

LAKE ZONE MINE DEVELOPMENT20,000 Tonnes Per DayGeneral DescriptionGeology

The Lake Zone porphyry deposit is located approximately 370 km northeast of Vancouver at latitude of 50°29'N, longitude 121°02'E. The copper mineralization is contained within the Guichon Creek batholith. These rocks are medium to coarse grained and vary in composition from the porphyritic granodiorite to porphyritic quartz monzonite. At least two types of porphyry dikes cut the orebody, but these are generally narrow and thus do not appreciably dilute the ore. Structure has had a dominant influence in localizing the ore and almost all of the deposit has been fractured to some degree. Two steeply dipping structural directions predominate - west-north-west and north-south; alteration and mineralized are localized along the shears and faults. No known major faults cut the orebody.

The ore mineralization is relatively simple. Bornite and chalcopyrite are the dominant copper minerals and the bornite-chalcopyrite ratio, although variable, averages about 2:1. Molybdenite occurs chiefly with quartz veins and along slips in a distinct halo near the perimeter of the deposit. Pyrite is scarce within the deposit and appears to form a halo around the periphery of the deposit. A zone of oxidation is present over a portion of the upper part of the deposit.

The deposit has been extensively explored by a comprehensive program of surface and underground drilling and bulk sampling. In excess of 38,000 m (125,000 ft.) in about 200 holes has been drilled and approximately 1,250 m (4,100 ft.) of underground development has been driven for sampling and metallurgical testing.

No geological hazards have been recognized in the mine area. No landslide scars have been identified, nor is the area seismically active. The orebody subcrops beneath a mantle of glacial tills and gravels.

Further holes are now being drilled over the preproduction area which will provide closer spaced information (200 ft. grid approx.) for initial year production plans.

Mining Plan

Pre-production mining will start over the southwest quadrant of the orebody. The pre-production mining will involve moving nearly 2.73 million cubic metres of till, sands and gravel and 370 thousand cubic metres of ore. Pioneering will be done with front end loaders, trucks and tracked dozers. Approximately 833,000 cubic metres will be mined in this way. The remainder of the mining will be by conventional shovel-truck method.

Mine design calls for a conventional pit worked on 10 metre benches. Waste flow will be on haul roads along contour to fan dumps west of the pit. Ore flow will be east and north to the main haul road to be built to the Bethlehem concentrator. Mining will be above valley floor elevation for the first 3 years. Mining will utilize the Bethlehem electric shovels and fleet of 21 M100 Lectra Haul trucks. It is anticipated that two front end loaders, three tracked dozers will be purchased in order to expedite the pioneering work.

A minimum of drilling and blasting is anticipated in the pre-production period and purchase of a pioneering drill is budgeted for. ANFO slurry mix from the existing Ireco plant is planned as the main explosive. Production drilling will be by the existing diesel power drills which drill a 250 mm hole.

The 20 year ore production plan calls for 144.6 million tonnes to be mined at an average 0.477% Cu grade. Cut off grade is 0.42% Cu for the first 8 million tonnes of ore and 0.37% Cu for the next 137 million tonnes. This plan will result in 29 million tonnes of marginal grade material at .32% Cu being stockpiled.

Strip Ratio will be 0.95:1 for the first full production year and will average 0.96:1 for the full 20 planned years.

Perimeter wells and a pumping system for local water table depressing will be required by year 5 of the operation in order to keep the pit dry. These wells will be situated in the unconsolidated sediments on the north and east portions of the pit perimeter. Water from these wells will be used as process water or dumped to the Lornex pond. Surface water will be diverted around the pit by ditches to be developed as part of the pre-production work.

The mining operation will be supported by the existing Bethlehem shops and overhead services. A change facility may be located near the pit area.

Concentrator

The Lake Zone ore is to be milled in the existing Bethlehem concentrator. No initial capital is required for the concentrator area.

The existing tailings pond will allow tailings from the concentrator to be stored for an 18 month period following resumption of milling. A reclaim water system from the Trojan pond must therefore be constructed during this period.

Metallurgical performance projections of the Bethlehem concentrator on Lake Zone ore is based on work done in 1970 at Lakefield Research and documented by Bechtel Canada Job No. 8042 in June of 1970. Bechtel have stated in 1981 that they consider the test work done in 1970 as reliable data on which to base design.

The Bethlehem concentrator has an existing molybdenite recovery circuit which can be activated should economics for molybdenite recovery turn favourable.

Environmental

During the long term operation of the mine it will be necessary to drain three lakes on the valley floor. The largest of these, Quiltanton Lake, will be overrun by the expanding pit. Both the other two lakes eventually will be covered by waste rock and overburden spoil piles. These latter two, Big Divide Lake and 24 Mile Lake, are situated north of the pit and between it and the upper dam of the tailings pond. Big Divide and Quiltanton Lake will be drained before year 5. Twenty Four Mile Lake will not be affected until after year 20.

The lakes to be drained by the operation provide a recreational resource for the people of British Columbia and it will be necessary for Bethlehem Copper to provide an enhancement of a like resource by way of mitigation. The company is presently engaged with local Fish and Wildlife groups and the Provincial Government is studying where this enhancement might best take place.

The mine is situated on the valley divide and forms the headwaters of the Witches Brook which in turn feeds the Guichon Creek. This latter creek is heavily licenced and it has been important for the company to plan stream diversions to minimize the loss of water to these streams. Through these diversions only the catchment area of the pit itself and the storage capacity of Quiltanton Lake will be lost to the watershed.

Power Supply

Power consumption will be similar to that of the present Bethlehem operation. The existing B.C. Hydro supply is therefore considered to be adequate.

The power distribution system will be changed to allow transmission of 13,800 V power from a modified Bethlehem primary substation to new secondary substations at the Lake Zone pit area. The mining equipment will operate at 4,160 V as at present.

DETAILED SCOPE

The scope description for this project is under five headings. Each heading is assignable as a specific responsibility.

- .0 Site Development
- .1 Electrical Power System
- .2 Ore Haul Road
- .3 Mine Pre-Production
- .4 Mine Services

.01 Site Development

This section of the Scope statement describes all the events necessary to prepare the areas for haulage road construction, power line construction and mining activities. Included are logging, clearing and grubbing and road relocations.

.011 Logging

A large area of the minesite has been previously logged by Valley Copper. The major portion of areas for the haul road and power lines have also been logged.

Approximately 140 hectares of low density timber must be logged during the construction period. This covers the minesite, waste dumps, haul roads, Calling Lake Road relocation, power line corridors, diversion ditches and perimeter fence.

.012 Clearing and Grubbing

Approximately 120 hectares will be cleared and grubbed for the Calling Lake Road, all rights-of-way, the preproduction pit area and stockpile areas. Dump areas will not be cleared and grubbed.

.02 Road Relocations

Calling Lake Road

Approximately five kilometers of new road will be constructed to replace the existing road traversing the minesite. The present road serves as an access road to the Dekalb Mine and recreational lakes. The new road will be built to standards equal to but not exceeding the present road standards.

.03 Drainage

The dump area will be drained through a system of open ditches which discharge toward the H-H dam.

A ditch 1,350 m long will divert miscellaneous runoff along the south-west rim of the long term pit area into Bethsaida Creek.

Surface drainage of low lying ponds will be picked up by 2,400 metres of ditch leading to McNaughton Lake and Quiltanton Lake.

.04 Landscaping

All areas disturbed by construction of roads, power lines, fences and ditches will be graded and revegetated to improve aesthetics.

.1 Electrical System

The electrical power system has been developed to achieve:

- a viable power system
- an economically feasible alternative
- adequate power for future pit dewatering (900 HP).

Where existing equipment is available and suitable, it will be utilized. The capital cost of such equipment is not included in this estimate but installation is allowed.

.10 Primary Substation

The 138 kV-4160V Primary Substation presently at the Bethlehem Concentrator site will be modified and expanded to include the additional power requirement called for in this study.

Modifications and improvements included in this estimate are:

- relocate the relaying current transformers from the incoming bus to the existing transformer bank.

- change the taps on the metering current transformers (by B.C. Hydro)
- relocate the existing spare transformer to an alternate storage site
- reconfigure the bus over the spare transformer bay
- upgrade curbing and fencing around the substation
- upgrade substation grounding
- add crushed rock to substation yard.

Expansion to the substation includes:

- 1 - 7.5/10 MVA, 138-13.8 kV transformer (existing)
- 3 - 108 kV station class lightning arresters (existing)
- 3 - relaying current transformers (existing)
- 1 - 13.8 kV current recloser
- 1 - ground resistor and transformer bank (existing)
- 2 - 13.8 kV-120 V potential transformers (existing)
 - extend the substation fencing
- 1 - relay and control panel.

.11 Secondary Substations

These substations utilize enclosed equipment including primary switchgear, oil-filled transformers and secondary switchgear and are a substation which is free of fencing and easily relocated.

All the substations are fed from the 13.8 kV bus and transform power to 4160 voltage for use in the pit area.

The work in each substation includes site preparation, necessary foundations, station grounding, equipment installations, and auxiliary components to form a complete installation.

.12 Distribution

Overhead power transmission is received at the Primary Substation at 138 kV from B.C. Hydro and is distributed at 13.8 kV.

The 13.8 kV overhead powerline runs south west (3800 m) from the Primary Sub to the Lake Zone Pit. A portion of the powerline (2500 m) to the pit will utilize the B.C. Hydro 138 kV line which was to have been demolished after the construction of the relocated line.

The pit distribution is 13.8 kV construction, and will supply the 3 Pit Mobile Substations as well as required lighting.

Underground distribution will be used to get from substations to overhead lines where surrounding structures make it awkward to install overhead powerlines.

.13 Lighting

Road lighting is provided at:

- the highway overpass
- the waste dump access.

Three mobile diesel powered lighting systems are provided for waste dump area lighting.

.14 B.C. Hydro Construction

The following construction by B. C. Hydro is planned:

- to raise the 138 kV powerline where it crosses over the haulage road
- change the taps on the metering current transformers
- the purchase of 2500 m of 138 kV powerline scheduled for demolition.

.2 Ore Haul Road to Bethlehem Crusher

.21 Overpass

An overpass structure built using the reinforced earth technique and reinforced concrete members and deck will carry the main ore haul road over the existing Highland Valley highway. This structure will be designed to carry fully loaded 154 tonne trucks single lane (2 truck widths).

.22 Roads

The ore haul road to the Bethlehem crusher will be built using waste material reclaimed from the Huestis dumps and waste material from the Lake Zone stripping. Crushed mine waste will be used as road topping.

.3 Mine Pre-Production

.31 Pre-Stripping

Bethlehem crews will perform the initial pioneering of the pre-production stripping as well as the initial access development to the pit and waste dump areas.

The Bethlehem crews would move 833,000 cubic metres of overburden from the pit area using two truck-loader fleets. This material will be placed to build the pit access road and dump access road.

.32 Pre-Production Stripping

The main stripping job will be done utilizing part of the existing Bethlehem mining fleet. This work will involve moving 2.73 million cubic metres of overburden and 370,000 cubic metres of ore. The overburden will be used for haul road construction and stockpile pad preparation with the remainder going to the waste dumps west of the pit area. Ore will be stockpiled pending haul road completion.

.33 Waste Haul Road

The initial haul roads will be topped with 50,000 cubic metres of crushed waste.

.34 Equipment

Two D8L, one D9L and two front end loaders will be purchased to augment the existing equipment.

.4 Mine Services

.41 Fuel and Lube

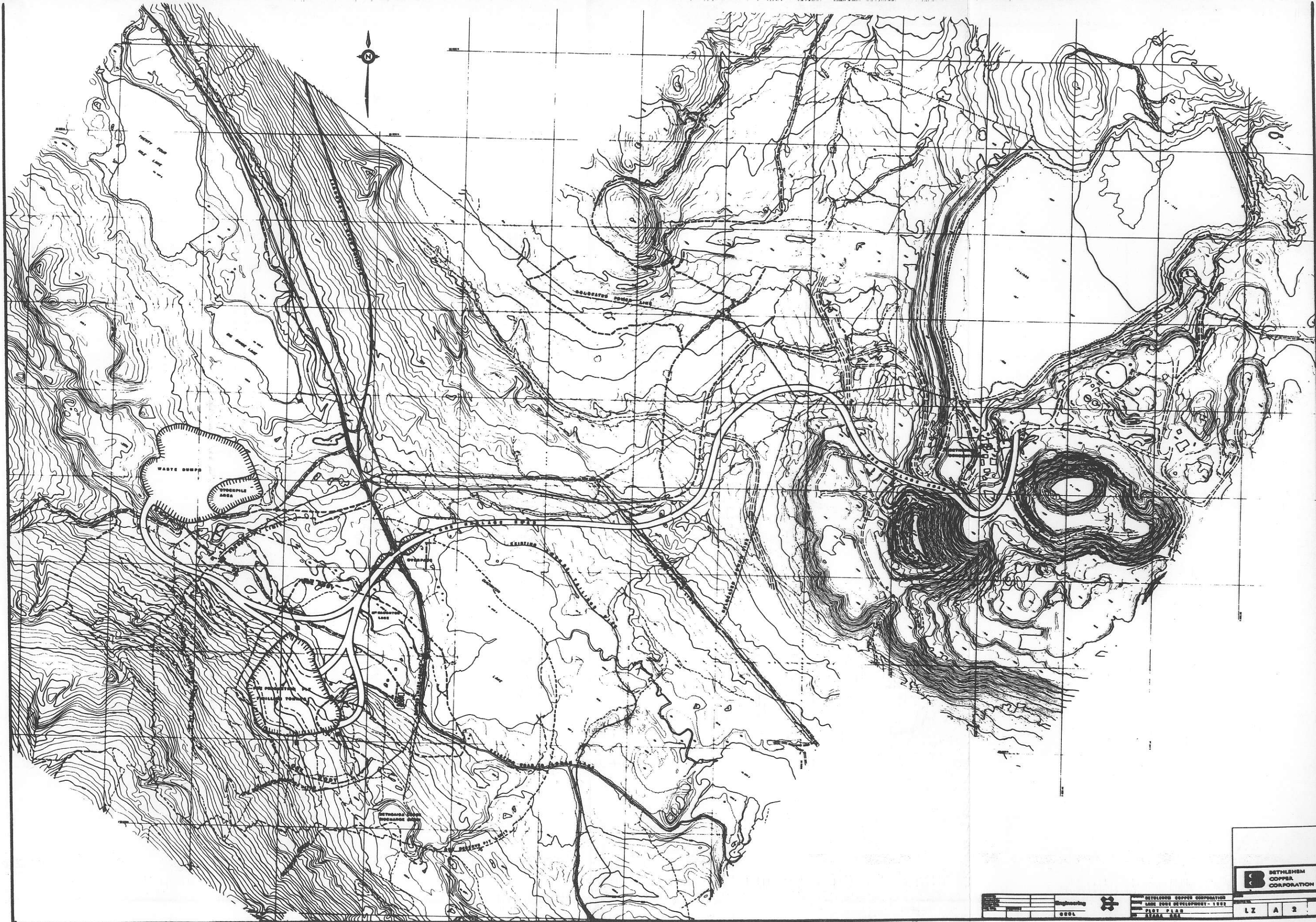
A diesel fuel storage tank and fuelling station will be provided through relocation of an existing Bethlehem tank. Purchase of one fuel and lube truck is budgetted.

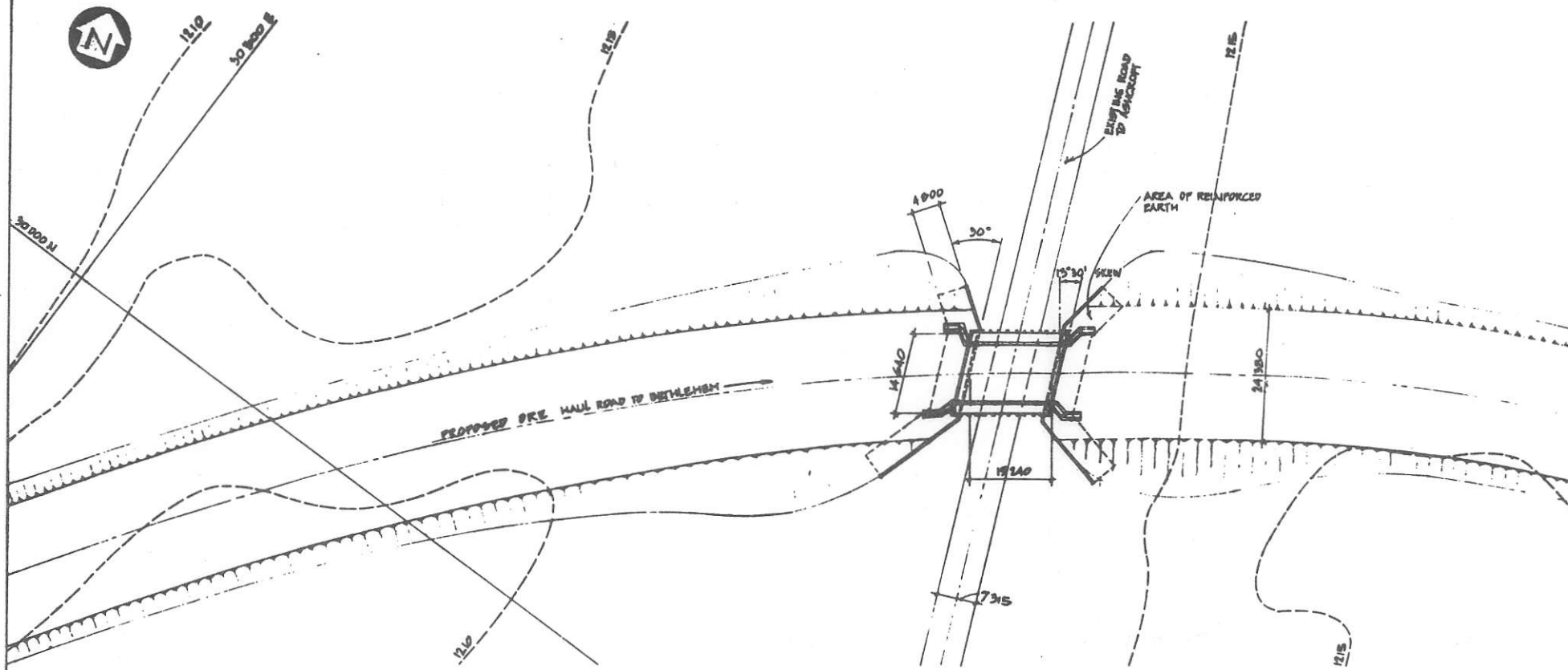
.42 Fencing

2400 m of fencing, to control access from the highway pit area, will be constructed.

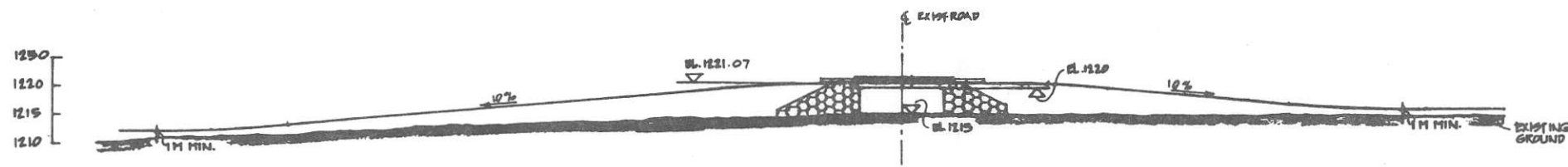
.43 Miscellaneous

Three wooden service sheds will house mine rescue equipment, bits, tools, spare teeth, etc. Two portable johns will be provided.





PLAN ON BRIDGE DECK & ACCESS RAMPS



ELEVATION ON PROPOSED OVERPASS

EXISTING ELEV. IN M.	1210	1211	1212	1213	1214	1214.5	1215	1215	1215	1215	1215	1216	1215
PROPOSED ELEV. IN M.	1211	1212	1213.5	1216	1218.5	1220	1221	1221	1220	1220	1218.5	1217	1216
HORIZ. DISTANCE IN M.	00	20	35	60	85	100	120	147	167	192	198.5	218.5	
GEOMETRY	VERT. CURVE		10% GRADE				VERT. CURVE		10% GRADE		VERT. CURVE		

KEY PLAN SCALE 1:1500



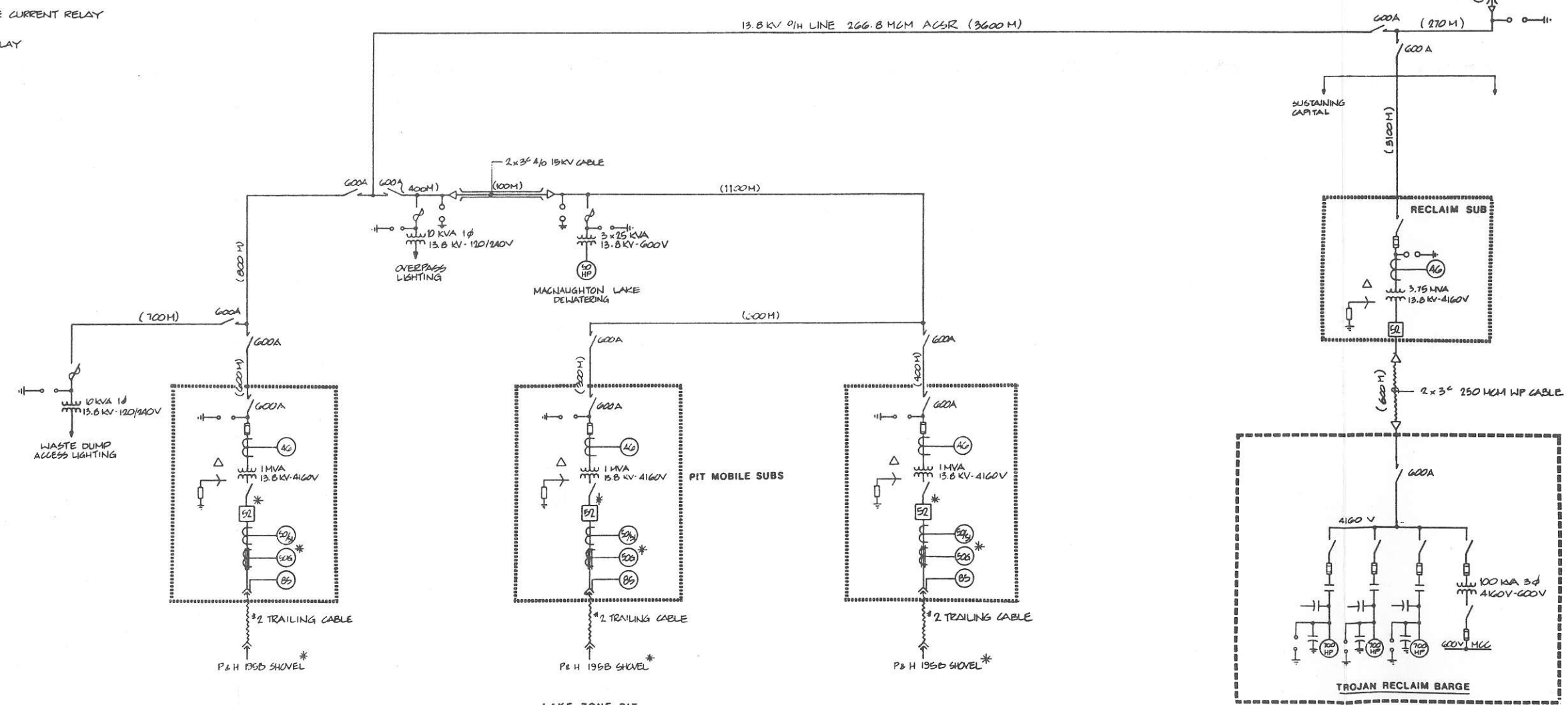
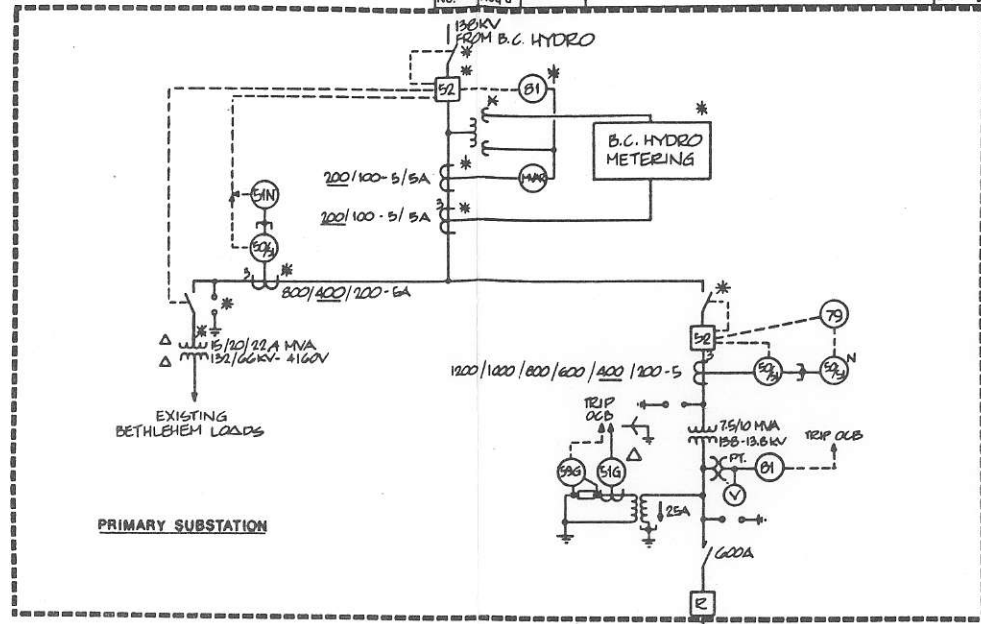
FOR DETAIL OF BRIDGEDECK & ABUTMENTS SEE DRAWING LZ-A-4.



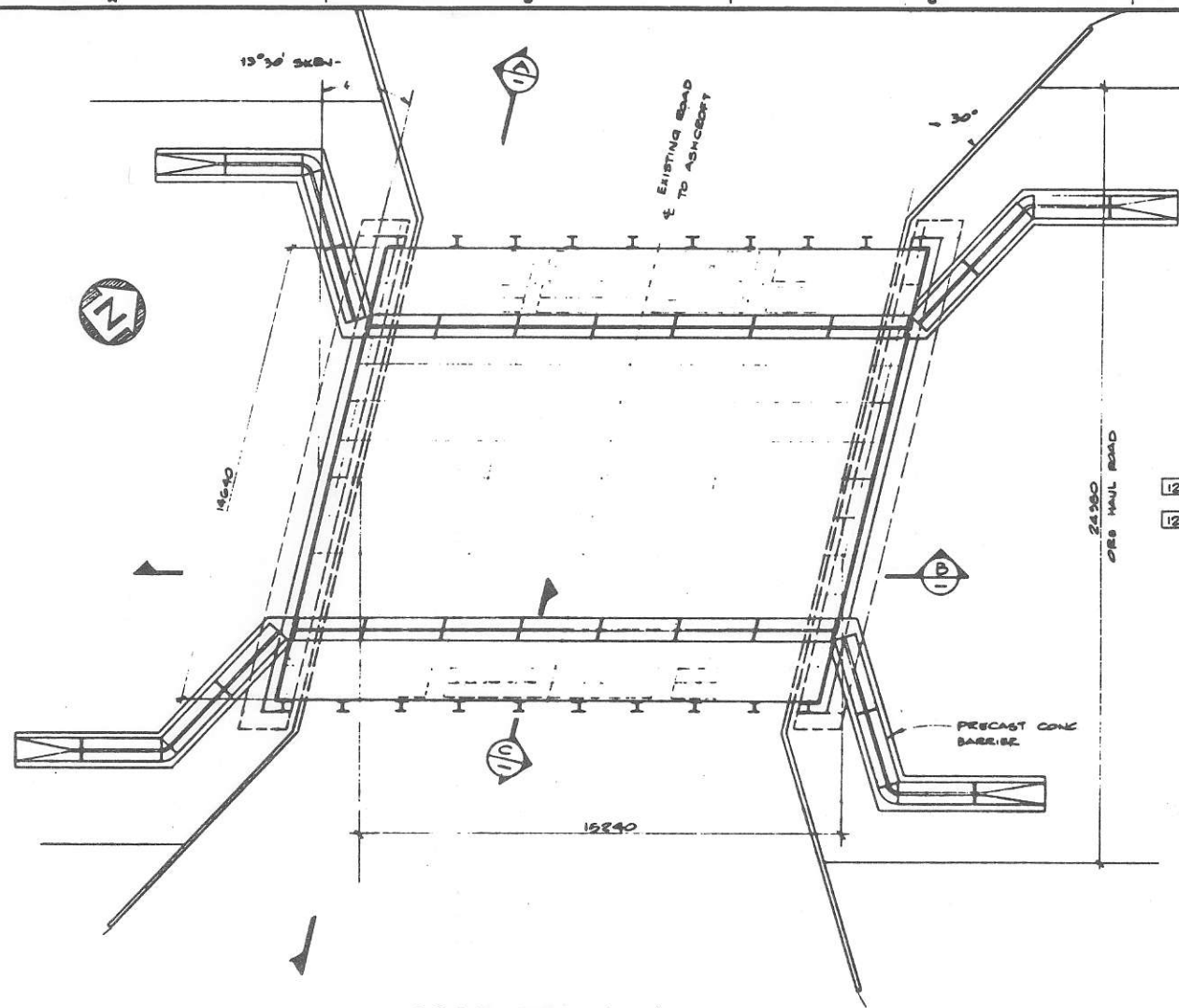
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LZ	A 3 R				L.T.				Engineering	BETHLEHEM COPPER CORPORATION	LAKE ZONE MINE DEVELOPMENT (1981)	RESULT OF PROPOSED OVERPASS ACCESS RAMP	GENERAL ARRANGEMENT	1:500	LZ A 3 R

- LEGEND!**
- ⊗ INSTANTANEOUS AND TIMED OVERCURRENT RELAY
 - ⊗ GROUND FAULT RELAY
 - ⊗ GROUND FAULT RELAY
 - ⊗ OVERVOLTAGE RELAY
 - ⊗ RECLOSE RELAY
 - ⊗ UNDERFREQUENCY RELAY
 - ⊗ VOLTMETER
 - ⊗ CIRCUIT BREAKER
 - ⊗ CIRCUIT RECLOSER
 - ⊗ LIGHTNING ARRESTER
 - ⊗ RESISTOR
 - ⊗ LOADBREAK DISCONNECT
 - ⊗ NON-LOADBREAK DISCONNECT
 - ⊗ CABLE TERMINATION
 - ⊗ CURRENT TRANSFORMER
 - ⊗ TRANSFORMER
 - ⊗ FUSE CUTOUT
 - ⊗ UNDERGROUND DUCT
 - * EXISTING BETHLEHEM EQUIPMENT.
 - ⊗ PHASE BALANCE CURRENT RELAY
 - ⊗ PILOT-WIRE RELAY
 - ⊗ FUSE

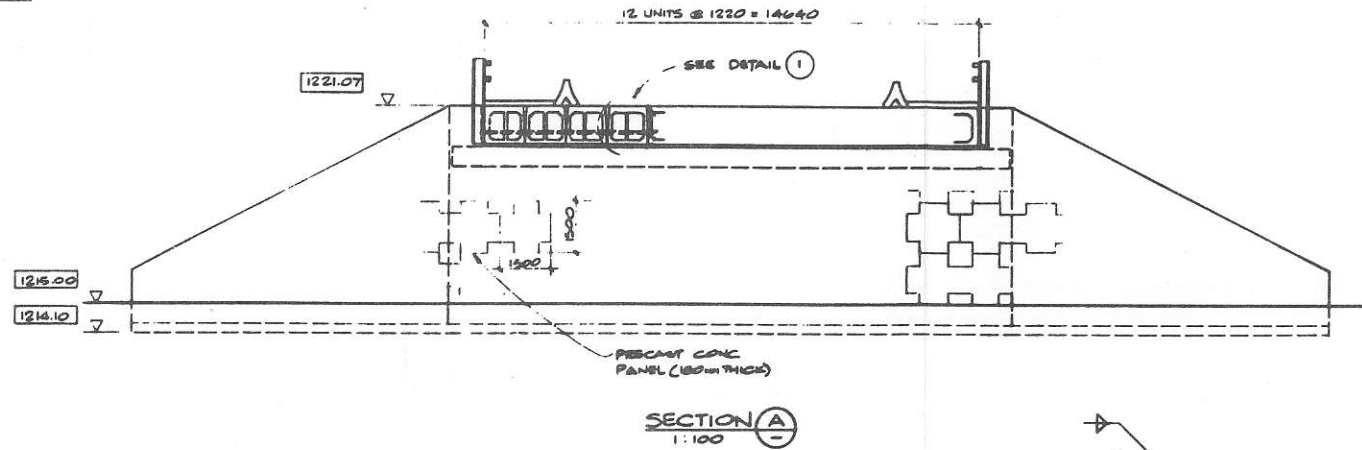
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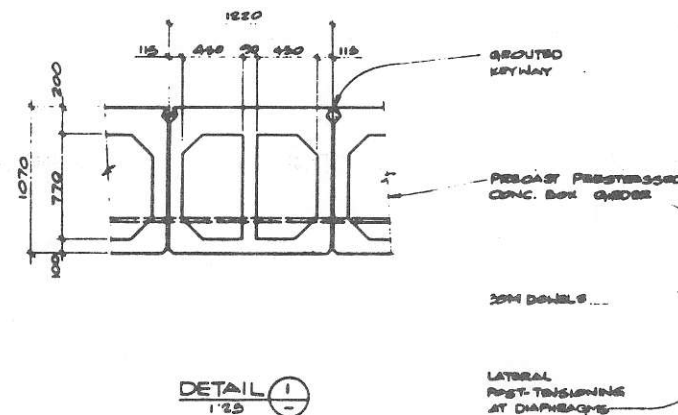
Job No. J.XXO-912	Revision	Issued to	Reference	Revisions	Drawn by ACTUR 6 MAY 82	Checked by DE MALO 14 MAY 82	Design Eng. DE MALO	Proj. Eng. Approved	Function BETHLEHEM COPPER CORPORATION	Activity LAKE ZONE MINE DEVELOPMENT (1982)	Section ELECTRICAL	Job ONE LINE DIAGRAM	Scale	Drawing No. LZ E 1 PL	Revision
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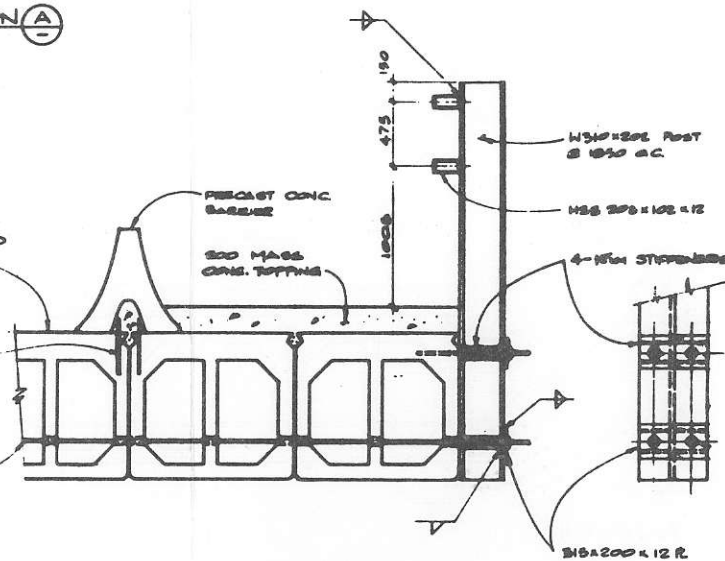
BRIDGE DECK PLAN
1:100



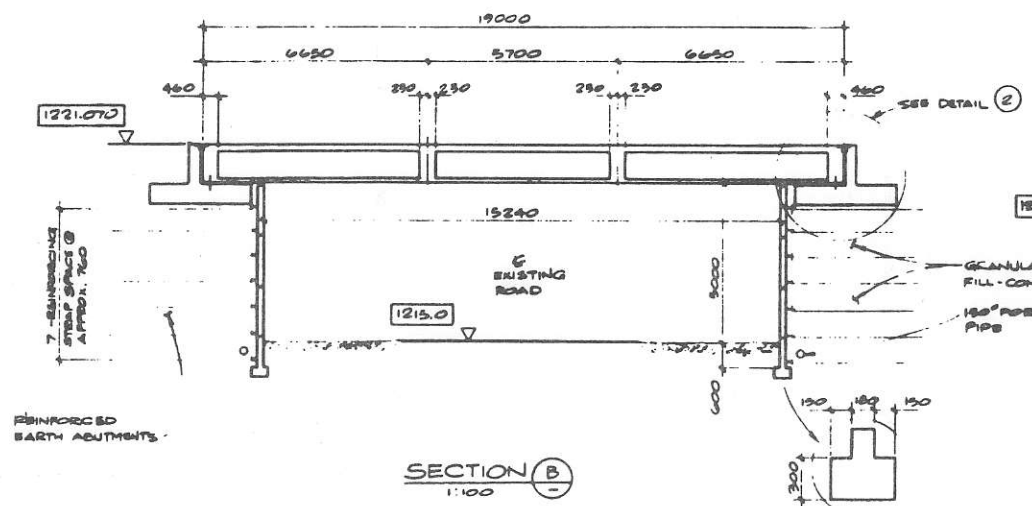
SECTION A
1:100



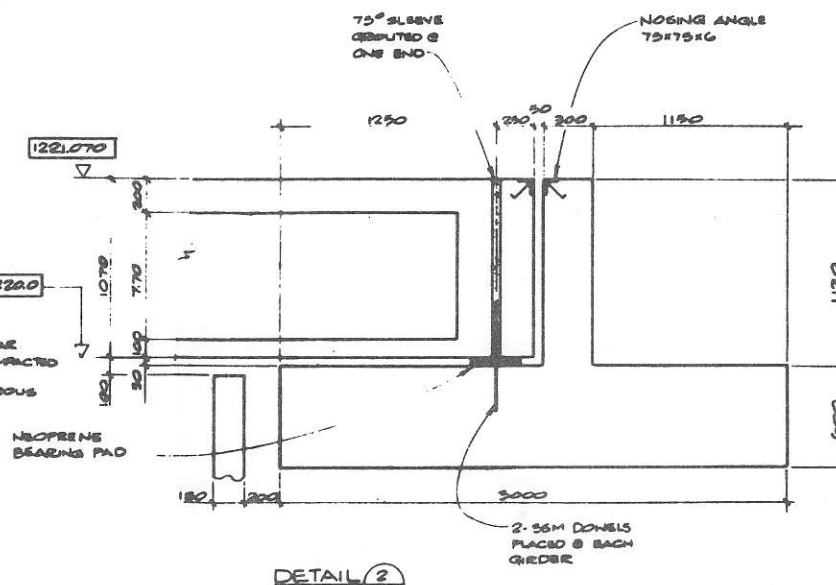
DETAIL 1
1:25



SECTION C
1:25



SECTION B
1:100



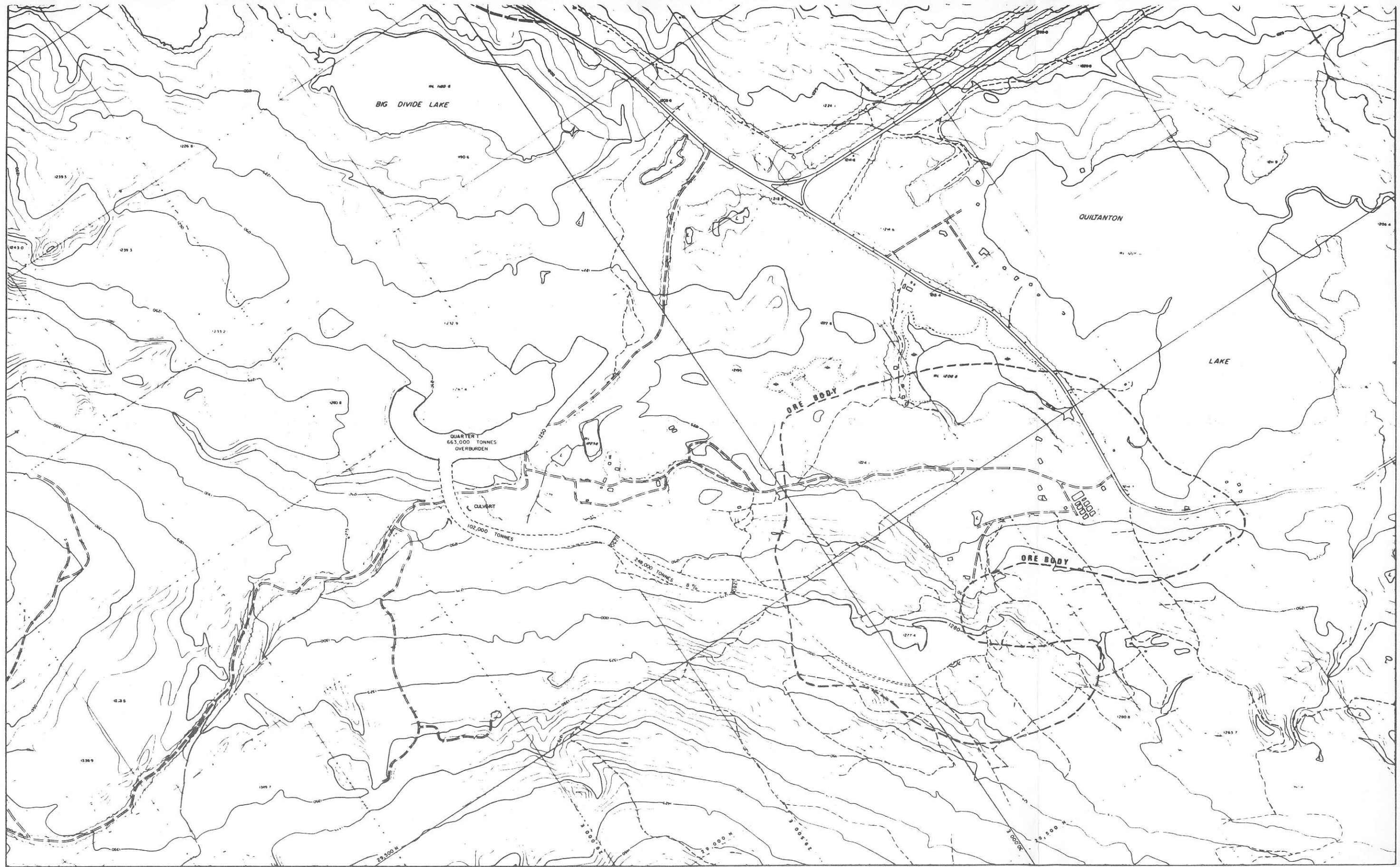
DETAIL 2
1:20

GENERAL NOTES:

- MATERIALS** - BRIDGEDECK - SINGLE SPAN PRESTRESSED PRECAST CONCRETE BOX GIRDERS. NO ADDITIONAL CONCRETE TOPPING OR WEARING SURFACE. LATERAL POST-TENSIONING APPLIED AT TRANSVERSE DIAPHRAGMS.
- ABUTMENTS** - REINFORCED BATH CRITERIA WITH CAST IN PLACE CONCRETE SEATING PROVIDING BEARING FOR PRESTRESSED PRECAST CONCRETE BOX GIRDERS.
- DESIGNS** - 1. THE BRIDGE MEMBERS SHALL BE DESIGNED TO CATER FOR THE ABNORMAL LOAD FROM ONE CARRYING LECTRA MAUL VEHICLES.
 2. SPECIFIED VEHICLE WEIGHTS
- | NET VEHICLE | CROSS VEHICLE |
|-----------------------|---------------|
| FRONT AXLE - 99404 kg | 81145 kg |
| REAR AXLE - 47846 kg | 168298 kg |
3. A RESTRICTION OF ONE VEHICLE CROSSING BRIDGE DECK AT ANY TIME SHALL BE RIGOROUSLY APPLIED.
 4. FOR GENERAL ARRANGEMENT REFER TO DRAWING LE-A-B.



Job No. J.	Revision	Issued to	Reference	Drawn by Y.Loc	Checked by	Design Eng.	Prof. Eng.	Approved	Engineering C.E.S.L.	Function BETHLEHEM COPPER CORPORATION	Scale AS SHOWN
Drawing No. LZ A 4 R										Activity LAKE ZONE MINE DEVELOPMENT (1982)	Drawing No.
										Division BRIDGE DECK AND ABUTMENT	LZ A 4 R
										Job DETAILS AND SECTIONS	



PREPRODUCTION: 1st QUARTER (JULY 1 - SEPTEMBER 30, 1982)

MAP SCALE



No	Date	MADE BY	DESCRIPTION
1			
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DATE	DRAWN BY	CHECKED	APPROVED
15 / 05 / 82			



BETHLEHEM
COPPER
CORPORATION

LAKE ZONE MINE
DEVELOPMENT 1982

OFFICE	DEPARTMENT	MAP INDEX NUMBER	SCALE	DRAWING NUMBER
	ENGINEERING	LZ - M	1: 5000	004



PREPRODUCTION : 2nd QUARTER (OCTOBER 1 - DECEMBER 31, 1982)

MAP SCALE



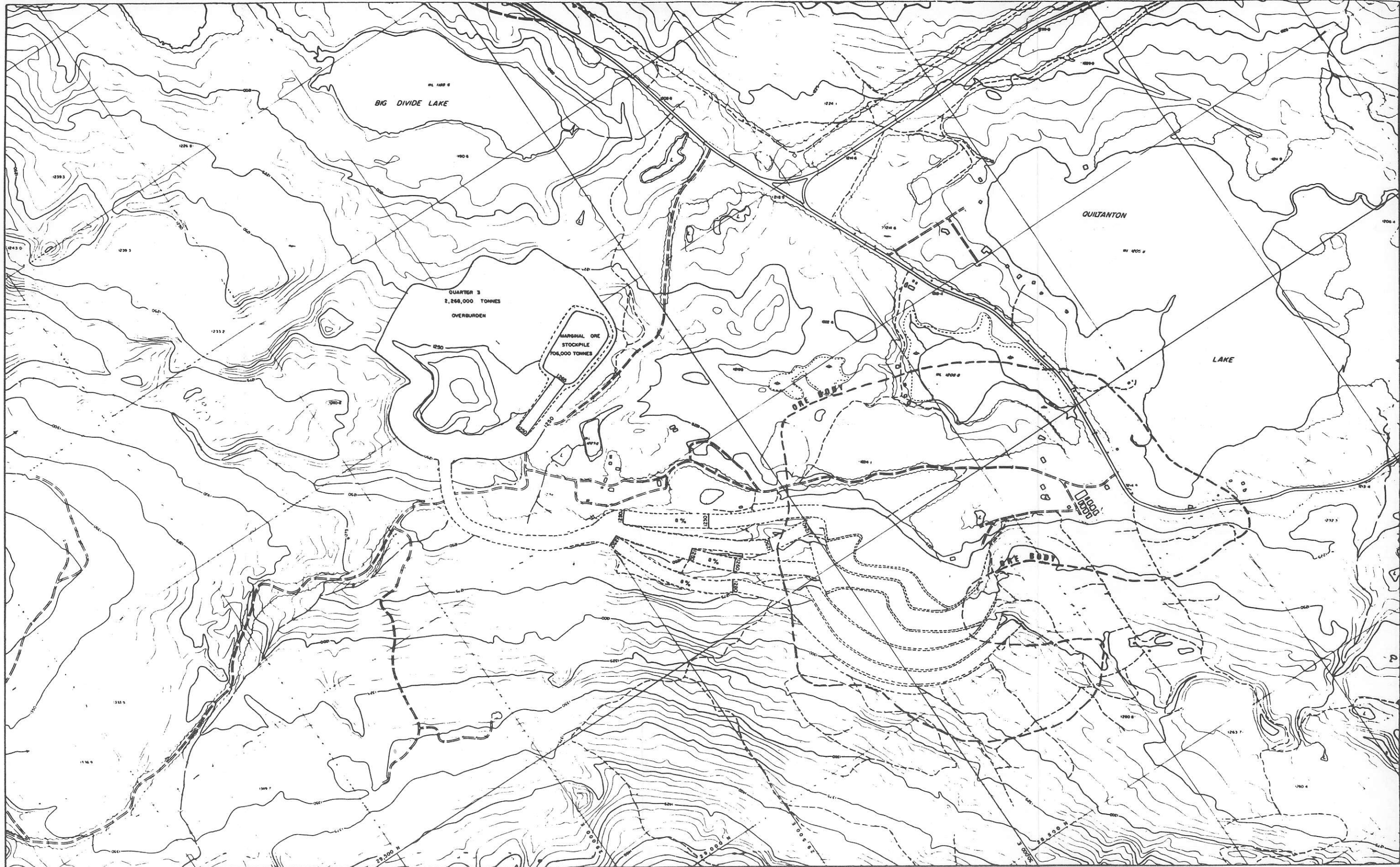
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LAKE ZONE MINE
DEVELOPMENT 1982

OFFICE	DEPARTMENT	MAP INDEX NUMBER	SCALE	DRAWING NUMBER
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PREPRODUCTION: 3rd QUARTER (JANUARY 1 - FEBRUARY 28, 1983)

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DATE	DRAWN BY	CHECKED	APPROVED	OFFICE	DEPARTMENT	MAP INDEX NUMBER	SCALE	DRAWING NUMBER
15 / 03 / 82					ENGINEERING	LZ - M	1 : 5000	008

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LAKE ZONE MINE
DEVELOPMENT 1982



DEVELOPMENT YEAR 5

MAP SCALE
METRES

No.	Date	MADE BY	DESCRIPTION
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DATE	DRAWN BY	CHECKED	APPROVED

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**LAKE ZONE MINE
DEVELOPMENT 1982**

OFFICE	DEPARTMENT	MAP SHEET NUMBER	SCALE	DRAWING NUMBER
CESL	ENGINEERING	LZ-M	1:5000	018