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SUSITNA PROJECT

HARZA-EBASCO
Susitna Joint Venture
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WATANA DAM
EXCAVATION & FILLS

FEASIBILITY LEVEL ESTIMATE

VOLUME II

HARZA-EBASCO SUSITNA JOINT VENTURE

MARCH 1984

0023

SUSITNA - WATANA

EXCAVATION & FILLS

(L.LEVY/TW)

DESCRIPTION		QUANTITY	DIRECT UNIT COST	TOTAL MAN-HOURS
Common Excavation				
Portals	BCY	169,680	3.64	5,400
Approach Channels	BCY	802,000	3.13	27,560
Spillway Chn & Bucket	BCY	318,300	3.46	11,760
Main Dam	BCY	4,942,000	3.58	180,480
Alluvium	BCY	1,060,000	4.09	42,320
Cofferdam Remv.	BCY	90,000	3.13	5,720
Rock Excavation				
Approach Channels	BCY	2,791,300	9.17	228,760
Spillway, Cntrl St.	BCY	274,000	14.63	31,600
Spillway Cht & Bucket	BCY	1,592,000	11.22	178,392
Portals	BCY	189,435	13.90	23,560
Main Dam	BCY	1,214,000	12.34	133,528
Intake Structure	BCY	115,300	14.63	19,580
Rockfill				
Rockfill from Quarry	FCY	18,563,400	7.26	1,118,400
Rockfill from Stackp	FCY	2,307,000	3.04	62,246
Rockfill from Excv.	FCY	3,924,000	0.50	35,592
Raking Rockfill	FCY	902,000	0.48	2,820
Granular & Imp. Fills				
Impervious Fills	FCY	7,950,000	7.10	630,886
Provide Drying Fac.	L.S.	1.0	10,000,000	-
Oper Drying Fac.	FCY	1,576,000	4.70	31,920
Sand & Gravel Fill	FCY	27,364,500	8.51	1,869,890
Const. Haul Roads	MILE	10	2,200,000	89,600
TOTAL MAN-HOURS				4,759,134

MAIN DAM FILL QTYS.

SUSITNA HYDROELECTRIC PROJECT - ALASKA

L.F.L.
Feb 7'84

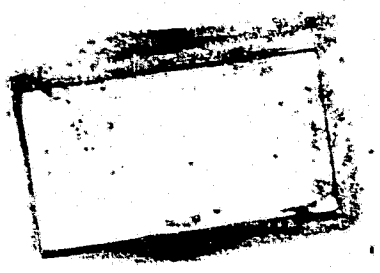
Years		1989	1990	1991	1992	1993	1994	TOTALS	Bid/Qty
MAT TYPE	Main Dam Elev.	1435	1560	1725	1885	2045	2210		
2 & 3	Filters (Fine & Coarse)	488,263	379,830	923,190	1,533,976	1,468,816	1,543,835	6,337,910	6,338,000
4	Sand Fill	-0-	533,980	2,014,705	3,067,720	2,213,390	1,012,900	8,842,695	
6	Gravel Fill (processed)	891,080	1,218,852	2,302,965	3,229,960	2,268,885	881,564	10,793,306	
	SUB-TOTAL (Processed)	1,379,343	2,132,662	5,240,860	7,831,656	5,951,091	3,438,299	25,973,911	20,626,000
5	Gravel Fill (Downstream)	466,449	522,830	-0-	-0-	-0-	-0-	989,279	
	TOTAL GRANULAR FCY	1,845,792	2,655,492	5,240,860	7,831,656	5,951,091	3,438,299	26,963,190	26,964,000
1	Impervious Fill	1,087,115	761,110	1,421,715	2,060,325	1,592,960	953,115	7,876,340	7,877,000
7/8	Rockfill	711,987	3,125,266	5,407,635	7,472,356	5,277,695	2,799,724	24,974,663	24,795,000
	TOTALS	3,644,894	6,541,868	12,070,210	17,364,337	12,821,746	7,191,138	59,634,193	59,636,000

MATERIAL BALANCE - EMBANK & REQ'D EXC.

SUSITNA HYDROELECTRIC PROJECT -ALASKA

L.F.L.
March 5, 1984

		U/S Gravel D/S Sandfill	Filters	Rockfill from Quarry	Rockfill from Stockpile	Rockfill from Excav.	Rockfill Total	Road Bases	Rock & Gravel Fill	Impervious	Concrete Aggregate	Waste	Totals
A. Embank-Main Dam	FCY	20,626,000	6,338,000	18,563,400	2,307,000	3,924,600	24,795,000	12,000	-0-	7,877,000	85,000		
U/S Coffdam	"	-0-	31,000	-0-	-0-	-0-	-0-	-0-	295,000	49,000	-0-		
D/S Coffdam	"	-0-	-0-	-0-	-0-	-0-	-0-	-0-	66,000	24,000	-0-		
Div. Tunnels	"	-0-	-0-	-0-	-0-	-0-	-0-	-0-	8,245	-0-	-0-		
Total Embankment	"	20,626,000	6,369,000	18,563,400	2,307,000	3,924,600	24,795,000	12,000	369,245	7,950,000	85,000		
Shrinkage Factor		1.10	1.10	0.75	0.75	0.75	0.75	1.10	1.10	1.20			
X1.05 for Overrun	BCY	23,823,000	7,356,000	14,618,900	1,816,500	3,090,600	19,526,000	14,000	427,000	9,540,000			
B. Non Pay Items	BCY							1,400,000					
C. Concrete U/G	CY										272,485		
Open	CY										250,670		
Total Concrete	CY												
Total Conc Aggr.	BCY										608,155		
X 1.05 For Waste											651,000		
I. Total Embank	BCY	62,737,000	23,823,000	7,356,000	14,618,900	1,816,500	3,090,600	19,526,000	1,414,000	427,000	9,540,000	651,000	
Undergr. Excs.													
Phase, Surge Chmb, Pnstock		631,500				126,000 20%	190,000 30%					315,400 50%	
Tailrace		123,000				24,600 20%	36,900 30%					61,500 50%	
Div. Tunnel		445,000				-0-	-0-					445,000 100%	
		1,199,400				150,600	226,900					821,900	
Open cut Exc. (Common)													
Portals		169,680 ✓										169,680 100%	
Cffdm (U/S + D/S)		6,000 ✓										6,000 100%	
Cffdm Removal		90,000 ✓										90,000 100%	
Main Dam		4,936,000 ✓	2,500,000 50%									2,436,000 50%	
Spillwy Appr.&Control		379,000 ✓	303,200 80%									75,800 20%	
" Chute & Bckt		318,300 ✓	254,600 80%									53,700 20%	
" Channel & Alluv.		1,060,000 ✓	848,000 80%									212,000 20%	
Power Int. Approach		423,000 ✓	338,400 80%									84,600 20%	
		7,381,980	4,244,200									3,137,780	
Open cut Exc. (Rock)													
Portals		189,435 ✓				104,200 50%						85,235 50%	
Main Dam		1,214,000 ✓				607,000 50%						607,000 50%	
Spillway Approach		1,096,000 ✓				219,200 20%	657,600 60%					219,200 20%	
" Control		274,000 ✓				54,800 20%	164,400 60%					54,800 20%	
" Chute & Bucket		1,592,500 ✓				318,500 20%	955,500 60%					318,500 20%	
Power Intake Approach		1,695,300 ✓				339,100 20%	1,017,100 60%					339,100 20%	
" " Struct.		115,300 ✓				23,100 20%	69,100 60%					23,100 20%	
		6,176,535				1,665,900	2,863,700					1,446,935	
II. Total Required Excavation	BCY	14,757,915	4,244,200	-0-	-0-	1,816,500	3,090,600	4,907,100	-0-	-0-	-0-	-0-	5,606,615
Borrow	BCY		19,578,800	7,356,000	14,618,900	-0-	-0-	-0-	1,414,000	427,000	9,540,000	651,000	
Borrow Distribution													
Quarry	BCY	14,618,900											
Alluvium	BCY	29,426,800											
Impervious	BCY	9,540,000											
Total Borrow	BCY	53,585,700											
Waste	BCY	5,606,615											
		-0-											



0029

SUSITNA HYDROELECTRIC PROJECT

WATANA DEVELOPMENT

MEMO TO ENGINEERING DIVISION FILES

SUBJECT: Geotechnical Evaluation of the Watana Dam Site

OCTOBER 1983

ENGINEERING EVALUATION OF THE WATANA
"WINTER 1983 EXPLORATIONS PROGRAM"

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ENGINEERING EVALUATION OF THE WATANA
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ENGINEERING EVALUATION OF THE WATANA
"WINTER 1983 EXPLORATIONS PROGRAM"

1.0 INTRODUCTION

The winter 1983 explorations were programmed to provide additional underground information to further verify the feasibility of the Watana Damsite. As a result of the additional investigations, a more knowledgeable assessment can now be made of the river valley dam embankment foundation and the north bank relict channel area. These assessments turned up nothing to indicate that a 885 feet high earth and rockfill dam should not be constructed at the proposed Watana location.

2.0 PURPOSE AND SCOPE

The purpose of this evaluation of the winter 1983 explorations program is part of a continuous process, in which the aim is, to obtain all the information necessary for the design of the Watana Dam and its appurtenances and for the preparation of construction drawings, specifications and quantity estimates.

A brief description of features included in the FERC license application is included, so that the reader may make comparisons with the proposed design adjustments. A recently distributed two volume report, entitled "Winter 1983 Geotechnical Exploration Program", outlined the results of subsurface investigations in the Susitna River Channel (beneath the proposed embankment foundations) and in the Borrow Area "D"/Relict Channel area. The explorations involved drilling and sampling, geophysical measurements, permeability testing in alluvium, and hydraulic pressure testing in bedrock. Laboratory identification tests were performed on representative overburden samples from all the explored areas.

A geologic reconnaissance and mapping program was conducted during late summer and fall of 1983 as a supplement to the winter program. The primary purpose of this program was to find, identify and trace the surficial geologic features within the area of the Watana site. This reconnaissance, in addition to furnishing information on discontinuities and shear zones will aid in planning future drilling operations.

3.0 RIVER CHANNEL-DAM EMBANKMENT FOUNDATIONS

3.1 INTRODUCTION

The objective of the winter 1983 explorations in the river channel was to provide information which would allow assessment of the characteristic of the overburden and underlying bedrock acting as a foundation for the cofferdams and the main dam embankment. Overburden borings defined the depth to bedrock and provided disturbed samples for examining the nature and condition of the alluvium. Core drill holes were used to explore the quality and structure of the foundation bedrock in the valley floor.

3.2 OVERBURDEN PHYSICAL CHARACTERISTICS

The overburden channel deposits are comprised of essentially four types of alluvium materials. Gravelly sand (SW) comprised 21% of the deposit, gravel (G^{-}), 68%, gravels (GW), 10% and isolated pockets of cobbles. These rounded to sub-rounded materials are relatively dense and clean, averaging less than 10% passing the #200 seive. The judgment on void ratio is based on material type and deposition as no definitive physical data was obtained from the winter 1983 explorations, nor from previous investigations. The angle of internal friction is estimated to be in the range of 35 to 38 degrees. Appraisals of grain size indicate the alluvium is very pervious, with permeability values ranging from 2000 x 10^{-4} cm/sec to 10,000 x 10^{-4} cm/sec. Based on typical value ranges of strength, permeability and void ratio, the channel deposits should offer good resistance against liquefaction. Judgment indicates alluvium settlement would occur almost simultaneous with the applied embankment load.

3.3 BEDROCK PHYSICAL CHARACTERISTICS

The bedrock underlying the embankments, within the river channel, is essentially a fresh unfrozen diorite which is very hard, and closely fractured in the upper 10 to 15 feet. Shear zones occur and joints are both open and healed. Results of the winter program did not indicate the presence of weak layers and there were no instances of unexplained core losses or drill rod dropping. There were no unusual water tables evidenced or indication of artesian pressures. Some of the borings indicate hydrothermally altered diorite, which in most instances is a fresh hard rock. The modulus of elasticity for the overall diorite is estimated to be in the range of 500,000 Kg/cm^2. Hydraulic pressure testing indicated generally low water losses in all bedrock areas beneath the river.

3.4 RIVER CHANNEL-DAM FOUNDATION, FERC LICENSE DESIGN TREATMENT

3.4.1 Cofferdam Foundations

The cofferdams would be constructed on alluvium foundations. A cement-bentonite slurry seepage cutoff was programmed through the riverbed alluvium to bedrock. The seepage cutoffs would be supplemented by downstream pumping.

3.4.2 Main Dam Foundation

The following design comments were included in the license application for river channel foundation treatment:

- Overburden removed beneath the entire dam embankment.

- Rock excavation would be in the order of 40 feet beneath the core and filters and 10 feet beneath the shells.

- Dental excavation and concrete backfill in sheared and altered zones.

- Consolidation grouting using a 10 foot grid in 30 foot deep holes.

- A double row grout curtain (vertical and inclined holes) from a gallery to a depth of 0.7 H with a maximum depth of 350 feet. Split spaced holes with primary holes at 40 foot spacing.

- Three inch diameter inclined drain holes drilled from a gallery.

3.5 RIVER CHANNEL - DAM FOUNDATION EVALUATION BASED ON THE 1983 WINTER EXPLORATIONS

3.5.1 Cofferdam Foundations

The cofferdam embankments will be designed to rest on overburden as the alluvial channel materials will provide suitble foundations. The large quantities of underseepage which would pass through the alluvium beneath the temporary embankments necessitate foundation treatment control measures. Although the construction contract will probably allow contractor options to control or prevent seepage into the main dam foundation, the installation of a seepage barrier such as a cement-bentonite cutoff will be required. No unusual bedrock foundation or abutment treatment is anticipated. B cause of the low head existing at the D/S cofferdam, bedrock seepage control measures

0 0 2 5 4

will be limited to the U/S cofferdam where surface or near-surface treatment such as dental treatment or consolidation grouting of the abutments may be necessary.

3.5.2 Main Dam Foundation

3.5.2.1 Overburden Treatment. Present thinking of the external review panel of consultants is that the majority of the alluvium beneath the dam, in the river channel, will be considered for removal down to bedrock. (A small portion would remain beneath the U/S and D/S toes of the embankment.) The large expenditure required to rest the major portion of the dam embankment on bedrock is being considered primarily because of the liquefaction potential. Although the alluvium appears to have good resistance to seismic action, sufficient void ratio data is not available to demonstrate that there is no possible risk of liquefaction in the natural foundation. The real and as yet unanswered question is whether the replacement fill material can be compacted to a density equal to or greater than the existing foundation alluvium. If subsequent judgments, studies or investigations so indicate, a less conservative approach will be considered. In any case, the potential for high seismic activity coupled with the presence of a 885 feet high embankment requires a most conservative design.

3.5.2.2 Bedrock Treatment. The explorations indicate the bedrock is of a better quality than originally anticipated. Therefore, only limited excavation of bedrock is foreseen in the river channel. Fresh hard diorite in most instances exists from the bedrock surface. Removal or foundation treatment (dental excavation of concrete backfill) will be performed in local areas beneath the shells where erodible or otherwise unsatisfactory foundation bedrock is encountered. Beneath the impervious core and the adjacent filters, detailed foundation cleanup of the bedrock will be performed before field mapping the

exposed bedrock surface. Excavation, if necessary will be accomplished, by careful blasting, to prevent damage to the dam's rock foundation. The excavated depth (±5') will be sufficient to join the impervious core with sound rock. In isolated areas, the rock surface will be dental treated and slush grouted as required. The intent here will be to provide a nonirregular surface, allowing good contact between the impervious core and the surficial rock. It will also prevent seepage through fractured or jointed rock where grouting alone would not be totally effective.

Low water losses, from the hydraulic pressure testing, along with the high quality of the recovered rock core, indicate seepage through the bedrock in the river channel will not be significant and can be effectively controlled by the use of consolidation grouting on a 10 foot grid pattern to a depth of 20 feet and a grout curtain. The grout curtain, in the river channel, is presently planned (for costing purposes) to be a single line of split spaced grout holes drilled along the dam axis. The holes will be angled upstream to intercept the dominent fracture system using stage grouting accomplished from the top down. Grout hole depths will be in the range of 250 feet as seepage potential decreases significantly at a depth of around 200 feet. It is likely that in some areas the grout take at depth will be very low. Primary holes will be considered as exploratory holes and should be core drilled. On the basis of the core and water pressure tests in the exploratory holes, the depth of secondary holes will be decided.

All holes will be water pressure tested in stages. The grouting program will be determined using these results along with appraisals of the rock cores. The grout curtain will be carried out using split spacing with the primary holes at 20 feet spacing. The secondary and tertiary holes would bring the final hole spacing to 5 feet if required.

The FERC license application plans call for a grout gallery tunnel beneath the river channel to facilitate bedrock drains and curtain grouting. Large costs are involved with adit construction along with increased grouting cost when accomplished from the confined space of an adit. The quality of the bedrock does not indicate the need for foundation drains, therefore consideration will be given to accomplishing the grout curtain from the top of foundation bedrock in the river channel. (Galleries will be considered in the right abutment and required under the dam's left abutment to enable grouting to be carried out following reservior filling and subsequent thawing of any permafrost.)

Special grouting techniques may be necessary should the river channel bedrock foundation be crossed by shear zones consisting of gouge and/or highly fractured rock. In addition to the normal dental treatment, consolidation grouting may be required to seal off these zones. Should a shear or fracture zone cross the impervious core, it may be appropriate to locally treat the downstream areas with filters. Another alternative would be to excavate along the zone and place a mortar or lean concrete cap containing pipe sleeves so that the zone can be grouted at varying depths beneath the U/S and D/S shells. These procedures will prevent the possibility of embankment materials from from migrating into the shears or fractures. The grout holes could either be cross-stitched or oriented in a direction that would intercept the maximum number of joints.

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3.5.2.3 Cost Comparisons - Revised Design Treatment vs. FERC License Designs.

Fdn. Treatment	Construction Cost (millions of dollars) FERC License	Revised Design	Difference
(1) Grouting	55.9	50.1	- 5.8
(2) Rock Excavation	102.9	28.3	-74.6
(3) Grouting Galleries	12.6	21.8	+ 9.2
(4) Alluvium Excacation	41.5	31.0	-10.5
		Net Difference	-8

(1) Based on the 1983 winter explorations, the depth of consolidation grouting has been reduced from 30 to 20 feet. The grout curtain depth has been reduced from a maximum of 350 feet to 250 feet. The grout take is expected to be less than originally anticipated.

(2) The depth of foundation rock excavation in the river channel beneath the shells and the central core area has been reduced by 10 feet and 35 feet respectively.

(3) Costs resulting from the decrease in gallery construction in the revised design is offset due to the difference in pricing underground excavation.

(4) Design refinements now limit excavation of the alluvium to the central ±80% of the dam foundation. All of the alluvium was removed in the FERC license design.

4. RELICT CHANNEL

4.1 INTRODUCTION

Approximately 1/2 mile upstream of the Watana right abutment-dam axis contact, underground investigations have outlined the presence of a buried depression in the bedrock surface, from the reservoir rim to Tsuesena Creek. The Relict Channel low ground surface is around elevation 2207 while the downstream thalweg bedrock surface is appproximately elevation 1775.

The 1983 winter drilling program and seismic refraction explorations supplemented previous work by providing information for further assessment of potential seepage through the overburden channel deposits and for assessing the effects due to seismic action.

4.2 PHYSICAL CHARACTERISTICS OF RELICT CHANNEL DEPOSITS

4.2.1 General

The majority of the overburden channel deposits are well graded non-plastic materials ranging from silty sand (SM) to sandy gravel (GW-GP). Exceptions include isolated clusters of cobbles and boulders and layers of glacial till which contain low plasticity clays. All of the materials appear to be dense to very dense.

4.2.2 Permeability

Due to the presence of stratification, lenticular structure and other geological complexities, extreme ranges of permeability exist within the relict channel deposits. As a result, the determination of an effective permeability coefficient would be most difficult to ascertain

even if elaborate field pumping tests and explorations had been performed. Under the present conditions, where only a portion of the programmed investigations have been completed, the determination of dependable permeability values might be judged as purely problematical. Appraisals of grain size indicate permeability ranges from $1x10^{-4}$ cm/see. for "SM" silty sands to $10,000x10^{-4}$ cm/see. for the "K" unit "GW" gravels.

4.2.3 Seepage

Although relict channel granular materials are permeable enough to carry lateral flows, the maximum overall seepage gradient ($\pm$6 percent) resulting from the $\pm$7000 foot long flow path is not conducive to detrimental seepage regardless of the permeability values assigned to the individual layers. Further, if the upstream entrance face is blocked by a covering of impervious (which is expected to be the case) it would not be possible to transmit a significant quantity of seepage through the channel deposits regardless of the unit "K" permeability magnitude. Based on the limited information available, the total seepage quantity passing from the reservoir rim through the buried channel thalweg into Tsusena Creek could range from 0 to $\pm$50 cfs depending on the permeability of the various units and/or the entrance conditions.

4.2.4 Open Gravels

Concern has been expressed by the FERC technical staff regarding the possibility of seepage problems associated with skeletal deposits within the "K" unit which may be subjected to the high reservoir heads. These concerns have been based primarily on drilling fluid (water and unknown quantity of mud admixture) losses in USCE boring DR-22 located near the center of the buried channel thalweg. The writer's exper-

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4.2.3 Seepage

Although relict channel granular materials are permeable enough to carry lateral flows, the maximum overall seepage gradient ($\pm$6 percent) resulting from the $\pm$7000 foot long flow path is not conducive to detrimental seepage regardless of the permeability values assigned to the individual layers. Further, if the upstream entrance face is blocked by a covering of impervious (which is expected to be the case) it would not be possible to transmit a significant quantity of seepage through the channel deposits regardless of the unit "K" permeability magnitude. Based on the limited information available, the total seepage quantity passing from the reservoir rim through the buried channel thalweg into Tsusena Creek could range from 0 to $\pm$50 cfs depending on the permeability of the various units and/or the entrance conditions.

4.2.4 Open Gravels

Concern has been expressed by the FERC technical staff regarding the possibility of seepage problems associated with skeletal deposits within the "K" unit which may be subjected to the high reservoir heads. These concerns have been based primarily on drilling fluid (water and unknown quantity of mud admixture) losses in USCE boring DR-22 located near the center of the buried channel thalweg. The writer's exper-

ience indicates, it is not unusual to lose drill fluid when drilling through any highly pervious media if the penetration rate is too fast or the amount of mud admixture is insufficient to "cake" or seal the borehole wall. In response to the possible presence of very permeable materials within the "K" unit, the USCE conducted a falling head permeability test between elevations 1900 and 2000. Results of these tests, in unit "K", gave no indication of open gravels or that seepage would be unusually significant. Because of equipment limitations "Winter 1983" boring HD 83-1 penetrated only ±35 percent of the depth of unit "K". Samples recovered from this boring contained finer particles within the coarser matrix and gave no indication of open materials. This would suggest that as a result of downward trending seepage forces, the upper portion of the unit would be devoid of fines if a skeletal free exit does, in fact, exist in the lower portion of the "K" unit.

4.2.5 Permafrost

Hammer drilling techniques utilized in the winter program were not conducive to identification of permafrost. Previous investigations have indicated the existance of light permafrost (within one degree of freezing). Extensive instrumentation would be needed before reasonable accessments could be made regarding the extent of permafrost, as judgements made in the past have been based largely on drill action and samples of questionable quality.

4.2.6 Artesian Pressures

As a reason for not including any cutoff through the saddle in the relict channel, the USCE relied on groundwater information from their DR-13 and DR-14. These borings encountered groundwater between elevations 2240 and 2280, with an artesian head (standpipe piezometer

measurements) which exceeds the 2185 elevation of the reservoir by 120 feet. The Corps concluded that since no seepage was found in either exit face (along the reservoir rim or Tsusena Creek) in spite of the high head condition, it was probable that the effect of the artesian pressure would be to resist flow from the reservoir into the aquifer.

Many conclusions can be drawn from the existance of excess hydro-static pressures which greatly exceed the expected reservoir levels in the relict channel area. The high pressures undoubtedly are the result of a seepage gradient extending north from the site where much higher ground exists. These pressures indicate that the buried channel is presently being subjected to hydrologic conditions in excess of those which will be prevalent during reservoir operation, without any seepage emerging along the Tsusena Creek exit face. On this basis there would be no reason to believe that additional seepage would occur after reservoir filling.

The writer feels that future design explorations should confirm the existance of these high pressures as a prelude to learning more about how the relict channel will react to high reservoir heads. The ground water regime could be established throughout the buried channel area with particular emphasis on the source of artesian aquifers and the drainage outlets from such aquifers.

4.2.7 Piping and Erosion

Soil particle movement through any foundation is influenced almost entirely by the existing seepage forces. Progressive sloughing or erosion results from seepage flowing from a saturated slope. In the relict channel, this can only occur when the seepage line emerges at an elevation well up on the Tsusena Creek exit face slope. This condition results in a seepage gradient (less than 3 percent) which is insuffi-

cient to result in any significant seepage forces to cause movement of soil particles. Even without consideration being given to the filter characteristics of the natural materials existing over the exit face area, evaluations assuming conservative values for permeability and reasonable gradients indicate piping is very improbable.

Naturally the unit of concern from the standpoint of erosion, progressive piping or unrestricted particle movement would be unit "K", if the lower portion of this unit, in fact, contains open gravels. As outlined above, the justification for the allegation that open gravels exist is not clear. Never the less until such time as further subsurface explorations deleniate the true characteristics of the materials from the "K" unit, this will continue to be an unanswered question.

4.2.8 Liquefaction

Although the theoretical cause of liquefaction is well known; the current state of knowledge provides only limited measures to estimate potential for liquefaction of naturally occuring soil deposits. Saturated foundations consisting of fine grained, poorly graded, cohesionless deposits (sands and silts) which are not laterally confined and only moderately dense appear to be the most likely prospects for liquefaction.

A saturated cohesionless soil, when subjected to dynamic stresses, tends to decrease in volume if drainage does not occur. This volume decrease results in increased pore pressures. As these excess hydrostatic pressures continue to increase, effective stresses decrease causing the soil to lose strength, possibly resulting in a liquified state as the strength approaches zero. This state of liquefaction depends on the extent to which the hydraulic gradient can be developed and maintained. The gradient in turn is influenced by density,

permeability and drainage conditions along with the intensity and duration of the dynamic stresses.

From a practical standpoint, experience with ground shaking resulting from actual earthquakes has furnished useful indicators in regard to the probable performance of soil deposits at other locations, but unless large scale field and laboratory investigations are undertaken, judgment and experience are the only guides for predicting the potential for liquefaction of a given natural deposit.

A summary liquefaction assessment of the buried channel area indicates the deposits are either cohesive or dense to very dense and therefore have a very low potential for liquefaction. The data indicates penetration resistance to be high in all areas except in the very thin surficial layers and in unit "G" glacial till deposits. Based on grain-size and Atterberg limit tests, unit "G" was found to be cohesive, which would account for the lesser penetration resistance.

4.3 RELICT CHANNEL FERC LICENSE DESIGN TREATMENT

To preserve the integrity of the Watana reservoir rim and to control reservoir losses, a number of technical measures were deemed appropriate in the license application to remedy the problems. These measures would be designed to cope with potential problems that might arise due to settlement of the reservoir rim, subsurface flows, permafrost and earthquake induced liquefaction.

4.3.1 Surface Flows

Potential problems were associated with settlement and surface flow overtopping the buried channel area, where the natural ground surface

saddle dips to near dam crest elevation 2205, for a short distance. A dike with a crest elevation of 2210 was proposed to provide additional freeboard protection against extreme reservoir water levels, should seismic shaking cause vertical deformations in the relict channel deposits.

4.3.2 Subsurface Flows

The potential for progressive piping and erosion in the area of discharge into the Tsusena Creek would be controlled by the placement of properly graded granular materials to form a filter blanket over any zones of emergence. Continuous monitoring of the outlet area would be undertaken for a lengthy period after reservoir filling to ensure that a state of equilibrium was established with respect to seepage gradients in the buried channel area.

If the observation devices indicated seepage gradients to be excessive, a provision would be made to carry out grouting of the upstream alluvium at a narrow thalweg reach to reduce and control reservoir leakage.

4.3.3 Permafrost

Thawing of permafrost was felt to have a potential impact on subsurface flows and relict channel ground settlement. Although no specific remedial measures were foreseen, ground water flows and surface elevations in the buried channel area would be carefully and continuously monitored by means of appropriate instrumentation systems and any necessary maintencance work carried out to control seepage discharge and maintain freeboard.

4.3.4 Liquefaction

The license application stated that to guarantee the integrity of the reservoir rim through the relict channel area, it is required that either:

- o there is no potential for land mass movement due to liquefaction, or

- o if there is such potential, there is a sufficient volume of upstream non-liquefiable materials present along the reservoir rim so that the land mass movement would not breach the reservoir shore line.

Requirement for remedial treatment would depend on the location and extent of unstable zones. Remedial treatment could range from stabilization by compaction (vibroflotation), grouting techniques (either cement, colloidal or chemical), or removal of unstable material and replacement with compacted fill materials not suceptable to liquefaction.

Appraisals of geotechnical information available at that time, indicated that the potential for liquefaction existed only in the upper 140 feet of soil deposits in the relict channel. Until further geotechnical studies were to be undertaken to fully define the extent and characteristics of the questionable materials, cost provisions would be made in the FERC license application for treatment to cover the worst conditions felt possible. These measures included:

- o Densification. Layers within about 100 feet of the ground surface would be compacted by vibroflotation techniques to

eliminate the risk of liquefaction and provide a stable zone by increasing the density of the insitu material.

- o Stabilization. Susceptible layers at any depth could be made stable by grouting either with cement for fine gravels and coarse sands or by chemical grouting for fine sands and silts.

- o Removal of Unstable Material. This provision could range from the replacement of liquefiable material near the valley slopes with dense well graded material (which would stabilize the toe of a potential slide and so prevent the initiation of failure that might otherwise cut back and cause major failures) to the excavation and replacement of large volumes of material to provide a stable zone.

In the license application, the most positive solution was assumed to be the removal and replacement of the assumed unstable zone with material that would not liquefy. This would involve an underground dam section located in the terrain low saddle. The dam would be constructed of selected materials and founded on the dense upper till layer through the outwash alluvium. Selected materials would be compacted to form a central stable zone, while surplus and unsuitable materials would be placed on either side of this central "dam" to complete backfilling to ground surface. The central zone would be designed to remain stable in the event that all upstream material would slide into the reservoir.

4.4 RELICT CHANNEL EVALUATION BASED ON WINTER 1983 EXPLORATIONS

4.4.1 General

Prior to submission of the intial FERC license application there was not sufficient data available to fully identify the extent of relict channel geotechnical parameters and conditions. Therefore it was not possible to precisely define the necessary remedial work and by necessity, conservative approaches were taken in selecting the the alternative methods or solutions included in the license application. As indicated below, as a result of the "Winter 1983 Underground Explorations", the ultimate treatment for most of the problems may now be based on an engineering and cost analysis study of the appropriate alternatives. Because the site conditions have been more clearly defined, it is no longer necessary to consider all of the solutions based on the worst conditions deemed possible. An exception involves the seepage control measures where future design studies and investigations are still necessary to finally decide the remedial treatment.

4.4.2 Surface Flows

As stated in the previous section, the FERC license application contained a concept for instituting a freeboard dike fill across lower ground in the relict channel. This concept was based on placing an earth fill embankment to an elevation 5 feet above the dam crest. The purpose for this dike was to provide additional freeboard in case excessive settlements resulted from potential seismic shaking.

Settlement or seismic instability problems are no longer considered prevalent in the relict channel area. Based on information gained from the 1983 Winter Exploration Program, the relict channel soils are either dense or cohesive and as such are not deemed to be subject to

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settlement resulting from seismic shaking. Therefore there are no plans to build a freeboard dike as a precaution against seismic settlement of the channel deposits. The low ground surface in the area will provide more than adequate freeboard as it is several feet above dam crest elevation 2205.

4.4.3 Subsurface Flows

Recently constructed top of bedrock contour maps, based on all the underground information accumulated to date (including the 1983 Winter Program), indicate a wide entrance into the buried channel area on the reservoir side of the relict channel. Downstream of the reservoir rim the buried channel width reduces to a narrow exit into the Tsusena Creek area. Based on this information, there are several, job tested, remedial measures that would positively control or eliminate potential reservoir leakage.

Should future geotechnical design explorations such as side hill inspection trenches and churn drill borings indicate that gravels with unexpected skeletal (open) voids exist deep in the channel along with an unobstructed reservoir entrance face, a positive seepage barrier would have to be considered. This type cutoff would utilize a cast-in-place concrete panel (I.C.O.S. type) wall across the "K" unit from elevation 2205 down to bedrock (maximum depth ±375 feet). The wall located in the relict channel throat where the width of the "K" unit is a minimum, would be constructed by drilling 2 foot diameter concrete piles down to bedrock. After excavating between the piles, concrete would be tremie placed, to form an interlocking panel. The 2 feet wide continuous concrete seepage barrier wall would be patterened after the 430 feet deep cutoff installed at Manic 3 Dam in Quebec.

Should further explorations and studies indicate, as expected, that skeletal gravels do not exist, detailed design studies will include other solutions or combinations of alternatives such as: (1) overburden grout curtain (2) toe drain and properly graded filter materials over portions of the Tsusena Creek exit face (3) downstream underground adit with intercepter drains. Consideration will also be given to placing a impervious blanket over the upstream thalweg entrance face slope ($\pm$1 on 4) by using waste topsoil from areas such as the townsite, construction camp and borrow area "D". Also, during the reservoir filling, which will require several years, piezometers will be located across the channel to monitor actual reservoir induced underground gradients. Should excessive hydrostatic pressures be measured, provisions will be made for additional preventative measures.

4.4.4 Permafrost

Investigations to date indicate that frozen material does exist in portions of the relict channel area. The permafrost is termed as "warm" ranging from 0°C to -1°C.

Now that ground settlement is no longer considered a problem, the only design impact forseen from the presence of frozen soil, would be a retardation of seepage. Because the permafrost temperature is only slightly below the freezing point, seepage retardation is considered to be only temporary as the reservoir water will eventually thaw any frozen material around the perimeter of the lake. Therefore, the remedial measures for controlling subsurface flows, as outlined above, would be designed for unrestricted "free flow" throughout the relict channel foundation materials. Based on this approach, the presence of permafrost would have no long term affect on the structural integrity of the relict channel.

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4.4.5 Liquefaction

Underground information compiled to date indicates that the buried channel area is filled with outwash, glacial till and lacustrine deposits. Initial evaluations, outlined in the license application indicated concern in regard to the upper outwash deposits because they did not appear dense enough to resist seismic shaking without experiencing considerable loss in stability.

The most likely prospects for liquefaction are saturated foundations consisting of fine grained, poorly graded, cohesionless deposits (sands and silts), that are not laterally confined and loose or only moderately dense. Based on the Winter 1983 Exploration Program and all other assembled data, an assessment of the liquefaction potential of the relict channel area indicates the deposits are either well graded, dense to very dense or cohesive and therefore have very low potential for liquefaction. Consequently no remedial measures are considered necessary as a precaution against the affects of liquefaction.

4.4.6 Cost Comparisons - Revised Design Treatment vs. FERC License Designs

FERC LICENSE DESIGN TREATMENT

Design Issue	Remedial Measure	Construction Cost $
Surface Flows	Freeboard Dike	600,000
Subsurface Flows	Filter Blanket or Grout Curtain	9,400,000
Permafrost	Monitor	---
Liquefaction	Underground Dam	100,000,000
	Total	110,000,000

REVISED DESIGN TREATMENT

Design Issue	Remedial Measure	Construction Cost $
Surface Flows	None	None
Subsurface Flows	Concrete Panel Wall and Drainage Gallery	51,000,000 6,100,000**
Permafrost	---	---
Liquefaction	None	None
	Total	57,100,000*

DIFFERENCE: $110,000,000 - $57,100,000 = $52,900,000

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* For cost estimating purposes, the worst case scenerio incorporates an I.C.O.S. type wall along with a downstream adit with intercepter drains at a cost of $57.1 million (the adit with drains has been included to intercept and control seepage which might bypass the panel wall around the sides). The best case scenerio (and most realistic) would include only the adit and intercepter drains at a cost of $6.1 million.

** Includes cost for piezometer installation.

4.4.7 Remedial Work Influence on Construction Schedules

Relict channel remedial treatment construction work will have practically no impact on the Watana Dam Construction schedule. Because the relict channel work will be located in proximity to borrow area "D", some coordination will be required between these two operations. Once this coordination has been accomplished, dam construction and the relict channel work can be concurrently accomplished.

4.5 RELICT CHANNEL TREATMENT SUMMARY

Early concerns regarding the critical impact of the relict channel on the Watana project appear to be unfounded. Nevertheless, some uncertainties still exist and, therefore, costs (57.1 million) for responding to the unknown concerns will be included in the Watana estimates for the revised license application.

During design investigations, additional boreholes and inspection trenches will be employed to further delineate the relict channel foundation. The area will be studied during borrow area "D" excavation. The area will also be thoroughly monitored by observation devices during the reservoir filling to access actual hydrological conditions in the relict channel.

Based on existing knowledge, the only remedial measures presently considered necessary for the relict channel involve seepage control. Until such time as future explorations indicate no seepage problems exist deep within the buried channel ("K" unit), a positive seepage cut-off similar to an I.C.O.S. wall, in combination with a drainage gallery will be considered in the revised FERC license application to satisfy project feasibility. Should future design studies and investigations indicate the nonexistance of skeletal materials, a less conservative design will be considered.

5.0 BORROW AREA "D"

5.1 INTRODUCTION

Because the Watana reservoir will be used for long term storage, the design intent is to construct the dam embankment impervious core zone using relatively low permeability materials. In addition to meeting the permeability criteria, the impervious soils must also be satisfactory from an overall design standpoint including strength and settlement.

5.2 IMPERVIOUS PHYSICAL CHARACTERISTICS

To satisfy the design intent, emphasis will be given to selecting materials which are not only impervious but have a wide range of grain sizes, such as gravelly clay (GC). These soil types are preferable to Silty Sand (SM) (FERC license design) as they are stronger, less susceptible to piping, erosion and liquefaction, and are easier to compact and therefore are less compressible.

5.3 CONSTRUCTION PROCEDURES

Appraisals of the Winter 1983 Exploration Program along with previous boring data indicates acceptable impervious soils are attainable from borrow area "D" by mixing of the layered deposits in prudent proportions. It is expected that the desired materials can be accomplished by a blending operation which will utilize vertical cuts from portions of the borrow that have been pre-drained by excavating the operating base of the pit on an incline. This job tested method should produce a satisfactory blend of materials without special processing procedures.

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5.4 LAKE DEPOSITS

Although not explored by the 1983 Winter Program, there are indications from earlier drilling and sampling programs that lake sediment deposits, suitable for impervious, exist within the relict channel-borrow "D" areas. Maximum thickness of these deposits, which contain clays and silts, is purported to be in the order of 30 feet and appears to be confined between elevations 2130 and 2190. Possible use of these core type materials will be considered in future design and exploration programs.

5.5 MOISTURE CONTENT - IMPERVIOUS CORE

The effect of moisture content on the engineering properties of the impervious core is of paramount design interest. Ideally, the core should be somewhat plastic but not to the extent that exorbitant pore pressures develop during construction. Potentially, the impervious zone could be placed at a moisture content and density so that the mass will be plastic while not allowing any additional consolidation on saturation. Use of this criteria would result in placement well on the wet side of optimum moisture. Full consideration would be given in the stability analysis for the pore pressures that would be developed.

Although the 1983 Winter Program moisture contents are suspect because of the hammer drill sampling techniques used, the low void ratio indicates to the writer that the glacial tills may be within a range practically obtainable without processing before compaction. More comprehensive studies and explorations are necessary before a final decision can be made as to whether pre-fill drying by artificial means (kilm dryer), will be necessary.

Test fills will be considered as a part of the early construction contracts. These test fills would be programmed to be completed prior

to finalization of the dam embankment design and will provide valuable insight into specification requirements for both the embankment and the borrow operations.

5.6 EMBANKMENT REQUIREMENTS

The impervious embankment core requires volumes of approximately 9,000,000 cubic yards for the Watana main dam and 400,000 cubic yards for the Devil Canyon saddle dam, all programed to be obtained from borrow area "D". Although many alternatives are available in borrow area "D" for blending satisfactory core materials, it is presently planned to mix gravelly soils from surficial outwash units with clays from the underlying tills. This combination will more than supply sufficient embankment quantities as borrow area "D" outwash units E/F are estimated to contain over 100 million cubic yards while glacial till unit G contains approximately 50 million cubic yards.

6.0 FINS FEATURE

6.1 INTRODUCTION

A concern has been raised by the FERC review team (subsequent to the "Winter 1983 Exploration Program") in regard to the possibility of detrimental reservoir seepage paths along the "Fins" feature. This concern resulted from a recent visual inspection of disintegrated core from USCE boring DR-20.

6.2 FINS DESCRIPTION

A discontinuity in the form of a ±450 feet wide shear zone area has been delineated on the steep right abutment slope just upstream from the diversion tunnel intake portals extending in a downstream N.W. direction to the Tsusena Creek valley.

The upstream "Fins" feature is exposed in the form of 7 near vertical rock fins varying from 5 to 40 feet in width. the fins are bounded on the sides by altered and fragmented rock. The broken rock within the shear zones consists mainly of moderately hard to very hard fragments but is disintegrated in places.

The sloping bedrock surface between the fins upstream exposures and Tsusena Creek is covered by overburden. The elevated terrace ground surface varies from elevation 2150 on the upstream side, rising to a maximum of elevation 2210 on top of the terrace, lowering to approximately elevation 2000 near Tsusena Creek. The overburden includes an organic topsoil layer which is underlain by glacial fluvial materials varying in depth from ±20 to ±130 feet. Bedrock is overlain by up to 120 feet of unit J glacial till.

6.3 EXISTING DATA

Both the USCE and Acres American shared a common concern over the design impact of the "Fins" feature. Seismic refraction survey lines were made transverse to the feature's trend at several locations between the reservoir rim and Tsusena Creek. Borings DR-18, 19 and 20 from the USCE exploration program were apparently located to intercept the fins feature shear zones. Piezometers were placed in these vertical borings to measure seepage potential in the bedrock.

USCE borings DR-18 and 19 were taken to a depth of ±20 feet below top of bedrock without encountering any shear zones. DR-20 encountered the top of bedrock beneath 210 feet of overburden near elevation 2000. The ±50 feet of bedrock penetrated was described on the log as diorite, soft, medium grained, highly fractured to decomposed, blue-gray, clay gouge common, shear zone. Core recovery was 82%.

No mention of water losses are indicated on the boring logs. Piezometers installed in DR-18, 19, and 20 indicated the static groundwater level in overburden and bedrock is near the ground surface. Based on an appraisal of the overall area, there are no indications of perched groundwater.

6.4 ENGINEERING EVALUATION

Logic would indicate that the 5 year old disintegrated core which has been subjected to dehydration and many freeze-thaw cycles, may not accurately represent in-situ material. Based on the field log description, high static groundwater level, 82% core recovery, and the absence of drilling fluid losses, it would appear that the material in place is essentially an intact rock. If detrimental zones of high permeability do, in fact, exist, drill fluid would have been lost or different groundwater levels would have been measured between the overburden and bedrock.

Existing piezometers indicate the fins area is presently being subjected to hydrologic conditions equal to the expected reservoir induced hydrostatic pressures. Based on this data, very little detrimental change could be expected to occur upon reservoir filling.

Available information suggests there is limited potential for detrimental seepage and resulting erosion in the Fins area. Although project feasibility is not compromised, future exploration for design purposes should be conducted to verify this conclusion.

7.0 FUTURE EXPLORATIONS

7.1 INTRODUCTION

Geotechnical investigations conducted to date were made to determine the advisability of authorization of the project for construction. Their primary purpose has been to determine the engineering and economic feasibility of the project. Future explorations will be more detailed than the previous investigations and will vary in scope with the nature and significance of the feature. They will be in sufficient detail to (1) ascertain the foundation condition and properties, (2) determine the type of structure best suited to the site, (3) fix all controlling elevations, (4) determine the approximate elevations of structure foundations, (5) determine any special treatment the foundations may require, and (6) locate the sources of construction materials.

A careful review of all existing information including a detailed reexamination of the existing bedrock core will be made in order to determine the character and the amount of explorations required. Investigations generally will be progressive and will be coordinated with the specific phase of the design.

7.2 PROJECTED FUTURE EXPLORATIONS - WATANA

The attached Table I contains a detailed summary of the projected future explorations for the Watana Development. Prior to the start of any exploration program, the detailed plans, exploration manual and specifications will be developed. Layouts and details of the specific programs will be made during the pre-drilling period.

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TABLE I
PROJECTED FUTURE EXPLORATIONS - WATANA
(SUBSEQUENT TO WINTER 83 DRILLING PROGRAM)

TASK 5 WORK (Programmed by Engineering)

1. Plans and Specifications (summer, fall and winter programs)
   a. Overburden Drilling and Sampling
   b. Bedrock Drilling and Pressure Testing
   c. Adit Contracts

2. Site Geological Mapping Program
   a. Embankment and Hydr. Structure Fdns.
   b. Relict Channel (Entrance & Exits)
   c. Reregulation Dam Area
   d. Adits

3. Exploration to Deleniate Lineament in River
   a. Fdn. Cleanup
   b. Overburden Fdn. Excavation
   c. Aerial Mapping
   d. Remote Sensing

4. Construction Material Explorations

   a. Borrow Area "D"
      (1) Auger Borings
      (2) Churn Borings
      (3) Dragline Test Pits

   b. Borrow Area "E"
      (1) Churn Borings
      (2) Dragline Test Pits

   c. Quarry "A"
      (1) Core Holes
      (2) Test Blast

   d. Laboratory Testing

5. Dam Foundation

   a. Left Abutment
      (1) Core Holes (Angle)
      (2) Pressure Testing
      (3) Test Adits

TASK 5 WORK (Programmed by Engineering) (Cont'd)

b. Right Abutment
(1) Core Holes (Angle)
(2) Pressure Testing
(3) Test Adits

6. Hydraulic Structure Foundation
a. Diversion Tunnels
(1) Upstream Portals
(a) Core Holes (Angle)
(2) D/S Portals
(a) Core Holes (Angle)
(3) Test Adits

b. Powerhouse
(1) Core Holes (Angle & Vertical)
(2) Pressure Testing

c. Spillway
(1) Approach Channel
(a) Overburden Churn Holes
(b) Core Holes

(2) Structure Base
(a) Core Holes
(b) Pressure Test

(3) Discharge Channel
(a) Core Holes

7. Relict Channel
a. Upstream Entrance Face
Dozer Test Pits

b. Downstream Exit Face
(1) Dozer Trenches
(2) Backhoe Test Pits

c. Thalweg Area (Overburden)
(1) Auger Holes (Thru units E & F)
(2) Churn Holes (Thru unit K)
(3) Observation Device Installation
(4) Field Pumping Test

TASK 5 WORK (Programmed by Engineering) (Cont'd)

b. Right Abutment
   (1) Core Holes (Angle)
   (2) Pressure Testing
   (3) Test Adits

6. Hydraulic Structure Foundation
   a. Diversion Tunnels
      (1) Upstream Portals
         (a) Core Holes (Angle)
      (2) D/S Portals
         (a) Core Holes (Angle)
      (3) Test Adits

   b. Powerhouse
      (1) Core Holes (Angle & Vertical)
      (2) Pressure Testing

   c. Spillway
      (1) Approach Channel
         (a) Overburden Churn Holes
         (b) Core Holes

      (2) Structure Base
         (a) Core Holes
         (b) Pressure Test

      (3) Discharge Channel
         (a) Core Holes

7. Relict Channel
   a. Upstream Entrance Face
      Dozer Test Pits

   b. Downstream Exit Face
      (1) Dozer Trenches
      (2) Backhoe Test Pits

   c. Thalweg Area (Overburden)
      (1) Auger Holes (Thru units E & F)
      (2) Churn Holes (Thru unit K)
      (3) Observation Device Installation
      (4) Field Pumping Test

TASK 5 WORK (Programmed by Engineering) (Cont'd)

8. Fins (Reservoir rim to Tsusena Creek)
   a. Core Holes (Angle)
   b. Pressure Testing

9. Fingerbusters
   a. Core Holes (Angle)
   b. Pressure Testing
   c. Adits

10. Upstream Cofferdam Abutments
    a. Core Holes
    b. Pressure Testing

11. Relog All Previous Core

12. Access Roads

13. Construction Camp

14. Construction Village

NOTES:

1. Down hole geophysics will be considered for all core holes.

2. Surface seismic work will be considered in many areas.

3. The exploratory drilling along with pressure test results will determine the ultimate grout curtain program beneath the dam embankment and the hydraulic structures. The extent and details of the grouting program will be adjusted as the explorations yield additional information and as observations of permafrost, grout take and other geological data become available.

4. All available underground information (including relogging of existing core) will be studied in developing future bedrock explorations in the relict channel area downstream of the fins.

5. Because of the large potential cost savings, consideration should be given to the possibility of integrating the programs for the grout curtain holes with dam abutment bedrock borings for foundation design.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry Drilling & Blasting	PROJECT Susitna-Alaska
	COMPUTED LFL CHECKED	FILE NO. 1563
		DATE Feb 7'84 PAGE 1 OF PAGES

Rockfill Requirements. - Main Dam.

Year	FCY	x0.7875 * = BCY	BCY From R'qd Ex.	BCY From ** Quarry
1989	711,987	561,000	561,000	-0-
1990	3,125,266	2,461,000	2,461,000	-0-
1991	5,407,635	4,258,000	1,885,100	2,372,900
1992	7,472,356	5,885,000	-0-	5,885,000
1993	5,277,695	4,156,000	-0-	4,156,000
1994	2,799,724	2,205,000	-0-	2,205,000
	24,794,663	19,526,000	4,907,100	14,618,900

Quarry Min. Requirements:

Schedule:

Years

1990 | 1991 | 1992 | 1993 | 1994

Mobilize. —

Open Up —

1st yr. Op. - (2,372,900 BCY) ($339,000 BCY/mo)

2nd yr. Op. - (5,885,000 BCY) ($840,700 BCY/mo)

3rd yr. Op - (4,156,000 BCY) ($593,714 BCY/mo)

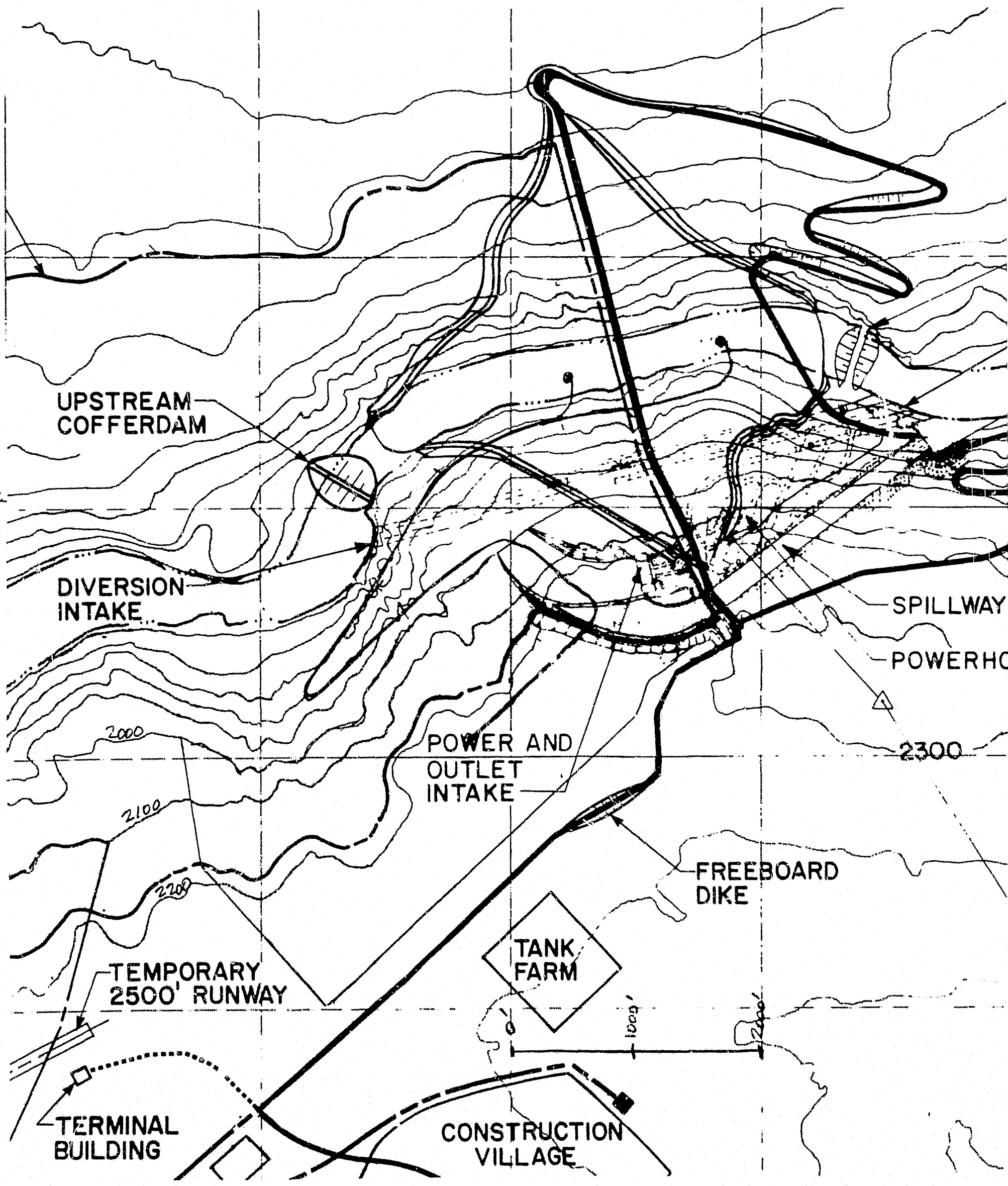
4th yr. Op - (2,205,000 BCY) ($315,000 BCY/mo)

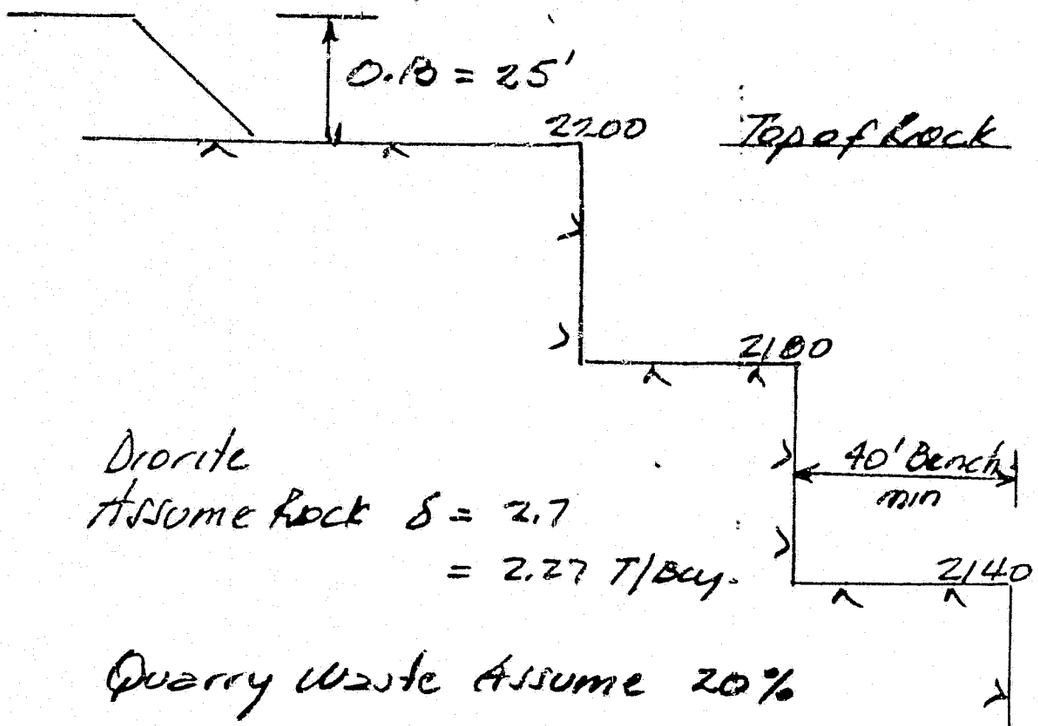
* Swell Factor = 0.75 ; Overburden Factor = 1.05 ∴ 0.75 x 1.05 = 0.7875

** Excludes Quarry Waste

0023 4

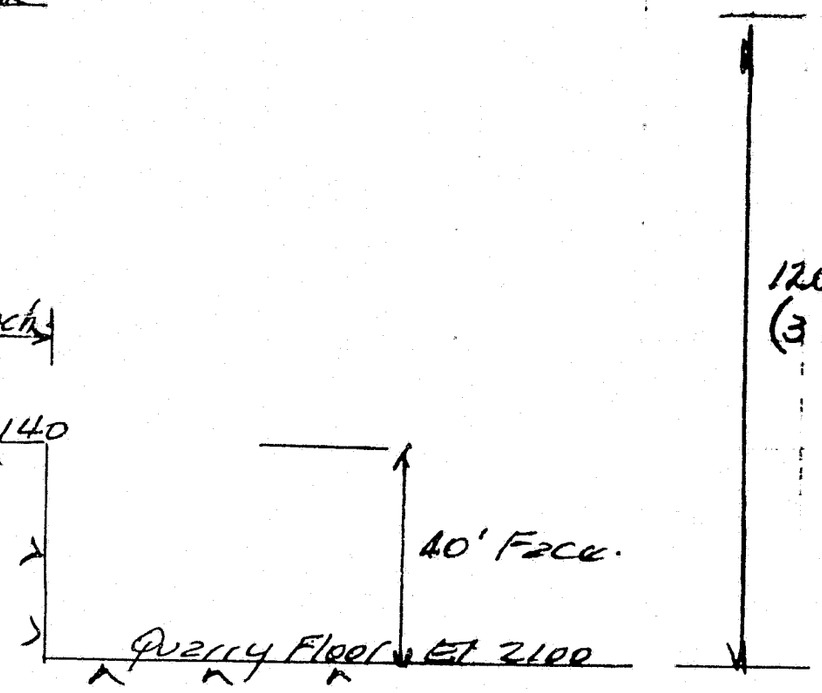
HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry Quarry Location	PROJECT Sardis-Olive
	COMPUTED LEL CHECKED	FILE NO. 1563
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Diorite
Assume Rock $\delta = 2.7$
$= 2.27$ T/Bcy.

Quarry Waste Assume 20%



Required : 14,618,900 Bcy.
$\times 27 \div 120 =$ 3,290,000 s.f.
$=$ 76 Acres.

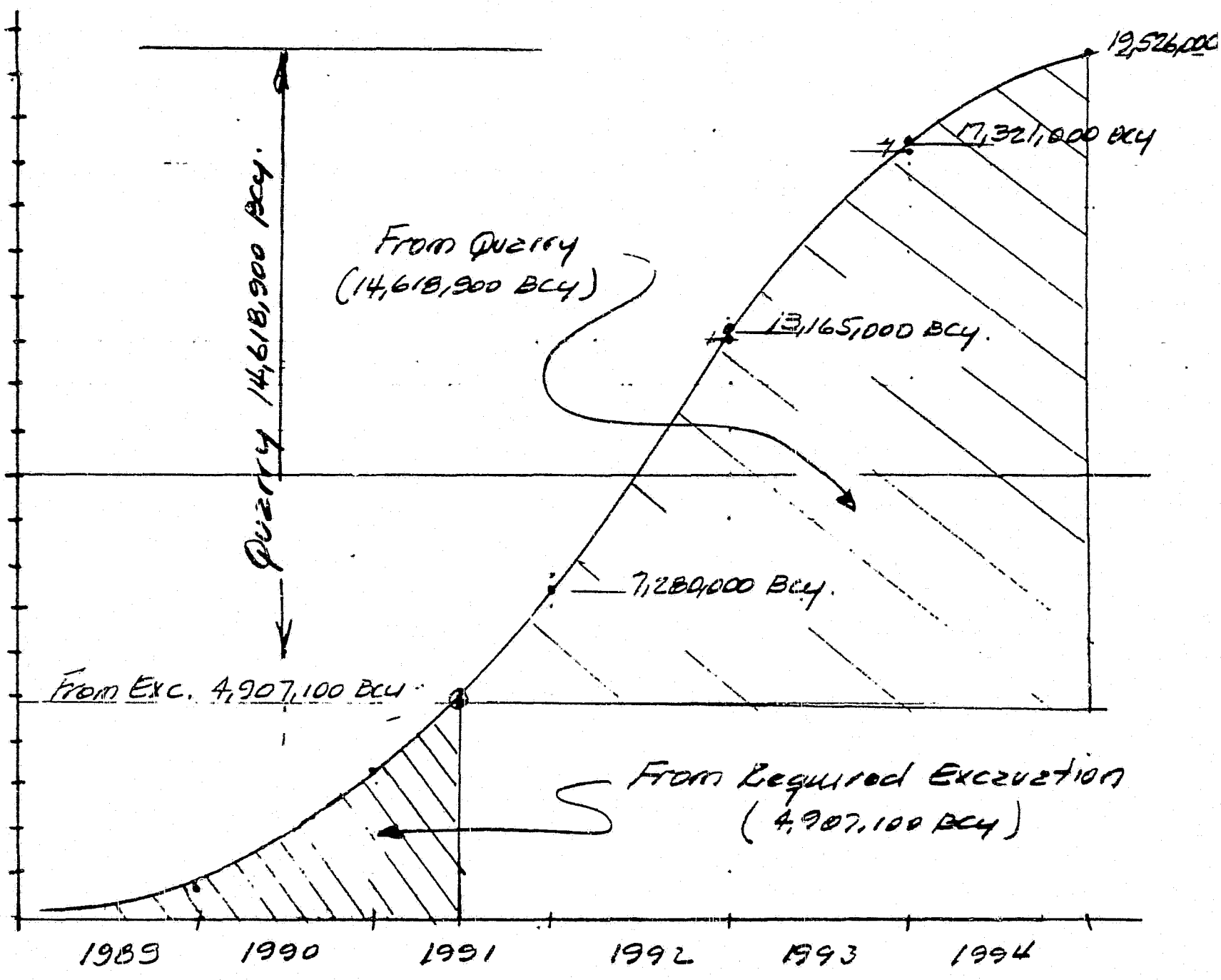
Assume Overburden = 25'
$\times$ 3,290,000 sf $\div$ 27 = 3,047,000 Bcy.

HARZA ENGINEERING COMPANY CHICAGO

SUBJECT Rockfill from Quarry
Quarry Section
COMPUTED 4/82
CHECKED

PROJECT Shuttle - Alaska
FILE NO. 176.3
DATE 6/14/82 PAGE 3 OF PAGES

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry Productions.	PROJECT Susitna - Alaska
	COMPUTED GFL CHECKED	FILE NO. 1563
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Quarry Production
(Excluding Quarry Waste)

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry Drilling & Blasting	PROJECT Susitna - Alaska
	COMPUTED GFL CHECKED	FILE NO. 1563
		DATE Feb 7'84 PAGE 5 OF PAGES

Drilling and Blasting. - Production Using Hydraulic Track-Drills

		%	60%	30%	5%	5%	Totals
Volume (No Waste)	BCy		8,771,000	4,385,400	731,000	731,000	14,618,900
Hole ϕ	inch		4½" ϕ	3½" ϕ	2½" ϕ	2" ϕ	
Bench Height	ft		40'	40'	20'	10'	
Overdrill	ft		3'	3'	2'	2'	
Stem	ft		15'	15'	7'	4'	
Column	ft		28'	28'	15'	8'	
Loading Density	δ		0.92	0.92	0.92	0.92	
Wt of Expl. per LF	#/LF		6.34	3.84	1.96	1.25	
Wt of Expl per hole	#/hole		177.52	107.52	29.40	10.00	
Powder Yield	#/cy		1.00	1.00	1.20	1.20	
Hole Yield	cy/hole		177.52	107.52	24.50	8.33	
Drilling Yield	cy/LF		4.13	2.50	1.11	0.69	
Length of hole	LF		2,123,728	1,754,000	658,558	1,059,420	
Quarry Waste x 1.20	LF		2,548,500	2,104,800	790,300	1,271,300	6,714,900 LF
Drill Production	LF/Hr.		45	41	50	55	
Drilling Time	Hrs.		56,630	44,783	15806	23,114	140,333 Hrs
							Call it 140,000 Hrs.

Above production represents:

14,618,900 BCy ÷ 6,714,900 LF = 2.18 BCy/LF of hole

6,714,900 LF ÷ 140,333 Drill Hr = 47.85 LF of hole / Drill Hr

No. of Holes	Ea.	59,300	48,900	35,000	106,000	249,200 Ea.
Explosives	#	10,525,200	5,263,100	1,052,600	1,052,600	17,893,500 #
Av. Powder Yield	#/cy.					1.22 #/cy.
Av. Length of Hole	ft					26.95'
Av.	#/hole					71.80 #/hole
Av. # of Powder/Hr.						1229 #/Hr.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry Drilling and Blasting	PROJECT Soutna - Alaska
	COMPUTED CFL CHECKED	FILE NO. 1563
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Drilling & Blasting - Cost Considerations (Track Drills only)

Base costs on drilling: 2-10 Hr shift/day, 6 days/wk

Available Time = 120 Hrs/wk (520 Hrs/mo x 28 mo = 14560 Hrs)

Effective Time* = 120 Hrs/wk x 0.75 = 90 Hrs/wk.

Assume 7.0 mos/yr x 4.33 = 330 Hrs/mo

Year	Req'd. BCY	@ 7.0 mo/yr. Monthly BCY/mo	@ 390 Hr/mo Hourly BCY/Hr.	x 1.2 Quarry Waste Hourly BCY/Hr.	@ 2.18 BCY/LF Hourly LF/Hr.	@ 47.85 LF/Hr. No. Drills
1991	2,372,900	339,000	869	1043	478	10
1992	5,885,000	840,700	2156	2587	1187	25
1993	4,156,000	593,700	1523	1828	838	18
1994	2,205,000	315,000	808	970	445	9

Labor:	1991	1992	1993	1994	Average Crew
Foremen (Drills)	1	+ 2 x	+ 2 x	+ 1	= 1.50 Gr.
Drillers (Track Drill)	10	25	18	9	= 15.50
Chucktenders	10	25	18	9	= 15.50
Compr. Op.	1	2	2	1	= 1.50
Powder Foreman	1	1	1	1	= 1.00
Powdermen (@ 150 #/hr)	2	5	3	2	= 3.00
Truck Driver	1	1	1	1	= 1.00
Grade-Checkers	2	2	2	2	= 2.00
	28	43	31	26	41.00 (14560 Pay-Hrs)

Above crew represents:

14560 pay-hrs x 41.00 mh/hr ÷ 6,714,900 LF = 0.089 mh/LF

0.089 mh/LF ÷ 2.18 BCY/LF = 0.041 mh/BCY

* Effective Time: excludes time lost for blasting and moves to different faces. Includes time for in-out of holes and repairs.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rocktill from Quarry Drilling & Blasting	PROJECT Susitna - Alaska
	COMPUTED CFC CHECKED	FILE NO. 1563
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Use Hydraulic Track Drills.

Drilling & Blasting - Cost (Continued)

Labor: See Average Crew Page.

Equipment (Average)

Based on 28 mos x 390 Hrs/mo

Track Drills - Hydraulic	15.50	x	9032 Hrs	=	140,000 Hrs.
1200 CFM Compressors	4.50	x	9032	=	40,644
Slurry Truck	1.00	x	10920	=	10,920
Flat Bed Truck	1.00	x	10920	=	10,920
Pick Up	2.00	x	10,920	=	21,840

Materials and Supplies:

Drill Bits & Steel	4½" Ø	2,548,000 LF	@ $ 0.60/LF =
" " "	3½	2,104,800	0.40
	2½	790,300	0.35
	2	1,271,300	0.30
Explosives		17,893,500 #	$ 1.70/#

Small Tools & Misc Supplies 10% of Labor Cost

Base Unit Cost of Drilling & Blasting on 14,618,900 BCY of Rock.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Backfill from Quarry — Loading & Hauling	PROJECT Sunitza - Alaska
	COMPUTED 4FC CHECKED	FILE NO. 1563
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Loading Trucks - Production. Based on: 14,618,900 BCy
or 18,563,400 FCy

Use 992 Cat FEL : 13.5 Cy Capacity., Loading 85T Rear Dumpers.

Bucket Capacity	13.5 BCy Heaped
Bucket Factor	0.70 (Blasted Rock)
Swell (Bank - Loose)	0.67
Bucket Payload:	
13.5 x 0.70 x 0.67	6.33 BCy
Truck Cap. 85Ton ÷ 2.27 T/BCy	37.50 BCy
Passes/Truck: 37.50 ÷ 6.33 ~	6.00 Ea
Truck Payload:	
6 passes x 6.33 BCy/pass ~	37.98 BCy/Truck Load
Pass Cycle	0.70 min/pass
Time per Truck Load:	
6 passes @ 0.70 min	4.20 min
+ Truck Exchange	0.20
	4.40 min per Truck Load
Truck Loads/Hr:	
45 min Hr ÷ 4.40 min	10.23 Truck Loads/Hr
Production per Hr: (Bank cy)	
10.23 Truck Loads @ 37.98 BCy	388 BCy/FEL Hr. Bank Measure.
Production per Hr: (Fill cy)	
388 BCy/FEL ÷ (0.788)	492 FCy/FEL Hr. Pay Fill Measure

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry Loading & Hauling	PROJECT Switna-Alaska
	COMPUTED LFC CHECKED	FILE NO. 1563
		DATE Feb 9 '84 PAGE 9 OF PAGES

Hauling - Production Cycle Time Quarry to Embankment

From - To	Dist LF	Grade %	R.R. %	E.G %	Speed fpm	Time min
Loaded :						
To Quarry Floor	2000'	-10.0	+3.0	-7.0	1848	1.08
To Embank	6000'	-12.0	+3.0	-9.0	1320	4.55
In Dam	2000'	-5.0	+3.0	-2.0	3432	0.58
Empty :						
In Dam	2000'	+5.0	+3.0	+8.0	2200	0.91
To Quarry Floor	6000'	+12.0	+3.0	+15.0	1232	4.87
In Bench	2000'	+10.0	+3.0	+13.0	1496	1.34
Acc/Desc						0.50
Total Travel RT	20,000'					13.80 min (16.5mph)
Maneuver						0.60
Unload						1.20
Load						4.40
Total Cycle						20.03 min

No. Trips (45min-Hr) = 2.25 Trips/Hr

BCy/Truck-Hr = 2.25 Trips/Hr x 37.98 BCy/Truck = 85.45 BCy/Truck Hr

No. Trucks Required =

80% of Material will go directly to Embankment

therefore :

0.8 x 388 BCy/FEL-Hr. = 310 BCy/FEL Hr

310 BCy/FEL Hr ÷ 85.45 BCy/Truck Hr = 3.6 Trucks.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rock fill from Quarry Loading & Hauling	PROJECT Susitna - Alaska
	COMPUTED LFL CHECKED	FILE NO. 1563
		DATE Feb 9 '84 PAGE 10 OF PAGES

Hauling - Production Cycle Time Quarry to Waste Disposal.

From - To	Dist LF	Grade %	R.R. %	E.G %	Speed fpm	Time Min.
Loaded:						
To Quarry Floor	2000'	-10.0	+3.0	-7.0	1848	1.08
To Waste	2000'	-5.0	+3.0	-2.0	3432	0.58
Empty:						
To Bench	2000'	+5.0	+3.0	+8.0	2200	0.91
In Bench	2000'	+10.0	+3.0	+13.0	1496	1.34
Acc/Desc.						0.50
Total Travel RT	8000'					3.91 min (23.5mph)
Maneuver.						0.60
Unload						1.20
Load						4.40
Total Cycle.						10.11 min

No Trips (45 min Hr). 4.45 Trips/Hr

BCY/Truck Hr = 4.45 Trips/Hr x 37.98 BCY/Truck = 169.05 BCY/Truck

No. Trucks Required:

20% of Material will be wasted within quarry area therefore:

0.20 x 388 BCY/FEL Hr = 77.6 BCY/FEL Hr.

77.6 BCY/FEL Hr ÷ 169.05 BCY/Truck Hr = 0.6 Trucks.

Total Trucks:

For 80% of Material	3.6 Units.
For 20% " "	0.6
	4.2 Units.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry Loading & Hauling	PROJECT Susitna - Alaska
	COMPUTED CFC CHECKED	FILE NO. 1563
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Material will be loaded w/ing 13.5cy FEL (992 Cats) onto 85 ton Rear Dump Trucks (777 Cats). 80% of the material will be hauled directly to the embankment and 20% will be wasted in the quarry.

The cost estimate will be based on working 2-10 Hr shifts per day, 6 days/wk or 520 Hrs/mo, 7 mo/yr (3640 Hr/yr) Front End Loader production was based on 45 min Hr (0.75 Eff).

Cost of construction roads will be included in the overheads. Road maintenance will be charged 50% to rockfill and 50% to impervious fill.

Year.	Required BCy.	x 1.2 for Quarry Waste BCy.	@ 388 BCy/Hr FEL-Hrs.	@ 3640 Hrs. No. FEL.
1991	2,372,900	2,847,480	7339	2.0
1992	5,885,000	7,062,000	18201	5.0
1993	4,156,000	4,987,200	12853	3.5
1994	2,205,000	2,646,000	6819	1.9
	14,618,900	17,542,680	45212 Hrs.	

Labor.	1991	1992	1993	1994	Av. Crew.
Foreman	1.0	2.0	2.0	1.0	1.50
FEL Op.	2.0	5.0	3.5	2.0	3.11
Dozer Op.	1.0	2.0	2.0	1.0	1.50
Truck Drivers.	8.4	21.0	14.7	8.4	13.13
Flagmen	2.0	2.0	2.0	2.0	2.00
Grader Op.	0.5	0.5	0.5	0.5	0.50
Water Truck Driver.	0.5	0.5	0.5	0.5	0.50
	15.40	33.00	25.20	15.40	22.24

14560 Pay Hrs

14560 Pay Hrs X 22.24 mh/Hr ÷ 14,618,900 BCy = 0.022 mh/BCy.

= 0.017 mh/FCy

Loading / Hauling - Cost (Continued)

Labor : See Average Crew Page. 11

Equipment : (Average)

Based on 28mo x 520 Hrs = 14560 Hrs.

992C Cat FEL (13.5cy Cap)	3.11 ea	x	14560	= 45,212 Hrs
D8K Cat Tractor w/Dozer.	1.5	x	14560	= 21,840
777 Cat Dump Trucks. (85T)	13.13	x	14560	= 191,173
No16 Cat Grader	0.5	x	14560	= 7,280
Water Truck	0.5	x	14560	= 7,280
Pick Up Truck.	1.5	x	14560	= 21,840

Small Tools & Misc. Allow 5% of Labor Cost.

Base Unit Cost of Loading & Hauling on. 18,563,400 Filcy

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry Overburden	PROJECT Sunitma-Hazite.
	COMPUTED LFL CHECKED	FILE NO. 1563
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Remove Overburden.

Assume 25' of O.B. - 3,047,000 BCy - will be removed and hauled to waste. Use 992 C Cat FEL & 777 Trucks 85T

Bucket Capacity	=	13.5 cy Heaped
Bucket Factor	=	0.75
Swell (Bank to Loose)	=	0.80 (25%E + 25%L)
Load : 13.5 x 0.75 x 0.80		8.10 BCy
Truck Cap. 85 ÷ 2.01	=	42.29 BCy.
No Pass / Truck	=	5. Cy. ∴ (5. x 8.10 = 40.5 BCy/Load)
Pass Cycle	=	0.70 min
Time/Truck Load	=	3.50 min
Truck Exchange	=	0.20
		3.70 min per truck load
45 min/Hr	=	12.16 Truck Loads.
x 40.5 BCy/Load	=	493 BCy/Hr. (6180 Hrs)

Truck Cycle: Haul to Waste. within quarry area assume haul distances as follows:

From - To	Dist.	Grade	R.R	EG	Speed	Time	
Loaded.	LF	%	%	%	fpm	min.	
Bench - Floor	2000	-10.0	3.0	7.0	1848	1.08	1.91 min
To Waste	2000	- 5.0	3.0	2.0	3432	0.58	@ 2094 fpm
Accelerate & Slow Down						0.25	23.8 mph.
Empty.							
To Bench.	2000	+5.0	3.0	8.0	2200	0.91	2.50 min
In Bench	2000	+10.0	3.0	13.0	1496	1.34	@ 1600 fpm
Accelerate & Slow Down						0.25	18.2 mph.
	4000' One way.					4.41	
+ Loading with FEL & Maneuver (3.70 + 0.60) =						4.30	
+ Unloading & Turning						1.20	
						9.91 min	

45 min hr ÷ 9.91 min/Truck load = 4.54 Trips/Hr.
x 40.5 BCy/Load = 183.91 BCy/Truck Hour, Rqd 493 BCy/Hr say. 3 Trucks

Overburden Removal - Cost.
Base Cost on 6180 Hrs.
Labor:

Foreman	1
FEL Op.	1
Dozer Op. Pit	1
Truck Drivers.	3
Dozer Op. Waste	1
Flagmen	1

7 x 6180 Hrs = 43260 mh.
÷ 3,047,000 Bcy = 0.014 mh/Bcy.

Equipment.

992 Cat FEL	1 ea
D8 Cat Dozer	2
777 Truck 85T	3
Pick Up.	1

Road maintenance cost is included under quarry operation Load & Haul.

Base Overburden Removal unit cost on 3,047,000 Bcy.

HARZA ENGINEERING COMPANY CHICAGO

SUBJECT Rockfill from Quarry Overburden

COMPUTED LFL CHECKED

PROJECT Scritnz - Alzitz

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Overburden Removal - Cost.
Base Cost on 6180 Hrs.
Labor:

Foreman	1
FEL Op.	1
Dozer Op. Pit	1
Truck Drivers.	3
Dozer Op. Waste	1
Flagmen	1

7 x 6180 Hrs = 43260 mh.
÷ 3,047,000 Bcy = 0.014 mh/Bcy.

Equipment.

992 Cat FEL	1 ea
D8 Cat / Dozer	2
777 Truck 85T	3
Pick Up.	1

Road maintenance cost is included under quarry operation Load & Haul.

Base Overburden Removal unit cost on 3,047,000 Bcy.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry. Clearing & Grubbing	PROJECT Saltnz - Alatna
	COMPUTED CFC CHECKED	FILE NO. 1563
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Clearing & Grubbing.

Assume 76 Acres. @ 2.0 Acre / Bulldozer day = 38 Days.
X 10 Hrs / Day = 380 Hrs.

Labor:
1- Foreman
10- Laborers.
1- Dozer Op.
1- Chipper Op.
2- Truck Drivers.
1- FEL Op.
16 men. x 380 Hrs = 6080 mh ÷ 76 Acres = 80 mh/Acre

Equipment.
1- D9 Cat & Dozer.
1- Chipper (Use D8 late)
2- 85T Trucks.
1- 992 FEL.

M&S.
Allow 15% of Labor for STS.

Base Unit Cost on 76 Acres

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry Placing Rockfill COMPUTED CFL CHECKED	PROJECT Switna-Alaska FILE NO. 563 DATE Feb 14'84 PAGE 16 OF PAGES

Placing Rockfill - Production.

Assume that rockfill will be dumped from 85 Ton Rear Dump Trucks and that the material will be spread using D9 Cat tractors with bulldozers and rakes. Material will be placed in 2' lifts and compacted using 10 Ton Flat Wheel Vibratory Rollers.

a) Bulldozer Production:	
Dozing Distance Average	150 ft. (300' Max. Distance)
Material Wt (Loose)	3130 #/cy.
Wt Correction Factor: 2300/3130	0.735
Job Eff. " " : 45min/hr.	0.750
Operator " "	0.750
Total Correction Factors:	
0.735 x 0.75 x 0.75 =	0.413
Uncorrected Max. Production	1300 Loose Cy
Shrinkage From Loose to Fill	
3130/3930	0.796
Production:	
1300 Lcy x 0.413 x 0.796	427 FCy (Pay Fill Measure)/Hr.
Rake Production:	
0.75 x 427 FCy	320 FCy/Hr. " "
b) Roller Production:	
Compactor Width/Pass	8'
Speed	6 mph.
Compacted lift thickness.	10 in
No. Passes.	4 Ea.
Production:	
(8 x 6 x 10 x 16.3 ÷ 4) x 0.60	1174 FCy/Hr

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Quarry. Placing Rockfill	PROJECT Susitna - Alaska
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Placing Rockfill — Production 18,563,400 FCY
14560 Hrs. @ 1274 FCY/Hr Average.

Year	Required BCY.	Required FCY. × 1.2698	Hourly @ 3640 Hr/Yr. FCY/Hr.	Dozers @ 320 FCY/Hr. E2.	Compactors. @ 1174 FCY/Hr. E2.
1991	2,372,900	3,013,200	828	2.6	0.71
1992	5,885,000	7,473,000	2053	6.4	1.75
1993	4,156,000	5,277,300	1449	4.5	1.23
1994	2,205,000	2,799,900	769	2.4	0.66
	14,618,900	18,563,400			

Labor. (Average Crew)

Fill Foreman	1.00
Dozer Op.	4.00
Compactor Op.	1.10
Grade Checkers.	2.00
Spotters.	2.00

10.10 men × 14560 Hrs ÷ 18,563,400 FCY = 0.008 mh/FCY

Equipment

D9 Cat w/Rakes	4.0 ea	×	14503 Hrs	=	58011 Hrs.
Compactors 815	1.1	×	14375 Hrs	=	15812
Pick Up.	1.0	×	14375 Hrs	=	14375

Small Tools allow 5% of Labor.

Base Unit Cost on 18,563,400 FCY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Stockpile Load & Haul.	PROJECT Susitna - Alaska
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Loading Trucks -

Rock materials from required excavations will be either hauled directly to embankments, stockpiled for later use or wasted. The cost estimate will be based on the following assumptions:

Required Excavations: Locations	BCY	To Stockpile BCY	Direct to Fill BCY	To Waste BCY.
Tunnel Portals		104,200	-0-	
Main Dam Fnd.	1,214,000	607,000	-0-	607,000
Spillway Approach	1,096,000	219,200	657,600	219,200
" Control	274,000	54,800	164,400	54,800
" Chute & Bucket	1,592,500	318,500	955,500	318,500
Power Intake Appr.	1,695,300	339,100	1,017,100	339,100
" " Struct.	115,300	23,100	69,100	23,000
Bank Measure		1,665,900	2,863,700	
Fill Measure (÷0.788)		2,307,000	3,924,600	

The cost estimate will be based on using 13.5 cy Cap. Front End Loaders (992C Cats) loading 85 Ton Rear Dump Trucks. (777 Cats) and hauling from stockpile to the embankment.

Work 2-10 Hr Shifts/Day, 6 days/wk or 520 Hrs/mo, 7 months/yr (3640 Hrs/yr) Front End Loader production is based on 45 min-hr @ 338 BCY/Hr or 429 FCY/Hr.

Cost of construction roads will be included in the overheads. Road maintenance will be considered included in the quarry operations.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Stockpile	PROJECT Susitna - Alaska
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Loading Trucks - Production Based on: 2,307,000 FCY
or 1,816,500 BCY.

Use Cat 992C FEL (13.5 CY Cap), Load 85T Rear Dump Trucks.

Bucket Capacity	13.5 BCY Heaped
Bucket Factor	0.65 (Rock Stockpile From Excav)
Swell (Bank - Loose)	0.67
Bucket Pay Load:	
13.5 x 0.65 x 0.67	5.88 BCY
Truck Cap: 85 Ton ÷ 2.27 T/BCY	37.50 BCY.
Passes/Truck: 37.50 ÷ 5.88	6.00 ea.
Truck Pay Load:	
6 passes x 5.88 BCY/pass.	35.28 BCY / Truck Load
Pass Cycle	
Time per Truck Load:	
6 passes @ 0.75 min	4.50 min
+ Truck Exchange	0.20
	4.70 min per Truck Load
Truck Loads/Hr:	
45 min/Hr ÷ 4.70 min	9.57 Truck Loads/Hr.
Production per Hr: (Bank Cy)	
9.57 x 35.28	338 BCY/FEL Hr Bank Measure
Production per Hr: (Fill cy)	
338 ÷ 0.788	429 FCY/FEL Hr.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Backfill from Stockpile Load & Haul	PROJECT Swiftz-Alaska
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Hauling Production - Cycle Time Stockpile to Dam Embankment.

From - To	Dist Lf.	Grade %	R.R %	E.G %	Speed fpm	Time min
Loaded:						
Stockpile to Dam	4000'	+6.0	+3.0	+9.0	880	4.55
Dam Road	2000'	+12.0	+3.0	+15.0	440	4.54
Within Dam	1000'	+1.0	+3.0	+4.0	1760	0.57
Empty.						
Within Dam	1000'	-1.0	+3.0	+2.0	3432	0.87
Dam Road.	2000'	-12.0	+3.0	-9.0	3432	0.58
To Stockpile	4000'	-6.0	+3.0	-3.0	3432	1.17
Acc/Desc.						0.50
Total Travel R.T						12.78 min
Maneuver						0.60
Unload.						1.20
Load.						4.70
Total Cycle						19.28 min

No. Trips (45 min/hr) 2.33 Trips/Hr.

BCY/Truck Hr = 2.33 Trips/Hr x 35.28 BCY/Truckload = 82.20 BCY/TL.

No. Trucks Required:

338 BCY/FEL Hr ÷ 82.20 BCY/Truckload per Hr = 4.1 62.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Backfill from Stockpile Load & Haul.	PROJECT Susitna-Alaska
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Rockfill from Stockpile - Cost.
Load & Haul.
Base Cost on 2,307,000 FCY ÷ 429 FCY/Hr = 5378 Hrs.

Labor:

Foreman	1
FEL Op.	1
Truck Drivers.	4
Dozer Op.	1
Flagmen.	1

8 ea x 5378 Hrs ÷ 2,307,000 FCY = 0.019 FCY.

Equipment.

992C Cat FEL	1	x 5378 Hrs.	=	5,378 Hrs.
85 Ton Trucks.	4	"	=	21,512
D8 w/ Dozer.	1	"	=	5,378
Pick Up.	1	"	=	5,378

Small Tools. Allow 5% of Labor Cost.

Base Unit Cost on 2,307,000 FCY.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Stockpile Placing Rockfill COMPUTED LFL CHECKED	PROJECT Swiftnz - Alaska FILE NO. 1563 DATE Feb 14 '84 PAGE ___ OF ___ PAGES

Placing Rockfill - Production & Costs.

Use same assumptions as in "Placing Rockfill from Quarry"
See Page 16 - Rockfill from Quarry.

2,307,000 FCY ÷ 320 FCY/Dozer Hr = 7209 Dozer Hrs.
2,307,000 FCY ÷ 1174 FCY/Comp. Hr = 1965 Compactor Hrs.

Labor. (Average Crew)

Fill Foreman	1.0 EA
Dozer Op.	3.7
Compactor Op.	1.0
Grade Checkers	2.0
Spotters.	2.0
	9.7

9.7 x 1965 Hrs ÷ 2,307,000 FCY = 0.008 mh/FCY

Equipment.

D9 Cats w/Rake.	3.7 EA x 1965 Hrs	= 7209 Hrs.
Compactors. 825	1.0 x 1965	= 1965
Pick Up.	1.0 x 1965	= 1965

Small Tools allow 5% of Labor.

Base Unit Costs on 2,307,000 FCY.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Rockfill from Excavation / Placing Rockfill	PROJECT Sevitne-Alaska
	COMPUTED LFL CHECKED	FILE NO. 1563
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Placing Rockfill - Production & Costs.

Use same assumptions as in "Placing Rockfill from Quarry"
See Page 16 - Rockfill from Quarry.

3,924,600 FCy ÷ 320 FCy/DozerHr = 12,264 Dozer Hrs.
3,924,600 FCy ÷ 1174 FCy/CompactorHr = 3,343 Compactor-Hrs.

Labor (Average Crew)

Fill Foreman	1.0	Ea.
Dozer Op.	3.7	
Compactor Op.	1.0	
Grade Checkers.	2.0	
Spotters.	2.0	

9.7 x 3343 Hrs ÷ 3,924,600 FCy = 0.008Mh/FCy

Equipment.

D9 Cats w/Rakes.	3.762	x 3343 Hrs	=	12264 Hrs.
Compactors 825	1.0	x 3343	=	3343
Pick Up.	1.0	x 3343	=	3343

Small Tools allow 5% of Labor.

Base Unit Costs on 3,924,600 FCy

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Raking Rockfill	PROJECT Susitna - Alaska
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Raking Rockfill - Production & Costs.

Use some assumptions as in "Placing Rockfill from Quarry"
See Page 16 - Rockfill from Quarry.

902,000 FCy ÷ 320 FCy / Rake hr. = 2819 Rake Hrs.

Labor.
Dozer Op 1 x 2819 Hrs ÷ 902000 FCy = 0.003 mh/FCy

Equip.
D9 with Rake 1 x 2819 Hrs

Small Tools allow 5% of Labor.

Base Unit Costs on 902,000 FCy

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Dragline Excavation	PROJECT Susitna - Alaska
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Dragline Information. 10290

Model 480W · RB Alaska – $3220,000

Total Excavation: (Alluvium)

Main Dam Bottom	2,500,000 cy.
Channel Alluvium	1,060,000
Borrow	28,026,800
	31,586,800
@ 486 Bcy/Hr =	65000 Dragline Hrs.
÷ 4 Ea =	16250 Hrs/Ea.

Depr. : $3,220,000 @ 12% in 6 yrs. = $
: 0.24323 x. = 783,200 /yr. Incl. Standby.
X 6 yrs. 4,699,100
Salvage 40% of. 1,288,000
Principal + Interest. 3,411,100 /yr.

÷ 16250 Hrs = $209.91 /Hr.

Fuel 47 GPH @ 1.35 =	63.45
Repair Parts @ .502 x (3,220,000 – 1,288,000) ÷ 16250 Hrs =	59.45
Maint. Labor @ 2 man hrs/hr x $35.00 =	70.00
	$402.81 /Hr.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Drainage Ditches	PROJECT Swiss - Alaska
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Item.		Qty
131A -	Impervious Fill	
	a) Overburden Removal	1,800,000 Bcy
	b) 2' Gravel Base.	1,200,000 Fcy.
	c) Drainage Ditches.	23,200 LF
	d) Load & Haul Materials	7,950,000 Fcy.
	e) Placing Fill	7,950,000 Fcy.
	Total Based on	7,950,000 Fcy.
131 B. -	Provide Drying Facilities Equip.	LS. ± 10,000,000
131C -	Drying Impervious Fill.	
	a) Operate Drying Plant.	1,576,000 Fcy.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill General	PROJECT Susitna - Alaska
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General -

It is assumed that acceptable impervious materials are attainable from borrow area "D" by properly mixing the layered deposits. It is expected that a suitable mix can be accomplished by blending the covering outwash gravelly layer with clays from the underlying tills, during the excavation of vertical cuts of the borrow area that has been pre-drained by opening the base of the pit on an incline. This method should produce an acceptable blend of materials without special processing procedures.

Maximum thickness of the deposits is in the order of 30', and the blending of the layers can be best accomplished by the use of large Backhoes working from the top surface and loading dump-trucks.

For estimating purposes it will be assumed that the pit will be pre-drained using ditches. It will be further assumed that 20% of the material will be dried by use of drying equipment capable of removing 5% moisture.

Construction Methods. -
Assume 6 yr. operation as shown in page 4
The borrow pit area is approximately:

9,540,000 Bcy x 1.25 for waste = 12,000,000 Bcy.
x 27 cf/cy ÷ 20' = 16,200,000 sf
÷ 43560 = 372 Acres.

The top 3' will be dozed to form stockpiles then loaded using FEL's and hauled 2000' to disposal. It is assumed that 1,800,000 Bcy will be handled this way.

Construction Methods (Continued)

A 2' Gravel base will be placed after removal of top soil to sustain excavating and hauling equipment. The total amount of gravel will be in the order of 1,200,000 cy and will be obtained from the river alluvium.

The mass excavation will be performed using 5cy backhoes (1266 Komatsu.)... It is assumed that the average depth of cut will be 20'. The backhoes will load 85 Ton Rear Dump Trucks (777 Cats.); 80% of the material will be hauled 12000' to embankment and 20% will be hauled 5000' to the drying plant where it will be dried, reloaded to trucks and hauled 8000' to embankment.

In the embankment the material will be spread using bulldozers and compacted in 8" layers. During the winter season the top of the core will be protected by covering with 3' of gravel to be removed in the spring prior to commencing placing core materials.

It is assumed that clay core operations can be performed from the middle of April until the middle of October. for a period of 6.0 mos. working 2-10 Hr shifts/day 6 days/wk. or 3118 Hrs/yr., allow 0.75 for effective time or 2340 effective hours. x 6 yr = 14,040 Hrs.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Required Production	PROJECT Switna - Alaska
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Required Production — Main Dam & Cofferdams.

Year	FCY.	= BCY.
		x 1.20 *
1989	1,087,115	1,304,500
1990	761,110	913,300
1991	1,421,715	1,706,000
1992	2,060,325	2,472,400
1993	1,592,960	1,911,600
1994	953,775	1,144,600
	7,877,000	9,452,400

+ Cofferdams.

73,000	87,600
7,950,000	9,540,000

* Assume: Wt in Bank = 3250 #/cy; Wt in Fill. = 3720 #/cy.
Swell Factor (Bank → Fill) = 1.15
x 1.05 for Over Run. Use. 1.20

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Overburden Removal.	PROJECT Susitna - Alaska
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Production :

5 Overburden Removal :- 1,800,000 BCy

The top 3' will be stockpiled using D8's with U Dozers pushing 300' then Loading with 992 FEL into 85 ton Truck, haul 5000'

a) Bulldozer Production :	
Dozing Distance	300' (600' max)
Mat. Wt. Loose	3130 #/Cy
Wt Correction Factor : 2300/3130	0.735 (1.57 T/Cy)
Job Eff. " " 45 min/Hr	0.750
Operator " "	0.750
Total Correction Factor : 0.735 x 0.75 x 0.75 =	0.413
Uncorrected Max Product.	550 Loose Cy
Shrinkage Factor.	0.80 to BCy
Production : 550 x 0.413 x 0.80 =	182 BCy/Hr.
b) Front End Loader Production	
Bucket Cap.	13.5 BCy Heaped
Bucket Factor.	0.90
Swell (Bank → Loose)	0.80
Bucket Payload.	9.72 BCy.
Truck Cap. 85T ÷ 1.57 T/Cy	54.31 BCy/Truck Load.
Passes/Truck.	5.6 ~ 6.0 ea ∴ (Truck Load = 6.0 x 9.75 = 58.5 BCy
Time/Truck Load = 6.0 pass @ 0.75 min	4.50 min
+ Truck Exchange.	0.20
	4.70 min per Truck Load
Truck Loads/Hr (45 min Hr)	9.57 ea Truck Loads/Hr
Production : 9.57 x 58.5 BCy	560 BCy/Hr.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Overburden Removal	PROJECT Susitna - Alaska
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Hauling Overburden - Cycle Time to Disposal Area.

From - To	Dist Ft	Grade %	R.R %	EG %	~~Speed~~ fpm	Time min
Loaded:	9000'	-10.0	+3.0	-7.0	1848	2.71
Empty:	5000'	+10.0	+3.0	+13.0	1496	3.34
Acc/Des.						0.50
Travel Time:						6.55 min
Maneuver.						0.60
Unload						1.20
Load.						4.70
Total Cycle.						13.05 min

No. Trips/45 min Hr. 3.45 ~~62~~ Trips/Hr.

Bcy/Truck Hr = 3.45 Trips/Hr x 58.5 Bcy = 201.72 Bcy/Truck Hr.

No. Trucks Required: =

560 Bcy/Hr ÷ 201.72 Bcy/Truck Hr = 2.8 Trucks.

Call it 3.0 ~~62~~

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Overburden Removal	PROJECT Svitna - Alaska
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Overburden Removal – Cost
Based on 1,800,000 BCY ÷ 560 BCY = 3215 Hrs.

Labor.

Foreman	1. 62.
FEL Op.	1
Dozer Op.	3
Truck Drivers.	3.
Flagmen	2

(560 BCY ÷ 182 BCY/Hr).

10 62 X 3215 Hrs = 32150 mh
÷ 1,800,000 CY = 0.018 mh/BCY.

Equip:

992C Cat FEL	1
85 Ton Trucks.	3
416 E w/U Dozer.	3
Pick Up.	1

Small Tools allow 5%

Base Cost on 1,800,000 BCY of Overburden Removal.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill 2' Gravel Base.	PROJECT Susitna - Alaska
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2' Gravel Base.

Place 1,200,000 Cy of gravel after removal of the top soil.

Use same unit costs as developed for Sand & Gravel Fills

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Temporary Fill Drainage Ditches.	PROJECT Susitna-Alaska
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Drainage Ditches.

Excavate 30' trenches @ 200' c.c fill bottom 10' with gravels and top 20' with pit run material. Assume trench side slopes @ 1:6.

Allow for 16,200,000 sf of Area ÷ 700 sf/lf = 23200' of Ditch.

Using 1066 Koahang Backhoe with a 3' wide bucket 2 cy Bucket. excavate a trench @ a rate of 2.0 x 0.80 x 40 swings/Hr = 64 Bcy/Hr. The trench will need 9 cy/LF ∴ 64 Bcy/Hr ÷ 9 cy/LF = 7.11 LF/Hr. and 23,200 LF of Ditch ÷ 7.11 LF/Hr = 3263 Hrs.

The bottom 10' of the trench will require about 2 cy/LF of trench or 23200' x 2 = 46400 cy of gravel. The gravel will be dumped on the trench side and placed using the same hoe. The rest of the trench will be backfilled using pit-run the same way.

Backhoe Hrs.

Dig Trench	: 23,200.' @	7.11 LF/Hr	=	3263 Hrs.
Place Gravel	: 46,400 cy @	50 cy/Hr	=	928
Backfill	: 162,400 cy @	50 cy/Hr	=	3246
				7439 Hrs.

Work 140 Hr Day x 6 Days/wk x 7 mos x 4 yrs.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Drainage Ditches.	PROJECT Susitna - Alaska
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Cost of Drainage Ditches.

Base on 7439 Hrs.

Labor

Foreman	1.0 Gz
Hoe Op.	1.0
Oiler	1.0
Spotter	1.0
Grade Checker	2.0
	6.0 Gz x 7439 Hrs ÷ 23200'
	= 1.92 mh/LF of Trench.

Equipment:

1066 Backhoe	1 Gz	7439 Hrs.
Pick Up.	1 Gz	7439

Supplies:

Gravel	46400 cy @ $10.00/cy =	$ 464000
Small Tools @ 5% of Labor.		

Base Cost on ∴ 23200' of trench.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Load & Haul - Mass Exc.	PROJECT Susitna - Alaska
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Production - Load & Haul.

Excavate & load trucks using 1266 Koehring Backhoe.

1266 D Koehring Production:	
Bucket Cap.	5.5 cy (Heaped)
Wt of Material	3130 #/Bcy ... (1.57 Ton/Bcy)
Swell	25% ∴ 100 ÷ (125) = 0.80
Loose wt	3130 x 0.80 = 2504 #/cy
∝ Repose for Sandy Clay	1:1
Payload Cap.	5.5 x 2504 = 13772 #
Bank Vol. Pay Load.	13772 # ÷ 3130 #/Bcy = 4.4 Bcy.
Truck Cap: 50T ÷ 1.57 Ton/Bcy	31.85 Ton
No. of Passes 31.85T ÷ 4.4	7.0 passes.
Pay Load Cap.	7.0 passes x 4.4 Bcy/Pass = 30.80 Bcy.
Time per Truck Load:	
7.0 passes @ 0.58 min	4.06.
+ Truck Exchange	0.20
	4.26.
Truck Loads per 50 min Hr.	11.74 Truck Loads.
Production:	
11.74 Truck Loads x 30.80 Bcy	362 Bcy./Hr.
9,540,000 Bcy ÷ 362 Bcy/Hr	= 26,354 Hoe-Hrs.
÷ 14,040 Effective Hrs.	= 1.88 Hoes Average.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Load/Haul - Mass Excav.	PROJECT Susitna - Alaska
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Hauling - Cycle Time to Embankment. (773B Cat 50 T Truck)

From - To	Dist LF	Grade %	R.R %	E.G %	Speed fpm	Time Min	
Loaded:	8000'	-6.0	+3.0	-3.0	3520	2.27	
	3000'	-10.0	+3.0	-6.0	1848	1.62	
	1000'	-6.0	+3.0	-3.0	3520	0.28	
Unloaded	1000'	+6.0	+3.0	+9.0	2112	0.47	
	3000'	+10.0	+3.0	+13.0	1584	1.89	
	8000'	+6.0	+3.0	+9.0	2112	3.79	
						10.32	
Acc/Dec.						0.50	
Travel Time	24000'					10.82 min	25.2 mph.
Maneuver.						0.60	
Unload.						1.20	
Load.						4.26	
Total Cycle:						16.88 min	

No Trips per 50 min Hr 2.96 Trucks/Hr.

BCy/Truck Hr = 2.96 Trucks/Hr x 30.80 BCy = 91.23 BCy/Truck Hr.

No. Trucks L'gd:

362 BCy/Hr ÷ 91.23 = 4 Trucks/Hoe.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Load & Haul - Mass Excav	PROJECT Susitna - Watana
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Load & Haul - Mass Excav.
Based on 64yr x 6mo/yr x 4.33 wk x 6 Day x 20 Hr = 18705 Hrs.

Labor.

Foreman	1.00
Hoe Op.	1.88
Oiler.	1.88
Truck Drivers.	7.52
Spotters, Flagmen	2.00

14.28 x 18705 Hr ÷ 9,540,000 cy = 0.028 mh/cy.

Equip:

1266 Koehring Hoe	1.88	x	14,040 Hrs.	= 26,354 Hrs.
50 Ton Dump Trucks.	7.52	x	14,040 Hrs.	= 105,581

Small Tools allow 5%.

Base Unit Cost for Load & Haul on 7,950,000 ~~Ecy~~ (Pay).

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Placing	PROJECT Susitna - Project
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Placing Impervious Fill.

Assume that impervious materials will be dumped from the 50 Ton Rear Dump Trucks and that it will be spread wing D8 Tractors with dozers in 8" lifts. The clays will then be disked, rolled and compacted to a 95% modified Proctor density. The average volume handled in the fill will be in the order of 1.08 Hoes x 362 Bcy/Hr = 680 Bcy/Hr.

a) Dozer Production:

Dozing Distance	300'
Mat. wt Loose	2504 #/cy (Clays Damp)
Wt. Correction Factor 2300/2504	0.92
Job. Eff. " " 45 min/hr	0.75
Operator " "	0.75
Total Correction Factor: 0.92 x 0.75 x 0.75 =	0.52
Uncorrected Max Product.	550 Loose cy.
Shrinkage Factor	0.80 to Bcy
Production: 550 x 0.52 x 0.80	229 Bcy/Hr.
Required No. of Dozers 680 Bcy ÷ 229	Use 3 Ea.

b) Compactor Production

Use 825C, 8" Lifts.	
5 passes @ 6MPH	1155 ccy/Hr. @ 100% Eff.
Efficiency 83%	958 ccy/Hr. > 680 Bcy/Hr.
Use 1 Unit.	

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Placing	PROJECT Switnz-Project
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Placing Impervious Fill

Cost:
Base Cost on 18705 Hrs.

Labor:

Foreman	1.0 EA
Dozer Op.	3.0
Compactor Op	1.0
Grader Op	1.0
Water Truck Op.	1.0
Grade Checker	2.0
Spotters.	2.0
Flagmen	1.0

12.0 EA × 18705 Hrs ÷ 7,950,000 BCy.
@ = 0.028 mh/BCy.

Equipment:

D8K Cat w/Dozer.	3 EA	× 18705 Hrs	=	56115 Hrs.
825C Compactor.	1	× 18705	=	18705
No 16 Grader w/Duals	1	× 18705	=	18705
Water Truck	1	× 18705	=	18705

Allow for STS 5% of Labor.

Base Unit Cost on 7,950,000 BCy.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fill Drying Equipment.	PROJECT Svitnz-Alzlz
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Drying Clays - Equipment Only.

The Board of Review has strongly recommended that provisions be included in the cost estimate for drying some portion of the impervious fill by artificial means.

A line item will be included in the estimate for providing drying equipment.

Societe Lemex of Perú quoted for the use on el Guavio Dam in Colombia (1980) a price for a plant capable of removing 5% moisture from 900 MT/Hr (≈ 600 cy/Hr) as follows:

	$
Price 1980	3,120,000
Escalate to Jan 1992	280,000
	$ 3,400,000
Allow for Feeders, Screens & Supports.	600,000
	$ 4,000,000
Ends, Etc. Allow	1,000,000
Installed Cost	$ 5,000,000 / Plant.

During the year of 1992 the requirements for impervious fill will be 2,472,400 Bcy ÷ 3118 Hr = 792 Bcy/Hr.
@ 1.57 Ton/Bcy = 1250 TPH.

Plant capacity = 900MTPH = 992 TPH

No. Plants Required = 1250 ÷ 992 = 1.26 units
Allow reserve factor of 1.5 ≈ 2 Ea
@ $ 5000,000/Ea = $ 10,000,000 ea

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fills Drying Operation	PROJECT Suitor - Alsea
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Drying Clays - Operation of Plant.

Cost.
Base Cost on 2800 Hrs.

Labor.

Plant Foreman	1.0 Ea
Feeder Op.	1.0
Plant Op.	2.0
Laborers.	4.0
FEL. Op.	1.0
Dozer Op	1.0
Driver	1.4

11.4 Ea × 2800 Hrs ÷ 1,908,000 BCy
= 0.017 mh/BCy.

Equipment.
Drying Plants. 1 Ea × 2800 Hrs = 2800 Hrs
Op. Only @ $0.15/TPH × 992 TPH = $148.80/Hr.

992 C FEL	1 Ea	× 2800 Hr	=	2800 Hrs.
D7 Dozer	1	2800	=	2800
50 Ton Truck	1.4	2800	=	3920

Supplies:
Fuel 2.0 gal per Cy @ $1.40/gal = $2.80/cy.
Small Tools @ 5% of Labor.

Unit Cost will be based on
1,950,000 FCy × 0.2 = 1,576,000 FCy.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Impervious Fills Drying Operation	PROJECT Susitna - Alaska
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Drying Clays - Operation of Plant.

The plant operation will involve a truck dump over a feeder. The materials will be passed thru the drier and stockpiled under a shed. From the stockpile, 70% of the materials will be loaded by FELs onto 50 ton Rear Dump Trucks, 30% will be loaded directly to the trucks.

The volume handled will average:

9,540,000 Bcy ÷ 14040 Hrs = 680 Bcy/Hr.

Load directly to Trucks 0.3 x 680 = 204 Bcy/Hr.
Rehandle w/ FEL 476 Bcy/Hr.

Use a 992C Cat FEL.

Drying requires: 0.4 gall of Fuel/cy per percentage of moisture removed. Assume that 5% moisture will be removed ∴ use 2.0 gall of Fuel/cy.

Dry 20% of total volume or:

9,540,000 Bcy x 0.2 = 1,908,000 Bcy.
÷ 680 Bcy/Hr = 2800 Hrs.

The dumping-over operation at the plant will slow down the cycle which was calculated when hauling directly from Pit to Fill. For estimating purposes it will be assumed that the following will be added: (See Page —)

Add = [0.70 x (0.60 + 1.20 + 4.26) + 0.30 (0.60 + 1.20 + 2.00)] = 5.4 min

Total Cycle: 16.88 + 5.4 = 22.28 min

(50.0 min ÷ 22.28 min) x 30.8 Bcy = 69.12 Bcy/Truck Hour

Add No. Trucks: 91.23 - 69.12 = 22.1 Bcy/Hr.

(22.1 ÷ 30.8) x 1.88 Hrs = 1.4 Hr.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills General	PROJECT Susitna - Alaska
	COMPUTED LFL CHECKED	FILE NO. 163
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General:-

Sand and gravel fills will be obtained from required excavations (4,244,200 BCY) and from Borrow Area "E" (29,426,800 BCY) which is located 15000' downstream of the dam axis on the right bank of the Susitna River. According to the Acres Report this deposit contains 35 to 45 x 10^6 cy of available materials. 55-65% of the total is below the water table. The materials from required excavations will be stockpiled over a tunnel and fed to processing plant directly. The material balance shows the following requirements:

	FCY	BCY (x 1.10 x 1.05)
A - Processed Materials (Pay Items)		
- Filters (Fine & Coarse)	6,369,000	7,356,000
- Sand Fill (Main Dam)	8,842,700	10,213,300
- Gravel Fill (Main Dam)	10,793,300	12,466,300
- Gravel Fill (Cofferdams)	369,245	427,000
- Road Base	12,000	14,000
- Concr. Aggregates	563,700	651,000
		31,127,600
B - Unprocessed Materials (Pay Items)		
- Gravel Fill D/S (Main Dam)	990,000	1,143,400
Total Req'd for Pay Items		32,271,000
From Req'd Excavation		4,244,200
Borrow for Pay Items		28,026,800
C - Non Pay Items:		
- 2' Gravel Base		1,200,000
- Construction Roads 8 miles		200,000
D - Borrow Total		29,426,800 BCY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills Requirements	PROJECT Susitna - Alaska
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Summary of Requirements: *

Processed (Pay Item)	31,127,600 BCy.
Processed (Non Pay Items)	1,400,000
Process.	32,527,600
Non-Processed (Pay Items)	1,143,400
Total Required	33,671,000 BCy.
From Required Excav.	4,244,200
	29,426,800 BCy.

* Does not include for Account 336 - Roads, Rail & Air Facilities nor Camp Construction. It is assumed that these items will be completed earlier under other contracts.

Material Wts: 3530 #/cy in Bank ÷ 2000 = 1.77 T/BCy.
3350 #/cy Loose ÷ 2000 = 1.68 T/BCy.
3640 #/cy Compacted ÷ 2000 = 1.82 T/BCy.

For E

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills. Dragline from Pit & Cast	PROJECT Susitna-Alaska
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Construction Methods.-
Materials from regld excav. will be stockpiled over tunnel & fed directly to plant. Materials from borrow will be dreglined from pit and cast to surge pile. Dozers will feed belt loaders which will load bottom-dump trucks. The material will then be hauled to screening plant. It is assumed that 100% of material will be processed. Work 7 mo/yr x 2-10 Hr Shifts/Day x 6 days/wk = 3638 Hr/yr.

Pit Work = x 5 years = 18186 Hrs.
Process = x 6 years = 21828 Hrs.

Year	Main Dam & Coffdm. BCY	Concrete & Bases. BCY	Total R'qd. BCY	From R'qd Excavation BCY.	Borrow Pit. E" BCY.	Require @ 3638 Hr. BCY/Hr.	TPH. x 1.77 T/cy x 1.1 Waste
1988	-0-	-0-	-0-				
1989	2,594,200	250,000	2,844,200	2,844,200	-0-	-0-	
1990	3,067,100	363,000	3,430,100	1,400,000	2,030,100	558	1100
1991	6,053,200	363,000	6,416,200	—	6,416,200	1764	3440
1992	9,045,600	363,000	9,408,600	—	9,408,600	2586	5040
1993	6,873,500	363,000	7,236,500	—	7,236,500	1989	3810
1994	3,972,400	363,000	4,335,400	—	4,335,400	1192	2320
	31,606,000	2,065,000	33,671,000	4,244,200	29,426,800	BCY.	

→ 52,085,400 Ton

x 1.77 Ton/cy
Allow for pit waste, 10% 2942,700

Excavate 32,369,500 BCY. Av. (3470 TPH)

Using 16 cy Draglines @ 657 BCY/Hr.
32,369,500 BCY ÷ 657 BCY/Hr = 49270 Hrs.

No. of Draglines required:
49270 Hrs ÷ 18186 Hrs = 2.7 ea.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sandy Gravel Fills. Dragline from Pit and Cost.	PROJECT Susitna-Alaska
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Production :

Use 480W Draglines. with 16.0 buckets.

Bucket Capacity	16 cy Dragline
Boom Length.	175'
Op. Radius. @ 40°	154'
Digging Depth Max.	80'
Max. Cap.	82000 #
Bucket Wt.	24700 #
Material in Bucket.	57300 #
Wt in Bank (Net).	3530 #/cy. ÷ 2000 = 1.77 T/Bcy.
Wt Loose (Net).	3350 #/cy. ÷ 27 = 125 #/cf.
Swell (Bank → Loose)	0.95
Bucket Factor	0.90
Bcy Load (57,300# ÷ 3530 #/cy) × 0.90	14.61 Bcy ÷ 0.95 = 15.38 Loose cy < 16.0
Swings/Hr @ 90° (45 min x 60) ÷ 60	45 swings/Hr.
Production : 45 Swings/Hr x 14.61	657 Bcy/Hr

basic specifications

480-W

BUCYRUS-ERIE

Walking Dragline — Diesel

WEIGHTS:

Boom length, ft.	175	195	215
Net weight*, domestic, approx. (with bucket) lbs.	1,305,000	1,310,000	1,315,000
Working weight, approx. (with bucket) lbs.	1,605,000	1,635,000	1,665,000
Ballast weight (furnished by purchaser) lbs.	300,000	325,000	350,000

*Add 7,500 lbs. for blocking on cars when estimating domestic freight.

BASE:

Outside diameter, ft.-in.	36-0
Bearing area, sq. ft.	1018
Circle rail diameter, ft.-in.	30-0
Rollers, quantity	88
average diameter, in.	10
Swing rack, pitch diameter, ft.-in.	23-9½

WALKING MOUNTING:

Shoe, width and length, ft.-in.	6-0x42-6
combined bearing area, sq. ft.	480
Overall width over shoes, ft.-in.	49-6
Cam, diameter, ft.-in.	5-8
Length of step, approx. ft.-in.	7-4
Walking speed, approx. m.p.h.	0.15

REVOLVING FRAME:

Upper machinery frame, width x length, ft.	30 x 53½
Girder depth, upper frame, in.	36

ELECTRICAL EQUIPMENT:

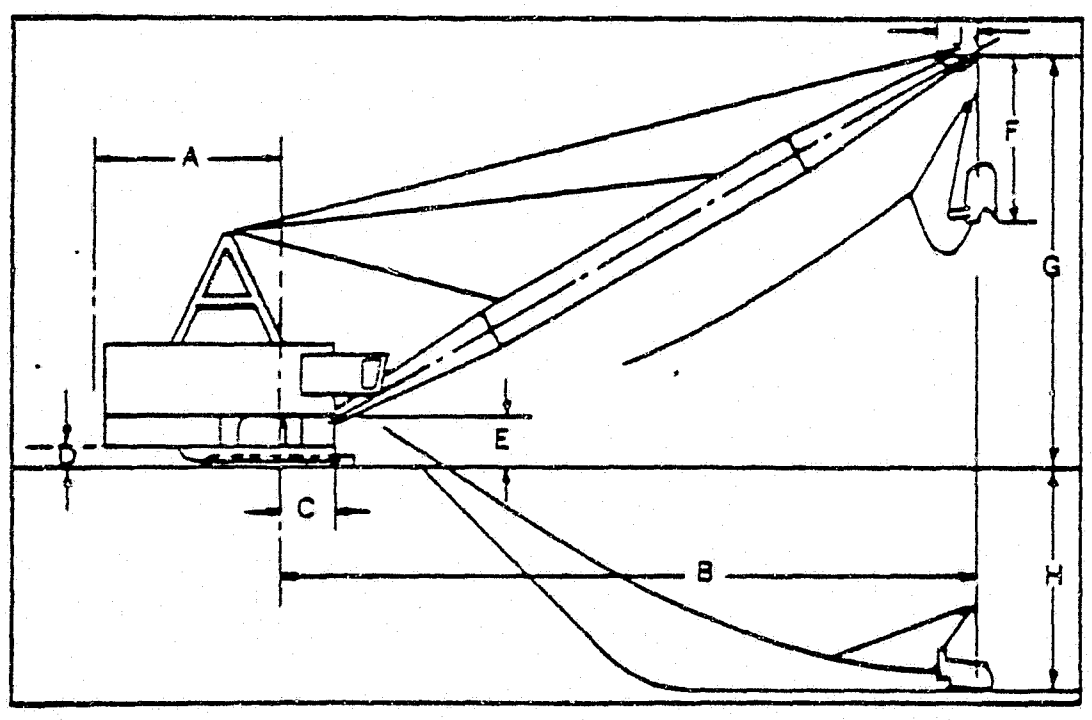
Swing motors (blown) — two 90/195 HP

All above motors rated at 75° continuous and at 230/475V.

Swing generator — W. L. control — Capacity to suit motor

ENGINE:

Caterpillar	twin D398
12 cyl. V-type, 4 cycle Turbocharged and aftercooled.	
Bore and stroke	6¼x8
Full load speed working, r.p.m.	1,200
Horsepower rating	1,500
Capacity of fuel tank, U. S. Gals.	1,500
Auxiliary Generator Set	Cat. 3406
175 KW - Continuous @ 1800 RPM	



WORKING DIMENSIONS

A	Clearance radius, ft.-in.	38-0
B	Operating radius	Read below
C	Boom foot radius, ft.-in.	16-8½
D	Clearance height, ft.-in.	4-8½
E	Boom foot height, ft.-in.	8-6
F	Dumping clearance*	Read below
G	Boom point height	Read below
H	Digging depth	Read below
J	Point sheave pitch diameter, in.	66

*Includes allowance for bucket, hoist chains, pick-up link and 10' clearance at hoist sheaves.

NOTE:

(1) Rope diameters may change with final geometry.

(2) Ballast requirements may vary pending final stability

(3) Bucyrus-Erie Company reserves the right to make changes in specifications or design which in its opinion are an improvement or are necessary because of unavailability of materials, without incurring any liability to make such changes on machines previously built.

Boom Length	B Operating Radius	Boom Angle	Maximum Suspended Load (lbs.)	G Boom Pt. Height	G-F Approx. Dumping Height	H Digging Depth	Drag			Hoist		
							Drum Diam.	Rope No.	Rope Diam.	Drum Diam.	Rope No.	Rope Diam
175′	154′	40°	82,000	120′	72′	80′	44″	1	2⅜″	46″	1	2⅛″
	163′	35°	82,000	108′	60′	92′	44″	1	2⅜″	46″	1	2⅛″
	171′	30°	82,000	95′	47′	105′	44″	1	2⅜″	46″	1	2⅛″
195′	169′	40°	80,000	133′	85′	67′	44″	1	2⅜″	46″	1	2⅛″
	179′	35°	76,000	119′	71′	85′	48″	1	2⅜″	50″	1	2⅛″
	188′	30°	72,000	105′	57′	110′	48″	1	2⅜″	50″	1	2″
215′	184′	40°	70,000	146′	107′	70′	48″	1	2¼″	50″	1	2″
	196′	35°	66,000	131′	92′	85′	52″	1	2¼″	56″	1	2″
	206′	30°	62,000	115′	76′	115′	52″	1	2¼″	56″	1	1⅞″

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills Dragline from Pit & Cast.	PROJECT Susitna - Alaska FILE NO. 183
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Cost of Excavating & Casting
Based on 18186 pay hours. (5 yrs.)

Labor

Foreman	2.7 ea
Dragline Op	2.7
Oilers.	2.7
Spotters.	2.7
Crane Op.	1.0
Truck Driver.	2.0
Dozer Op.	2.7

16.5 ea x 18186 Pay Hrs = 300,090 mh
÷ 29,426,800 Bcy = 0.010 mh/Bcy.

Equipment

16 cy Draglines 480 W.E -	2.7 ea	x 18,186 Hr.	= 45,465 Hrs.
D8 Dozers.	2.7	x 18,186	= 45,465
20T Grove Crane	1.0	x 18,186.	= 18,186
Flat Bed	2.0	x 18.186.	= 36,372
Pick Ups.	2.7	x 18.186	= 45,465

Supplies.
Small Tools allow 10% of Labor.
Steel Pads $500,000

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills. Load Trucks from Stockpile	PROJECT Susitna - Alaska
	COMPUTED LFL CHECKED	FILE NO. 1563
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Load Trucks from Stockpile.

Require an average of: 2.7 - 16CY Draglines
X 657 BCY/Hr = 1774 BCY/Hr.
@ 1.77 Ton/BCY = 3140 T/Hr. (Average)

1.1 X 2586 Max. Required = 2844 BCY/Hr (yr. 1992)
@ 1.77 Ton/BCY = 5040 T/Hr.

Belt Loader Production:	
Material Wt (Loose on Belt)	125 #/cf.
Belt Width	60"
Belt Cap. @ 100'/min	922 T/Hr. @ 100 FPM
Reqd Belt Speed:	
Max. 5040 TPH ÷ 922 T/Hr.	550 FPM.
Av. 3140 TPH ÷ 922 T/Hr	340 FPM
Allow margin of safety	2.0
Use 2 - 60" Belt Loaders.	@ 100 FPM @ 61.5 Ton/min
Truck Capacity	100 Ton ÷ 1.77 T/BCY = 56.5 BCY/Hr.
Time to Load one Truck:	
100 Ton ÷ 61.5 Ton/min	1.63 min
+ Truck Exchange	0.25
	1.88 min
No. Truck Loads per Hr.	
60 min ÷ 1.88 min/Truck	26.6 Truck Loads/Hr per belt.
Production:	
26.6 Truck Load/Hr x 56.5 BCY/Hr.	1503 BCY/Hr. per belt (Average)
	X 1.77 T/BCY = 2700 TPH

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills. Load Trucks from Stockpile	PROJECT Susitna - Alaska
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Load Trucks from Stockpile.

Require an average of: 2.7 - 16cy Dragliners

X 657 Bcy/Hr = 1774 Bcy/Hr.

@ 1.77 Ton/Bcy = 3140 T/Hr. (Average)

1.1 x 2586 Max. Required = 2844 Bcy/Hr (yr. 1992)

@ 1.77 Ton/Bcy = 5040 T/Hr.

Belt Loader Production:	
Material Wt (Loose on Belt)	125 #/cf.
Belt Width	60"
Belt Cap. @ 100 '/min	922 T/Hr. @ 100 FPM
Reqd Belt Speed:	
Max. 5040 TPH ÷ 922 T/Hr.	550 FPM.
Av. 3140 TPH ÷ 922 T/Hr	340 FPM
Allow margin of safety	2.0
Use 2 - 60" Belt Loaders.	@ 400 FPM @ 61.5 Ton/min
Truck Capacity	100 Ton ÷ 1.77 T/Bcy = 56.5 Bcy/Hr.
Time to Load one Truck:	
100 Ton ÷ 61.5 Ton/min	1.63 min
+ Truck Exchange	0.25
	1.88 min
No. Truck Loads per Hr.	
50 min ÷ 1.88 min/Truck	26.6 Truck Loads/Hr per Belt.
Production:	
26.6 Truck Load/Hr x 56.5 Bcy/Hr.	1503 Bcy/Hr. per Belt (Average)
	X 1.77 T/Bcy = 2700 TPH

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills. Load Trucks from Stockpile	PROJECT Susitna - Alaska.
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Hauling Cycle Time from Pits "E" to Processing Plant

From - To	Dist LF	Grade %	R.R %	E.G %	Speed fpm	Time min
Loaded:	3000'	-3.0	+3.0	-0-	3344	0.90
	4000'	-3.0	+3.0	-0-	3344	1.20
						2.10
Unloaded	4000'	+3.0	+3.0	+4.0	2288	1.75
	3000'	+3.0	+3.0	+4.0	2288	1.31
						3.06
Acc/Des						0.50 min
Travel Time:	14000'					5.66 min 28 mph
Maneuver.						1.00
Unload						1.20
Load.						1.88
						9.74 min

No. Trips / 45 min hr. 4.62 Trucks / Hr.

BCy / Truck Hr = 4.62 Trucks/Hr. x 56.5 BCy/Hr = 261 BCy/Truck-Hr.

Req'd Average : 1774 BCy/Hr ÷ 261 BCy/Truck Hr = 6.8 Trucks.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills. Load Trucks from Stockpile / Haul to Plant	PROJECT Swidnz - Alaska
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Load Trucks from Stockpile & Haul to Plant.

Cost.
Base on 18186 Hrs.

Labor		
Foremen	1.0	Hrs.
Belt Loader Op	2.0	
Oilers.	2.0	
Dozer Op.	6.0	
Truck Drivers.	6.8	
Spotters.	2.0	
Grader Op.	1.0	
Water Truck Driver	1.0	

21.8 man. x 18186 Hrs ÷ 29,426,800 BCY
= = 0.013 mh/BCY

Equipment.				
60" Belt Loaders	2	62 x 18186 Hrs	=	36372 Hrs.
D8 Dozers.	6	62 x 18186	=	36372
100T Bottom Dumps.	68	62 x 18186	=	123,665
No 16 Grader.	1.0	62 x 18186	=	18,186
Water Truck.	1.0	62 x 18186	=	18,186

Small Tools allow 5% of Labor.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills Processing Plant	PROJECT Saxitoz - Alaska
	COMPUTED CFL CHECKED	FILE No. 1563
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Processing Plant. (:52,085,400 T' ÷ 21828 Hrs = 2386 TPH

Materials will be processed by screening and washing. The average monthly output is estimated at about 2700 TPH" - with a peak of about 5100 TPH in yr. 1992...

For purposes of estimating, it was assumed that the plant will be made up of a receiving station with a double processing line and a screening tower producing sand and filter materials. It will be possible to by-pass the screening tower and send 0-12" material straight to surge pile. Max. output of each plant will be 3500 TPH. Two similar plants will be needed for a total of 7000 TPH. Materials from required excavation will be stockpiled over tunnel to be fed directly to plants.

Plant Components (Per Unit Plant)

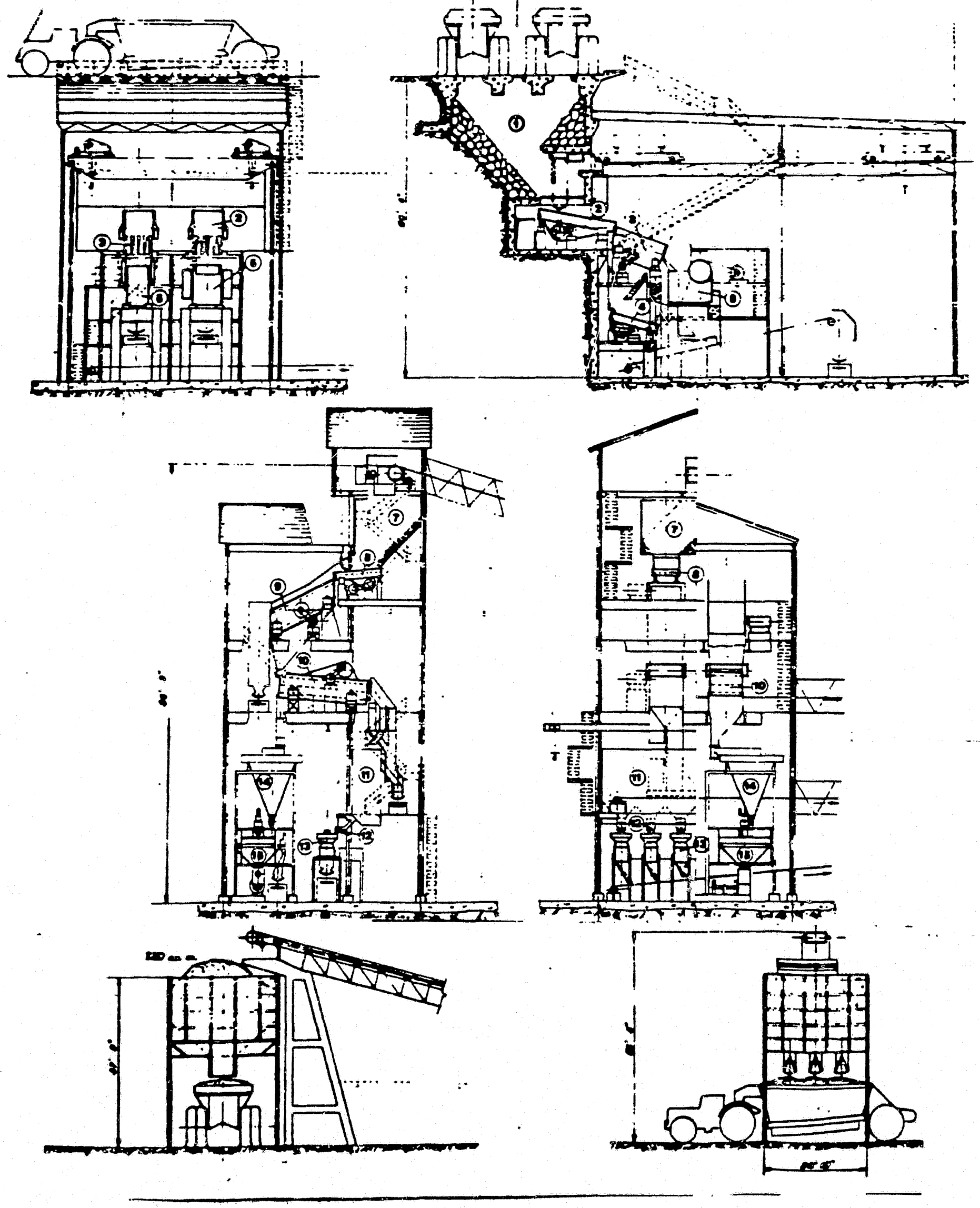
Item	Ea	Description	Ton Wt.	HP
a	1	Hopper.	50	—
b	2	6'x16' Feeder.	70	150
c	2	6'x12' Scalper (8")	12	80
d	2	6'x10' Feeder.	12	80
e	2	Crushers.	53	240
f	1	Hopper.	20	—
g	2	6x10 Feeders.	40	60
h	2	8'x16' Screen 2 Deck (4x1½)	20	100
i	2	7'x20' " 3 " (3½x3/8)	20	200
j	1	Hopper.	15	—
k	3	Feeders.	15	120
l	3	Gyratory Crushers	30	150
m	2	Densifier Cones	20	50
n	2	Lamox Washing & Sand Drying	25	100
o	3	Weighing Devices.	5	10
p	22	Conveyor Belts 30"→18"	64	1100
			473 Ton	2440 HP / Plant.

HARZA ENGINEERING COMPANY
CHICAGO

SUBJECT Sand & Gravel Fills
Processing Plant.

COMPUTED 4PL CHECKED

PROJECT Susitna - Alaska
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HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills. Processing Plant.	PROJECT Juneau - Alaska
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East of Plant. - Develop Hourly Rate.

a) Purchase components:

2 x 473 ton @ $8000/ton = $7,568,000

b) Provide Supports & Enclosures:

200 ton @ $2000 = 400,000

c) Ft: 1200 ton @ $200.00 = 240,000

d) Civil Work & Foundations = 1,000,000

e) Erection 1200 Tons 30mh/ton

x 43.00/mh = 1,548,000

f) Electrical; allow = 500,000

g) Tunnel for Stockpile for Rapid Exc. Mats. = 1,500,000

12,756,000

Assume That salvage in 7 yr we 3,000,000

Dismantle & De-Mob 2,000,000

Cost to Job. $11,756,000

1) Depreciate at a rate of:

$11,756,000 ÷ 52,085,400 ton = $0.23/ton

÷ 21828 Hrs. = $538.57/Hr.

2) Maintenance Labor.

13 man x 35.00/Hr = $455.00/Hr.

3) Equipment

25T Crane 1 x 75.00/Hr

Flat Bed Truck 1 x 30.00

105.00/Hr. $105.00/Hr.

4) Supplies

Parts @ $0.60/TH x 2400 TPH Av. = $1440.00

Power: 2 x 2440 HP x 0.75 = 3660 KW @ $0.135/KW = 494.00

Small Tools @ 10% of Labor. = 45.50

$1,979.50/Hr.

For 2 plants. $3,078.00/Hr.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills. Processing Plant	PROJECT Sinuta - Alaska
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Cost of Processing Materials.
Base on 21,828 Hrs (6 years)

a) Labor.

Plant Foreman & Receiving Station	2 Ea.
" " & Screening "	2
Receiving Sta. Op.	2
Screening Sta Op.	2
Concrete Aggr. Op	1
Sand Washing Op.	1
Laborers, Conveyor Tenders,	12
FEL. Op.	2
Dozer Op.	1
Truck Driver.	1
	26 Ea. x 1818 6 Hrs.

÷ 52,085,400 Ton
@ . = 0.009 mh/Ton

b) Equipment :

7000 TPH Processing Plant	1 Ea x 21,828 Hrs	=	21,828 Hrs.
992C FEL	1 Ea x 21,828	=	21,828
D7 w/ Dozer.	1 Ea x 21,828	=	21,828
Flat Bed Truck	1 Ea x 21,828	=	21,828
Pick Ups.	4 Ea x 21,828	=	87,312

c) Small Tools 10% of Labor

Base Unit Cost on 52,085,400 Ton.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sandy Gravel Fills. Haul from Plant to Dam	PROJECT Susitna-Alaska
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100 Ton Bottom Dumps will be loaded from hoppers, the material will be hauled 12000' to the embankment.
Use 776 Cat + 100T Bottom Dumps (309,340#)
Hauling Cycle Time from Plant to Embankment.
(Use 776 Cat off Highway Tractor)

From-To	Dist LF	Grade %	R.R %	E-G %	Speed fpm	Time min	
Loaded:	7000'	+6.%	+3.00	+9.00	~~800~~	2.95	
	5000'	+12.0%	+3.00	+15.00	528	9.47	
	12000'					17.42	min (7.8 mph).
Empty:	5000'	-12.0	+3.0	9.0	2640	1.90	
	7000'	-6.0	+3.0	-3.0	3080	2.27	
	12000'					4.17	min (32.7 mph.
Acc/Dec.						0.50	
Travel Time.						22.09	min (12.3 mph).
Maneuver:						0.60	
Unload:						1.20	
Load.						2.20	
						26.09	min

No. Trips / 50 min hr 1.92 Trucks/Hr.
Pay Load:
100 Ton ÷ 1.77 T/cy = 56.5 BCy / Truck Load. x 1.92 = 108.5 BCy/Hr.

Required Average: 31,606,000 BCy ÷ 2192 Hrs = 1447 BCy/Hr.
@ 108.5 BCy/Hr = = 14 Units

0 0 2 5 4

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fill. Haul from Plant to Dam.	PROJECT Sautne-Alzitz
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Cost of Hauling from Plant to Dam.
Base on 21828 Hrs. (6 Year)
& 31,606,000 BCY ÷ (1.1 x 1.05) = 27,364,500 FCY
Labor.

Foreman	1.
Truck Drivers.	14
Grader Op.	0.5
Water Truck	0.5
Flagman	2

18 men x 21828 Hrs ÷ 27,364,500 FCY
= 0.014 mh/FCY

x

Equipment.

100T Bottom Dump.	14 Ea	x 21,828 Hrs	=	305,592 Hrs.
No 16 Grader.	0.5	x "	=	10,914
Water Truck.	0.5	x "	=	10,914

Small Tools Allow 5% of Labor

Base Unit Cost on 27,364,500 FCY

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills Place Sands & Gravels	PROJECT Susitna-Alaska
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Placing Sands & Gravels.

Assume that granular fills will be bottom-dumped from 100 ton units. The material will be spread using D8± w/dozers in 10" lifts and compacted to 95% modified Proctor density. The average volume handled in the dam will be in the order of 108.5 Bcy/Hr x 16 units = 1447 Bcy or 1253 Fcy/Hr.

a) Dozer Production:

Dozing Distance	150'
Mat Wt Loose	3350 #/cy (Gravels & Sands)
Wt Correction Factor: 2300/3350	0.69
Job Eff " " 45 min	0.75
Operator " "	0.75
Total Correction Factor:	
0.69 x 0.75 x 0.75 =	0.39
Uncorrected Max. Product.	1090 LCy/Hr.
Shrinkage Factor:	0.95
Production:	
1090 x 0.39 x 0.95	403 Bcy/Hr. = 350 Fcy
Rig No. of Dozers:	
1253 Fcy/Hr. ÷ 350 Fcy	3.5 Ea.

b) Compactor.

Use 825C, 10" Lifts	
5 passes @ 6 MPH	1444 CCy/Hr @ 100% Eff.
Eff 83%	1200 LCy/Hr.
Use 1253 ÷ 1200	1.0 Ea.

HARZA ENGINEERING COMPANY CHICAGO	SUBJECT Sand & Gravel Fills. Place Sands & Gravels.	PROJECT Susitna - Alaska
	COMPUTED LFL CHECKED	FILE NO. 1563
		DATE Feb 21 '84 PAGE ____ OF ____ PAGES

Placing Sands & Gravels

Cost.
Base Cost on 18186 Hrs. & 27,364,320 Fcy.

Labor.

Foreman @ Fill	1.0 ea.
Dozer Op.	3.5
Compactor Op	1.0
Grader Op	0.5
Water Truck Driver	0.5
Grade Checkers.	2.0
Flagman	1.0

8.5 ea x 21828 Hrs ÷ 27,364,320 Fcy = 0.007 mh/Fcy

Equipment.

D8 Dozer.	3.5 ea x 21828	Hrs	= 76,398 Hrs.
825C Compactor	1.0	"	= 21,828
Xtra 16 Grader	0.5	"	= 10,914
Water Truck	0.5	"	= 10,914

Allow for STS 5% of Labor.

COMMON EXCAVATION

PORTALS

ITEM -01.01.01- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	LOADING	169680.0	BCY	3080	106005	157049	5360	0	268354	1.58
2	HAULING	169680.0	BCY	3960	136272	205858	6814	0	348944	2.06
T	PORTALS-COMMON EXCAV	169680.0	BCY	7040	242277	362907	12114	0	617298	3.64 ✓
	UNIT COST			0.04	1.43	2.14	0.07	0.00	3.64	

ITEM -01.01.01- CRITERIA

THIS ITEM CONSIDERS COMMON EXCAVATION FOR THE PORTALS. MATERIALS CONSIST OF ALLUVIUM SANDS AND GRAVEL. EXCAVATION WILL BE PERFORMED USING CAT 992C FEL LOADING TO 777 CAT REAR DUMP TRUCKS. 100% OF THE EXCAVATED MATERIAL WILL BE HAULED TO THE NORTH DISPOSAL AREA. THE COST OF COMMON EXCAVATION WILL BE CONSIDERED AS TWO SEPARATE SUBITEMS FOR LOADING AND HAULING.
PRODUCTION RATES AND TIMES ARE AS SUGGESTED BY EQUIPMENT MANUFACTURERS.
2 D8 CAT DOZERS WILL BE REQUIRED FOR SUPPORT AT THE EXCAVATION SITE AND 1 D8 CAT DOZER WILL BE REQUIRED AT THE DISPOSAL AREA FOR SPREADING OF MATERIAL DURING THE SAME PERIOD.
EXCAVATION RATE WILL BE SLOWER DUE TO DIFFICULT WORK AREA AND ACCESSES.
CREW AND EQUIPMENT REQUIREMENTS AND DURATION WILL BE AS ESTABLISHED IN THE FOLLOWING SUBITEMS.

1. [illegible] (in each crew of 3) [illegible] of 24 hrs)

2. [illegible] could be eliminated

ITEM -01.01.01- SUBITEM 1 CRITERIA
THE PARAMETERS USED TO CALCULATE THE PRODUCTION RATE FOR LOADING WITH A 992C CAT FEL ARE AS FOLLOWS:

SWELL FACTOR - 0.85 (DENSITY = 3650 PCY)
BUCKET CAP HEAPED- 13.5 CY
BUCKET FILL FACT - 0.80
FEL LOAD CYCLE - 0.70 MINUTES
TRUCK CAPACITY - 85 TONS OR 46.6 BCY
EFFECT PROD TIME - 45 MINUTES/HR AND 7.5 HRS/10 HR SHIFT; 2 SHIFTS/DAY

USING THESE FACTORS, THE PRODUCTION RATE FOR THIS EQUIPMENT CAN BE CALCULATED AS FOLLOWS:

BUCKET CAPACITY - 13.5 CY X 0.80 BF X 0.85 SF = 9.18 BCY/PASS
LOAD TRUCK - 46.6 BCY/9.18 BCY PER PASS = 5 PASSES/TRUCK

CYCLE:

LOAD TRUCK - 5 PASSES X 0.70 MIN = 3.5 MINUTES
EXCH TRUCK - = 0.5 MINUTES

TRUCK LOAD CYCLE- 4.0 MINUTES/TRUCK

PRODUCTION: 5 PASSES X 9.18 BCY/PASS = 45.9 BCY/TRUCK
45 MIN/4.0 MIN/TR X 45.9 BCY/TR = 516 BCY/HR X 7.5 HR/SH=3870BCY/SH=7700 BCY/DAY
169600BCY/7700BCY/DAY=22 DAYS. 2-D8 CAT DOZERS WILL PROVIDE SUPPORT.

ITEM -01.01.01- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 22 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
2.0	2.0	4.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1440.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.00
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
					4818.40

Total A-Labor Cost Per Day
(14.0 persons, 140.0 MH/day @ 34.42 ave.)

Total A-Labor Cost - 22 Days (3080 MH) @ 4818.40 = 106005

TOTAL LABOR 106005

ITEM -01.01.01- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 22 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
1.0	992C	FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
2.0	D8K		X 20.00 hrs @	77.90	3116.00
					7138.60

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 22 Days @ 7138.60 = 157049

TOTAL EQUIPMENT 157049

ITEM -01.01.01- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 106005) =				5300.25
TOTAL MATERIALS & SUPPLIES				5300
SUBITEM TOTAL				268354

ITEM -01.01.01- SUBITEM 2 CRITERIA
100% OF PORTAL COMMON EXCAVATION MATERIAL WILL BE HAULED TO THE NORTH DISPOSAL AREA.
HAULING WILL BE PERFORMED WITH 777 CAT DUMP TRUCKS. TRUCK CYCLES AND PRODUCTION TO THE DISPOSAL AREA WILL BE AS INDICATED IN THE FOLLOWING:(FEL AND TRUCK CAPACITIES ARE AS INDICATED IN PREVIOUS SUBITEM FOR LOADING)

FROM-TO	DISTANCE	CYCLE TIME	TRIPS/45MIN-HR	BCY/TR/HR
HAUL TO N. DISP AREA:	12000'	16.1 MIN	2.8	128

TRUCK REQUIREMENTS CAN BE CALCULATED AS FOLLOWS:
516 BCY/HR/FEL / 128 BCY/HR/TR = 4.0 TRUCKS.

A D8 CAT DOZER WILL BE PROVIDED AT THE DISPOSAL AREA FOR SPREADING OF MATERIAL.

ITEM -01.01.01- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 22 days.
NUMBER PER SHIFT - HAUL TO DISPOSAL AREA

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
4.0	4.0	8.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	2914.40
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.00
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					6194.20

Total A-Labor Cost Per Day
(18.0 persons, 180.0 MH/day @ 34.41 Ave.)

Total A-Labor Cost - 22 Days (3960 MH) @ 6194.20 = 136272

TOTAL LABOR 136272

ITEM -01.01.01- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 22 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
4.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	7799.20
1.0	DOK	X 20.00 hrs @	77.90	1558.00
Total Equipment Cost Per Day				9357.20

Total Subset-A Equipment Cost - 22 Days @ 9357.20 = 205858

TOTAL EQUIPMENT 205858

TOTAL LABOR 136272

ITEM -01.01.01- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 22 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
4.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	7799.20
1.0	DOK	X 20.00 hrs @	77.90	1558.00
Total Equipment Cost Per Day				9357.20

Total Subset-A Equipment Cost - 22 Days @ 9357.20 = 205858

TOTAL EQUIPMENT 205858

ITEM -01.01.01- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 136272) =				6813.60
TOTAL MATERIALS & SUPPLIES				6814
SUBITEM TOTAL				348944

APPROACH CHANNEL

ITEM -01.01.01- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	LOADING	802000.0	CY	9840	336069	457609	16803	0	810481	1.01
2	HAULING	802000.0	CY	17720	615757	1055861	30788	0	1702406	2.12
T	APP CH & STRCT-COM EXC	802000.0	CY	27560	951826	1513470	47591	0	2512887	3.13
	UNIT COST			0.03	1.19	1.89	0.06	0.00	3.13	

ITEM -01.01.01- CRITERIA

THIS ITEM CONSIDERS COMMON EXCAVATION FOR THE INTAKE APPROACH CHANNEL AND SPILLWAY APPROACH CHANNEL AND CONTROL STRUCTURE. COMMON EXCAVATION MATERIAL CONSISTS OF ALLUVIUM SANDS AND GRAVEL. EXCAVATION WILL BE PERFORMED USING 992C CAT FEL (13.5 CY) LOADING TO 777 CAT DUMP TRUCKS. 80% OF THE EXCAVATED MATERIAL WILL BE HAULED TO A STOCKPILE AREA DOWNSTREAM OF THE DAM, FOR FUTURE PROCESSING AND REUSE IN THE FILL. THE REMAINING 20% WILL BE HAULED TO THE NORTH DISPOSAL AREA.

EXCAVATION WILL BE PERFORMED IN THE PERIODS FROM APRIL 1, THRU OCTOBER 31. THE ABOVE MENTIONED PERIODS CORRESPOND TO THE SIX MONTH SUMMER CONSTRUCTION SEASON THAT IS EXPECTED TO GOVERN THIS WORK.

THE COST OF COMMON EXCAVATION WILL BE CONSIDERED AS TWO SEPARATE SUBITEMS; LOADING AND HAULING.

PRODUCTION RATES AND TIMES ARE AS SUGGESTED BY EQUIPMENT MANUFACTURERS.

A D8 CAT DOZER WILL BE REQUIRED FOR SUPPORT AT THE EXCAVATION SITE AND 1 D8 CAT DOZER WILL BE REQUIRED AT THE DISPOSAL AND STOCKPILE AREAS FOR SPREADING OF MATERIAL DURING THE SAME PERIOD.

ITEM -01.01.01- SUBITEM 1 CRITERIA
THE PARAMETERS USED TO CALCULATE THE PRODUCTION RATE FOR LOADING WITH A 992C CAT FEL ARE AS FOLLOWS:

SWELL FACTOR - 0.85 (DENSITY = 3650 PCY)
BUCKET CAP HEAPED- 13.5 CY
BUCKET FILL FACT - 0.80
FEL LOAD CYCLE - 0.70 MINUTES
TRUCK CAPACITY - 85 TONS OR 46.6 BCY
EFFECT PROD TIME - 45 MINUTES/HR AND 9.5 HRS/10 HR SHIFT; 2 SHIFTS/DAY

USING THESE FACTORS, THE PRODUCTION RATE FOR THIS EQUIPMENT CAN BE CALCULATED AS FOLLOWS:

BUCKET CAPACITY - 13.5 CY X 0.80 BF X 0.85 SF = 9.18 BCY/PASS
LOAD TRUCK - 46.6 BCY/9.18 BCY PER PASS = 5 PASSES/TRUCK
CYCLE:
LOAD TRUCK - 5 PASSES X 0.70 MIN = 3.5 MINUTES
EXCH TRUCK - = 0.5 MINUTES

TRUCK LOAD CYCLE- 4.0 MINUTES

PRODUCTION: 5 PASSES X 9.18 BCY/PASS = 45.9 BCY/TRUCK
45 MIN/4.0 MIN/TR X 45.9 BCY/TR = 516 BCY/HR X 9.5 HR/SH=4900CY/SH
4900 BCY/SH X 2 SH/DAY = 9800 BCY/DAY. USE 1 FEL FOR SHY, 82 DAYS.

ITEM -01.01.01- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 82 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.60
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
					4098.40

Total A-Labor Cost Per Day
(12.0 persons, 120.0 MH/day @ 34.15 Ave.)

Total A-Labor Cost - 82 Days (9840 MH) @ 4098.40 = 336069

TOTAL LABOR 336069

ITEM -01.01.01- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 82 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
1.0	992C	FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
1.0	D8K		X 20.00 hrs @	77.90	1558.00
					5580.60

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 82 Days @ 5580.60 = 457609

TOTAL EQUIPMENT 457609

ITEM -01.01.01- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 336069) =				16803.45
TOTAL MATERIALS & SUPPLIES				16803
SUBITEM TOTAL				810481

ITEM -01.01.01- SUBITEM 2 CRITERIA
80% OF CHANNEL AND CONTROL STRUCTURE EXCAVATION WILL BE HAULED TO STOCKPILE AREA NEAR PROCESSING PLANT. THE REMAINING 20% WILL BE HAULED TO NORTH DISPOSAL AREA. HAULING WILL BE PERFORMED WITH 777 CAT DUMP TRUCKS. TRUCK CYCLES AND PRODUCTION TO EACH DISPOSAL AREA WILL BE AS INDICATED IN THE FOLLOWING: (FEL AND TRUCK CAPACITIES ARE AS INDICATED IN PREVIOUS SUBITEM FOR LOADING)

	DISTANCE	CYCLE TIME	TRIPS/45'-HR	BCY/TRUCK/HR
HAUL TO STOCKPILE:	17,000'	23.0 MIN	2.0	89
HAUL TO N DISP AR:	12,000'	19.1 MIN	2.3	105

TRUCK REQUIREMENTS CAN BE CALCULATED AS FOLLOWS:
HAUL TO STOCKPILE AREA - 516 BCY/HR/FEL / 89 BCY/HR/TR = 5.8, SAY 6 TRUCKS
HAUL TO NORTH DISPOSAL AREA - 516 BCY/HR/FEL / 105 BCY/HR/TR = 4.9, SAY 5 TRUCKS

A D8 CAT DOZER WILL BE PROVIDED AT THE DISPOSAL AND STOCKPILE AREAS FOR SPREADING OF MATERIAL.

ITEM -01.01.01- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 66 days.
NUMBER PER SHIFT - HAUL TO STOCKPILE AREA

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
6.0	6.0	12.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	4371.60
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					7651.40

Total A-Labor Cost Per Day
(22.0 persons, 220.0 MH/day @ 34.78 Ave.)

Total A-Labor Cost - 66 Days (14520 MH) @ 7651.40 = 504992

ITEM -01.01.01- SUBITEM 2 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 16 days.
NUMBER PER SHIFT - HAUL TO N. DISP AREA

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
5.0	5.0	10.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	3643.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					6922.00

Total B-Labor Cost Per Day
(20.0 persons, 200.0 MH/day @ 34.61 Ave.)

Total B-Labor Cost - 16 Days (3200 MH) @ 6922.80 = 110765

TOTAL LABOR 615757

ITEM -01.01.01- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 66 days.

NO.	..EQUIPMENT.. TYPE		UNIT COST	TOTAL PER DAY
6.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	11698.80
1.0	D8K	X 20.00 hrs @	77.90	1558.00
	Total Equipment Cost Per Day			13256.00

Total Subset-A Equipment Cost - 66 Days @ 13256.00 = 874949

ITEM -01.01.01- SUBITEM 2 EQUIPMENT
B-Equipment estimate is based on 20.00 hours per day for 16 days.

NO.	..EQUIPMENT.. TYPE		UNIT COST	TOTAL PER DAY
5.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	9749.00
1.0	D8K	X 20.00 hrs @	77.90	1558.00
	Total Equipment Cost Per Day			11307.00

Total Subset-B Equipment Cost - 16 Days @ 11307.00 = 180912

TOTAL EQUIPMENT 1055861

ITEM -01.01.01- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 615757) = 30787.85

TOTAL MATERIALS & SUPPLIES 30788

SUBITEM TOTAL 1702406

SPILLWAY CHUTE
& BUCKET

0 0 2 5 4

ITEM -01.01.01- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	LOADING	318300.0	CY	3960	135247	184160	6762	0	326169	1.02
2	HAULING	318300.0	CY	7800	272168	490119	13600	0	775895	2.44
T	SPLW CH & BCK-COMM EXC	318300.0	CY	11760	407415	674279	20370	0	1102064	3.46
	UNIT COST			0.04	1.28	2.12	0.06	0.00	3.46	

ITEM -01.01.01- CRITERIA

THIS ITEM CONSIDERS COMMON EXCAVATION FOR THE SPILLWAY CHUTE AND BUCKET. MATERIA CONSISTS OF ALLUVIUM SANDS AND GRAVEL. EXCAVATION WILL BE PERFORMED USING 992C CAT FEL (13.5 CY) LOADING TO 777 CAT DUMP TRUCKS. 80% OF THE EXCAVATED MATERIAL WILL BE HAULED TO A STOCKPILE AREA DOWNSTREAM OF THE DAM, FOR FUTURE PROCESSING AND REUSE IN THE FILL. THE REMAINING 20% WILL BE HAULED TO THE NORTH DISPOSAL AREA.

EXCAVATION WILL BE PERFORMED IN THE PERIODS FROM APRIL 1, THRU OCTOBER 31. THE ABOVE MENTIONED PERIODS CORRESPOND TO THE SIX MONTH SUMMER CONSTRUCTION SEASON THAT IS EXPECTED TO GOVERN THIS WORK.

THE COST OF COMMON EXCAVATION WILL BE CONSIDERED AS TWO SEPARATE SUBITEMS; LOADING AND HAULING.

PRODUCTION RATES AND TIMES ARE AS SUGGESTED BY EQUIPMENT MANUFACTURERS.

A D8 CAT DOZER WILL BE REQUIRED FOR SUPPORT AT THE EXCAVATION SITE AND 1 D8 CAT DOZER WILL BE REQUIRED AT THE DISPOSAL AND STOCKPILE AREAS FOR SPREADING OF MATERIAL DURING THE SAME PERIOD.

CREW AND EQUIPMENT REQUIREMENTS AND DURATION WILL BE AS ESTABLISHED IN THE FOLLOWING SUBITEMS.

ITEM -01.01.01- SUBITEM 1 CRITERIA
THE PARAMETERS USED TO CALCULATE THE PRODUCTION RATE FOR LOADING WITH A 992C CAT FEL ARE AS FOLLOWS:

SWELL FACTOR - 0.85 (DENSITY = 3650 PCY)
BUCKET CAP HEAPED- 13.5 CY
BUCKET FILL FACT - 0.80
FEL LOAD CYCLE - 0.70 MINUTES
TRUCK CAPACITY - 85 TONS OR 46.6 BCY
EFFECT PROD TIME - 45 MINUTES/HR AND 9.5 HRS/10 HR SHIFT; 2 SHIFTS/DAY

USING THESE FACTORS, THE PRODUCTION RATE FOR THIS EQUIPMENT CAN BE CALCULATED AS FOLLOWS:

BUCKET CAPACITY - 13.5 CY X 0.80 BF X 0.85 SF = 9.18 BCY/PASS
LOAD TRUCK - 46.6 BCY/9.18 BCY PER PASS = 5 PASSES/TRUCK

CYCLE:

LOAD TRUCK - 5 PASSES X 0.70 MIN = 3.5 MINUTES
EXCH TRUCK - = 0.5 MINUTES

TRUCK LOAD CYCLE- 4.0 MINUTES

PRODUCTION: 5 PASSES X 9.18 BCY/PASS = 45.9 BCY/TRUCK
45 MIN/4.0 MIN/TR X 45.9 BCY/TR = 516 BCY/HR X 9.5 HR/SH=4900CY/SH
4900 BCY/SH X 2 SH/DAY = 9800 BCY/DAY. USE 1 FEL FOR SAY, 33 DAYS.

ITEM -01.01.01- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 33 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
					4098.40

Total A-Labor Cost Per Day
(12.0 persons, 120.0 MH/day @ 34.15 Ave.)

Total A-Labor Cost - 33 Days (3960 MH) @ 4098.40 = 135247

TOTAL LABOR 135247

ITEM -01.01.01- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 33 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
1.0	992C	FEL	13.5 CY	X 20.00 hrs @ 201.13	4022.60
1.0	D8K			X 20.00 hrs @ 77.90	1558.00
					5580.60

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 33 Days @ 5580.60 = 184160

TOTAL EQUIPMENT 184160

ITEM -01.01.01- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 135247) = 6762.35

TOTAL MATERIALS & SUPPLIES 6762

SUBITEM TOTAL 326169

ITEM -01.01.01- SUBITEM 2 CRITERIA
80% OF SPILLWAY CHUTE AND BUCKET EXCAVATION WILL BE HAULED TO STOCKPILE AREA NEAR PROCESSING PLANT. THE REMAINING 20% WILL BE HAULED TO NORTH DISPOSAL AREA. HAULING WILL BE PERFORMED WITH 777 CAT DUMP TRUCKS. TRUCK CYCLES AND PRODUCTION TO EACH DISPOSAL AREA WILL BE AS INDICATED IN THE FOLLOWING:(FEL AND TRUCK CAPACITIES ARE AS INDICATED IN PREVIOUS SUBITEM FOR LOADING)

	DISTANCE	CYCLE TIME	TRIPS/45'-HR	BCY/TRUCK/HR
HAUL TO STOCKPILE:	18,000'	26.2 MIN	1.7	78
HAUL TO N DISP AR:	13,000'	21.3 MIN	2.1	96

TRUCK REQUIREMENTS CAN BE CALCULATED AS FOLLOWS:
HAUL TO STOCKPILE AREA - 516 BCY/HR/FEL / 78 BCY/HR/TR = 6.6, SAY 7 TRUCKS
HAUL TO NORTH DISPOSAL AREA - 516 BCY/HR/FEL / 96 BCY/HR/TR = 5.4, SAY 6 TRUCKS

A D8 CAT DOZER WILL BE PROVIDED AT THE DISPOSAL AND STOCKPILE AREAS FOR SPREADING OF MATERIAL.

ITEM -01.01.01- SUBITEM 2 CRITERIA
80% OF SPILLWAY CHUTE AND BUCKET EXCAVATION WILL BE HAULED TO STOCKPILE AREA NEAR PROCESSING PLANT. THE REMAINING 20% WILL BE HAULED TO NORTH DISPOSAL AREA. HAULING WILL BE PERFORMED WITH 777 CAT DUMP TRUCKS. TRUCK CYCLES AND PRODUCTION TO EACH DISPOSAL AREA WILL BE AS INDICATED IN THE FOLLOWING: (FEL AND TRUCK CAPACITIES ARE AS INDICATED IN PREVIOUS SUBITEM FOR LOADING)

	DISTANCE	CYCLE TIME	TRIPS/45'-HR	BCY/TRUCK/HR
HAUL TO STOCKPILE:	18,000'	26.2 MIN	1.7	78
HAUL TO N DISP AR:	13,000'	21.3 MIN	2.1	96

TRUCK REQUIREMENTS CAN BE CALCULATED AS FOLLOWS:
HAUL TO STOCKPILE AREA - 516 BCY/HR/FEL / 78 BCY/HR/TR = 6.6, SAY 7 TRUCKS
HAUL TO NORTH DISPOSAL AREA - 516 BCY/HR/FEL / 96 BCY/HR/TR = 5.4, SAY 6 TRUCKS

A D8 CAT DOZER WILL BE PROVIDED AT THE DISPOSAL AND STOCKPILE AREAS FOR SPREADING OF MATERIAL.

ITEM -01.01.01- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 27 days.
NUMBER PER SHIFT - HAUL TO STOCKPILE AREA

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
7.0	7.0	14.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	5100.20
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					8380.00

Total A-Labor Cost Per Day
(24.0 persons, 240.0 MH/day @ 34.92 Ave.)

Total A-Labor Cost - 27 Days (6480 MH) @ 8380.00 = 226260

ITEM -01.01.01- SUBITEM 2 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 6 days.
NUMBER PER SHIFT - HAUL TO N. DISP AREA

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
6.0	6.0	12.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	4371.60
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					7651.40

Total B-Labor Cost Per Day
(22.0 persons, 220.0 MH/day @ 34.78 Ave.)

Total B-Labor Cost - 6 Days (1320 MH) @ 7651.40 = 45908

TOTAL LABOR 272168

ITEM -01.01.01- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 27 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
7.0	CAT 777 TRUCK	X	20.00 hrs @	97.49	13648.60
1.0	D8K	X	20.00 hrs @	77.90	1558.00
Total Equipment Cost Per Day					15206.60

Total Subset-A Equipment Cost - 27 Days @ 15206.60 = 410578

ITEM -01.01.01- SUBITEM 2 EQUIPMENT
B-Equipment estimate is based on 20.00 hours per day for 6 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
6.0	CAT 777 TRUCK	X	20.00 hrs @	97.49	11698.80
1.0	D8K	X	20.00 hrs @	77.90	1558.00
Total Equipment Cost Per Day					13256.80

Total Subset-B Equipment Cost - 6 Days @ 13256.80 = 79541

TOTAL EQUIPMENT 490119

ITEM -01.01.01- SUBITEM 2 MATERIALS & SUPPLIES

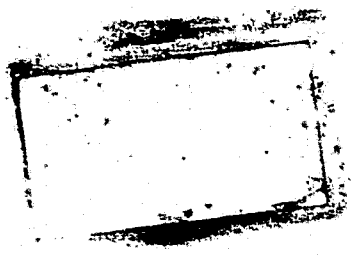
MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 272168) = 13608.40

TOTAL MATERIALS & SUPPLIES 13608

SUBITEM TOTAL 775895

MAIN DAM



ITEM -01.01.01- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	ABUTM1-LOADING	2442000.0	CY	27500	926975	1395150	46349	0	2368474	0.97
2	ABUTM-HAULING	2442000.0	CY	47500	1645450	2026750	82272	0	4554472	1.87
3	ROAD MAINTENACE	4942000.0	CY	7920	283536	497574	14177	0	795287	0.16
4	RIVERBED-COMMON EXCV	2500000.0	CY	97560	3378557	6416142	168928	0	9963627	3.99
T	MAIN DAM - COMMON EXCV	4942000.0	CY	180480	6234518	11135616	311726	0	17681860	3.58
	UNIT COST			0.04	1.26	2.25	0.06	0.00	3.58	

ITEM -01.01.01- CRITERIA

THIS ITEM CONSIDERS COMMON EXCAVATION FOR THE MAIN DAM ABUTEMENTS AND RIVERBED. COMMON EXCAVATION MATERIAL CONSISTS OF ALLUVIUM SANDS AND GRAVELS. ABUTEMENTS WILL BE EXCAVATED USING 992C CAT FEL (13.5 CY) LOADING TO 777 CAT DUMP TRUCKS AND HAULING TO DISPOSAL AREAS. RIVERBED MATERIAL WILL BE EXCAVATED USING A DRAGLINE OPERATION AND MATERIAL WILL BE LOADED ON BOTTOM DUMP TRUCKS AND HAULED TO A STOCKPILE AREA FOR PROCESSING. DRAGLINE WILL CAST TO A STOCKPILE WHERE FEL WILL PERFORM LOADING OF THE TRUCKS. IT IS EXPECTED THAT 2,500,000 BCY WILL BE EXCAVATED BY DRAGLINE FROM THE RIVERBED AREA AND THE REMAINDER WILL BE REMOVED USING FEL. STOCKPILE FOR RIVERBED MATERIAL WILL BE LOCATED DOWNSTREAM OF DAM AT APPROXIMATELY 11,000' FROM EXCAVATION AREA.
EXCAVATION WILL BE PERFORMED IN THE PERIODS FROM APRIL 1, THRU OCTOBER 31. THE ABOVE MENTIONED PERIODS CORRESPOND TO THE SIX MONTH SUMMER CONSTRUCTION SEASON THAT IS EXPECTED TO GOVERN THIS WORK. THIS ITEM ALSO INCLUDES 6000 CY OF CUFFERDAM COMMON MATERIAL EXCAVATION.
THE COST OF COMMON EXCAVATION WILL BE CONSIDERED AS FOUR SEPARATE SUBITEMS; ABUTEMENTS, HAULING, ROAD MAINTENANCE AND RIVERBED EXCAVATION.
PRODUCTION RATES AND TIMES ARE AS SUGGESTED BY EQUIPMENT MANUFACTURERS.
A D8 CAT DOZER WILL BE REQUIRED FOR SUPPORT AT THE EXCAVATION SITE AND 1 D8 CAT DOZER WILL BE REQUIRED AT THE DISPOSAL AND STOCKPILE AREAS FOR SPREADING OF MATERIAL DURING THE SAME PERIOD.

ITEM -01.01.01- SUBITEM 1 CRITERIA

THE PARAMETERS USED TO CALCULATE THE PRODUCTION RATE FOR LOADING WITH A 992C CAT FEL ARE AS FOLLOWS:

SWELL FACTOR - 0.85 (DENSITY = 3650 PCY)
BUCKET CAP HEAPED- 13.5 CY
BUCKET FILL FACT - 0.80
FEL LOAD CYCLE - 0.70 MINUTES
TRUCK CAPACITY - 85 TONS OR 46.6 BCY
EFFECT PROD TIME - 45 MINUTES/HR AND 9.5 HRS/10 HR SHIFT; 2 SHIFTS/DAY

USING THESE FACTORS, THE PRODUCTION RATE FOR THIS EQUIPMENT CAN BE CALCULATED AS FOLLOWS:

BUCKET CAPACITY - 13.5 CY X 0.80 BF X 0.85 SF = 9.18 BCY/PASS
LOAD TRUCK - 46.6 BCY/9.18 BCY PER PASS = 5 PASSES/TRUCK

CYCLE:

LOAD TRUCK - 5 PASSES X 0.70 MIN = 3.5 MINUTES
EXCH TRUCK - = 0.5 MINUTES

TRUCK LOAD CYCLE- 4.0 MINUTES

PRODUCTION: 5 PASSES X 9.18 BCY/PASS = 45.9 BCY/TRUCK
45 MIN/4.0 MIN/TR X 45.9 BCY/TR = 516 BCY/HR X 9.5 HR/SH=4900CY/SH
4900 BCY/SH X 2 SH/DAY = 9800 BCY/DAY. USE 2 FEL FOR SAY, 125 DAYS.

ITEM -01.01.01- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 125 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.9	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
2.0	2.0	4.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1440.00
2.0	2.0	4.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1440.00
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60
4.0	4.0	8.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	2503.20
					7415.00

Total A-Labor Cost Per Day
(22.0 persons, 220.0 MH/day @ 33.71 Ave.)

Total A-Labor Cost - 125 Days (27500 MH) @ 7415.80 = 926975

TOTAL LABOR 926975

ITEM -01.01.01- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 125.days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
2.0	992C FEL 13.5 CY	X 20.00 hrs @	201.13	8045.20
2.0	D8K	X 20.00 hrs @	77.90	3116.00
				11161.20

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 125 Days @ 11161.20 = 1395150

TOTAL EQUIPMENT 1395150

ITEM -01.01.01- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 926975) =				46348.75
TOTAL MATERIALS & SUPPLIES				46349
SUBITEM TOTAL				2368474

ITEM -01.01.01- SUBITEM 2 CRITERIA
100% OF ABUTEMENT COMMON EXCAVAT WILL BE HAULED DIRECTLY TO THE DISPOSAL AREA.
AT THE DISPOSAL AREA A CAT D8 DOZER WILL SPREAD THE MATERIAL.
HAULING WILL BE PERFORMED WITH 777 CAT DUMP TRUCKS. TRUCK CYCLES AND PRODUCTION
TO EACH DISPOSAL AREA WILL BE AS INDICATED IN THE FOLLOWING:(FEL AND TRUCK
CAPACITIES ARE AS INDICATED IN PREVIOUS SUBITEM FOR LOADING)

	DISTANCE	CYCLE TIME	TRIPS/45'-HR	BCY/TRUCK/HR
NORTH DISP AREA	10,000'	16.3 MIN	2.7	124
SOUTH DISP AREA	10,000'	17.6 MIN	2.6	117

HAUL TO NORTH DISPOSAL AREA - 516 BCY/HR/FEL / 124 BCY/HR/TR = 4.2, SAY 5 TRUCKS
HAUL TO SOUTH DISPOSAL AREA - 516 BCY/HR/FEL / 117 BCY/HR/TR = 4.4, SAY 5 TRUCKS

TOTAL = 10 TRUCKS

A D8 CAT DOZER WILL BE PROVIDED AT EACH DISPOSAL AREA FOR SPREADING OF MATERIAL.

ITEM -01.01.01- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 125 days.
NUMBER PER SHIFT - HAUL TO DISPOSAL AREAS

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
2.0	2.0	4.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1440.00
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60
10.0	10.0	20.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	7286.00
4.0	4.0	8.0	DUMP MAN	X 10.00 hrs @ 31.30	2504.00
					13163.60

Total A-Labor Cost Per Day
(38.0 persons, 380.0 MH/day @ 34.64 Ave.)

Total A-Labor Cost - 125 Days (47500 MH) @ 13163.60 = 1645450

TOTAL LABOR 1645450

ITEM -01.01.01- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 125 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
10.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	19498.00
2.0	DSK	X 20.00 hrs @	77.90	3116.00
	Total Equipment Cost Per Day			22614.00

Total Subset-A Equipment Cost - 125 Days @ 22614.00 = 2826750

TOTAL EQUIPMENT 2826750

ITEM -01.01.01- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 1645450) =				82272.50
TOTAL MATERIALS & SUPPLIES				82272
SUBITEM TOTAL				4554472

ITEM -01.01.01- SUBITEM 3 CRITERIA
ROAD MAINTENANCE WILL BE CHARGED AS A WEIGHTED AVERAGE OF THE QUANTITY AND DURATION OF EACH EXCAVATION ITEM IN RELATON TO THE TOTAL QUANTITY AND DURATION FOR ALL THE OPEN EXCAVATION ITEMS. THE AMOUNT OF ROAD MAINTENANCE TO BE CHARGED TO THIS ITEM WAS DETERMINED BASED ON THE FOLLOWING RELATIONSHIP.

BCY X DAYS THIS ITEM / SUMMATION BCY X DAYS ALL OPEN EXCAVATION ITEMS.

THE FACTOR CORRESPONDING TO THIS ITEM IS 0.5.
THIS PORTION OF A CREW FOR ROAD MAINTENANCE WILL BE ALLOWED FOR THE DURATION OF THIS ACTIVITY.

ITEM -01.01.01- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 396 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR			TOTAL PER DAY
0.5	0.5	1.0	LIGHT EQUIP OP	X 10.00 hrs @	35.17	351.70
0.5	0.5	1.0	HD DRIVR(-60CY)	X 10.00 hrs @	36.43	364.30
						716.00

Total A-Labor Cost Per Day
(2.0 persons, 20.0 MH/day @ 35.80 Ave.)

Total A-Labor Cost - 396 Days (7920 MH) @ 716.00 = 283536

TOTAL LABOR 283536

ITEM -01.01.01- SUBITEM 3 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 396 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
0.5	CAT 16G	X	20.00 hrs @	66.35	663.50
0.5	6000 GALS TRACTOR-TRLR	X	20.00 hrs @	59.30	593.00
					1256.50

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 396 Days @ 1256.50 = 497574

TOTAL EQUIPMENT 497574

ITEM -01.01.01- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 283536) =				14176.80
TOTAL MATERIALS & SUPPLIES				14177
SUBITEM TOTAL				795287

TOTAL LABOR 3378557

ITEM -01.01.01- SUBITEM 4 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 271 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	480W B-E 15 CY DRGLN	X 20.00 hrs @	402.81	8056.20
1.0	992C FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
2.0	D8K	X 20.00 hrs @	77.90	3116.00
5.0	CAT 772B BOT DMP 100T	X 20.00 hrs @	84.81	8481.00
Total Equipment Cost Per Day				23675.80

Total Subset-A Equipment Cost - 271 Days @ 23675.80 = 6416142

TOTAL EQUIPMENT 6416142

ITEM -01.01.01- SUBITEM 4 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 3378557) = 168927.85

TOTAL MATERIALS & SUPPLIES 168928

SUBITEM TOTAL 9963627

ITEM TOTAL 17681860

ALLUVIUM EXCAVATION

ITEM -01.01.01- SUMMARY

--	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	ROAD MAINTENANCE	1060000.0	CY	460	16468	28393	823	0	46190	0.04
2	ALLUVIUM EXCVAVATION	1060000.0	CY	41868	1450463	2761730	72523	0	4284716	4.04
T	ALLUVIUM EXCAVATION	1060000.0	CY	42328	1466931	2790529	73346	0	4330906	4.09
	UNIT COST			0.04	1.38	2.63	0.07	0.00	4.09	

ITEM -01.01.01- CRITERIA
THIS ITEM CONSIDERS EXCAVATION OF ALLUVIAL MATERIAL IN THE GENERAL AREA
OF THE SPILLWAY FLIP BUCKET AND DOWNSTREAM TO THE RIVER BED. THIS MATERIAL WILL
BE EXCAVATED USING A DRAGLINE OPERATION. DRAGLINE WILL CAST TO A STOCKPILE FROM
WHERE MATERIAL WILL BE LOADED ON CAT 772B BOTTOM DUMP TRUCKS WITH A CAT 992C FEL
EXCAVATION WILL BE PERFORMED IN THE PERIODS FROM APRIL 1, THRU OCTOBER 31.
THE ABOVE MENTIONED PERIODS CORRESPOND TO THE SIX MONTH SUMMER CONSTRUCTION
SEASON THAT IS EXPECTED TO GOVERN THIS WORK.
THE COST OF ALLUVIUM EXCAVATION WILL BE CONSIDERED AS TWO SUBITEMS:
ONE FOR THE ROAD MAINTENANCE CORRESPONDING TO THIS ITEM, AND THE OTHER FOR THE
DRAGLINE OPERATION WHICH WILL INCLUDE EXCAVATION, LOADING AND HAULING.
PRODUCTION RATES AND TIMES ARE AS SUGGESTED BY EQUIPMENT MANUFACTURERS.
A D8 CAT DOZER WILL BE REQUIRED FOR SUPPORT AT THE EXCAVATION SITE
AND 1 D9 CAT DOZER WILL BE REQUIRED AT THE DISPOSAL AND STOCKPILE AREAS FOR
SPREADING OF MATERIAL DURING THE SAME PERIOD.
A 495-U BUCYRUS ERIE DRAGLINE RIG WILL BE USED EXCAVATING AT A RATE OF
486 BCY/HR. 486 BCY/HR X 9.5 HR/SHIFT X 2 SHIFTS/DAY = 9234 BCY/DAY.
1,350,000 BCY / 9234 BCY/DAY = 115 DAY DURATION FOR THIS WORK.
CREW AND EQUIPMENT REQUIREMENTS, DURATION AND PRODUCTION RATES WILL BE AS
ESTABLISHED IN THE FOLLOWING SUBITEMS.

ITEM -01.01.01- SUBITEM 1 CRITERIA
ROAD MAINTENANCE WILL BE CHARGED AS A WEIGHTED AVERAGE OF THE QUANTITY AND DURATION OF EACH EXCAVATION ITEM IN RELATON TO THE TOTAL QUANTITY AND DURATION FOR ALL THE OPEN EXCAVATION ITEMS. THE AMOUNT OF ROAD MAINTENANCE TO BE CHARGED TO THIS ITEM WAS DETERMINED BASED ON THE FOLLOWING RELATIONSHIP:

BCY X DAYS THIS ITEM / SUMMATION BCY X DAYS ALL EXCAVATION ITEMS.

ROAD MAINTENANCE FACTOR CORRESPONDING TO THIS ITEM WILL BE 0.1. THIS PORTION OF A ROAD MAINTENANCE CREWAND EQUIPMENT WILL BE CHARGED TO THIS ITEM FOR THE DURATION OF THIS ACTIVITY.

ITEM -01.01.01- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 115 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
0.1	0.1	0.2	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	70.34
0.1	0.1	0.2	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	72.86
					143.20

Total A-Labor Cost Per Day
(0.4 persons, 4.0 MH/day @ 35.80 Ave.)

Total A-Labor Cost - 115 Days (460 MH) @ 143.20 = 16468

TOTAL LABOR 16468

ITEM -01.01.01- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 115 days.

EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.1	CAT 16G	X 20.00 hrs @	66.35	132.70
0.1	6000 GALS TRACTOR-TRLR	X 20.00 hrs @	59.30	118.60
				251.30

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 115 Drus @ 251.30 = 28899

TOTAL EQUIPMENT 28899

ITEM -01.01.01- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 16460) =				823.40
TOTAL MATERIALS & SUPPLIES				823
SUBITEM TOTAL				46190

ITEM -01.01.01- SUBITEM 2 CRITERIA
ALLUVIUM EXCAVATION WILL BE PERFORMED USING A 480-W BUCYRUS SRIE DRAGLINE RIG WITH A 15 CY BUCKET. DRAGLINE WILL CAST TO A STOCKPILE FROM WHERE MATERIAL WILL BE LOADED ON CAT 772D BOTTOM DUMP TRUCKS WITH A CAT 992C FEL.
THE FOLLOWING SWELL AND BUCKET FILL FACTORS WILL BE USED FOR THIS MATERIAL.
SWELL FACTOR = 0.9 ; BUCKET FILL FACTOR = 0.80
DRAGLINE CYCLE (90 DEGREE SWING) = 1.1 MIN/SWING,OR 45 SWINGS/HR-50 MIN HR
DRGLN PROD = 15 BCY/BKT X 0.9 SF X 0.8 BF = 10.8BCY/BKT X 45 SW/HR = 486 BCY/HR
USING MANUFACTURERS' RECCOMMENDATION FOR THIS EQUIPMENT AND THESE MATERIAL
THESE MATERIAL PROPERTIES, THE FEL LOADING RATE CAN BE DETERMINED AS FOLLOWS:
13.5 BCY/BKT X 0.9 SF X 0.8 BF = 9.72 BCY/BKT AT 0.7 MIN/CYCLE.
TRUCK CAPACITY = 100 TON = 61.73 BCY (120 PCF)
61.73 BCY/TR / 9.72 BCY/BKT = 7 FEL CYCL/TR X 0.7 MIN/CYCL = 4.9 MIN/TR
4.9 MIN/TR + 0.25 MIN/TR EXCH = 5.15 MIN/TRUCK
45 MIN/HR / 5.15 MIN/TR = 8.74 TR/HR X 61.7 BCY/TR = 548 BCY/HR LOAD RATE.
80% OF THIS MATERIAL WILL BE HAULED 10000' (CYCLE TIME = 21.7 MIN) TO STOCKPILE FOR PROCESSING AND FUTURE USE IN THE FILL, AND THE REMAINING 20% WILL BE HAULED 15900' TO THE NORTH DISPOSAL AREA (CYCLE TIME = 25.7 MIN). TRUCK REQUIREMENTS CAN BE DETERMINED AS FOLLOWS: 45 MIN/HR / 21.7 MIN X 61.7 BCY = 128 BCY/TR/HR TO STOCKPILE AREA. 45 MIN/HR / 25.7 MIN X 61.7 BCY/TR = 105 BCY/TR/HR TO DISPOSAL.
FOR LOADING RATE OF 540 BCY/HR NEED 5 AND 6 TRUCKS, RESPECTIVELY.

ITEM -01.01.01- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 115 days.
NUMBER PER SHIFT

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	CL A EQUIP OP	X 10.00 hrs @ 37.91	759.20
2.0	2.0	4.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1440.00
1.0	1.0	2.0	OILER	X 10.00 hrs @ 34.38	687.60
0.0	0.0	0.0	HD DRIVR(-00CY)	X 10.00 hrs @ 35.43	0.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60

Total A-Labor Cost Per Day 5544.20
(16.0 persons, 160.0 MH/day @ 34.65 Ave.)

Total A-Labor Cost - 115 Days (18400 MH) @ 5544.20 = 637583

ITEM -01.01.01- SUBITEM 2 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 115 days.
NUMBER PER SHIFT - STOCKPILE AND DISPOSAL AREA CREW

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.60
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00

Total B-Labor Cost Per Day 3279.80
(10.0 persons, 100.0 MH/day @ 32.80 Ave.)

Total B-Labor Cost - 115 Days (11500 MH) @ 3279.80 = 377177

ITEM -01.01.01- SUBITEM 2 LABOR
C-Labo estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 92 days.
NUMBER PER SHIFT - HAUL TO PROCESSING PLANT STOCKPILE

1ST	2ND	TOTAL	TYPE OF LABOR	TOTAL PER DAY
5.0	5.0	10.0	HD DRIVR(-03CY) X 10.00 hrs @ 36.43	3643.00
			Total C-Labor Cost Per Day (10.0 persons, 100.0 MH/day @ 36.43 Ave.)	3643.00

Total C-Labor Cost - 92 Days (9200 MH) @ 3643.00 = 335156

ITEM -01.01.01- SUBITEM 2 LABOR
D-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 23 days.
NUMBER PER SHIFT - HAUL TO NORTH DISPOSAL AREA

1ST	2ND	TOTAL	TYPE OF LABOR	TOTAL PER DAY
6.0	6.0	12.0	HD DRIVR(-03CY) X 10.00 hrs @ 36.43	4371.60
			Total D-Labor Cost Per Day (12.0 persons, 120.0 MH/day @ 36.43 Ave.)	4371.60

Total D-Labor Cost - 23 Days (2760 MH) @ 4371.60 = 100547

TOTAL LABOR 1450463

ITEM -01.01.01- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 115 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	420W B-E 15 CY DRGLN	X 20.00 hrs @	402.81	8056.20
1.0	950C FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
2.0	D8K	X 20.00 hrs @	77.99	3116.00
0.0	CAT 772B BOT DMP 100T	X 20.00 hrs @	04.81	0.00
Total Equipment Cost Per Day				15194.00

Total Subset-A Equipment Cost - 115 Days @ 15194.80 = 1747402

ITEM -01.01.01- SUBITEM 2 EQUIPMENT
B-Equipment estimate is based on 20.00 hours per day for 92 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
5.0	CAT 772B BOT DMP 100T	X 20.00 hrs @	04.81	8481.00
Total Equipment Cost Per Day				8481.00

Total Subset-B Equipment Cost - 92 Days @ 8481.00 = 780252

ITEM -01.01.01- SUBITEM 2 EQUIPMENT
C-Equipment estimate is based on 20.00 hours per day for 23 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
6.0	CAT 772B 80T DMP 100T	X 20.00 hrs @ 84.81		10177.20
Total Equipment Cost Per Day				10177.20

Total Subset-C Equipment Cost - 23 Days @ 10177.20 = 234076

TOTAL EQUIPMENT 2761730

ITEM -01.01.01- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 1450463) = 72523.15

TOTAL MATERIALS & SUPPLIES 72523

SUBITEM TOTAL 4284716

ITEM TOTAL 4330906

0 0 2 3 4

APPROACH CHANNELS

ITEM -01.01.02- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	DRILL & BLAST	2791300.0	CY	124700	4131010	3779872	7686301	0	15597183	5.59
2	LOADING ROCK	2791300.0	CY	47300	1594397	2399658	79720	0	4073775	1.46
3	HAULING ROCK	2791300.0	CY	55040	1932145	3722321	96607	0	5751073	2.06
4	ROAD MAINTENANCE	2791300.0	CY	1720	61576	108059	3079	0	172714	0.06
T	APP CHANNELS-ROCK EXCV	2791300.0	CY	228760	7719128	10009910	7865707	0	25594745	9.17
	UNIT COST			0.08	2.77	3.59	2.82	0.00	9.17	

ITEM -01.01.02- CRITERIA

INTAKE AND SPILLWAY APPROACH CHANNEL ROCK EXCAVATION WILL BE PERFORMED BY DRILLING AND BLASTING METHOD.
ROCK EXCAVATION WILL BE PERFORMED DURING THE SUMMER SEASONS BETWEEN APRIL 1 AND OCTOBER 31 OF THE CORRESPONDING YEAR.
BLASTED MATERIAL WILL BE LOADED WITH A 992C CAT FEL AND HAULED WITH CAT 777 DUMP TRUCKS. IT IS EXPECTED THAT 20% OF THIS MATERIAL WILL BE HAULED DIRECTLY TO THE NORTH DISPOSAL AREA, 60% WILL BE HAULED DIRECTLY TO FILL AND THE REMAINING 20% WILL BE HAULED TO TEMPORARY STOCKPILE AREA FOR LATER USE. THIS STOCKPILE AREA WILL BE LOCATED ADYACENT TO THE HAUL ROAD LEADING TO THE NORTH DISPOSAL AREA, UPSTREAM OF THE DAM. HAUL DISTANCE FOR THE MATERIAL HAULED TO DISPOSAL WILL BE 12,000'. HAUL DISTANCE TO TEMPORARY STOCKPILE AREA WILL BE 6000', AND HAUL DISTANCE FOR MATERIAL TAKEN DIRECTLY TO FILL WILL BE 7000'
ROCK EXCAVATION WILL CONSIDER FOUR SUBITEMS FOR, DRILLING AND BLASTING, LOADING, HAULING, AND ROAD MAINTENANCE.
PRODUCTION RATES USED ARE BASED ON EQUIPMENT MANUFACTURERS RECCOMENDATIONS.

ITEM -01.01.02- SUBITEM 1 CRITERIA
EXCAVATION BY DRILLING AND BLASTING WILL BE CALCULATED BASED ON THE FOLLOWING
PARAMETERS: (PRESPLITTING: 444,000 SF OF SLOPE AREA - DRILL 3" HOLES ON 2.0' CC)

MATERIAL	-	DIORITE, USE ANFO		
BANK CUT,	-	30'	30'	12'
HOLE SIZE,DIA	-	4"	3.5"	2.75"
LOADING,LB/LF OF HOLE	-	5.01(.92)	3.84(.92)	2.52(.98)
COLUMN	-	23'	23'	11'
PATTERN	-	9'X12.5'	8'X11'	7'X8.5'
YIELD, CY/ LF OF HOLE	-	3.79	2.96	1.89
DRILL RATE,FT/HR	-	45	50	55 -USING HYDR DRILLS
PERCENT OF EXCAVATION	-	40	50	10

EFFECTIVE TIME - 7.5 DRILL HRS/10 HR SHIFT + 2.5 HRS/SH TO SHOOT & MOVE
LOADING RATE WITH CAT 992 FEL = 3253 BCY/SH (SEE FOLLOWING SUBITEM) X 2
2,791,300 BCY X .4 / 3.79 BCY/LF = 294,600 LF-4" HOLE / 45'/HR = 6,560 HRS
2,791,300 BCY X .5 / 2.96 BCY/LF = 471,500 LF-3.5" HOLE / 50'/HR = 9,430 HRS.
2,791,300 BCY X .1 / 1.89 BCY/LF = 147,700 LF-2.75"HOLE / 55'/HR = 2,690 HRS
444,000 SF X 0.50 LF/SF(2.0' CC) = 222,000 LF-3" HOLE / 40'/HR = 5,550 HRS
TOTALS = 1,135,800 LF IN 24,230 HRS
24,230 HRS / 7.5 HRS/SHIFT = 3,232 DRILL SH / 858 FEL SHF X 2FEL=7.5,SAY 8 DRLS
TIME FOR EXCAVATION = 858 SHIFTS / 2 SHIFTS/DAY / 2 FEL = 215 DAYS

ITEM -01.01.02- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 215 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	681.40
8.0	8.0	16.0	DRILLER	X 10.00 hrs @ 32.89	5262.40
8.0	8.0	16.0	CHUCK TENDER	X 10.00 hrs @ 32.22	5155.20
2.0	2.0	4.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	1406.80
					12505.80

Total A-Labor Cost Per Day
(38.0 persons, 380.0 MH/day @ 32.91 Ave.)

Total A-Labor Cost - 215 Days (81700 MH) @ 12505.60 = 2688747

ITEM -01.01.02- SUBITEM 1 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 215 days.

NUMBER PER SHIFT - BLASTING 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	BLASTER	X 10.00 hrs @ 35.15	703.00
8.0	8.0	16.0	POWDERMAN	X 10.00 hrs @ 33.25	5320.00
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.26	685.20
					6708.20

Total B-Labor Cost Per Day
(20.0 persons, 200.0 MH/day @ 33.54 Ave.)

Total B-Labor Cost - 215 Days (43000 MH) @ 6708.20 = 1442263

TOTAL LABOR 4131010

ITEM -01.01.02- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 215 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
8.0	HYDRAULIC DRILL	X 20.00 hrs @	97.29	15566.40
2.0	COMPRESSOR 600 CFM	X 20.00 hrs @	40.36	1614.40
1.0	SLURRY TRUCK	X 20.00 hrs @	20.00	400.00
				17580.80

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 215 Days @ 17580.80 = 3779872

TOTAL EQUIPMENT 3779872

ITEM -01.01.02- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS		UNIT COST	TOTAL COST
Explosives	2792000.0	Lb	@	1.50	4188000.00
BITS AND STEEL	1135800.0	LF	@	0.50	567900.00
PRIMERS	50000.0	EA	@	50.00	2500000.00
PRIMERCORD	65000.0	LF	@	0.10	6500.00
DETONATORS	6000.0	EA	@	1.80	10800.00
Sub-Total					7273200.00

S T & Supply Cost @ 10.00 % Direct Labor (0.1000 X 4131010) = 413101.00

TOTAL MATERIALS & SUPPLIES 7686301

SUBITEM TOTAL 15597183

ITEM -01.01.02- SUBITEM 2 CRITERIA
EXCAVATED MATERIAL WILL BE LOADED USING 992C CAT FEL TO CAT 777 DUMP TRUCKS.
THE PARAMATERS USED FOR CALCULATING LOADING OF BLASTED ROCK MATERIAL ARE AS
INDICATED IN THE FOLLOWING:

BUCKET CAPACITY - 13.5 CY HEAPED
BUCKET FACTOR - 0.70
SWELL FACTOR - 0.65 (5000 LB/BCY DENSITY OR 2.5 TON/BCY)
LOAD CYCLE - 0.70 MINUTES
EFFECTIVE TIME - 45 MIN/HR, 9.5 HR/SHIFT
TRUCK CAPACITY - 34 BCY
TRUCK EXCH TIME - 0.50 MINUTES

PRODUCTION WILL BE CXALCULATED AS FOLLOWS:

13.5 CY X 0.70 BF X 0.65 SF = 6.1 BCY/PASS
34 BCY/TR / 6.1 BCY/PASS = 5.5, SAY 5 PASSES/TRUCK
5 PASSES/TR X 0.70 MIN/PASS = 3.5 MIN + 0.5 MIN/TR EXCH = 4.0 MIN/TR
45 MIN/HR / 4.0 MIN/TR = 11.25 TR/HR
5 PASSES X 6.1 BCY/PASS = 30.5 BCY/HR/TR X 11.25 TR/HR = 343 BCY/HR
343 BCY/HR X 9.5 HR/SH = 3259 BCY/SH X 2 SH/DAY = 6517 BCY/DAY
2,791,300 BCY / 6517 BCY/DY = 429 DAYS. USE 2 FEL FOR 215 DAYS.

2 CAT D8 DOZERS WILL ALSO BE PROVIDED DURING THIS PERIOD FOR SUPPORT IN THE
EXCAVATION.

ITEM -01.01.02- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 215 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
4.0	4.0	8.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2880.00
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60
4.0	4.0	8.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	2503.20
					7415.80

Total A-Labor Cost Per Day
(22.0 persons, 220.0 MH/day @ 33.71 Ave.)

Total A-Labor Cost - 215 Days (47300 MH) @ 7415.80 = 1594397

TOTAL LABOR 1594397

ITEM -01.01.02- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 215 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
2.0	992C FEL 13.5 CY	X 20.00 hrs @	201.13	8045.20
2.0	D8K	X 20.00 hrs @	77.90	3116.00
				11161.20

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 215 Days @ 11161.20 = 2399658

TOTAL EQUIPMENT 2399658

ITEM -01.01.02- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 1594397) =				79719.85
TOTAL MATERIALS & SUPPLIES				79720
SUBITEM TOTAL				4073775

ITEM -01.01.02- SUBITEM 3 CRITERIA
HAULING WILL BE PERFORMED WITH CAT 777 DUMP TRUCKS. 20% OF THE MATERIAL WILL BE HAULED TO THE NORTH DISPOSAL AREA, 20% WILL BE HAULED TO THE NORTH STOCKPILE AREA FOR LATER USE IN THE FILL,AND THE REMAINING 60% OF THE MATERIAL WILL BE HAULED DIRECTLY TO THE FILL.
CYCLE TIMES TO EACH OF THESE AREAS WILL BE AS INDICATED IN THE FOLLOWING:

	DISTANCE	CYCLE TIME	TRIPS/45'-HR	BCY/HR/TRK
DISPOSAL AREAS -	12,000'	19.1 MIN	2.3	70
STOCKPILE AREA -	6,000'	14.6 MIN	3.0	91
HAUL TO FILL -	7,000'	15.4 MIN	2.9	88

TRUCK REQUIREMENTS CAN BE CALCULATED AS FOLLOWS:
HAUL TO DISPOSAL: 343 BCY/HR/FEL X 2FEL / 70.0 BCY/HR/TR = 9.8, SAY 10 TRUCKS
HAUL TO STOCKPILE: 343 BCY/HR/FEL X 2FEL / 91.0 BCY/HR/TR = 7.5, SAY 8 TRUCKS
HAUL TO FILL: 343 BCY/HR/FEL X 2FEL / 88.0 BCY/HR/TR = 7.8, SAY 8 TRUCKS
A D8 CAT DOZER WILL BE PROVIDED AT THE DISPOSAL OR STOCKPILE AREA FOR SPREADING OF MATERIAL.

ITEM -01.01.02- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 43 days.
NUMBER PER SHIFT - HAUL TO DISPOSAL

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
10.0	10.0	20.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	7286.00
2.0	2.0	4.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1440.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
3.0	3.0	6.0	DUMP MAN	X 10.00 hrs @ 31.30	1878.00
					11911.80

Total A-Labor Cost Per Day
(34.0 persons, 340.0 MH/day @ 35.03 Ave.)

Total A-Labor Cost - 43 Days (14620 MH) @ 11911.80 = 512207

ITEM -01.01.02- SUBITEM 3 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 43 days.
NUMBER PER SHIFT - HAUL TO STOCKPILE

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
8.0	8.0	16.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	5829.80
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
3.0	3.0	6.0	DUMP MAN	X 10.00 hrs @ 31.30	1878.00
					9734.60

Total B-Labor Cost Per Day
(28.0 persons, 280.0 MH/day @ 34.77 Ave.)

Total B-Labor Cost - 43 Days (12040 MH) @ 9734.60 = 418588

ITEM -01.01.02- SUBITEM 3 LABOR
C-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 129 days.
NUMBER PER SHIFT - HAUL TO FILL

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
8.0	8.0	16.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	5828.80
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60
					7762.40

Total C-Labor Cost Per Day
(22.0 persons, 220.0 MH/day @ 35.28 Ave.)

Total C-Labor Cost - 129 Days (28380 MH) @ 7762.40 = 1001350

TOTAL LABOR 1932145

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 43 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
10.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	19498.00
2.0	D8K	X 20.00 hrs @	77.90	3116.00
				22614.00

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 43 Days @ 22614.00 = 972402

ITEM -01.01.02- SUBITEM 3 LABOR
C-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 129 days.
NUMBER PER SHIFT - HAUL TO FILL

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
8.0	8.0	16.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	5828.80
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60
					7762.40

Total C-Labor Cost Per Day
(22.0 persons, 220.0 MH/day @ 35.28 Ave.)

Total C-Labor Cost - 129 Days (28380 MH) @ 7762.40 = 1001350

TOTAL LABOR 1932145

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 43 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
10.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	19498.00
2.0	D8K	X 20.00 hrs @	77.90	3116.00
				22614.00

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 43 Days @ 22614.00 = 972402

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
B-Equipment estimate is based on 20.00 hours per day for 43 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
8.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	15598.40
1.0	D8K	X 20.00 hrs @	77.90	1558.00
	Total Equipment Cost Per Day			17156.40
	Total Subset-B Equipment Cost -	43 Days @	17156.40 =	737725

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
C-Equipment estimate is based on 20.00 hours per day for 129 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
8.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	15598.40
	Total Equipment Cost Per Day			15598.40
	Total Subset-C Equipment Cost -	129 Days @	15598.40 =	2012194

TOTAL EQUIPMENT 3722321

ITEM -01.01.02- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 1932145) = 96607.25

TOTAL MATERIALS & SUPPLIES 96607

SUBITEM TOTAL 5751073

ITEM -01.01.02- SUBITEM 4 CRITERIA
ROAD MAINTENANCE WILL BE CHARGED TO EACH ITEM AS A WEIGHTED AVERAGE OF THE PERCENTAGE OF TOTAL OPEN EXCAVATION AND PERCENTAGE OF TOTAL TIME REQUIRED FOR EACH ACTIVITY. THIS FACTOR CAN BE CALCULATED AS FOLLOWS:
   BCY THIS ITEM X DAYS THIS ITEM / SUMMATION BCY X DAYS ALL ITEMS
THE FACTOR TO BE USED FOR THIS ITEM WILL BE 0.2. THIS PORTION OF A ROAD MAINTENANCE CREW AND EQUIPMENT WILL BE CHARGED TO THIS ITEM FOR THE DURATION OF THIS ACTIVITY.

ITEM -01.01.02- SUBITEM 4 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 215 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
0.2	0.2	0.4	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	140.68
0.2	0.2	0.4	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	145.72
					286.40

Total A-Labor Cost Per Day
(0.8 persons, 8.0 MH/day @ 35.80 Ave.)

Total A-Labor Cost - 215 Days (1720 MH) @ 286.40 = 61576

TOTAL LABOR 61576

ITEM -01.01.02- SUBITEM 4 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 215 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
0.2	CAT 16G	X 20.00 hrs @	66.35	265.40
0.2	6000 GALS TRACTOR-TRLR	X 20.00 hrs @	59.30	237.20
				502.60

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 215 Days @ 502.60 = 108059

TOTAL EQUIPMENT 108059

ITEM -01.01.02- SUBITEM 4 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X G1576) =				3078.00
TOTAL MATERIALS & SUPPLIES				3079
SUBITEM TOTAL				172714

SPILLWAY CONTROL
STRUCTURE

SPILLWAY CHUTE
& BUCKET

0 0 2 3 4

ITEM -01.01.02- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	DRILL & BLAST	1592500.0	CY	88560	2933772	2740391	4895377	0	10569540	6.64
2	LOADING ROCK	1592500.0	CY	27060	912143	1372828	45607	0	2330578	1.46
3	HAULING ROCK	1592500.0	CY	33480	1103106	2427409	59155	0	3669670	2.30
4	ROAD MAINTENANCE	1592500.0	CY	492	17614	30910	881	0	49405	0.03
5	FOUND PREP	203500.0	SF	28800	918360	276648	45918	0	1240926	4.38
T	SPL CHT & BCK-ROCK EXC	1592500.0	CY	178392	5964995	6048186	5046938	0	17860119	11.22
	UNIT COST			0.11	3.75	4.30	3.17	0.00	11.22	

ITEM -01.01.02- CRITERIA

SPILLWAY CHUTE AND BUCKET ROCK EXCAVATION WILL BE PERFORMED BY DRILLING AND BLASTING METHOD.
ROCK EXCAVATION WILL BE PERFORMED DURING THE SUMMER SEASONS BETWEEN APRIL 1 AND OCTOBER 31 OF THE CORRESPONDING YEAR.
BLASTED MATERIAL WILL BE LOADED WITH A 992C CAT FEL AND HAULED WITH CAT 777 DUMP TRUCKS. IT IS EXPECTED THAT 20% OF THIS MATERIAL WILL BE HAULED DIRECTLY TO THE NORTH DISPOSAL AREA, 60% WILL BE HAULED DIRECTLY TO FILL AND THE REMAINING 20% WILL BE HAULED TO TEMPORARY STOCKPILE AREA FOR LATER USE. THIS STOCKPILE AREA WILL BE LOCATED ADYACENT TO THE HAUL ROAD LEADING TO THE NORTH DISPOSAL AREA, UPSTREAM OF THE DAM. HAUL DISTANCE FOR THE MATERIAL HAULED TO DISPOSAL WILL BE 14,500'. HAUL DISTANCE TO TEMPORARY STOCKPILE AREA WILL BE 7000', AND HAUL DISTANCE FOR MATERIAL TAKEN DIRECTLY TO FILL WILL BE 0000'.
ROCK EXCAVATION WILL CONSIDER FIVE SUBITEMS FOR, DRILLING AND BLASTING, LOADING, HAULING, ROAD MAINTENANCE, AND FOUNDATION PREPARATION.
PRODUCTION RATES USED ARE BASED ON EQUIPMENT MANUFACTURERS RECCOMENDATIONS.
CREWS AND EQUIPMENT REQUIREMENTS AND DURATION WILL BE AS ESTABLISHED IN THE FOLLOWING SUBITEMS.

ITEM -01.01.02- SUBITEM 1 CRITERIA
EXCAVATION BY DRILLING AND BLASTING WILL BE CALCULATED BASED ON THE FOLLOWING
PARAMETERS: (PRESPLITTING: 514,000 SF OF SLOPE AREA - DRILL 3" HOLES ON 2.0' CC)

MATERIAL	- DIORITE, USE ANFO			
BANK CUT,	-	30'	30'	12'
HOLE SIZE,DIA	-	4"	3.5"	2.75"
LOADING,LB/LF OF HOLE	-	5.01(.92)	3.84(.92)	2.52(.98)
COLUMN	-	23'	23'	11'
PATTERN	-	9'X12.5'	8'X11'	7'X8.5'
YIELD, CY/ LF OF HOLE	-	3.79	2.96	1.89
DRILL RATE,FT/HR	-	45	50	50 -USING HYDR DRILLS
PERCENT OF EXCAVATION	-	40	40	20

EFFECTIVE TIME - 7.5 DRILL HRS/10 HR SHIFT + 2.5 HRS/SH TO SHOOT & MOVE
LOADING RATE WITH CAT 992 FEL = 3259 BCY/SH (SEE FOLLOWING SUBITEM) X 2
1,592,500 BCY X .4 / 3.79 BCY/LF = 168,100 LF-4" HOLE / 45'/HR = 3,740 HRS
1,592,500 BCY X .4 / 2.96 BCY/LF = 215,200 LF-3.5" HOLE / 50'/HR = 4,300 HRS.
1,592,500 BCY X .2 / 1.89 BCY/LF = 168,500 LF-2.75"HOLE / 50'/HR = 3,370 HRS
514,000 SF X 0.50 LF/SF(2.0' CC) = 257,000 LF-3" HOLE / 40'/HR = 6,425 HRS
TOTALS = 808,800 LF IN 17,835 HRS
17,835 HRS / 7.5 HRS/SHFT = 2,378 DRILL SHFTS / 490 FEL SHFTS X 2=9.7,SAY 10 DRS
TIME FOR EXCAVATION = 490 SHIFTS / 2 SHIFTS/DAY / 2 FEL = 123 DAYS

ITEM -01.01.02- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 123 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	681.40
10.0	10.0	20.0	DRILLER	X 10.00 hrs @ 32.09	6578.00
10.0	10.0	20.0	CHUCK TENDER	X 10.00 hrs @ 32.22	6444.00
3.0	3.0	6.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	2110.20
					15813.60

Total A-Labor Cost Per Day
(48.0 persons, 480.0 MH/day @ 32.94 Ave.)

Total A-Labor Cost - 123 Days (59040 MH) @ 15813.60 = 1945073

ITEM -01.01.02- SUBITEM 1 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 123 days.

NUMBER PER SHIFT - BLASTING 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	BLASTER	X 10.00 hrs @ 35.15	703.00
10.0	10.0	20.0	POWDERMAN	X 10.00 hrs @ 33.25	6650.00
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.26	685.20
					8038.20

Total B-Labor Cost Per Day
(24.0 persons, 240.0 MH/day @ 33.49 Ave.)

Total B-Labor Cost - 123 Days (29520 MH) @ 8038.20 = 988699

TOTAL LABOR 2933772

ITEM -01.01.02- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 123 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
10.0	HYDRAULIC DRILL	X	20.00 hrs @	97.29	19458.00
3.0	COMPRESSOR 600 CFM	X	20.00 hrs @	40.36	2421.60
1.0	SLURRY TRUCK	X	20.00 hrs @	20.00	400.00
	Total Equipment Cost Per Day				22279.60

Total Subset-A Equipment Cost - 123 Days @ 22279.60 = 2740391

TOTAL EQUIPMENT 2740391

ITEM -01.01.02- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS		UNIT COST	TOTAL COST
Explosives	1593000.0	Lb	@	1.50	2389500.00
BITS AND STEEL	808800.0	LF	@	0.50	404400.00
PRIMERS	35000.0	EA	@	50.00	1750000.00
PRIMERCORD	500000.0	LF	@	0.10	50000.00
DETONATORS	4500.0	EA	@	1.80	8100.00
Sub-Total					4602000.00

S T & Supply Cost @ 10.00 % Direct Labor (0.1000 X 2933772) = 293377.20

TOTAL MATERIALS & SUPPLIES 4895377

SUBITEM TOTAL 10569540

ITEM -01.01.02- SUBITEM 2 CRITERIA
EXCAVATED MATERIAL WILL BE LOADED USING 992C CAT FEL TO CAT 777 DUMP TRUCKS.
THE PARAMATERS USED FOR CALCULATING LOADING OF BLASTED ROCK MATERIAL ARE AS
INDICATED IN THE FOLLOWING:

BUCKET CAPACITY - 13.5 CY HEAPED
BUCKET FACTOR - 0.70
SWELL FACTOR - 0.65 (5000 LB/BCY DENSITY OR 2.5 TON/BCY)
LOAD CYCLE - 0.70 MINUTES
EFFECTIVE TIME - 45 MIN/HR, 9.5 HR/SHIFT
TRUCK CAPACITY - 34 BCY
TRUCK EXCH TIME - 0.50 MINUTES

PRODUCTION WILL BE CXALCULATED AS FOLLOWS:

13.5 CY X 0.70 BF X 0.65 SF = 6.1 BCY/PASS
34 BCY/TR / 6.1 BCY/PASS = 5.5, SAY 5 PASSES/TRUCK
5 PASSES/TR X 0.70 MIN/PASS = 3.5 MIN + 0.5 MIN/TR EXCH = 4.0 MIN/TR
45 MIN/HR / 4.0 MIN/TR = 11.25 TR/HR
5 PASSES X 6.1 BCY/PASS = 30.5 BCY/HR/TR X 11.25 TR/HR = 343 BCY/HR
343 BCY/HR X 9.5 HR/SH = 3259 BCY/SH X 2 SH/DAY = 6517 BCY/DAY
1,592,500 BCY / 6517 BCY/DY = 245 DAYS. USE 2 FEL FOR 123 DAYS.

2 CAT D8 DOZERS WILL ALSO BE PROVIDED DURING THIS PERIOD FOR SUPPORT IN THE EXCAVATION.

ITEM -01.01.02- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 123 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
4.0	4.0	8.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2880.00
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60
4.0	4.0	8.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	2503.20
					7415.80

Total A-Labor Cost Per Day
(22.0 persons, 220.0 MH/day @ 33.71 p.o.)

Total A-Labor Cost - 123 Days (27060 MH) @ 7415.80 = 912143

TOTAL LABOR 912143

ITEM -01.01.02- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 123 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
2.0	992C	FEL	13.5 CY	X 20.00 hrs @ 201.13	8045.20
2.0	D8K			X 20.00 hrs @ 77.56	3116.00
					11161.20

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 123 Days @ 11161.20 = 1372828

TOTAL EQUIPMENT 1372828

ITEM -01.01.02- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 912143) =				45607.15
TOTAL MATERIALS & SUPPLIES				45607
SUBITEM TOTAL				2330578

ITEM -01.01.02- SUBITEM 3 CRITERIA
HAULING WILL BE PERFORMED WITH CAT 777 DUMP TRUCKS. 20% OF THE MATERIAL WILL BE HAULED TO THE NORTH DISPOSAL AREA, 20% WILL BE HAULED TO THE NORTH STOCKPILE AREA FOR LATER USE IN THE FILL,AND THE REMAINING 60% OF THE MATERIAL WILL BE HAULED DIRECTLY TO THE FILL.
CYCLE TIMES TO EACH OF THESE AREAS WILL BE AS INDICATED IN THE FOLLOWING:

	DISTANCE	CYCLE TIME	TRIPS/45'-HR	BCY/HR/TRK
DISPOSAL AREAS -	14,500'	19.2 MIN	2.3	70
STOCKPILE AREA -	7,000'	17.3 MIN	2.6	79
HAUL TO FILL -	8,000'	18.1 MIN	2.5	76

TRUCK REQUIREMENTS CAN BE CALCULATED AS FOLLOWS:
HAUL TO DISPOSAL: 343 BCY/HR/FEL X 2FEL / 70.0 BCY/HR/TR = 9.8, SAY 10 TRUCKS
HAUL TO STOCKPILE: 343 BCY/HR/FEL X 2FEL / 79.0 BCY/HR/TR = 8.7, SAY 9 TRUCKS
HAUL TO FILL: 343 BCY/HR/FEL X 2FEL / 76.0 BCY/HR/TR = 9.1, SAY 10 TRUCKS
A D8 CAT DOZER WILL BE PROVIDED AT THE DISPOSAL OR STOCKPILE AREA FOR SPREADING OF MATERIAL.

ITEM -01.01.02- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 25 days.
NUMBER PER SHIFT - HAUL TO DISPOSAL

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
10.0	10.0	20.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	7286.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					10565.80

Total A-Labor Cost Per Day
(30.0 persons, 300.0 MH/day @ 35.22 Ave.)

Total A-Labor Cost - 25 Days (7500 MH) @ 10565.80 = 264145

ITEM -01.01.02- SUBITEM 3 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 25 days.
NUMBER PER SHIFT - HAUL TO STOCKPILE

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
9.0	9.0	18.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	6557.40
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					9037.20

Total B-Labor Cost Per Day
(20.0 persons, 200.0 MH/day @ 35.13 Ave.)

Total B-Labor Cost - 25 Days (7000 MH) @ 9837.20 = 245930

ITEM -01.01.02- SUBITEM 3 LABOR
C-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 73 days.
NUMBER PER SHIFT - HAUL TO FILL

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
10.0	10.0	20.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	7286.00
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60
					9219.60

Total C-Labor Cost Per Day
(26.0 persons, 260.0 MH/day @ 35.46 Ave.)

Total C-Labor Cost - 73 Days (18980 MH) @ 9219.60 = 673031

TOTAL LABOR 1183106

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 25 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
10.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	19498.00
1.0	D8K	X 20.00 hrs @	77.90	1558.00
				21056.00

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 25 Days @ 21056.00 = 526400

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
B-Equipment estimate is based on 20.00 hours per day for 25 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
9.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	17548.20
1.0	D8K	X 20.00 hrs @	77.90	1558.00
	Total Equipment Cost Per Day			19106.20
	Total Subset-B Equipment Cost -	25 Days @	19106.20 =	477655

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
C-Equipment estimate is based on 20.00 hours per day for 73 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
10.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	19498.00
	Total Equipment Cost Per Day			19498.00
	Total Subset-C Equipment Cost -	73 Days @	19498.00 =	1423354

TOTAL EQUIPMENT 2427409

ITEM -01.01.02- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 1183106) =				59155.30
TOTAL MATERIALS & SUPPLIES				59155
SUBITEM TOTAL				3669670

ITEM -01.01.02- SUBITEM 4 CRITERIA
ROAD MAINTENANCE WILL BE CHARGED TO EACH ITEM AS A WEIGHTED AVERAGE OF THE PERCENTAGE OF TOTAL OPEN EXCAVATION AND PERCENTAGE OF TOTAL TIME REQUIRED FOR EACH ACTIVITY. THIS FACTOR CAN BE CALCULATED AS FOLLOWS:

BCY THIS ITEM X DAYS THIS ITEM / SUMMATION BCY X DAYS ALL ITEMS

THE FACTOR TO BE USED FOR THIS ITEM WILL BE 0.1. THIS PORTION OF A ROAD MAINTENANCE CREW AND EQUIPMENT WILL BE CHARGED TO THIS ITEM FOR THE DURATION OF THIS ACTIVITY.

ITEM -01.01.02- SUBITEM 4 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 123 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
0.1	0.1	0.2	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	70.34
0.1	0.1	0.2	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	72.86
					143.20

Total A-Labor Cost Per Day
(0.4 persons, 4.0 MH/day @ 35.80 Ave.)

Total A-Labor Cost - 123 Days (492 MH) @ 143.20 = 17614

TOTAL LABOR 17614

ITEM -01.01.02- SUBITEM 4 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 123 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
0.1	CAT 16G	X 20.00 hrs @	66.35	132.70
0.1	6000 GALS TRACTOR-TRLR	X 20.00 hrs @	59.30	118.60
				251.30

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 123 Days @ 251.30 = 30910

TOTAL EQUIPMENT 30910

ITEM -01.01.02- SUBITEM 4 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supplu Cost @ 5.00 % Direct Labor (0.0500 X 17614) =				880.70
TOTAL MATERIALS & SUPPLIES				881
SUBITEM TOTAL				49405

ITEM -01.01.02- SUBITEM 5 CRITERIA

FOUNDATION PREPARATION FOR CONCRETE STRUCTURES WILL BE CONSIDERED AS PART OF THE EXCAVATION WORK AND THE COST THEREOF WILL BE INCLUDED IN THIS ITEM. FOUNDATION PREPARATION WILL BE PERFORMED BY A 25 MAN CREW AT THE RATE OF 240 SF/HR. AT THIS RATE, THE ABOVE MENTIONED CREW WILL REQUIRE APPPROXIMATELY 60 DAYS TO PREPARE THE AREA CORRESPONDING TO THIS ITEM. IT IS EXPECTED THAT 1 CF OF MATERIAL WILL BE REMOVED PER SF OF SURFACE AREA. THIS WILL REPRESENT APPROXIMATELY 8 CY/HR OF MATERIAL TO BE REMOVED. A 75 TON CRANE WILL BE PROVIDED FOR THIS PURPOSE. A HIGH PRESSURE AIR-WATER MONITOR, MOUNTED ON A D8 CAT, WILL ALSO BE PROVIDED TO ACCOMPLISH THIS WORK. WORK WILL INCLUDE CLEANUP AND REMOVAL OF MATERIAL.

ITEM -01.01.02- SUBITEM 5 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 60 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	681.40
20.0	20.0	40.0	COMMON LABORER	X 10.00 hrs @ 31.29	12516.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	703.40
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.26	685.20
					15306.00

Total A-Labor Cost Per Day
(48.0 persons, 480.0 MH/day @ 31.89 Ave.)

Total A-Labor Cost - 60 Days (28800 MH) @ 15306.00 = 918360

TOTAL LABOR 918360

ITEM -01.01.02- SUBITEM 5 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 60 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	AM CRANE 150' BOOM 75 T	X 20.00 hrs @	113.86	2277.20
1.0	MONITOR	X 20.00 hrs @	80.90	1618.00
1.0	COMPRESSOR 1800 CFM	X 20.00 hrs @	8.67	173.40
1.0	TRI-AXLE RDUMP 8 CY	X 20.00 hrs @	27.11	542.20
				4610.80

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 60 Days @ 4610.80 = 276648

TOTAL EQUIPMENT 276648

ITEM -01.01.02- SUBITEM 5 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 918360) = 45918.00

TOTAL MATERIALS & SUPPLIES 45918

SUBITEM TOTAL 1240926

ITEM TOTAL 17860119

PORTALS

ITEM -01.01.02- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	DRILL & BLAST	109435.0	BCY	14208	[illegible]	424865	618567	0	1516599	8.91
2	LOADING	109435.0	BCY	4348	140670	221207	7468	0	378135	2.00
3	HAULING	109435.0	BCY	5888	[illegible]	319008	10147	0	532416	2.81
4	FOUND PREP	2750.0	SF	4000	155463	46156	7653	0	296821	75.21
T	PORTALS-ROCK EXCV	109435.0	BCY	29280	972046	1011090	643035	0	2617971	13.90
	UNIT COST			0.15	5.17	5.34	3.40	0.00	13.90	

ITEM -01.01.02- CRITERIA

[illegible] AND PARTIAL ACCESS ROAD EXCAVATION WILL BE PERFORMED BY DRILLING AND [illegible] METHOD. BLASTED MATERIAL WILL BE LOADED WITH CAT 992C FEL AND HAULED [illegible] 777 KBDR DUMP TRUCKS. 45% OF THE MATERIAL WILL BE HAULED TO THE NORTH [illegible] AND THE OTHER 55% WILL BE HAULED TO STOCKPILE AREA FOR LATER USE. [illegible] DISTANCES WILL BE 13000' AND 7000', RESPECTIVELY.

ROCK EXCAVATION WILL CONSIDER FOUR SUBITEMS FOR DRILLING AND BLASTING, LOADING, HAULING AND FOUNDATION PREPARATION. PRODUCTION RATES ARE BASED ON EQUIPMENT MANUFACTURER'S RECOMMENDATION.

ITEM -01.01.02- SUBITEM 1 CRITERIA
EXCAVATION BY DRILLING AND BLASTING WILL BE CALCULATED BASED ON THE FOLLOWING
PARAMETERS: (PRODUCTION USING HYDRAULIC TRACK DRILLS)

PERCENT OF EXCAVATION	70 %	30%
HOLE SIZE	3.5"	2.75"
CASE CUT	25'	10'
BURDEN	20'	9'
LOADING	4.02(.90)	2.52(0.90)
YIELD CY/LF	2.06	1.04
TOTAL FEET OF HOLE -	46,400	30,300

PRESPLITTING: 45000 SF AT 0.67LF/SF (1.5' OC) (AT 40 FPH) TOT DR = 107409 LF

DRILL RATE	45	45

DRILLING TIME, HOURS - 1,030 + 690 + 750 FOR PRESPLITTING = 2470 HRS

AVERAGE CREWS AND EQUIP WILL BE DETERMINED BASED ON THE FOLLOWING AVERAGE RATES:
2470 HRS / 7.5 HRS/SHIFT = 330 DRILL SHIFTS / 62 PEL SHIFTS = 5.3, SAY 6 DRILLS.
TIME FOR EXCAVATION = 62 SHIFTS / 2 SHIFTS/DAY/DRL = 31 DAYS.

ITEM -01.01.02- SUBITEM 1 LABOR
O-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 31 days.
NUMBER PER SHIFT

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	681.40
6.0	6.0	12.0	DRILLER	X 10.00 hrs @ 32.89	3946.80
6.0	6.0	12.0	CHUCK TENDER	X 10.00 hrs @ 32.22	3866.40
2.0	2.0	4.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	1406.80
					9901.40

Total O-Labor Cost Per Day
(30.0 persons, 300.0 MH/day @ 33.00 Ave.)

Total O-Labor Cost - 31 Days (9300 MH) @ 9901.40 = 306943

ITEM -01.01.02- SUBITEM 1 LABOR
O-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 31 days.
NUMBER PER SHIFT - BLASTING

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	BLASTER	X 10.00 hrs @ 35.15	703.00
6.0	6.0	12.0	POWDERMAN	X 10.00 hrs @ 33.25	3990.00
1.6	1.6	2.0	LD DRIVER	X 10.00 hrs @ 34.26	685.20
					5378.20

Total O-Labor Cost Per Day
(16.0 persons, 160.0 MH/day @ 33.61 Ave.)

Total O-Labor Cost - 31 Days (4960 MH) @ 5378.20 = 166724

TOTAL LABOR 473667

ITEM -01.01.02- SUBITEM 1 EQUIPMENT

A-Equipment estimate is based on 20.00 hours per day for 31 days.

EQUIPMENT NO.	TYPE			UNIT COST	TOTAL PER DAY
5.0	HYDRAULIC DRILL	X	20.00 hrs @	97.29	11674.80
2.0	COMPRESSOR 600 CFM	X	20.00 hrs @	40.30	1614.40
1.0	DELIVERY TRUCK	X	20.00 hrs @	20.68	434.00
Total Equipment Cost Per Day					13723.20
					425315
Total Fleet-A Equipment Cost -			31 Days @	13723.20 =	

TOTAL EQUIPMENT 425315

ITEM -01.01.02- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS		UNIT COST	TOTAL COST
RIB AND STEEL	107400.0	LF	@	3.50	53700.00
[illegible]	4000.0	EA	@	50.00	200000.00
[illegible]	65000.0	LF	@	5.50	32500.00
Explosives	190000.0	LB	@	1.50	285000.00
Sub-Total					571200.00

Direct Subcontract Cost @ 10.00 % Direct Labor (0.1000 X 473667) = 47366.70

TOTAL MATERIALS & SUPPLIES 618567

GE ITEM TOTAL 1516599

ITEM -01.01.02- SUBITEM 2 CRITERIA
EXCAVATED MATERIAL WILL BE LOADED USING CAT992C FEL TO CAT 777 DUMP TRUCKS.
THE PARAMETERS USED FOR CALCULATING LOADING OF BLASTED ROCK MATERIAL ARE AS
INDICATED IN THE FOLLOWING:

BUCKET CAPACITY - 13.5 CY HEAPED
BUCKET FACTOR - 0.70
FILL FACTOR - 0.65 (BANK CY / LOOSE CY)
LOAD CYCLE - 0.70 MINUTES
EFFECTIVE TIME - 45 MIN/HR, 9.5 HR/SHIFT
TRUCK CAPACITY - 85 TON OR 34 BCY
TRUCK EXCH TIME - 0.50 MINUTES

PRODUCTION WILL BE CALCULATED AS FOLLOWS:

13.5 CY X 0.70 BF X 0.65 SF = 6.1 BCY/PASS
34 BCY/TR / 6.1 BCY/PASS = 5.5, SAY 5 PASSES/TRUCK
5 PASSES/TR X 0.70 MIN/PASS = 3.5 MIN + 0.5 MIN/TR EXCH = 4.0 MIN/TR
45 MIN/HR / 4.0 MIN/TR = 11.25 TR/HR
5 PASSES X 6.1 BCY/PASS = 30.5 BCY/HR/TR X 11.25 TR/HR = 343 BCY/HR
343 BCY/HR X 9.5 HR/SH = 7259 BCY/SH X 2 SH/DAY = 6517 BCY/DAY.
189,435 BCY / 6517 BCY/DAY = 30 DAYS. USE 1 FEL FOR 30 DAYS.

2 D8 CAT DOZERS WILL BE PROVIDED FOR SUPPORT OF EXCAVATION DUE TO DIFFICULT
LOADING CONDITIONS AND ACCESSES. PROVIDE ONE MORE DAY FOR SEPARATE SITES.

ITEM -01.01.02- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 5.0 days/week,
for 31 days.
HOURS PER SHIFT

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
2.0	2.0	4.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1440.00
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.20	1561.60
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.25	625.00
					5010.40

Total A-Labor Cost Per Day
(14.0 persons, 140.0 MH/day @ 34.42 Ave.)

Total A-Labor Cost - 31 Days (4340 MH) @ 4010.40 = 149370

TOTAL LABOR 149370

ITEM -01.01.02- SUBITEM 2 EQUIPMENT
A Equipment estimate is based on 20.00 hours per day for 31 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
1.0	FEL	13.5 CY	X 20.00 hrs @	201.13	4022.60
1.0	EXC		X 20.00 hrs @	77.90	3116.00
					7138.60

Total Equipment Cost Per Day

Total Subset-0 Equipment Cost - 31 Days @ 7138.60 = 221297

TOTAL EQUIPMENT 221297

ITEM -01.01.02- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 5.0 days/week,
for 31 days.
WORKING 2-8 SHIFT

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
2.0	2.0	4.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1440.00
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
					5018.40

Total A-Labor Cost Per Day
(14.0 persons, 140.0 MH/day @ 34.42 Avg.)

Total A-Labor Cost - 31 Days (4340 MH) @ 4018.40 = 149370

TOTAL LABOR 149370

ITEM -01.01.02- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 31 days.

NO.	EQUIPMENT TYPE			UNIT COST	TOTAL PER DAY
1.0	988 CAT	FEL	13.5 CY	X 20.00 hrs @ 201.13	4022.60
1.0	4WD			X 20.00 hrs @ 77.90	3116.00
					7138.60

Total Equipment Cost Per Day

Total Subcat-0 Equipment Cost - 31 Days @ 7138.00 = 221297

TOTAL EQUIPMENT 221297

ITEM -01.01.02- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost 0 5.00 % Direct Labor (0.0500 X 149379) =				7468.50
TOTAL MATERIALS & SUPPLIES				7468
ITEM TOTAL				378135

ITEM -01.01.02- SUBITEM 3 CRITERIA
HAULING WILL BE PERFORMED WITH CAT 777 TRUCKS. 55% OF THE MATERIAL WILL BE HAULE
7000' TO STOCKPILES FOR LATER USE. THE REMAINING 45% WILL BE HAULED 12000' TO
THE DESIGNATED DISPOSAL AREAS.

FROM-TO	DISTANCE	CYCLE TIME	TRIPS/45MIN-HR	BCY/HR/TRK
DISPOSAL AREA	12,000	16.1 MIN	2.3	85
STOCKPILE AREA	7,000	12.4 MIN	3.6	111

TRUCK REQUIREMENTS WILL BE AS FOLLOWS:
TO DISPOSAL: 343 BCY/HR/FEL / 85 BCY/HR/TR = 4.1, SAY 5 TRUCKS
TO STOCKPILE: 343 BCY/HR/FEL / 110 BCY/HR/TR = 3.1, SAY 4 TRUCKS.

A D9 CAT DOZER WILL BE PROVIDED AT THE DISPOSAL AND STOCKPILE AREAS FOR
SPREADING OF MATERIAL.

ITEM -01.01.02- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 15 days.
NUMBER PER SHIFT - HAUL TO DISPOSAL

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
5.0	5.0	10.0	HD DRIVR(-00CY)	X 10.00 hrs @ 32.43	3243.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.80
					6922.00

Total A-Labor Cost Per Day
(20.0 persons, 200.0 MH/day @ 34.61 Ave.)

Total A-Labor Cost - 15 Days (3000 MH) @ 6922.80 = 103842

ITEM -01.01.02- SUBITEM 3 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 16 days.
NUMBER PER SHIFT - HAUL TO STOCKPILE

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
4.0	4.0	8.0	HD DRIVR(-00CY)	X 10.00 hrs @ 36.45	2914.40
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					6194.20

Total B-Labor Cost Per Day
(10.0 persons, 100.0 MH/day @ 34.41 Ave.)

Total B-Labor Cost - 16 Days (2000 MH) @ 6194.20 = 99107

TOTAL LABOR 202949

ITEM -01.01.02- SUBITEM 3 EQUIPMENT

0-Equipment estimate is based on 20.00 hours per day for 15 days.

..EQUIPMENT.. I.D.	TYPE			UNIT COST	TOTAL PER DAY
5.0	CAT 777 TRUCK	X	20.00 hrs @	97.49	9749.00
1.0	D9K	X	20.00 hrs @	77.90	1558.00
	Total Equipment Cost Per Day				11307.00
	Total Subset-A Equipment Cost -		15 Days @	11307.00 =	169605

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
E-Equipment estimate is based on 20.00 hours per day for 16 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
4.0	CAT 777 TRUCK	X	20.00 hrs @	97.49	7799.20
1.0	D6T	X	20.00 hrs @	77.90	1558.00
Total Equipment Cost Per Day					9357.20
Total Account-3 Equipment Cost -			16 Days @	9357.20 =	149715

TOTAL EQUIPMENT 319320

ITEM -01.01.02- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 202949) =				10147.45
TOTAL MATERIALS & SUPPLIES				10147
SUBITEM TOTAL				532416

ITEM -01.01.02- SUBITEM 4 CRITERIA

FOUNDATION PREPARATION FOR CONCRETE STRUCTURES WILL BE CONSIDERED AS PART OF THE EXCAVATION WORK AND THE COST THEREOF WILL BE INCLUDED IN THIS ITEM. FOUNDATION PREPARATION WILL BE PERFORMED BY A 25 MAN CREW AT THE RATE OF ONE PORTAL SITE EVERY TWO DAYS. THEREFORE A TOTAL OF 10 DAYS WILL BE REQUIRED DUE TO THE VARIOUS LOCATIONS CORRESPONDING TO THIS ITEM. IT IS EXPECTED THAT 1 CF OF MATERIAL WILL BE REMOVED PER SF OF SURFACE AREA. THIS WILL REPRESENT APPROXIMATELY 8 CY/HR OF MATERIAL TO BE REMOVED. A 75 TON CRANE WILL BE PROVIDED FOR THIS PURPOSE. A HIGH PRESSURE AIR-WATER MONITOR, MOUNTED ON A D8 CAT, WILL ALSO BE PROVIDED TO ACCOMPLISH THIS WORK. WORK WILL INCLUDE CLEANUP AND REMOVAL OF MATERIAL.

ITEM -01.01.02- SUBITEM 4 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 10 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	681.40
20.0	20.0	40.0	COMMON LABORER	X 10.00 hrs @ 31.20	12516.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.09	720.00
1.0	1.0	2.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	703.40
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.30	685.20
					15306.00

Total A-Labor Cost Per Day
(40.0 persons, 400.0 MH/day @ 31.89 Avg.)

Total A-Labor Cost - 10 Days (4000 MH) @ 15306.00 = 153060

TOTAL LABOR 153060

ITEM -01.01.02- SUBITEM 4 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 10 days.

NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	CRAWLER CRA BOOM 75 T	X 20.00 hrs @	113.86	2277.20
1.0	EXCAVATOR	X 20.00 hrs @	80.90	1618.00
1.0	COMPRESSOR 1000 CFM	X 20.00 hrs @	8.67	173.40
1.0	ARTICULATED DUMP 8 CY	X 20.00 hrs @	27.11	542.20
				4610.80

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 10 Days @ 4610.80 = 46108

TOTAL EQUIPMENT	46100

ITEM -01.01.02- SUBITEM 4 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 153000) =				7653.00
TOTAL MATERIALS & SUPPLIES				7653
SUBITEM TOTAL				206821

MAIN DAM

ITEM -01.01.02- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	DRILL & BLAST	1214000.0	CY	74800	2489418	2196016	5147942	0	9833376	8.10
2	LOADING ROCK	1214000.0	CY	22440	766401	1043572	38320	0	1848293	1.52
3	HAULING ROCK	1214000.0	CY	35540	1226804	1933078	61340	0	3221222	2.65
4	ROAD MAINTENANCE	1214000.0	CY	748	26778	46993	1339	0	75110	0.06
T	MAIN DAM ROCK EXCV	1214000.0	CY	133528	4509401	5219659	5248941	0	14978001	12.34
	UNIT COST			0.11	3.71	4.30	4.32	0.00	12.34	

ITEM -01.01.02- CRITERIA

ROCK EXCAVATION FOR THE MAIN DAM WILL BE PERFORMED BY THE DRILLING AND BLASTING METHOD.

ROCK EXCAVATION WILL BE PERFORMED DURING THE SUMMER SEASONS BETWEEN APRIL 1 AND OCTOBER 31 OF THE CORRESPONDING YEAR.

BLASTED MATERIAL WILL BE LOADED WITH A 992C CAT FEL AND HAULED WITH CAT 777 DUMP TRUCKS. IT IS EXPECTED THAT 50% OF THIS MATERIAL WILL BE HAULED TO THE NORTH DISPOSAL AREA, AND THAT THE REMAINING 50% WILL BE HAULED TO TEMPORARY STOCKPILE AREA FOR LATER USE. THIS STOCKPILE AREA WILL BE LOCATED ADJACENT TO THE HAUL ROAD LEADING TO THE NORTH DISPOSAL AREA, UPSTREAM OF THE DAM. HAUL DISTANCE FOR THE MATERIAL HAULED TO DISPOSAL WILL BE 16,000'. HAUL DISTANCE TO TEMPORARY STOCKPILE AREA WILL BE 4000'.

ROCK EXCAVATION WILL CONSIDER FOUR SUBITEMS FOR, DRILLING AND BLASTING, LOADING, HAULING, AND ROAD MAINTENANCE.

PRODUCTION RATES USED ARE BASED ON EQUIPMENT MANUFACTURERS RECCOMENDATIONS. CREWS AND EQUIPMENT REQUIREMENTS AND DURATION WILL BE AS ESTABLISHED IN THE FOLLOWING SUBITEMS.

ITEM -01.01.02- SUBITEM 1 CRITERIA
EXCAVATION BY DRILLING AND BLASTING WILL BE CALCULATED BASED ON THE FOLLOWING PARAMETERS: (NO PRESPLITTING WILL BE REQUIRED IN THIS CASE)

MATERIAL	- DIORITE, USE ANFO		
BANK CUT,	- 7.5'	7.5'	AVERAGE
HOLE SIZE,DIA	- 3.5"	2.75"	
LOADING,LB/LF OF HOLE	- 4.09(.98)	2.52(.99)	
COLUMN	- 5.5'	5.5'	
PATTERN	- 9'X9'	7'X7'	
YIELD, CY/ LF OF HOLE	- 2.37	1.43	
DRILL RATE,FT/HR	- 50	55 -USING HYDR DRILLS	
PERCENT OF EXCAVATION	- 80	20	

EFFECTIVE TIME - 7.5 DRILL HRS/10 HR SHIFT + 2.5 HRS/SH TO SHOOT & MOVE
LOADING RATE WITH CAT 992 FEL = 3259 BCY/SH (SEE FOLLOWING SUBITEM)
PRODUCTION CAN BE CALCULATED AS FOLLOWS:

1,214,000 BCY X .8 / 2.37 BCY/LF = 409,800 LF-3.5" HOLE / 50'/HR = 8,200 HRS.
1,214,000 BCY X .2 / 1.43 BCY/LF = 169,800 LF-2.75"HOLE / 55'/HR = 3,100 HRS
TOTALS = 579,600 LF IN 11,300 HRS

11,300 HRS / 7.5 HRS/SHFT = 1,508 DRILL SHFTS / 374 FEL SHFTS =4.04,SAY 5 DRILLS
TIME FOR EXCAVATION = 374 SHIFTS / 2 SHIFTS/DAY = 187 DAYS

ITEM -01.01.02- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 187 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	681.40
5.0	5.0	10.0	DRILLER	X 10.00 hrs @ 32.89	3289.00
5.0	5.0	10.0	CHUCK TENDER	X 10.00 hrs @ 32.22	3222.00
2.0	2.0	4.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	1406.00
					8599.20

Total A-Labor Cost Per Day
(26.0 persons, 260.0 MH/day @ 33.07 Ave.)

Total A-Labor Cost - 187 Days (48620 MH) @ 8599.20 = 1608050

ITEM -01.01.02- SUBITEM 1 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 187 days.

NUMBER PER SHIFT - BLASTING 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	BLASTER	X 10.00 hrs @ 35.15	703.00
5.0	5.0	10.0	POWDERMAN	X 10.00 hrs @ 33.25	3325.00
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.26	685.20
					4713.20

Total B-Labor Cost Per Day
(14.0 persons, 140.0 MH/day @ 33.67 Ave.)

Total B-Labor Cost - 187 Days (26180 MH) @ 4713.20 = 881368

TOTAL LABOR 2489418

ITEM -01.01.02- SUBITEM 1 EQUIPMENT
0-Equipment estimate is based on 20.00 hours per day for 187 days.

..EQUIPMENT.. NO.	TYPE				UNIT COST	TOTAL PER DAY
5.0	HYDRAULIC DRILL	X	20.00 hrs	@	97.29	9729.00
2.6	COMPRESSOR 600 CFM	X	20.00 hrs	@	40.36	1614.40
1.0	SLURRY TRUCK	X	20.00 hrs	@	20.00	400.00
Total Equipment Cost Per Day						11743.40

Total Subset-A Equipment Cost - 187 Days @ 11743.40 = 2196016

TOTAL EQUIPMENT 2196016

ITEM -01.01.02- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS		UNIT COST	TOTAL COST
Explosives	1214000.0	Lb	@	1.50	1821000.00
BITS AND STEEL	579600.0	LF	@	0.50	289800.00
PRIMERS	54000.0	EA	@	50.00	2700000.00
PRIMERCORD	810000.0	LF	@	0.10	81000.00
DETONATORS	4030.0	EA	@	1.00	7200.00
Sub-Total					4899000.00

S T & Supply Cost @ 10.00 % Direct Labor (0.1000 X 2489418) = 248941.80

TOTAL MATERIALS & SUPPLIES 5147942

SUBITEM TOTAL 9833376

ITEM -01.01.02- SUBITEM 2 CRITERIA
EXCAVATED MATERIAL WILL BE LOADED USING 992C CAT FEL TO CAT 777 DUMP TRUCKS.
THE PARAMATERS USED FOR CALCULATING LOADING OF BLASTED ROCK MATERIAL ARE AS
INDICATED IN THE FOLLOWING:

BUCKET CAPACITY - 13.5 CY HEAPED
BUCKET FACTOR - 0.70
SWELL FACTOR - 0.65 (5000 LB/BCY DENSITY OR 2.5 TON/BCY)
LOAD CYCLE - 0.70 MINUTES
EFFECTIVE TIME - 45 MIN/HR, 9.5 HR/SHIFT
TRUCK CAPACITY - 34 BCY
TRUCK EXCH TIME - 0.50 MINUTES

PRODUCTION WILL BE CXALCULATED AS FOLLOWS:

13.5 CY X 0.70 BF X 0.65 SF = 6.1 BCY/PASS
34 BCY/TR / 6.1 BCY/PASS = 5.5, SAY 5 PASSES/TRUCK
5 PASSES/TR X 0.70 MIN/PASS = 3.5 MIN + 0.5 MIN/TR EXCH = 4.0 MIN/TR
45 MIN/HR / 4.0 MIN/TR = 11.25 TR/HR
5 PASSES X 6.1 BCY/PASS = 30.5 BCY/HR/TR X 11.25 TR/HR = 343 BCY/HR
343 BCY/HR X 9.5 HR/SH = 3259 BCY/SH X 2 SH/DAY = 6517 BCY/DHY
1,214,000 BCY / 6517 BCY/DY = 187 DAYS. USE 1 FEL FOR 187 DAYS.

A CAT D8 DOZER WILL ALSO BE PROVIDED DURING THIS PERIOD FOR SUPPORT IN THE
EXCAVATION.

ITEM -01.01.02- SUBITEM 2 CRITERIA

EXCAVATED MATERIAL WILL BE LOADED USING 992C CAT FEL TO CAT 777 DUMP TRUCKS. THE PARAMATERS USED FOR CALCULATING LOADING OF BLASTED ROCK MATERIAL ARE AS INDICATED IN THE FOLLOWING:

BUCKET CAPACITY - 13.5 CY HEAPED
BUCKET FACTOR - 0.70
SWELL FACTOR - 0.65 (5000 LB/BCY DENSITY OR 2.5 TON/BCY)
LOAD CYCLE - 0.70 MINUTES
EFFECTIVE TIME - 45 MIN/HR, 9.5 HR/SHIFT
TRUCK CAPACITY - 34 BCY
TRUCK EXCH TIME - 0.50 MINUTES

PRODUCTION WILL BE CXALCULATED AS FOLLOWS:

13.5 CY X 0.70 BF X 0.65 SF = 6.1 BCY/PASS
34 BCY/TR / 6.1 BCY/PASS = 5.5, SAY 5 PASSES/TRUCK
5 PASSES/TR X 0.70 MIN/PASS = 3.5 MIN + 0.5 MIN/TR EXCH = 4.0 MIN/TR
45 MIN/HR / 4.0 MIN/TR = 11.25 TR/HR
5 PASSES X 6.1 BCY/PASS = 30.5 BCY/HR/TR X 11.25 TR/HR = 343 BCY/HR
343 BCY/HR X 9.5 HR/SH = 3259 BCY/SH X 2 SH/DAY = 6517 BCY/DAY
1,214,000 BCY / 6517 BCY/DY = 187 DAYS. USE 1 FEL FOR 187 DAYS.

A CAT D8 DOZER WILL ALSO BE PROVIDED DURING THIS PERIOD FOR SUPPORT IN THE EXCAVATION.

ITEM -01.01.02- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 187 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
2.0	2.0	4.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1440.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.00
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
					4098.40

Total A-Labor Cost Per Day
(12.0 persons, 120.0 MH/day @ 34.15 Ave.)

Total A-Labor Cost - 187 Days (22440 MH) @ 4098.40 = 766401

TOTAL LABOR 766401

ITEM -01.01.02- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 187 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
1.0	992C	FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
1.0	D8K		X 20.00 hrs @	77.90	1558.00
					5580.60

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 187 Days @ 5580.60 = 1043572

TOTAL EQUIPMENT 1043572

ITEM -01.01.02- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total:				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 766401) = 38320.05

TOTAL MATERIALS & SUPPLIES 38320

SUBITEM TOTAL 1848293

ITEM -01.01.02- SUBITEM 3 CRITERIA
50% OF THE EXCAVATED MATERIAL WILL BE HAULED TO THE NORTH DISPOSAL AREA AND THE REMAINING 50% OF THE MATERIAL WILL BE HAULED TO A STOCKPILE AREA FOR LATER USE IN THE FILL.
CYCLE TIMES TO EACH OF THESE AREAS WILL BE AS INDICATED IN THE FOLLOWING:

	DISTANCE	CYCLE TIME	TRIPS/45'-HR	BCY/HR/TRK
DISPOSAL AREAS -	10,000'	16.5 MIN	2.7	82
STOCKPILE AREA -	4,000'	12.0 MIN	3.7	113

TRUCK REQUIREMENTS CAN BE CALCULATED AS FOLLOWS:
HAUL TO DISPOSAL: 343 BCY/HR/FEL / 82.0 BCY/HR/TR = 4.2, SAY 5 TRUCKS
HAUL TO STOCKPILE: 343 BCY/HR/FEL / 113.0 BCY/HR/TR = 3.1, SAY 4 TRUCKS
A D8 CAT DOZER WILL BE PROVIDED AT THE DISPOSAL OR STOCKPILE AREA FOR SPREADING OF MATERIAL.

ITEM -01.01.02- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 94 days.
NUMBER PER SHIFT - HAUL TO DISPOSAL

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
5.0	5.0	10.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	3643.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					6922.00

Total A-Labor Cost Per Day
(20.0 persons, 200.0 MH/day @ 34.61 Ave.)

Total A-Labor Cost - 94 Days (18800 MH) @ 6922.80 = 650743

ITEM -01.01.02- SUBITEM 3 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 93 days.
NUMBER PER SHIFT - HAUL TO STOCKPILE

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
4.0	4.0	8.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	2914.40
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					6194.20

Total B-Labor Cost Per Day
(18.0 persons, 180.0 MH/day @ 34.41 Ave.)

Total B-Labor Cost - 93 Days (16740 MH) @ 6194.20 = 576061

TOTAL LABOR 1226804

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 94 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
5.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	9749.00
1.0	D8K	X 20.00 hrs @	77.90	1558.00
Total Equipment Cost Per Day				11307.00
Total Subset-A Equipment Cost -		94 Days @	11307.00 =	1062858

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
B-Equipment estimate is based on 20.00 hours per day for 93 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
4.0	CAT 777 TRUCK	X	20.00 hrs @	97.49	7799.20
1.0	D9K	X	20.00 hrs @	77.90	1558.00
Total Equipment Cost Per Day					9357.20

Total Subset-B Equipment Cost - 93 Days @ 9357.20 = 870220

TOTAL EQUIPMENT 1933078

ITEM -01.01.02- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 1226804) =				61340.20
TOTAL MATERIALS & SUPPLIES				61340
SUBITEM TOTAL				3221222

ITEM -01.01.02- SUBITEM 4 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 187 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
0.1	0.1	0.2	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	70.34
0.1	0.1	0.2	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	72.86
			Total A-Labor Cost Per Day		143.20
			(0.4 persons, 4.0 MH/day @ 35.80 Ave.)		

Total A-Labor Cost - 187 Days (748 MH) @ 143.20 = 26778

TOTAL LABOR 26778

ITEM -01.01.02- SUBITEM 4 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 187 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
0.1	CAT 16G	X 20.00 hrs @	66.35	132.70
0.1	6000 GALS TRACTOR-TRLR	X 20.00 hrs @	59.30	118.60
	Total Equipment Cost Per Day			251.30

Total Subset-A Equipment Cost - 187 Days @ 251.30 = 46993

TOTAL EQUIPMENT 46993

ITEM -01.01.02- SUBITEM 4 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 187 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
0.1	0.1	0.2	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	70.34
0.1	0.1	0.2	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	72.86
			Total A-Labor Cost Per Day		143.20
			(0.4 persons, 4.0 MH/day @ 35.80 Ave.)		
			Total A-Labor Cost - 187 Days (748 MH) @ 143.20 =		26770

TOTAL LABOR 26770

ITEM -01.01.02- SUBITEM 4 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 187 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
0.1	CAT 16G	X 20.00 hrs @	66.35	132.70
0.1	6000 GALS TRACTOR-TRLR	X 20.00 hrs @	59.30	118.60
	Total Equipment Cost Per Day			251.30
	Total Subset-A Equipment Cost - 187 Days @		251.30 =	46993

TOTAL EQUIPMENT 46993

ITEM -01.01.02- SUBITEM 4 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 26778) =				1338.90
TOTAL MATERIALS & SUPPLIES				1339
SUBITEM TOTAL				75110

INTAKE

ITEM -01.01.02- SUMMARY

DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1 DRILL & BLAST	115200.0	CY	11020	303923	356240	360292	0	1120455	9.79
2 LOADING ROCK	115200.0	CY	2160	73771	110451	3689	0	177911	1.54
3 HAULING ROCK	115360.0	CY	2560	97719	159401	4630	0	261445	2.22
4 FOUND PREP	26100.0	SF	2550	70646	27179	4592	0	244093	4.75
* P/U INTAKE-ROCK EXCV	115360.0	CY	18330	603149	653241	381209	0	1350072	14.63
UNIT COST			0.17	5.65	5.67	3.31	0.00	14.63	

ITEM -01.01.02- CRITERIA

POWER AND OUTLET INTAKE STRUCTURE ROCK EXCAVATION WILL BE PERFORMED BY THE DRILL AND BLASTING METHOD.

ROCK EXCAVATION WILL BE PERFORMED DURING THE SUMMER SEASONS BETWEEN APRIL 1 AND OCTOBER 31 OF THE CORRESPONDING YEAR.

EXCAVATED MATERIAL WILL BE LOADED WITH A 992C CAT FEL AND HAULED WITH CAT 777 DUMP TRUCKS. IT IS EXPECTED THAT 20% OF THIS MATERIAL WILL BE HAULED DIRECTLY TO THE EARTH DISPOSAL AREA. 53% WILL BE HAULED DIRECTLY TO FILL AREAS AND THE REMAINING 20% WILL BE HAULED TO TEMPORARY STOCKPILE AREA FOR LATER USE. THIS STOCKPILE AREA WILL BE LOCATED ADJACENT TO THE HAUL ROAD LEADING TO THE NORTH PORTAL PORTAL, UPSTREAM OF THE DAM. HAUL DISTANCE FOR THE MATERIAL HAULED TO DISPOSAL WILL BE 12,000'. HAUL DISTANCE TO TEMPORARY STOCKPILE AREA WILL BE 5,000'. AND HAUL DISTANCE FOR MATERIAL TAKEN DIRECTLY TO FILL AREAS WILL BE 7,000'.

ROCK EXCAVATION WILL CONSIDER FOUR SUBITEMS FOR, DRILLING AND BLASTING, LOADING, HAULING, AND FOUNDATION PREPARATION.

PRODUCTION RATES USED ARE BASED ON EQUIPMENT MANUFACTURERS RECOMMENDATIONS.

CREWS AND EQUIPMENT REQUIREMENTS AND DURATION WILL BE AS ESTABLISHED IN THE FOLLOWING SUBITEMS.

ITEM -01.01.02- SUBITEM 1 CRITERIA

EXCAVATION BY DRILLING AND BLASTING WILL BE CALCULATED BASED ON THE FOLLOWING PARAMETERS: (PRESPLITTING: 76,000 SF OF SLOPE AREA - DRILL 3" HOLES ON 1.5' CC)

MATERIAL	- DIORITE, USE ANFO		
BENCH CUT,	-	30'	10'
HOLE SIZE,DIA	-	3.5"	2.75"
LOAD WT.LB/LF OF HOLE	-	4.09(.98)	2.52(.99)
COLUMN	-	23'	9'
PATTERN	-	8.5'X10'	7'X9.5'
YIELD, CY/ LF OF HOLE	-	2.06	1.04
DRILL RATE,FT/HR	-	50	50 -USING HYDR DRILLS
PERCENT OF EXCAVATION	-	70	30

EFFECTIVE TIME - 7.5 DRILL HRS/10 HR SHIFT + 2.5 HRS/SH TO SHOOT & MOVE

LOADING RATE WITH CAT 992 FEL = 3250 BCY/SH (SEE FOLLOWING SUBITEM)

PRODUCTION CAN BE CALCULATED AS FOLLOWS:

115,300 BCY X .7 / 2.06 BCY/LF = 20,388 LF-3.5" HOLE / 50'/HR = 408 HRS.

115,300 BCY X .3 / 1.04 BCY/LF = 10,000 LF-2.75"HOLE / 50'/HR = 200 HRS

76,000 SF X 0.67 LF/SF(1.5' CC) = 50,900 LF-3" HOLE / 40'/HR = 1,272 HRS

TOTALS = 97,900 LF IN 1,880 HRS

1,880 HRS / 7.5 HRS/SHFT = 251 DRILL SHFTS / 35 FEL SHFTS =7.2,SAY 8 DRILLS

TIME FOR EXCAVATION = 35 SHIFTS / 2 SHIFTS/DAY = 18 DAYS

ITEM -01.01.02- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 18 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	681.40
9.0	9.0	18.0	DRILLER	X 10.00 hrs @ 32.85	5920.20
9.0	9.0	18.0	CHUCK TENDER	X 10.00 hrs @ 32.22	5799.60
3.0	3.0	6.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	2110.20
					14511.40

Total A-Labor Cost Per Day
(44.0 persons, 440.0 MH/day @ 32.98 Ave.)

Total A-Labor Cost - 18 Days (7920 MH) @ 14511.40 = 261205

ITEM -01.01.02- SUBITEM 1 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 12 days.

NUMBER PER SHIFT - BLASTING 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	BLASTER	X 10.00 hrs @ 35.15	703.00
9.0	9.0	18.0	POWDERMAN	X 10.00 hrs @ 37.25	6585.00
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.25	685.20
					7973.20

Total B-Labor Cost Per Day
(22.0 persons, 220.0 MH/day @ 33.51 Ave.)

Total B-Labor Cost - 18 Days (3960 MH) @ 7973.20 = 132718

TOTAL LABOR 393923

ITEM -01.01.02- SUBITEM 1 EQUIPMENT
N-Equipment estimate is based on 20.30 hours per day for 18days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
3.0	HYDRAULIC DRILL	X	20.00 hrs @	97.29	17512.20
3.0	COMPRESSOR 600 CFM	X	20.00 hrs @	40.36	2421.60
1.0	SLURRY TRUCK	X	20.00 hrs @	20.00	400.00
Total Equipment Cost Per Day					20333.80

Total Subset-A Equipment Cost - 18 Days @ 20333.80 = 366008

TOTAL EQUIPMENT 366008

ITEM -01.01.02- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS		UNIT COST	TOTAL COST
Explosives	116000.0	Lb	@	1.50	174000.00
BITS AND STEEL	90000.0	LF	@	0.50	45000.00
TIMERS	2000.0	EA	@	50.02	100040.00
PRIMERCORD	50000.0	LF	@	0.15	5400.00
DETONATORS	500.0	EA	@	1.00	300.00
Sub-Total					320960.00

S T & Supply Cost @ 10.00 % Direct Labor (0.1000 X 393923) = 39392.30

TOTAL MATERIALS & SUPPLIES 360292

SUBITEM TOTAL 1126223

ITEM -01.01.02- SUBITEM 2 CRITERIA
EXCAVATED MATERIAL WILL BE LOADED USING 992C CAT FEL TO CAT 777 DUMP TRUCKS.
THE PARAMETERS USED FOR CALCULATING LOADING OF BLASTED ROCK MATERIAL ARE AS INDICATED IN THE FOLLOWING:

- BUCKET CAPACITY - 13.5 CY HEAPED
- BUCKET FACTOR - 0.70
- SWELL FACTOR - 0.65 (5000 LB/BCY DENSITY OR 2.5 TON/BCY)
- LOAD CYCLE - 0.70 MINUTES
- EFFECTIVE TIME - 45 MIN/HR, 9.5 HR/SHIFT
- TRUCK CAPACITY - 34 BCY
- TRUCK EXCH TIME - 0.50 MINUTES

PRODUCTION WILL BE CALCULATED AS FOLLOWS:

13.5 CY X 0.70 BF X 0.65 SF = 6.1 BCY/PASS
34 BCY/TR / 6.1 BCY/PASS = 5.5, SAY 5 PASSES/TRUCK
5 PASSES/TR X 0.70 MIN/PASS = 3.5 MIN + 0.5 MIN/TR EXCH = 4.0 MIN/TR
45 MIN/HR / 4.0 MIN/TR = 11.25 TR/HR
5 PASSES X 6.1 BCY/PASS = 30.5 BCY/HR/TR X 11.25 TR/HR = 343 BCY/HR
343 BCY/HR X 9.5 HR/SH = 3259 BCY/SH X 2 SH/DAY = 6517 BCY/DAY
115,380 BCY / 6517 BCY/DY = 18 DAYS. USE 1 FEL FOR 18 DAYS.

A CAT D8 DOZER WILL ALSO BE PROVIDED DURING THIS PERIOD FOR SUPPORT IN THE EXCAVATION.

ITEM -01.01.02- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 18 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
2.4	2.3	4.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1440.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
2.5	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
					4098.40

Total A-Labor Cost Per Day
(12.0 persons, 120.0 MH/day @ 34.15 Ave.)

Total A-Labor Cost - 18 Days (2160 MH) @ 4098.40 = 73771

TOTAL LABOR 73771

ITEM -01.01.02- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 18 days.

..EQUIPMENT.. ID.	TYPE		UNIT COST	TOTAL PER DAY
1.0	D-9	FEL 13.5 CY	X 20.00 hrs @ 201.13	4022.60
2.0	950		X 20.00 hrs @ 77.90	1558.00
				5580.60

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 18 Days @ 5580.60 = 100451

TOTAL EQUIPMENT 100451

ITEM -01.01.02- SUBITEM 2 MATERIALS & SUPPLIES MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 73771) =				3688.55
TOTAL MATERIALS & SUPPLIES				3689
SUBITEM TOTAL				177911

ITEM -01.01.02- SUBITEM 3 CRITERIA
HAULING WILL BE PERFORMED WITH CAT 777 DUMP TRUCKS. 20% OF THE MATERIAL WILL BE HAULED TO THE NORTH DISPOSAL AREA, 20% WILL BE HAULED TO THE NORTH STOCKPILE AREA FOR LATER USE IN THE FILL,AND THE REMAINING 60% OF THE MATERIAL WILL BE HAULED DIRECTLY TO THE FILL.
CYCLE TIMES TO EACH OF THESE AREAS WILL BE AS INDICATED IN THE FOLLOWING:

	DISTANCE	CYCLE TIME	TRIPS/45'-HR	BCY/HR/TRK
DISPOSAL AREAS -	12,000'	17.0 MIN	2.5	75
STOCKPILE AREA -	6,000'	13.3 MIN	3.4	103
HAUL TO FILL -	7,000'	14.1 MIN	3.2	97

TRUCK REQUIREMENTS CAN BE CALCULATED AS FOLLOWS:
HAUL TO DISPOSAL: 343 BCY/HR/FEL X 2FEL / 75.0 BCY/HR/TR = 4.5, SAY 5 TRUCKS
HAUL TO STOCKPILE: 343 BCY/HR/FEL X 2FEL / 103. BCY/HR/TR = 3.3, SAY 4 TRUCKS
HAUL TO FILL: 343 BCY/HR/FEL X 2FEL / 97.0 BCY/HR/TR = 3.5, SAY 4 TRUCKS
A D3 CAT DOZER WILL BE PROVIDED AT THE DISPOSAL OR STOCKPILE AREA FOR SPREADING OF MATERIAL.

ITEM -01 01.02- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 4 days.
NUMBER PER SHIFT - HAUL TO DISPOSAL

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
5.0	5.0	10.0	HD DRIVR(-80CY)	X 10.00 hrs @ 30.43	3043.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.25	625.00
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					6922.00

Total A-Labor Cost Per Day
(20.0 persons, 200.0 MH/day @ 34.61 Ave.)

Total A-Labor Cost - 4 Days (800 MH) @ 6922.00 = 27691

ITEM -01.01.02- SUBITEM 3 LABOR
B-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 3 days.
NUMBER PER SHIFT - HAUL TO STOCKPILE

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
4.0	4.0	8.0	HD DRIVR(-80CY)	X 10.00 hrs @ 30.43	2914.40
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.25	625.00
2.0	2.0	4.0	DUMP MAN	X 10.00 hrs @ 31.30	1252.00
					6194.20

Total B-Labor Cost Per Day
(18.0 persons, 180.0 MH/day @ 34.41 Ave.)

Total B-Labor Cost - 3 Days (540 MH) @ 6194.20 = 18583

ITEM -01.01.02- SUBITEM 3 LABOR
C-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 11 days.
NUMBER PER SHIFT - HAUL TO FILL

1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	DUMP FOREMAN	X 10.00 hrs @ 34.10	682.00
4.0	4.0	8.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	2914.40
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
					4222.20

Total C-Labor Cost Per Day
(12.0 persons, 120.0 MH/day @ 35.18 Ave.)

Total C-Labor Cost - 11 Days (1320 MH) @ 4222.20 = 46444

TOTAL LABOR 92718

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
C-Equipment estimate is based on 20.00 hours per day for 4 days.

NO.	..EQUIPMENT.. TYPE		UNIT COST	TOTAL PER DAY
5.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	9749.00
1.0	D9K	X 20.00 hrs @	77.90	1558.00
				11307.00

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 4 Days @ 11307.00 = 45228

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
E-Equipment estimate is based on 20.00 hours per day for 3 days.

NO.	..EQUIPMENT.. TYPE		UNIT COST	TOTAL PER DAY
4.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	7799.20
1.0	DSK	X 20.00 hrs @	77.90	1558.00
	Total Equipment Cost Per Day			9357.20
	Total Subset-B Equipment Cost -	3 Days @	9357.20 =	28072

ITEM -01.01.02- SUBITEM 3 EQUIPMENT
E-Equipment estimate is based on 20.00 hours per day for 11 days.

NO.	..EQUIPMENT.. TYPE		UNIT COST	TOTAL PER DAY
4.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	7799.20
	Total Equipment Cost Per Day			7799.20
	Total Subset-C Equipment Cost -	11 Days @	7799.20 =	85791

TOTAL EQUIPMENT 159091

ITEM -01.01.02- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 92710) =				4635.50
TOTAL MATERIALS & SUPPLIES				4636
SUBITEM TOTAL				256445

ITEM -01.01.02- SUBITEM 4 CRITERIA

FOUNDATION PREPARATION FOR CONCRETE STRUCTURES WILL BE CONSIDERED AS PART OF THE EXCAVATION WORK AND THE COST THEREOF WILL BE INCLUDED IN THIS ITEM. FOUNDATION PREPARATION WILL BE PERFORMED BY A 25 MAN CREW AT THE RATE OF 240 SF/HR. AT THIS RATE, THE ABOVE MENTIONED CREW WILL REQUIRE APPPROXIMATELY 5 DAYS TO PREPARE THE AREA CORRESPONDING TO THIS ITEM. IT IS EXPECTED THAT 1 CF OF MATERIAL WILL BE REMOVED PER SF OF SURFACE AREA. THIS WILL REPRESENT APPROXIMATELY 6 CY/HR OF MATERIAL TO BE REMOVED. A 75 TON CRANE WILL BE PROVIDED FOR THIS PURPOSE. A HIGH PRESSURE AIR-WATER MONITOR, MOUNTED ON A D8 CAT, WILL ALSO BE PROVIDED TO ACCOMPLISH THIS WORK. WORK WILL INCLUDE CLEANUP AND REMOVAL OF MATERIAL.

ITEM -01.01.02- SUBITEM 4 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 6 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	681.40
20.0	20.0	40.0	COMMON LABORER	X 10.00 hrs @ 31.29	12516.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	703.40
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.26	685.20
					15306.00

Total A-Labor Cost Per Day
(48.0 persons, 480.0 MH/day @ 31.89 Ave.)

Total A-Labor Cost - 6 Days (2880 MH) @ 15306.00 = 91836

TOTAL LABOR 91836

ITEM -01.01.02- SUBITEM 4 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 6 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
1.0	A1 CRANE 150' BOOM 75 T	X	20.00 hrs @	113.86	2277.20
1.0	MONITOR	X	20.00 hrs @	80.90	1618.00
1.0	COMPRESSOR 1800 CFM	X	20.00 hrs @	8.67	173.40
1.0	T. T-AXLE RDUMP 8 CY	X	20.00 hrs @	27.11	542.20
					4610.80

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 6 Days @ 4610.80 = 27665

TOTAL EQUIPMENT					27665
ITEM -01.01.02- SUBITEM 4 MATERIALS & SUPPLIES					
MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST	
Sub-Total				0.00	
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 91836) =				4591.80	
TOTAL MATERIALS & SUPPLIES					4592
SUBITEM TOTAL					124093
ITEM TOTAL					1686672

5,023,934

ROCKFILL

ROCKFILL FROM
QUARRY

ITEM -01.01.05- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	CLEAR & GRUB	76.0	ACRE	6080	200575	224040	30086	0	454701	5982.91
2	OVERBURDEN EXCAVATION	3047000.0	BCY	49440	1777553	4075957	89878	0	5942388	1.95
3	DRILL & BLAST	14618900.0	BCY	596960	19580361	17087725	35405701	0	72073787	4.93
4	LOAD ROCK	18563400.0	FCY	117936	4175153	11000997	260758	0	15384908	3.83
5	HAUL ROCK	18563400.0	FCY	190736	6948512	18594053	347426	0	25990791	1.39
6	ROAD MAINTENANCE	18563400.0	FCY	14560	521248	914732	26062	0	1462042	0.08
7	PLACING ROCKFILL	18563400.0	FCY	147056	5051112	8301297	252556	0	13604965	0.73
T	ROCKFILL FROM QUARRY	18563400.0	FCY	1122768	38254514	68199601	36359467	0	134813582	7.26
	UNIT COST			0.06	2.06	3.24	1.96	0.00	7.26	

9.22 BCY

ITEM -01.01.05- CRITERIA

THIS ITEM CONSIDERS THE ESTABLISHMENT OF A QUARRY TO SUPPLY ROCKFILL FOR PLACEMENT IN THE DAM. THE ITEM CONSIDERS CLEARING AND GRUBBING OF THE AREA, OVERBURDEN EXCAVATION, DRILLING AND BLASTING, LOADING, HAULING, PLACING IN THE FILL, AND ROAD MAINTENANCE. THE PRESENT SCHEDULE FOR THIS WORK REQUIRES VARYING AMOUNTS OF MATERIAL FROM THE QUARRY OVER A FOUR YEAR PERIOD, AT DIFFERENT RATES OF PRODUCTION. COST FOR SOME OF THE ITEMS ARE BASED ON AVERAGE CREWS AND EQUIP SPREADS THAT WILL BE REQUIRED DURING THIS PERIOD, AS INDICATED IN THE FOLLOWING:

YEAR	FILL-CY	BANK-CY	BCY-REQ EXC	BCY-QUARRY	BCY/MO	#DRL	#FEL	#TR	#DOZ
1989	711,907	561,000	561,000	---	---				
1990	3,125,266	2,461,000	2,461,000	---	---				
1991	5,407,635	4,258,000	1,885,100	2,372,900	339,000	10	2	8.4	2.6
1992	7,472,356	5,885,000	---	5,885,000	840,700	25	5	20.5	6.4
1993	5,277,695	4,156,000	---	4,156,000	593,714	18	3.5	14.7	4.5
1994	2,799,724	2,205,000	---	2,205,000	315,000	9	2	8.4	2.4
	24,794,663	19,526,000	4,907,100	14,618,900		15.5	3.1	13.1	4.0

SWELL FACT=0.75 BCY/FCY X 1.05 WASTE FACT=0.7875 (NOT INCLUDING QUARRY WASTE).
AVERAGE CREWS AND EQUIPMENT ARE BASED ON MANUFACTURERS RECCOMMENDATION, AND AS INDICATED IN FOLLOWING SUBITEMS.

ITEM -01.01.05- SUBITEM 1 CRITERIA
QUARRY WILL BE EXCAVATED IN 30' BENCHES TO A DEPTH OF 120'. THIS WILL REQUIRE AN AREA DETERMINED AS FOLLOWS:

14,618,900 BCY X 27 CF/CY / 120' DEPTH = 3,290,000 SF. OR 76 ACRES.

DEPTH OF OVERBURDEN IS ASSUMED TO BE 25' OVER THIS AREA, RESULTING IN 3,047,000 BCY OF OVERBURDEN EXCAVATION WHICH WILL BE ANALYZED IN THE FOLLOWING SUBITEM.

CLEARING AND GRUBBING WILL BE PERFORMED USING A D9 CAT DOZER AND A CHIPPER.
MATERIAL WILL BE LOADED WITH A 992 CAT FEL ONTO 777 CAT REAR DUMP TRUCKS.
IT IS EXPECTED THAT THE DOZER WILL CLEAR AT TH RATE OF 2 ACRES PER 10 HOUR SHIFT REQUIRING 19 DAYS TO COMPLETE THE WORK.

ITEM -01.01.05- SUBITEM 1 CRITERIA
QUARRY WILL BE EXCAVATED IN 30' BENCHES TO A DEPTH OF 120'. THIS WILL REQUIRE AN AREA DETERMINED AS FOLLOWS:

14,618,900 BCY X 27 CF/CY / 120' DEPTH = 3,290,000 SF. OR 76 ACRES.

DEPTH OF OVERBURDEN IS ASSUMED TO BE 25' OVER THIS AREA, RESULTING IN 3,047,000 BCY OF OVERBURDEN EXCAVATION WHICH WILL BE ANALYZED IN THE FOLLOWING SUBITEM.

CLEARING AND GRUBBING WILL BE PERFORMED USING A D9 CAT DOZER AND A CHIPPER.
MATERIAL WILL BE LOADED WITH A 992 CAT FEL ONTO 777 CAT REAR DUMP TRUCKS.
IT IS EXPECTED THAT THE DOZER WILL CLEAR AT TH RATE OF 2 ACRES PER 10 HOUR SHIFT REQUIRING 19 DAYS TO COMPLETE THE WORK.

ITEM -01.01.05- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 19 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR			TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @	34.07	681.40
10.0	10.0	20.0	COMMON LABORER	X 10.00 hrs @	31.29	6258.00
3.0	3.0	6.0	HVY EQUIP OP	X 10.00 hrs @	36.00	2160.00
2.0	2.0	4.0	HD DRIVR(-80CY)	X 10.00 hrs @	36.43	1457.20
			Total A-Labor Cost Per Day			10556.60

(32.0 persons, 320.0 MH/day @ 32.99 Ave.)

Total A-Labor Cost - 19 Days (6080 MH) @ 10556.60 = 200575

TOTAL LABOR 200575

ITEM -01.01.05- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 19 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
1.0	D9 W/RIPPER	X	20.00 hrs @	115.57	2311.40
1.0	CHIPPER	X	20.00 hrs @	77.90	1558.00
1.0	992C FEL 13.5 CY	X	20.00 hrs @	201.13	4022.60
2.0	CAT 777 TRUCK	X	20.00 hrs @	97.49	3899.60
	Total Equipment Cost Per Day				11791.60

Total Subset-A Equipment Cost - 19 Days @ 11791.60 = 224040

TOTAL EQUIPMENT 224040

ITEM -01.01.05- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST	
Sub-Total				0.00	
S T & Supply Cost @ 15.00 % Direct Labor (0.1500 X 200575) =				30086.25	
TOTAL MATERIALS & SUPPLIES					30086
SUBITEM TOTAL					454701

ITEM -01.01.05- SUBITEM 2 CRITERIA

DEPTH OF OVERBURDEN IS EXPECTED TO BE 25'. EXCAVATION WILL BE PERFORMED USING A 992C CAT FEL LOADING CAT 777 REAR DUMP TRUCKS WHICH WILL HAUL THE MATERIAL TO A DISPOSAL AREA WITHIN THE QUARRY.

LOADING:
BUCKT CAPACITY - 13.5 CY (HEAPED)
BUCKET FACTOR - 0.75
SWELL(BANK-LOS)- 0.80 (75%E + 25%R)
LOAD 13.5X0.75X0.80=8.1 BCY
TRUCK CAP = 85T / 2.01 = 42.29 BCY
PASSES/TRUCK = 5 (5X8.1=40.5BCY/TR)
PASS CYCLE = 0.70 MIN
TIME/TRUCK = 3.5 MIN
TRUCK EXCH = 0.2 MIN
LOAD CYCLE = 3.7 MIN/TRUCK
45MIN/HR / 3.7MIN/TR = 12.16 TR/HR
12.16TR/HR X 40.16BCY/TR = 493 BCY/HR

HAULING:

	LOADED TO BENCH	LOADED TO WASTE	EMPTY BENCH	EMPTY IN BEN
DIST	2000'	2000'	2000'	2000'
GRADE	-10%	-5%	+5%	+10%
ROL REST	+3%	+3%	+3%	+3%
EFF GRD	-7%	-2%	+8%	+13%
SPEED,FPM	1840	3432	2200	1496
TIME,MIN	1.08	+ 0.58	+ 0.91	+ 1.34
ACC & DEC,MIN		+ 0.25		+ 0.25
DUMP & MANV,MIN		+ 1.0		
LOAD,MIN				+ 3.7

TOTAL TIME = 9.91 MIN

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45 MIN/HR / 9.91 MIN/TR = 4.54 TRIPS/HR X 40.5 BCY/TR = 183.91 BCY/HR/TR.
493 BCY/HR/FEL / 183.91 BCY/HR/TR = 2.7, SAY 3 TRUCKS.

ITEM -01.01.05- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 309 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
3.0	3.0	6.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	2185.80
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
					5752.60

Total A-Labor Cost Per Day
(16.0 persons, 160.0 MH/day @ 35.95 Ave.)

Total A-Labor Cost - 309 Days (49440 MH) @ 5752.60 = 1777553

TOTAL LABOR 1777553

ITEM -01.01.05- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 309 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	992C FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
2.0	D8K	X 20.00 hrs @	77.90	3116.00
3.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	5849.40
1.0	3/4 TON PICK UP TRUCK	X 20.00 hrs @	10.14	202.80
				13190.80

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 309 Days @ 13190.80 = 4075957

TOTAL EQUIPMENT 4075957

ITEM -01.01.05- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 1777553) = 88877.65

TOTAL MATERIALS & SUPPLIES 88878

SUBITEM TOTAL 5942388

ITEM -01.01.05- SUBITEM 3 CRITERIA

EXCAVATION BY DRILLING AND BLASTING WILL BE ESTIMATED BASED ON THE FOLLOWING PARAMETERS: (PRODUCTION DRILLING USING HYDRAULIC TRACK DRILLS)

					TOTALS
PERCENT OF EXCAV	- 60%	30%	5%	5%	
VOLUME (NO WASTE), BCY	- 8,771,000	4,385,900	731,000	731,000	14,618,900
HOLE DIAMETER, INCH	- 4.5"	3.5"	2.5"	2"	
BENCH HEIGHT, FEET	- 40'	40'	20'	10'	
OVERDRILL, FEET	- 3'	3'	2'	2'	
STEM, FEET	- 15'	15'	7'	4'	
COLUMN, FEET	- 28'	28'	15'	8'	
LBS/LF-HOLE (DENSITY)	-6.34(0.92)	3.84(0.92)	1.96(0.92)	1.25(0.92)	
LBS EXPL PER HOLE	- 177.52	107.52	29.40	10.00	
POWDER YIELD, LBS/CY	- 1.00	1.00	1.20	1.20	
HOLE YIELD, CY/HOLE	- 177.52	107.52	24.50	8.3.	
DRILLING YIELD, CY/LF	- 4.13	2.50	1.11	0.69	
LENGTH OF HOLE, FT	-2,123,728	1,754,000	658,558	1,059,420	
QUARRY WASTE X 1.2, LF	-2,548,500	2,104,800	790,300	1,271,300	6,714,900
DRILL PROD, LF/HR	- 45	47	50	55	
DRILLING TIME, HOURS	- 56,630	44,783	15,806	23,114	140,333

AVERAGE CREWS AND EQUIPMENT WILL BE DETERMINED BASED ON THE FOLLOWING RATES:

14618900BCY / 6714900LF = 2.18 BCY/LF-HOLE; 6714900LF / 140333DR-HRS =47.85LF/HR

ITEM -01.01.05- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 728 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.5	1.5	3.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	1022.10
15.5	15.5	31.0	DRILLER	X 10.00 hrs @ 32.89	10195.90
15.5	15.5	31.0	CHUCK TENDER	X 10.00 hrs @ 32.22	9988.20
1.5	1.5	3.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	1055.10
1.0	1.0	2.0	BLASTER	X 10.00 hrs @ 35.15	703.00
3.0	3.0	6.0	POWDERMAN	X 10.00 hrs @ 33.25	1995.00
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.26	685.20
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
					26896.10

Total A-Labor Cost Per Day
(82.0 persons, 820.0 MH/day @ 32.80 Ave.)

Total A-Labor Cost - 728 Days (596960 MH) @ 26896.10 = 19580361

TOTAL LABOR 19580361

ITEM -01.01.05- SUBITEM 3 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 728 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
15.5	HYDRAULIC DRILL	X	12.40 hrs @	97.29	18699.14
4.5	COMPRESSOR 1200 CFM	X	12.40 hrs @	69.39	3871.96
1.0	SLURRY TRUCK	X	15.00 hrs @	20.00	300.00
1.0	FLATBED (DIESEL)	X	15.00 hrs @	19.79	296.85
2.0	3/4 TON PICK UP TRUCK	X	15.00 hrs @	10.14	304.20
					23472.15

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 728 Days @ 23472.15 = 17087725

TOTAL EQUIPMENT 17087725

ITEM -01.01.05- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS		UNIT COST	TOTAL COST
DRILL BITS & STL-4.5"D	2548000.0	LF	@	0.60	1528800.00
DRILL BITS & STL-3.5"D	2104800.0	LF	@	0.40	841920.00
DRILL BITS & STL-2.5"D	790300.0	LF	@	0.35	276605.00
DRILL BITS & STL-2"D	1271300.0	LF	@	0.30	381390.00
EXPLOSIVES	17893500.0	LBS	@	1.70	30410950.00
					33447665.00

Sub-Total

S T & Supply Cost @ 10.00 % Direct Labor (0.1000 X *******) = 1958036.10

TOTAL MATERIALS & SUPPLIES 35405701

SUBITEM TOTAL 72073787

ITEM -01.01.05- SUBITEM 4 CRITERIA
LOADING WILL BE PERFORMED WITH CAT 992C FEL ONTO CAT 777 REAR DUMP TRUCKS.
PRODUCTION FOR THIS EQUIPMENT WILL BE BASED ON THE FOLLOWINF PARAMETERS:

BUCKET CAPACITY	- 13.5 CY HEAPED
BUCKET FACTOR	- 0.70 (BLASTED ROCK)
SWELL (BANK-LOOSE)	- 0.67
BUCKET PAYLOAD	- 13.5 CY X 0.70 X 0.67 = 6.33 BCY
TRUCK CAPACITY	- 85 TON / 2.27 TON/BCY = 37.50 BCY
PASSES PER TRUCK	- 37.50 BCY / 6.33 BCY/BCKT = 5.92, SAY 6
TRUCK PAYLOAD	- 6 PASSES X 6.33 BCY/PASS = 37.98 BCY/TRUCK
PASS CYCLE	- 0.70 MIN/PASS
TIME PER TRUCK LD	- 6 PASS X 0.70 MIN/PASS + 0.20 MIN/TR-EXCH =4.4MIN
TRUCK LOADS/HR	- 45 MIN/HR / 4.4 MIN/TR = 10.23 TRUCK LOADS/HR
PRODUCTION PER HR	- 10.23 TR/HR X 37.98 BCY/TR = 388 BCY/HR BANK MEAS
FILL PRODUCTION PER HO	- 388 BCY/HR / 0.788 = 492 FCY/FEL/HR,PAY FILL MEAS

BASED ON THIS RATE, AVERAGE CREWS AND EQUIPMENT WERE DETERMINED TO SATISFY THE VARIOUS MONTHLY PRODUCTION REQUIREMENTS FOR THE FILL. D8 DOZERS WILL ALSO BE PROVIDED FOR SUPPORT IN THE PIT.

ITEM -01.01.05- SUBITEM 4 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 728 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.5	1.5	3.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	1171.50
3.1	3.1	6.2	HVY EQUIP OP	X 10.00 hrs @ 36.00	2232.00
1.5	1.5	3.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	1080.00
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60
					5735.10

Total A-Labor Cost Per Day
(16.2 persons, 162.0 MH/day @ 35.40 Ave.)

Total A-Labor Cost - 728 Days (117936 MH) @ 5735.10 = 4175153

TOTAL LABOR 4175153

ITEM -01.01.05- SUBITEM 4 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 728 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
3.1	992C FEL 13.5 CY	X 20.00 hrs @	201.13	12470.06
1.5	D8K	X 20.00 hrs @	77.90	2337.00
1.5	3/4 TON PICK UP TRUCK	X 20.00 hrs @	10.14	304.20
				15111.26

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 728 Days @ 15111.26 = 11000997

TOTAL EQUIPMENT 11000997

ITEM -01.01.05- SUBITEM 4 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 4175153) = 208757.65

TOTAL MATERIALS & SUPPLIES 208758

SUBITEM TOTAL 15384908

ITEM -01.01.05- SUBITEM 5 CRITERIA
80% OF THE MATERIAL PRODUCED IN THE QUARRY WILL BE HAULED 10000' TO THE FILL AND THE REMAINING 20% WILL BE WASTE MATERIAL WHICH WILL BE HAULED 4000' TO DISPOSAL WITHIN THE QUARRY. HAULING WILL BE WITH CAT 777 REAR DUMP TRUCKS. TRAVEL TIME TO DISPOSAL WILL BE SIMILAR TO THAT INDICATED FOR OVERBURDEN EXCV DISPOSAL. CYCLE TIMES TO DISPOSAL AND TO EMBANKMENT WILL BE SA INDICATED IN THE FOLLOWING:

FROM-TO	DISTANCE	% GRADE	ROL RES	EFF GRD	SPEED	TIME	TOTAL CYC
LOADED: - TO FILL	2000'	-10	+3	-7	1840FPM	1.08MIN	
TO QUARRY FLOOR	6000'	-12	+3	-9	1320FPM	4.55MIN	
TO EMBANK	2000'	-5	+3	-2	3432FPM	0.58MIN	
IN DAM							
EMPTY: - FROM FILL							
IN DAM	2000'	+5	+3	+8	2200FPM	0.91MIN	
TO QUARRY FLOOR	6000'	+12	+3	+15	1232FPM	4.87MIN	
IN BENCH	2000'	+10	+3	+13	1496FPM	1.34MIN	

TO FILL - 0.5 MIN ACC/DESC + 1.8MIN MAN&DUMP + 4.4MIN LOAD = 6.70MIN 20.0MIN
TO DISPOSAL = 3.91MIN TRAVEL + 6.7MIN FIXED TIME = 10.6MIN = 4.25 TRIPS/45MIN-HR
HAUL TO FILL:0.8 X 388 BCY/HR/FEL / 2.25 TRP/TR/HR / 38 BCY/TR = 3.6TR/FEL.
HAUL TO DISP:0.2 X 388 BCY/HR/FEL / 4.25 TRP/TR/HR / 38 BCY/TR = 0.5TR/FEL.
3.6 + 0.5 = 4.1 TRUCKS/FEL OF THE AVERAGE CREW ESTABLISHED PREVIOUSLY.

ITEM -01.01.05- SUBITEM 5 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 720 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR	TOTAL PER DAY
13.1	13.1	26.2	HD DRIVR(-80CY) X 10.00 hrs @ 36.43	9544.66
			Total A-Labor Cost Per Day	9544.66
			(26.2 persons, 262.0 MH/day @ 36.43 Ave.)	
			Total A-Labor Cost - 720 Days (190736 MH) @ 9544.66 =	6948512

TOTAL LABOR 6948512

ITEM -01.01.05- SUBITEM 5 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 720 days.

...QUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
13.1	CAT 777 TRUCK	X 20.00 hrs @	97.49	25542.38
			Total Equipment Cost Per Day	25542.38
			Total Subset-A Equipment Cost - 728 Days @ 25542.38 =	18594853

TOTAL EQUIPMENT 18594853

ITEM -01.01.05- SUBITEM 5 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 6948512) = 347425.60

TOTAL MATERIALS & SUPPLIES 347426

SUBITEM TOTAL 25890791

ITEM -01.01.05- SUBITEM 6 CRITERIA
ROAD MAINTENANCE WILL BE DIVIDED BETWEEN THE ROCKFILL FROM QUARRY AND THE IMPERVIOUS FILL TO BE PLACED IN THE DAM. 0.5 OF A TYPICAL ROAD MAINTENANCE CREW AND THE CORRESPONDING EQUIPMENT WILL BE CHARGED TO THIS ITEM FOR THE DURATION OF THIS ACTIVITY.

ITEM -01.01.05- SUBITEM 6 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 728 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR	TOTAL PER DAY
0.5	0.5	1.0	LIGHT EQUIP OP X 10.00 hrs @ 35.17	351.70
0.5	0.5	1.0	HD DRIVR(-80CY) X 10.00 hrs @ 36.43	364.30
			Total A-Labor Cost Per Day	716.00
			(2.0 persons, 20.0 MH/day @ 35.80 Ave.)	

Total A-Labor Cost - 728 Days (14560 MH) @ 716.00 = 521248

TOTAL LABOR 521248

ITEM -01.01.05- SUBITEM 6 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 728 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
0.5	CAT 16G	X 20.00 hrs @	66.35	663.50
0.5	6000 GALS TRACTOR-TRLR	X 20.00 hrs @	59.30	593.00
			Total Equipment Cost Per Day	1256.50

Total Subset-A Equipment Cost - 728 Days @ 1256.50 = 914732

TOTAL EQUIPMENT 914732

ITEM -01.01.05- SUBITEM 6 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 521248) = 26062.40

TOTAL MATERIALS & SUPPLIES 26062

SUBITEM TOTAL 1462042

ITEM -01.01.05- SUBITEM 7 CRITERIA

ROCKFILL WILL BE DUMPED FROM 85T REAR DUMP TRUCKS AND MATERIAL WILL BE SPREAD USING CAT D9 TRACTORS WITH DOZERS AND RAKES. MATERIAL WILL BE PLACED IN 1' LIFTS AND COMPACTED USING 10T FLAT WHEEL VISRATORY ROLLERS. PRODUCTION WILL BE AS DETERMINED IN THE FOLOLWING:

AVERAGE DOZING DISTANCE	- 150' (300' MAX)
MATERIAL WEIGHT	- 3,130 LBS/CY
WEIGHT CORR FACTOR	- 2300/3130 = 0.735
JOB EFFICIENCY	- 45 MIN/HR = 0.750
OPERATOR EFFICIENCY	- 45 MIN/HR = 0.750
TOTAL CORR FACTORS	- 0.735 X 0.75 X 0.75 = 0.413
UNCORRECTED MAX PROD	- 1300 LOOSE-CY
SHRINKAGE LOOSE-FILL	- 3130/3930 = 0.796
PRODUCTION	- 1300 LCY X 0.413 X0.795=427 FCY(PAY MEAS)/HR
RAKE PRODUCTION	- 0.75 X 427 FCY/HR = 320FCY(PAY FILL MEAS)/HR
ROLLER PROD: WIDTH	- 8' COMPACTOR WIDTH/PASS
SPEED	- 6 MPH
COMPACTED LIFT THICKNESS	- 10 INCHES
NUMBER OF PASSES	- 4 EACH
PRODUCTION	- 8 X 6 X 10 X 16.3 X 0.6 / 4 = 1174 FCY\HR

AVERAGE CREWS AND EQUIPMENT WERE ESTABLISHED TO SATISFY VARYING FILL PRODUCTION.

ITEM -01.01.05- SUBITEM 7 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 728 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
4.0	4.0	8.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2880.00
1.1	1.1	2.2	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	773.74
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
2.0	2.0	4.0	SPOTTER	X 10.00 hrs @ 31.30	1252.00
					6938.34

Total A-Labor Cost Per Day
(20.2 persons, 202.0 MH/day @ 34.35 Ave.)

Total A-Labor Cost - 728 Days (147056 MH) @ 6938.34 = 5051112

TOTAL LABOR 5051112

ITEM -01.01.05- SUBITEM 7 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 728 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
4.0	D9 W/RIPPER	X 20.00 hrs @	115.57	9245.60
1.1	CAT 825C	X 20.00 hrs @	88.84	1954.48
1.0	3/4 TON PICK UP TRUCK	X 20.00 hrs @	10.14	202.80
				11402.88

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 728 Days @ 11402.88 = 8301297

TOTAL EQUIPMENT 8301297

ITEM -01.01.05- SUBITEM 7 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 5051112) = 252555.60

TOTAL MATERIALS & SUPPLIES 252556

SUBITEM TOTAL 13604965

ITEM TOTAL 134813582

ROCKFILL FROM
STOCKPILE

0 0 2 5 4

ITEM -01.02.01- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	LOAD ROCK	2307000.0	FCY	21520	765789	1555735	38289	0	2359813	1.02
2	HAUL ROCK	2307000.0	FCY	21520	783974	2097985	39199	0	2921158	1.27
3	PLACING FILL	2307000.0	FCY	19206	658548	1042646	32927	0	1734121	0.75
T	ROCKFILL FRM STOCKPILE	2307000.0	FCY	62246	2208311	4696366	110415	0	7015092	3.04
	UNIT COST			0.03	0.96	2.04	0.05	0.00	3.04	

ITEM -01.02.01- CRITERIA

THIS ITEM CONSIDERS LOADING HAULING AND PLACING ROCKFILL FROM STOCKPILE. REQUIRED EXCAVATION WILL BE EITHER HAULED DIRECTLY TO THE EMBANKMENTS, STOCKPILED FOR LATER USE OR WASTED. THE ESTIMATE WILL BE BASED ON THE FOLLOWING:

REQUIRED EXCAVATIONS LAOCATION	BCY	TO STOCKPILE BCY	DIRECT TO FILL BCY	TO WASTE BCY
TUNNEL PORTALS	169,680	104,200	---	65,480
MAIN DAM FOUND	1,214,000	607,000	---	607,000
SPLLWY APPR	1,096,000	219,200	657,000	219,200
SPLLWY CONTROL	274,000	54,800	164,400	54,800
SP CH & BUCKT	1,592,500	318,500	955,500	318,500
POWER INT APP	1,695,300	339,100	1,017,100	339,100
POWER INT STR	115,300	23,100	69,100	23,000
TOT BANK MEASURE		1,665,900	2,863,700	
TOT FILL MEASURE (BCY/0.788)		2,307,000	3,924,600	

THE COST ESTIMATE WILL BE BASED ON USING 13.5 CY CAP FRONT END LOADERS(992C CAT) LOADING 85T REAR DUMP TRUCKS(CAT 777) AND HAULING FROM STOCKPILE TO EMBANKMENT. WORK WILL BE ON 2-10 HR SHIFTS/DAY, 6 DAYS/WK OR 520 HRS/MO, 7 MO/YR, OR 3,640 HRS/YR. FEL PROD IS BASED ON 45 MIN/HR AT 338 BCY/HR OR 429 FCY/HR. COST OF HAUL ROADS WILL BE INCLUDED IN OVRHD. RD MAINT IS INCLUDED IN QUARRY OPERATION.

ITEM -01.02.01- SUBITEM 1 CRITERIA
STOCKPILE MATERIAL WILL BE LOADED USING 992C CAT FEL TO CAT 777 REAR DUMP TRUCKS
THE PARAMETERS USED FOR CALCULATING LOADING OF BLASTED ROCK MATERIAL ARE AS
INDICATED IN THE FOLLOWING:

BUCKET CAPACITY	- 13.5 CY HEAPED
BUCKET FACTOR	- 0.65
SWELL FACTOR	- 0.67 (BANK CY/LOOSE CY), 0.788 (BANK CY/FILL CY)
LOAD CYCLE	- 0.75 MINUTES
EFFECTIVE TIME	- 45 MIN/HR
TRUCK CAPACITY	- 85 TON / 2.27 TON/BCY = 37.5 BCY
TRUCK EXCH TIME	- 0.20 MINUTES

PRODUCTION WILL BE CALCULATED AS FOLLOWS:

13.5 CY X 0.65 BF X 0.67 SF = 5.88 BCY/PASS
37.5 BCY/TR / 5.88 BCY/PASS = 6.4, SAY 6 PASSES/TRUCK
6 PASSES/TR X 0.75 MIN/PASS = 4.5 MIN + 0.2 MIN TR EXCH = 4.7 MIN/TR
45 MIN/HR / 4.7 MIN/TR = 9.57 TR/HR
6 PASSES X 5.88 BCY/PASS = 35.28 BCY/HR X 9.57 TR/HR = 338 BCY/HR/FEL
338 BCY/HR / 0.788 = 429 FILL-CY/FEL-HR
2,307,000 FCY / 429 FCY/HR / 20 HRS/DAY = 269 DAYS

D8 CAT DOZERS WILL ALSO BE PROVIDED FOR SUPPORT.

ITEM -01.02.01- SUBITEM 1 CRITERIA
STOCKPILE MATERIAL WILL BE LOADED USING 992C CAT FEL TO CAT 777 REAR DUMP TRUCKS
THE PARAMETERS USED FOR CALCULATING LOADING OF BLASTED ROCK MATERIAL ARE AS
INDICATED IN THE FOLLOWING:

BUCKET CAPACITY	- 13.5 CY HEAPED
BUCKET FACTOR	- 0.65
SWELL FACTOR	- 0.67 (BANK CY/LOOSE CY), 0.788 (BANK CY/FILL CY)
LOAD CYCLE	- 0.75 MINUTES
EFFECTIVE TIME	- 45 MIN/HR
TRUCK CAPACITY	- 85 TON / 2.27 TON/BCY = 37.5 BCY
TRUCK EXCH TIME	- 0.20 MINUTES

PRODUCTION WILL BE CALCULATED AS FOLLOWS:

13.5 CY X 0.65 BF X 0.67 SF = 5.88 BCY/PASS
37.5 BCY/TR / 5.88 BCY/PASS = 6.4, SAY 6 PASSES/TRUCK
6 PASSES/TR X 0.75 MIN/PASS = 4.5 MIN + 0.2 MIN TR EXCH = 4.7 MIN/TR
45 MIN/HR / 4.7 MIN/TR = 9.57 TR/HR
6 PASSES X 5.88 BCY/PASS = 35.28 BCY/HR X 9.57 TR/HR = 338 BCY/HR/FEL
338 BCY/HR / 0.788 = 429 FILL-CY/FEL-HR
2,307,000 FCY / 429 FCY/HR / 20 HRS/DAY = 269 DAYS

D8 CAT DOZERS WILL ALSO BE PROVIDED FOR SUPPORT.

ITEM -01.02.01- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 269 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
					2846.80

Total A-Labor Cost Per Day
(8.0 persons, 80.0 MH/day @ 35.58 Ave.)

Total A-Labor Cost - 269 Days (21520 MH) @ 2846.80 = 765789

TOTAL LABOR 765789

ITEM -01.02.01- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 269 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	992C FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
1.0	D8K	X 20.00 hrs @	77.90	1558.00
1.0	3/4 TON PICK UP TRUCK	X 20.00 hrs @	10.14	202.80
				5783.40

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 269 Days @ 5783.40 = 1555735

TOTAL EQUIPMENT 1555735

ITEM -01.02.01- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 765789) =				38289.45
TOTAL MATERIALS & SUPPLIES				38289
SUBITEM TOTAL				2359813

ITEM -01.02.01- SUBITEM 2 CRITERIA
THE STOCKPILED MATERIAL WILL BE HAULED TO THE FILL OPERATION USING CAT 777
REAR DUMP TRUCKS. CYCLE TIMES AND PROD WILL BE AS INDICATED IN THE FOLLOWING:

FROM TO	DISTANCE	% GRADE	ROL RES	EFF GRD	SPEED	TIME	TOT CYCLE
LOADED: - TO FILL	4000'	+6	+3	+9	880FPM	4.55MIN	
STOCKPL TO DAM	2000'	+12	+3	+15	440FPM	4.54MIN	
DAM ROAD	1000'	+1	+3	+4	1760FPM	0.57MIN	
IN DAM							
EMPTY: - FROM FILL							
IN DAM	1000'	-1	+3	+2	3432FPM	0.87MIN	
DAM ROAD	2000'	-12	+3	-9	3432FPM	0.58MIN	
TO STOCKPILE	4000'	-6	+3	-3	3432FPM	1.17MIN	
ACCELERATE AND DESCELERATE TIME						0.50MIN	
DUMP AND MANEUVER TIME						1.80MIN	
LOAD TIME						4.70MIN	
TOTAL							19.28 MIN

TRIPS PER HOUR = 45 MIN/HR / 19.28 MIN/CYC = 2.33 TRIPS/HR/TR
2.33 TRIPS/HR X 35.28 BCY/TR = 82.2 BCY/HR/TR
338 BCY/HR/FEL / 82.2 BCY/HR/TR = 4.1, SAY TRUCKS WILL BE REQUIRED.

ITEM -01.02.01- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 269 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR	TOTAL PER DAY
4.0	4.0	8.0	HD DRIVR(-80CY) X 10.00 hrs @ 36.43	2914.40
			Total A-Labor Cost Per Day	2914.40
			(8.0 persons, 80.0 MH/day @ 36.43 Ave.)	
			Total A-Labor Cost - 269 Days (21520 MH) @ 2914.40 =	783974

TOTAL LABOR 783974

ITEM -01.02.01- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 269 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
4.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	7799.20
			Total Equipment Cost Per Day	7799.20
			Total Subset-A Equipment Cost - 269 Days @ 7799.20 =	2097985

TOTAL EQUIPMENT 2097985

ITEM -01.02.01- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 783974) =				39198.70
TOTAL MATERIALS & SUPPLIES				39199
SUBITEM TOTAL				2921158

ITEM -01.02.01- SUBITEM _ CRITERIA

ROCKFILL WILL BE DUMPED FROM 85T REAR DUMP TRUCKS AND MATERIAL WILL BE SPREAD USING CAT D9 TRACTORS WITH DOZERS AND RAKES. MATERIALWILL BE PLACED IN 1' LIFTS AND COMPACTED USING 10T FLAT WHEEL VIBRATORY ROLLERS. PRODUCTION WILL BE AS DETERMINED IN THE FOLLOWING:

AVERAGE DOZING DISTANCE	- 150' (300' MAX)
MATERIAL WEIGHT	- 3,130 LBS/CY
WEIGHT CORR FACTOR	- 2300/3130 = 0.735
JOB EFFICIENCY	- 45 MIN/HR = 0.75
OPERATOR EFFICIENCY	- 45 MIN/HR = 0.75
TOTAL CRRECTION FACTORS	- 0.735 X 0.75 X 0.75 = 0.413
UNCORRECTED MAX PROD	- 1300 LOOSE-CY
SHRINKAGE LOOSE-FILL	- 3130/3930 = 0.796
DOZER PRODUCTION	- 1300 LCY X 0.413 X 0.796 = 427 FCY/HR (PAY)
RAKE PRODUCTION	- 0.75 X 427 FCY/HR = 320 FCY(PAY FILL MEAS)/HR
ROLLER PROD: WIDTH	- 8' COMPACTOR WIDTH PER PASS
SPEED	- 6 MPH
COMPACTED LIFT THICKNESS	- 10 INCHES
NUMBER OF PASSES	- 4 EACH
PRODUCTION	- 8 X 6 X 10 X 16.3 X 0.6 / 4 = 1174 FCY/HR

ITEM -01.02.01- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 99 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
3.7	3.7	7.4	HVY EQUIP OP	X 10.00 hrs @ 36.00	2664.00
1.0	1.0	2.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	703.40
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
2.0	2.0	4.0	SPOTTER	X 10.00 hrs @ 31.30	1252.00
					6652.00

Total A-Labor Cost Per Day
(19.4 persons, 194.0 MH/day @ 34.29 Ave.)

Total A-Labor Cost - 99 Days (19206 MH) @ 6652.00 = 658548

TOTAL LABOR 658548

ITEM -01.02.01- SUBITEM 3 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 99 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
3.7	D9 W/RIPPER	X 20.00 hrs @	115.57	8552.18
1.0	CAT 825C	X 20.00 hrs @	83.84	1776.80
1.0	3/4 TON PICK UP TRUCK	X 20.00 hrs @	10.14	202.80
				10531.78

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 99 Days @ 10531.78 = 1042646

TOTAL EQUIPMENT 1042646

ITEM -01.02.01- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 658548) = 32927.40

TOTAL MATERIALS & SUPPLIES 32927

SUBITEM TOTAL 1734121

ITEM TOTAL 7015092

1

ROCKFILL FROM
EXCAVATION

ITEM -01.01.04- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
T	ROCKFILL FROM EXCAVT	3924600.0	FCY	32592	1117536	1769339	55877	0	2942752	0.75
	UNIT COST			0.01	0.28	0.45	0.01	0.00	0.75	

ITEM -01.01.04- CRITERIA

IT IS ASSUMED THAT ROCKFILL WILL BE DUMPED FROM 85 TON REAR DUMP TRUCKS AND THAT THE MATERIAL WILL BE SPREAD USING D9 CAT TRACTORS WITH BULLDOZERS AND RAKES. MATERIAL WIL BE PLACED IN 1' LIFTS AND COMPACTED USING 10T FLAT WHEEL VIBRATORY ROLLERS. PRODUCTION WILL BE AS DETERMINED IN THE FOLLOWING:

BULLDOZER PROD: DOZING DIST - AVERAGE = 150', (300' MAX)
MATERIAL WEIGHT-LOOSE - 3,130 LBS/CY
WEIGHT CORRECTION FACTOR - 2,300/3,130 = 0.735
JOB EFF CORR FACTOR - 45 MIN/HR = 0.75
OPERATOR CORR FACTOR - 45 MIN/HR = 0.75
TOTAL CORR FACTORS - 0.735 X 0.75 X 0.75 = 0.413
UNCORRECTED MAXIMUM PROD - 1300 LOOSE CY/HR
SHRINKAGE, LOOSE TO FILL - 3130/3930 = 0.796
-DOZER PRODUCTION = 1300 LCY X 0.413 X 0.796 = 427 FCY/HR (PAY FILL MEAS)
-RAKE PRODUCTION = 0.75 X 427 FCY = 320 FCY/HR (PAY FILL MEASURE)

ROLLER PRODUCTION: WIDTH - 8' COMPACTOR WIDTH/PASS
SPEED - 6 MPH
COMPACTED LIFT THICKNESS - 10 INCHES
NUMBER OF PASSES - 4 EACH
PRODUCTION - 8 X 6 X 10 X 16.3 X 0.6 / 4 = 1174 FCY/HR.

ITEM -01.01.04- LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 168 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
3.7	3.7	7.4	HVY EQUIP OP	X 10.00 hrs @ 36.00	2664.00
1.0	1.0	2.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	703.40
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
2.0	2.0	4.0	SPOTTER	X 10.00 hrs @ 31.30	1252.00
					6652.00

Total A-Labor Cost Per Day
(19.4 persons, 194.0 MH/day @ 34.29 Ave.)

Total A-Labor Cost - 168 Days (32592 MH) @ 6652.00 = 1117536

TOTAL LABOR 1117536

ITEM -01.01.04- EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 168 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
3.7	D9 W/RIPPER	X 20.00 hrs @	115.57	8552.18
1.0	CAT 825C	X 20.00 hrs @	88.84	1776.80
1.0	3/4 TON PICK UP TRUCK	X 20.00 hrs @	10.14	202.80
				10531.78

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 168 Days @ 10531.78 = 1769339

TOTAL EQUIPMENT 1769339

ITEM -01.01.04- MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST		
Sub-Total				0.00		
S T & Supplu Cost @ 5.00 % Direct Labor (0.0500 X 1117536) =				55876.80		
TOTAL MATERIALS & SUPPLIES					55877	
ITEM TOTAL						2942752

RAKING ROCKFILL

ITEM -01.01.04- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
T	RAKING ROCKFILL	902000.0	FCY	2820	101520	325907	5076	0	432503	0.48
	UNIT COST			0.00	0.11	0.36	0.01	0.00	0.48	

ITEM -01.01.04- CRITERIA

IT IS ASSUMED THAT ROCKFILL WILL BE DUMPED FROM 85 TON REAR DUMP TRUCKS AND THAT THE MATERIAL WILL BE SPREAD USING D9 CAT TRACTORS WITH BULLDOZERS AND RAKES.
PRODUCTION CRITERIA WILL BE AS FOLLOWS:

BULLDOZER PROD: DOZING DIST - AVERAGE = 150', (300' MAX)
MATERIAL WEIGHT-LOOSE - 3,130 LBS/CY
WEIGHT CORRECTION FACTOR - 2,300/3,130 = 0.735
JOB EFF CORR FACTOR - 45 MIN/HR = 0.75
OPERATOR CORR FACTOR - 45 MIN/HR = 0.75
TOTAL CORR FACTORS - 0.735 X 0.75 X 0.75 = 0.413
UNCORRECTED MAXIMUM PROD - 1300 LOOSE CY/HR
SHRINKAGE, LOOSE TO FILL - 3130/3930 = 0.796
-DOZER PRODUCTION = 1300 LCY X 0.413 X 0.796 = 427 FCY/HR (PAY FILL MEAS)
-RAKE PRODUCTION = 0.75 X 427 FCY = 320 FCY/HR (PAY FILL MEASURE)
902,000 FCY / 320 FCY/RAKE HR = 2819 RAKE HOURS / 20 HRS/DAY = 141 DAYS

ITEM -01.01.04- LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 141 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
					720.00

Total A-Labor Cost Per Day
(2.0 persons, 20.0 MH/day @ 36.00 Ave.)

Total A-Labor Cost - 141 Days (2820 MH) @ 720.00 = 101520

TOTAL LABOR 101520

ITEM -01.01.04- EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 141 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	D9 W/RIPPER	X 20.00 hrs @	115.57	2311.40
				2311.40

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 141 Days @ 2311.40 = 325907

TOTAL EQUIPMENT 325907

ITEM -01.01.04- MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 101520) =				5076.00
TOTAL MATERIALS & SUPPLIES				5076
ITEM TOTAL				432503

ASS & IMP FILL

IMPERVIOUS FILLS

WATANA EARTH DAM - EL 2185

PROJECT NO 1563

ITEM .310 - IMPERVIOUS FILLS - SUMMARY

DESCRIPTION	QUANTITY	UNIT	TIME	LABOR	EQUIP	M&S	TOTAL	UNIT COST
OVERB REMVL	1000000	BCY	37200	1142842	2374557	57142	3574541	1.39
2" GRV BASE	1200000	FCY	57200	1944380	5460000	130900	7534000	6.32
DRAIN DITCHS	23200	LF	44640	1526037	1319056	540342	3307035	145.99
LOAD & HAUL	7950000	FCY	267696	9500684	13754314	479434	23822432	3.00
PLACEMENT	7950000	FCY	224640	7711704	9054864	385585	17152153	2.16
WINTER PROTCT	130000	FCY	6510	229500	637620	20790	887910	6.58
TOTAL IMPERVS FILL	7950000	FCY	630900	22145567	32681211	1663293	56490071	
UNIT COSTS			0.60	2.79	4.10	0.21	7.10	

EOF..

ITEM -01.03.04- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	OVRBRDN REMV	1000000.0	BCY	32200	1142042	2374557	57142	0	3574541	1.99
2	DRAINAGE DITCHES	23200.0	LF	44649	1526057	1319856	540342	0	3387035	145.99
3	LOAD & HAUL	7950000.0	FCY	267696	9500604	13754314	479434	0	23022432	3.00
4	PLACING FILL	7950000.0	FCY	224640	7711704	9054054	385585	0	17152153	2.16
5	WINTER PROTECTION	135000.0	FCY	300	10000	23370	540	0	34710	0.26
T	IMPERVIOUS FILL	7950000.0	FCY	569476	19900867	26526961	1463043	0	47970871	6.03
	UNIT COST			0.07	2.51	3.34	0.18	0.00	6.03	

ITEM -01.03.04- CRITERIA
REFER TO ATTACHED BACKUP MATERIAL.

ITEM -01.03.04- SUBITEM 1 CRITERIA
REFER TO ATTACHED BACKUP MATERIAL.

TOTAL EQUIPMENT 2374557

ITEM -01.03.04- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 161 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
3.0	3.0	6.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2160.00
3.0	3.0	6.0	HD DRVR(-80CY)	X 10.00 hrs @ 36.43	2185.80
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60

Total A-Labor Cost Per Day 7090.40
(20.0 persons, 200.0 MH/day @ 35.49 Ave.)

Total A-Labor Cost - 161 Days (32200 MH) @ 7090.40 = 1142042

TOTAL LABOR 1142842

ITEM -01.03.04- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 161 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	992C FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
3.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	5849.40
3.0	DUK	X 20.00 hrs @	77.90	4674.00
1.0	3/4 TON PICK UP TRUCK	X 20.00 hrs @	10.14	202.80

Total Equipment Cost Per Day 14748.00

Total Subset-A Equipment Cost - 161 Days @ 14748.80 = 2374557

ITEM -01.03.04- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 161 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
3.0	3.0	6.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2160.00
3.0	3.0	6.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	2185.80
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60
					7090.40

Total A-Labor Cost Per Day
(20.0 persons, 200.0 MH/day @ 35.49 Ave.)

Total A-Labor Cost - 161 Days (32200 MH) @ 7090.40 = 1142842

TOTAL LABOR 1142842

ITEM -01.03.04- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 161 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	992C FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
3.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	5849.40
3.0	DUK	X 20.00 hrs @	77.50	4674.00
1.0	3/4 TON PICK UP TRUCK	X 20.00 hrs @	10.14	202.80
				14748.00

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 161 Days @ 14748.80 = 2374557

TOTAL EQUIPMENT	2374557

ITEM -01.03.04- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 1142842) =				57142.10
TOTAL MATERIALS & SUPPLIES				57142

SUBITEM TOTAL	3574541

ITEM -01.03.04- SUBITEM 2 CRITERIA
REFER TO ATTACHED BACKUP MATERIAL.

ITEM -01.03.04- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 372 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	CL A EQUIP OP	X 10.00 hrs @ 37.91	758.20
1.0	1.0	2.0	OILER	X 10.00 hrs @ 34.38	687.60
1.0	1.0	2.0	SPOTTER	X 10.00 hrs @ 31.30	626.00
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
					4104.40

Total A-Labor Cost Per Day
(12.0 persons, 120.0 MH/day @ 34.20 Ave.)

Total A-Labor Cost - 372 Days (44640 MH) @ 4104.40 = 1526837

TOTAL LABOR 1526837

ITEM -01.03.04- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 372 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	1066 KOEHRING BACKHOE	X 20.00 hrs @	167.26	3345.20
1.0	3/4 TON PICK UP TRUCK	X 20.00 hrs @	10.14	202.80
				3548.00

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 372 Days @ 3548.00 = 1319856

TOTAL EQUIPMENT 1319856

ITEM -01.03.04- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS		UNIT COST	TOTAL COST
TRENCH GRAVEL	46400.0	CY	@	10.00	464000.00
Sub-Total					464000.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 1526837) = 76341.85

TOTAL MATERIALS & SUPPLIES 540342

SUBITEM TOTAL 3387035

ITEM -01.03.04- SUBITEM 3 CRITERIA
REFER TO ATTACHED BACKUP MATERIAL.

ITEM -01.03.04- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 936 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.9	1.9	3.8	CL A EQUIP OP	X 10.00 hrs @ 37.91	1440.58
1.9	1.9	3.8	OILER	X 10.00 hrs @ 34.38	1306.44
7.5	7.5	15.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	5464.50
1.0	1.0	2.0	SPOTTER	X 10.00 hrs @ 31.30	626.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
					10244.32

Total A-Labor Cost Per Day
(28.6 persons, 286.0 MH/day @ 35.82 Ave.)

Total A-Labor Cost - 936 Days (267696 MH) @ 10244.32 = 9588684

TOTAL LABOR 9588684

ITEM -01.03.04- SUBITEM 3 EQUIPMENT
A-Equipment estimate is based on 15.00 hours per day for 936 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.9	1266 KOEHRING BACKHOE	X 15.00 hrs @	231.08	6585.78
7.5	CAT 773 DUMP TR - 50T	X 15.00 hrs @	72.08	8109.00
				14694.78

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 936 Days @ 14694.78 = 13754314

TOTAL EQUIPMENT 13754314

ITEM -01.03.04- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 9583684) =				479434.20
TOTAL MATERIALS & SUPPLIES				479434
SUBITEM TOTAL				23822432

ITEM -01.03.04- SUBITEM 4 CRITERIA
REFER TO ATTACHED BACKUP MATERIAL.

ITEM -01.03.04- SUBITEM 4 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 936 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
3.0	3.0	6.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2169.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	728.60
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
2.0	2.0	4.0	SPOTTER	X 10.00 hrs @ 31.30	1252.00
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
					8239.00

Total A-Labor Cost Per Day
(24.0 persons, 240.0 MH/day @ 34.33 Ave.)

Total A-Labor Cost - 936 Days (224640 MH) @ 9239.00 = 7711704

TOTAL LABOR 7711704

ITEM -01.03.04- SUBITEM 4 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 936 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
3.0	CAT D8K + DOZER	X 20.00 hrs @		77.90	4674.00
1.0	CAT 825C	X 20.00 hrs @		88.84	1776.80
1.0	CAT 16G GRDR W/DISCS	X 20.00 hrs @		66.35	1327.00
1.0	10000 GALS TRACTOR-TRLR	X 20.00 hrs @		94.81	1896.20
Total Equipment Cost Per Day					9674.00

Total Subset-A Equipment Cost - 936 Days @ 9674.00 = 9054864

TOTAL EQUIPMENT 9054864

ITEM -01.03.04- SUBITEM 4 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 7711704) = 385585.20

TOTAL MATERIALS & SUPPLIES 385585

SUBITEM TOTAL 17152153

ITEM -01.03.04- SUBITEM 5 CRITERIA
REFER TO ATTACHED BACKUP MATERIAL

ITEM -01.03.04- SUBITEM 5 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 15 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
					720.00

Total A-Labor Cost Per Day
(2.0 persons, 20.0 MH/day @ 36.00 Ave.)

Total A-Labor Cost - 15 Days (300 MH) @ 720.00 = 10800

TOTAL LABOR 10800

ITEM -01.03.04- SUBITEM 5 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 15 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	D8K	X 20.00 hrs @	77.90	1558.00
				1558.00

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 15 Days @ 1558.00 = 23370

TOTAL EQUIPMENT 23370

ITEM -01.03.04- SUBITEM 5 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supplu Cost @ 5.00 % Direct Labor (0.0500 X 10800) = 540.00

TOTAL MATERIALS & SUPPLIES 540

SUBITEM TOTAL 34710

ITEM TOTAL 47970871

0 0 2 5 4

WATANA EARTH DAM - EL 2185

PROJECT NO 1563

ITEM .318 - PROVIDE DRYING FACILITIES - (EQUIPMENT)<

DESCRIPTION	QUANTITY	UNIT	MHR	LABOR	EQUIP	M&S	TOTAL	UNIT COST
EQUIPMENT FOR DRYING IMPERV MATERIAL	1.0	LS			10000000		10000000	10000000
TOTAL	1.0	LS			10000000		10000000	10000000

EOF..

ITEM -01.03.05- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
T	DRYING IMPERV FILL-OPR	1576000.0	FCY	31920	1106454	1839942	4468123	0	7414519	4.70
	UNIT COST			0.02	0.70	1.17	2.84	0.00	4.70	

ITEM -01.03.05- CRITERIA
REFER TO ATTACHED BACKUP MATERIAL.

ITEM -01.03.05- LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 140 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	PLANT FORMN	X 10.00 hrs @ 39.00	780.00
1.0	1.0	2.0	PLANT OPERATOR	X 10.00 hrs @ 36.00	720.00
2.0	2.0	4.0	FEEDER OPERATOR	X 10.00 hrs @ 36.00	1440.00
4.0	4.0	8.0	COMMON LABORER	X 10.00 hrs @ 31.29	2503.20
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.4	1.4	2.8	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	1020.04
					7903.24

Total A-Labor Cost Per Day
(22.8 persons, 228.0 MH/day @ 34.66 Ave.)

Total A-Labor Cost - 140 Days (31920 MH) @ 7903.24 = 1106454

TOTAL LABOR 1106454

ITEM -01.03.05- EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 140 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
2.0	IMPERV DRYING PLANT	X 20.00 hrs @	148.80	5952.00
1.0	992C FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
1.0	D-7G	X 20.00 hrs @	57.48	1149.60
1.4	CAT 773 DUMP TR - 50T	X 20.00 hrs @	72.00	2018.24
				13142.44

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 140 Days @ 13142.44 = 1839942

TOTAL EQUIPMENT	1839942

ITEM -01.03.05- MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS		UNIT COST	TOTAL COST
FUEL	3152000.0	GAL	@	1.40	4412800.00
Sub-Total					4412000.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 1106454) = 55322.70

TOTAL MATERIALS & SUPPLIES	4468123
ITEM TOTAL	7414519

0 0 2 3 4

WATANA EARTH DAM - EL 2185

PROJECT NO 1563

ITEM .31D - SAND AND GRAVEL FILLS - SUMMARY

DESCRIPTION	QUANTITY	UNIT	MHR	LABOR	EQUIP	M&S	TOTAL	UNIT COST
PROCESSING	27364500	FCY	1269290	44330490	124508475	4104675	172943640	6.32
HAUL TO DAM	27364500	FCY	393120	14153740	27691373	707687	42552800	1.56
PLACEMENT	27364500	FCY	207480	7231988	9654809	361599	17248396	0.63
TOTAL SAND AND GRAVEL FILLS	27364500	FCY	1869890	65716216	161854657	5173961	232744836	8.51
UNIT COSTS			0.07	2.40	5.91	0.19	8.51	

EOF..

ITEM -01.03.01- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	DRAGLINE FR PIT & CAST	29426800.0	BCY	300300	10665036	25727065	1566504	0	37958605	1.29
2	LOAD TR & HAUL TO PLNT	29426800.0	BCY	396760	14154759	24253284	707738	0	39115781	1.33
3	PROCESSING PLANT	52085400.0	TON	567840	19431922	74191135	1943192	0	95566249	1.83
T	AGGREGATE PROCESSING	52085400.0	TON	1264900	44251717	124171484	4217434	0	172640635	3.31
	UNIT COST			0.02	0.85	2.38	0.08	0.00	3.31	

ITEM -01.03.01- CRITERIA
SEE BACK UP MATERIAL

ITEM -01.03.01- SUBITEM 1 CRITERIA
SEE BACKUP MATERIAL.

ITEM -01.03.01- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 910 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
2.7	2.7	5.4	EQUIP FOREMAN	X 10.00 hrs @ 39.05	2108.70
2.7	2.7	5.4	DRAGLINE OPERAT	X 10.00 hrs @ 37.90	2046.60
2.7	2.7	5.4	OILER	X 10.00 hrs @ 34.30	1856.52
2.7	2.7	5.4	SPOTTER	X 10.00 hrs @ 31.30	1690.20
2.7	2.7	5.4	HVY EQUIP OP	X 10.00 hrs @ 36.00	1944.00
1.0	1.0	2.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	703.40
2.0	2.0	4.0	LD DRIVER	X 10.00 hrs @ 34.26	1370.40
					11719.82

Total A-Labor Cost Per Day
(33.0 persons, 330.0 MH/day @ 35.51 Ave.)

Total A-Labor Cost - 910 Days (300300 MH) @ 11719.82 = 10665036

TOTAL LABOR 10665036

ITEM -01.03.01- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 910 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
2.7	480W B-E 16 CY DRGLN	X	20.00 hrs @	402.81	21751.74
2.7	D8K	X	20.00 hrs @	77.90	4206.60
1.0	GROVE RT 518 18 T	X	20.00 hrs @	48.70	974.00
2.0	FLATBED (DIESEL)	X	20.00 hrs @	19.79	791.60
2.7	3/4 TON PICK UP TRUCK	X	20.00 hrs @	10.14	547.56
					28271.50

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 910 Days @ 28271.50 = 25727065

TOTAL EQUIPMENT 25727065

ITEM -01.03.01- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS		UNIT COST	TOTAL COST
STEEL PADS	1.0	LS	@	500000.00	500000.00
Sub-Total					500000.00

S T & Supply Cost @ 10.00 % Direct Labor (0.1000 X *******) = 1066503.60

TOTAL MATERIALS & SUPPLIES 1566504

SUBITEM TOTAL 37958605

ITEM -01.03.01- SUBITEM 2 CRITERIA
SEE BACKUP MATERIAL.

ITEM -01.03.01- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 910 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
2.0	2.0	4.0	BELT LOADER OPE	X 10.00 hrs @ 36.00	1440.00
2.0	2.0	4.0	OILER	X 10.00 hrs @ 34.38	1375.20
6.0	6.0	12.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	4320.00
6.8	6.8	13.6	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	4954.48
2.0	2.0	4.0	SPOTTER	X 10.00 hrs @ 31.30	1252.00
1.0	1.0	2.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	703.40
1.0	1.0	2.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	728.60
					15554.68

Total A-Labor Cost Per Day
(43.6 persons, 436.0 MH/day @ 35.68 Ave.)

Total A-Labor Cost - 910 Days (396760 MH) @ 15554.68 = 14154759

TOTAL LABOR 14154759

ITEM -01.03.01- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 910 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
2.0	BELT LOADER 60INCHX60'	X	20.00 hrs @	81.42	3256.80
6.0	D8K	X	20.00 hrs @	77.90	9348.00
6.8	CAT 772B BOT DMP 100T	X	20.00 hrs @	84.81	11534.16
1.0	CAT 16G	X	20.00 hrs @	66.35	1327.00
1.0	6000 GALS TRACTOR-TRLR	X	20.00 hrs @	59.30	1186.00
Total Equipment Cost Per Day					26651.96

Total Subset-A Equipment Cost - 910 Days @ 26651.96 = 24253284

TOTAL EQUIPMENT 24253284

ITEM -01.03.01- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X *******) = 707737.95

TOTAL MATERIALS & SUPPLIES 707738

SUBITEM TOTAL 39115781

ITEM -01.03.01- SUBITEM 3 CRITERIA
SEE BACKUP MATERIAL.

ITEM -01.03.01- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 1092days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
2.0	2.0	4.0	REC PLANT FORMN	X 10.00 hrs @ 39.00	1560.00
2.0	2.0	4.0	SCRN PLANT FORM	X 10.00 hrs @ 39.00	1560.00
2.0	2.0	4.0	REC STAT OPER	X 10.00 hrs @ 36.00	1440.00
2.0	2.0	4.0	SCRN STAT OPER	X 10.00 hrs @ 36.00	1440.00
1.0	1.0	2.0	CONCR AGG OPER	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	SAND WASH OPER	X 10.00 hrs @ 36.00	720.00
12.0	12.0	24.0	COMMON LABORER	X 10.00 hrs @ 31.29	7509.60
3.0	3.0	6.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2160.00
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.26	685.20
					17794.80

Total A-Labor Cost Per Day
(52.0 persons, 520.0 MH/day @ 34.22 Ave.)

Total A-Labor Cost - 1092 Days (567840 MH) @ 17794.80 = 19431922

TOTAL LABOR 19431922

ITEM -01.03.01- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 1092days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
2.0	2.0	4.0	REC PLANT FORMN	X 10.00 hrs @ 39.00	1560.00
2.0	2.0	4.0	SCRN PLANT FORM	X 10.00 hrs @ 39.00	1560.00
2.0	2.0	4.0	REC STAT OPER	X 10.00 hrs @ 36.00	1440.00
2.0	2.0	4.0	SCRN STAT OPER	X 10.00 hrs @ 36.00	1440.00
1.0	1.0	2.0	CONCR AGG OPER	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	SAND WASH OPER	X 10.00 hrs @ 36.00	720.00
12.0	12.0	24.0	COMMON LABORER	X 10.00 hrs @ 31.29	7509.60
3.0	3.0	6.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2160.00
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.26	685.20
					17794.80

Total A-Labor Cost Per Day
(52.0 persons, 520.0 MH/day @ 34.22 Ave.)

Total A-Labor Cost - 1092 Days (567840 MH) @ 17794.80 = 19431922

TOTAL LABOR 19431922

ITEM -01.03.01- SUBITEM 3 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 1092 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
1.0	7000TPH PROCESSING PLANT	X	20.00 hrs @	3078.07	61561.40
1.0	992C FEL 13.5 CY	X	20.00 hrs @	201.13	4022.60
1.0	D-7G	X	20.00 hrs @	57.48	1149.60
1.0	FLATBED (DIESEL)	X	20.00 hrs @	19.79	395.80
4.0	3/4 TON PICK UP TRUCK	X	20.00 hrs @	10.14	811.20
Total Equipment Cost Per Day					67940.60

Total Subset-A Equipment Cost - 1092 Days @ 67940.60 = 74191135

TOTAL EQUIPMENT 74191135

ITEM -01.03.01- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 10.00 % Direct Labor (0.1000 X *******) = 1943192.20

TOTAL MATERIALS & SUPPLIES 1943192

SUBITEM TOTAL 95566249

ITEM TOTAL 172640635

ITEM -01.03.02- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	HAUL TO DAM	27364500.0	FCY	393120	14153740	27691373	707687	0	42552800	1.56
2	PLACING	27364500.0	FCY	207480	7231988	9654809	361599	0	17248396	0.63
T	SAND & GRAVEL FILLS	27364500.0	FCY	600600	21385728	37346182	1069286	0	59801196	2.19
	UNIT COST			0.02	0.78	1.36	0.04	0.00	2.19	

ITEM -01.03.02- CRITERIA
SEE BACKUP MATERIAL.

ITEM -01.03.02- SUBITEM 1 CRITERIA
SEE BACKUP MATERIAL.

ITEM -01.03.02- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 1092days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR			TOTAL PER DAY
1.0	1.0	2.0	TEAMSTR FOREMAN	X 10.00 hrs @	39.25	785.00
14.0	14.0	28.0	HD DRIVR(-80CY)	X 10.00 hrs @	36.43	10200.40
0.5	0.5	1.0	HVY EQUIP OP	X 10.00 hrs @	36.00	360.00
0.5	0.5	1.0	HD DRIVR(-80CY)	X 10.00 hrs @	36.43	364.30
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @	31.29	1251.60
						12961.30

Total A-Labor Cost Per Day
(36.0 persons, 360.0 MH/day @ 36.00 Ave.)

Total A-Labor Cost - 1092 Days (393120 MH) @ 12961.30 = 14153740

TOTAL LABOR 14153740

ITEM -01.03.02- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 1092 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
14.0	CAT 772B BOT DMP 100T	X	20.00 hrs @	84.81	23746.80
0.5	CAT 16G	X	20.00 hrs @	66.35	663.50
0.5	10000 GALS TRACTOR-TRLR	X	20.00 hrs @	94.81	948.10
					25358.40

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 1092 Days @ 25358.40 = 27691373

TOTAL EQUIPMENT 27691373

ITEM -01.03.02- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X *******) =				707687.00
TOTAL MATERIALS & SUPPLIES				707687
SUBITEM TOTAL				42552800

ITEM -01.03.02- SUBITEM 2 CRITERIA
SEE BACKUP MATERIAL.

ITEM -01.03.02- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 1092days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
3.5	3.5	7.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2520.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
0.5	0.5	1.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	360.00
0.5	0.5	1.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	364.30
2.0	2.0	4.0	GRADE CHECKERS	X 10.00 hrs @ 31.29	1251.60
1.0	1.0	2.0	FLAGMAN	X 10.00 hrs @ 31.29	625.80
					6622.70

Total A-Labor Cost Per Day
(19.0 persons, 190.0 MH/day @ 34.86 Ave.)

Total A-Labor Cost - 1092 Days (207480 MH) @ 6622.70 = 7231988

TOTAL LABOR 7231988

ITEM -01.03.02- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 1092 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
3.5	D8K	X 20.00 hrs @	77.90	5453.00
1.0	CAT 825C	X 20.00 hrs @	88.84	1776.80
0.5	CAT 16G	X 20.00 hrs @	66.35	663.50
0.5	10000 GALS TRACTOR-TRLR	X 20.00 hrs @	94.81	948.10
				8841.40

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 1092 Days @ 8841.40 = 9654809

TOTAL EQUIPMENT 9654809

ITEM -01.03.02- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 7231988) = 361599.40

TOTAL MATERIALS & SUPPLIES 361599

SUBITEM TOTAL 17248396

ITEM TOTAL 59801196

HAUL ROADS

ITEM -01.02.02- SUMMARY

	DESCRIPTION	QUANTITY	UNITS	MAN-HRS	LABOR	EQUIP	M&S	SUBCON	TOTAL	UNIT COST
1	CLEARING AND GRUBBING	54.0	ACRE	5760	190019	212249	28503	0	430771	7977.24
2	OVERBURDEN EXCAVATION	327600.0	BCY	8400	299747	666407	14987	0	981141	2.99
3	ROCK EXCAVATION	764400.0	BCY	74880	2532608	3584714	1863491	0	7980813	10.44
4	PAVING	230000.0	SY	560	19175	17970	12415459	0	12452604	54.14
T	CONSTR HAUL ROADS	52000.0	LF	89600	3041549	4481340	14322440	0	21845329	420.10
	UNIT COST			1.72	58.49	86.18	275.43	0.00	420.10	

ITEM -01.02.02- CRITERIA

ACCESS ROAD REQUIREMENTS WILL BE AS INDICATED IN THE FOLLOWING TABLE:

LOCATION	DISTANCE (FT)
MAIN HAUL ROAD N. BANK	21,000
ACCESS TO RIVERBOTTOM	2,000
ACCESS TO MAIN DAM N. ABT	4,000
ACCESS TO APPROACH CHANN	2,500
ACCESS TO FLIP BUCKET	2,000
ACCESS TO SPILW CHUTE	1,000
ACCESS TO IMPERV BOR AREA	3,000
MAIN HAUL ROAD SOUTH BANK	9,500
ACCESS TO RIVERBOTTOM	1,500
ACCESS TO SOUTH ABUTEMENT	5,500
TOTAL -	52,000 LINEAL FEET

THE AVERAGE SLOPE FOR THIS TERRAIN IS APPROXIMATELY 1V-1.5H. THE ASSUMED ROAD WIDTH IS 40'. BAESD ON THIS, IT WAS DETERMINED THAT THE REQUIRED ROAD EXCAVATION WILL BE APPROXIMATELY 21 BCY/LF OF ROAD. IT WAS ALSO ASSUMED THAT 70% OF THE EXCAVATION WOULD BE IN ROCK AND THE REMAINING 30% WOULD CONSIST OF OVERBURDEN REMOVAL. EXCAVATED MATERIAL WILL BE HAULED TO WASTE AS REQUIRED. THIS ITEM IS SUBDIVIDED INTO CLEAR & GRUB, OVERBURDEN EXCV, ROCK EXCV AND PAVING.

ITEM -01.02.02- SUBITEM 1 CRITERIA
CLEARING AND GRUBBING WILL BE PERFORMED USING A D9 CAT DOZER AND A CHIPPER. MATERIAL WILL BE LOADED WITH CAT 992 FEL ONTO 777 CAT REAR DUMP TRUCKS FOR HAULING TO DISPOSAL. AREA CAN BE COMPUTED AS FOLLOWS:

52,000 LF-ROAD X 45' WIDTH = 2,340,000 SF, OR 54 ACRES.

IT IS EXPECTED THAT THE DOZER WILL CLEAR AT THE RATE OF 1.5 ACRES/10 HR SHIFT. AT THIS RATE, 18 DAYS WILL BE REQUIRED TO COMPLETE THE WORK, ASSUMING 2-10 HR SHIFTS/DAY ARE WORKED.

ITEM -01.02.02- SUBITEM 1 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 18 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	681.40
10.0	10.0	20.0	COMMON LABORER	X 10.00 hrs @ 31.29	6258.00
3.0	3.0	6.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2160.00
2.0	2.0	4.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	1457.20
					10556.60

Total A-Labor Cost Per Day
(32.0 persons, 320.0 MH/day @ 32.99 Ave.)

Total A-Labor Cost - 18 Days (5760 MH) @ 10556.60 = 190019

TOTAL LABOR 190019

ITEM -01.02.02- SUBITEM 1 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 18 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
1.0	D9 W/RIPPER		X 20.00 hrs @	115.57	2311.40
1.0	CHIPPER		X 20.00 hrs @	77.90	1558.00
2.0	CAT 777 TRUCK		X 20.00 hrs @	97.49	3899.60
1.0	992C	FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
					11791.60

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 18 Days @ 11791.60 = 212249

TOTAL EQUIPMENT 212249

ITEM -01.02.02- SUBITEM 1 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 15.00 % Direct Labor (0.1500 X 190019) =				28502.85
TOTAL MATERIALS & SUPPLIES				28503
SUBITEM TOTAL				430771

ITEM -01.02.02- SUBITEM 2 CRITERIA
OVERBURDEN EXCAVATION WILL BE PERFORMED USING 992C CAT FEL LOADING ONTO CAT 777 REAR DUMP TRUCKS. IT WILL BE ASSUMED THAT MATERIAL WILL BE HAULED APPROXIMATELY 12,000' TO DISPOSAL. EXCAVTION QUANTITY WAS DETEMINED AS FOLLOWS:

52,000 LF X 21 BCY/LF X 0.3 = 327,600 BCY OF OVERBURDEN EXCAVATION.

FEL PRODUCTION: 13.5 CY/BUCKET X 0.75 BF X 0.80 SF = 8.1 BCY/BCKT.

42.29 BCY/TRUCK / 8.1 BCY/BCKT = 5 PASSES FOR 40.5 BCY/TR

0.70 MIN/PASS X 5 PASSES + 0.20 MIN-TR EXCH = 3.7 MIN/TR

45 MIN/HR / 3.7 MIN/TR = 12.16 TR/HR X 40.5 BCY/TR = 493 BCY/HR/FEL

TRUCK REQUIREMENTS: AVERAGE TRUCK CYCLE USED WILL BE 19.1 MIN], INCLUDING TRAVEL TIME, ACCELERATE AND DESCELERATE TIME, DUMP & MANEUVER TIME AMD LOAD TIME.

45 MIN/HR / 19.1 MIN/CYC/TR = 2.36 TRIPS/TR/HR X 40.5 BCY/TR = 95 BCY/HR/TR

493 BCY/HR/FEL / 95 BCY/HR/TR = 5.19, SAY 6 TRUCKS

DURATION: 327,600 BCY / 493 BCY/HR / 9.5 EFF HR/SHIFT / 2 SHIFTS/DAY = 35 DAYS

D8 DOZERS WILL BE PROVIDED AT THE EXCAVATION AND DISPOSAL AREAS FOR SUPPORT AND FOR SPREADING, RESPECTIVELY.

ITEM -01.02.02- SUBITEM 2 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week, for 35 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @ 39.05	781.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
1.0	1.0	2.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	720.00
6.0	6.0	12.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	4371.60
2.0	2.0	4.0	FLAGMAN	X 10.00 hrs @ 31.29	1251.60
					8564.20

Total A-Labor Cost Per Day
(24.0 persons, 240.0 MH/day @ 35.68 Ave.)

Total A-Labor Cost - 35 Days (8400 MH) @ 8564.20 = 299747

TOTAL LABOR 299747

ITEM -01.02.02- SUBITEM 2 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 35 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
1.0	992C FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
2.0	D8K	X 20.00 hrs @	77.90	3116.00
6.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	11698.80
1.0	3/4 TON PICK UP TRUCK	X 20.00 hrs @	10.14	202.80
				19040.20

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 35 Days @ 19040.20 = 666407

TOTAL EQUIPMENT	666407

ITEM -01.02.02- SUBITEM 2 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS	UNIT COST	TOTAL COST
Sub-Total				0.00
S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 299747) =				14987.35
TOTAL MATERIALS & SUPPLIES				14987
SUBITEM TOTAL				981141

ITEM -01.02.02- SUBITEM 3 CRITERIA
ROCK EXCAVATION WILL BE PERFORMED BY THE DRILLING AND BLASTING METHOD. MATERIAL WILL BE LOADED WITH 992C CAT FEL ONTO CAT 777 DUMP TRUCKS. IT WILL BE ASSUMED THAT THE MATERIAL WILL BE HAULED AN AVERAGE DISTANCE OF 12,000' TO DISPOSAL.
DRILLING & BLASTING: USE ANFO (0.98) , NO PRESPLITTING

	DIA	DEPTH	COLUMN	#/FT	#/HOLE	CY/LF	DRILL SPEED
EXCAVATE ON 10' BENCHES	2.75	12'	7'	2.52	17.6	1.23	50'/HR

764,400 BCY / 1.23 CY/LF = 621,500 LF-HOLE / 50'/HR = 12430 HRS/7.5 HR/SH=1658SH
1,658 DRILL SHIFTS / 208 FEL SHIFTS = 7.9, SAY 8 DRILLS.
FEL PROUCTION:
13.5 CY BCKT X 0.7 BF X 0.67 SF = 6.33 BCY/BCKT
85 T/TR / 2.27 TON/BCY = 37.5 BCY/TR / 6.33 BCY/BCKT = 5.92, SAY 6 PASSES/TR
6 PAS/TR X 6.33 BCY/BCK = 37.98 BCY/TR. 6 PS/TR X 0.70 MIN/CY+0.2 EXCH=4.4MIN/TR
45 MIN/HR / 4.4 MIN/TR = 10.23 TR/HR X 37.98 BCY/TR = 388 BCY/HR/FEL
TRUCK REQUIREMENTS:
ASSUME AN AVERAGE CYCLE OF 19.1 MIN TO DISPOSAL, INCLUDING TRAVEL, LOAD, DUMP, MANEUVER, ACCELERATE AND DESCELERATE TIMES.
45 MIN/HR / 19.1 MIN/CY = 2.36 TRIPS/HR X 37.98 BCY/TR = 89 BCY/HR/TR
388 BCY/HR/FEL / 89 BCY/HR/TR = 4.4, SAY 5 TRUCKS.
DURATION: 764,400 BCY / 388 BCY/HR / 9.5 HRS/SH / 2 SH/DAY = 104 DAYS.

ITEM -01.02.02- SUBITEM 3 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 104 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR		TOTAL PER DAY
1.0	1.0	2.0	LABOR FOREMAN	X 10.00 hrs @ 34.07	681.40
8.0	8.0	16.0	DRILLER	X 10.00 hrs @ 32.89	5262.40
8.0	8.0	16.0	CHUCK TENDER	X 10.00 hrs @ 32.22	5155.20
2.0	2.0	4.0	LIGHT EQUIP OP	X 10.00 hrs @ 35.17	1406.80
1.0	1.0	2.0	BLASTER	X 10.00 hrs @ 35.15	703.00
7.0	7.0	14.0	POWDERMAN	X 10.00 hrs @ 33.25	4655.00
5.0	5.0	10.0	HD DRIVR(-80CY)	X 10.00 hrs @ 36.43	3643.00
1.0	1.0	2.0	LD DRIVER	X 10.00 hrs @ 34.26	685.20
3.0	3.0	6.0	HVY EQUIP OP	X 10.00 hrs @ 36.00	2160.00
					24352.00

Total A-Labor Cost Per Day
(72.0 persons, 720.0 MH/day @ 33.82 Ave.)

Total A-Labor Cost - 104 Days (74880 MH) @ 24352.00 = 2532608

TOTAL LABOR 2532608

ITEM -01.02.02- SUBITEM 3 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 104 days.

..EQUIPMENT.. NO.	TYPE		UNIT COST	TOTAL PER DAY
8.0	HYDRAULIC DRILL	X 20.00 hrs @	97.29	15566.40
2.0	COMPRESSOR 600 CFM	X 20.00 hrs @	40.36	1614.40
1.0	992C FEL 13.5 CY	X 20.00 hrs @	201.13	4022.60
2.0	D8K	X 20.00 hrs @	77.90	3116.00
1.0	SLURRY TRUCK	X 20.00 hrs @	20.00	400.00
5.0	CAT 777 TRUCK	X 20.00 hrs @	97.49	9749.00
				34468.40

Total Equipment Cost Per Day 34468.40

Total Subset-A Equipment Cost - 104 Days @ 34468.40 = 3584714

TOTAL EQUIPMENT 3584714

ITEM -01.02.02- SUBITEM 3 MATERIALS & SUPPLIES

MATERIALS AND SUPPLIES	QUANTITY	UNITS		UNIT COST	TOTAL COST
BITS AND STEEL	621500.0	LF	@	0.50	310750.00
EXPLOSIVES	764400.0	LBS	@	1.70	1299480.00
Sub-Total					1610230.00

S T & Supply Cost @ 10.00 % Direct Labor (0.1000 X 2532608) = 253260.80

TOTAL MATERIALS & SUPPLIES 1863491

SUBITEM TOTAL 7980813

ITEM -01.02.02- SUBITEM 4 CRITERIA
PAVEMENT WILL CONSIST OF 12" OF BASE MATERIAL WITH A WEARING SURFACE. QUANTITY OF PAVING WAS CALCULATED AS FOLLOWS:

52,000 LF X 40' WIDE / 9 SF/SY = 230,000 SY.

BASE COURSE WILL BE PLACED BY A CREW AT THE RATE OF APPROXIMATELY 1000 CY/HR. AT THIS RATE, 4 DAYS WILL BE REQUIRED TO COMPLETE THIS WORK. THE COST OF DRAINAGE, SURFACING AND RESURFACING IS INCLUDED AS PART OF THE MATERIALS. IT WAS EXPECTED THAT DRAINAGE PROVISIONS WILL BE REQUIRED AT APPROXIMATELY EVERY 1000'. IT WAS ALSO EXPECTED THAT THE WEARING SURFACE WOULD REQUIRE RESURFACING OVER THE ENTIRE AREA, APPROXIMATELY 3 SEPARATE DURING THE CONSTRUCTION PERIOD. THE RATE INDICATED FOR THE MATERIALS INCLUDES THE COST OF PURCHASING AND INSTALLATION OF THE SAME.

ITEM -01.02.02- SUBITEM 4 LABOR
A-Labor estimate is based on 2-10.00 hour shifts/day, 6.0 days/week,
for 4 days.

NUMBER PER SHIFT 1ST	2ND	TOTAL	TYPE OF LABOR			TOTAL PER DAY
1.0	1.0	2.0	EQUIP FOREMAN	X 10.00 hrs @	39.05	781.00
2.0	2.0	4.0	LIGHT EQUIP OP	X 10.00 hrs @	33.17	1406.80
1.0	1.0	2.0	HD DRIVR(-80CY)	X 10.00 hrs @	36.43	728.60
3.0	3.0	6.0	COMMON LABORER	X 10.00 hrs @	31.29	1877.40
						4793.80

Total A-Labor Cost Per Day
(14.0 persons, 140.0 MH/day @ 34.24 Ave.)

Total A-Labor Cost - 4 Days (560 MH) @ 4793.80 = 19175

19175

TOTAL LABOR

ITEM -01.02.02- SUBITEM 4 EQUIPMENT
A-Equipment estimate is based on 20.00 hours per day for 4 days.

..EQUIPMENT.. NO.	TYPE			UNIT COST	TOTAL PER DAY
1.0	CAT 16G	X	20.00 hrs @	66.35	1327.00
1.0	CAT 825C	X	20.00 hrs @	88.84	1776.80
1.0	6000 GALS TRACTOR-TRLR	X	20.00 hrs @	59.30	1186.00
1.0	3/4 TON PICK UP TRUCK	X	20.00 hrs @	10.14	202.80
					4492.60

Total Equipment Cost Per Day

Total Subset-A Equipment Cost - 4 Days @ 4492.60 = 17970

17970

TOTAL EQUIPMENT

ITEM -01.02.02- SUBITEM 4 MATERIALS & SUPPLIES
MATERIALS AND SUPPLIES

	QUANTITY	UNITS		UNIT COST	TOTAL COST
CULVERTS	52.0	EA	@	2000.00	104000.00
BASE COURSE MTRL	76700.0	CY	@	15.00	1150500.00
SURFACE COURSE	230000.0	SY	@	12.00	2760000.00
RESURFACING	700000.0	SY	@	12.00	8400000.00
					12414500.00

Sub-Total

S T & Supply Cost @ 5.00 % Direct Labor (0.0500 X 19175) = 958.75

12415459

TOTAL MATERIALS & SUPPLIES

12452604

SUBITEM TOTAL

21845329

ITEM TOTAL