 Recommendations

1. The condition of the existing dam, especially the upstream portion, should be investigated during the 1982 field season. Based on this investigation, plans and specifications for the 1983 dam raising should be prepared.

2. Piezometric levels in the dam should be monitored on a monthly basis.

3. The tailings surface elevation should be monitored to ensure that the schematic profile presented in this report is maintained. Any significant variations in this profile will affect the tailings storage capacity.

KLOHN LEONOFF LTD.

V. RAJARAM, Ph.D., P.E.
Senior Division Engineer

MARK T. OLSEN, P.Eng.
Staff Consultant

VR/MTO/jas

APPENDIX I

LOGS OF BOREHOLES DRILLED BY GOLDER ASSOCIATES IN 1973

PROJECT No. V73218

RECORD OF BOREHOLE 2

LOCATION See Figure 1

BORING DATE NOVEMBER 1, 1973

DATUM TAKEN FROM COMINCO DRAWING NO. HB 285 P

BOREHOLE TYPE ROTARY TRICONE

BOREHOLE DIAMETER 4 IN

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES

PEN TEST HAMMER WEIGHT LB DROP INCHES

ELEVN DEPTH	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	BLOWS/FT.	ELEVATION SCALE	STANDPIPE INSTALLATION
2465.0 0.0'	GR. SURFACE					
	SOFT BROWN SANDY SILT WITH MED. & COARSE SAND & GRAVEL TO 1½" DIA. OFTEN TILL LIKE	1	2" DO	10	2460	WL 5.5' NOV 23, 1973
		2	2" DO	8		
		3	2" DO	13	2450	
		4	2" DO	4		
2438.6 26.4'	WOOD					
27.0'	SOFT TO FIRM STRATIFIED BROWN & GREY SILT WITH OCC. GRAVEL TO 1½" DIA.	5	2" DO	20	2440	
		6	2" DO			
2431.0 34.0'	SAND & GRAVEL				2430	
2429.0 36.0'	BEDROCK.	7	WS			
		8	WS		2420	
		9	WS			
		10	WS			
2410.0 55.0'	END OF HOLE.				2410	

DYNAMIC PENETRATION RESISTANCE BLOWS/FT

SHEAR STRENGTH C_u, LB/SQ FT

COEFFICIENT OF PERMEABILITY k, CM./SEC

WATER CONTENT, PERCENT W_P W W_L

ADDITIONAL LAB TESTING

15 ◇ 5 Percent axial strain at failure

VERTICAL SCALE 1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

2

DRAWN RMO

CHECKED

PROJECT No. V73218

RECORD OF BOREHOLE 3

LOCATION See Figure 1

BORING DATE NOVEMBER 1, 1973

DATUM TAKEN FROM COMINCO DRAWING NO. HB-285 P

BOREHOLE TYPE ROTARY TRICONE

BOREHOLE DIAMETER 4 IN.

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES

PEN. TEST HAMMER WEIGHT – LB DROP – INCHES

ELEVN / DEPTH	SOIL PROFILE – DESCRIPTION	STRAT PLOT	SAMPLES – NUMBER	SAMPLES – TYPE	SAMPLES – BLOWS/FT.	ELEVATION SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FT / SHEAR STRENGTH C_u, LB/SQ.FT	COEFFICIENT OF PERMEABILITY k, CM./SEC / WATER CONTENT, PERCENT W_P W W_L	ADDITIONAL LAB. TESTING	STANDPIPE INSTALLATION
2455.0 / 0.0'	GR. SURFACE.									
	VARIABLE DENSITY BROWN & GREY SILT SAND & GRAVEL		1	2" DO	>50	2450				
2448.0 / 7.0' / 8.0	WOODEN CULVERT									WL. 6.0' NOV 23, 1973
	VARIABLE DENSITY BROWN & GREY SILT WITH MED. & COARSE SAND & FINE GRAVEL.		2	2" DO	>100					
			3	2" DO	15	2440				
2435.0 / 20.0'	COMPACT BROWN & GREY SILT, SAND & GRAVEL (TILL)		4	2" DO	37					
2432.0 / 23.0										
2429.0 / 26.0'	VERY DENSE SAND & GRAVEL		5	2" DO	>100	2430				
			6	WS						
	BEDROCK.					2420				
			7	WS						
2410.0 / 45.0	END OF HOLE.					2410				

15 ○ 5 / 10 Percent axial strain at failure

VERTICAL SCALE
1 INCH TO 10 FEET

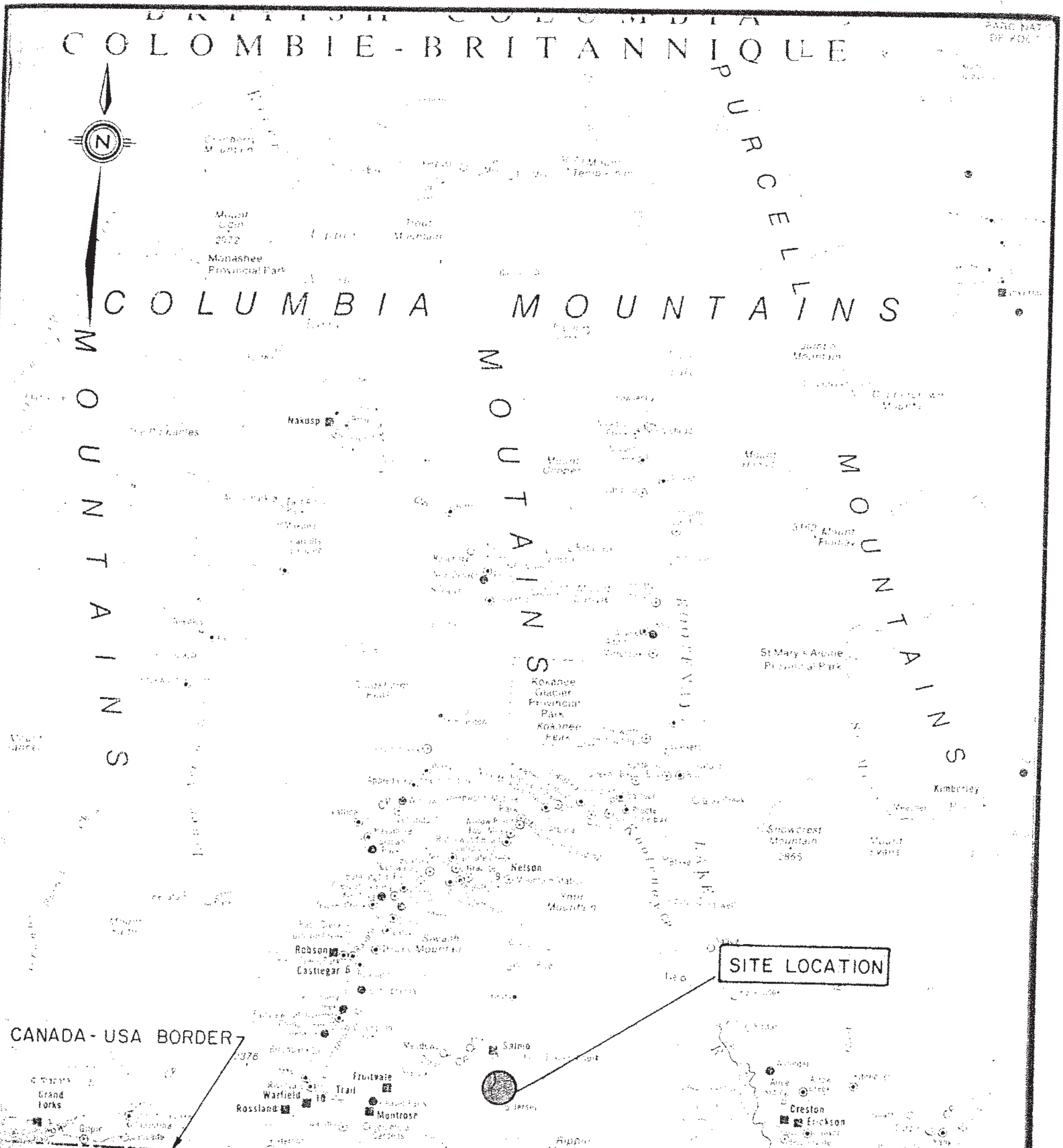
GOLDER, BRAWNER & ASSOCIATES

3

DRAWN
CHECKED

LIST OF DRAWINGS

A-2869-1	-	SITE LOCATION
B-2869-2	-	LOCATION OF TAILINGS DISPOSAL POND
B-2869-3	-	PLAN OF EXISTING TAILINGS POND
D-2869-4	-	PLAN AND SECTION OF EXISTING DAM
B-2869-5	-	SCHEMATIC PROFILE OF TAILINGS POND
B-2869-6	-	STABILITY ANALYSIS OF DAM
A-2869-7	-	WATER BALANCE



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REF.: CANADA GAZETTEER ATLAS, 1980.

SCALE 1 : 1 000 000

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT: HB MILL TAILINGS DISPOSAL

TITLE: SITE LOCATION

CLIENT: DAVID MINERALS LTD.

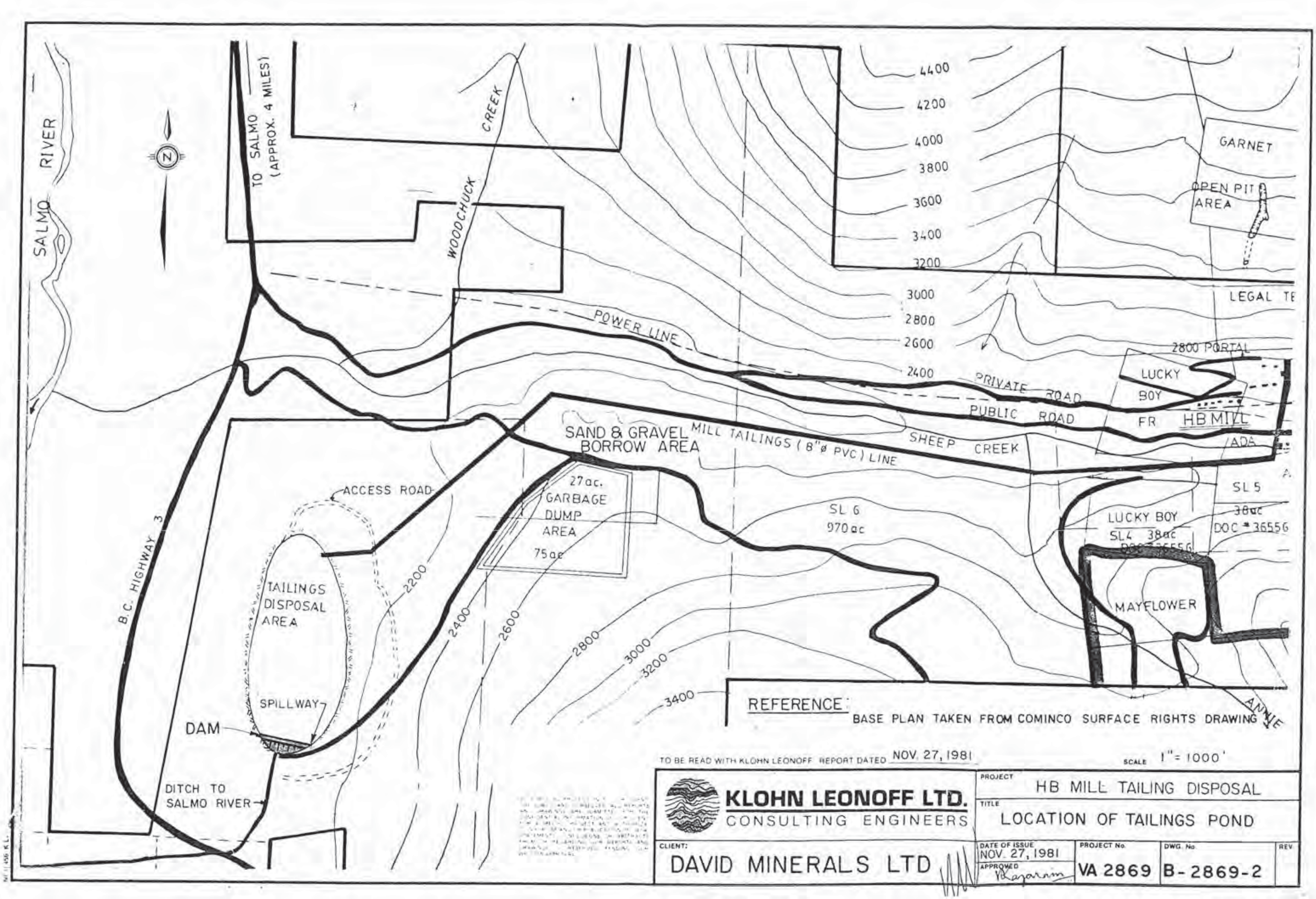
DATE OF ISSUE: NOV. 27, 1981

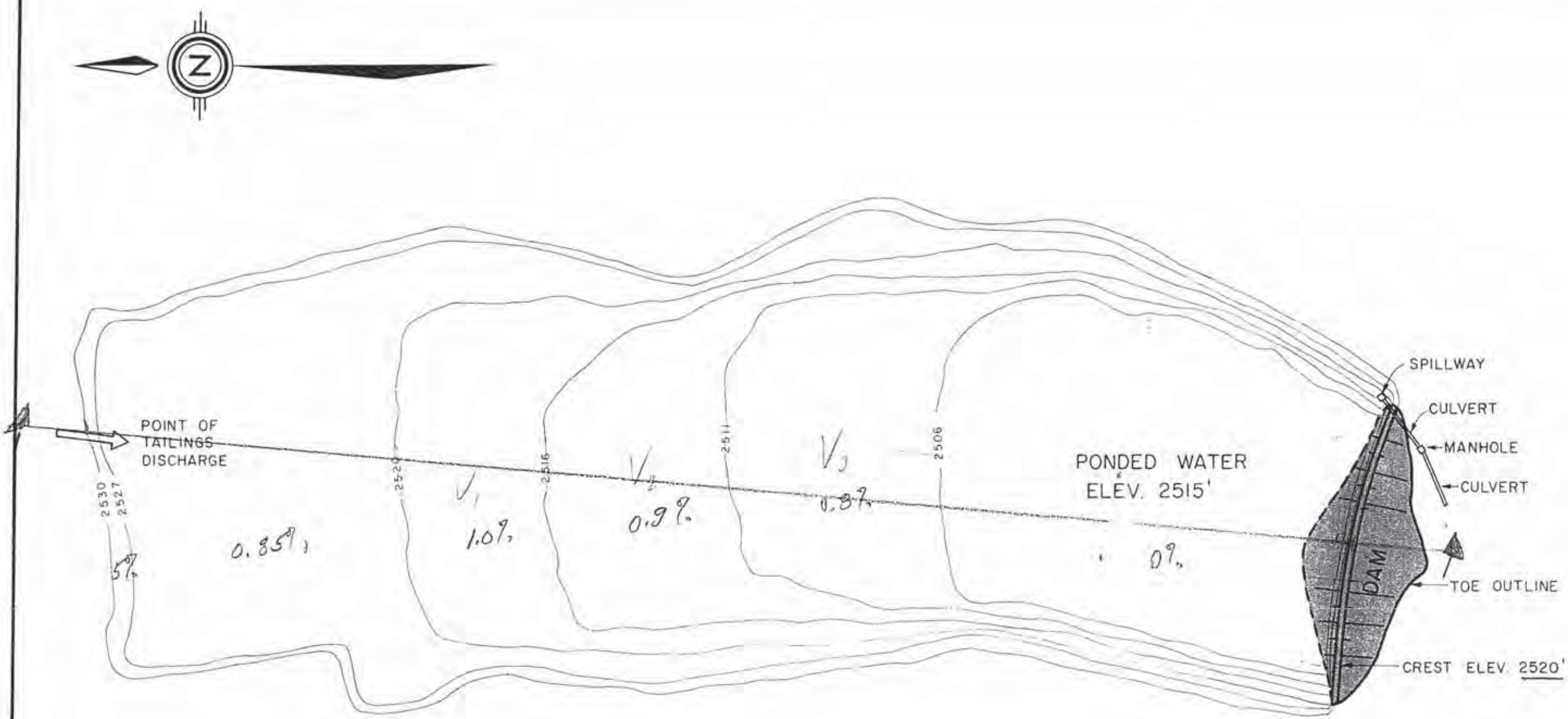
APPROVED

PROJECT No. VA 2869

DWG. No. A 2869 - 1

REV.


TO SALMO (APPROX. 4 MILES)
SALMO RIVER
WOODCHUCK CREEK
POWER LINE
PRIVATE ROAD
PUBLIC ROAD
SHEEP CREEK
SAND & GRAVEL BORROW AREA
MILL TAILINGS (8"ø PVC) LINE
ACCESS ROAD
27ac. GARBAGE DUMP AREA
75ac
SL 6 970ac
TAILINGS DISPOSAL AREA
B.C. HIGHWAY 3
SPILLWAY
DAM
DITCH TO SALMO RIVER
GARNET
OPEN PIT AREA
LEGAL TE
2800 PORTAL
LUCKY BOY
FR
HB MILL
ADA
SL 5
38ac
DOC # 36556
LUCKY BOY SL4 38ac
MAYFLOWER
ANNIE
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
REFERENCE: BASE PLAN TAKEN FROM COMINCO SURFACE RIGHTS DRAWING
TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981
SCALE 1" = 1000'
KLOHN LEONOFF LTD.
CONSULTING ENGINEERS
PROJECT HB MILL TAILING DISPOSAL
TITLE LOCATION OF TAILINGS POND
CLIENT: DAVID MINERALS LTD
DATE OF ISSUE NOV. 27, 1981
PROJECT No. VA 2869
DWG. No. B-2869-2
REV
APPROVED



NOTE

CONTOURS DRAWN FROM DATA OBTAINED FROM MR. NEWMAN OF COMINCO AND FROM MR. GIRDLER OF DAVID MINERALS LTD.

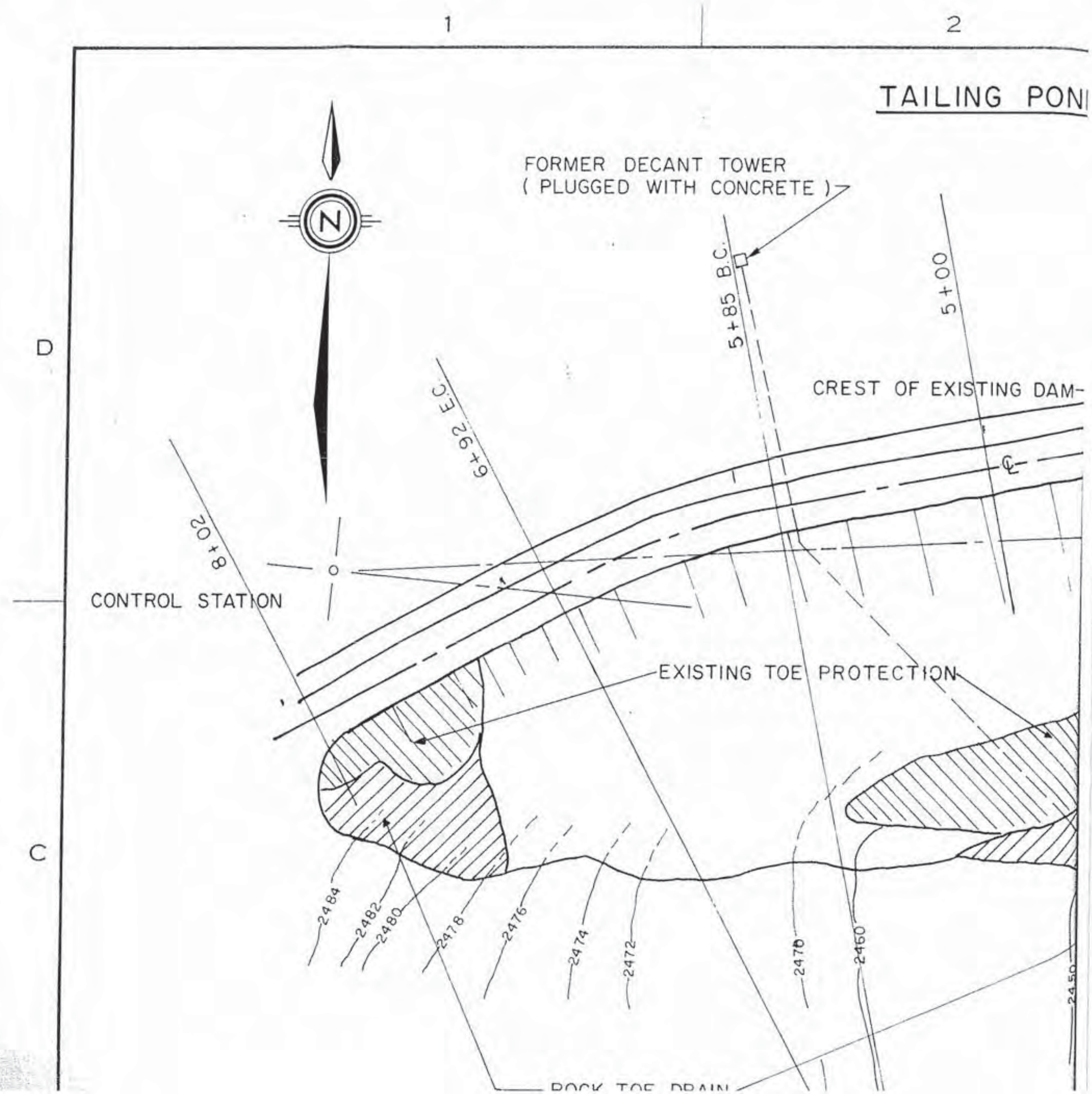
TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV 27, 1981

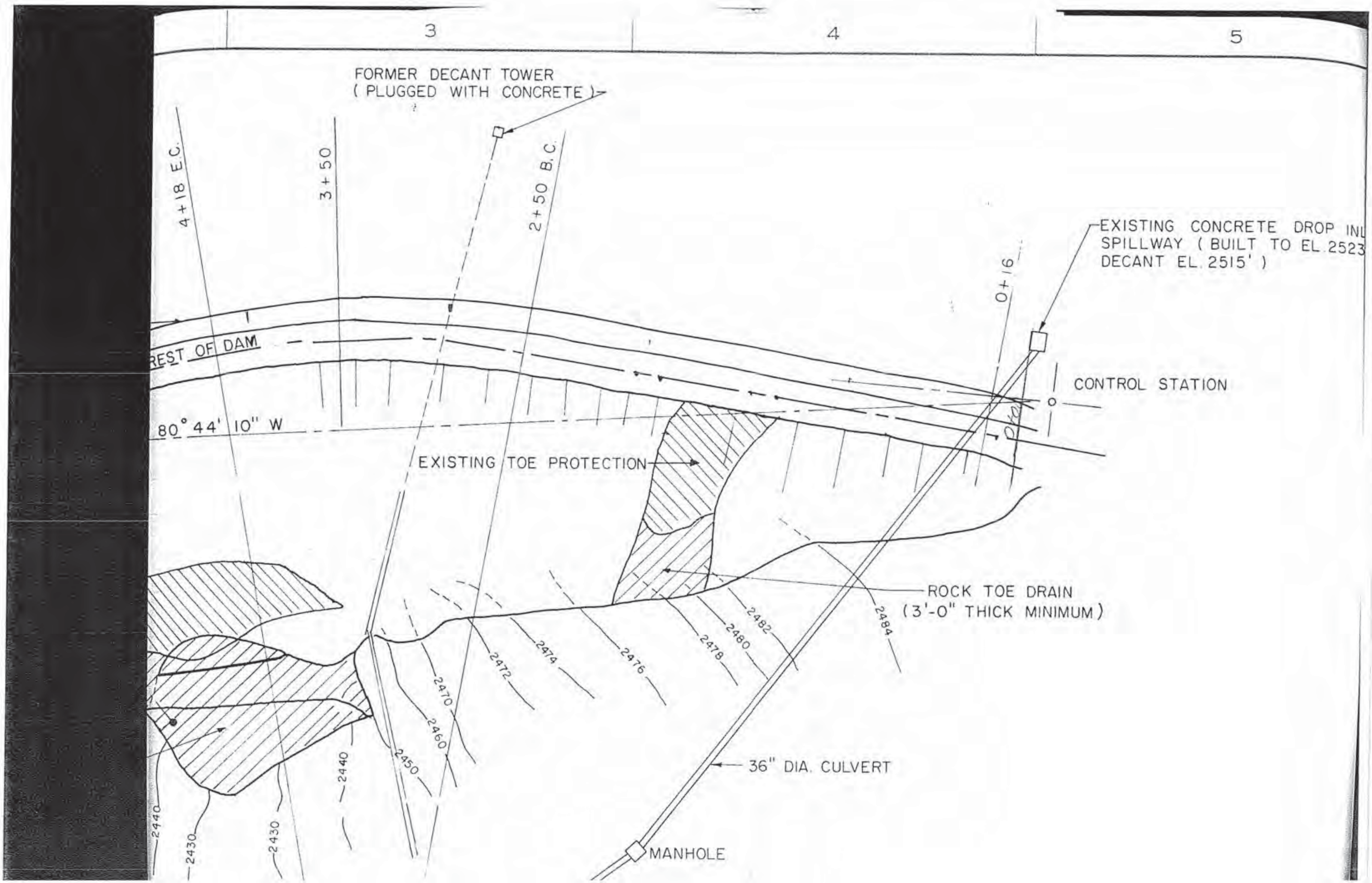
SCALE 1" = 300'

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT	HB MILL TAILINGS DISPOSAL
TITLE	TAILINGS SURFACE CONTOURS
CLIENT:	DAVID MINERALS LTD.
DATE OF ISSUE	NOV. 27, 1981
PROJECT No.	VA 2869
DWG. No.	B-2869-3
REV.	
APPROVED	

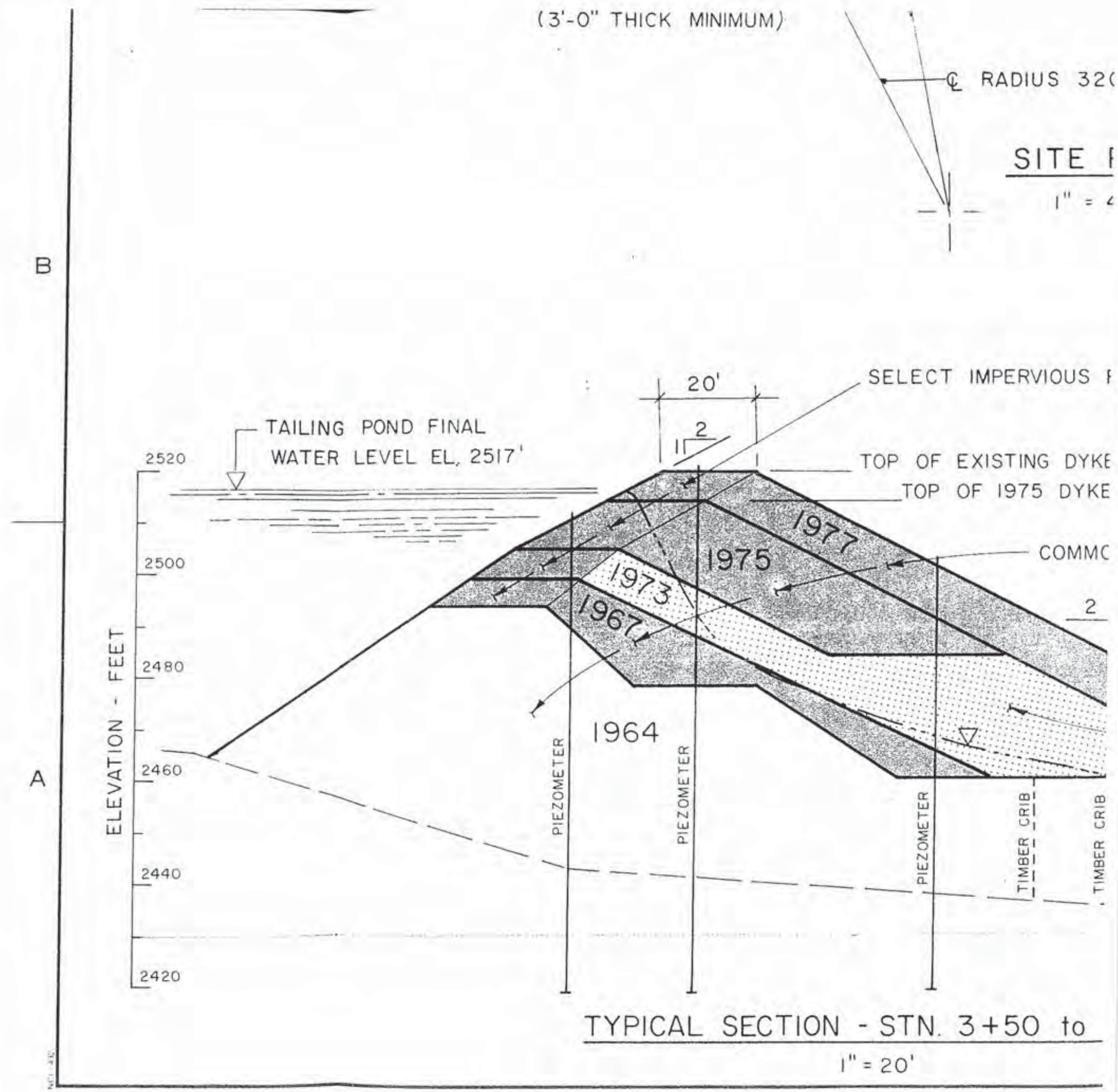
NCI-456-KL

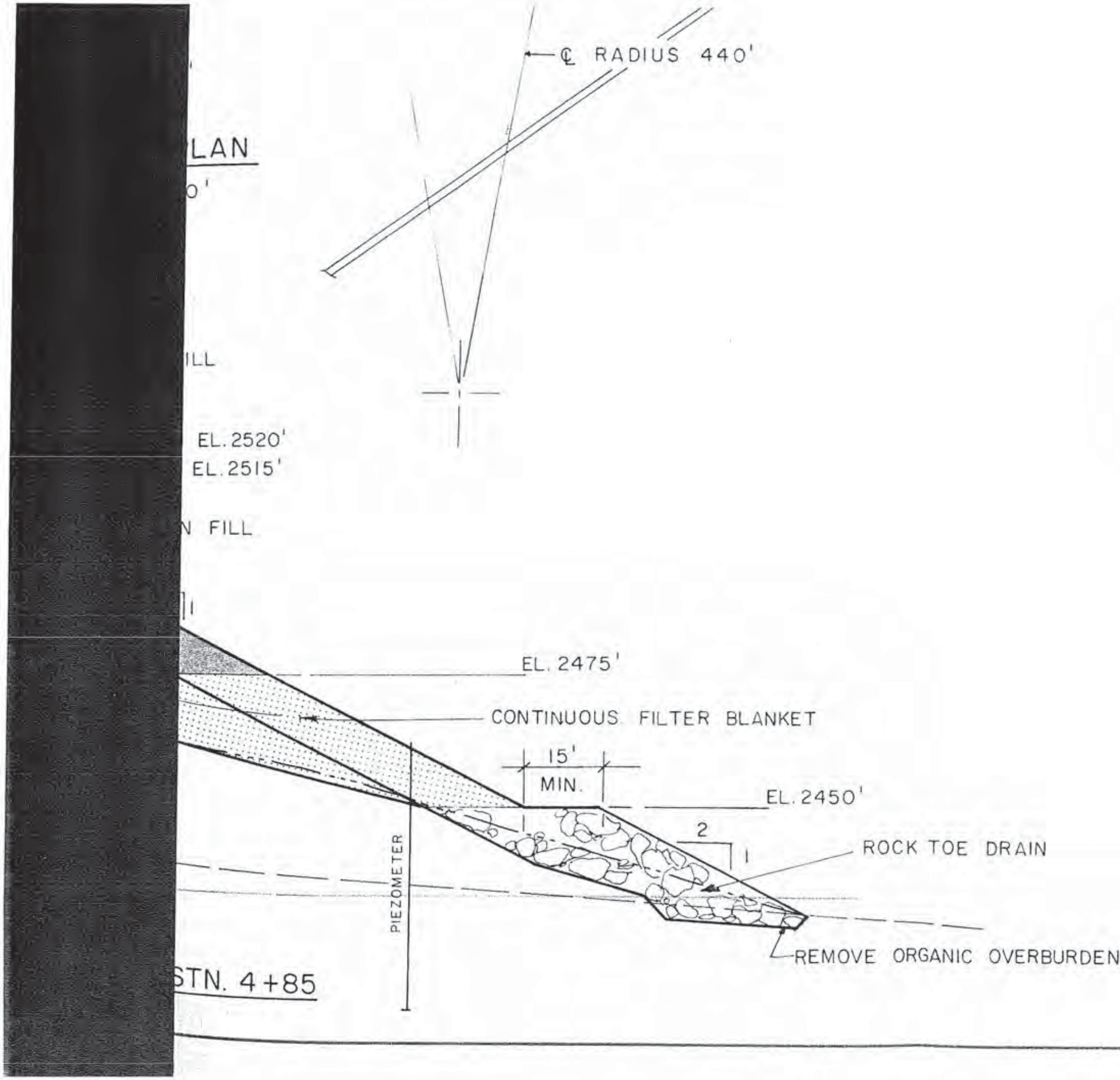

1
2
TAILING PON
FORMER DECANT TOWER
(PLUGGED WITH CONCRETE)
N
5+85 B.C.
5+00
D
CREST OF EXISTING DAM
6+92 E.C.
8+02
CONTROL STATION
EXISTING TOE PROTECTION
C
2484
2482
2480
2478
2476
2474
2472
2470
2460
2450
ROCK TOE DRAIN


3
4
5
FORMER DECANT TOWER
(PLUGGED WITH CONCRETE)
4+18 E.C.
3+50
2+50 B.C.
EXISTING CONCRETE DROP INL
SPILLWAY (BUILT TO EL. 2523
DECANT EL. 2515')
0+16
REST OF DAM
CONTROL STATION
80° 44' 10" W
EXISTING TOE PROTECTION
ROCK TOE DRAIN
(3'-0" THICK MINIMUM)
2484
2482
2480
2478
2476
2474
2472
2470
2460
2450
2440
2430
36" DIA. CULVERT
MANHOLE

6

ET


(3'-0" THICK MINIMUM)
℄ RADIUS 32(
SITE I
1" = 4
B
A
SELECT IMPERVIOUS I
20'
TAILING POND FINAL
WATER LEVEL EL. 2517'
2
1
TOP OF EXISTING DYKE
TOP OF 1975 DYKE
1977
1975
1973
1967
1964
COMMC
2
ELEVATION - FEET
2520
2500
2480
2460
2440
2420
PIEZOMETER
PIEZOMETER
PIEZOMETER
TIMBER CRIB
TIMBER CRIB
TYPICAL SECTION - STN. 3+50 to
1" = 20'



REFERENCE

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DWG. NO. HB 304 DATED

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TO BE READ WITH KLOHN LEONOFF R

SCALE: AS SHOW

KLOHN LI
CONSULTIN

CLIENT: DAVID MINE

MINCO ENGINEERING,
FEBRUARY 7, 1977.

ORT DATED NOV. 27, 1981

REV.	DATE	REVISION DETAILS

DESIGN	DRAWN	DATE	SCALES
COMINCO	S. S.	OCT., 1981	AS SHOWN

N

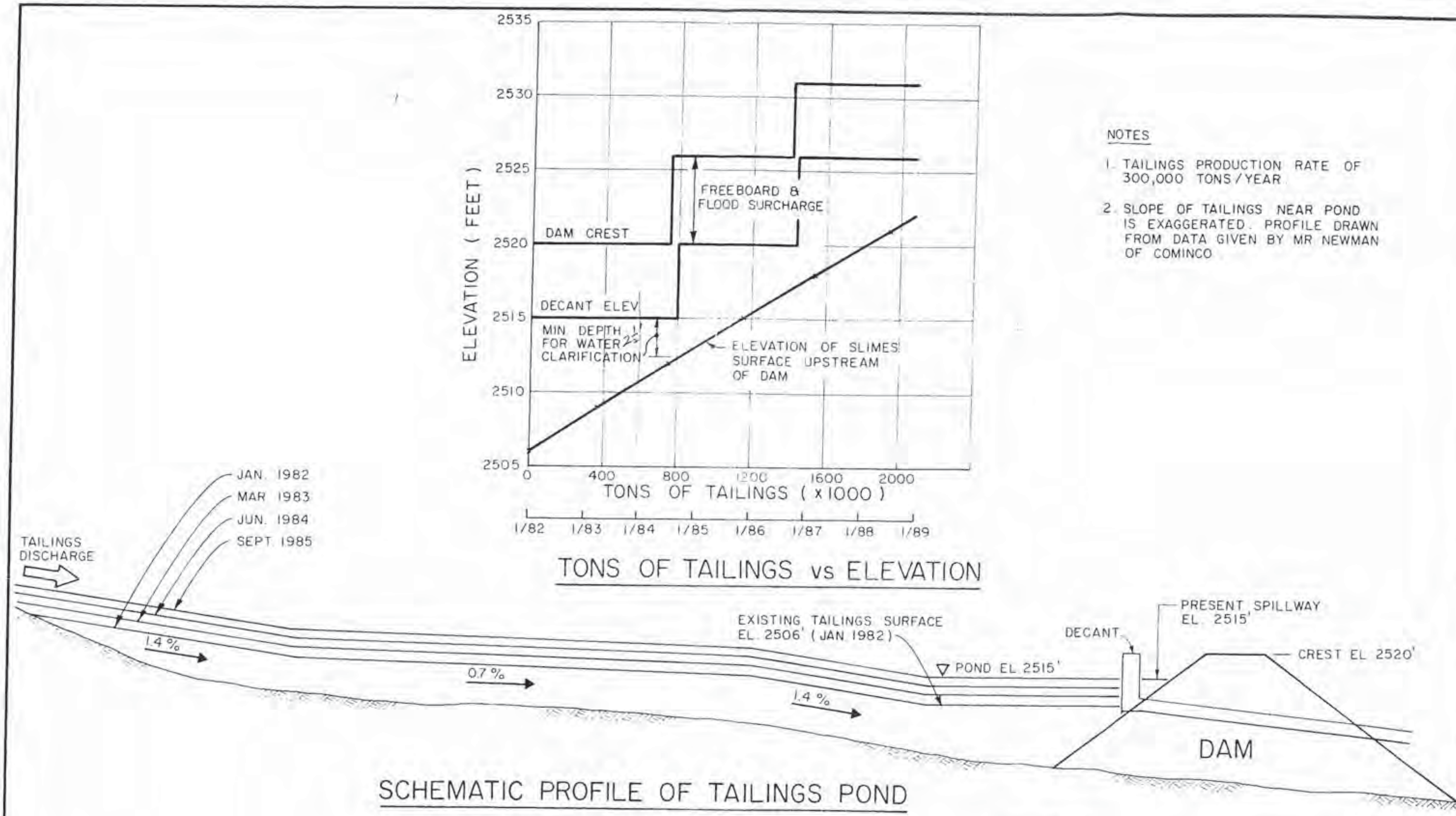
ONOFF LTD.
G ENGINEERS

PROJECT HB MILL TAILINGS DISPOSAL

TITLE PLAN AND SECTION OF EXISTING DAM

RALS LTD.

DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
NOV. 27, 1981	VA 2869	D-2869-4	
APPROVED			



TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981

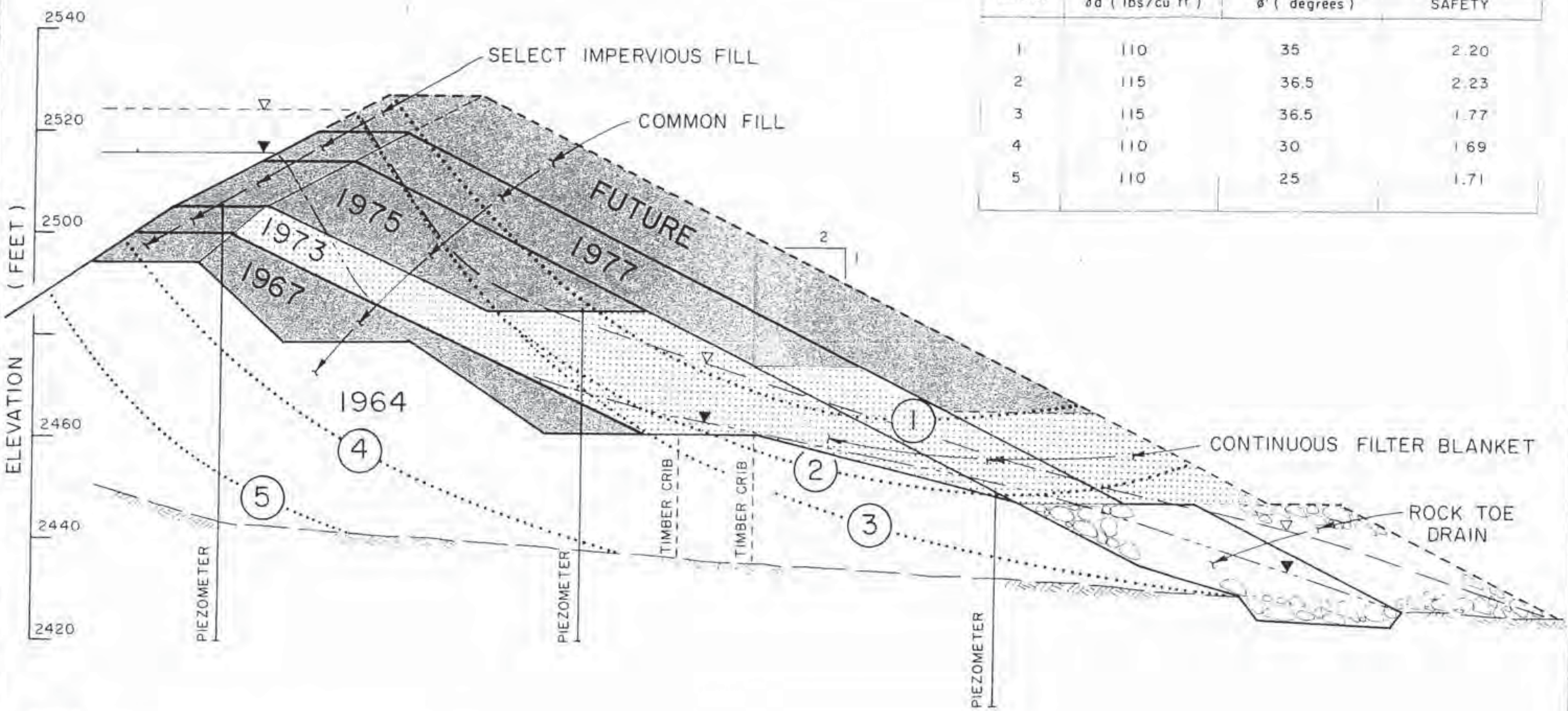
SCALE N.T.S.

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT	HB MILL TAILINGS DISPOSAL
TITLE	SCHEMATIC PROFILE OF TAILINGS POND
CLIENT:	DAVID MINERALS LTD.
DATE OF ISSUE	NOV. 27, 1981
PROJECT No.	VA 2869
DWG. No.	B-2869-5
REV.	

ASSUMPTIONS AND RESULTS OF ANALYSIS

CIRCLE	DRY DENSITY γd (lbs/cu ft)	FRICTION ANGLE ϕ' (degrees)	FACTOR OF SAFETY
1	110	35	2.20
2	115	36.5	2.23
3	115	36.5	1.77
4	110	30	1.69
5	110	25	1.71



NOTE

PIEZOMETERS INSTALLED BY GOLDER ASSOCIATES, 1973
THE TWO DOWNSTREAM PIEZOMETERS HAVE BEEN EXTENDED, AND A NEW PIEZOMETER HAS BEEN INSTALLED AT THE PRESENT DAM CREST.

TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981

SCALE 1" = 20'

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT: HB MILL TAILINGS DISPOSAL

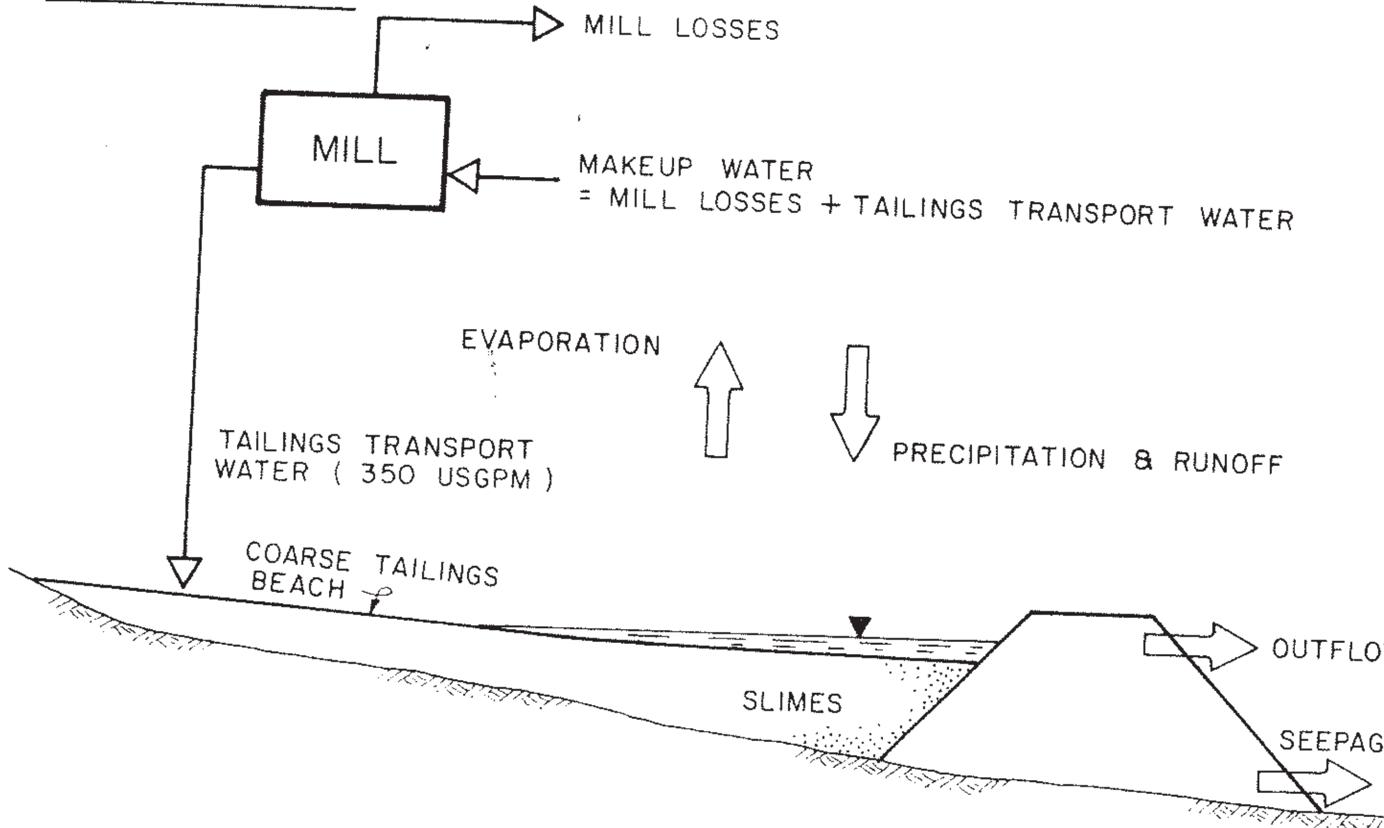
TITLE: STABILITY ANALYSIS

CLIENT: DAVID MINERALS LTD.

DATE OF ISSUE	PROJECT No.	DWG. No.	REV
NOV 27, 1981	VA 2869	B-2869-6	

APPROVED

900 T/day MILL



WATER BALANCE

INPUT (USGPM)	OUTPUT (USGPM)
350 gpm (TAILINGS WATER) 335 gpm (PRECIP. & RUNOFF)	50 gpm (VOIDS WATER) 20 gpm (EVAPORATION) 20 gpm (SEEPAGE) 595 gpm (OUTFLOW)
685 gpm (TOTAL)	685 gpm (TOTAL)

SCALE NTS

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

PROJECT: HB MILL TAILINGS DISPOSAL

TITLE: WATER BALANCE

CLIENT: DAVID MINERALS LTD.

DATE OF ISSUE: NOV. 27, 1981

PROJECT No.

DWG. No.

REV.

APPROVED

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED

CABLE ADDRESS "COMINCO"

DEPT. OF MINES
REC'D ... 1953
SUBJECT FILE 49-117
REFERRED TO

4266

H.B. Mine,
Salmo, B.C.,
March 31, 1953

Mr. J.A. Mitchell, Mining Engineer,
i/c Road and Trail Work,
Department of Mines,
Victoria, B.C.

Dear Sir:

In accord with Order in Council No. 967 approved April 25, 1952, in which the sum of $8,000.00 was authorized for the construction of the H.B. Mine road, I enclose details of expenditure and affidavit pertaining to these expenditures.

It will be noted that the total costs were $12,287.89 so that the departmental grant would only amount to $6,143.94.

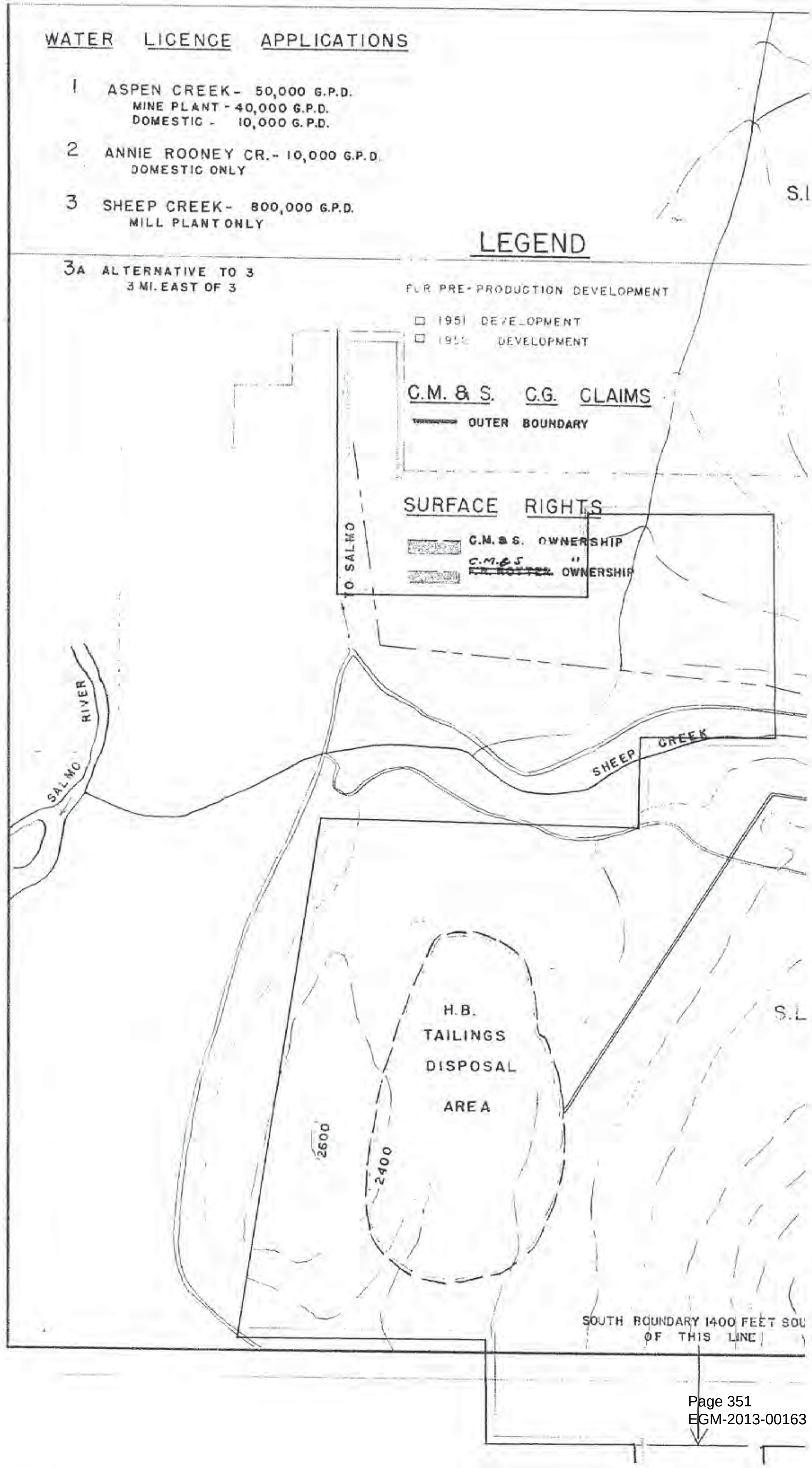
Thanking you for the interest you have shown in the development of our property, I am

Yours very truly,

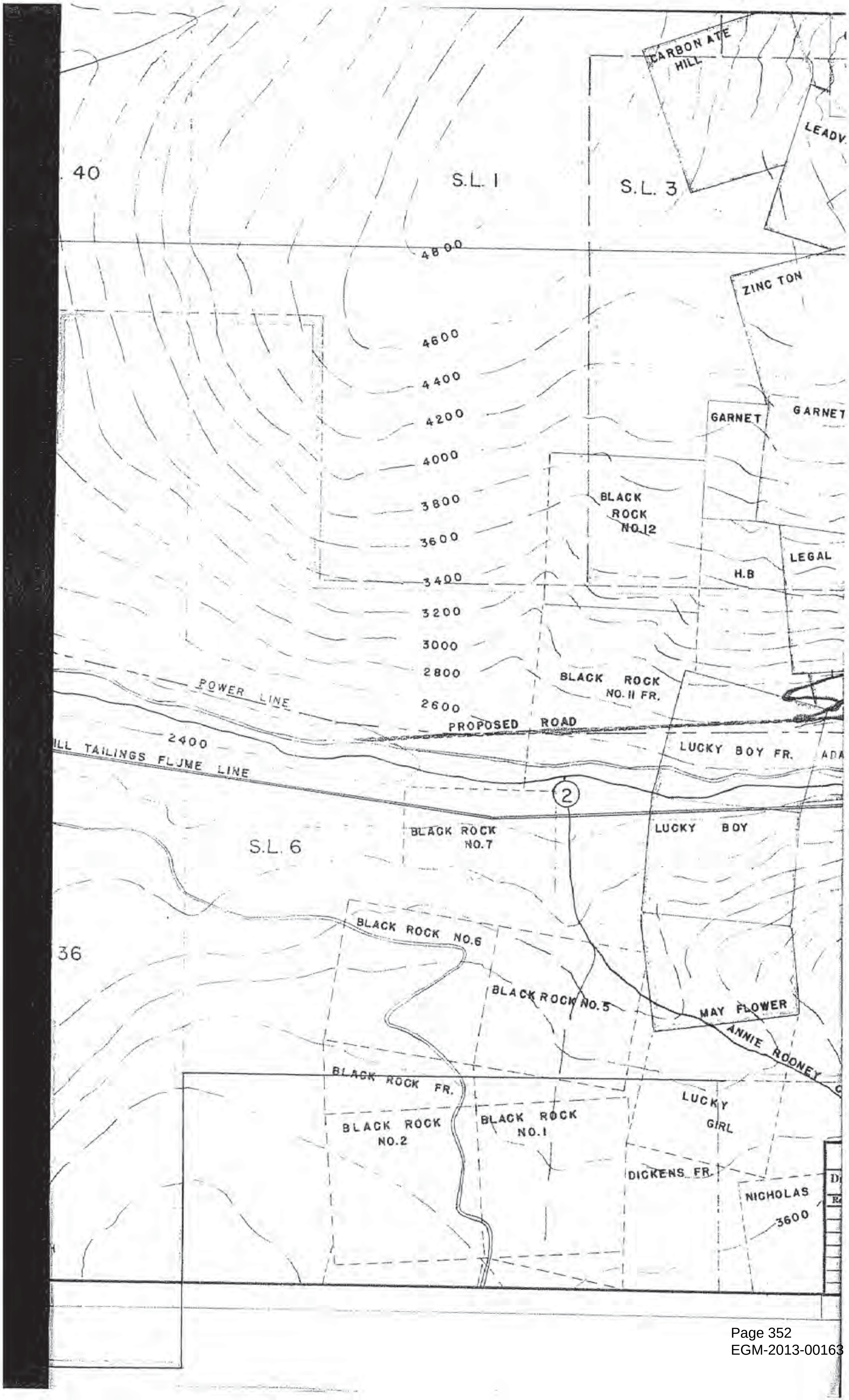
J.E. McMynn,
Property Superintendent.

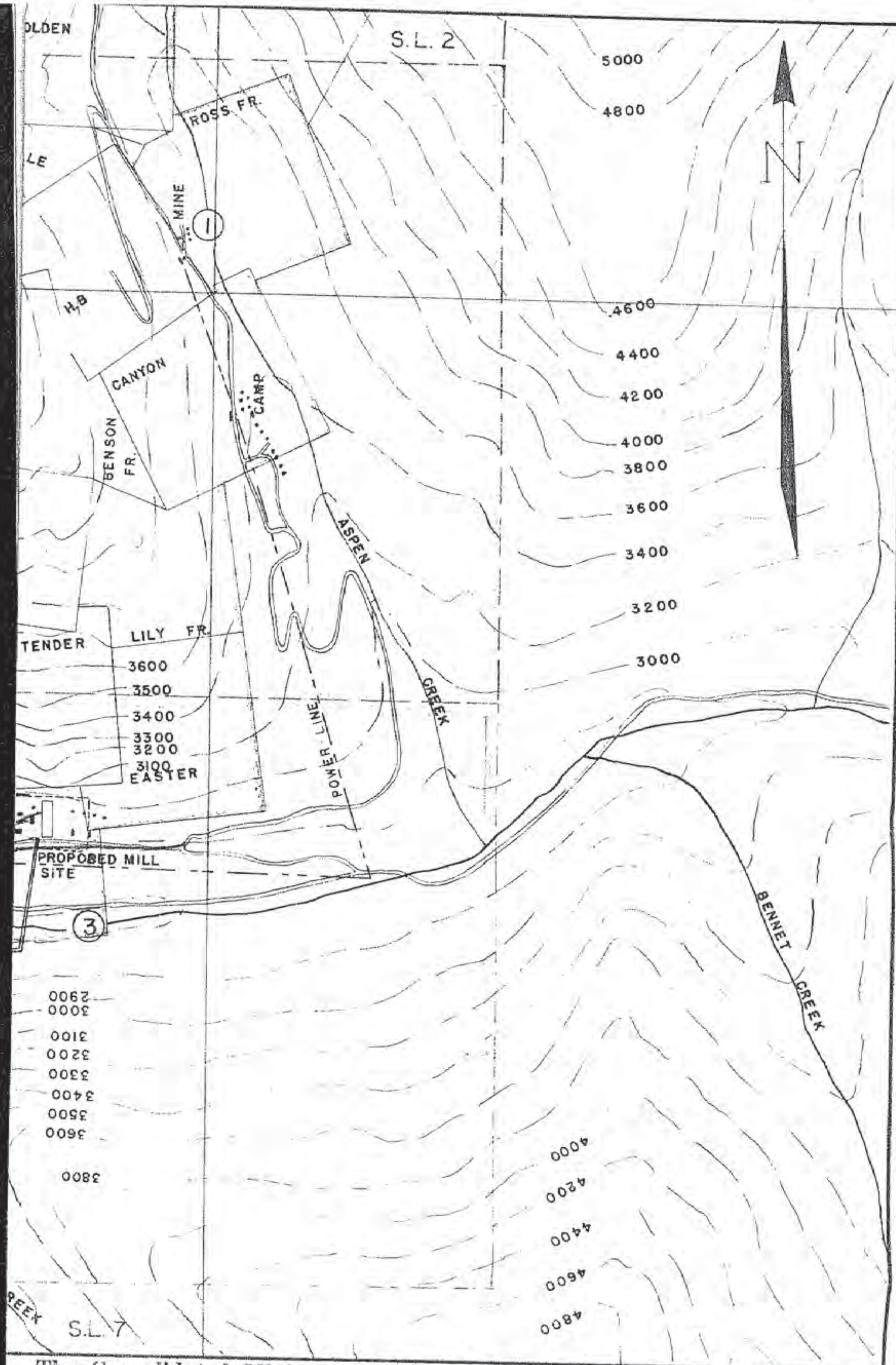
Enclosure

INITIAL ... C.I. C.A. RET.



WATER LICENCE APPLICATIONS
1 ASPEN CREEK - 50,000 G.P.D.
MINE PLANT - 40,000 G.P.D.
DOMESTIC - 10,000 G.P.D.
2 ANNIE ROONEY CR. - 10,000 G.P.D.
DOMESTIC ONLY
3 SHEEP CREEK - 800,000 G.P.D.
MILL PLANT ONLY
3A ALTERNATIVE TO 3
3 MI. EAST OF 3
LEGEND
FOR PRE-PRODUCTION DEVELOPMENT
1951 DEVELOPMENT
DEVELOPMENT
C.M. & S. C.G. CLAIMS
OUTER BOUNDARY
SURFACE RIGHTS
C.M. & S. OWNERSHIP
C.M.&S "
OWNERSHIP
TO SALMO
SALMO RIVER
SHEEP CREEK
S.L
H.B.
TAILINGS
DISPOSAL
AREA
2600
2400
SOUTH BOUNDARY 1400 FEET SOU
OF THIS LINE


CARBON ATE HILL
LEADV.
40
S.L. 1
S.L. 3
4800
ZINC TON
4600
4400
4200
GARNET
GARNET
4000
BLACK ROCK NO.12
3800
3600
LEGAL
H.B
3400
3200
3000
2800
BLACK ROCK NO. II FR.
POWER LINE
2600
PROPOSED ROAD
2400
ILL TAILINGS FLUME LINE
LUCKY BOY FR.
2
BLACK ROCK NO.7
LUCKY BOY
S.L. 6
BLACK ROCK NO.6
36
BLACK ROCK NO.5
MAY FLOWER
ANNIE ROONEY
BLACK ROCK FR.
LUCKY GIRL
BLACK ROCK NO.2
BLACK ROCK NO.1
DICKENS FR.
NICHOLAS
3600



The Consolidated Mining and Smelting Company of Canada, Limited

Drawn by: A.J.R.		Traced by:	
Revised by	Date	Revised by	Date

H.B. MINE
SURFACE PLANT
DISTRICT SERVICES AND WATER RIGHTS

Scale: 1" = 1000' | Date: DEC. 1950 | Plate:

Form 651

Pages 354 through 366 redacted for the following reasons:
- -
Not Responsive

COMINCO LTD.,

H.B. MINE TAILINGS DIKE EXTENSION

SPECIFICATION NO. HBO.010-1

FEBRUARY 1977 DUPLICATE #20

COMINCO LTD.

H.B. TAILING DIKE EXTENSION, 1977

INDEX

Pages	1 - 4	- Instructions to Tenderers
	5 - 7	- Form of Tender
	8 - 9	- Schedule of Quantities and Unit Prices
	10 - 12	- Form of Contract Agreement
	13 - 20	- General Conditions of Contract
	21 - 24	- Specification - Section 1 - Special Provisions
	25 - 40	- - Section 2 - Earthwork
		Drawings - Figure 1 HBO-304 - Rev. 0

GRIT
1037

Specification No. HBO.010-1

COMINCO LTD.

H.B. TAILING DIKE EXTENSION, 1977

INSTRUCTIONS TO TENDERERS

FORM OF TENDER

SCHEDULE OF QUANTITIES & UNIT PRICES

FORM OF CONTRACT AGREEMENT

GENERAL CONDITIONS OF CONTRACT

SPECIFICATION

DRAWINGS

Prepared by

Cominco Ltd.

February, 1977

INSTRUCTIONS TO TENDERERS

COMINCO LTD.

H.B. TAILING DIKE EXTENSION, 1977

INSTRUCTIONS TO TENDERERS

1. Tenders for the construction of H.B. Tailing Dike Extension, 1977 will be received by Cominco Ltd. until twelve noon, Pacific Standard Time, March 10, 1977.

2. The tender shall be submitted in duplicate to:

   Cominco Ltd.
   Attention: W. W. Thom, Assistant Purchasing Agent
   Trail, B. C.

   upon the official form of tender marked "Original" and on the form marked "Copy No. 1" and shall include the instruction to tenderers, all statements attached to the tender, the general conditions, the schedule of quantities and unit prices, the specifications and the drawings, bound together in the condition in which they were issued. The Tenderer shall not remove any page from the documents.

3. One copy of the tender, marked "Copy No. 2" shall be retained by the Tenderer.

   Should there be any discrepancy between the original tender and the copies, the original shall prevail.

4. The contract for which a tender is made in accordance with these instructions is a schedule of quantities and unit prices contract. The Tenderer shall complete the original and the additional two (2) forms of tender. He shall insert the unit price and amount for each item in the schedule of quantities and prices, and shall total these amounts so as to show the total sum of the tender.

5. All prices shall be firm prices, quoted in Canadian dollars, and shall include all applicable taxes.

6. Each item in the schedule of quantities and prices shall, in the judgement of the Engineer, be reasonably priced. Under no circumstances will a manifestly unbalanced tender be considered.

INSTRUCTIONS TO TENDERERS

7. No oral, telegraphic or telephonic proposals or modifications will be considered, and no tender will be accepted or considered that contains an escalator clause or any other qualifying condition.

8. Tenders shall be made without any connection, comparison of figures, or arrangement with or knowledge of any other person or persons making a tender for the same work and shall be, in all respects, fair and without collusion or fraud.

9. The signatures of all Tenderers shall be in their respective hand-writing, or if the Tenderer is a corporation, the tender shall be executed under its corporate seal.

10. The Tenderer is invited to inspect the site prior to submitting his tender in order to satisfy himself by personal examination as to the actual conditions and requirements of the work and as to the accuracy of the quantities in the schedule of quantities and prices.

11. The Tenderer shall not claim at any time after submission of his tender, or the subsequent execution of a contract, that there was any misunderstanding in regard to conditions imposed by the contract. If, during inspection of the site or at any other time before submission of his tender, the Tenderer notes facts or conditions which in any way conflict with the letter or spirit of the specification, or with any other data furnished to him, he shall apply to the Engineer for information and explanation before submitting his tender. The Tenderer will be held entirely responsible for any errors which he may make through failure to obtain such information and explanation or through any other cause.

12. The Tenderer shall be prepared to enter into a contract agreement as attached.

13. Tender shall be accompanied by a bid bond in an amount not less than 5% of the tender price, issued by a Surety Company properly licensed to carry on such business in Canada. The Tenderer may submit a certified cheque in lieu of the bid bond, and the said cheque shall be subject to the provisions stated in the Form of Tender.

INSTRUCTIONS TO TENDERERS

14. Complete compliance with the tender documents is mandatory. Tenders not complying with these provisions will be disqualified.

15. Subject to the foregoing, the Tenderer may submit alternative plans or specifications for the work for consideration.

16. Tenders received after the time stated in Clause 1 above will not be considered.

17. The Owner reserves the right to reject any or all tenders and the lowest bid will not necessarily be accepted.

18. All recipients of the documents for the proposed contract, whether or not they submit a tender, shall treat the details of the documents as private and confidential.

19. The work shall be completed not later than November 1, 1977.

FORM OF TENDER

COPY NO. 1

Specification No. HBO.010-1

COMINCO LTD.

H.B. TAILING DIKE EXTENSION, 1977

FORM OF TENDER

Tender by ______________________________,
of ______________________________,
a Company duly incorporated under the laws of ______________,
and licensed to carry on business in the Province of ______________,
and having its head office at ______________________,
hereinafter called the Tenderer.

To: Cominco Ltd.
Trail, B. C.

Having examined the Instructions to Tenderers, Form of Tender, Schedule of Quantities and Unit Prices, Form of Contract, General Conditions of Contract, Specification and Drawings, for the construction of the above-named work, the undersigned Tenderer hereby tenders and offers under and subject to the annexed Instruction to Tenders to construct, complete and maintain the said work in conformity with the said drawings, General Conditions of Contract and Specification for and at the unit prices set out in the annexed schedule of quantities and unit prices and by the date specified in Clause 19 of the Instructions to Tenderers.

The lump sum total of prices set out in the schedule of prices is

____

______________________(Canadian Dollars)($______________________).

The Tenderer also undertakes to enter into a contract incorporating said Instructions to Tenderers, Form of Tender, Schedule of Quantities and Unit Prices, Form of Contract, General Conditions of Contract, Specification and Drawings, and the Tenderer hereby agrees that until such contract is executed, the said Instructions to Tenderers, Form of Tender, Schedule of Quantities and Unit Prices, Form of Contract, General Conditions of Contract, Specification and Drawings and this tender together with your written acceptance thereof shall constitute a binding contract between us.

FORM OF TENDER

The Tenderer agrees that this tender shall continue open to acceptance and irrevocable until the formal contract is executed by the successful Tenderer for the said work, and the bond hereinafter mentioned is executed by the approved surety; and that Cominco Ltd. may, at any time within one hundred and twenty (120) days of the closing date for tenders, accept this tender without notice, whether any other tender has previously been accepted or not, and whether notice of acceptance of another tender has been given or not. The Tenderer encloses herewith as bid bond, in accordance with the provisions of the Instructions to Tenderers, a bid bond or certified cheque for the sum of ______________________________

______________________________(Canadian Dollars)($).

The Tenderer agrees that in the event that this tender is accepted and the Tenderer fails to execute a contract in the respect thereof, then the Company shall enforce the provision of the said bid bond or confiscate the said certified cheque, at the discretion of the Company.

IN WITNESS WHEREOF ______________________________

has executed these presents this ________ day of ______________, 197__.

SEALED with the Corporate Seal of)

______________________________)

______________________________)

And attested by its proper officers in)
that behalf.)   per______________________________

SCHEDULE OF QUANTITIES AND UNIT PRICES

Specification No. HBO.010-1

COMINCO LTD.

H.B. TAILING DIKE EXTENSION, 1977

SCHEDULE OF QUANTITIES AND UNIT PRICES

Item No.	Work or Material	Estimated Quantity	Unit	Tender Unit Price	Amount
1.	Clearing	2.5	acres		
2.	Stripping	4,000	cu.yd.		
3.	Foundation Preparation	10,000	sq.yd.		
4.	Unsuitable Materials	5,000	cu.yd.		
5.	Trim Existing Dike	1,500	cu.yd.		
6.	Drainage Zone - Sand and Gravel	3,000	cu.yd.		
7.	Drainage Zone - Rock Toe	1,800	cu.yd.		
8.	Select Impervious and Common Fill	18,000	cu.yd.		
9.	Decant Culverts	60	lin.ft.		
10.	Borrow Pit Treatment	12,000	sq.yd.		

It is understood and agreed that the quantities stated herein are approximate only and are given for the purpose of providing a uniform basis for the comparison of tenders. Payment will be made only on the quantities as actually determined on final measurements.

Tenderer ____________________

____

____

____

FORM OF CONTRACT AGREEMENT

CONTRACT AGREEMENT

THIS AGREEMENT made this day of in the year by and between COMINCO LTD. herein called the "Owner and herein called the "Contractor".

WITNESSETH: That the Contractor and the Owner undertake and agree as follows:

ARTICLE 1.

The Contractor shall:

(i) Provide all necessary materials, labour, supervision, and equipment and perform all work, and fulfill everything as set forth and in strict accordance with the Contract for the project entitled "H.B. Tailing Dike Extension, 1977".

(ii) Commence to actively proceed with the work within seven (7) days of the date of receipt of a Notice to Proceed from the Owner and complete same on or before November 1, 1977.

ARTICLE 2.

The Owner will pay to the Contractor as full compensation for the performance of the work and fulfillment of this Contract, the sum or sums of money calculated in accordance with the terms of the Contract.

ARTICLE 3.

The Contract shall supersede all communications, negotiations and agreements, either written or verbal, made between the parties hereto in respect of all matters in any way pertaining thereto prior to the execution and delivery hereof.

ARTICLE 4.

All communications in writing between the parties or between them and the Engineer shall be deemed to have been received by the addressee if delivered to the individual, or to any officer of the corporation for whom they are intended, or if sent by mail or by telegram addressed as follows:

CONTRACT AGREEMENT

The Contractor at:

The Owner at: Cominco Ltd.
Trail, British Columbia
V1R 4L8

Attention: Manager, Engineering

ARTICLE 5.

Time shall be of the essence of the Contract.

ARTICLE 6.

The Contract shall enure to the benefit of and be binding upon the parties, their respective successors, administrators and assigns.

IN WITNESS WHEREOF the parties hereto have executed this Agreement as of the day and year first above written.

Contractor:

Per: ______________________________

Cominco Ltd.

Per: ______________________________

GENERAL CONDITIONS OF CONTRACT

GENERAL CONDITIONS OF CONTRACT

1. As used herein and elsewhere in the Contract, unless the content requires a contrary meaning:

1.1 The words "The Contract" shall mean the written Agreement, the Instructions to Tenderers, the Form of Tender, the Schedule of Quantities and Unit Prices, the General Conditions of Contract, the Specification, the Drawings Figure 1 and HB-304 - Rev. 0 and the purchase order to be issued to the Contractor by the Owner, copies of all of which are annexed hereto and form part hereof, all of which shall be read together and shall constitute the entire Agreement between the parties relating to the work and its performance.

1.2 The words "The Engineer" shall mean and include the person holding the position or acting in the capacity of Project Superintendent, H.B. Tailing Dike Extension - 1977, appointed by the Owner to be responsible for the supervision of the work and includes any other person or persons designated by the Owner as Engineer for the purposes of the Contract.

1.3 The word "Materials" shall mean all machinery, tools, plant, materials, equipment, articles and things furnished by the Contractor and required for the execution of the Contract.

1.4 The words "The Work" shall mean and include all or any part of the work to be executed by the Contractor pursuant to the Contract, whether complete or incomplete, and as may be originally set forth or as varied by the Engineer.

2. The Contractor shall execute and perform all the labour of every kind and shall supply all material required in the construction and finishing of the work.

3. The Engineer shall be the sole judge of the work and material in respect of both quality and quantity, and his decision on all questions in dispute with regard thereto, or as to the meaning or intention of this Contract and as to the meaning or interpretation

GENERAL CONDITIONS OF CONTRACT

of the plans, drawings and specifications shall be final, and no work under this Contract shall be deemed to have been performed, nor materials or things provided, so as to entitle the Contractor to payment therefore, unless and until the Engineer is satisfied therewith, as evidenced by his estimates in writing, which estimate shall be a condition precedent to the right of the Contractor to be paid therefore. The work shall, in every particular, be under and subject to the control of the Engineer, and all orders, directions and instructions at any time given by the Engineer with respect thereto, or respecting the conduct thereof, shall be obeyed by the Contractor and promptly and efficiently performed and complied with to the satisfaction of the Engineer.

4. All work shall be done in a neat and workmanlike manner and according to instructions by the Engineer and the Contractor shall allow the Engineer or the Owner free access to the work and shall furnish full information concerning the work when requested by the Engineer or the Owner.

The Contractor and every one of its workmen, sub-contractors, agents and servants, shall in all things concerning the performance of the work obey, abide by and keep all the several conditions set forth herein and shall construct and execute the works in accordance with the Contract and to the satisfaction of the Engineer.

5. The Contractor shall submit progress payment invoices to the Owner by the 5th of the month for work performed in the preceding month. Payment for invoices shall be made 30 days after receipt of the invoice. Invoices shall be sent in triplicate to Senior Buyer, Cominco Ltd., Trail, British Columbia. The volume of material is to be approved by the Engineer prior to submission of invoice.

The Owner will pay 85% of the invoice amount each month. The 15% holdback will be paid forty (40) days after the work has been completed, in compliance with the Mechanic's Lien Act. The Engineer will certify that the work has been completed to the Owner's satisfaction. The Owner shall be entitled to retain from any payment otherwise payable to the Contractor a sum sufficient in the opinion of the Engineer to provide for payment of all claims against the Contractor of any kind arising out of the work and which have not been settled. Before the issuance of the certificate indicating that the work has been completed to the Owner's satisfaction, the Contractor shall submit to the Owner's Engineer in charge evidence satisfactory to him that all payrolls and bills for materials and other indebtedness connected with the work have been paid.

GENERAL CONDITIONS OF CONTRACT

The compensation herein provided shall constitute full payment for the work indicated, completed and in place, including the furnishing of all materials, tools, machinery, equipment, labour and work incidental thereto as well as any and all expenses incurred by reason of any cause whatever.

The quantities given in the Schedule of Quantities and Unit Prices are approximate only. Final payment to the Contractor will be made for the actual quantities only of work performed or materials furnished in accordance with the Contract as determined by measurements made by the Engineer. It is agreed that the quantities or work to be done or materials to be furnished may be altered by the Owner and such alterations shall not be considered as a waiver of any condition of the Contract, or as invalidating any of the provisions thereof, nor shall any changes be made in the Contract unit prices on account of such alterations, but the same unit prices shall apply as if no alteration had been made.

6. If the contractor suspends the construction of the work, or neglects or fails to proceed with due diligence in the performance of same, the Engineer shall have the right to give notice in writing to the Contractor requiring that the work be proceeded with in a reasonable manner and with reasonable dispatch. Such notice shall not be unreasonably given, and must signify that it purports to be a notice under the provisions of this paragraph, and must specify the act or default on the part of the Contractor upon which it is based. After such notice has been given, the Contractor shall not be at liberty to remove from the site of the work or from any ground contiguous thereto, any plant or materials belonging to it; and the Owner shall have a lien upon all such plant and materials, to subsist from the date of such notice being given until the notice has been complied with: Provided always that such lien shall not under any circumstances subsist after the expiration of thirty-one (31) days from the date of such notice being given unless the Owner shall have entered upon and taken possession of the works and the site of the work as hereinafter provided. If the Contractor fails for seven (7) days after such notice has been given to proceed with the work as therein demanded, the Owner may enter upon and take possession of the work and the said site and all plant and materials thereon (or on any ground contiguous thereto) belonging to the Contractor and intended to be used in connection with the construction of the work, and all such materials shall thereupon become the property of the Owner absolutely, and the Owner shall retain and hold a lien upon all such plant until the work shall have been completed under the powers hereinafter conferred upon him. If the Owner exercises the above power he may engage any other person to complete the work, and exclude the

GENERAL CONDITIONS OF CONTRACT

Contractor, his agents and servants, from entering upon and having access to the same, except that the Contractor or any one person nominated by him may have access at all reasonable times to inspect, survey and measure the work. The Owner shall take such steps as may be reasonably necessary for completing the work, using for that purpose the plant and materials above mentioned insofar as they are suitable and adapted to such use. Upon completion of the work, the Owner shall certify the amount of the expenses properly incurred consequent on and incidental to the default of the Contractor aforesaid and in completing the work by itself or by employing other persons. Should the amount of such expenses so certified be less than the amount which would be owing to the Contractor under this Agreement had it completed its obligations hereunder, the differences shall be paid to the Contractor by the Owner: should the amount of the former exceed the latter, the difference shall be paid by the Contractor to the Owner. The Owner shall not be liable to make any payment or compensation to the Contractor for or on account of the use of the said plant for the completion of the work under the provisions hereinbefore contained. After the work has been so completed by either the Owner or persons other than the Contractor under the provisions hereinbefore contained, the Owner shall give notice to the Contractor of such completion, and may require the Contractor from time to time before and after such completion to remove from the said site his plant and all such materials as aforesaid as may not have been used in the completion of the work. If such plant and materials are not removed within a reasonable time after notice has been given, the Owner may remove and sell the same, holding the proceeds, less the cost of removal and sale, to the credit of the Contractor.

7. The Contractor shall furnish all labour and superintendence required to complete the work in accordance with the Contract, but shall not employ on the works any unfit person or anyone not skilled in the work assigned to him. All labour shall be performed in the best and most workmanlike manner by persons skilled in their respective trades. The standards of work throughout shall be of such grade as will bring results of the first class only.

8. The Contractor shall be responsible for faulty materials supplied by it and faulty workmanship, and shall remedy same at its own expense.

9.1 The Contractor shall provide, maintain, and pay for Comprehensive General Liability Insurance covering it, its sub-contractors and the Owner against damages arising from personal injury (including death) and from claims for property damage which may arise out of its or its sub-contractors' operations under this contract. Such insurance shall:

GENERAL CONDITIONS OF CONTRACT

(i) Have a limit of liability of not less than $500,000 inclusive for any one occurrence or such greater amount as may, at the discretion of the Owner, be required.

(ii) Cover all liability arising out of products, either the Contractor's or supplied by him, completed operations, contingent employer's liability and liability assumed by the Contractor under this Contract.

9.2 The Contractor shall also provide, maintain and pay for automobile insurance on its own vehicles and non-owned automobile insurance on vehicles not owned by it protecting itself and the Owner against damages arising from personal injury (including death) and from claims for property damage arising out of the use or operation of same. Limits of liability under such policies will be placed in accordance with paragraph 9.1 (1) (i) hereof.

Evidence of insurance, in such form as may be required, shall be lodged with Insurance and Risk Manager, Cominco Ltd., Vancouver, B. C., before the work is commenced.

10. The Contractor shall be responsible for all loss or damage to the work including materials delivered to site for incorporation therein and any materials supplied by the Owner.

11. Neither the final certificate nor payment thereunder, nor payment of the final balance payable pursuant to the Contract, nor any provision in the Contract shall relieve the Contractor from responsibility for faulty materials or workmanship, which appear within a period of one year from the date of completion of the works, and the Contractor shall remedy any defects due thereto which appear within the said period and pay for all resulting damage. The Owner shall give notice of observed defects promptly.

12. The Contractor shall not assign this Agreement, or subcontract the work, without first obtaining the written permission of the Owner. If, with the Owner's permission the work or any part of it is done by a sub-contractor, the Contractor shall be fully responsible to the Owner for the acts and omissions of such sub-contractor and of all persons employed by him.

GENERAL CONDITIONS OF CONTRACT

13. The Contractor shall commence the work within the time provided in the Contract Agreement and shall continue with the same uninterruptedly and with diligence, with the required crew of workmen.

14. It is agreed that the Contractor enters into this Agreement as an independent contractor and in no sense is to be considered as an agent or employee of the Owner.

15. The Contractor shall save the Owner harmless from and idemnify him against all claims, demands, actions and suits arising out of or in connection with the construction of the work, whether such actions are brought by members of the public or workmen employed on the work. The Contractor shall, in carrying out the work, conform to all laws, rules, regulations and conditions applicable to the Contractor and to the work, and shall give all notices prescribed thereby and shall keep his employees covered and pay all assessments levied under, and shall keep his employees covered and pay all assessments levied under, and shall in every respect comply with, the applicable Workmen's Compensation Laws.

16. The Owner, or the Engineer, without invalidating the Contract, may make changes by altering, adding to, or deducting from the work, the amount to be paid pursuant to the contract sum being adjusted accordingly. All such work shall be executed under the conditions of the Contract except that any claim for extension or reduction of time caused thereby shall be adjusted at the time of ordering such change. No change shall be made unless in pursuance of a written order from the Engineer and no claim by the Contractor for compensation for any such change sum shall be valid unless so ordered and at the same time valued or agreed to be valued as provided in Paragraph 17.

17. The value of any change shall be determined in one or more of the following ways, prior to proceeding with the change:

(a) By estimate and acceptance in a lump sum.

(b) By unit prices agreed upon.

(c) By cost and percentage or by cost and a fixed fee.

GENERAL CONDITIONS OF CONTRACT

18. No implied contract of any kind whatsoever by or on behalf of the Owner shall arise or be implied from anything contained in this Contract or from any position or situation of the parties at any time, it being understood and agreed that the express contracts, convenants, and agreements contained herein and made by the parties hereto are and shall be the only contracts, convenants, and agreements on which any rights against the Owner may be founded.

19. In the case of any dispute arising between the Owner (or the Engineer acting on his behalf) and the Contractor as to their respective rights and obligations under the Contract, either party hereto shall be entitled to give to the other notice of such dispute and to request arbitration thereof: and the parties shall, with respect to the particular matters then in dispute, agree to submit the same to arbitration in accordance with the applicable law of the place of building.

Arbitration proceedings shall not take place until after the completion or alleged completion of the work except (a) on a question of certificate for payment, or (b) in a case where either party can show that the matter in dispute is of such nature as to require immediate consideration while evidence is available.

20. The Owner shall have the right to require the Contractor to furnish a bond covering the faithful performance of the Contract including the corrections after completion provided for in Paragraph 20 and the payment of all obligations arising under the Contract, in such form as the Engineer may prescribe and with such sureties as he may approve. If such bond is required by written instructions given previous to the receipt of bids, the premium shall be paid by the Contractor; if subsequent thereto, it shall be paid by the Owner.

SPECIFICATION

Specification No. HBO.010-1

SPECIFICATION

SECTION 1

SPECIAL PROVISIONS

1-01 LOCATION

The site of the H.B. Tailing Dike is located four and one half miles south of Salmo, B. C., one half mile south of Sheep Creek and about one mile east of Provincial Highway No. 3.

1-02 ACCESS TO SITE

Access to the site is by two lane gravel road towards the Canex Mine from Highway No. 3 immediately south of Sheep Creek. An unimproved single lane bush road starting three quarters of a mile north of Highway No. 3 leads one mile south to the tailings dike.

1-03 SCOPE OF THE WORK

Except as otherwise specified, the work described in this specification comprises the furnishings of labour, materials, transportation, tools, equipment, supplies, supervision, and all other things necessary for the construction of the H.B. Tailing Dike Extension, 1977, all in accordance with the Contract.

1-04 DRAWINGS

The following drawings are hereby incorporated in this specification:

Figure 1
Drawing: HB-304 - Rev. 0

1-05 AVAILABILITY OF BUILDING MATERIALS

It is proposed to use select impervious and common materials from an extension towards the southeast of the existing borrow pit at the east abutment.

SPECIAL PROVISIONS

The material for the filter blanket and berm will come from the existing borrow pit located approximately one quarter mile east of the turn-off to the dike on the Canex Road.

The material for the rock fill toe will come from the mine waste dump at the Canex Mine.

1-06 SITE INVESTIGATION

The extension is to be built on the backslope and top of the existing dike. Seepage is apparent in several locations on the backslope and the Contractor shall place the filter blanket over these wet areas as specified herein before crossing these areas with equipment. It may be necessary to thicken the blanket in the area of haul roads to avoid disturbance of the foundations in the seepage areas.

A geotechnical report by Golder Brawner & Associates Ltd. dated December, 1976, has been made available to the Contractor. Further geotechnical information may be issued from time to time and will be available to the Contractor. Details on geotechnical information gathered before and during the construction of the existing dike will be available to the Contractor upon request. No warranty or representation is made with respect to the accuracy of such information.

The Contractor must make its own deductions and conclusions as to the nature of the materials available, the difficulties of making and maintaining the required work and of doing other work affected by site conditions and must accept full responsibility therefor.

1-07 STORAGE

The Contractor shall, to the approval of the Engineer, erect within the working areas assigned to it, buildings and other facilities necessary for the safe storage of materials and equipment.

1-08 CONTRACTOR'S CAMP

Contractor shall be responsible for supplying his own accommodation.

SPECIAL PROVISIONS

1-09 WATER SUPPLY

The Contractor shall, to the approval of the Engineer, make all necessary arrangements for the supply of water needed for all purposes at the site.

1-10 COMMUNICATIONS

The Contractor shall be responsible for providing his own communications.

1-11 SEWAGE DISPOSAL AND SANITATION

The Contractor shall, to the approval of the Engineer, provide and maintain adequate toilet facilities at the site and no pollution shall result from these installations.

1-12 FIRE PRECAUTIONS

The Contractor shall provide all necessary precautions against fire and shall rigidly comply with all laws, rules and regulations relating thereto.

In the event of fire, the Contractor will be required to fight the fire to the full limit of its available manpower and equipment. If a fire is caused by an act or omission on the part of the Contractor it shall bear all costs incurred in fighting it, including those of the Owner.

1-13 DECANT WATER

The Contractor is advised that water from the tailings pond is decanted beneath the dike. It shall be the responsibility of the Contractor to select a method of construction that will in no way impair the discharge of the decant water.

SPECIFICATION

SECTION 2

EARTHWORK

2-01 SCOPE

The work covered in this section includes all earthwork, clearing and development of borrow pits, establishment and maintenance of access and haulroads, dewatering and extending of the decant discharge culverts necessary for the fulfillment of the contract.

2-02 GENERAL ARRANGEMENTS

All excavation, fill placing and other construction work shall be completed to the lines, elevations and sections shown on the drawings or directed by the Engineer.

Fill material shall be obtained from borrow areas suggested in Section 1 hereof or from other locations which may be located and developed during the course of construction and as approved by the Engineer. Approval by the Engineer of a source of fill material shall not be construed as constituting approval of all materials to be taken from that source.

2-03 CLEARING

The work to be done under this Clause shall comprise the supply of all labour, material and plant and the performance of all work necessary for clearing of the site as shown on the drawings, as required by the Engineer and as specified herein.

Clearing shall consist of cutting and disposing of all trees, shrubs, brush, debris and all other perishable materials, including fallen trees and logs within the areas to be cleared.

All trees, shrubs and brush shall be cut to within two inches above the ground surface. The organic cover of topsoil on the ground surface shall be left intact, except where excavation is required as stated in these documents.

All vegetation and debris resulting from clearing operations regardless of size, shall be removed from the areas cleared, and shall be disposed of by the following methods, upon written approval of the Engineer.

EARTHWORK

(a) Combustible materials may be piled and burned on open fires as specified herein. Material to be disposed of in this way shall be completely burned so that it is all reduced to ashes.

(b) Materials obtained from clearing which cannot be burned may be placed in nearby disposal areas as directed by the Engineer. The material placed in disposal areas shall be crushed with a tractor or other heavy equipment to a thickness of not more than five feet. The material shall be covered with mineral soil obtained from the borrowing operation compacted to a thickness of not less than two feet.

The Contractor shall be responsible for any damage done by fire resulting from the work under this item and shall at no time leave a fire unattended until it is fully extinguished. All burning shall be done in strict conformance with the rules and regulations of local, provincial, and federal agencies and it shall be the responsibility of Contractor to obtain all burning permits.

Sufficient equipment shall be ready and available together with a sufficient force of men to control burning operations at any time.

Measurement for payment for clearing will be made of the number of acres cleared in accorcance with these specifications, measured to the nearest 1/10 acre as the projection onto a horizontal plane.

Payment for clearing will be made at the unit price per acre bid in the Schedule of Quantities and Unit Prices.

2-04 STRIPPING

The work to be done under this Clause shall comprise the supply of all labour, material and plant for the performance of all work necessary for the stripping of organic materials in order to expose underlying mineral soils in the borrow areas and new dike foundation areas as shown on the drawings and as specified by the Engineer.

The stripped material shall be stockpiled in nearby areas under the direction of the Engineer.

Payment for stripping will be made at the unit price per cubic yard shown in the Schedule of Quantities and Unit Prices.

Measurement shall be by cross-section, measured before and after construction in the borrow pit and new dike foundations.

EARTHWORK

2-05 FOUNDATION PREPARATION

The work to be done under this item shall comprise the supply of all labour, material and plant for the performance of all work necessary for the preparation of the foundations for the dike as shown on the drawings, as specified herein and as required by the Engineer.

Foundation preparation shall be scheduled such that the appropriate fill material may be placed shortly thereafter. No fill material shall be placed on any part of the foundation area until each part of the foundation has been approved by the Engineer.

Foundation preparation shall include the removal of any coarse rock or boulders that are laying where construction is to take place. The coarse rock and boulders shall be removed to ensure a good contact between the new and the existing work. The coarse rock may be removed by bulldozing the rock off the crest and down the downstream slopes so that the remaining rock protruding above the general surface is not larger than six inches in size.

If necessary, the Engineer may require that the foundation surface be moistened or dried prior to compaction, and scarified, moistened or dried prior to placing of the fill material to create a satisfactory bond between the foundation and the fill materials.

The foundation surface shall be compacted by four complete passes of compaction equipment as specified herein. Pockets of poor or unsuitable materials, which during this operation cannot be satisfactorily compacted, shall be excavated to the limits ordered by the Engineer.

Unsuitable materials excavated and disposed of when ordered by the Engineer shall be measured by cross-sectioning the area to be excavated before and after removal. Payment will be made at the unit price bid for "Unsuitable Material" in the Schedule of Quantities and Unit Prices.

Foundations soils which become soft due to inadequate control of surface or subsurface water, or for any other reason become unacceptable due to the Contractor's operations, shall be removed and replaced with fill material and compacted as specified herein at no additional expense to the Owner.

The placing of fill will not be permitted on foundation soils which are frozen. The removal of any frozen foundation soils shall be accomplished at no additional expense to the Owner.

EARTHWORK

Measurement for payment for the preparation of the foundations will be made of the actual prepared surface area, projected onto a horizontal plane, measured in square yards, prepared as specified herein, with no allowance made for irregularities.

Payment for the preparation of the foundation soil complete in every respect and as specified herein, will be made at the unit price per square yard bid in the Schedule of Quantities and Unit Prices.

2-06 TRIM EXISTING DIKE

In order to provide sufficient working width where the existing dike was overbuilt during previous construction, this extra material shall be incorporated into the new work.

As the new fill is placed, the extra fill is to be progressively cut from the existing embankment back to the original neat line and mixed into the new fill to produce a homogeneous material within the specifications for the zone being constructed.

Care shall be taken that no excavation shall go into the dike beyond the existing neat line as shown on the drawing and as shown in the field by the Combined Survey Crew.

Payment for this work shall bear the unit price per cubic yard bid in the Schedule of Quantities and Unit Prices and shall cover all costs to carry out the work.

Measurement shall be by cross section back to the existing neat line.

2-07 DRAINAGE ZONE

(a) Scope of Work

The work to be carried out under this item shall comprise the supply of all labour, material, plant, equipment, fuel and the performance of all work necessary to prepare, develop, excavate, load, haul, rehandle if necessary, place, compact, upgrade the existing haul road, maintain, leave in good condition and any other operations necessary to carry out the work as required by the Engineer.

(b) Fill Material

(1.) Sand and Gravel

This material is a clean sand and gravel or clean gravel

EARTHWORK

and cobbles, the gradation of which lies within the shaded envelope shown on Figure 1. Material in this size range is available about 1-1/2 miles from the dike.

Cobbles and boulders larger than nine inches shall be removed from all fill prior to compaction.

All fill material shall be free of organic materials, roots, and other perishable materials. No fill material shall contain ice or snow, or shall be placed in a frozen condition.

(2.) Rock Toe

This material is an igneous rock to be selected from the waste pile at the Canex Mine located approximately six miles from the dike.

The rock shall be well graded within a size range of 3/4 inch to 12 inches with very few fines.

The material shall be free of organics, roots, ice or snow or other deletrious materials.

The material shall be placed in layers not exceeding 18 inches in thickness and be compacted by at least four passes of the grid-roller specified in Paragraph 2-07 (e).

Payment for this material shall be at the unit price per cubic yard bid in the Schedule of Quantities and Unit Prices and shall cover all costs to carry out the work.

Measurement shall be by cross-section from the existing ground contours to the neat line.

2-07 (c) Borrow Operations

Fill materials shall be obtained from the borrow area as indicated in the Tender Documents and as approved by the Engineer. Approval by the Engineer of a source of fill material shall not be construed as constituting approval of all materials to be taken from that source.

The Contractor shall conduct its operations in borrow areas in such a manner which shall ensure that the maximum possible volume of suitable construction material may be obtained. Measures shall be taken to ensure adequate drainage of water from the borrow areas so that the borrow material is obtained at a water content suitable for compaction and so that the borrow operations are not affected adversely. Ponding and infiltration of water shall be prevented.

Some of the material in the borrow areas may be frozen. The Contractor shall conduct its operations in such a manner to ensure that the frozen material shall be thawed prior to placement in the dikes. To meet this requirement the Contractor shall open and work as large an area of the borrow areas practical, and shall rip, scarify, disc, harrow or use any other similar means to expose the frozen material to permit thawing.

The detailed planning of the operation of the borrow area shall be the responsibility of the Contractor and shall be subject to the approval of the Engineer.

Prior to commencement of the work, the Contractor shall submit for approval by the Engineer, a plan showing the details of its proposed methods and the sequence and schedule of operations to be followed for the utilization of the borrow area to obtain the required fill material. During construction the plan shall be reviewed and modified as required. A copy of the modified plan and schedule shall be provided for the Engineer's approval prior to implementation of any changes.

Unsuitable material shall be disposed of as directed by the Engineer and graded off to present a reasonably uniform appearance.

The Contractor shall be responsible at all times for the safe operation of the borrow area. All slopes left permanently exposed shall be approved by the Engineer.

2.07 (d) Haul Roads

Approval by the Engineer of any proposed haul roads shall be obtained before commencing construction of the haul roads.

All haul roads built and maintained by the Contractor shall be available, without charge, for use by the Engineer and by others authorized by the Engineer, and at completion of the Contract, shall become the property of the Owner.

2-07 (e) Compaction Equipment

The Drainage Zone shall be compacted with a grid-roller towed by a suitable tractor. The grid-roller shall be a Hyster

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Model D with concrete ballast weighing approximately 13 tons, or an alternative approved by the Engineer.

Power tampers for compaction near structures shall weigh not less than 200 pounds and shall have a ramming foot area not exceeding 80 square inches. The rammer shall be capable of delivering at least 200 foot pounds of compacting energy per blow.

2-07 (f) Placing and Compacting

No fill material shall be placed in any section of the dike until the foundation soil for that section has been suitably prepared according to the requirements of these specifications.

Placing of fill material shall be directed at obtaining a stable and a reasonably homogeneous fill. The fill material shall be spread in approximately horizontal layers of uniform thickness by bulldozers or other approved means. If necessary, discing, harrowing, or other approved means shall be employed to break up the material and to blend it before compaction.

The thickness of sand and gravel layers shall not exceed twelve inches before compaction.

The fill shall be placed in such a way that the top surface of any section, along the axis of the dike, shall remain approximately level. During spreading and compaction, a slope towards the downstream toe shall be maintained on the fill surface providing a transverse grade not exceeding ten percent so that water from precipitation will drain. In order that the effect of precipitation on placed fill be minimized, the surface shall be rolled smooth, and adequate drainage shall be provided prior to periods of precipitation when operations must be suspended.

Care shall be maintained so that the mixing of the Drainage Zones and Common Fill is not allowed to take place. Each zone shall be kept clearly separate.

All openings through the dike for construction purposes shall be subject to the Engineer's approval. The slope of openings left through dikes and at the end of any unfinished section shall not be steeper than four horizontal to one vertical.

The water content of the fill prior to and during compaction shall be distributed uniformly throughout each layer. The water content shall be maintained within the range required to obtain the specified soil density during compaction.

Each layer of fill of "Drainage Zone - Sand and Gravel" shall be compacted by at least four complete coverages of the compaction equipment as specified in paragraph 2-07 (e). Additional coverages with the compaction equipment shall be made if necessary to ensure the fill materials are compacted to a dry density at least equal to 95% of the laboratory maximum dry density as determined from the Proctor compaction tests as specified in ASTM D698.

No separate payment will be made for compaction, watering or drying of the fill.

Overbuilding or underbuilding shall be remedied at the Contractor's expense to the satisfaction of the Engineer.

2-07 (g) Measurement and Payment for "Drainage Zone - Sand and Gravel"

The unit price tendered for "Drainage Zone" shall include all costs to complete the work as described in Section 2-07, and as detailed elsewhere in the Tender Documents. A free-haul distance of two miles is to be included in the tender price for the item "Drainage Zone - Sand and Gravel."

The unit of measure is the cubic yard and is the volume measured in place on the dike by cross-sectioning before and after the placement and compaction of the drainage zone.

All measurements for payment purposes shall be carried out by a survey crew as laid out in Paragraph 2-11. Measurement will be made to the theoretical neat lines where a zone is built to or beyond the theoretical neat line. Measurement will be made to the actual surface where the surface of a zone is not built out to the theoretical neat line. Payment for all work carried out under this Section and completed in all respects will be the product of the volume measured and the unit price tendered for "Drainage Zone."

2-08 SELECT IMPERVIOUS AND COMMON FILL

2.08 (a) Scope of Work

The work to be carried out under this item shall comprise the supply of all labour, material and plant, fuel and the performance of all work necessary to prepare and maintain

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borrow areas and haul roads, rip, excavate, load, transport, dump, spread and compact fill material for the tailings dikes as shown on the drawings, as required by the Engineer and as specified herein.

2-08 (b) Fill Material

Select impervious fill shall be a glacial till, well graded with a maximum size of 9 inches and with at least 20% finer than the No. 200 U.S. Standard sieve size.

Common fill shall be a glacial till, well graded with a maximum size of nine inches.

Both select impervious fill and common fill must be of a gradation and moisture content that allows them to be placed and adequately compacted as specified herein.

All fill shall be free of organic materials, roots, and other perishable materials. No fill material shall contain ice or snow, or shall be placed in a frozen condition.

Cobbles and boulders larger than nine inches shall be removed from all fill prior to compaction.

2-08 (c) Borrow Areas

Fill material shall be obtained from the borrow areas near the east abutment of the existing dike and as approved by the Engineer. Approval by the Engineer of a source of fill material shall not be construed as constituting approval of all materials to be taken from that source.

2-08 (d) Borrow Operations

The Contractor shall conduct its operations in borrow areas in such a manner which shall ensure that the maximum possible volume of suitable construction material may be obtained. Measures shall be taken to ensure adequate drainage of water from the borrow areas so that the borrow material is obtained at a water content suitable for compaction and so that the borrow operations are not affected adversely. Ponding and infiltration of water shall be prevented.

Some of the material in the borrow areas may be frozen. The Contractor shall conduct its operations in such a manner to ensure that the frozen material shall be thawed prior to placement in the dikes. To meet this requirement, the Contractor shall open and work as large an area of the borrow

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area as practical, and shall rip, scarify, disc, harrow or use any other similar means to expose the frozen material to permit thawing.

The detailed planning of the operation of the borrow area shall be the responsibility of the Contractor and shall be subject to the approval of the Engineer.

Prior to commencement of the work, the Contractor shall submit for approval by the Engineer, a plan showing the details of his proposed methods and the sequence and schedule of operations to be followed for the utilization of the borrow area to obtain the required fill material. During construction the plan shall be reviewed and modified as required. A copy of the modified plan and schedule shall be provided for the Engineer's approval prior to implementation of any changes.

The Contractor shall be responsible at all times for the safe operation of the borrow area. Slopes left permanently exposed shall be not steeper than one vertical on two horizontal and shall be approved by the Engineer.

Unsuitable materials shall be removed and placed in disposal areas as directed by the Engineer. The disposal area and pile shall be kept neatly graded for appearance, drainage and stability.

2-08 (e) Haul Roads

Approval by the Engineer of any proposed haul roads shall be obtained before commencing construction of the haul roads.

All haul roads built and maintained by the Contractor shall be available, without charge, for use by the Engineer and by others authorized by the Engineer, and at completion of the Contract, shall become the property of the Owner.

2-08 (f) Compaction Equipment

The zone shall be compacted with a grid-roller towed by a suitable tractor. The grid-roller shall be a Hyster Model D with concrete ballast weighing approximately 13 tons or an alternative approved by the Engineer.

Power tampers for compaction near structures shall weigh not less than 200 pounds and shall have a ramming foot area not exceeding 80 square inches. The rammer shall be capable of delivering at least 200 foot pounds of compacting energy per blow.

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2-08 (g) Placing and Compacting

No fill material shall be placed in any section of the dike until the foundation soil for that section has been suitable prepared according to the requirements of these specifications.

The placing of fill material shall be directed at obtaining a stable and a reasonably homogeneous fill. The fill material shall be spread in approximately horizontal layers of uniform thickness by bulldozers or other approved means. If necessary, discing, harrowing, or other approved means shall be employed to break up the material and to blend it before compaction.

The thickness of fill layers shall not exceed twelve inches before compaction.

The fill shall be placed in such a way that the top surface of any section, along the axis of the dike, shall remain approximately level. During spreading and compaction, a slope towards the downstream toe shall be maintained on the fill surface providing a transverse grade not exceeding ten percent so that water from precipitation will drain. In order that the effect of precipitation on placed fill be minimized, the surface shall be rolled smooth, and adequate drainage shall be provided prior to periods of precipitation when operations must be suspended.

If the impervious fill material is too dry or too wet, water shall be added or removed by working the fill with a harrow, scarifier or other approved equipment until the water is uniformly distributed and satisfies the requirements of these specifications. Any conditioning of the fill material that may be required to obtain fill with a water content within the required range may be undertaken in the borrow area or after placement in the layer.

Each layer of fill shall be compacted by at least four complete coverages of the compaction equipment as specified in paragraph 2-08 (f). Additional coverages with the compaction equipment shall be made if necessary to ensure both the select impervious and the common fill materials are compacted to a dry density at least equal to 95% of the laboratory maximum dry density as determined from the Proctor compaction tests as specified in ASTM D698.

The surface of the existing dike, against which the select impervious fill or common fill is to be placed, is to be bladed and scarified and then blended in with the new materials to create a homogeneous fill free of any unconformity.

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The fill within any zone shall be effectively bladed and mixed so as to create a homogeneous gradation. Care shall be taken to avoid building horizontal layers into the dike that are of a gradation differing largely from the adjacent layers.

If, in the opinion of the Engineer, the surface of the prepared foundation, or the rolled surface of any layer of the fill is too dry or too smooth to bond properly with the layer of material to be placed thereon, it shall be moistened and worked with a harrow, scarifier, or other suitable equipment, in an approved manner and to a sufficient depth to provide a satisfactory bonding surface, before the succeeding layer of material is placed.

If, in the opinion of the Engineer, the surface of the prepared foundation, or the rolled surface of any layer of the fill is too wet for proper compaction of the layer of fill material to be placed thereon, it shall be removed and allowed to dry, or worked with harrow, disc, or other suitable equipment, to reduce the moisture content to the required amount; then it shall be recompacted before the succeeding layer of fill is placed thereon.

Ruts in the surface of any layer shall be graded level and recompacted to the approval of the Engineer.

Any and all materials not approved as fill which accumulate on the surface of any layer or prepared foundation, shall be removed by the Contractor before placing the succeeding layer.

Final acceptance of the fill material will only be made after the material has been placed, spread and compacted in place. Rejection by the Engineer of fill material may be made in the borrow area, in the transporting vehicle, or in place. The Contractor shall co-operate with the Engineer to ensure that only acceptable fill material will be hauled from the borrow area to the work.

Particular care shall be taken to ensure that the compaction requirements are satisfied in areas of fill adjacent to any structure. Compaction adjacent to the structures shall be carried out carefully and thoroughly utilizing approved power tampers where necessary to ensure that the material is tightly compacted at the boundaries of the structure. The thickness of these fill layers compacted by power tampers shall not exceed four inches before compaction. No cobbles or pebbles larger than two inches in size will be permitted in the fill material within one foot of structures. Fill shall be placed and compacted against the structures only during laylight hours, unless adequate lighting is provided to the satisfaction of the Engineer.

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Any layer or layers which, in the opinion of the Engineer, have suffered a reduction in density after compaction due to the action of frost, rain or for any other reason, shall be removed by the Contractor at no additional compensation, before placing operations are resumed.

Fill shall not be placed in a frozen condition and shall not be placed on a surface which is frozen or on which there is any snow or ice. Placing of fill in freezing weather shall not be permitted except when approved by the Engineer, and when proper measures are taken to prevent freezing of the material.

No separate payment will be made for compaction, or work entailed to adjust the moisture content or removal and disposal of materials rejected after being placed on the dike. All openings through the dike for construction purposes shall be subject to the Engineer's approval. The slope of openings left through dikes and at the end of any unfinished section shall not be steeper than four horizontal to one vertical.

Overbuilding or underbuilding shall be remedied at the Contractor's expense to the satisfaction of the Engineer.

2-08 (h) Measurement and Payment for "Select Impervious and Common Fill"

The unit price tendered for "Select Impervious and Common Fill" shall include all costs to complete the work described in this Section 2-08, and as detailed elsewhere in the Tender Documents. A free-haul distance of 3,000 feet is to be included in the tender price for the Item "Select Impervious and Common Fill".

The unit of measure is the cubic yard and is the volume measured in place on the dike by cross-sectioning before and after the placement and compaction of the fill.

All measurements for payment purposes shall be carried out by a combined survey crew as laid out in paragraph 2-11. Measurement will be made to the theoretical neat lines where a zone is built to or beyond the theoretical neat line. Measurement will be made to the actual surface where the surface of a zone is not built out to the theoretical neat line.

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Payment for all work carried out under this Section and completed in all respects will be the product of the volume measured and the unit price tendered for "Select Impervious and Commom Fill".

2-08 (i) Measurement and Payment for Unsuitable Materials

The unit price tendered for "Unsuitable Materials" shall include all costs to complete the work as described in this Section and as detailed elsewhere in the Tender Documents. No overhaul will be paid on this item.

The unit of measure is the cubic yard and the volume for payment purposes is measured by cross-sectioning the area to be excavated before removal and after removal.

Only material designated as "Unsuitable Material" by the Engineer and removed and disposed to his satisfaction will be paid for.

All measurements for payment purposes shall be carried out by a Combined Survey Crew as laid out in paragraph 2-11.

2-09 DECANT CULVERTS

2-09 (a) Scope of the Work

The Contractor shall remove part of the existing wood flume as necessary; purchase, have delivered and handle the pipes, haul, place, and compact bedding and backfill material; install and connect the pipes; backfill and compact and carry out all other works necessary to extend the east decant culvert. The cost of all labour, materials, plant, equipment, fuel and other items necessary shall be included in the unit price tendered for "Decant Culverts" in the Schedule of Quantities and Unit Prices.

The Owner will arrange to divert the flow through one decant during the period of alterations to the other. The Owner will connect the wood flume to the finished east culvert.

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The Contractor is to co-operate with the Owner's forces and to keep the work necessary to rebuild the flume to a minimum.

2-09 (b) Materials

The decant pipes shall be 24" diameter, 14 gauge, standard 2 ounce galvanized corrugated (2-2/3" x 1/2") pipe.

Couplings shall be two-piece corrugated (or Universal Dimple) bands, 24 inches long with angle flanges drilled for bolted connection. All metal parts shall be zinc-coated.

A 3/8 inch thick by 24 inch wide continuous neoprene gasket shall be installed between the coupling and the pipes being connected.

A caulking compound of thiocaulk (polysulphide architectural grade) shall be applied on the pipe side of the neoprene gasket.

All pipe and couplings shall be fabricated in accordance with Specification 501-74 of the Corrugated Steel Pipe Institute.

The bedding and backfill material shall be a clean coarse sand with a maximum size of 3/4". Not more than 15% by weight shall pass the No. 200 U.S. Standard sieve.

2-09 (c) Installation

The culvert shall be installed to the manufacturer's recommendations. A bed of sand 18" thick shall be laid and compacted in layers not exceeding 4" thick, each layer being tamped to 95% of maximum density as established by ASTM D698. A bed shaped to the outside of the pipe and sloped to the correct grade shall be scraped from this bed to a depth of 6". The pipe shall be laid in this trench, connected to the existing pipe, and backfill placed on each side of the pipe in 4" layers and tamped to 95% of maximum density. The backfill shall be continued in this manner until 18" has been placed on top of the pipe. Care shall be taken to save the culvert from damage by the passage of vehicles.

Particular care shall be taken to provide a completely leakproof joint under full flow conditions. Any joint found to leak shall be disassembled and reconnected as necessary until a tight joint is achieved.

The tamper shall be as specified in paragraph 2-07 (e).

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2-09 (d) Measurement and Payment of "Decant Culverts"

The unit price tendered for "Decant Culverts" shall include all costs to cover the work as described in this Section and as detailed elsewhere in the Tender Documents.

The payment for the work shall be the product of the length of culvert installed from centre of joint to end and the unit price tendered in the Schedule of Measurement and Unit Prices.

2-10 BORROW PIT TREATMENT

In the event it is found necessary to carry out a final treatment of the select impervious and common fill borrow pit, the following work shall be completed to the satisfaction of the Engineer.

Areas specifically designated for treatment shall be first scarified to a depth of twelve inches using a ripper or harrow as necessary to break down all lumps of earth to a size smaller than three inches.

Topsoil stockpiled during the stripping operations shall be hauled into the area to be treated and spread to an even depth to present a neat and smoothly graded appearance.

The area shall be left sloped to drain with no pockets of water.

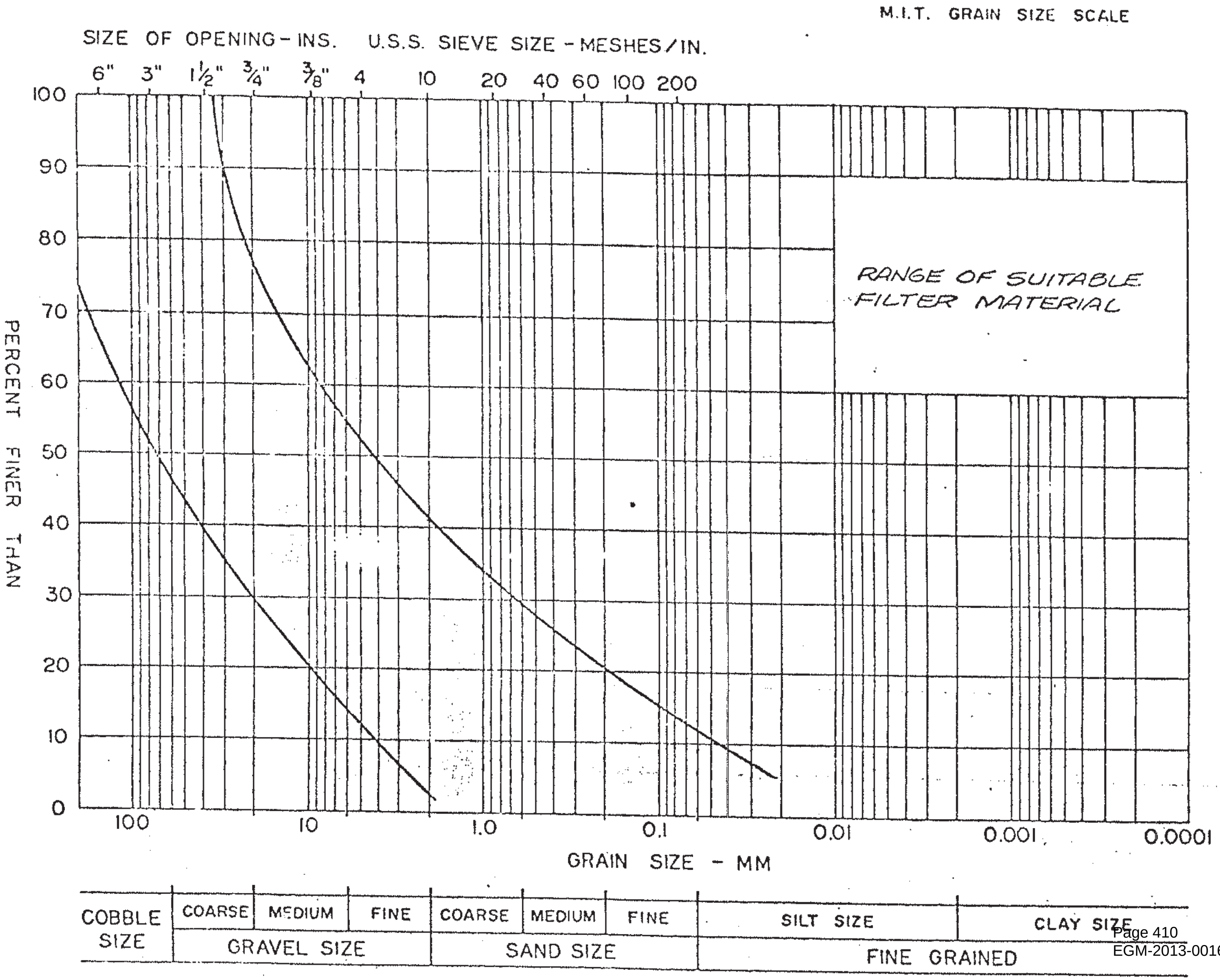
Payment for this work shall be at the unit price shown in the Schedule of Quantities and Unit Prices and shall cover all costs to carry out the work.

Measurement shall be by the square yard as projected on a horizontal plane and shall be carried out by the Combined Survey Crew.

2-11 COMBINED SURVEY CREW

Survey control, layout and measurements of all work performed are to be carried out by a Combined Survey Crew supplied by the Owner and under the jurisdiction of the Engineer. The Contractor shall assign one or more members of his staff to serve on the crew at the expense of the Contractor. The representative supplied by the Contractor to the survey crew shall satisfy the Contractor as to the accuracy of the survey work. In case of conflict over measurements the Engineer and the Contractor shall exhaust all means of arriving at a satisfactory agreement before applying the arbitration clause referred to in the General Conditions.

The Contractor shall employ a grade foreman to bring up slope stakes and to ensure the work is kept to the correct slopes.



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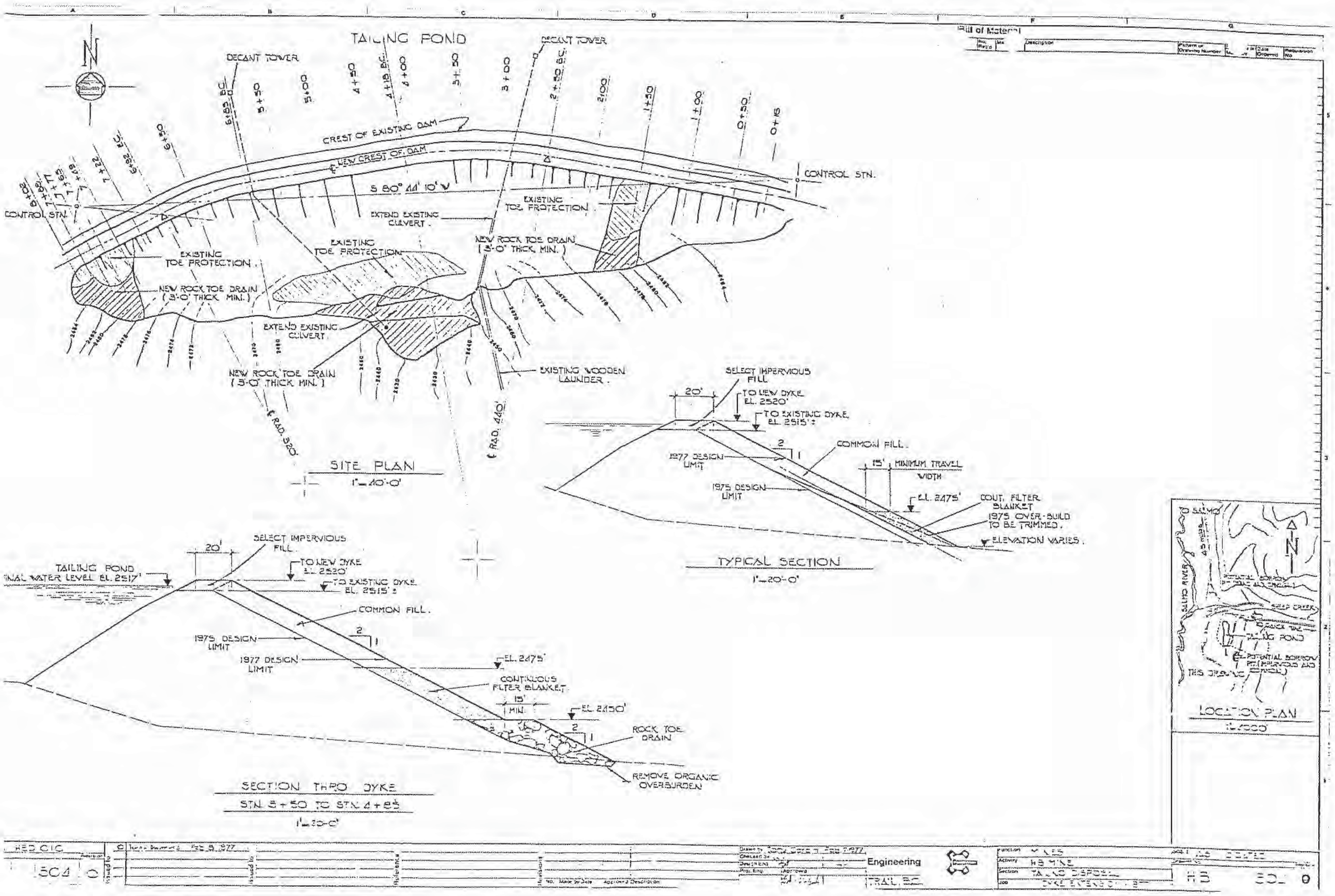
GRAIN SIZE DISTRIBUTION

FIGURE 1


TAILING POND
DECANT TOWER
DECANT TOWER
CREST OF EXISTING DAM
℄ NEW CREST OF DAM
S 80° 44' 10" W
CONTROL STN.
CONTROL STN.
EXTEND EXISTING CULVERT.
EXISTING TOE PROTECTION.
EXISTING TOE PROTECTION
EXISTING TOE PROTECTION
NEW ROCK TOE DRAIN (3'-0" THICK MIN.)
NEW ROCK TOE DRAIN (3'-0" THICK MIN.)
NEW ROCK TOE DRAIN (3'-0" THICK MIN.)
EXTEND EXISTING CULVERT.
EXISTING WOODEN LAUNDER.
℄ RAD. 320'
℄ RAD. 440'
SITE PLAN
1" = 40'-0"
SELECT IMPERVIOUS FILL
20'
TO NEW DYKE EL. 2520'
TO EXISTING DYKE EL. 2515'±
COMMON FILL.
1977 DESIGN LIMIT
1975 DESIGN LIMIT
15' MINIMUM TRAVEL WIDTH
EL. 2475'
CONT. FILTER BLANKET
1975 OVER-BUILD TO BE TRIMMED.
ELEVATION VARIES.
TYPICAL SECTION
1" = 20'-0"
TAILING POND FINAL WATER LEVEL EL. 2517'
SELECT IMPERVIOUS FILL.
TO NEW DYKE EL. 2520'
TO EXISTING DYKE EL. 2515'±
COMMON FILL.
1975 DESIGN LIMIT
1977 DESIGN LIMIT
EL. 2475'
CONTINUOUS FILTER BLANKET
15' MIN.
EL. 2450'
ROCK TOE DRAIN
REMOVE ORGANIC OVERBURDEN
SECTION THRO DYKE
STN. 8+50 TO STN. 4+85
1" = 30'-0"
SALMO
SALMO RIVER
SHEEP CREEK
TAILING POND
LOCATION PLAN
Bill of Material
Engineering
TRAIL, B.C.
H B MINE
TAILING DISPOSAL
HB

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REPORT TO

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HB TAILINGS DAM NEAR SALMO, B.C.

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INTRODUCTION

This report presents the results of an investigation of the existing HB Tailings Dam south of Salmo, B.C., together with an assessment of its stability. An assessment is also made of the suitability of the existing dam to impound tailings that would be generated in the event that Cominco decide to put the HB mine and concentrator back into operation. The investigation and this report were authorized by Cominco Purchase Order HB2 dated June 1, 1972.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

1) The water level in the existing tailings pond can be raised to elevation 2502; 3 ft. below the crest of the existing HB Tailings Dam.

2) Normal water surface in the tailings pond should be maintained at a level not higher than elevation 2502 to assure that adequate freeboard is maintained.

3) The results of stability analyses indicate that the existing embankment has an adequate factor of safety with respect to a shearing failure of the downstream slope.

4) The foundation soils on which the HB Tailings Dam has been constructed consist of dense glacial till. These glacial till soils exhibit high shear strength characteristics, and are relatively incompressible. They provide unyielding foundation support for the tailings dam, and preclude the possibility of a shearing failure through the foundation.

5) In the event that Cominco decide to raise the crest of the existing tailings dam, this should be done by placing additional fill on the crest, and on the downstream fill slope. A drainage blanket consisting of clean, well-graded sand and gravel should be provided adjacent to the existing downstream fill slope prior to placement of new fill.

PROCEDURE

The HB Tailings Dam was insepcted by the writer in company with Mr. G. Shoblom of Cominco Ltd. on May 24th and 25, 1972. At the time of this inspection, the existing borrow pits at the east and west abutments of the dam were examined to gain an appreciation of the nature and type of soils that had been used in its construction.

Two test pits were excavated into the existing embankment fill. Test pit no. 1, located on the crest of the tailings dam was excavated to a depth of 4 1/2 ft. using a small backhoe. Owing to difficulty of access, test pit no. 2, located at the toe of the fill slope was excavated by hand. Representative samples of soil from test pits 1 and 2 were retained for laboratory testing.

A 20 ft. long section of perforated pipe was installed in a drilled hole on the centreline of the dam crest to permit measurement of the phreatic water surface within the section.

Representative samples of the embankment fill materials were subjected to grain size analysis to determine the particle size distribution of the fill material. Two typical grain size curves are shown on Fig. 5. Samples of the no. 4 minus fraction of the material were subjected to laboratory shear strength tests to evaluate the shear strength parameters of the soils used in the construction of the embankment (see Fig. 6). A ground survey by Mr. H. Dixon of Cominco Ltd. established the configuration of the existing downstream fill slope.

Using the data collected in the course of the field and laboratory investigations, stability analyses were performed to assess the factor safety of the dam with respect to potential shearing failure through the embankment.

HB TAILINGS DAM

The HB Tailings Dam is located approximately four miles south of Salmo, B.C. (see Fig. 1). The dam was originally constructed in 1955 for retention and storage of tailings produced at the HB Mine, which operated from 1955 to 1966. The mining operations were suspended in 1966.

The crest of the HB Tailings Dam is approximately 650 ft. long, and is curved in the upstream direction. The maximum height of the dam is of the order of 50 to 60 ft. above the original ground surface. Contours on the downstream face of the tailings dam, together with three typcial cross sections are shown on Fig. 2. Photographs of the tailings dam are shown on Figs. 3 and 4.

The HB Tailings Dam is equipped with two decant outlets to pass water from the upstream to the downstream side of the structure. Each decant consists of a timber tower on the upstream side of the dam, with a 24 in. diameter steel corrugated pipe passing through the embankment from the upstream to the downstream side of the dam. The present inlet elevation at the easterly decant tower is 2496.3, while the inlet elevation at the westerly decant tower is 2499.6. The east decant tower passes normal flows which enter the tailings dam, while the west decant tower would serve as an emergency outlet in the event that the capacity of the east decant were exceeded.

The HB tailings dam is an earthfill embankment constructed of materials borrowed from the east and west abutments. We understand that the borrow materials were excavated and transported to the section by bulldozers. Compaction within the section was achieved by the traffic of the construction equipment used to spread and place the fill.

The materials used in construction of the dam consist of silty sand and gravel with scattered cobbles and small boulders. Most of the available borrow materials have now been removed from the east abutment. The limited amount of material which remains on the east abutment consists predominantly of slightly silty fine to medium sand. The materials from the west borrow pit consist of a well graded heterogeneous mixture of silt, sand, gravel, cobbles and boulders (glacial till). The materials incorporated within the west half of the dam contain more stone than those within the east half, reflecting the higher stone content of the borrow materials that were available from the west abutment.

The crest of the dam was raised periodically during the period 1955 to 1966 as the tailings storage requirements increased. The crest of the dam was raised by the downstream method of construction, i.e. additional fill was placed on the crest and on the downstream slope of the dam.

We understand that the original dam was constructed with an earthfilled timber crib retaining wall at the downstream toe. Subsequent to construction of this retaining wall, a flat earth fill supporting berm has been constructed on its downstream side, and the crib has been covered over. Prior to placement of this stabilizing fill, several concrete pipe drains were installed at the downstream toe of the dam. The outlets of some of these drains were seen during the site inspection on May 25th.

FOUNDATION SOILS

Soil exposures at the downstream toe of the dam were examined during the May 24th - 25th inspection. The in situ soils exposed at the downstream toe of the HB Tailings Dam consist of dense glacial till composed of a heterogeneous assortment of silt, sand, gravel and occasional small cobbles. The material is very dense, and exhibits high shearing strength characteristics. These materials are capable of providing foundation support for the structure without any danger of shearing failure or significant settlement under the weight of the embankment fill.

EMBANKMENT STABILITY

Direct shear tests on representative samples of the embankment fill show that the fill material has an angle of internal friction of approximately 35 1/2° with 0 cohesion. The flat toe berm below elevation 2470 on the downstream side of the dam provides a high degree of stability to the structure, and precludes the possibility of a deep seated shearing failure within the embankment. This toe berm reduces the effective height of the embankment to approximately 35 ft.

The stability of the existing embankment between elevation 2470 and the present crest at elevation 2505 is governed by the gradient of the downstream fill slope between these elevations, the shear strength characteristics of the embankment fill, and the position of the phreatic surface within the section. The approximate position of the phreatic surface for a tailings pond level at elevation 2503 is shown on section BB, Fig. 2. The phreatic surface shown on Section BB is based on the water level measurement in the observation well installed at Section AA on the centreline of the dam, a water level at elevation 2503 on the upstream face, and the approximate position of the drains on the downstream side of the buried timber crib.

The stability analyses indicate that the minimum factor of safety of the embankment, for potential failure surfaces which intersect the upstream slope at or below the crest is 1.3. The factor of safety is considered adequate, although it is near the lower limit of the range considered acceptable by conventional engineering practice.

SAFETY AGAINST OVERTOPPING

The size of the catchment area surrounding the HB Tailings Pond is approximately 480 acres. The approximate boundaries of the catchment area are indicated on Fig. 1. The closest station at which long term percipitation records have been maintained is Nelson, B.C., which is approximately 26 miles north of the HB Tailings Dam. The long term percipitation records at Nelson indicate a maximum rainfall of 2.6 in. in 24 hrs. Assuming a runoff coefficient of 0.8, a rainfall of 2.6 inches in 24 hours over an area of 480 acres would result in an average runoff rate of approximately 40 cu.ft./sec. The two 24 in. diameter decant pipes are capable of passing between 50 and 60 cu.ft./sec. Thus, the existing decant system at the HB Tailings Dam is considered to have sufficient capacity to pass the maximum anticipated flow into the tailings pond. We therefore conclude, that the existing outlet capacity is adequate, and that the structure would not be over topped during the maximum anticipated runoff.

SEEPAGE

Based on examination of the ground surface at the downstream toe of the existing dam, the total leakage was estimated to be of the order of 5 to 10 gallons per minute. If the water surface in the pond is raised from its present level to elevation 2502, the rate of seepage will increase only slightly. Examination at points where drains exit on the downstream slope indicated that the existing drains are not carrying soil particles. The existing drains appeared to be operating satisfactorily.

SURFACE EROSION

The presence of cobbles and gravel within the embankment fill affords a degree of erosion protection on the downstream face of the existing embankment. Examination of the dam indicates that no significant surface erosion has occurred on the downstream fill slope during the six year interval 1966 to 1972. Also, there is no evidence that wave action in the tailings pond has resulted in any significant deterioration of the upstream fill slope. The performance of the existing structure indicates that the dam has adequate protection against surface erosion.

In conclusion, our analyses and studies indicate that the existing HB Tailings Dam will perform satisfactorily after the water level in the tailings pond has been raised to elevation 2502. If during operation, it is decided that the crest of the dam should be raised to provide a greater depth of water for clarification of the tailings effluent, the crest of the dam should be raised by placing additional fill on the crest, and on the downstream fill slope. To assure that the phreatic surface within the section does not rise above the level of the existing downstream fill slope, a layer of free draining granular fill should be placed adjacent to the existing downstream slope, as illustrated on Fig. 7. The fill placed on the crest and on the downstream slope should be spread in horizontal layers not exceeding 12 in. thickness, and each layer should be compacted to a minimum density equivalent to 95 percent of maximum dry density as determined by the Standard Proctor Compaction Test prior to placement of each succeeding layer.

GOLDER BRAWNER & ASSOCIATES LTD.

David B Campbell

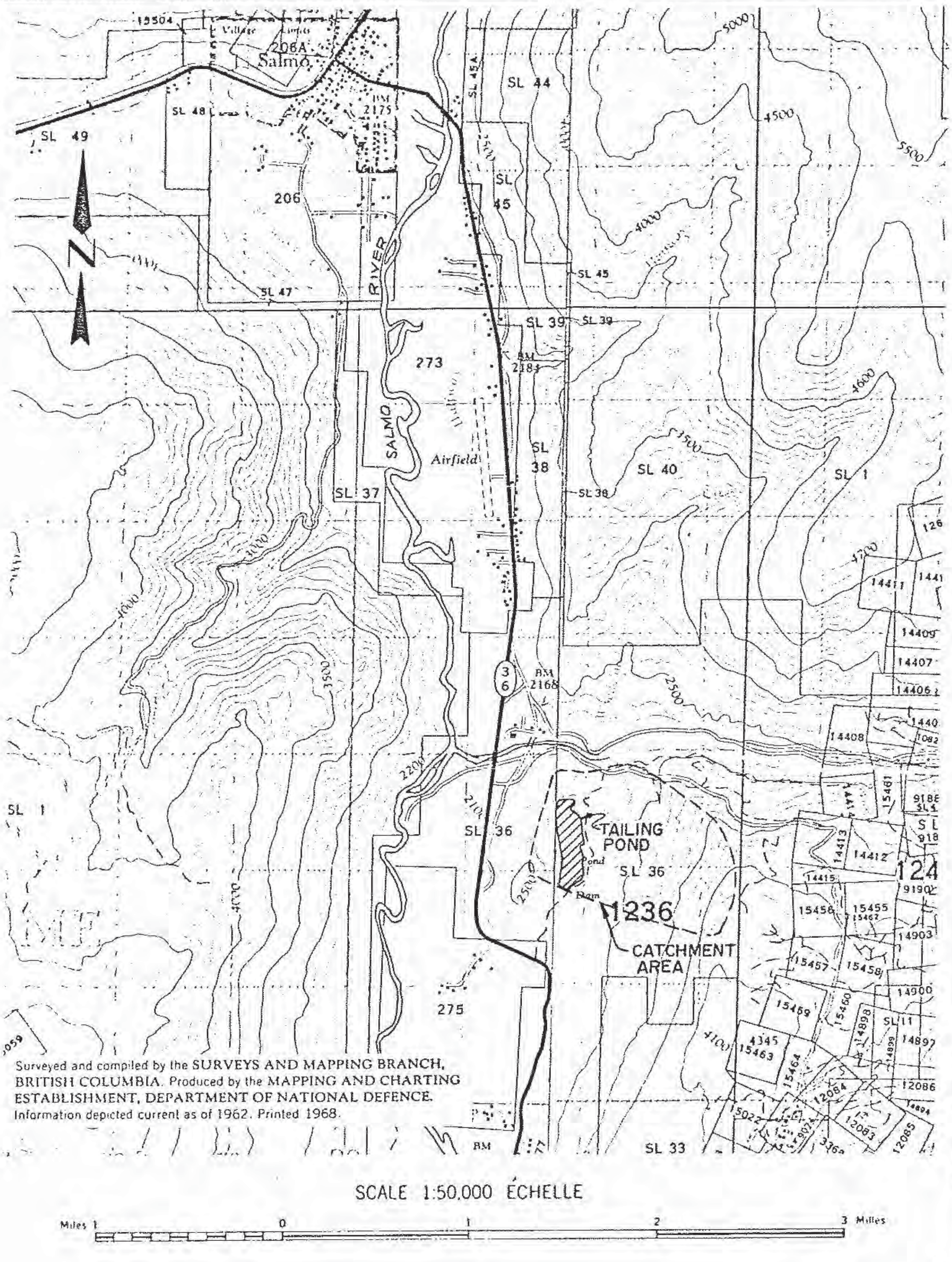
DBC/sm

D.B. Campbell, P. Eng.

PROJECT No. 12102

LOCATION PLAN

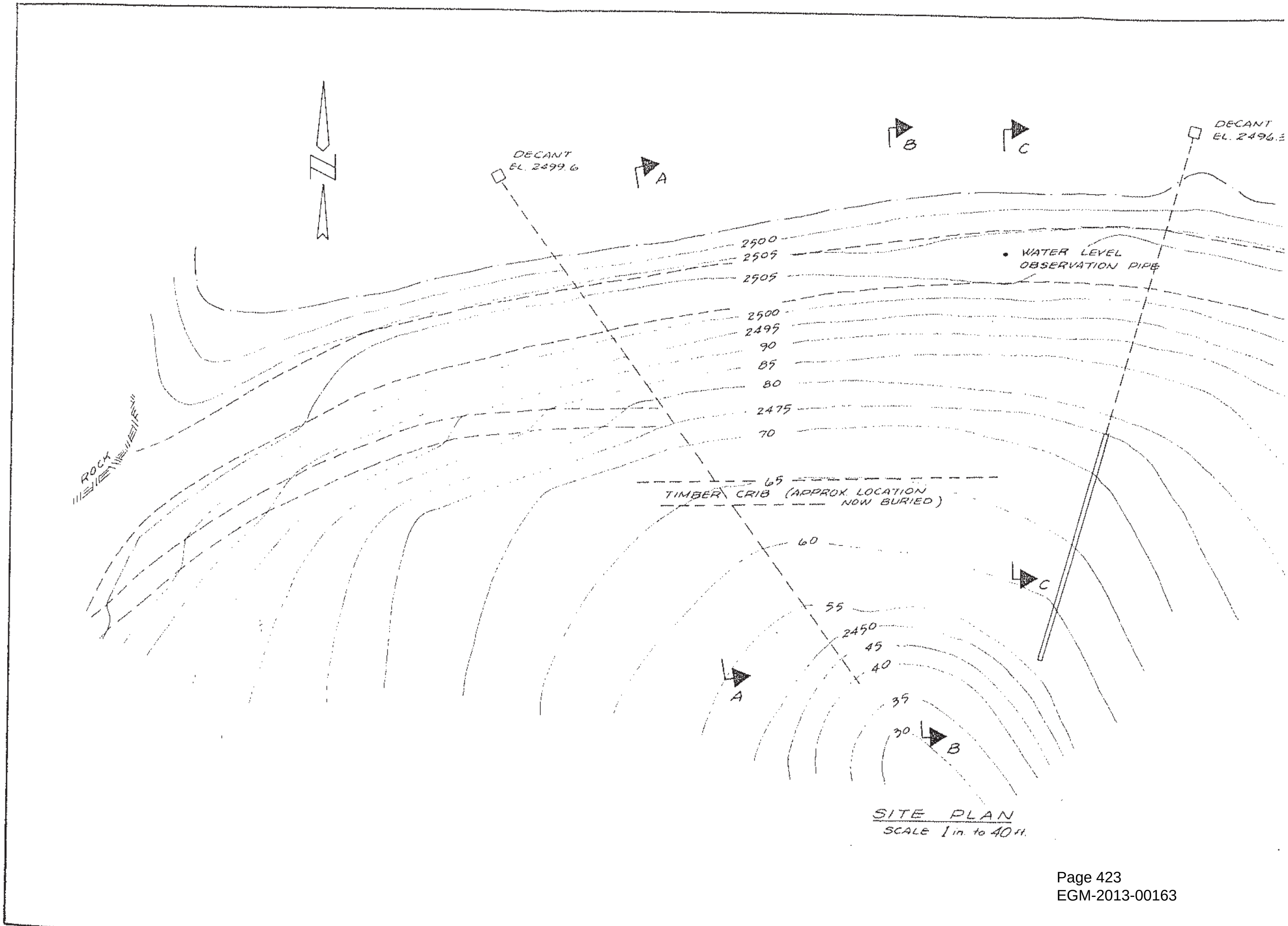
FIGURE 1



GOLDER, BRAWNER & ASSOCIATES

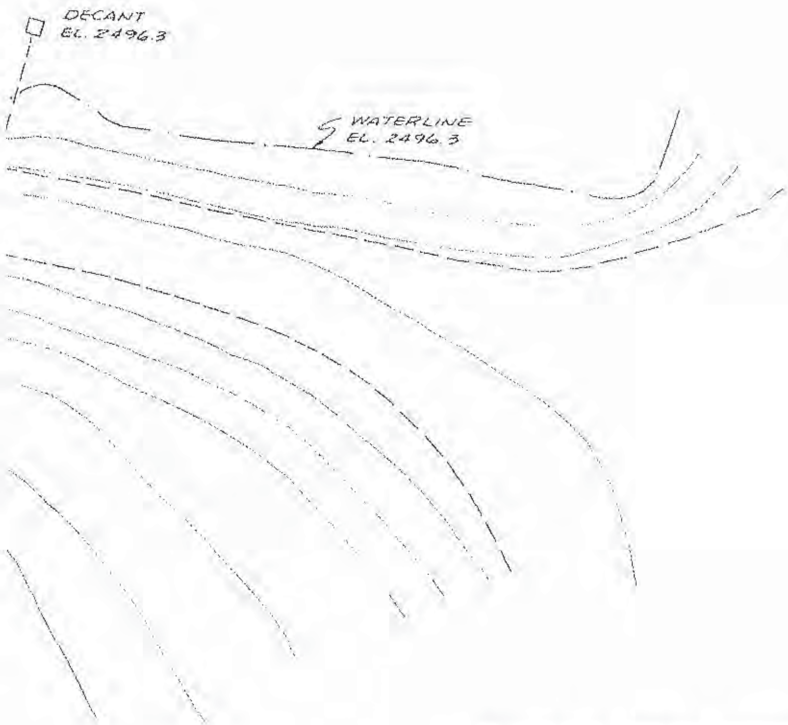
Made
Chkd.
Appd.

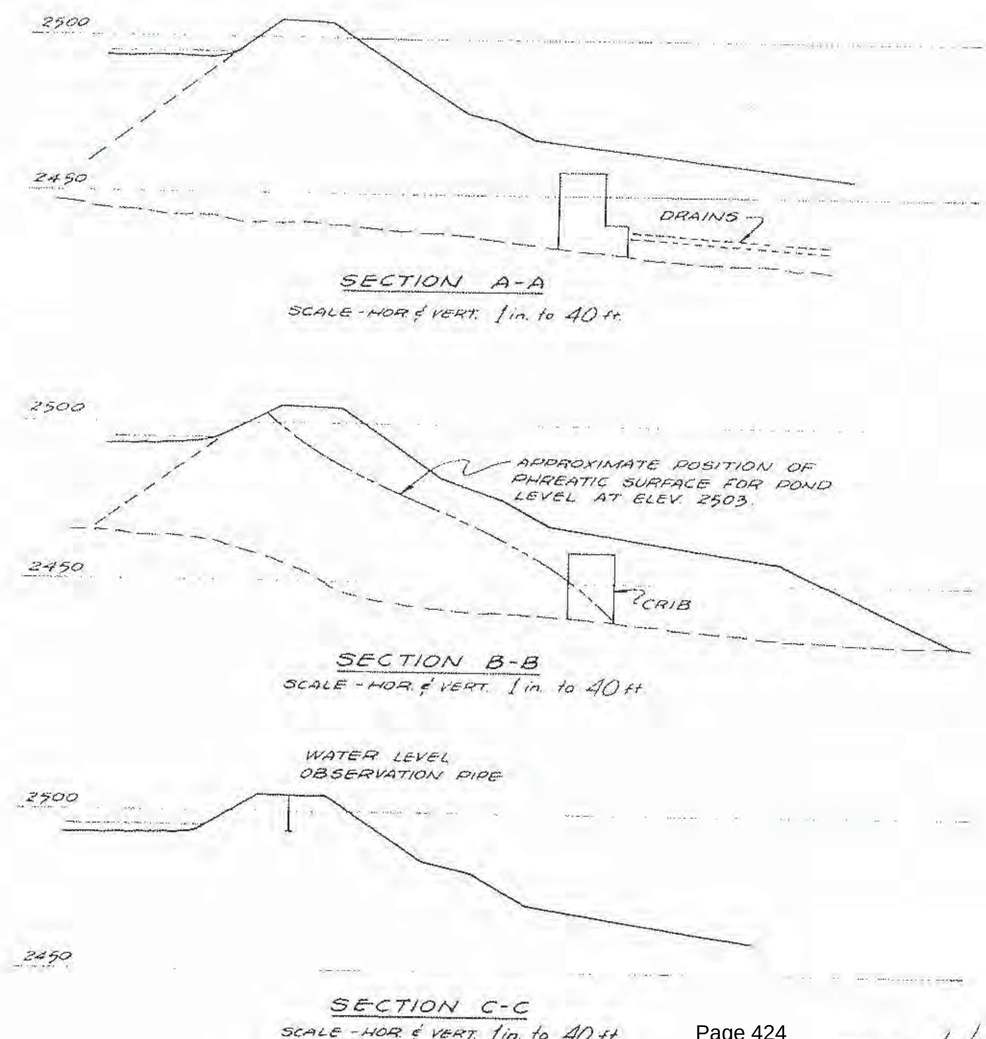
GB 19


DECANT
EL. 2499.6
DECANT
EL. 2496.3
A
B
C
2500
2505
2505
WATER LEVEL
OBSERVATION PIPE
2500
2495
90
85
80
2475
70
ROCK
65
TIMBER CRIB (APPROX. LOCATION
NOW BURIED)
60
55
2450
45
40
35
30
SITE PLAN
SCALE 1 in. to 40 ft.

H.B. MINE TAILINGS DAM
SITE PLAN & SECTIONS

FIGURE 2





REFERENCE: COMINCO, ENGINEERING DWG. No. SURVEY 3 308, TITLED "H.B. MINE TAILINGS DAM," DATED JUNE 2, 1972.

GOLDER, BRAWNER & ASSOCIATES

DRAWN
APP'D
DATE JUNE '72

SITE PHOTOGRAPHS	FIGURE 3

HB Tailings Dam-
Looking toward
west abutment.
Note west
abutment
borrow pit to
left of centre.

HB Tailings Dam-
Looking toward
east abutment.
East abutment
borrow pit is
located beyond
east abutment.

GOLDER, BRAWNER & ASSOCIATES

Made I.D.T.
Chkd.
Appd.

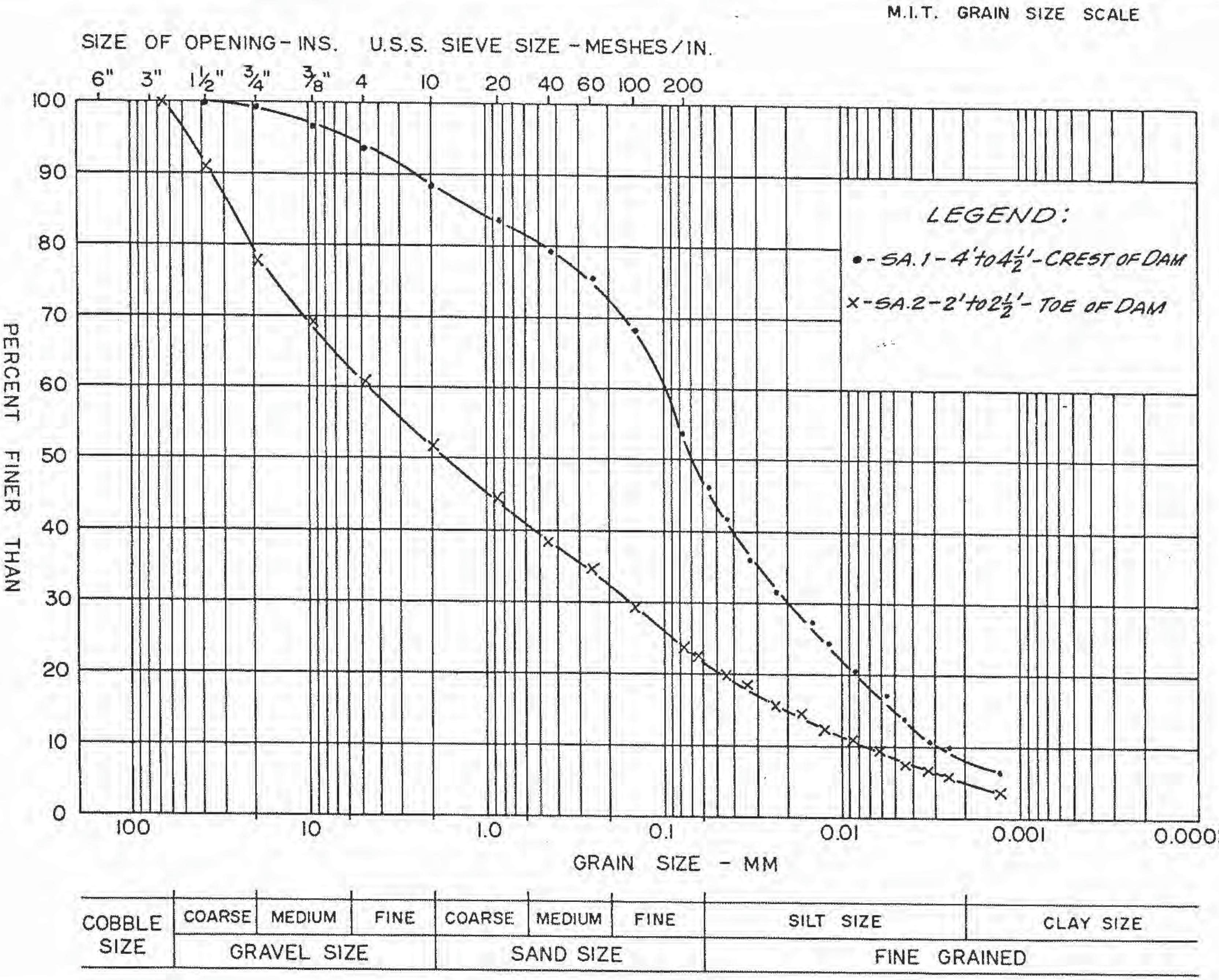
SITE PHOTOGRAPH

FIGURE 4

*View of downstream face of H.B Tailings Dam.
Flume at far side of toe berm carries discharge from east decant tower.*

Made ......
Chkd. ......
Appd. ......

GOLDER, BRAWNER & ASSOCIATES



GOLDER, BRAWNER & ASSOCIATES

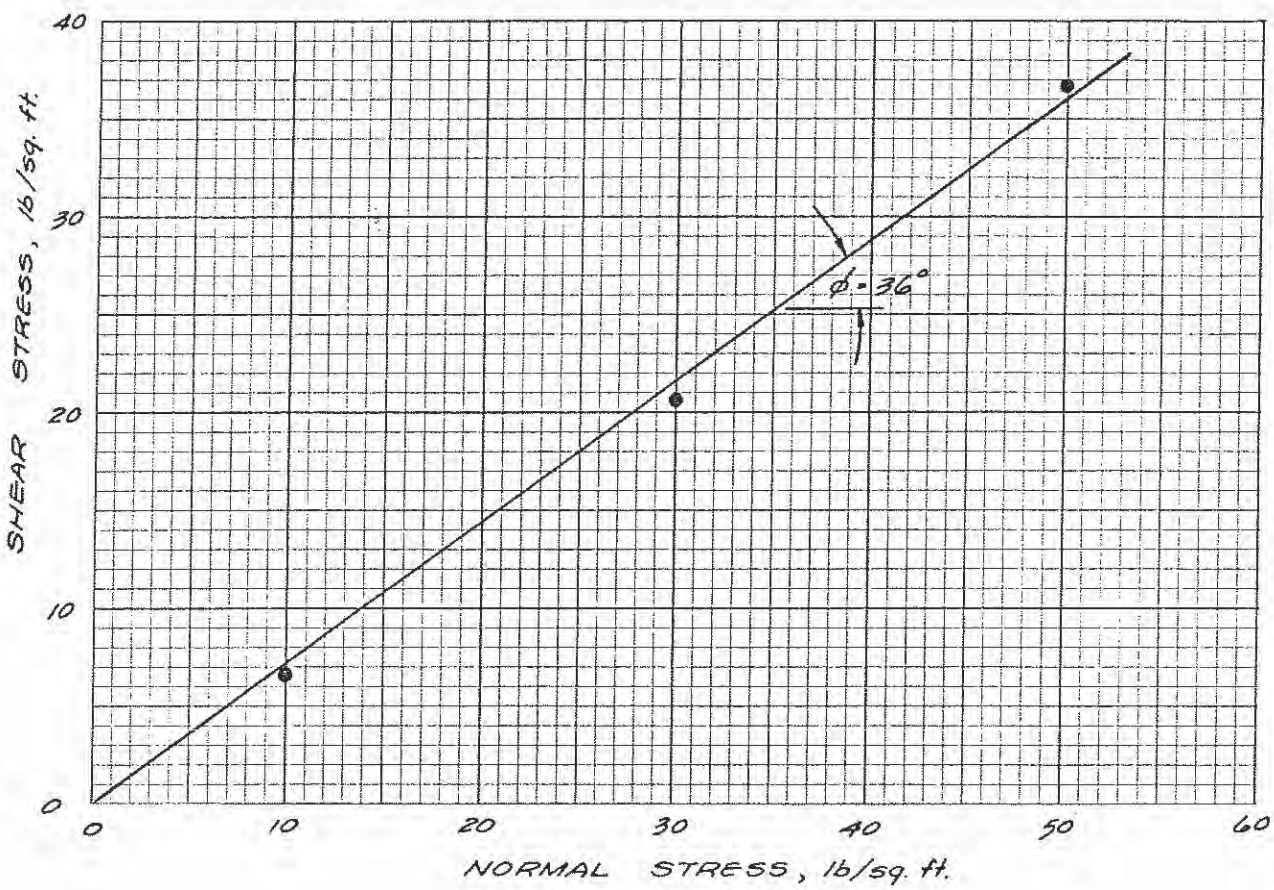
GRAIN SIZE DISTRIBUTION

FIGURE 5

DIRECT SHEAR TEST RESULT

H.B. TAILINGS DAM

FIGURE 6



RESULTS OF DIRECT SHEAR TEST ON MINUS # 4 FRACTION OF MATERIAL FROM TEST PIT #2. MATERIAL PLACED IN SHEAR BOX AT DENSITY OF 106 lb/cu. ft., THEN SATURATED. RATE OF STRAIN 0.01 in/min.

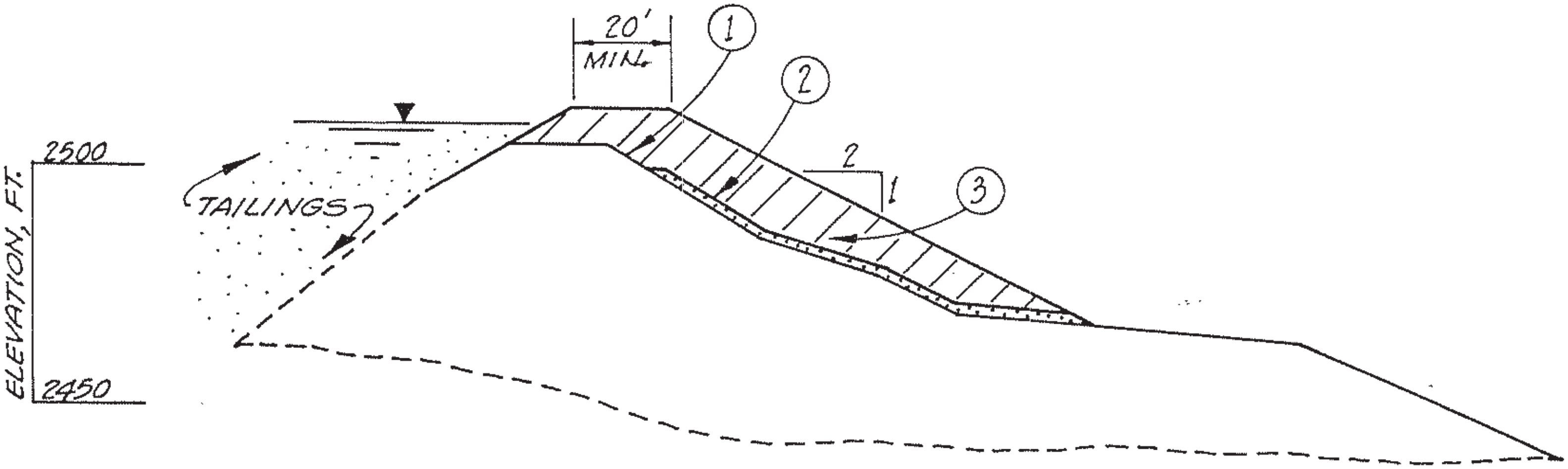
Drawn N.L.

Approved [illegible]

Date JUNE '72

GOLDER, BRAWNER & ASSOCIATES

Project No. 9



SCALE : 1 IN. TO 50 FT. VERT. & HOR.

(1) EXISTING DOWNSTREAM FILL SLOPE.

(2) LAYER OF CLEAN FREE-DRAINING SAND AND GRAVEL MINIMUM THICKNESS 18".

(3) NEW FILL - PLACED IN UNIFORM LAYERS OF 12" MAXIMUM THICKNESS. COMPACT EACH LAYER TO A MINIMUM DENSITY EQUIVALENT TO 95% MAXIMUM DRY DENSITY AS DETERMINED BY STANDARD PROCTOR COMPACTION TEST.

METHOD OF RAISING DAM CREST LEVEL

FIGURE 7

GOLDER, BRAWNER & ASSOCIATES

Drawn
Approved
Date

Golder Brawner Associates

CONSULTING GEOTECHNICAL ENGINEERS

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A. A. GASS
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H. G. GILCHRIST

REPORT TO COMINCO LTD. ON SITE INVESTIGATION AT EXISTING H.B. MINES TAILINGS POND

SALMO B.C.

Distribution:

4 copies - Cominco Ltd.
Trail, British Columbia

2 copies - Golder Brawner & Associates Ltd.
Vancouver, British Columbia

January, 1974

V 73218

GRIT
1634

GOLDER, BRAWNER & ASSOCIATES LTD., 224 WEST 8th AVE., VANCOUVER 10, B.C., CANADA • TELEPHONE 879-9266 • TELEX 0[illegible]508800

Golder Brawner Associates

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D. L. PENTZ
H. G. GILCHRIST

January 2, 1974

Cominco Ltd.,
Engineering Dept.,
Trail, B.C.

ATTENTION: Mr. D. Boyle

Re: Site Investigation at Existing
H.B. Mines Tailings Pond, Salmo, B.C.

Dear Sir:

As requested by your Purchase Order No. HB 15017 dated October 26, 1973, and in accordance with our proposal of September 20, 1973, we have carried out a detailed drilling program at the above site. The purpose of this investigation was to determine the condition of the existing dyke and foundation soils to enable a detailed stability analysis to be carried out. This report is further to our report No. V 72109 of June, 1973.

FIELD INVESTIGATION

Three boreholes were drilled at the site between October 29, 1973 and November 1, 1973 using a truck-mounted rotary drill rig. These boreholes were drilled to depths varying from 45 to 85 ft. and extended approximately 20 ft. into bedrock. One borehole was drilled from the crest and two boreholes from the lower slope of the existing tailings dyke as shown on Fig. 1. Stan-

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dard split spoon samples were obtained of the overburden and wash samples of drill cuttings were obtained of the bedrock. All samples were identified in the field and returned to our laboratory for classification and testing.

Perforated plastic standpipes were installed in the open boreholes to enable groundwater levels to be monitored.

SITE CONDITIONS

The existing tailings pond is located approximately 4 miles south of Salmo, B.C. The tailings dyke is located at the southern end of a valley and has been constructed 50 to 60 ft. high using borrow fill obtained from the abutment slopes. Contours of the downstream face of the dyke together with a typical cross section are shown on Fig. 1.

The borehole results indicate that the dyke is generally comprised of soft to firm brown sandy silt containing varying amounts of medium to coarse sand and fine gravel. Standard penetration test results gave average 'N' values of the order of 10 blows/ft. indicating a loose to compact state of relative density.

Examination of the overburden samples enabled an approximate estimate of the location of original ground surface beneath the dyke fill. The approximate location of the existing ground surface is shown on Fig. 2. In borehole 1, the natural ground surface was estimated to be located approximately 59 ft. below the crest of the dyke. Underlying the fill, a 4 ft. thick stratum of very dense silty till was identified overlying a 5 ft. thick layer of hard desiccated silt. Bedrock was encountered at approximately 68 ft. below the crest of the dyke.

In borehole 2, the original ground surface was estimated as being located approximately 27 ft. below the dyke fill surface. The boreholes en-

countered a 7 ft. thick stratum of soft to firm silt beneath the fill. Underlying the silt, a 2 ft. thick layer of sand and gravel was identified overlying bedrock.

In borehole 3, the original ground surface was estimated to be located approximately 20 ft. below the fill. The borehole encountered a 3 ft. thick stratum of dense silty till beneath the dyke fill. Underlying the silt, a 3 ft. thick layer of sand and gravel was identified overlying bedrock.

More detailed descriptions of the soil conditions are given on the Record of Boreholes. A cross section showing the inferred soil stratigraphy is shown on Fig. 2.

GROUNDWATER CONDITIONS

The standpipes installed in the boreholes were monitored for approximately 4 weeks after installation to enable the water levels to stabilize. From the recorded water levels, we have inferred the phreatic surface in the dyke to be located as shown on Figure 2.

Inspection of the dam during the period of the drilling program indicated that seepage was occurring near the toe of the upper slope of the dam and at each abutment. Soft saturated soil was observed at several locations in the middle slope of the dam and very soft saturated soil was encountered at the east abutment.

This seepage and degree of saturation was not observed at the time of the original site investigation in May 1972. The occurrance of seepage above the phreatic line as inferred from the standpipe levels is believed to be caused by local variations in the permeability of the dam material. The location of the phreatic line is expected to vary somewhat across the dam.

DYKE STABILITY

The investigation has indicated that the existing dyke has been constructed essentially with silty soils which have been placed in a loose condition. The design parameters used in our previous calculations are considered to be still applicable although the phreatic surface assumed in our original report appears to have been somewhat lower than now exists. This present condition may be a result of a change in ponded water level upstream. Stability calculations for the present condition indicate a safety factor against a shearing type failure of the order of 1.3 which is considered adequate.

It is understood that it is proposed to eventually raise the pond water level to a maximum elevation of 2502 ft. behind the existing dam. As the pond water level is raised, the phreatic surface will also rise. Stability calculations for these future conditions indicate a factor of safety against a shearing type failure of the order of 1.1 which is lower than is normally acceptable. To increase the dyke stability, it is recommended that a berm be constructed on the downstream section of the dam as shown on Fig. 3. Provision of this berm will increase the factor of safety to approximately 1.3 which is adequate.

SEEPAGE

At present, seepage is occurring at the intersection of the upper and middle slope of the dyke and at the abutments. Examination of this seepage during the drilling program indicated that the flow was clear and did not appear to be carrying any soil particles. However, the dyke is essentially homogeneous and has been constructed with silty soils which are most susceptible to internal backward erosion. The potential for this type of erosion will increase as the ponded water level is raised. To provide protection against internal backward

erosion, filter material should be placed on the downstream slope of the dyke. This can be accomplished by constructing the previously recommended stability berm (Figure 3) of a suitable filter material which satisfies the gradation requirements shown on Figure 4. It is possible that mine waste rock will be suitable.

The berm should be adequately compacted to provide the required strength for support of possible future dyke extensions, yet should not be over-compacted so as to reduce its permeability. Generally, if heavy equipment is available and if the gradation of the filter material tends to be towards the coarser fraction of the range shown on Figure 4, satisfactory compaction without excessive reduction in permeability will be achieved by spreading the material in 16 in. lifts using a heavy crawler tractor.

We would be pleased to provide more specific construction details when the gradation of material and type of construction equipment are known.

To accommodate the seepage at the abutment, a filter blanket should be placed at these locations as shown on Fig. 3. This blanket should consist of similar filter material to that described above and should have a minimum thickness of 2 ft. This filter material should also be placed as described above.

It is pointed out that the specification given above for the filter material is critical if the filter blanket is to perform satisfactorily. As a result, we recommend, that when potential sources of material have been established, that we review the suitability of the material. In addition during raising of the ponded water level to elevation 2502, we recommend that the dyke be inspected by a member of our staff to ensure that the filter blanket is performing as desired.

At the time of the drilling, examination of the upper face of the dyke indicated that some surface erosion had occurred due to water ponding on the crest of the dyke and flowing downstream. It is recommended that these slopes be renovated by using granular material. In addition some surface grading should be carried out on the crest of the dyke to prevent ponding of rain water. During this work the crest could be sloped inwards towards the pond in order to direct run-off in that direction.

FUTURE DYKE EXTENSION

If the height of the existing dyke and pond level are increased in the future to elevations 2511 ft. and 2508 ft. respectively, the crest of the dyke should be raised by placing additional fill on the crest and on the downstream slope. In addition, the filter material recommended above should be extended as shown on Fig. 5 to a maximum elevation of 2500 ft. The additional filter material should be placed as previously recommended while the fill material should be placed in horizontal lifts of 12 inch maximum and compacted to at least 95 per cent of Standard Proctor Density.

We trust that this is the information you require. We would be pleased to discuss the report in more detail should you desire.

Yours very truly,

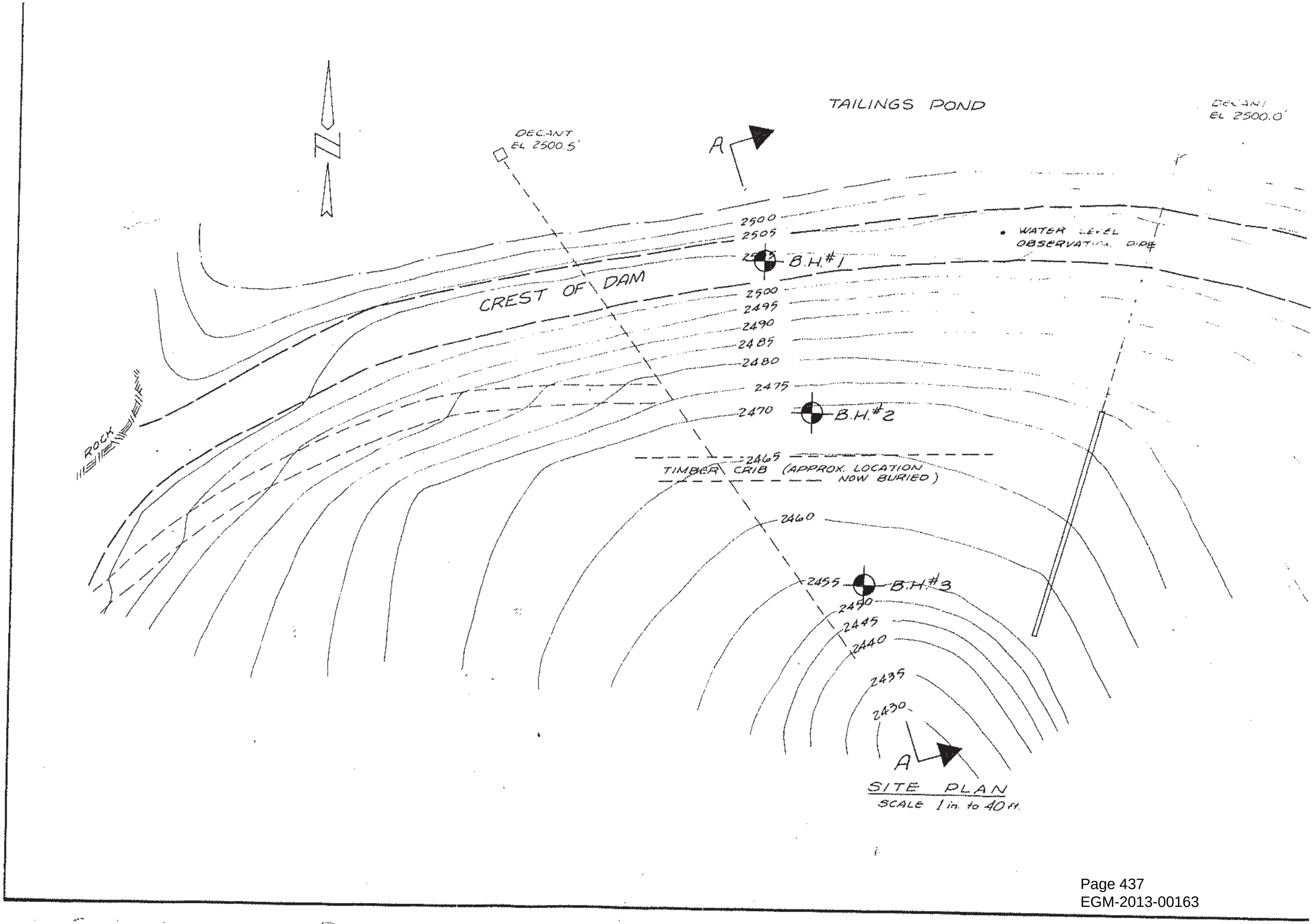
GOLDER BRAWNER & ASSOCIATES LTD.

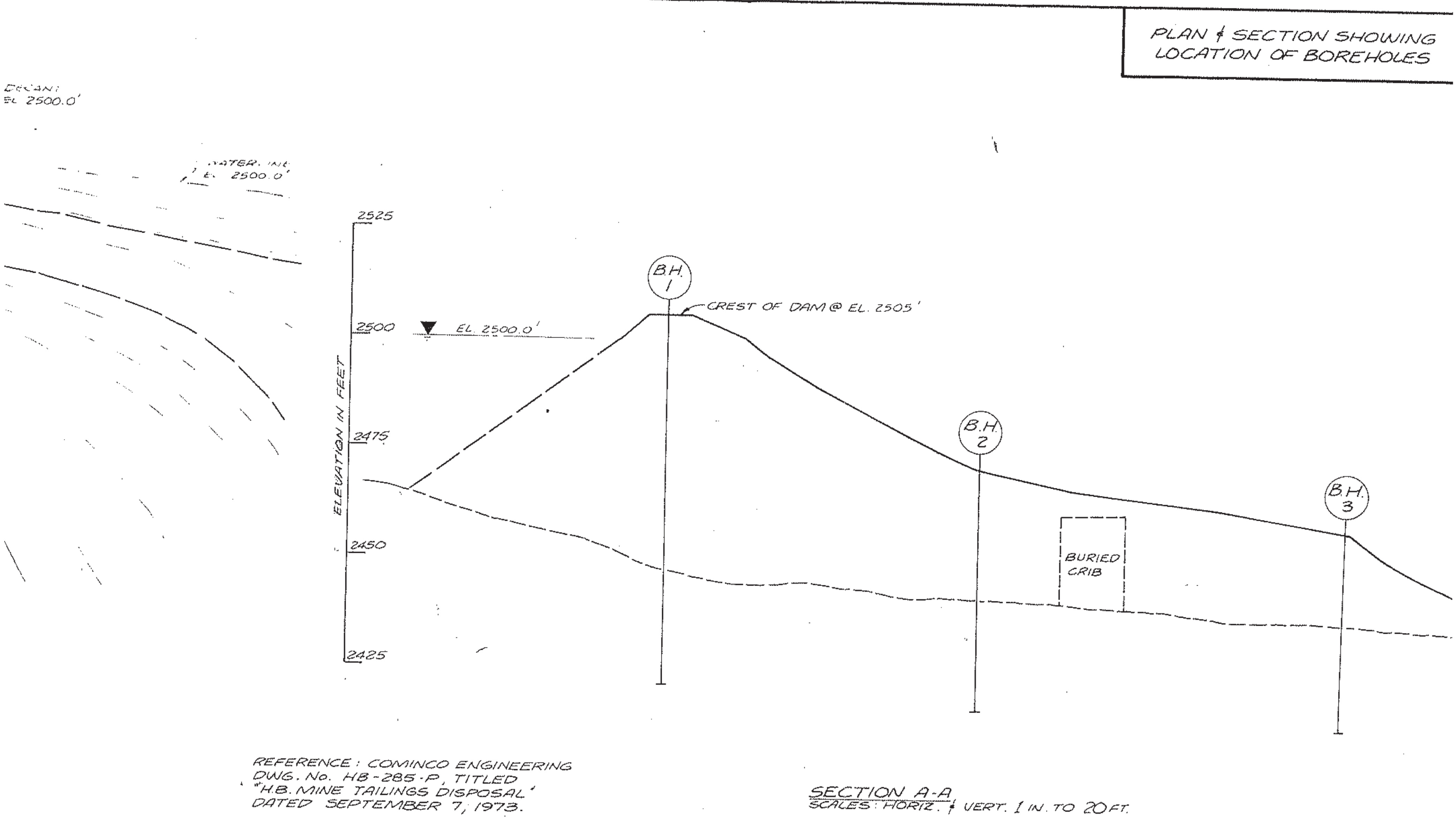
R.M. Wilson, P.Eng.

H.H. Hawson, P.Eng.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA H. HAWSON

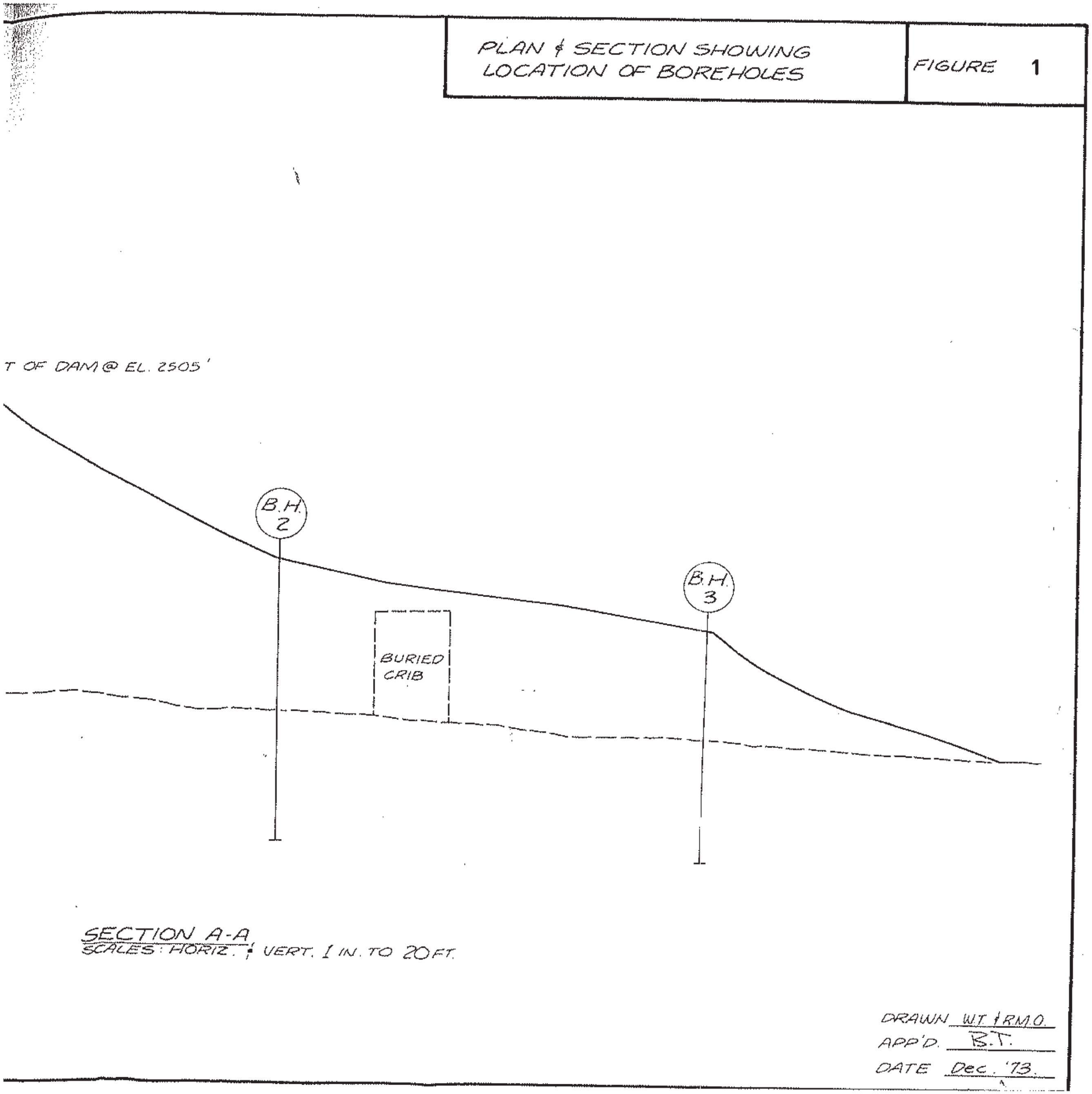
RMW/HHH/sm
V73218


TAILINGS POND
DECANT
EL 2500.5'
DECANT
EL 2500.0'
A
CREST OF DAM
B.H.#1
B.H.#2
B.H.#3
WATER LEVEL
ROCK
TIMBER CRIB (APPROX. LOCATION NOW BURIED)
2500
2505
2495
2490
2485
2480
2475
2470
2465
2460
2455
2445
2440
2435
2430
SITE PLAN
SCALE 1 in. to 40 ft.



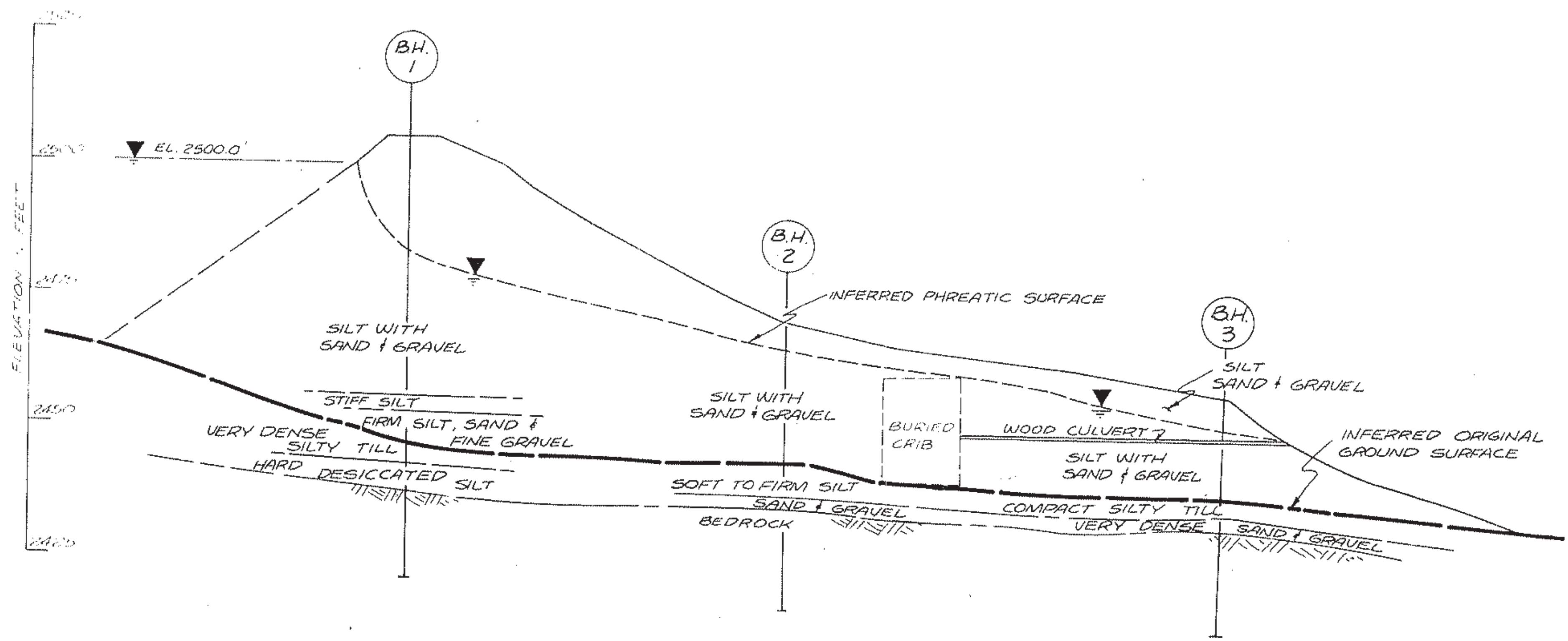
REFERENCE: COMINCO ENGINEERING DWG. No. HB-285-P, TITLED "H.B. MINE TAILINGS DISPOSAL" DATED SEPTEMBER 7, 1973.

GOLDER, BRAWNER & ASSOCIATES


PLAN & SECTION SHOWING
LOCATION OF BOREHOLES
FIGURE 1
T OF DAM @ EL. 2505'
B.H. 2
B.H. 3
BURIED CRIB
SECTION A-A
SCALES: HORIZ. & VERT. 1 IN. TO 20 FT.
DRAWN WT & RMO.
APP'D. B.T.
DATE Dec. '73.

CROSS SECTION A-A SHOWING
INFERRED SOIL STRATIGRAPHY
& PHREATIC SURFACE

FIGURE 2

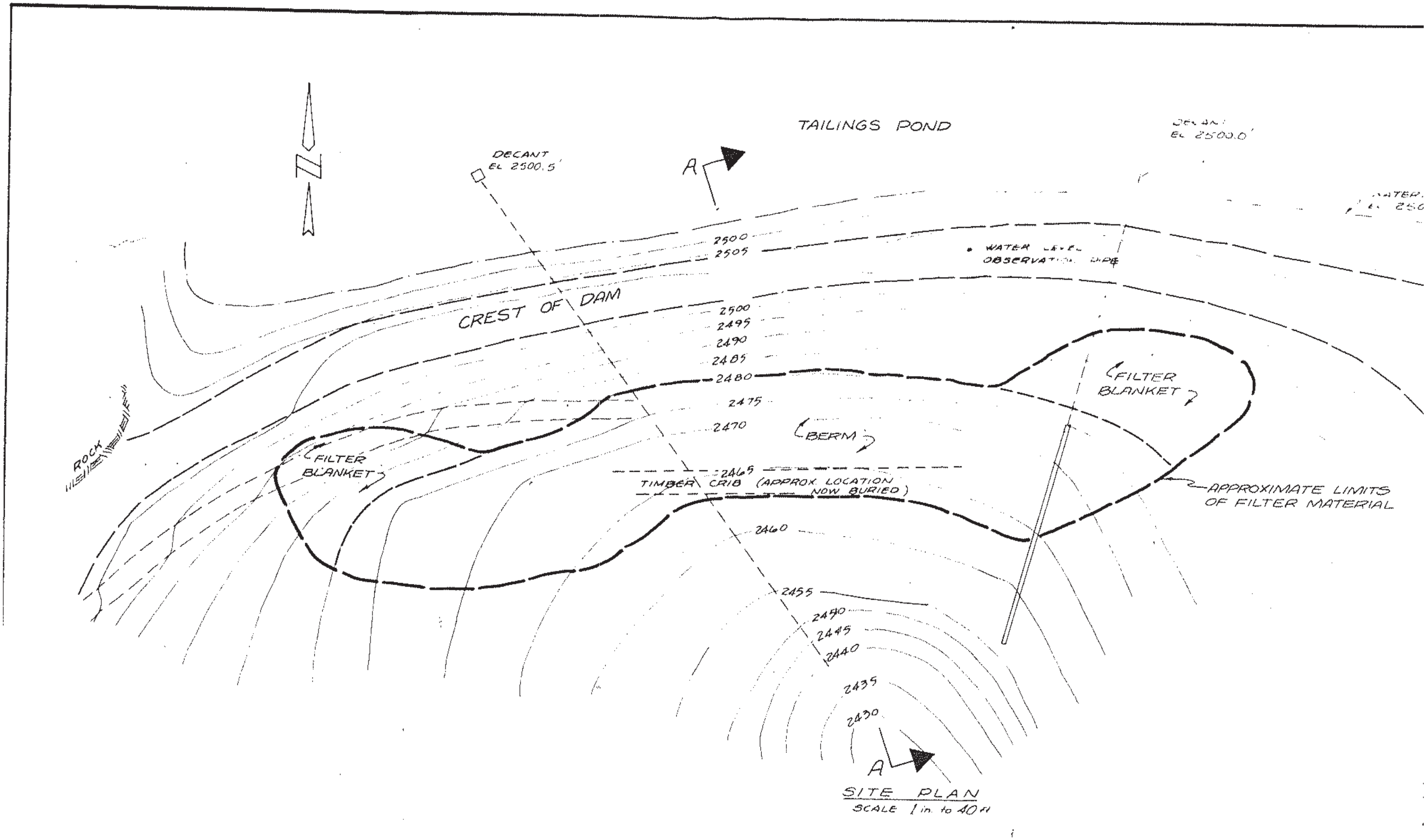


REFERENCE: COMINCO ENGINEERING
DWG. No. HB-285-P, TITLED
"HB MINE TAILINGS DISPOSAL"
DATED SEPTEMBER 7, 1973.

SECTION A-A
SCALES: HORIZ. & VERT. 1 IN. TO 20 FT.

GOLDER, BRAWNER & ASSOCIATES

DRAWN RMO
REQ'D B.T.
DATE Dec. '73.

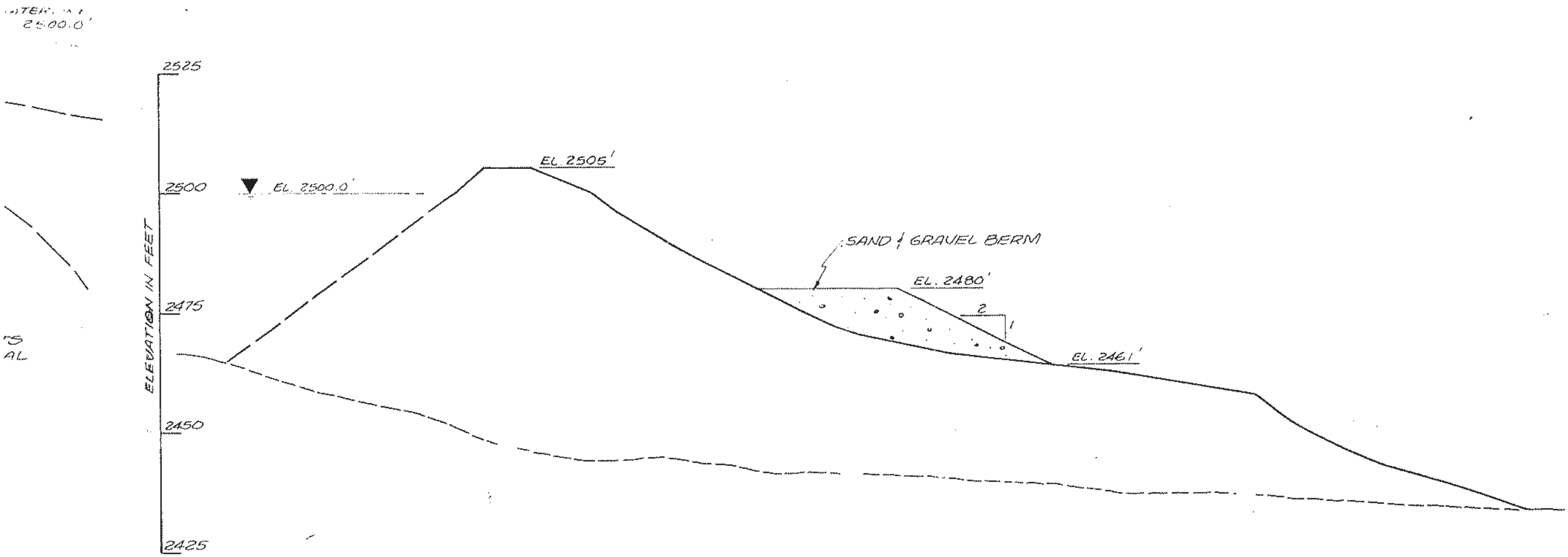


TAILINGS POND
DECANT
EL 2500.5'
DECANT
EL 2500.0'
A
CREST OF DAM
WATER LEVEL
OBSERVATION PIPE
2500
2505
2500
2495
2490
2485
2480
2475
2470
2465
2460
2455
2450
2445
2440
2435
2430
FILTER BLANKET
FILTER BLANKET
BERM
ROCK
TIMBER CRIB (APPROX LOCATION NOW BURIED)
APPROXIMATE LIMITS OF FILTER MATERIAL
A
SITE PLAN
SCALE 1 in. to 40 ft

GOLDER

RECOMMENDED
BERM CONSTRUCTION

FIGURE 3



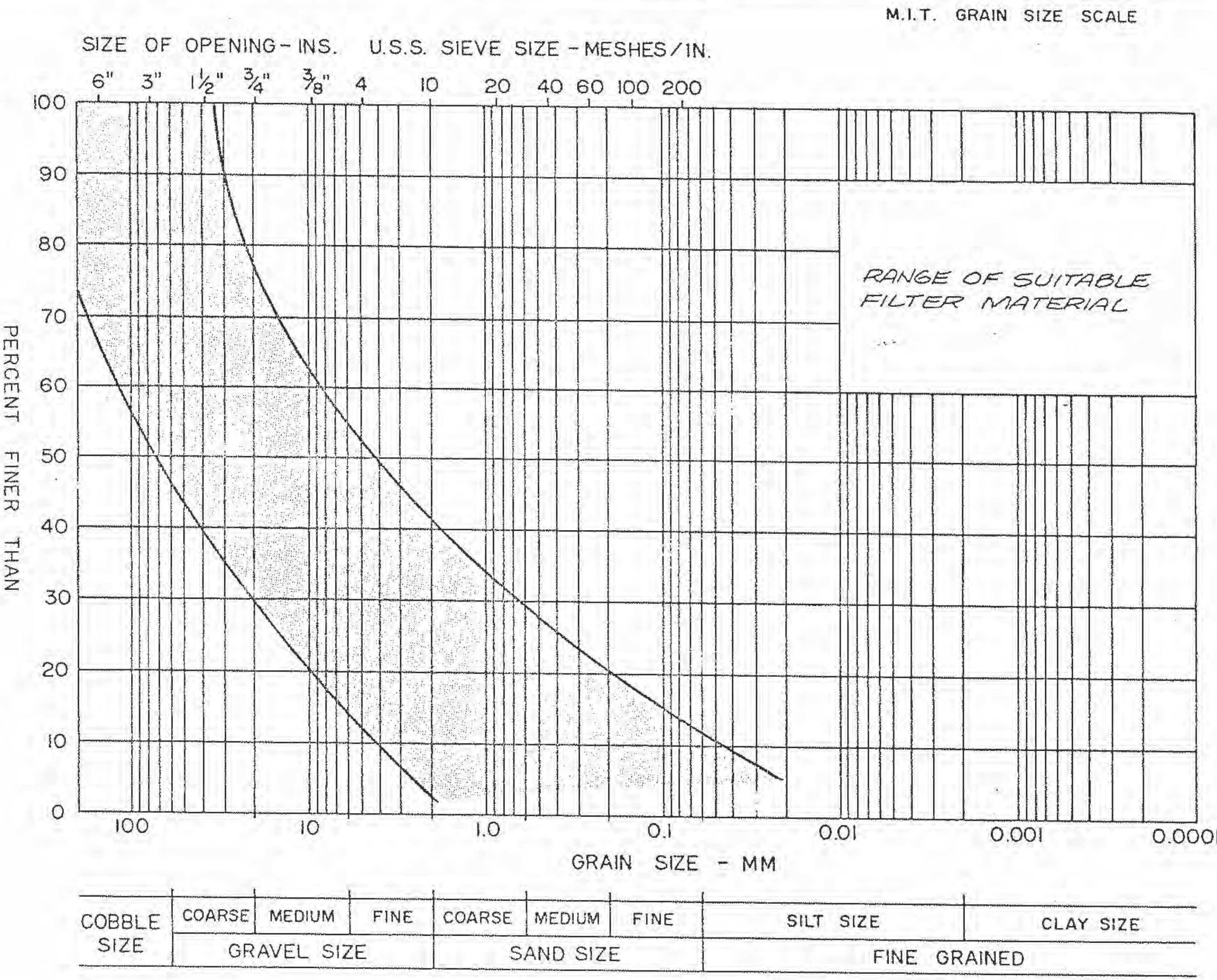
REFERENCE: COMINCO ENGINEERING
DWG. No. HB-285-P, TITLED
"H.B. MINE TAILINGS DISPOSAL"
DATED SEPTEMBER 7, 1973.

SECTION A-A
SCALES: HORIZ. & VERT. 1 IN. TO 20 FT.

OLDER, BRAWNER & ASSOCIATES

DRAWN W.T. & R.M.O.
APP'D. B.T.
DATE Dec. '73.
V73218

GOLDER, BRAWNER & ASSOCIATES

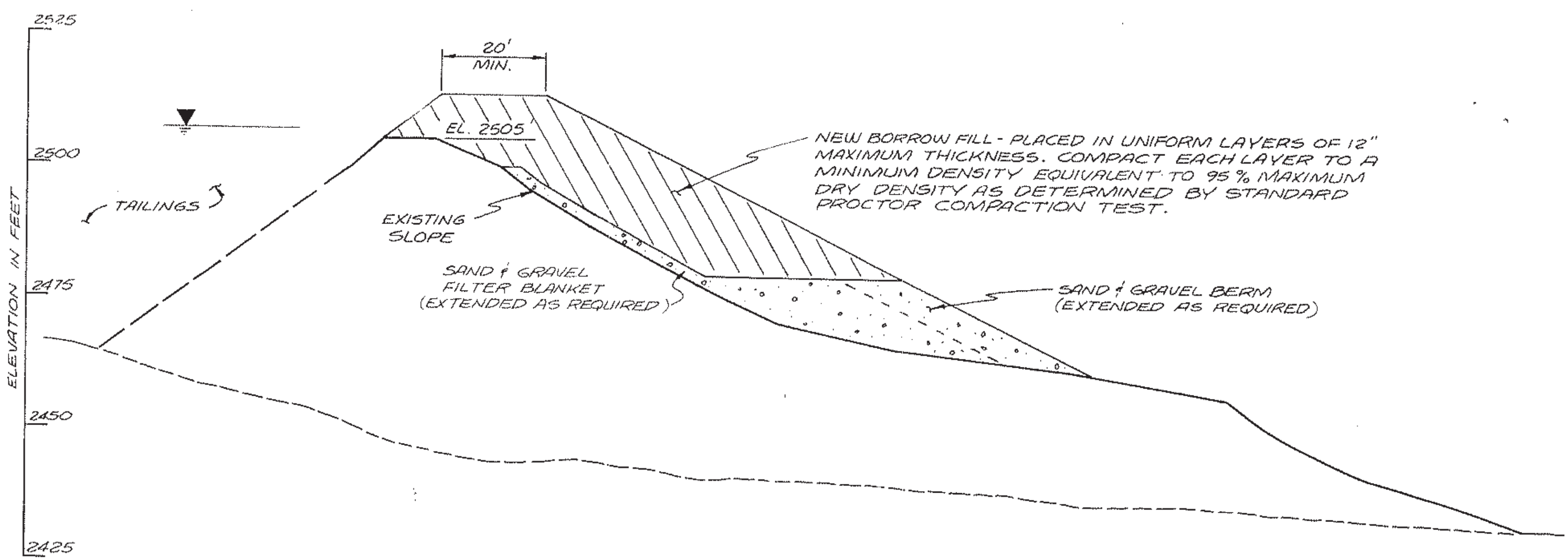


GRAIN SIZE DISTRIBUTION

FIGURE 4

SECTION SHOWING RECOMMENDED METHOD OF RAISING EXISTING DAM

FIGURE 5



REFERENCE: COMINCO ENGINEERING DWG. No. HB-285-P, TITLED "H.B. MINE TAILINGS DISPOSAL" DATED SEPTEMBER 7, 1973.

SECTION A-A
SCALES: HORIZ. & VERT. 1 IN. TO 20 FT.

DRAWN RMO
APP'D B.T.
DATE Dec. '73.

PROJECT No. V73218

RECORD OF BOREHOLE 1

LOCATION See Figure 1

BORING DATE OCTOBER 29, 30, 1973 DATUM TAKEN FROM COMINCO DRAWING NO. HB-285-P

BOREHOLE TYPE ROTARY TRICONE

BOREHOLE DIAMETER 4 IN

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES

PEN. TEST HAMMER WEIGHT — LB DROP — INCHES

SOIL PROFILE

ELEVN. / DEPTH	DESCRIPTION
2505.0 / 0.0'	GR. SURFACE.
	SOFT TO FIRM NON-PLASTIC BROWN SANDY SILT WITH SOME MED. & COARSE SAND & FINE GRAVEL.
2455.0 / 50.0'	STIFF STRATIFIED GREY & BROWN CLAYEY SILT WITH A TRACE OF MED. SAND.
2452.0 / 53.0'	FIRM BROWN & DARK BROWN SILT WITH SOME MED. & COARSE SAND, FINE GRAVEL & ORGANICS.
2446.0 / 59.0'	
2442.0 / 63.0'	VERY DENSE DARK GREY SILT, SAND & GRAVEL TO 1" DIA. (TILL).
2437.0 / 68.0'	VERY DENSE BLACK FRIABLE DESICCATED SILT WITH THIN PYRITE LENSES & ROUNDED GRAVEL TO 1½" DIA.
	BEDROCK.
2420.0 / 85.0'	END OF HOLE.

SAMPLES

NUMBER	TYPE	BLOWS / FT.
1	2" D.O.	11
2	2" D.O.	4
3	2" D.O.	14
4	2" D.O.	5
5	2" D.O.	15
6	2" D.O.	
7	2" D.O.	13
8	2" D.O.	13
9	2" D.O.	23
10	2" D.O.	37
11	2" D.O.	24
12	2" D.O.	>100
13	2" D.O.	>100
14	WS	
15	WS	
16	WS	

ELEVATION SCALE: 2500, 2490, 2480, 2470, 2460, 2450, 2440, 2430, 2420

DYNAMIC PENETRATION RESISTANCE BLOWS/FT

SHEAR STRENGTH C_u, LB/SQ.FT

COEFFICIENT OF PERMEABILITY k, CM/SEC.

WATER CONTENT, PERCENT W_P W W_L

ADDITIONAL LAB. TESTING

STANDPIPE INSTALLATION

W.L. 23.0' NOV. 23, 1973

15 ◇ 5 Percent axial strain at failure 10

VERTICAL SCALE 1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

1

DRAWN RMO

CHECKED

PROJECT No. V73218

RECORD OF BOREHOLE 2

LOCATION See Figure 1 BORING DATE NOVEMBER 1, 1973 DATUM TAKEN FROM COMINCO DRAWING NO. HB 285 P

BOREHOLE TYPE ROTARY-TRICONE BOREHOLE DIAMETER 4 IN.

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT LB DROP INCHES

ELEVN. / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	BLOWS / FT.	ELEVATION SCALE
2465.0 / 0.0'	GR. SURFACE.				
	SOFT BROWN SANDY SILT WITH MED. & COARSE SAND & GRAVEL TO 1½" DIA. OFTEN TILL LIKE	1	2" DO	10	2460
		2	2" DO	8	
		3	2" DO	13	2450
		4	2" DO	4	
2438.6 / 26.4'	WOOD	5	2" DO	20	2440
27.0'	SOFT TO FIRM STRATIFIED BROWN & GREY SILT WITH OCC. GRAVEL TO 1½" DIA.	6	2" DO		
2431.0 / 34.0	SAND & GRAVEL.				2430
2429.0 / 36.0	BEDROCK.	7	WS		
		8	WS		2420
		9	WS		
		10	WS		
2410.0 / 55.0	END OF HOLE.				2410

DYNAMIC PENETRATION RESISTANCE BLOWS/FT

SHEAR STRENGTH C_u, LB./SQ.FT

COEFFICIENT OF PERMEABILITY k, CM./SEC.

WATER CONTENT, PERCENT W_P W W_L

ADDITIONAL LAB. TESTING

STANDPIPE INSTALLATION

WL 5.5' NOV 23,1973

15 ◊ 5 Percent axial strain at failure 10

VERTICAL SCALE 1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

2

DRAWN RMO

CHECKED

PROJECT No. V73218

RECORD OF BOREHOLE 3

LOCATION See Figure 1 BORING DATE NOVEMBER 1, 1973 DATUM TAKEN FROM COMINCO DRAWING NO. HB-285-P

BOREHOLE TYPE ROTARY-TRICONE BOREHOLE DIAMETER 4 IN.

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT – LB DROP – INCHES

SOIL PROFILE: ELEVN / DEPTH	SOIL PROFILE: DESCRIPTION	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS / FT.	ELEVATION SCALE	STANDPIPE INSTALLATION
2455.0' / 0.0'	GR. SURFACE. VARIABLE DENSITY BROWN & GREY SILT SAND & GRAVEL	1	2" D.O.	>50	2450	
2448.0' / 7.0' – 8.0	WOODEN CULVERT					W.L. 6.0' NOV 23, 1973
	VARIABLE DENSITY BROWN & GREY SILT WITH MED. & COARSE SAND & FINE GRAVEL.	2	2" D.O.	>100		
		3	2" D.O.	15	2440	
2435.0' / 20.0'	COMPACT BROWN & GREY SILT, SAND & GRAVEL (TILL)	4	2" D.O.	37		
2432.0' / 23.0'		5	2" D.O.	>100	2430	
2429.0' / 26.0'	VERY DENSE SAND & GRAVEL	6	WS			
	BEDROCK.				2420	
		7	WS			
2410.0' / 45.0'	END OF HOLE.				2410	

DYNAMIC PENETRATION RESISTANCE BLOWS / FT. ---------- SHEAR STRENGTH C_u, LB./SQ.FT

COEFFICIENT OF PERMEABILITY k, CM./SEC. WATER CONTENT, PERCENT W_P W W_L

ADDITIONAL LAB. TESTING

15 ○ 5 Percent axial strain at failure (0, 10)

VERTICAL SCALE 1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

3

DRAWN RMO
CHECKED

ORIGINAL REPORT IN NELSON

1105??

Golder Associates
CONSULTING GEOTECHNICAL ENGINEERS

REPORT TO

COMINCO LTD.

ON

PROPOSED DAM EXTENSION 1976

H.B. MINE

SALMO B.C.

Distribution:

5 copies - Cominco, Trail, B.C.

2 copies - Golder Brawner Associates, Vancouver

December, 1976 K76681

1367

GOLDER, BRAWNER & ASSOCIATES LTD., 224 WEST 8th AVE., VANCOUVER, B.C., V5Y 1N5 CANADA • PHONE: (604) 879-9266 • TELEX: 04-508800

Golder Associates
CONSULTING GEOTECHNICAL ENGINEERS

December 20, 1976

Cominco Ltd.
Engineering Department
Trail, British Columbia

ATTENTION: Mr. G. Shoblom, P.Eng.

Dear Sirs:

Re: Proposed Dam Extension 1976,
H.B. Mines, Salmo, B.C.

As requested, Golder, Brawner & Associates have carried out a geotechnical study for the proposed extension to the existing H.B. Mines tailings dam. The work involved a review of the soil conditions at the existing dam and a site investigation to determine the availability of borrow material for the proposed work.

The soil and site conditions were determined during previous soil investigations at the dam site and are outlined in our report on the Site Investigation at Existing H.B. Mines Tailings Pond, Salmo, B.C., dated January 1974 (refer V73218). This report also included a stability assessment of the dam and recommendations for proposed construction measures for the dam in 1974. The recommendations for the proposed work were carried out in 1974 and 1975 when the old dam section was raised by 10 ft. The construction work was carried out under the supervision of Golder, Brawner and Associates personnel.

The field work for the proposed new extension involved an investigation of potential sources of borrow fill for the dam construction.

The area considered as a potential borrow source is located to the south of the present general or bulk fill borrow pit. A total of 5 test pits were excavated in the area on October 28, 1976 using a bulldozer. The test pits were located in the field and inspected by a member of our engineering staff. The soil strata encountered were visually identified and classified in the field. Several representative samples of the soil encountered were obtained and sent to our laboratory for detailed inspection and classification. Detailed descriptions of the soil strata encountered in the test pits are presented on the attached Record of Test Pit Logs. The results of gradation tests carried out on selected samples are presented on Fig. 4.

SOIL CONDITIONS

Foundation Soils

The tailings dam is located at the southern end of a north-south trending valley and has been constructed to a height of 60 to 70 ft. using borrow fill. The fill for the construction was obtained from borrow pits located on the abutments at the dam site.

The original dam which existed at the site prior to the 1974 construction was constructed generally of a sandy silt with varying amounts of sand and fine gravel. A chimney drain of sand and gravel and an additional 10 ft. cap of silt and fine sand were constructed in 1974. The results of the previous soil investigation indicate that the dam is underlain by a 5 ft. thick stratum of hard desiccated silt. Bedrock was encountered beneath the silt layer.

Standpipes installed during the 1974 investigation were not operational at the time of the test pit excavation program in October 1976. Inspection of the dam, however, indicated no major seepage was occurring at the toe of the dam. Some minor seepage was observed on the west abutment near the toe of the existing gulley area below the dam. Based on data from the original construction of the dam, it is considered that this seepage is associated with several buried wooden pipes and culverts in the dam fill.

Borrow Area

The borrow area which was utilized in 1974 and 1975 to supply the required bulk fill quantities is located on the east abutment.

Test pits excavated during this investigation program south of the old borrow area indicate that the fine sand and sandy silt material obtained previously from this area extends some 300 to 400 ft. to the south. This material is suitable for future bulk fill requirements. To extend the existing borrow area would require stripping and stockpiling of the topsoil and organic forest litter which covers the area.

The sand and gravel filter material was obtained from a pit located approximately ½ mile north of the damsite. Examination of the area indicates that additional suitable material would be available from this location for the future extensions proposed.

PROPOSED FUTURE EXTENSIONS

It is understood that consideration is being given to increasing the present height of the existing dam to develop additional storage. The dam would be increased either 5 ft. or 15 ft. in height, using similar construction techniques to those used previously. It is proposed that the fill for the increase would be obtained by extending the previous borrow pit on the east abutment. Select sand and gravel fills would probably be obtained from the borrow pit of the Department of Highways on the road leading up Sheep Creek. [illegible]

Based on the results of the test pit program, preliminary estimates indicate that the above sources should be adequate to provide the required bulk fill quantities for the 5 ft. extension. It may, however, be necessary, if a 15 ft. height increase is carried out to develop additional local alternative sources of borrow material. This additional fill material may be available in the area along the east side of the present access road within 1,500 ft. of the dam. Alternatively, a design utilizing cycloned tailings sand for fill could possibly be developed.

DAM STABILITY AND PROPOSED EXTENSIONS

The design parameters used for the previous studies and given in our previous reports are still considered to be appropriate. As proposed, the increase in pond elevation will result in an increase in the phreatic surface within the dam. To accommodate the resultant higher phreatic surface, a sand and gravel filter drain is recommended. The drain material should be placed in the gulley area at the centre of the downstream side of the dam and over both abutments and should be extended to cover any seepage points which presently exist. The bulk fill required for the construction may consist of the local borrow glacial materials.

Details of the construction for the 5 ft. and 15 ft. elevation increase are shown on Figure 3.

The results of stability calculations carried out for the proposed extensions gave minimum safety factors for downstream slope stability during maximum seepage conditions of 1.3. These analyses were carried out considering the maximum pond level as shown on Figure 3, and a 15 foot depth of water at the face of the dam.

DECANT SYSTEM

The present decant system consists of discharing excess water, which is free of suspended solids, through a vertical timber shaft. The water is carried through the dam by corrugated metal pipes which are located in the dam fill. This type of decant is not, in our opinion, adequate for any future increase and it is recommended that this system be discontinued and that a new method of decanting be provided. The new system could consist of a reinforced concrete culvert placed on the east abutment and provided with water control inlets. The system would be constructed on the ground surface and the increase in contour elevation would be utilized to control water levels. (See figure 3). Alternatively, a spillway type system would be developed at the same location. The flow of water from this new decant system should be channelled into a gravel lined ditch along the east abutment and hence into the existing creek channel down the valley in a controlled manner. Having constructed the new system, the present decant tower and pipes should be completely sealed. The outlet of the existing decant culvert pipe should be exposed, cleared, and then provided with a 5 foot grannular surround consisting of sand and gravel filter material.

CONSTRUCTION

The construction of the extensions will require site preparation at the base of the downstream toe of the existing dam. It is recommended that any organic matter or topsoil be removed from within the limits of the proposed construction area. Care should be exercised in clearing the areas of seepage to prevent disturbance of the native materials.

The sand and gravel drain material and the bulk fill or sandy silt should be placed in maximum horizontal lifts of 12 in. and compacted to a minimum of 95 percent of maximum Standard Proctor dry density. The bulk fill material in the borrow area will probably require ripping to enable the material to be excavated. More specific construction details will be provided after the details and specifics of the extension are finalized. All new fills should be blended or keyed into the existing dam and the native abutment materials.

It is recommended that during the construction, several piezometers be installed in the dam so that future monitoring of the phreatic surface which develops can be carried out over the life of the ponds.

FILL MATERIALS

At this time, it is not known which alternative will be constructed. It is probable that if the higher dyke is selected, the borrow pit on the east abutment may not contain sufficient material for the required work. It is recommended that, if this alternative is adopted, additional fieldwork should be carried out in the borrow area prior to construction to enable a more accurate estimate of fill quantities to be made. At this time, the availability of additional material adjacent to the access road to the damsite should also be investigated.

We trust that this is the information you require. We would be pleased to discuss the report with you in more detail, should you desire.

Yours very truly,

GOLDER BRAWNER & ASSOCIATES LTD.

Per:

for H. HAWSON, P.Eng

for J.A. HULL, P.Eng.

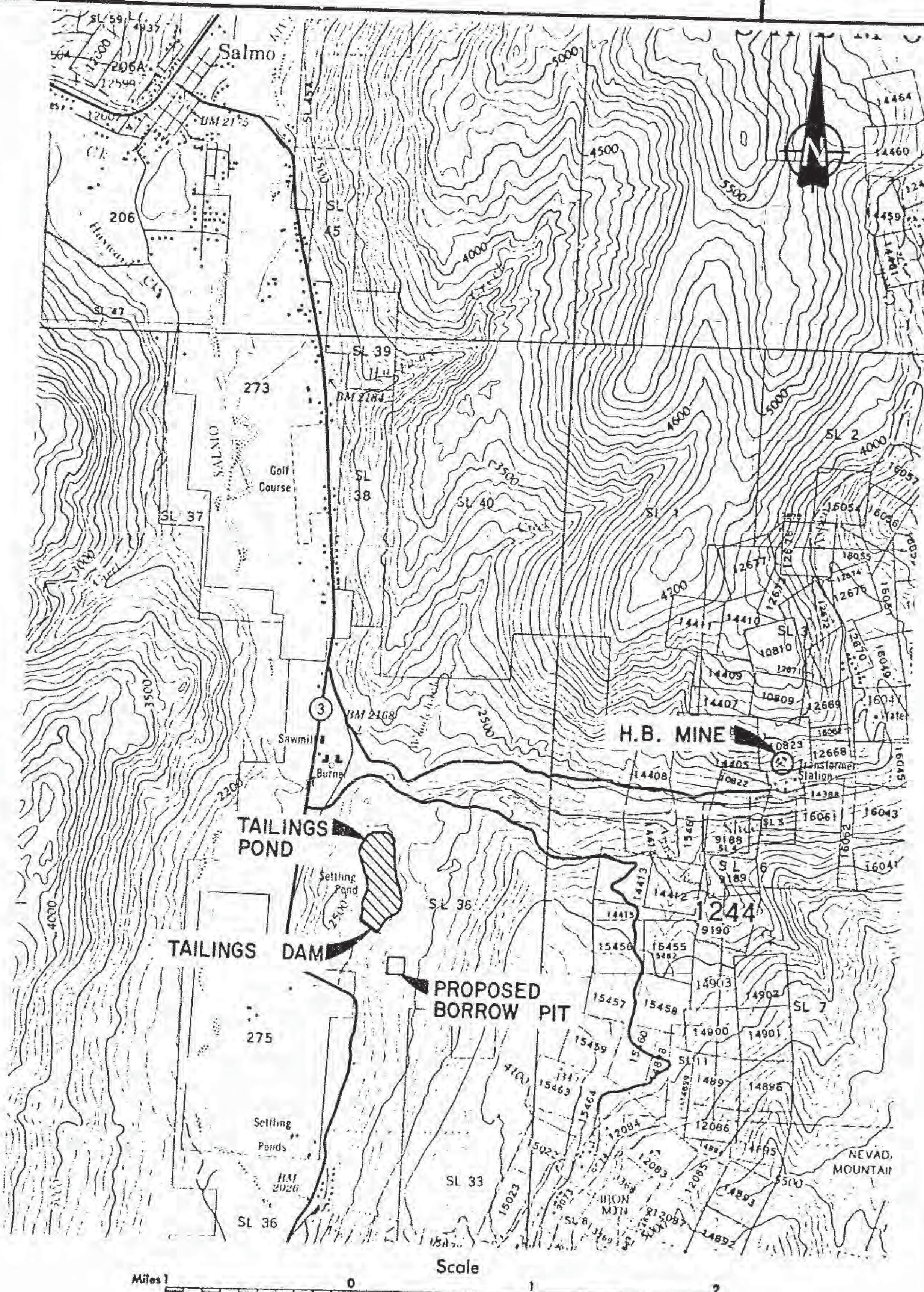
HH:mg

K76681.

Project No. 5 766-81

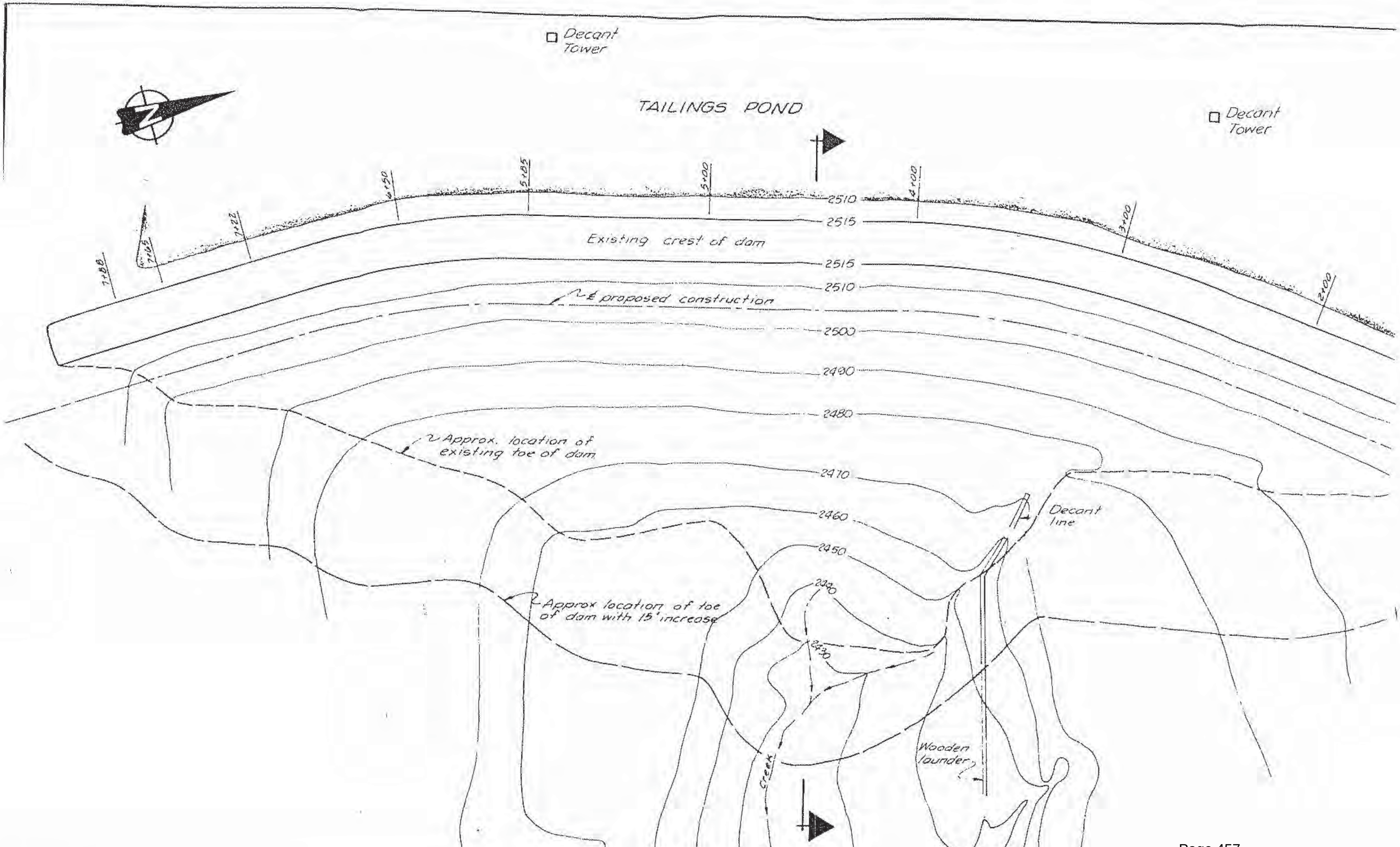
KEY PLAN

FIGURE 1



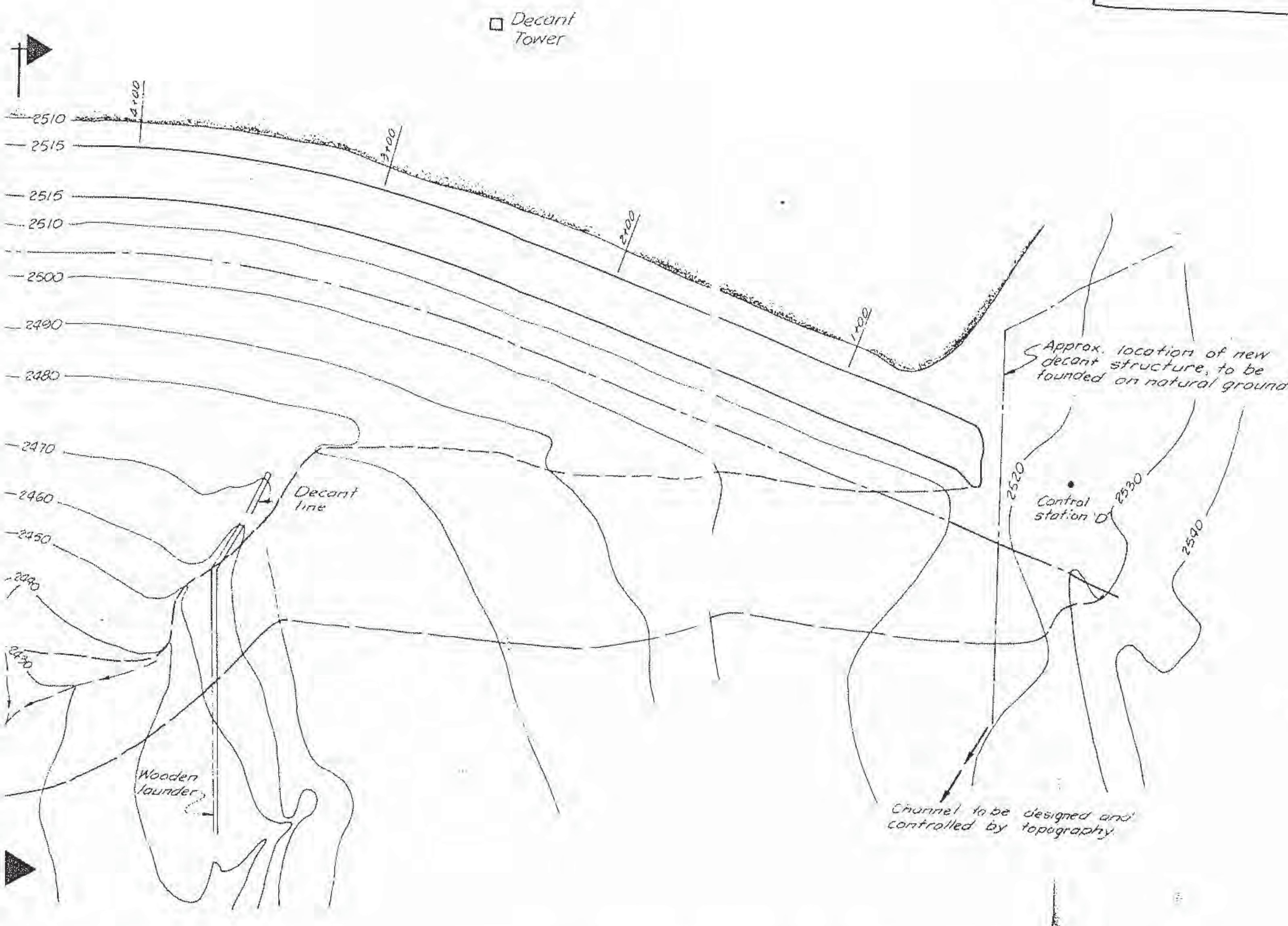
Golder Associates

Drawn
App'd
Date


Decant Tower
TAILINGS POND
Decant Tower
7+88
7+65
7+22
6+50
5+85
5+00
4+00
3+00
2+00
2510
2515
Existing crest of dam
2515
2510
℄ proposed construction
2500
2490
2480
Approx. location of existing toe of dam
2470
2460
Decant line
2450
2440
2430
Approx location of toe of dam with 15' increase
Creek
Wooden launder

SITE PLAN

Figure



Note

Design of decant structure to be carried out after proposed dam height increase is finalized.

Reference:

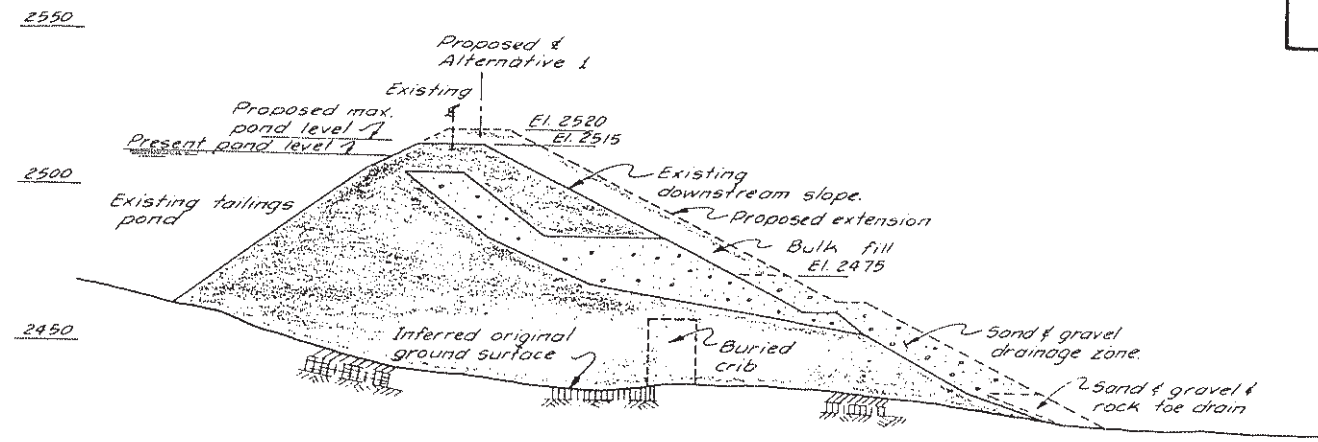
Cominco drawing "H.B. Mine Tailings Disposal Dyke - Downstream Topography Survey 1-85-0" Dated Nov. 1976.

Scale - 1 in. to 40 ft.

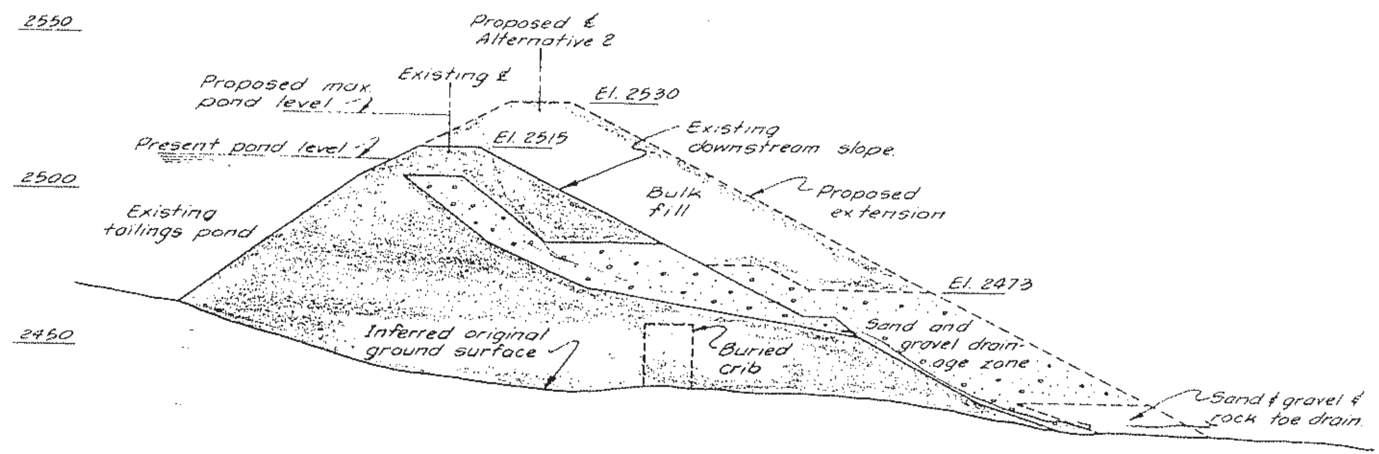
Drawn
App'd
Date Dec '76

SECTIONS SHOWING RECOMMENDED METHOD OF CONSTRUCTION

Figure



ALTERNATIVE 1



ALTERNATIVE 2

LEGEND

- Firm to stiff brown sandy silt trace gravel.
- Very dense silty glacial till.
- Weather bedrock.
- Compact to dense sand ¢ gravel.
- Compact sand ¢ gravel, trace of silt (drainage zone)

NOTE:

1 Soil conditions at dam site determi[...] in previous site investigation. Refe[...] to G.B.A report V73218.

2 Sand ¢ gravel ¢ rock toe drain to b[...] sized depending on availability o[...] material and gradation of materi[...] utilized.

Reference: Cominco Dwg. No. HB-285P ¢ Cross sections, Dated Dec. 31, 1974

Scale - Hor. ¢ vert. 1 in. to 40 ft.

Drawn
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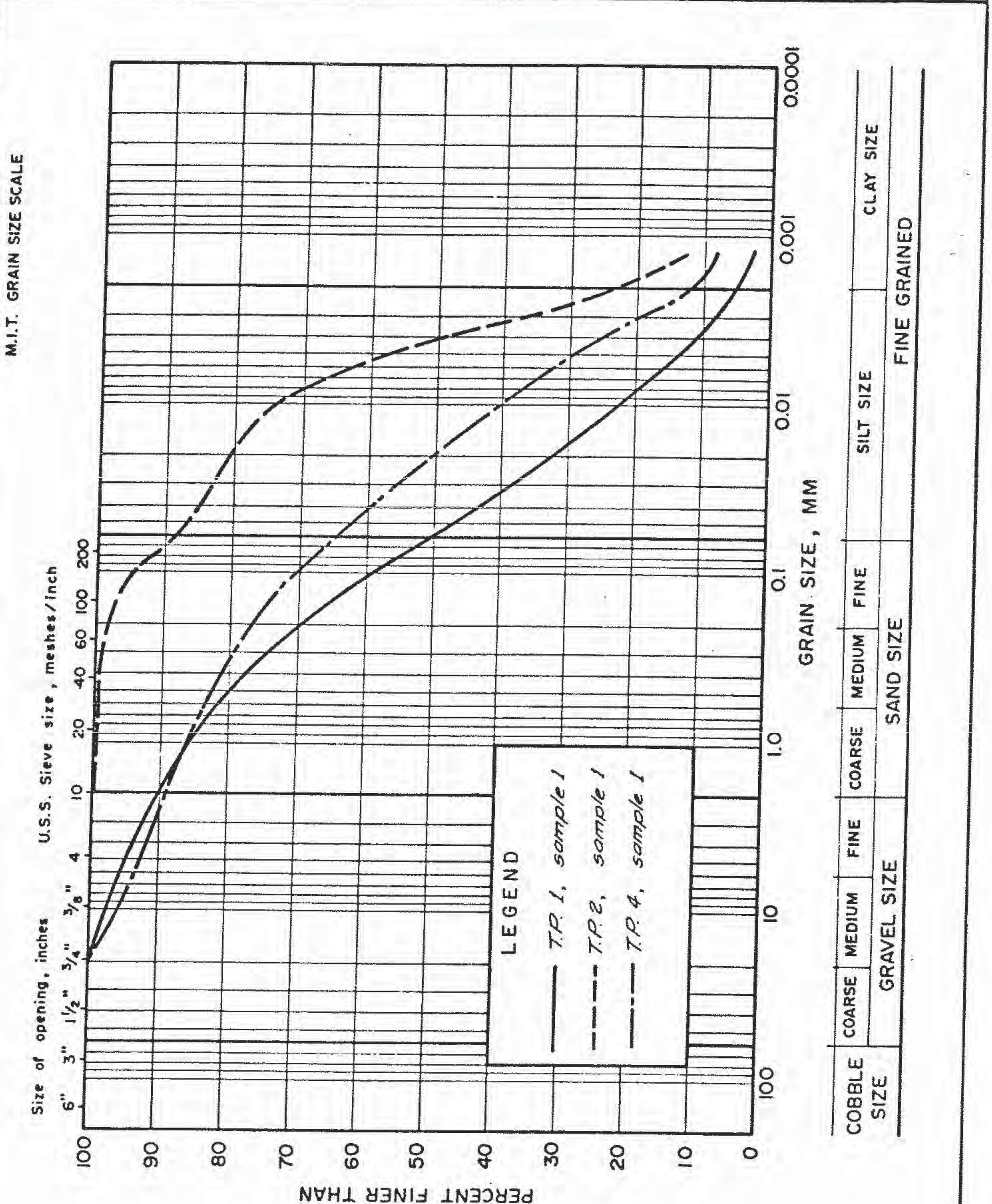
Date Dec

GRAIN SIZE DISTRIBUTION

FIGURE **4**

Project No. K76601



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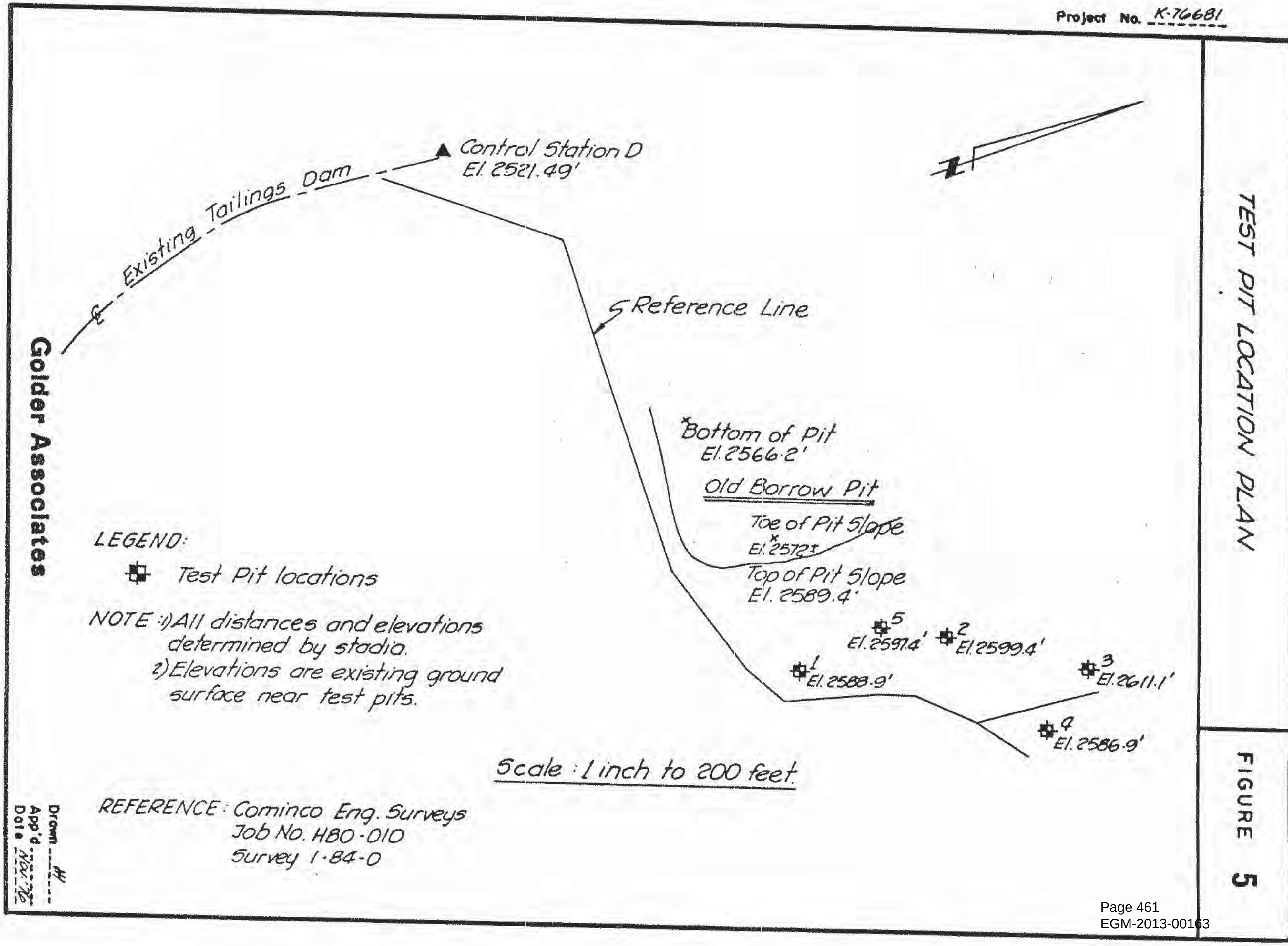
Project No. K-76681
TEST PIT LOCATION PLAN
FIGURE 5
Golder Associates
Control Station D
El. 2521.49'
Existing Tailings Dam
Reference Line
Bottom of Pit
El. 2566.2'
Old Borrow Pit
Toe of Pit Slope
El. 2572±
Top of Pit Slope
El. 2589.4'
5 El. 2597.4'
2 El. 2599.4'
1 El. 2588.9'
3 El. 2611.1'
4 El. 2586.9'
LEGEND:
Test Pit locations
NOTE: 1) All distances and elevations determined by stadia.
2) Elevations are existing ground surface near test pits.
Scale: 1 inch to 200 feet.
REFERENCE: Cominco Eng. Surveys
Job No. H80-010
Survey 1-84-0
Drawn
App'd
Date Nov '76

Project No. K-76681

RECORD OF TEST PIT #1

LOCATION (See Figure) DATE October 28, 1976 DATUM –

METHOD OF EXCAVATION Backhoe PROJECT H. B. Mines

SOIL PROFILE		STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT W_P W W_L	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
ELEVN. / DEPTH	DESCRIPTION							
	Ground Surface							
0.0'	Loose brown silt and sand some organic matter							
1.0'	Hard grey silt trace sand and gravel - west side of pit sand & gravel seam from 6 to 10 ft.							
8.0'	Cobbles up to 6" dia.							
9.0'								
10.0'	End of Test Pit.							

VERTICAL SCALE 1 inch to 2 feet

Golder Associates

DRAWN JH

CHECKED TJ

Project No. K-76681

RECORD OF TEST PIT #2

LOCATION (See Figure) DATE October 28, 1976 DATUM –

METHOD OF EXCAVATION Backhoe PROJECT H.B. Mines

SOIL PROFILE: ELEVN. / DEPTH	SOIL PROFILE: DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT (W_P — W — W_L)	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
	Ground Surface							
0.0'	Loose reddish brown sandy silt and organic matter							
1.0'	Firm to stiff grey silt, fine sand; pocket of sand on west side of pit		1					
6.0'	Stiff grey silt, trace to some sand, trace clay		2					
7.0'	End of Test Pit							

VERTICAL SCALE
1 inch to 2 feet

Golder Associates

DRAWN *H*
CHECKED *T.J.*

Project No. K-76681

RECORD OF TEST PIT #3

LOCATION (See Figure) DATE October 28, 1976 DATUM -

METHOD OF EXCAVATION Backhoe PROJECT H.B. Mines

SOIL PROFILE								
ELEVN. / DEPTH	DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT W_P W W_L	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
	Ground Surface							
0.0'	Loose brown sand & organic matter							
1.0'	Loose to compact brown silty sand with gravel and cobbles rounded							
5.0'	Reddish brown talus material angular							
6.0'	End of Test Pit.							

VERTICAL SCALE
1 inch to 2 feet

Golder Associates

DRAWN H
CHECKED T.J.

Project No. K-76681

RECORD OF TEST PIT #4

LOCATION (See Figure) DATE October 28, 1976 DATUM -

METHOD OF EXCAVATION Backhoe PROJECT H.B. Mines

SOIL PROFILE								
ELEVN. / DEPTH	DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT W_P W W_L	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
	Ground Surface							
0.0'	Loose brown silt with organic matter							
1.6'	Firm grey silt with some sand							
3.0'	Compact brown fine sand with silt layers							
5.0'	Compact brown sand and silt some cobbles and gravel		1					
9.0'	End of Test Pit. Terminated on large boulder or bedrock at 9.0 ft. on east side of test pit.							

VERTICAL SCALE
1 inch to 2 feet

Golder Associates

DRAWN
CHECKED

Project No. K-76681

RECORD OF TEST PIT #5

LOCATION (See Figure) DATE October 28, 1976 DATUM –

METHOD OF EXCAVATION Backhoe PROJECT H.B. Mines

SOIL PROFILE: ELEVN. / DEPTH	SOIL PROFILE: DESCRIPTION	STRATIGRAPHY PLOT	SAMPLE NUMBER	SAMPLE TYPE	ELEVATION SCALE	WATER CONTENT, PERCENT (W_P — W — W_L)	ADDITIONAL LAB. TESTING	GROUNDWATER CONDITIONS
	Ground Surface							
0.0'	Loose brown sandy silt & organic matter							
1.0'	Stiff to compact brown silty fine sand and some gravel							
6.5'	End of Test Pit							

VERTICAL SCALE 1 inch to 2 feet

Golder Associates

DRAWN [initials]
CHECKED [initials]

DAVID MINERALS LTD.

STAGE I SUBMISSION
FOR REACTIVATION OF
THE HB MILL LOCATED
AT SALMO, B.C.

for

DAVID MINERALS LTD.

International
Environmental
Consultants Ltd.
Vancouver / Calgary / Toronto / Montreal

STAGE I SUBMISSION
TO METAL MINES STEERING COMMITTEE
FOR REACTIVATION OF THE HB MILL,
LOCATED AT SALMO, B.C.

14745-20

Prepared for

DAVID MINERALS LTD.

By:

IEC INTERNATIONAL ENVIRONMENTAL CONSULTANTS LTD.
202-5600 Cedarbridge Way
Richmond, B.C. V6X 2A7

R.Y. Ting, Ph.D., Project Manager

T.C. Griffing, Ph.D., Project Principal

3089.5

March 1982

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

MEMORANDUM

To: Selected Participants,
Metal Mines Guidelines Review Process

Date: May 5, 1982

Our File: HB Gold Project

Re: David Minerals Ltd. Stage I Submission for Reactivation of the H. B. Mill located at Salmo, B.C.

The Metal Mines Steering Committee has now received the Stage I submission for the above project.

This is a reactivation of an old mine and there will be no new impacts. The only change will be the ore and the milling process. David Minerals has discussed the project with the regional people and applications for amending existing permits have been made.

Since this is a reactivation of an old mine and no additional impacts are noted, it is recommended that the Stage I report is all that is required.

Review comments should be forwarded to this office no later than May 30th, 1982.

J. D. McDonald,
Chairman
Metal Mines Steering Committee
c/o Inspection and Engineering Branch
Mineral Resources Division.

JDM:vv

Attachment: David Minerals Stage I report.

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C-1 Appendix C - Tailings Disposal Scheme for the HB Mill - Prepared by Klohn Leonoff Consulting Engineers.

1.0 SUMMARY

David Minerals Ltd. wishes to reactivate the HB Mill located within the property of the HB Mine to produce gold and iron concentrates. The property was purchased from Cominco Ltd. in September 1981. The lead and zinc mine and mill operations were closed in August 1978 due to depressed metal prices. The mine-mill complex is located in the Sheep Creek Valley, 10 km southeast of the village of Salmo, in the Salmo district in the southwestern portion of the Province of British Columbia.

The reactivated mill will treat high sulphide ore mined in the Salmo district by crushing, grinding, flotation and thickening. Treatment will be on a 10,000 ton batch basis at a rate of up to 1,200 tons per day. The resultant concentrate, containing gold and iron, will be transported to Helena, Montana for refining.

The tailings will be transported to the tailings pond used during Cominco's operation. An eight-inch plastic tailing line was installed in 1981 by David Minerals to replace the original wooden flume. Flow rate and sediment concentration of the tailings will be monitored. Automatic alarm systems and daily maintenance will ensure the integrity of the tailings transport system. The quality of the tailings pond overflow will also be monitored.

There will be no significant environmental impacts on the ecology of the site or Salmo district due to the reactivation and operation of the HB Mill. The operation will not only enhance the economy of Salmo village but also that of the Nelson region. This is particularly timely as the largest employer of the region, Cominco Ltd., is planning to temporarily close down, due to depressed metal market.

2.0 ACKNOWLEDGEMENT

IEC International Environmental Consultants Ltd. wish to acknowledge the assistance rendered by Dr. M. Clark and Mr. R. Mickel of the Waste Management Branch, Provincial Ministry of Environment Victoria and Nelson respectively, in retrieving the water quality data of the Salmo district, and Mr. P.G. Stent, Conservation officer, Fish and Wildlife Branch in Trail, for supplying biological data.

Special thanks is due to the staff of Cominco Ltd. at Trail for their full cooperation in making the water quality and reclamation information available.

Messrs. C. Moore, R. Neri, P. Santos and other staff of David Minerals Ltd. at the HB Mill were particularly helpful in supplying the background information for this report.

3.0 INTRODUCTION

3.1 Location

The HB Mill is situated within the property of the HB Mine (Latitude 49° 08' 40" N, Longitude 117.12' 2" W). The HB Mine is located in the district of Salmo in the southeastern part of the province of British Columbia. The town closest to the mine is the village of Salmo. Salmo is 30 km directly south of the city of Nelson and 22 km north northeast of the city of Trail (Figures 3.1, 3.2).

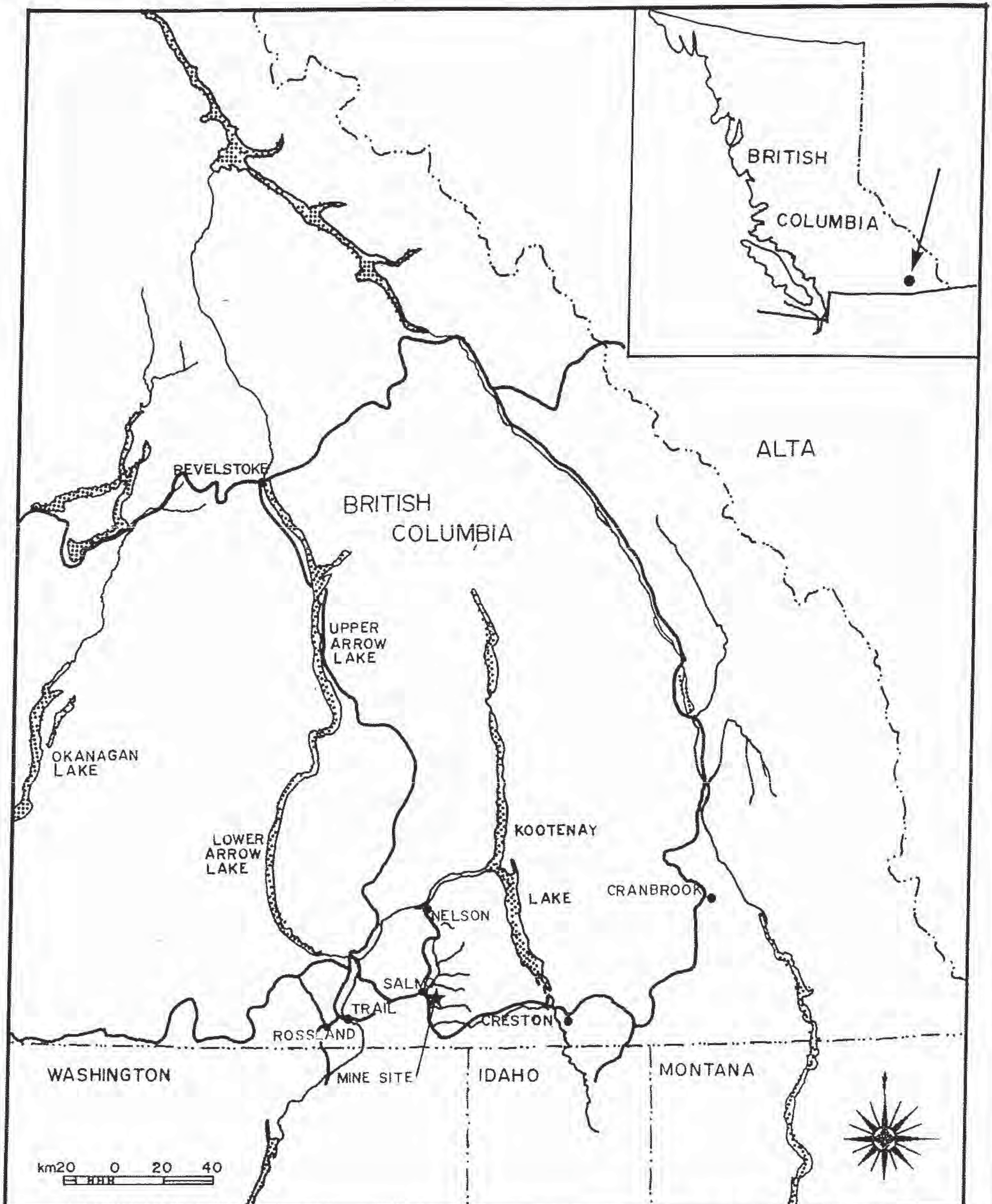
The property is located 7 km to the southeast of Salmo and 4 km east of the bridge of old Highway 3-6 which crosses Sheep Creek.

The HB Mine encompasses approximately 971 ha (2400 ac) in area on the north and south slopes of the Sheep Creek valley. The mine-mill complex is situated at an elevation of approximately 762 m. The layout of the mine and its property line are shown in Figure 3.3.

3.2 History

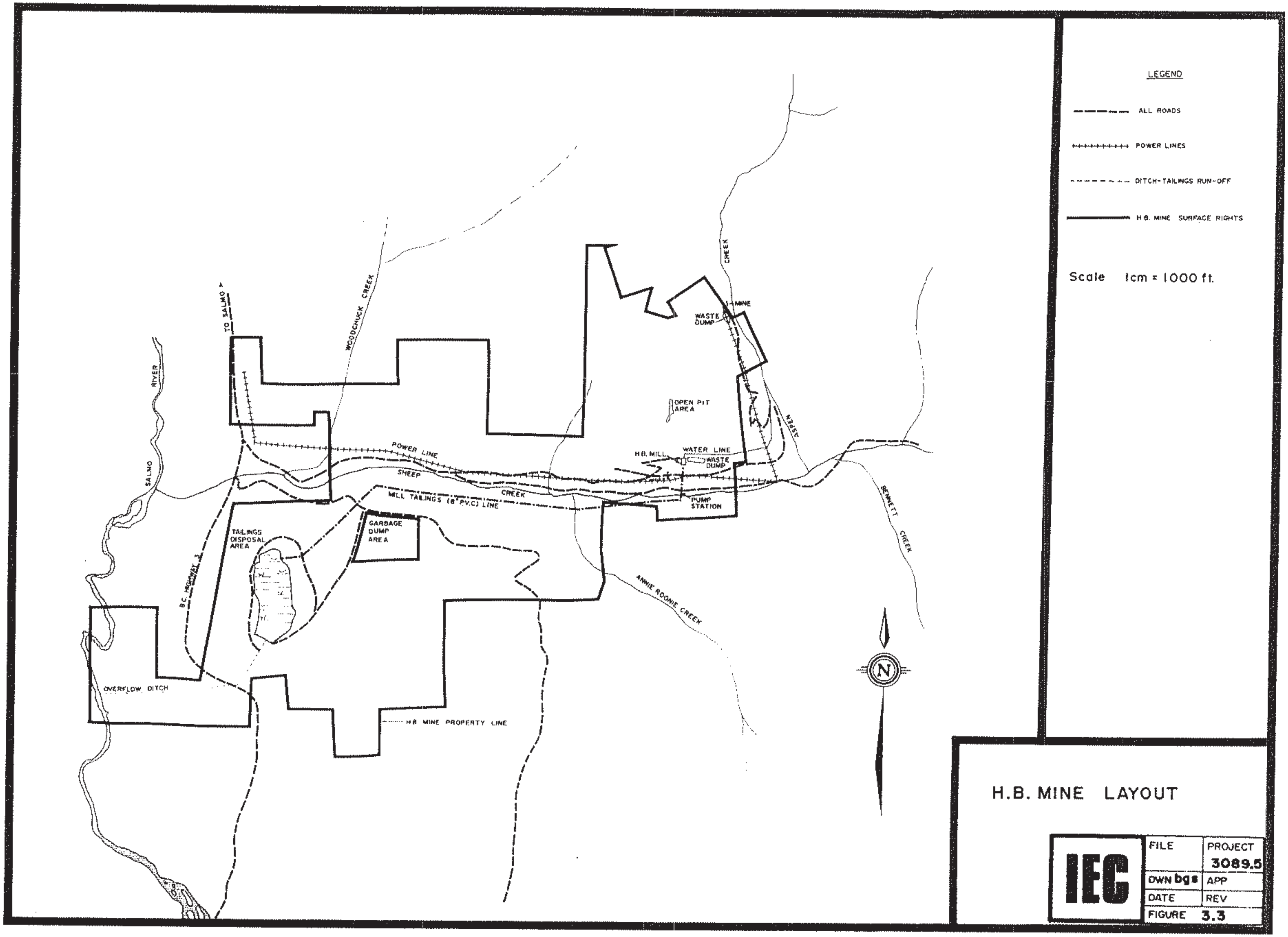
In September 1981, David Minerals Ltd. purchased certain Crown Granted and recorded mineral claims from Cominco Ltd. Included were surface rights, buildings, machinery and equipment associated with the HB Mine.

The property was originally staked by Messrs. Horton and Benson (hence HB) in 1907 when they discovered deeply oxidized outcrops of lead-zinc ore. There were a long and intermittent series of commercial mining operations designed mainly to develop and extract oxidized lead-zinc ore. In 1925 a determined attempt was made by a British syndicate to develop a large tonnage of sulphide ore, but this ended in failure after some 3000 ft of lateral development was done. The property was subsequently purchased by the Consolidated Mining and Smelting Co. Ltd. (later known as Cominco Ltd.) in 1927. The mine lay idle until 1946, when a geological study, followed by a program of surface drilling, encountered extensive sulphide mineralization. An extensive diamond drilling program was undertaken, followed by underground



LOCATION OF THE H.B. MILL - SALMO, B.C.

IEC	DRAWN R.K.	DATE 3/82
	CHECKED	APPROVED
	FIGURE: 3.1	


LEGEND
ALL ROADS
POWER LINES
DITCH-TAILINGS RUN-OFF
H.B. MINE SURFACE RIGHTS
Scale 1cm = 1000 ft.
TO SALMO
WOODCHUCK CREEK
CREEK
MINE
WASTE DUMP
OPEN PIT AREA
ASPEN
SALMO
RIVER
POWER LINE
H.B. MILL
WATER LINE
WASTE DUMP
SHEEP
CREEK
MILL TAILINGS (8" P.V.C) LINE
PUMP STATION
BENNETT CREEK
TAILINGS DISPOSAL AREA
GARBAGE DUMP AREA
B.C. HIGHWAY 3
ANNIE ROONIE CREEK
N
OVERFLOW DITCH
H.B. MINE PROPERTY LINE
H.B. MINE LAYOUT
IEC
FILE
PROJECT 3089.5
DWN bgs
APP
DATE
REV
FIGURE 3.3

exploration, which revealed more details of the deposit. With sufficient ore outlined, Cominco Ltd. started the construction of a 1000 ton per day concentrator in April 1952. It was completed in the spring of 1953. Due to unfavorable metal prices, production of lead and zinc concentrates did not commence until May 1955. The production was suspended in October 1966 for the same reason. The HB Mine resumed production in February 1973. It was closed permanently in August 1978. During the life of the mine, some 7,305,599 tons of ore, grading 0.93% lead and 4.45% zinc were produced.

3.3 Project Description and Schedule of Development

David Minerals Ltd. proposes to reactivate the concentrator mill located on the HB Mine property, to custom mill gold-bearing ores produced in the Salmo district. No on-site mining is planned.

Phase I of the project consists of a general clean-up of the overall milling facilities at the HB Mine property. Renovation of one circuit to treat high sulphide ore by crushing, grinding, flotation and thickening will produce a concentrate containing gold and iron. Treatment will be on a 10,000 ton batch basis at a rate up to 1,200 tons per day. Due to the high iron content of the concentrate, arrangements for further processing will be made with Asarco in Helena, Montana. Lead and zinc ores which are known to exist in the district may be concentrated, as was done before the mine closure, if it is proven economical.

Phase II of the HB Mill project consists of constructing facilities for a second circuit, to treat 120 tons per day of concentrates or ores, which contain gold. Extraction of gold is accomplished by cyanidation. Metallurgical testing has been started but sufficient metallurgical data is not yet available to determine a flowsheet for the process.

Phase III of the project consists of the construction and activation of a third circuit of the HB Mill. David Minerals anticipates acquiring and mining certain mineral-bearing lands in the Rossland area. The ores in this area contain molybdenum, cobalt and gold. Flotation treatment would separate the minerals from the ore. The concentrate would then be treated in the cyanide circuit constructed in Phase II to recover the gold. The concentrate would then return to the flotation circuit, where the cobalt would be separated from the molybdenite. A considerable amount of exploration by diamond drilling of the ore bodies in Rossland in addition to metallurgical testing, must be completed to determine the feasibility of Phase III.

David Minerals Ltd. wishes to proceed with Phase I of the project immediately. It has already been granted necessary amendments to the previously existing permits, which include:

1. Permit PR 2665 - covering Solid Refuse Disposal - issued 5 December 1973.
2. Permit PA 1854 - covering Air Emissions - issued 26 February 1973.
3. Permit PE 1853 - covering Effluent Disposal - issued 7 February 1973
4. Amendment of Licence No. 17622 - Department of Land and Forests, Water Rights Branch - issued 1 March 1961.

These amendments delineated transfer of responsibility to accompany transfer of the property ownership to David Minerals Ltd.

4.0 DESCRIPTION OF EXISTING ENVIRONMENTAL AND SOCIAL CONDITIONS

4.1 Physiography

According to Holland (1976) the Salmo area lies within the Interior System of the Canadian Cordillera. It is located on the southwestern slope of the Selkirk Mountains, a subdivision of the Columbia Mountains. The mountains of the southern Selkirks are more subdued and rounded than those of the north and are characterized by fewer rugged peaks and serrated ridges. The southern peaks lack these youthful glacial forms due to higher uplifts and more recent sculpture by mountain glaciers.

The Selkirk Mountains encompass an area about 220 mi long and 40 to 50 mi wide. They lie within the big bend of the Columbia River and are flanked on the west by the Monashee Mountains and on the east by the Purcell Mountains.

The Selkirk Mountains are underlain by a variety of Proterozoic and Lower Palaeozoic sedimentary and metamorphic formations, by gneisses of both sedimentary and igneous origin, by late Palaeozoic and Mesozoic sedimentary and volcanic rocks and by granitic stocks and batholiths of Cretaceous and early Tertiary age. The Proterozoic and Lower Palaeozoic rocks include prominent quartzite and limestone members which are resistant to erosion.

The Salmo area is drained by the Salmo River, which separates the Nelson Ranges, (west of south Kootenay Lake), from the Bonnington Ranges (to the east of the Columbia River). The Salmo River flows southward and joins the Pend'Oreille River, which is a tributary of the Columbia River.

4.2 Land Tenure and Settlement Patterns

Settlement of the Salmo district developed as a result of the discovery and development of natural resources. Initial settlement occurred in late 1880's and early 1900's due to the mineral discoveries. Logging was developed in the surrounding areas, growing in importance when mining activities declined in the 1930's. Salmo was incorporated as a village in 1946.

David Minerals Ltd. purchased 971 ha of land and mineral claims in the Sheep Creek Valley. The lands surrounding the property are still owned by Cominco Ltd.

4.3 Climate and Meteorology

Table 4.1 summarizes data collected at the B.C. Forest Service Weather Station, located approximately 14 km northwest (Latitude 49° 11' N, Longitude 117° 18' W - Elevation 685 m) of the project site. Only temperature and precipitation data from 1972 to 1980 are available for this station. Table 4.2 summarizes temperature and precipitation data collected at the Kootenay Pass Weather Station (Station #808, Latitude 49° 04' N, Longitude 117° 02' W - Elevation 1774 m), located 14 km southeast of the site. Wind direction and velocity measurements were not available at either station.

The nearest source of wind data is the Trail-Tadanac Station (Latitude 49° 06' N, Longitude 117° 46' W - Elevation 579 m), 32 km west of the mill site. Figures 4.1 and 4.2 summarize wind direction and speed for the period of 1968 to 1982.

4.3.1 Temperature

Salmo mean daily temperatures range between -7.8°C in January and 18.0°C in July with the annual mean daily temperature of 6.3°C. Mean daily maximum temperatures varied between -2.6°C in January and 27.1°C in July, and mean daily minimum temperatures varied between -12.3°C in January and 8.8°C in July. The extreme temperatures on the record varied from 40.6°C in August to -27°C in January.

Kootenay Pass mean daily temperature varied in a range of -10.3°C in January and 12.2°C in July with an annual mean daily temperature of 0.7°C. The extreme temperatures on record varied from 28.3°C in July to -33°C in December.

It appears that, in the Salmo district, December and January are the coldest months with July and August being the warmest months.

TABLE 4.1

SUMMARY OF CLIMATIC NORMALS BETWEEN 1972 AND 1980 FOR SALMO, B.C.
(FORESTRY SERVICE WEATHER STATION: LATITUDE 49° 11'N, LONGITUDE 117°18'W), ELEVATION - 685 m.
(SOURCE: ATMOSPHERIC ENVIRONMENT SERVICE OF CANADA)
LOCATED 14 KM SW OF HB MILL SITE

Temperature (°C)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
mean daily	-7.8E	-1.8E	-1.3E	6.8E	10.1E	14.8E	18.0E	17.6E	12.8E	6.6E	-1.2E	-1.5E	6.3
mean daily max	-2.6E	2.5	6.8E	13.9E	17.7E	23.5E	27.1E	26.6E	21.2E	13.3E	2.9E	0.0E	12.7
mean daily min	-12.3E	-6.1E	-4.4	-0.4E	2.4E	6.0E	8.8E	8.5E	3.9E	-0.1E	-4.7E	-3.8E	-0.2
extreme max	6.7	11.7	17.0	27.0	32.2	37.2	37.8	40.6	33.9	25.0	16.7	8.9	40.6
extreme min	-27.0	-23.4	-21.7	-12.8	-5.0	-0.6	0.0	-1.1	-5.6	-10.6	-14.5	-26.7	-27.0
Precipitation (mm)													
mean rainfall	10	22.9	37.6	49.9	79.8	58.2	59.1	65.8	46.9	58.1	58.8	33.2E	580.3
mean snowfall	69.2	50.4	16.2	3.5	0.0	0.0	0.0	0.0	0.0	1.2	31.6E	61.2E	233.3
mean total	79.2E	73.4E	53.8	53.4E	79.8	57.2	59.1	65.8	46.9	59.3	90.4E	94.4E	813.7
greatest rainfall in 24 hrs	19.3	19.4	15.0	33.0	27.4	21.9	25.9	48.4	26.7	37.3	26.0	21.8	48.4
greatest snowfall in 24 hrs	20.1	24.9*	12.7	15.0	0.0*	0.0*	0.0*	0.0*	0.0*	2.5	17.8	36.8	36.8
greatest precip. in 24 hrs	20.1	24.9*	15.0	33.0	27.4	21.9	25.9	48.4	26.7	37.3	26.0	36.8	48.4
no. days with measurable rain	2	3	8	10	16	11	10	12	9	10	9	5	105
no. days with measurable snow	13	10	5	1	0	0	0	0	0	1	6	10	46
no. days with m. precip.	15	13	13	11	16	11	10	12	9	11	15	15	151

E: Estimate
M: Missing
T: Trace
*: New Record

TABLE 4.2

SUMMARY OF CLIMATIC NORMALS BETWEEN 1974 AND 1980 FOR STATION 808, KOOTENAY PASS, B.C.
(LATITUDE 49°04'N, LONGITUDE 117°02'W), ELEVATION - 1774 M
(SOURCE: ATMOSPHERIC ENVIRONMENT SERVICE OF CANADA, TEMPERATURE AND PRECIPITATION, 1974 - 1980, BRITISH COLUMBIA)
LOCATED 14 KM SE OF HB MILL SITE

Temperature (°C)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
mean daily	-10.3E	-6.8	-5.2	0.0	3.5E	7.7	12.2	10.8	7.6	1.9	-4.1	-7.5	0.7
mean daily max	-7.4E	-3.9	-1.7	4.3	7.7E	12.4	17.6	15.4	12.0	5.3	-3.3	-5.0	4.5
mean daily min	-13.0	-9.6	-8.6	-4.3	-0.6E	3.0	6.5	6.1	3.2	-1.6	-8.9	-10.0	-3.1
extreme max	2.8	6.7	11.0	19.0	17.2	23.5	28.3	26.5	24.5	18.3	8.9	5.0	28.3
extreme min	-29.5	-23.3	-25.0	-17.8	-7.0	-3.9	-1.0	-0.6	-5.0	-12.8	-26.8	-33.0	-33.0
Precipitation (mm)													
mean rainfall	3.8	7.8	10.0	17.4	87.2E	95.5E	83.0	97.0	89.5E	40.3	1.5	15.6	548.6
mean snowfall	1459.0	2030.0	1904.0	846.0	390.0E	109.0E	0	0	76.0E	639.0	1314.0	2080.0	10808.0
mean total	149.7	210.8	200.4	102.0	126.2E	106.4E	83.9	97.4	91.9E	104.2	132.9	223.6	1629.4
greatest rainfall in 24 hrs	2.7	5.2	4.3	3.0	20.4E	31.8	17.0	29.9	24.0E	18.4	0.8	8.9	31.8
greatest snowfall in 24 hrs	23.9	33.5	32.5	18.2	12.9E	4.5	0.9	0.3	2.0	22.7	22.8	34.7	34.7
greatest precip. in 24 hrs	23.9	35.7	32.7	18.2	28.3E	31.8	17.0	29.9	24.0E	34.8	22.8	34.7	34.7
no. days with measurable rain	1	1	2	3	9	11	12	14	12	5	1	1	72
no. days with measurable snow	19	20	20	12	5	2	*	*	*	8	15	21	122
no. days with m. precipitation	20	21	22	15	14	13	12	14	12	13	16	22	194

* - New Record
E - Estimate
M - Missing
T - Trace

4.3.2 Precipitation

In Salmo district, precipitation is recorded on 9 to 16 days a month with an average of 13 days per month. The mean total precipitation varies from 46.9 mm in September to 94.4 mm in December. The precipitation averaged 813.7 mm on an annual basis and 67.5 mm on a monthly basis. Snowfall occurs between October and April and is more common from December to February. Snowfall has yet to be recorded between May and September.

Rainfall varies from a minimum average of 10 mm in January to a maximum average of 79.8 mm in May. The annual rainfall averages 580.3 mm and 45^{o} mm on a monthly basis. Maximum daily rainfall generally occurs in August.

At the Kootenay Pass station, precipitation is recorded on 12 to 22 days per month and averaged 16 days per month. The mean precipitation varies from 83.9 mm in July to 210.8 mm in February with an average of 135.5 mm per month.

The rainfall varies from 1.5 mm in November to 97.0 mm in August with an average of 44^{o} mm per month. The mean snowfall ranged up to 2080.0 mm in December with an average of 901.0 mm per month. The greatest rainfall (in 24 hours) of 31.8 mm was recorded in June and greatest snowfall (in 24 hours) of 34.7 mm was recorded in December.

The total annual rainfall records for the Salmo and Kootenay Pass stations are similar but snowfall was considerably higher at Kootenay Pass because of higher elevation.

4.3.3 Wind

The Wind Roses in Figure 4.1 indicates that winds in the Trail-Tadanac area are primarily from the northeast and southwest and, to a lesser extent, from the north and south directions.

Figure 4.2 shows that the yearly mean wind speed was 7.9 km/hr. The mean speed stayed relatively constant throughout the year. The highest mean wind speed for the 14-year period was 41 km/hr in December.

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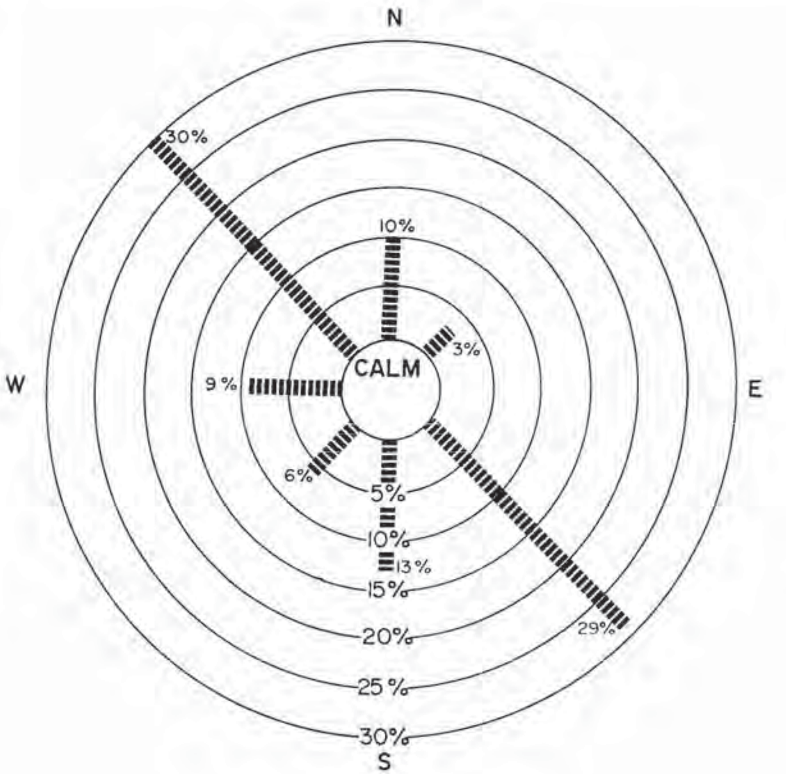

MEAN WIND SPEED = 7.9 km/hr

MAX. HOURLY SPEED = 41 km/hr

Source: Atmospheric Environment Canada

TRAIL-TADANAC B.C. WIND ROSE 1968-1982
PERCENTAGE FREQUENCY BY DIRECTION
LAT. 49°06'N LONG. 117°45'W

IEC

DRAWN	DATE
R.K.	3/82
CHECKED	APPROVED
FIGURE: 4.1	

Months / Wind Direction	J	F	M	A	M	J	J	A	S	O	N	D	Average %
N	9	9	10	9	11	11	11	10	10	11	11	9	10
NE	2	2	3	4	4	4	5	4	3	2	2	2	3
E	0	1	0	0	1	1	1	1	0	0	0	0	0
SE	37	30	78	28	28	26	21	22	22	26	34	41	29
S	15	17	17	13	12	12	10	9	11	14	15	15	13
SW	4	4	6	7	6	5	6	8	7	5	4	5	6
W	6	9	8	9	9	10	12	12	11	10	7	6	9
NW	27	29	27	30	31	31	34	33	36	32	26	21	30
Calm	1	1	1	0	0	0	1	2	1	1	0	1	1
Mean Speed (Km/h)	8.3	8.0	7.5	8.7	8.8	8.5	7.8	7.1	7.4	7.2	7.6	7.6	7.9

Data compiled from location 32 km W. of H.B. Minesite - Lat. 49° 06'N
Long. 117° 45'W
Elev. 579 m

From A.E.C.

PERCENTAGE WIND DIRECTION (AND CALMS) AND MEAN WIND SPEED BY MONTH (1968-1982) AT TRAIL TADANAC, B.C.

IEC

DRAWN	DATE
bgs	3/82
CHECKED	APPROVED

FIGURE: 4.2

4.4 Air Quality

No air quality data have been collected by the Atmospheric Environment Service of Canada or by the B.C. Provincial Government in the vicinity of Salmo.

Because Salmo is a small village, located away from large population and industrial centers, air quality is excellent.

Any airborne particles picked up from the mill site will not disperse over great distances because the mill is located on the north side of a steep hill in the Sheep Creek Valley and it is relatively sheltered from the prevailing winds.

4.5 Surface Water

4.5.1 Drainage

The HB Mine property is situated within the drainage system of Sheep Creek. Figure 3.2 shows the major streams in the Sheep Creek drainage system. Those draining southward are: Woodchuck, Aspen, Hedgehog, Nugget, Clyde and Twilight Creeks. Those draining northward are Annie Rooney, Bennett, Billings, Waldie, Muskrat, Curtis, Panther and Gamble Creeks.

Aspen Creek drains southward into Sheep Creek near the eastern border of the Mine site. The creek is dammed near the mill and a portion of the overflow will be diverted to be used for the mill and the camp operation.

The surface runoff and mine drainage water are collected through ditches along the side of the mine road and then discharged into Sheep Creek. The mine drainage flow rates measured by Cominco Ltd. in 1979, are given in Table 4.3.

TABLE 4.3

HB Mine Drainage Flowrates Measured in 1979
by Cominco Ltd. (in cumecs)

Month	Average	Mininum	Maximum
Jan	Frozen		
Feb	11.0 (388)*	8.3 (294)	12.5 (440)
Mar	29.5 (1042)	12.5 (440)	36.0 (1272)
Apr	3.3 (115)	2.0 (70)	4.4 (156)
May	4.4 (156)	4.4 (156)	4.4 (156)
Jun	3.5 (125)	2.7 (94)	4.4 (156)

* ( ) in gallons per minute.

4.5.2 Water Quality

Water quality above and below the Salmo River/Sheep Creek confluence was determined by Cominco Ltd. in the first and second quarters of 1979, in compliance with the HB Mine Pollution Control Permit (PE 1853). The results are given in Table 4.4.

In addition, computerized summaries of the water quality data were obtained from the Waste Management Branch, B.C. Ministry of Environment, for the rivers and streams in the Salmo district. They are given in Tables 4.5 - 4.7. Analysis of the water quality samples taken at Sheep Creek upstream and downstream from the mine and at Salmo River below Sheep Creek confluence showed that the water quality was generally good. There were no significant differences in the water quality of the stations above and below the mine when the mine was operating.

4.5.3 Hydrology

Sheep Creek drains westward from Three Sisters Peak and the mountains of the Nelson Range, from elevations of 2000 to 2134 m (6500 to 7000 ft). It drains into the Salmo River which flows southwards and joins the Pend'Oreille River near the Canadian - U.S. border.

No hydrological information has been collected from Sheep Creek and its tributaries in recent years. The records available from the Historical Streamflow Summary, British Columbia (Fisheries and Environment Canada, 1977) indicate that some streamflow measurements were taken from the tributaries of Sheep Creek and the Salmo River in the summer months through the period of 1930-1940. These streamflow measurements are summarized in Table 4.8.

The closest hydrological station located in the Salmo district is Station No. 08NE074 (Latitude 49° 04' 07" N, Longitude 117° 16' 37" W) of Water Survey of Canada on the Salmo River. It is located 8 km south of the confluence of Sheep Creek and the Salmo River and 14 km south of the village of Salmo. The monthly and annual mean discharge in cubic feet per second (cfs) and annual total discharge in acre feet (ac-ft)

TABLE 4.4

Water Quality of the Salmo River, Upstream and Downstream from the Sheep Creek Confluence: Determined by Cominco Ltd. in 1979*

Date - 1979	Salmo River Upstream Feb 22	Apr 10	May 8	Jun 5	Salmo River Downstream Feb 22	Apr 10	May 8	Jun 5
pH	7.2	8.0	7.7	7.4	7.4	8.2	7.5	7.5
Total Solids	74	64	63	50	60	64	49	57
Suspended Solids	1	1	13	6	1	1	9	9
Dissolved SO_4	8.9	8.2	3.9	3.1	11	7.9	5.3	4.7
Total CN	L0.01	L0.01	L0.01	L0.01	L0.01	L0.01	L0.01	L0.01
Dissolved Fe	L0.05	L0.05	L0.05	L0.05	L0.05	L0.05	L0.05	L0.05
Dissolved Pb	L0.01	L0.01	L0.01	L0.01	L0.01	L0.01	L0.01	L0.01
Dissolved Zn	0.02	0.01	L0.01	0.01	0.02	0.01	L0.01	0.01
Dissolved Cu	L0.005	L0.005	L0.005	L0.005	L0.005	L0.005	L0.005	L0.005

* All measurements except pH are reported in milligrams per litre (mg/L) = PPM.

TABLE 4.5

Water Quality of Sheep Creek Upstream from HB Mine
(Source: Waste Water Management Branch, Ministry of Environment)

PARAMETER	TEST CODE	UNITS	DATE RANGE	NO. OF VALUES	MAXIMUM	MINIMUM	MEAN	STANDARD DEVIATION	T TEST
COLOR TR	002	REL UNIT	7001-7412	6	10.	L 5.	5.8333	2.0412	
			7501-7912	5	5.	L 5.	5.	0.0	0.9
PH	004	REL UNIT	7001-7412	5	7.9	7.	7.4667	0.3011	
			7501-7912	24	8.5	7.2	7.875	0.28778	3.1
RES 105C	005	MG/L	7001-7412	5	78.	34.	58.	15.646	
			7501-7912	14	80.	32.	55.	14.223	0.4
RESF 105	007	MG/L	7501-7912	7	79.	28.	52.	18.027	
RESNF105	008	MG/L	7001-7412	6	25.	L 1.	5.6667	9.5573	
			7501-7912	7	3.	L 1.	1.4286	0.7868	1.2
SPE COND	011	US/CM	7001-7412	9	132.	56.	92.778	28.547	
			7501-7912	15	150.	41.	83.667	29.805	0.8
TEM APPV	012	DEG.C	7001-7412	5	18.	5.	10.667	4.5858	
T SAMPLG	013	DEG.C	7001-7412	6	11.	0.	3.5	4.3243	
			7501-7912	11	12.	0.	4.9636	4.6852	0.6
OXY DISS	014	MG/L	7001-7412	5	14.6	11.1	12.25	1.3766	
			7501-7912	6	14.	9.2	12.067	1.6281	0.2
TURBIDTY	015	N.T.U.	7001-7412	6	5.5	0.25	1.8833	1.9418	
			7501-7912	14	4.6	0.2	0.83643	1.1986	1.5
BAR.PRES	017	KPASCALS	7001-7412	6	94.05	91.526	93.275	0.97345	
			7501-7912	7	103.25	89.401	93.618	4.5267	0.2
AIR TEMP	020	DEG.C	7001-7412	3	15.	1.	8.5	6.6081	
			7501-7912	3	19.	-7.	9.1667	14.11	0.1
COLR:TAC	024	T.A.C.	7501-7912	7	6.	L 1.	3.	2.0817	
ALKALI T	102	MG/L	7001-7412	6	50.	30.	40.167	9.1524	
			7501-7912	15	52.	25.5	36.819	10.262	0.7
CARBN OR	103	MG/L	7001-7412	5	4.	2.	3.	0.63246	
CHLORIDE	104	MG/L	7001-7412	6	0.5	L 0.5	0.5	0.0	
CYANIDE	105	MG/L	7001-7412	5	L 0.01	L 0.01	0.01	0.0	
			7501-7912	13	L 0.01	L 0.01	0.01	0.0	*****

TABLE 4.5 (continued)

PARAMETER	TEST CODE	UNITS	DATE RANGE	NO. OF VALUES	MAXIMUM	MINIMUM	MEAN	STANDARD DEVIATION	T TEST
FLUORIDE	106	MG/L	7001-7412 7501-7912	6 1	L 0.1 L 0.1	L 0.01 L 0.1	0.085 0.1	.036742	
HARDNESS	107	MG/L	7001-7412 7501-7912	6 12	53.6 52.5	24.7 17.0	40.65 36.431	13.946 11.888	0.7
AMMONIA	108	MG/L	7001-7412 7501-7912	6 3	0.02 0.009	L 0.01 L 0.005	.013333 .0063333	0.005164 .0023094	2.2
NO2/NO3	109	MG/L	7501-7912	3	0.1	0.03	0.06	.036055	
NITRATE	110	MG/L	7001-7412 7501-7912	6 8	0.09 0.06	L 0.02 L 0.02	.051667 0.04	.029269 0.01633	0.7
NITRITE	111	MG/L	7001-7412 7501-7912	6 4	L 0.005 L 0.005	L 0.005 L 0.005	0.005 0.005	0.0 0.0	*****
NIT ORGN	112	MG/L	7001-7412 7501-7912	5 1	0.13 L 0.01	0.02 L 0.01	.056667 0.01	.038816	
NIT KJEL	113	MG/L	7501-7912	7	0.1	L 0.01	.048571	.034365	
NIT TOTL	114	MG/L	7501-7912	4	0.18	0.08	0.1175	0.045	
PHOS ORT	118	MG/L	7001-7412 7501-7912	6 4	0.005 0.008	0.003 L 0.003	.0038333 0.00525	.0009832 .0020616	1.5
PHOS TOT	119	MG/L	7001-7412 7501-7912	6 7	0.043 0.031	0.005 0.005	.015833 .014143	.014999 .0090633	0.3
SILICA	120	MG/L	7501-7912	4	7.2	4.2	6.025	1.3326	
SULPHATE	121	MG/L	7001-7412 7501-7912	6 4	9.8 8.7	L 5. L 5.	7. 6.025	2.1005 1.7933	0.8
ARSENIC DISSOLVED	251D	MG/L	7501-7912	1	L 0.005	L 0.005	0.005		
ARSENIC TOTAL	251T	MG/L	7501-7912	7	L 0.005	L 0.005	0.005	0.0	
CADMIUM DISSOLVED	253D	MG/L	7501-7912	4	L 0.0005	L 0.0005	0.0005	0.0	
CADMIUM TOTAL	253T	MG/L	7501-7912	7	0.0009	L 0.0005	.0006143	.0001952	
CALCIUM DISSOLVED	254D	MG/L	7001-7412 7501-7912	5 13	17. 16.9	7.9 5.7	13.083 11.769	4.4233 3.7922	0.7
COPPER DISSOLVED	256D	MG/L	7001-7412 7501-7912	6 5	0.004 0.001	L 0.001 L 0.001	.0018333 0.001	.0013292 0.0	1.4
COPPER TOTAL	256T	MG/L	7501-7912	7	0.001	L 0.001	0.001	0.0	

TABLE 4.5 (continued)

PARAMETER	TEST CODE	UNITS	DATE RANGE	NO. OF VALUES	MAXIMUM	MINIMUM	MEAN	STANDARD DEVIATION	T TEST
IRON DISSOLVED	2570	MG/L	7001-7412	6	L 0.1	L 0.04	0.06	.030984	3.2
			7501-7912	6	L 0.1	L 0.1	0.1	0.0	
IRON TOTAL	257T	MG/L	7001-7412	5	1.2	L 0.04	0.28833	0.45653	1.0
			7501-7912	8	0.3	L 0.1	0.125	.070711	
LEAD DISSOLVED	2580	MG/L	7001-7412	6	0.01	L 0.001	0.003	.0036332	1.2
			7501-7912	6	0.002	L 0.001	.0011667	.0004082	
LEAD TOTAL	258T	MG/L	7501-7912	8	0.002	L 0.001	0.001125	.0003536	
MGNESIUM DISSOLVED	2590	MG/L	7001-7412	5	2.7	1.17	1.9417	0.7015	0.7
			7501-7912	13	2.5	0.87	1.7108	0.58951	
MANGNESE DISSOLVED	2600	MG/L	7001-7412	6	L 0.01	L 0.01	0.01	0.0	
MERCURY TOTAL	261T	MG/L	7501-7912	2	L 0.00005	L 0.00005	0.00005	0.0	
POTASIUM DISSOLVED	2640	MG/L	7001-7412	5	0.7	0.4	0.53333	0.12111	
SODIUM DISSOLVED	2650	MG/L	7001-7412	6	0.9	0.5	0.71667	0.20412	
ZINC DISSOLVED	2660	MG/L	7001-7412	6	0.013	L 0.005	.0063333	0.003266	0.5
			7501-7912	5	0.018	L 0.005	0.0076	.0058138	
ZINC	266T	MG/L	7501-7912	8	0.008	L 0.005	0.00575	.0013887	

TABLE 4.6

Water Quality of Sheep Creek Downstream from HB Mine
(Source: Waste Water Management Branch, Ministry of Environment)

PARAMETER	TEST CODE	UNITS	DATE RANGE	NO. OF VALUES	MAXIMUM	MINIMUM	MEAN	STANDARD DEVIATION	T TEST
COLOR TR	002	REL UNIT	7001-7412	5	10.	L 5.	6.	2.2361	
			7501-7912	6	10.	L 5.	6.6667	2.582	0.5
PH	004	REL UNIT	7001-7412	6	7.9	7.	7.6083	0.32926	
			7501-7912	27	8.5	7.2	7.8667	0.31622	1.8
RES 105C	005	MG/L	7001-7412	5	100.	44.	71.2	21.476	
			7501-7912	14	92.	40.	67.571	17.667	0.4
RESF 105	007	MG/L	7501-7912	6	90.	40.	64.333	23.509	
RESNF105	008	MG/L	7001-7412	6	30.	L 1.	6.9	11.379	
			7501-7912	9	5.	L 1.	2.	1.6036	1.2
SPF COND	011	US/CM	7001-7412	9	155.	60.	111.89	37.099	
			7501-7912	20	139.	45.	94.7	29.838	1.3
TEM ARRV	012	DEG.C	7001-7412	6	18.	5.	10.667	4.5898	
T SAMPLG	013	DEG.C	7001-7412	6	10.	0.	3.3333	3.9833	
			7501-7912	12	12.	0.	5.2667	4.4903	0.9
OXY DISS	014	MG/L	7001-7412	6	14.6	11.2	12.517	1.4784	
			7501-7912	7	14.	9.4	12.143	1.4593	0.5
TURBIDTY	015	N.T.U.	7001-7412	6	8.2	0.25	2.6833	2.9554	
			7501-7912	14	2.3	0.1	0.61571	0.65993	2.6
BAR.PRES	017	KPASCALS	7001-7412	6	94.714	92.854	93.895	0.7931	
			7501-7912	7	103.25	90.596	94.036	4.2789	0.1
AIR TEMP	020	DEG.C	7001-7412	4	15.	1.	8.5	6.6081	
			7501-7912	3	19.	-7.	9.3333	14.224	0.1
COLR:TAC	024	T.A.C.	7501-7912	7	6.	L 1.	2.8571	1.8645	
C.D.C.	030	US/CM	7501-7912	1	134.	134.	134.		
ALKALI T	102	MG/L	7001-7412	6	60.	29.	46.667	14.814	
			7501-7912	17	58.4	21.5	42.947	12.14	0.6
CARBN DR	103	MG/L	7001-7412	6	3.	2.	2.8333	0.40825	
			7501-7912	1	1.	1.	1.		

TABLE 4.6 (continued)

PARAMETER	TEST CODE	UNITS	DATE RANGE	NO. OF VALUES	MAXIMUM	MINIMUM	MEAN	STANDARD DEVIATION	T TEST
CHLORIDE	104	MG/L	7001-7412	6	1.2	L 0.5	0.73333	0.30111	
			7501-7912	2	1.	0.6	0.8	0.28284	0.3
CYANIDE	105	MG/L	7001-7412	6	L 0.01	L 0.01	0.01	0.0	
			7501-7912	14	L 0.01	L 0.01	0.01	0.0	*****
FLUORIDE	106	MG/L	7001-7412	6	0.11	L 0.1	0.10167	.0040822	
			7501-7912	1	L 0.1	L 0.1	0.1		
HARDNESS	107	MG/L	7001-7412	6	73.1	25.4	50.917	20.727	
			7501-7912	14	65.2	20.4	44.807	15.351	0.7
AMMONIA	108	MG/L	7001-7412	6	0.02	L 0.01	.013333	0.005164	
			7501-7912	3	0.013	0.005	0.008	.0043589	1.5
NO2/NO3	109	MG/L	7501-7912	3	0.09	0.04	0.06	.026457	
NITRATE	110	MG/L	7001-7412	6	0.08	0.02	.048333	.027869	
			7501-7912	5	0.05	L 0.02	0.034	.013416	1.0
NITRITE	111	MG/L	7001-7412	6	L 0.005	L 0.005	0.005	0.0	
			7501-7912	4	L 0.005	L 0.005	0.005	0.0	*****
NIT ORGN	112	MG/L	7001-7412	6	0.09	L 0.01	.046667	.030111	
			7501-7912	1	L 0.01	L 0.01	0.01		
NIT KJEL	113	MG/L	7501-7912	7	0.27	L 0.01	.084286	0.10998	
NIT TOTL	114	MG/L	7501-7912	5	0.26	L 0.02	0.108	0.10035	
PHOS ORT	118	MG/L	7001-7412	6	0.004	L 0.003	.0033333	.0005164	
			7501-7912	3	0.018	L 0.003	.0086667	.0081445	1.7
PHOS TOT	119	MG/L	7001-7412	6	0.039	0.005	.013667	0.01314	
			7501-7912	6	0.026	0.006	.014333	.0087101	0.1
SILICA	120	MG/L	7501-7912	4	8.2	4.5	6.575	1.5861	
SULPHATE	121	MG/L	7001-7412	6	12.8	L 5.	8.5333	3.3608	
			7501-7912	5	10.1	L 5.	6.8	2.2147	1.0
ARSENIC DISSOLVED	251D	MG/L	7501-7912	1	L 0.005	L 0.005	0.005		
ARSENIC TOTAL	251T	MG/L	7501-7912	7	L 0.005	L 0.005	0.005	0.0	
CADMIUM DISSOLVED	253D	MG/L	7501-7912	5	L 0.0005	L 0.0005	0.0005	0.0	
CADMIUM TOTAL	253T	MG/L	7501-7912	7	0.001	L 0.0005	.0005714	0.000189	
CALCIUM DISSOLVED	254D	MG/L	7001-7412	6	23.5	8.3	16.4	6.593	
			7501-7912	14	21.	6.6	14.521	4.8776	0.7

TABLE 4.6 (continued)

PARAMETER	TEST CODE	UNITS	DATE RANGE	NO. OF VALUES	MAXIMUM	MINIMUM	MEAN	STANDARD DEVIATION	T TEST
COPPER DISSOLVED	2560	MG/L	7001-7412 7501-7912	6 7	0.001 0.003	L 0.001 L 0.001	0.001 .0012857	0.0 .0007559	0.9
COPPER TOTAL	256T	MG/L	7501-7912	7	L 0.001	L 0.001	0.001	0.0	
IRON DISSOLVED	2570	MG/L	7001-7412 7501-7912	6 9	L 0.1 L 0.1	L 0.04 L 0.1	0.06 0.1	.030984 0.0	3.7
IRON TOTAL	257T	MG/L	7001-7412 7501-7912	6 8	1.1 0.3	0.04 L 0.1	0.31 0.1375	0.39329 .074402	1.2
LEAD DISSOLVED	2580	MG/L	7001-7412 7501-7912	6 8	0.013 0.004	L 0.001 L 0.001	.0041667 0.001375	0.004916 .0010607	1.6
LEAD TOTAL	258T	MG/L	7501-7912	8	0.006	L 0.001	0.001625	.0017678	
MGNESIUM DISSOLVED	2590	MG/L	7001-7412 7501-7912	6 14	3.5 3.1	1.14 0.95	2.4233 2.075	1.0353 0.77429	0.8
MANGNESE DISSOLVED	2600	MG/L	7001-7412	6	L 0.01	L 0.01	0.01	0.0	
MERCURY TOTAL	261T	MG/L	7501-7912	2	L 0.00005	L 0.00005	0.00005	0.0	
POTASIUM DISSOLVED	2640	MG/L	7001-7412 7501-7912	6 1	0.7 0.6	0.4 0.6	0.56667 0.6	0.15055	
SODIUM DISSOLVED	2650	MG/L	7001-7412 7501-7912	6 1	1.3 1.2	0.6 1.2	1.05 1.2	0.2881	
ZINC DISSOLVED	2660	MG/L	7001-7412 7501-7912	6 7	0.02 0.014	L 0.005 L 0.005	.012333 0.007	.0053541 .0033166	2.2
ZINC	266T	MG/L	7501-7912	9	0.023	L 0.005	0.009	.0060474	

TABLE 4.7

Water Quality of the Salmo River, Downstream from Sheep Creek Confluence

(Source: Waste Management Branch, Ministry of Environment)

PARAMETER	TEST CODE	UNITS	DATE RANGE	NO. OF VALUES	MAXIMUM	MINIMUM	MEAN	STANDARD DEVIATION	T TEST
COLOR TR	002	REL UNIT	7001-7412	4	5.	L 5.	5.	0.0	
			7501-7912	5	5.	L 5.	5.	0.0	*****
OILAGRSE	003	MG/L	7501-7912	10	L 5.	L 1.	4.6	1.2649	
PH	004	REL UNIT	7001-7412	4	7.9	7.	7.3875	0.37499	
			7501-7912	59	8.3	6.5	7.6898	0.38222	1.5
RES 105C	005	MG/L	7001-7412	4	96.	46.	74.5	22.353	
			7501-7912	51	94.	38.	63.373	12.657	1.6
RESF 105	007	MG/L	7001-7412	1	84.	84.	84.		
			7501-7912	6	82.	46.	63.833	14.511	
RESNF105	008	MG/L	7001-7412	3	3.6	1.	1.9	1.4731	
			7501-7912	46	14.	1.	2.2826	2.9564	0.2
SPF COND	011	US/CM	7001-7412	4	142.	70.	115.75	33.925	
			7501-7912	17	130.	53.	96.471	27.377	1.2
TEM ARRV	012	DEG.C	7001-7412	4	18.	9.	12.5	4.3589	
T SAMPL G	013	DEG.C	7001-7412	4	9.	2.	5.5	3.1091	
			7501-7912	9	13.	0.	5.4444	5.2288	0.0
OXY DISS	014	MG/L	7001-7412	4	15.	11.2	12.325	1.8025	
			7501-7912	4	13.4	9.2	11.725	1.8062	0.5
TURBIDTY	015	N.T.U.	7001-7412	4	2.4	1.2	1.725	0.57373	
			7501-7912	13	2.5	0.2	0.68231	0.7268	2.6
BAR.PRES	017	KPASCALS	7001-7412	4	95.246	94.316	94.615	0.42165	
			7501-7912	3	93.519	92.19	92.81	0.66679	4.4
AIR TEMP	020	DEG.C	7001-7412	3	16.	3.	11.	7.	
			7501-7912	2	19.	1.	10.	12.728	0.1
COLRTAC	024	T.A.C.	7501-7912	5	5.	L 1.	4.	1.8708	
ALKALI T	102	MG/L	7501-7412	4	66.	31.	47.5	15.022	
			7501-7912	13	55.8	23.4	42.5	9.4692	0.8
CARBN DR	103	MG/L	7001-7412	4	4.	1.	2.5	1.291	
			7501-7912	1	2.	2.	2.		

TABLE 4.7 (continued)

PARAMETER	TEST CODE	UNITS	DATE RANGE	NO. OF VALUES	MAXIMUM	MINIMUM	MEAN	STANDARD DEVIATION	T TEST
CHLORIDE	104	MG/L	7001-7412	4	0.8	L 0.5	0.625	0.15	
			7501-7912	3	0.7	L 0.5	0.63333	0.11547	0.1
CYANIDE	105	MG/L	7001-7412	4	L 0.01	L 0.01	0.01	0.0	
			7501-7912	49	0.03	L 0.01	.010612	.0031676	0.4
FLUORIDE	106	MG/L	7001-7412	4	L 0.1	L 0.1	0.1	0.0	
			7501-7912	1	L 0.1	L 0.1	0.1		
HARDNESS	107	MG/L	7001-7412	4	61.9	29.	48.05	16.023	
			7501-7912	13	58.6	23.9	45.338	10.701	0.4
AMMONIA	108	MG/L	7001-7412	4	L 0.01	L 0.01	0.01	0.0	
			7501-7912	7	0.017	L 0.005	0.009	0.004	0.5
NO2/NO3	109	MG/L	7501-7912	8	0.1	L 0.02	0.05125	.033568	
NITRATE	110	MG/L	7001-7412	4	0.07	0.03	0.045	.019149	
			7501-7912	4	0.1	L 0.02	0.0475	.037749	0.1
NITRITE	111	MG/L	7001-7412	4	L 0.005	L 0.005	0.005	0.0	
			7501-7912	4	L 0.005	L 0.005	0.005	0.0	*****
NIT ORGN	112	MG/L	7001-7412	4	0.06	0.02	0.04	0.01633	
			7501-7912	6	0.11	0.01	.056667	.037771	0.8
NIT KJEL	113	MG/L	7501-7912	10	0.15	L 0.01	0.066	.044771	
NIT TOTL	114	MG/L	7501-7912	4	0.17	0.09	0.125	.033166	
PHOS ORT	118	MG/L	7001-7412	4	L 0.003	L 0.003	0.003	0.0	
			7501-7912	7	0.004	L 0.003	.0032857	.0004879	1.1
PHOS TOT	119	MG/L	7001-7412	4	0.022	0.005	0.01025	.0080571	
			7501-7912	10	0.018	0.004	0.0078	.0039944	0.8
SILICA	120	MG/L	7501-7912	2	8.5	8.4	8.45	.070621	
SULPHATE	121	MG/L	7001-7412	4	9.	L 5.	7.5	1.8511	
			7501-7912	43	13.	L 1.	6.1628	2.6538	1.0
ARSENIC DISSOLVED	251D	MG/L	7501-7912	4	L 0.005	L 0.005	0.005	0.0	
ARSENIC TOTAL	251T	MG/L	7501-7912	6	L 0.005	L 0.005	0.005	0.0	
CADMIUM DISSOLVED	253D	MG/L	7501-7912	4	L 0.0005	L 0.0005	0.0005	0.0	
CADMIUM TOTAL	253T	MG/L	7501-7912	5	L 0.0005	L 0.0005	0.0005	0.0	
CALCIUM DISSOLVED	254D	MG/L	7001-7412	4	21.	9.9	16.35	5.3532	
			7501-7912	13	20.	9.1	15.523	3.6277	0.4

TABLE 4.7 (continued)

PARAMETER	TEST CODE	UNITS	DATE RANGE	NO. OF VALUES	MAXIMUM	MINIMUM	MEAN	STANDARD DEVIATION	T TEST
COPPER DISSOLVED	2560	MG/L	7001-7412 7501-7912	4 46	0.002 0.01	L 0.001 L 0.001	0.00125 0.004587	0.0005 .0015857	4.2
COPPER TOTAL	256T	MG/L	7501-7912	6	0.001	L 0.001	0.001	0.0	
IRON DISSOLVED	2570	MG/L	7001-7412 7501-7912	4 47	L 0.1 L 0.1	L 0.04 L 0.05	0.055 .059574	0.03 .019106	0.4
IRON TOTAL	257T	MG/L	7001-7412 7501-7912	4 8	0.49 0.3	0.07 L 0.1	0.1825 0.1375	0.20549 .074402	0.6
LEAD DISSOLVED	2580	MG/L	7001-7412 7501-7912	4 48	0.005 0.01	L 0.001 L 0.001	0.00275 0.0085	.0017078 .0033896	3.3
LEAD TOTAL	258T	MG/L	7501-7912	8	0.001	L 0.001	0.001	0.0	
MGNESIUM DISSOLVED	2590	MG/L	7001-7412 7501-7912	4 13	2.3 2.1	1.03 0.9	1.7525 1.6	0.64814 0.42032	0.6
MANGNESE DISSOLVED	2600	MG/L	7001-7412	4	0.01	L 0.01	0.01	0.0	
MERCURY TOTAL	261T	MG/L	7501-7912	1	L 0.00005	L 0.00005	0.00005		
POTASIUM DISSOLVED	2640	MG/L	7001-7412 7501-7912	4 2	0.9 0.8	0.5 0.8	0.7 0.8	0.18257 0.0	0.7
SODIUM DISSOLVED	2650	MG/L	7001-7412 7501-7912	4 2	1.5 1.3	0.7 1.2	1.175 1.25	0.3594 .070701	0.3
ZINC DISSOLVED	2660	MG/L	7001-7412 7501-7912	4 46	0.011 0.03	L 0.005 L 0.005	0.008 .010913	.0024495 .0043144	1.3
ZINC TOTAL	266T	MG/L	7501-7912	8	0.02	L 0.005	0.0085	0.004928	
COL.FECL	450	M.P.N.	7501-7912	1	23.	23.	23.		
COL.TOTL	451	M.P.N.	7501-7912	1	33.	33.	33.		

TABLE 4.8

Monthly Mean Discharges In Cubic Feet Per Second for Sheep Creek and Salmo River Tributaries (From Fisheries and Environment Canada, 1977)

Location	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Lat (N)	Long (W)	Drainage Area (mi^2)
Sheep Creek near Salmo	1930	-	-	-	-	-	277	62.7	29.0	23.0	-	-	-	49°08'33"	117°15'11"	51.9
Nugget Creek near Sheep Creek	1938	-	-	-	-	-	-	-	-	1.3	-	-	-	49°09'04"	117°08'42"	3.6
	1939	-	-	-	-	33.8	17.6	9.5	4.7	4.1	-	-	-			
	Mean	-	-	-	-	33.8	17.6	9.5	4.7	2.7	-	-	-			
Billings Creek near Sheep Creek	1938	-	-	-	-	-	-	-	-	0.20	-	-	-	49°08'40"	117°08'50"	1.1
	1939	-	-	-	-	8.0	4.2	1.6	0.45	0.40	-	-	-			
	Mean	-	-	-	-	8.0	4.2	1.6	0.45	0.30	-	-	-			
Halfway Creek near Salmo	1937	-	-	-	-	-	3.6	1.2	0.22	0.20	-	-	-	49°10'20"	117°15'18"	2.8
	1938	-	-	-	18.0	23.1	10.2	1.4	0.54	0.40	-	-	-			
	1939	-	-	-	-	10.6	4.9	1.8	0.38	0.21	-	-	-			
	Mean	-	-	-	18.0	16.9	6.2	1.5	0.38	0.27	-	-	-			

for the period of 1949 to 1976 are given in Table 4.9. Those for the period of 1977 to 1980 are given in Table 4.10.

It is evident from the tables that peak flows occur in May and decrease substantially between August and March.

The maximum instantaneous discharges and maximum daily discharges recorded for the Salmo River have generally occurred in May and June. The flow minima occurred during the fall and winter months.

4.5.4 Water Licences

On 1 March 1957, Cominco Ltd. was granted Water Licence No. 16532. This allowed the company to divert and use a maximum of 2727 m^3 (600,000 gallons) of water per day from Sheep Creek for the purpose of mining and milling.

In addition, on 1 March 1961, Cominco Ltd. obtained Licence No. 17622 to divert a maximum of 1282 m^3 (282,000 gallons) a day from Aspen Creek, a tributary of Sheep Creek (from the Water Rights Branch, Department of Lands and Forests, Province of B.C.). The breakdown of water uses are as follows: 1282 m^2 (250,000 gallons) a day for mining and milling, 100 m^3 (22,000 gallons) a day for industrial purposes (compressor) and 46 m^2 (10,000 gallons) a day for waterworks.

All of these licences have been transferred to David Minerals by the Water Rights Branch consistent with the transfer of title of the HB Mill.

4.5.5 Fisheries

There are no anadromous fish present in the Salmo River system. The Salmo River system is a tributary of the Columbia River, located 122 km above the Grand Coulee Dam. There are no known commercial or native food fisheries in the Salmo district. Very little information is available on the sport fishery patterns in the District.

TABLE 4.9

Monthly and Annual Mean Discharges from 1949-1976
for Salmo River Near Salmo
(From Fisheries and Environment Canada, 1976)
Located 8 km S of Confluence with Sheep Creek

SALMO RIVER NEAR SALMO - STATION NO. 08NE074

MONTHLY AND ANNUAL MEAN DISCHARGES IN CUBIC FEET PER SECOND FOR THE PERIOD OF RECORD

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1949	---	---	327	2390	5770	1980	506	219	151	206	441	476	---	194
1950	276	256	407	1320	4080	4820	1310	383	183	795	803	871	1200	195
1951	647	835	523	2110	5050	2710	953	235	215	561	375	975	1230	195
1952	284	232	252	2710	4620	2630	886	251	150	112	107	105	1030	195
1953	198	264	284	1120	4340	6220	1340	389	278	269	456	324	1130	195
1954	286	296	447	1190	5800	4560	2040	441	394	342	696	675	1420	195
1955	318	247	322	920	3090	5830	2370	547	278	563	659	421	1290	195
1956	359	313	349	2410	5520	3350	842	300	215	266	215	188	1190	195
1957	152	169	296	1320	6980	2170	446	255	192	227	211	191	1020	195
1958	179	402	623	1440	5350	1720	416	191	187	236	249	259	943	195
1959	340	246	289	1790	4150	4660	922	256	789	1000	688	468	1300	195
1960	293	281	622	2080	3830	4210	941	231	222	296	325	189	1120	196
1961	257	538	558	1890	5100	4580	691	210	190	273	216	183	1220	196
1962	149	178	209	2010	3210	2860	663	272	203	311	375	490	912	196
1963	343	469	483	1360	3850	2730	801	263	198	179	305	264	938	196
1964	226	188	200	884	3970	4960	1100	386	340	367	377	282	1110	196
1965	232	231	381	2010	3620	2930	653	274	237	188	323	349	944	196
1966	200	176	398	1770	4310	2970	837	233	190	158	217	319	973	196
1967	267	333	402	866	3970	5500	942	212	124	219	329	203	1110	196
1968	238	386	961	844	3830	4310	843	425	453	570	719	519	1170	196
1969	296	296	352	2250	5260	3120	1200	283	224	358	499	303	1200	196
1970	227	223	317	760	3400	2820	557	199	184	186	203	188	782	197
1971	258	581	382	1600	5510	3790	1490	344	391	254	274	215	1250	197
1972	186	200	1180	1590	6020	4700	1780	389	272	283	259	189	1430	197
1973	327	193	412	1170	3850	2580	624	178	168	364	703	578	925	197
1974	795	549	620	2210	4330	7220	1940	442	208	145	248	227	1570	197
1975	183	157	236	790	4020	4850	1390	434	385	368	896	1080	1240	197
1976	471	347	330	1640	5060	3950	1400	861	526	282	224	185	1330	197
MEAN	252	316	431	1590	4540	3800	1070	326	264	335	407	358	1150	MEA

LOCATION - LAT 49 04 07 N
LONG 117 16 37 W

DRAINAGE AREA 476 SQ MILES
NATURAL FLOW

SALMO RIVER NEAR SALMO - STATION NO. 08NE074

ANNUAL EXTREMES OF DISCHARGE IN CFS AND ANNUAL TOTAL DISCHARGE IN AC-FT FOR THE PERIOD OF RECORD

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1949	11600 CFS AT 0300 PST ON MAY 14	10700 CFS ON MAY 13	---	---	1949
1950	7630 CFS AT 0630 PST ON MAY 13	6730 CFS ON MAY 13	132 CFS ON SEP 24	838000 AC-FT	1950
1951	9240 CFS AT 0330 PST ON MAY 12	8460 CFS ON MAY 12	146 CFS ON SEP 21	886000 AC-FT	1951
1952	8200 CFS AT 0515 PST ON APR 27	7490 CFS ON APR 27	58.0 CFS ON DEC 26 *	746000 AC-FT	1952
1953	8630 CFS AT 1900 PST ON MAY 19	8050 CFS ON MAY 19	94.0 CFS ON JAN 7	815000 AC-FT	1953
1954	12800 CFS AT 0600 PST ON MAY 19	11900 CFS ON MAY 19	268 CFS ON OCT 10	1030000 AC-FT	1954
1955	10400 CFS AT 0330 PST ON JUN 13	9400 CFS ON JUN 12	170 CFS ON MAR 28	935000 AC-FT	1955
1956	12300 CFS AT 0440 PST ON MAY 21	10900 CFS ON MAY 21	154 CFS ON OCT 9	866000 AC-FT	1956
1957	12200 CFS AT 0500 PST ON MAY 6	10700 CFS ON MAY 6	125 CFS ON FEB 20	739000 AC-FT	1957
1958	10000 CFS AT 0330 PST ON MAY 22	8750 CFS ON MAY 22	140 CFS ON SEP 8	682000 AC-FT	1958
1959	8890 CFS AT 1530 PST ON JUN 6	8360 CFS ON JUN 6	128 CFS ON JAN 9	942000 AC-FT	1959
1960	12100 CFS AT 0130 PST ON MAY 13	10200 CFS ON MAY 12	126 CFS ON OCT 5	817000 AC-FT	1960
1961	---	7120 CFS ON JUN 8	111 CFS ON DEC 11	886000 AC-FT	1961
1962	6090 CFS AT 0300 PST ON MAY 25	5620 CFS ON MAY 25	112 CFS ON JAN 10	660000 AC-FT	1962
1963	6380 CFS AT 0115 PST ON MAY 25	6250 CFS ON MAY 24	130 CFS ON OCT 17	679000 AC-FT	1963
1964	8670 CFS AT 0430 PST ON MAY 21	7770 CFS ON MAY 20	142 CFS ON DEC 16	809000 AC-FT	1964
1965	6800 CFS AT 0140 PST ON MAY 30	6110 CFS ON MAY 29	154 CFS ON DEC 15	683000 AC-FT	1965
1966	7830 CFS AT 0330 PST ON MAY 7	7220 CFS ON MAY 7	118 CFS ON SEP 24	705000 AC-FT	1966
1967	9420 CFS AT 2330 PST ON JUN 3	8660 CFS ON JUN 3	96.0 CFS ON SEP 30	806000 AC-FT	1967
1968	16300 CFS AT 2120 PST ON JUN 2 *	11400 CFS ON JUN 2	154 CFS ON JAN 6	854000 AC-FT	1968
1969	8790 CFS AT 0230 PST ON MAY 13	8210 CFS ON MAY 13	154 CFS ON SEP 13	872000 AC-FT	1969
1970	6900 CFS AT 0617 PST ON MAY 26	6600 CFS ON MAY 26	118 CFS ON NOV 22	567000 AC-FT	1970
1971	11500 CFS AT 1350 PST ON MAY 13	10600 CFS ON MAY 13	125 CFS ON JAN 1	907000 AC-FT	1971
1972	11800 CFS AT 0210 PST ON JUN 1	10600 CFS ON MAY 31	92.2 CFS ON DEC 4	1040000 AC-FT	1972
1973	9260 CFS AT 0100 PST ON MAY 18	8290 CFS ON MAY 17	107 CFS ON SEP 14	670000 AC-FT	1973
1974	13700 CFS AT 0305 PST ON JUN 17	12400 CFS ON JUN 16 *	130 CFS ON NOV 3	1140000 AC-FT	1974
1975	9200 CFS AT 0300 PST ON MAY 16	8290 CFS ON MAY 16	84.7 CFS ON FEB 6	895000 AC-FT	1975
1976	9370 CFS AT 1616 PST ON MAY 11	8380 CFS ON MAY 11	153 CFS ON DEC 31	894000 AC-FT	1976
				832000 AC-FT	MEAN

* - EXTREME RECORDED FOR THE PERIOD OF RECORD

TABLE 4.10

SALMO RIVER NEAR SALMO - STATION NO. 08NE074
MONTHLY AND ANNUAL MEAN DISCHARGE IN CUBIC FEET PER SECOND FOR 1977-1980

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN	YEAR
1977	169	185	220	1240	2290	1530	363	212	296	286	379	337	626	1977
1978	285	250	688	1990	4070	4220	1210	427	667	431	290	212	1230	1978
1979	180	173	466	1042	4061	1769	597	219	207	211	177	344	791	1979
*	(5.09)	(4.90)	(13.2)	(29.5)	(115)	(50.1)	(16.9)	(6.19)	(5.86)	(5.97)	(5.0)	(9.73)	(224)	*
1980	247	285	629	3407	4590	1532	533	339	364	281	459	614	1109	1980
*	(6.99)	(8.08)	(17.8)	(96.5)	(130)	(43.4)	(15.1)	(9.59)	(10.3)	(7.97)	(13.0)	(17.4)	(31.4)	*
MEAN	220	223	501	1920	3753	2263	676	299	384	302	326	377	939	MEAN

* Bracketed figures report values in cubic metres per second (m^3/sec) = cumecs

ANNUAL EXTREMES OF DISCHARGE IN CFS AND ANNUAL TOTAL DISCHARGE IN AC-FT FOR 1977-1980

YEAR	MAXIMUM INSTANTANEOUS DISCHARGE	MAXIMUM DAILY DISCHARGE	MINIMUM DAILY DISCHARGE	TOTAL DISCHARGE	YEAR
1977	5810 CFS AT 0258 PST ON JUN 8	4510 CFS ON MAY 3	150 CFS ON JAN 2	454000 AC-FT	1977
1978	8670 CFS AT 2355 PST ON JUN 8	7450 CFS ON JUN 5	183 CFS ON DEC 25	891000 AC-FT	1978
1979	7168 CFS AT 0238 PST ON MAY 5 (203 m^3/s)	6780 CFS ON MAY 5 (192 m^3/s)	106 CFS ON NOV 29 (3.01 m^3/s)	574719 AC-FT (709000 dam^3)	1979
1980	15501 CFS AT 1026 PST ON APR 29 (439 m^3/s)	13488 CFS ON APR 29 (382 m^2/s)	183 CFS ON JAN 19 (5.18 m^3/s)	804121 AC-FT (992000 dam^3)	1980

According to Mr. P.G. Stent, Conservation Officer for the Provincial Ministry of Environment, Fish and Wildlife Branch stationed at Trail, sportsfishing for rainbow trout (Salmo gairdneri) and Dolly Varden char (Salvelinus malma) take place on both Salmo River and Sheep Creek, but fishing intensity and catch statistics have never been collected. Most of the fish taken in Sheep Creek are usually less than 25 cm in length. Fishing for rainbow trout and Dolly Varden char occurs along the banks of the Salmo River. The favorite fishing location is 4 km south of Salmo near the old Highway 3-6 bridge which crosses Sheep Creek. Rainbow trout weighing up to 9 kg have been caught by anglers at this spot. Mr. Stent also reported that rainbow trout spawning has been observed in the lower reach of Sheep Creek, but details on their abundance are not available. A small number of Eastern brook trout (Salvelinus fontinalis) are found in Erie Lake and Erie Creek, which drain into the Salmo River near Salmo. These trout are rarely caught by anglers in the Salmo River.

Other fish found in the rivers and creeks of the Salmo district are: longnose sucker (Catostomus catostomus), largescale sucker (Catostomus macrocheilus), lake chub (Couesius plumbeus), redside shiner (Richardsonius balteatus), shorthead sculpin (Cottus confusus), mottled sculpin (Cottus bairdi), slimy sculpin (Cottus cognatus), longnose dace (Rhinichthys cataratae), and northern squawfish (Ptychocheilus oregonensis). According to [redacted] a local angler and trapper, the number of squawfish is said to be increasing in the Salmo River.

4.6 Groundwater

There are no known accounts of groundwater hydrology that are relevant to the HB Mine property. There is considerable evidence of groundwater present in the closed mine shaft. In 1979, Cominco Ltd. determined the mine groundwater flow rates and analyzed its quality.

4.6.1 Quantity

Table 4.3 shows the mine drainage flow rates. Between January and June, the flow rate was highest during the month of March. It was seven to nine times higher than monthly rates from April to June.

4.6.2 Quality

Water quality samples of the mine ground water were taken on 22 February, 10 April, 8 May and 5 June 1979. The results are given in Table 4.11. The drainage water was slightly alkaline with pH values remaining relatively constant for the period sampled. Total solid, total cyanide, dissolved iron and copper concentrations remained relatively constant. On the other hand, suspended solids, dissolved sulphate, lead and zinc concentrations varied on the four sampling dates.

4.7 Soils and Surficial Geology

According to Jungen (1980), Salmo soils are most frequent on the lower slopes of major valleys such as the Sheep Creek Valley. They occur on glacial till deposits that have long, smooth slopes. The topography is gently to steeply sloping and is broken by smooth linear gullies. The soils have developed in compact glacial (basal) till that is principally associated with coarse-grained bedrock. The deposits are generally over 1.5 m in depth and non-calcareous. The surface texture is moderately coarse (mainly sandy loam) and grades to very coarse with increasing depth. Typical soil development is Orthic Dystric Brunisol. Significant inclusions of Orthic Humo-Ferric Podzol are found in the cooler and moister transition zone at higher elevations, with Brunisolic Gray Luvisols occurring where the glacial till is of finer texture than usual. Orthic Eutric Brunisols are also present at lower elevations and where the parent material is slightly higher in calcareous content. Salmo soils are moderately acid, have low cation exchange capacities and are moderately base saturated. Salmo soils are well to rapidly drained.

4.7.1 General Geology

The geology of the Salmo district has been described by Walker (1934) and more recently by Little (1950). Palaeozoic sedimentary rocks of the area rest on Proterozoic sediments, and are overlain by Mesozoic volcanic rocks. The Palaeozoic rocks are made up of quartzites, limestones and argillites and form a broad belt which extends northward from the Salmo area into the Kootenay Lake district. In the Salmo area, the most economically important group is the Lower Cambrian Laib group of

TABLE 4.11

H B Mine Drainage Water Quality
HB Mine Pollution Control Permit, P.E. - 1853
Monitoring Data - First and Second Quarter, 1979

Mine Drainage

	Feb. 22	Apr. 10	May 8	June 5
pH	8.0	8.3	8.2	8.2
Total Solids	481.0	407.0	420.0	331.0
Suspended Solids	1.0	64.0	140.0	11.0
Dissolved SO_4	200.0	119.0	64.0	93.0
Total CN	L0.01	L0.01	L0.01	L0.01
Dissolved Fe	0.11	L0.05	L0.05	L0.05
Dissolved Pb	0.04	0.05	0.08	0.07
Dissolved Zn	0.90	0.80	0.19	0.48
Dissolved Cu	0.005	0.005	0.005	L0.005

*All measurements except pH are reported in milligrams per litre (mg/l = PPM).

slates and limestones, in the calcareous members of which all the productive zinc-lead deposits of the area are found.

The Palaeozoic rocks are extensively folded and faulted, and have been intruded by a long narrow granitic tongue which extends south from the main Nelson batholith, following a line of regional faults. Also apparently associated with the post-Triassic intrusive period are numerous smaller granitic bodies which follow the same trend. Several of these smaller granitic stocks are in close proximity to the HB Mine, and it is probable that the ore is related to the granite.

4.7.2 Geology of the HB Mine

The HB Mine is located within the Kootenay Arc, which in the Salmo area consists of an assemblage ranging from quartzites through argillites to limestones and back into argillites. The HB ore bodies are localized within the dolomitized lower part of the Reeves Limestone.

In the mine vicinity, the Lower Laib is folded isoclinally, with axial planes striking north-south and inclined steeply east. The folds plunge 20 degrees to the south. The main ore bodies are confined to a syncline approximately 1067 m (3500 ft) in length and 61 to 122 m (200 to 400 ft) wide. The Garnet ore body 152 m (500 ft) to the west is in a smaller syncline. There are essentially two types of ore bodies, a steeply dipping variety of ore stringers and a flat lying type. Both types of ore zones conform to the 20 degree plunge of the fold.

The fine-grained dolomite host rocks for the ore are either described as crackled or as grey, massive. Crackle dolomite is a white dolomite containing dark carbonaceous material in lineations, patches and streaks. It represents a banded rock which has undergone tremendous stresses. The grey, massive dolomite is untextured and hosts only a small percentage of the total HB reserves. The mineralogy of the ore is simple with sphalerite, pyrite and galena with pyrrhotite occurring locally. The larger steep zones have a Zn:Pb ratio of about 6:1 whereas the flat zones have a Zn:Pb ratio of 2.4:1.

The boundaries of the HB ore bodies are determined by structure, lithology and topography. To the south, the ore zones pinch-out apparently caused by an upward re-folding of the synclinal package. To the east and west the syncline and the dolomite host rock control the extent of mineralization. To the north, the ore zones plunge up to surface and are almost completely oxidized within 91 m (300 ft) of the surface. The chief economic constituents of the ore body were lead and zinc, occurring as marmatite and galena, in a gangue of talc, tremolite, limestone and dolomite. There were also considerable iron sulphides in the form of pyrite and pyrrhotite.

4.7.3 Mining

The ore bodies were mined by Cominco Ltd. from underground by both longhole and open stoping methods.

Access to the mine was through two main openings. The portal of the main entrance, and the 853 m (2800 ft) level haulageway, is situated about 91 m (300 ft) above Sheep Creek and provides access from the main surface buildings. Most of the personnel and supplies were carried underground on this level and all the ore and waste was trammed out.

The 1067 m (3500 ft) level portal is located about 122 m (200 ft) above Aspen Creek, and provides access to the upper reaches of the No.1 zone and to the hoist-room for the service shaft. Some material and a few personnel entered the mine through this opening. A third access of lesser importance, the 7006 m (3300 ft) portal, is located above the 1853 m (2800 ft) level portal and on the same slope.

Underground, the only ore tramming was on the 1853 m (2800 ft) level. This was done by a Ruston-Hornsby diesel locomotive pulling eleven 6-ton cars from various areas dumping at the coarse ore bin located on the surface about 103 m (340 ft) east of the portal. All other ore and waste movement underground was affected by 20 to 60 HP air or electric slushers and by gravity down to the 1853 m (2800 ft) level.

4.8 Vegetation*

The Sheep Creek Valley is situated in the Western larch subzone of the Interior Hemlock biogeoclimatic zone, characterized by a total annual precipitation in the range of 56-89 cm (22-35") Krajina (1969).

Land on the south facing slope surrounding the mine complex includes areas of productive and non-productive woodland. Immature stands of quaking aspen, lodgepole pine and Douglas fir occupy medium quality productive sites (Forest cover map 82-F-3-g 1962). Paper birch is common and black cottonwood is dominant along the river bottoms. Fire destroyed the cover over part of this area in 1905 and in 1925. The tailings pond occupies a depression, bounded on the west by unproductive land (rock) and by productive woodland in other directions. Productive woodland has a cover of predominantly miniature western larch with minor Douglas fir, lodgepole pine and western white pine inclusions on medium quality sites. Fire also destroyed forest cover over part of the tailings pond area in 1925.

The regrowth of trees in the areas destroyed by forest fires is poor, primarily due to erosion of the thin topsoil layer after the fire. There is some harvestable timber in the area below the company houses, which was untouched by fire.

Other trees and shrubs found on the HB Mine property are: rose snowberry and dogwood. The species of grasses found include: red top alsike clover, red clover, sweet clover, timothy, bluebunch wheatgrass and field horsetail.

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* Common and scientific names of the vegetations found in the HB Mine site are listed in Appendix A

4.9 Wildlife

4.9.1 Ungulates

Good habitat for ungulates is found all along the Salmo River valley, extending up into the valleys of its tributaries. Sheep Creek valley, one of these tributaries, is part of this network of land classified as 3W (C.L.I. 1971). This classification indicates that the land has slight limitations to the production of ungulates, and provides good winter range for ungulates from the surrounding area. In the Sheep Creek valley area, excessive snow depth may limit ungulate production by reducing the mobility of ungulates and the availability of food plants.

There is a large area of class 2 W land (C.L.I. 1971) located in the Pend d'Oreille River valley approximately 15 km south east of the HB Mill area. Deer tagged on the Pend'Oreille winter range have been relocated more than 30 km north of their capture site s.22 [redacted] Local Biologist, Fish and Wildlife Branch, Nelson, pers. comm.). It is believed that most of the deer from the Salmo area migrate along the river valley bottoms to winter on this more favourable winter range, which has only very slight limitations for overwintering deer.

Mule deer (<u>Odocoileus hemionus</u>), whitetail deer (<u>Odocoileus virginanus</u>) and a few elk (<u>Cervus canadensis</u>) have been seen near the minesite and tailings pond during the winter months. In February 1982, 15 mule deer were seen in the vicinity of the tailings pond and the old highway (3-6) bridge at Sheep Creek. The deer appeared to be feeding on alfalfa planted in the borrowed area near the tailings pond as a part of the reclamation programs. Whitetail deer prefer the dense cover found in major valley bottoms and therefore are probably not numerous along the narrow, steep-sided valley of Sheep Creek.

Caribou (<u>Rangifer tarandus</u>) have not been seen in the study area. The Selkirk herd is centered in the Nelson Range east of the Sheep Creek valley. This herd utilizes high elevation ranges in northern Washington and Idaho and adjacent areas in British Columbia.

4.9.2 Carnivores

American black bear (Ursus americanus) are relatively common in the Sheep Creek valley, and grizzly bears (Ursus arctos horribilis) are sometimes sighted. One black bear was shot at the garbage dump site near the tailings pond in 1977. Cougar (Felis concolor) and coyote (Canis latrans) occur in the study area although no information is available concerning population levels.

4.9.3. Furbearers

Reclamation/revegetation procedures as well as extensive forest fires have resulted in a mixture of plant communities in the Sheep Creek valley. Riparian habitats, mature coniferous forests, second growth mixed woodlands and meadow lands support a variety of furbearing mammals. The furbearers occurring in the Salmo district are listed in Table 4.12.

Traplines in the Salmo District are licensed to Mr. Max Eberts of Salmo, who traps in the Erie Creek, Sheep Creek and Lost Creek areas, and to Mr. Harry Mueller of Salmo, who traps in the Hidden Creek, Porcupine Creek, and Wildhorse Creek areas up to Ymir. Mr. Derick Leduc has trap lines in the Salmo and Erie areas. Mr. Eberts reported catches of 10 beaver, 5 marten, 5 mink, 1 muskrat, and 3 weasel, to make a total of 24 pelts in 1982. It is not possible to extrapolate trapping records to give estimates of animal populations since trapping effort varies greatly and fluctuates with market prices for furs.

4.9.4 Waterfowl

The HB Mine property is classified as having such severe limitations to waterfowl production that almost no waterfowl are produced. This is because so much of the Sheep Creek valley terrain is bounded by steep hillsides, and there are few suitable feeding areas for waterfowl. In addition, there are almost no permanent water bodies in the study area.

TABLE 4.12

Species of Furbearers Occurring in the Salmo District
Nomenclature after Cowan and Guiguet, 1956

Common Names	Scientific Name	Occurrence
Bobcat	Lynx rufus	Rare
Lynx	Lynx canadensis	Rare
Beaver	Castor canadensis	Common
Marten	Martes americana	Common
Fisher	Martes pennanti	Common
Weasel	Mustela spp.	Rare
Mink	Mustela vison	Common
Muskrat	Ondatra zibethica	Common
Wolverine	Gulo luscus	Rare

4.9.5 Birds

Ravens are plentiful in the area and congregate at the garbage dump. The open woodlands and denser conifer stands of Sheep Creek valley provide good summer and winter habitat for Ruffed grouse which is the most common upland game bird in the area. Great blue heron are occasionally sighted during the summer months on the HB Mine property. It is expected that the normal complement of passerines (small perching birds) occupy suitable habitats throughout the study area.

4.10 Land Capability and Use

The physical capability of the land surrounding the mine and tailing pond has been classified for use in agriculture, forestry, recreation, ungulate and water fowl production (Canada Land Use Inventory). The classification was based on data from surveys conducted under the Canada Land Inventory Program and reported by Gardiner (1974). The following are physical capabilities of the land at the HB Mine for each use group:

4.10.1 Agriculture

(a) The Mine has severe limitations for agricultural use due to adverse topography, shallowness to bedrock and climate. Eighty percent of the land possesses no capability for agriculture or permanent pasture. Twenty percent is capable only of producing perennial forage crops.

(b) The tailing pond land has severe limitations for agricultural use due to adverse topography, stoniness and climate. Forty percent of the land area possesses no capability for agriculture or permanent pasture while 60% is capable only of producing perennial forage crops. Improvement practices are considered feasible.

4.10.2 Forestry

(a) The land at the mine site has moderate to severe limitations to the growth of commercial forest. Growth limiting factors include restriction of the rooting zone by bedrock and soil moisture deficiency. A small area has severe limitations which preclude growth of commercial forests.

(b) The tailing pond land has slight (60%) to moderate (40%) limitations to growth of commercial forest. Growth may be limited by restriction of rooting zone by bedrock and soil moisture deficiency.

4.10.3 Recreation

a) Mine and tailings pond land lacks the natural capability and significant features to rate higher than low capability for outdoor recreation, but has natural capability to engender and sustain a low annual use based on such activities such as hiking, nature study or for aesthetic appreciation. The land possesses continuous flowing streams in upland areas.

4.10.4 Ungulates

(a) The mine and tailings pond land is classed as winter range of moderately high capability for deer and moose. Productivity may be reduced in some years due to excessive snow depth that reduces mobility of ungulates and availability of food plants.

4.10.5 Waterfowl

(a) Mine and tailing pond capability for the production of waterfowl is negligible or nonexistent due to adverse topography.

4.10.6 Trapping

The trapping licence for the Sheep Creek Valley is issued to Messrs. Max and Melvin Eberts.

4.10.7 Guiding

There are no records of big game guiding ventures in the Salmo district.

4.11 Reclamation Work at the HB Mine Site

A reclamation program was carried out by Cominco. Ltd., in accordance with terms and conditions of Surface Work Permit M-85, issued by the Provincial Ministry of Energy, Mines and Petroleum Resources on 28 March 1973. The objectives of the reclamation program were to:

1. improve growth conditions on the disturbed land areas and to encourage succession of native vegetation;

2. accelerate soil formation and control erosion, by establishment and maintenance of an initial vegetative cover with grass and legume species;

3. provide forage for wildlife;

4. improve the aesthetic appearance of disturbed land surfaces.

The extent of the surface areas disturbed by the mining and milling operations during Cominco's ownership are given in Table 4.13 (Rusnell and Gardiner, 1982). The size of areas reclaimed and of those not yet reclaimed are also given. The locations of the reclaimed areas are shown in Figure 4.3. Of the 35.7 ha of surface area disturbed, Garnet Zone opening and tailings dam(2.4 ha), borrow pits (3.4 ha) and the waste rock dump at 1,067 m elevation (0.1 ha) were completely reclaimed. The waste rock dump at the 853 m elevation was not reclaimed because it remained in use as a storage area. Approximately 23% of the tailings impoundment was reclaimed.

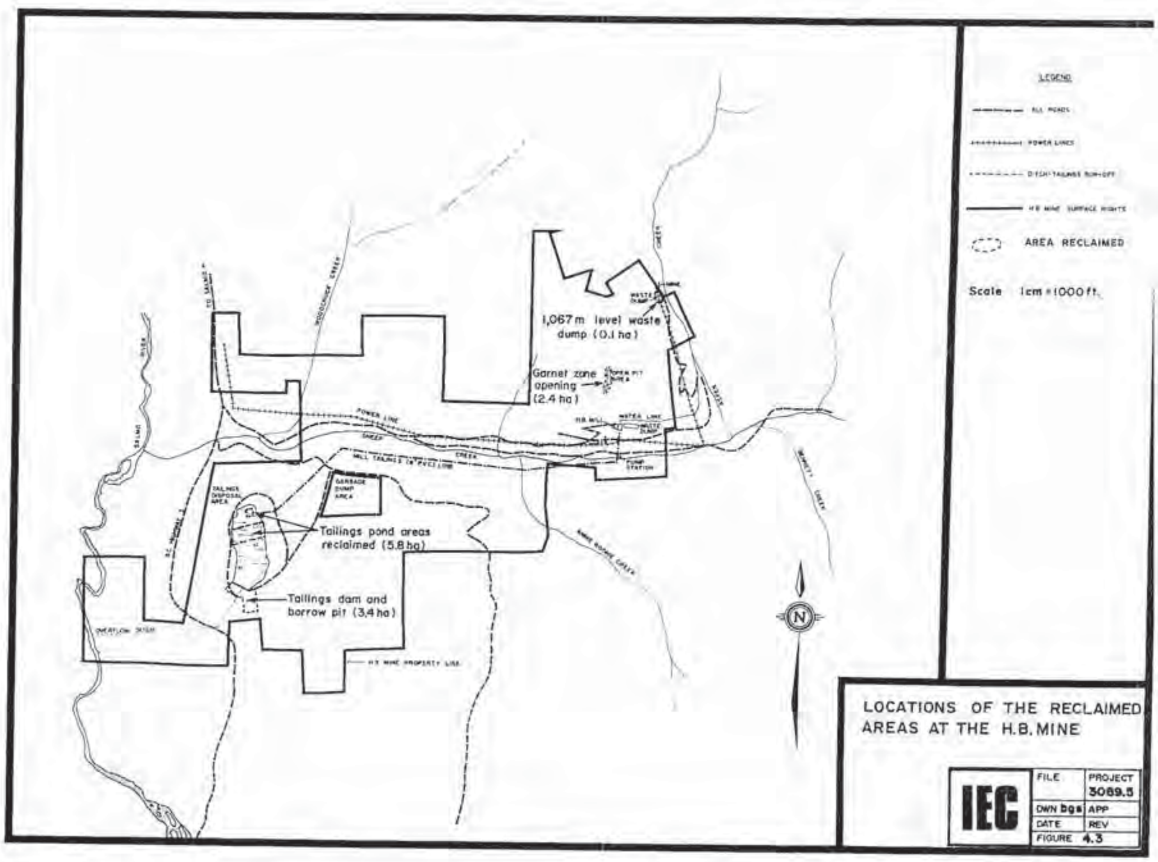

1,067 m level waste dump (0.1 ha)
Garnet zone opening (2.4 ha)
Tailings pond areas reclaimed (5.8 ha)
Tailings dam and borrow pit (3.4 ha)
POWER LINE
LEGEND
AREA RECLAIMED
Scale 1cm = 1000 ft.
LOCATIONS OF THE RECLAIMED AREAS AT THE H.B. MINE
IEC
FILE
PROJECT 3089.5
DWN bgs
APP
DATE
REV
FIGURE 4.3

Table 4.13

The Nature and Extent of Land Disturbance and Reclamation at H.B. Operations (From Table 1, Rusnell and Gardiner 1981)

	Area of Disturbance		Area of Completed Reclamation			Non-vegetated Areas remaining		
	ac	ha	ac	ha	%	ac	ha	%
Waste rock dumps								
853 m (2800 ft) level	2.2	0.9	0	0	0	2.2	0.9	100
1,067 m (3500 ft) level	0.2	0.1	0.2	0.1	100	0	0	0
Garnet Zone opening	6.0	2.4	6.0	2.4	100	0	0	0
Tailings impoundment	61.3	24.8	14.3	5.8	23	47.0	19.0	77
Tailings dam and borrow pits	8.4	3.4	8.4	3.4	100	0	0	0
Buildings and service area	4.0	1.6	0	0	0	4.0	1.6	100
Roads	6.1	2.5	0	0	0	6.1	2.5	100
TOTAL	88.2	35.7	28.9	11.7		59.3	24.0	

A grass seed mixture composed of creeping red fescue, Canada bluegrass, timothy, and red top, and legume seed mixture composed of rambler alfalfa, alsike clover and birdfoot trefoil, were used to seed the disturbed surfaces. Ponderosa pine, lodgepole pine, Douglas fir and paper birch seedlings were also planted.

The following is a summary of the results of reclamation efforts reported by Rusnell and Gardiner (1982) at the HB Mine site.

853 m (2800 ft) level waste rock dump:

This area was used as a storage space so that the revegetation program was not initiated prior to the sale of the property.

1,067 m (3500 ft) level waste rock dump:

Cool, wet weather during May and June 1981 promoted satisfactory growth and cover at this site. Vegetation was dominated by creeping red fescue with significant timothy, red top, Canada blue grass and minor alsike clover distributed irregularly over the waste dump surface.

Lodgepole pine seedlings were planted on the waste dump in May, 1980 and were establishing satisfactorily. However, survival rates for other woody species was poor, as indicated by the following values: black cottonwood 25%, quaking aspen 4% and birch 3%.

Natural revegetation of the old housing site and around the Garnet Zone pit has progressed satisfactorily, with fertilizer applications enhancing growth and extent of coverage. Establishment of seeded legume and grass species near the Garnet Zone pit was variable, being poorest on the broken rock and best on the natural, undisturbed soil with its layer of organic matter on the surface.

Tailings Dam and Borrow Pits

a) Tailings Dam and West Borrow Area

A dense cover of alfalfa, timothy and creeping red fescue was growing on the tailings dam slopes and the west borrow area. Vegetative growth was excellent with no evidence of chlorosis. Maintenance fertilizer was not applied to either area in 1981.

Species composition varied somewhat on the compact top portion of the dam, however vegetative growth was very good. Canada bluegrass was the dominant species with significant amounts of red top, creeping red fescue and alfalfa also present. Minor amounts of birdsfoot trefoil were also present.

b) 1974 and 1977 Borrow Areas

A satisfactory vegetative cover dominated by grasses was sustaining growth throughout both borrow areas without maintenance fertilizer. Species composition varied throughout the areas, being affected by soil composition, seepage, moisture accumulation and replacement of surface soil. Woody species, including willow and poplar, were invading the 1974 borrow area along east and west perimeters. All drainage ditches have been stabilized with vegetation.

Canada bluegrass was the dominant grass on the 1974 borrow pit floor with timothy and creeping red fescue becoming co-dominant within seepage areas and on the less compact slopes along either side of the pit. Alsike clover was present but distribution was irregular and overall cover minor.

Lodgepole pine establishment on the 1974 borrow area slopes appears to have been satisfactory. Trees were growing satisfactorily and emerging above the grass cover.

Tailings Pond

The HB tailings pond occupies approximately 25 ha (Table 4.13). Water impounded behind the tailings dam covers approximately 25% of the pond area. The remaining area is covered by tailings and tailing slimes. Approximately one-third of this area has been revegetated.

Seed mixtures composed of a variety of agronomic grass and legume species were broadcast on untilled tailings surfaces during May, 1979 and October,1980.

Fertilizer was broadcast prior to seeding to promote seedling establishment. Maintenance fertilizer was applied in June, 1980 and April, 1981 to sustain vegetative growth and promote seed production. 1981 maintenance fertilizer treatment was 46-0-0 applied at 109 kg/ha. The current year's vegetation was monitored in detail on June 29 and 30.

Broadcast application of seed and fertilizer on the untilled tailings surface has proven effective as a technique for revegetating the H.B. tailings pond. Due to the smooth tailings surface, seed and fertilizer were re-distributed by wind action, resulting in accumulation of high concentrations of both seed and fertilizer within cracks and micro-depressions. For example, vegetation growing on tailings seeded in spring 1979 was characterized by large clumps of vigorously growing grasses, varying in basal area and irregularly distributed throughout the seeded area. Interspersed among the clumps, grass and legume plants established by self-seeding have increased plant density and overall vegetative cover. A thick carpet of moss covers most of the tailings surface between the clumps of grasses. Tall fescue and redtop were spreading onto unseeded tailings along surface drainage channels. Plant populations and vegetative cover continued to increase on coarse tailings within the main drainage channel.

Quantitatively, biomass averaged 1971 kg/ha. The combined cover of grasses, legumes, mosses and litter averaged 88%. Only 12% of the tailings surface was bare of any plant cover. Seeded grasses and legumes contributed 53%, mosses 23%, with litter from previous years' growth amounting to 12%. Species composition was diverse, nine grass and legume species being identified. Tall fescue and red top were co-dominant, while all other grasses were minor to significant. Alsike clover was the only legume to provide significant cover.

A dense population of grass seedlings has been established throughout the area of tailings seeded in the fall of 1980. On areas of coarse textured tailings, large numbers of alsike clover seedlings emerged, but many were severely chlorotic and will likely die out. Others were healthy in appearance and growing satisfactorily. Alkaligrass was widely distributed. Mosses were providing ground cover, promoted by fertilizer applied at seeding and again early in the spring.

4.12 Historic and Archaeological Sites

The Salmo district has not been systematically inventoried for heritage resources. It appears that the site has a very low potential for the occurrence of historical or archaeologically significant sites within the mine property or the district.

4.13 Existing Social Environment

4.13.1 Setting

The Village of Salmo is located in the Regional District of Central Kootenay in the south-east corner of the Province. It is known as the "Crossroads of the Kootenay's" and is a small town nestled in a valley of farm and timber lands. Salmo was incorporated in 1946 and expanded its municipal boundaries in the early 1970's so that it now occupies an area of 220.6 ha (545 ac.). The village is 42 km (26 mi) south of Nelson, 42 km (26 mi) east of Trail and 83 km (52 mi) west of Creston, with access by both the Southern Trans-Provincial Highway (Highway 3) and Highway 6.

The economy of the Regional District is well-diversified. Trade and service industries play the dominant role with Nelson being the historical regional centre for those sectors. Also, the resource industries continue to contribute to the well-being of the Region's economy with forestry being the most important. Mining played a much larger role in the past but now is only significant at New Denver, Silverton and Salmo. Agriculture is not a large part of the economy, however, it does provide income on a part-time or subsistence basis. Tourism is becoming increasingly important with the main centre of attraction located in environs of the Nelson-Balfour strip along the west arm of Kootenay Lake. The area around Nelson lost a major part of the through traffic on the Southern Trans-Provincial route when the Salmo-Creston link was completed in 1964, but it remains a popular tourist destination (British Columbia Regional Index, 1978).

4.13.2 Population

The population of the Regional District of Central Kootenay in 1981 was 51,505 (Statistics Canada Interim Report 1981). This represented a 5.2 percent increase over the 1976 population of 48,980. The age composition of the Region is comparable to the Provincial average with approximately 58 percent of the population being under 35 years of age. The population of Salmo was relatively stable between 1971 and 1976. During this time the village expanded its municipal boundaries which accounts for the increase in population from 870 in 1971 to 1090 in 1976. Between 1976 and 1981 the village increased its population by approximately 6 percent to 1154. Salmo's population represents only 2.2 percent of the Regional population. Table 4.14 illustrates the 1976 age and sex composition for both Salmo and the Regional District of Central Kootenay.

4.13.3 Employment

The total labour force of the Regional District of Central Kootenay in 1971 was over 16,550. Recent figures compiled by the Regional District's Planning Department indicate that the greatest concentration of labour is found within the trade and financial services sector (37 percent) while primary industry accounts for only 15 percent of the labour force. In contrast, the village of Salmo's labour force is concentrated in the primary industry sector (37.5 percent). Table 4.15 compares the

TABLE 4.14

POPULATION BY AGE GROUP AND SEX (1976)

Regional District of Central Kootenay	Male	%	Female	%	Total [1]	%
0 - 19	8,720	(17.8)	8,425	(17.2)	17,145	(35.0)
20 - 34	5,830	(11.9)	5,340	(10.9)	11,170	(22.8)
35 - 64	7,790	(15.9)	7,640	(15.6)	15,430	(31.5)
65 +	2,745	5.6	2,645	(5.4)	5,390	(11.0)
	25,080	(51.2)	24,050	(49.1)	48,980	(100.0)
Salmo						
0 - 19	210	(19.3)	200	(18.3)	410	(37.6)
20 - 34	105	(9.6)	105	(9.6)	210	(19.2)
35 - 64	190	(17.9)	180	(16.5)	370	(34.4)
65 +	50	(4.6)	50	(4.6)	100	(9.2)
	555	(51.4)	535	(49.0)	1090	(100.0)

[1] Figures may not total due to rounding

Source: Regional District of Central Kootenay, Economic Profile, 1979.

TABLE 4.15

EXPERIENCED LABOUR FORCE BY INDUSTRY (1976)

	Salmo	Regional District of Central Kootenay	British Columbia
Primary Industry	37.5 %	14.8 %	7.6 %
Manufacturing	9.4	17.8	16.1
Construction	4.7	6.7	7.0
Transportation & Communications	6.2	10.4	9.5
Trade & Financial Services	32.8	36.8	45.6
Public Administration and Defence	3.1	5.3	6.3
Other	6.3	8.3	7.9
	100.0	100.0	100.0

Source: F. Dykeman, Director of Planning, Regional District of Central Kootenay, pers. comm., 1982.

percentage of the labor force employed by sector for Salmo, the Regional District of Central Kootenay and British Columbia for 1976.

By far the largest employer of the Kootenay region, which includes the Salmo area, is the Cominco Ltd. operation in Trail. Cominco employs 6,300 persons with a monthly payroll of approximately $7,000,000. Approximately 25 persons from Salmo work for Cominco Ltd. in Trail. The Cominco operation is scheduled for temporary shut down effective 30 June 1982 because of the general slowdown in the economy being experienced in B.C. and other parts of Canada. This event will significantly affect the economy of the region.

There are approximately 50 persons employed by various business establishments in the village of Salmo. The elementary and secondary schools employ a total of 22 teachers and staff. Louisiana Pacific Canada Ltd. operated a sawmill 5 km south of Salmo on old Highway 3-6. It employed 75 persons until September 1981 when the company shut down its operation. The company continues to employ nine persons as maintenance staff.

4.13.4 Unemployment

Recent unemployment figures are available from the Canada Manpower Centre in Nelson which administers unemployment claims for the Salmo area. However, there are no detailed statistics concerning occupational groupings or accurate figures for monthly unemployment rates.

The current number of registered claimants at the Nelson Manpower office was 2,726 (1,946 male, 668 female) for the week ending 16 April 1982 [redacted] s.22 Manager, Nelson Manpower office, pers. comm.). The mining and quarrying occupational group had a total of 65 registered claimants (63 male, 2 female) representing 3 percent of the total. The forestry and processing occupational groups exhibited a greater number of registered claimants, 234 (12 percent) and 417 (21 percent) respectively. The latest Statistics Canada estimated rate of unemployment for B.C. Economic Region No. 92, which includes the Nelson-Salmo area as well as the Kootenay-Columbia region, was 16.4 percent for the third week in March, 1982. This rate would be higher if the Kootenay-Columbia region was excluded from this estimate [redacted] s.22 Manager, Nelson Manpower office, pers. comm.).

4.13.5 Housing

As of 1982 there are approximately 430 single family homes, 4 duplex units, 8 apartments and 40 mobile homes within the Village of Salmo [redacted] Municipal Clerk, Village of Salmo, pers. comm.). In addition, there are approximately 60 mobile homes in a trailer park located about 3 km (2 mi) south of the village.

The average price of a house in Salmo is $40,000 with a range from $10,000 to $100,000. The monthly rental of a 2-bedroom apartment is estimated to be less than $300 ([redacted] Municipal Clerk, Village of Salmo, pers. comm.). In 1981 there were 39 building permits issued for a total value of $2,119,000, of which $884,000 was for residential developments. There were 18 new homes built in 1981 and currently there is a 24-unit apartment complex under contruction.

4.13.6 Education

Educational services in the Salmo district are administered from Nelson (School District No.7). The Salmo Elementary School has an enrollment of 346 students, while the Salmo Secondary School has an enrollment of 183 students. The student teacher ratio is 15:1 including administration, library staff, and counsellors. These schools serve the areas between Ymir and Nelway and halfway to Fruitvale. There is an elementary school in Ymir with an enrollment of 50 students.

4.13.7 Commercial Services and Community Facilities

Though the village of Salmo has a relatively small population, it offers a wide range of commercial services and community facilities which are listed below:

<u>Village of Salmo Facilities</u>

- RCMP Office
- Medical Clinic
- Fire Hall/Village Office
- Post Office
- Liquor Store
- Bus Depot - Greyhound
- Air Strip

West Kootenay Power and Light
Forest Ranger Station
Department of Highways - Public Works
Provincial Courthouse

Community Halls

Royal Canadian Legion #217
KP Hall
Masonic Hall
Guide and Scout Hall

Banks

Canadian Imperial Bank of Commerce
Kootenay Savings Credit Union

Churches of the Community

Salmo Community Memorial Church
Hillcrest Pentecostal Church
Sacred Heart Parish
Jehovah Witnesses Kingdom Hall

Recreation Facilities

Salmo Ski Hill - CSPS/CSIA
Salmo Golf Course
Swimming Pool
Salmo Tennis Courts
Curling Club
Golden Age Activity Centre
Salmo Public Library

Schools

Salmo Elementary
Salmo Secondary
Selkirk Health Unit

Grocery Stores

Liberty Foods
Valu-Mart Foods
Riverside Service
Salmo Corner Store

Food Restaurants

Birch's Burgers
Dragon Inn Restaurant

Ernie's Chicken & Ribs
Trapper John's Restaurant
The Last Straw Dining

Industries

HB Mill; David Minerals Ltd.
Louisiana Pacific Can. Ltd.
Sedy Cedar Sales
Kootenay Stone Centre
T.V. Views Publications
Interior Paper Recycling Ltd.
Norman Industries
Goldbelt Mines Inc.

Organizations

Legion
Lions
Kiwanis
Chamber of Commerce
Hospital Auxiliary
Pythian Sisters
Knights of Pythias
Masons

Lodging - Hotels and Motels

Salmo Hotel
Sharlyles Hotel
Sal Crest Motel - 18 Units
Selkirk Motel - 10 Units
Reno Motel - 7 Units
Pine Springs Motel - 16 Units

Campgrounds and Trailer Parks

Hidden Creek Campground
Wildwood Campground - Trailer Park
Pine Springs
Selkirk Trailer Park
Evergreen Trailer Park
Riverside Trailer Park
Government Picnic Site -Eric Creek

Gas Stations and Repairs

Marathon Motors
Salmo Texaco
Riverside Service - Propane
Whiteline Truck Stop

Speedway Salvage Ltd.
Mountain Auto Body

<u>Auto Dealerships</u>

Skyway Truck & Trailer Ltd.
(International Dealership)

<u>Other Businesses of Salmo</u>

Salmo Drugs
Salmo Building Supply
Skyway Hardware Ltd.
Salmo Sewing Basket
Simpson Sears - Catalog Office
West Kootenay Sound Services
Hipwell Realty
Ted Peil Agencies
John's Insurance Agency
Salmo Payless Store
Taylor - Wilton Nel. Ltd.
Alca Kennels
G. & G. Trucking
Salmo Transport
Shell Can. Bulk Sales
Hanson Sawmills Ltd.
P. & B. Contracting
Blackwood Electric Ltd.
Solar House
Laundromat

4.13.8 Police and Fire Protection

A complement of four RCMP officers are permanently stationed in Salmo. The present staffing guideline is 1 officer for every 1,500 citizens. The fire protection of the Salmo district is provided by two fire trucks and two "fast attack units", manned by 30 volunteer firemen.

4.13.9 Medical Service

Medical service in the Salmo District is provided by the Medical Associated Clinic which has a staff of two medical doctors and three office helpers. There is no dental care available at the present time. Nelson and Trail are the closest communities providing dental services.

Salmo has recently acquired a new ambulance which is manned by the volunteer fire department. The nearest hospitals are located in both Nelson and Trail, equidistant from Salmo. The Selkirk Health Unit, operated by the Ministry of Human Resources, is also available to Salmo area residents on an on-call basis.

4.13.10 Transportation

Salmo is served by Highway 6 to the north and south and by Highway 3 to the west. Greyhound bus services are available for north and west bound passengers. Salmo is also served by Burlington Northern Railway, which carries freight only. There is also a small air strip which can accomodate small planes.

4.13.11 Recreational Opportunities

The Salmo area possesses the potential for a variety of outdoor recreation activities such as fishing, hunting, cross-country and downhill skiing, hiking and camping. The Salmo ski hill, located 3 km (2 mi) from the village, offers excellent skiing facilities. It is equipped with a 1235 m (4050 ft) long T-bar lift and with lighting equipment which allows night skiing. The vertical drop is 320 m (1050 ft).

In the village itself there is a curling club with three rinks, a golf course, swimming pool, tennis courts, and an ice rink is currently under construction.

4.13.12 Water/Sanitation

Salmo is currently provided with water from three 60-ft wells. The extent of the water supply has not been determined, however, it is felt that the system is more than adequate to meet the needs of the community in the foreseeable future

The water from the wells is pumped uphill to a 100,000 gallon storage tank and from there is delivered to the community on a gravity feed system.

The sanitary sewer system consists of a collection network, a transfer main, two oxidation lagoons with chlorination at the outfall into Sheep Creek.

The Regional District is responsible for garbage pick-up and disposal in the Salmo area. At present, private contractors carry out this service, transporting the garbage to the dump which is located on the south bank and uphill from Sheep Creek, approximately 9 km (5 mi) from Salmo and 3 km (2 mi) from the HB Mill.

4.13.13 Utilities

West Kootenay Power and Light Company Ltd. supplies electrical power to Salmo and the surrounding Region. Natural gas is piped to Salmo by Inland Natural Gas Co. while fuel oil and gasoline is supplied by Shell Canada Ltd., Imperial Oil Ltd. and Chevron Canada Ltd. Propane is also available and supplied by a Castlegar-based distributor.

4.13.14 Communications

The Salmo area is served by two newspapers, the Daily Nelson News and the Trail Times, Cable TV (4 channels), CBC, and two radio stations, CBUT and CJAT.

Telephone service is provided by B.C. Telephone Co.

4.13.15 Municipal Finance

The Village of Salmo's current financial situation is considered to be very healthy [redacted] s.22 Municipal Clerk, Village of Salmo, pers. comm.).

Tax assessment for Salmo is based on the actual market value of the property less 10 percent. In 1981, residential property was taxed at a rate of 11.5 percent of the assessed value, businesses at 23 percent and industrial property at 27 percent. The approximate 1982 mill rates for Salmo are as follows: School - 60; the Regional District, Hospital, Municipal Finance Authority and B.C. Assessment Authority - 13; the General Municipality - 23; for a total of 96 mills.

5.0 PROJECT DESCRIPTION

David Minerals Ltd. is seeking an approval of Phase I of their project. This encompasses reactivation of the HB Mill for concentrating the gold bearing ore mined elsewhere in the Salmo district. No mining is planned within the HB Mine property.

5.1 Characteristics of Ore to be Processed

One source of the gold bearing ore is production from the Sheep Creek Mine, owned and operated by Goldbelt Mines Ltd. The mine is located approximately 10 km east of the HB Mine site. Table 5.1 shows the results of ore sampled and assayed on 15 June 1981 and 2 February 1982 by Kamloops Research and Assay Laboratory Ltd. of Kamloops, B.C.

TABLE 5.1

Head Assay of the Ore Sample from the Sheep Creek Mine, Goldbelt Mines Ltd.

	Au*	Ag*	Cu	Pb	Zn	Fe	Po
Jun 15 1981	0.52	0.70	0.02	0.54	0.27	3.4	ND
Feb 02 1982	0.47	0.41	0.03	0.25	0.31	3.18	1.96

* Troy ounce per dry short

ND = not determined

Gold content of the ores delivered to the HB Mill from the Sheep Creek Mine were determined by the assaying laboratory located in the mill. The results are shown in

Table 5.2. It appears that the gold concentration varies a great deal from load to load. The primary reasons for this are:

1) the mine is still in the exploration stage and
2) the gold concentrations in the vein fluctuate from place to place.

TABLE 5.2

Results of Gold Assays of Ore Delivered to the HB Mill from the Sheep Creek Mine

Delivery Date	Amount Delivered (Dry Short tons)	Gold Concentration*
2/16/82	460.0	0.077
2/17/82	246.2	0.201
2/18/82	199.8	0.340
2/00/82	114.5	0.090
2/00/82	150.8	0.125

* Troy ounce per dry short ton.

5.2 Milling Process

The flowsheet for concentrating gold and iron from the ore produced from the Sheep Creek Mine is given in Figure 5.1. The mill flowsheet and description of the processes used for concentrating lead and zinc from the ore produced at the HB Mine are given in Appendix B. Cominco Ltd. transported the concentrates to the smelter at Trail for refining. Gold bearing concentrate produced by the HB Mill will be transported to Helena, Montana for refining.

FIGURE 5.1

H.B. Mill Project, Mill Flowsheet for Processing the Gold Ore from the Sheep Creek Mine, Goldbelt Mines Inc.

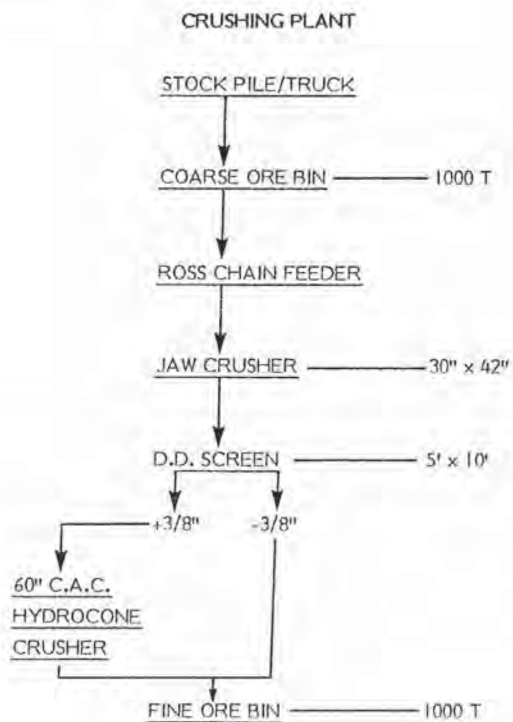


FIGURE 5.1 continued

Mill Flowsheet for Processing the Gold Ore from the Sheep Creek Mine, Goldbelt Mines Inc.

CONCENTRATOR FLOWSHEET

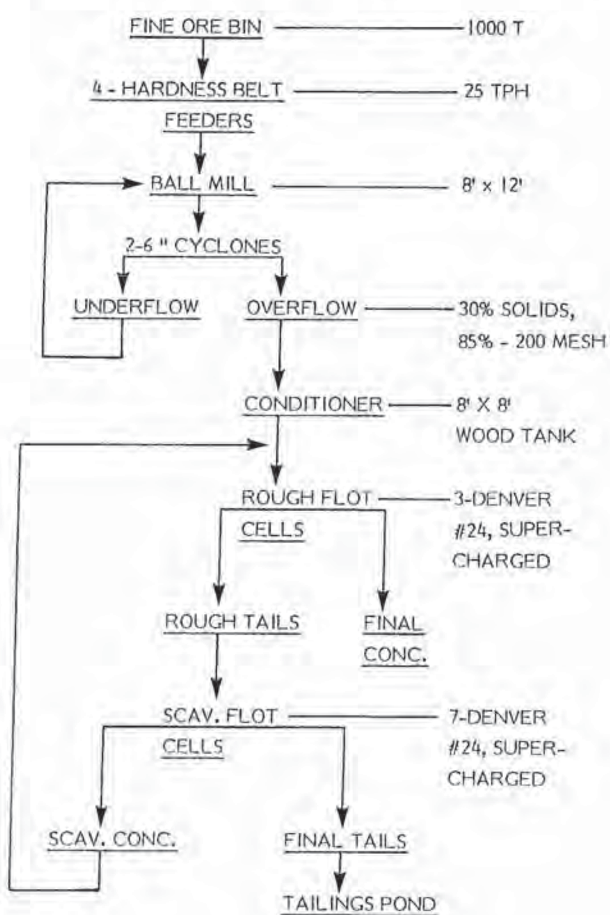
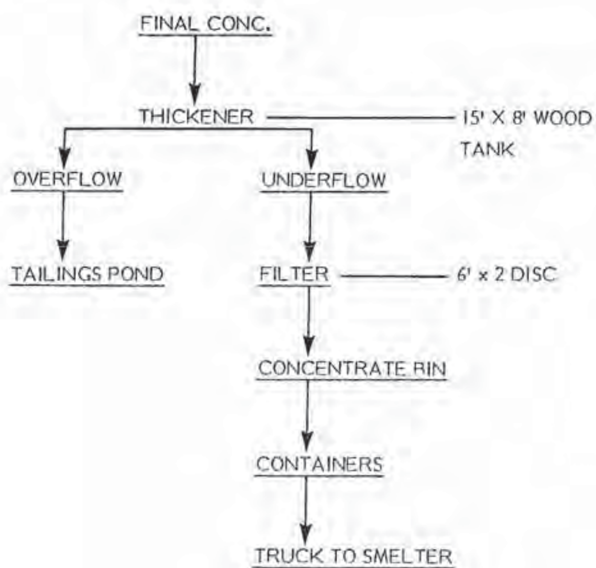


FIGURE 5.1 continued

H.B. Mill Project, Mill Flowsheet for Processing the Gold Ore from the Sheep Creek Mine, Goldbelt Mines Inc.

CONCENTRATOR FLOWSHEET



Reagents:

Sodium Isobutyl Xanthate
Aerofloat 208
Copper Sulphate
MIBC

3089.5

5.3 Transportation

The gold bearing ore will be transported from the Sheep Creek Mine by trucks with an 8-ton capacity over a 19 km dirt road, approximately 8 m wide, which follows the path of Sheep Creek.

Gold concentrate will be placed in bins with canvas covers, and transported 322 km (200 mi) to Helena, Montana via paved Highway 3-6 to Creston and then to U.S. Highways in 25-ton trucks.

5.4 Sewage and Garbage Disposal

Domestic sewage from the office, mill, and company houses will be treated in septic tanks of sufficient capacity to retain the maximum anticipated loads for at least 24 hours. Overflow will be discharged into the tailings line and then into the tailings pond.

Garbage will be dumped at a location near the tailings pond within the HB Mine site (Figure 5.2). This garbage dump is owned and operated by the Central Kootenay Regional District, and garbage from all over the region is dumped there.

5.5 Utilities

Electrical power for the mill complex is supplied by West Kootenay Power and Light Company. The 60,000 volt, 3-phase main power line is strung along the strip of land between the public and private roads on the HB Mine property from Highway 3-6. A substation located in the vicinity of the mill reduces the voltage to 2300 or 550 volts to power the motors in the mill. Further reduction to 110 volts, single-phase for domestic use is made by transformers located at various sites.

Telephone service for the mill is provided by B.C. Telephone.

The water supplies for the mill, fire fighting and domestic use are obtained by diverting water from Aspen Creek. A 10,000 gallon covered wooden stave pen is used as the reservoir. David Minerals Ltd. also has a permit to pump water from Sheep Creek, but does not intend to use it because there are adequate supplies of water available throughout the year for the entire mill operation from the Aspen Creek diversion.

The office and houses in the mill complex are heated by oil.

5.6 Employment

Since the purchase of the mine in September 1981, David Minerals Ltd. has employed 24 workers through a Vancouver contractor to overhaul one circuit for concentrating gold bearing ore. The contractor's employees have the following job classifications: pipe fitter, carpenter, electrician, equipment operator, welder, millwright, labourer and helper. Most of them have been recruited locally from the Nelson-Salmo area.

David Minerals Ltd. currently has a total of ten direct employees working at the mill site. They are: one each of mill manager, district geologist, geological helper-fieldman, metallurgist, assayer, surface foreman, temporary helper-draftsman and stenographer and two cooks. In addition, there are four shift workers temporarily working one circuit. Renovation of this circuit was completed on 8 March 1982.

Overhaul of the second circuit has been initiated and is expected to be completed by June 1982.

The number of additional shift workers which will be needed to man the proposed 3 shifts per day, 7 days per week mill operation will be approximately 12. Thus a total of 16 people will be needed for all the shifts (including a swing shift). In addition, a 4-man clean-up crew, a 4-man maintenance crew and a warehouseman will be needed to support the mill operations.

In the first instance, recruitment for all of these positions will be carried out locally.

The salaried staff which will be required for the operation include a mill manager, district geologist, metallurgist, junior metallurgist, mill superintendent, assayer, two laboratory technicians, time keeper and a secretary-stenographer. The total number of people employed at the mill will be approximately 37.

5.7 Housing

There are seven company-owned houses on the mine premises. Some of the company's and the contractor's employees are housed there. With few exceptions, most of the persons staying in the company housing return to their homes for weekends. Some of the employees commute from Salmo and the surrounding communities. It is expected that the increase in the employment opportunities at the mill will not have an adverse effect on housing availability in the Salmo district, because of the weak housing market in the area.

5.8 Development Schedule

Operation of the mill will be initiated immediately upon receiving the approval of the Metal Mines Steering Committee, Ministry of Energy, Mines and Petroleum Resources.

5.9 Reclamation

No mining is planned in Phase I of the HB Mill project. Therefore, no new surface disturbances will be created. Moreover, the disturbed areas reclaimed by Cominco Ltd. on the mine property will be monitored to determine the need for further reclamation work.

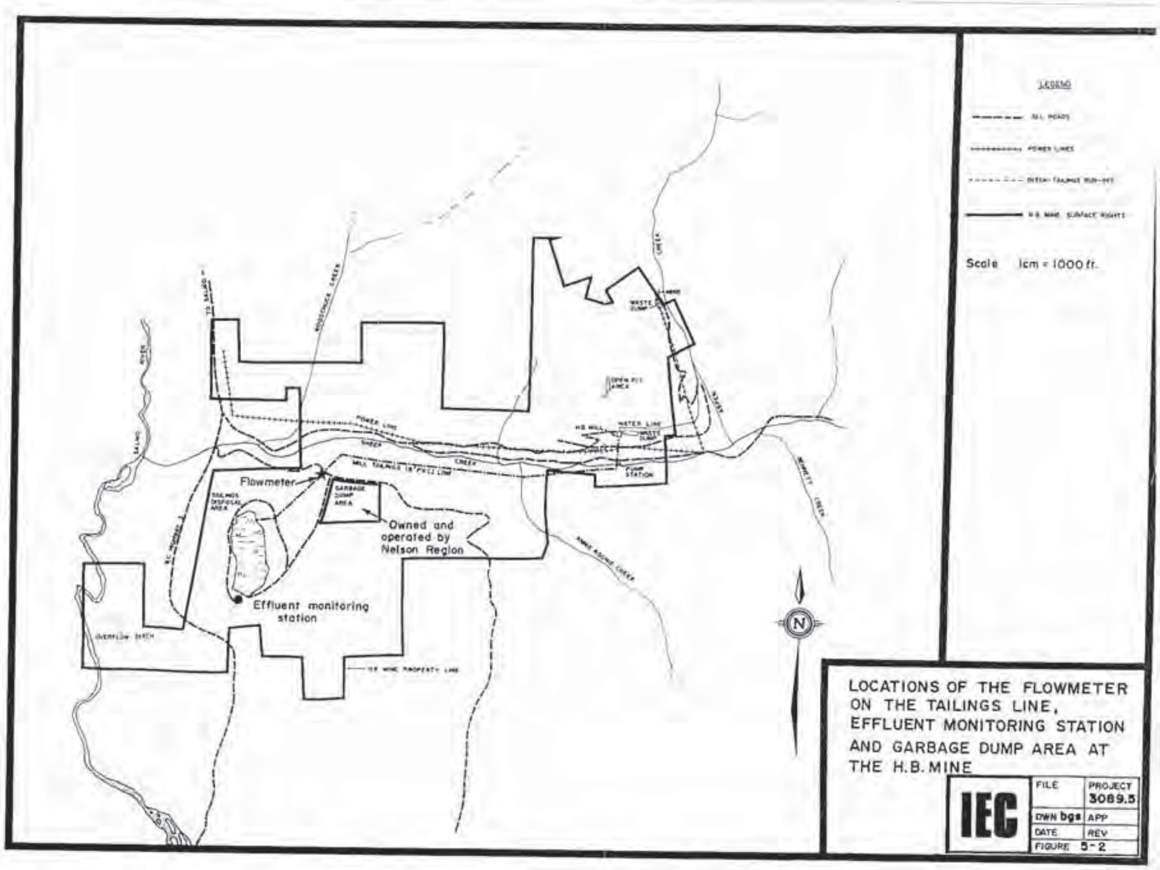
5.10 Effluent Control and Monitoring

The tailings pond used during the Cominco operation will be reused to dispose of tailings generated by the new operation. The original wooden flume used to carry the tailings from the mill to the tailings pond has been replaced by 8 in. plastic pipe in 1981. The layout of the tailing line is shown in Figure 5.2. A sagging and leaky flume sometimes allowed tailings to spill into Sheep Creek during the previous operation. Installation of the plastic pipe eliminates this problem. The tailings line was inspected by personnel of the Waste Management Branch, Nelson Regional office, on 3 and 9 March 1982.

Klohn Leonoff Consulting Engineers were responsible for a detailed study of the feasibility of using the tailings pond. Results of the study and their recommendations are given in Appendix C. They concluded that the existing dam which was designed for a discharge of 80 cfs, can handle the 200 year flood estimated for the site, and has a capacity of approximately 790,000 tons. Depending on availability of ore, no substantial modifications to the dam height will be needed before mid-1984.

A constant flow of water is fed to the tailings pipe at the rate of 1.45 m^3 per minute (320 gallons per minute) at the mill. The flow of water prevents sediment accumulation and freezing of the line during the winter.

A magnetic flow meter will be installed in the tailings pipe close to the tailings pond (Figure 5.2) to monitor the flow of tailings to the pond. An indicator will show flow rate and percentage composition of solid in the tailings. A totalizer will record total gallonage discharged each day up to one week period. These meters are connected to the office located in the mill complex and an alarm will be activiated if flowrate drops below a pre-set level. Water samples of the tailings pond overflow will be taken (Figure 5.2), and water quality will be determined.


Scale 1cm = 1000 ft.
Flowmeter
Owned and operated by Nelson Region
Effluent monitoring station
LOCATIONS OF THE FLOWMETER ON THE TAILINGS LINE, EFFLUENT MONITORING STATION AND GARBAGE DUMP AREA AT THE H.B. MINE
IEC
FILE
PROJECT 3089.5
DWN bgs
APP
DATE
REV
FIGURE 5-2

6.0 ENVIRONMENTAL AND SOCIAL IMPACTS

The proposed reactivation of the HB Mill will treat high sulphide ore by crushing, grinding, flotation and thickening to produce a concentrate containing gold and iron. The concentrate will be transported to Helena, Montana by truck for refining.

Cominco Ltd. operated both the mine and mill for over 15 years with a minimum of environmental impact on the mine site, and with many beneficial social impacts on the communities of Salmo district. The mill's long history of successful operation suggests that if there were any adverse environmental impacts associated with the mill then they would have become evident long ago. Thus, it is espected that the reactiviation of the mill by David Minerals Ltd. will involve no significant adverse environmental impacts on the area surrounding the mine site.

6.1 Environmental Impacts

There will be some fugitive dust generated by transportation of ore and ore concentrate to and from the mill. Both public and private roads adjacent to and within the mine property are unpaved. Trucks are unable to travel over 10 km per hour because of the narrow road and steep grade of the hill. If excessive dust is generated by this traffic, a water truck will be used to wet the road during dry months. Dust emissions from unloading of the ore at the mill site and transporting the stockpile will be controlled by water spraying.

No significant change in the water quality of Sheep Creek or the Salmo River is anticipated from the tailings pond runoff. Overflow is discharged into the Salmo River, while surface runoff and mine drainage are discharged into Sheep Creek.

Tailings pond capacity is far greater than the amount of tailings to be discharged in the next two years.

No significant impact on the aquatic fauna and flora of Sheep Creek and the Salmo River is anticipated. During the previous Cominco operation no fish kill was ever reported.

Although there are some ungulates present on the mine property, they are rarely encountered on the road. The speed limit for vehicles is 40 km per hour within the mine property, so that vehicle-ungulate collisions are most unlikely to occur. It was observed that deer fed on the alfalfa growing in reclaimed areas near the tailings pond during February 1982. Both Messrs. Graham Kenyon, President of the B.C. Wildlife Association, who resides in Trail, and Randy De Biasio, President of the Trail Wildlife Association, have stated that reactivation of the HB Mill will not adversely affect the wildlife of the Salmo district.

6.2 Socio-Economic Impacts

6.2.1 Employment

The information basis for the following employment estimates must be considered preliminary because:

1. Manpower estimates are not finalized.

2. All estimates are best guesses based on previous experience. Each project is unique, therefore actual employment will probably vary somewhat from that predicted.

Despite these limitations the available employment estimates are valuable for planning purposes.

The mill operations will function year-round based on a 7-day week. Employees will work on an 8-hour shift basis, 3 shifts per day with a swing shift to permit a 5-day work week. Table 6.1 describes the workforce that will be required to operate and manage the mill. It is assumed that the main source of labor will be from the Nelson-Salmo area. Manpower officials in Nelson have indicated that local recruitment for the mill positions should not be a problem as there is presently a large number of unemployed people with mining and mill working experience in the area (Al Sabiskoss, Manager, Canada Manpower, pers. comm.).

TABLE 6.1

OPERATING WORKFORCE REQUIREMENTS

	Job Description	Number of Employees
Salaried Staff	Mill manager	1
	Geologist	1
	Metallurgist	1
	Junior Metallurgist	1
	Mill Superintendent	1
	Chief Assayer	1
	Lab Technician (assay)	1
	Lab Technician (metallurgical)	1
	Timekeeper	1
	Cooks	2
	Secretary	1
Hourly-basis Staff	Mill operators	12
	Helpers	4
	Clean-up crew (1 leader & 3 helpers)	4
	Maintenance crew	4
	Warehouseman/Storekeeper	1
	TOTAL	37

Approximately 35 to 45 people will be employed during Phase I of the reactivation of the HB mill. Since September 1981 David Minerals Ltd. has employed 24 workers to overhaul one circuit for concentrating gold bearing ore. Direct and indirect/induced employment has already occurred as a result of Phase I and similar impacts are expected for Phase II and III.

The milling operations will create 16 basic jobs which in turn will generate about 5 non-basic jobs in the area to service the mill and the employees. The multiplier used to estimate the number of non-basic jobs is 0.35. Thus, for every job created at the mill, 0.35 non-basic jobs will be created in the Nelson-Salmo area. The multiplier is small because the Nelson and Trail areas already offer many goods and services which may be needed during the mill operations. Many businesses in the non-basic sector will require little or no expansion in terms of employment since many are not working at capacity as a result of the recent downturn in the region's economy precipitated by high interest rate, depressed lumber market and low metal prices.

6.2.2 Population

The impact on the Salmo area population will be minimal since most employees will be recruited locally and will commute to work rather than relocate. Moreover, the scale of the operation is small so that the number of people possibly migrating to the area as a result of the mill will not be significant. There will be minimal impacts to community facilities and services in Salmo since most are not operating at full capacity.

6.2.3 Summary

David Minerals' H.B. Mill Reactivation Project is expected to create positive impacts on the local, regional and provincial economies. Its taxes will also contribute to the provincial and federal government revenues. In 1981, property taxes for the H.B. property were $45,000.

David Minerals Ltd. is currently spending about $115,000 to $120,000 per month on payroll and equipment/supply purchases ($95,000 and $26,000-25,000 respectively).

When all three phases of the reactivation project are completed, it is estimated that operating costs will increase to approximately $190,000 to $200,000 per month with $120,000 allocated to payroll and $70,000-80,000 to equipment/supplies.

The number of jobs created by the mill reactivation, when all phases are complete, will be approximately 20-25. Twelve additional shift workers will be needed to keep the mill operating on a 24-hour per day basis, 6-8 people will be needed for clean-up and maintenance operations, while approximately 3-5 additional professional staff will be required. Five non-basic jobs are expected to generated in the Nelson-Salmo area as a result of the mill operations.

The project is expected to have minimal disruptive impacts on the Salmo community since the scale of the project is small and the communities in the immediate area have adequate facilities and services to accomodate any increased use by mill workers.

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APPENDIX A

Common and Scientific Names of the Vegetations Found in the HB Mine Site.

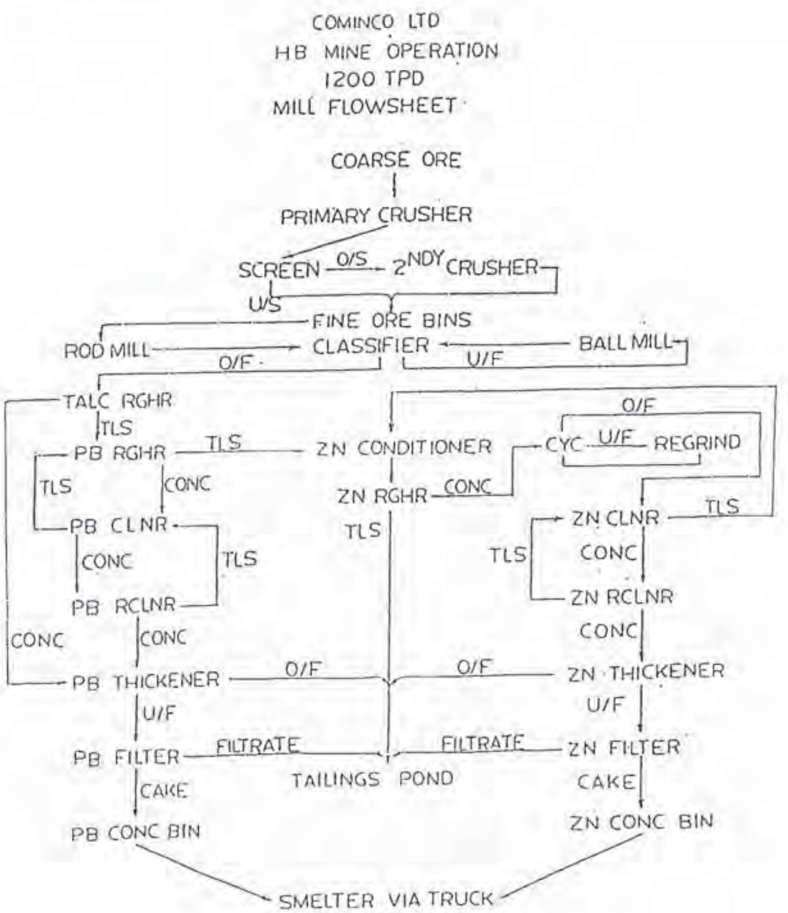
Appendix A

Vegetations found in the HB Mine

Common Name	Scientific Name
Quaking aspen	Populus tremuloides
Black cottonwood	Populus trichocarpa
Lodgepale pine	Pinus contorta
Western white pine	Pinus monticola
Ponderosa pine	Pinus ponderosa
Douglas fir	Pseudotsuga menziesii
Paper birch	Betula papyrifera
Dogwood	Cornus stolonifera
Western larch	Larix occidentalis
Rose	Rosaceae
Snowberry	Sympharicarpus albus
Red top	Agrostis alba
Alsike clover	Trifolium hybridum
Red clover	Trifolium incarnatum
Sweet clover	Trifolium melilotus alba
Timothy	Phleum pratense
Blue bunch wheatgrass	Agropyron spicatun
Field horsetail	Equisetuin telmateia
Birdfoot trefoil	Lotus corniculotus
Canada blue grass	Poa compressa
Creeping red fescue	Festuca rutna
Tall fescue	Festuca arundinacea

APPENDIX B

Mill Flowsheet and Process Description for Concentrating of Lead and Zinc from the Ore of the HB Mine - by Cominco Ltd.


COMINCO LTD
HB MINE OPERATION
1200 TPD
MILL FLOWSHEET
COARSE ORE
PRIMARY CRUSHER
SCREEN
O/S
2NDY CRUSHER
U/S
FINE ORE BINS
ROD MILL
CLASSIFIER
BALL MILL
O/F
U/F
TALC RGHR
TLS
PB RGHR
ZN CONDITIONER
CYC
REGRIND
CONC
ZN RGHR
PB CLNR
ZN CLNR
PB RCLNR
ZN RCLNR
PB THICKENER
ZN THICKENER
PB FILTER
FILTRATE
ZN FILTER
CAKE
TAILINGS POND
PB CONC BIN
ZN CONC BIN
SMELTER VIA TRUCK

A. <u>Crushing Plant</u> - (Cont'd)

The jaw crusher is a Traylor Blake type 30" x 42" unit which has been in existence since 1914. It came to H.B. from Pinchi Lake where it was used in the first operation of that mine. The drive for the crusher is a 150 H.P. 2300 V. 580 RPM motor through a set of 11 V-belts to the main shaft sheave of the crusher. The set of the crusher is 6" close side.

Ore is discharged to #1 conveyor belt, a 36" belt and from there, over a tyrock 5' x 10' double deck screen. The top deck is punch plate 2½" diameter holes and the lower deck is woven wire. Passing size is 1". Average from both decks is fed to a 1260 C.A.C. hydrocone crusher with the close side set at 3/4". Hydrocone drive is a 150 H.P. 2300 V, 900 R.P.M. motor to a V-belt drive. A flow switch prevents hydrocone start-up unless cooling water is flowing.

Screen undersize and hydrocone discharge are then joined on #2 belt, a 30" belt inclined at 19½°. This belt goes to the top of the west fine ore bin.

A chute over the west F.O.B. can be used to direct muck directly to the west bin (under the head pulley of #2 belt) or via a cross conveyor (#3 belt) to the east bin. The F.O.B.'s are constructed of laminated 2" x 10", 2" x 8" and 2" x 6" with 1" sheathing on the inside face. Design capacity of all bins was 1,000 tons each, but dead space limits coarse ore capacity to approximately 500 tons and fine ore storage to approximately 650 tons per bin.

Controls for all equipment except the jaw crusher and cone crusher are located at the operator's pedestal located on the west side of #1 conveyor. There is an emergency stop button for the hydrocone here as well. Controls for the jaw crusher are located on the west wall of the plant and for the hydrocone are at the south wall. There are also local controls for the air operated arc gate and the hydraulic lift gate located above the jaw crusher.

An electrical interlock system exists between #2 conveyor, the screen and #1 conveyor. The jaw crusher has thermocouples installed to monitor temperatures of critical bearing areas and a chart recorder is located on the east wall close to the operator's pedestal to record these temperatures. An alarm is set at 45° C and will also activate a scam alarm in the concentrator. Power meters are also installed on the jaw, the hydrocone and #2 conveyor.

Plant throughput is designed at 200 tons per hour and this figure is easily attained unless muck conditions are particularly difficult - i.e. large muck requiring some blasting. Plant operation is one shift per day to fulfil milling requirements. There have been two operators in this plant from start-up but it is likely that one man is sufficient if the shift boss is available to help this man when blasting. Plant operation is scheduled in conjunction with tramming due to the coarse ore storage limitations.

In-plant dust is adequately controlled by a 10,000 C.F.M. services fan pulling air through a dust cyclone from under the crushers. The cyclone is a wet operation with underflow travelling by gravity to the classifier in the concentrator.

The plant is serviced with a 10-ton capacity overhead trolley crane.

Operating problems arise when either very wet fine muck or very coarse muck is supplied to the crushing plant. Feed control is inadequate to handle wet sloppy muck which leads to overloading of the conveyor belts (particularly #2). Coarse muck leads to blasting in the feed chute to the jaw crusher.

Continued . . . .

B. Concentrator

From the fine ore bins, muck is fed to the rod mill. Each bin is equipped with four chutes and four Hardinge type "C" constant weight feeders. The feeders under the east bin are driven through variable speed drives while those under the west bin are fixed speed.

Generally speaking ore is fed from one bin at a time. One 24" belt takes feed from under the west fine ore bin to the rod mill. Two 18" conveyors (No.5 and No.6) take feed from the east bin to #4 belt. There is no weightometer on these conveyors. Tonnage checks are carried out based on a two foot belt cut on #4 conveyor.

B-1 Grinding Circuit

The main features of the grinding circuit are the 7' x 12' Dominion rod mill, the 66" Wemco Duplex spiral classifier and the 8' x 12' C.A.C. ball mill.

The rod mill requires a drum feeder in this installation. The feeder presently installed was overhauled in 1978 and was put into service on June 14, 1978. The mill is powered by a C.G.E. 300 H.P. 705 R.P.M. 2300 volt motor through a speed reducer with a ratio of 2.15 to 1. Mill speed is 24.0 R.P.M. or 83.6% of critical. All liners are Ni-hard iron and can be cast in Trail Central Shops.

Mill discharge flows by gravity to the Wemco classifier. This unit is a duplex spiral with each spiral being 66" diameter by 33' 9" long. Wear shoes are cast iron and are also a Trail Central Shops item. Each spiral requires 114 shoes. Drive is supplied by a C.G.E. 15 H.P. motor through a 20:1 speed reducer. Speed of the spirals is 4 R.P.M.

Sands discharge from the classifier is laundered to the ball mill through a 54" scoop feeder. The ball mill is a 8' x 12" C.A.C. unit equipped with Ni Hard liners.

The ball mill drive is from a 400 H.P., 720 R.P.M., 2300 Volt C.G.E. motor through a V-belt drive. Mill speed is 22.7 R.P.M. which is 82.9% of critical.

Mill discharge is returned to the classifier by means of a discharge elevator scoop.

Classifier overflow flows via gravity to the talc machine in the flotation section.

The controlling factors in the grinding circuit are densities in the mills and on the classifier overflow which are as follows:

Rod Mill Discharge	75% Solids
Ball Mill Discharge	72% Solids
Classifier Overflow	45% Solids

Water is added at the following points.

Rod Mill - i) Feed
ii) Discharge

Ball Mill - i) Feed Launder
ii) Discharge Launder

Continued . . . .

B-I Grinding Circuit - (Cont'd)

Steel consumption in the mills is as follows:

Rod Mill 3½" dia. x 11' Rods - 1977 Consumption - 0.217 #/T
1978 Consumption - 0.237 #/T

Ball Mill 2" dia. Balls - 1977 Consumption - 0.311 #/T
1978 Consumption - 0.380 #/T

Rods are usually charged weekly (6 Rods/Wk.) and balls are charged every two days (900 #/Charge).

B-II Flotation

The sequence of flotation is a single stage talc float followed by a lead roughing and a zinc roughing float. The lead and zinc rougher concentrates are each then cleaned twice before the final concentrates are sent on to thickening and filtering.

Machine sizes are as follows and all are Denver units.

Float	No. of Banks	Size	No. of Cells
Talc	1	30's (100 c.f.)	8
Pb Rghr.	2	24's (50 c.f.)	20
Pb Clean/Reclean	1	18 Specials	6
Zn Rghr	1	30's (100 c.f.)	12
Zn Clean/Reclean	1	30's (100 c.f.)	8

Supercharged air is supplied from a fan type blower rated at 1350 c.f.m. @ 12 ozs. pressure. This unit is located in the basement under the lead rougher cells.

The talc concentrate can either be combined with the lead concentrate at the thickener underflow stage or may be directed to tails as necessary. The talc tails pass through a splitter box to two banks of lead rougher cells. Lead rougher concentrate passes through a 2 x 2 S.R.L. pump to the cleaner/recleaner machine. Cleaner tails join the talc tails as feed to the roughers. Lead rougher tails flow by gravity to the 8' x 8' Denver wood stave zinc conditioner and then on to the one bank of zinc rougher cells.

Zinc rougher concentrate is laundered to a splitter sump where a portion is split to the two regrind cyclones which are 6" diameter Dorrclones. Overflow is carried back to the second side of the splitter box and then pumped via 1-1/4" Wilfley pump to the cleaner/recleaner machine. Cyclone underflow is fed to the 5' x 10' C.A.C. regrind mill.

The regrind mill is driven from a 125 H.P. 1800 R.P.M., 2300 Volt English electric motor through a Farrell speed reducer with a ratio of 4.58:1. Final mill speed is 31 R.P.M. which is 88% of critical. Liners are all Ni-hard iron and can be fabricated in Trail Central Shops. Grinding media are 1-1/4" diameter balls and these are charged every second day in 200 lb. lots. Ball consumption is as follows:

1977 Consumption - .057 #/T.

1978 Consumption - .087 #/T.

Regrind discharge is pumped back to rejoin the cyclone overflow at the splitter box and on to the cleaner/recleaner machine.

The cleaner/recleaner machine can be set up to have any number from one to five cells on recleaning service. Tails from this machine are recycled by gravity to the zinc conditioner.

Continued . . . .

B-II *Flotation* - (Cont'd)

Reagents used in flotation are as follows:

Reagent	Consumption 1977 #/T	Consumption 1978 #/T
Sodium Cyanide	.052	.052
M.I.B.C. Frother	.022	.021
Sodium Isopropyl Xanthate	.305	.255
Lime	.882	.941
Dowfroth 250	.057	.062
Copper Sulphate	.295	.301

Flotation control is achieved by density checks, monitoring of pH's in the circuits, quick assays and reagent addition. Density checks are made on the zinc cleaner feed and the zinc cleaner tails to ensure that this machine is being pulled correctly. Alkalinity of the lead cleaner and the zinc cleaners are checked to control iron content in the concentrates. There is an automatic lime addition made to the zinc cleaner feed based on a continuous monitoring probe in the cleaner machine. Other checks are performed manually and the lime addition is reset using per cent of cycle timers. Iron assays are carried out three times a shift on the final concentrates and a zinc colorimetric assay is made on the same frequency on the zinc rougher tails. Based on the above input, the operator can then make any required changes in reagent addition to the circuits.

Samples of classifier overflow, talc concentrate, lead rougher feed, lead recleaner concentrate, lead final concentrate, zinc final concentrate, zinc rougher tails and final tails are taken every two hours and are used to produce the daily assay report and the final daily metallurgy. Only the lead recleaner concentrate, the zinc final concentrate and the final tails are reported on a shift basis. All other samples are combined to a 24 hour sample. Classifier overflow and final tails are cut automatically by Galigher Auto-Samplers every half hour. All other samples are cut manually every two hours.

Mechanically, the flotation circuit is quite flexible. The talc circuit can be bypassed for maintenance purposes. The lead roughing circuit can be cut to half production with one bank of cells down for maintenance. The zinc regrind circuit can be bypassed and when in operation, flows to the regrind circuit can be varied at the splitter sump. Cleaning and recleaning capacity for both lead and zinc can be varied according to the conditions by adding or subtracting trays on the lip of the machines.

Water addition to the flotation circuit is made as spray water in the concentrate launders and in some pump sumps.

B-III Thickening - Filtering and Concentrate Load Out

Lead recleaner concentrate flows by gravity to a 15' x 8' Dorrco thickener which has a relatively high rake speed of 1 revolution every 45 seconds. The reason for this speed is to prevent excessive settling. The drive is a 1.5 H.P. 1800 R.P.M. C.G.E. gear motor with a 4.13 ratio, through a chain drive. Lead thickener underflow at 40% solids combines with the talc concentrate at the sump to the 1" Wilfley thickener underflow pump.

The combined flow travels to the Oliver 2 Disc American Filter which produces concentrate at approximately 12-15% moisture.

Lead thickener overflow goes directly to the tailings disposal system and as a result of some noticeable losses of lead in this overflow, Separan was added on a trial basis with only moderate success. No filter aids have been tried on this circuit.

Continued . . . .

B-III Thickening - Filtering and Concentrate Load Out (Cont'd)

Zinc concentrate flows by gravity to a 30' x 8' Dorr thickener with a rake speed of 1 revolution every 1-3/4 minutes. A 1" Wilfley pump delivers thickener underflow at 60% solids to a 6' diameter x 6 disc Oliver American Filter which produces final concentrate at a moisture content of 10-11%. Aerodri 100 was being added to the filter feed but due to frothing problems on the tailings launder system which were thought to be partially associated with this reagent, it was discontinued and Separan was added to the thickener instead. The Separan addition was also to minimize thickener overflow losses of zinc as this overflow also went directly to the tailings system.

Vacuum to both filters is supplied from either of two 22" x 9" C.I.R. vacuum pumps located in the mill basement. A Roots Connerville No.67 A.F. rotary blower supplies blow air at 150 c.f.m. at 5 psi. The filtrate is handled by a 1-1/4" Oliver filtrate pump.

Dried concentrate is stored in two bins directly under the filter Boots and is loaded into trucks with a #50-D Hough payloader equipped with a 1-1/3 cu. yd. bucket.

Filter bags which were cotton have been changed in the last year to a nylon Neotex fabric made by Porritts and Spencer Ltd. as the cotton bag life was very poor. An improvement was noticed with the Neotex bag as usage dropped from an average 62 bags per month in 1977 down to 27 bags per month in 1978.

Personnel required to operate the entire concentrator are as follows for a seven day per week, 24 hour a day operation.

4 - Mill Shift Bosses

4 - Mill Operators

4 - Utility Operators

3 - Crushing Operators

In general the mill operator is occupied with the flotation circuit while the utility man controls the grinding circuit and carries out any required clean-up duties. The utility operator can also fill in as required in the crushing plant should an operator be off sick. In this case the mill shift boss would control the flotation circuit and the mill operator operates the grinding circuit.

B-III-a Assay Lab.

There is a fully equipped bucking room and assay lab. located on the west side of the mill building. The assay lab. is equipped to carry out analysis of mill samples using a wet chemical method. At the time of shutdown an Atomic Adsorption Unit was included in the lab. equipment but it was in bad working order and would require major repairs before use. There is also a small testing lab. next to the assay lab. This area is equiped with bench style flotation machines, a filter press and ball mill. The equipment in this lab. is to remain at the H.B. property while all assay supplies are to be shipped out as required at other properties (particularly Trail Analytical Services).

This area of the operation employed a full time Bucker-Assayer and a full time Staff Assayer. It was found that the routine daily assay run was all that could be accomplished in the lab. due to lack of hot plate space and to lack of time. The method of analysis used was only suitable for lead, zinc and iron assay. If the property is reopened, some consideration should be given to purchasing an A.A. unit or to fix the one presently in the lab. in order to make this area more adaptable.

Continued . . . .

B-IV Tailings Disposal

Mill tailings during Phase I would be produced in the order of 500 tons per day when the mill is actually operating. A continuous program of operation is not anticipated until an adequate economic supply is forthcoming, possibly in Phase III when ores from the Rossland properties become available. The tailings product would leave the mill at 35% to 40% solids and travel through a Sclair pipeline in the form of a U from one side of the Sheep Creek Valley to the bank on the other side. Also, at this point, the excess mine drainage water which is carried through a 6-inch diameter steel pipe from the mine portal, enters the disposal system and the flow is then carried some 4,000 yards to the tailings impoundment area in an 8-inch diameter high density polyethylene pipe (Driscopipe, Series 1600).

As stated in the report by Klohn Leonoff, dated November 1981, Exhibit 'C' states that "the existing tailings structure has a capacity of approximately 790,000 tons."

Present plans for treatment of ores at the HB Mill are as follows:

1982	(first half)	35,000 tons
1982	(second half)	126,000 tons
1983		252,000 tons
1984		252,000 tons
1985	(first half)	126,000 tons

It is evident that no major addition to the tailings facilities will be required until mid 1985 but, depending on company production and availability of ores for custom milling, no substantial modifications will commence, subject to your prior approval, before mid 1984.

APPENDIX C

Tailings Disposal Scheme for the HB Mill - Prepared by Klohn Leonoff Consulting Engineers.

IEC

DAVID MINERALS LTD.

Tailings Disposal Scheme

HB Mill, Salmo, B.C.

KLOHN LEONOFF
CONSULTING ENGINEERS

PROJECT: HB Mill Tailings Disposal Scheme

LOCATION: Salmo, B.C.

CLIENT: David Minerals Ltd.

OUR FILE: VA 2869 November 27, 1981

VA 2869 November 27, 1981

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APPENDIX

I - LOGS OF BOREHOLES DRILLED BY GOLDER ASSOCIATES IN 1973

LIST OF DRAWINGS

A-2869-1 - SITE LOCATION

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B-2869-3 - PLAN OF EXISTING TAILINGS POND

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B-2869-5 - SCHEMATIC PROFILE OF TAILINGS POND

B-2869-6 - STABILITY ANALYSIS OF DAM

A-2869-7 - WATER BALANCE

1. INTRODUCTION AND SUMMARY

Klohn Leonoff Ltd. was requested by David Minerals Ltd. to investigate the feasibility of using the existing tailings pond at the HB Mill for the deposition of about one million tons of tailings. This report has been prepared for submission to the Nelson Branch of the B.C. Ministry of Energy, Mines and Petroleum Resources so that a permit can be obtained by David Minerals to operate the pond.

The HB Tailings Dam is located approximately four miles south of Salmo, B.C. (Drawings A-2869-1 and B-2869-2). The dam was originally built by Cominco in 1955 using a timber crib over which borrow materials from the west end of the pond were placed. The dam was raised in this manner to a height of about 40 ft. In 1964, a portion of the timber crib failed and moved about 10 to 15 ft. Drains were placed and toe protection was provided to stabilize the failure. Construction of the dam raising continued by the downstream method until operations were suspended in 1967. We understand that there was no independent geotechnical control of dam construction until 1973. In 1973, Golder Associates drilled three holes, one in the crest and two in the downstream portion of the dam. They encountered relatively soft material (as low as four blows per foot) in two holes. They recommended measures to reduce the phreatic surface within the dam, which were implemented. Subsequently, Golder Associates supervised the construction of dam raisings in 1975 and 1977. The operations at the HB Mill were suspended by Cominco in 1978.

The tailings dam is located at the southern end of a valley and has been constructed about 75 to 80 ft high using borrow materials. The tailings were deposited at the back of the pond, about 2900 ft from the crest of the dam and clarified water ponded against the upstream face of the dam (Drawing B-2869-3). Initially, two timber

decant towers were used in conjunction with two 24-inch diameter steel pipes to pass water from the upstream to the downstream side of the dam. In 1977, these decant towers were filled with concrete and replaced with a new spillway and drop manhole arrangement (Drawing D-2869-4).

Dr. Rajaram of Klohn Leonoff visited the damsite on September 23, 1981. Discussions were held with Mr. Newman of Cominco Engineering to obtain details of the tailings dam operation during the period 1955 to 1978. A profile of the tailings pond from the tailings flume to the dam crest was obtained from Mr. Newman and from Mr. Girdler of David Minerals. A schematic profile of the tailings pond is presented in Drawing B-2869-5. Assuming that tailings will be deposited uniformly on the existing tailings surface, a curve relating tons of tailings to elevation was developed. Approximately 790,000 tons of tailings can be deposited in the existing pond and dam. The dam will have to be raised by about 6 ft before the anticipated one million tons of tailings are deposited.

Klohn Leonoff will assess the condition of the existing dam by conducting a program of field investigation and laboratory analysis. Based on the results of this investigation, specifications for the dam raising will be provided.

The hydrology of the site was briefly analyzed to determine the water balance in the pond. It was concluded that the present spillway, which we understand is designed for a peak flow of 80 cu ft per second, is adequate to handle the runoff from a 200 year flood.

A seismic risk analysis of the site indicated that the acceleration amplitude with return periods of 100 years is 0.015 g (1.5 percent gravity). Since this figure indicates that the site has very low seismic risk, a static stability analysis was performed. The

analysis indicates that the dam has a minimum factor of safety against a shearing type failure of 1.7.

This report details the condition of the existing dam and describes the physical and hydrologic setting of the tailings pond, the tailings disposal scheme, and final abandonment of the pond.

2. DESCRIPTION OF EXISTING TAILINGS POND AND DAM

The existing tailings pond is located approximately four miles south of Salmo, B.C. A plan of the pond area showing the contours of the tailings surface is presented on Drawing B-2869-3. The tailings dam is located at the southern end of a valley and has been constructed about 75 to 80 ft high using borrow material obtained from the abutment slopes. The dam is about 800 ft long and the pond occupies an area of about 67 acres. A plan and section through the dam are presented on Drawing D-2869-4.

2.1 Cominco's Operating History

Cominco operated the tailings pond during the period 1955 through 1978. The tailings pond was used during 1955 through 1967, and subsequently during the period 1974 through 1978. The crest of the dam was raised periodically during these years to accommodate the increasing volumes of tailings. These dam raisings were performed using the downstream method of construction, i.e., additional fill was placed on the crest and the downstream slope of the dam. It is our understanding that the dam construction during the years 1955 through 1967 was not performed under independent geotechnical control.

When the dam was initially constructed in 1955, a timber crib structure was used. This crib was covered with borrow material obtained from the west end of the pond. The dam was raised in this manner to a height of about 40 ft. In 1964, a portion of the

timber crib failed and moved about 10 to 15 ft. Drains were placed and toe protection was provided to stabilize this failure. Construction of the dam raising continued by the downstream method until operations were suspended in 1967.

Before Cominco re-opened the HB Mill in 1974, Golder Associates investigated the stability of the tailings dam in 1972 and 1973. They drilled three holes, one on the crest and two on the downstream portion of the dam. They encountered soft materials (as low as four blows per foot) in two of the three holes. They recommended that a filter blanket be placed on the downstream slope of the dam to reduce the phreatic surface and improve dam stability. This was implemented in 1974. Two subsequent dam raisings in 1975 and 1977 were supervised by Golder Associates (personal communication, Newman, 1981). Cominco has been monitoring the water levels in the dam since the installation of piezometers in 1973. These observations indicate that the phreatic surface within the dam has not changed since Cominco shut down their operation in 1978.

2.2 Geotechnical Aspects of Dam Construction

Cominco re-opened the HB Mine and Mill in 1973. In 1972 and 1973, Golder Associates of Vancouver investigated the stability of the tailings dam. In 1973, three boreholes were drilled to depths varying from 45 to 85 ft and extended approximately 20 ft into bedrock. One borehole was drilled from the crest and two boreholes from the downstream slope of the existing tailings dam. Logs of the boreholes obtained by Golder Associates are presented in Appendix I. Samples were obtained for laboratory testing, and perforated plastic standpipes were installed in the boreholes to monitor groundwater levels. A plan and section of the dam, showing the location of these boreholes, is presented on Drawing D-2869-4.

A review of Golder Associates reports dated June 1972 and January 1974, and discussions with Mr. Newman of Cominco reveal the following about the tailings dam:

- The dam is generally comprised of brown sandy silt containing varying amounts of medium to coarse sand and fine gravel.
- There are zones of soft material in the fills placed before 1967 (as low as four blows per foot).
- A timber crib was used during the initial construction of the dam, and a portion of this crib failed in 1964 and moved about 10 to 15 ft.
- The foundation material under the fill consists of bedrock overlain by 6 to 8 ft of dense silty till with minor amounts of sand and gravel.
- The fill material has an angle of internal friction of approximately 35 1/2 degrees with zero cohesion, as determined by Golder Associates' laboratory tests.
- The factor of safety against a shearing type failure is of the order of 1.3. Since this analysis was completed by Golder Associates in 1973, the phreatic surface has been lowered and so the present factor of safety is considered to be greater than this figure.
- The dam has adequate protection against surface erosion.

Golder Associates recommended that if the ponded water level is raised, the dam should be raised using a filter blanket to maintain the phreatic surface below the level of the existing downstream fill slope. The specifications for the 1975 and 1977 dam raisings were prepared by Cominco on the basis of the Golder reports, and we

understand that the construction was supervised by Golder Associates. A review of the piezometer readings through July 1981 indicates that the phreatic surface has been relatively constant, since Cominco shut down in 1978.

2.3 Spillway

Prior to 1977, two timber decant towers were used in conjunction with two 24-inch diameter steel pipes to pass water from the upstream to the downstream side of the dam. Due to operating and maintenance problems with this system, Cominco filled these structures with concrete and installed a new spillway and drop manhole structure (Drawing D-2869-4). This structure is equipped with a 36-inch diameter steel pipe, and we understand was designed to pass a maximum flow of 80 cu ft per second (35,900 USGPM).

3. TAILINGS DISPOSAL SITE

The tailings disposal area is situated in a natural basin covering about 67 acres in the Salmo Provincial Forest. It is to the east of Provincial Highway 3 and the Salmo River, about four miles south of Salmo, B.C. (Drawing B-2869-2). To the east and west of the pond are heavily treed slopes consisting of 80 to 90% of evergreens. The dam is situated at the southern end of the basin.

3.1 Hydrological Setting

Dr. McCreath of Klohn Leonoff, obtained data on snowcourse, streamflow, and precipitation from measuring stations at Creston, Nelson, Trail, and Edgren Creek. From analysis of the data, the average annual precipitation at the site is 31.5 inches, and the average annual evaporation is 16.7 inches. The average annual runoff from a catchment area of about 445 acres to the east of the tailings pond is about 14.5 inches. The water balance for the pond was calculated using these estimates for precipitation, evaporation, and runoff.

The peak 200 year flood inflow into the pond is estimated to be in the order of 120 to 150 cu ft per second (cfs). About 30 to 50% of this inflow can be temporarily stored in the pond since a flood surcharge of 2 ft has been assumed in computing the volume-elevation curve. Thus, the existing spillway, which we understand has been designed for a discharge of 80 cfs, can handle the 200 year flood estimated for the site.

4. TAILINGS DISPOSAL SCHEME

4.1 Existing Capacity of the Pond

The tailings pond has been operated since 1955 with the tailings being deposited at the upstream end of the tailings pond and the dam being raised as necessary by the downstream method of construction using borrow materials. Klohn Leonoff recommends that this method of tailings disposal be continued by David Minerals Ltd. In an effort to estimate the present capacity of the tailings pond, and the extent of dam raising necessary to store the anticipated 1,000,000 tons of tailings, a curve relating the tons of tailings to the elevation of the dam crest was developed (Drawing B-2869-5).

A schematic profile of the existing tailings surface is presented on Drawing B-2869-5. The water level in the pond is 5 ft below the dam crest, and the depth of the ponded water on the upstream side of the dam is 9 ft. The tailings should be discharged in layers over the existing tailings surface. In June 1984, after about 790,000 tons of tailings have been deposited, the ponded water capacity and flood surcharge provision will be reduced to a minimum. At that point, the dam will have to be raised by about 6 ft before additional tailings can be deposited. During operation of the tailings pond, the elevations of the tailings should be monitored to ensure that the schematic profile presented on Drawing B-2869-5 is maintained. The depth from the crest of the slimes

surface on the upstream side of the dam should be maintained as depicted in the tons of tailings versus elevation curve.

4.2 Tailings Dam Raising

The tons of tailings versus elevation curve indicates that the dam crest has to be raised prior to June 1984. Klohn Leonoff recommends that before the dam raising is undertaken, a program of field investigation should be conducted to assess the condition of the upstream portion of the dam. The upstream portion of the dam contains some soft zones, and also has a timber crib buried within it.

During the 1982 field season, two to three boreholes should be drilled to assess the condition of the upstream side. Soil samples should be obtained for conducting laboratory tests. Based on the results of the field and laboratory testing program, Klohn Leonoff will develop detailed specifications for the dam raising.

A stability analysis of the dam was performed using the parameters presented in Drawing B-2869-6. A preliminary profile of the dam raised by 6 ft was used to perform the analysis. A seismic risk analysis of the site indicated that the acceleration amplitude with return periods of 100 years is 0.015 g (1.5% gravity). Since this represents a very low seismic risk, a static stability analysis was performed. The minimum factor of safety for the dam was found to be 1.7.

4.3 Water Balance

The hydrological data given in Section 3.1 of this report was utilized to compute the water balance for the tailings pond (Drawing A-2869-7). Using a production rate of 900 tons per day, a tailings pulp density of 30%, and no recycling of the water, the tailings

transport water required is 350 USGPM. Of this amount about 50 USGPM remains within the voids of the tailings. The runoff and precipitation into the pond is estimated to be 335 USGPM. Assuming that 40 USGPM are lost due to evaporation and seepage, the average amount of daily flow out of the spillway is 595 USGPM. This represents an average dilution factor of about two for the tailings water. During periods of heavy runoff and precipitation, this factor could be much higher.

4.4 Permanent Spillway

On final abandonment of the pond, a permanent spillway should be constructed at the east abutment of the dam. This should be an open-channel spillway which will safely pass flood water from the upstream to the downstream side of the dam. The design of this spillway is beyond the scope of the present study.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

1. The existing tailings dam has a capacity of approximately 790,000 tons.

2. The tailings should be discharged from the northern end of the pond, in layers over the existing tailings surface. The depth from the crest of the slimes surface on the upstream side of the dam should be maintained at a minimum of about 8 ft.

3. The dam crest should be raised by about 6 ft during the 1983 field season to accommodate the anticipated one million tons of tailings.

5.2 Recommendations

1. The condition of the existing dam, especially the upstream portion, should be investigated during the 1982 field season. Based on this investigation, plans and specifications for the 1983 dam raising should be prepared.

2. Piezometric levels in the dam should be monitored on a monthly basis.

3. The tailings surface elevation should be monitored to ensure that the schematic profile presented in this report is maintained. Any significant variations in this profile will affect the tailings storage capacity.

KLOHN LEONOFF LTD.

V Rajaram

V. RAJARAM, Ph.D., P.E.
Senior Division Engineer

Mark Olsen

MARK T. OLSEN, P.Eng.
Staff Consultant

VR/MTO/jas

APPENDIX I

LOGS OF BOREHOLES DRILLED BY GOLDER ASSOCIATES IN 1973

IEC

PROJECT No. V73218

RECORD OF BOREHOLE 2

LOCATION: See Figure 1
BORING DATE: NOVEMBER 1, 1973
DATUM: TAKEN FROM COMINCO DRAWING NO. HB 285 P
BOREHOLE TYPE: ROTARY TRICONE
BOREHOLE DIAMETER: 4 IN
SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES
PEN. TEST HAMMER WEIGHT LB DROP INCHES

ELEV. DEPTH	SOIL PROFILE – DESCRIPTION	STRAT PLOT	SAMPLES – NUMBER	SAMPLES – TYPE	SAMPLES – BLOWS/FT.	ELEVATION SCALE
[illegible]	GR. SURFACE.					
						2460
	SOFT BROWN SANDY SILT WITH MED. & COARSE SAND & GRAVEL TO 1½" DIA. OFTEN TILL LIKE.		1	2" DO	10	
			2	2" DO	8	
						2450
			3	2" DO	13	
			4	2" DO	4	
						2440
[illegible]	WOOD		5	2" DO	20	
	SOFT TO FIRM STRATIFIED BROWN & GREY SILT WITH OCC. GRAVEL TO 1½" DIA.		6	2" DO		
[illegible]	SAND & GRAVEL.					2430
[illegible]	BEDROCK.		7	WS		
			8	WS		2420
			9	WS		
			10	WS		
[illegible] 50.0	END OF HOLE.					2410

DYNAMIC PENETRATION RESISTANCE BLOWS/FT

SHEAR STRENGTH C_u, LB./SQ.FT

COEFFICIENT OF PERMEABILITY k, CM./SEC

WATER CONTENT, PERCENT W_p — W — W_L

ADDITIONAL LAB. TESTING

STANDPIPE INSTALLATION: WL 5.5' NOV. 25, 1973

○ = Percent axial strain at failure

VERT. SCALE 1 INCH TO 10 FEET

GOLDER, BRAWNER & ASSOCIATES

2

DRAWN RMO
CHECKED

PROJECT No. V73218

RECORD OF BOREHOLE 3

LOCATION See Figure 1 BORING DATE NOVEMBER 1, 1973 DATUM TAKEN FROM COMINCO DRAWING NO. HB-285 P

BOREHOLE TYPE ROTARY TRICONE BOREHOLE DIAMETER 4 in

SAMPLER HAMMER WEIGHT 140 LB. DROP 30 INCHES PEN. TEST HAMMER WEIGHT - LB DROP - INCHES

ELEV. / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	BLOWS/FT.	ELEVATION SCALE	STANDPIPE INSTALLATION
2455.0 / 0.0	GR. SURFACE.					
	VARIABLE DENSITY BROWN & GREY SILT SAND & GRAVEL	1	2" DO	+50	2450	WL 6.0 NOV 25 1973
2448.0 TO / 8.0	WOODEN CULVERT					
	VARIABLE DENSITY BROWN & GREY SILT WITH MED. & COARSE SAND & FINE GRAVEL.	2	2" DO	+100		
		3	2" DO	15	2440	
2435.0 / 20.0	COMPACT BROWN & GREY SILT, SAND & GRAVEL (TILL)	4	2" DO	37		
2437.0 / 23.0						
2428.0 / 26.0	VERY DENSE SAND & GRAVEL	5	2" DO	+100	2430	
		6	WS			
	BEDROCK.				2420	
		7	WS			
2410.0 / 45.0	END OF HOLE.				2410	

DYNAMIC PENETRATION RESISTANCE BLOWS/FT

SHEAR STRENGTH C_u, LB/SQ.FT

COEFFICIENT OF PERMEABILITY k, CM/SEC

WATER CONTENT, PERCENT W_p W W_l

ADDITIONAL LAB. TESTING

+3, ×3: Percent axial strain at failure

VERTICAL SCALE 1 INCH TO 10 FEET

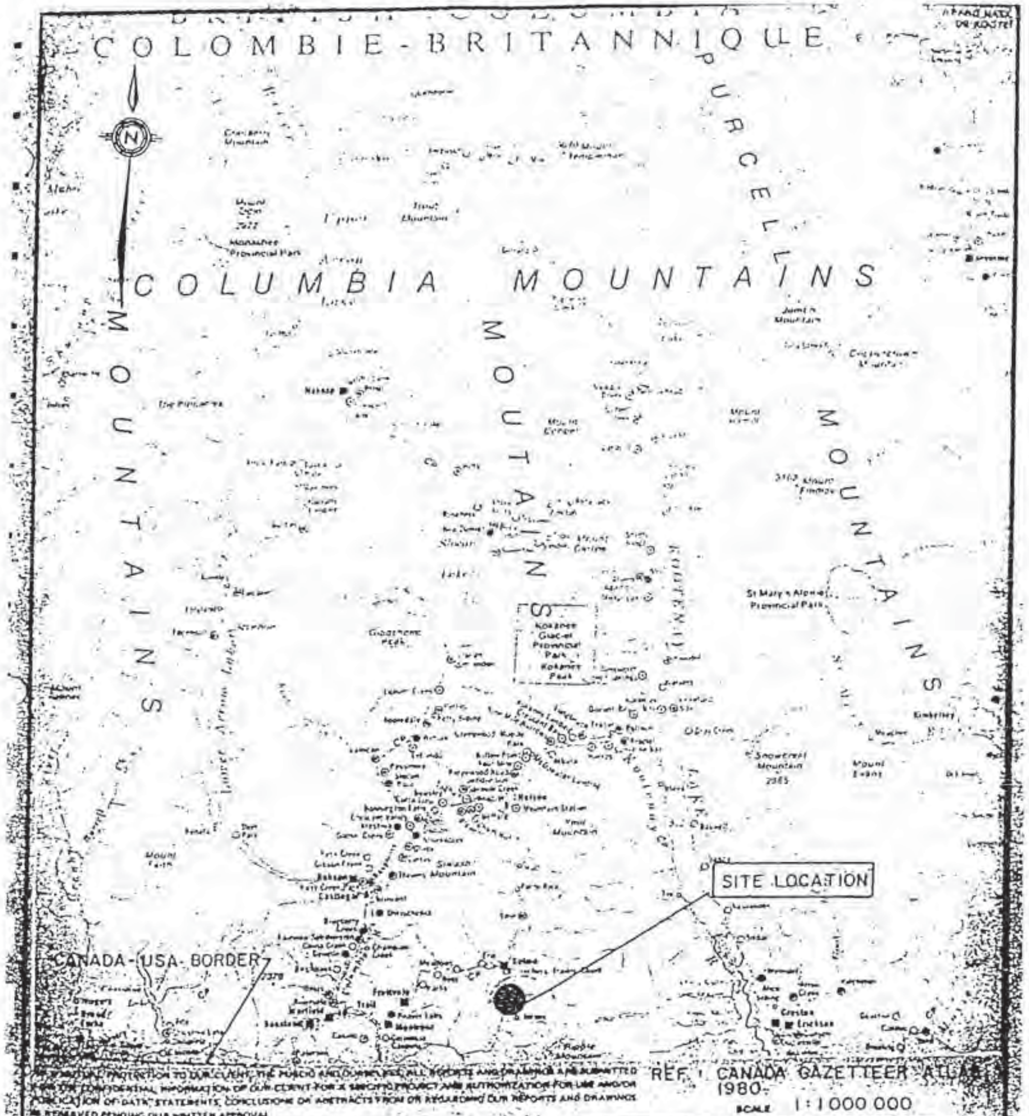
GOLDER, BRAWNER & ASSOCIATES

3

DRAWN ...... CHECKED ......

LIST OF DRAWINGS

A-2869-1	-	SITE LOCATION
B-2869-2	-	LOCATION OF TAILINGS DISPOSAL POND
B-2869-3	-	PLAN OF EXISTING TAILINGS POND
D-2869-4	-	PLAN AND SECTION OF EXISTING DAM
B-2869-5	-	SCHEMATIC PROFILE OF TAILINGS POND
B-2869-6	-	STABILITY ANALYSIS OF DAM
A-2869-7	-	WATER BALANCE

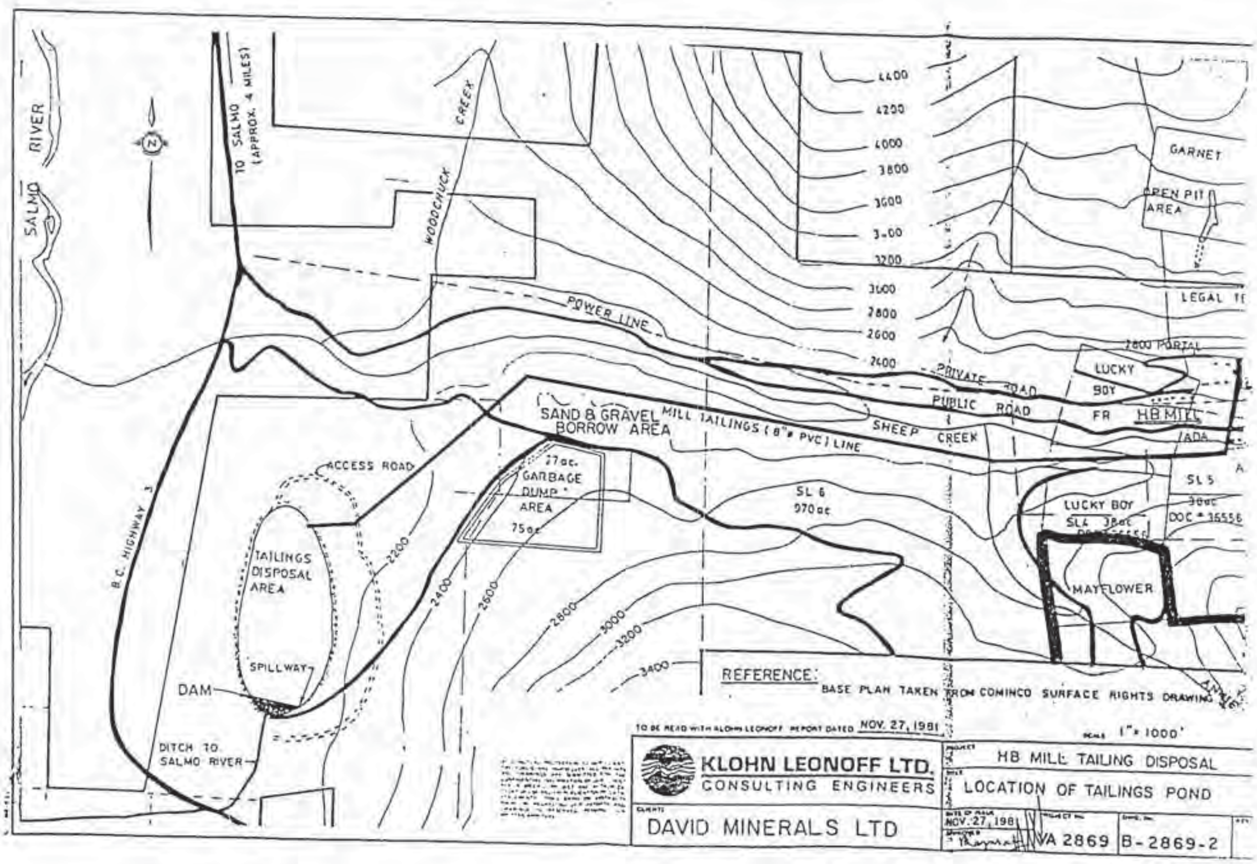


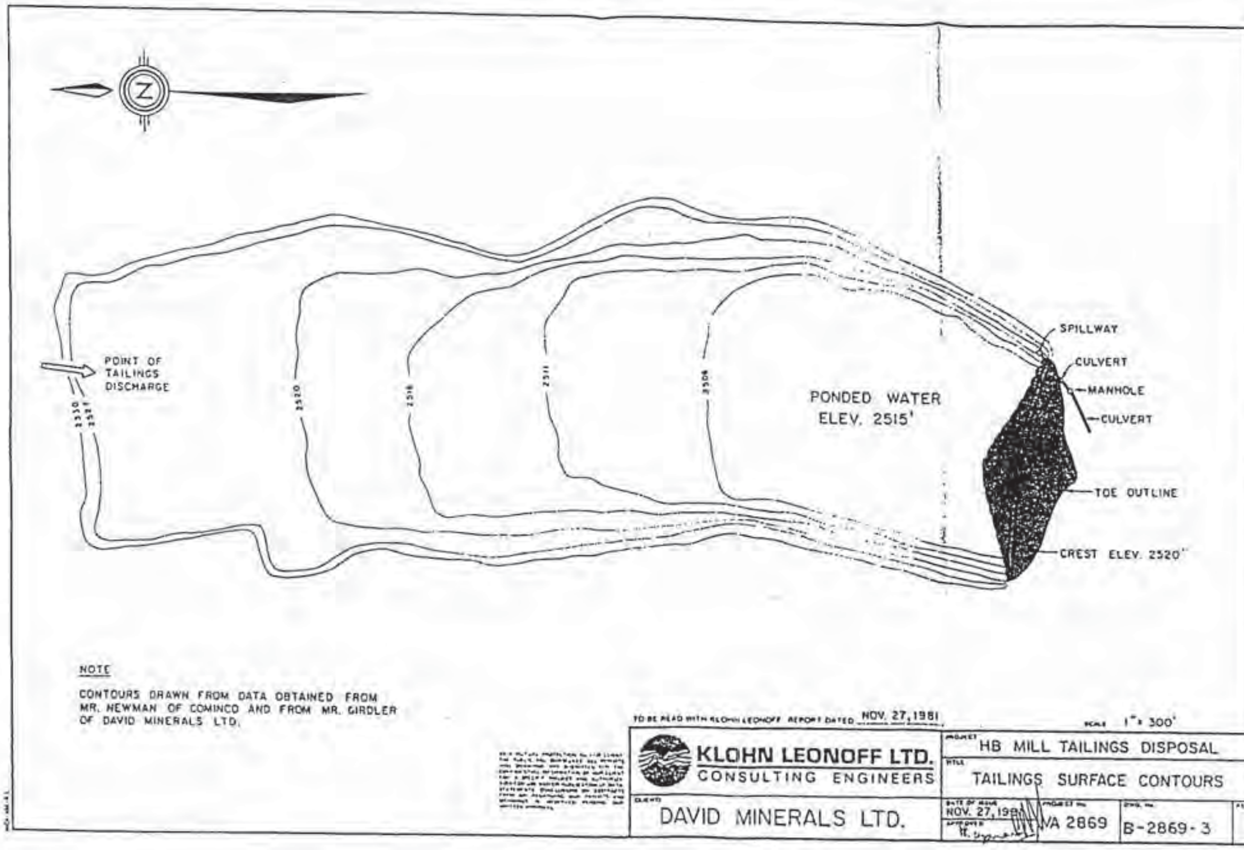
PROJECT: HB MILL TAILINGS DISPOSAL

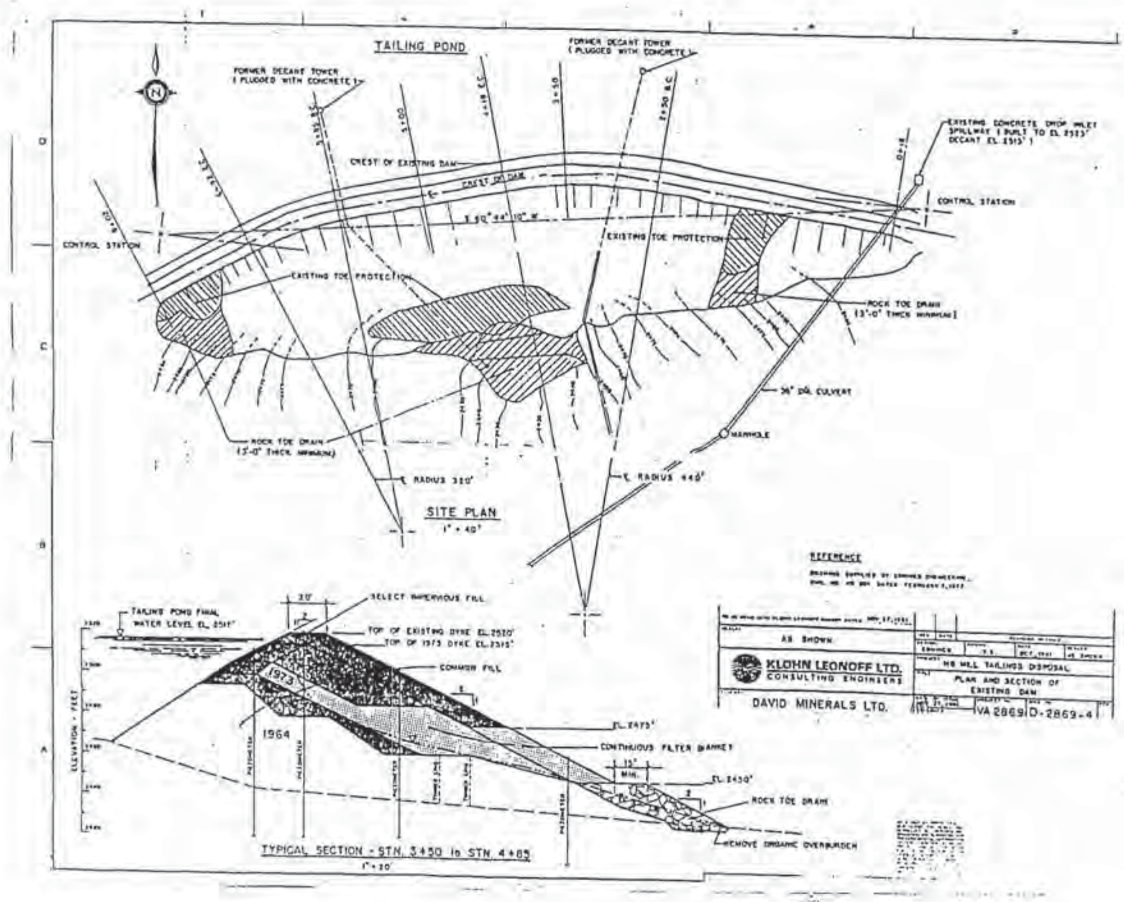
KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

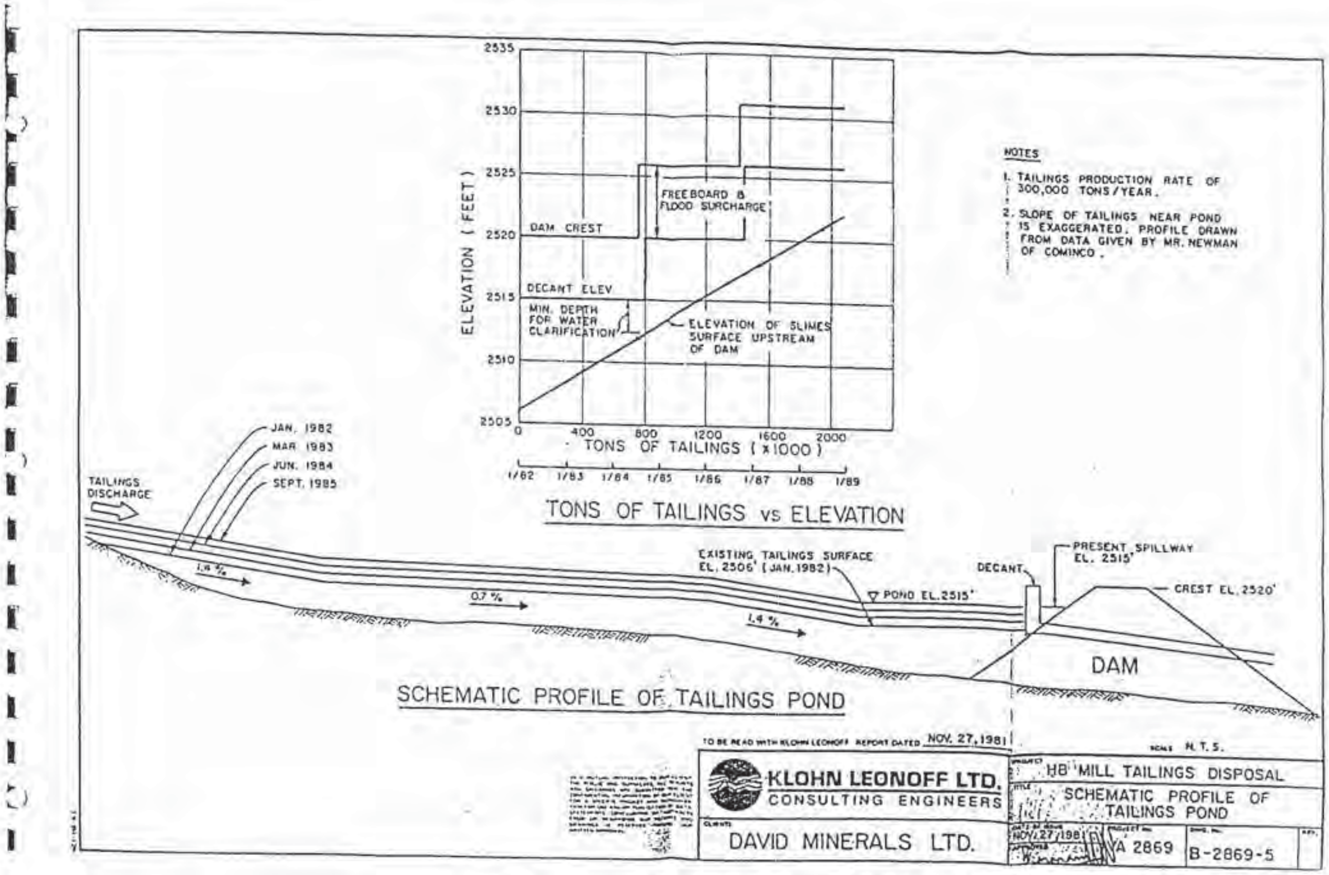
TITLE: SITE LOCATION

CLIENT	DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
DAVID MINERALS LTD.	NOV. 27, 1981	VA 2869	A-2869-1	


SALMO RIVER
TO SALMO (APPROX. 4 MILES)
WOODCHUCK CREEK
POWER LINE
GARNET
OPEN PIT AREA
LEGAL
2800 PORTAL
LUCKY BOY
PRIVATE ROAD
PUBLIC ROAD
SHEEP CREEK
HB MILL
SAND & GRAVEL BORROW AREA
MILL TAILINGS (8"ø PVC) LINE
ACCESS ROAD
27ac. GARBAGE DUMP AREA
75ac
SL 6
970ac
SL 5
LUCKY BOY
SL4
MAYFLOWER
B.C. HIGHWAY 3
TAILINGS DISPOSAL AREA
SPILLWAY
DAM
DITCH TO SALMO RIVER
REFERENCE:
BASE PLAN TAKEN FROM COMINCO SURFACE RIGHTS DRAWING
TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981
1" = 1000'
KLOHN LEONOFF LTD.
CONSULTING ENGINEERS
HB MILL TAILING DISPOSAL
LOCATION OF TAILINGS POND
DAVID MINERALS LTD
NOV. 27, 1981
VA 2869
B-2869-2


POINT OF TAILINGS DISCHARGE
2530
2527
2520
2516
2511
2506
PONDED WATER
ELEV. 2515'
SPILLWAY
CULVERT
MANHOLE
CULVERT
TOE OUTLINE
CREST ELEV. 2520'
NOTE
CONTOURS DRAWN FROM DATA OBTAINED FROM MR. NEWMAN OF COMINCO AND FROM MR. GIRDLER OF DAVID MINERALS LTD.
TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981
SCALE 1" = 300'
KLOHN LEONOFF LTD.
CONSULTING ENGINEERS
HB MILL TAILINGS DISPOSAL
TAILINGS SURFACE CONTOURS
DAVID MINERALS LTD.
NOV. 27, 1981
VA 2869
B-2869-3

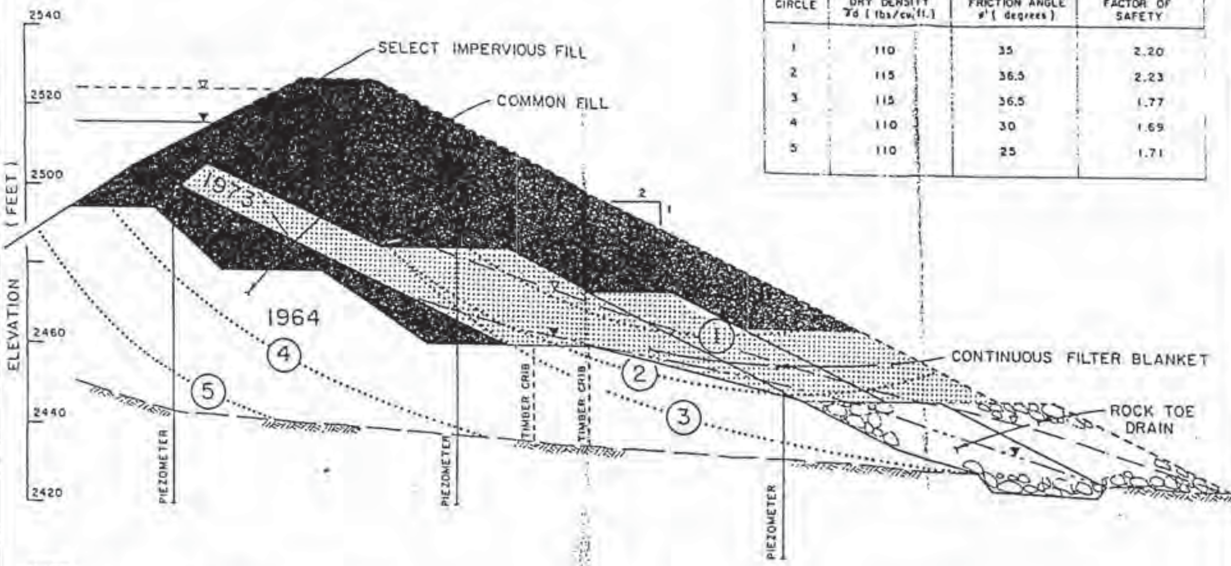

TAILING POND
SITE PLAN
TYPICAL SECTION - STN. 3+50 to STN. 4+85
KLOHN LEONOFF LTD.
CONSULTING ENGINEERS
DAVID MINERALS LTD.
VA 2869 D-2869-4



TONS OF TAILINGS vs ELEVATION
ELEVATION (FEET)
TONS OF TAILINGS (x1000)
DAM CREST
FREEBOARD & FLOOD SURCHARGE
DECANT ELEV
MIN. DEPTH FOR WATER CLARIFICATION
ELEVATION OF SLIMES SURFACE UPSTREAM OF DAM
NOTES
1. TAILINGS PRODUCTION RATE OF 300,000 TONS/YEAR.
2. SLOPE OF TAILINGS NEAR POND IS EXAGGERATED. PROFILE DRAWN FROM DATA GIVEN BY MR. NEWMAN OF COMINCO.
JAN. 1982
MAR. 1983
JUN. 1984
SEPT. 1985
TAILINGS DISCHARGE
EXISTING TAILINGS SURFACE EL. 2506' (JAN. 1982)
POND EL. 2515'
DECANT
PRESENT SPILLWAY EL. 2515'
CREST EL. 2520'
DAM
1.4 %
0.7 %
SCHEMATIC PROFILE OF TAILINGS POND
TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981
N.T.S.
KLOHN LEONOFF LTD.
CONSULTING ENGINEERS
DAVID MINERALS LTD.
HB MILL TAILINGS DISPOSAL
SCHEMATIC PROFILE OF TAILINGS POND
NOV. 27, 1981
A 2869
B-2869-5

ASSUMPTIONS AND RESULTS OF ANALYSIS

CIRCLE	DRY DENSITY γ_d (lbs/cu.ft.)	FRICTION ANGLE ϕ' (degrees)	FACTOR OF SAFETY
1	110	35	2.20
2	115	36.5	2.23
3	115	36.5	1.77
4	110	30	1.69
5	110	25	1.71



NOTE

PIEZOMETERS INSTALLED BY GOLDER ASSOCIATES, 1973. THE TWO DOWNSTREAM PIEZOMETERS HAVE BEEN EXTENDED, AND A NEW PIEZOMETER HAS BEEN INSTALLED AT THE PRESENT DAM CREST.

TO BE READ WITH KLOHN LEONOFF REPORT DATED NOV. 27, 1981

SCALE 1" = 20'

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

CLIENT: DAVID MINERALS LTD.

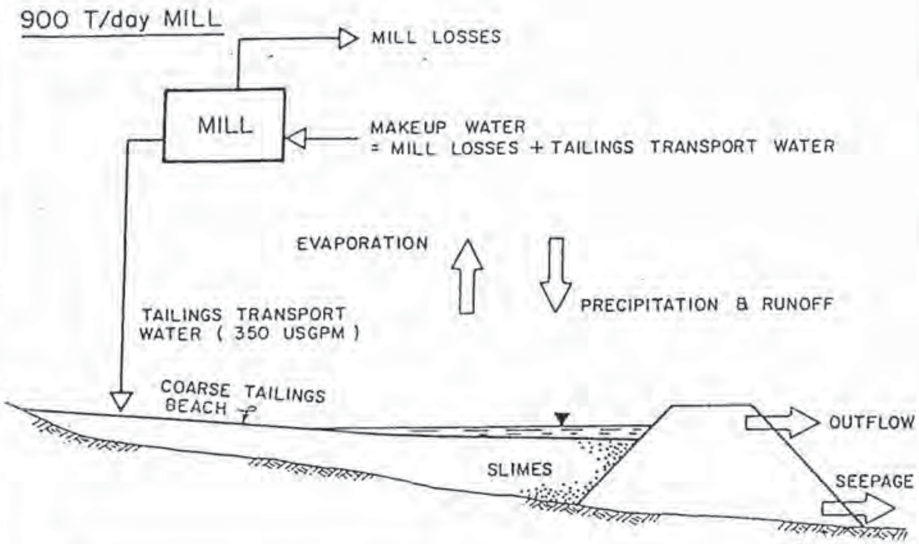
PROJECT: HB MILL TAILINGS DISPOSAL

TITLE: STABILITY ANALYSIS

DATE OF DRAWING: NOV. 27, 1981

PROJECT No.: 2869

DWG. No.: B-2869-6



WATER BALANCE	
INPUT (USGPM)	OUTPUT (USGPM)
350 gpm (TAILINGS WATER) 335 gpm (PRECIP. & RUNOFF)	50 gpm (VOIDS WATER) 20 gpm (EVAPORATION) 20 gpm (SEEPAGE) 595 gpm (OUTFLOW)
685 gpm (TOTAL)	685 gpm (TOTAL)

SCALE NTS

KLOHN LEONOFF LTD.
CONSULTING ENGINEERS

CLIENT: DAVID MINERALS LTD.

PROJECT: HB MILL TAILINGS DISPOSAL

TITLE: WATER BALANCE

DATE OF ISSUE	PROJECT No.	DWG. No.	REV.
NOV. 27, 1981	VA 2869	A-2869-7	

APPROVED

BRITISH COLUMBIA

October 30, 1997
File: 18040-02-07/HB/01
x M-85

Mr. Walter Kuit
Manager, Environmental Affairs
Cominco Ltd.
200 Burrard Street
Vancouver, BC V6C 3L7

Nu-Dawn Resources Inc.
102 Piper Crescent
Nanaimo, BC V9T 3G3

Dear Sir/Madam(s):

Re: HB Mine Tailings Impoundment, Salmo, B.C.

According to our records the HB Mine near Salmo, B.C. is permitted under Mines Act Permit M-85 to Cominco, while mineral title and fee simple land is owned by Nu-Dawn Resources. Geotechnical inspections of the tailings impoundment were performed by the Mines Branch in April 1993 and June 1997. Attached you will find copies of these inspection reports.

On July 22, 1977 the Acting Chief Inspector of Mines approved construction of a spillway at the dam by letter addressed to Mr. J.S. Newman, P.Eng., Civil Engineer for Cominco. The spillway was never installed.

In summary, site conditions at HB Mine tailings impoundment have deteriorated and pose public safety and environmental hazards. The main concerns are that the impoundment was never decommissioned with a permanent spillway on closure and the current decant structure is deteriorating; the intake channel and structure are filling with debris and the discharge flume and channel on the downstream face are in need of repair. The integrity of the dam itself appears to be satisfactory except that there should be more freeboard. Overtopping and breaching of the dam or regressive erosion at the decant outlet is considered a distinct possibility in the foreseeable future.

.../2

Ministry of Employment and Investment
Regional Operations, Health and Safety Branch, Energy and Minerals Division
Mailing Address: PO Box 9320 Stn Prov Govt Victoria BC V8W 9N3
Telephone: (250) 952-0462
Facsimile: (250) 952-0481
Location: 5th Floor, 1810 Blanshard Street Victoria

While it is unusual to have different entities as Permittee and Owner, you both have obligations to make the tailings impoundment safe, remove the hazard(s) and decommission the tailings site so the Mines Branch can close its file on the tailings impoundment. I must add that there are other safety concerns at the mill building which our health and safety inspectors will review next year after another safety inspection. Ultimately, Mines Branch wants to close all its files on the site and you should proceed with this in mind.

If you have any questions please do not hesitate to call me at (250) 952-0485 in Victoria. I would appreciate a response from you on this matter before the end of January 1998, with a plan to take appropriate action in the summer of 1998.

Yours sincerely,

Tim Eaton

Tim Eaton, P.Eng.
Manager, Geotechnical Engineering

TE/tl

cc: Ricci Berdusco
Andrew Whale

Attachments

Add.
- old timber cribs in dam?
- seepage around/from old lower
decant pipe in toe of dam.

File: 18040-02-07/HB & [redacted] Not Responsive

To: Fred Hermann, Chief Inspector

From: Tim Eaton

Date: June 25, 1997

Re: [redacted] S14

[redacted] S14

Tim

File 18040-02-07/HB

FAX COVER SHEET

MINISTRY OF ENERGY AND MINES

MINES BRANCH

FAXED 2:40PM

Street: 5th Floor, 1810 Blanshard Street, Victoria,

Mailing: PO Box 9320 Stn Prov Govt, Victoria British Columbia V8W 9N3

DATE SENT: May 21

TO: Raymond Carson - Nu-Dawn Res.

FAX NUMBER: 250-756-0298

FROM:

Tim Eaton, P. Eng.
Manager, Geotechnical Engineering
Ph: (250) 952-0485 Fax: (250) 952-0481
Email: tim.eaton@gems2.gov.bc.ca

COMMENTS:

FYI - A geotechnical inspection of HB tailings facility is scheduled for June 3 AM.

NUMBER OF PAGES INCLUDING COVER SHEET: 1

BRITISH COLUMBIA

Province of British Columbia
Ministry of Employment and Investment

ENERGY AND MINERALS DIVISION

REPORT OF GEOTECHNICAL INSPECTOR

(Issued pursuant to Section 15 of the Mines Act)

Name of Property: HB Mine — File: 18040-02-07/HB/01

Location: Salmo

Mine Manager: n/a

Company: Cominco and Nu-Dawn
Address: as per cover letter

Persons Contacted: n/a

Type of Mining: Closed, u/g, base metal

Date of Inspection: June 10, 1997

An inspection of the tailings impoundment was conducted in the company of Art O'Bryan. The previous geotechnical inspection was April 29, 1993. The following areas in particular were noted:

The upstream dam face (Photo 1) is in good condition with no evidence of effects from wave action. The dam crest and downstream slope (Photo 2) are also in good condition with no evidence of cracks, settlement, slumps or erosion. Vegetation cover (mainly grasses and legumes) is healthy and thick and an alder has started on the upstream face at waterline.

The downstream toe is wet in the same areas as observed in 1993 and the toe drains appear to be functioning satisfactorily. The grouted CMP (old decant outlet) near the central toe of the dam is dry and not showing any signs of leakage inside or outside of the pipe.

The operating decant or water control structure is structurally sound. However the inlet channel to the decant is completely full if cattails and the alders are much larger. Compare Photo 3 (April 29, 1993) and Photo 4 (June 10, 1997). The log at the entrance to the channel is still in place. However the concrete water level control beams have not been removed from inside the structure as ordered in my 1993 inspection, although I note that the wooden support posts for the upper beam appear to have been replaced with steel pipe. Note that the same number of concrete beams are resting on top of the control structure in both photos.

A 900 mm CMP conducts water from the decant control structure to a drop structure (manhole) part way through the dam and another CMP from the drop structure to the downstream dam toe. The drop structure has had the steel cover secured so that we could not inspect inside and the steel plate has been removed from inside as ordered in my 1993 inspection.

The downstream outlet for the decant structure has had some minor improvements made to it, compare Photo 5 (April 29, 1993) and Photo 6 (June 10, 1997). The steel and fibreglass plume has been realigned and now carries the discharge water from the outlet CMP and discharges it into the drainage natural plunge pool, about seven metres away. However this outlet structure needs repair.

Discussion

The current arrangements at the dam require monitoring and maintenance to ensure satisfactory long term operation. The existing decant structure will eventually plug with debris with a potential dam breach the end result. The flume in the downstream outlet for the decant will topple out of place again in the near future. Discharge water will gradually erode and undermine the toe of the dam in this area.

As stated in my 1993 inspection report this tailings facility must be permanently decommissioned. An engineered spillway and outlet channel need to be designed and installed for the 1:200 year 24 hour flood or combination flood and freshet, whichever is determine to be the bigger event. Static stability must have a minimum factor of safety of 1.5 and seismic stability reviewed to satisfy the 1:475 year probabilistic event. In the event stability is inadequate the pond level should be further lowered by the new spillway to reduce risk and improve stability. If necessary the entire pond should be permanently drained from the impoundment by the spillway/outlet structure.

Tim Eaton

Tim Eaton, P.Eng.
Manager Geotechnical Engineering

Date: October 30, 1997

PHOTO 1

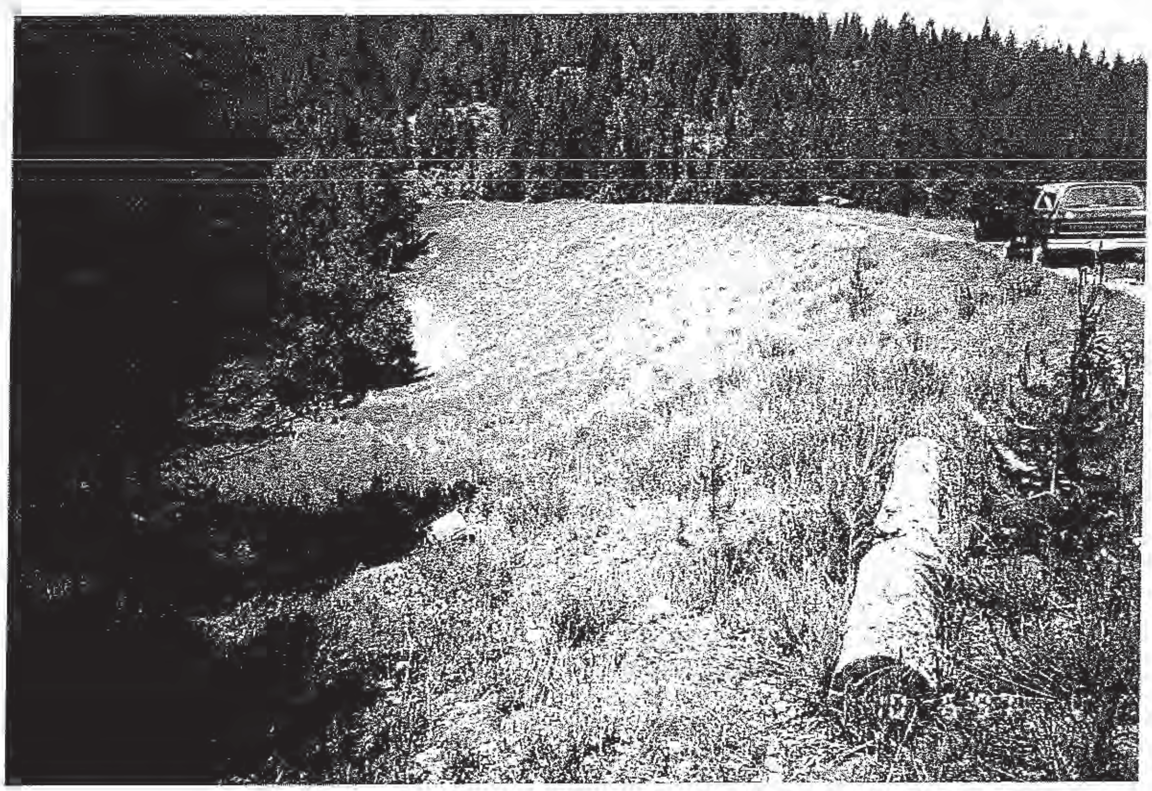


PHOTO 2

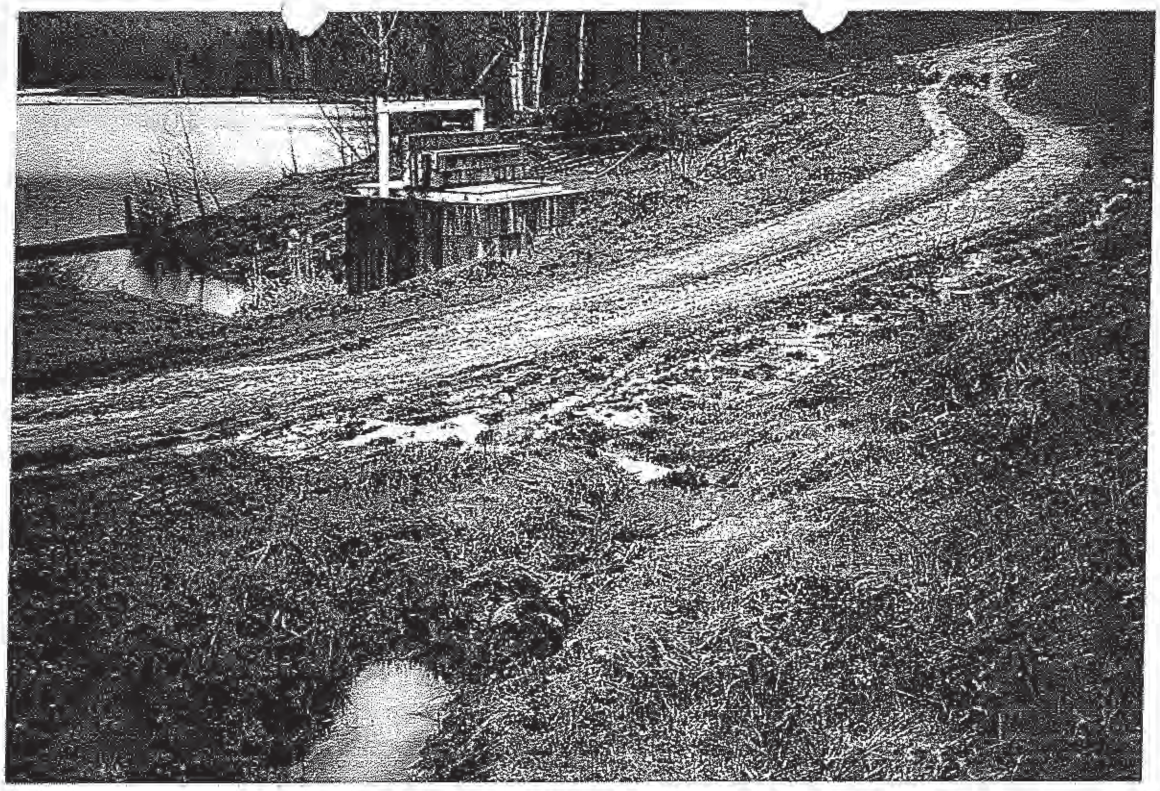


PHOTO 3

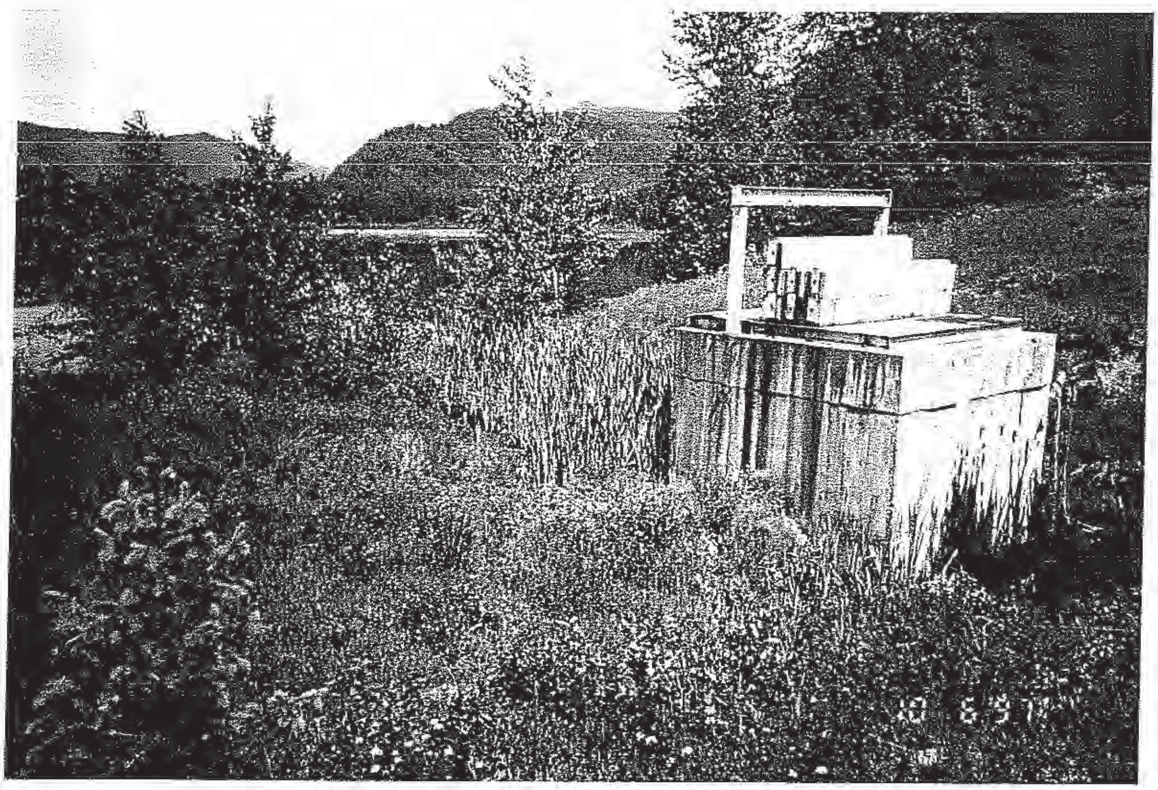


PHOTO 4

PHOTO 5

PHOTO 6

2035

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources 18040-02-07/HB/01

ok to file

Report of Inspector of Mines
(Issued pursuant to Section 15 of the Mines Act)

GEOTECHNICAL - EIM

Name of Mine: HB Mine

Locality: Salmo, B.C.

Owner or Operator: Nor-Quest Resources Ltd.

Address: 102 Piper Crescent Nanaimo, B.C. V9T 3G3

Manager: Mr. Raynerd Carson

Areas Inspected: Tailings Dam

Persons Contacted

Management: No one available.

The mine manager shall complete the right hand column noting specific corrective actions taken, or to be taken by a specified date, and return a copy to the Inspector within 15 days of receiving the report.

Inspection Report	Manager's Response of Action Taken
1. Crest good, no settlement.	
2. Upstream slope good, beach/ wave action/ erosion minimal.	
3. Downstream slope covered with grass and alder, wet zones at toe and several seeps, but no seeps were obvious on downstream slope face. Stability looks good; no sloughs, settlements, toe drains operating.	
4. Piezometer standpipe near toe at centre of dam is dry to a depth of approx. (plumbed with small stone) 45-50 feet. Check Fig. 1 from Golder Brawner 74 report (Feb. 12, 1979 Rep# E/74/124) assume it to be BH 2 which is drawn at about 50 foot depth on the section so assume piezo is dry.	

Copies To:

Tim Eaton, P. Eng.
Geotechnical Manager

Tim Eaton
Signature - Inspector

105-525 Superior St. Victoria, B.C., V8V 1X4
Address

Signature - Manager

Date of Inspection: April 29, 1993

Dated: 19

Inspection Report	Manager's Response of Action Taken

5. Decant structure at E end looks structurally sound, flow not impeded but bullrushes growing at inlet are being drawn into structure. Large log at entrance to outlet ditch is okay and prevents other debris from passing. Inside the decant well there are 2 concrete outlet water level control beams. One is raised approx. 18" and supported entirely by 2"x2"x4" on end which are rotting. This must be removed as soon as possible. The lower beam sits on the bottom and should be removed to create additional free board between dam crest to panel level.

6. Drop structure looks sound but water has flowed out of the MH as evidenced by recent erosion and flattened grass around the MH . A 1/4" steel plate inside the MH must be removed as soon as possible. It is fastened by rusting bolts to the concrete and will block the outlet when it falls.

7. The downstream decant outlet requires maintenance. A steel and fibreglass flume has partially collapsed and should be removed. There is some resulting erosion. The channel below the outlet should be armoured along a 15 m. stretch with rock larger than 300 m in diameter.

8. Surface runoff shall be diverted from the crest of the dam, E end.

9. **For abandonment**, this facility requires a geotechnical inspection (annual report) and assessment of long term stability and capacity to accommodate 1:200 year 24 hour flood through a spillway structure. Recommendations shall be made in this report by a registered B.C. geotechnical engineer. Flood precipitation data shall be reviewed at this time. Seismic stability shall be reviewed for the 1:475 year. event.

Date of Inspection: ______________ Initials: LE Inspector ______________ Manager

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Parliament Buildings
Victoria
British Columbia
V8V 1X4

Rm. 105 - 525 Superior Street, Victoria, B.C. V8V 1X4

October 16, 1987

File: 18040-02-07/HB/01

Nor-Quest Resources Ltd.
Box 369
Salmo, B.C.
VOG 1ZO

Attention: Mr. Greg Carriere, Project Manager

Dear Sir:

Re: H.B. Mill Project

Attached is my inspection report for the geotechnical inspection of the tailings dam conducted September 28th. Please post a copy in the usual, conspicuous location. You should also forward a copy to your corporation headquarters.

As I had said during my inspection the white plastic sleeve of the piezometer could not be located; it will be useful when you submit your engineering report for approval of recomissioning. You will also need to sound the pond and present the results of the sounding survey along with the engineering report in order to recomission this pond. You would be wise to undertake the sounding survey and the restoration of the piezometer as soon as possible.

The placing of the coarse material on the upstream face can probably be delayed until next year, for I am not likely to conduct my next inspection until Autumn of 1988.

Yours truly,

Terrence Martin

R.T. Martin, P.Eng.,
Sr. Geotechnical Inspector

RTM:blh
Attachments:

cc: A.W. Whale, Fernie
R.A. Fyles, Victoria

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

REPORT OF INSPECTOR OF MINES

(Issued pursuant to section 4 of the *Mines Act*, 1980)

GEOTECHNICAL INSPECTION

Name of Mine: H.B. MILL

District and Location: District no.5, Nelson, near Salmo

Owner or Agent: Nor-Quest Resources Limited

Designated Manager: Greg Carriere

Date of Inspection: September 28, 1987

Person(s) attending: A. Whale, Inspector of Mines & Res. Eng.) E.M.P.R.
T. Martin, Sr. Geotechncial Inspector)
G. Carriere, Manager

Part inspected: Tailings dam

Remarks:

Sunny, warm, calm.

The usual springs at the junction of the downstream face and both the west abutment and the rock toe berm still exist, but they were severely reduced by the prolonged dry conditions this year. The piezometer on the toe berm seems to have been snapped off. Relocate and restore it if possible.

Freeboard was adequate, but undercutting of the upstream face of the dam is becoming significant. Place coarse gravel and cobble-sized protection over the affected area before my next inspection.

Although no overflow was occurring at the time, the overflow had obviously been functioning this year. However, one stoplog was jammed in the guides. Remove the jammed log to allow free overflow. Check overflow occasionally during periods of high runoff.

R.T. Martin, P.Eng.,
Sr. Geotechnical Inspector

MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES
ENGINEERING & INSPECTION BRANCH
105 - 525 SUPERIOR STREET
VICTORIA, B.C. V8V Address

Date of inspection report October 16, 19 87

HB Mine
1997

PHOTO 1

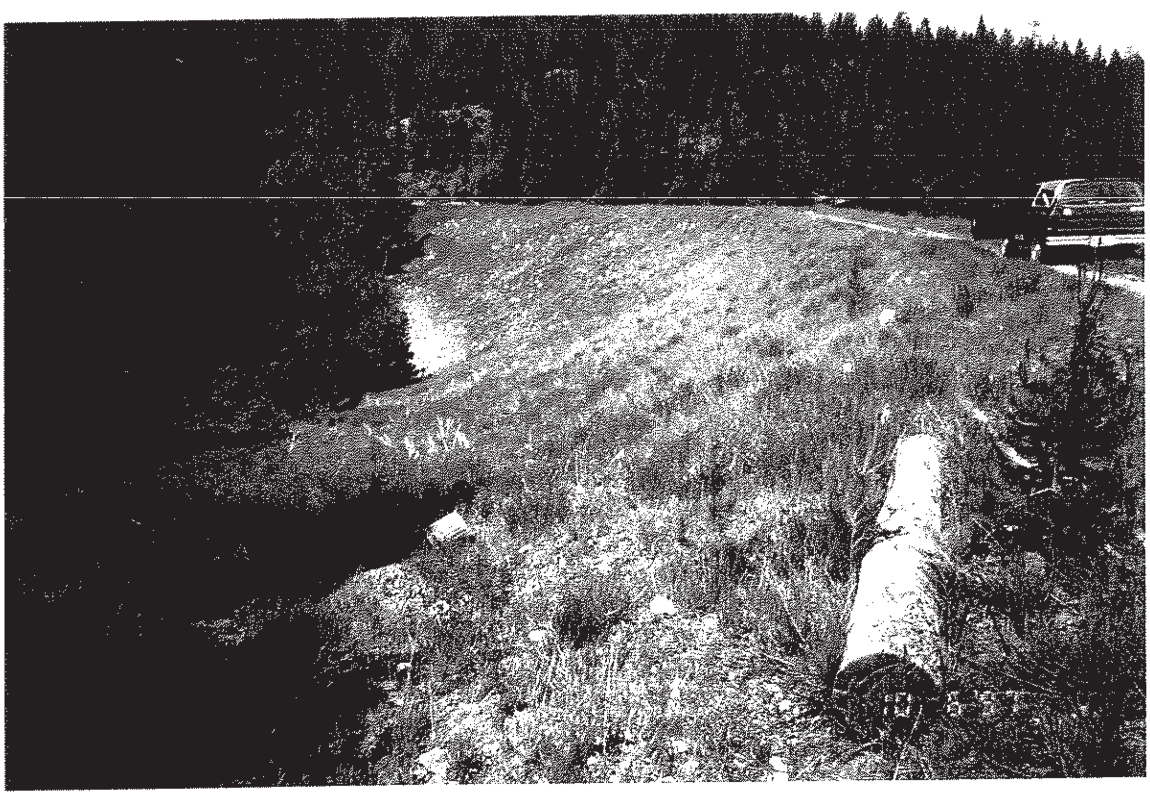


PHOTO 2

PHOTO 3

PHOTO 4

PHOTO 5

PHOTO 6

XI/18

R. T. Martin

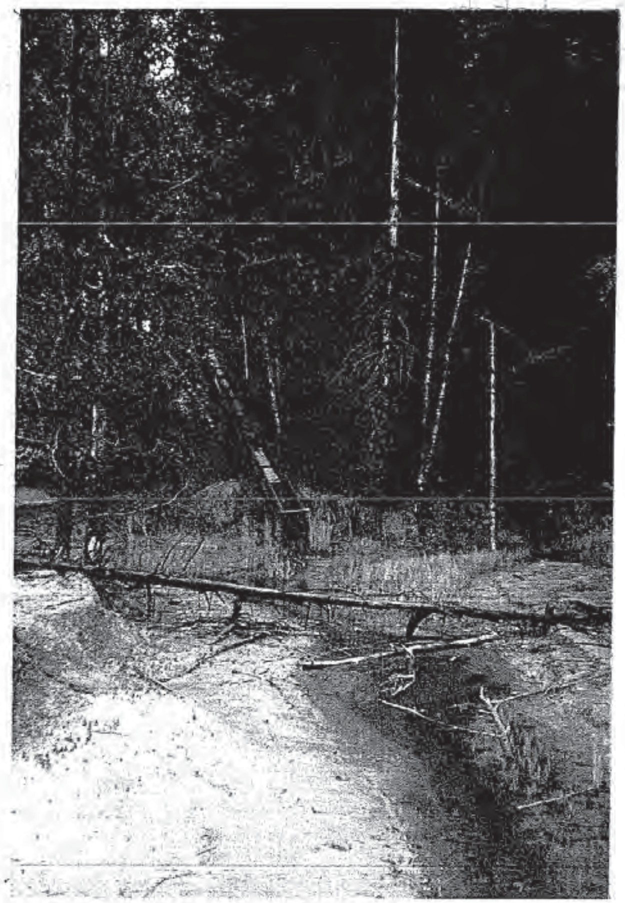


Photo 22 — View of inlet [illegible] of flume. Most of the [illegible] [illegible] up [illegible] the [illegible] [illegible] [illegible] [illegible] the background here.

Tailings Pond

Photo 23 — A view of the pond from the dam. The [illegible] is to the right on the back of the pond. [illegible] [illegible] [illegible] water [illegible] plugged the [illegible] tunnel.

July 1981

H. B. MINE

[illegible] 1 of [illegible]

H.B. Mine Sheet 2 of 3

Tailings Dam

Photo 22 – From the same spot as photo 23 but looking toward the present discharge into the concrete control box and then into a conduit through the abutment beyond the spillway into the creek gulley below the dam. Note the lush vegetation on dam

Photo 24 – Area of the reclaimed [illegible] beyond the vehicle. There is more water ponding in [illegible] in [illegible] of the [illegible] wheel tracks in the foreground.

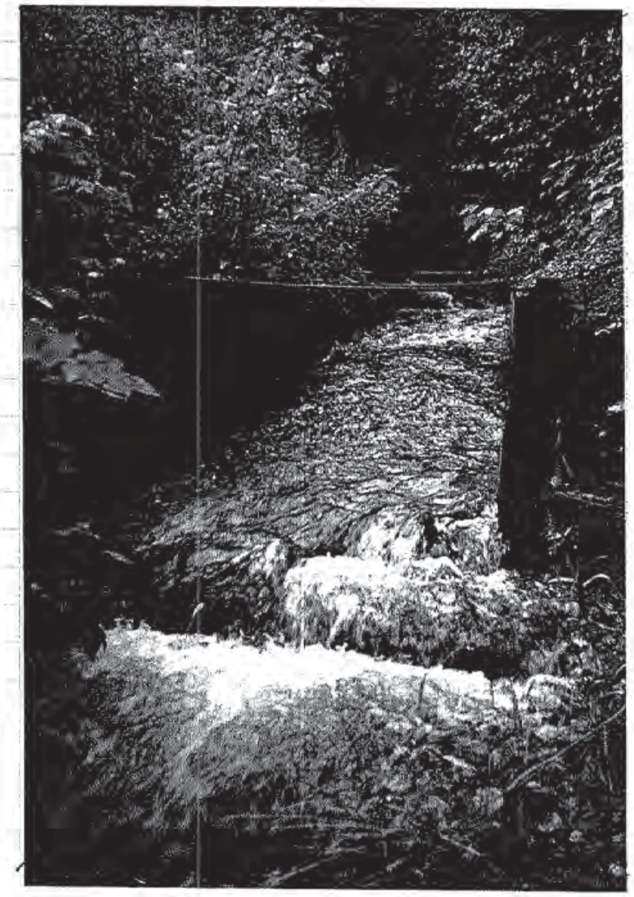


Photo 25 – The monitoring flume in the creek (a few kilometres downstream of the tailings dam [illegible] the [illegible] Deposit. This shows the quantity of water flowing through the dam [illegible] little augmenting between the dam and the flume.

HB TAILINGS DAM

May 16, 1984.

Photo 9A

A view of the dam and the pond lapping against it.

Photo 11A

A view from the dam at the pond and the beach area in the background.

Film Roll no. May B '84

by R.T. Martin.

HB TAILINGS DAM

May 16, 1984

Sheet 2/4

Photo 8 A

A view of the inlet structure. The channel leading to it is very shallow throughout most of the year, and consequently, reeds to grow in it.

Photo 16A

A view of the outlet flume with the discharge plummeting down onto fallen brush which breaks the fall and seems to dissipate the erosive energy of the moving water.

Roll no. May B'84

by R.T. Martin

HB DAM

May 16/84.

Sht 3/4

Photo 12A

The previous decanting system discharged from the protruding conduit seen near the toe of the dam.

Photo 13A

A view looking upward from the toe at the decant conduit. The grouting pipe and end plug used to plug it. No seepage can be seen either through the plug or around the conduit.

Roll May B'84

R.T. Martin

Roll May B'84

R.T. Martin

May 16/84.

HB DAM

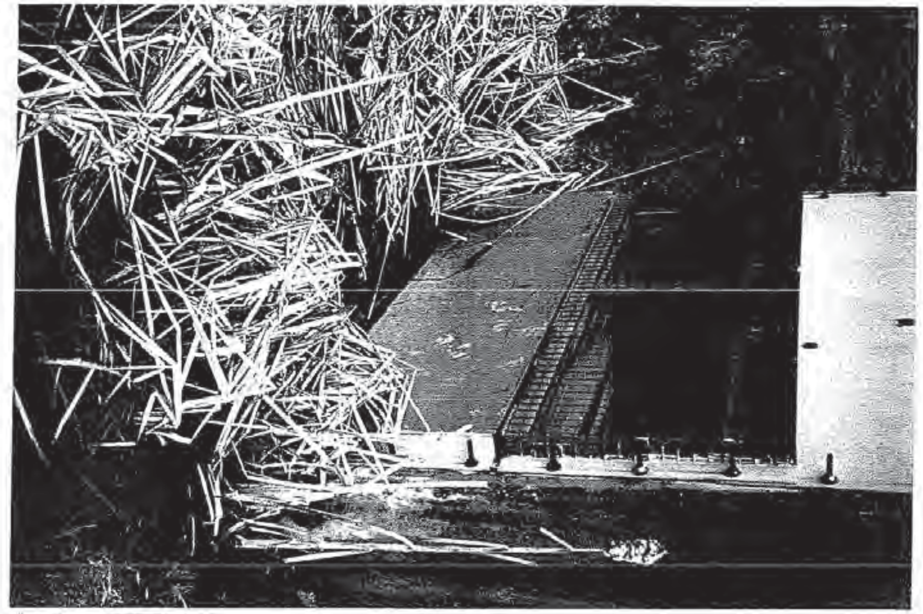
Photo 14A

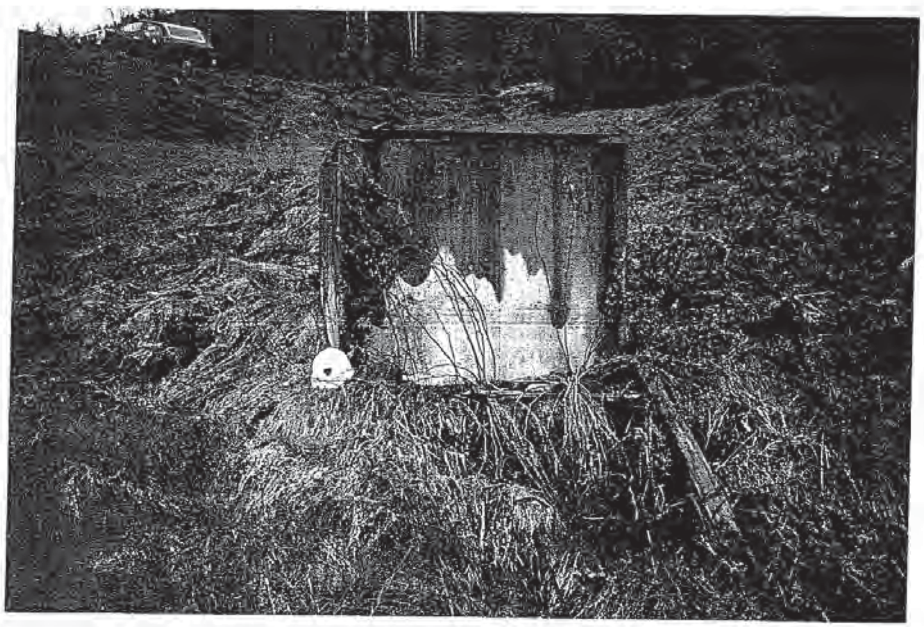
Several seepages occur at the toe. This is the most prominent one.

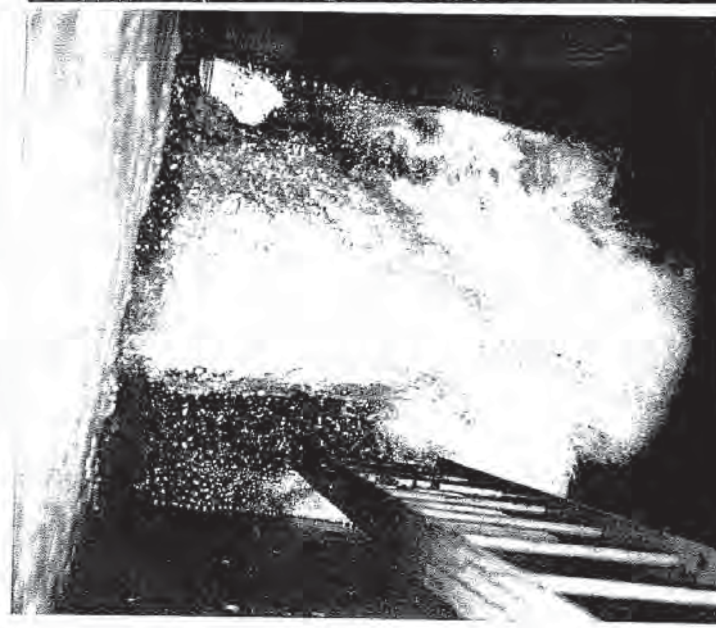
Photo 15A

A closer view of the seepage in 14A. The spring exudes right at the toe near the piezometer stand-pipe.

Inc. 4/4







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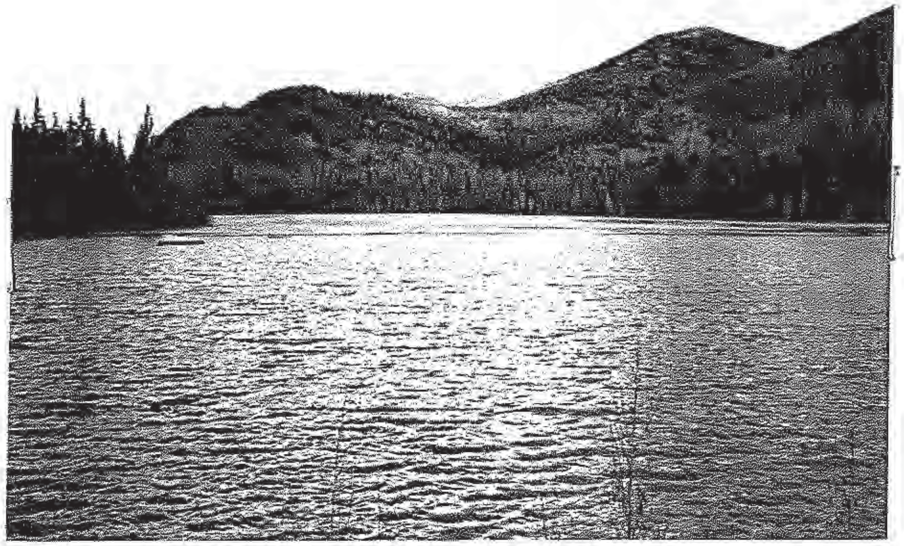
HB TAILINGS
POND

SALMO, BC



POND &
DAM

PRIOR TO MILL

START-UP 1972

←

TEST HOLE
ON DAM ℄.

BRITISH COLUMBIA

October 30, 1997
File: 18040-02-07/HB/01
x M-85

Mr. Walter Kuit
Manager, Environmental Affairs
Cominco Ltd.
200 Burrard Street
Vancouver, BC V6C 3L7

Nu-Dawn Resources Inc.
102 Piper Crescent
Nanaimo, BC V9T 3G3

Dear Sir/Madam(s):

Re: HB Mine Tailings Impoundment, Salmo, B.C.

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In summary, site conditions at HB Mine tailings impoundment have deteriorated and pose public safety and environmental hazards. The main concerns are that the impoundment was never decommissioned with a permanent spillway on closure and the current decant structure is deteriorating; the intake channel and structure are filling with debris and the discharge flume and channel on the downstream face are in need of repair. The integrity of the dam itself appears to be satisfactory except that there should be more freeboard. Overtopping and breaching of the dam or regressive erosion at the decant outlet is considered a distinct possibility in the foreseeable future.

.../2

Ministry of Employment and Investment

Regional Operations, Health and Safety Branch
Energy and Minerals Division

Mailing Address:
PO Box 9320 Stn Prov Govt
Victoria BC V8W 9N3
Telephone: (250) 952-0462
Facsimile: (250) 952-0481

Location:
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Victoria

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If you have any questions please do not hesitate to call me at (250) 952-0485 in Victoria. I would appreciate a response from you on this matter before the end of January 1998, with a plan to take appropriate action in the summer of 1998.

Yours sincerely,

Tim Eaton

Tim Eaton, P.Eng.
Manager, Geotechnical Engineering

TE/tl

cc: Ricci Berdusco
Andrew Whale

Attachments

BRITISH COLUMBIA

Province of British Columbia
Ministry of Employment and Investment

ENERGY AND MINERALS DIVISION

REPORT OF GEOTECHNICAL INSPECTOR

(Issued pursuant to Section 15 of the Mines Act)

Name of Property: HB Mine — File: 18040-02-07/HB/01

Location: Salmo

Mine Manager: n/a

Company: Cominco and Nu-Dawn
Address: as per cover letter

Persons Contacted: n/a

Type of Mining: Closed, u/g, base metal

Date of Inspection: June 10, 1997

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Tim Eaton

Tim Eaton, P.Eng.
Manager Geotechnical Engineering

Date: October 30, 1997

1800502-20/HB/01
OK to
file

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

Report of Inspector of Mines

(Issued pursuant to Section 15 of the Mines Act)

GEOTECHNICAL - EIM

Name of Mine: HB Mine

Locality: Salmo, B.C.

Owner or Operator: Nor-Quest Resources Ltd.

Address: 102 Piper Crescent Nanaimo, B.C. V9T 3G3

Manager: Mr. Raynerd Carson

Areas Inspected: Tailings Dam

Persons Contacted

Management: No one available.

The mine manager shall complete the right hand column noting specific corrective actions taken, or to be taken by a specified date, and return a copy to the Inspector within 15 days of receiving the report.

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2. Upstream slope good, beach/ wave action/ erosion minimal.	
3. Downstream slope covered with grass and alder, wet zones at toe and several seeps, but no seeps were obvious on downstream slope face. Stability looks good; no sloughs, settlements, toe drains operating.	
4. Piezometer standpipe near toe at centre of dam is dry to a depth of approx. (plumbed with small stone) 45-50 feet. Check Fig. 1 from Golder Brawner 74 report (Feb. 12, 1979 Rep# E/74/124) assume it to be BH 2 which is drawn at about 50 foot depth on the section so assume piezo is dry.	

Copies To:

Tim Eaton, P. Eng.
Geotechnical Manager

105-525 Superior St. Victoria, B.C., V8V 1X4
Address

Tim Eaton
Signature - Inspector

Signature - Manager

Date of Inspection: April 29, 1993

Dated: 19

Inspection Report	Manager's Response of Action Taken

5. Decant structure at E end looks structurally sound, flow not impeded but bullrushes growing at inlet are being drawn into structure. Large log at entrance to outlet ditch is okay and prevents other debris from passing. Inside the decant well there are 2 concrete outlet water level control beams. One is raised approx. 18" and supported entirely by 2"x2"x4" on end which are rotting. This must be removed as soon as possible. The lower beam sits on the bottom and should be removed to create additional free board between dam crest to panel level.

6. Drop structure looks sound but water has flowed out of the MH as evidenced by recent erosion and flattened grass around the MH . A 1/4" steel plate inside the MH must be removed as soon as possible. It is fastened by rusting bolts to the concrete and will block the outlet when it falls.

7. The downstream decant outlet requires maintenance. A steel and fibreglass flume has partially collapsed and should be removed. There is some resulting erosion. The channel below the outlet should be armoured along a 15 m. stretch with rock larger than 300 m in diameter.

8. Surface runoff shall be diverted from the crest of the dam, E end.

9. **<u>For abandonment</u>**, this facility requires a geotechnical inspection (annual report) and assessment of long term stability and capacity to accommodate 1:200 year 24 hour flood through a spillway structure. Recommendations shall be made in this report by a registered B.C. geotechnical engineer. Flood precipitation data shall be reviewed at this time. Seismic stability shall be reviewed for the 1:475 year. event.

Date of Inspection: ____________ Initials: LE Inspector ____________ Manager

Pages 621 through 623 redacted for the following reasons:
- -
s.3

HB Mine

→ M-85

FE

MINFILE NUMBER: **082FSW004**   NATIONAL MINERAL INVENTORY: 082F3 Zn2

NAME(S): **HB (L.12672)**, ZINCTON (L.10810), GARNET (L.10809), HB MINE   [illegible] Resources Ltd

STATUS: Past Producer   Underground   MINING DIVISION: Nelson
REGIONS: British Columbia
NTS MAP: 082F03E   UTM ZONE: 11 (NAD 27)
LATITUDE: 49 09 08 N   NORTHING: 5444177
LONGITUDE: 117 11 55 W   EASTING: 485516
ELEVATION: 1220 Metres
LOCATION ACCURACY: Within 500M
COMMENTS: West of Aspen Creek and about 1.5 kilometres north of Sheep Creek.

COMMODITIES: Lead, Zinc, Silver, Cadmium, Copper, Gold, Talc

MINERALS

SIGNIFICANT: Pyrite, Sphalerite, Galena, Pyrrhotite, Anglesite, Smithsonite, Spencerite
ASSOCIATED: Dolomite, Talc, Calcite
ALTERATION: Dolomite, Silica, Talc, Anglesite, Tremolite
COMMENTS: The northern area is oxidized to a depth of 100 metres.
ALTERATION TYPE: Carbonate, Silicific'n, Oxidation
MINERALIZATION AGE: Unknown

DEPOSIT

CHARACTER: Stratabound, Massive, Shear
CLASSIFICATION: Sedimentary, Exhalative, Industrial Min.
TYPE: E12 Mississippi Valley-type Pb-Zn   E13 Irish-type carbonate-hosted Zn-Pb
J01 Polymetallic manto Ag-Pb-Zn
SHAPE: Tabular
MODIFIER: Faulted, Sheared
DIMENSION: 140 x 30 Metres   STRIKE/DIP: TREND/PLUNGE: 090/
COMMENTS: Shape of deposit is also bladed. Best mineralization occurs at junction of steeply dipping and flat lying shears. The dimensions of the largest and most easterly ore zone.

HOST ROCK

DOMINANT HOST ROCK: Sedimentary

STRATIGRAPHIC AGE	GROUP	FORMATION	IGNEOUS/METAMORPHIC/OTHER
Lower Cambrian	Undefined Group	Laib	

LITHOLOGY: Limestone
Dolomite
Siliceous Limestone
Argillite
Diabase Dike

HOST ROCK COMMENTS: The orebodies occur in limestone of the Reeves Member which is correlative with rocks of the Badshot Formation.

GEOLOGICAL SETTING

TECTONIC BELT: Omineca   PHYSIOGRAPHIC AREA: Selkirk Mountains
TERRANE: Kootenay

INVENTORY

ORE ZONE: HB

CATEGORY: Combined   YEAR: 1978
QUANTITY: 36287 Tonnes

COMMODITY	GRADE
Lead	0.1000 Per cent
Zinc	4.1000 Per cent

COMMENTS: Measured and indicated ore.
REFERENCE: Energy, Mines and Resources Canada, Mineral Bull. MR 198, page 209

CAPSULE GEOLOGY

The HB orebodies are currently thought to be Kootenay Arc-type carbonate hosted sedimentary exhalative (sedex) deposits. The orebodies are located within dolomitized limestone of the Lower Cambrian Laib Formation, Reeves Member (correlative with limestone of the Badshot Formation). The east boundary of the Laib Formation is in contact with argillites of the Lower to Middle Ordovician Active Formation, on a fault contact, with the Active rocks overthrust from the east over the Reeves rocks.

Two distinct calcareous layers of the Reeves Member can be recognized in the area, an upper one about 110 metres thick separated from a lower 12 metre member by 15 to 30 metres of micaceous brown limey argillite. The HB orebodies occur within a hundred metres or

CAPSULE GEOLOGY

so to the west of the thrust fault. It is thought that the mineralization is related to the intrusion of granitic stocks of the Middle to Late Jurassic Nelson Intrusions with the nearest outcrop about 1 kilometre away from the mine. The only intrusives present in the mine are post-ore diabase dykes up to 3 metres thick.

In the vicinity of the HB mine, the beds are folded into a broad synclinorium, and the limestone layers in the mine are on the west limb of this structure. There is evidence of much isoclinal folding within the trough of the synclinorium, with axial planes steeply inclined to the east and folds plunging 20 degrees to the south. There may be similar folding along the west limb within the mine area, but the portions of the folded beds revealed by the mine workings indicate that here the limestone has only formed thickened wrinkles. Within these wrinkles the beds are highly distorted by complex folding. In the central portion of the structures there is cleavage banding which strikes north and dips steeply. The primary folding is disturbed by major crossfolding in at least two places, one at the north end of the mine, the other just south of the main orebodies. The crossfolds plunge steeply to the north and resemble "S" type dragfolds.

The principal ore zones consist of three steeply dipping, parallel zones lying approximately side by side and extending as pencil-like shoots for about 900 metres along the gentle south plunge of the controlling structures. The largest and most easterly ore zone has a maximum height of about 140 metres and a maximum width of 30 metres. Within these zones are steeply dipping discontinuous ore stringers with a lead to zinc ratio of 1:5.

In addition to the steep stringer lodes there is a second type consisting of flat lying, slightly brecciated zones with a lead to zinc ratio of about 1:2.5. These zones plunge at 20 degrees to the south, in general agreement with the plunge of the other orebodies. There are several separate ore zones of the flat lying variety. The layers of ore range from a few metres to 12 metres in thickness, but are generally from 3 to 4.5 metres thick. The sulphide mineralization within these layers is fairly regular and resembles bedding.

There is evidence to indicate ore deposition was controlled by shear zones within the folded limestone; the best ore concentrations occurring at the junctions between steeply dipping shears (the pencil-like ore bodies) and flat lying shears (the flat-lying brecciated orebodies).

The mineralogy of the ore is relatively simple with pyrite, sphalerite and galena in order of abundance and minor pyrrhotite found locally. The northern portion of these bodies is exposed at surface, near the original HB claim, and are oxidized to a depth of about 100 metres at that point. Where the ore is protected by enclosing dolomite relatively little oxidation has occurred. Other secondary minerals include calamine, smithsonite, anglesite, and the rare zinc phosphate, spencerite.

Wallrock alteration is typical of lead-zinc deposits in the area. The ore zones are enveloped by a broad zone of dolomitization which is bordered along its contact with the limestone by a narrow zone in which limestone is replaced by fine-grained silica. Talc and tremolite alteration, thought to be pre-ore, is concentrated near the silica-rich zone resulting from the silicification of dolomite. An appreciable amount of talc is found locally within the ore zone.

A smaller zone, located to the southwest of the main HB mine, is known as the Garnet orebody (082FSW249). The Garnet zone was mined from the surface from a small open pit, whereas the main mine is entirely underground.

The HB mine produced a total of 6,656,101 tonnes of ore in 29 years between 1912 and 1978. Recovered from this ore were 29,425,521 grams of silver, 49,511,536 kilograms of lead, 260,431,646 kilograms of zinc, 2,019,586 kilograms of cadmium, 105,412 kilograms of copper and 6,159 grams of gold. Measured and indicated reserves published December 31, 1978 by Canadian Pacific Limited were given as approximately 36,287 tonnes grading 0.1 per cent lead and 4.1 per cent zinc (Energy, Mines and Resources Canada Mineral Bulletin MR 198, page 209).

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DATE CODED: 850724	CODED BY: GSB	FIELD CHECK: N
DATE REVISED: 910218	REVISED BY: GJP	FIELD CHECK: N

MINFILE NUMBER: 082FSW004 NAME: HB (L.12672) STATUS: Past Producer

Production Year	Tonnes Mined	Tonnes Milled	Commodity	Grams Recovered	Kilograms Recovered
1978	200,888	200,888	Silver	827,713	
			Cadmium		67,298
			Lead		1,451,180
			Zinc		8,381,566
1977	357,256	357,256	Silver	996,696	
			Cadmium		95,893
			Copper		615
			Lead		1,931,566
			Zinc		12,593,518
1976	374,163	374,163	Silver	937,071	
			Gold	684	
			Copper		274
			Lead		2,036,925
			Zinc		12,796,512
1975	411,084	411,084	Silver	1,130,314	
			Gold	622	
			Lead		1,666,762
			Zinc		12,480,257
1974	232,348	232,348	Silver	1,024,004	
			Gold	498	
			Cadmium		58,068
			Lead		2,089,780
			Zinc		7,843,388
1973	319,039	319,039	Silver	1,312,391	
			Gold	871	
			Cadmium		94,802
			Lead		2,805,817
			Zinc		12,031,747
1966	352,804	352,804	Silver	1,344,427	
			Cadmium		113,539
			Lead		3,139,705
			Zinc		14,781,827
1965	376,743	376,743	Silver	1,733,339	
			Cadmium		149,146
			Lead		4,243,461
			Zinc		18,417,332
1964	433,451	433,451	Silver	2,115,533	
			Cadmium		156,051
			Lead		2,855,168
			Zinc		18,996,984
1963	429,921	429,921	Silver	2,132,297	
			Cadmium		158,721
			Lead		2,993,875
			Zinc		18,736,025
1962	425,448	425,448	Silver	1,866,273	
			Cadmium		147,567
			Lead		3,291,149
			Zinc		18,410,012
1961	428,852	428,852	Silver	2,259,664	
			Cadmium		168,769
			Lead		3,314,291
			Zinc		20,038,427
1960	421,302	421,302	Silver	2,244,330	
			Cadmium		149,015
			Lead		3,591,335
			Zinc		17,562,315
1959	420,482	420,482	Silver	2,153,416	
			Cadmium		156,841
			Lead		3,295,966
			Zinc		18,951,716
1958	415,682	415,682	Silver	2,582,295	
			Cadmium		160,211
			Lead		3,768,843
			Zinc		18,490,324

MINFILE NUMBER: **082FSW004** NAME: **HB (L.12672)** STATUS: Past Producer

Production Year	Tonnes Mined	Tonnes Milled	Commodity	Grams Recovered	Kilograms Recovered
1957	409,484	409,484	Silver	2,485,192	
			Cadmium		141,370
			Lead		3,037,483
			Zinc		16,782,771
1956	394,900	394,900	Silver	2,312,508	
			Cadmium		126,691
			Lead		2,565,979
			Zinc		14,484,983
1955	224,348	224,348	Silver	814,401	
			Cadmium		75,604
			Lead		1,145,482
			Zinc		6,206,890
1950	2,610		Silver	404,930	
			Lead		350,015
			Zinc		676,804
1949	8,083		Silver	347,887	
			Lead		280,583
			Zinc		639,627
1927	595		Silver	49,205	
			Gold	187	
			Lead		137,876
			Zinc		20,275
1924	27		Silver	2,084	
			Lead		6,571
1919	34		Silver	4,230	
			Lead		13,043
1917	1,363		Zinc		445,566
1916	5,914		Lead		87,742
			Zinc		1,573,974
1915	4,706		Silver	3,173	
			Lead		9,440
			Zinc		1,418,470
1914	2,193		Silver	200,988	
			Lead		476,767
			Zinc		150,593
1913	1,708		Silver	179,277	
			Lead		429,688
1912	673		Silver	80,028	
			Lead		161,806

SUMMARY TOTALS: 082FSW004 NAME: HB (L.12672)

		Metric		Imperial	
	Mined:	6,656,101	tonnes	7,337,095	tons
	Milled:	6,628,195	tonnes	7,306,334	tons
Recovery:					
	Silver:	31,543,666	grams	1,014,151	ounces
	Gold:	2,862	grams	92	ounces
	Cadmium:	2,019,586	kilograms	4,452,424	pounds
	Copper:	889	kilograms	1,960	pounds
	Lead:	51,178,298	kilograms	112,828,802	pounds
	Zinc:	272,911,903	kilograms	601,667,585	pounds

Comments:

1978: Production ceased Aug. 17.

BRITISH COLUMBIA

Ministry of Environment, Lands and Parks

Crown Land Registry Services
Office of the Surveyor General

MINISTRY OF EMPLOYMENT AND INVESTMENT
REC'D SEP 22 1997

MEMORANDUM

To: Theresa Leonard
Mines Branch
Ministry of Employment and Investment
Victoria, British Columbia

Date: September 19, 1997

File: 10450-02-004

Job No. 151897

As discussed with Tim Eaton September 19, 1997, enclosed please find cut sheets of official plans 18 Tray 17 and 7 Tray 6 along with copies of the survey plans for District Lots 966, 1221 and 1244, Kootenay District.

No charges were incurred in completing this order.

for Brendan J. Feary
Manager
Registry Management Section

BAM:pd
bcgeu

Enclosure

BRITISH COLUMBIA

FAX COVER SHEET

PROVINCE OF BRITISH COLUMBIA

MINISTRY OF EMPLOYMENT AND INVESTMENT

ENERGY AND MINERALS DIVISION

MINES BRANCH

Location: 5th Floor, 1810 Blanshard Street
Address: PO Box 9320, Stn. Prov. Gov't, V8W 9N3
Victoria, B.C.

Phone: (250) 952-0486 **Fax: (250) 952-0481**

DATE SENT: Sept ~~11~~ 17, 1997

TO: Bev Morton
Crown Land Registry Services

FAX NUMBER: 387-1830

FROM: Theresa

COMMENTS: Bev, As disc[illegible] [illegible] I would like to know who owns [illegible] for the following properties and their [illegible] [illegible] number [illegible]
Lot 1244, 1221 and 966 as attached.

Would it be possible to get a map of these areas as well?

NUMBER OF PAGES INCLUDING COVER SHEET: 2

Page 631 redacted for the following reason:
- -
Not Responsive

BRITISH COLUMBIA

Province of British Columbia

Ministry of Employment and Investment

Energy and Minerals Division

Fifth Floor
1810 Blanshard Street
Victoria
British Columbia
V8V 1X4
Fax: (250) 952-0481

Facsimile Cover Sheet

To: Barry Baldigara

Company:

Phone:

Fax: (250) 352-9300

From: John Errington

Ministry: Employment and Investment
Energy and Minerals Division

Phone: (250) 952-0470

Fax: (250) 952-0481

Date: 6/18/97

Pages including this cover page: 8

Original will be mailed: Yes ✓ No

Comments:

H. B. Mine

jce-fax

BRITISH
COLUMBIA

Ph: (250) 952-0475

June 17, 1997

File: M-85
14675-35-04

Mr. B. Baldigara
Secretary, Assistant Administrator
Regional District of Central Kootenay
601 Vernon Street
Nelson, B.C.
V1L 4E9

Dear Mr. Baldigara:

Re: H.B. Mine Tailings Impoundment

I have been asked to reply to your May 15, 1997 letter to Andrew Whale, Regional Manager, Ministry of Employment and Investment, regarding possible future liabilities associated with the H.B. tailings impoundment.

Status of Permits Covering the Tailings Impoundment

The mine is regulated under the Mines Act.

The mine, including the tailings impoundment, is covered by Permit M-85 issued to Cominco Ltd. (copy attached). However, they sold this property to David Minerals [redacted] and the last record we have of an owner is Nu-Dawn Resources.

Over the years, in spite of numerous attempts to get the new owner to assume the responsibilities of the permit, Cominco still remains the permittee.

Cominco carried out considerable research in the early 1970's to determine the feasibility of establishing vegetation directly on the tailings material, and to determine the metal uptake in plants. That information is stored off-site and I do not have that information immediately available. I don't recall any major issues, however.

I could not find a closure plan and I don't believe that one was ever filed.

...2

Dam Safety

I have included Part 9 of our Health, Safety and Reclamation Code for Mines in British Columbia (Code). The owner and permittee have not satisified the requirements of part 9.2.4, 9.3.2 and 9.3.5 The obligations in this regard should be discussed with Tim Eaton, P.Eng., Manager, Geotechnical Engineering. At present there are no significiant dam safety issues, however some work is required.

Should the Regional District purchase this property, the tailings impoundment would still be regarded as part of a mine, albeit a closed mine, and regulated under the Mines Act. As such, there would still be requirements for maintenance, periodic inspections and monitoring. These requirements would likely not be onerous, however.

Contamination Level of the Liquid and Solid in the Tailings

This a potential concern especially in relation to the new Contaminated Sites Provisions of the Waste Management Act. Our own internal review several years ago made a preliminary assessment of acid rock drainage potential of these tailings and it was felt that the abundance of limestone which hosted this ore deposit was likely sufficient to prevent sulphide oxidation, and acid mine drainage from occurring. This needs to be confirmed through samples of tailings and seepage from the impoundment. If there is any metal release, it will be associated with neutral to alkaline drainage.

If you have any further questions or concerns, please do not hesitate to call either myself (250) 952-0470 or Tim Eaton (250) 952-0485.

Yours very truly,

Carol Howell

for John C. Errington, Ph.D., P.Ag.
Manager, Reclamation and Permitting

JCE:ch
Encl.

cc: Andrew Whale, Cranbrook
Tim Eaton
Fred Hermann

let-hb

Pages 635 through 636 redacted for the following reasons:
- -
Not Responsive

M-85

I N T E R O F F I C E   M E M O R A N D U M

Created: 03-Sep-1996 07:31am PDT
Sent: 03-Sep-1996 07:39am PDT
From: Andrew Whale of EI
AWHALE
Title. Regional Manager, Kootenay
Dept: Employment & Investment
Tel No: 426-1653

TO: John Errington of EI (JERRINGTON)

CC: Tony Milligan ~~of EI~~ (TMILLIGAN)
CC: Tim Eaton ~~of EI~~ (TEATON)

Subject: RE: HB, mine

I've recently raised the HB issue with Bruce Donald who Cominco have tasked to look after all their old canadian properties. so let's hope that they take some action.

the tailings dam is a major liability. although it was well constructed and is currently in good shape [perhaps a little wave damage], it is not ready to be abandoned. spiggoting took place away from the dam and water level is controlled by a lareg decant . there is no spillway or other long term means of controlling the water level when the decant stops functioning [which it will do some day]

the major issue is, should we let cominco off the hook. if yes then any company can sell their exhausted mine and escape reclamation obligations. successive owners of the hb property have no money or security

andrew

Pages 638 through 639 redacted for the following reasons:
- -
Not Responsive

YC.S

I N T E R O F F I C E   M E M O R A N D U M

Created: 29-Aug-1996 09:35am PDT
Sent: 29-Aug-1996 09:38am PDT
From: John Errington of EI
JERRINGTON
Title. Reclamation Manager
Dept: Employment & Investment
Tel No: 952-0470

TO: Andrew Whale of EI (AWHALE)
TO: Tony Milligan of EI (TMILLIGAN)

Subject: HB, mine

Michael Hardin, lawyer for Cominco was here yesterday looking through the HB file (not the main purpose of the visit), and I let him know that they still were the permittee even though they sold the property many years ago.

They may write a letter saying they want out.

Our remedies with respect to Cominco are not clear. We still need to go after the present owner and try to get them to transfer the permit into their name.

I N T E R O F F I C E   M E M O R A N D U M

Created: 16-May-1996 12:54pm PDT
Sent: 16-May-1996 12:59pm PDT
From: Steve Wuschke of EI
SWUSCHKE
Title:
Dept: Employment & Investment
Tel No: 426-1655

TO: Andrew Whale of EI (AWHALE)

CC: Tony Milligan of EI (TMILLIGAN)
CC: John Errington of EI (JERRINGTON)
CC: Art O'Bryan of EI (AOBRYAN)

Subject: RE: M-~~58~~ 85, HB Mine

HB Mill

Just for the record I have inspected the mill (several yrs. ago) and I am concerned about the foundations for the leach tanks in the "new" expansion. I do not think that any permits should be let until an engineer inspects the tanks and thier foundations. My concern is that the foundations will not be able to bear the load and the tanks may quite possibly topple and spill cyanide laced leachate, with the possibility of serious injury and environmental damage.

Steve W.

I N T E R O F F I C E   M E M O R A N D U M

Created: 16-May-1996 10:13am PDT
Sent: 16-May-1996 10:22am PDT
From: Andrew Whale of EI
AWHALE
Title: Regional Manager, Kootenay
Dept: Employment & Investment
Tel No: 426-1653

TO: Tony Milligan of EI (TMILLIGAN)

CC: John Errington of EI (JERRINGTON)
CC: Art O'Bryan of EI (AOBRYAN)
CC: Steve Wuschke of EI (SWUSCHKE)

Subject: RE: M-~~58~~ 85, HB Mine

Tony,

you should also discuss this with steve as he has intimate knowledge of the site and problems

BF June 30/96

I N T E R O F F I C E   M E M O R A N D U M

Created: 15-May-1996 03:23pm PDT
Sent: 15-May-1996 03:34pm PDT
From: John Errington of EI
JERRINGTON
Title: Reclamation Manager
Dept: Employment & Investment
Tel No: 952-0470

TO: Tony Milligan of EI (TMILLIGAN)

CC: Andrew Whale of EI (AWHALE)
CC: Art O'Bryan of EI (AOBRYAN)

Subject: ~~M-58~~ m-85, HB Mine

This mine has not operated for many years but is still on our books. Permit M-85 was last issued in November 1978 to Cominco Ltd. and not long after sold to David minerals who were given permission to work by [redacted] S22 (unknown to us) and who subsequently went broke. The last thing in the file was an attempt to issue a permit to Nu-dawn Resources with an increase in security to $110,000. I would really like to have this permit transferred into the new owner's name and some agreement on responsibility, then we can get Cominco out of it.

Under no circumstances should any work be allowed on the property either in removal of assets or exploration, until we get the permit sorted out.

Suggest you discuss this file with Art as he has a long history with it.

FAX to Tony Milligan August 12/96

As we discussed, pls try to get to this by fall.

JCE

FAX then file

I N T E R O F F I C E   M E M O R A N D U M

Created: 15-May-1996 03:23pm PDT
Sent: 15-May-1996 03:34pm PDT
From: John Errington of EI
JERRINGTON
Title: Reclamation Manager
Dept: Employment & Investment
Tel No: 952-0470

TO: Tony Milligan of EI (TMILLIGAN)

CC: Andrew Whale of EI (AWHALE)
CC: Art O'Bryan of EI (AOBRYAN)

Subject: M-58, HB Mine

This mine has not operated for many years but is still on our books. Permit M-85 was last issued in November 1978 to Cominco Ltd. and not long after sold to David minerals who were given permission to work by [redacted] (unknown to us) and who subsequently went broke. The last thing in the file was an attempt to issue a permit to Nu-dawn Resources with an increase in security to $110,000. I would really like to have this permit transferred into the new owner's name and some agreement on responsibility, then we can get Cominco out of it.

Under no circumstances should any work be allowed on the property either in removal of assets or exploration, until we get the permit sorted out.

Suggest you discuss this file with Art as he has a long history with it.

Pages 645 through 646 redacted for the following reasons:
- -
s.3

.NERAL RESOURCES DIVISION
RESOURCE MANAGEMENT BRANCH

MINISTRY OF ENERGY, MINES & PETROLEUM RESOURCES.
REC'D MAR 0 5 1993
NELSON, B.C.

NOTICE OF WORK AND RECLAMATION PROGRAM ON A MINERAL PROPERTY

1. NAME OF PROPERTY: NU-DAWN RESOURCES INC. H. B. SITE

Previous Annual Work Approval Number (applicable only to those properties previously worked)
(ie. SMI91-0100500-123)

Reclamation Permit Number, if previously issued (may be several years old)

Name of Claims: ADA #DL14388, Legal Tender MC L10823/ Tailings Pond SL.36 DL1236

2. LOCATION: Is any part of this Property in a Recreation Area or Park? ___Yes _x_No

Are any of the surface rights of this property privately owned? _x_Yes ___No (Operator responsible for contacting owner)

Name and address of private land owner:

Mining division: Nelson District All NTS map sheets (ie. 094L/02E)

Latitude: 49 ° 08 ' Longitude: 117 ° 10 ' Minfile No. (if known)

Access route (from nearest town to property): From Salmo, B. C. east on Airport Rd. to Sheep Creek Rd., North on Sheep Creek Rd. to Nu-Dawn sign then up hill to Mine.

3. OPERATOR/AGENT (Person or Company controlling property on behalf of the owner):

Name: NU-DAWN RESOURCES INC. Telephone No.: 604-357-2222

Company contact person: Jim Wadsworth Fax No.: 604-357-2516

Address Box 369 City Salmo

Province British Columbia Postal Code: VOG 1Z0

Signature of Operator/Agent: [signature] Date: March 6, 1993

4. OWNER: (Title Holder)

Name: NU-DAWN RESOURCES INC. Fax No: 604-756-0298

Address 102 Piper Crescent City Nanaimo

Province British Columbia Postal Code: V9T 3G3 Telephone No: 604-756-0291

Signature of Owner (or letter of Authorization from Owner): [signature] Date: March 6/93

5. NAME OF MANAGER: J. Wadsworth Manager's Telephone No.: 604-357-2222

(Person responsible for management and operation of property)

To whom does the Branch send correspondence regarding this notice? ___Owner _x_Operator

NEL 93 - 0500032 - 789

6. **DURATION:** Duration of work: From ......March 6, 1993...................... To..August 31, 1994..................

7. **EXPLORATION WORK** (Brief Description, if applicable)

Blasting .... Geophysical ....

Geochemical .... Clearing Trees ....

Prospecting .... Geological ....

Line cutting (distance, width, method) ....

Campsite: Length: .... m Width: .... m Area .... m^2

If Blasting, give details of explosives, magazines, etc. ....

Give number of existing explosives storage permit .... Name of Blaster: ....

8. **WATER SUPPLY** (subject to approval under the *Water Act*)

Describe the source of water supply ....

Pump size: .... " Capacity ....c.f.s. Location of water intake (show on plan) ....

9. **WASTE WATER TREATMENT** (subject to approval under the *Waste Management Act*) including disposal of drilling mud and sludge.

Describe treatment and disposal facilities (size of settling pond, recycling, distance to nearest stream, etc). Show on plan.

....

....

10. **ESTIMATED NUMBER OF WORKERS ON SITE** (including Contractors):........7.................

11. **EQUIPMENT LIST**

Note: all motorized equipment to comply with the Mining Code

Number and Type	Size/Capacity	Number and Type	Size/Capacity
a)	....	e)	....
b)	....	f)	....
c)	....	g)	....
d)	....	h)	....

12. **FIRST AID FACILITIES** (Must comply with W.C.B. Regulations)

Describe methods of communication, emergency transportation, and type of first aid kit....Phone, ½-Ton Pick-Up with.....

..........Canopy, First Aid Kit #2, 1 Stretcher, First Aid Room on Site..............................

Location of nearest hospital: ...Nelson, B.C........ Travel time to hospital: ....35 Minutes..............................

13. SURFACE DISTURBANCE OFF MINERAL CLAIMS

Campsite: # of people.................. Length: ....m Width: ....m Area .... m²

Road access construction: Total length: .... m Approximate width: .... m Area: .... m²

Other (specify) ....

14. SURFACE DISTURBANCE ON MINERAL CLAIMS

(a) Settling ponds: #. .... Length .... m Width: ....m Area: .... m²

(b) Road construction: Total length .... m Width: ....m Area: .... m²

(c) Drilling: # of sites: .... Depth: .... Length: .... m Width: ....m Area: .... m²

(d) Trenching # of trenches: .... Depth: .... Length: .... m Width: ....m Area: .... m²

(e) Test pits: # of pits: .... Depth: .... Length: .... m Width: ....m Area: .... m²

(f) Campsite: # of people .... Length: .... m Width: ....m Area .... m²

(g) Underground work: area of surface disturbance Length: .... m Width: ....m Area: .... m²

(h) Rock dumps: area of surface disturbance Length: .... m Width: ....m Area: .... m²

(i) Other: describe: Area: .... m²

TOTAL SURFACE AREA DISTURBED ON MINERAL CLAIMS THIS YEAR: .... m²

PRIOR DISTURBANCE ON CLAIM .... m² PLANNED RECLAMATION THIS YEAR: .... m²

BALANCE OF UNRECLAIMED DISTURBANCE AT THE END OF PROJECT THIS YEAR:.................. m²

15. PRESENT STATE OF LAND ON WHICH WORK IS PROPOSED

Present land use:...Caretakers..for..Security.of.Plant.................. Type of vegetation:.............................

Access roads (present use and condition) ...Roads..are..in..good..condition,..Access..for.Caretakers.................

Old workings (location, condition).......N/A.......Adits..closed..with..doors..

16. RECLAMATION PROGRAM: Proposed use of land after reclamation: ..Recreation and Housing..........................

Describe protective measures and proposed site reclamation methods with reference to the items listed below.

Topsoil handling (where applicable): ...Topsoil..to..be..put..over..old..mill..bases..and..other..buildings removed.

Camp sites: 7..Houses..to..be..left..for..new..owners..to..do..with..whatever..they..plan.. and sheds and office, warehouse.

Trenches, drill sites, major excavations: ....Glory..Hole..above..mill..site,..new..chain..link..fence to be put around complete opening.

Roads: ......Roads..are..in..good..condition...

Revegetation of disturbed areas:..

Waste dumps: ....

Adits.....Both..adits..to..be..filled..in..with..drill..core..and..topsoil..put..over..adits.........................

Drill core storage ..Core..storage..building..to..be..taken..down,..core..put..into..adits...........................

Other:..Concentrator,..Leach..Plant,..Refinery,..Oil..Storage..Shed,..Mine..Dry,..Compressor..Shop,.....

..Mine..Shop,..Machine..Shop,..All..to..be..taken..down,..all..machinery..removed..from..property,........

Tailings Dam...we will place coarse material on the upstream face as required by Geotechnical Inspector, R. T. Martin.

17. URANIUM/THORIUM

Is any part of this property designated as a Uranium/Thorium area? ___Yes _x_ No

If yes - has a survey been completed? ___Yes ___No

Note: if underground exploration or development is contemplated, an additional 'Underground Exploration Work Application for Approval' form must be completed.

This application will be returned if it is not accompanied by a legible map showing location of claim posts, property boundaries, location of property, access to property, location of work areas, roads, watercourses, proposed grid layouts, camps and other surface facilities. Preferred maps are: a)1:50,000 topographic maps; b)claim maps; c)detailed map of area disturbed; or as required by the District Manager.

Page 651 redacted for the following reason:
- -
Not Responsive

Province of British Columbia

Ministry of Energy, Mines and Petroleum Resources

MEMORANDUM

Tel: 354-6125 Fax: 354-6120

To: Art O'Bryan
Inspector of Mines (Reclamation)

March 17, 1993

Re: Acid Generation Potential at the H.B. Mine Site

I do not have any personal familiarity with the current situation at the abandoned H.B. mine/mill site but have reviewed several geological descriptions of the orebodies and their setting.

All mineralization at the H.B. occurs within dolomite and limestone with minor zones of calcareous quartzite and calcareous argillite associated. All of these host rock types are carbonates or are carbonate-bearing. Pyrite is reported to be the most abundant sulphide in the ore zones but, on a mine scale, it is probably still much less abundant than the total of carbonate minerals. The No. 1 orebody is reported to have been weathered to a depth of about 100 metres meaning that the pyrite in that part of the mine would have been converted by oxidation to limonite prior to any mining. All of this information infers very strongly that any exposed rock within the mine workings or on surface will be acid-consuming due to the predominance of carbonate gangue and host rock. Likewise any waste rock or mill tailings can reasonably be expected to be acid-consuming. The only situation which might lead to possible acid generation on the site would be where sulphide concentrate containing the original high proportion of pyrite had been left behind. If no piles of sulphide concentrate are found, there should be no concern about significant acid generation on the site.

H. Paul Wilton

H. Paul Wilton, P. Eng.
District Geologist
Nelson

DRAFT

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

AMENDMENT TO RECLAMATION PERMIT
(Issued pursuant to section 10(6) of the **Mines Act** S.B.C. 1989)

Permit **M-85**

Issued to **NU-DAWN RESOURCES INC.**
102 Piper Crescent
Nanaimo, B.C.
V9T 3G3

for reclamation of surface work located at the:

H.B. MINE, SALMO

is hereby revised subject to the appended conditions.

Amended at Victoria, British Columbia, this 6th day of April in the year 1993.

R.A. Fyles, P. Eng.
Chief Inspector of Mines

DRAFT

PREAMBLE

An application to amend Reclamation Permit M-85 dated March 5, 1993, from Dr. John C. Errington, an inspector appointed pursuant to section 5 of the Mines Act was filed with the Chief Inspector of Mines on April 6, 1993.

This permit contains the requirements of the Ministry of Energy, Mines and Petroleum Resources for reclamation. It also is compatible, to the extent possible, with the requirements of other provincial ministries for reclamation issues. The amount of security required by this permit and the manner to which this security may be applied, will also reflect the requirements of those ministries. However, nothing in this permit limits the authority of other provincial ministries to set other conditions, or to act independently, under their respective permits and legislation.

Decisions made by staff of the Ministry of Energy, Mines and Petroleum Resources will be made in consultation with other Ministries.

AMENDMENTS

The Chief Inspector of Mines (Chief Inspector) of Energy, Mines and Petroleum Resources hereby approves the amended program for protection and reclamation of the land surface and watercourses affected by the mine subject to compliance with the following terms and conditions:

1. Reclamation Security

   (a) The owner, agent or manager (herein called the Permittee) shall cause to be deposited with the Minister of Finance and Corporate Relations within thirty (30) days of receipt of this amendment, an additional security in the amount of **One Hundred Thousand dollars** ($100,000.00), bringing the total security for this permit to **One Hundred and Ten Thousand dollars** ($110,000.00). The security will be held by the Minister of Finance and Corporate Relations for the proper performance of the approved program and all the conditions of this permit in a manner satisfactory to the Chief Inspector.

   (b) Beginning on January 1, 1993, and annually thereafter, the security shall be increased at a rate equal to the previous year's annual increase in the British Columbia Consumer Price Index.

DRAFT

SPECIAL CONDITION

1. Removal of Assets

   Until the security referred to in amended condition 1 above has been placed, there shall be no sale or removal of assets from the H.B. mine property.

2. Annual Reclamation Report

   By March 31 of each year, an annual reclamation report shall be submitted in a form and containing the information required by the Chief Inspector.

3. Land Use

   The surface of the land and watercourses shall be reclaimed to the following land use: **Recreation and Housing.**

4. Productivity

   The level of land productivity to be achieved on reclaimed areas shall not be less than existed prior to mining on an average property basis unless the Permittee can provide evidence which demonstrates, to the satisfaction of the Chief Inspector, the impracticality of doing so.

5. Long-term Stability

   Land and watercourses shall be left in a stable condition. To ensure long-term stability, engineered structures including waste dumps, major haul roads, and tailings impoundments shall be constructed and maintained in accordance with part 9 of the Health, Safety and Reclamation Code for Mines in British Columbia .

6. Revegetation

   Land shall be revegetated to a self sustaining state using appropriate plant species.

DRAFT

7. Use of Suitable Growth Medium

On all lands to be revegetated, the growth medium shall satisfy land use, productivity, and water quality objectives. All surficial soil material removed for mining purposes shall be saved for use in reclamation programs unless these objectives can be otherwise achieved.

8. Treatment of Structures and Equipment

Prior to abandonment, and unless the Chief Inspector has made a ruling otherwise, such as heritage project consideration or industrial use,

(a) all machinery, equipment and building superstructures shall be removed,

(b) concrete foundations shall be covered and revegetated unless, because of demonstrated impracticality, they have been exempted by the Inspector, and

(c) all scrap material shall be disposed of in a manner acceptable to the Inspector.

9. Waste Dumps

Waste dumps shall be reclaimed to ensure

(a) long-term stability,

(b) long-term erosion control,

(c) water quality released from waste rock dumps to the receiving environment is of a standard acceptable to the Chief Inspector, and

(d) land use and productivity objectives are achieved.

10. Watercourses

Watercourses shall be reclaimed to a condition that ensures

DRAFT

(a) long-term water quality is maintained to a standard acceptable to the Chief Inspector,

(b) drainage is restored either to original watercourses or to new watercourses which will sustain themselves without maintenance, and

(c) use and productivity objectives are achieved and the level of productivity shall not be less than existed prior to mining unless the Permittee can provide evidence which demonstrates, to the satisfaction of the Chief Inspector, the impracticality of doing so.

11. Pits

(a) Pit walls constructed in overburden shall be reclaimed in the same manner as waste dumps.

(b) Revegetation of pit walls constructed in rock, and/or on steeply sloping footwalls greater than 2:1, is not required. Pit wall seepage may require treatment to ensure that water is of a quality acceptable to the Chief Inspector.

(c) Where the pit floor is free from water, and safely accessible, vegetation shall be established.

(d) Where the pit floor will impound water and become a watercourse, provision must be made to create a body of water where use and productivity objectives are achieved.

12. Tailings Impoundments

(a) All tailings ponds and impoundment structures shall be reclaimed to the approved land use.

(b) Prior to mine closure, a report shall be submitted to the Chief Inspector outlining the post-operational state of the dams, dikes, related seepage control, spillway works, mine water deportment, and post-operational monitoring.

DRAFT

(c) A permanent spillway shall be designed to a standard required by the Chief Inspector and installed prior to final decommissioning of any permanent impoundment structures.

13. Roads

(a) All roads shall be reclaimed in accordance with land use objectives unless permanent access is required to be maintained.

(b) Individual roads will be exempted from the requirement for total reclamation under condition 13(a) if either:

(1) the Permittee can demonstrate that an agency of the Crown has explicitly accepted responsibility for the operation, maintenance and ultimate deactivation and abandonment of the road, or

(2) the Permittee can demonstrate that another private party has explicitly agreed to accept responsibility for the operation, maintenance and ultimate deactivation and abandonment of the road and has, in this regard, agreed to comply with all the terms and conditions, including bonding provisions, of this reclamation permit, and to comply with all other relevant provincial government (and federal government) regulatory requirements.

14. Metal Uptake in Vegetation

(a) Vegetation shall be monitored for metal uptake.

(b) Where harmful metal levels are found, reclamation procedures shall ensure that levels are safe for plant and animal life.

15. Disposal of Fuels and Toxic Chemicals

Fuels, chemicals or reagents which cannot be returned to the manufacturer/supplier are to be disposed of as directed by the Chief Inspector in compliance with municipal, regional, provincial and federal statutes.

16. Acid Generating Material

All potential acid generating material shall be placed in a manner which minimizes the production and release of acid mine drainage to a level that assures protection of environmental quality.

17. Monitoring

The Permittee shall undertake monitoring programs, as required by the Chief Inspector, to demonstrate that reclamation objectives including land use, productivity, water quality, and stability of structures are being achieved.

18. Safety Provisions

All safety and other provisions of the **Mines Act** shall be complied with to the satisfaction of the Chief Inspector.

19. Responsibility to Reclaim

Any reclamation that remains outstanding under the terms and conditions of Reclamation Permit(s) », at the time of issuance of this amended permit, shall become the responsibility of the Permittee under the terms and conditions of this permit.

20. Closure Plan

The Permittee shall continually develop and evaluate closure options and on or before », shall prepare and submit a revised closure plan, and as soon as possible after that day, the Reclamation Advisory Committee may consider revisions to the permit. This provision shall not be construed as limiting the power of the Minister or the Chief Inspector to amend this permit at any time.

21. Special Conditions:

Province of British Columbia

Ministry of Energy, Mines and Petroleum Resources

Office address:
...rnon Street
...on, B.C. V1L 4E6
Telephone: (604) 354-6125
Mailing address:
310 Ward Street
Nelson, B.C. V1L 5S4

From Fax No: (604) 354-6120

If there are any problems with the message please call (604) 354-6125

file
Cominco - H.B.

MINES INSPECTION SINCE 1877
RESOURCE MANAGEMENT BRANCH

FAX TRANSMISSION COVER SHEET

Date Sent: MARCH 5/93 Time: 3.50 Pm

Fax Number: VICTORIA

PLEASE DELIVER THE FOLLOWING MESSAGE

TO: JOHN ERRINGTON

FROM: M. MELLOR

Resource Management Branch
Ministry of Energy, Mines and Petroleum Resources
310 Ward Street
Nelson, B.C.
V1L 5S4

Telephone: (604) 354-6125

Art is dealing with this. JCS

RE: 1. IS This an acceptable Reclamation Plan?
2. As this is reclamation of a Major Mine (Final) I recommend you respond with reclamation Security requirements or otherwise inform me or Art O'.

Q. What should recl. deposit be??

Number of pages sent 5 including cover sheet

MINERAL RESOURCES DIVISION
RESOURCE MANAGEMENT BRANCH

MINISTRY OF ENERGY, MINES & PETROLEUM RESOURCES.
REC'D MAR 0 5 1993
NELSON, B.C.

NOTICE OF WORK AND RECLAMATION PROGRAM ON A MINERAL PROPERTY

1. **NAME OF PROPERTY:** NU-DAWN RESOURCES INC. H. B. SITE
Previous Annual Work Approval Number (applicable only to those properties previously worked)
(ie. SMI91-0100500-123) ...
Reclamation Permit Number, if previously issued (may be several years old) ...
Name of Claims: ADA #DL14388, Legal Tender MC L10823/ Tailings Pond SL 36 DL1236

2. **LOCATION:** Is any part of this Property in a Recreation Area or Park? ___ Yes _x_ No
Are any of the surface rights of this property privately owned? _x_ Yes ___ No (Operator responsible for contacting owner)
Name and address of private land owner: ...
Mining division: Nelson District All NTS map sheets (ie. 094L/02E) ...
Latitude: 49 ° 08 ' Longitude: 117 ° 10 ' Minfile No. (if known) ...
Access route (from nearest town to property): From Salmo, B. C. east on Airport Rd. to Sheep Creek Rd., North on Sheep Creek Rd. to Nu-Dawn sign then up hill to Mine.

3. **OPERATOR/AGENT** (Person or Company controlling property on behalf of the owner):
Name: NU-DAWN RESOURCES INC. Telephone No.: 604-357-2222
Company contact person: Jim Wadsworth Fax No.: 604-357-2516
Address: Box 369 City: Salmo
Province: British Columbia Postal Code: V0G 1Z0
Signature of Operator/Agent: [signature] Date: March 6, 1993

4. **OWNER:** (Title Holder)
Name: NU-DAWN RESOURCES INC. Fax No: 604-756-0298
Address: 102 Piper Crescent City: Nanaimo
Province: British Columbia Postal Code: V9T 3G3 Telephone No: 604-756-0291
Signature of Owner (or letter of Authorization from Owner): [signature] Date: March 6/93

5. **NAME OF MANAGER:** J. Wadsworth Manager's Telephone No.: 604-357-2222
(Person responsible for management and operation of property)

To whom does the Branch send correspondence regarding this notice? ___ Owner _x_ Operator

NEL /93 05 000 32

6. **DURATION:** Duration of work: From ......March 4, 1993...................... To..August 31, 1994..................

7. **EXPLORATION WORK** (Brief Description, if applicable)

Blasting .... Geophysical ....

Geochemical .... Clearing Trees ....

Prospecting .... Geological ....

Line cutting (distance, width, method) ....

Campsite: Length: .... m Width: .... m Area .... m^2

If Blasting, give details of explosives, magazines, etc. ....

Give number of existing explosives storage permit .... Name of Blaster: ....

8. **WATER SUPPLY** (subject to approval under the *Water Act*)

Describe the source of water supply ....

Pump size: .... " Capacity ....c.f.s. Location of water intake (show on plan) ....

9. **WASTE WATER TREATMENT** (subject to approval under the *Waste Management Act*) including disposal of drilling mud and sludge.

Describe treatment and disposal facilities (size of settling pond, recycling, distance to nearest stream, etc). Show on plan.

....

....

10. **ESTIMATED NUMBER OF WORKERS ON SITE** (including Contractors):........7.................

11. **EQUIPMENT LIST**

Note: all motorized equipment to comply with the Mining Code

Number and Type	Size/Capacity	Number and Type	Size/Capacity
a)	....	e)	....
b)	....	f)	....
c)	....	g)	....
d)	....	h)	....

12. **FIRST AID FACILITIES** (Must comply with W.C.B. Regulations)

Describe methods of communication, emergency transportation, and type of first aid kit....Phone, ½-Ton Pick-Up with ....Canopy, First Aid Kit #2, 1 Stretcher, First Aid Room on Site..........

Location of nearest hospital: ...Nelson, B.C......... Travel time to hospital: ....35 Minutes..........

13. SURFACE DISTURBANCE OFF MINERAL CLAIMS

Campsite: # of people.................. Length: ....m Width: ....m Area.....................m²

Road access construction: Total length: .... m Approximate width: .... m Area: .... m²

Other (specify) ....

14. SURFACE DISTURBANCE ON MINERAL CLAIMS

(a) Settling ponds: #. .... Length .... m Width: ....m Area: .... m²

(b) Road construction: Total length .... m Width: ....m Area: .... m²

(c) Drilling: # of sites: .... Depth: .... Length: .... m Width: ....m Area: .... m²

(d) Trenching # of trenches: .... Depth: .... Length: .... m Width: ....m Area: .... m²

(e) Test pits: # of pits: .... Depth: .... Length: .... m Width: ....m Area: .... m²

(f) Campsite: # of people .... Length: .... m Width: ....m Area .... m²

(g) Underground work: area of surface disturbance Length: .... m Width: ....m Area: .... m²

(h) Rock dumps: area of surface disturbance Length: .... m Width: ....m Area: .... m²

(i) Other: describe. Area: .... m²

TOTAL SURFACE AREA DISTURBED ON MINERAL CLAIMS THIS YEAR: .... m²

PRIOR DISTURBANCE ON CLAIM .... m² PLANNED RECLAMATION THIS YEAR: .... m²

BALANCE OF UNRECLAIMED DISTURBANCE AT THE END OF PROJECT THIS YEAR:................. m²

15. PRESENT STATE OF LAND ON WHICH WORK IS PROPOSED

Present land use: ...Caretakers..for..Security..of..Plant.................. Type of vegetation:..........................

Access roads (present use and condition) ...Roads..are..in..good..condition,..Access..for..Caretakers...............

Old workings (location, condition).......N/A.......Adits..closed..with..doors..

16. RECLAMATION PROGRAM: Proposed use of land after reclamation: ..Recreation and Housing...........................

Describe protective measures and proposed site reclamation methods with reference to the items listed below.

Topsoil handling (where applicable): ..Topsoil..to..be..put..over..old..mill..bases..and..other..buildings removed.

Camp sites: 7..Houses..to..be..left..for..new..owners..to..do..with..whatever..they..plan.. and sheds and office, warehouse.

Trenches, drill sites, major excavations: ....Glory..Hole..above..mill..site,..new..chain..link..fence to be put around complete opening.

Roads: ......Roads..are..in..good..condition..

Revegetation of disturbed areas:...

Waste dumps: ....

Adits.....Both..adits..to..be..filled..in..with..drill..core..and..topsoil..put..over..adits.

Drill core storage ..Core..storage..building..to..be..taken..down,..core..put..into..adits.

Other:..Concentrator,..Leach..Plant,..Refinery,..Oil..Storage..Shed,..Mine..Dry,..Compressor..Shop,.....

..Mine..Shop,..Machine..Shop,..All..to..be..taken..down,..all..machinery..removed..from..property,.........

Tailings Dam...we will place coarse material on the upstream face as required by Geotechnical Inspector, R. T. Martin.

17. URANIUM/THORIUM

Is any part of this property designated as a Uranium/Thorium area? __ Yes X No

If yes - has a survey been completed? ___ Yes ___ No

Note: if underground exploration or development is contemplated, an additional 'Underground Exploration Work Application for Approval' form must be completed.

This application will be returned if it is not accompanied by a legible map showing location of claim posts, property boundaries, location of property, access to property, location of work areas, roads, watercourses, proposed grid layouts, camps and other surface facilities. Preferred maps are: a)1:50,000 topographic maps; b)claim maps; c)detailed map of area disturbed; or as required by the District Manager.

File Note: H.B. Mine March 4, 1993

File: M-85

I talked to Red Mellor and Art O'Bryan.

Red will inform Nor-Quest that no work (including removal of assets) can take place until an application has been submitted under Section 10 of the Mines Act.

Once we have the application we can amend the existing permit, establish an appropriate security and get them working on the reclamation as they dissmantle the site.

We can set up an escrow account Not Responsive if we need to.

J.C.E.

Dr. J.C.Errington, P. Ag.
Manager, Reclamation and Permitting

jce

cc Greg McKillop

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Office address:
...ernon Street
Nelson, B.C. V1L 4C0
Telephone: (604) 354-6125
Mailing address:
310 Ward Street
Nelson, B.C. V1L 5S4

Tel: 354-6131 Fax: 354-6120

M-85

March 3, 1993

File: 14675-20
H.B. MILL

Mr. Raynerd Carson, Pres.
Nor-Quest Resources Ltd.
102 Piper Crescent
Nanaimo B.C.
V9T 3G3

Dear Mr. Carson:

Re: H.B. Mill and Tailings Pond, Nelson Mineral Division

This letter is written confirmation of the meeting in my office on March 2, 1993, where you requested information on Mines Act requirements for selling off the H.B. Mill machinery and milling equipment.

Prior to the sale and removal of any of the milling equipment and machinery on this mining property, and any other work, filing of a Notice of Work and Reclamation Plan, and a permit pursuant to the Mines Act, Section 10, is required.

Section 10(1) of the Mines Act states: "Before commencement of any work in, on, or about a mine, the owner, agent or manager shall apply for and obtain a permit from the Chief Inspector of Mines and shall, as part of the application, file with the District Inspector a plan outlining details of the proposed work and a program for the protection and reclamation of the land and watercourses affected by the mine, including the information, particulars, and maps established by the regulations or the Code".

At the present time, Nor-Quest Resources does not have any permit as required by the Mines Act to conduct any work on this property.

Also, pursuant to the Mines Act Section 10(8), a valid and subsisting permit shall be maintained and no work shall take place in or about a mine without one.

As well as a permit to proceed with work on a mineral property, supervisory requirements of actual work performed

...../2

must also be complied with. Work that will involve dismantling and removing equipment from the mine site, is subject to compliance with the Occupational Health & Safety Code Section 1.12.5., where the manager shall ensure that every worker is under the supervision of the holder of a Supervisors Certificate.

Pursuant to the OHS Code Section 1.12.6, the manager may designate in writing a qualified person to act as a supervisor for a period not exceeding six months. From my experience [redacted] Not Responsive your present H.B. Mill property caretaker/manager Mr. Jim Wadsworth would qualify for this supervisor requirement.

Any work to be conducted underground, such as rail removal from the Ymir Mine, will require the supervision of a certified Underground Shift Boss. This work will also require submission of a Notice of Work and Reclamation Program and approval or permitting pursuant to the Mines Act Section 10.

As you indicate no future mining work is planned, and the H.B. Mine property is to be sold for residential or recreation interests, final reclamation of the mine adits, any other mine openings, waste dumps, drill core storage, roads, mill buildings, and tailings pond and dyke will have to be addressed in the Reclamation Plan section of your Notice of Work submission. Use extra paper to provide essential details, if necessary for this report.

Part 10 of the OHS Code details standards and requirements for reclamation and closure. As discussed, sections 10.6.3 through to 10.6.7 will all be particular areas of concern.

Pursuant to the Mines Act Section 10(4), the Chief Inspector may, as a condition of issuing a permit require that the owner, agent, or manager give security in the amount, form, and subject to conditions specified by the Chief Inspector.

Final reclamation and long term stability of the tailings pond and dyke will be a prime concern. This area will be subject to inspections and regulating by Mr. T. Eaton, Manager of MEMPR Geotechnical Engineering section. Pursuant to the OHS Code Section 9.3.5, a report to the Chief Inspector of Mines for his acceptance, listing steps that will be taken to ensure structural stability and run-off control will be required.

...../3

Page 3

Final reclamation of the mine surface areas, dumps, major excavations, mill buildings, tailings area, roads etc. (as detailed in the OHS Code Sections 10.5.3 to 10.5.6) will be subject to regulating and inspections by myself, Mr. S. Wuschke, District Manager/Engineer Occupational Health and Safety, and Mr. A. O'Bryan, Reclamation Inspector of Mines. Also Waste Management and Water licenses issued for the property through Ministry of Environment, will be subject to their reviews.

I am optimistic, as indicated by your co-operative reception to reclamation and closure requirements as discussed, that this work should proceed and be completed to the satisfaction of all.

[redacted] s.22

Yours very truly,

M.A. Mellor
District Manager, EIM,

MAM/sb

c.c : J.Errington, Manager, Reclamation & Permitting
T. Eaton , Manager,Geotechnical Engineering
S. Wuschke, District Manager/Engineer, OHS
A. O'Bryan, Reclamation Inspector of Mines
R. Crozier, Manager, Waste Management, MOELP

Province of
British Columbia

Ministry
Energ... ...and
Pe... ...sources

Office address:
...ernon Street
Nelson, B.C. V1L 4E6
Telephone: (604) 354-6125
Mailing address:
310 Ward Street
Nelson, B.C. V1L 5S4

From Fax No: (604) 354-6120

→ JCE for info/action as you see fit.

If there are any problems with the message please call (604) 354-6125

...X TRANSMISSION COVER SHEET

Date Sent: FEB 25/93 Time: 3.45 PM

Fax Number: VICTORIA

PLEASE DELIVER THE FOLLOWING MESSAGE

TO: GREG McKILLOP

(N.B.)

IMPORTANT

FROM: M. A. MELLOR

Resource Management Branch
Ministry of Energy, Mines and Petroleum Resources
310 Ward Street
Nelson, B.C.
V1L 5S4

Telephone: (604) 354-6125

RE: H. B. MILL RECLAMATION

Number of pages sent 3 including cover sheet

MINES INSPECTION SINCE 1877
RESOURCE MANAGEMENT BRANCH

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

MEMORANDUM

February 25, 1993

Mr, G. McKillop
Assistant Director
Environmental Impact Management

Re: H.B. Mine, H.B. Mill, and H.B. Tailings Pond

It has come to my attention that Nor - Quest Resources Ltd. are in the process of selling off the H.B.concentrator equipment and machinery.

My source informs that a buyer from South America has been interested, but this may mean nothing at this time. The equipment was reported to be listed with Nelson Machinery for sale.

My telephone call to this firm, as a potentially interested party, confirmed this. The entire plant is for sale and is listed with Nelson Machinery . This includes the 1200 tpd grinding and flotation mill and also the 100 tpd cyanide gold circuit, installed new, by David Minerals and never used.

I was informed Nelson Machinery is currently drawing up a new catalogue that includes this entire mill, to be sold in pieces or as a unit.

Also it has been reported there has been some transferring of land ownership to another Nor - Quest Company, to Raynerd Resources, whatever this means. A Mr. Raynerd Carson, who lives or has an office in Nanaimo, is President of Nor -Quest Resources. Apparently there are back taxes owing on the property, that the equipment sale is intended to alleviate.

This news if true, concerns me knowing there are outstanding reclamation obligations on this property. This includes the Mill infrastructure, tailings pond, and very likely some mine openings, that could involve a glory hole to surface.

The last inspection report on file for the concentrator is one of mine, dated October 23, 1986, where mill reagents were ordered removed and the mine portal ordered sealed. Freeboard of the tailings pond was noted to be 10 feet, and the dam noted to appear stable. The mill chemicals etc. were removed at that time.

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

MEMORANDUM

page 2,

The last recorded Geotechnical Inspection of the property by T. Martin, was September 28, 1987. Terry's one concern was undercutting of the upstream face of the dam becoming significant and requiring course gravel and cobble-sized protection being placed before his next inspection. There is no record in the file of this work being done. Mr. Greg. Carriere the Mine Engineer at the time, informs me this work was never done, as management avoided it.

I have discussed my concerns with Steve Wuschke. He has scheduled a property inspection tomorrow, to check out mine openings, and conditions in the mill.The tailings pond will still be snow covered.

I understand Ted Hall took action to ensure assets were guaranteed available for reclamation obligations that involved placing a lien on all of the mill equipment on a similar situation.

I recommend we take similar action with this property without delay.

M.A.Mellor
District Manager, EIM.
Nelson.

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

C''' address:
ernon Street
Nelson, B.C. V1L 4E6
Telephone: (604) 354-6125
Mailing address:
310 Ward Street
Nelson, B.C. V1L 5S4

From Fax No: (604) 354-6120

If there are any problems with the message
please call (604) 354-6125

MINES SINCE 1877 INSPECTION
RESOURCE MANAGEMENT BRANCH

FAX TRANSMISSION COVER SHEET

Date Sent: Feb 26/93 Time: 9.30 AM

Fax Number: VICTORIA

PLEASE DELIVER THE FOLLOWING MESSAGE

TO: John Errington

FROM: M. A. Mellor, Nelson

Resource Management Branch
Ministry of Energy, Mines and Petroleum Resources
310 Ward Street
Nelson, B.C.
V1L 5S4

Telephone: (604) 354-6125

RE: For Necessary Action. I have discussed this with Art.

Number of pages sent 3 including cover sheet

Province of British Columbia

Ministry of Energy, Mines and Petroleum Resources

MEMORANDUM

February 25, 1993

Mr, G. McKillop
Assistant Director
Environmental Impact Management

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Province of British Columbia
..nistry of Energy, Mines and Petroleum Resources

MEMORANDUM

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I understand Ted Hall took action to ensure assets were guaranteed available for reclamation obligations that involved placing a lien on all of the mill equipment on a similar situation.

I recommend we take similar action with this property without delay.

M.A.Mellor
District Manager, EIM.
Nelson.

CC. A. O'Bryan
T. Eaton
S. Wuschke.
J. Errington

MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

AUG 13 1990

ENGINEERING AND INSPECTION BRANCH

Bank of Montreal

Corporate and Government Banking Group
First Bank Tower
595 Burrard Street
P.O. Box 49400
Vancouver, B.C.
V7X 1L5

August 10, 1990

Ministry of Energy,
Mines and Petroleum Resources
Room 105, 525 Superior St.,
Victoria, B. C.
V8V 1X4

Attn: Carol Howell

Dear Sirs

Letters of Credit No. [redacted] s.21

Further to our telephone conversation today, we enclose photocopies of the subject letters of credit. We also enclose copies of letters from your office addressed to Cominco, dated March 17, 1986 stating that the original letters of credit would be held in your office.

Yours truly,

G. M. Fox,
Manager,
Credit Administration

Page 676 redacted for the following reason:
- -
s.21

Province of British Columbia

Ministry of Energy, Mines and Petroleum Resources

Office address:
10 ... non Street
Nelson, B.C. V1L 4E6
Phone: (604) 354-6125
Mailing address:
310 Ward Street
Nelson, B.C. V1L 5S4

January 11, 1989

Our File: 14675-50/

J.C.E.

Mr. M. Henningson
Manager
Cominco Ltd.
P.O. Box 2000
Kimberley, B.C.
V1A 2G3

Dear Sir:

Re: Annual Reclamation Report, Reclamation Permit M-85

The Annual Reclamation Report for the year 1988 and plans for the 1989 program are due March 31, 1989. Please use the enclosed report format as a checklist and modify the organization of the report to satisfy your particular program.

Document activities using a map or airphoto base at a convenient scale; a scale of 1:10,000 is suggested.

Ensure that the enclosed tables, which summarize surface disturbance and reclamation, are completed accurately.

Please submit three copies of your Reclamation Report, two to this office and one to Dr. J.C. Errington, Head of Reclamation, Rm. 105, 525 Superior St., Victoria, B.C. V8V 1X4.

Yours very truly,

Arthur O'Bryan

A.L. O'Bryan
Inspector of Mines (Reclamation)

JCE/ALO/db
Enclosure

cc: A. Whale, District Inspector & Resident Engineer
J.C. Errington, Head of Reclamation

MINE H.B. Mine

COMPANY Cominco Ltd.

ADDRESS Salmo, B.C.

V0G - 1Z0

MANAGER Mr. R. Wyko

PERMIT NO. M - 85

BONDING $10,000.00

DATES:

1. REPORT SUBMITTED December 22 1977
2. GAZETTED May 1, 1978 NEWSPAPER: May 1, 1978
3. ADVISORY COMMITTEE APPROVAL June 5, 1978
4. MINISTER APPROVAL June 30, 1978
5. ORDER-IN-COUNCIL - DATE APPROVED 2411 Sept 7/78
6. LETTER REQUESTING BONDING STAYS THE
7. BONDING RECEIVED SAME
8. PERMIT SENT November 14, 1978
9. RENEWAL Permanent
10. REMARKS

364-4109

Page 679 redacted for the following reason:
- -
Not Responsive

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Parliament Buildings
Victoria
British Columbia
V8V 1X4

EXPO 86

Rm. 105, 525 Superior St., Victoria, B.C. V8V 1X4 PH: 387-3781
FAX: 387-5713

March 17, 1986

Our File: M-85

Mr. G.R. Soper
Co-ordinator, Banking
Cominco Ltd.
200 Granville St.
Vancouver, B.C.
V6C 2R2

Dear Mr. Soper:

Re: Exchange of Securities
Reclamation Permit M-85
H.B. Mine

Receipt is acknowledged of your new security described as:

s.21 [redacted]

which will be retained in this office for safekeeping.

By copy of this letter, we are asking the Registrar of Securities to forward your old securities described as:

s.21 [redacted]

to you.

Yours very truly,

J.C. Errington, P.Ag.
Senior Reclamation Inspector

JCE:sf

cc: Registrar of Securities, Ministry of Finance

Bank of Montreal, International Service Centre (B.C.)
Treasury Group, 595 Burrard St., P.O. Box 49350
Vancouver, B.C. V7X 1L5

Province of British Columbia
Ministry of Finance

SECURITY NOTICE

CONTROL # 02913

DATE	REGISTERED MAIL NUMBER	NOTE:
March 20, 1996		M-65

☐ RECEIVED FROM ☒ RELEASED TO

Mr. G. E. Soper
Co-Ordinator, Banking
Cominco Ltd
200 Granville Street
Vancouver, B.C.
V6C 2R2

NOTE: [illegible]

☐ We acknowledge receipt of the securities listed below
☐ We are returning the securities listed below. Acknowledge receipt by returning pink copy to: Registrar of Securities, Provincial Treasury, Parliament Bldgs. Victoria, B.C. V8V 1X4
☐ Please have signature of transferor guaranteed by a chartered bank.
☐ Please have signature on assignment form guaranteed by a chartered bank.
☐ Other (see above 'Note')

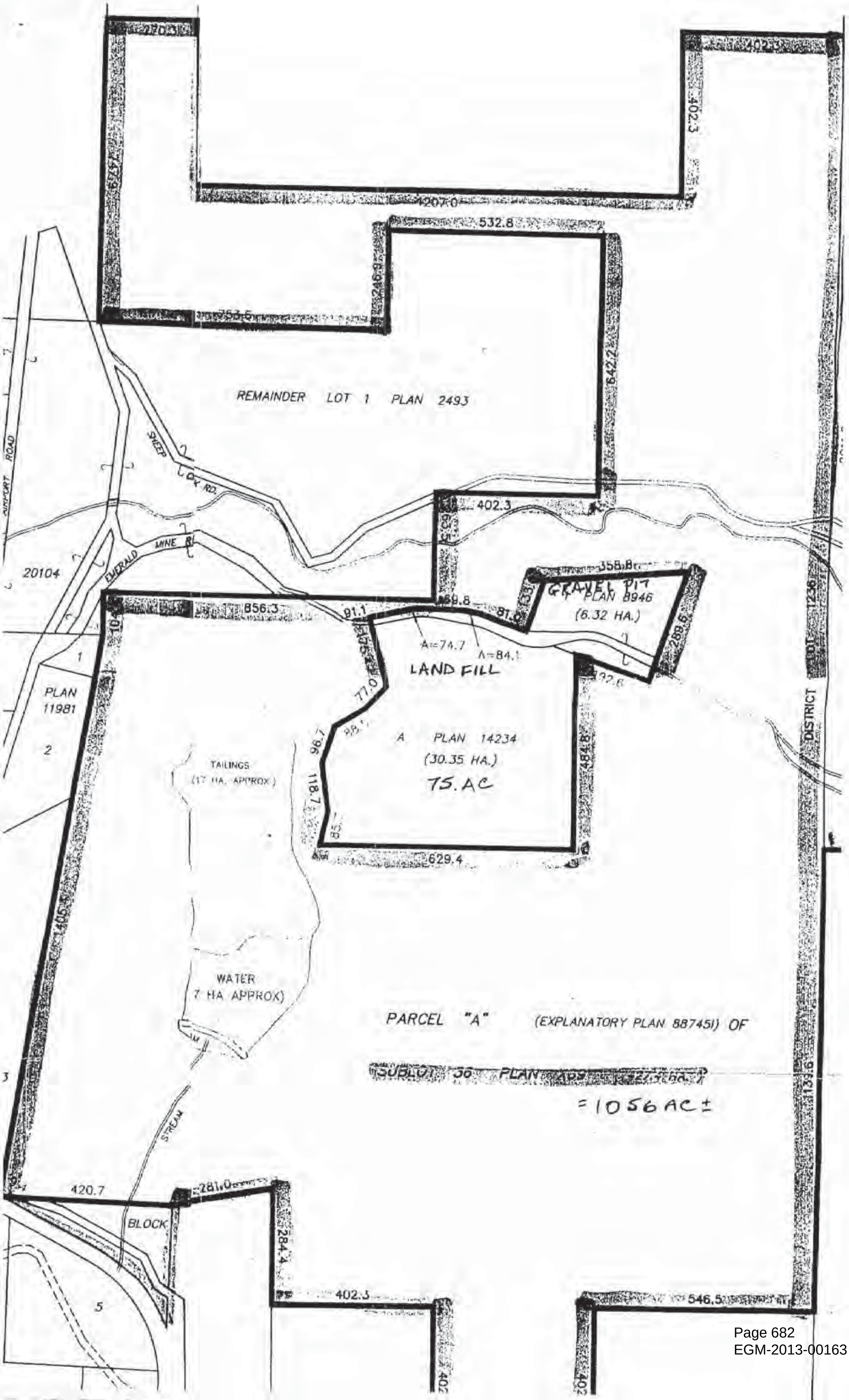
VALUE	DESCRIPTION (RECEIVED)	REGISTRATION
	1	OK

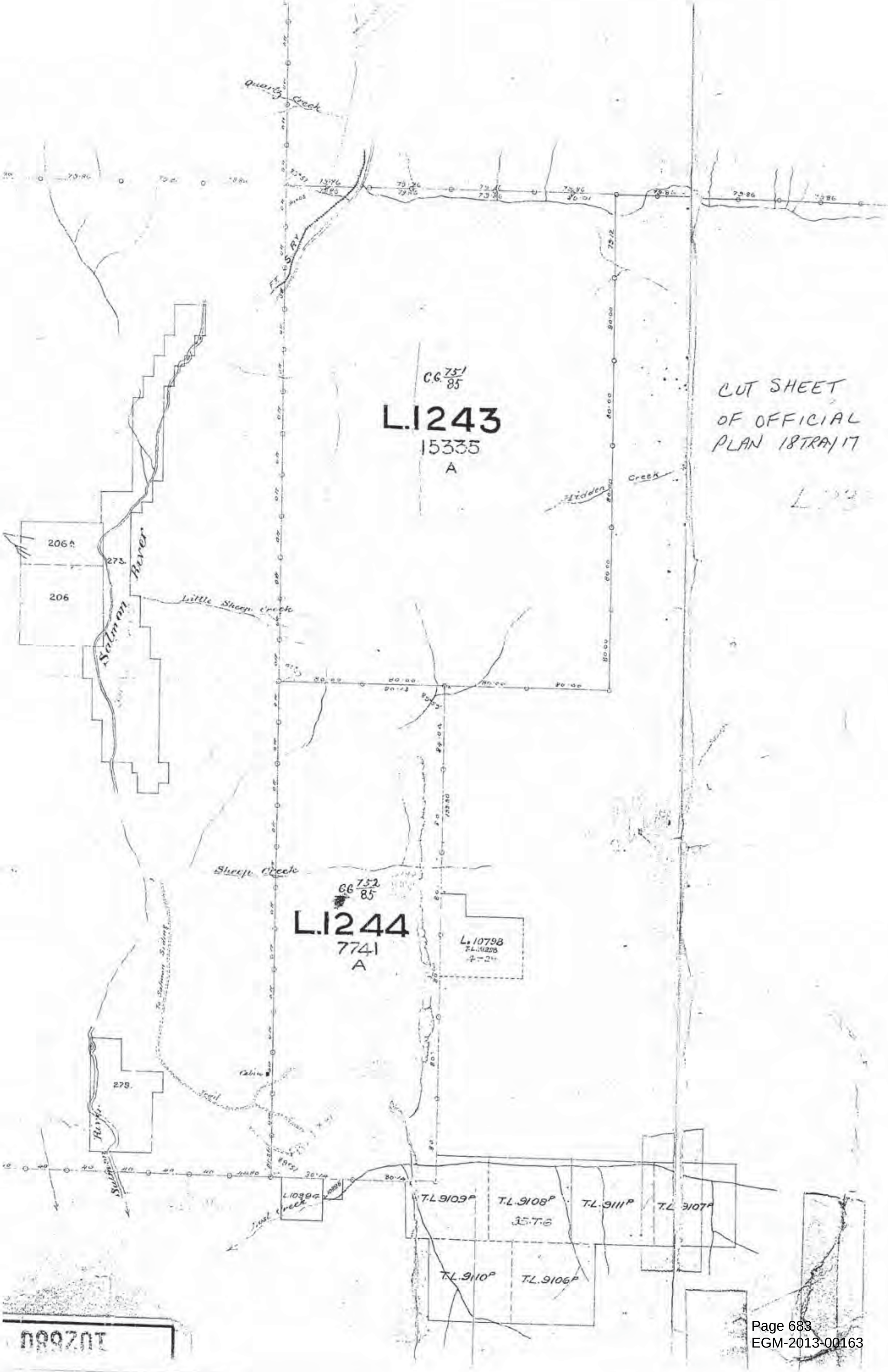
Promptly acknowledge receipt of enclosures listed below by returning pink copy to: Registrar of Securities, Provincial Treasury, Parliament Bldgs. Victoria, B.C. V8V 1X4.

☐ We have transferred the above noted securities and are releasing the following to you.
☒ We are releasing the following securities to you
☐ Released in exchange for new securities.

VALUE	DESCRIPTION (RELEASED)	REGISTRATION
[illegible]	The Government of Canada [illegible] due March [illegible], [illegible] [illegible] [illegible] in the name of 2	[illegible]

TYPIST INITIAL	CHECKED BY	SIGNATURE FOR RECEIPT OF SECURITIES
CL		[signature]


REMAINDER LOT 1 PLAN 2493
AIRPORT ROAD
SHEEP CK. RD.
EMERALD MINE RD.
20104
PLAN 11981
GRAVEL PIT
PLAN 8946
(6.32 HA.)
LAND FILL
A PLAN 14234
(30.35 HA.)
75.AC
TAILINGS
(17 HA. APPROX.)
WATER
7 HA APPROX)
STREAM
PARCEL "A" (EXPLANATORY PLAN 88745I) OF
=1056AC±
BLOCK
DISTRICT LOT 1236
402.3
532.8
246.9
642.2
856.3
358.8
91.1
A=74.7
A=84.1
77.0
96.7
118.7
484.8
629.4
1405.8
420.7
281.0
284.4
546.5


Quartz Creek
C.G. 75/1 85
L.1243
15335
A
CUT SHEET
OF OFFICIAL
PLAN 18TRAY17
Hidden Creek
Salmon River
273.
206
Little Sheep Creek
Sheep Creek
C.G. 752/85
L.1244
7741
A
L.10798
Cabin
Trail
279.
L.10994
T.L.9109P
T.L.9108P
T.L.9111P
T.L.9107P
35-T-6
T.L.9110P
T.L.9106P

P. H. No. 22.

L.1243-1244

Department No. 186/97

District: W. KOOTENAY

Description Land Grant	For whom Surveyed
L.1243	NELSON and
L.1244	FORT SHEPHERD
	R.R.Co.

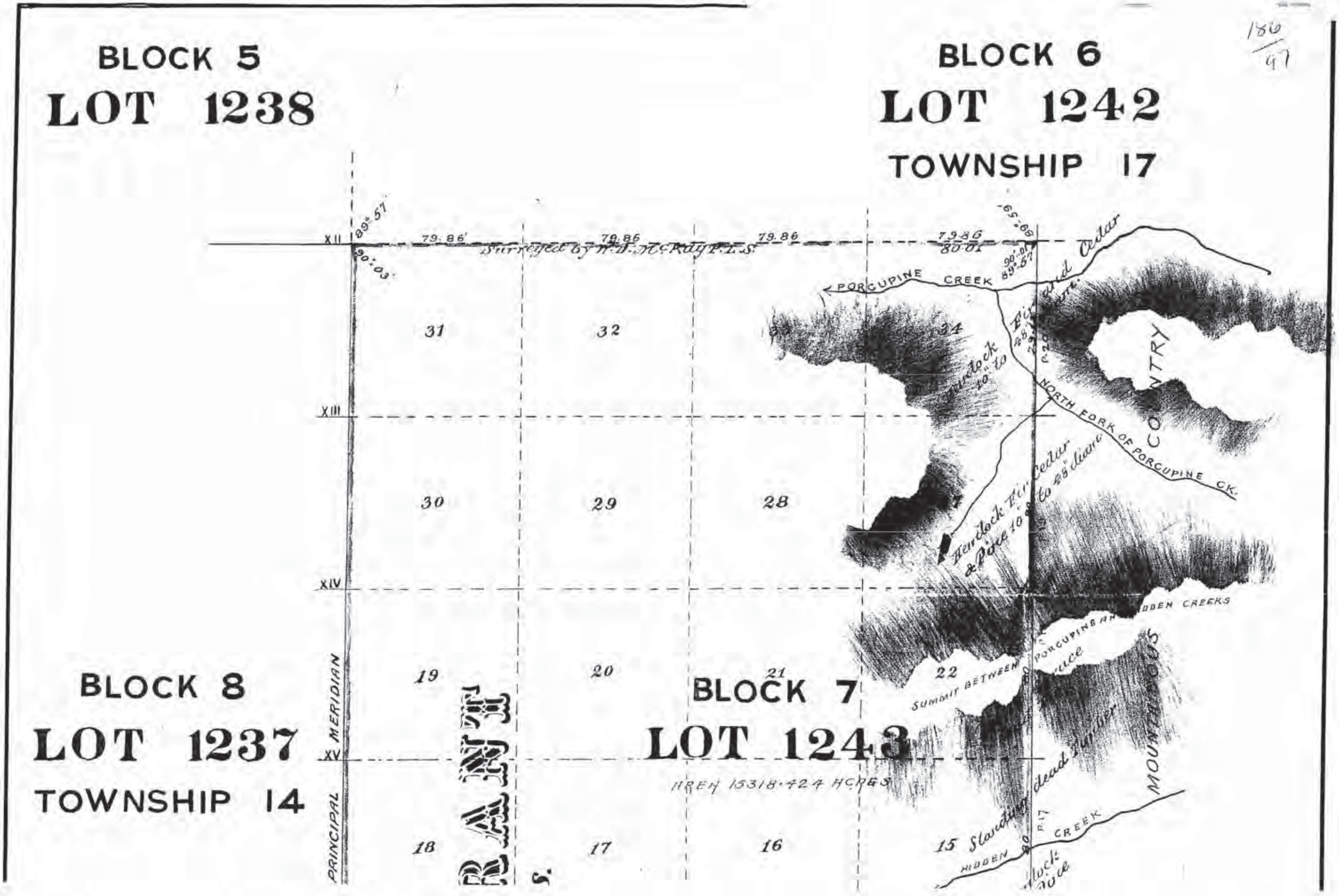
Surveyed by H. B. Smith P.L.S.

Feby and March 1897

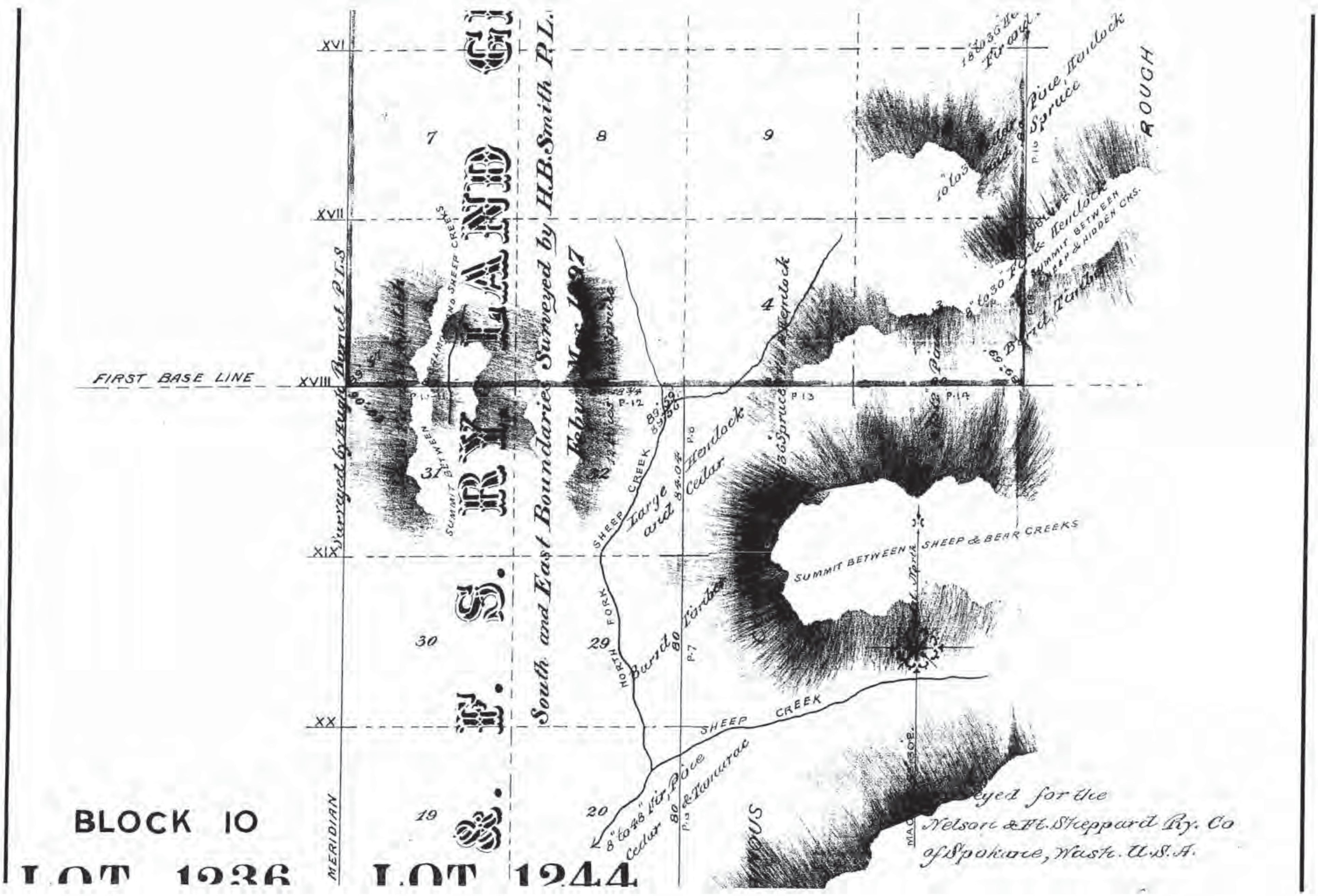
Plotted April 1897

By whom T. Bamford

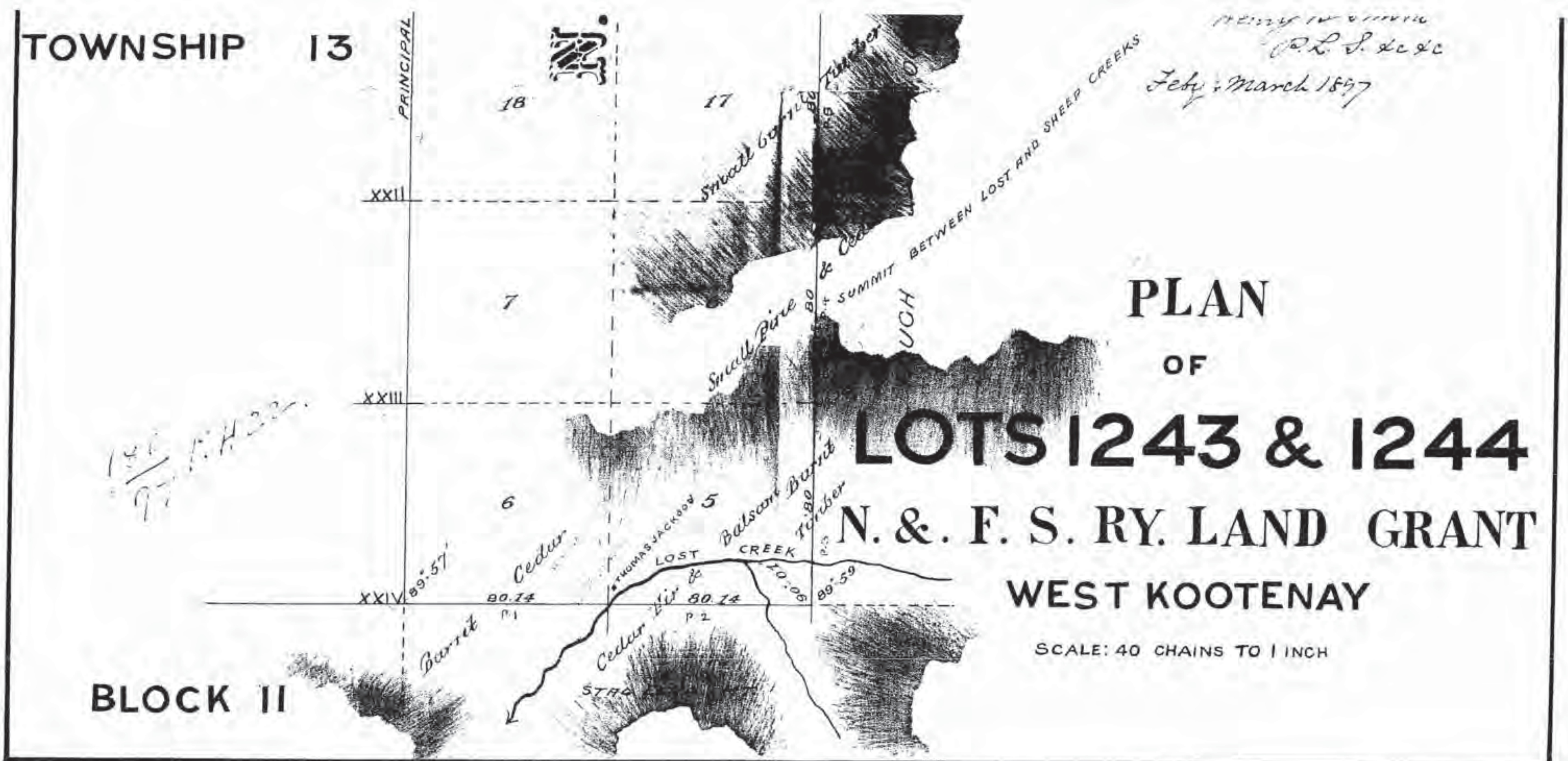
Survey Gazetted 22nd April 1897



186/47
BLOCK 5
LOT 1238
BLOCK 6
LOT 1242
TOWNSHIP 17
Surveyed by
PORCUPINE CREEK
NORTH FORK OF PORCUPINE CK.
COUNTRY
31
32
34
30
29
28
19
20
21
22
18
17
16
15
BLOCK 8
LOT 1237
TOWNSHIP 14
BLOCK 7
LOT 1243
PRINCIPAL MERIDIAN
SUMMIT BETWEEN PORCUPINE AND HIDDEN CREEKS
HIDDEN CREEK
MOUNTAINOUS
Standing dead timber



BLOCK 10
LOT 1936
LOT 1944
FIRST BASE LINE
MERIDIAN
XVI
XVII
XVIII
XIX
XX
7
8
9
4
31
32
30
29
19
20
South and East Boundaries Surveyed by H.B.Smith P.L.
Surveyed by Hugh Burnet P.L.S.
SUMMIT BETWEEN SHEEP & BEAR CREEKS
SUMMIT BETWEEN SHEEP & HIDDEN CKS.
SHEEP CREEK
NORTH FORK
ROUGH
Large and Cedar
Hemlock
Pine, Hemlock & Spruce
Burnt Timber
Nelson & Ft. Sheppard Ry. Co
of Spokane, Wash. U.S.A.


TOWNSHIP 13
PRINCIPAL
18
17
7
6
5
XXII
XXIII
XXIV
89°57'
80.74
80.74
89°59
LOST CREEK
Small Pine & Cedar
Burnt Cedar
Balsam Burnt Timber
SUMMIT BETWEEN LOST AND SHEEP CREEKS
Feby: March 1897
PLAN
OF
LOTS 1243 & 1244
N. &. F. S. RY. LAND GRANT
WEST KOOTENAY
SCALE: 40 CHAINS TO 1 INCH
BLOCK 11

Pages 688 through 690 redacted for the following reasons:
- -
Not Responsive

14745-40/HB

JC

I N T E R O F F I C E   M E M O R A N D U M

Created: 15-Apr-1997 10:35am PDT
Sent: 15-Apr-1997 10:45am PDT
From: Tim Eaton of EI
TEATON
Title. Manager - Geotechnical Engineeri
Dept: Employment & Investment
Tel No: 952-0485

TO: John Errington of EI (JERRINGTON)

CC: Carol Howell of EI (CHOWELL)

Subject: HB Mine M-85

FYI and M-85 file.

Theresa checked the mineral title of the HB mine as per John's suggestion to me. Title ownership was confirmed by Ron Stewart of MTB.

Crown Grant Title is owned by:

Nu-Dawn resources Inc.
102 Piper Cres
Nanaimo, BC V9T 3G3

Contact: Ray Carson 250-756-0291 or 756-0298

I am sending a minfile report to M-85.

Tim

Permit still in Cominco's name.

Province of British Columbia | Ministry of Energy, Mines and Petroleum Resources

MEMORANDUM

11050-20/H.B/01

To: J. B. C. Lang

David Minerals - HB Mine File

Date: June 21, 1982

Our File: H. B. Mine

subject: "Safe" storage level of tailings

ABM

Further to my memo of March 1st on this matter, I have been trying to devise some sort of equation that would enable me to determine quickly the mean equivalent storage level of tailings. You may recall that I have recommended that the stacking of tailings above the crest of the dam was permissable provided that in the event of liquifaction the levelled tailings would still not reach a level any higher than the present overflow (2515 ft. a.m.s.l.). I am still committed to this condition--at least until somebody can give me a good argument to the contrary.

Imperfect though they may be, I have settled upon the following six equations:

$V_s \not> V_p$......(1),

and

$V_s \not> V_f$......(2)

wherein V_s is the volume of tailings stacked above the mean "safe" storage level,

V_p is the volume of supernatant stored above that level but below the overflow level,

and V_f is the volume of storage available in the original reservoir above the overflow but below the lowest point on the dam.

$V_p \doteqdot 2/3\ (B \cdot W \cdot D \cdot)$..................(3)

in which B is the distance from the dam to beachline at the time,

W is the mean width of the supernatant pond, and

D is the mean depth of water overlying the tailings against the dam.

$V_s \doteqdot \frac{1}{2} \cdot (S \cdot U \cdot T \cdot)$..................(4)

in which S is the difference in elevation between the top of the stacked tailings and the overflow level,

U is the average width of the tailings stacked above the overflow level,

and $T = C - B$............(5)

with C being the distance from the dam to the point where the original contour of the overflow level reached farthest into the basin before tailings had been deposit in it.

$V_f \doteqdot C \cdot W \cdot F \cdot$ ....(6)

in which F is the depth of freeboard that could safely be filled with stored water without fear of overtopping the dam on a windy day.

The use of these equations is not easy and the problem is compounded when the information must be assumed or estimated. However, if substitution of the values shows that at any given time V_s equals, or exceeds, either V_p or V_f, then the safe storage level has been exceeded and operations should cease immediately.

You are welcome to try these equations. On the other hand, you may use your own formuli. The important thing is to have some convenient way of determining when the tailings are being stacked too high and the operator should be chedking his storage level several times each year. For your benefit I am attaching a calculation of the situation at the start of operations this year.

Terence Martin

R. T. Martin, P.Eng.,
Senior Geotechnical Inspector

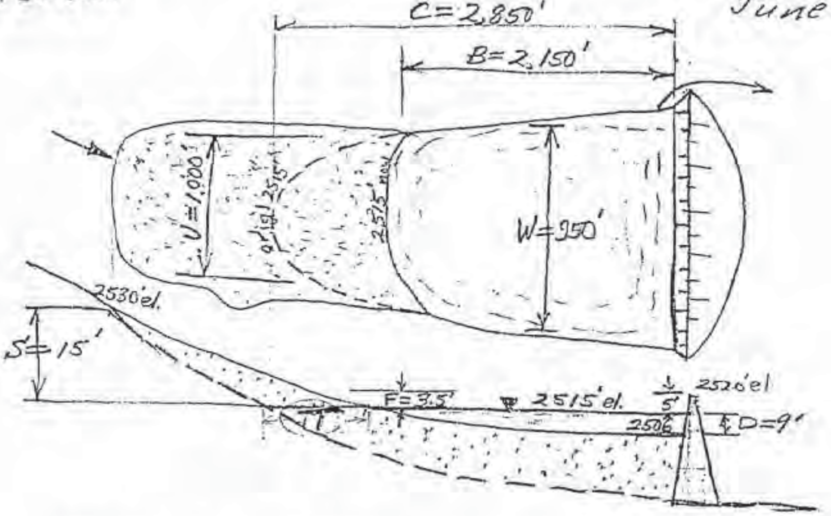
RTM:kw
attach.

c.c. A. J. Richardson ✓

H. B. MINE (DAVID MINERALS)
TAILINGS STORAGE STATUS AT OUTSET OF 1982

R.T. Martin

June 18, 1982,



In (5) $T = C - B = 2{,}850' - 2{,}150' = 700'$

In (4) $V_s \doteq \frac{1}{2}(S \cdot U \cdot T) = \frac{1}{2}(15' \times 1000' \times 700') = 5.25 \times 10^6 ft^3$

(say) $\underline{V_s = 5 \times 10^6 ft^3}$

In (3) $V_p \doteq \frac{2}{3}(B \cdot W \cdot D) = \frac{2}{3}(2150' \times 950' \times 9') = 12.25 \times 10^6 ft^3$

(say) $V_p = 12 \times 10^6 ft^3$

Trying (1), $\underline{\underline{V_s \ngtr V_p \quad \text{(Okay)}}}$

In (6) $V_f \doteq CWF = 2{,}850' \times 950' \times 3.5' = 9.48 \times 10^6 ft^3$

(say) $V_f = 9 \times 10^6 ft^3$

Trying (2) $\underline{\underline{V_s \ngtr V_f \quad \text{(Okay)}}}$

CONCLUSION : At the outset there existed plenty of storage for the stacked tailings (twice as much as required). Therefore, the impoundment could not possibly be overtopped by either tailings or supernatant fluid.

Setting $\frac{S}{D} \doteq 2 \quad W \doteq U$ in (1) $V_s \ngtr V_p$

or by (4) and (3) $\frac{SUT}{2} \ngtr \frac{2BWD}{3}$

By equ'n (5) $\frac{(S/D)}{2}(C-B) \ngtr \frac{2}{3}B$

$C \ngtr \frac{5}{3}B$

Yielding, $\frac{B}{C} \nless \frac{3}{5}$

And, if $C \approx 2850'$ (as estimated above) $\boxed{B \nless 1700'}$

Thus, the beach can shrink to about 1700 feet depending upon how valid my assumptions are. RTM.

1835 Fort Street,
Victoria, B.C. V8R 1J6.

July 22, 1977.

Mr. J. S. Newman, P.Eng.,
Civil Engineer,
Cominco Ltd.,
TRAIL, B.C.
V1R 4L8.

Dear Mr. Newman:

Re: H.B. Mine Tailings Dam Spillway.

Further to our telephone conversation of July 21st, please find attached a copy of a letter to Mr. John Brodie, Head of the Mining Section, Pollution Control Branch.

In regard to the proposed spillway this has been reviewed and the design considered to be adequate. Care should be taken to see that the spillway is keyed in to the abutment in the proper manner.

Yours very truly,

J. E. Merrett, P.Eng.,
Acting Chief Inspector of Mines.

JEM:jau

copy: Mr. J. D. McDonald
Mr. J. B. C. Lang
Mr. K. Meyers
Mr. P. Wyke

THE DEPARTMENT OF
MINES AND PETROLEUM RESOURCES
PARLIAMENT BUILDINGS, VICTORIA, BRITISH COLUMBIA V8V 1X4

MINERAL RESOURCES BRANCH

WHEN REPLYING PLEASE REFER TO

FILE NO

1835 Fort Street,
Victoria, B.~~C. V8R 1J6.~~

May 5, 1977.

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd MAY 5 1977

Mr. John Brodie,
Head, Mining Section,
Pollution Control Board,
Ministry of the Environment,
Parliament Buildings,
Victoria, B.C.

Dear Sir:

Re: H.B. Tailings Pond Extension 1977 - Stability of Dam

A meeting was held between representatives of the B.C. Ministry of Mines, Golder Brawner Associates and Cominco Ltd., at 1:30 p.m., April 20, 1977 in Trail to discuss the proposed extension of the H.B. Mine tailings pond.

A report has been submitted by Mr. McDonald and Mr. Lang along with their recommendations.

Permission to proceed with the extension of the H.B. tailings dam is granted subject to the following provisions:

1. Present lift to be 5 feet only.
2. A further extension of 10 feet is permissible as per Golder Brawner Report.
3. No further extension over the 15 feet will be allowed without full review of the overall stability.
4. Three piezometers to be installed in the dam, location to be determined by Golder Brawner & Associates.
5. The proposed spillway to be constructed and operating in 1977.

. . ./2

6. When the spillway is completed and operational the present decant system is to be sealed with concrete. Placing concrete in the decant pipes must be supervised by an appropriate staff member of the H.B. Mine.

Yours very truly,

J.E. Merrett, P.Eng.,
Acting Chief Inspector of Mines.

JEM:jau

copy: Mr. J.B.C. Lang,
Mr. J.D. McDonald,
Mr. K. Meyers,
Mr. R. Wyka.

1835 Fort Street,
Victoria, B.C. V8R 1J6.

June 9, 1977.

Mr. J. S. Newman, P.Eng.,
Civil Engineer,
Cominco Ltd.,
TRAIL, B.C.
V1R 4L8.

Dear Sir:

Re: H.B. Mine Tailing Dam Spillway.

This will acknowledge receipt of your letter of June 1, 1977 enclosing copies of letter and attachments sent to Mr. J. Lang, in Nelson, concerning the above-mentioned subject.

In due course you will be contacted by Mr. J.E. Merrett, P.Eng., Acting Chief Inspector of Mines concerning your submission.

Thank you for your communication.

Yours very truly,

J.D. McDonald, P.Eng.,
Senior Reclamation Inspector.

JDM:jau

Cominco Ltd./Trail, British Columbia, Canada V1R 4L8
Tel. (604) 364-422? Telex 041-4426

Cominco

Engineering

Mr. J. D. McDonald
Senior Reclamation Inspector
Department of Mines and Petroleum Resources
1837 Fort Street
Victoria, B. C.
V8R 1J6

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd JUN 6 1977

June 1, 1977

Dear Mr. McDonald:

Re: H. B. Mine Tailing Dam Spillway

I am enclosing two copies of a letter and attachments sent to-day to Mr. Lang in Nelson.

Yours truly,

J. S. Newman, P. Eng.
Civil Engineer

JSN/af

Enclosures

AC 14/M.

Cominco Ltd./Trail, British Columbia, Canada

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd JUN 1977

Cominco

Engineering

Mr. J. B. C. Lang
District Inspector of Mines
Ministry of Mines and Petroleum Resources
310 Ward Street
Nelson, B. C.
V1L 5S4

June 1, 1977

Dear Mr. Lang:

Re: H. B. Mine Tailing Dam Spillway

I am enclosing a copy of the technical specification and drawings for the spillway for your perusal and approval.

The work will be constructed after the completion of the extension to the dyke, about September of this year.

Since the Construction Contract and order for pipe has to be placed, your early attention will be appreciated.

Yours truly,

J. S. Newman, P. Eng.
Civil Engineer

JSN/af

Attachments: Technical Specification HBO.007-1, Rev. 2
Drawings: HB-298-1; HB-299-1; HB-300-1;
HB-301-1; HB-302-0

cc: J. D. McDonald (2)
KVSM
RW
GTJH

310 Ward Street,
Nelson. B.C. V1L 5S4.

March 29th, 1977

Mr R.E. Jones, P. Eng.,
Mill Superintendent,
Cominco Ltd.,
H.B. Mine,
Salmo. B.C.
VOG 1ZO

Dear Mr Jones,

Thank you for sending me copies of the H.B. Tailings Dike Extension proposal and specification No. HBO.010-1. I have gone over it with interest, and in the light of past proposals and future needs several questions come to mind.

First of all, the estimated life of the concentration operation is a major factor. The proposed 5 Foot Lift design will carry us through to 1979. At this time, however, a major change in the physical structure will have to be made to satisfy stability requirements acceptable to the Ministry of Mines. Should operations cease at this time which would mean the end of daily inspection and maintenance, area drainage and spillway modifications will be mandatory and extensive. Should the operations continue beyond 1979, a further ~~dike~~ extension will be required which shall also mean a new spillway for ~~effluent,~~ but area drainage will not be as vital.

Fifteen feet of water on the upstream dike face is not a good situation and would indicate a rather high Phreatic water surface. This will be lowered by an efficient blanket drainage and toe drain system. The choice of material and subsequent deposition in place is therefore critical. It is suggested that standpipes, piezometers, be installed in the dam for monitoring future levels, and that an independent Geotechnical Engineer supervise the selection and placement of the blanket and toe drain material.

In 1976, Cominco did considerable planning on a new spillway system. This work indicated the entertainment of the shortcomings of the present method of decantation. Why was this plan abandoned? We also ask you to consider a system of cycloning the tails across the upstream dike surface, to keep the water away from the dike, and to effectively strengthen it.

We would be pleased to have your comments on these items before considering your proposal.

Yours truly,

J.B.C.Lang

J.B.C.Lang, P. Eng.,
District Inspector of Mines
and Resident Engineer.

c.c. J.W.Peck, P.Eng., Victoria.

JBCL/elg

1835 Fort Street,
Victoria, B.C. V8R 1J6.

March 25th, 1976.

Mr. F. Hodgson,
Chief of Mining Division,
Pollution Control Branch,
Department of the Environment,
Parliament Buildings,
VICTORIA, British Columbia.

Dear Mr. Hodgson:

Re: P.C.B. File No. 0262100-PE-1853
Stability of Tailings Dam - H.B. Mine.

Further to a review of correspondence and reports and a telephone discussion with your John Clarke, we confirm our approval of stability.

Yours very truly,

J.W. Peck, P.Eng.,
Chief Inspector of Mines.

JWP:jau

John Clark

Jake

I was not aware of any stability problem with the HB tailings dam, were you?

Would you acknowledge receipt with any pertinent comments you may have.

It would appear that Cedka Browns are satisfied with the remedial work done.

(Over)

The [illegible] copy of the dam inspection reports [illegible] will sent to all inspectors so as to make [illegible] assessments of dams in their area.

[illegible]

Cominco Ltd./Trail, British Columbia, Canada/Tel. (604) 364-422?

Mr. J.W. Peck
Chief Inspector of Mines
Department of Mines
Parliament Buildings
Victoria, B.C.

February 25, 1976

Dear Sir: Reference P.C.B. File No. 0262100-PE-1853
Application for Amendment to H.B. Mine
Permit No. PE-1853

As requested by Mr. J. Petrie, Expeditor, with the Pollution Control Branch, we are submitting the following information pertaining to the stability of the H.B. Mine Tailings Dam:

1) Golder-Brawner Report - dated June, 1972
2) Golder-Brawner Report - dated January, 1974
3) Technical Specs of Cominco Contract HB0.005-1 - Section 2
4) Letter (Cominco to Golder-Brawner) dated June 19, 1974
5) Letter (Golder-Brawner to Cominco) dated July 5, 1974
6) Letter (Cominco to Mines Dept. - Peck) dated August 2, 1974
7) Letter (Cominco to Mines Dept. - Waterland) dated August 2, 1974
8) Golder-Brawner Report - December 24, 1974
9) Golder-Brawner Report - June 6, 1975
10) Golder-Brawner Report - October 6, 1975
11) Golder-Brawner Report - October 6, 1975
12) Cominco As-built Drawing - HB-289-0

Yours truly,

R.L. Brown

R.L. Brown
Supervisor
Waste Control

RLB:jf

ENCLOSURES

Golder Associates
CONSULTING GEOTECHNICAL ENGINEERS

October 6, 1975.

Cominco Ltd.,
Engineering Department,
Trail, British Columbia.

Attention: Mr. S. Newman, P. Eng.

Dear Sirs:

Re: H.B. TAILINGS DYKE CONSTRUCTION

As requested, a visit was made to the above site in conjunction with Cominco personnel on September 18, 1975. The purpose of the visit was to review the completed dyke construction work. The following observations were made during the visit:

i) The dyke fill had been placed according to specifications.

ii) The coarse rock toe berm had been placed as required.

iii) The borrow pit areas had been dressed and graded.

iv) Surficial ditching had been carried out for run-off control.

v) The pond water level was located at the approximate elevation of the original dyke crest.

It is our opinion that the work has been carried out satisfactorily but it is recommended that regular dyke inspections

continued..........2

be carried out. These inspections should ensure that the dyke is performing as designed and that no potential seepage problems are developing.

As requested, we have attached in point form, the areas which should be reviewed during these inspections. As discussed previously, a form could be prepared for the mine usage.

We trust that this is to your satisfaction.

Yours very truly,

GOLDER, BRAWNER & ASSOCIATES LTD.,

H. HAWSON, P. Eng.

HH*ah.

V75095.

cc. MM

H.B. TAILINGS DYKE INSPECTION

DATE OF INSPECTION ______________________________

WATER DEPTH IN PONDS ______________________________

WATER ELEVATION IN PONDS ______________________________

ITEM	NO	YES	LOCATION
1. Any cracks on dyke?	____	____	____________
2. Any sloughs or failures on dyke?	____	____	____________
3. Any erosion on downstream slope?	____	____	____________
4. Any boiling at toe of the dyke?	____	____	____________
5. Is surface run-off from abutments saturating the toe of the fill?	____	____	____________

SEEPAGE	COLOUR OF SEEPAGE		
	CLEAN	DIRTY	LOCATION IF DIRTY
1. Toe seepage.	____	____	____________
2. East abutment seepage	____	____	____________
3. West abutment seepage.	____	____	____________
4. Downstream gully seepage.	____	____	____________
5. Seepage around decant pipe.	____	____	____________

Golder Associates
CONSULTING GEOTECHNICAL ENGINEERS

October 6, 1975.

Cominco Ltd.,
Engineering Department,
Trail, British Columbia.

Attention: Mr. S. Newman, P. Eng.

Dear Sirs:

Re: H.B. TAILINGS DAM CONSTRUCTION

Please find enclosed our inspection report for the construction work carried out at the above site in September 1975.

Yours very truly,

GOLDER, BRAWNER & ASSOCIATES,

H. HAWSON, P. Eng.

HH*ah.

V75095.

GOLDER, BRAWNER & ASSOCIATES LTD., 785 TRANQUILLE ROAD, KAMLOOPS, B.C., CANADA V2B 3J3 • TELEPHONE: (604) 376-1206

SUMMARY OF FIELD INSPECTION

TAILINGS DAM INSPECTION, H.B. MINES, SALMO, B.C. (SEPTEMBER 10, 1975)

1. DYKE CONSTRUCTION

Some surface ponding had occurred on the dyke crest since the construction was suspended in December, 1974. The surface was scarified and the existing material was mixed with a thin lift of the new fill prior to recompaction. The dyke was brought up to a final elevation of 2,515 ft., using the borrow material from the east borrow pit. Bedrock was encountered at some locations in the pit and numerous boulders were present in the fill. The material in excess of 9 in. diameter was removed in the pit or discarded over the upstream slope during fill placement.

A sample of the material from the pit was sent to our laboratory and a Standard Proctor Dry Density test was carried out (Figure 1). These results were used for compaction control (Table 1).

Additional clearing was carried out on the western abutment to ensure a good bond between the fill and natural soil. On reaching the design dyke elevation, the crest was graded towards the tailings pond to ensure that no surface ponding could take place and that all run-off from the crest was directed towards the upstream slope.

2. RE-GRADING OF THE DOWNSTREAM SLOPE

A number of erosion gulleys had developed on the downstream slope the centre of the dam and tapered off towards the edge of the berm.

(c) A large gulley, washed out of the filter zone on the east abutment, was filled with the rock and the top of the filter blanket was re-graded.

4. FINAL SITE GRADING

The slopes in the borrow pit were graded so that the area could be re-seeded at a later date.

Numerous ditches and berms were constructed in the abutment areas to ensure that positive drainage was established which was directed away from the toe of the tailings dyke. Access roads to the downstream toe of the dyke were constructed on the western abutment in order to facilitate inspection and maintenance of the dam.

TABLE I

RESULTS OF IN SITU DENSITY TESTS

(Impervious Till Material)

Date	11-9-75	12-9-75	13-9-75
Test Number	1	2	3
Location	Central	West End	W. Central
Elevation (approximate)	2,512	2,511	2,514
Moisture Content (%)	6.3 (1)	6.3 (1)	6.3 (1)
Dry Weight (lbs/cu.ft.)	127.1	134.5	131.2
Relative Compaction (Standard Proctor)	96.9%	102.5%	101.1%

NOTES:

1. Moisture content supplied by H.B. Mines. Samples 1 and 2 were destroyed so results are assumed the same as for Test No. 1.

since termination of the 1974 construction. A small bulldozer was used to re-grade the surface of the till fill in a relatively smooth slope. An attempt was made to fill the gulleys in the sand and gravel material using the same method, but due to trafficability problems, this work was eventually completed manually.

3. ROCK TOE BERM

The material used for the rock toe berm consisted of 75 percent screened gravel from the B.C. Highways pit close to the tailings pond, and 25 percent waste rock from the old Can-Ex mine about 6 miles from the site. Material greater than 1 ft. diameter was rejected. Two gradation tests were performed on the B.C. Highways material and the resulting gradations, along with the approximate gradation of the mixed material, are given on Figure 2.

Prior to placement of the rock berm some of the existing wet material was removed. The rock material was placed in three areas, as follows:

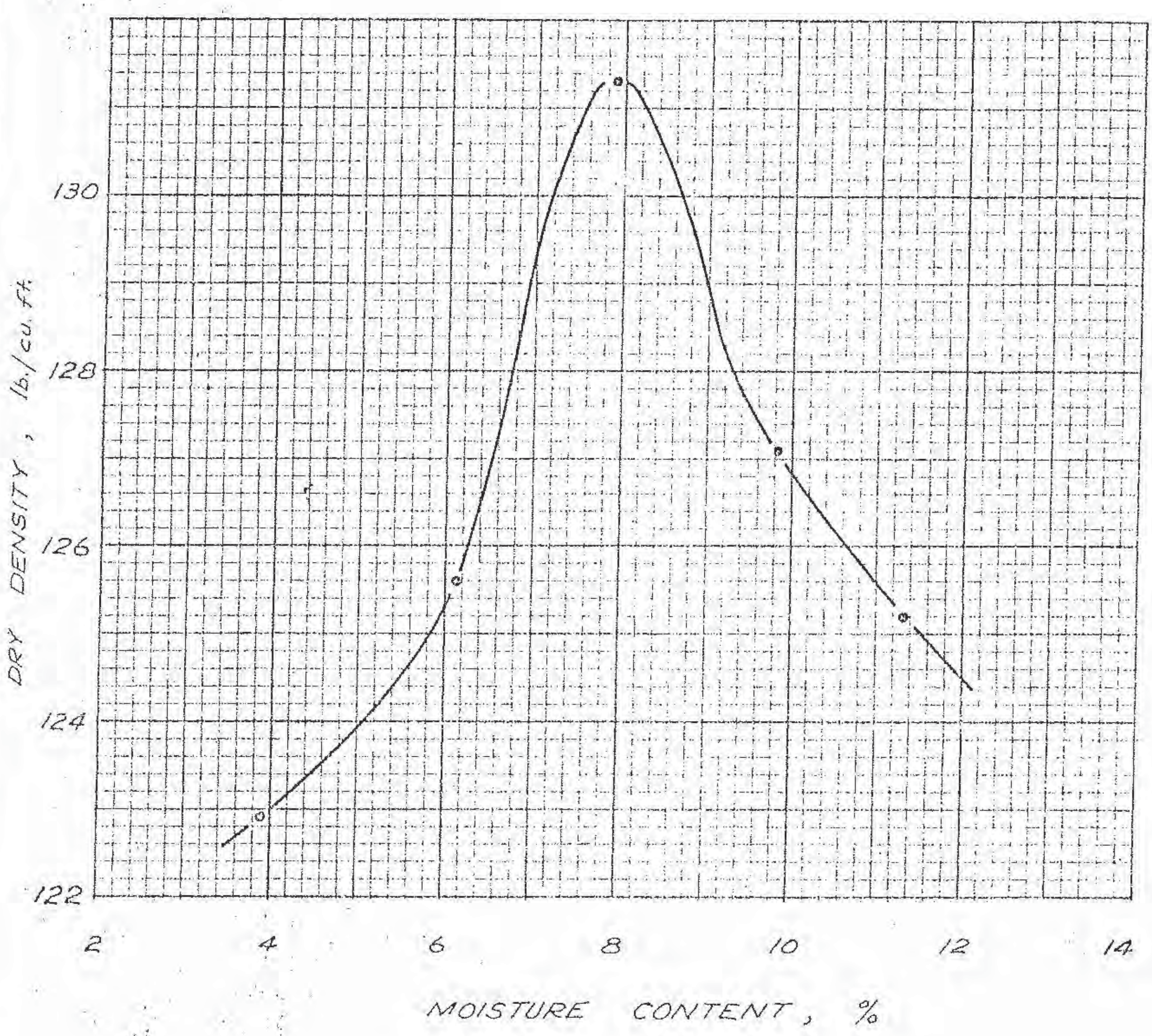
(a) A thin layer of the rock was placed over the wet area resulting from seepage from the western abutment area, and it was ensured the seepage was directed well away from the toe of the dyke.

(b) A 15 ft. wide rock berm was placed along the downstream toe of the dyke in the area where concentrated seepage was present. This berm was approximately 4 ft. thick close to the gulley at

Project No. Y75095

STANDARD PROC. ?R COMPACTION TE. T

FIGURE 1



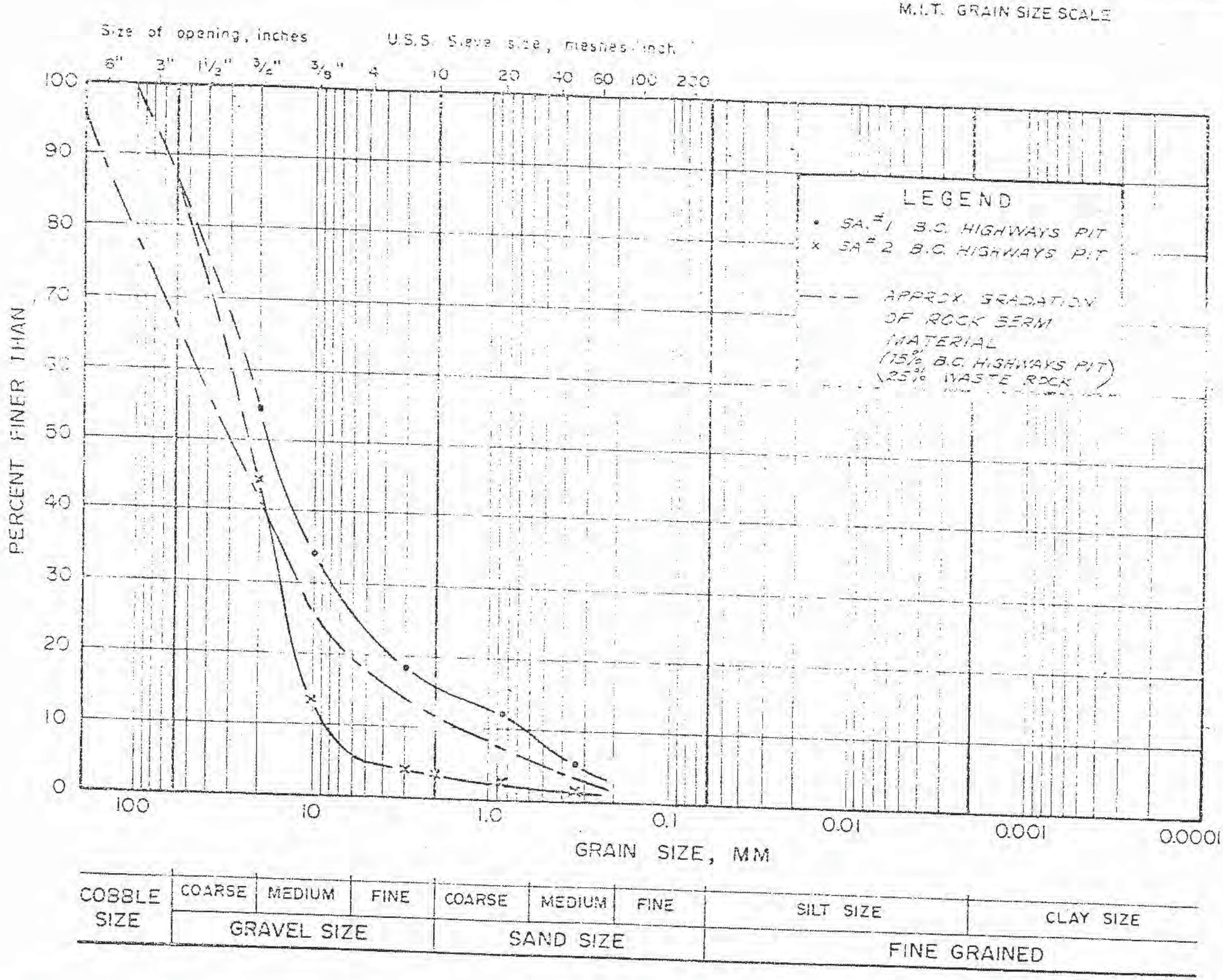
MAXIMUM DRY DENSITY - 131.3 lb/cu. ft.

OPTIMUM WATER CONTENT - 7.9 %

Golder Associates

Drawn D.E.H.
App'd
Date Oct/75

Project No.



Golder Associates

GRAIN SIZE DISTRIBUTION

FIGURE 2

JSN

Golder Associates
CONSULTING GEOTECHNICAL ENGINEERS

E/75/433
June 6, 1975,

Cominco Ltd.,
Trail, B. C.

ATTENTION: Mr. J. S. Newman, P. Eng.

Re: Site Inspection, H.B. Tailings Pond Dyke, Salmo, B. C.

Dear Sir,

As requested we visited the above site along with Mr. J. S. Newman on May 29, 1975. The purpose of the visit was to inspect the H.B. Mine Tailings dyke and review the performance of the dyke since termination of construction in December 1974.

The following observations were made during the visit:

1. The pond water level at the time of the visit was located at the top of the original dyke crest (i.e., approximately elevation 2,505).

2. Seepage was observed exiting at the downstream toe of the dyke and was estimated to be at approximately elevation 2,468 in the pit run sand and gravel toe filter.

3. Concentrated seepage zones which were present prior to construction at the dyke abutments are still evident. At the east abutment the seepage tends to saturate the ground surface at the toe of the dam.

4. Concentrated seepage zones were observed in the downstream gully. These zones were present in this area prior to construction.

5. Runoff from the ~~west~~ east abutment has developed erosion channels in the fill.

6. Surface ravelling has occurred on the downstream slope of the dyke due to ponding of surface water on the ungraded fill surface.

7. The seepage was observed to be clear.

The construction work carried out in the fall of 1974 was terminated in December due to bad weather and working conditions. At this time the majority of the dyke fill had been placed and the dyke crest elevation varied from elevation 2,515 at the west end to 2,510 at the east end. Our letter of December 24, 1974 contains a summary of this construction. Additional work is scheduled to be carried out in the summer of 1975 to complete the dyke.

Examination of the pond area indicates that the dyke has performed satisfactorily during the last 6 months since termination of last year's construction. However, some local seepage is evident and as discussed at the site, it would be advantageous to provide a layer of coarser material at the toe to assist in controlling the seepage. As discussed, coarse mine waste rock would be suitable for this purpose and could be placed during this year's construction. The waste rock should be placed as a berm at the toe to cover the present seepage line. In addition, it is recommended that 2 to 3 feet of sand and gravel be spread over the relatively flat area at the toe of the west abutment. Further, the seepage flow at this abutment should be channelized out of the area. This will provide better trafficability in this area.

At the east abutment some additional sand and gravel fill should be placed to repair the erosion damage caused by the spring runoff. Also it is recommended that a diversion trench be excavated to prevent surface runoff water from the east borrow area, flowing around the toe of the dyke.

To reduce surface slope ravelling, the downstream face of the dyke should be graded and shaped to remove irregularities which tend to pond surface water. The final dyke crest should be graded towards the north so that surface water will be directed into the pond area.

It is understood that consideration is being given to sealing the existing timber decants and providing a spillway to control pond water level. In our opinion this type of water control is far superior to the present timber decant tower and as a result would recommend that this be carried out. To enable the spillway to be designed, runoff and survey data would be required. In addition the method of adequately sealing the present system should be reviewed.

Yours very truly,

GOLDER BRAWNER & ASSOCIATES LTD.

H. Hawson

H. Hawson, P. Eng.

HH/jh
V75095

Golder Associates
CONSULTING GEOTECHNICAL AND MINING ENGINEERS

E/74/943

December 24, 1974

Cominco Ltd.,
Trail, B.C.

ATTENTION: Mr. M. S. Newman, P. Eng

Re: Field Inspection - Tailings Dam Extension
H. B. Mines, Salmo, B.C.

Dear Sir,

Please find enclosed a summary of our field inspection carried out at the above project, during November 6 to December 9, 1974 inclusive.

The results of in situ density tests carried out during this period are presented on Tables 1 and 2. The results of the Standard Proctor compaction tests which were carried out on the materials used for construction are presented on Figures 1 and 2.

We trust that this is to your satisfaction.

Yours very truly,

GOLDER BRAWNER & ASSOCIATES LTD.

H. H. Hawson, P. Eng.

HHH/cc

V 74234

JAN 6 1975

J. S. N.

GOLDER, BRAWNER & ASSOCIATES LTD., 224 WEST 8th AVE., VANCOUVER, B.C., V5Y 1N5 CANADA • PHONE: (604) 879-9266 • TELEX: 04-508800

SOIL MECHANICS · FOUNDATIONS · GEOTECHNICAL SURVEYS · EARTH DAMS · LANDSLIDES · ROCK SLOPE STABILITY
PAVEMENT EVALUATION · SOIL STABILIZATION · AIR PHOTO INTERPRETATION

Summary of
Field Inspection
Tailings Dam Extension
H.B. Mines
Salmo, B.C.

1. SEEPAGE

East Abutment Area

An area of seepage was encountered during the construction at the downstream toe of the existing dam near the east abutment. A small ditch had been previously excavated to channel the seepage flow away from the dam. The ground surface in this area was grass covered and soft due to the continued seepage. The area immediately east of this seepage had been covered by material pushed off the haul road.

An attempt was made to clear the disturbed material, however, the bulldozer used was unable to effectively clear the area. It was decided to place the required filter blanket in this area by pushing the disturbed material ahead of the sand and gravel blanket. In this manner the seepage area was covered with a filter blanket 4 to 5 feet thick and 16 to 20 feet wide.

West Abutment Area

Seepage was ecnountered at two locations on the west abutment. One area of seepage was located at the toe of the fill at approximately elevation 2461. This seepage appeared to be minor, but minor sloughing of the placed sand and gravel occurred in this area. To protect the toe of the dam a sand and gravel berm was placed to cover this seepage.

The berm was constructed 2 to 6 feet thick and 12 to 16 feet wide. After placement of the berm there was no further indication of any movement or sloughing in the main dam section.

Seepage was also located further up the abutment slope at approximately elevation 2495. A small ditch had been excavated to channel the seepage away from the dam.

A small tracked bulldozer was used to clean out the majority of the soft material in the ditch. A sand and gravel filter blanket was then placed to cover the seepage. This filter blanket was constructed 3 to 5 feet thick and extended approximately 20 feet beyond the toe of the dam.

2. SAND AND GRAVEL - FILTER BLANKET

The sand and gravel used for the dam construction was obtained from a borrow pit located approximately 1 mile north of the dam site.

Several in situ density tests were carried out on this material. The results of the tests are presented on Table 1.

3. DECANT CULVERT

The decant culvert under the eastern part of the existing dam was extended to enable construction of the dyke extension.

During the construction, water flowing through the culvert had not been completely stopped. The minor flow which continued was diverted to flow across the fill.

The sand and gravel fill beneath the culvert extension was placed in maximum lifts of 6 inches and compacted with a portable hand compactor. No density tests were performed but this material was well placed and compacted.

When the pipe was connected, two of the joints had minor leaks. Both leaks were eventually sealed using roofing tar and burlap. The joints were then backfilled and the pipe was buried.

4. TILL FILL - IMPERVIOUS MATERIAL

The till fill or select fill material was supplied from a pit just east of the dam site.

The pit was worked in such a manner as to ensure that most of the run-off would drain towards the north or lower end of the pit. There were occasional pockets of fine sand in the pit. These pockets of sand were mixed in with the till which was taken from the pit. When the pit was initially opened, occasional roots were left from the cleaning operation. Any of the organic material which was found in the fill was removed. The pit also contained some large boulders. These boulders were also generally removed from the fill.

The results of in situ density tests performed on the till fill are presented on Table 2.

5. PHREATIC SURFACE WITHIN DAM SECTION

The water level in the standpipe on the top of the old dyke. (BH #1) and at the toe of the new extension (BH #3) were checked on December 9, 1974. At that time the water level in the pond was at approximately elevation 2502.

The water levels of the pond and in the standpipes were compared to those taken in December 1973 and referred to in our report of January 1974. (Refer V 73218) The comparison indicates with an increase in pond elevation of 2 feet, a 2 foot increase in the phreatic surface at BH #1 and a minor increase in the phreatic surface at BH #3 has occurred.

A third standpipe installed on December 1973 in BH #2 unfortunately had been destroyed during the construction.

6. SUSPENSION OF OPERATION - DECEMBER 9, 1974

The continual warm wet weather had increased the moisture content of the till fill which was being placed. This increase in moisture content made trafficability on the top of the new dyke very difficult. It was also considered that this increase in moisture content would make handling and proper placement of the till fill difficult and impractical. Further it became apparent that continued operation would result in disturbance of the material already placed.

Therefore, it was recommended that the construction be suspended until such time as the fill could be properly placed.

At the suspension of operation the east end of the dyke had reached grade at elevation 2515 while the west end was generally 5 feet below grade at elevation 2510. The top of the dyke was graded prior to leaving the site to prevent ponding of precipitation on top of the dyke.

It is also recommended that the dam be periodically inspected over winter and spring.

Yours very truly,

GOLDER BRAWNER & ASSOCIATES LTD.

for J. A. Hull

JAH/cc

V. 74234

TABLE 1

RESULTS OF IN SITU DENSITY TESTS

	Sand and Gravel				
Date	14-11-74	14-11-74	15-11-74	28-11-74	30-11-74
Test No.	1	2	3	4	5
Location	West End	East End	Central	Central	Central
Elevation	2470	2470	2475	2490	2505
Moisture Content (%)	3.18(1)	3.7(1)	2.6(1)	3.5(1)	1.2(1)
Dry Weight (lbs./cu.ft.)	136	132	124	125	134
Relative Compaction (Standard Proctor)	111.5%	108.5%	102%	102.5%	110%

Note (1) Moisture content supplied by H.B. Mines.

TABLE 2

RESULTS OF IN SITU DENSITY TESTS

Silt Till (Select Fill Material)

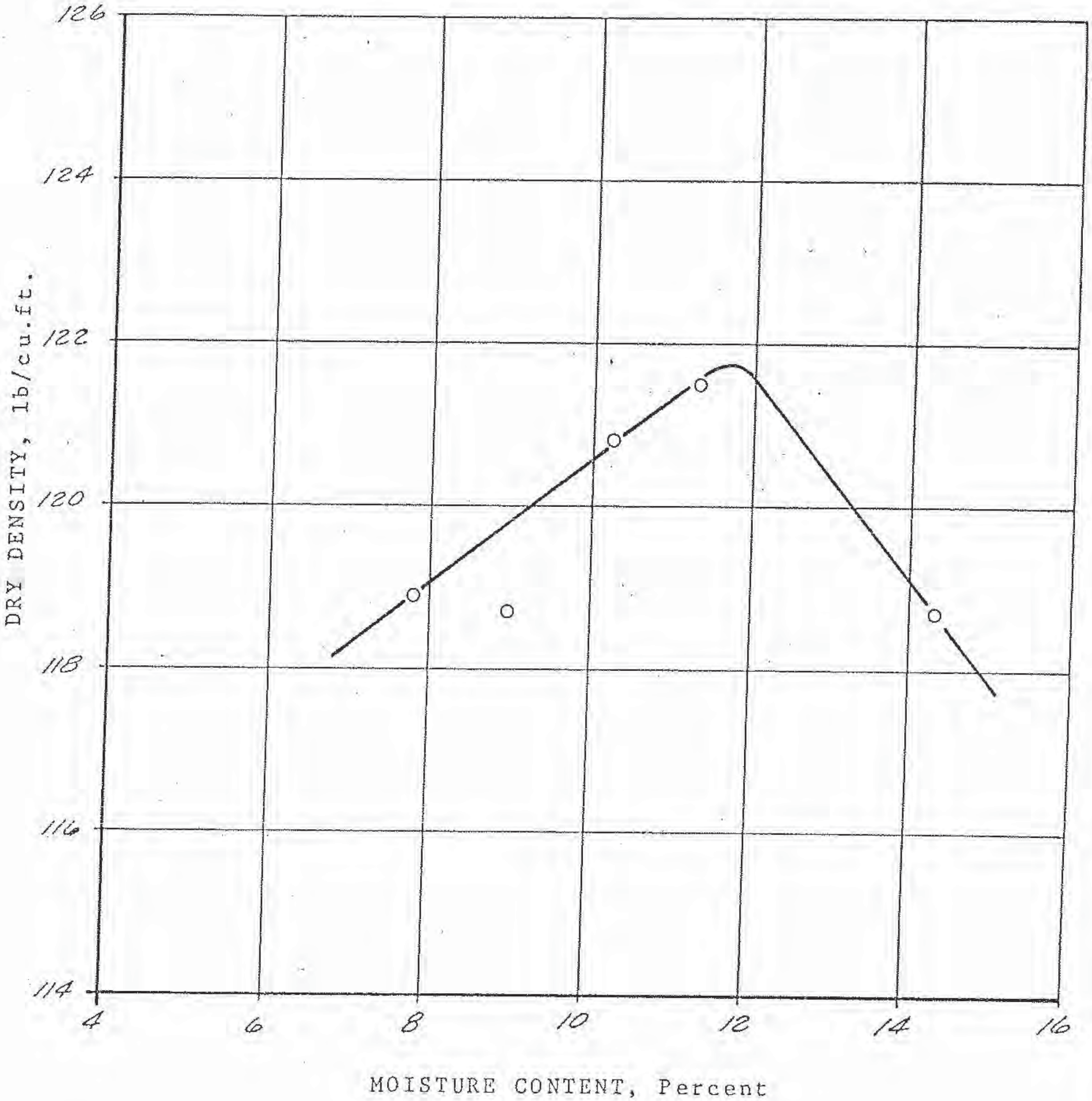
Date	28-11-74	30-11-74	2-12-74	8-12-74
Test No.	1	2	3	4
Location	Central Area	Central Area	Central Area	Central Area
Elevation	2490	2500	2506	2510
Moisture Content(%)	2.1(1)	1.6(1)	1.2(1)	11.4(2)
Dry Weight (lbs./cu.ft.)	133.5	130.0	143.2	120.0
Relative Compaction (Standard Proctor)	109%	106%	118%	98%

Note (1) Moisture content supplied by H. B. Mines
(2) Moisture content supplied by Golder Brawner & Associates Ltd.

CC PACTION TEST
SAND & GRAVEL.

FIGURE 1

Project No. V74234



MAXIMUM DRY DENSITY 121.8 lb/cu.ft.

OPTIMUM MOISTURE CONTENT 11.7 %

Golder Associates

Drawn N.T.

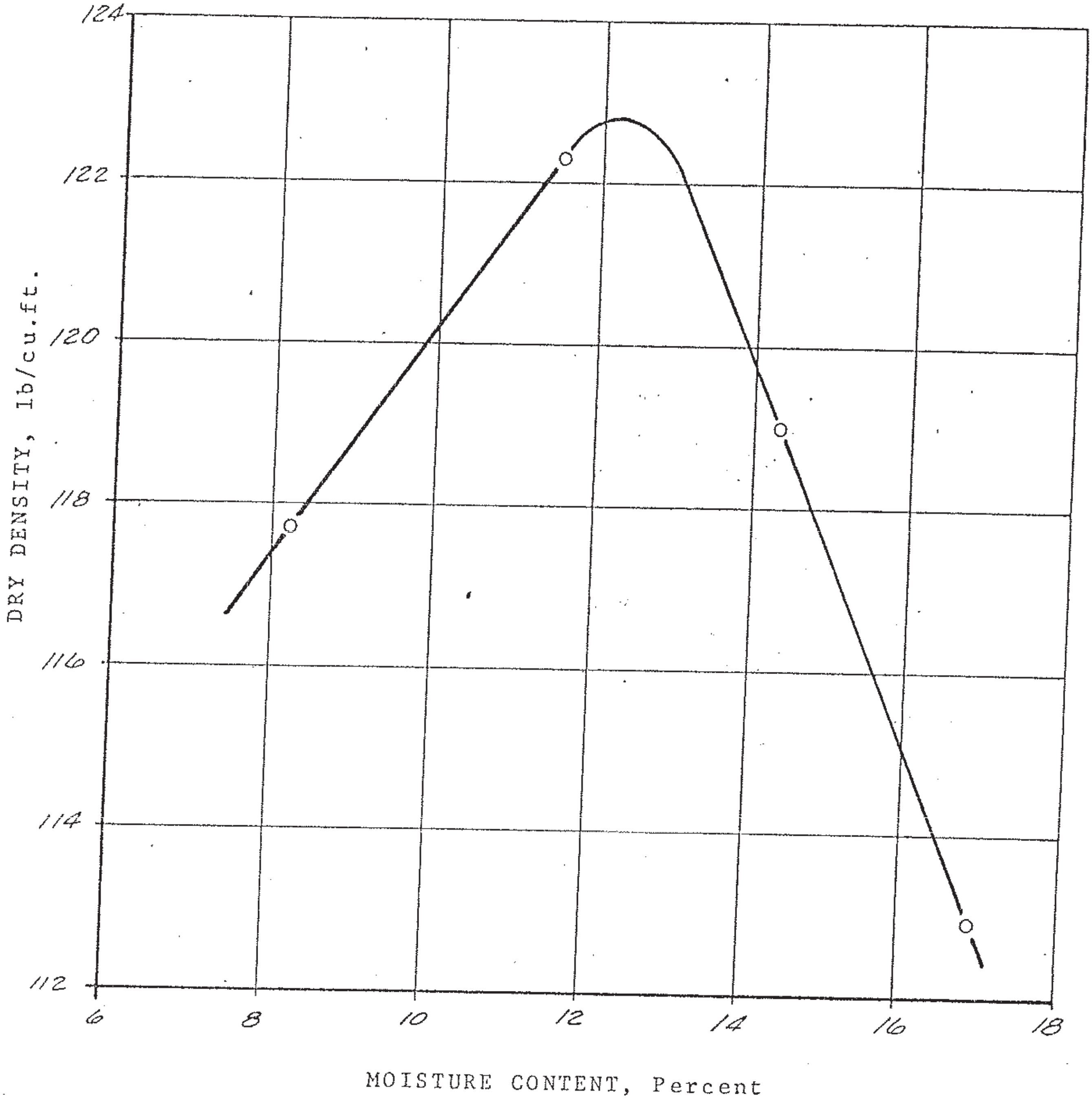
App'd

Date Dec '74

Project No. V-74234

COMPACTION TEST
SILT TILL - SELECT FILL

FIGURE 2



MAXIMUM DRY DENSITY 122.8 lb/cu.ft.

OPTIMUM MOISTURE CONTENT 12.2 %

Golder Associates

Drawn N.F.
App'd
Date Dec '74

Engineering

Mr J. W. Peck, P.Eng,
Chief Inspector of Mines,
Department of Mines and Petroleum Resources,
Victoria, B.C.
August 2, 1974.

Dear Mr. Peck,

Re: H.B. Mine, Salmo - Tailings Dike Extension

The existing facility at the H.B. Mine is nearly full and to provide further necessary storage we wish to increase the height of the dike by ten feet. this summer.

We have been in contact with our consultants, Golder Brawner and Associates and I am enclosing a letter received from them indicating their agreement to the proposed construction.

I am also enclosing a copy of the specifications and a copy of drawing HB-289-P showing the proposed works.

The first point mentioned in the letter is covered in the last paragraph on page 37 [para 2-06(g)]. Points two and three are shown on the drawing. Arrangements will be made to carry out the field controls requested in the fourth point.

We would appreciate your approval at your earliest convenience to enable us to proceed with the above works.

Yours very truly,

J.S. Newman
Design Engineer.

Encl: Letter (Sjolder-Brawner July 5/70)
Drawing HB-289-P
Specifications HBO.005-1

cc. Mr. T. Wakeland (Nelson)
G.S.
M.M.

Engineering

Mr. T. Wakeland,
Inspector of Mines,
Court House,
Nelson, B.C.
August 2, 1974.

Dear Mr. Wakeland,

Re: H.B. Mine, Salmo - Tailings Dike Extension.

As requested this morning in our telephone conversation, I have sent a letter to Mr. J.W. Peck today with the information required for approval to raise the dike by ten feet.

I am enclosing a copy of the letter and enclosures for your use.

Yours very truly,

J.S. NEWMAN
Design Engineer.

Encl.

cc G.S.

I have not done anything about this
SJ

Golder Brawner Associates

CONSULTING GEOTECHNICAL ENGINEERS

H. Q. GOLDER
C. O. BRAWNER
V. MILLIGAN
J. L. SEYCHUK
N. R. McCAMMON
R. M. WILSON
D. L. PENTZ
D. B. CAMPBELL
A. A. GASS
H. G. GILCHRIST

E/74/492

July 5, 1974

Cominco Ltd.,
Engineering Department,
Trail, B.C.

Attention: Mr. G. Shoblom

Dear Sirs:

Re: Dike Extension,
H. B. Mine Tailings Pond,
Salmo, B.C.

As requested, we have examined the proposed dam extension design and fill specifications at the H. B. Mine Tailings Pond as outlined in your letter of June 19, 1974 and as shown in your Drawing HB-289-P. We are in general accord with the specifications and design shown but would like to point out the following:

1. The surface of the existing dike should be scarified prior to placement of the select impervious fill and the common fill. See par. 2-ab(g)

2. The slopes of the dike extension, both upstream and downstream, should not be constructed steeper than 2 horizontal to 1 vertical as shown on the drawing. as per dwg!

GOLDER, BRAWNER & ASSOCIATES LTD., 224 WEST 8th AVE., VANCOUVER, B.C., V5Y 1N5 CANADA • PHONE: (604) 879-9266 • TELEX: 04-508800

3. The filter material should be placed on the existing dike slope to provide a continuous blanket no less than 2 ft. thick.

4. It is recommended that strict field control be exercised to insure that the fill materials excavated from the borrow pits are compatible with respect to filter requirements at all times.

We trust that this satisfies your present requirements. If we can be of further assistance, please contact us.

Yours very truly,

GOLDER BRAWNER & ASSOCIATES LTD.

W. H. Highter

W. H. Highter

WHH/mm

V73218

Cominco

Engineering

Mr. H.H. Hawson
Golder Brawner & Associates Ltd.
224 West 8th Avenue
Vancouver, British Columbia
V5Y 1N5

June 19, 1974

Dear Mr. Hawson:

RE: H.B. MINE TAILINGS POND

As a result of our recent discussions, I am enclosing two copies of our Drawing HB-289-P for your perusal.

To take advantage of the materials available onsite, we are specifying a zoned construction with a select impervious material on the upstream face, and a relaxed specification for the common fill.

The specification for the fills is as follows:

"Select fill shall be a glacial till, well graded with a maximum size of nine inches, and with at least 20% finer than the No. 200 U.S. Standard sieve size.

Common fill shall be a glacial till, well graded with a maximum size of nine inches."

For both zones we are specifying 12" maximum layers before compaction, and compacted to 95% of maximum dry density as determined for the Proctor compaction tests specified in ASTM D-698.

The samples we have taken from the west borrow area are coarser with 11 to 25% finer than No. 200, whereas the east borrow pit samples have 35 to 60% finer than No. 200.

For compaction equipment we are specifying a Hyster Model D grid-roller with concrete ballast, which weighs 13 tons.

Continued ....

JL

I N T E R O F F I C E   M E M O R A N D U M

Created: 29-Aug-1997 04:35pm PDT
Sent: 29-Aug-1997 04:40pm PDT
From: Tim Eaton of EI
TEATON
Title. Manager - Geotechnical Engineeri
Dept: Employment & Investment
Tel No: 952-0485

TO: Fred Hermann of EI (FHERMANN)
TO: John Errington of EI (JERRINGTON)
TO: Andrew Whale of EI (AWHALE)

Subject: HB

File: 14745-40/HB

FYI

Walter Kuit just called me. Cominco has rediscovered their liability at HB tailings dam. They are negotiating with NuDawn (apparently the ownership has chaged hands since my title searches in June and the owner is now based in Seattle but consists of the same people that were NuDawn) and the Regional District. The landfill environmental problems are complicating matters and Cominco will decide on a course of action soon. Cominco want to see a proper spillway installed.

Tim

14745-40/H13

↑ 22

BRITISH
COLUMBIA

Ph: (250) 952-0475

June 17, 1997

File: M-85
14675-35-04

Mr. B. Baldigara
Secretary, Assistant Administrator
Regional District of Central Kootenay
601 Vernon Street
Nelson, B.C.
V1L 4E9

Dear Mr. Baldigara:

Re: H.B. Mine Tailings Impoundment

I have been asked to reply to your May 15, 1997 letter to Andrew Whale, Regional Manager, Ministry of Employment and Investment, regarding possible future liabilities associated with the H.B. tailings impoundment.

Status of Permits Covering the Tailings Impoundment

The mine is regulated under the Mines Act.

The mine, including the tailings impoundment, is covered by Permit M-85 issued to Cominco Ltd. (copy attached). However, they sold this property to David Minerals who subsequently went bankrupt, and the last record we have of an owner is Nu-Dawn Resources.

Over the years, in spite of numerous attempts to get the new owner to assume the responsibilities of the permit, Cominco still remains the permittee.

Cominco carried out considerable research in the early 1970's to determine the feasibility of establishing vegetation directly on the tailings material, and to determine the metal uptake in plants. That information is stored off-site and I do not have that information immediately available. I don't recall any major issues, however.

I could not find a closure plan and I don't believe that one was ever filed.

...2

Dam Safety

I have included Part 9 of our Health, Safety and Reclamation Code for Mines in British Columbia (Code). The owner and permittee have not satisified the requirements of part 9.2.4, 9.3.2 and 9.3.5 The obligations in this regard should be discussed with Tim Eaton, P.Eng., Manager, Geotechnical Engineering. At present there are no significiant dam safety issues, however some work is required.

Should the Regional District purchase this property, the tailings impoundment would still be regarded as part of a mine, albeit a closed mine, and regulated under the Mines Act. As such, there would still be requirements for maintenance, periodic inspections and monitoring. These requirements would likely not be onerous, however.

Contamination Level of the Liquid and Solid in the Tailings

This a potential concern especially in relation to the new Contaminated Sites Provisions of the Waste Management Act. Our own internal review several years ago made a preliminary assessment of acid rock drainage potential of these tailings and it was felt that the abundance of limestone which hosted this ore deposit was likely sufficient to prevent sulphide oxidation, and acid mine drainage from occurring. This needs to be confirmed through samples of tailings and seepage from the impoundment. If there is any metal release, it will be associated with neutral to alkaline drainage.

If you have any further questions or concerns, please do not hesitate to call either myself (250) 952-0470 or Tim Eaton (250) 952-0485.

Yours very truly,

Carol Howell

for John C. Errington, Ph.D., P.Ag.
Manager, Reclamation and Permitting

JCE:ch
Encl.

cc: Andrew Whale, Cranbrook
✓Tim Eaton
Fred Hermann

let-hb

Page 736 redacted for the following reason:
- -
Not Responsive

Province of British Columbia

MEMORANDUM

TO: Art O'Bryan

FROM: J.C. Errington

SUBJECT: H.B. Mine M-85

DATE: Feb 14/85

☐ For Your Information ☐ Please O.K. and Return ☐ Please Discuss With Me ☐ Per Your Request ☐ For Your Signature

☐ Please Process ☐ Return With More Details ☐ Investigate and Report ☐ Please Answer ☐ For Your File

Please inspect & advise this summer.

JCE

Fold Here for Window Envelope

REPLY:

Fold Here for Window Envelope

Province of British Columbia

MEMORANDUM

TO: Art O'Bryan / Bruce Lang

FROM: J.C. Errington

SUBJECT: H.B. Mine

DATE: July 17/84

☐ For Your Information ☐ Please O.K. and Return ☐ Please Discuss With Me ☐ Per Your Request ☐ For Your Signature
☐ Please Process ☐ Return With More Details ☐ Investigate and Report ☐ Please Answer ☐ For Your File

Fold Here for Window Envelope

Cominco still holds permit M-85 and we have $10,000 bond.
David Minerals never put up bond although the applied for amendment of Cominco's permit to their name and agreed to abide by the conditions of this permit.
No-one should be allowed to work on this property until a permit is applied for and received.
If you have any suggestions as to how we are going to reclaim this area, please advise.

JCE

REPLY:

Fold Here for Window Envelope

RETAIN THIS COPY AND FORWARD BALANCE OF SET

File Note M-85 David/[illegible]/H.R.

Dec 8/8- talked to [illegible], [illegible]
- [illegible] [illegible] that [illegible] [illegible] [illegible] for David.
must talk to [illegible] [illegible] [illegible] [illegible]
- should not be allowed to resume work until all permits are in place.

ORIGINAL: FORWARD TO SENDER

MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES
Rec'd SEP 06 1983

THE PROVINCE OF BRITISH COLUMBIA
REGISTRAR OF SECURITIES
MINISTRY OF FINANCE
VICTORIA, B.C. V8V 1X4

RECEIVED FROM

Cominco Limited
2300 - 200 Granville Street
Vancouver, BC
V6C 2R2

TRUST ACCOUNT:
REG. MAIL INCOMING: 16449
VAULT INWARDS:
YOUR FILE:
OUR FILE:

DATE RECEIVED September 6, 1983

YOUR REGISTERED LETTER
NO. Courier DATED Aug. 31/83

	Re: Mines Deposit	M-85
[redacted] s.21		
	FULLY REGISTERED in the name of:	COMINCO LIMITED.

2.5M·4·81· EVERGREEN PRESS · VICTORIA

WE ACKNOWLEDGE RECEIPT OF THE ENCLOSURES LISTED ABOVE.

INITIALS
hsg

FOR REGISTRAR OF SECURITIES.
DEPARTMENT OF FINANCE

Recd.
For Registrar of Securities

DUPLICATE: MINISTRY RELEASE NOTICE

THE PROVINCE OF BRITISH COLUMBIA
REGISTRAR OF SECURITIES
MINISTRY OF FINANCE

VICTORIA, B.C. V8V 1X4

OUR FILE:

YOUR FILE:

RELEASED TO: —
- Cominco Ltd.
- 200 Granville Street
- Vancouver, BC
- V6C 2R2

DATE September 7 1983

Attn: G. B. Soper

WE HAVE FORWARDED TO YOU THE FOLLOWING SECURITIES:

AMOUNT	PARTICULARS	REGISTRATION
	Re: Mines Deposit	Rec'd SEP [illegible] 1983
[redacted] s.21		BEARER.......
		M-85

EVERGREEN PRESS · VICTORIA

hsg

OK

KINDLY ACKNOWLEDGE RECEIPT OF THE ABOVE ENCLOSURES ON THE DUPLICATE COPY OF THIS LETTER.

DEPOSIT RELEASED FROM PROVINCIAL TREASURY ON: Sep 7/83

FOR REGISTRAR OF SECURITIES.
DEPARTMENT OF FINANCE

[signature]
FOR REGISTRAR OF SECURITIES

Q.P. 31989

Cominco Ltd./200 Granville Street/Vancouver, B.C./Canada V6C 2R2
Tel. (604) 682-0611 / Telex 04-507730

Not Responsive

M-85

Not Responsive

Cominco

Finance

August 31, 1983

Registrar of Securities
Ministry of Finance
Parliament Buildings
Victoria, British Columbia
V8V 1X4

ATTEN s.22

Dear

We enclose Performance Bonds in respect of Reclamation Permits registered in the name of Cominco Ltd. with Powers of Attorney attached as follows:

Bond	%	Due Date	$ Amount	#'s	Property
Not Responsive					
" "	"	"	"	10,000	H1V03368 H1V03369	Cominco Ltd., H.B. Mine M-85

Not Responsive

...../2

Please forward the following Bonds which are to be replaced by the above, as soon as possible, by registered mail.

Bond	%	Due Date	$ Amount	#'s	Property
Not Responsive					
" " "	"	"	(2x5,000) 10,000	T22C115656-57 ?	Cominco Ltd., H.B. Mine M-85
			Not Responsive		

Not Responsive

Yours very truly,

COMINCO LTD.

Graham R. Soper.

G. R. Soper
Project Analyst
Cash Management

GRS:st
Encl.

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Parliament Buildings
Victoria
British Columbia
V8V 1X4

Rm. 105, 525 Superior St., Victoria, B.C. V8V 1T7 387-3781

January 25, 1983

Our File: M-85

Mr. George Robbins
Director of Environmental Affairs
David Minerals Ltd.
4th Floor - 535 Howe Street
Vancouver, B.C.
V6C 2C2

Dear Mr. Robbins:

Re: Reclamation Permit M-85
H. B. Mine

In your letter of November 12, 1982, you stated that the completed Receipt and Agreement form would be forthcoming.

This form has not yet been received in this office. Please advise us as to its status.

Yours very truly,

J. D. McDonald, P. Eng.,
Senior Reclamation Inspector

J. C. Errington

J. C. Errington, P. Ag.,
Reclamation Inspector

JCE:sf

cc: J.B.C. Lang, Nelson
A. O'Bryan, Nrldon

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Parliament Buildings
Victoria
British Columbia
V8V 1X4

Rm. 105, 525 Superior St.
Victoria, B.C. V8V 1T7

January 24, 1983

Our File: M-85

Mr. George Robbins
David Minerals Ltd.
4th Floor
535 Howe St.
Vancouver, B.C.
V6C 2C2

Dear Sir:

Re: Annual Reclamation Report

The annual Reclamation report for the year 1982 and plans for the 1983 program are due March 1, 1983. Please use the attached report format as a checklist and modify the organization of the report to satisfy your particular program. Document activities using an airphoto base at a convenient scale. A scale of 1:10,000 is suggested.

Please submit three copies of the reclamation report to this office and we will forward copies to our district staff.

Yours very truly,

J.D. McDonald, P.Eng.
Senior Reclamation Inspector

J. C. Errington

J.C. Errington, P.Ag.
Reclamation Inspector

JCE/eaa

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

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Victoria
British Columbia
V8V 1X4

Our File: M-85

105-525 Superior Street,
Victoria, B.C. V8V 1T7.
Telephone: 387-3781
November 23 1982.

Mr. George Robbins,
Director of Env. Affairs,
David Minerals Limited,
4th Floor - 535 Howe Street,
VANCOUVER, B.C. V6C 2C2

Dear Mr. Robbins:

Re: Reclamation Permit M-85 - H.B. Mine.

Receipt is acknowledged of your letter dated November 12, 1982 in which you agree to abide by the Terms and Conditions of Permit M-85.

Upon receipt of the completed Receipt and Agreement form, Reclamation Permit M-85 will be transferred into the name of David Minerals Ltd.

Yours very truly,

J.D. McDONALD, P.ENG.,
Senior Reclamation Inspector.

J.C. Errington, P.Ag.
Reclamation Inspector.

JCE:NG

DAVID MINERALS LTD.
4th Floor - 535 Howe Street
Vancouver, British Columbia, Canada V6C 2C2
Telephone: (604) 684-3333 Telex: 04-55346

MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES
Rec'd NOV 1 8 1982

November 12, 1982

Mr. J. C. Errington, P.Ag.,
Reclamation Inspector,
Ministry of Energy, Mines & Petroleum Resources,
105 - 525 Superior Street,
Victoria, B.C.
V8V 1T7

Dear Mr. Errington:

RE: Reclamation Permit for the H.B. Mine

Further to your letter to Mr. N. C. Croome of October 24, 1982, and to our subsequent telephone conversation, I am, by way of this letter, pleased to provide assurance that David Minerals Ltd. agrees to abide by the Terms and Conditions of Permit M-85. Receipt and Agreement documents establishing security in the amount of $10,000.00 should be forthcoming from the Royal Bank of Canada. Accordingly, we ask that you transfer Permit M-85 into the name of David Minerals Ltd.

It is also our understanding that the above is an interim measure and that a formal reclamation plan must be submitted in support of an application for a permit authorizing surface work. We anticipate completion of a reclamation plan for the H.B. operation by March 1, 1983. It would be our intent to tailor this document to also serve the purposes of an annual reclamation report as required under Permit M-85. Please advise if this is satisfactory.

Yours truly,

DAVID MINERALS LTD.

George H. Robbins

George H. Robbins,
Director - Environmental Affairs.

GHR:dep

cc: N.C. Croome
C.P. Moore

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Parliament Buildings
ctoria
British Columbia
V8V 1X4

105-525 Superior Street,
Victoria, B.C. V8V 1T7.
Telephone: 387-3781
November 18 1982.

Mr. George Robbins,
Director of Env. Affairs,
David Minerals Limited,
5th Floor - 535 Howe Street,
VANCOUVER, B.C. V6C 2C2.

Dear Sir:

Re: H.B. Property

I enclose a copy of Cominco's December 23, 1977 reclamation program, as requested.

Yours very truly,

J.D. McDONALD, P.ENG.,
Senior Reclamation Inspector.

J.C. Errington, P.Ag.
Reclamation Inspector.

JCE:NG

Province of British Columbia

Ministry of Energy, Mines and Petroleum Resources

Parliament Buildings
Victoria
British Columbia
V8V 1X4

105-525 Superior Street,
Victoria, B.C. V8V 1T7.
Telephone: 387-3781
October 24, 1982.

Mr. N.C. Croome, P.Eng.,
Secretary - Treasurer,
David Minerals Limited,
5th Floor - 535 Howe Street,
VANCOUVER, B.C. V6C 2C2.

Dear Sir:

Our letter of March 15, 1982, described the procedure for making application for a reclamation permit for the H.B. property. The procedure of obtaining this reclamation permit will take approximately eight months from the time the application is received in this office, and to date we have not received your application.

As an interim measure you can assume responsibility for Cominco's Permit by agreeing to abide by the Terms and Conditions of the existing Permit (M-85, copy enclosed), and by placing a security of $10,000 in the name of David Minerals Limited.

The security deposit, which should be submitted before work commences, must be in the form of cash, Government of Canada or Provincial direct or guaranteed securities having a maturity of not longer than three years, or Chartered banks', Trust companies', or Credit Unions' certificates of deposit where supported by an appropriate letter giving direction concerning payment of the funds to the Minister of Finance. Enclosed are Receipt and Agreement forms which should be completed by your bank with the original to be forwarded to this office.

Upon receipt of this security and upon a written assurance by David Minerals that it will agree to abide by the Terms and Conditions of Permit M-85, the Permit will be transferred into the name of David Minerals, and Cominco will be released from their obligations.

This interim measure will not remove the requirement for submitting an application for a reclamation permit as described in our letter of March 15, 1982.

I would remind you that failure to obtain a reclamation permit will be an offense under Section 10 of the Mining Regulation Act.

Yours very truly,

J.D. McDONALD, P.ENG.,
Senior Reclamation Inspector.

J.C. Errington

J.C. Errington, P.Ag.
Reclamation Inspector.

JCE:NG

CC: J.R.C. Lang, Nelson

DAVID MINERALS LTD.
5thxx Floor - 535 Howe Street
Vancouver, British Columbia, Canada V6C 2C2
Telephone: (604) 684-3333 Telex: 04-55346

MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES
JUL 15 1982
Rec'd

July 13, 1982

Mr. J.D. McDonald, P.Eng.
Senior Reclamation Inspector
Ministry of Energy, Mines and
Petroleum Resources
#105 - 525 Superior Street
Victoria, B.C. V8V 1T7

Dear Sir:

Re: Reclamation - HB Tailings Pond

This is written with respect to the proposed reclamation procedure for the HB tailings pond.

As you are aware, this is not a new operation. The pond was developed by Cominco for its HB mine and no physical changes have been introduced. We are working on the assumption that the reclamation procedures introduced by Cominco and approved by your Department continue to apply.

However, we are now treating, and plan to continue to treat, ores which will vary in chemical composition from the HB ores and we will be using different reagents. Under these circumstances, it is possible that some change in reclamation procedure may become necessary. We wish to assure you that we will monitor the situation on an on-going basis and will be prepared to make any changes which are called for by the varying circumstances.

With this assurance, we trust that issuance of the necessary Reclamation Permit may proced.

Yours very truly,

DAVID MINERALS LTD.

H. Brodie Hicks

H. Brodie Hicks, P.Eng., M.Eng.
Consulting Engineer

HBH:jd

cc: Mr. J.B.C. Lang
Mr. N.C. Croome
Mr. C.P. Moore

Province of British Columbia

Ministry of Energy, Mines and Petroleum Resources

MEMORANDUM

David Minerals

To: J.D. McDonald, P.Eng.
Senior Reclamation Inspector

Date: May 11, 1982

Our File: M-85

Re: H.B. Gold Project
Stage I report dated March 1982

Review of Stage I

This document is of limited use and contains no statement on the reclamation of the tailings area.

Current status of their application for a reclamation permit:

By letter dated March 15, 1982, David Minerals has been requested to apply for a reclamation permit. No response to date.

J.C. Errington, P.Ag.
Reclamation Inspector

JCE/eaa

J.D. McDonald, P.Eng.
Senior Reclamation Inspector

May 11, 1982

M-85

Re: U.B. Gold Project
Stage I report dated March 1982

Review of Stage I

This Document is of limited use and contains no statement on the reclamation of the tailings area.

Current status of their application for a reclamation permit:

By letter dated March 15, 1982, David Minerals has been requested to apply for a reclamation permit. No response to date.

J.C. Errington, P. Ag.
Reclamation Inspector

[illegible]

Our File: M-85

Rm. 105, 525 Superior St.
Victoria, B.C. V8V 1T7
387-3781

March 15, 1982

Mr. N.C. Croome, P.Eng.
Secretary-Treasurer
David Minerals Ltd.
1016 - 475 Howe Street
VANCOUVER, B.C.
V6C 2B3

Dear Mr. Croome:

Thank you for your letter of February 2, 1982 advising of your purchase of the H.B. Mine. Our apology in the delay of reply.

In order to apply for a reclamation permit you must submit a reclamation plan. I have enclosed a format which may assist you in the preparation of this report and realize that much of this checklist will not apply to your proposed custom milling operation. Particular attention should be paid to describing the nature of the tailings material and its potential to support plant growth.

Once you have filed this report you are required to publish "Notice of Filing" pursuant to Section 10, subsection (4) of the Mining Regulation Act.in the B.C. Gazette and the local daily newspaper. (Form attached.) It is only necessary to publish the Notice once. Please provide us with the tear sheets and date "Notice of Filing" appeared in the Gazette and newspaper as the dates are required for inclusion in the necessary Order-in-Council. Instruction regarding security deposit will be following after approval by Order-in-Council.

If you require any additional information regarding the requests of this report please do not hesitate to call.

Yours very truly,

J.D. McDonald, P.Eng.
Senior Reclamation Inspector

J.C.E.

J.C. Errington, P.Ag.
Reclamation Inspector

JCE/eass

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Parliament Buildings
Victoria
British Columbia
V8V 1X4

Our File: M-85

387-3781

Room 105
525 Superior Street
Victoria, B. C.
V8V 1T7

March 10, 1982

Mr. R.T. Gardiner, P.Ag.
Reclamation Agronomist
Cominco Ltd.
TRAIL, B.C.
V1R 4L8

Dear Mr. Gardiner:

Re: Annual Report 1981
Permit: M-85
Property: H.B. Mine

This will acknowledge receipt of your Annual Reclamation Report for the above property.

Yours very truly,

J. D. McDONALD, P.ENG.,
Senior Reclamation Inspector

J. C. Errington, P.Ag.,
Reclamation Inspector

JCE:kw/eaa

c.c. J.B.C. Lang
A. O'Bryan

Cominco Ltd./Trail, British Columbia, Canada V1R 4L8
Tel. (604) 364-4222/Telex 041-4426

Cominco

Mr. J.D. McDonald
Senior Reclamation Inspector
Ministry of Energy, Mines & Petroleum Resources
525 Superior Street
Victoria, B.C.

MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES
FEB 1 1982
Rec'd

February 8, 1982

Dear Mr. McDonald:

Re: Cominco Ltd. H.B. Mine, Surface Work Permit M-85

Respectfully submitted are three copies of the 1981 report on progress of reclamation at the H.B. Mine located near Salmo, B.C. Preparation of the report was completed prior to receiving a copy of the revised reporting format. We have taken the liberty of submitting the report as prepared since all requested information was included in the report. We trust the report is satisfactory.

During 1981, the mine-mill complex including equipment, surface structures, buildings and land were sold by Cominco Ltd. to David Minerals Ltd., 1004-595 Howe Street, Vancouver, B.C. V6C 2T5. Formal notification of this sale will be forthcoming following legal transfer of title to property to the new owners.

Yours sincerely,

R.T. Gardiner, P. Ag.
Reclamation Agronomist

RTG/jb

Enclosures

1016-475 Howe Street,
Vancouver, B.C. V6C 2B3

Telephone (604) 684-3333

DAVID MINERALS LTD.

February 2, 1982

Mr. J.D. McDonald, P.Eng.
Senior Reclamation Inspector
Ministry of Energy, Mines and
Petroleum Resources
#105 - 525 Superior Street
Victoria, B.C.
V8V 1T7

Dear Sir:

Please be advised that David Minerals Ltd. has purchased the assets of the HB Mine located five miles south of the Village of Salmo, British Columbia, consisting of surface rights, Crown Granted and recorded mineral claims, buildings, machinery and equipment.

David Minerals has agreed to assist and fully cooperate with Cominco Ltd. to enable Cominco to obtain refund of its Bond of $10,000 presently filed with the Government of British Columbia under the Mines Regulation Act. It is in this regard that we wish to apply for a reclamation permit under the said Act. Would you please advise us of the necessary procedure to be followed in obtaining a reclamation permit to enable David Minerals Ltd. to renovate and re-open the HB Mill for treatment of ores, using the existing flotation system.

Thank you for your kind consideration in this matter.

Yours very truly,

DAVID MINERALS LTD.

N.C. Croome, P.Eng.
Secretary-Treasurer

NCC:jd

Province of British Columbia

Ministry of Energy, Mines and Petroleum Resources

MEMORANDUM

To: FILE NOTE - Cominco - H.B. Mine

Date: May 1, 1981

Our File: M-85

Ken Davies, Cominco telephoned

H.B. Property - $10,000.00 Bond.

They are negotiating to sell the H.B. Property and enquired whether they would get the bond back upon the completion of sale.

I said that the bond would be returned on the condition that the new owner assumed the responsibility for reclamation and posted a separate bond.

J.C. Errington, P.Ag.
Inspector of Mines
(Reclamation)

JCE/eas

cc: J.D. McDonald

To: FILE NOTE - Cominco - H.B. Mine

Date: May 1, 1981

Our File: M-85

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J.C. Errington

J.C. Errington, P.Ag.
Inspector of Mines
(Reclamation)

JCE/eas

cc: J.D. McDonald

Talked R. Cowden. - File H.B.

Province of
British Columbia

Ministry of
Energy, Mines and
Petroleum Resources

Parliament Buildings
Victoria
British Columbia
V8V 1X4

387-3781

Our File: M-85

Room 105
525 Superior Street
Victoria, B. C.
V8V 1T7

April 10, 1981

Cominco Ltd.
Trail, B. C.
V1R 4L8

Attention: R. T. Gardiner
Reclamation Agronomist

Dear Sir:

Re: Annual Report 1980
Permit: M-85
Property: H. B. Operations

This will acknowledge receipt of your Annual Reclamation Report for the above property.

Yours very truly,

J. D. McDONALD, P.ENG.,
Senior Reclamation Inspector

J. C. E

J. C. Errington, P.Ag.,
Reclamation Inspector

JCE:kw

c.c. A. L. O'Bryan, Reclamation Inspector Technician - Nelson
J. B. C. Lang, District Inspector - Nelson

Cominco Ltd./Trail, British Columbia, Canada V1R 4L8
Tel. (604) 364-4222/Telex 041-4426

File

Cominco

Mr. J.D. McDonald
Senior Reclamation Inspector
Ministry of Energy, Mines & Petroleum Resources
525 Superior Street
Victoria, B.C.

1981

April 2, 1981

Dear Mr. McDonald:

Re: Permit M-85: Cominco Ltd., H.B. Mine

Please find enclosed three copies of the Annual Reclamation Report for 1980 and Proposed Program for 1981 for the H.B. Mine.

Yours sincerely,

R.T. Gardiner, P.Ag.
Reclamation Agronomist

RTG/jb

Enclosures

75 YEARS 1906-1981

EVERGREEN PRESS (V.I.) LIMITED CARBON READY SETS
201-723 FORT ST., VICTORIA, B.C.

THE DEPUTY MINISTER OF FINANCE
OFFICE OF THE REGISTRAR
PARLIAMENT BUILDINGS
VICTORIA, B.C.

RECORD OF INCOMING REGISTERED MAIL

RECEIVED FROM

Cominco Ltd.
200 Granville Street
Vancouver, B. C.
V6C 2R2

T.A. 10645

File: 2112

DATE RECEIVED September 4, 1980

YOUR REGISTERED LETTER

No. 9894 DATED Sept. 3, 1980

Re: Ministry of Mines Deposit
COMINCO LTD.

[redacted] s.21

Bond Nos: T29C115656/8 (3 x $5,000)

[redacted] s.21

M-85
~~$10,000~~
M-5

BEARER...

WE ACKNOWLEDGE RECEIPT OF THE ENCLOSURES LISTED ABOVE

Sept. 4/80

INITIALS

wp	

Recd. T.W.

For Deputy Minister of Finance
PROV. OF BRITISH COLUMBIA

TRIPLICATE...

GOVERNMENT OF THE PROVINCE OF BRITISH COLUMBIA
REGISTRAR OF SECURITIES
DEPARTMENT OF FINANCE
VICTORIA, B.C. V8V 1X4

TO:— Cominco Ltd.
200 Granville Street
Vancouver, B. C.
V6C 2R2

DATE September 5 1980

File: 2112

WE HAVE TODAY FORWARDED TO YOU BY REGISTERED MAIL, THE FOLLOWING SECURITIES:

AMOUNT	PARTICULARS	REGISTRATION
	Re: Ministry of Mines Deposit COMINCO LTD.	
[redacted] s.21		
	Bond Nos: [redacted] Not Responsive EA-E 743 (1 x $10,000)	BEARER... $10,000.00 ✓ OK [redacted] Not Responsive H.B. M... -M-85 [redacted] Not Responsive

EVERGREEN PRESS - VICTORIA

wp/ JR

SEPT. 5/80

REGISTRAR OF SECURITIES

PER.....................

Our File: M-85

Room 105
525 Superior Street
Victoria, B. C.
V8V 1T7

March 21, 1980

Cominco Ltd.
Trail, B. C.
V1R 4L8

Attention: R. T. Gardiner, P.Ag.,
Reclamation Agronomist

Dear Sir:

Re: Annual Report, Permit M-85
Cominco Ltd., H. B. Mine

This will acknowledge receipt of your letter dated March 14, 1980, enclosing your Annual Reclamation Report on the H.B. Mine.

Yours very truly,

J. D. McDONALD, P.ENG.,
Senior Reclamation Inspector

J.C.E.

J. C. Errington, P.Ag.,
Reclamation Inspector

JCE:kw

c.c. A. O'Bryan
B. Lang

Cominco Ltd./Trail, British Columbia, Canada V1R 4L8
Tel. (604) 364-4222/Telex 041-4426

Environmental Control

EN Doyle
Manager
Tel. (604) 364-4143

FJL Miller
Asst. Manager
Tel. (604) 364-4152

Mr. J.D. McDonald
Senior Reclamation Inspector
Ministry of Energy, Mines & Petroleum Resources
525 Superior Street
Victoria, British Columbia
V8V IT7

Permanent

DEPT. OF MINES AND PETROLEUM RESOURCES
Rec'd

March 14, 1980

Dear Mr. McDonald:

Re: Permit No. 85: Cominco Ltd. H.B. Mine

Please find enclosed three copies of the Annual Reclamation Report for 1979 and Proposed Program for 1980 for the H.B. Mine.

Yours sincerely,

R.T. Gardiner P. Ag.
Reclamation Agronomist

RTG:sjs

Enclosure

Our File: M-85

1835 Fort Street
Victoria, B. C.
V8R 1J6

March 1, 1979

Cominco Ltd.
Trail, B. C.
V1R 4L8

Attention: R. T. Gardiner
Reclamation Agronomist

Dear Sir:

This will acknowledge receipt of your letter of February 20, 1979 enclosing your Annual Reclamation Report for the H.B. Mine - Permit No. M-85.

Thank you for forwarding same to this office.

Yours very truly,

J. D. McDonald, P.Eng.,
Senior Reclamation Inspector

JCE:kw

Cominco Ltd./Trail, British Columbia, Canada V1R 4L8
Tel. (604) 364-42??/Telex 041-4426

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd ?? 26 1979

Cominco

Mr. J.D. McDonald
Senior Reclamation Inspector
Ministry of Energy, Mines &
Petroleum Resources
1835 Fort Street
Victoria, B.C.

February 20, 1979

Dear Mr. McDonald:

Re: Cominco Ltd. HB Mines
Annual Reclamation Report for 1978
and Proposed Program for 1979
Operation and Surface Work Permit M-85

Enclosed are three copies of the aforementioned report each containing an airphoto with transparent overlay documenting operational reclamation activities at the HB mine.

Yours sincerely,

R.T. Gardiner
Reclamation Agronomist

RTG/bf

Enclosure

Our File: M-85

1835 Fort Street
Victoria, B.C.
V8R 1J6

November 10, 1978

Mr. L.M. McBride
Solicitor
Cominco Ltd. - H.B. Operations
TRAIL, B.C.
V1R 4L8

Dear Mr. McBride:

Re: Section 11, Mines Regulation Act.

Please find enclosed Permit No. M-85 issued to Cominco Ltd. - H.B. Operations authorizing surface work on the H.B. Operations, duly signed and sealed by the Honourable James R. Chabot, Minister of Mines and Petroleum Resources.

Yours very truly,

J.D. McDonald, P.Eng.,
Senior Reclamation Inspector

JDM/eas

cc: J.B.C. Lang, District Inspector

Encl.

M-85

Dr. J.T. Fyles
Deputy Minister
Ministry of Mines and Petroleum
Resources

October 31, 1978

Re: Signatures required for attached permits

Attached are two permits each for the following companies which require the Minister's signature and seal.

Not Responsive

M-85	Cominco Ltd. - H.B. Mine	O.I.C. 2411

Not Responsive

These permits do not require further security deposits.

Please forward these permits to the Minister for his signature and return to Mr. J.D. McDonald, Senior Reclamation Inspector, for processing.

VED.

W.C. Robinson, P.Eng.,
Chief Inspector of Mines

/eas

THE GOVERNMENT OF THE PROVINCE OF BRITISH COLUMBIA

2411

APPROVED AND ORDERED SEP. - 7 1978

Lieutenant-Governor

EXECUTIVE COUNCIL CHAMBERS, VICTORIA SEP. - 7 1978

Pursuant to the Section 11, Mines Regulation Act, and upon the recommendation of the undersigned, the Lieutenant-Governor, by and with the advice and consent of the Executive Council, orders that

the programme and report concerning the mining programme of Cominco Ltd. - H.B. Operations on property located near Salmon River south of Salmo, dated December 23, 1977, compiled in accordance with Section 11 of the Mines Regulation Act, is hereby approved for renewal of Permit Number M-85 on a permanent basis.

AND FURTHER ORDERS THAT the form and the amount of the security deposit for this renewal shall be the security deposit in the amount of $10,000.00 presently held by the Minister of Finance.

Minister of Mines and Petroleum Resources

W. R. Bennett

Presiding Member of the Executive Council

Our File: M-85

1835 Fort Street
Victoria, B. C.
V8R 1J6

June 13, 1978

Cominco Ltd.
Box 2000
Kimberley, B. C.
V1A 2G3

Dear Sirs:

Re: Surface Work Permit No. M-85
H. B. Mine Project

The period of Surface Work Permits granted by the Minister of Mines and Petroleum Resources, is being changed from 3 years to permanent. Would you please, therefore, forward your copy of the Surface Work Permit, so that the appropriate change can be made, is you have not already done so.

An annual report of work and reclamation is still bequired and on the basis of this, and field inspections, bonding will be adjusted.

Yours very truly,

J. D. McDonald, P.Eng.,
Senior Reclamation Inspector

DMG:kw

1835 Fort Street
Victoria, B.C.
V8R 1J6

May 24, 1978

Mr. R.E. Jones
Mill Superintendent
H.B. Operations
Cominco Ltd.
SALMO, B.C.
VOG 1ZO

Dear Sir:

Re: Surface Work Permit #85

Thank you for submitting the extra copies of maps which we requested to accompany previously submitted 1977/1978 reclamation work report.

This material will be reviewed by the Advisory Committee on Reclamation and you will be notified as soon as it has been considered.

Renewal will be on a permanent basis.

Yours very truly,

J.D. McDonald, P.Eng.,
Senior Reclamation Inspector

DMG/bm

bcc: Bruce Lang
Art O'Bryan

ADVISORY COMMITTEE ON RECLAMATION

To: Mr. W.C. Robinson, Chairman, Ministry of Mines & Petroleum Resources
Mr. D.M. Galbraith, Ministry of Mines & Petroleum Resources
Dr. J.C. Errington, Ministry of Mines & Petroleum Resources
Mr. A.S. Schori, Ministry of Agriculture
Mr. T.A.J. Leach, Ministry of the Environment
Mr. E. Smith, Ministry of Forests
Mr. D. Zirul, Ministry of the Environment
Mr. B. Pendergast, Ministry of Recreation & Conservation (Coal)
Mr. C. Newcombe, Ministry of Recreation & Conservation (Mineral)

Re: Mines Regulation Act, Section 11

Information is attached for your review as noted below. A committee meeting will be called in the near future to discuss approval of Surface Work Permits. Please contact me if you have any questions.

M.R.A. Permit No. 85, H.B. Mine, Cominco Ltd.
1977/78 Work/Reclamation Report

Yours very truly,

Dwy for

J.D. McDonald, P.Eng.,
Senior Reclamation Inspector

DMG/bm

Cominco Ltd. / H. B. Mine, Salmo, British Columbia, Canada, V0G 1Z0 / Tel. (604) 357-2276

Cominco

Mines

D. M. Galbraith
Reclamation Inspector
1837 Fort St.
Victoria, B.C.

May 3, 1978

Dear Sir:

Enclosed are six copies of the map sent into Mr. J.D. McDonald with our application for extension of Reclamation Permit No.85 as per your request.

Yours truly,

R Wyka

R. Wyka
Acting Superintendent

RW:mfl

Enclosures (6)

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd 1978

Environment Canada / Environnement Canada
Environmental Protection / Protection de l'Environnement

7?? McDonald

H.B. Mine 35

4th Floor, Kapilano 100, Park Royal,
West Vancouver, B.C. V7T 1A2

April 20, 1978

DEPT. OF MINES AND PETROLEUM RESOURCES
Rec'd APR 24 1978

Your file Votre référence

Our file Notre référence
4780-37/C685-2

Mr. R. Wyka,
Mine Manager,
Cominco Ltd.,
H.B. Mine,
Salmo, B.C. VOC 1ZO

Dear Mr. Wyka:

Re: Effluent Quality Survey, October, 1977

As you are aware, during the period from October 4-6, 1977, the Environmental Protection Service conducted a study to determine the quality of the Cominco H.B. mine tailings pond decant. Samples were collected for chemical and bioassay analyses. We have enclosed for your information and records a copy of the results obtained.

A review of the data indicated that the decanted effluent is in compliance with the effluent quality requirements of our "Metal Mining Liquid Effluent Guidelines" for all parameters except fish toxicity. Based on the available data we are unable to determine the component or components of the effluent contributing to the toxicity.

Under normal circumstances, we would be concerned about the discharge of toxic effluent to the Salmo River and would be endeavouring to have this problem resolved. However, noting that the effluent is only marginally toxic and that your mine will be shutting down in September 1978, we are willing to live with the existing situation until the specified closure date.

With respect to site reclamation following mine closure, we have made arrangements with the Ministry of Mines and Petroleum Resources to obtain from that agency a copy of your plans for reclamation when submitted. Following our review of the plans, we will be providing comments as required to that Ministry for incorporation in their agreement with your Company.

...2

If you have any questions or comments with respect to the enclosed data, please feel free to contact Mr. J. Villamere or Mr. G. Trasolini (telephone number 666-6711) of my staff.

Yours truly,

ORIGINAL SIGNED BY
B. A. HESKIN
A SIGNÉ L'ORIGINAL

B. A. Heskin, P. Eng.,
Regional Director General, Pacific Region,
Environmental Protection Service,
Department of Fisheries and the Environment

Encl.

cc: Mr. W.N. Venables, P. Eng.,
Director, Pollution Control Branch,
Water Resources Administration,
Ministry of the Environment,
Parliament Buildings,
Victoria, B. C. V8V 4S5.

Mr. J. McDonald,
Senior Reclamation Inspector,
Ministry of Mines and Petroleum Resources,
1837 Fort Street,
Victoria, B.C. V8R 1J6

COMINCO H.B. MINE

TAILINGS POND DECANT

COMPOSITE SAMPLE RESULTS

October 4 - 6, 1977

A. CHEMICAL ANALYSES

PARAMETER		DAY 1	DAY 2	DAY 3
As (T)	mg/l	0.004	0.004	0.005
Cd (T)	mg/l	<0.01	<0.01	<0.01
Cd (D)	mg/l	<0.01	<0.01	<0.01
Cu (T)	mg/l	0.02	0.02	0.01
Cu (D)	mg/l	<0.01	<0.01	<0.01
Hg (T)	µg/l	<0.2	<0.2	<0.2
Ni (T)	mg/l	<0.05	<0.05	<0.05
Ni (D)	mg/l	<0.05	<0.05	<0.05
Pb (T)	mg/l	0.1	<0.1	0.1
Pb (D)	mg/l	0.03	0.04	0.04
Zn (T)	mg/l	0.09	0.08	0.08
Zn (D)	mg/l	0.05	0.07	0.07
N.F.R.	mg/l	<5	<5	<5
pH		7.5	7.6	7.5

B. TOXICITY DETERMINATION

	DAY 1	DAY 3
LC_{50} (96 hour)	56%	73%

COMINCO H.B. MINE

TAILINGS POND DECANT

GRAB SAMPLE RESULTS

October 5, 1977.

PARAMETER			
As	(T)	mg/l	0.004
Cd	(T)	mg/l	<0.01
Cd	(D)	mg/l	<0.01
Cu	(T)	mg/l	0.01
Cu	(D)	mg/l	<0.01
Hg	(T)	µg/l	<0.2
Ni	(T)	mg/l	<0.05
Ni	(D)	mg/l	<0.05
Pb	(T)	mg/l	0.1
Pb	(D)	mg/l	0.03
Zn	(T)	mg/l	0.09
Zn	(D)	mg/l	0.04
N.F.R.		mg/l	<5
pH			7.5

Hon. J.R. Chabot

Minister of Mines & Petroleum
Resources

BUILDINGS

Aug 21 78

Subject: Cominco Ltd. - Request for extension of Surface Work Permit, pursuant to Section 11, Mines Regulation Act.

Pursuant to Section 11, Mines Regulation Act, the reclamation programme of Cominco Ltd. is approved on a permanent basis with no increase of security bonding at this time. Cominco Ltd. has submitted a programme dated January 1978 which has been considered by all affected ministries of Government at an Advisory Committee Meeting on Reclamation held June 5, 1978, and approved by yourself, June 30, 1978.

The reclamation report has been filed and approved and Notice of Filing was published in the B.C. Gazette on May 1, 1978 and in the local daily newspaper May 1, 1978 and no representations have been made by others affected by the report.

JAMES T. FYLES
Deputy Minister

/eas

MEMORANDUM FROM W. C. Robinson, P.Eng., Chief Inspector

TO The Honourable James R. Chabot
Minister
Ministry of Mines and Petroleum Resources

THE DEPARTMENT OF MINES AND PETROLEUM RESOURCES

DATE June 30, 1978

Re: Surface Work Permit No. M-85
Cominco Ltd., HB Mine
Pursuant to Mines Regulation Act

Cominco Ltd. has submitted to the Ministry of Mines and Petroleum Resources, their Reclamation Report, dated December 23, 1978. This has been reviewed by Mr. J. D. McDonald, Senior Reclamation Inspector and has been submitted to the Advisory Committee on Reclamation. It has been recommended that approval be granted on a permanent basis.

Work at the HB Mine will be terminated this fall. Field and laboratory research is underway to determine the most effective means for revegetation of both tailings and waste dumps. Level of bonding is considered to be adequate for the closing phase.

If you concur with these recommendations, please indicate so by signing this memorandum and returning to Mr. J. D. McDonald for processing.

W. C. Robinson

W. C. Robinson, P.Eng.,
Chief Inspector of Mines

DMG:kw

c.c. Dr. J. T. Fyles

Chabot

Our File: M-85

1835 Fort Street
Victoria, B.C.
V8R 1J6

June 30, 1978

Mr. R. Wyka
Superintendent
Cominco Ltd.
H.B. Mine
SALMO, B.C.
V0G 1Z0

Dear Sir:

Re: Surface Work Permit No. M-85
Cominco Ltd, H.B. Mine

The Advisory Committee on Reclamation has recommended approval of renewal of your Surface Work Permit. This will be on a permanent basis, and no further applications need be made.

An Annual Report of work and reclamation will still be required and adjustment of bonding will be done on this basis.

If you have not already done so please advise this office when your report has been advertised. Forms attached.

Please also forward your copy of the permit so the change to permanent status can be made.

Yours very truly,

J.D. McDonald, P.Eng.,
Senior Reclamation Inspector

JDMG/eas

cc: J.B.C. Lang, District Inspector
A. O'Bryan, District Reclamation Inspector Technician

Cominco Ltd./Trail, British Columbia, Canada V1R 4L8
Tel. (604) 364-4222/Telex 041-4426

Cominco

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd JUN 28 1978

FHP Dewdney
Regional Counsel
Tel. (604) 364-4114

LM McBride
Solicitor
Tel. (604) 364-4108

TD Tutti
Solicitor
Tel. (604) 364-4109

Mr. J.D. McDonald
Senior Reclamation Inspector
Ministry of Mines and
Petroleum Resources
1835 Fort Street
Victoria, B. C.
V8R 1J6

June 27, 1978

re: Permit No. 85 - H.B. Mine

Dear Sir:

Pursuant to your letter dated June 13, 1978 addressed to our Kimberley Office, I enclose herewith Permit No. 85 to be amended as indicated in your letter.

After the permit has been amended to read "permanent" please return to the attention of L. M. McBride, Solicitor, Cominco Ltd., Trail, B. C. V1R 4L8

Yours very truly,

LMMcBride

L. M. McBride

LMM:A
Encl.

REGISTERED

Cominco Ltd./H. B. Mine, Salmo, British Columbia, Canada, V0G 1Z0/Tel. (604) 357-2276

M-85

Cominco

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd APR 24 1978

Mines

Nelson Daily News
266 Baker St.
Nelson, B.C.

April 19, 1978

Dear Sir or Madam:

Please insert the enclosed advertisement in your paper beginning with "Mines Regulation Act" in the form as shown.

We would like to have this advertisement placed in your paper on May 1st, 1978 for the one day only.

Please forward the bill for this advertisement to

Cominco Ltd.
H.B. Operations
Salmo, B.C.
V0G 1Z0

Yours truly,

R. Wyka
Acting Superintendent

RW:mfl

Enclosure

cc: Dept. Of Mines

RE: SECTION 11, MINES REGULATION ACT

Notice of the filing of the report with the Minister, as required by Subsection 4 of Section 11, is to be in the form as follows:

M I N E S   R E G U L A T I O N   A C T

Notice pursuant to Section 11

Take notice that . . Robert Wyka . . . .
(owner, agent or manager)

of . . . . . . H.B. Mine, Cominco Ltd. . . . .
(name(s) of mine(s) and/or company)

has filed with the Minister of Mines and Petroleum Resources at Victoria a report made pursuant to Section 11 of the Act in respect to the surface mine(s) located at . . Salmo, B.C. . . . .

Cominco Ltd./H. B. Mine, Salmo, British Columbia, Canada, V0G 1Z0/Tel. (604) 357-2276

Cominco

Mines

B. C. Gazette
Victoria, B.C.

April 19, 1978

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd APR 24 1978

Dear Sir or Madam:

Please insert the enclosed advertisement in your paper beginning with "Mines Regulation Act" in the form as shown.

We would like to have this advertisement placed in your paper on May 1st, 1978 for the one day only.

Please forward the bill for this advertisement to

Cominco Ltd.
H.B. Operations
Salmo, B.C.
VOG 1ZO

Yours truly,

R. Wyka
Acting Superintendent

RW:mfl

Enclosure

cc: Dept. of Mines ✓

RE: SECTION 11, MINES REGULATION ACT

Notice of the filing of the report with the Minister, as required by Subsection 4 of Section 11, is to be in the form as follows:

MINES REGULATION ACT

Notice pursuant to Section 11

Take notice that . . Robert Wyka . . . .
(owner, agent or manager)

of . . . . . . H.B. Mine, Cominco Ltd. . . . .
(name(s) of mine(s) and/or company)

has filed with the Minister of Mines and Petroleum Resources at Victoria a report made pursuant to Section 11 of the Act in respect to the surface mine(s) located at . . Salmo, B.C. . . . .

1835 Fort Street
Victoria, B.C.
V8R 1J6

April 11, 1978

Mr. R. Wyka
Superintendent
Cominco Ltd.
H.B. Mine
SALMO, B.C.
VOG 1Z0

Dear Sir:

Re: Section 11, Mines Regulation Act
Permit No. 85 - H.B. Mine Operations
Cominco Ltd.

This will acknowledge with thanks your letter of March 15, 1978 requesting renewal of Permit No. 85. This will be reviewed at the next Advisory Committee on Reclamation meeting.

Renewals require that the application be advertised. Attached is the appropriate form to be used. The advertisement is to be placed once only in the B.C. Gazette and once only in the Nelson Daily News. This office is to be advised as to the date of the advertisement along with a copy.

Yours very truly,

JD

J.D. McDonald, P.Eng.,
Senior Reclamation Inspector

JDM/bm

Cominco Ltd. / H. B. Mine, Salmo, British Columbia, Canada, V0G 1Z0 / Tel. (604) 357-2276

Cominco

Mines

Mr. J.D. McDonald
Senior Inspector of Mines - Reclamation
Ministry of Mines and Petroleum Resources
Parliament Buildings
Victoria, B.C.
V8V 2M2

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd MAR 29 1978

March 15, 1978

Dear Sir: Re: Section 11, Mines Regulation Act
Reclamation Permit No. 85
H.B. Mine Operations.

Please accept this letter as an application for extension of Reclamation Permit No. 85.

Permit No. 85 was issued March 28, 1978, authorizing surface work at H.B. Operations for a period of 5 years.

In compliance with items 6, 7, 8 and 9 of the Terms and Conditions of this permit a program of research on land reclamation has been carried out since 1973. Progress of research has been recorded in the yearly reports previously submitted to the Senior Reclamation Inspector.

It is intended to terminate current mining operations as of September 1st, 1978 although the plant is to remain on the property for at least another year. Progress of the reclamation research program for 1978 will be submitted to the Senior Reclamation Inspector by January 31, 1979.

Land disturbance subsequent to March 28, 1978 will be very minimal or unchanged from the present time. The nature, extent and location of disturbed land at H.B. Operations is summarized in Table I and illustrated in Figure I.

Continued ....

The disposal of some buildings around the 3500 level area will begin in 1978 as well as the surface preparation of the 3500 level waste dump. The reclamation of the remaining waste rock dump, plant and service area, tailings pond and roads will be done subsequent to the removal of the mill and attendant buildings. This removal will be contingent upon a decision to do custom milling in the future.

We trust that our request for permit renewal will meet with your approval.

Yours truly,

R. Wyka
Superintendent

RW/das

cc: E.N. Doyle
K.V.S. Meyer
R.T. Gardiner
R.E. Jones

TABLE I. TOTAL ACREAGE OF DISTURBED AND REVEGETATED LAND AT H.B. OPERATIONS.

NATURE OF DISTURBANCE	AREA (hectares) MARCH 28, 1973	MARCH 28, 1978
Waste Rock Dumps: 2800 Level	0.9 (2.2 acres)	0.9
3500 Level	0.1 (0.2 acres)	0.1
Open Pit	0	2.4
Tailings Impoundment	24.3 (60 acres)	24.8
Tailings Dam Construction and Borrow Pits	0	3.4
Buildings and Service Areas	4.0 (10 acres)	1.6
Roads	1.6 (4.0 acres)	2.5

1835 Fort Street,
Victoria, B.C. V8R 1J6.

January 3rd, 1978.

Mr. R. E. Jones,
Mill Superintendent,
H.B. Operations,
Cominco Ltd.,
Salmo, B.C. V0G 1Z0

Dear Sir:

Re: Progress Report - 1977.

This will acknowledge receipt of your letter of December 23rd, 1977 enclosing "Mined Land Reclamation at Cominco Ltd., H.B. Operations, Salmo, B.C. Progress Report 1977".

Thank you for forwarding same to this office.

Yours very truly,

J. D. McDonald, P.Eng.,
Senior Reclamation Inspector.

JDM:jau

Cominco Ltd./H. B. M~~e, Salmo, British Columbia, Canada, V0G 1Z0/T~~ (604) 357-2276

85

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd DEC 30 1977

Cominco

Mines

Mr. J.D. MacDonald
Senior Reclamation Inspector
Mineral Resources Branch
Ministry of Mines and Petroleum Resources
Parliament Buildings
Victoria, B.C.
V8V-1X4

December 23, 1977

Mr. MacDonald:

I am enclosing one copy of the "Mined Land Reclamation at Cominco Ltd., H.B. Operations, Salmo, B.C. Progress Report 1977" for your files.

The report explains the work which was carried out in 1977 on reclamation studies and also a brief idea as to the work planned for 1978.

Yours Truly

R.E. Jones

R.E. Jones
Mill Superintendent
H.B. Operations

RJ/das

1835 Fort Street,
Victoria, B.C. V8R 1J6.

March 1, 1977.

Cominco Ltd.,
H.B. Mine,
Salmo, British Columbia.
VOG 1ZO.

Attention: Mr. R. Wyka,
Acting Superintendent.

Dear Sir:

Re: Progress Report - 1976.

This will acknowledge, with thanks, receipt of your letter of February 23, 1977 enclosing "Progress Report 1976" regarding Permit No. 85 submitted pursuant to Section 11 of the Mines Regulation Act.

Yours very truly,

J.D. McDonald, P.Eng.,
Senior Reclamation Inspector.

JDM:jau

Cominco Ltd. / H. B. Mine, Salmo, British Columbia, Canada, V0G 1Z0 / Tel. (604) 357-2276

Cominco

Mines

Mr. J. D. McDonald
Senior Reclamation Inspector
Department of Mines and Petroleum Resources
Parliament Buildings
Victoria, B.C.

February 23, 1977

Dear Sir:

Enclosed is our report on reclamation research at H.B. Mine for the year 1976.

Yours sincerely,

R. Wyka

R. Wyka
Acting Superintendent

RW:mfl

Enclosure

1835 Fort Street,
Victoria, B.C. V8R 1J6.

January 29th, 1976.

Mr. H.G. Barker,
Superintendent,
Cominco Ltd.,
H.B. Mine,
SALMO, British Columbia.
VOG 1ZO.

Dear Sir:

This will acknowledge receipt of your letter dated January 27th, 1976 enclosing Progress Report on Land Reclamation at your H.B. Operations for the year 1975 which includes proposed 1976 programme.

Thank you for forwarding same to our office.

Yours very truly,

J.D. McDonald, P.Eng.,
Senior Reclamation Inspector.

JDM:jau

Cominco Ltd./H. B. Mine, Salmo, British Columbia, Canada, V0G 1Z0/Tel. (604) 357-2276

Cominco

Mines

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd JAN 29 1976

Mr. J. D. McDonald
Senior Reclamation Inspector
Department of Mines and Petroleum Resources
1835 Fort St.
Victoria, B.C. V84 IJ6

January 27, 1976

Dear Mr. McDonald:

Enclosed is our Progress Report on Land Reclamation at our H.B. Operations.

Yours sincerely,

for.

H. G. Barker
Superintendent

HGB:mfl

Enclosure

Mined-Land Reclamation at Cominco Ltd.

H.B. Operations

Salmo, B.C.

Progress Report 1975

R.T. Gardiner, P.Ag.
Reclamation Agronomist

J.E. Stathers
Assistant Reclamation Agronomist

Cominco Ltd.
Trail, B.C.

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Mined-Land Reclamation at Cominco Ltd. - H.B. Operations Salmo, B.C.

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Mined-Land Reclamation at Cominco Ltd.

H.B. Operations

Progress Report 1975

1. Introduction

The general approach to reclamation of disturbed land surfaces at H.B. Operations is to improve growth conditions on waste disposal and other disturbed land areas and to encourage succession of native vegetation. Establishment and maintenance of an initial vegetative cover of grass and legume species will accelerate soil formation, control erosion, provide forage for wildlife, and improve the aesthetic appearance of disturbed land surfaces.

2. Mining Program

Land areas disturbed at H.B. Operations were described in "Application for Permit Authorizing Surface Work - Cominco Ltd., H.B. Operations, January, 1973", and the "Mined-Land Reclamation Research Report 1974"(1,2). Mining operations in 1975 conformed to the plans outlined in the original permit application. During 1975 construction of access roads to surface diamond drilling sites disturbed 0.7 acres. Land disturbed in construction of the lift to the tailings dam was inspected by Mr. Art O'Brien, Reclamation Inspector, on October 7, 1975. Improvement of drainage along the access road has been completed as suggested. Revegetation of the borrow pit will be carried out when more definite information related to future construction of the tailings dam and further disturbance to the borrow pit area is available.

The nature and extent of land surfaces disturbed to the end of 1975 are summarized in Table 1.

3. Reclamation Research

3.1 Suitability of H.B. Tailings as a Liming Material

The feasibility of using calcareous H.B. tailings as a liming material for neutralization of acidic mill waste at Sullivan Operations has been investigated since 1973(3). Mixing H.B. tailings at 25% by weight with oxidized iron and siliceous tailings reduced salt concentrations and maintained the pH within a range tolerated by most plant species for a period of 20 weeks in growth chamber studies.

The cost of commercial liming materials varies with purity (content of magnesium and heavy metals), degree of fineness or particle size, and calcium carbonate equivalence or neutralizing capacity. In 1975 a study was carried out to determine the suitability of calcareous tailings from three Cominco Ltd. operations as liming materials (unpublished report by Stathers and Gardiner, 1975). H.B. tailings has a particle size and calcium carbonate equivalence (the major factors affecting rate of neutralization in an acid medium) comparable to agricultural grade dolomitic limestone. The total lead and zinc content of H.B. tailings is high relative to agricultural grade dolomitic limestone (Table 2).

3.2 Climatic Conditions During 1975

A summary of weather data recorded during 1975 at the B.C. Forest Service weather station located approximately 10 miles north-west of the H.B. mine is presented (Table 3). Precipitation during the 1975 growing season (May through September) was 283.2 mm. The period May through September 1975, had a mean monthly temperature of 13.9°C. The frost free period was 101 days, occurring between June 9 and September 18.

4. Operational Reclamation

In April 1974, approximately 2 hectares of road cut embankments were hydroseeded in an attempt to reduce surface creep and erosion(2). Maintenance fertilizer the equivalent of 66 Kgm/ha was applied to hydroseeded areas on April 29, 1975. Subjective evaluation of vegetative growth in September, 1975 indicated that where adequate plant populations had established plant growth was vigorous. Limitations to plant growth appeared to be caused by instability of steeply sloping embankments and soil moisture deficiency, rather than nutrient deficiency. On steeply sloping road cuts constructed through coarse-textured material vegetative cover was sparse. On gradually sloping embankments composed of finer-textured material, and seepage sites, vegetative cover was satisfactory.

5. Proposed Research and Operational Reclamation Programs for 1976

Reclamation research investigations planned for H.B. Operations during 1976 will include:

a) establishment of field experiments on shallow tailings deposited adjacent the tailings pipeline

b) continuation of growth chamber studies to determine cultural techniques and plant species for revegetation of tailings and tailings slimes.

6. References

(1) Barker, H.G., 1973. Application for permit authorizing surface work - Cominco Ltd., H.B. Operations, Submitted to Senior Inspector of Mines, Reclamation, Dept. of Mines and Petroleum Resources, Parliament Buildings, Victoria.

(2) Gardiner, R.T., 1975. Mined-Land Reclamation Research at H.B. Operations, Progress Report 1974, Submitted to Senior Reclamation Inspector, Dept. of Mines and Petroleum Resources, Parliament Buildings, Victoria, January 31, 1975.

(3) Gardiner, R.T., 1975. Mined-Land Reclamation Research at Sullivan Operations, Progress Report 1974, Submitted to Senior Reclamation Inspector, Dept. of Mines and Petroleum Resources, Parliament Buildings, Victoria, January 31, 1975.

7. List of Tables

Table 1: Disturbed Land at H.B. Operations

Table 2: Characterization of H.B. Tailings as a Liming Material

Table 3: Weather Summary for 1975.

Table 1: Disturbed Land at H.B. Operations

Nature of Disturbance		Area (Hectares)
Waste rock dumps:	2800 level	0.9
	3500 level	0.1
Open pit		2.4
Tailings impoundment		24.8
Buildings and service area		1.6
Roads		2.3
		34

Table 2: Characterization of H.B. Tailings as a Liming Material

Property		H.B. Tailings	Agricultural Dolomitic Limestone
Particle Distribution (%)			
mesh size	-4	100	100
	-8	100	100
	-20	99.4	87.5
	-40	98.3	80.5
	-60	98.0	62.5
	-80	96.7	42.3
	-100	94.6	26.8
$CaCO_3$ Equivalence (%)		84	87
Total Pb content (ppm)		445	80
Total Zn content (ppm)		3000	225

Table 3:

Weather Summary for the Year: 1975

Station: B.C. Forest Service, Salmo, B.C.

Month	Temperature °C					Precipitation		
	Means			Extremes		Rain	Snow	Total[1]
	Max	Min	Mean	Max	Min	mm	cm	mm
Jan	-2.3	-11.3	-6.8	4.4	-23.3	5.59	111.51	117.09
Feb	1.4	-10.7	-4.6	7.2	-23.3	25.40	86.61	112.01
Mar	5.3	-5.5	-0.1	8.3	-13.9	205.99	25.91	231.90
Apr	11.8	-3.3	4.2	20.0	-12.8	36.30	-	36.30
May	18.8	0.7	9.7	28.3	-7.2	38.10	-	38.10
Jun	21.1	6.0	13.5	28.9	0	71.88	-	71.88
Jul	28.4	10.6	19.5	37.7	1.7	69.34	-	69.34
Aug	23.1	7.9	15.5	31.1	3.9	94.74	-	94.74
Sep	23.1	3.5	11.6	27.8	-0.6	9.14	-	9.14
Oct	9.6	1.5	5.6	25.0	-5.6	143.00	5.59	148.59
Nov	4.1	-5.4	-1.0	16.7	-13.3	83.30	-	83.30
Dec	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

[1] In rainfall equivalents: 1 cm snow = 1 mm rain

Mean annual temperature: n.a.
Mean monthly temperature: January -6.8°C
Mean monthly temperature: July 19.5°C
Months above 10°C: 4
Months below 0°C: 4
Months above 4.5°C: 6
Frost free days (period): June 9 - Sept. 18 (101 days)
Total annual precipitation: n.a.
Annual snowfall: n.a.
Season occurrence of ppt:
Wet season n.a.
Wettest month n.a.
Dryest season n.a.
Dryest month Sept. (9.14 mm)

1835 Fort Street,
Victoria, B.C. V8R 1J6,
May 7, 1974.

Mr. H.G. Barker,
Superintendent,
H.B. Mine,
SALMO, British Columbia.

Dear Sir: Re: Exploration Programme.

This will acknowledge receipt of your "Notice of Opening of a Mine or Quarry or of Work on a Mineral Property".

The exploration work is within the boundaries of your production area and therefore is covered under your Permit 85.

For your information and guidance, enclosed is a copy of "Reclamation Guidelines for Exploration".

Yours very truly,

J.D. McDonald, P.Eng.,
Senior Reclamation Inspector.

JDM:sl

encl.

cc. - Mr. P.E. Olson, P.Eng.,
Inspector of Mines.

May, 1972

NOTICE TO ALL FREE MINERS AND ALL PERSONS ENGAGED IN MINING EXPLORATION

Forest Damage Abatement

The Department of Forests has become seriously alarmed at the amount of unnecessary damage and waste of forest growth arising out of indiscrimination in the performance of mining exploration work. Included in its summary of areas where damage and waste are taking place are:—

(1) Access roads.
(2) Bulldozed geophysical grid lines.
(3) Drilling-sites.
(4) Trenching.
(5) Mine-camp locations.

The main items of concern are: (1) Slash is not disposed of, leaving very severe hazards from both fire and disease; (2) in many cases access roads are not properly located and much waste takes place where the bulldozer operator makes several attempts to get through; (3) timber is destroyed because little or no care is taken to avoid waste.

Today's concept of forest growth and production is based on a perpetual-yield basis, and every effort must therefore be taken to minimize waste of standing timber as well as the destruction of surface capable of perpetual yield. It need not be construed that legitimate mining exploration work will be unnecessarily hampered by the need for sensible conservation of forest growth, but it is essential for all those in the mining exploration field to recognize that failure to co-operate in carrying out the requirements detailed herein will result in stringent official regulations to the probable detriment of the mining fraternity.

Section 10 of the *Mines Regulation Act* requires that whenever persons are employed in the opening-up, development, or proving of any mineral deposit, the appropriate District Inspector of Mines shall be notified. The reverse side of this notice is for that purpose.

The object is to establish where and what work is proposed so that the Inspector of Mines and the District Forester, in co-operation, can limit damage and waste.

Section 10 referred to above will be enforced to the point of penalties being imposed for its non-observance.

Section 115 of the *Forest Act* is quoted below for the benefit of those who may not be aware of the authority of the Forest Service to exercise control:—

> 115. (1) Where as the result of the carrying-on of any operation for the cutting or removal of trees or timber any slash, including in that expression any brush or debris, is occasioned or accumulated, the person carrying on the operation shall, on the demand of any officer authorized by the Minister, dispose of the slash by burning or otherwise to the satisfaction of the Minister.
>
> (2) Where any person fails or neglects to dispose of any slash at the time and in the manner required under this section, the Minister may dispose of the slash, in which case all expenses incurred therein are forthwith due and payable to the Crown from that person.

The form of notice of exploration work to be done (*see* reverse side) should be completed in triplicate and one copy forwarded to the Inspector of Mines for the district in which the property lies and one to the District Ranger.

Free miners have rights and privileges! Free miners also have responsibilities and liabilities!

The accepted principles of multiple resource use require that free miners respect the rights of other natural-resource users—loggers, cattlemen, recreationists, water-users, and many others.

NOTE.–The District Inspector and District Ranger should be notified every time work starts after any shutdown in addition to the original notification.

Use of Surface

All claim holders must reach agreement with the owner of the surface rights before commencing the work being reported on the other side of this form. If agreement cannot be reached the Gold Commissioner or Mining Recorder should be contacted as per section 12 (2) of the *Mineral Act*.

File H.B. Mine

Please complete and forward one copy to the District Inspector of Mines and one copy to District Forest Ranger.

THE GOVERNMENT OF THE PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Notice of Opening of a Mine or Quarry, or of Work on a Mineral Property

(Pursuant to Section 10, Mines Regulation Act)

DEPT. OF MINES AND PETROLEUM RESOURCES
Rec'd MAY 6 1974

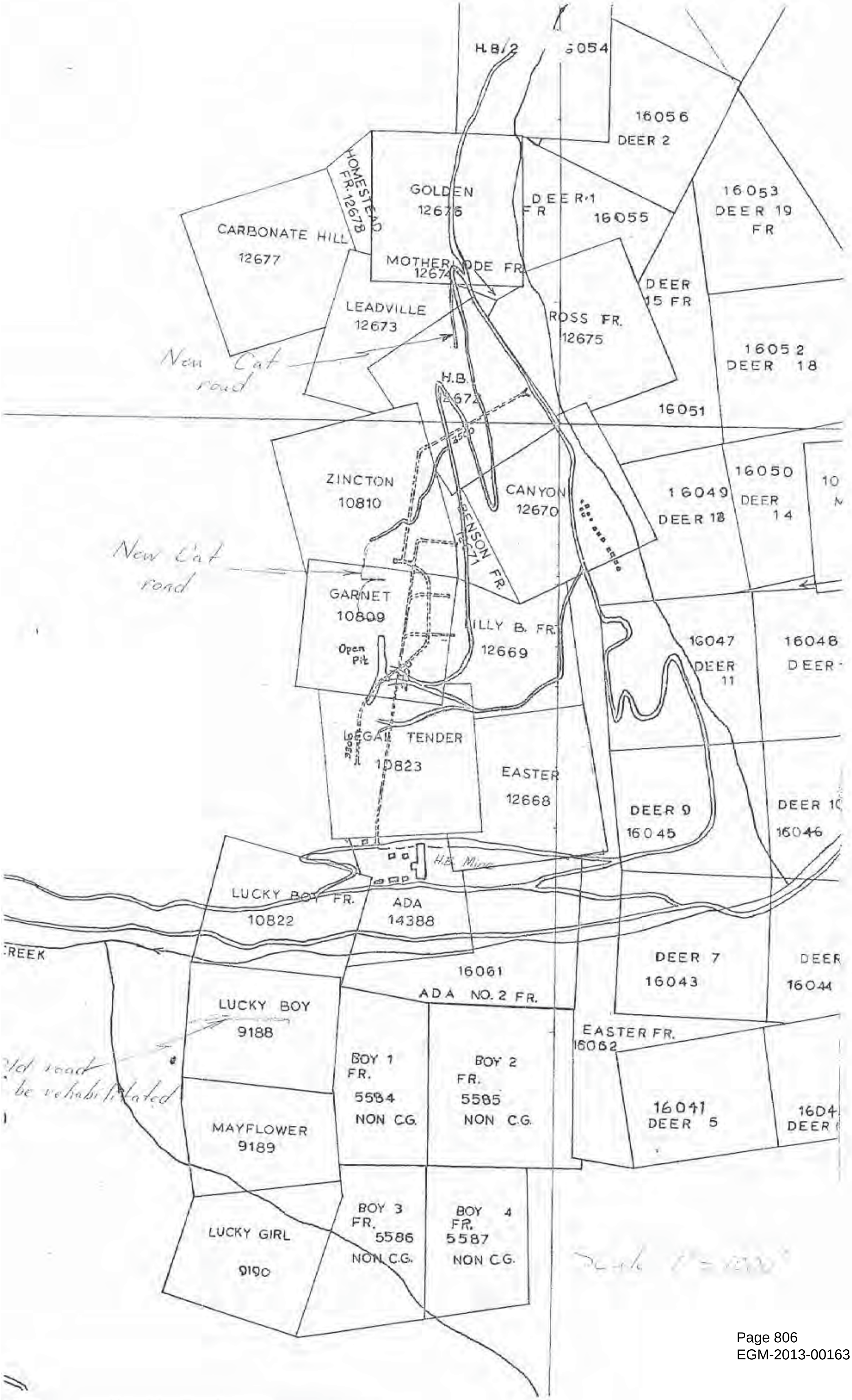
1. Name of property H.B. Mine
2. Location of property Salmo, B.C.
3. Owner's name and address Cominco Ltd.
   Trail, B.C.
4. Operator's name and address Same as above.
5. Estimated duration of specified exploration or mine development programme: Drilling Program
   From May, 19 74, to October, 19 74
6. Approximate number of men to be employed 1 Man on Road Construction
7. Give approximate details of any of the following work you propose to do:
   (a) Road construction (distance and width of clearing*) 1000' - 1200' of new cat road (12'-14' Wide) 1000' of old road to be rehabilitated.
   (b) Line-cutting (distance, width, and method) -
   (c) Total area of clearing other than above -
   (d) Total area of:
   Trenching (square feet) -
   Surface stripping (square feet) -
   Test-pitting (square feet) -

* Include sketch of location where necessary.

8. Date Forest Service advised by operator April 18, 1974
9. When work ceases on a mining property, the owner, agent, or manager shall, within one week of cessation, give notice to the District Inspector of Mines (section 10, *Mines Regulation Act*).

Signature H.G. Barker
Name (print) H. G. Barker
Position Supt. H. B. Mine
Date April 18/74

o


H.B./2
6054
16056
DEER 2
HOMESTEAD FR. 12678
GOLDEN 12676
DEER 1 FR
16055
16053
DEER 19 FR
CARBONATE HILL 12677
MOTHER LODE FR. 12674
DEER 15 FR
LEADVILLE 12673
ROSS FR. 12675
New Cat road
16052
DEER 18
H.B. 12672
16051
ZINCTON 10810
CANYON 12670
16050
16049
DEER 18
DEER 14
BENSON FR. 12671
New Cat road
GARNET 10809
LILLY B. FR. 12669
Open Pit
16047
DEER 11
16048
LEGAL TENDER 10823
EASTER 12668
DEER 9
16045
DEER 10
16046
H.B. Mine
LUCKY BOY FR. 10822
ADA 14388
CREEK
DEER 7
16043
16044
16061
ADA NO. 2 FR.
LUCKY BOY 9188
EASTER FR. 16062
BOY 1 FR. 5584 NON C.G.
BOY 2 FR. 5585 NON C.G.
Old road be rehabilitated
MAYFLOWER 9189
16041
DEER 5
LUCKY GIRL 9190
BOY 3 FR. 5586 NON C.G.
BOY 4 FR. 5587 NON C.G.

1051.

report

THAT pursuant to Section 11 of the Mines Regulation Act, the mining company named herein has submitted a programme for the protection and reclamation of the surface of the land and watercourses to be affected by its operations:

AND THAT there has been filed with the Minister of Mines and Petroleum Resources a report compiled in accordance with Section 11 of the Mines Regulation Act, that a notice of filing of the report has been published in the Gazette and that the report and the programme has been approved by the aforesaid Minister:

AND THAT after due consideration by all Departments of Government affected by or interested in the programme submitted, the Minister of Mines and Petroleum Resources is prepared to approve the programme:

AND TO RECOMMEND THAT the Minister of Mines and Petroleum Resources be authorized to issue a permit for a period of five years commencing on the date of approval of this Order to the following company:

Cominco Ltd., H.B. Mine $10,000.00

AND TO FURTHER RECOMMEND THAT the said permit be not issued until security in the sum shown opposite the name of the company above is received by the Minister of Finance.

DATED THIS 26 DAY OF Mar A.D. 1973

"Leo T. Nimsick"

Minister of Mines and Petroleum Resources

APPROVED THIS 26 DAY OF Mar A.D. 1973

"D. Barrett"

Presiding Member of the Executive Council.

#120 - 1006 Government St.,
Victoria, British Columbia,
July 30, 1973.

Mr. L.M. McBride,
Cominco Ltd.,
Trail, British Columbia.

Dear Sir: Re: Section 11, Mines Regulation Act,
and H.B. Mine, Salmo, British Columbia.

Enclosed herewith Permit Authorizing Surface Work, duly signed and sealed by the Minister of Mines and Petroleum Resources, under authorization of Order-in-Council No. 1051.

In particular, your attention is drawn to the Terms and Conditions, which are a part of this permit.

Yours very truly,

J.D. McDonald, P.Eng.,
Senior Inspector of Mines - Reclamation.

JDM:sl

encl.

cc. - Mr. P.E. Olson, P.Eng.,
Inspector of Mines & Resident Engineer,
Nelson, British Columbia.

THE DEPUTY MINISTER OF FINANCE
OFFICE OF THE REGISTRAR
PARLIAMENT BUILDINGS
VICTORIA, B.C.

RECORD OF INCOMING REGISTERED MAIL

[illegible]

RECEIVED FROM

Cominco Ltd.,
Trail, British Columbia

Attention: [illegible]

DATE RECEIVED June 25, 1973

YOUR REGISTERED LETTER

NO. C 99 DATED June 21, 1973

	Re: Dept. of Mines & Petroleum Deposit Cominco Ltd.	
$10,000.00	British Columbia Hydro and Power Authority 6% Parity Development Bond due August 15, 1977	
	No. [illegible] (1 x $10,000) Fully registered in the name of:	COMINCO LIMITED

WE ACKNOWLEDGE RECEIPT OF THE ENCLOSURES LISTED ABOVE.

INITIALS

DEPOSIT RECEIVED IN PROVINCIAL TREASURY ON: June 25/73
FOR REGISTRAR OF SECURITIES,
DEPARTMENT OF FINANCE

Recd. [signature]
For Deputy Minister of Finance
PROV. OF BRITISH COLUMBIA

Cominco Ltd./Trail, British Columbia, Canada/Telex 041-4426

FHP Dewdney
Regional Counsel
Tel. (604) 364-4114

LM McBride
Solicitor
Tel. (604) 364-4106

TD Tutti
Solicitor
Tel. (604) 364-4109

Cominco

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd JUN 25 1973

Registrar of Securities
Department of Finance
Parliament Buildings
VICTORIA, B.C.

June 21, 1973

re: Section 11, Mines Regulation Act
and security to be furnished -
Cominco H. B. Operations -
$10,000.00
Order-in-Council No. 1051

Dear Sir:

April 3, 1973 the Senior Inspector of Mines, Reclamation advised Cominco that a permit would issue authorizing surface work at its H. B. Operations (located at Salmo, B.C.) for a period of five years upon deposit of satisfactory security with the Minister of Finance. I now enclose 1 x $10,000 British Columbia Hydro and Power Authority 6% Parity Development Bond due August 15, 1977 numbered CS-ER 669. The bond is registered as to principal and interest in the name of Cominco Limited and annexed to the bond is a stock Power of Attorney executed under seal by the Executive Vice-President and Secretary of the company whose signatures have been guaranteed by a chartered bank.

Upon receipt of the enclosed bond and power of attorney I understand you will so advise the Department of Mines and Petroleum Resources after which the Minister of Mines will sign Permit No. 85. We would request that when the permit is signed by the Minister the original be forwarded to this office rather than to Mr. H. G. Barker, Superintendent, H. B. Mine. We will then forward Mr. Barker a copy for his information.

The bond is deposited for the duration of the permit or any extension thereof and we assume that if there is any breach or alleged breach of the Regulations or Act we will be notified and given the opportunity to remedy the same before the deposit is used.

Yours very truly,

L. M. McBride

LMM/mc
Encls.
Registered Mail

cc: Mr. J. D. McDonald, P. Eng.
Senior Inspector of Mines, Reclamation
Department of Mines and Petroleum Resources
Parliament Buildings
Victoria, B.C.

#120 - 1006 Government St.,
Victoria, British Columbia,
April 3, 1973.

Mr. H.G. Barker,
Superintendent,
Cominco Ltd., H.B. Mine,

SALMO, BRITISH COLUMBIA.

Dear Sir: Re: Section 11, Mines Regulation Act.

By Order-in-Council No. 1051, approved by the Lieutenant-Governor in Council on March 28, 1973, a copy of which is enclosed, the Minister of Mines and Petroleum Resources was authorized to issue to you a permit authorizing surface work, for a period of five years, upon deposit with the Minister of Finance of security in the amount as shown in the Order-in-Council.

The security deposit, which should be submitted forthwith, must be in the form of British Columbia parity bonds or cash. It must be deposited directly with the Minister of Finance, as outlined in subsections (6) and (7) of Section 11 of the Act, and the last paragraph of the Order-in-Council, or, alternately, the security deposit may be deposited with any Canadian chartered Bank, whereupon the Bank must complete the enclosed Receipt and Agreement form in duplicate, with the original to be forwarded to the Minister of Finance of the Province of British Columbia, and the copy os to be retained by the Bank for its files, as per condition (6) of the form.

A photocopy of the permit, listing the Terms and Conditions under which it is being issued, is enclosed for your information.

Upon receipt by this Department of advice from the Department of Finance that the security deposit has been received, the Minister of Mines will sign the permit, which will then be forwarded to you.

Yours very truly,

J.D. McDonald, P.Eng.,
Senior Inspector of Mines - Reclamation.

JDM:sl

Enclosures.

o

MEMORANDUM

TO The Hon. L. Nimsick,
Minister,
Dept. of Mines & Petroleum Res.

FROM THE

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

VICTORIA, B.C., March 5, 1973

WHEN REPLYING PLEASE REFER TO FILE No.

Re: Section 11, Mines Regulation Act.
Cominco Ltd., H.B. Mine, Salmo, B.C.

The Advisory Committee on Reclamation, consisting of three representatives of the Department of Lands, Forests, and Water Resources, one from the Department of Recreation and Conservation, (the representative of the Department of Agriculture was unable to attend but submitted a covering memorandum), the Inspector of Mines - Reclamation, and with myself as Chairman, has studied the report submitted by Cominco Ltd., H.B. Mine, as appended hereto. The Committee has approved the report, with the additions and amendments as listed below.

A notice of the filing of the Cominco Ltd. H.B. Mine reclamation report as required by subsection 4 of Section 11 of the Act was published, for one insertion only, in the B.C. Gazette on Thursday, February 8, 1973, and in the Nelson Daily News and the Trail Times on Thursday, February 8, 1973.

The report is submitted for your approval, under subsection 5 of Section 11 of the Act, with the following additions and amendments:

1. That topsoil and overburden soil stripped from the surface shall be conserved, as feasible, for possible useage in the reclamation of disturbed areas.

2. That investigations and research be carried out covering:
(a) the location, stability, and erosion control of waste dumps, tailing ponds, and stockpiles;
(b) the protection of watercourses, as applicable;
(c) the reclamation of disturbed areas;
all to the satisfaction of the Chief Inspector of Mines.

3. That upon completion of the programme in (2) above, a plan and report describing in detail the reclamation and protection of the disturbed areas be submitted to the Chief Inspector of Mines for approval.

4. That the permit be valid for a period of five (5) years, or until approval of the report in (3) above, whichever is the sooner: the permit to be renewable upon application and upon evidence of satisfactory performance.

5. The total acreage to be disturbed during the planned life of the operation is 76.4 acres. Cost of reclamation is estimated at $100 per acre. A bond in the amount of $10,000 is recommended.

Approved - Leo Nimsick

J.W. Peck, P.Eng.,
Chief Inspector of Mines.

JWP:sl
encl.

COMINCO LTD.

H.B. MINE - SALMO, B.C.

Application for Permit Authorizing Surface Work

I. INTRODUCTION

The H.B. Mine and concentrator is situated about seven miles south-east of the village of Salmo, B.C. on the North side of the Sheep Creek valley.

The property which was originally staked by Horton and Benson (hence H.B.) about 1907 was purchased by Cominco Ltd. in 1927. Intermittent work was carried out until 1946. Later, an extensive diamond drilling program was undertaken followed by underground exploration.

With sufficient ore outlined, construction of a 1000 ton/day concentrator was started in April of 1952 and completed in the spring of 1953. Due to unfavourable metal prices, operation did not commence until May, 1955 and was suspended in 1966. The mine is scheduled to resume production in early 1973.

The current head office address of Cominco Ltd. is 1199 West Pender Street, Vancouver 1, B.C.

II. PRODUCTION PROGRAM

General

It is planned to treat up to 1200 tons of ore per day from an underground source, thereby producing separate lead and zinc concentrates which will be shipped to Cominco-owned smelters in Trail.

With current ore reserves it is expected that the mine will operate for 3 1/2 years.

Nature of Mining and Milling Operations

(a) Geology

The main mineralization at the H.B. Mine consists of several zinc-lead sulphide ore bodies localized in the Reeves limestone member of the lower Hiab group of lower Cambrian age. The Reeves limestone has been thickened by folding to several times its original thickness. It has increased from an original thickness of 40' - 70' to a maximum of 700'. This bulge in the limestone member plunges 20° south and the ore bodies maintain their relative position in the lime band with a similar plunge. The main ore body, the No. 1 zone, is steeply dipping and varies from a depth of 400' in the northern section near 3500 level to about 10' at its southern tip where it reaches to within 200 ft. of the surface. Several other ore zones lie just to the west and below the crest of the No. 1 ore zone. The Garnet zone ore body, however, lies approximately 600' to the west of the main ore body and extends to the surface.

The chief economic constituents of the ore body are lead and zinc occurring as marmatite and galena in a gangue of calc, tremolite, limestone and dolomite. There are also considerable iron sulphides in the form of pyrite and pyrrhotite.

(b) Mining

The ore bodies will be mined from underground by both longhole and open stoping methods with a minimum of pillars remaining. No disturbance of the surface area is expected except for the Garnet Zone which will be extracted through to the surface. The final dimensions of the breakthrough will be about 1000' long by 70' wide by a maximum of 200' deep.

Access to the mine is through two main openings. The portal of the main entrance, the 2800 level haulageway, is situated about 300' above Sheep Creek and provides access from the main surface buildings. Most of the personnel and supplies are carried underground on this level and all the ore and waste is trammed out.

The 3500 level portal is located about 200' above Aspen Creek and provides access to the upper reaches of the No. 1 zone and to the hoist-room for the service shaft. Some material and a few personnel enter the mine through this opening. A third access of lesser importance, the 3300 portal, is located about the 2800 level portal and on the same slope.

Underground, the only ore tramming that is done is on the 2800 level. This is done by a Ruston-Hornsby diesel locomotive pulling eleven 6-ton cars from various areas and dumping at the coarse ore bin located on surface about 340' east of the portal. All other ore and waste movement underground is effected by 20 to 60 H.P. air or electric slushers and by gravity through a system of ore passes down to the 2800 level.

The waste produced underground is generally a limestone or dolomite with sizes ranging from 1/2 inch to 24 inches. A portion of this waste is disposed of underground into accessible mined out stopes and the remainder is removed to surface via the 2800 level portal. On surface, a waste dump has been established east of the coarse ore bin, along the hillside and extending about 500 feet along the hill and 150 feet down the slope. The resulting talus slope rests at an angle of repose of about 40° and is about 200 ft. across, from the toe to the side of the hill.

There is also an established waste dump below the 3500 level portal that may be used in future to dispose of waste from planned development of an ore body north of the service shaft and extending above the 3500 level. The expected annual waste production is about 6000 tons.

(c) Milling

Milling of the H.B. ore is straightforward with production of separate lead and zinc concentrates. Open-circuit primary and secondary crushing is followed by open-circuit rod milling and closed circuit ball milling. The talc and tremolite which are readily floatable are floated out first to avoid contamination of the lead concentrate. This is followed by lead rougher flotation and zinc rougher flotation. The final concentrates, about 100 tons/day, are thickened, filtered and then shipped to the smelters. The talc concentrate joins the zinc rougher tails and goes to waste.

The mill waste, about 1100 tons per day of solids, flows by gravity to a surge box, some 30 feet below the mill level, from where it crosses the Sheep Creek Valley through a "U-tube". The tailings drop 180 feet down the north arm of the "U-tube" to the creek level and go up the south arm some 120 feet where it discharges to a wooden flume. The "U-tube" is of 7" wood stave pipe and approximately 750 feet in length.

The wooden flume, of which 100% has been rebuilt, carries the tailings some 2 1/2 miles to the west to a settling pond. The tailings pond is a small depression about 1/2 mile wide by 3/4 mile long, ringed on three sides by steeply dipping hillsides and an earth fill dam on the fourth. Clear overflow is handled by a 30 inch culvert pipe through the dam with a vertical intake of 3 x 12 timber cribbing. The cribbing as well as the earth fill dam is raised as required. The clear decant water is discharged from the culvert into a ditch and flows by gravity to the Salmon River. It is estimated that the tailings area will increase in area from about 60 acres to 69 acres in the 3 1/2 years of project operation.

(d) Disturbed Land Area

Land area disturbed by mining and milling activity is summarized.

2800 level waste dump	2.2 acres
3500 level waste dump	0.2 acres
Tailings disposal pond	60.0 acres
Buildings and Service area	10.0 acres
Roads	4.0 acres
	76.4

III. NATURE AND PRESENT USE OF LAND

The Sheep Creek valley is bounded on the north and south by steep mountain slopes. Relief in the area of the mine extends from 2500 to over 5500 feet. Elevation of the tailings pond is 2200 feet.

The valley is situated in the Western larch subzone of the Interior Western Hemlock biogeoclimatic zone which is characterized by total annual precipitation in the range 22-35"[1]. Zonal soils include orthic ferro-humic podzol developed on shallow glacial deposits over bedrock.

Land on the south facing mountain slope surrounding the mine complex includes areas of productive and non-productive woodland[2]. Immature stands of trembling aspen, lodgepole pine and Douglas fir occupy medium quality productive sites[3]. Fire destroyed forest cover over part of the area in 1905 and in 1925. The tailings pond occupies a depression bounded on the west by unproductive land (rock) and by productive woodland in other directions[2]. Productive woodland has a cover of immature western larch with minor Douglas fir, lodgepole pine and white pine on medium quality sites[3]. Fire destroyed forest cover on part of the area in 1925.

Land surrounding the mine and tailings pond has been classified with respect to physical capability for use by agriculture, forestry, recreation, big game and waterfowl[2]. Classification was based on data from surveys conducted under the Canada Land Inventory program. Physical capability of land at the H.B. Mine for each use group listed is summarized.

1. Agriculture

(a) Mine: land has severe limitations for agricultural use due to adverse topography, shallowness to bedrock and climate. 80% of land possesses no capability for arable culture or permanent pasture. 20% is capable only of producing perennial forage crops. Improvement practices are not feasible.

(b) Tailings pond: land has severe limitations for agricultural use due to adverse topography, stoniness and climate. 40% of land possesses no capability for arable culture or permanent pasture. 60% is capable only of producing perennial forage crops. Improvement practices are considered feasible.

2. Forestry

(a) Mine: land has moderate to severe limitations to growth of commercial forest. Growth limiting factors include restriction of rooting zone by bedrock and soil moisture deficiency. A small area has severe limitations which preclude growth of commercial forests.

(b) Tailings pond: land has slight (60%) to moderate (40%) limitations to growth of commercial forest. Growth may be limited by restriction of rooting zone by bedrock and soil moisture deficiency.

3. Recreation

(a) Mine and tailings pond: land lacks natural capability and significant features to rate higher than low capability for outdoor recreation, but has natural capability to engender and sustain low annual use based on dispersed activities such as hiking, nature study or for aesthetic appreciation. Land possesses continuous streams in upland areas and vegetation possessing recreational value.

4. Ungulates

(a) Mine and tailings pond: land classed as winter range of moderately high capability for deer and moose. Productivity may be reduced in some years due to excessive snow depth that reduces mobility of ungulates and availability of food plants.

5. Waterfowl

(a) Mine and tailings pond: capability for production of waterfowl is negligible or nonexistent due to adverse topography.

IV. RECLAMATION PROGRAM

Land disturbance at the H.B. Mine will be kept to a minimum by utilizing existing waste rock and tailings disposal areas. Upon completion of mining operations, disturbed areas will be reclaimed to an appearance and use compatible with surrounding areas.

Currently in British Columbia mined land reclamation practices are not well established nor are conditions limiting plant growth on mine and mill waste well defined. To provide basic information for preparation of a reclamation program for the H.B. Mine, a research program is proposed. The general research approach is summarized:

1. characterize the nature of mine and mill waste by field inspection, sampling and analysis of chemical and physical properties which influence growth,

2. evaluate the suitability of mine and mill waste as a growth medium for plants using laboratory and growth chamber techniques,

3. when areas of mine and mill waste become final, initiate field investigations to determine physical treatments, plant species, planting techniques, fertilizer requirements and soil amendments necessary to establish and maintain suitable plant cover on waste disposal areas.

V. REFERENCES

(1) Krajina, V.J., 1969, Ecology of Forest Trees in British Columbia In Ecology of Western North America, Vol. 2, No. 1. Published by the Department of Botany, University of British Columbia.

(2) Canada Land Inventory, Land capability analysis sector maps of Salmo area for agriculture, forestry, recreaction, ungulates, waterfowl and present land use. B.C. Map Librarian, B.C. Dept. of Agriculture, Victoria.

and Canada Land Inventory: Objectives, Scope and Organization: Report No. 1, 1970. Dept. of Regional Economic Expansion, Queen's Printer, Ottawa.

(3) Forest Cover Map: Salmo PSYU, 1962. Surveys Division, B.C. Forest Service, Victoria, B.C.

RTG:car
January 5, 1973

Cominco Ltd./Trail, British Columbia, Canada/Telex 041-4426

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd FEB 15 1973

Cominco

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Department of Mines and Petroleum
Resources
#120 - 1006 Government St.
Victoria, B. C.

Attention: Mr. W. B. Montgomery
Inspector of Mines - Reclamation

re: H. B. Mine

February 13, 1973

Dear Sir:

We have complied with your instructions of January 25th last. Notice of the filing of the Report was published for one insertion only, in the B.C. Gazette on Thursday, February 8th, 1973 and in the Nelson Daily News and the Trail Times on Thursday, February 8, 1973. I enclose a copy of the Notice which was mailed to the three publications. The Trail and Nelson papers printed it correctly but the Gazette omitted the last two words, "British Columbia." Is the Gazette notice satisfactory?

Yours very truly,

L M McBride

L. M. McBride
Solicitor

MINES REGULATION ACT

Notice pursuant to Section 11

TAKE NOTICE that L.J. Nicholson, Agent of Cominco Ltd. (H.B. Mine), has filed with the Minister of Mines and Petroleum Resources at Victoria a report made pursuant to Section 11 of the Act in respect to the surface operations of the mine located at Sheep Creek, near Salmo, British Columbia.

#120 - 1006 Government St.,
Victoria, British Columbia,
January 25, 1973.

Mr. H.G. Barker,
Superintendent,
Cominco Ltd./H.B. Mine,

SALMO, BRITISH COLUMBIA.

Dear Mr. Barker: Re: Section 11, Mines Regulation Act.

This will acknowledge receipt of the reclamation report, with enclosures, of date January 19, 1973, addressed to the Honourable Minister of Mines and Petroleum Resources.

Subsection (4) of Section 11 of the Mines Regulation Act requires that you publish notice of the filing of the report. The notice should be in the form as per the attached. It is to be published, for one insertion only, in the B.C. Gazette on Thursday, February 8, 1973, and in the Nelson Daily News and the Trail Times on Thursday, February 8, 1973.

Following publication of the notice as above, please confirm in writing that it has been published, listing the date on which the notice appeared in each publication.

Yours very truly,

(Mrs.) Sylvia I. Little,
Secretary.

for W.B. Montgomery, P.Eng.,
Inspector of Mines - Reclamation.

:sl

encl.

P.S. The B.C. Gazette is published by the Queen's Printer, Victoria. The fee for this notice is $6.50 (tax exempt) per issue, payment to be remitted with the order (cheque or money order in favour of the Minister of Finance).

Cominco Ltd./H. B. Mine, Salmo, British Columbia, Canada/Tel. (604) 357-2276

Cominco

Mines

The Honourable L. Nimsick
Minister of Mines and Petroleum Resources
Parliament Buildings
Victoria, B.C.

January 19, 1973

Dear Mr. Nimsick:

Enclosed are seven copies of our report "Application for Permit Authorizing Surface Work" at the H.B. Mine near Salmo, B.C.

Yours truly,

H G Barker

H. G. Barker
Superintendent

/mfl

Enc. (7)

cc: LJN
RPD

Pages 823 through 825 redacted for the following reasons:
- -
Not Responsive