Task 9 - Group 2

BOOK C

WATANA DAM/DEVIL CANYON
PRODUCTION RATES

WATANA DAM/DEVIL CANYON
PRODUCTION RATES

(C)

UNIT PRICES - BACKUP CALCULATIONS

WATANA DAM/DEVIL CANYON

PRODUCTION RATES - WATANA

Powerhouse
Access Tunnels
Access Shafts
Fire Protection Headtank
Bus Tunnels & Shafts
Transformer Gallery
Cable Shafts
Diversion Tunnel
Grout Galleries
Surge Chamber
Penstocks
Tailrace Tunnel
Surface Preparation
Rock Slope Mesh
Instruments

DEVIL CANYON

Powerhouse
Access Tunnels
Main Access Shaft
Fire Protection Headtank
Bus Tunnels/Shafts
Transformer Gallery
Cable Shaft
Diversion Tunnel
Grout Galleries
Surge Chamber
Penstock
Tailrace Tunnels
Structural Steel Sets
Grading & Drainage
Service Material - Heat & Vent.
Rockbolts, Mesh & Shotcrete
Portal - Overburden, Rock Excavation
& Surface Preparation
Instruments

Watana

Estimate Work Sheet

ACRES

PROJECT SUSITNA HYDRO ELECTRIC PROJ
CONTRACT WATANA

ITEM REFERENCE No.
DESCRIPTION
OPERATION No. REF.
DESCRIPTION

JOB No.
SHEET OF
BY R. Carey 21 Jan 82
CKD DATE

cy/Day
@18hr/day
÷

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM.MATERIALS UNIT COST	PERM.MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT.OWNERSHIP UNIT COST	EQPT.OWNERSHIP AMOUNT	EQPT.OPERATION UNIT COST	EQPT.OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
590	Powerhouse		cy	14 23		4 99					12 14				31 36	
625	Access Tunnels = Devil Canyon		cy	13 84		6 44					13 63				33 91	
117	Main Access Shaft = Devil Canyon		cy	37 93		10 44					36 20				84 17	
660	Fire Protection Headtank		cy	12 42		4 74					10 18				27 34	
55	Bus Tunnels & Shafts Horiz		cy	63 36		21 60					46 01				131 97	
30	Vert.		cy	110 92		16 26					81 95				209 13	
522	Transformer Gallery		cy	12 33		5 16					20 86				38 35	
30	Cable Shaft		cy	110 82		16 26					81 95				209 13	
728	Diversion Tunnel 40'ϕ Devil Canyon: 32'ϕ		cy	13 59		5 50					13 14				32 23	
55	Grout Galleries Horiz		cy	44 36		21 60					46 01				131 97	
39	Vertical/Incline		cy	96 56		21 60					69 02				187 16	
590	Surge Chamber		cy	14 23		4 99					12 14				31 36	
64	Penstock 17'ϕ ≈ Devil Canyon 16'		cy	83 31		14 49					73 70				171 50	
758	Tail Race Tunnels 35'ϕ: Devil Canyon 39'ϕ		cy	15 09		6 29					14 57				35 95	
268	Outlet Tunnel 33'ϕ Inclined		cy	7 87		7 65					27 61				64 05	

17.02.02 Form 131-A

FOLD LENGTH
12
11
8.5
8
AUTO
MANUAL
FEED

ACRES

Calculations

SUBJECT: TRUCK CYCLE TIME & TRUCKS REQUIRED FOR VARIOUS HAUL DISTANCES

JOB NUMBER _____
FILE NUMBER _____
SHEET _____ OF _____
BY R. Long DATE 21 Jan 82
APP _____ DATE _____

Assume Loader Cycle Time Constant 3.5 min load
3.0 min spot
6.5 min

Assume Travel Speed of Trucks is the Same for all haul distances 20MPH Loaded = 1760 ft per min.
25MPH Empty = 2220 ft per min.

	1 MILE	2 MILE	3 MILE	4 MILE	5 MILE
LOAD	3.5	3.5	3.5	3.5	3.5
TRAVEL LOADED	3.0	6.0	9.0	12.0	15.0
DUMP	3.0	3.0	3.0	3.0	3.0
TRAVEL EMPTY	2.4	4.8	7.2	9.6	12.0
SPOT	3.0	3.0	3.0	3.0	3.0
TOTAL TRK. CYCLE TIME	14.9 MIN	20.3	25.7	31.10	36.5
÷ Loader Cycle Time Includes 3.0 min to Spot	÷ 6.5	÷ 6.5	÷ 6.5	÷ 6.5	÷ 6.5
TRUCKS REQD.	2.29	3.12	3.95	4.8	5.6
ROUNDED TRKS. REQD.	3	3	4	5	6

The underground haul distances used in the Cost Estimate is based on total hauling distance (one way) of 2 miles and a 50 minute hour

FORM NO. 162 REV. 1

ACRES

Calculations

SUBJECT: UNIT COSTS
Revisions to Computer Sheets

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Long DATE 4 Feb 82
APP DATE

Cost for WATANA & DEVIL CANYON

PRODUCTION / DAY		LAB	MATL JOB	MATL PERM	EQUIP OWN	EQUIP OPER	TOTAL
700 LF	CURTAIN GROUTING (DRILL) LF	5.82	0.25		1.21	1.49	8.77
1400 CF	(GROUT) CF	10.75	0.62	10.50	1.75	2.73	25.75
900 LF	CONSOLIDATION GROUT (DRILL) LF	2.47	0.25		0.53	0.65	3.90
543 CF	(GROUT) CF	7.05	0.25	12.50	0.78	0.95	21.53

SHOTCRETE (USING 2 NOZZLEMEN)

14,[illegible] SF/Day	1"	.45	—	1.47	.08	.09	1.09
11,790	2"	.55	—	1.92	.09	.11	1.67
9180	3"	.77	—	1.39	.13	.15	2.44
6570	4"	.99	—	1.86	.17	.20	3.22
4860	6"	1.34	—	2.80	.22	.28	4.64

PORTAL

2268 CY	OVERBURDEN	2.74			1.45	1.78	5.97
3500 CY	ROCK EXCAV.	4.44	4.22	—	3.82	4.68	17.16
64	SURFACE PREP	0.72	—	—	0.13	0.15	1.00
225/Day/Crew	DRAIN HOLES	9.91	0.26	—	2.50	3.05	15.72

FORM NO. 152 REV. 1

5

production per drill & blast day

	Rock Bolts	Lab	Matl	Equip. Own	Equip. Oper	Total
50	3/4 x 6'	55.76	11.10	17.09	20.89	104.84
39	1" x 9	71.25	18.70	21.84	26.69	138.48
36	1" x 10	77.45	20.60	23.74	29.01	150.80
32	1"x12	86.74	23.50	26.59	32.49	169.32
24	1x15	123.91	27.50	37.98	46.42	235.81
18.5	1x25	176.57	98.90	54.12	6615	395.74

MESH

Rock Bolt Spacing

	Lab	Matl	Equip Own	Equip Oper	Total
0	2.82	1.31	.39	.47	2.07
3 x 3	2.32	1.05	.67	.82	1.70
4x4	3.99	1.36	.94	1.15	2.81
5x5	2.88	1.24	.69	.85	2.01
6x6	2.30	1.18	.65	1.05	1.85
2/3(0), 1/3(6x6)	2.65	1.27	.54	.67	2.02
4/5(0), 1/5(6x6)	2.72	1.28	.48	.59	2.04

production varies, THE MAJORITY will BE 600 SF or day

ACRES

Calculations

SUBJECT: WATANA

COST BREAKDOWN & REVISIONS

JOB NUMBER P5700.09
FILE NUMBER
SHEET 1 OF
BY R. Beal DATE 11 FEB 82
APP DATE

ITEM No.	DESCRIPTION	FIELD LABOR L (1)	PERMANENT & JOB MATERIAL M (3)	CONSTRUCTION EQUIPMENT E (5+6)	NET UNIT	NET AMOUNT	GROSS UNIT	GROSS AMOUNT
331.118	STRUCTURAL STEEL	22% 463 000	75% 1,577,000	3% 63,000		2,103,000		3,260,000
331.119	POWER HOUSE ARCHITECTURAL FINISHES	25% 213 000	75% 639 000			852,000		1,320,000
331.129	MAIN PORTAL DOORS HANGER TYPE 480 SF @ $30 = 14400 FRAME 1200 SF @ $15 = 18 000 TRACK BOTTOM = 2000 MOTORIZED UP. = 5000 LABOR TO ERECT = 9100 48500 / EA	19% 9100	79% 38400	2% 1000	450 550 48500		75000	
331.138	MISC. STEEL WORK @ ACCESS SHAFT →	25% 592	70% 1660	5% 118	53 65 2370/TON		3675/T	
331.148	MISC. STEEL @ HEAD TANK →	23½% 3500	70% 10,500	6½% 1000			15,000	23,250
331.178	MISC. STEEL @ CABLE SHAFT →	23½% 1200	70% 3500	6½% 300	5000/TON		7750/TON	
331.179	ARCHITECTURAL ENCLOSURES →	20% 11500	75% 43500	5% 3000			58000	90 000
331.181	DEWATERING P.H. FACILITY (USE LABOR FROM VENTRATION)	—	33% 128000	67% 261 000		389 000		603000
331.191	INSTRUMENTATION @ P.H. FACILITY	56½% 383 000	35½% 178000	8% 38 000		499 000		773 000

	GROSS	NET	L	M	E
INSTRUMENTS	273 000	176000	-	176 000	-
INSTAL. LABOR	333 000	215 000	215,000		
DRILLING	167 000	108 000	68 000	2000	38000
	773 000	499 000	283 000	178000	38000

60.04.01 Form 148A

C5

ACRES **Calculations**

SUBJECT: WATANA
COST BREAKDOWN & REVISIONS

JOB NUMBER P5700.09
FILE NUMBER
SHEET 1 OF
BY RBEAL DATE 11/FEB/85
APP DATE

ITEM No.	DESCRIPTION	L	M	E	NET UNIT	NET AMOUNT	GROSS UNIT	GROSS AMOUNT
331.20	MISC. BLDGS. & STRUCTURES	20% 258 000	75% 968 000	5% 64 000		1,290,000		2 000,000
332.110	CLEARING	27½% 275	10% 100	62½% 625	1000/AC		1500/AC	
332.223	WELL POINT DEWATERING (ON UPSTREAM COFFERDAM)	76% 2, 244,000	2% 66 000	22% 660000		2,970,000		4,603, 000
332.22D	DEWATERING, INITIAL	21% 352 000	41% 694 000	38% 646 000		1,692, 000		2,622, 000
	DEWATERING, MAINTENANCE (USE LABOR FROM VENTILATION)	— 352,	33% 128 150 822,	67% 260,610 906,	408 498	2,080,	388 760	602 000
332.331	INSTRUMENTATION — POWER HOUSE FACILITY	58% 3,630,000	35% 2, 193,000	7% 475,000		6,298,000		9, 762,000
332.329	PORTAL DOORS. — GROUT GALLERIES	20% 2600	77% 9900	3% 400	12,960/EA		20,000/EA	
332.513	CONTACT GROUT @ STEEL MANIFOLD LINER	51% 82600	29% 48000	20% 33100	1412		16570	257000
332.51C	STEEL MANIFOLD LINER @ TUNNEL SPILLWAY	30% 850	65% 1850	5% 140	2840/TN.		4400/TON	

	GROSS	NET	L	M	E
INSTRUMENTS	3,357,800	2, 166,000	—	2,166,000	—
INSTAL. LABOR	4, 300,000	2, 774,000	2,774,000	-	-
DRILLING	2, 104,200	1, 358,000	856,000	27,000	475000
TOTALS	9,762,000	6, 298,000	3,630,000	2, 193,000	475,000

60.04.01 Form 148A

ACRES

Calculations

SUBJECT: WATANA
COST BREAKDOWN & REVISIONS

JOB NUMBER P5700.00
FILE NUMBER
SHEET 3 OF
BY R Bear DATE 10 Feb 82
APP DATE

ITEM No.	DESCRIPTION	L	M	E	NET UNIT	NET AMOUNT	GROSS UNIT	GROSS AMOUNT
332.53B	✓ BRIDGE (SAME % AS DEVIL CANYON BRIDGE)	32.5%	62.5%	5%				1,937,500
		406 000	781,000	63000	35000	1,250,000		
332.61D	✓ INTAKE BLDG. (SAME % AS DEVIL CANYON BLDG)	30%	60%	10%				100,000
		19500	39000	6500	3575	65000		
332.813	✓ CONTACT GROUTING @ PENSTOCK LINERS	51%	29%	20%				259 000 ~~120,000~~
		~~39 500~~	~~22 400~~	~~15500~~	15000	~~77400~~		
		85 300	48 500	33 400	12400	167 200		
	✓ CONSOLIDATION GROUTING @ PENSTOCKS	37%	51%	12%				360 000
		86 000	118 000	28000		232 000		
332.818	✓ STEEL PENSTOCK LINER	30%	65%	5%			4800/TON	
		930	2015	155	3100/TON			

33400
18400
5.55
167000
167
1837000

60.04.01 Form 148A

(WATANA) COST REVISIONS

	Item #	Labour	Material	Equipment (OWN / OPER)	Total	Mark L. Price
Main Dam						
Excavation						
Rock Useable above 1470ft	532.511	4.70	4.83	2.45 / 5.44 / 2.99	14.97 ✓	23.2
Rock Waste above 1470ft	.511	4.70	4.83	2.45 / 5.44 / 2.99	14.97 ✓	23.2
Rock Useable below 1470 ft	.511	5.00	5.15	2.28 / 5.06 / 2.78	15.21 ✓	23.5
Rock Waste below 1470 ft	.511	6.12	4.24	3.20 / 7.10 / 3.90	17.46 ✓	27.0
Main (Chute) Spillway Excavation						
Approach						
Rock Useable	552.521	3.46	4.24	2.17 / 4.83 / 2.66	12.53 ✓	19.4
Rock Waste	.521	3.46	4.24	2.17 / 4.83 / 2.66	12.53 ✓	19.4
Control Structure						
Rock Waste	.521	2.84	4.30	1.99 / 4.42 / 2.43	11.56 ✓	17.9
Rock Useable (No need to distinguish between inclined + vertical)	.521	3.64	4.54	2.23 / 4.95 / 2.72	12.93 ✓	20.0
Upper Chute						
Rock Waste	.521	3.46	4.24	2.17 / 4.83 / 2.66	12.53 ✓	19.4
Rock Useable	.521	5.09	5.15	2.59 / 5.76 / 3.17	16.00 ✓	24.8
Lower Chute						
Rock Waste	.521	2.94	4.24	1.41 / 3.13 / 1.72	10.31 ✓	15.9
Rock Useable	.521	4.57	5.15	1.83 / 4.07 / 2.24	13.79 ✓	21.3
le Block / Flip and Outfall.						
Rock Waste	.521	2.94	4.24	1.41 / 3.13 / 1.72	10.31 ✓	15.9
Rock Useable	.521	4.57	5.15	1.83 / 4.07 / 2.24	13.79 ✓	21.3
Emergency Spillway Excavation						
Rock Useable	.531	3.64	4.54	2.26 / 5.02 / 2.76	13.00 ✓	20.1
Rock Waste	.531	3.11	4.30	2.40 / 5.34 / 2.94	12.75 ✓	19.7

Notes - Above table summarises the revisions made to the unit costs for Watana Dam Rock Excavation. Following discussion with Cousineau Monday 15th February it was decided to increase drill rates of airtrackers from 20 ft/hour to 30 and 40 ft/hour depending on location. Changes to costs calculated and compiled by R. D. Chamberlain 16th and 17th February 1982.

Entered on Print out #78 for Corrections to next computer run.

R. Tang 2-17-82

(C) Production Rates - Watana Powerhouse

Estimate Work Sheet

ACRES

PROJECT

CONTRACT WATANA

ITEM REFERENCE No.

DESCRIPTION POWERHOUSE

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY R. Lang 21 Jun 82

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
The excavation unit cost for the Powerhouse will be similar to the Surge Chamber excavation.																
See Devil Canyon back up for Unit Cost development.																
PRODUCTION = 590 C/DAY.		C.Y.	14.23		4.99						12.14				3.36	

(C) Production Rates - Watana

Access Tunnels

ACRES

Calculations

SUBJECT: TUNNELS — WATANA

COST ESTIMATE REFERENCE

JOB NUMBER
FILE NUMBER
SHEET OF
BY R.Carey DATE 28 Jan 82
APP DATE

	REFERENCE
MAIN TUNNEL	ACCESS TUNNEL
TRANSFORMER GALLERY TUNNEL	ACCESS TUNNEL
GROUT GALLERY	GROUT GALLERY — INCLUDES Water & GROUT PIPES
SURGE CHAMBER	PENSTOCK LOWER TUNNEL ACCESS
PENSTOCK ACCESS TUNNEL	" " " "
PENSTOCK ELBOW ACCESS TUNNEL	" " " "
ACCESS SHAFT TUNNEL	" " " "
CONNECTOR TUNNEL	GROUT GALLERY
SPILLWAY TUNNEL	TAILRACE TUNNEL
DRAIN TUNNEL	GROUT GALLERY

FORM NO. 1... REV. 1

C12

Estimate Work Sheet

ITEM REFERENCE No.

DESCRIPTION ACCESS TUNNEL

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET 1 OF 1

BY R. Lang 13 Jan 82

CKD T. LITTLE DATE 1-16-82

[illegible] WATANA

[illegible] AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
[illegible] 35 IN X 28 h.																
18 { 9 Hrs [illegible] DRILL (625 CY Round)			3.70		0.90						4.61				9.21	
3 Hrs [illegible] BLAST			0.84		5.11						0.41				6.36	
6 Hrs [illegible] MACK (3 haul units - 1 mile haul)			3.89		–						6.57				10.46	
6 Hrs BULL GANG			2.38		–						0.88				3.26	
6 Hrs SERVICE CREW (includes duct, elec service mat'ls.)			3.03		0.43						1.16				4.62	
34.7 ¢/CF Production (625.3 ¢/Day)		CY	13.84		6.44						13.63				~~33.62~~ 33.91	

16

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5702.02 Form 131A

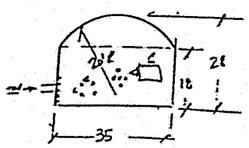
Calculations

ACRES

SUBJECT: SUSITNA ~~[illegible]~~ WATANA

ACCESS TUNNEL

JOB NUMBER
FILE NUMBER
SHEET 1 OF 6
BY [illegible] DATE 1-4-82
APP RBB. DATE 18 JAN 82



AREA = $(.1748 \times 35^2) + (18 \times 35)$ = 844.13 sf. (214.13, 630)

Arc Length = 1.855 × R = 37.1'

EXPLOSIVES: 99 holes @ 3 min/hole = 297 ÷ 50 min/hr = 5.94
6 hrs ÷ 3 men = 2 hrs
VENTILATE 1
3 Hrs.

LINE DRILLING = 2.0' c.c 37+35+36 = 108' ÷ 2 = 54' holes
FACE DRILLING = 844 sf ÷ (4×6) = 40
BURN HOLES = 5
99 holes

PULL ≈ 60% width = .6(35) ≈ 20 ft.
DRILL LENGTH = 22 ft. × 99 holes = 2178 lf.

1-4 Boom Jumbo @ 1.1 ft/min/drill = 4.4'/min Jumbo

$\frac{2178 \text{ lf}}{4.4'/\text{min}}$ = 495 min. ÷ 60 min/hr. = 8.25 Hours

move in/out & set up = .75

9.0 hour shift

VOLUME/ROUND 844.13 × 20/27 = 625.28 ℄ Bank
×1.3 = 812.8' Loose cy. HAUL

LOAD/HAUL CYCLE = LOAD 3.5 min
20 MPH 29.33 FPS Travel 18.0 (6 miles)
Dump 3.0
24 MPH 35.2 FPS Return 15.0
39.5 min
SPOT 3.
42.5'

42.5 ÷ 3.5 = 12 HAUL UNITS REQD.

Volume/Round HAUL = $\frac{812.8 \text{ LCY}}{20 \text{ ℄ TRK}}$ = 40.6 = Say 41 loads

41 loads
× 6.5 min
267 min ÷ 50 min/hr. 5.3 Hrs HAUL
Say 6' Hours

LOAD/HAUL CYCLE (Changed to 1 mile haul.)
Load ~ 3.5 min.
Travel loaded - 3.0 min @ 20 MPH. (1760 fpm)
Dump ~ 3.0 min
Return Empty ~ 2.4 min @ 25 MPH (2220 fpm)
Spot. ~ 3.0 min
14.9' min/cycle

$\frac{14.9 \text{ min}}{6.5 \text{ min/load}}$ = 2.3 ≈ 3 Trucks Reqd.

60.04.01 Form 148A

Estimate Work Sheet

ACRES

PROJECT SUSITNA

CONTRACT WATANA

ITEM REFERENCE No.

DESCRIPTION ACCESS TUNNELS

OPERATION No. REF.

DESCRIPTION

JOB No. P5700.09

SHEET 2 OF 6

BY R. Lang 1-4-82

CKD T. Little DATE 1-16-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
DRILLING																
$/Hour																
LABOR 1 foreman 33.15																
1 Jumbo Oper. 32.43																
1 Drillers 32.08																
1 Helper 30.54																
1 Drill Doctor 31.43																
1 Comp. Oper. 33.62																
1 Electrician 40.45																
$233.70/Hr.																
$233.70 x 9+10% = 2313.63																
Cost/cy. = $2313.63 / 625 cy = $3.70/cy		cy	3.70													
MATERIAL Drill bits, rods, shanks, etc.																
$0.25/lf drilling																
2178 ft. x .25 = $544.50																
Cost/cy = $544.50 / 625 cy ≈ $ .90/¢		cy			0.90											
$/Hour																
EQUIPMENT 1 Jumbo 215																
2 - 600 cfm compr. (35) 70																
1 Drill Grinder 10																
1 pick up 4x4 25																
$320/Hr.																
$320 x 9 hours = 2880																
Cost/cy = 2880 / 625 cy = 4.61/cy.		cy									4.61					
DRILLING COST.		cy	3.70		0.90						4.61				9.21	

57.02.02 Form 131A

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Estimate Work Sheet

ACRES

PROJECT SUSITNA

CONTRACT WATANA

ITEM REFERENCE No.

DESCRIPTION Access Tunnels

OPERATION No. REF.

DESCRIPTION

JOB No. P5700.07

SHEET 3 OF 4

BY R. Long 1-5-82

CKD T. Little DATE 1-14-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM.MATERIALS UNIT COST	PERM.MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT.OWNERSHIP UNIT COST	EQPT.OWNERSHIP AMOUNT	EQPT.OPERATION UNIT COST	EQPT.OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
BLAST																
LABOR 1 - powderman 32.43																
3 - Helpers (31.75) 95.25																
1 - Tk. Dr. 31.75																
$159.43/Hr.																
$159.43/Hour X 3 Hours + 1/2 = $ 526.12																
Cost/cy = $526.12 ÷ 625 cy = $0.84		cy	.84													
MATERIAL																
Explosives - Dynamite 2.3#/cy @ $1.50 = $3.45																
Fuse 1.00																
Wire & Accessories 15% .66																
Cost/cy $5.11/cy		cy			5.11											
EQUIPMENT 1 ANFO loader $600.00/20,000 #11# 44.00																
1. Panel Truck $25.00																
1. pick up 20.00																
$86.00/Hr.																
.86 = x 3 hrs = $258																
Cost/cy $258 ÷ 625 cy = $0.41		cy									0.41					
BLAST COST.		cy	.84		5.11						0.41				6.36	

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Estimate Work Sheet

ACRES

PROJECT

CONTRACT WATANA

ITEM REFERENCE No.

DESCRIPTION ACCESS TUNNEL

OPERATION No. REF.

DESCRIPTION

JOB No. PS700.09

SHEET 4 OF 6

BY R.Lang 1-5-82

CKD T.LITTLE DATE 1-6-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
MUCK/HAUL																
LABOR		$/Hr														
1 LOADER OPER																
3 DRIVERS (33.90)																
3 TRAFFICMEN (30.54)																
2 FOREMAN (35.11)																
1 DOZER OPER.																
1 GRADER OPER																
		$368.58/Hr.														
$368.58 × 6 HRS +10% = $2432.63																
COST/CY : $2432.63 ÷ 625 cy = $3.89		cy	3.89													
EQUIPMENT		$/Hr.														
1 LOADER		87.00														
3 R-50 TRUCKS (140)		420.00														
1 DOZER		82.00														
2 PICK-UP 4X4 (25.)		50.00														
1 GRADER		45.00														
		$684.00/Hr														
$684 x 6 HRS = $4104.00																
COST/CY $4104 ÷ 625 CY = $6.57		cy										6.57				
MUCK/HAUL COST		cy	3.89									6.57			10.46	

87.02.02 Form 131A

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Estimate Work Sheet

ACRES

PROJECT

CONTRACT WATANA

ITEM REFERENCE No.

DESCRIPTION ACCESS TUNNEL

OPERATION No. REF.

DESCRIPTION

JOB No. P5700-09

SHEET 5 OF 6

BY R. Lang 1-5-82

CKD T. Lime DATE 1-16-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM.MATERIALS UNIT COST	PERM.MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT.OWNERSHIP UNIT COST	EQPT.OWNERSHIP AMOUNT	EQPT.OPERATION UNIT COST	EQPT.OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
BULL GANG CREW (VENT & AIR)																
LABOR 1 Foreman $/HR 31.35																
4 Helpers (30.54) 122.16																
1 Rigger 37.89																
1 Cherry Op. 34.41																
$225.81/HR																
$225.81 x 6 HRS +10% = $1490.34																
Cost/cy = $1490.34 ÷ 625 cy = $2.38		cy	2.38													
EQUIPMENT $/HR																
1 pickup 4x4 25.00																
1 CHERRY PICKER 60.00																
1 F.D. TRUCK 25.00																
$110.00/HR																
$110. X 5 HRS = $550.00																
Cost/cy = $550. ÷ 625 cy = $0.88/cy		cy										0.88				
BULL GANG UNIT COST		cy	2.38									0.88				3.26

5702.02 Form 131A

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Estimate Work Sheet

ITEM REFERENCE No.

DESCRIPTION ACCESS TUNNEL

JOB No. P5700.09

SHEET 6 OF 6

PROJECT

OPERATION No. REF.

BY R. Lang 1-5-82

CONTRACT WATANA

DESCRIPTION

CKD T. Little DATE 1-16-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM.MATERIALS UNIT COST	PERM.MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT.OWNERSHIP UNIT COST	EQPT.OWNERSHIP AMOUNT	EQPT.OPERATION UNIT COST	EQPT.OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
SERVICE CREW $/HR																
LABOR 1 foreman 45.33																
1 pipefitter 44.33																
2 helpers (40.79) 81.58																
1 Elect. 40.45																
1 El. helper 40.45																
1 Cherry Oper. 34.41																
$286.55/HR																
$286.55 x 6 Hrs + 10% = $1891.23																
Cost/cy: $1891.23 ÷ 625 cy =		cy	3.03													
EQUIPMENT																
2 pick ups (25) 50																
1 cherry picker 60																
$110/Hr																
$110. x 6 Hrs = $660.00 + 10% = 726																
Cost/cy: $660 ÷ 625 cy = 1.06 1.16		cy									1.16					
SERVICE CREW COST/CY		cy	3.03		0.43						1.16				4.62	
MATERIALS $13.50/Ft (20 ft) Rd. = 0.43/cy																
Duct, Wire & Lights																
WATER & AIR 625 $/Rd.																

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57.02.02 Form 131A

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AUTO MANUA FEED

(C) Production Rates - Watana

Access Shafts

Estimate Work Sheet

ACRES

ITEM REFERENCE No. | JOB No.

DESCRIPTION MAIN ACCESS SHAFT 24'ϕ | SHEET OF

PROJECT | OPERATION No. | REF. | BY R. Long

CONTRACT WATANA | DESCRIPTION | CKD | DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Excav. 8'ϕ w/ ALIMAK (9 hours)	15	CY	110.92	1663.80	16.26	243.90					81.95	1229.25			209.13	3136.95
SLASH to 24'ϕ (16 hours)	149	cy	31.60	4708.40	9.42	1403.58					25.14	3745.86			66.16	9857.84
(25 hours)	164	cy		.6372 -		1647.48						4975				12994
UNIT COST			38.85		10.04						30.33	(13.65)		(16.68)	77.22	

Avg. Production $\frac{164\ CY}{25\ hrs} = 6.56\ CY/HR \times 18\ hrs. = 118\ CY/DAY$

5702.02 Form 131 A
FOLD LENGT 12 11 8.5 8 AUTO MANUA FEED

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C21

ACRES

Calculations

SUBJECT: ACCESS EXHAFT.
WATANA

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Cuny DATE 14 Jan 82
APP P.B.B. DATE 18 JAN 82

PROCEDURE (1) Drive 8'ϕ aux. shaft w/ Alimac – BOTTOM UP
(2) Slash remaining from bottom up (Hoist & Platform)

Volume of 8'ϕ = 50.26 SF x 8ft. pull / 27 = 14.89 ≈ 15 cy/round
perimeter 25.12 ft. ÷ 1.5 c.c. = 17 holes
BURN + Area holes = 15
32 holes x 9 ft./drill = 288 ft.

(1) DRILL PRODUCTION 20ft/hr./drill x 2 drills = 40 ft/hr. = 288/40 = 7.2 hrs.
LOAD & BLAST = 32 holes x 4 min ea ÷ 50 min/hr. ÷ 2 men = 1.3 hrs. (LOW)
8.5 hrs = Say 9 hrs.

LABOR (Drill & Blast)

1 foreman		33.15
2 drillers	(32.08)	64.16
1 oper.		32.43
1 Labor.		30.54
		$160.28 x 9 hours + 10% = $1586.7

LABOR (HAUL) + Trk Dr, 33.90
+ FEL oper 36.22
$70.12 x 1 hours + 10% = $77.13

BULL GANG & SER. CREW NOT REQD.

TOTAL LABOR = $1663.80 ÷ 15 ≈ $110.92

EQUIPMENT

1 Alimac	60.00
2 Stoper. (20.00)	40.00
1-600 Compr.	38.50
	$138.50 x 7.5 hrs = $1038.75
1-25T Trk.	55.00
1-FEL	36.50
	91.50 x 1 hr. = 91.50
1-ANFO Loader	41
1-Panel Trk	25
	66 x 1.5 hrs. = 99.00

$1229.25 ÷ 15 ≈ 81.95/cy

MATERIAL - DRILL BIT, RODS, ETC 288 ft. x .20/LF = $57.60
EXPLOSIVES 15 x 4 = 60.00
FUSE/CORD 153 x .3 + 32 x 1.5 = 93.90
DELAY 17 x 1.20 = 20.40
WIRE & ACCESSORIES (20% powder) = 12.00
$343.90 ÷ 15 = 16.26

(2) SLASH
AREA 12² x π = 452.2 – 8'ϕ = 402 SF
VOLUME 10' (402) / 27 = 148.9 cy.

DRILL 50' perimeter holes
34' Area holes, incl burn 330'
84 holes x 11' depth = 924 ft.
4 drills @ 20 ft/hr. = 80 ft./hr.
∴ 924 ÷ 80 = 11.5 hrs +
.5 hr. above in
12 hrs.

LOAD & BLAST 54 x 4 = 50 = 3.5 hrs. MUCK OUT
16 HRS.

LABOR			EQUIP	
1 foreman		33.15	1 Hoist/Platform	64.50
4 drillers	(32.08)	128.32	4 Stoper (20)	80.00
1 oper.		32.43	2-600 Compr. (38.50)	77.00
1 helper (lab)		30.54		
1 Hoist Oper.		34.01		
		258.85 x 12 hrs +10%		22.50 x 12 = 3544
LABOR =		3416.82		2658 ÷ 149 = $17.84
				23.79

HAUL 1 mile: Load: 3.0
Travel 3.0 20 MPH (1760 fpm)
Dump 3.0
Return 2.4 25 MPH (2220 fpm)
Spot 3.0
14.4 = Say 4 loads/Hr./Trk.

149 CY/Round x 1.2 Swell ÷ 20 T/load = 9 Loads
149 x 1.2 ÷ 20 x 6 Min/Ld. = 53 min/hr = 1.07 Say 1 Trk.

Equip: Say 3 Trks (55) = 165.00
1 Loader 36.50
201.50 x 146.50 ÷ 149 ≈ 1135 $/hr

LABOR 3 Trk Dr. (33.90) = 67.80 101.70
1 Lunkin Lyer 36.22
137.92 x 104.82 + 10% x 1 hr = $114.42

MATLS Drill Bits, Rods 924 x .40 = 370.00
Explosives 150 x 2 x 2 = 600.00
Fuse/Cord 550 x .3 + 59 x 1.5 = 253.50
Delay 50 x 1.2 = 60.00
Wire & Accessories (20% powder) = 120.00
1403.50 ÷ 149 cy = 9.42

L $4555.76 / 3416.82 + 114.42 = 4207.47 / 3531.24 ÷ 149 = 31.59/cy
$23.70/cy

60.04.01 Form 148A

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(C) Production Rates - Watana

Fire Protection Headtank

Estimate Work Sheet

ACRES

PROJECT

CONTRACT WAIANA

ITEM REFERENCE No.

DESCRIPTION FIRE PROTECTION HEADTANK

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY R. Lang 17 Feb 82

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Reference: Devil Canyon Back up for Grout Gallery.																
Assume Headtank cost will be similiar to Incline excavation unit costs		C.Y.	9.54		27.44						31.06		37.96		193.00	

5702.02 Form 131A

C21

Estimate Work Sheet

ACRES

PROJECT

CONTRACT WATANA

ITEM REFERENCE No.

DESCRIPTION FIRE PROTECTION HEADTANK

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY R'Lang 21 Jan 82

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Methods of excavation similiar to Devil Canyon Surge Chamber Unit Cost with Adjustments made to deduct the need for Auxillary Shaft during construction.																
Access Tunnel (thru Chamber)	2719	cy	13.84	37631	6.44	17,510					13.63	37065			33.91	92,201
Dome Slash	4671	cy	10.81	50494	6.01	28,073					12.47	58,247			29.29	136,814
Benching	42,250	cy	11.78	497,705	4.49	189,702					10.32	436,020			26.59	1,123,427
	49,640	cy		585,830		235,285						531,327				1,352,442
UNIT COST →			11.80		4.74						10.70				27.24	
AVG DAILY PRODUCTION 660 ¢																
NOTE: These Quantities Do Not Reflect the HEADTANK QUANTITIES Only the Unit Costs.																

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(C) Production Rates - Watana

Bus Tunnels & Shafts

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

PROJECT

DESCRIPTION BUS TUNNELS/SHAFTS

JOB No.

CONTRACT WATANA

OPERATION No. REF.

SHEET OF

DESCRIPTION

BY R. Lang 21 Jan 82

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
1																
Tunnels Unit Cost = Same as Devil Canyon See Devil Canyon Backup																
2108/Day Tunnels Horiz.		CY	36.43		9.44						28.29				74.36	
		CY														
Shafts Unit Cost = Same as Alimac Raise for Access Shaft See Devil Canyon Back up																
308/Day Shafts		CY	110.93		16.26						8.95	(36.86)		(45.07)	209.13	

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57.02.02 Form 131A

(C) Production Rates - Watana

Transformer Gallery

C28

Estimate Work Sheet

ACRES

PROJECT

CONTRACT

ITEM REFERENCE No.

DESCRIPTION TRANSFORMER GALLERY

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY R. Lang 21 Jan 82

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Assumed Size 50W x 45h w/crown Assume 15ft. Top heading and 2-15ft Bench operations Reference: Devil Canyon Transformer Backup.																
559 Y/Day		CY	11.72		5.11						11.83	(5.32)		(6.51)	28.66	

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57.02.02 Form 131A

(C) Production Rates - Watana

Cable Shafts

C30

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

JOB No.

DESCRIPTION CABLE SHAFT 8 ft Dia.

SHEET OF

PROJECT

OPERATION No. REF.

BY R. Long 21 Jan 82

CONTRACT WATANA

DESCRIPTION

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Reference Devil Canyon Backup for Main Access Shaft excavation with ALIMAC RAISE CLIMBER. PRODUCTION = 30 CY/DAY.																
UNIT COST		CY.	110.92		16.26						81.95				209.13	

57.02.02 Form 131A
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(C) Production Rates - Watana

Diversion Tunnel

C32

Estimate Work Sheet

ITEM REFERENCE No.

DESCRIPTION DIVERSION TUNNELS

JOB No. P5700.09

PROJECT

OPERATION No. REF.

SHEET OF

CONTRACT WATANA

DESCRIPTION

BY R. Beal 19 JAN 82

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
EXCAVATE DIVERSION TUNNEL 40'Ø																
DRILL 931 CY/ROUND		C	5.78 ✓		0.97 ✓						5.46 ✓				12.21 ✓	
BLAST			1.15 ✓		4.24 ✓						0.49 ✓				5.88 ✓	
MUCK & HAUL (up to 2 miles)			2.26 ✓		–						5.30 ✓				7.56 ✓	
BULL GANG & SERVICE CREW		--	4.40 ✓		0.29 ✓						1.89 ✓				6.58 ✓	
		CY	13.59 ✓		5.50						13.14				32.23 ✓	

PRODUCTION = 931 CY Round / 23 Hrs = 40.47/HR

X 18 Hrs/Day

728.6 CY/Day.

57.02.02 Form 131 A

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FEED

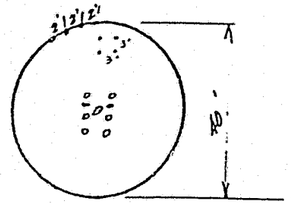
C33

Calculations

ACRES

SUBJECT: WATANA DIVERSION TUNNELS

JOB NUMBER P5700.09
FILE NUMBER
SHEET OF
BY R. Beal DATE 19 JAN 82
APP R. Lang DATE 20 Jan 82



FULL FACE EXCAVATION
AREA = $\frac{\pi}{4}(40)^2$ = 1257 S.F.
VOLUME = 1257/27 x 20' PULL = 931 CY/ROUND
931 x 1.25 = 1164 CY LOOSE
DRILL 21 L.F. TO PULL 20 L.F.

HAUL CYCLE - (1-MILE)
LOAD = 3.5 MIN
TRAVEL W/ LOAD = 3.0 (1760 F/MIN) @ 20 MPH
DUMP = 3.0
RETURN 2.4 2200 FPM @ 25 MPH
SPOT 3.0
14.9 MIN/CYCLE

MATERIAL.
POWDER 931 x 1.7 x 1.75 = 2769.72
FUSE & CORD 172 x 3 = 516.
BITS/ROD ETC. 3612 x .25 = 903.
ACC .20 x 2770 554.
DELAYS 62 x 1.8 = 111.60
$4854.30
SERVICE VENT DUCT 20' (13.50/LF) = 270.00
$5124.3 ÷ 931 = $5.50/CY

PERIMETER HOLES = 40π ÷ 2' = 62 HOLES
PATTERN HOLES = 40 - 2(3) = (34)² x π/4 = 908 ÷ 9 = 101 HOLES
BURN HOLES = 9
TOTAL 172 HOLES x 21 LF = 3612 LF ÷ 440 FT/HR = 8.2 HOURS. Say 9 HRS INCL SET-UP

PRODUCTION - USING 2 - 4 BOOM JUMBO DRILLS @ 1.1 LF/MIN x 50 MIN/HR
2(4) x 1.1 x 50 = 440 L.F./HR.

LABOR

DRILL
1 - FOREMAN = 33.15
2 - JUMBO OP. (32.43) 64.86
4 - DRILLER (32.08) 128.32
4 - CHUCK TEND. (31.43) 125.72
2 - DRILL DOC (31.43) 62.86
2 - COMPRESS OP. (33.62) 67.24
2 - HELPERS (30.54) 61.08
17 MEN 543.23 x 9 HRS + 10% = $5377.98
5378/931 = $5.78/CY

BLAST
1 - POWD. MAN 32.43
3 - HELPERS (31.75) ~~63.50~~ 95.25
1 - TR. DRIVER 32.15
~~128.08~~ 161.83 x 6 HRS + 10% = ~~$845.33~~ 1,066.76
~~845.33~~ 1066.76/931 = ~~$0.91~~/CY. 1.15/F

LOAD 171 HOLES x 5 MIN = 855/50 = 17.1 HR.
17.1 HRS ÷ 4 MEN = 4.27 HRS
VENTILATE = 1.0
5.27 Say 6 HRS.

MUCK
1 - FOREMAN 34.30
3 - TR DR. (33.90) 101.70
2 - OPER. (36.22) 72.44
1 - FLAGMAN 30.54
238.98 x 8 HRS + 10% = $2103.02
2103/931 = $2.26/CY

MUCK 1164 CY LOOSE/20 = 58 LOADS x 6.5 MIN/LOAD = 377 MIN.
377 MIN/50 MIN/HR = 7.5 HRS. Say 8 HR.
14.9 MIN/CYCLE ÷ 6.5 MIN LOAD = 2.3 Say 3 TRUCKS
NOTE: Same # Trks Reqd. for 2 mile haul
R. Lang.

BULL GANG & SERVICE (SAME AS ACCESS TUNNEL) = 512.36/HR x 8 HRS = $4098.88
4098.88/931 = $4.40/CY

TOTAL LABOR = $ ~~13.35~~/CY
13.59/CY

EQUIPMENT

DRILL
2 - 4 BOOM JUMBO (215) = 430
2 - 1000 CFM COMPRESSOR (45) = 90
2 - BIT GRINDER (10) = 20
1 - PICKUP TR. = 25
565 x 9 HRS = $5085 ÷ 931 = $5.46/CY.

BLAST
1 - EXPLOSIVE LOADER 41
1 - PANEL TRUCK 25
1 - PICK UP TR. 25
91 x 5 HRS = $455 ÷ 931 = $0.49/CY.

HAUL
3 - R-50 TRKS (140) = 420
1 - FEL = 87
1 - DOZER = 85
1 - PICKUP TR. = 25
617 x 8 HRS = $4936 ÷ 931 = $5.30/CY.

SERVICE & BULL GANG
110 + 110 = 220 x 8 HRS = $1760 ÷ 931 = $1.89/CY

TOTAL EQUIPMENT = $13.14/CY.

TOTAL MATERIAL = $5.50/CY

60.04.01 Form

(C) Production Rates - Watana

Grout Galleries

Estimate Work Sheet

ACRES

PROJECT

CONTRACT

ITEM REFERENCE No.

DESCRIPTION GROUT GALLERIES

OPERATION No. REF

DESCRIPTION

JOB No.

SHEET OF

BY R. Lang 21 Jan 82

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
Reference: Devil Canyon Back up for 10x10 Gallery																
Horiz. Drill				496.25		294.76						405.00				
55¢/DAY Blast				208.38								132.00				
Muck-Haul				54.21								63.25				
Service Crew (every other round)				343.07		75.00						137.50				
	17.12¢/Rd.	CY		1101.91		369.76						787.75				2259.42
Horiz. Excavation Allowance for Water & Grout pipes $20.00/LF Gallery x 5 ft/Rd ÷ 17.12¢ = $5.84/cy		CY	64.36		21.60 5.84 27.44						46.01				131.97 5.84 137.81	
Vertical/~~[illegible]~~ Excavation 39¢/DAY Allow 50% more for labor & equipment (No Water or Grout Pipes)		CY	96.54		21.60						69.02				187.16	
Incline add $5.84 for Water & Grout pipe Matl Only.		CY	96.54		27.44						69.02				193.00	

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57.02.02 Form 131 A

(C) Production Rates - Watana

Surge Chamber

C.27

Estimate Work Sheet

ACRES

PROJECT

CONTRACT WATANA

ITEM REFERENCE No.

DESCRIPTION SURGE CHAMBER

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY R. Lang 21 Jan 82

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Reference: Devil Canyon Estimate Back up.																
1) Construct Access Tunnel thru Dome of chamber																
2) Alimac raise shaft from Tailrace Tunnels to top Access Tunnel (muck will be dropped down shaft for hauling out Tailrace Tunnel																
3) Side Slash Dome to full width																
4) Bench remaining cavatity to lower level																
1 Access Tunnel thru Chamber	2719		13.84	37631	6.44	17510					13.63	37060			33.91	92201
2 Aux Shaft (ALIMAC)	690		189.27	130596	22.67	15642					115.30	79587			327.29	225795
3 Dome Slash	4671		10.81	50494	6.01	28073					12.47	58247			29.29	136814
4 Benching	42250		11.78	497705	4.45	189702					10.32	436020			26.59	1123427
	50330	CY		716,426		250927						619,804				1578,237
			14.23		4.99						12.14				31.36	
AVG PRODUCTION = 590 #/DAY																

FOLD LENGTH
12
11
8.5
8
AUTO
MANUAL
FEED

5702.02 Form 131A

(C) Production Rates - Watana

Penstocks

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

JOB No.

DESCRIPTION Penstock Lower Tunnel Access

SHEET OF

PROJECT

OPERATION No. REF.

BY [illegible] 22 Jan 82

CONTRACT

DESCRIPTION

✓ CKD DATE

182.4 ¢/Rd.

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
Penstock Lower Access Tunnels 22x22 w/crown																
5 Hrs Drill		CY	8.60		6.73						8.09					
3 Blast			2.29								1.50					
2 Muck-Haul			2.85								6.77					
3 Bull Gang & Service Crew			9.27		0.81						3.62					
			23.01		7.54						19.98				50.53	

Production = 182.4 ¢/Rd. / 10 Hrs = 18.24 ¢/Hr × 18 Hrs = 328 ¢/Day

12

11

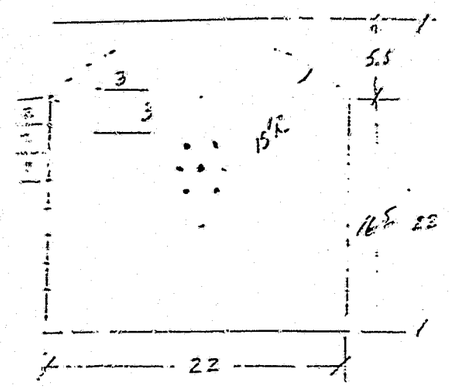
7

Calculations

ACRES

SUBJECT: PENSTOCK LOWER TUNNELS

JOB NUMBER
FILE NUMBER
SHEET OF
BY K. Lang DATE 21 Jan 82
APP E. Ben DATE 22 JAN 82



Arc Length = 1.855(R) = 37.8 ft.

Crown Area = .1748(22)² = 84.60 sf
Lower Area = 16.5 x 22 = 363.00
447.60 sf

Assume Full Face Method
Pull 50% Width = 11 ft. x 447.6/27 = 182.4 ¢B x 1.25 = 228 ¢/loose
Drill = 12 ft.

perimeter holes 28 + 33 + 22 ÷ 2 = 41
pattern holes 447.60 − (41 x 2) ÷ 9 = 40
burn holes 7
85 holes

88 holes x 12 ft = 1056 Lf. drilling
Using 1-4 Boom Jumbo @ 1 ft/min/drill
x 4 drills x 50 min/hr = 220 ft/hr

∴ 1056 ft ÷ 220 ft/hr. = 4.80 hrs. ≈ 5.0 Hrs.

Blast Cycle
88 holes @ 3 min/hole = 264 min.
264 ÷ 50 min/hr. = 5.28 hrs.
Say 2 men loading = 2.6 ≈ 3 hrs.

Muck Cycle - 2 mile Haul
Load * 3.5 min
Travel loaded 6.0' (20 MPH)
Dump 3.0'
Travel Empty 4.8' (25 MPH)
Spot * 3.0'
20.3 min trk cycle
20.3 min ÷ 6.5* = 3.12 Trks = Say 3 Trks Reqd.

225 ¢ Loose / 20 ¢/Trk = 12 Loads x 6.5 min/Load = 78 min.
78 min ÷ 50 min/hr. = 1.56 Hrs ≈ 2 hours.

Labor Drilling

1 foreman		33.15
1 Jumbo oper		32.43
2 Drillers	(32.08)	64.16
2 Chuck Tenders	(31.43)	62.86
1 Drill Doc.		31.43
1 Comp Oper		33.62
1 helper		30.54

Equip

1-4 Boom Jumbo	215
1-1000 cfm compr.	45
1 Bit Grinder	10
1 Pick up.	25
	295 x 3

1475 ÷ 182.4 = 8.60
285.19 x 5 hrs + 10% = 1585.03 ÷ 184.2 ¢ = 8.61 ¢

Blast

Labor. 1 powderman 32.43
2 helpers. (31.75) 63.50
1 laborer 30.54

Equip 1 Exp. loader 41
Panel Trk 25
pick up 25
91 x 3 = 273 ÷ 184.2 = 1.48
126.47 x 3 hrs + 10% = $417.35 ÷ 184.2 ¢ = $2.27 ¢

Muck/Haul

Labor 1 foreman 34.30
3 Trk Dr. (33.09) 99.27
1 FEL oper 56.22
1 Dozer oper. 56.22
1 flagman 30.54

3-R50 Trks (140) 420
1 FEL 87
1 Dozer 85
1 Pickup 25
617 x 2 = 1234 ÷ 184.2 = 6.70 ¢
236.55 x 2 + 10% = $520.41 ÷ 182.4 = $2.85

Materials
Explos. 182.4 x 1.7 x 1.75 = 542.64
Fuse & Cord = 88 holes x 3 = 264.00
Bits, Rod, etc. 1056 ft x .25 = 264.00
Access. 20% Expl. = 108.53
Delays 41 x 1.20 = 49.20
$1,228.37 ÷ 182.4 ¢ = $6.73/¢

Bull Gang & Ser. Crew (Reference Access Tunnel) = 220 x 3 hrs = $660 ÷ 182.4 = $3.58/¢ .3

" " " : 512.36 x 3 hrs + 10% = $1690.79 ÷ 182.4 = $9.18/cy 9.

Services Mat'l 13.50/LF x 11 ft. = $148.50 ÷ 182.4 ¢ = $0.81/cy

60.04.01 Form 148A

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION Inclined Penstock

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY R Lang 16 Feb 82

CKD DATE

PROJECT

CONTRACT

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
Incline Penstock																
8'ϕ Alimac Raise	15	cy/Rd.	165.59	2484	22.67	340	—		—		46.20	693	56.48	847	290.94	4364
16'ϕ Slashing	61.4	cy/Rd.	20.42	1254	8.18	502			—		11.08	680	13.54	831	53.21	3267
	76.4	cy		3738		842						1373		1678		7631
Unit Cost			48.93		11.02						17.97		21.96		99.88	

C-42

Calculations

ACRES

SUBJECT: PENSTOCK EXCAVATION (INCLINE)

Revised per L. Cousineau Feb. 15-82

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lang DATE 16 Feb 82
APP R. Beal DATE 24 FEB 82

1. 8' ϕ Inclined Alimac Raise Volume = 15¢/Round

Labor

Drill & Blast	1 foreman	$33.15	
	2 Drillers (32.08)	64.16	
	1 Comp. Oper.	33.62	
	1 Labor	30.54	
		$161.47 × 8 hrs + 10%	$1420.94
Muck	1/2 FEL Oper (36.22)	$18.11	
	1/2 Trk Dr. (33.09)	16.54	
		$34.65 + 10%	38.11
Service & Bull Gang (Reference Access Tunnel)			
	$512.36/hr. Say 2 hrs =		1024.72
Total			$2,483.77
Unit Cost @ 15¢/Round			165.59

Equipment

1 Alimac	60.00	
2 Stoper drills (20)	40.00	
1-600 cfm compr.	38.50	
1 Bit Grinder	10.00	
	$148.50 × 4½ hrs. =	$668.25
Panel Trk	25.-	
Exp. Loader	41.-	
Pick up	25.-	
	91.- × 3½ hrs.	318.50
FEL	87.-	
R50 Trk	140	
	227 × ½ hrs.	113.50
Bull Gang & Sen Crew	220 × 2 hrs =	440.00
		$1,540.25
		102.68

46.20
56.48

Materials

Drill Bits, Rod etc. 270 ft. × .25 =	67.50
Expl. 1.5 × 15¢ × 2.0	45.00
Fuse & Cord 30 holes × 3	90.00
Delay 17 × 1.20	20.50
Wire & Access. 20% powder	9.00
	232.00 ÷ 15¢ = $15.47/¢

Material-Service $13.50/LF × 8 = 108.00 ÷ 15¢ = 7.20

$22.67/¢

60.04.01 Form 148A

55

CA3

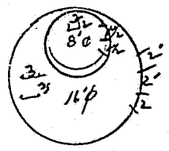
ACRES **Calculations**

SUBJECT: PENSTOCK EXCAVATION (INCLINE)

Revised to 30 ft/hour drill production.
Changed drill pattern from 2x2 to 3x3

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lang DATE 16 Feb 82
APP R. Bear DATE 14 Feb 82

16 ft. ϕ Penstock



1. Drive incline shaft with Alimac Raise Climber 8' ϕ
2. Excavate to full 16 ft. ϕ Slashing Method Using a 4-Boom Jumbo. Rock will be pushed to 8' ϕ incline & excavated material hauled thru the Access Tunnel. Hoist & Head frame will be required to raise & lower Equipment for Slashing Operations

Area 8' ϕ = 50.3 sf × 8' pull = 15 ¢/Round.
Area 16' ϕ = 201.1 − 50.3 = 150.8 sf × 11' pull = 61.4 ¢/Round

1 - 8' ϕ perimeter holes. $\pi d \div 1\frac{1}{2}'$ = 17 holes
Burn & Pattern holes 50 sf ÷ 4 = 13
30 holes

Drill 30 holes × 9 ft = 270 ft.
Drill Production = 30 ft/hr/drill includes setup. (Rate seems high)
270 ft. ÷ 30 = 9 hours w/2 drills = 4½ hours.

2 - 16' ϕ perimeter holes = $\pi d \div 2'$ = 25 holes
pattern holes = 150.4 ÷ 9 sf = 17 holes
42 holes

Drill 42 holes × 12' = 504 ft.
Drill Production = 1.0 ft/min/drill × 4 drills = 4 ft/min
504 ft. ÷ 4 ft/min = 126 min ÷ 50 min/hr. = 2.5 Hours.
Move Drill in & out of shaft 1 Hr.

Explosive Loading

1. − 8' ϕ ≈ 5 min/hole × 30 holes ÷ 50 min/hr. = 3 hrs.
Ventilate ≈ ½ hr.
3½ hours.

2. − 16' ϕ ≈ ~~5~~ 4 min/hole × 42 holes ÷ 50 min/hr. = ~~4.2~~ 3.4 hrs.
Say 2 men loading = ~~3.1~~ 1.7 hrs.
Ventilate = .5 hrs.
~~2.6~~ 2.2 hrs.
Say ~~3.0~~ 2.5 hrs.

1. Drill & Blast Cycle (Alimac) 4½ hrs.
3½
8 hours. = 15.0 ¢

2. Drill 16' ϕ Area = 2.5 ~~3 hrs.~~
2.5 ~~3 hrs.~~
5.0 ~~6 hours~~ = 61.4 ¢

Haul Time: 8' ϕ = 15.0 ¢ × 1.25 = 18.8 ¢ loose = Say ½ hrs. FEL oper Trk. Dr.

16' ϕ = 61.4 ¢ × 1.25 = 76.7 ¢ loose = Say 1 hr. FEL oper Trk Dr. Hoe Ram

@ Face

60.04.01 Form 148A

12

11

Calculations

ACRES

SUBJECT: PENSTOCK EXCAVATION (INCLINE)

JOB NUMBER
FILE NUMBER
SHEET OF
BY [illegible] DATE 2-16-82
APP R BEAL DATE 24 FEB 82

SLASHING w/ 4 BOOM JUMBO = 61.4 ¢/ROUND

LABOR

DRILLING · 1 foreman 33.15
Jumbo oper. 32.43
2 Drillers (32.08) 64.16
2 Chk Tend. (31.43) 62.86
1 ~~Oper.~~ Oper. 33.62 — ?
1 Helper 30.54
256.76 x 2.5 Hrs + 10% = $564.87
HOIST DRILL IN & OUT x 1 = 282.44

BLAST 1 powderman 32.43
2 helpers (31.25) 63.50
1 Labi 30.54
126.47 (2.5 hrs + 10%) = $347.79

PUSH & MUCK oper FEL 36.22
oper ~~Dozer~~ HOE RAM 34.41
Trk Dn 33.09
103.72 x 1 hr + 10% = $114.09
MOVE HOE RAM IN & OUT 1 HR = 37.85

SERVICE CREW w/ ALIMAC RAISE

Hoist Oper 34.41 x ~~6~~ 8 Hrs. + 10% $~~227.71~~ 302.81

TOTAL/ROUND $1,253.86 1649.85

UNIT COST @ 61.4 ¢/ROUND 20.42/¢ 26.87

Equip. 1-4 Boom ~~Jumbo~~ HYDRA DRILL $215.00
Bit Grinder 10
Pick up 4x4 25
250 x 2.5 = $625.00

Expl. Loader 41
Panel Trk 25
Pick up 25
91 x 2.5 227.50

~~Dozer~~ HOE RAM 45
FEL 87
Dump Trk (R50) 140
272 x 1 272.00

Hoist & FRAME w/ RAILS 64.50 x ~~6~~ 8 = 387.00 516.00

$1,511.50 1640.50

$24.62/¢ 26.71 — 11.08 own, 13.54 open

MATERIALS

Expl. 61.4 ¢ x 1.7 x 1.75 = $183
Fuse & Cord. 42 x 3 126
Bits, Rod, etc 504 ft x .25 = 126
Delays 25 x 1.20 = 30
Wire & Acc = 20% powder = 37
$502

$502.00

$8.18

60.04.01 Form 148A

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION PENSTOCK 17'ϕ

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY L. Cang 21 Jan 82

CKD DATE

PROJECT

CONTRACT

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
Devil Canyon = 16 ft ϕ																
Say Watana = Same Unit Cost.																
Alimac Raise Climb	15¢/Rd.	CY	189.9	2839	22.67	340					115.30	1729			327.24	4908
Slash to 17 ft. ϕ	61.4	CY	57.42	3525	12.49	767					63.54	3901			133.45	8193
	76.4	CY		6364		1107						5630				13101
Unit Cost			83.31		14.49						73.70				171.50	
Production = 64¢/Day																

Void

57.02.02 Form 131 A

(C) Production Rates - Watana

Tailrace Tunnel

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION TAILRACE TUNNELS

OPERATION No. REF.

DESCRIPTION

JOB No. P5700.09

SHEET OF

BY R Beal 25 JAN '82

CKD R Lang DATE 25 Jan 82

PROJECT

CONTRACT WATANA

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM.MATERIALS UNIT COST	PERM.MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT.OWNERSHIP UNIT COST	EQPT.OWNERSHIP AMOUNT	EQPT.OPERATION UNIT COST	EQPT.OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
2 TUNNELS @35'Ø																
FULL FACE EXCAVATION		—														
DRILL			6.52 ✓								6.17 ✓				12.69	
BLAST			0.87 ✓		5.91 ✓						0.57 ✓				7.35	
MUCK & HAUL			2.43 ✓								5.77 ✓				8.20	
BULL GANG & SERVICE CREW			5.27 ✓		0.38 ✓						2.06 ✓				7.71	
TOTAL			15.09 ✓		6.29 ✓						14.57 ✓				35.95 ✓	

641 ¢ Round / 18 Hours = 35.6 ¢/Hr
X 18 Hrs/Day
641 ¢/Day

FOLD LENGT
12
11
8.5
8
AUTO
MANUA
FEED

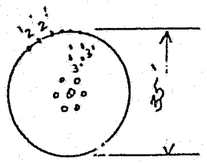
57.02.02 Form 131 A

Calculations

SUBJECT: WATANA

TAILRACE TUNNELS

JOB NUMBER P5700.09
FILE NUMBER
SHEET ____ OF ____
BY R.BEAL DATE 23 Jan 82
APP R.Long DATE 25 Jan 82



EXCAVATION
FULL FACE METHOD
AREA = $\frac{\pi}{4}(35^2)$ = 962 #
VOLUME = 18 x 962/27 = 641.4 BANK CY
641.4 x 1.25 = 801.8 LOOSE ✓
35/2 = 17.5 Say pull 18', Drill 19'

PERIMETER HOLES = 35π ÷ 2' = 55 HOLES ✓
PATTERN HOLES 962 - (25 x 35π) = 742 ÷ (8x3) = 82 HOLES
BURN HOLES = 7
TOTAL 144 HOLES x 19' = 2736 L.F. ÷ 440 FT/HR. = 6.2 HRS. Say 7 HRS. ✓

USE 2-4 Boom JumBo DRILLS
PRODUCTION 2(4)(6.1 FT/MIN) x 50 MIN/HR = 440 FT/HR.

BLAST CREW TIME 144 HOLES x 3 MIN/HOLE = 432 ÷ 50 MIN/HR = 8.64 ✓
8.64 HR ÷ 3 MEN = 2.88 HR Say 3 HRS.
VENTILATE 1 HR
4 HRS ✓

MUCK CREW CYCLE = SAME AS DEVIL CANYON DIVERSION TUNNEL = 14.9 MIN
801.8 c.y. LOOSE / 20 CY/TR. = 40.1 loads x 6.5 MIN/LOAD = 260.6 ÷ 50 MIN/HR = 5.2 HRS ✓
Say 6 HRS. ✓
14.9 ÷ 6.5 MIN = 3 TRUCKS REQ'D

LABOR - 17 MEN. (SAME AS DIVERSION TUNNEL @ DEVIL CANYON)
DRILL $543.23 x 7 HR +10% = $4182.87 ÷ 641.4 CY = $6.52/cy. ✓

BLAST - 4 MEN (SAME AS DEVIL CANYON DIVERSION TUNNEL)
$126.47 x 4 HR +10% = $556.47 ÷ 641 = $0.87 ✓

MUCK
1 - FOREMAN 34.36
3 - TRK DRIVER (33.09) = 99.27
2 OPER. (36.22) = 72.44
1 FLAGMAN 30.54
$236.55 x 6 HRS +10% = $1561.23 ÷ 641 = $2.43/cy ✓

BULL GANG & SERVICE CREW (SAME AS DEVIL CANYON ACCESS TUNNEL)
$225.81 + 286.55 = $512.36 x 6 HRS. +10% = $3381.58 ÷ 641.4 $5.27/cy ✓

MATERIAL
POWD. 641 x 2.7 x 1.75 = 2244
FUSE & CORD 143 x 3 = 429
BITS, DRILL RD 2736 x .25 = 684
ACCESS. 15% OF POWD. = 337
DETAIL 55 x 1.80 = 99
$3793 ✓

3733 ÷ 641.4 = $5.91/cy. ✓

DUCTS 13.50/LF x 18 = 243.00
243 ÷ 641.4 = 0.38/LF ✓

EQUIPMENT (SAME COST/HR AS DEVIL CANYON DIVERSION TUNNEL)
DRILL $565. x 7 = 3955 ÷ 641.4 = $6.17/cy. ✓

BLAST $91. x 4 = 364 ÷ 641.4 = $0.57/cy ✓

MUCK $617 x 6 = 3702 ÷ 641.4 = $5.77/cy ✓

BULL GANG & SERVICE CREW $220 x 6 = 1320 ÷ 641.4 = $2.06/cy ✓

TOTAL LABOR = $15.09/LF ✓

TOTAL MATERIAL = 6.29/LF ✓

TOTAL EQUIPMENT = $14.57/LF ✓

60.04.01 Fo... 8A

C-1-1

Estimate Work Sheet

ACRES

PROJECT

CONTRACT

ITEM REFERENCE No.

DESCRIPTION 33φ OUTLET TUNNEL (INCLINED)

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY R. Ilsley 26 Jan 82

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
8'φ Inclined Alimac Raise	15	cy/Rd	233.67	3505	22.67	340					139.07	2086			395.41	5931
SLASH TO 33'φ	298	cy/Rd	18.48	5507	6.90	2056					22.00	6556			47.38	14,119
	313	cy	28.79	9012	7.65	2396					27.61	8642			64.05	20,050

PRODUCTION = $\frac{313}{2/10}$ = 268 cy/day.

FOLD LENGTH
12
11
8.5
8

AUTO

MANUAL

FEED

57.02.02 Form 131A

C50

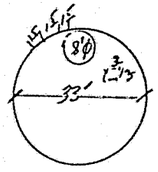
ACRES **Calculations**

SUBJECT: 33' ϕ OUTLET TUNNEL (INCLINED)

JOB NUMBER P5700.09
FILE NUMBER
SHEET ___ OF ___
BY R. Lang DATE 26 Jan 82
APP RBB DATE 27 Jan 82

1- Drive 8'ϕ inclined shaft in the middle of Tunnel with ALIMAC RAISE CLIMBER

2- Excavate with slash method to 33'ϕ using 4-Boom Jumbo. Rock will be pushed to the inclined shaft and removed through the outlet tunnel.
Hoist & Headframe will be required to raise & lower equipment for slashing operations



AREA 8'ϕ = .7854 x 8² = 50.27 x 8 ft/27 = 15 ¢/Round = 18.75 ¢ Loose
AREA 33'ϕ = (.7854 x 33²) − (50.27) x 18 ft/27 = 298 ¢/Round. = 372 ¢ Loose
IF 805 PULL = 20' = 596 cy = 745

1. 8'ϕ = perimeter holes @ 1½' cc. πd ÷ 1½ = 17 holes
burn & pattern holes = 50 ¢ ÷ 4 = 13
30 holes

DRILL HOLES = 30 x 9 ft = 270 ft. drilling
DRILL Production = 20 ft/hr/drill includes setup
270 ft ÷ 20 = 13.5 hours w/2 drills = 6.75 hours ≈ 7.0 Hrs

2. 33 ft ϕ = perimeter holes @ 1½ ft c.c. πd ÷ 1.5 = 69 holes
pattern holes 805 sf ÷ 9 = 89
158 holes

Drill production = .75 ft/min/drill x 4 drills = 3 ft./min.
158 holes x 11 = 1738 lf. ÷ 3 ft/min = 579 ÷ 50 = 11.6 hrs. ≈ 12 hrs.

EXPLOSIVE LOADING 1.) 8'ϕ = 5 min/hole x 30 holes = 150 min ÷ 50 min/hr = 3 hrs. (overhead)

2.) 33 ft. ϕ = 5 min/hole x 158 holes = 790 min ÷ 50 min/hr = 15.8 hrs.
w/3 man loading = 5.27 + blowout = 6.00 hours

1.) 8'ϕ: DRILL & BLAST CYCLE = 7 hrs + 3 = 10 hrs = 15 cy.

2.) 33'ϕ DRILL & BLAST CYCLE = 12 hrs + 6 hrs = 18 hrs = 372 cy.

HAUL TIME
1.) 8'ϕ = 18.75 cy = 1 load = Say ½ hr. FEL & Truck

2.) 33'ϕ = 372 ¢ / 20 ¢ = 19 loads @ 6.5 min/loader cycle ÷ 50 min/hr = 2.47 Hrs ≈
Say 3 Hours w/3 Trucks.

60.04.01 Form 148A

C51

Calculations

SUBJECT: 33'ϕ OUTLET TUNNEL

JOB NUMBER P5700.09
FILE NUMBER
SHEET OF
BY R. Lang DATE 26 Jan 82
CHKD RAS DATE 27 JAN 82

8'ϕ Inclined Alimak Raise

LABOR-Drill/Blast

1 foreman	33.15
2 Drillers (32.08)	64.16
1 Compr. Oper	33.62
1 Laborer	30.54
	161.47 x 10 hrs +10% = 1776.17 ✓

Equip.

1 ALIMAK	60.00
2 St. Drills (20)	40.00
1600 cfm compr.	38.50
1 Bit Grind.	10.00
	148.50 x 7 = 1039.50 ✓

Equip. Exp.

1 Panel Trk =	25.-
Exp. Loaders	41
1 pickup	25
	91.- x 3 = 273 ✓

Muck 1½ FEL (32.22) 18.11
½ Oper (33.08) 16.54
34.65 +10% = 38.12 ✓

FEL 87
RS0 Trk 140
227 x .5 hrs. = 113.50 ✓

Service & Bull Gangs (Ref: Access Tunnel)
512.36 x 3 hrs +10% = 1690.79 ✓

220 x 3 hrs = 660.00 ✓

MATL Drill Bits, Rod, etc. = 270 x .25 = $67.50
Explos. 1.5 x 15 x 2.00 = 45.00
Fuse & Cord 30 holes x 3 90.00
Delay 17 x 1.20 20.50
Wire & access. 20% of powder 9.00
$232.00 ✓

Ser MATL's
13.50/LF x 8 ft = $108.00 ✓

LABOR	$3505.08 ÷ 15 =	233.67
MATL	340.00	22.67
Equip	2086.00	139.07
	$5931.08 ÷ 15 =	$395.41

Slashing w/ 4 Boom Jumbo lowered on bench

Drilling

LABOR

1 foreman	33.15
1 Jumbo op.	32.43
2 Drillers (32.08)	64.16
2 Clk Tend. (31.43)	62.86
1 Compr. Oper	33.62
1 Helper	30.54
	256.76 x 12 +10% = $3389.23 ✓

Equip. 1-4 Boom Jumbo 215
Bit Grind 16
Pick up 25
250 x 12 = 3000

Blast

1 powderman	32.43
2 helpers (31.75)	63.50
1 Laborer	30.54
	126.47 x 6 +10% = $834.70 ✓

Expl. Loader	41
Panel Trk	25
Pick up	25
	91.- x 6 = $546

Muck

1 dozer op.	34.41	1 Dozer	45
1 FEL op.	36.22	1 FEL	87
3 Trk Dr. (33.09)	99.27	3 RS0 TRKS (40)	120
	$169.90 x 3 +10% = $560.67 ✓		$552 x 3 = $1656

Hoist & Head Frame

Open 34.41 x 21 +10% $722.61 / Hoist & H.Frame 64.50 x 21 = $1354.50

MATL's Ex 298# x 1.7 x 1.75 = 886.55
Fuse Cord 158 x 3 = 474.00
Bits, Rod, etc = 1738(.25) 434.50
Delay 69 x 1.20 82.80
Misc. Wire & Acc. 20% Ex. 177.31
$2055.16

LABOR	5,507.21	= 18.48
MATL	2055.16	= 6.90
Equip.	6556.50	= 22.00
	14,118.87 ÷ 298 =	47.38

60.04.01 Form 148A

FOLD
LENGTH
12
11
8.5
8
AUTO
MANUA
FEED

(C) Production Rates - Watana

Surface Preparation

Estimate Work Sheet

ACRES

ITEM REFERENCE No. | JOB No.

DESCRIPTION Surface Prep. | SHEET OF

PROJECT | OPERATION No. | REF. | BY R. Jang 12 Feb 82

CONTRACT WATANA & DEVIL CANYON | DESCRIPTION | CKD | DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Surface Preparation																
1. Dam - Rough Grade By Machine and Load Out Loose Rock 2000 sf/hour Outside Core Area		sf.	0.16		—						0.10		0.12		0.38	
2. Dam / Tunnels Core Area - Bare Rock Clean 1500 sf/hour Horizontal		sf	0.37		0.04						0.13		0.16		0.70	
3. Dam / Tunnels Bare Rock Clean 1000 sf/hour Incline		sf.	0.57		0.04						0.18		0.21		1.02	

FOLD LENGTH
12
11
8.5
8

AUTO
MANUAL
FEED

57.02.02 Form 131A

ACRES

Calculations

SUBJECT: SUSITNA
WATANA & DEVIL CANYON
SURFACE PREPARATION

JOB NUMBER P 5700.09
FILE NUMBER
SHEET OF
BY R. Beal DATE 5 FEB 82
APP R. Lang DATE 8 FEB 82

2. UNDER EARTH FILL DAM OUTSIDE OF CORE AREA
ROUGH GRADE BY MACHINE & LOAD OUT LOOSE ROCKS & MUCK

PRODUCTION: 150 CY/HR. LOADED OUT @ 2' DEPTH.
2000 S.F./HR. GRADED

LABOR

1- FOREMAN	38.31
1- OPERATOR, B.H.	35.10
1- OPER. F.E.L.	35.10
3- TR. DRIVER. 35.58 =	106.74
1- OPER DOZER	35.10
1- LABOR-FLAG.	30.54
1- OILER	33.53

$314.42/HR. ÷ 2000 = $0.16/SF

EQUIPMENT

1- 1 CY BACK HOE	57.00
1- 3 CY LOADER, TRACK	36.50
1- D-8 DOZER W/ RIPPER	155.00
3- 25T. TRUCKS. @ 55 =	165.00
1- PICKUP TR.	20.

$433.50/HR ÷ 2000 = $0.22/SF.

3. FOR BARE ROCK SURFACE AT TUNNEL CONCRETE (HYDRAULIC STRUCTURES)
WATER JET CLEAN DUST & ROCK CHIPS FROM SURFACE, COMPRESSED AIR DRY, & LOAD OUT DEBRIS
ASSUME COMPRESSED AIR & WATER LINES EXISTING IN TUNNEL

PRODUCTION: 300 L.F. OF 40'Ø TUNNEL/DAY
SIDES & CROWN = 0.75 x 40π x 300 = 28,260 SF.
BOTTOM = 0.25 x 40π x 300 = 9420 SF x 0.25/27 = 87 CY
TOTAL 37,680 SF/DAY
OR.

LABOR

1- FOREMAN	33.23
1- OPER - B.H	35.10
1- OPER - F.E.L	35.10
2- OILER & PUMP (33.53)	67.06
1- OPER - CRANE	35.10
1- OPER - BROOM	34.29
6 LABOR (30.54) =	389.59
1/2 TR. DRIVER (33.47) =	16.74

$646.21/HR + 10% = $710.83 x 9 HRS = $6397.47

JOB MATERIAL

SMALL TOOLS 2% x 612 =	12.25
RAIN GEAR 2 x 10 =	.20
WATER 5000 GAL x 0.50/1000 =	2.50
	$34.75

$34.75 / 28260 = .0012 Say .01

EQUIPMENT

1- CHERRY PICKER.	60.
1- BACK HOE 1 CY	57
1- LOADER 3 CY WH.	62.
1- MECH. BROOM	25.
1- LOT HOSES	4.50
1- 20T TRUCK	28.00
1- PICKUP TR.	25.00
1- PUMP.	12.00

273.50 x 9 HRS = $2461.50

WALLS = $6397.47 / 4 ÷ 28260 SF = $0.06/SF.
INVERT = 3/4 (6397.47) ÷ 9420 SF = $0.51/SF.

WALLS = 1/4 (2461.50) ÷ 28,260 SF = $0.02/SF.
INVERT = 3/4 (2461.50) ÷ 9420 SF = $0.20/SF.

60.04.01 Form 148A

LA

C55

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Calculations

ACRES

SUBJECT: SUSITNA HYDRO

JOB NUMBER PS70000
FILE NUMBER
SHEET 1 OF
BY DATE
APP RBG DATE 5 FEB 81

— SURFACE PREP. — SITE WORK

UNDER DAM CORE, SPILLWAYS, INTAKES, BARE ROCK CLEAN

✓ RGA 1/28/81

HORIZONTAL

— EQUIPMENT —

1 — ~~D-8 w/ Ripper~~ D-7	~~165.00~~ 85	~~165.00~~ 85	
2 — ~~600~~ 1000 CFM COMPR.	~~27.00~~ 45	~~54.00~~ 90	
2 — 6" PUMP HI. PR.	12.00	24.00	
2 — 2" MONITOR	16.50	33.00	MOBILE
1 — ~~TRACTOR BROOM~~ BACKHOE	~~13.50~~ 57	~~13.50~~ 57	
2 — 25 TRUCK	55	~~52.00~~ 110	
1 — 3CY LOADER	36.50	~~34.00~~ 36.50	

~~375.50~~ 435.50 × 10 = $3755.—

PRODUCTION:

10 HR PRODUCTION = 15,000 □' SF

0.29
U/C = 0.25 ✓

— LABOUR —

1 ~~2~~ — FOREMAN	38.31	~~76.62~~ 38.31
1 ~~2~~ — COMPR. OP.	~~35.40~~ 34.29	~~70.80~~ 34.29
2 ~~1~~ — PUMP OP	31.85	~~31.85~~ 63.70
1 — MECH		30.24
1 — ~~TRACTOR~~ BACKHOE OP.	35.10	~~21.85~~ 35.10
1 — LOAD OP.		~~36.21~~ 35.70
2 1 — TRUCK DRN.	~~34.94~~ 35.55	~~34.94~~ 71.16
6 — LABOUR	30.54	183.24
2 — MONITOR OP.	35.40	70.80

575.65 × 10 = $5757.—
561.44

.37
U/C = 0.38 ✓

MAT'L

SMALL TOOLS RAINGEAR

2s 1½" HI PR. HOSE @ 6.50 = 162.50
FITTINGS LS = 120.00
MONITOR NOZZLES LS = 300.00
$582.50

U/C = 0.04 ✓

✓ U/C = 0.67 ≈
.70

70

FORM NO. 152 REV 1

(C) Production Rates - Watana

Rock Slope Mesh

C56

Calculations

ACRES

SUBJECT: SUSITNA HYDRO

ROCK - SURFACE PREPARATION -

JOB NUMBER P570009
FILE NUMBER
SHEET (2) OF
BY DATE
APP RMB DATE 5 FEB 81

SITEWORK UNDER DAM CORE, SPILLWAYS, PORTALS ✓ RGA 1/28/81

INCLINE BARE ROCK CLEAN

PRODUCTION

10 HR PRODUCTION = 10,000 -

1 - 35T 200' BOOM CRANE		93 ~~72.00~~	
2 - MONITOR	16.50	33.00	
2 - PUMP	12.00	24.00	
4 - TAGGER HOIST	5.60	22.40	
4 - PLATFORM	3.00	12.00	
2 ~~4~~ 600 CFM COMPR.	45 ~~27.00~~	90 ~~108.00~~	
1 ~~2~~ - 4x4 PICKUP	20.00	20 ~~40.00~~	
1 - 3CY LOADER		~~34.00~~	36.50
1 - 2ST TRUCK		~~52.00~~	55.00

397.00 x10 = $ 3970.-
385.90

.39 U/C ~~0.40~~ / SF

(~0.397) SF RGA

- LABOUR -

1 ~~2~~ - FOREMAN	38.31	38.31 ~~76.62~~
1 2 - COMPR. OP	34.29 ~~35.40~~	34.29 ~~70.80~~
2 - PUMP. OP	31.85 -	63.70
1 - MECH		39.34
1 - CRANE OP		35.10 ~~36.21~~
1 - OILER	33.53	33.53 ~~34.63~~
2 - MONITOR OP	35.40	70.80
1 - TRUCK DRV.		34.94
6 8 - LABOUR	30.54	33.24 ~~244.32~~
1 - LOADER OP		36.21

707.57 x10 = $ 7078.7
568.86

RGA 0.708/SF

U/C 0.57 ~~0.71~~ / SF

5 MILL TOOLS, 1 RAINGEAR MAT'L (SAME AS "CORRONTAL") $ 582.5

U/C 0.06

$0.058/SF RGA

✓ $1.17/SF

1.02

CK

FORM NO. 152 REV. 1

ACRES

Calculations

SUBJECT: SUSITNA
WATANA & DEVIL CANYON
SAFETY MESH ON CANYON WALLS ON DAM SITE

JOB NUMBER P5700.09
FILE NUMBER
SHEET OF
BY R.B. Beal DATE 6 FEB 82
APP R. Lang DATE 8 FEB 82

ASSUME 10' WIDE STRIPS OF FABRIC PLACED PARALLEL TO CONTOURS (ROLLS UNROLLED ON SURFACE) 50'/ROLL × 4 ROLLS/HR = 2000 SF/HR. (-) 10% LAP = 1800 SF/HR.
MESH ANCHORS PLACED 10' O.C. ALONG 12" LAP OF STRIPS
DRILL 1"Ø HOLES @ 1/2 FT/MIN W/ 4 HAND HELD AIR DRILLS. = 2 LF/MIN/CREW
1.5 LF/BOLT / 2 FPM/CREW = 0.75 MIN/HOLE + 0.75 MIN TO SPOT + 1 MIN TO BOLT = 2.5 MIN/BOLT OR 50 MIN HR / 2.50 = 20 BOLTS/HR/CREW

LABOR:

1- FOREMAN	33.23
4- DRILLERS (32.08) =	128.32
1- TR DRIVER	33.47
1- OPER- CRANE	36.96
1- OILER	33.53
1 OPER COMP	34.29
1- OPER DOZER	35.10
4 LABOR (30.54)	122.16

$457.06/HR ÷ 1800 = 0.253/SF

Say 0.25/SF

MATERIAL

JOB. DRILLS, BIT 1.5' × 0.25 = 0.375/BOLT × 20 = 7.50
Rolls Say 8 × 1.25 = = 10.00
$17.50 ÷ 1800 = $0.01/SF

PERMANENT No 6 GALV CHAIN LINK $1.00/SF × 2000 SF = 2000
1/2"Ø × 18 MESH ANCHORS $3.56 × 1.12 = 4.00/BOLT × 20 = 80
2080

$2080 ÷ 1800 = $1.16/SF

EQUIPMENT

4- JAIL HAMMER DRILLS (10)	40.
1- 600 COMP.	38.50
1- LONG BOOM CRANE	93.
1- FLAT BED TR.	25.
1- PICK UP	25.00
1- HOSES ETC.	4.50
1- D-6 DOZER.	45.

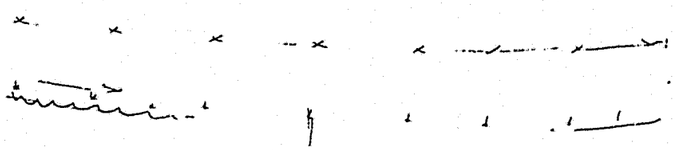
271.00/HR. ÷ 1800 = 0.151
Say 0.15/SF

TOTAL MATERIAL $1.17/SF

200'

20 holes

1 hr/Strip



Drill – 4 Drillers – 5 holes/driller	– 3.75 × 5 =	18.75	30.00
Spread Mesh 2 1/2 roll	–	10.00	20.00
Bolt	–		10.00
			50.00

60.04.01 Form 148A

(C) Production Rates - Watana

Instruments

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

JOB No.

DESCRIPTION INSTRUMENTATION

SHEET OF

PROJECT

OPERATION No. REF.

BY R. BEAL 24 FEB 1982

CONTRACT WATANA

DESCRIPTION

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
MAIN DAM & RELICT CHANNEL																
PIEZOMETERS		LS						1,742,500								1,742,500
INCLINOMETERS		LS						165,000								165,000
VERTICAL SETTLEMENT		LS						417,000								417,000
HORIZONTAL STRAIN		LS						100,000								100,000
HORIZONTAL SETTLEMENT		LS						760,000								760,000
SURFACE SETTLEMENT		LS						100,000								100,000
SEEPAGE MONITORING WEIR		LS						26,000								26,000
THERMISTERS		LS						47,000								47,000
DRILLING ROCK FOR INSTALLATION		LS		1,326,000		42000		-		-		336,500		400,000		2,104,500
LABOR FOR INSTALLATION		LS		4,300,000												4,300,000
MAIN DAM TOTAL																9,762,000
PENSTOCKS, POWERHOUSE, TAILRACE																
ROCK DEFORMATION MEASUREMENTS		LS						239,000								239,000
ROCK BOLT LOAD CELLS		LS						22,000								22,000
STEEL & STRESS MEASUREMENT		LS						12,000								12,000
DRILLING ROCK FOR INSTALLATION		LS		105 000		3000						27000		32,000		167,000
LABOR FOR INSTALLATION		LS		333,000												333 000
PENSTOCK, P.H, TR TOTAL																1773,000

57.02.02 Form 131 A

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Estimate Work Sheet

ACRES

PROJECT

CONTRACT WATANA

ITEM REFERENCE No.

JOB No.

DESCRIPTION ELECTRICAL EQUIP. INSTALLATION SHEET OF

OPERATION No. REF. BY RBB 24 FEB 1982

DESCRIPTION CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
TOTAL COSTS BY L. PEREIRA																
BREAKDOWN BY FITCH																
333.21 GENERATORS & EXCITERS.	6	EA		8,200,000		—		25,670,000		—		203000		247 000		34320 000
334.11 STRUCTURES —																
.121 GENERATOR ISOLATED PHASE BUS	1	LS		650 000				2,500,000				23000		28000		3,200 000
.122 HV POWER CABLES & ACC.	1	LS		455 000				780,000				29 000		36 000		1,300 000
.123 LV. " " "		LS		240 000				335 000				14 000		14 000		600,000
.124 CONTROL CABLES & ACC.		LS		470 000				579 000				27 000		33 000		1,100,000
.125 GRNDING SYSTEM.		LS		62 000				85000				1000		2000		150,000
.13 CONDUITS & FITTINGS		LS		195 000				200 000				2000		3000		400,000
.121 AUXIL. TRANSFORMERS		LS		20 000				126 000				4000		6000		156,000
.22 CIRCUIT BREAKERS-GEN.	6	EA		1,000,000				3,100 000				45000		55000		4,200,000
.123 SURGE PROTECT. & GEN. CUBICLE		LS		85,000				370 000				2000		3000		460,000
.24 SWITCH BOARDS		LS		105,000				665000				5000		6000		780,000
.25 AUXIL. POWER EQUIP. & BATTERIES.		LS		45,000				173 000				1000		1000		220 000
.131 CONTROL RELAY, METER BOARD		LS		405,000				470 000				11000		14000		900,000
.32 Computer control system } INCLUDED IN TRANSMISSION		—		—				—				—				—
.33 Supervisory T/M system } ENERGY MANAGE SYSTEM		—		—				—				—				—
.4 POWER TRANSFORMERS	10	EA		720,000				4 000 000				81000		99 000		4,900,000
.151 LIGHTING - P.H. & TRANSF. HALL		LS		220,000				510 000				18000		22000		770,000
.152 ACCESS TUNNELS		LS		70 000				95000				2000		3000		170,000
.6 MISC. ELECTRIC EQUIP.		LS		50 000				240 000				18000		22000		330,000
.711 SWITCH BOARD		LS		16 000				70 000				2000		2000		90 000
.712 CABLES		LS		82 000				100 000				4000		5000		190,000
.713 AUXIL. TRANSFORMERS		LS		16 000				100 000				2000		2000		120,000
.731 DIESEL GENERATORS-STAND BY	2	EA		35 000				250 000				7000		8000		300,000
174 EXTERIOR LIGHTING		LS		65 000				80 000				2000		3000		150,000
.75 MIMIC BOARD - CONTROL BLDG.		LS		180 000				220 000				45000		55000		500,000
335.5 COMMUNICATIONS		LS		25 000				63000				1000		1000		90000

57.02.02 Form 131A

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Estimate Work Sheet

ACRES

EXCAVATION SUMMARY

PROJECT SUSITNA HYDRO

CONTRACT DEVIL CANYON

Without Markups Indirects or Heat/Power.

ITEM REFERENCE No. | DESCRIPTION | OPERATION No. | DESCRIPTION | REF.

JOB No. | SHEET OF | BY R Levy 17 Jan 82 | CKD DATE

Based on 18 hr 1 day

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM.MATERIALS UNIT COST	PERM.MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT.OWNERSHIP UNIT COST	EQPT.OWNERSHIP AMOUNT	EQPT.OPERATION UNIT COST	EQPT.OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
570 CY/Day Power House		cy	~~14.85~~ 14.23		4.99						~~11.46~~ 12.14				~~3.42~~ 31.36	
625 CY/Day Access Tunnels 35x28 high		cy	13.84		6.41						13.63				33.91	
117 CY/Day Main Access Shaft 24'ϕ		cy	37.93		10.42						36.20				84.17	
660/Day Fire Protection Headtank		cy	~~2.42~~ 11.80		4.74						~~10.19~~ 10.70				~~27.34~~ 27.25	
55/Day Bus Tunnels & Shafts 10' w/dome. Horiz		cy	~~6.36~~ 31.43		~~8.60~~ 9.64						~~28.91~~ 28.29				~~43.27~~ 74.36	
30/Day Vert.		cy	116.92		16.26						81.95				209.13	
522/Day Transformer Gallery		cy	12.33		5.16						38.86				38.35	
30 CY/Day Cable Shaft 8'ϕ		cy	110.92		16.26						81.95				209.13	
600 CY/Day Diversion Tunnel 32'ϕ		cy	16.56		5.37						16.21				38.14	
68 CY/Day Grout Galleries 10x10 Horiz.		cy	64.36		21.60						46.01				131.97	
Vertical			96.54		21.60						69.02				187.16	
590/Day Surge Chamber includes 10'ϕ shaft		cy	~~14.85~~ 14.23		4.95						~~12.42~~ 12.14				~~31.46~~ 31.36	
~~240~~ 64 CY/Day Penstock (Inclined) 16'ϕ		cy	83.31		14.99						73.76				171.56	
750 CY/Day Tailrace Tunnels 39'ϕ		cy	12.98		6.43						12.88				32.29	

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Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY R. Beal 19 FEB 1982

CKD DATE /

PROJECT Devil Canyon

CONTRACT

	DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
332.329	ARCHITECTURAL ENCLOSURES HEADSHAFT STRUCTURE ~~FOR ACCESS SHAFT~~ ~~40' x 28' x 40' HIGH x $250 = 280,000~~	1	LS	~~[illegible]~~	85000			~~[illegible]~~	167,000			~~[illegible]~~	12000		16 000		280 000
332.328	STRUCTURAL — MISCELLANEOUS STEEL & GUIDES IN SHAFT Reference Devil Canyon Acct. 331.138 Unit Costs	50	TON	592.00				1660.00				53.00		65.00		2370.00	
332.32C ~~332.32C~~	MECHANICAL EQUIPMENT ELEVATOR	1	LS		185,000				525,000	-	~~750,000~~		17,000		23,000		750,000
	MOBILE CRANE FOR VALVE MAINTENANCE	1	LS	~~[illegible]~~	129,000			~~[illegible]~~	258,000		~~430,000~~		19,000		24,000		430,000
	MISCELLANEOUS P.H. MECHANICAL EQUIP	1	LS		36,000				72,000		~~120,000~~		5,000		7000		120,000
332.328 ~~332.32F~~ Richardson	STEEL STAIRWAY 1 (30') = 11 STORY 3615 x 1.25 = $4520/12' STORY 18 M.H./STORY. EQUIP DAY, 1-WEEK 6 x $750/DAY = 4500				6000				50 000				2.000		2500		

RECOPIED

57.02.02 Form 131 A

Estimate Work Sheet

ACRES

ITEM REFERENCE No. | JOB No.

PROJECT | DESCRIPTION MISCELLANEOUS | SHEET OF

CONTRACT DEVIL CANYON | OPERATION No. REF. | BY R BEAL 19 FEB 1982

DESCRIPTION | CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
ACCOUNT No. STRUCTURAL —																
332.328 STEEL STAIRWAY 130'	1	LS		6000				50,000				2000		3000		61,000
MISCELLANEOUS STEEL IN SHAFT	50	TON	592.00	30 000			1660.00	83,000			53.00	3000	65.00	3 000	2370.00	119, 000
332.329 ARCHITECTURAL ENCLOSURES — HEAD SHAFT STRUCTURE	1	LS		85,000				167000				12000		16 000		280,000
332.32C MECHANICAL EQUIPMENT — ELEVATOR	1	LS		185,000				525,000				17,000		23,000		750,000
MOBILE CRANE (VALVE MAINTENANCE)	1	LS		129,000				258,000				19.000		24,000		430,000
MISC. P.H. MECHANICAL EQUIP.	1	LS		36,000				72,000				5,000		7.000		120, 000

57.02.02 Form 131A

FOLD LENGT
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Calculations

ACRES

SUBJECT: DEVIL CANYON
COST BREAK DOWN

JOB NUMBER P5700.09
FILE NUMBER
SHEET 1 OF 3
BY R BEAL DATE 9 FEB 82
APP DATE

ITEM No.	DESCRIPTION		FIELD LABOR L	PERMANENT & JOB MATERIAL M	CONSTRUCTION EQUIPMENT E	NET UNIT	NET AMOUNT	GROSS UNIT	GROSS AMOUNT
331.118	P.H. STRUCTURAL STEEL PER MEANS 1982	LS	22%	75%	3%				1,500 000
			212,900	725,000	29000		967,700		
	8' ϕ STEEL PIPE		35%	60%	5%				1,976000
		LS	446,000	765,000	64,000		1,275,000		
331.119	ARCHITECTURAL FINISHES		25%	75%					750,000
			121,000	363,000			484,000		
331.129	MAIN PORTAL DOORS HANGER TYPE DOOR 468# @ $30 = $14000		13%	85%	2%			75,000/EA	
	FRAME 1440# @ $15 = 21000		6,300	41,200	1,000	48,500/EA			
	TRACK, BOTTOM 2000								
	MOTORIZED OPER. 5000								
	LABOR TO ERECT 6500								
	TOTAL $48500								
	COMPENSATING WATER PORTAL DOOR. 400SF @ $10 = $4000		20%	77%	3%			25,000/EA	
	FRAME 3000		3,200	12,300	500	16,000/EA			
	CONCRETE SILL 2000								
	MOTORIZED W/LABOR 2000								
	ELECTRIC SUPPLY 5000								
	$16,000								
331.138	MISC. STEEL WORK @ ACCESS SHAFT		25%	70%	5%			3,675/TON	
			592	1660	118	2370/TON			
331.148	MISC. STEEL WORK @ HEAD TANK		23½%	70%	6½%				
			3500	10,500	1,000		15 000		23,250
331.178	MISC. STEEL WORK @ CABLE SHAFT		24%	70%	6%			7750/TON	
			1200	3500	300	5000/TON			
331.179	CABLE SHAFT HEAD FRAME & ENCLOSURE		30%	50%	20%				90 000
			17,500	29000	11500		58000		

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ACRES

Calculations

SUBJECT: DEVIL CANYON
COST BREAK DOWN

JOB NUMBER P5700.09
FILE NUMBER
SHEET 2 OF
BY R. BEAL DATE 10/28/82
APP DATE

ITEM No.	DESCRIPTION	L	M	E	NET UNIT	NET AMOUNT	GROSS UNIT	GROSS AMOUNT
331.181	DEWATERING POWER FACILITY (AUTOMATIC SUMP OPERATION)	10% 45,000	88% 396,000	2% 9,000	4.50 4.95	450,000 +49,000		700,000
331.191	INSTRUMENTATION @ POWER FACILITY, T.R. & PENSTOCKS	56½% 283000	35½% 178 000	8% 38000	17.00 21.00	499000		773000
	GROSS NET L M E INSTRUMENTS 273000 176000 176000 INSTAL. LABOR 333 000 215000 215000 4.91/LF DRILLING 167 000 108 000 68000 2 000 0.26/LF 38000 5.55/LF 773 000 499 000 283 000 178000 38 000							
331.200	MISC. BLDGS. & STRUCTURES	20% 26 000	75% 97000	5% 6,000	77.00 33.00	129 000		200 000
332.110	CLEARING. By FMA	27½% 275	10% 100	62½% 6.25	.11 542 1,000/AC		1500/AC	
332.22D	DEWATERING. BETWEEN COFFERDAMS (INITIAL) by FT	24% 119 000	57% 279 400	19% 90700	400.00 479.00	489100		758,000 785 000
332.314	JOINT GROUTING @ MAIN DAM-CONCRETE by FT	66½% 1, 090 000	23% 375, 000	10½% 175000	79.00 11.00	1,64, 000		2,542,00
332.32D	DEWATERING - MAINTENANCE by FT.	63% 1,575,800	6% 143,200	31% 777,800	360.00 427.00	2, 496,800		3, 870, 000
332.329	GALLERY PORTAL DOORS	20% 2600	77% 9900	3% 400	12,900/EA		20,000/EA	
332.331	INSTRUMENTATION @ MAIN DAM.	57½% 1,449,000	35% 882000	7½% 189,000		2,520,000		3,905,000

60.04.01 Form 148A

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Calculations

SUBJECT: DEVIL CANYON
COST BREAKDOWN

JOB NUMBER P5700.09
FILE NUMBER
SHEET 3 OF 3
BY R BEAL DATE 10/[illegible]
APP DATE

ITEM No.	DESCRIPTION	L	M	E	NET UNIT	NET AMOUNT	GROSS UNIT	GROSS AMOUNT
332.538	GUARD RAILS	36% 6.85	60% 11.40	4% 0.75	.34 .41 19.00/LF		30.00/LF	
332.53B	BRIDGE CONCRETE FDN & DECK / STR STL: / AVG. L 45% / 20% / 32.5 / 262 100 M 50% / 75% / 62.5 / 504 100 E 5% / 5% / 5.0 / 40 300	32.5% 262,100	62.5% 504,100	5% 40,300	18100 22 200		806,500	1,250,000
332.61D	INTAKE BLDG.	30% 38700	60% 77400	10% 12900	[illegible]	129,000		200,000
332.813	CONTACT GROUT & PENSTOCKS	51% 57,000 ~~26500~~	29% 33000 ~~15,000~~	20% 22,500 ~~10,500~~	10100 12400	112 500 ~~52 000~~		175000 ~~80 000~~
332.813	CONSOLIDATION GROUTING	37% 57400	51% 79 000	12% 6600	[illegible] 3630	155 000		240,000
332.818	PENSTOCK STEEL LINERS	30% 930	60% 1860	10% 310	140 170	3100/T.	4800/T.	

22 500
.55
112500
1125
12375.00

60.04.01 Form 148A

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DEVIL CANYON SITE — REVISIONS TO ROCK EXCAVATION COSTS.

Compiled: R. D. Chamberlain 17th February 1982.

Description.	Item #	Labour	Material	Equipment	Total	Mark Up Price
				OWN OPER.	OWN OPER.	
Main Dam ~ Excavation						
Rock ✓	532.511	6.12	4.24	3.20 7.10 3.90	17.46 ✓	
Main Saddle Dam ~ Excavation						
Rock ✓	.411	3.46	4.24	2.17 4.83 2.66	12.53 ✓	
Main (Chute) Spillway ~ Excavation						
Approach						
Rock Useable ✓	.521	3.46	4.24	2.17 4.83 2.66	12.53 ✓	
Rock Waste ✓	.521	3.46	4.24	2.17 4.83 2.66	12.53 ✓	
Control Structure						
Rock Useable ✓	.521	3.64	4.34	2.23 4.95 2.72	12.93 ✓	
Rock Waste ✓	.521	2.84	4.30	1.99 4.42 2.43	11.56 ✓	
Chute and Flip						
Rock Useable ✓✓	.521	5.09	5.15	2.59 5.76 3.17	16.00 ✓	
Rock Waste ✓	.521	3.46	4.24	2.17 4.83 2.66	12.53 ✓	
Outfall						
Rock Useable ✓✓	.521	4.57	5.15	1.83 4.07 2.24	13.79 ✓	
Rock Waste ✓✓	.521	2.94	4.24	1.41 3.13 1.72	10.31 ✓	
Emergency Spillway						
Rock Useable	.531	5.64	4.34	2.26 5.02 2.76	13.00 ✓	
Rock Waste	.531	3.11	4.30	2.40 5.34 2.94	12.75 ✓	

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(C) Production Rates - Devil Canyon Powerhouse

Estimate Work Sheet

ACRES

ITEM REFERENCE No. | JOB No.

DESCRIPTION PowerHouse | SHEET OF

PROJECT | OPERATION No. | REF. | BY R. Long 17 Nov. 1982

CONTRACT | DESCRIPTION | ✓CKD | DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
The excavation of the POWERHOUSE will be similiar to the methods used for the Surge Chamber. 50,330 cy / 85.3 days. Assume Unit Cost to be equal. production = 590 cy/Day		cy	14.23		4.99						12.14	(5.46)		(6.68)	3.36	

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57.02.02 Form 131 A

(C) Production Rates - Devil Canyon Access Tunnels

C12

Estimate Work Sheet

ACRES

PROJECT

CONTRACT DEVIL CANYON

ITEM REFERENCE No.

DESCRIPTION ACCESS TUNNEL

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET 1 OF 1

BY L. Tang 13 Jan 82

CKD T. LITTLE DATE 1-16-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
EXCAV. TUNNEL 35W X 28 H.																
9 hrs. DRILL (225 CY Round)			3.70		0.90						4.61				9.21	
3 hrs BLAST			0.84		5.11						0.41				6.36	
6 hrs. MUCK (3 haul units - 1 mile haul)			3.89		-						6.57				10.46	
6 BULL GANG			2.38		-						0.88				3.26	
6 SERVICE CREW (include duct, elec service mtls.)			3.03		0.43						1.06				4.62	
34.7 CY/HR. PRODUCTION (626.3 CY/Day) (18 HRS)		CY	13.84		6.44						13.93	(6.13)	(7.50)		33.62	
															33.91	

57.02.02 Form 131 A

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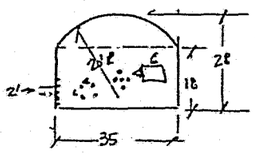
Calculations

ACRES

SUBJECT: SUSITNA
DEVIL CANYON ACCESS TUNNEL

JOB NUMBER
FILE NUMBER
SHEET 1 OF 6
BY [signature] DATE 1-4-82
APP RBB. DATE 18 JAN 82



AREA = (.1748 × 35²) + (18 × 35) = 844.13 sf.
214.13' 630'

Arc Length = 1.855 × R = 37.1'

LINE DRILLING = 2.0' c.c 37+35+36 = 108' ÷ 2 = 54' holes
FACE DRILLING = 844 sf ÷ (4×6) = 40 OK
BURN HOLES = 5
99 holes

PULL ≈ 60% width = .6(35) ≈ 20 ft.
DRILL LENGTH = 22 ft. × 99 holes = 2178 lf.

1-4 Boom Jumbo @ 1.1 ft/min/drill = 4.4'/min Jumbo

2178 lf / 4.4'/min = 495 min. ÷ 60 min/hr. = 8.25 Hours

move in/out & set up = .75

9.0 hour shift

VOLUME/ROUND 844.13 × 20/27 = 625.28 ¢ Bank
× 1.3 = 812.8' Loose cy. HAUL

~~LOAD/HAUL CYCLE = LOAD 3.5 min~~
~~Travel 18.0 (6 miles)~~
~~Dump 3.0~~
~~Return 15.0~~
~~39.5 min~~
~~SPOT 3.~~
~~42.5'~~

20 MPH 29.33 FPS
24 MPH 35.2 FPS

41 loads
× 6.5 min
267 min ÷ 50 min/hr. 5.3 Hrs HAUL
Say 6' Hours

VOLUME/ROUND HAUL = 812.8 LCY / 20 ¢ TRK = 40.6' = Say 41 loads

EXPLOSIVES: 99 holes @ 3 min/hole = 297 ÷ 50 min/hr. 5.94
6 hrs ÷ 3 men = 2 hrs
VENTILATE 1
3 Hrs.

Allow for 2 mile HAUL
Load = 3.5 min
Travel loaded: 6.0 @ 20 MPH
Dump 3.0
Return 4.8 @ 25 MPH
Spot 3.0
20.3 min trk cycle ÷ 6.5 loader cycle = 3.12 Trks
Say 3.

LOAD/HAUL CYCLE (changed to 1 mile haul)
Load ~ 3.5 min.
Travel loaded - 3.0 min @ 20 MPH. (1760 fpm)
Dump ~ 3.0 min
Return Empty ~ 2.4 min @ 25 MPH (2220 fpm)
Spot. ~ 3.0 min
14.9 min/cycle

14.9 min / 6.5 min/load = 2.3 ≈ 3 Trucks Reqd.

60.04.01 Form 148A

Estimate Work Sheet

ACRES

PROJECT SUSITNA

CONTRACT

ITEM REFERENCE No.

DESCRIPTION ACCESS TUNNELS

OPERATION No. REF.

DESCRIPTION

JOB No. P5700.09

SHEET 2 OF 6

BY R.Lang 1-4-82

CKD T.Little DATE 1-16-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM.MATERIALS UNIT COST	PERM.MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT.OWNERSHIP UNIT COST	EQPT.OWNERSHIP AMOUNT	EQPT.OPERATION UNIT COST	EQPT.OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
DRILLING																
			$/Hour													
LABOR 1 foreman			33.15													
1 Jimbo Oper.			32.43													
1 Drillers			32.08													
1 Helper			30.54													
1 Drill Doctor			31.43													
1 Comp. Oper.			33.62													
1 Electrician			40.45													
			$233.70/Hr.													
$233.70 x 9+10% = 2313.63																
Cost/cy. = $2313.63 / 625 cy = $3.70/cy		cy	3.70													
MATERIAL Drill bits, rods, shanks, etc.																
$0.25/lf drilling																
2178 ft. x .25 = $544.50																
Cost/cy = $544.50 / 625 cy = $.90/cy ✓		cy			0.90											
EQUIPMENT			$/Hour													
1 Jumbo 4 Boom			215													
2 - 600 cfm compr. (35)			70													
1 Drill Grinder			10													
1 pickup 8x4			25													
			$320/Hr.													
$320 x 9 hours = 2880																
Cost/cy = 2880 / 625 cy = $4.61/cy.		cy										4.61				
DRILLING COST.		cy	3.70		0.90							4.61			9.21	

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Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION Access Tunnels

JOB No. P5700.07

SHEET 3 OF 6

PROJECT SUSITNA

OPERATION No. REF.

BY R. Long 1-5-82

CONTRACT

DESCRIPTION

CKD T. Little DATE 1-16-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
BLAST																
Labor 1 - powderman 32.43																
3 - Helpers (31.75) 95.25																
1 - Trk. Dr. 31.75																
$159.43/Hr.																
$159.43/Hour X 3 Hours + 1/2 = $ 526.12																
Cost/cy = $526.12 ÷ 625 cy = $0.84		cy	.84													
MATERIAL																
Explosives - Dynamite 2.3#/cy @ $1.50 = $3.45																
Fuse 1.00																
Wire & Accessories 15% .66																
Cost/cy $5.11/cy		cy			5.11											
Equipment 1 ANFO loader $600,000/20,000 + 11% 41.00																
1 - Panel Truck $25.00																
1 - pick up 20.00																
$86.00/Hr.																
.86 x 3 hrs = $258																
Cost/cy $258 ÷ 625 cy. = $0.41		cy										0.41				
BLAST COST.		cy	.84		5.11							0.41				6.36

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Estimate Work Sheet

ACRES

PROJECT

CONTRACT

ITEM REFERENCE No.

DESCRIPTION ACCESS TUNNEL

OPERATION No. REF.

DESCRIPTION

JOB No. P5700.09

SHEET 4 OF 6

BY R. Long 1-5-82

CKD T. LITTLE DATE 1-16-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM. MATERIALS		SUBCONTRACTS		EQPT. OWNERSHIP		EQPT. OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Muck / Haul																
LABOR		$/Hr														
1 Loader Oper.				36.22												
3 Drivers (33.90)				101.70												
3 Trafficmen (30.54)				91.62												
2 Foreman (35.11)				70.22												
1 Dozer Oper.				34.41												
1 Grader Oper.				34.41												
				$368.58/Hr.												
$368.58 x 6 HRS +10% = $2432.63																
Cost/cy : $2432.63 ÷ 625 cy = $3.89		cy	3.89													
Equipment		$/Hr.														
1 Loader		87.00														
3 R-50 Trucks (140)		420.00														
1 Dozer		82.00														
2 Pick-up 4x4 (25.)		50.00														
1 Grader		45.00														
		$684.00/Hr														
$684 x 6 HRS = $4104.00																
Cost/cy $4104 ÷ 625 cy = $6.57		cy										6.57				
Muck/Haul Cost		cy	3.89									6.57				10.46

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Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION Access Tunnel

JOB No. P5700.09

SHEET 5 OF 6

PROJECT

OPERATION No. REF.

BY R. Lang 1-5-82

CONTRACT

DESCRIPTION

CKD T. Lime DATE 1-16-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM.MATERIALS UNIT COST	PERM.MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT.OWNERSHIP UNIT COST	EQPT.OWNERSHIP AMOUNT	EQPT.OPERATION UNIT COST	EQPT.OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
Bull Gang Crew (Vent & Air)																
Labor — 1 Foreman $/Hr 31.35																
4 Helpers (30.54) 122.16																
1 Rigger 31.89																
1 Cherry Op. 34.41																
$225.81/Hr.																
$225.81 x 6 Hrs + 10% = $1490.34																
Cost/cy = $1490.34 ÷ 625 cf = $2.38		cy	2.38													
Equipment — $/Hr																
1 pickup 4x4 25.00																
1 Cherry Picker 60.00																
1 F.D. Truck 25.00																
$110.00/Hr																
$110 x 5 Hrs = $550.00																
Cost/cy = $550. ÷ 625 cf = $0.88/cy		cy										0.88				
Bull Gang Unit Cost		cy	2.38									2.88				3.26

Include also Bull Gang 2 for Prime 2 Day 2

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57.02.02 Form 131 A

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Estimate Work Sheet

ACRES

PROJECT

CONTRACT

ITEM REFERENCE No.

DESCRIPTION ACCESS TUNNEL

OPERATION No. REF.

DESCRIPTION

JOB No. P5700.09

SHEET 6 OF 6

BY R. Lang 1-5-82

CKD T. Little DATE 1-16-82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
SERVICE CREW																
		$/Hr														
LABOR 2 1 foreman		45.33														
1 - pipefitter		44.33														
2 - helpers (40.79)		81.58														
1 Elect.		40.45														
1 - El. helper		40.45														
1 - Cherry Oper.		34.41														
		$286.55/Hr														
$286.55 x 6 Hrs + 10% = $1891.23																
Cost/cy: $1891.23 ÷ 625 cy =		cy	3.03													
EQUIPMENT																
2 pickups (25) 50																
1 cherry picker 60																
$110/Hr																
$110. x 6 Hrs = $660.00 + 10% = 726																
Cost/cy = $660 ÷ 625 cy = 1.06 1.16		cy											1.66			
SERVICE CREW COST/CY		cy	3.03		0.43								1.16		4.62	
MATERIALS $13.50/LF (20 ft) Rd. Duct, Wire & Lights / 625 $/Rd. = 0.43/cy																

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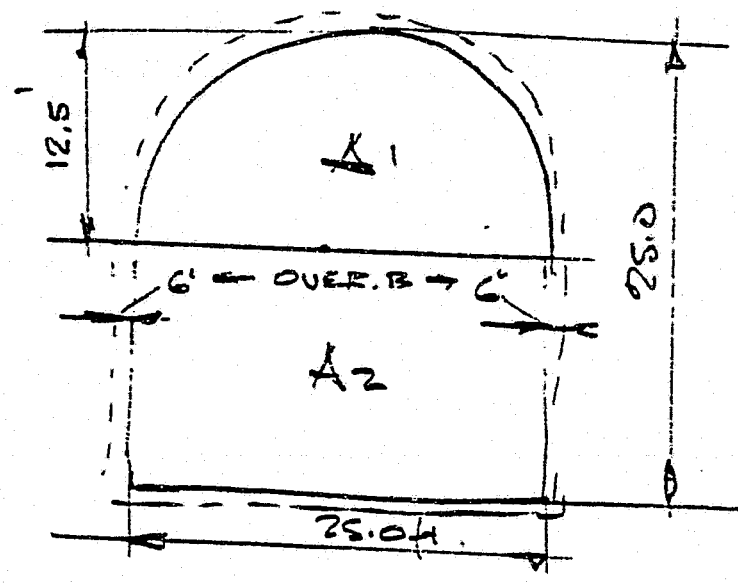
ACRES **Calculations**

SUBJECT: SUSITUA

JOB NUMBER P570006
FILE NUMBER
SHEET 2 OF
BY DATE
APP DATE

ACCESS TUNNELS

1 = 2000 ft.
2 = 3000 "
3 = 200 "
5200 ft.



$A_1 = (12.5^2 \times 3.14) \div 2 = 245.3$ sf ✓

$245.3 \div 27 =$ 9.0 CY

$A_2 = 12.5 \times 25.0 = 312.5$ sf ✓
$312.5 \div 27 =$ 11.57 cy

OVERBREAK $(39.5 + 25 + 25) \cdot 89.5 \times .5 = 44.75$
1.66 cy

TOTAL = ~~20.6~~ 22.3 cy

$L = 5200' \times 20.6 =$ 107,100 CY

107,100 x 88.54 = $ 9,484,405

FORM NO. 162 REV. 1

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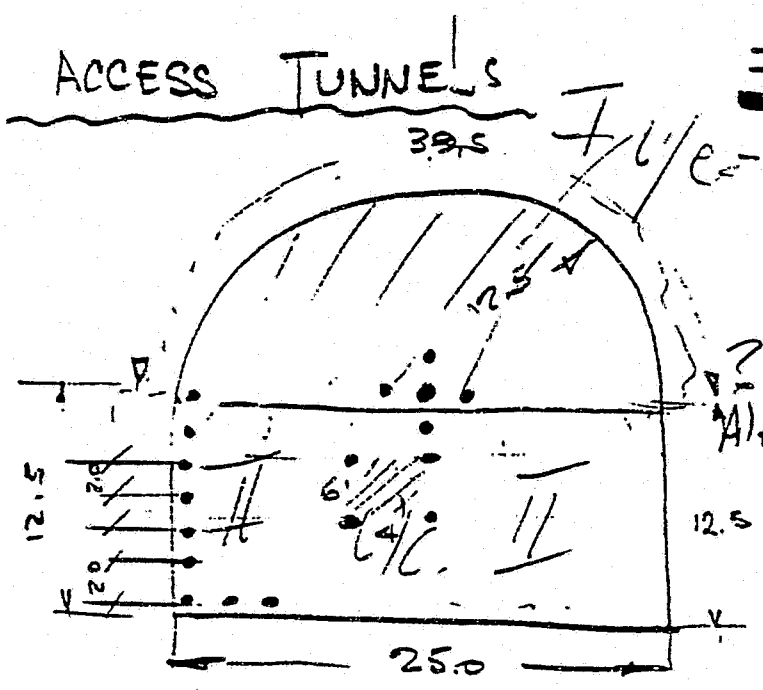
ACRES

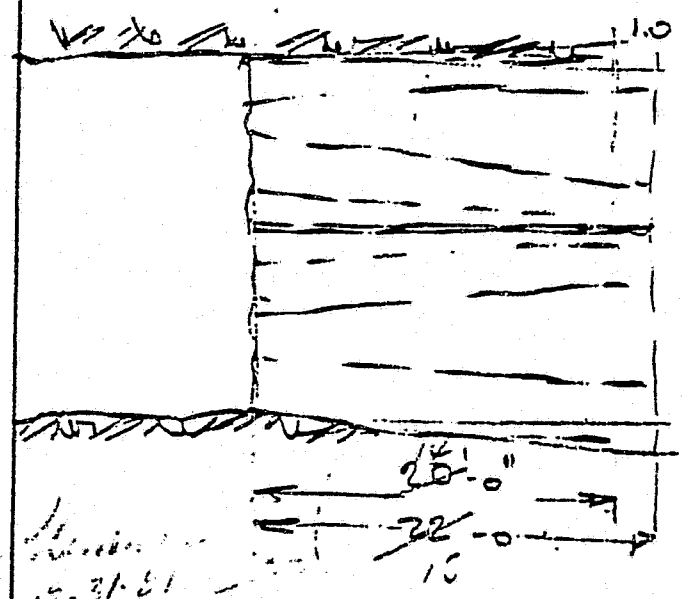
Calculations

SUBJECT: SUSITNA

JOB NUMBER P570006
FILE NUMBER
SHEET 3 OF
BY DATE
APP DATE

ACCESS TUNNELS





12-31-81

HAT'L

DRILL RIG, RODS & MISC ETC = 0.25/ft.

1342 x .25 = 336.0 ÷ 4142 = 312 CY

1095 274

0.81/cy

FULL FACE METHOD.

Line Drilling: 2'-0" cc

64.5 ÷ 2 + 25 = 89.5 ÷ 2 = 45 HOLES

Face Drilling:

265 ÷ (6×4) = 11 HOLES

Vol/Round = 414 CY / 12.3 x 14 = 312 CY

73 1095

61 x 22 = 1342 ft

H. HOLES
23
5
6T. HOLES
73 Holes

4 - High Speed Drill Jumbo.

1095 274

1342 ÷ 4 = 336 ft/Drill.

- Drill Production -

Penetration 1.1 Min/ft/Drill

274 336 ÷ 1.1 = 306 Min

249 306 ÷ 55 = 249

4.5 5.6 Hr

3.4

9.0?

SETUP

MOVE EQUIP

OVER BREAK = 2.5 CY/ft. of Tunnel

BANK YARDS 20.7 CY/ft 14 312 CY

464 x .25 = 232 CY x 20 = 464 CY

312 x 1.25 600 CY TO HAUL.

390 cy to Haul

SECOND SHIFT.

Load & Blast = 4.5 Hr.

Load & Haul = 4.5

9.0 Hr.

Smooth out 1.0

10.00

99

FORM NO. 152 REV. 1

C82

Calculations

SUBJECT: SUSITNA POWER TUNNEL

JOB NUMBER P570006
FILE NUMBER
SHEET 4 OF
BY DATE
APP DATE

EXPLOSIVE

DYNAMITE 2.3 lbs/cy @ 1.50 = 3.45/CT
FUSE 1.00/CT
WIRE & ACCESSORIES 15% of POWDER .66/CY

5.11/CT × 414 = 2116.-

DRILLING

1- FOREMAN		32.00	
1- JUMBO OP		27.50	
2-1 DRILLER	26.30	52.60	(1)
1- HELP		25.00	(1)
1- DRIL DOC.		27.00	
1- COMPR. OP		26.30	
1- ELECTR.		29.60	
		220.0/hr.	

× 12.5 = 2750.00/SHFT.

BULL GANG. (VENTILATE)

1- FOREMAN		28.00	
4- HELP	25.00	100.00	
1- RIGGER		27.50	
1- CHERRY. OP.		26.30	
		181.80	

6.5 = 1182./SFT. (1)

BLAST.

1- POWDER. MAN		30.00
6- HELP	25.00	150.00
1- TR. DRIVER		24.10
		204.10

× 6.5 = 1327/SF.

5259/SF.

1/-
100

FORM NO. 152 REV. 1

C23

Calculations

SUBJECT: SUSITNA POWER TUNNEL

JOB NUMBER P570006
FILE NUMBER
SHEET 5 OF
BY DATE
APP DATE

LAB. CARRIED, FT. · 5,205/SHT.

SECU. CREW

1- FOREMAN		30.00
1- PIPE FITER		29.90
2- HELP	26.0	52.00
1- ELECTR		29.70
1- HELP		25.00
1- CHR. OP		26.30
		192.90

192.90 x 4 = 771.60 /SHFT.

LABOUR LOAD HAUL

1- LOADER OP		26.30
12- DRIVER	25.00	300.00
3- TRAFFIC MAN	24.00	72.00
2- FOREMAN	30.00	60.00
1- DOZER OP		27.00
1- GRADER OP		27.00
		512.30

512.30 x 4.5 → = 2305./SHFT.

LOAD & HAUL

CYCLE . USE 15 CY-TRUCKS.

LOAD 3.5 MIN.
TRAVEL = 1.8 — (6 MILE)
DUMP = 3 —
RETUEL = 15 —
SPOT = 3 —
42.5 MIN = 12 UNITS

TOTAL LABOUR

8335

8335 ÷ 414 = $20.13 /CY

FORM NO. 162 REV. 1

201

C 34

ACRES

Calculations

SUBJECT: SUSITNA POWER TUNNEL

JOB NUMBER PS70006
FILE NUMBER
SHEET 6. OF
BY DATE
APP DATE

EQUIPMENT.

DRILLING

1- JUMBO		85.00
2- 600 CFM COMPR.	35.00	70.00
1- DRIL. GR.		10.00
1- PICKUP 4x4		25.00
		190.00 x 10 =

$ 1930.00/SF.

BULL GANG

1- PICK UP 4x4	25.00
1- CHERRY PICKER	60.00
1- F.D TRUCK	25.00
	110 x 5.0 =

550.00/SHIFT

BLAST.

1- PANEL TRUCK	25.00
1- PICKUP	20.00
	45.00 x 5.0 =

225.00 SF.

SERV. CREW

2- PICKUPS	25.00	50.00
1- CHERRYPICK.		60.00
		110.00 x 4 =

440/SF.

3145/SF

1.102

FORM NO. 152 REV. 1

C.F.C

Calculations

SUBJECT: SUSITNA POWER TUNNELS

JOB NUMBER P570006
FILE NUMBER
SHEET 7 OF
BY DATE
APP DATE

-/ 3145.0

Load & Haul

1 - LOADER		87.00
12 - R50 TRUCK.	140[00]	1680.-
1 - DOZER		82.00
2 - PICKUP 4x4	25.00	50.00
1 - GRADER		45.00
		1944. x 5 = 9720.-

12,865 ÷ 414. = 31.07

12,865.-

TOTAL DIRECT COST

DRILL MAT'L = .81 / CY
EXPLOSIVE = 5.11 / CY
LABOUR = 20.13 / CY
EQUIPT = 31.07 / CY

57.12 / CY

MARK UP 1.55

88.54 / CY

FORM NO. 152 REV. 1

(C) Production Rates - Devil Canyon

Main Access Shaft

000254

HONES

JOB No.

DESCRIPTION MAIN ACCESS SHAFT

SHEET

PROJECT

OPERATION No.

REF.

BY [illegible]

CONTRACT

DESCRIPTION

✓CKD RBB

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT
EXCAV. 24 ft. Diameter														
~~[illegible]~~ EXCAV 8'φ w/Alimac Volume/Rd = 15 cy	15.0	cy.	110.92	1663.80	16.26	243.90					81.95	1229.25		
SLASH to 24 ft φ	149.0	cy	31.60 / 30.58	4708.40 / ~~4556.42~~	9.42	1403.58					25.14 / 31.59	3745.86 / ~~4706.91~~		
	164	cy		~~6220.22~~		1647.48						5936.16		
			37.93		10.04						~~36.20~~			
			38.85	6372							30.33	(13.65) 4975		(16.68)

PRODUCTION = 15 cy = 9 hrs

149 cy : 17 ~~12~~ hrs.

164 : 25 ~~21~~ hrs = 6.3 ~~7.8~~ ¢/hr.

X 18 hr. ?

~~140~~ ¢/day

Avg. 114 ¢/day

DEVIL CANYON

BY R. Lang DATE 14 J
APP RBB DATE 18 J

(1) Drive 8' ϕ aux. shaft w/ Alimac – BOTTOM UP
(2) Slash remaining from bottom up (Hoist & Platform)

of 8' ϕ = 50.26 SF × 8 ft. pull / 27 = 14.89 ≈ 15 CY/Round
er 25.12 ft. ÷ 1.5 c.c. = 17 holes
+ Area holes = 15
32 holes × 9 ft./drill = 288 ft.

DUCTION 20 ft/hr./drill × 2 drills = 40 ft/hr. = 288/40 = 7.2 hrs.
AST = 32 holes × 4 min ea ÷ 50 min/hr. ÷ 2 men = 1.3 hrs. (LOW)
8.5 hrs = Say 9 hrs.

(Drill & Blast)	1 foreman		33.15
	2 drillers	(32.08)	64.16
	1 oper.		32.43
	1 Labor.		30.54
			$160.28 × 9 hours + 10% = $1586.7

(IL)	1 Trk Dr.	33.90
	1 FEL OPER	36.22
		$70.12 × 1 hours + 10% = $77.13

& SER. CREW NOT REQD.

TOTAL LABOR = $1663.80 ÷ 15¢ = $110.92

EQUIPMENT

1 Alimac	60.00
2 Stoper (20.00)	40.00
1 600 Compr.	38.50
	$138.50 × 7.5 hrs = $1038.75
1 25 T. Trk.	55.00
1 FEL	36.50
	91.50 × 1 hr. = 91.50
1 ANFO Loader	41
1 Panel Trk	25
	66 × 1.5 hrs. = 99.00

$1229.25 ÷ 15¢ = 81.95/CY

DRILL BITS, ROD, ETC	288 ft. × .20/LF	$57.60
EXPLOSIVES	15¢ × 4.00	60.00
FUSE/CORD	153 × .3 * 32 × 1.5	93.90
DELAY	17 × 1.20	20.40
WIRE & ACCESSORIES (20% powder)		12.00
		$243.90 ÷ 15¢ = 16.26

(2) SLASH

AREA 12² × π = 452.2 – 8' ϕ = 402 SF
VOLUME 10' (402) / 27 = 148.9 CY.

DRILL 50' perimeter holes
34' Area holes, INCL BURN 330 □'
84' holes × 11' depth = 924 ft.
4 drills @ 20 ft/hr. = 80 ft./hr.
∴ 924 ÷ 80 = 11.5 hrs +
.5 hr. move in
12 hrs.

LOAD & BLAST 24 × 4 ÷ 50 ÷ 2 = 3.5
.5 MOVE OUT
16 HRS.

			Equip
LABOR	1 foreman	33.15	1 Hoist/Headfram
	4 drillers	(32.08) 128.32	4 Stoper (20
	1 oper.	32.43	2 - 600 Comp. (3
	1 help. (lab)	30.54	
	1 Hoist Oper.	34.41	
		258.85 × 12 hrs + 10%	221.50 × 1
		LABOR = 3416.82	3544 (2658 ÷ 149

4555.76 ÷ 149 = 30.5

HAUL 1 mile = Load = 3.0
Travel 3.0 20 MPH (1760 fpm
Dump 3.0
Return 2.4 25 MPH (2220 fpm
Spot 3.0
14.4 = Say 3 Loads/Hr.

149 CY/Round × 1.2 Swell ÷ 20¢/Load = 9 Lo
149 × 1.2 ÷ 20 × 6 MIN/LD. ÷ 50 min/hr = 1.07 Say 1 Hr

Equip = Say 3 Trks (55) = 165 (110.00)
1 Loader 36.50
201.50
146.50 ÷ 149 ≈ 1.35 (1.60)/¢

LABOR 3 TRK DR. (33.90) = 67.80 101.70
1 LOADER Oper = 36.22
137.92
104.02 + 10% × 1 hr = $114.42 (151.71)

4555.76 + 151.71 = 4707.47
$3416.82 + 114.42 = 3531.24 ÷ 149 = $31.50

MATLS DRILL BITS, Rods 924 × .4
EXPLOSIVES 150 × 2 × 2
Fuse & Cord 550 × .3 + 59 × 1.5
Delay 50 × 1.2
Wire & Accessories (20% powder

(C) Production Rates - Devil Canyon

Fire Protection Headtank

MORRISON-KNUDSEN

DESCRIPTION Fire Protection Headtank SHEET

PROJECT OPERATION No. REF. BY L. Jo

CONTRACT Devil Canyon DESCRIPTION CKD

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION	
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT
Reference: Devil Canyon Backup for Grout Gallery Assume Headtank cost will be similiar to Incline excavation Unit Cost.		C.Y.	9.65		27.44						31.06		37.96	

JOB NUMBER

C87

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION MAIN ACCESS SHAFT

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY L. Tang 13 Jan 82

VCKD RLB DATE 18 Jan 82

PROJECT

CONTRACT

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
Excav. 24 ft. Diameter																
1.67 cy/Hr 30¢/day Excav 8'φ w/Alimac Volume/Rd: 15 cy	15.0	cy.	110.92	1663.80	16.26	243.90					81.95	1229.25			209.13	3136.95
12.42 cy/Hr Slash to 24 ft φ	149.0	cy	31.60 30.58	4709.40 ~~4556.42~~	9.42	1403.58					25.14 31.59	3745.86 ~~4706.91~~			66.16 ~~41.32~~	9857.84 ~~70666.96~~
	164	cy		~~6270.22~~		1647.48						5936.16				13803.86
			37.93		10.04						~~36.20~~				84.17	
			38.85	6372							30.33	(13.65) 4975		(16.68)	79.22	12,994

PRODUCTION = 15 cy = 9 hrs

149 cy = 17 hrs.

164 = 25 hrs = 6.3 ~~7.8~~ ¢/hr.

x 18 hrs ?

~~140~~ ¢/day

Avg. 115 ¢/day

FOLD LENGT

12

11

8.5

8

AUTO

MANUA

FEED

57.02.02 Form 131 A

ACRES

Calculations

SUBJECT: Access Shaft.
DEVIL CANYON

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lang DATE 14 Jan 82
APP RBB DATE 18 Jan 82

PROCEDURE (1) Drive 8' ϕ aux. shaft w/ Alimac – BOTTOM UP
(2) Slash remaining from bottom up (Hoist & Platform)

Volume of 8' ϕ = 50.26 SF × 8 ft. pull / 27 = 14.89 ≈ 15 cy/Round
perimeter 25.12 ft. ÷ 1.5 c.c. = 17 holes
BURN + Area holes = 15
32 holes × 9 ft./drill = 288 ft.

(1)
DRILL PRODUCTION 20 ft/hr./drill × 2 drills = 40 ft/hr. = 288/40 = 7.2 hrs.
LOAD & BLAST = 32 holes × 4 min ea ÷ 50 min/hr. ÷ 2 men = 1.3 hrs. (LOW)
8.5 hrs = Say 9 hrs.

LABOR (Drill & Blast) 1 foreman 33.15
2 drillers (32.08) 64.16
1 oper. 32.43
1 Labor. 30.54
$160.28 × 9 hours + 10% = $1586.7

LABOR (HAUL) 1 Trk Dr. 33.90
1 FEL OPER 36.22
$70.12 × 1 hours + 10% = $77.13

BULL GANG & SER. CREW NOT REQD.

TOTAL LABOR = $1663.80 ÷ 15¢ = $110.92

EQUIPMENT
1 Alimac 60.00
2 Stoper (20.00) 40.00
1-600 Compr. 38.50
$138.50 × 7.5 hrs = $1038.75

1-25 T. Trk. 55.00
1-FEL 36.50
91.50 × 1 hr. = 91.50

1-ANFO Loader 41
1-Panel Trk 25
66 × 1.5 hrs. = 99.00

$1229.25 ÷ 15¢ = 81.95/cy

MATERIAL - DRILL BITS, ROD, ETC 288 ft. × .20/LF $57.60
EXPLOSIVES 15¢ × 4.00 60.00
FUSE/CORD 153 × .3 * 32 × 1.5 93.90
DELAY 17 × 1.20 20.40
WIRE & ACCESSORIES (20% Powder) 12.00
$243.90 ÷ 15¢ = 16.26

(2) SLASH
AREA 12² × π = 452.2 – 8' ϕ = 402 SF
VOLUME 10' (402) / 27 = 148.9 cy.

DRILL 50' perimeter holes
34' Area holes, INCL BURN @ 30'
84' holes × 11' depth = 924 ft.
4 drills @ 20 ft/hr. = 80 ft./hr.
∴ 924 ÷ 80 = 11.5 hrs +
.5 hr. move in
12 hrs.

LOAD & BLAST 924 × 4 ÷ 50 ÷ L = 3.5
.5 MOVE OUT
16 HRS.

LABOR 1 foreman 33.15
4 drillers (32.08) 128.32
1 oper. 32.43
1 help. (lab) 30.54
1 Hoist Oper. 34.41
→ 258.85 × 12 hrs + 10%
LABOR = 3416.82

Equip
1 Hoist/Headframe 64.50
4 Stoper (20) 80.00
2-600 Comp (38.50) 77.00
221.50
221.50 × 12 = 2658
3544
2658 ÷ 149¢ = $17.84
23.79

4555.76 ÷ 149 = 30.58

HAUL 1 mile = Load = 3.0
Travel 3.0 20 MPH (1760 fpm)
Dump 3.0
Return 2.4 25 MPH (2220 fpm)
Spot 3.0
14.4 = Say 3/4 Loads/Hr./Trk.

149 cy/Round × 1.2 Swell ÷ 20¢/Load = 9 Loads.
149 × 1.2 ÷ 20 × 6 min/ld. ÷ 50 min/hr = 1.07 Say 1 Hr.

Equip = Say 3/4 Trks (55) = 110.00 (165)
1 Loader 36.50
146.50 (201.50) ÷ 149 ≈ 1.35 (1.60)/¢

LABOR 3/4 TRK DR. (33.90) = 67.80 (101.70)
1 LOADER Oper = 36.22
104.02 (137.92) + 10% × 1 hr = $114.42 (151.71)

L $3416.82 (4555.76) + 114.42 (151.71) = 3531.24 (4707.47) ÷ 149 = $31.59/cy
$23.70 ¢

MATLS DRILL BITS, Rods 924 × .40 = 370.00
EXPLOSIVES 150 × 2 × 2 = 600.00
Fuse & Cord 550 × .3 + 59 × 1.5 = 253.50
Delay 50 × 1.2 60.00
Wire & Accessories (20% powder) 120.00
1403.50
÷ 149 cy = 9.42/¢
107

60.04.01 Form 148A

(C) Production Rates - Devil Canyon

Fire Protection Headtank

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

JOB No.

DESCRIPTION Fire Protection Headtank

SHEET OF

PROJECT

OPERATION No. REF.

BY L Yang 17 Feb 82

CONTRACT Devil Canyon

DESCRIPTION

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Reference: Devil Canyon Backup for Grout Gallery Assume Headtank cost will be similiar to Incline excavation Unit Cost.		C.Y.	9.54		2.74						3.06		3.96		19.30	

57.02.02 Form 131 A

Estimate Work Sheet

ACRES

ITEM REFERENCE No. | JOB No.

DESCRIPTION FIRE PROTECTION HEADTANK | SHEET OF

PROJECT | OPERATION No. | REF. | BY R Jang 17 Jan 82

CONTRACT | DESCRIPTION | CKD CBB DATE 19 JAN 82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Methods of Excavation similar to Surge Chamber. with adjustments made to deduct the need for Aux. Shaft during excavation.																
Used quantities for Surge Chamber to develope this Unit Costs as a direct ratio to Fire Prot Headtank																
13 1. Access tunnel thru Chamber (incl Service)	2719	cy	13.84	37631	6.44	17,510							13.63	37060	33.91	92,201
75 2. Dome Slash	4671	cy	10.81	50494	6.01	28,073							12.47	58247	29.29	136,814
37 3. Benching	42,250	cy	11.78	497,705	4.49	189,702							10.32	436020	26.59	1,123,427
75	49,640	cy		585,830		235,285								531,327		1,352,442
			11.80		4.74							(4.82)	10.70	(5.88)	27.24	

NOTE THESE QUANTITIES DO NOT REFLECT HEADTANK QUANTITIES ONLY THE UNIT COSTS.
R. Jang.

Avg Production/Day = 49,640 / 75 = 660 cy

VOID
Cost Too Low
See Revised

57.02.02 Form 131 A

(C) Production Rates - Devil Canyon

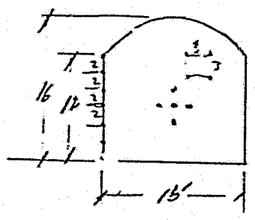
Bus Tunnels/Shafts

C9:

Calculations

SUBJECT: BUS GALLERY

JOB NUMBER
FILE NUMBER
SHEET OF
BY RLaney DATE 25 Jan 82
APP DATE



Span height = $\frac{16}{4} = 4'$
Radius = .625 W = 10'
Arc length = 1.855 R = 18.5'

Crown Area = .1248 (16^2) = 44.7
Lower Area = 12 x 16 = 192.0
236.7 SF x 8/27 = 70.13 CY B
70.13 CY x 1.25 = 87.7 CY Loose

ASSUME FULL FACE METHOD

pull 30'. width = 8 ft ; drill depth = 9 ft.
perimeter holes = 12+12+16+18.5 ÷ 2 = 29 holes
pattern holes 236.7 - (29 x 2)/9 = 20
burn holes 5
54 holes

DRILL CYCLE :
54 holes x 9 = 486 LF drilling
Using 1-4 Boom Jumbo @ 1 $\frac{ft}{min}$ drill x 50 $\frac{min}{hr}$ = 220 ft/hr.
∴ 486 LF ÷ 220 = 2.2 hrs = 3.0 Hrs.

BLAST CYCLE = 54 holes x 3 $\frac{min}{hole}$ = 162 min. ÷ 50 $\frac{min}{hr}$ = 3.2 hrs.
with 2 men loading = 1.6 hrs + Venting = 2.0 hrs

MUCK CYCLE = 2-Mile haul = 20.3 min truck cycles
$\frac{87.7 CY Loose}{20. CY/Trk} \simeq 5$ loads x 6.5 $\frac{min}{load}$ = 32.5 min = 1 hr.
2 TRUCKS REQD.

BULL GANG & SERVICE CREW = 2.0 Hrs.

PRODUCTION: $\frac{70.13 CY/Rd}{6 Hrs/Rd}$ = 11.7 CY/Hr x 18 hrs = 210 CY/DAY

LABOR DRILLING

1 foreman	33.15	
1 Jumbo Oper.	32.43	
2 Drillers (32.08)	64.16	
2 Chuck Tend. (31.43)	62.86	
1 Drill Doc	31.43	
1 Comp Oper.	33.62	
1 helper	30.54	
	288.19 x 3 hrs + 11% = $895.02 ÷ 70.13 CY =	$12.76/CY

EQUIP

1-4 Boom Jumbo	215
1-1000 cfm compr.	45
1-Bit Grinder	10
1 Pickup	25
295 x 3 ÷ 70.13 =	$12.62/CY

BLAST LABOR

1 powderman	32.43	
2 helpers (31.75)	63.50	
1 Laborer	30.54	
	126.47 x 2 hrs + 10% = $252.94 ÷ 70.13 CY =	$3.61/CY

EQUIP.

Expl Loader	41
panel Trk	25
pickup	25
91 x 2 ÷ 70.13 CY =	$2.60/CY

MUCK LABOR

1 foreman	34.30	
2 Trk dr. (33.09)	66.18	
1 FEL	36.22	
1 Dozer	36.22	
1 Flagman	30.54	
	203.46 x 1 hr + 10% = $223.80 ÷ 70.13 CY =	$3.19/CY

EQUIP

2 RSA Trks (14)	280
1 FEL	87
1 Dozer	85
1 Pick up	25
477 ÷ 70.13 CY =	$6.80/CY

BULL GANG & SER. CREW (Reference Access Tunnel)
LABOR = 512.36 x 2 + 10% = 1127.19 ÷ 70.13 CY = $16.07/CY

EQUIP. 220 x 2 ÷ 70.13 CY = 6.27/CY

MATL

Explos. 70.13 x 1.7 x 1.75 =	$208.64
Fuse & Cord 54 holes x 3' =	162.00
Bits, Rods etc. 486 x .25	121.50
Access. 20% Exp.	41.73
Delays 29 x 1.20	34.80
	$568.67 ÷ 70.13 = $8.10/CY

SERVICE MATL
$13.50/LF x 8 LF/Rd. = 108
108 ÷ 70.13 CY = $1.54/CY

60.04.01 Form 1-82A

FOLD LENGTH
12
11
8.5
8
AUTO
MANUAL
FEED

C97

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

JOB No.

DESCRIPTION BUS GALLERY

SHEET OF

PROJECT

OPERATION No. REF.

BY R. Lang 26 Jan 82

CONTRACT

DESCRIPTION

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
BUS GALLERY 16'x16' w/ Dome																
2108/DAY → FULL FACE METHOD																
TUNNELS																
DRILL		CY	13[illegible]		8.10						12.62					
BLAST			3[illegible]								2.60					
MUCK-HAUL			3[illegible]								6.80					
BULLGANG & SERVICE CREW			16[illegible]		1.54						6.27					
		CY	36[illegible]		9.64						28.29				74.36	
SHAFTS. (Same as ALIMAC RAISE Cost for Access Shaft)																
30cy/DAY →		CY	11[illegible]		16.26						81.95				209.13	

FOLD LENGT

12

11

8.5

8

AUTO

MANUA

FEED

57.02.02 Form 131 A

(C) Production Rates - Devil Canyon

Transformer Gallery

Estimate Work Sheet

ACRES

PROJECT

CONTRACT

ITEM REFERENCE No.

DESCRIPTION TRANSFORMER GALLERY

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET OF

BY R. Lang 20 Jan 82

CKD RBal DATE 29 Jan 82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Top Heading Drill			7.61		6.74						8.14					
Blast			1.35								0.87					
Muck			2.50								5.93					
Ser. Crew			5.42								2.11					
312.22 Y/Rd / 10.5 Hr = 29.74 Y/Hr x 18 hr/day = 535 Y/day.	6453	CY	16.88	108,927	6.74	43,493					17.65	110,024			40.67	262,444
Gallery = 310LF long x 562sf ÷ 27																
Benching Drill			6.97		4.55						4.50					
Blast			0.63								0.41					
Muck			2.34								5.11					
444.44 Y/Rd / 14 = 31.75 Y/Hr x 18 hr/day = 571 Y/day	18,657	cy	9.94	185,450	4.55	84,889					10.02	186,943			24.51	457,282
Gallery = 310LF x 1625sf ÷ 27																
	25,110	cy		294,377		128,382						296,967				719,726
Avg. Unit Cost Transformer Gallery	—	cy	11.72		5.11						11.83	(5.32)		(6.51)	28.66	

Avg Daily Production 535 Heading
571 1st Bench
576 2nd Bench
1677/3 = 559 Y/day.

57.02.02 Form 131 A

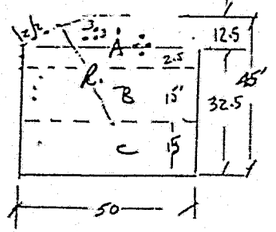
ACRES

Calculations

SUBJECT: TRANSFORMER GALLERY

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lang DATE
APP RBB DATE 28 JAN 82

APPROXIMATE SIZE 310 ft long.



SPAN to RISE RATIO = 4

R. = .625W = 31.25'

Arc length = 1.855(R.) = 58'

Crown Area = .1748(50²) = 437 ¢

Lower Area 32.5 (50) = 1625

Total Area = 2062 ¢ = 73.37 ¢/FT.

(A) ASSUME TOP HEADING 15'
(B/C) BENCHING 2@15 = 30
45' high

Area A = 437SF + (2.5×50) = 562 sf

DRILL 16 ft. pull 15 ft.

VOLUME = 562×15/27 = 312.22 B¢ × 1.25 = 390 ¢ loose

perimeter holes 58+2.5+2.5+50 ÷ 2 = 56'

pattern holes 562 sf − (56×4) ÷ 9 = 38'

Burn holes 4

98 holes

98 holes × 16 ft = 1568 ft. drilling

Using 2-4 Boom Jumbos @ 1.5 ft min × 8 drills × 50 min/hr. = 440 ft/hr

1568 ft ÷ 440 ft/hr = 3.6 Hrs.

≈ Say 4.50 hrs includes setups & moves.

BLAST CYCLE

98 Holes × 3 min/hole = 294 min.

294 ÷ 50 min/hr. = 5.9 hrs.

Say 3 men loading = 6/3 = 2 hrs.

Vent 1

3 hrs.

Muck Cycle. (Say 2 mile haul.)

Load	3.5
Travel loaded	6.0' @ 20 MPH
Dump	3.0
Return Empty	4.8' @ 25 MPH = 200 FPM
Spot	3.0
	20.3 min cycle ÷ 6.5 = 3.12 Trks

390 ¢ loose / 20 ¢ load = 20 loads/Round.

20 × 20.3 = 406 ÷ 3.135 ÷ 50 = 2.7

Say 3 Trks @ 3 load/hr each = 9 loads/hour

∴ 20 loads ÷ 9/hr = 2.2 hrs × 1.20 = 2.6 =

Say 3 hrs to muck out.

Top Heading

Labor			
Drill	1 foreman		33.15
	2 Jumbo open	(32.43)	64.86
	4 Drillers	(32.08)	128.32
	4 Chuck Tenders	(31.43)	125.72 / 62.86
	2 Comp Open	(33.62)	67.24
	2 helpers	(30.54)	61.08

480.37 543.23 × 4.5 + 10% = 2377.83 / 2689 ÷ 312.22 ¢ = 7.61 / $8.61 ¢

Equip.			
	2-4 Boom Jumbo's	(215)	= 430
	2 1000 cfm Compr.	(45)	90
	2 Bit Grinder	(10)	20
	1 pickup	(25)	25

565 × 4.5 hrs = $2542.50 ÷ 312.22 ¢ = $8.14/¢

Blast			
	1 powderman		32.43
	2 helpers	(31.75)	63.50
	1 Trk Dr.		32.15

128.08 × 3 hrs + 10% = $422.66 ÷ 312.22 ¢ $1.35/¢

Equip.		
	1 Loader Exp.	41.00
	panel trk	25.00
	Pickup	25.00

91.00 × 3 = $273 ÷ 312.22 = $0.87/¢

Muck			
	1 foreman		34.30
	3 Truck Dr.	(33.09)	99.27
	2 open	(36.22)	72.44
	1 flagman		30.54

236.55 × 3 hrs + 10% = $780.62 ÷ 312.22 = $2.50 ¢

Equip		
	3-R50 Trks (140)	420
	1 FEL	87
	1 DOZER	85
	1 Pickup	25

617 × 3 hrs = $1851 ÷ 312.22 $5.93/¢

BULL GANG & SER. CREW Same as Access Tunnel

512.36/hr. 3 hrs + 10% = $690.79 ÷ 312.22 $5.42 ¢

BULL GANG & Ser Crew Eq. = 220 × 3 = $660 ÷ 312.22 = 2.11/¢

MATL

Explosives	312.22 ¢ × 1.7 × 1.75 =	$928.85
Fuse & Cord	98 holes × 3.00 =	294.00
Bits, Rod, etc.	1568 ft × .25 =	392.00
Delays	56 × 1.80 =	100.80
Accessories	20% Exp. =	185.77
		$1901.42
Vent/Duct & Services	15 ft (13.50 LF)	202.50
		2103.92

$2103.92 ÷ 312.22 = $6.74/¢

60.04.01 Fo. .dA

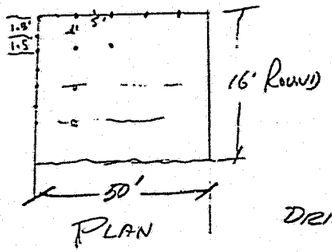
ACRES

Calculations

SUBJECT: TRANSFORMER GALLERY

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lang DATE
APP RPB DATE 29 JAN 82

BENCHING 15' pull, drill depth 16'



PLAN

pre shear holes 16+16 ÷ 15 = 21 holes
blast holes 4 × 9 = = 36'
57 holes

57 holes × 16 ft. depth = 912' ft.

DRILL PRODUCTION = 30 ft/hr./drill × 4 Drills = 120 ft.
912 ft. ÷ 120 ft = 7.6 hrs. ≈ 8 hrs includes moves.

Volume/Round: 15 × 16 ft. × 50/27 = 444.44 ¢ Bank × 1.25 = 555.55 cy loose

BLAST CYCLE = 57 Holes × 5 min/hole = 285 min ÷ 50 min/hr = 5.7 hrs.

Say 2 men loading holes = 5.7/2 = 2.85 hrs
Blow Out .50
3.35 ≈ 3.5 hrs.

Muck Cycle Say 2 mile haul = 20.3 min (see prev. sheet)
555.55 ¢ loose ÷ 20 cy/load = 28 loads per round.

Say 3 Trks reqd. @ 3 loads/hr./trk = 9 loads/hr.
∴ 28 loads ÷ 9/hr. = 3.1 Hrs. ≈ Say 4 Hrs. to muckout.

Labor. Drilling

1 foreman	(33.15)	33.15
4 wagon drillers	(32.08)	128.32
4 chuck Tend.	(31.43)	125.72
1 Drill Doc.		31.43
1 Comp Oper.		33.62

352.24 × 8 hrs + 10% = $3099.71 ÷ 444.44 ¢ = $6.97/¢

Blast.

1 powderman		32.43
2 helpers.	31.25	63.50
1 Lab.		30.54

126.47 × 3.5 + 10% = $486.92 ÷ 444.44 = $1.10/¢ (278.23; 0.63)

Excav

1 foreman		34.30
1 FEL Oper.		36.22
3-Trk Dr.	(33.09)	99.27
1 Dozer Oper.		36.22
1 Flagman	30.54	30.54

236.55 × 4 + 10% = $1040.82 ÷ 444.44 = $2.34/¢

MAT'LS

Powder 444.44 ¢ × 1.7 × 1.75 = $1322
Fuse & Cord. 57 × 3 (225) 171
Bits & Rod 912 × .25 (202) 228
Acc. 20% Powder 264
Delay 21 × 1.75 37

$2050 ÷ 444.44 = $4.61 (2022; 4.55)

Equip. Drilling

4 wagon Drills	(28.50)	114.00
4-600 cfm compr.	(27.00)	108.00
1 Bit Grinder		3.00
1 4×4 Pickup		25.00

250.00 × 9 = 2250 ÷ 444.44 = $5.06 (1200; 4.50)

Blast

1 Expl. Loader		41.00
panel Trk		25.00
pickup		25.00

91.00 × 3.5 hrs = 318.50 ÷ 444.44 = $0.72 (182; 0.41)

Excav.

1-5 ¢ Loader		87
3-R50 Trks	(140)	420
1 DC Dozer		36
1 pickup		25

568 × 4 = $2272 ÷ 444.44 = $5.11/¢

60.04.01 Form ...8A

(C) Production Rates - Devil Canyon Cable Shaft

C.D.C

ACRES

Calculations

SUBJECT: CABLE SHAFT
8ft Diameter

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. [illegible] DATE 12 Jan 82
APP DATE

Reference Main Access Shaft (portion)

Excav. w/ Alimac

Production : 30 CY/DAY

Cab	110.92	$ ~~83.43~~
Matl.	16.26	~~20.10~~
Equip.	81.95	~~72.77~~

36.88 (45.07)

$209.13 $ ~~181.30~~ ✓ OK per Fee C.

FORM NO. 152 REV. 1

(C) Production Rates - Devil Canyon Diversion Tunnel

C107

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION DIVERSION TUNNELS

JOB No.

SHEET OF

PROJECT

OPERATION No. REF.

BY R.Lang 16 Jan 82

CONTRACT DEVIL CANYON

DESCRIPTION

CKD T.L.H/e DATE 16 Jan 82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
DIVERSION TUNNELS 32' ϕ																
31.6 #/Hr EXCAVATION (Full face Method)		cy.	16.56		4.92						16.21				37.69	
Add. MATC for Services 13.50/LF x 20 Ft ÷ 600 cy/Rd =		cy.	16.56		.45						16.21	(7.29)		(8.92)	.45	
					5.37										38.14	
600 cy / 19 Hrs = 31.6 cy/Hr. x 18 Hr/DAY = 569 cy/Day																

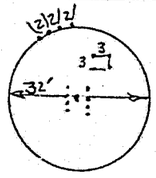
37.02.02 Form 131 A

Calculations

SUBJECT: DIVERSION TUNNELS

JOB NUMBER ____ FILE NUMBER ____ SHEET ____ OF ____
BY R. Lacy DATE 16 Jan 82
APP T. Little DATE 16 Jan 82

32ft. ϕ Tunnel
Drill 21ft.
Pull 20ft.



(FULL FACE METHOD)

Area = $32^2 \times .7854 = 804$ sf.
Volume = 30¢/CF × 20ft = 600¢/Round. Bank
× 1.25 = 750¢/Loose Haul.

Perimeter Holes = 32π ÷ 2 = 50 holes
Pattern Holes = 530 ÷ 9 = 59
Burn Holes 9
118 holes

118 holes × 21ft. = 2478 ft.
Using 2 - 4 Boom Jumbos @ 1½ ft min/drill × 50 min/hr = 55 ft/hr/drill
production = 4 × 2 × 55 = 440 ft
2478 ÷ 440 ft/hr = 5.6 hrs. ≈ 6 Hours
Say 9 hrs include moving, etc.

Haul Cycle - 1 mile haul
Load * 3.5 min
Travel Loaded 3.0 min @ 20 MPH (1760 fpm)
Dump 3.0 min
Return Empty 2.4 min @ 25 MPH (2220 fpm)
Spot * 3.0 min
14.9 min/cycle.

14.9 min ÷ 6.5* min/load = 3 Trucks Regd.

750 ¢ Haul / 20 ¢ load = 38 Loads × 6.5 min/load ÷ 50 min/hr = 5 hrs.

LABOR

DRILLING	1 foreman		33.15
	2 Jumbo Oper	(32.43)	64.86
	4 Driller	(32.08)	128.32
	4 chuck Tenders	(31.43)	125.72
	2 Drill Doc.	(31.43)	62.86
	2 Comp. Oper.	(33.62)	67.24
	2 Helpers	(30.54)	61.08
	17 men		543.23

543.23 × 9 hrs + 10% = 5377.57 ÷ 600 cy = $8.96/cy.

BLAST	1 powderman	32.43	32.43
	2 helpers	(31.75)	63.50
	1 laborer		30.54

126.47 × 5 hrs + 10% = 695.59 ÷ 600 cy = 1.16/cy.

Muck	1 foreman		34.30
	3 Trk dr.	(33.09)	99.27
	2 ~~EEL~~ oper	(36.22)	72.44
	1 flagman		30.54

236.55 × 5 hrs + 10% = 1301 ÷ 600 cy = 2.17/cy

Bull Gang & Service Crew (Same as Access Tunnel): 512.36/hr. × 5 = 1562 ÷ 600 cy = 4.27/cy.
225.81 + 286.55 = 512.36

TOTAL MATL from above = $4.92/¢ TOTAL LABOR → 16.56/¢

MATL

600 × 1.17 × 1.75 =	$1785
Fuse & Cord	335
Bits/Rod etc.	496
Acc.	268
Delays 39 × 1.8 =	70
2954 ÷ 600 =	$4.92/¢

Equipment

DRILL	2 - 4 Boom Jumbo's	(215)	430
	2 - 1000 cfm Comp	(45)	90
	2 - Bit Grinder	(10)	20
	1 pickup 4x4	(25)	25

565 × 9 hrs = 5085 ÷ 600 = 8.48/¢

BLAST	1 Explosive Loader		41.00
	Panel Truck		25.00
	pick up		25.00

91.00 × 5 hrs = 455 ÷ 600 = 0.76/¢

HAUL	3 - R50 Trucks	(140)	420
	1 FEL		87
	1 Dozer		85
	1 pick-up		25

617 × 5 hrs = 3085 ÷ 600 = 5.14/¢

Bull Gang & Ser. Equip
(Reference Access Tunnel.)
110 + 110 = 220 × 5 hrs = 1100 ÷ 600¢ = 1.83/¢

TOTAL EQUIPMENT. → 16.21/¢

60.04.01 Form ...-8A

C110

Calculations

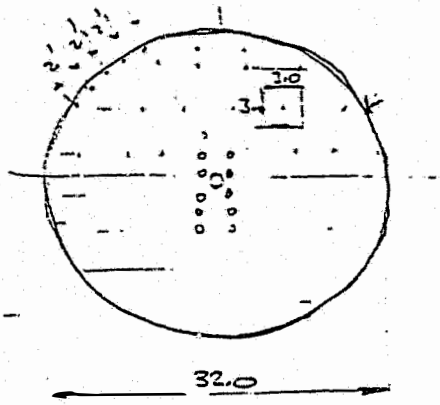
ACRES

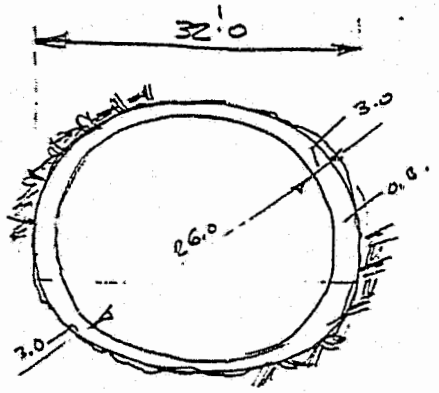
SUBJECT: DEVIL CANYON

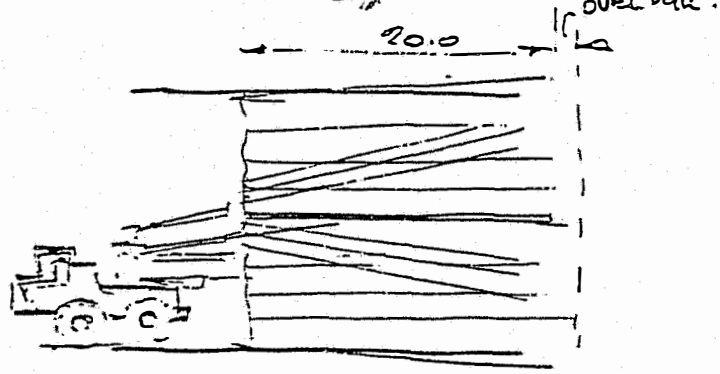
DIVERSION TUNNEL

JOB NUMBER
FILE NUMBER
SHEET 1 OF 1
BY DATE 10/22/81
✓APP RJH DATE 10/29/81

A = 804.0 □'







100.5 ÷ 2 = 50.0 PERIM HOLES
530 ÷ 9 = 59.0 PATTERN HOLES
9 - BURN HOLES
118 HOLES.

FULL FACE METHOD

USING 2 - 4 AUTO DRILL SUMMOS 1.1 ft/min
PRODUCTION IS = 4 × 2 × ~~35~~ 55 = ~~280~~ 440 ft/hr.
118 × 21 = 2478 ft. ÷ ~~280~~ 440 = ~~8.9~~ 5.6 = 6 = 9 HR.
SAY 9 ~~10~~ hr INCL MOVE OFF RIGS
SAME AS ~~SURRECH~~ TAILRACE TUNNEL.

Vol = 30 CY LF.

600 CYD ROUND.

MATERIAL

600 × 1.7 × 1.75 =	1785
FUSE, CORD =	335
BITS, ROD, ETC. =	496
ACCESSORIES =	268
DELAY 39 × 1.8 =	70
	$2954

LABOUR (DRILLING)

~~414.12~~ 277.15 /hr × ~~10~~ 9 = ~~4140~~ 2494

EQUIPT. DRILLING

~~338.0~~ 229 × ~~10~~ 9 = ~~3380~~ 2001

BLASTING

L = ~~108.16~~ 122.22 × ~~10~~ 5 = ~~1082~~ 611

E = 18.5 × ~~10~~ 5 = ~~185~~ 92.5

EXCAVATE

L = ~~273.02~~ 271.67 × 5 = ~~1390~~ 1453.35

E = 406.00 × 5 = 2030

T = ~~$15,161~~ $ ÷ 600 = ~~$25.27~~ $ /CY

BLASTING: 118 holes @ 5 min/hole. 590 minutes
590 ÷ 50 min/hr. = 11.8 hrs ÷ 3 min = 3.9 say 4.0 Hrs
move in/out & ventilate fr. 1.0
5 min

FORM NO. 152 REV. 1

(C) Production RAtes - Devil Canyon

Grout Galleries

C-117

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION GROUT GALLERIES 10'x10'

JOB No.

SHEET OF

PROJECT

OPERATION No. REF.

BY R. Lang 17 Jan 82

CONTRACT

DESCRIPTION

CKD FBB DATE 19 JAN 82

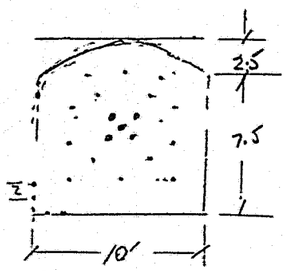
DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
EXCAVATION HORIZ.																
DRILL drill 5.5 pull 5.0 ft.				496.25								405.00				
EXPLOSIVES				208.38		294.76						182.00				
HAUL				54.21								63.25				
Service Crew (every other round)				343.07		75.00						137.50				
55 68.4¢/DAY	17.12	cy/Rd.		1104.91		369.76						787.75				2259.42
UNIT COST = HORIZ.		cy	64.36		27.60						46.01	(20.70)		(25.32)	131.97	
ALLOWANCE FOR WATER & GROUT PIPES					5.84										5.84	
$20.00 / LF x 5 = 100 ÷ 17.12 = 5.84					27.44										137.81	
EXCAVATION VERTICAL/~~INCLINE~~																
Allow 50% more for Lab & Equip due to delays.		cy	96.54		21.60						69.02				187.16	
55 x .70 = 39¢/ day.																
EXCAVATION - INCLINED																
ADD $5.84 FOR WATER & GROUT PIPES		cy	96.54		21.60						69.02				193.00	
					5.84											
					27.44											

ACRES

Calculations

SUBJECT: GROUT GALLERIES 10' X 10'

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lang DATE 17 Jan 82
✓APP RBB DATE 19 JAN 82



FULL FACE METHOD,

Area = (.1748 X 10²) + (10 X 7.5) = 92.48 SF (17.48 + 75)

Assume Pull 50% of width = 5 ft. = 17.1 cy.
Drill depth ≈ 5.5 ft.

PERIMETER DRILLING (40/2) = 40/1.5 — 27 — 20 holes
pattern drilling 92.48/6.6 — 14
burn holes — 5
39 holes (46)

(39) holes X 5.5 ft. = (215) ft drilling (46, 253)
Say 3 Boom Jumbo @ 1 ft/min/drill = 3 ft/min

215 ft ÷ 3 = 72 min ÷ 50 min/hr. = 1.4 hrs. Say 2 hrs. Round. (84, 1.7)

EXPLOSIVE LOADING 39 holes @ 5 min/hole = 195 min ÷ 50 min/hr = 3.9 hrs. (46, 4, 184, 3.7)
3.9 hrs Say 2 men loading ≈ 2 hrs.

Muck ≈ 92.48 SF X 5 ft pull ÷ 27 = 17.12 ¢ Bank X 1.25 = 21.4 cy Loose
Due to small size of gallery it is assumed a 3 cy Load, Haul, Dump Unit will be used to muck out the material. Allowing for an average hauling distance of 1000 ft it will take approximately 1/2 hr to muck out.
ALLOW HOIST & HEADFRAME 1/2 HR / ROUND.

Haul Cycle
1.00 min / load
1.13 min / travel loaded @ 10 MPH (880 ft/min) 1000/880 = 1.13 (1.14)
1.00 min / dump
1.13 min / return @ 10 MPH
4.26 min / 3 cy. ≈ 21.4 cy loose / 3 cy ≈ 7 loads @ 4.26 min = 29.8 min.

TOTAL CYCLE
DRILL 2 hrs
EXPLOSIVES 2
VENTILATE 1
MUCK 1/2
5 1/2 4 1/2 hrs

Say (2) Rounds / shift: (1.6)

17.12 X (2) = 34.2 cy/shift (1.6, 27.4)
68.4 cy/day (54.8)

LABOR DRILL
1 foreman 33.15
1 Jumbo Oper 32.43
1 Driller 32.08
(1) Chuck Tender 31.43 (62.86)
1 Drill Doc. 31.43
1 Comp Open 33.62
194.74 X 2 hrs + 10% = $427.10 (225.57)

Equip.
1 Jumbo 3 Boom — 136.00
1 - 600 cfm comp 38.50
Grinder 3.00
1 pick-up 4X4 25.00
496.25
$202.50 X2 = 403.00

EXPLOSIVES
1 Powderman 32.43
1 helper 31.75
1 Laborer 30.54
94.72 X 2 hrs + 10% = $208.38

Equip.
1 Exp. Loader $41.00
1 Panel Trk 25.00
1 Pick up 25.00
$91.00 X2 = $182.00

MUCK & HAUL
1 - Hoist oper. 33.62
1 - LHD oper. 34.41
1 - flagman 30.54
98.57 (64.95) X 1/2 + 10% = $35.72 (54.21)

Hoist LHD ≈ 64.50 / $62 / 126.50 X 1/2 = $31.00 (63.25)

SERVICE CREW & BULL GANG
1 foreman 31.35
2 helpers 30.54 61.08
1 Rigger 37.39
1 Open 34.41
1 pipefitter 44.33
1 elec 40.45
249.51 X 2 1/2 hrs + 10% = $686.15

Equip.
Cherry picker 60
2 pick up (25) 50
110 X 2 1/2 = $275 ÷ 2 = 137.50

ASSUME Services installed every other round = 686.15/2 = $343.07 (LAB)

MATLS. EXPLOSIVES 17.12 cy X 1.7 X 1.75 = $50.93
Fuses/Cord 39 holes X 3 = 117.00 (46) 138.00
Delay (20) X 1.20 = 24.00 (27) 32.40
Wire & Acc 20% powder = 10.18
Drill bit, rods, etc 215 (25) 53.95 (253) 63.25
$255.88 (294.76)
Service Matls (15 X 5) 75.00 → $330.86 (369.76) 132

60.04.01 Form 148A

(C) Production Rates - Devil Canyon

Surge Chamber

C115

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION SURGE CHAMBER

JOB No.

SHEET 1 OF 1

PROJECT

OPERATION No.

REF.

BY R. Lang 17 Jan 82

CONTRACT

DESCRIPTION

CKD RBB. DATE 19 JAN 82

	DESCRIPTION AND BASIS OF ESTIMATE		QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
	SURGE CHAMBER (EXCAVATION) Reference F. Toth backup w/adjustments 265 ft long, 54 ft wide																	
625/day	1. Access Tunnel thru Chamber	5	2719	cy	13.84	37631	6.44	17,510					13.63	37060			33.91	92,201
37.2 cy/day	2. Aux Shaft.	18.5	690	cy	189.27	130,596	22.67	15,642					115.30	79557			327.24	225,795
625 cy/day	3. Dome Slash	7.5	4671	cy	10.81	50,494	6.01	28,073					12.47	58,247			29.29	136,814
778 cy/day	4. CAVITY BENCHING	54.3	42,250	cy	11.78	497,705	4.49	189,702					10.32	436,020			26.59	1,123,427
	TOTALS	85.3 days.	50,330	cy		716,426		250,927						610,884				1,578,237
	AVG. UNIT COST.				14.23		4.99						12.14				31.36	

Avg Production/day $\frac{50,330}{85.3 \text{ days}} = 590$ & Avg/day

FOLD LENGT

12

11

8.5

8

AUTO

MANUA

FEED

7.02.02 Form 131A

C11E

Calculations

SUBJECT: SURGE CHAMBER 265ft. long 54'Wide x 16'Height top portion

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lang DATE 17 Jan 82
APP RBB DATE 19 JAN 82

			C	M	E	TOTAL
1	ACCESS TUNNEL PORTION (Same Cost as Access Tunnel)	625 ft/Day	13.24	6.44	13.63	33.91
2	AUX. SHAFT (Same Cost as Penstock Raise Climb)	30 ft/Day	189.27	22.67	115.30	327.24
3	DOME - SLASH (Same Cost as Access Tunnel Less Services	625 ft/Day	10.81	6.01	12.47	29.29
4.	SURGE CAVITY (BENCHING) (Ref. F. Toth Backup) Say 1 3/4 Rds (Day)	778 ft/Day	11.78	4.49	10.32	26.59

Benching (See Below)
Labor = $5241.62 ÷ 445 ft = 11.78
Matl. = 1999.40 = 4.49
Equip. = 4591.00 = 10.32
26.59

Benching Haul ⇒ Allow total 2 miles
Load = 3.5 min.
Travel loaded = 6.0 min @ 20 mPH
Dump = 3.0 min
Return Empty = 4.8 min @ 25 MPH
Spot = 3.0 min
20.3 min cycle = 3 Loads/hr.
445 CY ÷ 20 CY/Load = 22 Loads
22 Loads / 3 per hr./trk = 7.3 hrs. x 1.20 (50 min/hr.) = 8.76 hrs.
Say 9 hours ÷ 3 trucks = 3 hours.
20.3 min / 6.5 loader cycle = 3.12 Trucks
Say 3 Trucks

BENCHING

DRILL LABOR
1 foreman 33.15
4 Drillers (32.08) 128.32
4 Chuck Tend. (31.43) 125.72
1 Drill Doc. 31.43
1 Comp. Oper. 33.62
352.24 x 9 + 10% = $3487.18

Equip. 13 holes @ 16 ft.
4-Wagon Drills (28.50) 114.00
4-600 cfm Comp. (27.00) 108.00
1 Bit Grinder 3.00
1-4x4 Pickup 25.00
250.00 x 9 = $2250.00

MATLS.
Powder 445 x 1.7 x 1.75 = 1325.00
Fuse & Cord 225.50
Bits & Rods 201.60
Acc. 15% Powder 200.00
Delay 27 x 1.75 47.30
$1999.40

BLASTING
1 Powderman 32.43
2 Helpers (31.75) 63.50
1 LAB 30.54
126.47 x 7 + 10% = $973.82

Equip.
Explos loader 41.00
Panel Trk 25.00
pick up 25.00
91.00 x 7 = $637.00

EXCAV.
1 Foreman 34.50
1 5X Loader 36.22
3 Trk Dr. Dr. (33.09) 99.27
1 Dozer 36.22
1 Flagmen 30.54
236.55 x 3 + 10% = $780.62

Equip
1 D6 Dozer 36.
3-R50 TRKS (140) 420
1-Scy Loader 67
1-Pickup 25
568 x 3 = $1,704.00

60.04.01 Form 148A

131

Estimate Work Sheet

ITEM REFERENCE No.

JOB No.

DESCRIPTION SURGE CHAMBER ACCESS TUNNEL

SHEET OF

PROJECT

OPERATION No. REF.

BY R. Lang 22 Jan 82

CONTRACT #

DESCRIPTION

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
SURGE CHAMBER ACCESS TUNNEL 25 W X 20 h w/ Crown																
DRILL		CY	9.07		6.56						8.44					
BLAST			1.99								1.30					
MUCK - HAUL			2.48								5.88					
BULL GANG - SERVICE CREW			8.06		0.80						3.15					
UNIT COST		CY	21.60		7.36						18.77	(8.45)		(10.32)	47.73	

57.02.02 Form 131 A

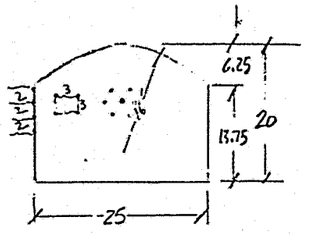
FOLD LENGT
12
11
8.5
8
AUTO
MANUA
FEED

C118

ACRES **Calculations**

SUBJECT: SURGE CHAMBER ACCESS TUNNEL

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Jang DATE 22 Jan 82
LAPP [illegible] DATE 22 Jan 82



Arc Length = 1.855(R) = 29.7 ft.
Crown Area = .1748 (25²) = 109.25 sf
Lower Area = 25 x 13.75 = 343.75
453.00 sf x 12.5/27 = 209.72 B℄
x 1.25 = 262.15 Loose ℄

Pull 50% width = 25 x .5 = 12.5 ft.
Drill Depth ≈ 14 ft.

ASSUME FULL FACE METHOD w/4 Boom Jumbo DRILLING

Perimeter Holes 25 + 13.75 + 13.75 + 29.7 ÷ 2 = 41 holes
pattern Holes 453 − (41 x 2) ÷ 9 = 41
Burn Holes 7
89 holes

Drill Cycle
89 holes x 14 ft = 1246 lf. drilling
Using 1-4 Boom Jumbo @ 1½ ft/min/drill
x 4 drills x 50 min/hr = 220 ft/hr.

∴ 1246 ÷ 220 ft/hr = 5.7 ≈ 6.0 HRS DRILLING

BLAST 89 holes @ 3 min/hole = 267 min ÷ 50 min/hr = 5.34 hrs.
Say 2 men loading = 5.34 ÷ 2 = 2.67 ≈ 3 Hours BLAST

MUCK-HAUL Load * 3.5 min
2 MILE HAUL Travel Loaded 6.0
Dump 3.0
Travel Empty 4.8
Spot * 3.0
20.3 min./Trk cycle

20.3 ÷ 6.5* = 3.12 Trucks ≈ 3 Trucks Req'd.

262.15 ℄ Loose / 20 ℄ Load = 13 LOADS x 6.5 min/Load = 84.5 min
84.5 min ÷ 50 min/hr. = 1.7 ≈ 2 hrs Muck

MATERIAL

Explos. 209.72 x 1.7 x 1.75 =	$623.92
Fuse/Cord 89 holes x 3 =	267.00
Bits, Rod, etc. 1246 x .25 =	311.50
Accessories 20% Explos =	124.78
Delays 41 x 1.20 =	49.20
	$1376.40
	= 6.56 CY

SERVICES MAT'L
$13.50 LF x 12.5 = $168.75
$0.80 ℄

DRILLING

LABOR		Equip.	
1 foreman	33.15	1-4 Boom Jumbo	215
1 Jumbo Open	32.43	1 1000 cfm compr.	45
2 Drillers (32.08)	64.16	1 Bit Grinder	10
2 Check Tend (31.43)	62.88	1 Pick up	25
1 Drill Doc	31.43		295
1 Comp Open	33.62		x 8 hrs
1 helper	30.54		

288.19 x 6 hrs + 10% = $1,902.05 = $9.07 ℄ $1770 = $8.44 ℄

BLAST

LABOR		Equip.	
1 powderman	32.43	1 Exp. Loader	41
2 helpers (31.75)	63.50	Panel Trk	25
1 laboren	30.54	Pick up	25
			91
			x 3 HRS

126.47 x 3 + 10% = $417.35 = $1.99 ℄ $273 = $1.30 ℄

MUCK-HAUL

LABOR			
1 foreman	34.30	3 R50 Trks (140)	420
3 Trk. Dr (33.09)	99.27	1 FEL	87
1 FEL Oper.	36.22	1 DOZER	85
1 DOZER Open	36.22	1 Pick up	25
1 flagman	30.54		617
			x 2

$236.55 x 2 hrs + 10% = $520.41 = $2.48 ℄ $1234 = $5.88 ℄

BULL GANG - SER. CREW
Reference Access Tunnel

LABOR
512.36 x 3 hrs + 10% = $1690.79 = $8.06 ℄
EQUIPMENT 220 x 3 hrs = $660 = $3.15 CY

60.04.01 Form 148A

ACRES

Calculations

SUBJECT: SURGE CHAMBER EXCAV.

JOB NUMBER
FILE NUMBER
SHEET OF
BY DATE
APP DATE

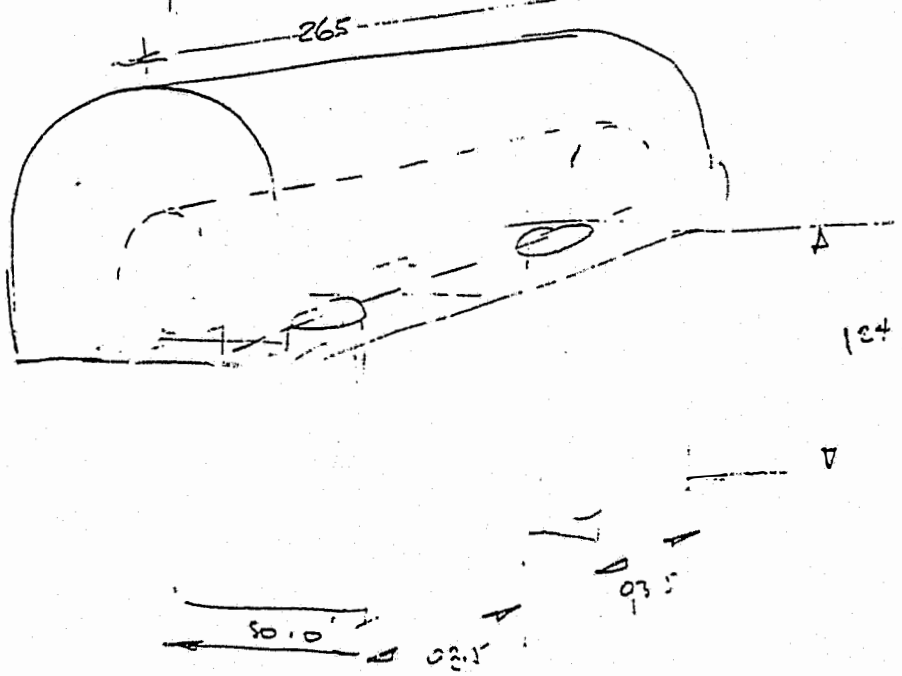
181 hrs
458
383
1895
2917 hrs
÷ 18 hrs/day
162 days

1, ACCESS TUNNEL	= 2719 CY ×	34.65	= 94,213	1 =	1542 : 10 hrs : 15 cy/hr.
2, DOME	= 4671 CY ×	32.81	= 153,255		10.2
3. AUX SHAFTS	= 690 CY ×	144.78	= 99,898		1.5
4 SURGE CAVITY	= 42,250 CY ×	23.90	= 1,009,275		22.3
			$ 2,366,916		

O.H. & MARKUP 1.55 · $3,668,720 ÷ 50,330 = 72.89.

U/C $73.00/CY

1. ACCESS TUNNEL THROUGH SURGE CH.



FORM NO. 152 REV. 1

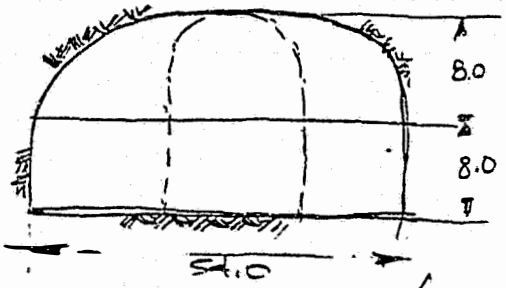
C120

ACRES **Calculations** DEVIL CANYON

SUBJECT: — SURGECHAMBER EXCAV. —

JOB NUMBER
FILE NUMBER
SHEET 1 OF 4
BY DATE
✓APP RJH DATE 10/28/81

1) DRIVE ACCESS TUNNEL THROUGH THE CENTER OF SURGE CHAMBER DOME. USING A 4-DRILL AUTO JUMBO.



LABOUR (DRILLING)

1- FOREMAN		~~31.00~~	32.05	
~~2~~ 1- JUMBO OP	~~28.50~~	~~57.60~~	31.30	
~~2~~ 1- DRILL HELP	~~26.50~~	53.00	30.39	140.68 ✓
~~1- COMPR OP.~~		~~26.80~~	—	
1- DRILL DOC.		~~29.00~~	30.39	
½ MECH. 33.09	~~29.55~~	~~14.78~~	16.55	

~~219.15~~ /h. × 8 = ~~1697.4~~ $1125.44

- EQUIPMENT - 140.68 × 8 u/c = 7.30

1- HYDRA DRILL	195.50
1- 1000 CFM COMPR.	~~[illegible]~~
1- 3/4 TON PICKUP	14.00
1- IT. PANEL	16.00

~~179.50~~ 125.50 × 8 = ~~1436.0~~ $ 6.52 1004 ✓

MATERIALS

DRILL BITS, ROD ETC. 20×784 =	157.0	÷154 = 1.02
EXPLOSIVE 1.5×154×2.00 =	462.0	
FUSE & CORD 49×1.50 =	73.5	67 ÷ 154 = 4.36
DELAY 28×1.75 =	43.0	49
ACCESSORIES 20% POWDER =	92.5	
	$828.0	$5.34

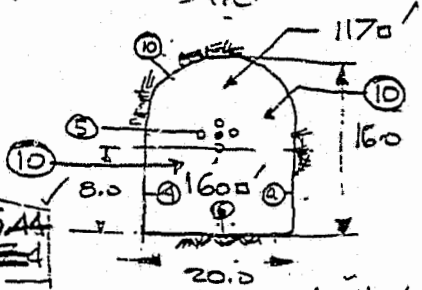
5.32

EQUIPMENT (LOAD & HAUL)

6- 25 TR.	55.0	330.00
1- SQ. F.EL		62.00
1- PICKUP		14.00
		406.00 × 2 = 812.0

$ 5.27

L = 11.09
M = 5.38
E = 11.79
28.26



T - 49 HOLES.

FULL-FACE EXCAV.

49 × 16 = 784 ft.
784 ÷ 4 = 196 ft/DRILL

ASSUMMED PRODUCTION:
25 ft/HR 196 ÷ 25 = 7.8 HR

LOAD & BLAST → 2.2 --
10.0 HR

VOLUME / ROUND = 10.26 cy/ft
15 × 10.26 = 154 CY/ROUND

LOOSE 1.25×154 = 193 CY FOR HAUL ONLY

LOAD & HAUL (LAB)

1- FOREMAN		~~29.70~~	34.08
6- TRUCK DR 32.21	~~28.20~~	~~169.20~~	193.26
1- F.EL.		~~28.80~~	34.77
1- FLAG.MAN	~~25.16~~	~~50.32~~	29.56
		~~278.02~~	291.67

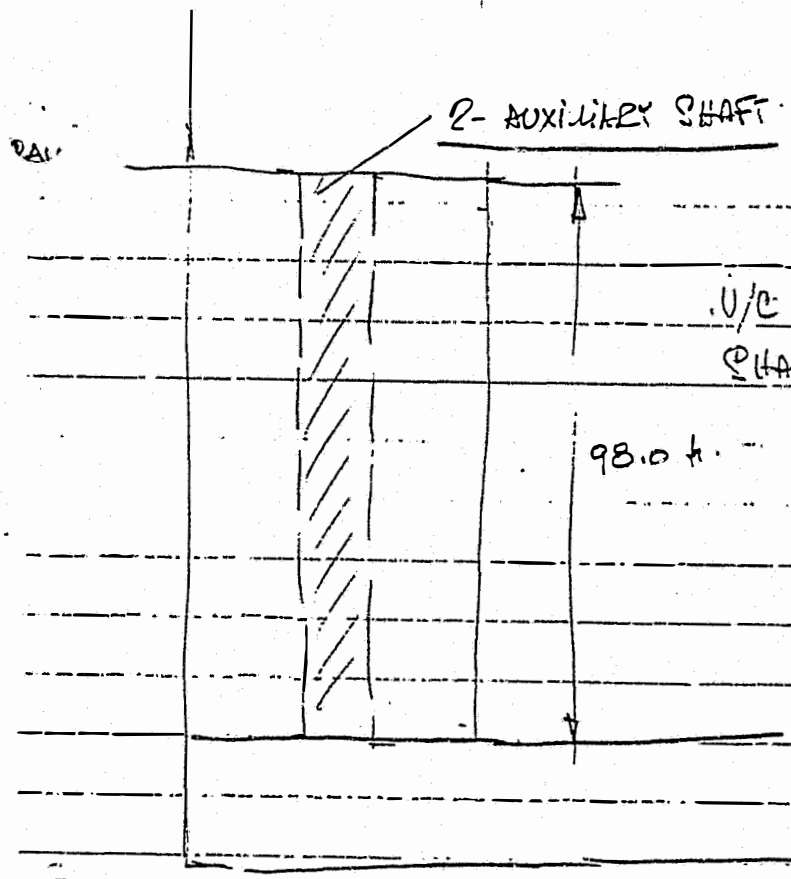
~~278.02~~ 291.67 × 2 = ~~556.0~~ 583.34 ÷ 154 cy = 3.79

T = 5329 ÷ 154 = ~~$ 34.61/CY~~
5335.40

FORM NO. 152 REV. 1

C121

② -4



VOL = 345 CY × 2 = $\boxed{690\ CY}$

U/C FROM PENSTOCK AUXILIARY 10'Φ SHAFT EXCAV.

LABOUR = $ ~~80.16~~ 73.22 /CY × 690 = $ ~~55,310~~ 50,521 :-

EQUIPMENT = $ ~~55.59~~ 43.31 /CY × 690 = $ 38,357 :- 29,854

MAT'L $ 9.03 × 690 = $ 6,231 :-

~~$ 144.78~~ /CY ~~$ 99,898~~ :- 107,626

125.56

U/C = $\boxed{99,898 \div 690}$ = $\boxed{\$\ 144.78/CY}$

~~[illegible]~~ = ~~[illegible]~~

$\frac{29\%}{16\ Hrs.}$ = 1.8 cy/Hr.

6 Jan 82
R. Tay
141.

ACRES **Calculations**

SUBJECT: DEVIL CANYON
SURGE CHAMBER EXCAVATION

JOB NUMBER
FILE NUMBER
SHEET 3 OF 4
BY DATE
APP DATE

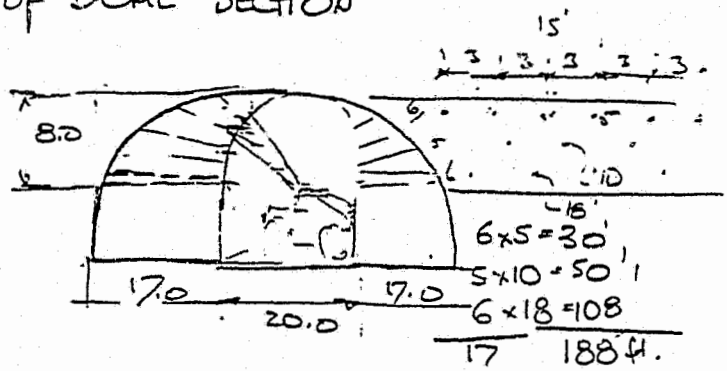
2, EXCAVATE TOP HEADING OF DOME SECTION

LABOUR (SAME AS ACCESS TUNNEL)

~~212.18~~/h × 2.5 = ~~$ 530.45~~ 352
~~[illegible]~~ 140.68

EQUIPT:

~~179.5~~ × 2.5 = ~~$ 448.75~~ 313.75
125.50



6×5 = 30
5×10 = 50
6×18 = 108
17 188 ft.

MAT'L

	$
DRILL BITS RODS ETC .20×188 =	37.60
EXPLOSIVE 1.5 × 56 × 2. =	168.00
FUSE & CORD 17 × 1.50 =	25.50
DELAY 8 × 1.75 =	14.00
ACCESSORIES 20% of POWDER =	33.60
	278.70

DRILL PRODUCTION 20 ft/HR / DRILL.
INCL. MOVES. 4 DRILLS = 80 ft/HR.
188 ÷ 80 = 2.35 = 2.5 hr. DRILL TIME.
VOL (12.5 × 8 × 15) ÷ 27 = 56 CY.

BLASTING.

1- POWDERMAN ~~30.00~~ 31.30
1- HELP ~~26.50~~ 30.68
61.98 × 2 = 123.96
~~56.50~~ × 2 = ~~113.00~~

EQUIPMENT (BLAST)

1- PANEL TRUCK 16.00 × 2 = 32.00

T = 1837.32 ÷ 56 = $32.81/CY.

LABOUR HAUL

1- FOREMAN		~~29.70~~	34.05
3- 25T DRIVER	32.21 ~~28.20~~	84.60	96.63
1- F.E.L.	34.77	~~28.80~~	34.77
2- FLAG. MAN	29.56 ~~25.16~~	50.32	59.12
		~~193.42~~	

193.42 × 1 = ~~193.42~~ $224.65

EQUIPMENT HAUL

3- 25T TR.	55.0	165.00
1- 5CY F.E.L.		62.00
1- PICKUP		14.00
		241.00

LABOUR	352.00 + 123.96 + 224.6 =	700.56	12.51
MATL		278.70	4.98
EQUIP.	313.75 + 32 + 241	586.75	10.48
		1566.01 ÷ 56 =	27.96

56
5.5 hrs

FORM NO. 152 REV. 1

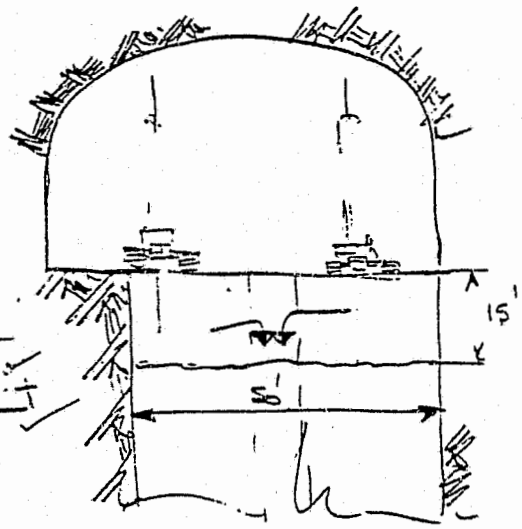
ACRES **Calculations**

SUBJECT: DEVIL CANYON

SURGE CHAMBER EXCAVATION

JOB NUMBER
FILE NUMBER
SHEET 4 OF 4
BY DATE
APP DATE

3, BENCHING & DISPOSING ROCK THROUGH AUXILLIARY SHAFTS.



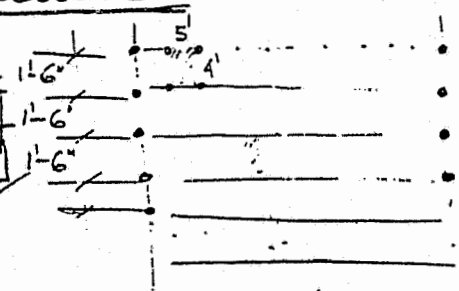
~ LABOUR (DRILLING) ~

1- FOREMAN 32.05		~~31.00~~	32.05
4- DRILLER 31.30	~~28.80~~	~~115.20~~	125.20
4- CH TENDER 30.39	~~26.50~~	~~106.00~~	121.56
1- DRILL DOC 30.39		~~29.25~~	30.39
~~1- Compr. op~~		~~26.80~~	309.20
		~~308.25~~ 309.20	/hr. x10 = $ ~~3083~~ 3092

EQUIPMENT (DRILLING)

4. WAGON DRILL	28.50	114.00
~~4- 600 CFM COMPR.~~	~~27.00~~	~~108.00~~
1- BIT GRINDER		3.00
1- 4x4 pickup		16.00
		~~241.00~~ 133.00 x 10 = $ 2410 1330

~ PRODUCTION ~



27 PRE SHEARING HOLES
36 BLAST HOLES.
63 HOLES DEPTH - 16 ft.

L: 5015.54 × 11.27 (UC)
N. 1999.40 = 4.49
E 2791.50 - 6.27
22.03

~ MATERIALS ~

POWDER 445 × 1.7 × 1.75	=	1,325.00
FUSE & CORD	=	225.50
BITS & RODS.	=	201.60
ACCESSORIES 15% POWDER	=	200.00
DELAY 27 × 1.75		47.30
		$1999.40

DRILL PRODUCTION:
~~26~~ 30 ft/HR / DRILL 4 DRILLS = ~~104~~ 120 ft/HR
TOTAL LENGTH of HOLES = 63 × 16 = 1008 ft
1008 ÷ ~~104~~ 120 = 9.69 ≈ ~~10~~ HR.
8.4 ≈ 9

VOLUME:
50 × 16 × 15 ÷ 27 = 445 CY
445 × 1.25 (HEAVE) = 556 CY FOR HAUL.

445 / 20 hrs = 22.3 cy/hr

~ EXCAVATE ~

LABOUR.-

1- FOREMAN		~~29.70~~	34.08
1- 5CT TRACK LOP.		~~28.80~~	34.77
6- 25T. DRIVER 32.24	~~28.20~~	~~169.20~~	193.26
1- F.E.L. OP		~~28.80~~	34.77
2.- FLAGMAN 29.56	~~25.16~~	~~50.32~~	59.12
		356.00 ~~306.82~~	× 3 = $ 1068.00 ~~920.46~~
1- D6 DOZER		36.00	
6- 25T TRUCK	55.00	330.00	
1- 5CT F.E.L.		62.00	
1- PICKUP 4x4		16.00	
		444.00	× 3 = $ 1332.00

EQUIPMENT (BLAST)

1- PANEL TR	16.0
TOOLS	2.5
	8.5
18/5 × 7 =	129.50

356

BLASTING

1- POWDERMAN		~~30.00~~	31.30
2- HELP 30.68	~~26.50~~	53.00	61.36
1- LAB		~~25.16~~	29.56
		~~108.16~~	122.22

108.16 × 7 = $ 757.12
122.22 × 7
855.54

T = 10,631.47 ÷ 445 = ~~23.90~~ /CY

FORM NO. 152 REV. 1

(C) Production Rates - Devil Canyon

Penstock

Calculations

JOB NUMBER
FILE NUMBER

ACRES **Estimate Work Sheet**

ITEM REFERENCE No. JOB No.

DESCRIPTION Penstock Lower Tunnel Access SHEET OF

PROJECT OPERATION No. REF. BY L. Gay 22 Jan 82

CONTRACT DESCRIPTION ✓CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Penstock Lower Access Tunnels 22x22 w/crown															*	
Drill 5 hr.		cy	8.60		6.73						8.09					
Blast 3			2.29								1.50					
Muck-Haul 2			2.85								6.77					
Bull Gang & Service Crew —			9.27		0.81						3.62					
10 hr.																
182 cy / 10 hr. = 18.2/hr x 18 = 327 cy/day			23.01		7.54						19.98	(8.99)		(10.99)	50.53	

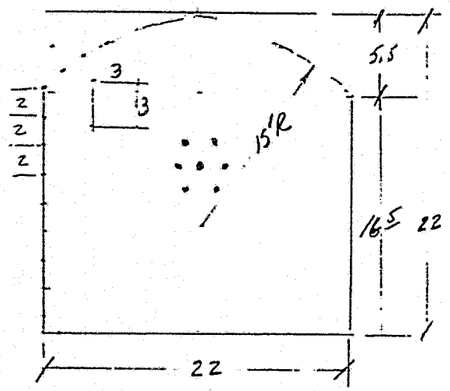
57.02.02 Form 131A

ACRES Estimate — JOB No. — SHEET OF — TOCK

ACRES **Calculations**

SUBJECT: PENSTOCK LOWER TUNNELS

JOB NUMBER
FILE NUMBER
SHEET OF
BY K Lacy DATE 21 Jan 82
APP R. Bear DATE 22 JAN 82



Arc Length = 1.855(R) = 27.8 ft.

Crown Area = .1748(22)² = 84.60 sf
Lower Area = 16.5 x 22 = 363.00
447.60 sf.

Assume Full Face Method
Pull 50% Width = 11 ft. x 447.6/27 = 182.4 CB x 1.25 = 228 CY/case
Drill = 12 ft.

perimeter holes 28 + 33 + 22 ÷ 2 = 41
pattern holes 447.60 − (4 x 2) ÷ 9 = 40
burn holes 7
88 holes

88 holes x 12 ft = 1056 Lf. drilling
Using 1-4 Boom Jumbo @ 12 ft/min/drill
x 4 drills x 50 min/hr = 2200 ft/hr

∴ 1056 ft ÷ 2200 ft/hr. = 4.80 hrs. ≈ 5.0 Hrs.

BLAST Cycle
88 holes @ 3 min/hole = 264 min.
264 ÷ 50 min/hr. = 5.28 hrs.
Say 2 men loading = 2.6 ≈ 3 hrs.

MUCK Cycle - 2 mile Haul
Load + 3.5 min
Travel loaded 6.0' (20 MPH)
Dump 3.0'
Travel Empty 4.8' (25 MPH)
Spot + 3.0'
20.3 min/trk cycle
20.3 min ÷ 6.5* = 3.12 Trks = Say 3 Trks Reqd.

228 CY Loose / 20 CY/Trk = 12 Loads x 6.5 min/load = 78 min.
78 min ÷ 50 min/hr. = 1.56 Hrs ≈ 2 hours.

LABOR Drilling

			Equip	
1 Foreman	33.15		1 - 4 Boom Jumbo	215
1 Jumbo oper	32.43		1 - 1000 cfm compr.	45
2 Drillers	(32.08)	64.16	1 Bit Grinder	10
2 Chuck Tenders	(31.43)	62.86	1 Pick up.	25
1 Drill Doc.	31.43			295 x 3/3 = 8.09
1 Comp Oper	33.62			
1 helper	30.54			

288.19 x 5 hrs + 10% = 1585.03 ÷ 182.4 = $8.69/CY

BLAST

			Equip	
Labor: 1 powderman	32.43		1 Exp. loader	41
2 helpers	(31.75)	63.50	Panel Trk	25
1 laborer	30.54		Pick up	25

91 x 3 = 273 ÷ 182.4 = 1.50
126.47 x 3 hrs + 10% = $417.35 ÷ 182.4 = $2.29/CY

MUCK/HAUL

Labor: 1 foreman	34.30		3-R50 Trks (140)	420
3 Trk Dr.	(33.09)	99.27	1 FEL	27
1 FEL oper	36.22		1 Dozer	85
1 Dozer oper.	36.22		1 Pickup	25
1 flagman	30.54		617 x 2 = 1234 ÷ 182.4 = 6.77	

236.55 x 2 + 10% = $520.41 ÷ 182.4 = $2.85/CY

MATERIALS
Explos. 182.4 x 1.7 x 1.75 = 542.64
Fuse & Cord = 88 holes x 3' = 264.00
Bits, Rod, etc. 1056 ft x .25 = 264.00
Access. 20% Expl. = 108.53
Delays 41 x 1.20 = 49.20
$1,228.37 ÷ 182.4 CY = $6.73/CY

Bull Gang & Ser. Crew (Reforma Access Tunnel) = 220 x 3 hrs = $660 ÷ 182.4 = $3.62/CY EQUIP

" " " = 512.36 x 3 hrs + 10% = $1690.79 ÷ 182.4 = $9.27/CY LABOR $6.18/CY

Services Main 13.50/LF x 11 ft. = $148.50 ÷ 182.4 CY = $0.81/CY

60.04.01 Fo... .48A

Calculatio

JOB NUMBER

Estimate Work Sheet

ITEM REFERENCE No.

JOB No.

DESCRIPTION Inclined Penstock

SHEET OF

PROJECT

OPERATION No. REF.

BY R Lang 16 Feb 82

CONTRACT

DESCRIPTION

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Incline Penstock																
8'ϕ Alimac Raise	15	cy/Rd.	165.59	2484	22.67	340	—		—		46.20	693	32.48	847	290.94	4364
16'ϕ Slashing	61.4	cy/Rd.	20.42	1254	8.18	502			—		11.08	680	13.54	831	53.21	3267
	76.4	cy		3738		842						1373		1678		7631
Unit Cost:			48.93		11.02						17.97		21.96		99.88	

148

5702.02 Form 131A

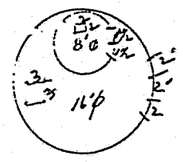
ACRES **Calculations**

SUBJECT: PENSTOCK EXCAVATION (INCLINE)

Revised to 30 ft/hour drill production.
Changed drill pattern from 2x2 to 3x3

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lay DATE 15 Feb 82
APP DATE

16 ft. ϕ Penstock



1. Drive incline shaft with ALIMAC RAISE CLIMBER 8' ϕ
2. Excavate to full 16 ft. ϕ Slashing Method Using a 4-Boom Jumbo. Rock will be pushed to 8' ϕ incline & excavated material hauled thru the Access Tunnel.
   Hoist & Head frame will be required to raise & lower Equipment for Slashing Operations

Area 8' ϕ = 50.3 sf × 8' pull = 15¢/Round.
Area 16' ϕ = 201.1 − 50.3 = 150.8 sf × 11' pull = 61.4¢/Round

1 - 8' ϕ perimeter holes. $\pi d \div 1\frac{1}{2}'$ = 17 holes
Burn & Pattern holes 50 sf ÷ 4 = 13
30 holes

DRILL 30 holes × 9 ft = 270 ft.
DRILL PRODUCTION = 30 ft/hr/drill includes setup.
270 ft. ÷ 30 = 9 hours w/2 drills = 4½ hours.

2 - 16' ϕ perimeter holes = $\pi d \div 2'$ = 25 holes
pattern holes = 150.4 ÷ 9 sf = 17 holes
42 holes

DRILL 42 holes × 12' = 504 ft.
DRILL PRODUCTION = 1.0 ft/min/drill × 4 drills = 4 ft/min
504 ft. ÷ 4 ft/min = 126 min ÷ 50 min/hr. = 2.5 Hours.

EXPLOSIVE LOADING

1. — 8' ϕ ≈ 5 min/hole × 30 holes ÷ 50 min/hr. = 3 hrs.
Ventilate ≈ ½ hr.
3½ hours.

2. - 16' ϕ ≈ 5 min/hole × 42 holes ÷ 50 min/hr. = 4.2 hrs.
Say 2 men loading = 2.1 hrs.
Ventilate = .5 hrs.
2.6 hrs.
Say 3.0 hrs.

1. DRILL & BLAST CYCLE (ALIMAC) 4½ hrs.
3½
8 hours. = 15.0¢

2. DRILL 16' ϕ Area = 2.5 ~~5 hrs.~~
2.5 ~~5 hrs.~~
5.0 ~~6 hours~~ = 61.4¢

HAUL TIME: 8' ϕ = 15.0¢ × 1.25 = 18.8¢ loose = Say ½ hrs. FEL open Trk. Dr.

16' ϕ = 61.4¢ × 1.25 = 76.7¢ loose = Say 1 hr. FEL open Trk Dr.

60.04.01 Form 148A

C130

ACRES

Calculations

SUBJECT: PENSTOCK EXCAVATION (INCLINE)

Revised per L. Cousineau Feb. 15-82

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lang DATE 15 Feb 82
APP DATE

1. 8' ϕ Inclined Alimac Raise Volume = 15¢/Round

LABOR DRILL & BLAST

1 foreman		$33.15	
2 Drillers	(32.08)	64.16	
1 Comp. Oper.		33.62	
1 Labor		30.54	
		$161.47 X 8 hrs + 10%	$1420.94

MUCK

1/2 FEL Oper (36.22)		$18.11	
1/2 Trk Dr. (33.09)		16.54	
		$34.65 + 10%	38.11

SERVICE & BULL GANG (Reference Access Tunnel)

$512.36/hr. Say 2 hrs = 1024.72

TOTAL $2,483.77

UNIT COST @ 15¢/Round 115.59

EQUIPMENT

1 Alimac	60.00	
2 Stoper drills (20)	40.00	
1-600 cfm compr.	38.50	
1 Bit Grinder	10.00	
	$148.50 X 4 1/2 hrs. =	$668.25
Panel Trk	25.-	
Exp. Loader	41.-	
Pick up	25.-	
	91.- X 3 1/2 hrs.	318.50
FEL	87.-	
R50 Trk	140	
	227 X 1/2 hrs.	113.50
Bull Gang & Sen Crew	220 X 2 hrs =	440.00
		$1,540.25

102.68 — 46.20, 56.48

MATERIALS

Drill Bits, Rod etc. 70 ft. X .25 =	67.50
Expl. 1.5 X 15¢ X 2.0	45.00
Fuse & Cord 30 holes X 3	90.00
Delay 17 X 1.20	20.50
Wire & Access 20% powder	9.00
	232.00 ÷ 15¢ = $15.47/¢

MATERIAL-Service $13.50/LF X 8 = 108.00 ÷ 15¢ = 7.20

$22.67/¢

60.04.01 Form 148A

ACRES **Estimate Work** JOB No.

C130

ACRES **Calculations**

SUBJECT: PENSTOCK EXCAVATION (INCLINE)

JOB NUMBER
FILE NUMBER
SHEET OF
BY Lang DATE 2-16-82
APP DATE

SLASHING w/ 4 Boom Jumbo = 61.4 ¢/Round

LABOR

Drilling · 1 foreman	33.15	
Jumbo oper.	32.43	
2 drillers (32.08)	64.16	
2 Chk Tend. (31.43)	62.86	
1 Oper. Oper.	33.62	
1 Helper	30.54	
	256.76 x 2 ¢/Hrs + 10%	= $564.87
Blast 1 powderman	32.43	
2 helpers (31.75)	63.50	
1 Cabl	30.54	
	126.47 (2 ¢/hrs + 10%)	= $347.79
Push & Muck oper FEL	36.22	
oper Dozer	34.41	
Trk Dr	33.09	
	103.72 x 1 hr. + 10%	= $114.09

SERVICE CREW w/ ALIMAK RAISE

Hoist Oper 34.41 x 6 Hrs. + 10% $227.11

TOTAL / ROUND $1,253.86

UNIT COST @ 61.4 ¢/ROUND 20.42 / ¢

Equip

1-4 Boom Jumbo	$215.00	
Bit Grinder	10	
Pick up 4x4	25	
	250 x 25	= $625.00
Expl. Loader	41	
Panel Trk	25	
pick up	25	
	91 x 25	227.50
Dozer	45	
FEL	87	
Dump Trk (R50)	140	
	272 x 1	272.00
Hoist & Frame	64.50 x 6 ·	387.00

$1,511.50

$24.62 / ¢ < 11.08 own, 13.54 oper

MARRIAGES

Expl.	61.4 ¢ x 1.7 x 1.75 =	$183
Fuse & Cord.	42 x 3	126
Bits, Rod, etc	504 ft x .25 =	126
Delays	25 x 1.20 =	30
Wire & Acc = 20% powder		= 37
		$502

$502.00

$8.18

60.04.01 Form 148A

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C132

Calculations

JOB NUMBER P5700.09

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION PENSTOCK

OPERATION No. REF.

DESCRIPTION

JOB No.

SHEET 1 OF

BY R Lacy 17 Jan 82

CKD RBB DATE 18 Jan 82

PROJECT

CONTRACT

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
INCLINED PENSTOCK 16'ϕ																
~~30/DAY~~ ALIMAC RAISE CLIMB 8'ϕ (10ft) 12HR	15.	cy	189.27	2839.05	22.67	340.05					115.30	1729.50			327.24	4908.60
~~61.4/DAY~~ SLASH ⊄ 16'ϕ 10	61.4	cy	57.42	3525.59	12.49	766.89					63.54	3901.35			133.45	8193.83
91.4 ÷ 2 = ~~45/7 ¢/Day~~	76.4	cy	83.31	6364.64	14.49	1106.94					73.70	5630.85 (33.16)		(40.54)	171.50	13,102.43

76.4 cy / 21.5 hrs = (18) 64 ¢/Day

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57.02.02 Form 131 A

C132

ACRES **Calculations**

SUBJECT:

JOB NUMBER P5700.09
FILE NUMBER
SHEET 3 OF

ACRES **Calculations**

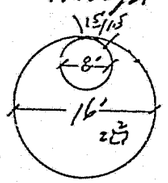
SUBJECT: PENSTOCK EXCAVATION

JOB NUMBER P5700.09
FILE NUMBER
SHEET 1 OF
BY R.Clary DATE 16 Jan 82
APP RBB DATE 18 JAN 82

16 ft. ϕ Penstock

1.- Drive incline shaft in the middle of penstock with "ALIMAK" RaiseClimber

2.- Excavate with slash method using 4-Boom Jumbo. Rock will be ~~dumped~~ pushed to the incline shaft & removed through the access tunnel. Hoist & Headframe will be required to raise & lower equipment for slashing operations



Area 8'ϕ = 50.3 SF = 1.86 ℄/LF x 8' = 15 cy/round
AREA 16'ϕ = 201.1 - 50.3 = 150.8 SF = 5.58 ℄/LF x 11' = 61.4 cy/round

1.) 8'ϕ = perimeter holes π0 ÷ 1½' = 17 holes.
BURN & pattern holes 50 ÷ 4 = 13
30 holes

DRILL 30 holes x 9 (10) ft./round. = 270 (300) ft.

DRILL PRODUCTION = 20 ft/hr./drill includes setup.

270 (300) ft. ÷ 20 = 13.5 (15) hrs w/2 drills = 6.75 (7½) hrs. Say 7 HRS

2.) 16'ϕ = perimeter holes π16 ÷ 1½ = 33 holes
pattern holes = 150.8 ÷ 4 = 37
70 holes

DRILL PRODUCTION = 75 ft/min/drill x 4 = 3 ft/min.

(SLANT HOLED) 70 holes x 12 (10) = 840 (700) ft. ÷ 3 = 280 (233) min ÷ 50 min/hr. 5.6 (4.7) = 6 (5) hrs.

EXPLOSIVE LOADING

1.) 8'ϕ = 5 min hole x 30 holes = 150 min ÷ 50 min/hr = 3 hrs (OVERHEAD)
3 hrs Say 2 men loading = 7½ hrs. NO

2) 16'ϕ = 5 min hole x 70 holes = 350 min ÷ 50 min/hr = 7 hrs.
7 hrs with say 2 men loading = 3½ hrs.
VENTILATE = ½/4

1.- 8'ϕ drill/blast cycle = 7 (5) hrs + 3 (2½) hrs = 10 (8) hrs. ✓ = 15 (18.6) cy.

2.- 16'ϕ drill-blast cycle = 8 (5) hrs. + 3½ hrs = 11½ (9) hrs ✓ = 61.4 (55.8) cy.

Haul Time = 8'ϕ = 15 (18.6) ℄ x 1.25 = 18.9 (23.2) ℄ loose = Say ½ hr. FEL open Trk Dr.

16'ϕ = 61.4 (55.8) ℄ x 1.25 = 76.7 (69.7) ℄ loose = Say 1 hr. FEL oper Trk Dr. 1 Dr. Doz. D-4

60.04.01 Form 148A

ACRES **Calculations**
SUBJECT:

JOB NUMBER P5700.09
FILE NUMBER
SHEET 3 OF

ACRES **Calculations**
SUBJECT: INCLINED PENSTOCK

JOB NUMBER P5700.09
FILE NUMBER
SHEET 3 OF
BY R. Cary DATE 17 Jan 82
APP R. Ibb. DATE 18 Jan 82

(2) Slashing (Using 4 Boom Jumbo lowered on hoist)

LABOR
DRILLING
1 foreman 33.15
1 Jumbo Oper 32.43
2 Drillers (32.08) 64.16
2 Chuck Tend. (31.43) 62.86
1 Comp Oper 33.62
1 Helper 30.54
256.76 × 8 hrs + 10% = $2259.49 / $1412.48

BLAST
1 powderman 32.43
2 helpers (31.75) 63.50
1 Laborer 30.54
126.47 × 4 hrs + 10% = 556.47

EQUIPMENT
1 4 Boom Jumbo — $215
~~1 1000 cfm comp — 45~~ NOT REQD
1 Bit Grinder 10
1 Pick up 4×4 25
250 × 8 = $2000.00 / $1475.00

1 Explosive Loader 41
1 Panel Trk 25
1 Pick up 25
91 × 4 + 10% = 400.40

MATERIALS 61.4 (55.8 cy) × 1.7 × 1.75 = 166.00 183
Fuse & Cord 70 holes × 3.00 = 210.00
Bits & Rod & etc 1108 (700 ft.) × .25 = 175.00 297
Delay 33 × 1.20 = 40.00
Wire & Acc. 20% powder = 33.00 37
$624.00 767.00

Hoist. Open 34.41 × 14 hrs + 10% = 481.74 / 187.77 / 55.8 cy = 3.37 / 7.85
Hoist & Headframe = 64.50 × 14 = 322.50 903. / 61.4 / 55.8 cy = 5.78 / 14.71

PUSH MUCK MATERIAL TO FALL to Bottom down Incline Alimac Raise
61.4 (55.8) B¢ = 76.7 (69.7 cy) loose Allow 2 (1) hour to haul away.
1 - OPER. DOZER 34.41
1 oper FEL 36.22
1 TRK Dr 33.09
69.31 + 10% × 2 HRS = 228.18 / 76.24
103.72

1 DOZER D-4 45
FEL — 37
1 - R50 TRK — 140
227 × 2 + 10% 598.00 / 227.00
272

SERVICE CREW included w/ ALIMAC RAISE

Hoist & Headframe = 481.74 / 187.77 903. / 322.50

TOTAL / ROUND LAB. ~~$2044.89~~ 3525.88 EQUIP ~~2702.40~~ 3901.40 MAT'L. $624.00 767.00 $3281.56 8194.28

UNIT COST = ÷ 61.4 (55.8) ¢/Rd. ~~36.64~~ 57.42/cy ~~37.67~~/cy 63.54/cy $11.18 12.49/cy $85.50 133.45/cy

PRODUCTION = 61.4 cy/RD ÷ 14 HRS = 4.4 cy/HR.
(55.8) cy/Shift (×2) 111.6 cy/day
4.4 × 18 HRS = 79 cy/day

60.04.01 Form 148A

C135

ACRES **Calculations**

SUBJECT: INCLINED PENSTOCK

JOB NUMBER P5700.09
FILE NUMBER
SHEET 2 OF
BY R. Lang DATE 6 Jan 82
APP RBB DATE 18 Jan 82

(1.) 8' ϕ Inclined Alimac Raise Climb Volume/Rd = 18.6 (15) cy

LABOR DRILLING & Blast.
1 foreman 33.15
2 Drillers (32.08) 64.16
1 Comp Oper. 33.62
1 Laborer 30.54
161.47 × 9 hrs + 10% = ~~1776.17~~ ~~1598.55~~ ~~1[illegible]~~

EQUIPMENT
1 Alimac 45.00 (60)
2 SI Drills (20) 40.00
1 600 cfm comp. 38.50
1 Bit Grinder 10.00
148.50
133.50 × 7½ = 1001 (1039.50)

MATERIALS
Drill Bits, Rod, etc = 700 ft (270) × .25 = 175.00 67.50
Explosives 1.5 × 18.6 (15) × 2.0 = 56.00 45.00
Fuse & Cord 30 holes × 3.00 = 90.00 90.00
Delay 17 holes × 1.20 = 20.00 20.50
Wire & Acc. 20% of powder = 11.00 9.00
352.00 232.00

MUCK
½ FEL Oper (36.22) 18.11
½ TRK Dr. (33.09) 16.54
34.65 + 10% = $38.11

(MUCKING CAN BE DONE w/ DRILLING)

1 Panel Truck 25.00
Explosive Loader 41.00
1 Pick up 25.00
91.00 × 1½ = 137 (136.50)

FEL 87
R50 TRK 140
227 × .5 hr = 113.50

286.55 225.81
SERVICE & BULL GANG (Reference Access Tunnel)
512.36/hr 2 hrs: 1024.72

Equip. @ 220 × 2 hrs = 440

2839.
2661.38
243.08/cy 189.27

1691.50 1729.5
90.94 115.3/cy.

MAT'L SERVICES 13.50/LF × 10 (8) ; 135.00 (108)

340
487
26.18 22.67

4908.50
4839.88
260.20
327.28

UNIT COST = ÷ 18.6 (15) ¢/ROUND
15 cy/RD ÷ 12 = 1.25 cy/hr

PRODUCTION 18.6 (15) ¢/shift × 2 = 37.2 (30) ¢/DAY.
1.25 × 18 HR = 22.

60.04.01 Form 148A

C135

ACRES

Calculations

SUBJECT: DEVIL CANYON

DENSTOCK EXCAV.

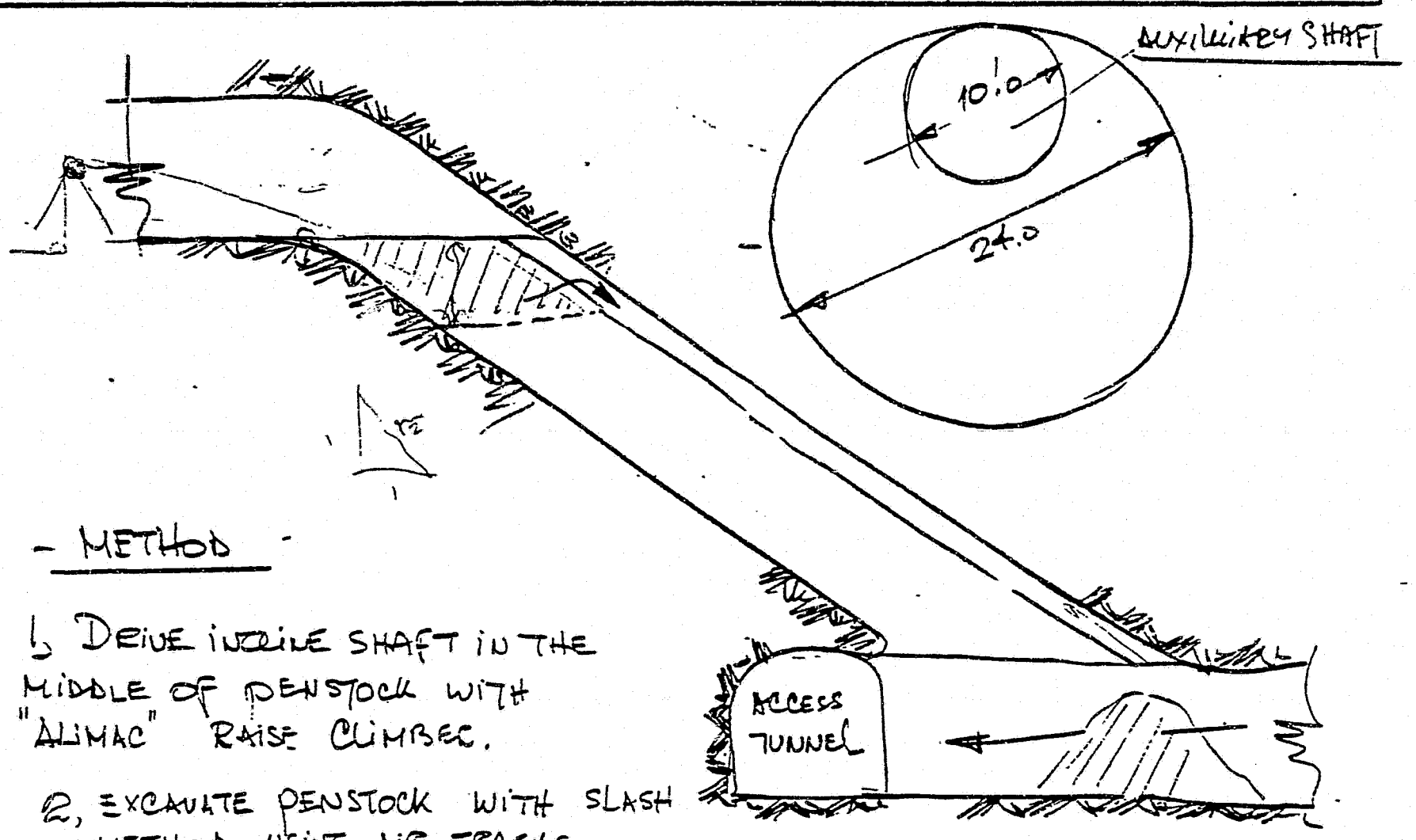
JOB NUMBER _____

FILE NUMBER _____

SHEET 1 OF 5

BY RJH DATE 20/10/81

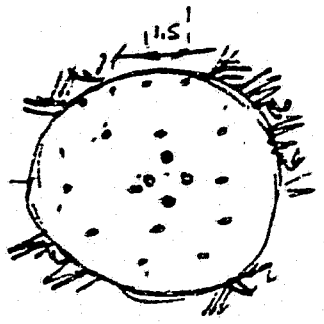
APP CEM DATE 16/10/81



- METHOD -

1, DEIVE INCLINE SHAFT IN THE MIDDLE OF DENSTOCK WITH "ALIMAC" RAISE CLIMBER.

2, EXCAVATE DENSTOCK WITH SLASH METHOD USING AIR TRACKS. ROCK WILL BE DUMPED TO THE INCLINE SHAFT. & REMOVED THROUGH THE ACCESS TUNNEL.



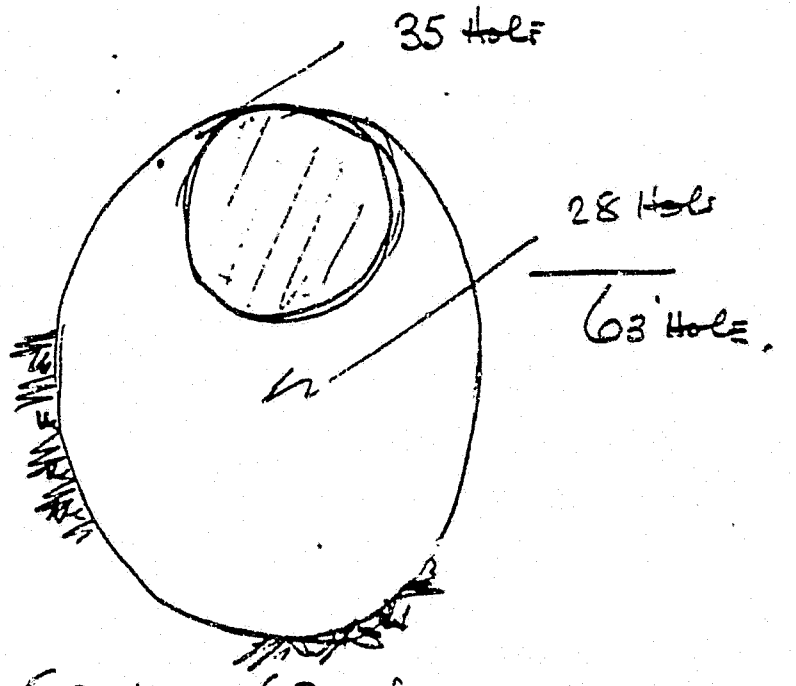
15
13
28 HOLES 10 ft Ea -

28 x 10 = 280 ft.

DRILL PROD 15 ft/HR. INCL. SETUP.

280 ÷ 15 = 19 HR.

2 DRILLS ≈ 9.5 HRS : -



63 x 10 = 630 ft.

DRILL PRODUCTION = 30 ft /hr./DRILL.

630 ÷ 30 = 21.0 hr.

2 DRILLS 21 ÷ 2 = 10.5 hr. - -

FORM NO. 152 REV. 1

154

Calculations

SUBJECT: DEVIL CANYON
DENSTOCK EXCAV.

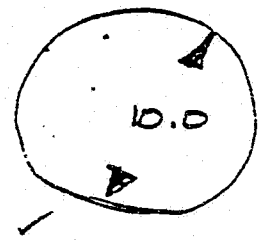
JOB NUMBER
FILE NUMBER
SHEET 2, OF 5
BY RJH DATE 23/10/81
APP GFM DATE 16/10/81
✓ R. Lang Jan 6-82

LABOUR

1- FOREMAN		~~29.70~~	32-05
2- DRILLER 31.30	~~28.60~~	~~57.60~~	62.60
~~[redacted]~~	~~28.60~~	~~28.60~~	—
1- LABOUR 29.56		~~26.22~~	29.56
			124.21 ✓

~~142.32 × 10 = 1423.20~~
124.21 × 10 = 1242 ✓

SHAFT.



Vol/ROUND = 29 cy.

EQUIP'T.

1- ALIMAC		45.0
2. S.I. DRILL	20.0	40.0
~~1- 600CFM~~		38.50
		~~123.5~~ 123.50

~~123.5 × 10 = 1235.0~~
85 × 10 = 850 ✓

HAUL

LABOUR

1- FOREMAN 34.08	~~29.70~~	~~29.70~~	34.08
1- F.E.L. Op 34.77	28.80	~~28.80~~	34.77
2- 25T TRUCK 32.21	28.70	~~57.40~~	64.42
2- FLAGMAN 29.56	25.76	~~50.32~~	59.12
		~~166.22~~	192.39

~~166.22 × 2 = 332.0~~
192.39 × 2 = 384.78 ✓

EQUIPMENT HAUL

1- F.E.L.		36.50
2- 25T TRUCK	55.00	110.00
1- PICKUP		12.00
		158.50

158.5 × 2 = 317.00

MAT'L.

DRILL BITS & SHANKS & ROD

280 × .20	= 56.00
EXPLOSIVE 1.5 × 29 × 2.0	= 87.00
FUSE & CORD 28 × 3.0	= 84.00
DELAY 15 × 1.2	= 18.00
WIRE & ACCESSORIES 20% OF POWDER.	= 17.00
	262.00

29 cy / 16 Hr = 1.8 cy/Hr

TOTAL FOR 10Φ.

LAB =	~~1423.20~~	1242.00
EQ. =	~~1235.00~~	850.00
LAB =	~~332.00~~	384.78
EQ =	317.00	
MAT'L =	262.00	
LAB =	~~569.30~~	496.94
EQ =	60.00	
	~~4198.50~~	
	3612.62 ✓	

LAB. : 2123.62 ÷ 29 : 73.22
EQUIP. 1227.00 : 43.31
MAT'L. 262.60 9.05
125.58 ✓

FORM NO. 152 REV. 1

C137

ACRES **Calculations** DEVIL CANYON

SUBJECT: DENSTOCK EXCAV.

JOB NUMBER
FILE NUMBER
SHEET 3 OF 5
BY RJH DATE 28/10/81
APP GEM DATE 28/10/81

LOAD & BLAST

1- FOREMAN	~~2870~~	~~1565~~	
2- DRILLER	31.42 ~~29.60~~	57.60	
1- OP		28.80	
1- HELP		26.22	Same as Drilling Labor = $124.21
		~~142.32~~ x 4 =	~~569.30~~.
		124.21 x 4 =	$496.84

EQUIPT.

1-BANECTR	15.00	x 4 =	60.00.

U/C FOR 10-0 ϕ DIA SHAFT EXCAV = ~~410.50 + 29~~ = ~~144.75/cy~~

to

FORM NO. 152 REV. 1

158

ACRES **Calculations**

SUBJECT:

JOB NUMBER
FILE NUMBER
SHEET 4 OF 5
BY RJH DATE 28/10/81
APP DATE

SLASH TO 24.0 DIA.

Vol: 16.75 x 10 = 167.50 CY / Road.

DRU

-LABOUR-

1- FOREMAN	32.05		~~29.70~~	32.05
2- DRILLER	31.00	~~28.80~~	~~57.60~~	62.60
2- DRILL HELP	30.39	~~26.22~~	~~52.44~~	60.78
~~1- COMP OP.~~			~~27.40~~	
1- LAB.	29.56	~~25.16~~		29.56
		~~184.99~~		184.99

~~184.99~~ x 11.0 = ~~$2145.30~~ 2034.89

EQUIPT

2- AIRTRACK	46.50	93.00	
~~1- COMP OP.~~	~~28.50~~	~~28.50~~	
		~~121.50~~ 93	~~$1446.50~~

x 11 = 1023.00

EXCAV & HAUL

LABOUR

1- DOZ. OP.	34.77	~~28.80~~	34.77
1- F.E. OP.	34.77	~~28.80~~	34.77
8- 25T TR.	32.21	~~28.70~~ ~~229.60~~	257.68
2- FLAG M.	29.56	~~25.16~~ ~~50.32~~	59.12
1- FOREMAN	34.08	~~29.70~~	34.08
		~~367.22~~ 420.42	

x 3. = ~~$1101.70~~ 1261.26

EQUIPMENT

1- F.E. (Scat)		36.50
1- DOZER D/4		35.50
8- 25T TRUCK	55.00	440.00
1- pickup		12.00
	524.00 x 3. =	$ 1572.00

FORM NO. 152 REV. 1

C139

Calculations DEVIL CANYON

SUBJECT: DENSTOCK EXCAV.

JOB NUMBER
FILE NUMBER
SHEET 5. OF 5
BY RJH DATE 28/10/81
APP DATE

63 Hole

BLAST 1

~~1 - POWDER~~ ~~29.10~~
1 - POWD MNJ 3/30 29.50 31.30
2 - HELP 30.68 ~~26.22~~ ~~52.44~~ 61.36
~~114.64~~ 92.66 x 4 =
92.66 x 4

$ ~~446.60~~
~~245.44~~ 370.64

EQUIPMENT

1 - PANEL TR 15.00 x 4 = 60.00

MAT'L

DRILL BITS & KEL'S.

630 x .20 = 126.00
EXPLOSIVE 1.50 x 168 x 2.0 = 504.00
FUSE & CORD .63 x 3 = 189.00
DELAY 32 x 1.2 = 38.00
WIRE & KEL'S .20% of
POWDER - 101.00
958.00

Total:

				UNIT COST
EXC. LAB	= ~~2115.30~~	2034.89	LAB 3541.59	21.05
EQ	= ~~446.50~~	1023.00	MATL 958.00	5.70
HAUL LAB	= ~~1361.70~~	1261.26	EQUIP 2655.00	15.80
EQ	= 1572.00 ✓	1572.00	7154.59	42.58
BLAST LAB	= ~~446.60~~	245.44		
E	= 60.00 ✓	60.00		
MAT'L	= 958.00 ✓	958.00		
	$ ~~7700.10~~	# 7154.59 ✓		

Production: 168 / 12 Hrs = 9.7

U/C = ~~7700~~ / 7154.59 x 1 ÷ 168 = $ ~~45.83~~ /CY = 42.58/CY

PENSTOCK U/C = ~~60.05~~ /CY

140

FORM NO. 152 REV. 1

(C) Production Rates - Devil Canyon

Tailrace Tunnels

Estimate Work Sheet

ACRES

PROJECT

CONTRACT DEVIL CANYON

ITEM REFERENCE No.

DESCRIPTION TAILRACE

OPERATION No. REF.

DESCRIPTION

JOB No. P5700.09

SHEET OF

BY L. Clary 16 Jan 82

CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
TAILRACE 39' ϕ																
EXCAVATION																
DRILL 9 HRS.			6.08		6.17						5.75					
BLAST 5			0.79								0.51					
MUCK/HAUL 7			2.06								4.88					
BULL GANG & SERVICE CREW —			3.82		.30						1.74					
21 HRS.			12.98		6.47						12.88	(5.80)		(7.08)	32.33	
$\frac{885}{21}$ = 42.1 cy/HR x 18 = 758 cy/day																

163

57.02.02 Form 131A

FOLD LENGTH
12
11
8.5
8

AUTO

MANUAL

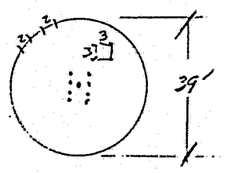
FEED

ACRES

Calculations DEVIL CANYON

SUBJECT: TAILRACE TUNNELS

JOB NUMBER P5700.09
FILE NUMBER
SHEET ___ OF ___
BY R. Lang DATE 16 Jan 82
APP RDB DATE 18 JAN 82



FULL FACE METHOD
Area = $39^2 \times .7854$ = 1195 SF
Volume = 44.24 ¢/LF × 20 ft pull = 885 cy/Round Bank
× 1.25 = 1106 cy Loose Haul
DRILL 21 ft = pull 20 ft.

Perimeter holes = 39 π ÷ 2 = 61 holes
Pattern holes $(D-6)^2(.7854) \div 9$ = 95 holes.
Burn holes = 9 holes
165 holes

165 holes × 21 ft. = 3465 ft.
Using 2-4 Boom Jumbos @ 1.1 ft/min/drill × 50 min/hr. = 55 ft/hr/drill
production = 4 × 2 × 55 ft. = 440 ft.
3465 ft. ÷ 440 ft/hr. = 7.8 hours ≈ 9 hrs includes setup.

BLAST CYCLE 165 Holes × 3 min/hole = 495 min ÷ 50 min/hr = 9.9 hours ÷ 2 men = 4.9 hrs ≈ 5 hrs.

MUCK CYCLE Same as Diversion Tunnel = 14.9 min.
1106 885 cy ÷ 20 cy/load = 55 45 loads
55 45 loads × 6.5 min/load ÷ 50 min/hr ≈ 7 6 hrs.

LABOR = 17 men (Same as Diversion Tunnel)
DRILL 543.23 513.53 9 hrs + 10% = 5377.98 5080.98 ÷ 885 cy = 6.08 5.74/cy.

BLAST 4 men (Same as Diversion Tunnel)
$126.47 × 5 hrs + 10% = 695.59 ÷ 885 cy = 0.79 1.16/cy

MUCK 1 foreman, 3 Truck Dn, 2 Open, 1 Flagman } Same as Diversion Tunnel $236.55/hour.
$236.55 × 7 6 hrs + 10% = 1821.44 1511.23 ÷ 885 cy = 2.06 1.76/cy

BULL GANG & SERVICE CREW (Same as Diversion Tunnel) =
$512.36 × 7 6 hrs + 10% = 3586.52 3381.58 ÷ 885 cy = 4.05 3.82/cy.

12.98

TOTAL LABOR u/c → 12.48/cy

PRODUCTION DRILL 9 hrs
BLAST 5
MUCK 6 7
20 hrs 21

585 cy / 20 hrs (18 hrs) = 758 796 cy/Day
21

EQUIPMENT (SAME COST/HR AS DIVERSION TUNNEL)

DRILL $565 × 9 hrs = $5085 ÷ 885 = $5.75

BLAST $91 × 5 hrs = $455 ÷ 885 = 0.51

MUCK/HAUL $617 × 7 6 hrs = $4319 3702 ÷ 885 = 4.88 4.18

BULL GANG & SER CREW $220 × 7 6 hrs = 1540 1320 ÷ 885 = 1.74 1.49

12.88

TOTAL EQUIPMENT → $11.93

MATERIALS POWDER 885 cy × 2 × 1.75 = 3098
FUSE & CORD (165 holes × 1.5) + (22 × 24 × .3) = 406
247.5 + 158.4
Bits & Rod 3465 ft × .40 = 1386
ACCESSORIES 15% Powder = 465
DELAY 6 39 × 1.80 = 70
$5425 ÷ 885 = $6.12/cy. 6.17
5465

DUCT, Elec etc 13.50/LF/Tunnel (20 ft) ÷ 885 cy = .30/cy.
$6.42/cy 6.47/cy 164

60.04.01 F... .48A

ACRES

Calculations

SUBJECT: DEVIL CANYON

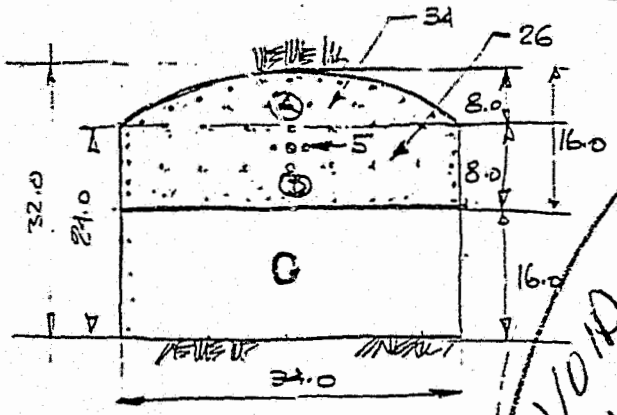
THREE TUNNELS - EVENT = 292,000cy

JOB NUMBER PS70000
FILE NUMBER
SHEET 1 OF 2
BY DATE
APP RJH DATE 10/29/81

N TOP HEADING, N

34
26
5
65 HOLES

PENETRATION: 24 ft
PULL: 21 ft



VOL: A = 1760'
B = 2720'
4480 x 23 ÷ 27 = 382 cy.

VOID CHANGED TO 391

HOLES 65 x 24 = 1560 ft.
USING 2-4 DRILL COBRA JUMBO.
DRILL PROD = 25 ft/HR x 8 = 200 ft.
1560 ÷ 200 = 7.8 ~ SAT 8 HR.
MOVE JUMBO 1 HR.
9

- LABOUR (DRILLING)

1 - FOREMAN 32.05 ~~32.00~~ 32.05
4 - DRILLER 31.20 ~~26.80~~ 125.20
~~4 - CHAINMAN 26.80 105.00~~
~~2 - COMPR OP 26.80 52.60~~
2 - DRILL DOC 30.39 ~~29.50~~ 60.78
2 - HELP 29.56 ~~28.50~~ 59.12
15
~~414.12 x 10 = 4141~~
= 72.15 x 9 = $2494

MATERIALS -

POWDER 382 x 2 x 1.75 = 1337
FUSE & CORD 65 x 1.5 (22.29 x .3) 256
BITS & RODS .40 x 1560 = 624
ACCESSORIES 15% POW. = 201
DELAY 34 x 1.80 = 61
2479

- EQUIPMENT - (DRILLING)

2 - JUMBO DRILL 95.50 | 191.00
~~2 - COMPRESSOR 26.50 106.00~~
2 - BIT GRINDER 3.00 | 6.00
2 - PICKUP 4x4 16 | 32.00
~~229.50~~ 229.00 x 9 = ~~$2350~~ 2061

BLASTING

SAME AS SURGE CHAMBER

L = ~~108~~ 122.22 x 8 = ~~865~~ 978
E = 18.5 x 8 = 148

- EXCAVATE - (SURGE CHAMBER - REV)

E = 406.00 x 4 = 1624
L = ~~2780~~ 291.67 x 4 = ~~1112~~ 1167

T = ~~2487~~ ÷ 382 = ~~6.51~~ cy

15 Hrs x 21 hrs = 315 Hrs.
5730 ÷ 315 = 18.24/Hr.

L	4639 ÷ 382 cy =	12.14
M	2479	6.49
E	3873	10.03
	10,951	28.66

FORM NO. 152 REV. 1

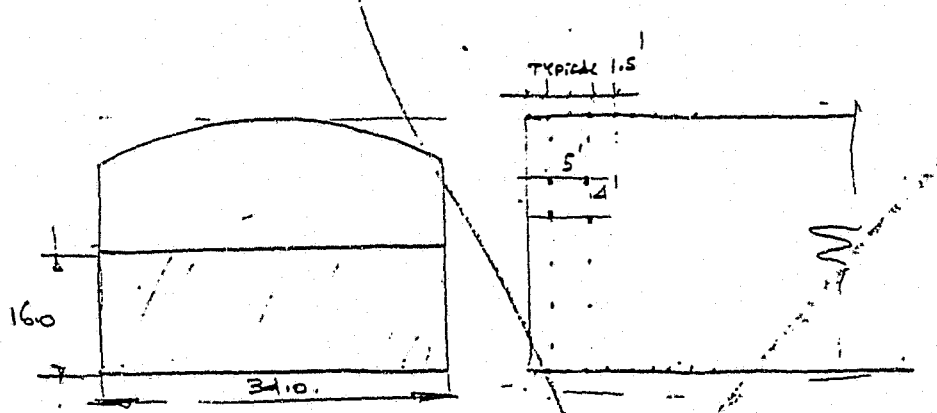
ACRES

Calculations

SUBJECT: TAILRACE TUNNEL

JOB NUMBER
FILE NUMBER
SHEET 2 OF 2
BY DATE
✓APP RJH DATE 10/28/81

BENCHING.



Vol/Round 23 = 463.4 CY

U/C SAME AS SURGE CHAMBER

U/C = ~~23.90~~ /CY.
22.03

TUNNEL = U/C 29.0

L = 345 ft. 3 = 115 ft

463.4
382.
845.4

(BULGANE FOR 24 DAYS.)

VOLUME: 16x34X

COMPUTED TOTAL LENGTH = 345 ft.

L	11.27
M	4.49
E	6.27
	22.03

FORM NO. 152 REV. 1

(C) Production Rates - Devil Canyon

Structural Steel Sets

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION See Below

OPERATION No. REF.

DESCRIPTION

PROJECT

CONTRACT

JOB No.

SHEET OF

BY R. Lang

CKD PPB DATE 25 Jan 82 ~~3 FEB 82~~

	DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
3 Ton/Day Crew	Structural Steel Tunnel Supports Allow 3 Ton/Day/Crew		Ton	1330.-		2125.-						606-	(272.70)		(333.30)	4061.-	
	Curtain Grouting 0.4 c.f/LF.																
700 ft/day	Drilling		LF	5.82		0.25						2.70	(1.21)		(1.49)	8.77	
1400 cf/day	Grouting 0.4 c.f/LF.		~~LF~~	~~8.30~~		~~0.25~~		~~4.20~~				~~1.55~~					
			CF	10.75		0.62		10.50				3.88	(1.75)		(2.13)	25.75	
	Consolidation Grouting 1-c.f/LF.																
900 ft/day	Drilling		LF	2.47		0.25						1.18	(0.53)		(0.63)	3.90	
540 cf/day	Grouting – 1 cf/LF		CF	7.05		0.25		12.50				1.73	(0.78)		(0.95)	21.53	
	Drain Holes 3"ϕ																
12.0 ft/hr	Drilling 20-40 ft. depth		LF	10.27		0.26						5.75				16.28	
12.9 ft/hr.	Drilling 50-400 ft. depth		LF	9.55		0.26						5.35				15.16	
24.9 ÷2 = 12.5 ft/hr. x 18 hrs = 225 ft per day	Avg. for Estimate Purposes			9.91		0.26						5.55	(2.50)		(3.05)	15.72	

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57.02.02 Form 131A

C147

Calculations

SUBJECT: SOSITNA

INSTALL STRUCTURAL STEEL TUNNEL SUPPORTS

JOB NUMBER P5700.09
FILE NUMBER
SHEET OF
BY R. BEAL DATE 25 JAN 82
APP R. LANG DATE 25 JAN 82

LABOR CREW:

	RATE	$/HR.
1- FOREMAN, I.W.	41.11	41.11
2- OPERATOR	34.41	68.82
1 TR. DRIVER-LB.	33.09	33.09
5- IRON WORKER	37.89	189.45
1 TR. DRIVER	36.45	30.45
		362.92 +10% = $399.21 /HR. +10%: $439.13/HR

Allow 3 Ton/DAY ÷ 9 hr/day = .33 Ton/Hr.

$439.13 / .33 Ton/Hr = $1330./TON.

MATERIAL:

FABRICATED STEEL FOB SITE $0.85/LB. = $1700/TON
STEEL LINER PLATES Say 20% = 340
MISC. STEEL WEDGES, ETC. Say 5% = 85
$2125/TON

EQUIPMENT:

	$/HR.
1- 20 T. HYDRAULIC CRANE P&H	60
1- MOVEABLE PLATFORM.	16
1- LOW BED TRACTOR TRAILER	49
4- 100 T HYDRAULIC JACKS	5.
1- TON TRUCK HD.	25.
1- PICKUP TRUCK 4x4 HD.	25
1- WELDING EQUIP.	20

200/HR. ÷ .33 Ton/Hr = $606/TON.

TOTAL = $4061/TON.

80.04.01 Form 148A

(C) Production Rates - Devil Canyon

Grading & Drainage

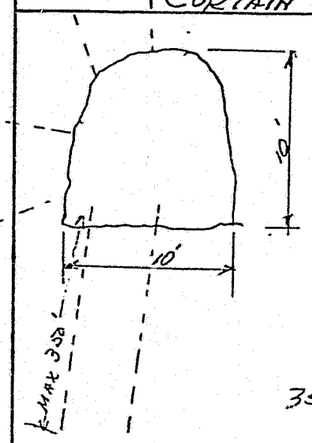
ACRES

Calculations

SUBJECT: SUSITNA

JOB NUMBER P5700.09
FILE NUMBER
SHEET OF
BY R. Beal DATE 23 JAN 82
APP R. Lang REV. DATE 3 FEB 82, 15 Jan 82, 4 Feb 82

CURTAIN GROUTING WITHIN DRAIN TUNNELS - GALLERIES



$1\frac{3}{4}$" ϕ × 350' DRILL HOLE

ASSUME - DRILL STEEL IN 6' LENGTHS $\frac{350'}{6}$ = 58 LENGTHS.

- DRILLING RATE ½ FT/MIN. = 700 MIN
- ADD DRILL STEEL (& REMOVE 30m + 60m) = (½ MIN + 1 MIN) 58 = 87 MIN
- BIT CHANGE @ 120' & 240' = 90 MIN

877 MIN

877 MIN ÷ 50 MIN/HR = 17.5 HR + 0.5 SPOT = 18 HR/HOLE ÷ 2 CREWS = 9 HRS/350'

FLUSH HOLES. Say 1 HR PER HOLE (BY GROUT CREW)
TEST HOLES (HYDRAULIC) Say 1 HR/HOLE (BY GROUT CREW)
GROUTING Say 20 BAGS/HR.

350' (0.4 CF/LF) = 140 CF ÷ 20 = 7 HRS.
9 HRS/HOLE

$1\frac{3}{4}$" ϕ × 20' DRILL HOLE

DRILL 20' × 2 MIN/LF = 40 MIN ✓ DRILL EQUIP. $106.5 / 2 CREWS = 53.25 ; 53.25 ÷ 20 = $2.66/LF ✓

DRILL STEEL $\frac{20}{6}$ = 3 × 1.5 = 4.5 MIN ✓

SPOT = 5.5 MIN ✓

LABOR = 50 MIN/HOLE = 1 HR × 208.78 + 10% = $114.83
114.83 ÷ 20 = $5.74/LF ✓

FLUSH 20' HOLE = 10 MIN =

TEST 20' HOLE = 10 MIN

GROUT 20' = $\frac{0.4 \times 20}{20}$ × 60 = 24 MIN

LABOR = 44 MIN ÷ 50 = 0.9 Say 1 HR.
202.63 × 1 + 10% = $222.89 ÷ 40 = $5.72/LF ✓

GROUT EQUIPMENT = $82 × 1 ÷ 40 = $2.05/LF ✓

NOTE: ADD SERVICE LINES 2" WATER & 2" GROUT LINES IN TUNNEL @ $20/LF TUNNEL (SEE TUNNEL EXCAVATION)

LABOR

(2-DRILL CREWS)

2-DRILLER	(32.08)	= 64.16
2-CHUCK TENDER	(31.43)	= 62.86
1-FOREMAN		= 32.91
½-TR. DRIVER	(30.45)	= 15.23
1-OPERATOR	33.62	= 33.62
		208.78

208.78 × 9 + 10% = 2066.92 ÷ 350 = $5.90/LF

(1-GROUT CREW)

1-PUMP MAN	(31.23)	31.23
2-NOZZLE MEN	(32.08)	64.16
1-GROUT MIXER		30.94
½-TR. DRIVER	(30.45)	15.22
2-LABOR	(30.54)	61.08

$202.63/HR × 9 + 10% = 2006.04 ÷ 700 = $2.87/LF

PERMANENT MATERIAL

PORTLAND CEMENT 0.4 CF/LF @ 10.00 =	4.00
ADMIXTURE (5% × CEMENT)	0.20
	$4.20/LF
BITS & DRILL STEEL	$0.25/LF
	$4.45/LF

JOB MATERIAL

WATER	$0.01
MISC. SUPPLIES	.24
	$0.25/LF

EQUIPMENT

2-STOPER DRILL (20)	40.00
1-600 CFM COMPRESSOR	38.50
1-BIT GRINDER	3.00
1-PICKUP TR.	25.00
	106.50/HR × 9 = 958.50 ÷ 350 = $2.74/L.F.

2-GROUT PUMPS (13.75)	27.50
1-GROUT MIXER	20.00
1-FLAT BED TR.	25.00
1-WATER PUMP	5.00
1-MISC. HOSES, ETC.	4.50
	82.00/HR × 9 = 738 ÷ 700 = $1.05/LF

AVERAGE COSTS =

	LABOR	EQUIPMENT	MAT'L
DRILL	$\frac{5.90 + 5.74}{2}$ = $5.82/LF	$\frac{2.74 + 2.66}{2}$ = $2.70/LF	0.25/LF
GROUT	$\frac{2.87 + 5.72}{2}$ = 4.30/LF	$\frac{1.05 + 2.05}{2}$ = $1.55/LF	4.45/LF
TOTAL	10.12/LF	4.25	$4.70/LF

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60.04.01 Form 48A

C149

ACRES

Calculations

SUBJECT: SUSITNA

CONSOLIDATION GROUTING FOR DAMS (SURFACE WORK)

JOB NUMBER P5700.dS
FILE NUMBER
SHEET OF
BY R. BEAL DATE 4 FEB 82
APP R. Lang DATE 4 FEB 82

1 3/4" DRILL HOLES @ 10' O.C × 30 FT. DEEP.

PRODUCTION:

DRILLING RATE 1.1 FT/MIN = $\frac{30}{1.1}$ = 27.3 MIN/HOLE + 2.7 MIN SPOT = 30 MIN/HOLE

PER 9 HR SHIFT (50 MIN HRS) = 450 MIN ÷ 30 MIN/HOLE = 15 HOLES/SHIFT OR 450 LF/SHIFT

GROUTING.

FLUSH HOLE - 10 MIN
CONNECT & TEST HOLE - 25 MIN.
GROUT HOLE - 60 MIN
HOLD & DISCONNECT - 10 MIN
TOTAL 105 MIN/HOLE

$\frac{450 \text{ MIN/SHIFT}}{105 \text{ MIN/HOLE}}$ = 4.3 HOLES/SHIFT/CONNECTION
× 2 CONNECTIONS
TOTAL 8.6 HOLES SAY 9 HOLES/SHIFT OR 270 LF/SHIFT

LABOR

DRILLING -
1/2 FOREMAN (34.28) = $17.14
1 - DRILLER 32.44
1 - HELPER 31.43
1/4 TR. DRIVER (32.07) 8.02
1 OPER-COMP. 34.29
$123.32 × 9 HRS = 1109.88 ÷ 450 = $2.47/LF

GROUTING -
1/2 FOREMAN (34.28) $17.14
1 OPERATOR 31.85
4 LABOR (30.54) 122.16
1/4 TR. DRIVER (32.07) 8.02
1 - MIXER OP. 32.44
$211.61 × 9 HRS = $1904.49
$1904.49 ÷ 270 = $7.05/LF

MATERIAL

JOB - BITS & DRILL STEEL $0.25/LF

JOB - WATER, FUEL 0.01
MISC. SUPPLIES 0.24
$0.25/LF

PERMANENT -
PORTLAND CEMENT - 1 BAG/CF = $10.00
ADMIXTURE 5% OF P.C. = 0.50
SAND - 1/2 BAG @ $4.00 = 2.00
$12.50/LF

EQUIPMENT

DRILL -
1 - AIR TRACK 28.50
1 - COMP. 350 18.00
1 - BIT GRIND. 3.00
1 - MISC. HOSES 4.50
1/4 - TRUCK (20) 5.00
$59.00/HR × 9 = $531
$531 ÷ 450 = $1.18/LF

GROUT
1 - GROUT MIXER & PUMP 37.50
1 - WATER PUMP 5.00
1 - MISC. HOSES, VALVES 4.50
1/4 TRUCK (20) = 5.00
52.00 × 9 = 468
$468 ÷ 270 = $1.73/LF

8

60.04.01 Form 1-dA

173

C150

Calculations

SUBJECT: SUSITNA

INSTALL 3" DRAIN HOLES INSIDE TUNNELS

JOB NUMBER P5700.09
FILE NUMBER
SHEET OF
BY R.BEAL DATE 15 JAN 82
APP R.Lang DATE 25 Jan 82

150' TO 400' HOLE DEPTH

DRILLING INSIDE 10 x 10 GALLERIES.

DRILL RATE ASSUMED 20 LF/HR ✓

DRILL STEEL IN 6' LENGTHS = 67 LENGTHS/HOLE x 1.5 MIN/PC = 100 MIN ✓

MAX DEPTH 400' ÷ 20 = 20 HRS ÷ = 1200 MIN ✓

BIT CHANGES @ 90', 180', 270, 360' = 1.5 MIN (15+30+45+60) = 225 MIN ✓

1525 MIN ÷ 50 MIN/HR = 30.5 HR + 0.5 HR SPOT = 31 HRS. ✓

LABOR:

½ FOREMAN	(32.91) =	16.46
1 - DRILLER		32.08
1 - CHUCK TENDER		31.43
½ TRK. DRIVER	(30.95)	15.22
½ COMPRESS OPER.	(33.62)	16.81
		112.00 /HR. x 31 HRS + 10% = $3819.20

3819.20 ÷ 400' = $9.55/LF ✓

MATERIAL:

WATER	0.01
BITS & DRILL STEEL	0.25
	$0.26/LF. ✓

EQUIPMENT:

STOPER DRILL	20
COMPRESSOR 350 CFM	16
BIT GRINDER	3
MISC. HOSES ETC	5
PICK UP TRUCK	25
	$69 /HR x 31 = $2139 ✓

2139 ÷ 400' = $5.35/LF ✓

TOTAL = $15.16/LF

20' - 40' HOLE DEPTH

DRILLING INSIDE GALLERIES - RATE 20 LF/HR

DRILL STEEL 6' LENGTH $\frac{20+40}{2} \div 6$ = 5 LENGTHS x 1.5 MIN/PC = 7.5 MIN.

AVG. DEPTH 30' ÷ 20 = 1.5 HRS = 90.0 MIN

97.5 ÷ 50 MIN/HR = 1.95 HR + 0.5 HR SPOT ≅ 2.5 HR.

LABOR: $112.00/HR x 2.5 HR + 10% = $308

308.00 ÷ 30' = $10.27/LF. ✓

MATERIAL: = $0.26/LF. ✓

EQUIPMENT $69/HR x 2.5 = $172.50

172.50 ÷ 30' = $5.75/LF. ✓

TOTAL = $16.28/LF

60.04.01 Fo... dA

C151

ACRES **Calculations** ~~DEVIL CANYON~~ WATANA

SUBJECT: SUSITNA HYDRO

PENSTOCK CONTACT GROUTING.

JOB NUMBER PS70009
FILE NUMBER
SHEET 1 OF
BY DATE
APP RDC Feb DATE 9/82

[illegible] = [illegible]
13 ⇒ πd = 40.84

Spillway Tunnel.

DIA = 33.0
L = 3300
L_{BF} = 1140

CONTACT AREA 103.62 × 3300 = 341,946 □ DIA. = 13
40.82 × 1440 = 58,781 □ Steel lined
400,727 □

103.62 × 275 = 28,500 □ Steel lined.

TOTAL STEEL LINING CONTACT AREA

58,781
28,500
87,281 □

PENSTOCKS (6)

DIA = 15.0 ft.
L = 200' eq
PTY 1200'

CONTACT AREA

47.1 × 1200 = 86,520 □

EQUIPMENT

1- 4×4	20.00
1- HYRA LIFT & PLATFORM	45.50
1- GROUT MIX & PUMP	55.00
1- 600 CFM COMPR.	27.00
	147.50 ×10 = 1475 — ×23 = 33,925

PRODUCTION.
2500 □/SHIFT
23 SHIFT

LABOUR

1- FOREMAN		38.15
4- LABOUR	31.43	125.72
1- CEM.		34.93
2- GROUT MAN	32.62	65.28
1- CRANE OP		36.22
1- MIXER OP		33.62
1- COMPR OP		33.62
		364.54 ×10 = 3645.4 ×23 = 83,844 —

MAT'L
SAND 360 cy @ 25.- 9000 —
CEM 290 × 135 39150
48,150 —

LAB	MAT'L	EQ.	TOTAL
84,525	48,150	33,925 -	166,600
1.50	0.86	0.60	2.96

FORM NO. 152 REV. 1

C152

ACRES **Calculations** DEVIL CANYON

SUBJECT: SUSITNA HYDRO

PENSTOCK CONTACT GROUTING.

JOB NUMBER P570009
FILE NUMBER
SHEET 1 OF
BY DATE
APP RDC Feb DATE 9/82

[illegible]
[illegible] = 40.[illegible]

SPILLWAY TUNNEL.

DIA = 33.0
L = 3300
L_{BF} = 1140

CONTACT AREA 103.62 x 3300 = 341,946 □' DIA. = 13
40.82 x 1440 = 58,781 □' Steel lined
400,727 □'

103.62 x 275 = 28,500 □' Steel lined.

TOTAL STEEL LINING CONTACT AREA

58,781
28,500
87,281 □'

PENSTOCKS (6)

DIA = 15.0 ft.
L = 200 ft
TOTAL 1200

CONTACT AREA

47.1 x 1200 = 86,520 □'

EQUIPMENT

1- 4 x 4	20.00
1- HYRA LIFT & PLATFORM	45.50
1- GROUT MIX & PUMP	55.00
1- 600 CFM COMPR.	27.00
	147.50 x 10 = 1475. — x23 = 33,925

PRODUCTION.
2500 □'/SHIFT
23 SHIFT

LABOUR

1- FOREMAN		38.15
4- LABOUR	31.43	125.72
1- CEM.		34.93
2- GROUT MAN	32.62	65.28
1- CRANE OP		36.22
1- MIXER OP.	?	33.62
1- COMPR OP		33.62
		364.54 x 10 = 3645.4 x 23 = 83,844 —

MAT'L
SAND 360 cy @ 25.- 9000.-
CEM 290 x 135 - 39150
48,150 -

LAB	MAT'L	EQ.	TOTAL
84,525	48,150	33,925 -	166,600
1.50	0.86	0.60	2.96

FORM NO. 152 REV. 1

(C) Production Rates - Devil Canyon

Service Material - Heat & Vent.

Estimate Work Sheet

ACRES

ITEM REFERENCE No.

DESCRIPTION Underground Service MATLS.

JOB No.

SHEET OF

PROJECT

OPERATION No. REF.

BY R. Lang 15 Jan 82

CONTRACT

DESCRIPTION

CKD PBeal DATE 16 JAN 82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
SERVICE MATERIAL (Labor w/ Bull Gang & Service Crew)																
Cost Based on duct & elec. service installed as tunnel advances and developed as Cost/lf excavation. This cost to be used for all underground excavations based on lf. and included in The Unit Cost/cy.																
UNIT COST = Reference R.S. Means. 1982 Cost Data																
3 ft. ϕ duct 18 ga Stl @ .75 #/SF 3×π = 9.4 SF/LF	26	lb.		—	0.50	10.00										
Electrical Wire Armored cable #10/3	1	lf.		—	0.75	0.75										
Lights 10 ft. c.c. wallmounted 100 W. Incandecent 15.00/Ea.	1 Ea ÷ 10 lf.	ea.				1.50										
sub total						12.25										
Anchors & Misc supplies (10%)						1.25										
TOTAL MATERIAL UNIT COST/LF of advance	1	lf/advance				13.50										
LABOR w/ BULL GANG & SERVICE CREW.																
(To be included w/ all underground excavations.)																

57.02.02 Form 131A

C155

Estimate Work Sheet

ACRES

ITEM REFERENCE No. | JOB No.

DESCRIPTION Vent, Heat, Services operation cost & materials | SHEET OF

PROJECT | OPERATION No. REF. | BY R Clary 15 Jan 82

CONTRACT | DESCRIPTION | CKD R Beal DATE 16 Jan 82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
— Cost per Day —																
Fuel for Boiler ~ 2920 MBH output																
@ 80% Efficiency = 2336 ≃ 2300 MBH																
Assume 75% heat required = 1725 MBH																
1725 MBH × 18 Hrs/day = 31,050 MBH																
19,000 BTU = 1 # fuel																
∴ 31,050 (10³) ÷ 19,000 = 1,634.210 # fuel/day																
÷ 7.2 #/Gal. = 227 Gal./Day Diesel fuel	227	Gal											1.33	302		302
Covered with INDIRECTS																
LABOR ~~Diesel Guard + Laborer 30.54~~																
Gen & Boiler Oper. — 1 Oper. 33.62 ~~30.54~~ /Hr.																
Say 33.62 /hr. × 24 hr./day = 806.88	.24	hr.	33.62	~~1540~~ 807												807
Generator Cost/Day allowance (fuel)																
1 MW plant @ Say Avg. 50% capacity																
per hour = .5 MW × 18 hr/day = 9 MW/Day																
Fuel Cost @ 3 Bbl/mwH (9 mw) = 27 Bbl.																
27 Bbl × 42 Gal/Bbl = 1134 Gal.	1134	Gal											1.33	1508		1508
Cost/Day for Services Operation														1810		2617
Use for duration of project.	1	Day		807												
Underground Work.																
Cost Using Interlie	1	Day		807								(@.10/kwh.)		900 302		1207

57.02.02 Form 131 A

FOLD LENGTH
12
11
8.5
8

AUTO
MANUAL
FEED

C156

Estimate Work Sheet

ACRES

ITEM REFERENCE No. | JOB No.

DESCRIPTION Ventilation, Heat, Services Major Equipment | SHEET OF

PROJECT | OPERATION No. | REF. | BY R. Lang 15 Jan 82

CONTRACT | DESCRIPTION | CKD R Boyd DATE 16 Jan 82

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
Vent Fans (allow)	3										100,00	300,000 ✓				
Oil fired Boiler 2920 MBH output (1 spare) (RS. Means)	2										20,00	40,000 ✓				
Make-up Air Units 50,000 cfm (steam)	2										15,000	30,000 ✓				
Air Curtain (Allowance)	1											100,000 ✓				
Tunnel Door (Allowance)	1.											100,000 ✓				
Misc.												30,000 ✓				
Cost for each Tunnel Opening												600,000				600,000
Labor to install ≈ 20%				120,000												120,000
Construction Power																
Say 1.0MW Plant @ $500/KW												500,000				500,000
Sub Total				120,000								1,100,000				1,220,000
To be depreciated over project. include as seperate pay item																
Allow for 2 Each location	2			2								2,200,000				2,440,000
2ND PLANT																
Less Air Curtain, Door & Constn Power				100,000								370,000				470,000
				220,000								1,370,000				1,590,000

57.02.02 Form 131 A

FOLD LENGTH
12
11
8.5
8
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FEED

000254

(C) Production Rates - Devil Canyon

Rockbolts, Mesh & Shotcrete

ACRES

Calculations

SUBJECT: COMPUTER INPUT UNIT COSTS FOR ROCK BOLTS WATANA & DEVIL CANYON = SAME

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Carey DATE 1 Feb 82
APP DATE

DESCRIPTION	UNIT PRICES LABOR	FORM. MATL.	EQUIP. OWN	EQUIP. OPER.	TOTAL
Rock Bolts 3/4" @ 6'	55.76	11.10	17.09	20.89	104.84
" 1" @ 9'	71.25	18.70	21.84	26.69	138.48
" 1" @ 10'	77.45	20.66	23.74	29.01	150.86
" 1" @ 12'	86.74	23.50	26.59	32.49	169.32
" 1" @ 15'	123.91	27.50	37.98	46.42	235.81
" 1" @ 25'	176.57	98.90	54.12	66.15	395.74

FORM NO. 152 RLV. 1

C159

ACRES

Calculations

SUBJECT: SUSITNA

ROCK BOLTS – RESIN ANCHORED

JOB NUMBER P5700-G
FILE NUMBER
SHEET ___ OF ___
BY R.B.B. DATE 14 JAN 82
APP JTJ / R. Lang DATE 1/16/82
✓ R. Lang 1-29-82

LABOR CREW:

1/2 FOREMAN I.W.	41.11	=	20.55
1 DRILLERS	32.08	=	32.08
1 IRON WORKERS	37.89	=	37.89
1 OPERATORS	34.41	=	34.41
1/2 TR. DRIVER	31.77	=	15.88
			$ 140.81

+10% = $154.89/HR

ASSUME DRILLING CONTINUES ON OTHER AREAS DURING CURE PERIOD. ALLOW 10 min / 5 Em = 2 min TO TENSION

	SET-UP & DRILL	INSERT BOLT & RESIN	ROTATE	CURE	TENSION & ROCK	RELOCATE	MINUTES TOTAL	50 MIN. HRS.	UNIT LABOR COST $	OWN UNIT EQUIP. COST	OPERATE UNIT MATERIAL COST	TOTAL/BOLT
PRODUCTION: 3/4"ø BOLT x 6' IN 1 1/8"ø HOLE	6	2	1	2	2	5	18	0.36	55.76	~~39.98~~ 17.09 – 20.89	11.10	$104.84
(MINIMUM TIME) 1"ø BOLT x 9' IN 1 3/8" HOLE	9	4	1	2	2	5	23	0.46	71.25	~~48.53~~ 21.84 – 26.69	18.70	138.48
1"ø BOLT x 10' " "	10	5	1	2	2	5	25	0.50	77.45	23.74 – 29.01	20.60	150.80
1"ø BOLT x 12' " " "	12	6	1	2	2	5	28	0.56	86.74	~~59.08~~ 26.59 32.49	23.50	169.32
1"ø BOLT x 15' " " "	15	8	2	8	2	5	40	0.80	123.91	~~84.40~~ 37.98 46.42	27.50	235.81
1"ø BOLT x 25' " " "	25	12	3	8	4	5	57	1.14	176.57	~~120.27~~ 54.12 66.15	98.90	395.74

EQUIPMENT:

	$/HR
1 – ROCK BOLTER DRILL	28.50
1/2 MOVEABLE PLATFORM (44)	22.00
1/2 FLAT BED TRUCK (25)	72.50
1 – 600 CFM COMPRESSOR	38.50
1 – ACCESSORIES	4.00
	$ 105.50

PERMANENT MATERIALS

DYWDAG COST. Reference — DUPONT COST. Reference

GR60	3/4"ø x 6' BOLT ASSEMBLY	$7.60	+ RESIN	$3.50 =	11.10
GR60	1"ø x 9' BOLT "	13.90	+ RESIN	$4.80 =	18.70
GR60	1"ø x 12' " "	16.80	+ RESIN	6.70 =	23.50
GR60	1"ø x 15' " "	20.70	+ RESIN	6.80 =	27.50
GR150	1"ø x 25' " "	85.50	+ RESIN	13.40 =	98.90

80.04.01 Form 1-dA

185

FOLD LENGTH
12
11
8.5
8
AUTO
MANUAL
FEED

0 0 0 2 5 4

C160

ACRES **Calculations**

SUBJECT: LARGE DIAMETER ROCK BOLTS

JOB NUMBER
FILE NUMBER
SHEET OF
BY DATE
APP ✓ TJL DATE 1/16/82

			$/Hr.
LABOR CREW:	1 foreman	41.11	41.11 ✓
	2 drillers	32.08	64.16 ✓
	2 D. HELPERS	31.43	62.86 ✓
	1 T.K. Dr.	31.77	31.77 ✓
	2 - E. OPER.	34.41	68.82 ✓
	1 - RIGGER	37.89	37.89 ✓
			306.61

+10% = $337.24/HR. ✓

Production = 2 Boom Jumbo drilling = 1.1 ft/min/drill
or 2.2 ft/min. Allow 50% for set up & bolt installation
2.2 ÷ 2 = 1.1 ft min to drill & install bolt.
@ 50 min/hour ÷ 1.1 ft/min = 45 ft./hour.

Labor UNIT Cost. = $337.24/Hr. ÷ 45 ft/hr. = $ 7.50/lf. ✓

EQUIPMENT
2 Boom Jumbo — 20.00 ✓
1 Rockbolt Platform — 8.00 ✓
1 Ser. Truck — 16.00 ✓
1 HYD. CRANE. 15T — 44.00 ✓
$88.00 ÷ 45 = 1.96 Say $2.00/LF. ✓

SUB MATERIAL Drill Steel, bits. couplings: 0.40/lf. ✓

PERM. MATERIAL Reference DYWIDAG (April 1981 quote + 10%)

1½" ϕ 150 GRADE THREADBAR: = $2.60/lf ✓
Couplings 11.00 each ✓
GROUT PR
WASHERS
NUT
RESIN

60.04.01 For... -18A

C161

ACRES

Calculations

SUBJECT: Sositna Rock Bolts.

JOB NUMBER
FILE NUMBER
SHEET OF
BY RBD DATE 14 JAN 82
APP TJL DATE 1/16/82

3/4" ϕ DYWIDAG IN 1 1/8" ϕ HOLE 0.62' RESIN CARTRIDGE)/LF.

1" ϕ DYNIDAG IN 1 3/8" ϕ HOLE 0.57' RESIN CART./LF.

1 1/16" ϕ (DuPont) TRUCK LOAD COSTS FAST LOCK RESIN CART IN 1 1/8" HOLE COST = ~~$9.50~~/110 + ~~15.00~~ = ~~16.00~~ FOB W.VA. FREIGHT & PERMIT 12.15 6¢

+ESCALATION 73

1 1/4" ϕ " " " IN 1 3/8" HOLE COST = ~~65.00~~ + 20. = ~~85.00~~ 5 MIN CURE

SIZE	L	No. RESIN CARTRIDGE	COST	BIT COST	NUT COST	PL COST	BEVEL WASHER COST	COUPLER COST		TOTAL MATERIAL COST
3/4" ϕ	6'	4(0.75) = 3.00	6(0.50) = 3.00	0.88	2.25	2(.35) = .70	—	=	9.93	
						ESCALATION	+12%	=	11.12 ✓	
1" ϕ	9'	5(0.83) = 4.25	9(0.88) = 7.92	1.48	2.25	2(.38) = .76	—	=	16.66	
							+12%	=	18.66 ✓	
1" ϕ	12'	7(0.85) = 5.95	12(0.88) = 10.56	1.48	2.25	.76	—	=	21.00	
							+12%	=	23.52 ✓	
1" ϕ H.S.	15'	8(0.85) = 6.80	15(1.85) = 27.75	4.65	10.50	7.00	—	=	56.70	
							+12%	=	63.50 ✓	
1" ϕ H.S.	25'	14(0.85) = 11.90	25(1.85) = 46.25	4.65	10.50	7.00	8.20	=	88.30	
							+12%	=	98.90 ✓	
1" ϕ GR60	15'	6.80	15(0.88) = 13.20	1.48	2.25	0.76	=	24.49	27.43	
							+12% =		Say 27.50	
1" ϕ	10'	6(0.85) = 5.10	10(0.88) = 8.80	1.48	2.25	0.76	=	18.39		
							+12% =		20.60	

FORM NO. 162 REV. 1

C182

ACRES

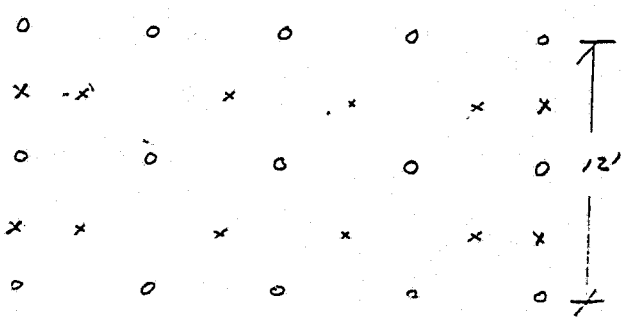
Calculations

SUBJECT: MESH ANCHORS

JOB NUMBER
FILE NUMBER
SHEET OF
BY L. Gray DATE 29 Jan 02
APP L. Beal DATE 29 Jan 02

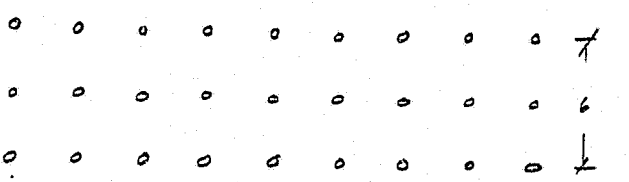
24'

6x6



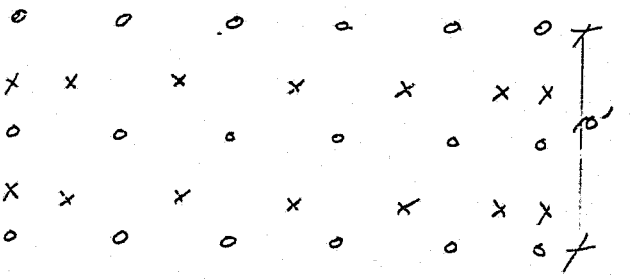
AREA 12'x24' = 288 sf.
Rock Bolt Clips = 10 Each = .035/sf
Fabric Anchors = 12 Each. = .042/sf

3x3



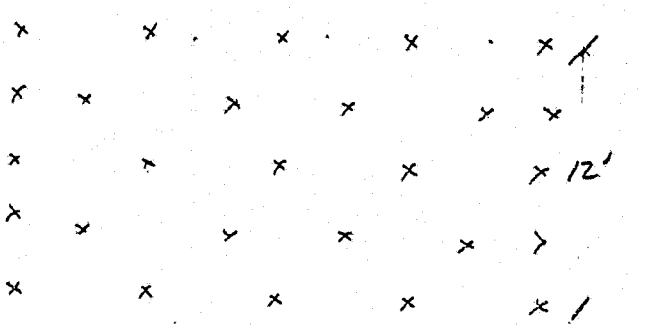
AREA 24x6 = 144 sf
Rock Bolt clips = 18 Each = .125/sf
Fabric Anchor = —

5x5



AREA 25x10 = 250 sf
Rock Bolt clips = 12 Each = .048/sf
Fabric Anchors = 14 Each. = .056/sf

No Rock Bolts.



AREA 24x12 = 288 sf.
Rock Bolt clips = —
FABRIC ANCHORS = 22 Each = .076/sf

FORM NO. 182 REV. 1

1 of

C163

Calculations

ACRES

SUBJECT: SAFTY MESH COST SUMMARY

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Fang DATE 15 Feb 82
APP DATE

BOLT PATTERN AREA (sf)	288	144	192	250	288	2/3 - 0	4/5 - 0
ROCK BOLT SPACING	0	3x3	4x4	5x5	6x6	1/3 - 6x6	1/5 - 6x6
LABOR - MESH $0.73/sf	224.64	112.32	149.76	195.00	224.64		
ANCHOR $2.96/hole	(22) 65.12	(0) —	(16) 47.36	(14) 41.44	(12) 35.52		
CLIPS $1.67/each	(0) —	(18) 30.06	(14) 23.38	(12) 20.04	(10) 16.70		
TOTAL	289.76	142.38	220.50	256.48	276.86		
LABOR UNIT COST	$1.01	$0.99	$1.15	$1.03	$0.96	$0.99	$1.00
MATERIALS - Mesh 0.40/sf	115.20	57.60	76.80	100.00	115.20		
Anchors 4.00/ea	(22) 88.00	(0) —	(16) 64.00	(14) 56.00	(12) 48.00		
Clips 0.40/ea	(0) —	(18) 7.20	(14) 5.60	(12) 4.80	(10) 4.00		
TOTAL	203.20	64.80	146.40	160.80	167.20		
Perm. MATERIAL UNIT COST	$0.71	$0.45	$0.76	$0.64	$0.58	$0.67	$0.68
Job MATERIAL UNIT COST $0.38/hole	$0.03	—	$0.03	$0.02	$0.02	$0.03	$0.03
EQUIPMENT Mesh $0.23/sf	66.24	33.12	44.16	57.50	66.24		
Anchors $1.42/ea	31.24	—	22.72	19.88	17.04		
Clips $0.24/ea.	—	4.32	3.36	2.88	2.40		
TOTAL	97.48	37.44	70.24	80.26	85.68		
EQUIPMENT UNIT COST	$0.34	$0.26	$0.37	$0.32	$0.30	$0.33	$0.33
45% Own	.15	.12	.17	.14	.14	.15	.15
55 Oper.	.19	.14	.20	.18	.16	.18	.18
TOTAL UNIT COST	$2.09	$1.70	$2.31	$2.01	$1.86	$2.02	$2.04
was prior to change on Computer Est	4.99	4.86	7.44	5.66	5.38	5.13	5.07

ASSUMPTIONS.

1. TOTAL CREW INCLUDED IN MESH INSTALLATION COST.
2. ANCHOR COST IS BASED ON DRILLERS, HELPERS, OPER & 1/2 foreman
3. CLIPS COST IS BASED ON WELDER LABOR ONLY.
4. THE ABOVE ASSUMPTIONS ARE BASED ON ACTIVITIES BEING PERFORMED CONCURENTLY AND MEN ARE NOT WAITING FOR WORK TO DO.

2-16-82
Reduced Material Cost of Mesh from $1.00/sf to $0.40/sf per. L. Cousineau recommendation
R. Fang

60.04.01 Form 148A

ACRES

Calculations

SUBJECT: SAFETY WIRE MESH & SHOTCRETE REINFORCING
WATANA & DEVIL CANYON

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lang DATE 17 Feb 82
APP DATE

PRODUCTION: · Set Fabric Bolts @ 1 Ea/minute + 2 min Bolt up = 3 minutes/Bolt. = 17 Bolts/Hour (somminutes)
· Weld Clips to Rock Bolt Plates @ 25 pcs per 50 min hour
· Drilling Rate for 1" ϕ Bolt @ 1 ft/min x 2 Drills = 2 ft/min

1.5 ft. bolt ÷ 2 fpm = .75 min ∴ $\frac{50 \text{ min/hr}}{.75 \text{ min/bolt}}$ = 66 holes/hour.
Install fabric @ 500 sf per 50 min hour.

LABOR:

1 foreman		33.15
2 drillers	(32.08)	64.16
3 opers.	(33.62)	100.86
2 drill helpers	(31.75)	63.50
1 Welder		37.89
1 Trk Dr.		31.77
		331.33/hr. x 1.10 = $364.46

LABOR BREAKDOWN / ACTIVITY

Fabric / Bolts (Say full Crew) $364.46 ÷ 500 sf/hr. = $0.73/sf.

Drill-Bolts – ½ foreman 16.58
2 drillers 64.16
2 helpers 63.50
1 Oper. 33.62
177.86 x 1.10 = $195.65 ÷ 66 hole/hr. = $2.96/hole

Weld Clips 1 Welder 37.89 x 1.10 = $41.68 ÷ 25/hour = = $1.67/Each

MATERIAL Job – Drill Bits, Rod, etc. – 1.5 x .26/ft = $ 0.38 hole

Perm. – No. 6 Galv. Chain Link Fabric — $0.40/sf.
– ½" x 18" Mesh Anchors — $4.00/each
½ϕ mesh clips Say $0.10/each

EQUIPMENT

Hyd. Crane $44
Platform 44
Truck 25
} $113/Hour. ÷ 500 sf/hr = $0.23/sf.

2 Boom Rock Bolt drill $60
1-600 cfm compr. 34
} $94/Hour ÷ 66 holes/hr = $1.42/hole

1 welder 6.–/hour ÷ 25/hr. = $0.24/clip.

60.04.01 Form 148A

C165

Calculations

ACRES

SUBJECT: WATANA & DEVIL CANYON

SAFETY WIRE MESH AND SHOTCRETE REINFORCING

JOB NUMBER
FILE NUMBER
SHEET OF
BY P. Boyle DATE 29 Jan 82
APP R. Long DATE 29 Jan 82

PRODUCTION:

✓ SET FABRIC BOLTS @ 1 PER MIN + 2 MIN BOLT-UP = 3 MIN/BOLT = 17 BOLTS / 50 MIN HR.
✓ WELD CLIPS TO ROCK BOLT PLS @ 25 PCS PER 50 MIN HR.
✓ DRILLING RATE FOR 1"Ø @ 1 FOOT/MIN X 2 DRILLS = 2 FPM.

$\frac{1.5'/\text{BOLT}}{2\ \text{FPM}} = 0.75\ \text{MIN} \times \frac{50}{.75} = 37.5$ (66) HOLES DRILLED / 50 MIN HR.

ASSUME INSTALL CHAIN LINK MESH @ 500 SF. / 50 MIN HR.

LABOR/UNIT
331.33/17 = $19.49/PC ✓
CLIPS → 331.33/25 = 13.25/PC ✓
DRILL → 331.33/37.5 = 8.84/PC ✓
MESH → 331.33/500 = 0.66/SF ✓
= $28.33/PC

LABOR:

1- FOREMAN		33.15
2- DRILLERS	32.08 =	64.16
3- OPERATORS	33.62 =	100.86
2- DRILL HELPERS	31.75	63.50
1- WELDER		37.89
1- TRUCK DRIVER		31.77
		331.33/HR. ✓

JOB MATERIAL

DRILL BITS, WELDING RD 1.5 x 0.25 = ~~0.04~~ .38/BOLT
WELD ROD 0.01
~~0.05~~ .39/BOLT

PERM. MATERIAL

No. 6 GALV. CHAIN LINK FABRIC $1.00/SF
½"Ø X 18" MESH ANCHORS 3.56 x 1.12 = 4.00/PC
½" MESH CLIPS Say 0.40/PC

EQUIPMENT

1- 2 BOOM ROCK BOLT DRILL	60.00
1- HYD. CRANE	44.
1- MECHANIZED PLATFORM	44.
1- 600 CFM COMPRESS.	34
1- FLAT BED TRUCK	25
1- WELDER	6
	213/HR. ✓

PATTERN AREA	288 SF	144 SF	192 SF	250 SF	288 SF	2/3 (0)	4/5 (0)
ROCK BOLT SPACING	0	3x3	4x4	5x5	6x6	1/3 (6x6)	1/5 (6x6)
MESH LABOR	$190.08 ✓	95.04 ✓	126.72	165.00 ✓	190.08 ✓		
FABRIC ANCHOR LABOR	(22) 623.26 ✓	0	(16) 453.28	(14) 396.62	(12) 339.96 ✓		
FABRIC CLIP LABOR	0	0	(18) 235.50	(14) 185.50	(12) 159.00	(10) 132.50 ✓	
TOTAL	813.34 ✓	333.54	765.50	720.62	662.54		
UNIT LABOR	$2.82 ✓	$2.32 ✓	3.99 ✓	2.88 ✓	2.30 ✓	2.65 ✓	2.72 ✓
MESH MATERIAL	288.00 ✓	144.00 ✓	192.00 ✓	250.00 ✓	288.00 ✓		
ANCHORS	22 88.00 ✓	0	(16) 64.00	(14) 56.00 ✓	(12) 48.00 ✓		
CLIPS	0	0	(18) 7.20	(14) 5.60 ✓	(12) 4.80	(10) 4.00 ✓	
TOTAL	376.00	151.20	261.60	310.80	340.00		
UNIT COST MATERIAL	$1.31	1.05 ✓	1.36 ✓	1.24 ✓	1.18 ✓	1.27 ✓	1.28 ✓
MESH EQUIP.	132.69 ✓	61.34 ✓	81.79 ✓	106.50 ✓	122.69 ✓		
ANCHORS	124.97 ✓	0	(18) 200.48	(14) 175.40	(12) 339.96 ✓		
CLIPS	0	(18) 153.36	(14) 119.28	(12) 102.24	(10) 85.20		
TOTAL	247.66	214.70	401.55	384.14	547.85		
UNIT COST EQUIPMENT	$0.86 .447 .67	1.49 .82	2.09 1.15	1.54 .85	1.90 1.05	1.21 .67	1.07 .59
TOTAL UNIT	$4.99 ✓	4.86 ✓	7.44 ✓	5.66 ✓	5.38 ✓	5.17 ✓	5.07 ✓

VOID. See Revisions to Unit Costs 15 Feb 82

60.04.01 Form 148A

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ACRES

Calculations

SUBJECT: SAFETY SOFFIT WIRE MESH & SHOTCRETE REINFORCING

JOB NUMBER P5700-d
FILE NUMBER
SHEET ___ OF ___
BY RBB DATE 12 JAN 82
APP TJL DATE 1/16/82

VOID 1-29-82

LABOR CREW: (USE EITHER A SHOT CRETE CREW OR A ROCK BOLT CREW)

			$/HR
1- FOREMAN, I.W.	41.11	=	41.11
2- DRILLERS	32.08	=	64.16
1- TR. DRIVER	31.77	=	31.77
2- LABOR	30.54	=	61.08
3- OPERATORS	34.41	=	103.23
1- WELDER (I.W.)	37.89	=	37.89
10			339.24

+10% = $373.16

PRODUCTION: 10 PS ½"Ø MESH BOLTS/HR INSTALLED
MESH IN PLACE = $1.58/SF INSTALLED (BID COST FROM MECHANICVILLE HYDRO 1981-1982)
MESH MAT'L = 1.00/SF ∴ L = $0.58/SF @ 75% ABOVE RATE OR $0.77/SF. ALASKA RATE. PROD = 373.16/0.77 = 485 SF/HR.
CLIPS Say 22 PER HR.

LABOR UNIT COST: ½" BOLTS = $373.16/10 ≅ $37.32/EA
MESH = $373.16/485 SF/HR. ≅ $0.77/SF
CLIPS 373.16/22 ≅ 16.96/EA

3' MAXIMUM SPACING OF SUPPORT

EQUIPMENT:

1- ROCK BOLT DRILL @60 =	60.00
1- MOVEABLE PLATFORM	44.00
1- HYDRO CRANE	44.00
1- 600 CFM COMPRESSOR	34.00
1- FLAT BED TRUCK	25.00
1- WELDING GEN.	6.00
	$213.00/HOUR

EQUIPMENT UNIT COSTS:
MESH 213/485 = 0.44
BOLTS - 213/10 = 21.30
CLIPS 213/22 = 9.68

JOB MATERIAL: DRILL BITS, WELDING RODS

PERMANENT MATERIAL:
No 6 GALV. CHAIN LINK FABRIC @ $1.00/SF
½"Ø x 18" MESH ANCHOR BOLTS @ 3.56/PC
½" CLIPS WELDED TO ROCK BOLT WASHERS. SAY 0.40/PC

LABOR COST PER 485 SF INCL. ANCHORS

1/5	0	3x3	4x4	5x5	6x6	8x8	ROCK BOLT SPACING
	373	373	373	373	373	373	MESH
	88 3284	0 —	96 3883	62 2314	44 1642	66 2463	MESH BOLTS
	—	60 1018	35 594	23 390	17 288	10 170	CLIPS
	3657	1391	4850	3077	2303	3006	TOTAL LABOR
UNIT LABOR COST → 6.75	7.54	2.87	10.00	6.34	4.75	6.26	SF UNIT LABOR COST

EQUIPMENT COST PER 485 SF

	213	213	213	213	213	213	MESH
	88 1874	0 —	96 2045	62 1321	44 937	66 1406	MESH BOLTS
	—	60 581	35 339	23 223	17 165	10 97	CLIPS
	2087	794	2597	1757	1315	1716	TOTAL EQUIP
UNIT EQUIPMENT COST 3.95	4.30	1.64	5.35	3.62	2.71	3.54	S.F. UNIT EQUIP. COST

MATERIAL COST PER 485 SF AREA

	0	3x3	4x4	5x5	6x6	8x8	BOLT SPACING
	485	485	485	485	485	485	MESH
	88 313	0 —	96 342	62 221	44 157	66 235	MESH BOLTS
	—	60 24	35 14	23 9	17 7	10 4	CLIPS
	798	509	841	715	649	724	TOTAL MAT'L
UNIT MATERIAL COST → 1.57	1.65	1.05	1.73	1.47	1.34	1.50	SF UNIT MATERIAL
TOTALS 2.55	13.49	5.56	17.08	11.43	8.80	11.24	SF COST IN PLACE

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60.04.01 Form 48A

FOLD LENGTH 12 11 8.5 8 AUTO MANUAL FEED

000254

2167

Calculations

ACRES

SUBJECT: SUSITNA – DEVIL CANYON SITE

MANUAL PNEUMATICALLY APPLIED CONCRETE (SHOT CRETE)

JOB NUMBER P5700.09
FILE NUMBER
SHEET ___ OF ___
BY R.RB DATE 12 JAN 82
APP ✓ TJL DATE 1/16/82

LABOR CREW:

			$/HR
1- FOREMAN, C.M.	36.20	–	36.20
1- MIX OPERATOR	32.64	=	32.64
2- NOZZLEMEN	32.43	=	64.86
1- PLATF. OPER.	34.41	=	34.41
1- COMPRESS. OPER.	34.41	=	33.62
1- TRK DR.	31.77	=	31.77
2- LABOR.	30.54	=	61.08
1- CEMENT FIN.	32.64	=	32.64

327.22 + 10% = $360.00

PRODUCTION: (MINIMUM TIME USING 2 NOZZLE APPLICATION)

				UNIT LABOR $/S.F.	EQUIPMENT UNIT COST $/SF	MATERIAL UNIT COST $/SF	TOTAL
WALLS – 2" THK	1300 SF/HR	= 8.0 CY/HR.		360/1300 = 0.28	133/1300 = 0.10	151.20 ~~133.20~~ x 8 / 1300 = ~~0.82~~ 0.93	~~1.20~~ 1.31
" 6" THK	400 S.F/HR	= 7.4 CY/HR		360/400 = 0.90	133/400 = 0.33	~~133.20~~ x 7.4 / 400 = ~~2.47~~ 2.80	3.70 4.03
SOFFITS – 1" THK	800 SF/HR	= 2.5 CY/HR		360/800 = 0.45	133/800 = 0.17	~~133.20~~ x 2.5 / 800 = ~~0.42~~ 0.47	1.04 1.09
" 2" THK	655 SF/HR	= 4.0 CY/HR		360/655 = 0.55	133/655 = 0.20	~~133.20~~ x 4 / 655 = ~~0.82~~ 0.92	~~1.57~~ 1.67
" 3" THK	365 SF/HR	= 4.5 CY/HR		360/365 = 0.99	133/365 = 0.37	~~133.20~~ x 4.5 / 365 = ~~1.65~~ 1.24 1.39	~~3.00~~ 2.29 2.44
" 4" THK	270 SF/HR.	= 5.0 CY/HR.		360/270 = 1.34	133/270 = 0.50	~~133.20~~ x 5 / 270 = ~~2.47~~ 2.80	~~4.31~~ 4.64

LABOR UNIT COST = TOTAL LABOR ÷ SF. PRODUCTION RATE

EQUIPMENT:

	$/HR
GROUT MACHINE, DRY MIX	15.00
600 CFM COMPRESSOR	34.00
1- FLAT BD. TRUCK	25.00
1- MOVEABLE PLATFORM (INSTALLED ON FRONT END LOADER)	44.00
1- WATER TANK TRAILER 1500 gal	15.00
	133.00

EQUIPMENT UNIT COST = TOTAL HOURLY EQUIP. COST ÷ SF PRODUCTION RATE

PERMANENT MATERIAL: DRY SAND, CEMENT MIXTURE (ALLOW 50% WASTE BECAUSE OF REBOUND)

NEW PRICE
COST OF SAND FROM DREDGING OPERATION @ 3000#/c.y = $5.00
CEMENT @ $114/TON + 38.75 FREIGHT = $52.75 x 660#/2000/cy = 59.40 = 50.40
CALCIUM CHLORIDE 100#/cy x $11.20/BAG = 11.20

$75.60 (WASTE) $151.20
66.60/cy ÷ 0.50 = 133.20/c.y.

60.04.01 Form ...dA

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(C) Production Rates - Devil Canyon

Portal - Overburden, Rock Excavation
& Surface Preparation

C160

Estimate Work Sheet

ACRES

ITEM REFERENCE No. • PORTAL OVERBURDEN
DESCRIPTION • PORTAL ROCK EXCAV.
• SURFACE PREPARATION
OPERATION No. REF.
DESCRIPTION

JOB No.
SHEET OF
BY R. Tang 3 Feb 82
CKD DATE

PROJECT SUSITNA
CONTRACT

	DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR UNIT COST	LABOR AMOUNT	JOB MATERIALS UNIT COST	JOB MATERIALS AMOUNT	PERM. MATERIALS UNIT COST	PERM. MATERIALS AMOUNT	SUBCONTRACTS UNIT COST	SUBCONTRACTS AMOUNT	EQPT. OWNERSHIP UNIT COST	EQPT. OWNERSHIP AMOUNT	EQPT. OPERATION UNIT COST	EQPT. OPERATION AMOUNT	Equiv UNIT	TOTAL AMOUNT
2268 ¢/BCY	OVERBURDEN EXCAV., LOAD & HAUL		CY	2.74								1.45		1.78		5.97	
3500 ¢	ROCK EXCAVATION DRILL BLAST SCALE, MUCK, HAUL		CY	2.40 0.37 1.68 4.44		4.22 4.22						2.11 0.26 6.13 ~~8.50~~ 3.82		4.68		17.16	
6400 SF	SURFACE PREPARATION		SF	0.72								0.13		0.15		1.00	

1 2

FOLD LENGT
12
11
8.5
8
AUTO
MANUA
FEED

57.02.02 Form 131 A

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C170

ACRES **Calculations** SUSITNA

SUBJECT: PORTAL EXCAVATIONS

(SURFACE RATES)

JOB NUMBER P5700.09
FILE NUMBER
SHEET OF
BY R. Lang DATE 1 Feb 82
APP RBB DATE 1 FEB 82

OVERBURDEN

LABOR.	1 foreman		36.21
	1 Doz. Oper		35.10
	1 FEL. OPER		35.10
	1 Backhoe Oper		35.10
	2 Laborers	(30.54)	61.08
(ALLOW 2 MILE HAUL)	4 TRK DR.	(35.55) (33.09)	132.36
			142.32

344.91
334.95 / HOUR ÷ 126 ¢/HR = $2.66/¢ (2.74)

EQUIPMENT	1-D7 DOZER		85.00
	1-FEL 3cy		36.50
	1-Backhoe (Cat 225)		50.00
	4-Dump TRKS. (25 Ton)	(55.00)	220.00
	Hoe Ram Attachment		16.00
			$407.50 / HOUR ÷ 126 ¢/HR =

$3.23/¢ < 1.45 OWN, 1.78 OPER = 3.23

PRODUCTION BASED ON FEL PRODUCTION CYCLE

Load Trks ≈ 3.5 min
Spot ≈ 2.0
5.5 min. = 12 ¢/TRUCK

TRUCK CYCLE Load 3.5
Travel/loaded 6.0 (20 MPH)
Dump 3.0
Return 4.8 (25 MPH)
Spot 2.0
19.3 min. ≈ 3 loads/Hr.

$\frac{19.3 \text{ min}}{5.5 \text{ min}}$ = 3.5 TRUCKS ≈ 4.0 Say.

3. Loads/HR/TRK × 3.5 × 12 ¢/TRK = 126 ¢/HOUR.

60.04.01 Form 148A

ACRES

Calculations

SUBJECT: PORTAL EXCAVATION
WATANA DIVERSION TUNNEL → PRODUCTION = 194.4¢/Hr × 18 Hr/day = 3499 ¢/day = 45 days = 7½ weeks.

JOB NUMBER
FILE NUMBER
SHEET OF
BY R. Lang DATE 3 Feb 82
APP RBB DATE 4 FEB 82

DOWNSTREAM PORTAL ~ 157,600 ¢ to be excavated in 8 weeks

8 weeks × 6 days/week = 48 days.
48 days × 18 Hours/Day = 864 Hours

157,600¢ ÷ 864 Hours = 182.4 ¢/Hour Required Avg. Production

Assumed that drilling crews can continue during mucking operations.

Excavation Volume/Round Drill 23ft & Pull 20d × 21w × 50' ÷ 27 = 777.8 B¢ = 1011 Loose ¢

PRODUCTION ~ DRILLING ½ ft./min/drill × 7 drills = 3½ ft/min.
Allow 7×7 drill pattern w/2ft cc. line drilling @ face

Drilling Requirements (7×7 Spreng) 3 Rows × 7/row = 21 holes
line drilling 50 ÷ 2ft. cc (40%) = 10
31 holes

31 holes × 23ft depth = 713 ft. ÷ 3.5 ft/min = 204 min.
204 min ÷ 50 min/hr = 4.07 hrs. drilling Say 4.0 hours. — 777.8 ¢ ÷ 4 Hrs = 194.4 ¢/Hr. "Avg."

BLAST 31 holes × 10 min/hole 310 min ÷ 50 min/hr = 6.2 Hrs w/2 men
Say 3 Hours

MUCK/SCALE/HAUL 4.0 min to Spot & load = 20¢ Trk

1011 ¢ loose / 20¢ = 51 loads × 4.0 min = 204 min.
204 min ÷ 50 min/hr = 4.08 Hours.

Allow for blowout & move 1.00
SAY 5.0 Hours

50 min/hr / 4 min/trk = 12.5 loads/hr. 2 mile Haul = 20 min = 3 Trips/Hr./trk
∴ 12.5 loads/hr. / 3 /trk. = 4 Trks Reqd.

	LABOR		EQUIP	
DRILLING.				
1 foreman	33.23		7 Air TRAC (28.50)	199.50
7 drillers (32.08)	224.56		4-1000 Compr (45.00)	180.00
3½ Helpers (31.43)	110.00		Grinder	10.00
1 Drill Doc.	31.43		pickup	20.00
2 Compr. Opr. (34.29)	68.58			409.50 × 4 ÷ 777.8 = $2.11/¢
	467.80 × 4 hours ÷ 777.8 = $2.40/¢			
BLAST			Expl. loader	41
1 powderman	32.43		Truck	25
2 helpers (31.75)	63.50			66 × 3 ÷ 777.8 = $0.26/¢
	95.93 × 3 hours ÷ 777.8 = $0.37			
MUCK				
D9 open	35.10		D9	175
FEL Open	36.96 ~~35.10~~		FEL (10cy)	185
4 Trk Dr. (35.58)	142.32		4-R50 Trks (140)	560
1 Lab	30.54		½ Backhoe/Ram (66)	33
½ Backhoe (35.10)	17.55			953 × 5 ÷ 777.8 = $6.13/¢
	260.61 × 5 hours ÷ 777.8 = $1.68			

MATLS.
Expl. 777.8¢ × 2.2 × 1.50 = $2,567
Fuse & Cord. 3.00 × 31 holes = 93
Bits, etc. Say .30/LF × 713 ft = 214
Acc. .15% Expl. 385
Delays 13 × 1.75 23
$3,282 ÷ 777.8 = $4.22/¢

	LABOR	MATL	EQUIP	TOTAL
DRILL	2.40	4.22	2.11	
BLAST	0.37		0.26	
MUCK	1.68		6.13	
TOTAL	4.44	4.22	8.50	$17.16

OWN 3.82
OPER 4.68
8.50
198

60.04.01 Form 14dA

C172

ACRES

Calculations

SUBJECT: SUSITNA
SURFACE PREPARATION OF ROCK SURFACE

JOB NUMBER P5700.08
FILE NUMBER
SHEET OF
BY R BEAL DATE
APP DATE

SURFACE PREPARATION

USE AIR-WATER JET TO CLEAN MUD & DEBRIS FROM ROCK SURFACE PRIOR TO CONCRETE PLACEMENT — Say 3200 SF/9HR DAY

LABOR

1 - FOREMAN	33.23	33.23
4 - LABOR	30.54	122.16
1 - Comp. oper.	34.29	34.29
1 - pump oper	31.85	31.85
1 - TRK DRIVER	33.47	33.47
		$255.00

$255 x 9HR ÷ 3200 SF = $0.72/SF

EQUIPMENT

1 - 600 CFM Comp.	38.50
1 - pump	5.
1 - HOSES	3.50
1 - AIR-WATER JET	3.00
1 - 10CY Dump TRK.	28.
1 - PICK-UP TRK	20.
	$100.00

$100.00/HR x 9 HR ÷ 3200 = $0.28/SF

60.04.01 Form 148A

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C173

ACRES

Calculations

SUBJECT: SUSITNA

FILTER CLOTH

JOB NUMBER P5700.02
FILE NUMBER
SHEET OF
BY R Beal DATE 4 FEB 82
APP [signature] DATE 4 FEB 82

POLY FILTER-X by CARTHAGE MILLS
SAY 18' x 400' ROLLS = 7200 SF x .05#/SF = 360 LB/ROLL
1' LAP = − 418 SF
6782 SF NET
200 PINS = 25
385#

PRODUCTION: Say 4500 S.F./HR ✓

LABOR.

1- FOREMAN	33.23	
6- LABOR	(30.54) = 183.24	
1- OPERATOR	35.10	
½ TR. DRIVER	(32.08) 16.04	
	$267.61/HR	

$267.61 ÷ 4500 x .60/50 = $0.07/SF. ✓

MATERIAL

$0.16/SF. x 7200 SF = $1152.00
FREIGHT TO WATANA $10.59/CWT x 3.85 = 40.77
PINS 418/2 = 210 PC @ 0.39 ✓ = 81.90
$1274.67 ✓ Say $1275/ROLL ✓
$1275 ÷ 6782 SF = $0.19/SF ✓

EQUIPMENT

½-TRUCK (20) 10.00
1- LOADER 36.50
$46.50/HR.
$46.50 ÷ 4500 = $0.01/SF.

60.04.01 Form 148A

(C) Production Rates - Devil Canyon

Instruments

C175

Estimate Work Sheet

ACRES

ITEM REFERENCE No. | JOB No.

DESCRIPTION *INSTRUMENTATION* | SHEET OF

PROJECT *SUSITNA HYDRO-ELECTRIC* | OPERATION No. | REF. | BY *E. BEAL 24 FEB 1982*

CONTRACT *DEVIL CANYON* | DESCRIPTION | CKD | DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
MAIN DAM & RELICT CHANNEL																
PIEZOMETERS		LS						697,000								697,000
INCLINOMETERS		LS						66,000								66,000
VERTICAL SETTLEMENT		LS						167,000								167,000
HORIZONTAL STRAIN		LS						40,000								40,000
HORIZONTAL SETTLEMENT		LS						304,000								304,000
SURFACE SETTLEMENT		LS						40,000								40,000
SEEPAGE MONITORING WEIR		LS						10,000								10,000
THERMISTERS		LS						19,000								19,000
DRILLING ROCK FOR INSTALLATION		LS		530,000		17,000		—				135,000		160,000		842,000
LABOR FOR INSTALLATION		LS		1,720,000												1,720,000
MAIN DAM TOTAL																3,905,000
PENSTOCKS, POWERHOUSE & TAILRACE																
ROCK DEFORMATION MEASUREMENTS		LS						239,000								239,000
ROCK BOLT LOAD CELLS		LS						22,000								22,000
STEEL & STRESS MEASUREMENT		LS						12,000								12,000
DRILLING ROCK FOR INSTALLATION		LS		105,000		3,000						27,000		32,000		167,000
LABOR FOR INSTALLATION		LS		333,000												333,000
PENSTOCK P.H. & T.R. TOTAL																773,000

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CTC

Estimate Work Sheet

ACRES

ITEM REFERENCE No. JOB No.

DESCRIPTION ELECTRICAL EQUIP. INSTALLATION SHEET OF

PROJECT OPERATION No. REF. BY R.BENT 24 FEB 82

CONTRACT DEVIL CANYON DESCRIPTION CKD DATE

DESCRIPTION AND BASIS OF ESTIMATE	QUANTITY	UNIT	LABOR		JOB MATERIALS		PERM.MATERIALS		SUBCONTRACTS		EQPT.OWNERSHIP		EQPT.OPERATION			
			UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	Equiv UNIT	TOTAL AMOUNT
TOTAL COSTS By L. PEREIRA BREAKDOWN By F. TOTH																
333.21 GENERATORS & EXCITERS	4	EA		4,400,000		—		17,000,000		—		270 000		330,000		22,000,000
334.11 STRUCTURES	—															
.121 GENERATOR ISOLATED PHASE BUS		LS		500 000				1,450 000		—		23 000		28 000		2, 000 000
.122 HV. POWER CABLES & ACC.		LS		500 000				670 000				14 000		17 000		1, 200 000
.123 L.V. " " " "		LS		180,000				210 000				5 000		6 000		400 000
.124 CONTROL CABLES & ACC.		LS		250,000				335,000				7 000		8 000		600 000
.125 GROUNDING SYSTEM		LS		60,000				85,000				2 000		3,000		150 000
.13 CONDUITS & FITTINGS		LS		75 000				150 000				35 000		40,000		300 000
.21 AUXIL. TRANSFORMERS		LS		16 000				100 000				2 000		2,000		120 000
.22 GEN. CIRCUIT BREAKERS {NOT REQ'D	—			—				—				—		—		—
.23 SURGE PROTECT. & GEN. CUBICLES		LS		56 000				250 000				2 000		2000		310 000
.24 SWITCH BOARDS		LS		130,000				575 000				7 000		8000		720 000
.25 AUXIL. POWER EQUIP. & BATTERIES		LS		35 000				180 000				2 000		3 000		220 000
.31 CONTROL RELAY METER BOARD		LS		300 000				370 000				14 000		17 000		700 000
.32 COMPUTER CONTROL SYSTEM} INCLUDED IN TRANSMISSION		—		—				—				—		—		
.33 SUPERVISORY T/M SYSTEM (ENERGY MANAGE SYSTEM		—		—				—				—		—		
.4 POWER TRANSFORMERS	13	EA		690,000				4.000,000				113 000		137000		4, 940, 000
.51 LIGHTING – P.H. & TRANST. HALL		LS		180.000				430,000				23 000		28 000		660,000
.52 ACCESS TUNNELS		LS		50 000				90 000				14 000		17 000		170,000
.6 MISC. ELECTRIC EQUIP.		LS		58 000				150 000				9 000		11 000		220,000
.711 SWITCH BOARD		LS		13 000				55 000				1000		1000		70 000
.712 CABLES		LS		87 000				121 000				5000		7000		220 000
.713 AUXIL. TRANSFORMERS		LS		16000				100 000				2000		2000		120 000
.731 DIESEL GENERATORS - STANDBY	2	EA		60000				230 000				4000		6 000		300 000
.74 EXTERIOR LIGHTING		LS		90000				150 000				4000		6 000		250 000
335.5 COMMUNICATIONS		LS		25000				65 000				1000		1000		90000

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