FARO MINE - DOWN VALLEY TAILINGS IMPOUNDMENT DECOMMISSIONING PLAN

007791 9/1/92

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IMPLICATIONS OF UPGRADING DESIGN TO ACCOMODATE FULL PMF & MAXIMUM CREDIBLE EARTHQUAKE

ITEM	ESTIMATED COST USED IN REPORT 60635	REVISED COST FOR PMF & MCE	COST DIFFERENCE
1. INTERMEDIATE DAM SPILLWAY	$ 1,000,000	$2,000,000	$ 1,000,000
2. PILOT CHANNEL	$ 153,000	$600,000	$ 447,000
3 INTERMEDIATE DAM	$ 2,157,960	$ 2,818,960	$ 661,000
SUBTOTAL	$ 3,310,960	$ 5,418,960	$ 2,108,000
ENGINEERING & CONTINGENCY (20%)	$ 662,192	$ 1,083,792	$ 421,600
TOTAL	$ 3,973,152	$6,502,752	$ 2,529,600

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IMPLICATIONS OF UPGRADING DESIGN TO ACCOMODATE FULL PMF & MAXIMUM CREDIBLE EARTHQUAKE

DESIGN CRITERIA USED IN REPORT 60635:

1. INTERMEDIATE DAM SPILLWAY — 500-yr FLOOD w̄ 1m FREEBOARD
2. PILOT CHANNEL — " " " " "
3. INTERMEDIATE DAM — 2×475-yr EARTHQUAKE

COST ESTIMATES FROM REPORT 60635

1. INTERMEDIATE DAM SPILLWAY — $1,000,000
2. PILOT CHANNEL — $153,000
3. INTERMEDIATE DAM — $2,157,960
   (RAISE FROM 1045.7m TO 1049.3m)

1. INTERMEDIATE DAM SPILLWAY

ALTERNATIVE 4 used side-channel spillway designed to pass ½ PMF with 2m freeboard (and full PMF with no freeboard). Estimated cost $1,650,000

Assume similar cost for proposed plan upgraded for full PMF with some additional concrete to accomodate full PMF → $2,000,000

2. PILOT CHANNEL

ESTIMATED COST OF PILOT CHANNEL (RIP-RAP LINED) TO PASS FULL PMF IS $600,000 (from Pat Leslie, 23 Jan 1990)

3. INTERMEDIATE DAM

- 475yr event → 0.063g
- used 0.12g for analyses (assuming MCE is 2× 475-yr event)
- K-L(1981) estimated MCE at 0.4g
- analysis performed for dam crest at 1055.7m ELEV.
  dam will be at 1049.3m elev. w̄ 2:1 max. d/s slope

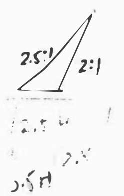
3. INTERMEDIATE DAM CONT'D.

Analysies for 2:1, 2.5:1 & 3:1 slopes, for k = 0.12g → 2.5:1 slope recommended (FS ≥ 1.3 for all but most extreme gw conditions)

COST OF BRINGING DOWNSTREAM SLOPE TO 2.5:1

~~TOTAL FILL VOLUME REQUIRED TO RAISE DAM TO 1049.3 m WITH 2.5:1 =~~

FILL VOLUME REQUIRED TO BRING D/S SLOPE TO 2.5:1 W CREST AT 1049.3m



$A = \frac{1}{2} H (0.5H) = 0.25 H^2$

SECTION (m)	H (m)	AREA (m^2)	AVE AREA (m^2)	DIST. (m)	SEGMENT VOL. (m)
50	13.6	46.2	23.1	50	1155
			71.1	10	711
60	19.6	96.0			
			129.9	40	5196
100	25.6	163.8			
			163.8	150	24,570
250	25.6	163.8			
			129.9	10	1299
260	19.6	96.0			
			82.5	75	6188
335	16.6	68.9			
			68.9	95	6546
430	16.6	68.9			
			82.5	60	4950
490	19.6	96.0			
			96.0	130	12,480
620	19.6	96.0			
			48	90	4320
710	0	0			
					67,415 m^3

~~Say 70,000 m^3~~

67,415 m^3 @ \$9.80 = ~~\$660,000~~ \$660,667

Factor of Safety for Downstream Seismic Slope Stability — West Tailings Section

FAILURE MODE	As built at 2:1 plus 1m rock cover	2.5:1 slope of rock
SHALLOW FAILURE	1.19	1.47
DEEP SEATED FAILURE	>1.31	1.41
DEEP SEATED FAILURE plus LIQUIFIED TAILINGS	---	1.15

The factors of safety for the 2:1 slope are ~~not sufficient~~ marginal for closure ~~and~~ so that the 2.5:1 slope ~~is recommended.~~ has been selected for design.

Stability of Intermediate Dam

A section through the Intermediate Dam at station 6 + 30 was selected as representative. Hydraulic modelling was not conducted to determine the location of the water table through the dam so analyses were conducted for four water table conditions, as follows and as shown on Figure 11.?: probable case, slightly elevated case, moderately elevated case, and extremely elevated case. The factor of safety for these cases was determined for a downstream slope of 2:1, 2.5:1 and 3:1. Soil strengths and the critical failure path are as shown on Figure 11.?. The results of the analyses for dynamic stability are summarized below. Generally, static analyses yield a factor of safety which is greater by approximately 0.1.

Factor of Safety for Downstream Seismic Slope Stability — Intermediate Dam

~~DYNAMIC FACTOR OF SAFETY~~

k = 0.12g

WATER TABLE	D/S SLOPE @ 2:1	D/S SLOPE @ 2.5:1	D/S SLOPE @ 3:1
Probable water table	1.29	1.52	1.80
Slightly elevated water table	1.25	1.48	1.76
Moderately elevated water table	1.05	1.30	1.59
Extremely elevated water table	-	1.08	1.44

The cases for the moderately and extremely elevated water table are considered to be improbable because the dam is composed of clean and durable material and is free draining. Therefore a 2.5:1 slope will ~~yield the~~ provide a suitable ~~required factor of safety~~ degree of security for closure.

Stability of Cross Valley Dam

At closure the cross valley dam will be breached and overall stability will not be an issue. The side slopes through the breach will be 2:1 which will make them safe against siesmic induced slumping. In the improbable event that a slump or flow slide where to occur and plug the breach ~~only a small washout would occur because of the small catchment of the Cross Valley Dam.~~ the [dam] would wash out with only limited water release because of the small volume of water impounded. Therefore, flatter slopes in the breach are not ~~recommended.~~ considered necessary.

From P. Leslie

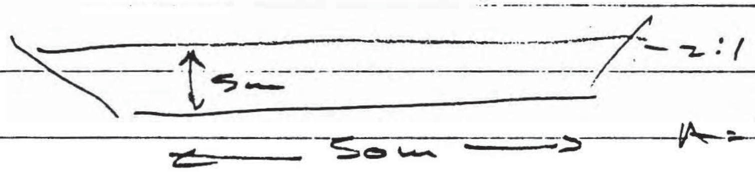
Faro.

23 Jan 1991

If Cross Valley Dam breached. need required to divert flow over old relocation [illegible] to Rose Creek. L = 500 m.

For $Q = 560\ m^3/s$ and $V = 2\ m/s$

X-Sect Area $= \frac{560}{2} = 280\ m^2$



$A = 300\ m^2$.

Vol. of exc $= 300 \times 500$

$= 150,000\ m^3$

Cost @ $4.00/m³ = $600,000.

Total Cost = $2,600,000

+ 20% = $3,120,000 + an

for 50m spillway costs for rip rap.

3.5m surcharge.