ENGINEERING DIVISION RECORD CO.
DO NOT REMOVE FROM FILE

ENGINEERING DIVISION RECORD CO.
DO NOT REMOVE FROM FILE

GOVERNMENT ESTIMATE

FOR

FRANKLIN FALLS DAM

MERRIMACK VALLEY FLOOD CONTROL

1939

ENGINEERING DIVISION RECORD CO.
DO NOT REMOVE FROM FILE

CORPS OF ENGINEERS, U.S. ARMY

ENGINEER OFFICE BOSTON, MASS.

COPY NO.

GOVERNMENT ESTIMATE

for Construction of

FRANKLIN FALLS DAM

with Government Plant and Hired Labor;

exclusive of District and Division Overhead;

Survey and Inspection Costs

SCHEDULE OF BID ITEMS

Item No.	Quantity	Unit	Designation	Unit Price	Amount
1	SUM	Job	FIELD OFFICE	$ L.S.	$12,637.32
2	SUM	Job	REMOVAL OF EXISTING STRUCTURES	L.S.	6,855.44
3	SUM	Job	DIVERSION OF RIVER AND COFFERDAM PUMPING	L.S.	184,103.91
4	250,000	Cu.Yd.	STRIPPING DAMSITE	.334-	83,387.16
5	1,887,000	Cu.Yd.	COMMON EXCAVATION ABOVE EL. 301.0 M.S.L.	.231-	435,305.18
6	739,000	Cu.Yd.	COMMON EXCAVATION BELOW EL. 301.0 M.S.L.	.383-	282,726.83
7	215,000	Cu.Yd.	STRIPPING BORROW AREAS A, B, AND C	.302+	64,979.05
8	300,000	Cu.Yd.	EXCAVATION AND HAUL, BORROW AREA A	.771-	231,224.57
9	550,000	Cu.Yd.	EXCAVATION AND HAUL, BORROW AREA B	.312+	171,855.39
10	185,000	Cu.Yd.	EXCAVATION AND HAUL, BORROW AREA C	.437+	80,886.21
11	315,000	Cu.Yd.	ROCK EXCAVATION ABOVE EL. 301.0 M.S.L.	1.039+	327,310.15
12	75,000	Cu.Yd.	ROCK EXCAVATION BELOW EL. 301.0 M.S.L.	1.617-	121,258.33
13	10,600	Cu.Yd.	STRUCTURE BACKFILL, UNCOMPACTED	.075+	799.09
14	12,700	Cu.Yd.	STRUCTURE BACKFILL, COMPACTED	.390-	4,948.29
15	1,952,000	Cu.Yd.	ROLLED FILL, PERVIOUS	.134+	261,951.41
16	300,000	Cu.Yd.	ROLLED FILL, IMPERVIOUS	.124-	37,128.83
17	-	-	Omitted	-	-
18	575,000	Cu.Yd.	ROCK FILL	.308+	177,262.19

SCHEDULE OF BID ITEMS (Continued)

Item No.	Quantity	Unit	Designation	Unit Price	Amount
19	13,200	Cu.Yd.	HAND-PLACED RIPRAP	$ 1.600-	$ 21,083.14
20	2,600	Cu.Yd.	DERRICK STONE	1.353+	3,518.10
21	115,000	Cu.Yd.	GRAVEL FOR FILTERS & BACKING	1.328-	152,678.52
22	7,700	Lin.Ft.	8" GRAVEL DRAINS	.292+	2,250.02
23	81,000	Cu.Yd.	SAND FOR FILTERS	1.087-	88,024.38
24	68,000	Sq.Ft.	LINE DRILLING FOR ROCK EXCAVATION	.669-	45,489.71
25	5,700	Lin.Ft.	DRILLING HOLES IN ROCK FOR PRESSURE GROUTING	.667-	3,799.81
26	3,000	Lin.Ft.	DRILLING HOLES IN ROCK FOR, AND GROUTING ANCHORS	.772-	2,315.18
27	2,300	Cu.Ft.	PRESSURE GROUTING	1.739-	3,998.72
28	87,000	Bbl.	FURNISHING CEMENT	2.589+	225,249.58
29	18,000	Cu.Yd.	CONCRETE IN INTAKE STRUCTURE, CONDUIT TRANSITION, AND BRIDGE PIERS	10.837+	195,970.46
30	8,800	Cu.Yd.	CONCRETE IN CONDUITS	7.803+	68,669.11
31	29,500	Cu.Yd.	CONCRETE IN OUTLET APPROACH CHANNEL WALLS, SPILLWAY WALLS & WEIR	6.665+	196,619.33
32	90	Cu.Yd.	CONCRETE IN BRIDGE DECK	40.626-	3,656.32
33	1,200	Cu.Yd.	CONCRETE IN STEPS, TRASH BARS, GROUT RECESSES & MISCELLANEOUS WORK	7.198+	8,638.10
34	18,500	Cu.Yd.	CONCRETE IN STILLING BASIN	4.515-	83,519.60
35	2,051,000	Lb.	REINFORCING STEEL	.053+	109,129.52
36	168,000	Lb.	SERVICE BRIDGE METAL	.069-	11,514.76

Note:
The unit prices on the attached sheets were read at the opening of bids, Aug. 9, 1939.

SCHEDULE OF BID ITEMS (Continued)

Item No.	Quantity	Unit	Designation	Unit Price	Amount
57	5,000	Lin.Ft.	HIGHWAY GUARD RAIL	$ .684+	$ 3,422.11
58	2,300	Lin.Ft.	COBBLE GUTTERS	.342-	786.53
59	170	Lin.Ft.	12" PIPE DRAINS	1.290	219.30
60	25,000	Cu.Yd.	TOP SOIL	.604-	15,099.82
61	30	Acre	SEEDING	158.601-	4,758.02

Total.....$ 4,223,495.39

Government Estimate including District and Division Overhead, Survey and Inspection Costs Total.....$ 4,856,383.00

Notes:- (1) All amounts and totals given above will be subject to verification by the United States. In case of variation between unit bid price and totals shown by bidder, the unit price will be considered to be his bid.

(2) All bids must be for the entire work and must have each blank space filled in.

(3) The quantities of each item of the bid, as finally ascertained at the close of the contract, and the unit prices of the several items stated by the bidder, in the accepted bid, will determine the total payments to accrue under the contract. The unit price bid for each item must allow for all collateral or indirect costs connected with it.

MERRIMACK VALLEY FLOOD CONTROL

GOVERNMENT ESTIMATE

FOR

CONSTRUCTION OF

FRANKLIN FALLS DAM

PEMIGEWASSETT RIVER, NEW HAMPSHIRE

CORPS OF ENGINEERS, U. S. ARMY

U. S. ENGINEER OFFICE-BOSTON, MASS.

(1) Specifications No. 175-40-1 July, 1939

TABLE OF CONTENTS

SECTION	DESCRIPTION
	GENERAL
1.	Letter of Transmittal
2.	Job Estimate Summary
3.	Abstract of Bids
4.	General Information
5.	Schedule of Bid Items
6.	Proposed Schedule of Operations
	(A) Discussion (B) Charts
7.	Proposed Schedule of Major Equipment
8.	Equipment Proposed & Rental Data
9.	Schedule of Material Unit Prices
10.	Fuel Consumption Data
11.	Hourly Operating Costs of Fuel & Lubricants
12.	Minimum Wage Rates
13.	Mobilization and Demobilization
14.	Shop, Utilities and Yard
	(A) Shop, Garage, Etc. (B) Layout of Construction Roads (C) Construction Roads and Bridges (D) Illumination of Work
15.	Inspection and Field Overhead
16.	Field Office Overhead (Contract Operation)
17.	Gravel and Batching Plant
18.	Drilling and Blasting
19.	Well Point System
20.	(A) Sprinkling Embankment (B) Rolling and Compacting (C) Pipeline Layout

SECTION	DESCRIPTION
	DETAILED ESTIMATE
21.	Item No. 1 (See Section 5.)
22.	Item No. 2 " " "
23.	Item No. 3 " " "
24.	Item No. 4 " " "
25.	Item No. 5 " " "
26.	Item No. 6 " " "
27.	Item No. 7 " " "
28.	Item No. 8 " " "
29.	Item No. 9 " " "
30.	Item No. 10 " " "
31.	Item No. 11 " " "
32.	Item No. 12 " " "
33.	Item No. 13 " " "
34.	Item No. 14 " " "
35.	Item No. 15 " " "
36.	Item No. 16 " " "
37.	Item No. 17 " " "
38.	Item No. 18 " " "
39.	Item No. 19 " " "
40.	Item No. 20 " " "
41.	Item No. 21 " " "
42.	Item No. 22 " " "
43.	Item No. 23 " " "
44.	Item No. 24 " " "
45.	Item No. 25 " " "
46.	Item No. 26 " " "
47.	Item No. 27 " " "
48.	Item No. 28 " " "
49.	Item No. 29 " " "
50.	Item No. 30 " " "
51.	Item No. 31 " " "

SECTION	DESCRIPTION

DETAILED ESTIMATE

52.	Item No. 32	(See	Section	5)
53.	Item No. 33	"	"	"
54.	Item No. 34	"	"	"
55.	Item No. 35	"	"	"
56.	Item No. 36	"	"	"
57.	Item No. 37	"	"	"
58.	Item No. 38	"	"	"
59.	Item No. 39	"	"	"
60.	Item No. 40	"	"	"
61.	Item No. 41	"	"	"
62.	Item No. 42	"	"	"
63.	Item No. 43	"	"	"
64.	Item No. 44	"	"	"
65.	Item No. 45	"	"	"
66.	Item No. 46	"	"	"
67.	Item No. 47	"	"	"
68.	Item No. 48	"	"	"
69.	Item No. 49	"	"	"
70.	Item No. 50	"	"	"
71.	Item No. 51	"	"	"
72.	Item No. 52	"	"	"
73.	Item No. 53	"	"	"
74.	Item No. 54	"	"	"
75.	Item No. 55	"	"	"
76.	Item No. 56	"	"	"
77.	Item No. 57	"	"	"
78.	Item No. 58	"	"	"
79.	Item No. 59	"	"	"
80.	Item No. 60	"	"	"
81.	Item No. 61	"	"	"

Subject: Government Estimate, Franklin Falls Dam.

To: The District Engineer, U. S. Engineer Office, Boston, Mass.

1. Transmitted herewith is the government estimate for the construction of the Franklin Falls Dam. This estimate is for the actual construction work, and does not include the costs of rights of way, highway relocation and construction or land damages.

2. The paragraphs below explain the various column headings which appear on the job estimate summary sheet. (Section 2).

(a) Plant Rental is calculated on the basis of the Contractor's Equipment Ownership Expense pamphlet of the Associated General Contractors, due allowance being made for special conditions existing on the project. Rental is charged at 30 days per calendar month. Unless otherwise indicated, the small tools are charged at approximately 5% of the labor costs.

(b) Materials and Supplies include the cost of all materials entering into the construction as well as the fuel, and lubricants used in the operation of the various items of plant.

(c) Labor covers the cost of all labor employed on the items of direct field cost. The assumption is made that work will proceed from 20 to 22 days per month.

(d) Total Direct Field Cost is the sum of the Plant Rental, Materials and Supplies, and Labor.

(e) Field Overhead includes all labor and expenses of operating the field office as well as the superintendence of the work. All salaried employees, except those in surveys and inspection, above the rank of foreman are included in this item as well as the cost of plant rental and material and supplies pertaining thereto.

(f) Shop, Utilities and Yard charges include plant rental, material and supplies, commissary and housing, and labor in the machine, blacksmith and carpenter shops as well as the yard charges for transporting materials and supplies from the rail head to the yard and from the yard to the work. Illumination, telephone, water supply, construction roads and bridges, and all other utilities are also included in this item.

(g) Mobilization and Demobilization includes the cost of mobilizing and demobilizing all plant proposed for the project and also the cost of cleanup.

(h) Employees Liability Insurance is calculated as 1¼% of the entire labor on the project.

(i) Total Indirect Field Cost is the sum of the Shop Utilities and Yard, Field Overhead, Mobilization and Demobilization and Employees Liability.

(j) The Total Field Cost is the sum of the Direct and Indirect field costs.

(k) District and Division Overhead is calculated as 10% of the Total Field Cost and is added to the Total Field Cost to arrive at the Total Cost of the Project.

(l) The unit costs are arrived at by dividing the total estimated cost of each pay item by the quantity of the item and the unit costs for government bid are obtained by rounding off the fractions of cents.

3. All figures in each column of the Summary Sheet, under Indirect Field Costs are computed by proportion. The Field Overhead and Employees Liability are in direct proportion to the figures in the Labor column. The District and Division Overhead is also prorated on the labor costs. Shop Utilities and Yard, and Mobilization and Demobilization are prorated according to the corresponding figures in the Plant Rental Column.

4. Surveys and Inspection are added in at the bottom of the summary sheet to prevent distortion of the unit prices.

5. Interest on investment charges are included in the charge for plant rental.

John E. Allen
Senior Engineer
Chief of the Flood Control Subdivision

UNITED STATES ENGINEER OFFICE
BOSTON, MASS.

GOVERNMENT
JOB ESTIMATE SUMMARY
for
CONSTRUCTION OF FRANKLIN FALLS DAM, N. H.

PAY ITEM	DESIGNATION	QUANTITIES	PLANT RENTAL	MATERIALS AND SUPPLIES	LABOR	TOTAL DIRECT FIELD COST	FIELD OVERHEAD	SHOP UTILITIES AND YARD	MOBILIZATION AND DE-MOBILIZATION	EMPLOYERS' LIABILITY INSURANCE	TOTAL INDIRECT FIELD COST	TOTAL FIELD COST	DISTRICT AND DIVISION OVERHEAD (10%)	TOTAL COST ESTIMATE	UNIT COST ESTIMATE	UNIT COST FOR BID	TOTAL COST FOR BID
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1	Field Office	Sum	$ 235.00	$ 6,300.00	$ 4,660.00	$ 11,195.00	1,255.12	99.20	5.21	84.79	1,444.32	12,637.32	1,516.98	14,154.30	14,154.30		14,150.00
2	Removal of Existing Structures	Sum	2,613.00	290.08	2,160.30	5,063.38	581.85	1,112.52	58.38	39.31	1,792.06	6,855.44	703.25	7,558.69	7,558.69		7,550.00
3	Cofferdam Pumping	Sum	80,824.44	8,623.77	45,387.33	134,835.54	12,224.53	34,412.18	1,805.80	825.86	49,268.37	184,105.91	14,775.03	198,878.94	198,878.94		198,800.00
4	Stripping Dam Site	250,000 c.y.	36,247.35	4,872.84	20,212.53	61,332.70	5,444.00	15,432.73	809.85	367.73	22,054.46	83,387.16	6,579.83	89,966.99	.360	.36	90,000.00
5	Common Excavation above Elev. 301	1,887,000 c.y.	195,129.27	28,295.28	96,651.34	320,075.89	26,031.85	83,079.13	4,359.64	1,758.64	115,229.29	435,305.18	31,463.11	466,768.29	.247	.25	471,750.00
6	Common Excavation below Elev. 301	739,000 c.y.	111,425.88	25,742.19	74,272.27	211,440.34	20,004.55	47,441.19	2,489.51	1,351.44	71,286.49	282,726.83	24,178.01	306,904.84	.415	.42	310,380.00
7	Stripping Borrow Areas A, B, & C	215,000 c.y.	28,505.85	3,995.45	15,303.74	47,805.04	4,121.88	12,136.78	636.89	278.46	17,174.01	64,979.05	4,981.86	69,960.91	.325	.32	68,800.00
8	Excavation & Haul, Borrow Area A	300,000 c.y.	97,462.59	19,423.39	54,883.95	171,769.93	14,782.33	41,496.12	2,177.54	998.65	59,454.64	231,224.57	17,866.49	249,091.06	.830	.83	249,000.00
9	Excavation & Haul, Borrow Area B	550,000 c.y.	78,163.04	8,503.74	38,960.70	125,627.48	10,493.60	33,279.05	1,746.34	708.92	46,227.91	171,855.39	12,682.96	184,538.35	.336	.33	181,500.00
10	Excavation & Haul, Borrow Area C	185,000 c.y.	36,093.95	4,568.82	18,678.73	59,341.50	5,050.89	15,367.53	806.42	339.87	21,544.71	80,886.21	6,080.53	86,966.74	.470	.47	86,950.00
11	Rock Excavation above Elev. 301	315,000 c.y.	102,290.51	68,566.49	85,913.14	256,770.14	21,139.68	45,551.67	2,285.41	1,563.25	70,540.01	327,310.15	27,967.48	355,277.63	1.128	1.13	355,950.00
12	Rock Excavation below Elev. 301	75,000 c.y.	37,164.88	23,741.35	33,939.51	94,845.74	9,141.20	15,823.49	830.35	617.55	26,412.59	121,258.33	11,048.40	132,306.73	1.764	1.76	132,000.00
13	Structure Backfill, Uncompacted	10,600 c.y.	232.00	40.32	328.38	600.70	88.45	98.78	5.18	5.98	198.39	799.09	106.90	905.99	.085	.08	848.00
14	Structure Backfill, Compacted	12,700 c.y.	319.61	28.98	3,461.25	3,809.84	932.25	136.08	7.14	62.98	1,138.45	4,948.29	1,126.75	6,075.04	.478	.48	6,096.00
15	Rolled Fill, Pervious	1,952,000 c.y.	40,052.80	13,433.00	147,971.02	201,456.82	39,848.22	17,053.06	894.87	2,698.44	60,494.59	261,951.41	48,169.31	310,120.72	.159	.16	312,320.00
16	Rolled Fill, Impervious	300,000 c.y.	10,693.78	2,074.60	15,198.43	27,966.81	4,093.52	4,553.03	238.92	276.55	9,162.02	37,128.83	4,947.58	42,076.41	.140	.14	42,000.00
17	Omitted																
18	Dumped Rock Fill	575,000 c.y.	34,557.52	6,680.66	93,619.71	134,857.89	25,215.35	14,713.57	772.10	1,703.48	42,404.30	177,262.19	30,476.22	207,738.41	.361	.36	207,000.00
19	Hand-laid Riprap	13,200 c.y.	775.15		15,503.00	16,278.15	4,175.55	330.03	17.32	282.09	4,804.99	21,083.14	5,046.72	26,129.86	1.980	1.98	26,136.00
20	Derrick Stone	2,600 c.y.	1,260.08	146.16	1,201.68	2,607.92	323.46	536.50	28.15	21.87	910.18	3,518.10	391.19	3,909.29	1.503	1.50	3,900.00
21	Gravel for Filters & Backing	115,000 c.y.	56,185.18	10,499.66	47,235.02	113,919.86	12,722.19	23,921.66	1,255.31	859.48	38,758.64	152,678.52	15,376.51	168,055.03	1.461	1.46	167,900.00
22	8" Gravel Drains	7,700 l.f.	283.13	212.22	1,264.28	1,759.63	340.52	120.55	6.32	23.00	490.39	2,250.02	411.56	2,661.58	.346	.34	2,618.00
23	Sand for Filters	81,000 c.y.	36,389.15	6,723.12	22,217.57	65,329.84	5,984.04	15,493.21	813.02	404.27	22,694.54	88,024.38	7,232.53	95,256.91	1.176	1.17	94,770.00
24	Line Drilling for Rock Excavation	68,000 s.f.	11,434.80	5,168.10	18,456.06	35,058.96	4,970.92	4,868.53	255.48	335.82	10,430.75	45,489.71	6,008.04	51,497.75	.757	.75	51,000.00
25	Drilling 3" Holes in Rock for Grouting	5,700 l.f.	944.49	359.38	1,609.83	2,913.70	433.59	402.13	21.10	29.29	886.11	3,799.81	524.05	4,323.86	.759	.76	4,332.00
26	Drilling 2½" Holes in Rock for Anchors	3,000 l.f.	371.23	329.74	1,124.52	1,825.49	302.88	158.06	8.25	20.46	489.69	2,315.18	366.07	2,681.25	.894	.90	2,700.00
27	Pressure Grouting	2,300 s.f.	820.59	274.24	1,969.80	3,064.63	530.54	349.38	18.33	35.84	934.09	3,998.72	641.23	4,639.95	2.017	2.00	4,600.00
28	Furnishing Cement	87,000 bbls.	8,107.11	200,657.28	9,982.14	218,746.53	2,688.57	3,451.72	181.13	181.63	6,503.05	225,249.58	3,249.50	228,499.08	2.626	2.63	228,810.00
29	Concrete, in Intake Structure, Bridge Pier & Conduit Transition	18,000 c.y.	33,012.92	39,116.06	85,194.23	157,323.21	24,025.40	12,352.67	648.22	1,622.96	38,647.25	195,970.46	29,035.58	225,006.04	12.50	12.50	225,000.00
30	Concrete in Conduits	8,800 "	11,085.73	16,420.18	28,112.36	55,618.27	7,471.73	4,719.91	247.68	511.52	13,050.84	68,669.11	9,151.47	77,820.58	8.843	8.85	77,880.00
31	Concrete in Outlet Approach Channel Walls, Spillway Walls and Weir	29,500 "	35,081.05	43,581.85	79,404.82	158,067.70	21,386.74	14,936.27	783.79	1,444.83	38,551.63	196,619.33	25,848.81	222,468.14	7.541	7.60	224,200.00
32	Concrete in Bridge Deck	90 "	211.67	798.47	1,981.56	2,991.70	533.71	90.12	4.73	36.06	664.62	3,656.32	645.06	4,301.38	47.793	47.00	4,230.00
33	Concrete in Steps, Trash Bars, Grout Recesses & Misc. Work	1,200 "	2,190.32	1,142.53	3,358.17	6,691.02	904.48	932.56	48.94	61.10	1,947.08	8,638.10	1,093.19	9,731.29	8.109	8.20	9,840.00
34	Concrete in the Stilling Basin	18,500 "	18,441.97	11,797.25	34,963.28	65,202.50	9,416.94	7,851.94	412.04	636.18	18,317.10	83,519.60	11,381.67	94,901.27	5.130	5.13	94,905.00
35	Reinforcing Steel	2,051,000 lbs.	1,746.38	61,830.00	34,927.68	98,504.06	9,407.35	743.55	39.02	635.54	10,825.46	109,129.52	11,370.08	120,499.60	.059	.06	123,060.00
36	Service Bridge Metal	168,000 "	811.03	7,610.09	2,120.50	10,541.62	571.13	345.31	18.12	38.58	973.14	11,514.76	690.29	12,205.05	.073	.07	11,760.00
37	Wrought Iron & Steel Trash Bars	169,000 "	299.30	13,537.52	345.92	14,122.74	93.17	101.89	5.35	6.29	206.70	14,329.44	112.61	14,442.05	.085	.09	15,210.00
38	Cast Iron Conduit Liners	624,000 "	771.81	81,176.92	916.24	82,864.97	246.78	328.61	17.24	16.67	609.30	83,474.27	298.27	83,772.54	.134	.14	87,360.00
39	Water Level Recording System	Sum	4.40	279.00	88.00	371.40	23.70	1.87	.10	1.60	27.27	398.67	28.65	427.32	427.32		430.00
40	Sheet Metal	14,000 lbs.	66.83	1,960.00	1,336.60	3,363.43	360.00	28.45	1.49	24.32	414.26	3,777.69	435.11	4,212.80	.301	.30	4,200.00
41	Miscellaneous Metal	105,000 "	521.10	8,400.00	10,422.00	19,343.10	2,807.04	221.88	11.64	189.64	3,230.20	22,573.30	3,392.70	25,966.00	.247	.25	26,250.00
42	Copper Water Stops	6,000 "	17.28	1,980.00	345.60	2,342.88	93.08	7.36	.39	6.29	107.12	2,450.00	112.50	2,562.50	.427	.42	2,520.00
43	Hand Rail, Stilling Basin	300 l.f.	21.09	747.67	301.70	1,070.46	81.26	8.98	.47	5.49	96.20	1,166.66	98.21	1,264.87	4.216	4.20	1,260.00
44	Service Bridge Railing	Sum	51.07	2,189.00	841.30	3,081.37	226.59	21.74	1.14	15.31	264.78	3,346.15	273.87	3,620.02	3,620.02		3,600.00
45	18" Corrugated Iron Pipe	270 "	8.96	769.50	179.44	957.60	48.25	3.81	.20	3.26	55.52	1,013.12	58.32	1,071.44	3.968	4.00	1,080.00
46	Piezometer & Settlement Gauges	Sum	501.10	3,158.15	7,990.00	11,649.25	2,152.01	213.35	11.20	145.38	2,521.94	14,171.19	2,601.00	16,772.19	16,772.19		16,800.00
47	Tile Gauges	120 "	34.56	673.80	691.20	1,399.56	186.17	14.71	.77	12.58	214.23	1,613.79	225.01	1,838.80	15.323	15.00	1,800.00
48	Operating House Superstructure	Sum	2,488.73	44,249.64	32,521.25	79,259.62	8,759.21	1,059.62	55.60	591.75	10,466.18	89,725.80	10,586.71	100,312.51	100,312.51		100,300.00
49	Gates, Guides and Hoists	Sum	1,744.56	185,161.28	4,651.20	191,557.04	1,252.74	742.77	38.98	84.63	2,119.12	193,676.16	1,514.11	195,190.27	195,190.27		195,200.00
50	Crane	Sum	90.83	11,594.00	1,816.60	13,501.43	489.28	38.67	2.03	33.05	563.03	14,064.46	591.36	14,675.82	14,675.82		14,700.00
51	Gasoline Electric Generating Set	Sum	20.98	5,304.25	439.46	5,764.89	113.03	8.93	.47	7.64	130.07	5,894.96	136.61	6,031.57	6,031.57		6,000.00
52	Miscellaneous Operating House Equipment and piping	Sum	111.80	4,645.00	2,236.00	6,992.80	609.24	47.60	2.50	40.69	693.03	7,685.83	727.89	8,413.72	8,413.72		8,400.00
53	Electrical Conduits & Supports	Sum	142.89	2,843.36	2,857.80	5,844.05	769.71	60.84	3.19	52.00	885.74	6,729.79	930.31	7,660.10	7,660.10		7,700.00
54	Elec. Power and Light System	Sum	245.00	11,129.59	4,899.80	16,274.39	1,319.70	104.31	5.47	89.16	1,518.64	17,793.03	1,595.04	19,388.07	19,388.07		19,400.00
55	Gravel Surfacing for Roadway	8,000 s.y.	1,086.66	225.34	931.40	2,243.40	250.96	462.66	24.28	16.95	754.75	2,998.15	303.20	3,301.35	.413	.40	3,200.00
56	Bituminous Surface Treatment for Roadway	6,000 gal.	149.44	1,001.04	268.72	1,419.20	72.58	63.63	3.34	4.89	144.24	1,563.44	87.48	1,650.92	.275	.28	1,680.00
57	Highway Guard Rail	5,000 l.f.	59.82	1,795.20	1,196.30	3,051.32	322.21	25.47	1.34	21.77	370.79	3,422.11	389.43	3,811.54	.762	.80	4,000.00
58	Cobble Gutters	2,300 "	98.59	113.66	411.72	623.97	110.89	41.98	2.20	7.49	162.56	786.53	134.03	920.56	.400	.40	920.00
59	12" Tile Drains	170 "	4.00	110.50	80.00	194.50	21.58	1.70	.06	1.46	24.80	219.30	26.04	245.34	1.443	1.40	238.00
60	Top Soil	25,000 c.y.	4,888.44	915.20	5,518.80	11,322.44	1,486.42	2,081.32	109.22	100.42	3,777.38	15,099.82	1,796.55	16,896.37	.676	.70	17,500.00
61	Seeding	30 Acres	280.13	731.04	2,812.60	3,823.77	757.54	119.27	6.26	51.18	934.25	4,758.02	915.59	5,673.61	189.120	190.00	5,700.00
	SUB-TOTALS		1,120,810.80	1,016,377.95	1,230,308.38	3,367,497.13	331,366.84	477,201.52	25,041.52	22,386.38	855,998.26	4,223,495.39	400,504.84	4,624,000.23			4,638,183.00
	Inspection		6,115.08	3,676.05	94,689.43	104,480.56	25,501.47	2,603.59	136.62	1,722.94	29,966.62	134,447.18	30,824.45	165,271.63			165,300.00
	Surveys		4,570.56	2,318.40	27,292.00	34,180.96	7,334.61	1,945.98	102.12	495.51	9,878.22	43,999.18	8,864.89	52,864.07			52,900.00
	TOTALS		1,131,496.44	1,022,372.40	1,352,229.81	3,506,098.65	364,206.92	481,751.09	25,280.26	24,604.83	895,843.10	4,401,941.75	440,194.18	4,842,135.93			4,856,383.00
						79.6%	8.3%	10.9%	0.6%	0.6%	20.4%	100%	10%	110%			

Approved:

A. K. B. Lyman
Colonel, Corps of Engineers
District Engineer

Section 2

(7)

ABSTRACT OF BIDS

Invitation for Bids No. 175-40-1 for
Construction of Franklin Falls Dam, Pemigewasset River, N. H.

U. S. Engineer Office, Boston, Mass.
Opened 2:00 P.M., E.D.S.T., August 9, 1939

BID NUMBER			1		2		3		4		5		6		7		8		GOVERNMENT ESTIMATE	
NAME AND ADDRESS OF BIDDER			C. J. Maney Co., Inc. 84 Dane Street Somerville, Mass.		B. Perini & Sons, Inc. Framingham, Mass.		The Arundel Corp. Pier 2, Pratt St. Baltimore, Md.		Utah Construction Co., Missouri Valley Bridge & Iron Co., Winston Bros. Co. Minneapolis, Minn.		Harrison Constr. Co., Pittsburgh, Pa. Winder Constr. Corp., Chicago, Ill.		Geo. H. Brewster & Son, Inc. 275 Fort Lee Rd., Bogota, N. J.		Arthur A. Johnson Corp. Moore Co., Inc. Long Island City, N.Y.		Coleman Bros. Corp., 245 State Street Boston, Mass.			
Item No.	Designation	Quantities	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount	Unit Price	Amount
1.	Field Office	Lump Sum	-	$ 20,000.00	-	$ 15,000.00	-	$ 18,000.00	-	$ 11,000.00	-	$ 7,300.00	-	$ 15,000.00	-	$ 20,000.00	-	$ 28,000.00	-	$ 14,150.00
2.	Removal of Existing Structures	Lump Sum	-	2,500.00	-	1,000.00	-	5,000.00	-	9,000.00	-	5,000.00	-	90,000.00	-	2,500.00	-	15,000.00	-	7,550.00
3.	Diversion of River and Cofferdam Pumping	Lump Sum	-	215,000.00	-	150,000.00	-	250,000.00	-	245,000.00	-	232,000.00	-	202,870.00	-	310,000.00	-	100,000.00	-	198,800.00
4.	Stripping Rounds	250,000 c.y.	.30	75,000.00	.35	87,500.00	.50	125,000.00	.50	125,000.00	.37	92,500.00	.50	125,000.00	.37	92,500.00	.50	125,000.00	.36	90,000.00
5.	Common Excavation above El.301.0 MSL	1,887,000 c.y.	.39	735,930.00	.35	660,450.00	.40	754,800.00	.25	471,750.00	.32	603,840.00	.30	566,100.00	.24	452,880.00	.22	415,140.00	.25	471,750.00
6.	Common Excavation below El.301.0 MSL	739,000 c.y.	.39	288,210.00	.35	258,650.00	.40	295,600.00	.40	295,600.00	.44	325,160.00	.42	310,380.00	.45	332,550.00	.33	243,870.00	.42	310,380.00
7.	Stripping Borrow Areas A, B, and C	215,000 c.y.	.30	64,500.00	.20	43,000.00	.28	60,200.00	.35	75,250.00	.22	47,300.00	.25	53,750.00	.30	64,500.00	.50	107,500.00	.32	68,800.00
8.	Excavation and Haul, Borrow Area A	300,000 c.y.	.75	225,000.00	.60	180,000.00	.65	195,000.00	.70	210,000.00	.80	240,000.00	.50	150,000.00	.57	171,000.00	.42	126,000.00	.83	249,000.00
9.	Excavation and Haul, Borrow Area B	550,000 c.y.	.25	134,500.00	.20	110,000.00	.30	165,000.00	.25	137,500.00	.33	181,500.00	.36	198,000.00	.22	121,000.00	.22	121,000.00	.33	181,500.00
10.	Excavation and Haul, Borrow Area C	185,000 c.y.	.25	42,550.00	.25	46,250.00	.30	55,500.00	.31	57,350.00	.34	62,900.00	.41	75,850.00	.24	44,400.00	.26	48,100.00	.47	86,950.00
11.	Rock Excavation above El. 301.0 MSL	315,000 c.y.	2.00	630,000.00	1.75	551,250.00	2.50	787,500.00	1.30	409,500.00	1.40	441,000.00	2.25	708,750.00	1.45	456,750.00	1.65	519,750.00	1.13	355,950.00
12.	Rock Excavation below El. 301.0 MSL	75,000 c.y.	2.00	150,000.00	1.75	131,250.00	3.00	225,000.00	1.45	108,750.00	1.45	108,750.00	3.50	262,500.00	2.25	168,750.00	5.50	412,500.00	1.76	132,000.00
13.	Structure Backfill, unassigned	10,600 c.y.	.50	5,300.00	.60	6,360.00	.50	5,300.00	.15	1,590.00	.12	1,272.00	.15	1,590.00	.10	1,060.00	.13	1,378.00	.08	848.00
14.	Structure Backfill, compacted	12,700 c.y.	.60	7,620.00	.75	9,525.00	.75	9,525.00	.70	8,890.00	.73	9,271.00	.90	11,430.00	.12	1,524.00	.35	4,445.00	.48	6,096.00
15.	Hauled Fill, pervious	1,952,000 c.y.	.10	195,200.00	.12	234,240.00	.09	175,680.00	.14	273,280.00	.085	165,880.00	.07	136,640.00	.12	234,240.00	.07	136,640.00	.16	312,320.00
16.	Hauled Fill, impervious	300,000 c.y.	.10	30,000.00	.14	42,000.00	.10	30,000.00	.16	48,000.00	.085	25,500.00	.10	30,000.00	.12	36,000.00	.08	24,000.00	.14	42,000.00
17.	Omitted																			
18.	Rock Fill	575,000 c.y.	.40	230,000.00	.40	230,000.00	.25	143,750.00	.35	201,250.00	.24	138,000.00	.15	86,250.00	.40	230,000.00	.15	86,250.00	.36	207,000.00
19.	Hand-placed Riprap	13,200 c.y.	1.50	19,800.00	1.32	17,424.00	5.50	72,600.00	3.50	46,200.00	4.25	56,100.00	4.00	52,800.00	2.15	28,380.00	3.00	39,600.00	1.98	26,136.00
20.	Derrick Stone	2,600 c.y.	4.00	10,400.00	3.40	8,840.00	3.25	8,450.00	3.50	9,100.00	3.75	9,750.00	7.00	18,200.00	1.85	4,810.00	3.50	9,100.00	1.50	3,900.00
21.	Gravel for Filters & Backing	115,000 c.y.	1.15	132,250.00	1.00	115,000.00	2.35	270,250.00	1.50	172,500.00	1.60	184,000.00	1.20	138,000.00	1.77	203,550.00	1.00	115,000.00	1.46	167,900.00
22.	8" Gravel Drains	7,700 l.f.	.50	3,850.00	.60	4,620.00	1.25	9,625.00	.60	4,620.00	.35	2,695.00	.25	1,925.00	.65	5,005.00	1.00	7,700.00	.34	2,618.00
23.	Sand for Filters	82,000 c.y.	.60	48,600.00	.80	64,800.00	1.70	137,700.00	1.00	81,000.00	1.40	113,400.00	1.20	97,200.00	1.15	93,150.00	.75	60,750.00	1.17	94,770.00
24.	Line Drilling for Rock Excavation	68,000 s.f.	.40	40,800.00	.40	27,200.00	.70	47,600.00	.50	34,000.00	1.15	78,200.00	.65	44,200.00	.50	34,000.00	1.50	102,000.00	.75	51,000.00
25.	Drilling Holes in Rock for Pressure Grouting	5,700 l.f.	.50	2,850.00	.98	5,586.00	.70	3,990.00	1.00	5,700.00	2.50	14,250.00	.45	2,565.00	.35	1,995.00	1.00	5,700.00	.76	4,332.00
26.	Drilling Holes in Rock for, and Grouting Anchors	3,000 l.f.	.50	1,500.00	.75	2,250.00	1.00	3,000.00	1.50	4,500.00	.60	1,800.00	.55	1,650.00	.85	2,550.00	.50	1,500.00	.90	2,700.00
27.	Pressure Grouting	2,300 s.f.	1.00	2,300.00	1.00	2,300.00	1.40	3,220.00	2.00	4,600.00	1.45	3,335.00	.40	920.00	.95	2,185.00	1.00	2,300.00	2.00	4,600.00
28.	Furnishing Cement	87,000 bbl.	2.90	252,300.00	3.00	261,000.00	2.70	234,900.00	2.50	217,500.00	3.05	265,350.00	2.88	250,560.00	2.70	234,900.00	2.40	208,800.00	2.63	228,810.00
29.	Concrete in Intake Structure, Conduit Transition, and Bridge Piers	18,000 c.y.	10.50	189,000.00	11.00	198,000.00	11.50	207,000.00	13.00	234,000.00	11.90	214,200.00	12.00	216,000.00	10.00	180,000.00	8.50	153,000.00	12.50	225,000.00
30.	Concrete in Conduits	8,800 c.y.	10.00	88,000.00	11.00	96,800.00	10.50	92,400.00	17.00	149,600.00	10.10	88,880.00	10.50	92,400.00	10.00	88,000.00	18.00	158,400.00	8.85	77,880.00
31.	Concrete in Outlet Approach Channel Walls, Spill Way Walls and Weir	29,500 c.y.	6.50	191,750.00	7.00	206,500.00	9.50	280,250.00	9.50	280,250.00	8.20	241,900.00	6.25	184,375.00	6.00	177,000.00	8.50	250,750.00	7.60	224,200.00
32.	Concrete in Bridge Deck	90 c.y.	20.00	1,800.00	22.50	2,025.00	33.00	2,970.00	26.00	2,340.00	26.50	2,385.00	25.00	2,250.00	22.00	1,980.00	20.00	1,800.00	47.00	4,230.00
33.	Concrete in Steps, Trash Bars, Grout Recesses and Miscellaneous Work	1,200 c.y.	10.00	12,000.00	10.00	12,000.00	22.00	26,400.00	13.00	15,600.00	17.00	20,400.00	15.00	18,000.00	8.00	9,600.00	18.00	21,600.00	8.20	9,840.00
34.	Concrete in Stilling Basin	18,500 c.y.	7.25	134,125.00	7.00	129,500.00	9.50	175,750.00	10.00	185,000.00	9.00	166,500.00	6.60	122,100.00	9.00	166,500.00	9.00	166,500.00	5.13	94,905.00
35.	Reinforcing Steel	2,051,000 lb.	.039	79,989.00	.04	82,040.00	.05	102,550.00	.045	92,295.00	.043	88,193.00	.046	94,346.00	.04	82,040.00	.03	61,530.00	.06	123,060.00
36.	Service Bridge Metal	168,000 lb.	.15	25,200.00	.10	16,800.00	.08	13,440.00	.08	13,440.00	.11	18,480.00	.085	14,280.00	.07	11,760.00	.07	11,760.00	.07	11,760.00
37.	Wrought Iron and Steel Trash Bars	169,000 lb.	.15	25,350.00	.10	16,900.00	.16	27,040.00	.11	18,590.00	.18	30,420.00	.13	21,970.00	.20	33,800.00	.14	23,660.00	.09	15,210.00
38.	Cast Iron Conduit Liners	624,000 lb.	.10	62,400.00	.09	56,160.00	.12	74,880.00	.08	49,920.00	.10	62,400.00	.0918	57,283.20	.12	74,880.00	.08	49,920.00	.14	87,360.00
39.	Water Level Recorder System	Lump Sum	-	2,000.00	-	1,500.00	-	2,000.00	-	360.00	-	1,000.00	-	1,196.69	-	4,000.00	-	3,000.00	-	430.00
40.	Sheet Metal	14,000 lb.	.25	3,500.00	.20	2,800.00	.20	2,800.00	.32	4,480.00	.20	2,800.00	.095	1,330.00	.19	2,660.00	.14	1,960.00	.30	4,200.00
41.	Miscellaneous Metal	105,000 lb.	.15	15,750.00	.12	12,600.00	.20	21,000.00	.14	14,700.00	.06	6,300.00	.125	13,125.00	.12	12,600.00	.11	11,550.00	.25	26,250.00
42.	Copper Water Stops	6,000 lb.	.50	3,000.00	.30	1,800.00	.60	3,600.00	.45	2,700.00	.50	3,000.00	.50	3,000.00	.50	3,000.00	.50	3,000.00	.42	2,520.00
43.	Hand-rail, Stilling Basin	300 l.f.	3.00	900.00	3.50	1,050.00	3.50	1,050.00	3.50	1,050.00	2.40	720.00	3.25	975.00	3.45	1,035.00	3.50	1,050.00	4.20	1,260.00
44.	Service Bridge Railing	Lump Sum	-	3,000.00	-	3,500.00	-	4,000.00	-	5,000.00	-	4,000.00	-	4,000.00	-	7,000.00	-	3,000.00	-	3,600.00
45.	18" Corrugated Iron Pipe	270 l.f.	2.50	675.00	2.00	540.00	2.50	675.00	2.50	675.00	3.00	810.00	2.80	756.00	3.60	972.00	4.00	1,080.00	4.00	1,080.00
46.	Piezometers, Settlement Gages, Observation and Auxiliary Wells	Lump Sum	-	5,000.00	-	5,000.00	-	10,000.00	-	19,000.00	-	20,000.00	-	3,000.00	-	16,000.00	-	20,000.00	-	16,800.00
47.	Tile Gages	120 l.f.	10.00	1,200.00	5.00	600.00	5.00	600.00	6.00	720.00	8.50	1,020.00	7.00	840.00	4.50	540.00	5.00	600.00	15.00	1,800.00
48.	Operating House Superstructure	Lump Sum	-	75,000.00	-	50,000.00	-	70,000.00	-	60,000.00	-	60,000.00	-	70,000.00	-	95,000.00	-	50,000.00	-	100,300.00
49.	Gates, Guides and Hoists	Lump Sum	-	175,000.00	-	150,000.00	-	160,000.00	-	180,000.00	-	200,000.00	-	177,560.00	-	195,000.00	-	150,000.00	-	195,200.00
50.	Crane	Lump Sum	-	10,000.00	-	10,000.00	-	11,500.00	-	11,500.00	-	13,000.00	-	12,000.00	-	15,000.00	-	10,000.00	-	14,700.00
51.	Gasoline-Electric Generator Set	Lump Sum	-	5,000.00	-	4,000.00	-	4,500.00	-	4,500.00	-	5,500.00	-	4,600.00	-	8,000.00	-	4,000.00	-	6,000.00
52.	Misc. Operating House Equipment & Piping	Lump Sum	-	5,000.00	-	6,000.00	-	3,500.00	-	6,500.00	-	6,400.00	-	6,500.00	-	9,000.00	-	5,000.00	-	8,400.00
53.	Electrical Conduits and Supports	Lump Sum	-	5,000.00	-	4,000.00	-	6,000.00	-	6,000.00	-	6,800.00	-	4,560.00	-	7,000.00	-	4,500.00	-	7,700.00
54.	Electrical Power and Lighting System	Lump Sum	-	7,000.00	-	7,000.00	-	14,000.00	-	8,000.00	-	15,800.00	-	10,000.00	-	16,000.00	-	8,000.00	-	19,400.00
55.	Gravel Surface for Roadway	8,000 s.y.	.50	4,000.00	.35	2,800.00	1.00	8,000.00	.45	3,600.00	.75	6,000.00	.45	3,600.00	.60	4,800.00	.50	4,000.00	.40	3,200.00
56.	Bituminous Surface Treatment for Roadway	6,000 gal.	.15	900.00	.20	1,200.00	.15	900.00	.20	1,200.00	.25	1,500.00	.25	1,500.00	.14	840.00	.13	780.00	.28	1,680.00
57.	Highway Guard Rail	5,000 l.f.	1.00	5,000.00	.90	4,500.00	1.20	6,000.00	.75	3,750.00	1.45	7,250.00	.65	3,250.00	.60	3,000.00	.70	3,500.00	.80	4,000.00
58.	Cobble Gutters	2,300 l.f.	1.00	2,300.00	.80	1,840.00	1.25	2,875.00	1.10	2,530.00	1.50	3,450.00	.55	1,265.00	.80	1,840.00	1.00	2,300.00	.40	920.00
59.	12" Pipe Drains	170 l.f.	1.00	170.00	1.00	170.00	2.00	340.00	1.00	170.00	2.50	425.00	3.00	510.00	1.32	224.40	2.00	340.00	1.40	238.00
60.	Top Soil	25,000 c.y.	1.00	25,000.00	.75	18,750.00	1.00	25,000.00	.60	15,000.00	.60	15,000.00	.75	18,750.00	.55	13,750.00	.25	6,250.00	.70	17,500.00
61.	Seeding	30 acre	150.00	4,500.00	200.00	6,000.00	125.00	3,750.00	275.00	8,250.00	200.00	6,000.00	85.00	2,550.00	300.00	9,000.00	200.00	6,000.00	190.00	5,700.00
	TOTAL BID PRICE			$4,726,469.00		$4,375,134.00		$5,456,960.00		$4,669,150.00		$4,604,006.00		$4,785,001.89		$4,602,000.40		$4,265,853.00		$4,636,183.00
	SURETY AND AMOUNT			Fidelity & Deposit Company of Maryland $600,000.00		Maryland Casualty Company $500,000.00		Fidelity & Deposit Company of Maryland $600,000.00		The Aetna Casualty and Surety Company 10 Percent of Bid		Fidelity & Deposit Company of Maryland $600,000.00		The Aetna Casualty and Surety Company $500,000.00		Fidelity & Deposit Company of Maryland $600,000.00		Maryland Casualty Company $500,000.00		(Inspection) 165,300.00 (Surveys) 52,900.00
	TOTAL, including Overhead and Supervision																			$4,856,383.00

Section 3

DATA FOR COMPARING ESTIMATE WITH LOWEST RESPONSIBLE BID

1. Total estimated cost by Government plant and hired labor: $4,856,383.00

2. Total estimated cost of doing work by contract:

   (a) Contract Cost (Lowest Responsible Bid) $4,265,853.00

   (b) Estimated Government Cost:

1. Surveys	$ 43,022.08	
2. Inspection	$ 124,624.60	
3. Superintendence	$ 119,733.12	
4. Material furnished by United States	$ 0.00	
5. Overhead 7½% of $4,553,232.80 (low bid plus Government field cost)	$ 341,492.46	$628,872.26

   TOTAL (a) plus (b) $4,894,725.26

3. Difference . . . . . $ 38,342.26

4. Percent of difference . . . . . = .79 of 1%

GENERAL INFORMATION

1. LOCATION: On Penigewasset River about 2-1/2 miles north of Franklin Falls, in Merrimack County, New Hampshire.

2. TYPE OF CONSTRUCTION: Rolled earth fill, excavated spillway with concrete weir, discharge channel partially in rock excavation. Concrete outlet conduits in rock excavation with excavated approach concrete gate & control tower with control and emergency gates and operating mechanism. Concrete stilling basin and excavated discharge channel serving both spillway and outlet.

3. TOP LENGTH AND ELEVATION OF DAM:
   Top length: 2560 feet
   Elevation: 416 M.S.L.

4. HEIGHT: (Max.) 136 feet

5. BASE WIDTH (Max.) 1400 feet

6. BORROW PIT LOCATION: Pervious fill and concrete material just east of east end of dam. Core material Webster Lake Pit approximately 4 miles west of west end of dam reached by concrete highway #3A and 14. All other fill available from required excavation.

7. AVERAGE LENGTH HAUL:

Compacted pervious fill	2,200 feet
Selected pervious fill	3,200 feet
Impervious fill	4-1/4 miles

8. GRAVEL PIT LOCATION: Borrow Area "C" - East of east end of Dam.

9. AVERAGE LENGTH HAUL: 3600 feet.

10. PROPOSED PLANT EARTH EXCAVATION: Power shovels, LeTourneau scrapers, Linn Tractors, Bulldozers, etc.

11. PROPOSED PLANT ROCK EXCAVATION: Power shovels, dump truck, Linn tractors, Bulldozers, Compressors, wagon drills, drifters and jackhammers.

12. PROPOSED PLANT, CONCRETE PLACING: Screening, crushing and washing plant, bins, batcher transit mixers and pump-crete.

13. STRUCTURES TO BE MOVED: 3200 feet of 18-foot concrete highway #3A, one set of farm buildings, fences, etc.

14. NEAREST RAILROAD SIDING: Franklin Falls, approximately 3 miles.

15. KIND OF ROAD TO SITE: On west side of river 18-foot concrete highway. On east side bituminous macadam 18 feet wide for 2 miles - then over 1 mile of construction road.

16. SUPPLIES TO BE DELIVERED BY: Trucks of various sizes. New Hampshire law allows no more than 26,000 lbs. on two axles and 38,000 lbs. on three axles.

17. AVAILABILITY OF ELECTRIC POWER: High tension line passes about half mile west of west end of dam.

SCHEDULE OF BID ITEMS

Item No.	Description	Unit
1.	Field Office	Lump Sum
2.	Removal of Existing Structures	Lump Sum
3.	Cofferdam Pumping	Lump Sum
4.	Stripping Damsite	250,000 C.Y.
5.	Common Excavation Above El. 301 Damsite	1,887,000 C.Y.
6.	Common Excavation Below El. 301 Damsite	739,000 C.Y.
7.	Stripping Borrow Areas A, B and C	215,000 C.Y.
8.	Excavation and Haul, Borrow Area A	300,000 C.Y.
9.	Excavation and Haul, Borrow Area B	550,000 C.Y.
10.	Excavation and Haul, Borrow Area C	185,000 C.Y.
11.	Rock Excavation Above El. 301	315,000 C.Y.
12.	Rock Excavation Below El. 301	75,000 C.Y.
13.	Structure Backfill, Uncompacted	10,600 C.Y.
14.	Structure Backfill, Compacted	12,700 C.Y.
15.	Rolled Fill, Pervious	1,952,000 C.Y.
16.	Rolled Fill, Impervious	300,000 C.Y.
17.	Omitted	
18.	Dumped Rock Fill	575,000 C.Y.
19.	Hand-laid Riprap	13,200 C.Y.
20.	Derrick Stone	2,600 C.Y.
21.	Gravel for Filters and Backing	115,000 C.Y.
22.	8" Gravel Drains	7,700 L.F.
23.	Sand for Filters	81,000 C.Y.
24.	Line Drilling for Rock Excavation	68,000 S.F.
25.	Drilling 3" Holes in Rock for Grouting	5,700 L.F.
26.	Drilling 2-1/2" Holes in Rock for Anchors	3,000 L.F.
27.	Pressure Grouting	2,300 C.F.
28.	Furnishing Cement	87,000 Bbl.
29.	Concrete in Intake Structure, Bridge Piers and Conduit Transition	18,000 C.Y.
30.	Concrete in Conduits	8,800 C.Y.
31.	Concrete in Outlet Approach Channel Walls, Spillway Walls and Weir	29,500 C.Y.

Item No.	Description	Unit
32.	Concrete in Bridge Deck	90 C.Y.
33.	Concrete in Stops, Trash Bars, Grout Recesses and Miscellaneous Work	1,200 C.Y.
34.	Concrete in Stilling Basin	18,500 C.Y.
35.	Reinforcing Steel	2,051,000 Lb.
36.	Service Bridge Metal	168,000 Lb.
37.	Wrought Iron and Steel Trash Bars	169,000 Lb.
38.	Cast Iron Conduit Liners	624,000 Lb.
39.	Water-Level Recorder System	Lump Sum
40.	Sheet Metal	14,000 Lb.
41.	Miscellaneous Metal	105,000 Lb.
42.	Copper Water Stops	6,000 Lb.
43.	Hand-rail, Stilling Basin	300 L.F.
44.	Service Bridge Railing	Lump Sum
45.	18" Corrugated Iron Pipe	270 L.F.
46.	Piezometer and Settlement Gages	Lump Sum
47.	Tile Gages	120 L.F.
48.	Operating House Superstructure	Lump Sum
49.	Gates, Guides and Hoists	Lump Sum
50.	Crane	Lump Sum
51.	Gasoline-electric Generating Unit	Lump Sum
52.	Miscellaneous Operating House Equipment and Piping	Lump Sum
53.	Electrical Conduits and Supports	Lump Sum
54.	Electric Power and Light System	Lump Sum
55.	Gravel Surfacing for Roadway	8,000 S.Y.
56.	Bituminous Surface Treatment for Roadway	6,000 Gal.
57.	Highway Guard Rail	5,000 L.F.
58.	Cobble Gutters	2,300 L.F.
59.	12" Tile Drains	170 L.F.
60.	Top Soil	25,000 C.Y.
61.	Seeding	30 Acres

PROPOSED SCHEDULE OF OPERATIONS

DISCUSSION

1. Since operations will start late in the 1939 season, it will be necessary to carry on construction operations during three working seasons, 1939, 1940 and 1941. The controlling factor in the construction schedule is the necessity for planning operations in such a manner as to allow for the annual spring flood. The critical season will be in 1941 when diversion of the river, closure of the dam and placement of a very large volume of material will have to be accomplished.

2. First Season. - From August 1 to December 15, 1939, it is proposed to construct the drainage trenches on the terraces on either side of the river section, commence stripping in excavation and borrow areas, excavate for and start construction of the conduits, and place embankment on both terraces with materials excavated from the conduit area. In addition, construction roads will be started and completed where necessary and the bridge built downstream from the embankment. Operations will be started on excavation of the discharge channel, most of which will be done by hydraulic dredging since the channel area is below normal water elevations.

3. Second Season. - In this season the major portion of the concrete work of the project will be completed, only the spillway walls and weir being left for 1941. The outlet structures and appurtenances, including the service bridge but not the operating house superstructure are to be completed and placed in condition to allow the diversion of the river through the conduits at the start of the 1941 season. The embankment section on both terraces will be built to Elev.390.

4. Third Season. - As early in 1941 as the river stage and frost conditions will permit, it is proposed to construct the cofferdams, divert the stream through the outlet works, unwater the river section, construct the drainage trench in the river section, remove mucky material and proceed with the completion of the embankment as rapidly as possible. It will be necessary to place more than 20,000 cu. yds. per 24-hour day for a portion of the season in order to accomplish the objective. The operating house superstructure will be constructed. Placement of concrete in the spillway walls and weir will be undertaken as soon as excavation is completed in those sections, and construction of access roads, placement of top soil and seeding must be done before the ground freezes.

5. General Discussion - a. As previously noted, the greater portion of the under-water excavation in the discharge channel will be done by hydraulic dredging. For all other under-water excavation, including the drainage trenches on the terraces, the outlet approach channel, portions of the spillway and outlet discharge channels, and the unwatering operations in the river section, wellpoints will be used. In addition, 12-inch pumps will be used in the unwatering operations between cofferdams in the river section.

b. Rock excavation operations in the spillway and outlet channels will be carried on at such rates as necessary to build up the rock shell to approximately the same elevations as the earth fill in the embankment.

c. In order to furnish water for all operations it is proposed to bury 6-inch water mains in the foundation upstream and downstream from and parallel to the center line of the dam and to take 2-inch risers off these mains at about 300-foot intervals, carrying the risers up within the fill.

d. An air compressor station for drilling operations in the outlet and spillway areas will consist of two 625-cubic-foot compressors, Diesel operated, and will be located on the west abutment downstream of the center line of the dam and between the spillway channel and stilling basin walls.

e. In order to secure a maximum flexibility in concrete operations, it is proposed to use 4-yard transit mixers charged at a processing and batching plant located between Borrow Areas B and C. Placement will be by means of pumpcrete.

DISCUSSION (continued)

f. Because of the New Hampshire limitation on loads on state highways of 26,000 pounds on 2 axles and 38,000 pounds on 3 axles, it has been necessary to resort to the use of 4-yard trucks for the procurement of core material from Borrow Area A near Webster Lake. For selected pervious materials and sand and gravel it is proposed to use 9-yard Linn tractor trucks because of their great adaptability in loose sand. Eighteen-yard LeTourneau scrapers powered with D8 tractors will be used in the spillway excavation area because of the suitability of this plant for short hauls in soft materials. Two-and-one-half-yard power shovels will be used for rock excavation and 2-yard power shovels for excavation in the spillway and outlet channel areas where boulders are expected to be encountered. The 9-yard Linn tractor trucks will be used for transporting these materials.

CONSTRUCTION SCHEDULE 1939

OPR. NO.	PAY ITEM	OPERATING ITEMS	EXCAV QUAN. IN CUBIC YDS.	PLACEMENT LOCATION	PLACEMENT QUANTITY	OPERATING TIME (AUG. – DEC.)	HAULING EQUIPMENT ETC.
1	Sec. 14(C)	Construction Trestle		Downstream 650 Feet		①	Boiler 30 H.P., D4 Bulldozer 30 H.P., Compressor 315 cu. ft., Crane Boom
2	Sec. 14(C)	Construction Roads	145,000	Left Bank		④	D4 30 H.P. and D8 90 H.P. Bulldozer with each shovel
3	7	Stripping, Borrow Areas "B" and "C"	"C" 44,000 "B" 80,000	Spoil at Site		⑤ 2 LeT. 2 LeT.	6 Dump Trucks, 4 cu.yd. [illegible] 8 Dump Trucks, 4 cu.yd. [illegible] Use one D8 Bulldozer 90 H.P. for loading.
4	4	Stripping, Left Terrace	40,000	Spoil Downstream		① ② D.L. D.L. 2 LeT.	2 D8 Bulldozers 90 H.P., 2 Linn Tractor Trucks 9 cu.yd.
5	4	Stripping, Right Terrace	62,900	Spoil Downstream		③ D.L. 2 LeT.	2 D8 Bulldozers 90 H.P., 2 Linn Tractor Trucks until August 15
6	Sec. 17	Excavation and Haul	256,500	Gravel and Batching Plant		3 LeT. 2 LeT.	D8 Bulldozer 90 H.P. Loading, Boiler 90 H.P. after October 15
7A	5	Earth Excavation (Drainage Trench)	26,800	Compacted Fill under Impervious Blanket	W 14,400 E 9,700	② D.L.	D4 Bulldozer 30 H.P., 2 Linn Tractor Trucks
7B	5	Earth Excavation (Core Trench "A")	3,900	Compacted Fill under Impervious Blanket	E 3,500		
7C	23	Sand (From Processing Plant)	9,500	3 Foot Sand Filter (Drainage Trenches)	W 4,600 E 3,900		2 Linn Tractor Trucks
7D	21	Gravel (From Processing Plant)	25,300	Gravel Backfill (Drainage Trenches)	W 13,750 E 9,060		3 Linn Tractor Trucks, One D4 Bulldozer 30 H.P.
8	Sec. 14(C)	Construction Roads	42,000	Right Bank		③	4 Dump Trucks, 4 cu.yd., Two D8 Bulldozers 90 H.P.
9	5	Earth Excavation — Right Terrace Conduit Section	30,200 50,200	Compacted Fill under Impervious Blanket	W 14,600 E 57,800	④ ②	2 Linns with No. 4-8/25 to 9/3 otherwise 4 required with each shovel
10	4	Stripping, Spillway Discharge Channel	30,000	Spoil in Dike, Downstream		③	3 Linn Tractors and one D8 Bulldozer 90 H.P.
11	7	Stripping, Borrow Area "A"	22,000	Spoil at Site		①	4 Dump Trucks, 4 cu.yd., one D8 Bulldozer 90 H.P.
12	23	Sand (From Processing Plant)	48,000	Filter (Downstream)	W 22,900 E 20,300		4 Linn Tractor Trucks, 9 cu.yd.
13	21	Gravel (From Processing Plant)	40,200	Filter (Downstream)	W 18,750 E 17,450		3 Linn Tractor Trucks, 9 cu.yd.
14	11	Rock Excavation (Conduit Section, etc)	42,145	Rock Ballast (Downstream)	W 37,300 E 5,900	③ ②	5 Linn Tractor Trucks, 9 cu.yd.
15	5	Earth Excavation (Stilling Basin)	5,300	Compacted Fill below elevation 312.0	E 4,800	④	5 Linn Tractor Trucks, 9 cu.yd.
16	8	Excavation and Haul (Borrow Area "A")	74,200	3 Ft. Impervious Blanket and Core below elev. 320.	E 39,100 W 27,700	① ⑤	15 Dump Trucks, 4 cu.yd. (30 days), 21 Dump Trucks, 4 cu.yd. (15 days), 1 D8 Bulldozer 90 H.P.
17	5	Earth Excavation (Stilling Basin)	54,000	Compacted and dumped Fill above elev. 315.0	E 48,600	④	4 Linn Tractor Trucks, 9 cu.yd. until Oct. 6, then use 3 and 2 Dump Trucks.
18	9	Excavation and Haul (Borrow Area "B")	30,000	Selected Pervious Fill (Downstream)	E 26,400	⑤	4 Linn Tractor Trucks, 9 cu.yd.
19	11	Rock Excavation from vicinity Weir Section	29,800	Ballast and Shell Downstream to elev. 320.0	E 44,800	② ③	8 Linn Tractor Trucks, 9 cu.yd.
20	4	Stripping, Outlet Approach Channel	18,640	Dumped Fill above elevation 320.0	W 17,000	4 LeT	D8 Bulldozer 90 H.P. Loading
21	24	Line Drilling		Core Trench	Sq.ft. 3,000		Compressor and Drilling Equipment
22	33	Concrete		Grout Cap	250		3 Transit Mixers, 4 cu.yd., one Pumpcrete No. 160, one shift.
23	27	Pressure Grouting		Core Trench			1 Grout Pump, 1 Grout Mixer 10S, 1 Compressor 315 cu.ft., 1 Dump Truck 2 cu.yd.
24	30	Concrete Class "B"		Invert (Conduit Section)	3,170		4 Transit Mixers, 4 cu.yd., one Pumpcrete No. 200, one Steam Boiler 90 H.P.
25	29	Concrete Class "A"		Invert (Transition and Gate House)	2,640		4 Transit Mixers, 4 cu.yd., one Pumpcrete No. 200, one Steam Boiler 90 H.P.
26	30	Concrete		Conduits above Invert	5,670		4 Transit Mixers, 4 cu.yd., one Pumpcrete No. 200, one Steam Boiler 90 H.P.
27	29	Concrete		Transition and Gate House below elev. 334.0	7,444		3 Transit Mixers, 4 cu.yd., one Pumpcrete No. 200, one Steam Boiler 90 H.P.
28	33	Concrete		Grout Recesses	732		2 Transit Mixers, 4 cu.yd., 1 Pumpcrete No. 160 one shift, 1 Steam Boiler 90 H.P. three shifts
29	38	Cast Iron		Conduit Liners	Lbs. 624,000	⑦	Transportation furnished by Shop. Shovels equipped with Crane Boom
30	37	Wrought Iron and Steel		Trash Bars	Lbs. 169,000	②	Transportation furnished by Shop. Shovel equipped with Crane Boom
31	33	Concrete		Trash Bars	92	②	2 Transit Mixers, 4 cu.yd., 1 Pumpcrete No. 160 two shifts, 1 Steam Boiler 90 H.P. three shifts
32	Sec. 20(B)	Rolling and Compacting Embankment					3 D8 Bulldozers 90 H.P., 2 D4 Bulldozers 30 H.P., 2 Disc Rollers, 2 Sheepsfoot Rollers
33	Sec. 20(A)	Sprinkling Embankment					3 - 6" Pumps
34	18	Placing Rock Fill			108,000		4 D8 Bulldozers 90 H.P.
35	49	Gates and Guides			Lbs. 573,000	③	1 D4 Tractor 30 H.P. Shovel equipped with Crane Boom
36	29	Hauling Cement			Bbls. 84,000		2 Trailer Trucks, Cement, Cement Handling Equipment
37	35	Placing Steel			Lbs. 1,233,800		
38	Sec. 14(D)	Illumination					See Section 14 (D)
39	Sec. 14(A)	Shop and Garage, etc.					See Section 14 (A)
40	5	Earth Excavation (Outlet Discharge Channel)	140,000	Spoil on Right Bank			1 Dredge Hydraulic 12": 1 Motor Boat 7 H.P. and Barge 12' x 20'

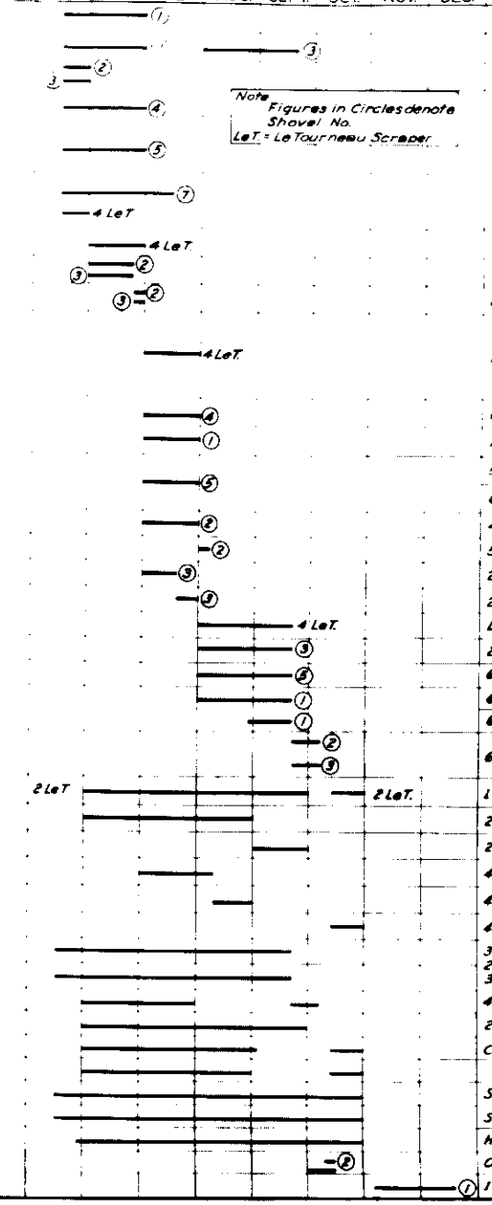
Note: Figures in circles denote Shovel No.
LeT. = LeTourneau Scraper
D.L. = Dragline

CONSTRUCTION SCHEDULE 1940

OPR NO.	PAY ITEM	OPERATING ITEMS	EXCAV QU (IN CU YDS)	PLACEMENT LOCATION	PLACEMENT QUANTITY	HAULING EQUIPMENT ETC.
1	8	Excavation and Haul (Borrow Area "A")	26,200	Compacted Impervious Fill, Elev. 320 to 350	E 23,600	10 Dump Trucks, 4 cu yd, 1 D4 Bulldozer, 30 H.P., 2 shifts
2	7	Stripping, Borrow Area "A"	50,000	Spoil at Site		4 Dump Trucks, 4 cu yd, 1 D4 Bulldozer, 30 H.P., 1 Shift with Shovel No. 1. 8 Dump Trucks, 4 cu yd, 1 D8 and 1 D4 Bulldozer, 1 Shift with Shovel No. 3
3	5	Earth Excavation (Stilling Basin)	6[illegible],470	Compacted Pervious Fill below Elev. 350.0	E 55,300	8 Linn Tractor Trucks, 9 cu yd
4	5	Earth Excavation (Spillway Discharge) (Weir	78,600	Compacted Pervious Fill below Elev. 350.0	E 70,700	5 Linn Tractor Trucks, 9 cu yd
5	9	Excavation and Haul (Borrow Area "B")	45,600	Selected Pervious Fill below Elev. 350.0	E 40,100	4 Linn Tractor Trucks, 9 cu yd at 27 Days
6	10	Excavation and Haul (Borrow Area "C")	28,900	4 Ft. Sand and Gravel Filter	E 25,400	5 Linn Tractor Trucks, 9 cu yd at 18 Days
7	4	Stripping (East Abutment)	28,000	Dumped Fill & Cofferdam (upstream)	E 25,200	3 Dump Trucks, 4 cu yd
8	Sec. 17	Stripping (For Processed Material)	58,000	Spoil at Site		D8 Bulldozer, 90 H.P.
9	5	Earth Excavation (Spillway Discharge Channel)	64,000	Compacted Pervious Fill to Elev. 350.0	E 57,600	D8 Bulldozer, 90 H.P.
10	11	Rock Excavation (Stilling Basin)	39,620	Rock Shell, East Bank and Riprap (Stilling Basin)	W 5,500 E 54,000	8 Linn Tractor Trucks, 9 cu yd
11	11	Rock Excavation (Spillway Discharge Channel)	10,200	Rock Shell, East Bank to Elev. 350.0	E 15,300	8 Linn Tractor Trucks, 9 cu yd
12	5	Earth Excavation (Spillway Discharge Channel)	40,000	Compacted Fill, Elev. 350.0 to 380.0	E 36,000	
13	5	Earth Excavation (Access Road)	37,700	Compacted Fill, Elev. 380.0 to 390.0	E 34,000	D8 Bulldozer, 90 H.P.
14	5	Earth Excavation (Access Road)	7,000	Compacted Fill (Access Road)	6,300	
15	5	Earth Excavation (Spillway Discharge Channel)	54,700	Compacted Fill, Elev. 350.0 to 390.0	E 49,200	6 Linn Tractor Trucks, 9 cu yd.
16	8	Excavation and Haul (Borrow Area "A")	25,600	Compacted Impervious Fill Elev. 350.0 to 390.0 Elev. 320.0 to 330±	E 15,800 W 7,200	15 Dump Trucks, 4 cu yd, 1 D4 Bulldozer, 30 H.P., 2 Shifts
17	9	Excavation and Haul (Borrow Area "B")	28,900	Selected Pervious Fill Elev. 350.0 to 390.0 Elev. 320.0 to 330±	E 11,000 W 14,600	5 Linn Tractor Trucks, 9 cu yd. at 15 Days
18	10	Excavation and Haul (Borrow Area "C")	28,900	4 Ft. Sand and Gravel Filter Elev. 350.0 to 390.0 Elev. 320.0 to 330±	E 21,800 W 3,600	6 Linn Tractor Trucks, 9 cu yd at 15 Days
19	11	Rock Excavation (Spillway Discharge Channel)	28,200	Rock Shell, Elev. 350.0 to 390.0	E 42,300	4 Linn Tractor Trucks, 9 cu yd.
20	5	Earth Excavation (Spillway Approach Channel E. Wall)	1,700	Stock Pile for Upstream Cofferdam	E 2,550	5 Linn Tractor Trucks, 9 cu yd at one Shift
21	11	Rock Excavation (Spillway Approach Channel E. Wall)	33,000	Compacted Fill, Elev. 320.0 to 330±	W 29,700	2 Linn Tractor Trucks, 9 cu yd, 2 Dump Trucks, 4 cu yd
22	5	Earth Excavation (Outlet Approach Channel)	12,000	Rock Shell, Elev. 320.0 to 330±	W 18,000	2 Linn Tractor Trucks, 9 cu yd, 2 Dump Trucks, 4 cu yd
23	8	Excavation and Haul (Borrow Area "A")	185,000	Compacted Fill, Elev. 330± to 390.0	W 166,300	D8 Bulldozer, 90 H.P.
24	9	Excavation and Haul (Borrow Area "B")	33,500	Compacted Impervious, Elev. 330± to 390.0	W 30,200	22 Dump Trucks, 4 cu yd, 1 D4 Bulldozer, 30 H.P., 1 Shift
25	10	Excavation and Haul (Borrow Area "C")	93,300	Selected Pervious, Elev. 330± to 390.0	W 82,100	6 Linn Tractor Trucks, 9 cu yd
			24,500	4 Ft. Sand and Gravel Filter, Elev. 330± to 390.0	W 21,600	6 Linn Tractor Trucks, 9 cu yd, at 1 Shift
			12,000	Stock pile for Upstream Cofferdam	W 10,800	6 Linn Tractor Trucks, 9 cu yd, at 1 Shift
26	11	Rock Excavation (Outlet Approach Channel)	31,440	Rock Shell, Elev. 330± to 390.0	W 37,600	
				Riprap (Outlet Approach Channel)	W 9,500	6 Linn Tractor Trucks, 9 cu yd., for 7 days, then 8 required
27	Sec. 17	Excavation and Haul	195,200	Gravel and Batching Plant		1 D8 Bulldozer, 90 H.P., Boiler 90 H.P. after Oct. 12
28A	29	Concrete		Intake Structure above Elev. 334.0	7,345	2 Transit Mixers, 4 cu yd, 1 Pumpcrete No. 160, 1 Hoist, gas, 25 H.P.
28B	29	Concrete		Bridge Pier and Abutment	570	2 Transit Mixers, 4 cu yd until Sept. 21, then use 1, 1 Pumpcrete No. 160.
29	34	Concrete		Stilling Basin	18,500	4 Transit Mixers, 4 cu yd, 1 Pumpcrete No. 200
30	31	Concrete		Spillway Channel East Wall	9,410	4 Transit Mixers, 4 cu yd, 1 Pumpcrete No. 200
31	31	Concrete		Outlet Approach Channel Walls	8,850	4 Transit Mixers, 4 cu yd, 1 Pumpcrete No. 200, Steam Boiler 90 H.P.
32	Sec. 20(B)	Rolling and Compacting Embankment				3 D8 Bulldozers, 90 H.P. (Rolling), 2 D4 Bulldozers, 30 H.P., 2 Disc Rollers, 2 Sheepsfoot Rollers.
33	Sec. 20(A)	Sprinkling Embankment				3 Pumps, 6"
34	18	Placing Rock Fill			167,200	4 D8 Bulldozers, 90 H.P. except 2 required July 1 to 18
35	21	Gravel for Filters	20,400	1 Ft. Layer under Rock Shell (Upstream)	18,400	2 Dump Trucks, 2 cu yd
36	28	Hauling Cement			Bbls. 50,500	Cement Truck, See Section 48
37	35	Placing Steel			Lbs. 772,800	
38	Sec. 14(D)	Illumination				See Section 14 (D)
39	Sec. 14(A)	Shop and Garage, etc.				See Section 14 (A)
40	5	Earth Excavation (Lower Discharge Channel)	385,000	Spoil on West Bank		Hydraulic Dredge, 12", Boat (outboard motor), Barge 12' x 20'
41	36	Service Bridge			Lbs. 168,000	Compressor 315 cf, Shovel No. 2 with Crane Boom Oct. 10 to 15, Shop Equip.
42	Sec. 14(C)	Construction Trestle (Move)				1 D4 Bulldozer, 30 H.P., Boiler 30 H.P., Pile Hammer, Crane Boom

OPERATING TIME: APRIL, MAY, JUNE, JULY, AUG., SEPT., OCT., NOV., DEC.

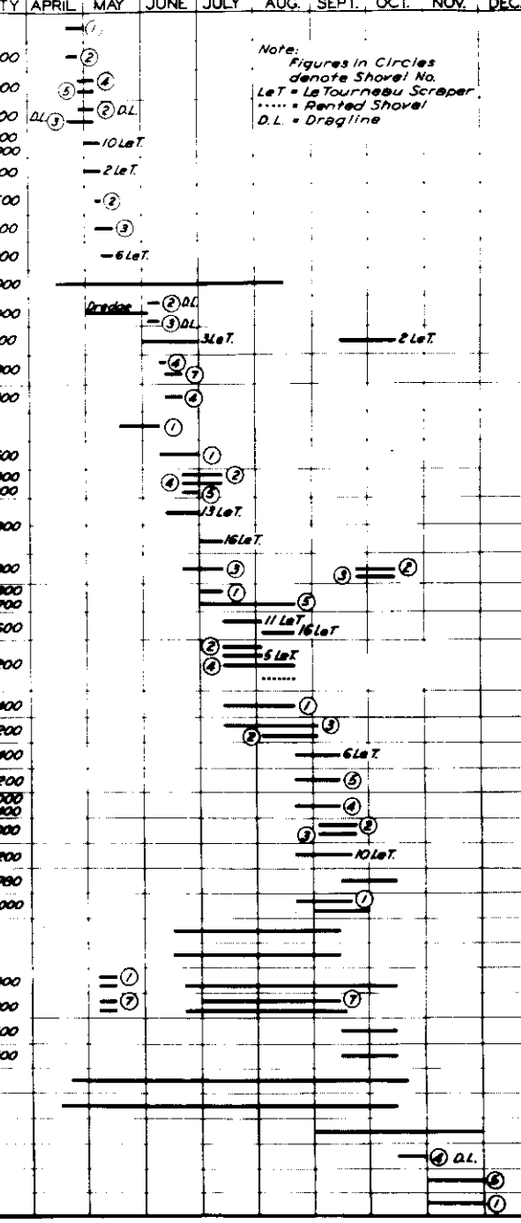
Note: Figures in Circles denote Shovel No.
LeT. = Le Tourneau Scraper



Section 5 (B)

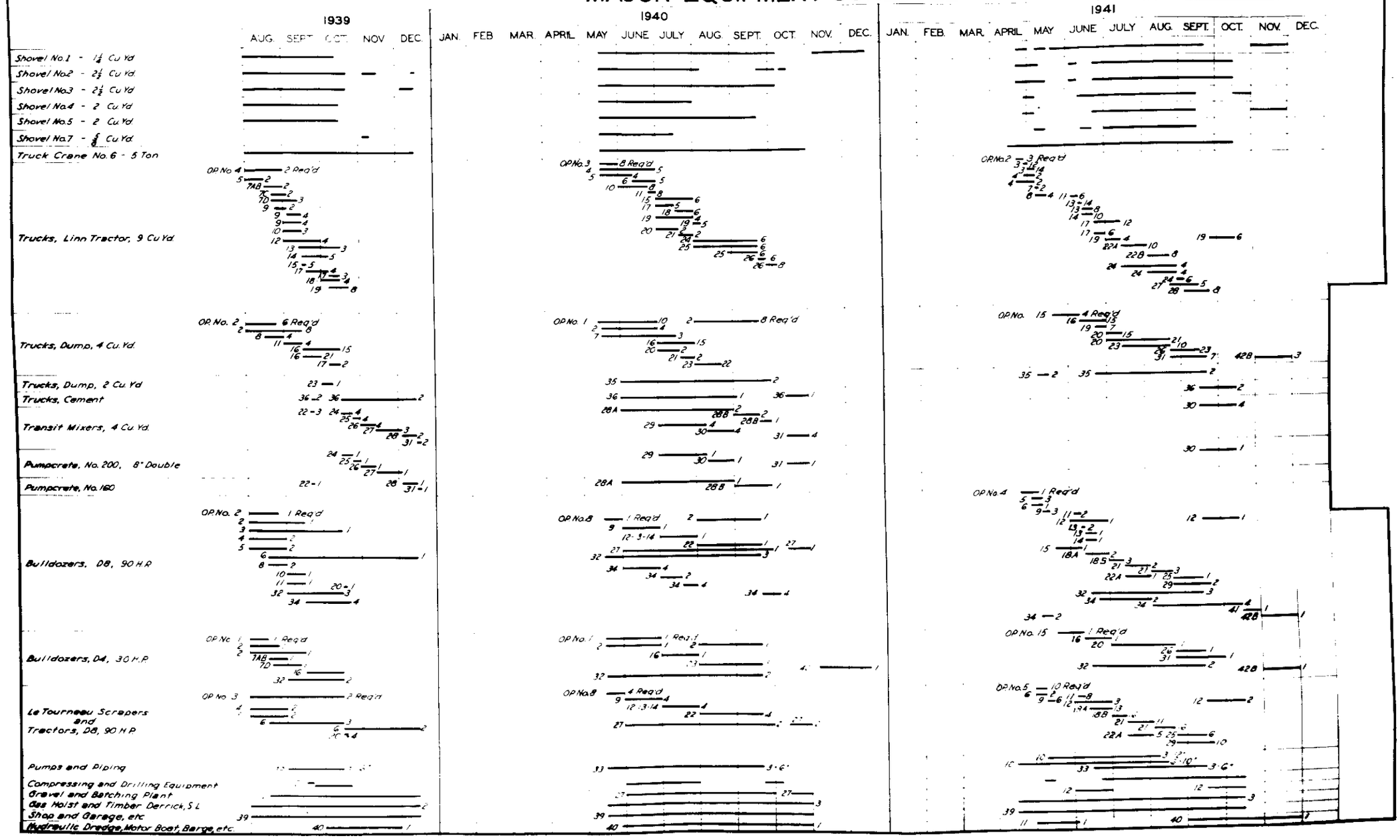
CONSTRUCTION SCHEDULE 1941

OPR. NO.	PAY ITEM	OPERATING ITEMS	EXCAV QU IN CU YDS	PLACEMENT LOCATION	PLACEMENT QUANTITY	HAULING EQUIPMENT ETC.
1	3	Cofferdam Trestle				Steam Boiler 30 H.P., Pile Hammer, Crane Boom
2	10	Load and Haul Sand and Gravel (From Stockpile)	11,000	Upstream Cofferdam	10,000	3 Linn Tractors, 9 cu.yd.
3	10	Excavation and Haul (Borrow Area "C")	34,100	Upstream and Downstream Cofferdam	30,000	12 Linn Tractors for 3 days then use 14
4	5	Earth Excavation (Outlet Approach Channel Plug)	23,450	Dumped Fill Upstream Cofferdam	21,100	1 D8 Bulldozer, 90 H.P., 2 Linn Tractors with each Dragline
5	4	Stripping (Spillway Approach Channel)	71,000	Stockpile (For Loaming) Dumped Fill, Upstream Cofferdam	18,000 46,000	3 D8 Bulldozers, 90 H.P.
6	5	Earth Excavation (Spillway Approach Channel)	11,400	Dumped Fill, Upstream Cofferdam	10,900	1 D8 Bulldozer, 90 H.P.
7	18	Load and Haul Rock (From Stockpile)	2,550	Closure Section, Upstream Cofferdam	2,500	2 Linn Tractors, 9 cu.yd.
8	11	Rock Excavation (Spillway Approach Channel)	8,600	Closure Section and Upstream Slope Cofferdam	12,800	4 Linn Tractors, 9 cu.yd.
9	5	Earth Excavation (Spillway Discharge Channel)	26,000	Dumped Fill, Downstream Cofferdam	23,200	3 D8 Bulldozers, 90 H.P.
10	3	Wellpoint System and Dewatering		Water in River Section Cu.Ft.	9,540,000	Centrifugal Pumps, Six 10" at 120 days, three 12" at 90 days
11	5	Muck Excavation in River Section	102,000	Dumped Fill (Both Terraces)	75,000	2 D8 Bulldozers, 6 Linns, 8 LeT's, June 4 to 9
12	Sec. 17	Excavation and Haul		Gravel and Batching Plant	138,100	1 D8 Bulldozer, 90 H.P., Sept. 16 to Oct. 15, two Shifts
13	23	Sand (From Processing Plant)	32,000	Filter Downstream	28,800	2 D8 Bulldozers, 90 H.P. for 3 days then use 1 14 Linn Tractors for 3 days then use 8
14	21	Gravel (From Processing Plant)	23,800	Filter Downstream	21,400	10 Linn Tractors, 1 D8 Bulldozer 90 H.P.
15	7	Stripping (Borrow Area "A")	20,000			4 Dump Trucks, 4 cu.yd. 1 D8 Bulldozer, 90 H.P. 1 D4 Bulldozer, 30 H.P. 2 Shifts
16	8	Excavation and Haul (Borrow Area "A")	21,800	Compacted Impervious Material to Elev. 312.0	19,600	15 Dump Trucks, 1 D4 Bulldozer, 30 H.P. 2 Shifts
17	9	Excavation and Haul (Borrow Area "B")	110,900	Selected Pervious Fill, Below Elev. 320.0 4 Ft. Sand and Gravel Filter, Downstream, Below El. 320.	93,800 5,800	6 Linn Tractors with each Shovel
18(A)	5	Earth Excavation (Spillway Discharge Channel)	143,700	Compacted Pervious Fill to Elev. 320.0	236,800	2 D8 Bulldozers, 90 H.P.
18(B)	5	Earth Excavation (Spillway Approach Channel)	119,400			3 D8 Bulldozers, 90 H.P.
19	11	Rock Excavation (Spillway Discharge Channel)	64,200	Rock Shell and Ballast, Downstream to Elev. 320.0	96,300	7 Dump Trucks 4 cu.yd. in June, 4 Linn Tractors in July 3 Linn Tractors with each shovel in Sept. and Oct.
20	8	Excavation and Haul (Borrow Area "A")	45,400 69,700	3 Ft. Impervious Blanket and Core to Elev. 320.0 Compacted Impervious material, Elev. 320.0 to 390.0	40,900 62,700	1 D4 Bulldozer 15 Dump Trucks 4 cu.yd. with Shovel No. 1 21 Dump Trucks 4 cu.yd. with Shovel No. 5
21	5	Earth Excavation (Spillway Approach Channel)	401,800	Compacted Pervious Fill, Elev. 320.0 to 390.0	361,600	2 D8 Bulldozers until Aug. 3 then use 3
22(A)	9	Excavation and Haul (Borrow Area "B")	151,200	Selected Pervious Fill, Elev. 320.0 to 350.0	181,200	5 Linn Tractors with Shovel No. 4, 5 Linns with No. 2 and 3 with Rented Shovel, 1½ cu.yd. 1 D8 with LeT's
22(B)		Excavation and Haul (Borrow Area "B")	54,700	Selected Pervious Fill, Elev. 350.0 to 390.0		
23	10	Excavation and Haul (Borrow Area "C")	56,100	4 Ft. Sand and Gravel Filter, Elev. 320.0 to 390.0	49,400	10 Dump Trucks, 4 cu.yd.
24	11	Rock Excavation, Spillway Discharge Channel Spillway Approach Channel	70,000 14,100	Rock Shell, Elev. 320.0 to 390.0	126,200	4 Linn Tractors with each shovel until Aug. 27, then 3 Linn Tractors with each shovel to Sept. 3
25	5	Earth Excavation (Spillway Approach Channel)	107,100	Compacted Pervious Fill, Elev. 390.0 to 416.0	96,400	1 D8 Bulldozer, 90 H.P.
26	8	Excavation and Haul (Borrow Area "A")	39,100	Compacted Impervious Fill, Elev. 390.0 to 416.0	35,200	1 D4 Bulldozer, 30 H.P., 23 Dump Trucks, 4 cu.yd.
27	9	Excavation and Haul (Borrow Area "B")	47,000	Selected Pervious Fill, Elev. 390.0 to 416.0 4 Ft. Sand and Gravel Filter, Elev. 390.0 to 416.0	7,000 34,400	5 Linn Tractors
28	11	Rock Excavation (Spillway Approach Channel)	41,300	Rock Shell, Elev. 390.0 to 416.0	62,000	8 Linn Tractors
29	5	Earth Excavation (Spillway Approach Channel)	231,300	Dumped, Elev. 315.0 to 340.0	208,200	2 D8 Bulldozers, 90 H.P.
30	31	Concrete		Spillway Weir and East Wall	10,780	Pumpcrete No. 200, 4 Transit Mixers, 4 cu.yd., Steam Boiler 80 H.P.
31	89 & 61	Top Soil and Seeding	30,000		25,000	7 Dump Trucks and 1 D4 Bulldozer with No. 1 Shovel Two Shifts and 1 D4 Bulldozer one Shift after Sept. 21
32	Sec. 20(B)	Rolling and Compacting Embankment				3 D8 and 2 D4 Bulldozers, 2 Disc Rollers, 2 Sheepsfoot Rollers
33	Sec. 20(A)	Sprinkling Embankment				3 Pumps, 6"
34	18	Placing Rock			239,800	2 D8 Bulldozers, 90 H.P. until Aug. 3 then use 4, Crane Boom
35	21	Gravel for Filters	18,000	1 Ft. Layer under Rock Shell (Upstream)	16,200	2 Dump Trucks, 2 cu.yd.
36	28	Hauling Cement			Bbls. 12,500	2 Cement Trailers, one Shift
37	35	Placing Steel			Lbs. 44,400	
38	Sec. 14(D)	Illumination				See Section 14 (D)
39	Sec. 14(A)	Shop and Garage, etc.				See Section 14 (A)
40	5	Earth Excavation (Lower Discharge Channel)	197,000			Dredge, Hydraulic, 12" Motor Boat and Barge
41	5	Earth Excavation (Downstream Cofferdam)	29,400			D8 Bulldozer, 90 H.P.
42(A)	Sec. 14(C)	Removal of Construction Bridges				Steam Boiler 30 H.P. 3 Shifts, Pile Hammer, Shovel with Crane Boom 2 Shifts
42(B)	Sec. 18	Cleanup and Demobilization				1 D8 Bulldozer 90 H.P., 1 D6 Bulldozer 30 H.P., 3 Dump Trucks 4 cu.yd. 1 Shift



Section 6 (B)

MAJOR EQUIPMENT SCHEDULE



EQUIPMENT PROPOSED AND RENTAL DATA

No. Units	Designation	Unit Value	Daily Rental (each) 1 Shift	2 Shifts	3 Shifts
1	Barge, 20' x 12'	$ 500.00	$ 1.00	$ 1.50	$ 2.00
1	Boat, Motor 7 HP	500.00	1.00	1.50	2.00
2	Boiler, Steam 90 HP	1,620.00	5.00	7.50	10.00
1	Boiler, Steam 30 HP	750.00	1.83	2.75	3.66
1	Bucket, Clamshell 1-1/2 C.Y.	1,200.00	3.00	4.50	6.00
10	Bulldozer 90 HP	9,350.00	18.00	27.00	36.00
4	Bulldozer 30 HP	3,625.00	7.50	11.25	15.00
1	Car Puller (Used) 30 HP	90.00	1.00	1.50	2.00
6	Cart, Concrete 1/6 C.Y.	32.00	.10	.15	.20
2	Compressor, Air 625 C.F.	9,500.00	25.00	37.50	50.00
2	Compressor, Air 315 C.F.	4,500.00	11.50	17.25	23.00
3	Derrick, Timber S.L. 40-ft. Boom	700.00	1.67	2.50	3.33
1	Dredge, Hydraulic 12"	60,000.00	100.00	150.00	200.00
6	Drill, Jackhammer	200.00	.75	1.13	1.50
10	Drill, Wagon, Air	1,500.00	3.00	4.50	6.00
1	Elevator, Cement	850.00	2.00	3.00	4.00
1	Garage (see Shop, Garage, Etc.)				
1	Gravel & Batching Plant	30,000.00	50.00	75.00	100.00
1	Hammer, Pile 4000-lb.	700.00	4.00	6.00	8.00
1	Harrow, Spring Tooth	40.00	.50	.75	1.00
3	Hoist, 2 Drum, Gas, 25 HP	1,600.00	2.00	3.00	4.00
2	Hoist, Hand 2 Ton	300.00	.50	.75	1.00
1	Mixer, Concrete 7 S	1,000.00	2.67	4.00	5.34
1	Mixer, Grout & Mortar 10S	1,300.00	3.17	4.75	6.34
1	Office Equipment	3,300.00	1.00	1.50	2.00
6	Paving Breaker	185.00	.57	.85	1.14
1	Pump, Cement, Electric	2,000.00	6.00	9.00	12.00
3	Pump, Centrifugal 12"	1,797.00	5.66	8.49	11.32
12	Pump, Centrifugal 10"	2,250.00	7.00	10.50	14.00
3	Pump, Centrifugal 6"	1,050.00	2.80	4.20	5.60
2	Pump, Centrifugal 4"	650.00	1.83	2.75	3.67
2	Pump, Centrifugal 2"	225.00	.67	1.00	1.33

EQUIPMENT PROPOSED AND RENTAL DATA (Cont'd.)

No. Units	Designation	Unit Value	Daily Rental (each) 1 Shift	2 Shifts	3 Shifts
1	Pumpcrete #200	$12,000.00	$ 30.00	$ 45.00	$ 60.00
1	Pumpcrete Pipe, 1000'-8"	8,263.00	15.00	22.50	30.00
1	Pumpcrete #160	4,362.00	12.00	18.00	24.00
1	Pumpcrete Pipe, 400'-6"	2,135.00	5.00	7.50	10.00
1	Pump, Grout	2,000.00	5.00	7.50	10.00
1	Pump, Piston, 4"	1,750.00	5.50	8.25	11.00
1	Pump, Reciprocating, 2"	200.00	.50	.75	1.00
5	Roller, Disc	1,150.00	3.00	4.50	6.00
1	Roller, Road, Gas 10 Ton	4,100.00	6.30	9.45	12.60
2	Roller, Sheepsfoot	1,250.00	3.33	5.00	6.67
16	Scraper 18 C.Y.	6,475.00	17.00	25.50	34.00
10	Sedans, Auto, Light	600.00	1.67	2.50	3.33
1	Shop, Garage, Etc. (See Section 14(A))		230.00	345.00	460.00
1	Shovel 5/8 C.Y.	7,800.00	15.00	22.50	30.00
1	Shovel 1-1/4 C.Y.	17,500.00	32.00	48.00	64.00
2	Shovel 2 C.Y.	28,500.00	51.00	76.50	102.00
2	Shovel 2-1/2 C.Y.	32,000.00	55.50	83.25	111.00
1	Silo, Cement (Used)	2,500.00	6.00	9.00	12.00
1	Surveying Instruments	2,000.00	1.00	1.50	2.00
6	Tamper, Air	90.00	.27	.41	.54
14	Tractor 90 HP	7,500.00	14.50	21.75	29.00
18	Tractor Truck 9 C.Y.	9,325.00	16.00	24.00	32.00
5	Truck, Cement (Used) 50 Bbl.	2,000.00	6.00	9.00	12.00
25	Truck, Dump 4 C.Y.	4,700.00	9.00	13.50	18.00
2	Truck, Dump 2 C.Y.	3,100.00	7.00	10.50	14.00
14	Truck, Pick-up 1/2 Ton	750.00	1.83	2.75	3.67
6	Truck, Transit mixer 4 C.Y.	8,500.00	15.00	22.50	30.00
10	Vibrator, Concrete Electric	650.00	1.67	2.50	3.33
3	Wagon, Station	750.00	1.57	2.35	3.15

SCHEDULE OF MATERIAL UNIT PRICES

F.O.B. FRANKLIN FALLS

Description	Unit Price
Bits, Rock 2-2/3"	$ .32 ea.
" " 2"	.27 "
" " 1-3/4"	.24 "
Bituminous Material	.15 gal.
Boat Spikes	.10 ea.
Bolts, Eye 1" x 18" long (Galv.)	.25 "
" 3/4" x 9" long "	.08 "
" 3/4" x 16"	.20 "
" hook 3/8" x 10" "	.08 "
Burlap	.04 sq. yd.
Cabinet, Lighting Complete	50.00 ea.
Cable, 3/4" Galv.	.10 ft.
Caps, Blasting	.07 ea.
Cast Iron	.13 lb.
Cement (Bulk)	2.27 bbl.
Conduit, Galv. Iron 2½"	.585 ft.
" " " 1½"	.275 ft.
" " " 1¼"	.23 "
" " " 1"	.17 "
" " " 3/4"	.115 "
Copper, Sheet	.33 lb.
Culvert, Metal, 18"	2.85 ft.
Drift Pins	.15 ea.
Dynamite	.10 lb.
Fertilizer	20.00 ton
Gasoline	.09 gal.
Gear Compound	.08 lb.
Gravel, Filters, Drains, Etc. at Plant	.54 c.y.
Grease	.08 lb.
Hose, Rubber 1½"	.40 ft.

Iron, Wrought	$ .08 lb.
Lamps, Flood	50.00 ea.
Lumber, struct. and bracing	80.00 M.B.F.
Lumber, lagging and forms	45.00 "
Masonite	80.00 M. Ft.
Metal, Sheet	.14 lb.
Nails	2.50 keg
Oil, Fuel	.075 gal.
Oil, Motor, Lubricating	.17 "
Paint, Aluminum	3.50 "
Paint, Primer	3.00 "
Piles, Timber	.40 ft.
Pins, Drift	.15 ea.
Pipe, blk. Stl. 1"	.09 ft.
" " " 1½"	.15 "
" " " 2"	.20 "
" " " 2½"	.27 "
" " " 3"	.42 "
" " " 4"	.63 "
" " " 6"	1.10 "
" V. C. 12"	.65 "
" Wrought Iron	80.00 ton
" " " 2½"	.54 ft.
" " " 2"	.31 "
Poles, for lighting	6.00 ea.
Rod, Welding	.12 lb.
Rope, Wire Galv. 3/4"	.10 ft.
Sand at Plant	.54 c.y.
Seed, Grass	.33 lb.
Steel, Drill 1½"	.75 ft.
" " 7/8"	.60 ft.
Steel, Structural	.042 lb.
Steel, Reinforcing	.03 lb.
Wire, Tie	.08 "

FUEL CONSUMPTION DATA

Gasoline Equipment

Designation	Gasoline Gals. Per Hr.	Lub. Oil Gals. Per Hr.	Grease Lbs. Per Hr.	Gear Comp. Lbs. Per Hr.
Boat, Motor 7 HP	.3	.1	.1	
Car Puller 30 HP	.1	.1	.1	
Compressor, Air 105 C.F.	2.0	.1	.1	
Compressor, Air 315 C.F.	6.0	.1	.1	
Crane, Utility 5 Ton	4.0	.1	.5	.1
Hoist, 2 Drum 25 HP	1.0	.1	.1	
Mixer, Concrete 7 S	.5	.1	.1	
Mixer, Grout & Mortar 10 C.F.	1.0	.1	.1	
Pump, Centrifugal 12"	5.0	0.2	0.2	
Pump, Centrifugal 10"	4.0	0.1	0.2	
Pump, Centrifugal 6"	2.0	0.1	0.2	
Pump, Centrifugal 4"	1.0	0.1	0.1	
Pump, Centrifugal 2"	0.5	0.1	0.1	
Pumpcrete, #200	4.5	0.2	0.8	
Pumpcrete, #160	2.0	.2	.6	
Pump, Grout	.5	.1	.1	
Pump, Piston 4"	2.5	.1	.2	
Pump, Reciprocal 2"	.5	.1	.1	
Roller, Gas, Road, 10 Ton	2.0	.1	.2	.1
Sedan, Auto, Light	0.3	0.1	0.1	0.1
Shovel, 5/8 C.Y.	4.0	0.1	0.5	0.1
Truck, Cement, 50 Bbl.	6.0	0.2	0.2	0.3
Truck, Dump, 2 C.Y.	2.0	0.1	0.2	0.1
Truck, Dump, 4 C.Y.	3.0	0.1	0.2	0.2
Truck, Pickup, 1/2 Ton	1.0	0.1	0.1	0.1
Truck, Stake Body, 2 Ton	2.0	0.1	0.2	0.1
Truck, Stake Body, 5 Ton	3.0	0.1	0.2	0.2
Truck, Tank Gas & Oil	3.0	0.1	0.2	0.2
Truck, Transit mixer 4 C.Y.	4.0	0.2	0.2	0.2
Truck, Water Sprinkler	3.0	0.1	0.2	0.2
Wagon, Station	1.0	0.1	0.1	0.1

FUEL CONSUMPTION DATA (Cont'd)

Diesel Equipment

	Fuel Oil Gals. Per Hr.	Lub. Oil Gals. Per Hr.	Grease Lbs. Per Hr.	Gear Comp. Lbs. Per Hr.
Compressor, 625 C.F.	6.0	0.2	0.2	
Dredge, Hydraulic, 12"	27.0	0.8	2.0	1.0
Grader, Road, 40 H.P.	3.0	0.1	0.6	0.2
Shovel, 1-1/4 C.Y.	4.0	0.2	0.5	0.1
Shovel, 2 C.Y.	6.0	0.2	0.5	0.2
Shovel, 2½ C.Y.	8.0	0.2	0.7	0.3
Tractor, 30 H.P.	2.0	0.1	0.5	0.2
Tractor, 90 H.P.	5.0	0.1	0.75	0.2
Tractor, Truck, 9 C.Y.	3.0	0.1	0.5	0.2

Electrical Equipment

Elevator, Cement Bin	8 K.W.	per hour
Gravel Plant	100 "	" "
	0.3 gal. Lub. Oil	" "
	2.0 lbs. grease	" "
	0.5 " gear comp.	" "
Pump, Cement	25 K.W.	" "
Shop, Garage, Etc.	20 K.W.	" "
Vibrator, Concrete	1/4 "	" "

Other Equipment

Boiler 30 HP	90 lbs. Coal per hour
Boiler 90 HP	270 lbs. " " "

SUMMARY OF OPERATING COSTS OF FUEL AND LUBRICANTS

Equipment	Cost Per Hour
Boat, Motor, 7 HP	0.05
Boiler, Steam, 30 HP	.45
Boiler, Steam, 90 HP	1.35
Car Puller 30 HP	0.03
Compressor, 105 C.F.	.21
Compressor, 315 C.F.	.565
Compressor, 625 C.F.	.50
Crane, Utility, 5 Ton	.425
Dredge, Hydraulic, 12"	2.40
Elevator, Cement Bin	.16
Grader, Road 40 HP	.32
Gravel Plant	2.25
Hoist, 2 Drum, 25 HP	.115
Mixer, Concrete 7 S	.07
Mixer, Grout & Mortar, 10 C.F.	.115
Pump, Cement	.50
Pump, Centrifugal, 12"	.50
Pump, Centrifugal, 10"	.39
Pump, Centrifugal, 6"	.21
Pump, Centrifugal, 4"	.115
Pump, Centrifugal, 2"	.07
Pumpcrete, #200	.50
Pumpcrete, #160	.26
Pump, Grout	.07
Pump, Piston, 4"	.26
Pump, Reciprocating, 2"	.07
Roller, Gas, Road 10 Ton	.22
Sedan, Auto, Light	.06
Shop, Garage, Etc.	.40
Shovel, 5/8 c.y.	.425
Shovel, 1-1/4 c.y.	.39
Shovel, 2 C.Y.	.55
Shovel, 2-1/2 c.y.	.73
Tractor, 30 HP	.23
Tractor, 90 HP	.48
Tractor, Truck 9 c.y.	.30
Truck, Cement, 50 Bbl.	.61
Truck, Dump, 2 c.y.	.22
Truck, Dump, 4 c.y.	.32
Truck, Pickup 1/2 Ton	.12
Truck, Stake Body 2 Ton	.22
Truck, Stake Body 5 Ton	.32
Truck, Tank, Gas & Oil	.32
Truck, Transit Mixer, 4 C.Y.	.43
Truck, Water Sprinkler	.32
Vibrator, Concrete	.005
Wagon, Station	.12

HOURLY OPERATING COSTS OF FUEL & LUBRICANTS

(See Sections 9 & 10)

Boat, Motor 7 HP

Gasoline:	3 gals. @	0.09	=	$0.027	
Lub. Oil:	1 gals. @	0.17	=	.017	
Grease:	1 gals. @	0.08	=	.008	
				$0.052	Use $0.05

Boiler, Steam 30 HP

Coal 90 lbs. @ $10.00 per Ton .45 Use $0.45

Boiler, Steam 90 HP

Coal 270 lbs. @ $10.00 Per Ton $ 1.35 Use $1.35

Car Puller 30 HP

Gasoline:	1 gals. @	0.09	=	.009	
Lub. Oil:	1 gals. @	0.17	=	.017	
Grease:	1 lbs. @	0.08	=	.008	
				$0.034	Use $0.03

Compressor, Air 105 C.F.

Gasoline:	2.0 gals. @	0.09	=	0.180	
Lub. Oil:	0.1 gals. @	0.17	=	0.017	
Grease:	0.1 lbs. @	0.08	=	0.008	
				$0.205	Use $0.21

Compressor, Air 315 C.F.

Gasoline:	6 gals. @	0.09	=	$0.540	
Lub. Oil:	1 gal. @	.17	=	.017	
Grease:	1 lb. @	.08	=	.008	
				$0.565	Use $0.565

HOURLY OPERATING COSTS OF FUEL AND LUBRICANTS (Cont'd)

(See Sections 9 & 10)

Compressor Air 625 C.F.

Fuel Oil:	6 gals.	@	$0.075	=	$0.450
Lub. Oil	.2 gals.	@	.17	=	.034
Grease:	.2 lb.	@	.08	=	.016
					$0.500

Use $0.500

Utility, 5 Ton Crane

Gasoline:	4 gals.	@	$0.09	=	$0.360
Lub. Oil:	.1 gals.	@	.17		.017
Grease:	.5 lb.	@	.08		.040
Gear Comp.:	.1 lb.	@	.08		.008
					$0.425

Use $0.425

Dredge, Hydraulic 12"

Fuel Oil:	27.0 gals.	@	$0.075	=	$2.025
Lub. Oil	0.8 gals.	@	.17	=	.136
Grease	2.0 lbs.	@	.08	=	.160
Gear Comp.	1.0 lbs.	@	.08	=	.08
					$2.401

Use $2.40

Elevator, Cement

Electricity: 8 K.W. @ $0.02 = $0.16 Use $0.16

Hoist, 2 Drum, 25 HP

Gasoline:	1.0 gals.	@	$0.09	=	$0.09
Lub. Oil:	1 gals.	@	.17	=	.017
Grease:	1 lbs.	@	.08	=	.008
					$0.115

Use $0.115

Grader, Road 40 HP

Fuel Oil	3.0 gals.	@	.075	=	$0.225
Lub. Oil:	0.1 gals	@	.17	=	.017
Grease:	0.6 lbs	@	.08	=	.048
Gear Comp.:	0.2 lbs.	@	.08	=	.016
Gasoline					.014
					$0.320

Use $0.32

HOURLY OPERATING COSTS OF FUEL AND LUBRICANTS (Cont'd)

(See Sections 9 & 10)

Gravel Plant

Electricity:	100 kw.	@	$0.02	=	$2.000
Lub. Oil:	.3 gal.	@	.17	=	.051
Grease:	2 lbs.	@	.08	=	.160
Gear Comp.:	.5 lb.	@	.08	=	.040
					$2.251

Use $2.25

Mixer, Concrete, 7 S

Gasoline:	.5 gals.	@	$0.09	=	$0.045
Lub. Oil:	.1 gals.	@	.17	=	.017
Grease:	.1 lbs.	@	.08	=	.008
					$0.070

Use $0.07

Mixer, Grout & Mortar, 10 C.F.

Gasoline:	1.0 gals.	@	$0.09	=	$0.090
Lub. Oil:	0.1 gals.	@	.17	=	.017
Grease	0.1 lbs.	@	.08	=	.008
					$0.115

Use $0.115

Pump, Cement

Electricity: 25 KW @ $0.02 = $0.50 Use $0.50

Pump, Centrifugal, 12"

Gasoline:	5.0 gals.	@	$0.09	=	$0.450
Lub. Oil:	0.2 gals.	@	.17	=	.034
Grease:	0.2 lbs.	@	.08	=	.016
					$0.500

Use $0.50

Pump, Centrifugal, 10"

Gasoline:	4.0 gals.	@	$0.09	=	$0.360
Lub. Oil:	0.1 gals.	@	.17		0.017
Grease:	0.2 lbs.	@	.08		0.016
					$0.393

Use $0.39

HOURLY OPERATING COSTS OF FUEL AND LUBRICANTS (Cont'd)

(See Sections 9 & 10)

Pump, Centrifugal, 6"

Gasoline:	2.0 gals.	@	$0.09	=	$0.180
Lub. Oil:	.1 gals.	@	.17	=	0.017
Grease:	.2 lbs.	@	.08	=	.016
					$0.213

Use $0.21

Pump, Centrifugal, 4"

Gasoline:	1.0 gals.	@	$0.09	=	$0.090
Lub. Oil:	0.1 gals.	@	.17	=	.017
Grease:	0.1 lbs.	@	.08	=	.008
					$0.115

Use $0.115

Pump, Centrifugal, 2"

Gasoline:	0.5 gals.	@	$0.09	=	$0.045
Lub. Oil:	0.1 gals.	@	.17	=	.017
Grease:	0.1 lbs.	@	.08	=	.008
					$0.070

Use $0.07

Pumpcrete, #200

Gasoline:	4.5 gals.	@	$0.09	=	$0.405
Lub. Oil:	.2 gals.	@	.17	=	.034
Grease:	.8 lbs.	@	.08	=	.064
					$0.503

Use $0.50

Pumpcrete, #160

Gasoline:	2.0 gals.	@	$0.09	=	$0.180
Lub. Oil:	0.2 gals.	@	.17	=	.034
Grease:	0.6 lbs.	@	.08	=	.048
					$0.262

Use $0.26

Pump, Grout

Gasoline:	.5 gals.	@	$0.09	=	$0.045
Lub. Oil:	.1 gals.	@	.17	=	.017
Grease:	.1 lbs.	@	.08	=	.008
					$0.070

Use $0.07

HOURLY OPERATING COSTS OF FUEL AND LUBRICANTS (Cont'd)

(See Sections 9 & 10)

Pump, Piston 4"

Gasoline:	2.5 gals.	@	$0.09	= $0.225	
Lub. Oil:	.1 gal.	@	.17	= .017	
Grease:	.2 lb.	@	.08	= .017	
				$0.258	Use $0.26

Pump, Reciprocating 2"

Gasoline:	.5 gal.	@	$0.09	= $0.045	
Lub. Oil:	.1 gal.	@	.17	= .017	
Grease:	.1 lb.	@	.08	= .008	
				$0.070	Use $0.07

Roller, Road 10-ton

Gasoline:	2.0 gals.	@	$0.09	= $0.180	
Lub. Oil:	0.1 gal.	@	.17	= .017	
Grease	0.2 lb.	@	.08	= .016	
Gear Comp:	0.1 lb.	@	.08	= .008	
				$0.221	Use $0.22

Sedans, Auto, Light

Gasoline:	.3 gals.	@	$0.09	= $0.027	
Lub. Oil:	.1 gal.	@	.17	= .017	
Grease:	.1 lb.	@	.08	= .008	
Gear Comp.:	.1 lb.	@	.08	= .008	
				$0.060	Use $0.06

Shop, Garage, Etc.

Electricity 20 KW @ $0.02 = $0.40 Use $0.40

Shovel, 5/8 c.y.

Gasoline:	4 gals.	@	$0.09	= $0.360	
Lub. Oil:	.1 gal.	@	.17	= .017	
Grease:	.5 lb.	@	.08	= .040	
Gear Comp.:	.1 lb.	@	.08	= .008	
				$0.425	Use $0.425

HOURLY OPERATING COSTS OF FUEL AND LUBRICANTS (Cont'd.)

(See Sections 9 & 10)

Shovel, 1-1/4 C.Y.

Fuel Oil:	4 gals.	@	$0.075	= $0.300	
Lub. Oil:	.2 gal.	@	.17	= .034	
Grease:	.5 lb.	@	.08	= .040	
Gear Comp.:	.1 lb.	@	.08	= .008	
Gas:				.008	
				$0.390	Use $0.39

Shovel, 2 C.Y.

Fuel Oil:	6 gals.	@	$0.075	= $0.450	
Lub. Oil:	.2 gal.	@	.170	= .034	
Grease:	.5 lb.	@	.08	= .040	
Gear Comp.:	.2 lb.	@	.08	= .016	
Gas:				.010	
				$0.550	Use $0.55

Shovel, 2-1/2 C.Y.

Fuel Oil:	8 gals.	@	$0.075	= $0.600	
Lub. Oil:	.2 gal.	@	.17	= .034	
Grease:	.7 lb.	@	.08	= .056	
Gear Comp.:	.3 lb.	@	.08	= .024	
Gas:				.016	
				$0.730	Use $0.73

Tractor 30 HP

Fuel Oil:	2 gals.	@	$0.075	= $0.150	
Lub. Oil:	.1 gal.	@	.17	= .017	
Grease:	.5 lb.	@	.08	= .040	
Gear Comp.:	.2 lb.	@	.08	= .016	
Gas:				.007	
				$0.230	Use $0.23

Tractor 90 HP

Fuel Oil:	5 gals.	@	$0.075	= $0.375	
Lub. Oil:	.1 gal.	@	.17	= .017	
Grease:	.75 lb.	@	.08	= .060	
Gear Comp.:	.2 lb.	@	.08	= .016	
Gas:				.012	
				$0.480	Use $0.48

Tractor, Truck 9 C. Y.

Fuel Oil:	3 gals.	@	$0.075	= $0.225	
Lub. Oil:	.1 gal.	@	.17	= .017	
Grease:	.5 lb.	@	.08	= .040	
Gear Comp.:	.2 lb.	@	.08	= .016	
				$0.298	Use $0.30

HOURLY OPERATING COSTS OF FUEL AND LUBRICANTS (Cont'd)

(See Sections 9 & 10)

Truck, Cement 50 Bbl.

Gasoline:	6 gals.	@	$0.09 =	$0.540	
Lub. Oil:	.2 gal.	@	.17 =	.034	
Grease:	.2 lb.	@	.08 =	.016	
Gear Comp.:	.3 lb.	@	.08 =	.024	
				$0.614	Use $0.61

Truck, Dump 2 C.Y.

Gasoline:	2.0 gals.	@	$0.09 =	$0.180	
Lub. Oil:	0.1 gal.	@	.17 =	.017	
Grease:	0.2 lb.	@	.08 =	.016	
Gear Comp.:	0.1 lb.	@	.08 =	.008	
				$0.221	Use $0.22

Truck, Dump 4 C.Y.

Gasoline:	3.0 gals.	@	$0.09 =	$0.270	
Lub. Oil:	0.1 gal.	@	.17 =	.017	
Grease:	0.2 lb.	@	.08 =	.016	
Gear Comp.:	0.2 lb.	@	.08 =	.016	
				$0.319	Use $0.32

Truck, Pickup 1/2-Ton

Gasoline:	1.0 gal.	@	$0.09 =	$0.090	
Lub. Oil:	0.1 gal.	@	.17 =	.017	
Grease:	0.1 lb.	@	.08 =	.008	
Gear Comp.:	0.1 lb.	@	.08 =	.008	
				$0.123	Use $0.12

Truck, Stake Body 2-Ton

Gasoline:	2.0 gals.	@	$0.09 =	$0.180	
Lub. Oil:	.1 gal.	@	.17 =	.017	
Grease:	.2 lb.	@	.08 =	.016	
Gear Comp.:	.1 lb.	@	.08 =	.008	
				$0.221	Use $0.22

Truck, Stake Body 5-Ton

Gasoline:	3 gals.	@	$0.09 =	$0.270	
Lub. Oil:	.1 gal.	@	.17 =	.017	
Grease:	.2 lb.	@	.08 =	.016	
Gear Comp.:	.2 lb.	@	.08 =	.016	
				$0.319	Use $0.32

HOURLY OPERATING COSTS OF FUEL AND LUBRICANTS (Cont'd)

(See Sections 9 & 10)

Truck, Tank, Gas & Oil

Gasoline:	3.0 gals. @ $0.09 =	$0.270		
Lub. Oil:	0.1 gal. @ .17 =	.017		
Grease:	0.2 lb. @ .08 =	.016		
Gear Comp.:	0.2 lb. @ .08 =	.016		
		$0.319	Use $0.32	

Truck, Transit-Mixer 4 C.Y.

Gasoline:	4.0 gals. @ $0.09 =	$0.360	
Lub. Oil:	0.2 gal. @ .17 =	.034	
Grease:	0.2 lb. @ .08 =	.016	
Gear Comp.:	0.2 lb. @ .08 =	.016	
		$0.426	Use $0.43

Truck, Water Sprinkler

Gasoline:	3.0 gals. @ $0.09 =	$0.270	
Lub. Oil:	0.1 gal. @ .17 =	.017	
Grease:	0.2 lb. @ .08 =	.016	
Gear Comp.:	0.2 lb. @ .08 =	.016	
		$0.319	Use $0.32

Vibrators, Concrete

Electricity 1/4 Kw @ $0.02 =	$0.005	Use $0.005

Wagons, Station

Gasoline:	1.0 gal. @ $0.09 =	$0.090	
Lub. Oil:	0.1 gal. @ .17 =	.017	
Grease:	0.1 lb. @ .08 =	.008	
Gear Comp.:	0.1 lb. @ .08 =	.008	
		$0.123	Use $0.12

MINIMUM WAGE RATES

Classification	Hourly Rate
Skilled Labor	
Automotive mechanic	$ .90
Blacksmith	1.00
Boiler maker	1.00
Bricklayer	1.25
Bulldozer Operator (over 30 H.P.)	.75
Cableway operator	1.25
Carpenter	.80
Cement finisher	1.25
Cement gun operator	.75
Compressor operator (over 400 cu. ft. displacement)	.85
Concrete-mixer operator (over 27 cu. ft.)	1.00
Concrete-pump operator	.75
Core-drilling equipment operator	1.00
Derrick, dragline, crane, power-shovel operator	1.25
Diver	2.00
Electrician	.85
Glazier	.80
Hoisting engineer (2 or 3 drums)	1.25
Iron worker, structural and ornamental (rivetor, heater, bucker-up, sticker)	1.25
Lineman	.85
Locomotive operator (steam or gas)	1.00
Machinist	1.00
Mechanic (repair and maintenance on heavy machines, cranes, etc.)	1.00
Painter	.80
Paving-machine operator	1.00
Pile-driver operator	1.25
Plasterer	1.25
Plumber	1.00
Powderman, blaster	1.00
Rodman - Reinforcing-Steel placer - Bldg. const.	.80
Heavy const.	1.12½
Rigger	1.25
Roofer (slate, tile or composition)	.85
Saw filer	.80
Sheet-metal worker	1.00
Steam and pipe fitter	1.00
Stone mason and cutter	1.25
Tile setter	1.50
Terrazzo worker	1.25
Trenching-machine operator	1.00
Tool dresser	1.00
Welder (acetylene and electric)	1.00
Whirler operator	1.00
Semi-Skilled Labor	
Asphalt and bituminous-mixer operator	.70
Brakeman (train)	.65
Compressor operator (400 cu. ft. and under)	.60
Concrete man (puddler, screeder, vibrator, rubber grinder)	.60
Concrete-mixer operator (below 5 cu. ft.)	.60
Concrete-mixer operator (5 to 27 cu. ft.)	.75

Semi-Skilled Labor (Cont'd)

	Hourly Rate
Dinkey-locomotive operator	$ .75
Diver's tender	.75
Driller and broacher (rock-channeling machine)	.75
Finisher (rough concrete)	.75
Fireman	.60
Form erector and mover	.65
Fresnoer or wheeled-scraper operator	.75
Grader operator	.75
Greaser and oiler (any machinery)	.60
Grouting-machine operator	.65
Handyman (repair and maintenance)	.60
Helper:	
Blacksmith	.70
Boiler maker	.70
Core driller	.65
Electrician	.55
Machinist	.55
Mason	.50
Mechanic	.55
Plumber	.60
Roofer	.55
Sheet-metal worker	.60
Steam fitter	.60
Tile setter	.95
Terrazzo worker	.80
Hoisting engineer (1 drum)	1.00
Jack-hammer man	.60
Leader (wheeler, fresno, etc.)	.60
Mortar mixer	.60
Pile-driving leadsman, winchman, nozzleman	.75
Pipe layer	.60
Pneumatic tool operator	.60
Powder monkey	.60
Pumpman (power)	.60
Roller operator	.75
Tractor operator	.75
Truck driver ($1\frac{1}{2}$ tons and under)	.50
Truck driver (over $1\frac{1}{2}$ tons)	.60
Tunnel mucker	.55
Well driller	.85

Unskilled or Common Labor

Asphalt and bituminous raker, shoveler, tamper, handler	.50
Axman, adz man	.45
Brushman or burner	.45
Clearer (saw, axe or brush hook)	.45
Concretoman (mixing, transporting, dumping, placing and curing)	.50
Dresser (earth and rock)	.45
General pick and shovel man	.45
Grubber	.45
Lumber handler	.45
Riprap placer and handler	.45
Root picker and sodder	.45
Trackman	.45
Unskilled labor (not covered by the above)	.45

MOBILIZATION & DEMOBILIZATION

DESCRIPTION

This item includes the cost of mobilizing and demobilizing all plant and equipment, including the equipment in the shops and garage, and also the estimated cost of the final cleanup.

	Plant Rental	Total Cost M.&S.	Labor
Mob. & Demob.	$14,497.29	$ 800.00	$3,018.12
Cleanup	2,730.25	329.60	3,905.00
	$17,227.54	$1,129.60	$6,923.12

S U M M A R Y

PLANT RENTAL	$17,227.54
MATERIALS & SUPPLIES	$ 1,129.60
LABOR	$ 6,923.12
TOTAL	$25,280.26

MOBILIZATION & DEMOBILIZATION

PLANT RENTAL

No. Units	Designation	Time (Cal. Days)	No. Shifts	Rate Day	Amount
1	Barge, 20' x 12	6	1	$ 1.00	$ 6.00
1	Boat, Motor, 7 H.P.	6	1	1.00	6.00
2	Boiler, Steam, 90 HP	6	1	5.00	60.00
1	Boiler, Steam, 30 HP	6	1	1.83	10.98
1	Bucket, Clamshell 1-1/2 C.Y.	6	1	3.00	18.00
10	Bulldozer, 90 HP	6	1	18.00	1080.00
4	Bulldozer, 30 HP	6	1	7.50	180.00
1	Car Puller (Used) 30 HP	6	1	1.00	6.00
6	Cart - Concrete 1/6 C.Y.	6	1	.10	3.60
2	Compressor, Air 625 C.F.	6	1	25.00	300.00
2	Compressor, Air 315 C.F.	6	1	11.50	138.00
3	Derrick, Timber S.L. 40 ft. Boom	6	1	1.67	5.01
1	Dredge, Hydraulic, 12"	6	1	100.00	600.00
6	Drill, Jackhammer	6	1	.75	27.00
10	Drill, Wagon, Air	6	1	3.00	180.00
1	Elevator, Cement	6	1	2.00	12.00
1	Garage (See Shop, Garage, Etc.)				
1	Gravel & Batching Plant	6	1	50.00	300.00
1	Hammer Pile 4000 lbs.	6	1	4.00	24.00
1	Harrow, Spring Tooth	6	1	.50	3.00
3	Hoist, 2 Drum, Gas, 25 HP	6	1	2.00	36.00
2	Hoist, Hand 2 Ton	6	1	.50	6.00
1	Mixer, Concrete 7 S	6	1	2.67	16.02
1	Mixer, Grout & Mortar, 10 c.f.	6	1	3.17	19.02
1	Office Equipment	6	1	1.00	6.00
6	Paving Breaker	6	1	.57	20.52
1	Pump, Cement, Electric	6	1	6.00	36.00
3	Pump, Centrifugal 12"	6	1	5.66	101.88
12	Pump, Centrifugal 10"	6	1	7.00	504.00

MOBILIZATION & DEMOBILIZATION

PLANT RENTAL (Cont'd)

No. Units	Designation	Time (Cal. Days)	No. Shifts	Rate Day	Amount
3	Pump, Centrifugal 6"	6	1	$ 2.80	$ 50.40
2	Pump, Centrifugal 4"	6	1	1.83	21.96
2	Pump, Centrifugal 2"	6	1	.67	8.04
1	Pumpcrete #200	6	1	30.00	180.00
1	Pumpcrete, Pipe 1000'-8"	6	1	15.00	90.00
1	Pumpcrete #160	6	1	12.00	72.00
1	Pumpcrete, Pipe 400'-6"	6	1	5.00	30.00
1	Pump, Grout	6	1	5.00	30.00
1	Pump, Piston 4"	6	1	5.50	33.00
1	Pump, Reciprocating 2"	6	1	.50	3.00
5	Roller, Disc	6	1	3.00	90.00
1	Roller, Road, Gas 10 Ton	6	1	6.30	37.80
2	Roller, Sheepsfoot	6	1	3.33	39.96
16	Scraper, 18 C.Y.	6	1	17.00	1632.00
10	Sedan;Auto Light	6	1	1.67	100.20
1	Shop, Garage, etc.(See Section 14(A))	6	1	230.00	1380.00
1	Shovel, 5/8 C.Y.	6	1	15.00	90.00
1	Shovel, 1-1/4 C.Y.	6	1	32.00	192.00
2	Shovel, 2 C.Y.	6	1	51.00	612.00
2	Shovel, 2-1/2 C.Y.	6	1	55.50	666.00
1	Silo, Cement (Used)	6	1	6.00	36.00
1	Surveying Instruments	6	1	1.00	6.00
6	Tamper, Air	6	1	.27	9.72
14	Tractor 90 HP	6	1	14.50	1218.00
18	Tractor, Truck 9 C.Y.	6	1	16.00	1728.00
5	Truck, Cement (Used) 50 Bbl.	6	1	6.00	180.00
25	Truck, Dump 4 C.Y.	6	1	9.00	1350.00
2	Truck, Dump 2 C.Y.	6	1	7.00	84.00
14	Truck, Pickup 1/2 Ton	6	1	1.83	153.72
6	Truck, Transit mixer 4 C.Y.	6	1	15.00	540.00
10	Vibrator, Concrete, Electric	6	1	1.67	100.20
3	Wagon, Station	6	1	1.57	28.26
			TOTAL		$14,497.29

MOBILIZATION AND DEMOBILIZATION

MATERIAL AND SUPPLIES (See Section 11)

Designation	No. Units	Rate	Amount
Fuel Oil	2,000 gals.	$0.075	$ 150.00
Gasoline	5,000 "	.09	450.00
Lub. Oil	200 "	.17	34.00
Grease	300 lbs.	.08	24.00
Gear Comp.	200 "	.08	16.00
Lumber	2,000 F.B.M.	35.00	70.00
Miscellaneous			56.00
		Total	$ 800.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	10	6	8	$ 7.22 day	$433.20
Foremen (Electrician)	1	6	8	7.22 "	43.32
Electricians	2	6	8	1.00	96.00
Mechanics	5	6	8	1.00	240.00
Truck Drivers	6	6	8	.60	172.80
Shovel Operators	3	6	8	1.25	180.00
Shovel Oilers	3	6	8	.60	86.40
Carpenters	6	6	8	.80	230.40
Carpenters Helpers	6	6	8	.55	158.40
Tractor Operators	4	6	8	.75	144.00
Riggers	2	6	8	1.25	120.00
Plumbers	2	6	8	1.00	96.00
Plumbers Helpers	2	6	8	.60	57.60
Laborers	40	6	8	.50	960.00
				Total	$3,018.12

MOBILIZATION & DEMOBILIZATION
(Cleanup)

Operation No. 42(B)

Date Nov. 1 to Nov. 30, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel 1-1/4 yd.	1	30	1	$32.00	$ 960.00
Bulldozer D8	1	30	1	18.00	540.00
Bulldozer D4	1	30	1	7.50	225.00
Trucks, Dump, 4 yd.	3	30	1	9.00	810.00
Small Tools					195.25
				Total	$2,730.25

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel 1-1/4 yd.	1	160	$ .39	$ 62.40
Bulldozer D8	1	160	.48	76.80
Bulldozer D4	1	160	.23	36.80
Trucks, Dump, 4 yd.	3	160	.32	153.60
			Total	$ 329.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	1	30	8	$7.22 day	$ 216.60
Foremen	3	30	8	5.16 "	464.40
Shovel Operators	1	20	8	1.25	200.00
Oilers	1	20	8	.60	96.00
Bulldozer Operators	2	20	8	.75	240.00
Truck Drivers	3	20	8	.60	288.00
Laborers	30	20	8	.50	2,400.00
				Total	$3,905.00

BASIS OF ESTIMATE

This item is to cover the cost of cleaning up around the different parts of the job and around the camps and headquarters. It is very difficult to say in advance just what equipment or personnel will be used but it is believed that what is shown will cover the work to be done.

SHOP, UTILITIES AND YARD

DESCRIPTION

All utilities such as lighting, water supply, transportation, etc., as well as the regular activities of the shops, warehouse and yard have been grouped together under Section 14. The costs have been calculated largely on a monthly basis and then extended to cover the time that the utility is expected to function. Allowance has been made for the fact that a large amount of major repair work is provided for in the item of Plant Rental. (See adjustment, below).

	PLANT RENTAL	MATERIAL & SUPPLIES	LABOR
Shop & Yard (Sec. 14A)	$186,129.60	$61,463.20	$222,524.00
Roads & Bridges (Sec. 14C)	33,235.18	69,797.13	40,846.87
Illumination (Sec. 14D)	3,527.33	45,284.40	44,146.40
Totals	$222,892.11 (31.53%)	$176,544.73 (24.97%)	$307,517.27 (43.50%)

ADJUSTMENT:

The Plant Rental charged against each individual pay item includes the cost of major repairs. Since the shop as shown in Section 14(A) is completely equipped to make such repairs, the following adjustment is made, that is, 16% of all Plant Rental charges of the total estimate is deducted from the Shop Utilities and Yard Charges.

TOTAL PLANT RENTAL CHARGE

Items No. 1 to No. 61, incl.	$ 1,120,810.80
Inspection (Section 15)	6,115.08
Surveys (Section 15)	4,570.56
Shop, Utilities & Yard (as above)	222,892.11
Mobilization & Demobilization (Section 13)	17,227.54
Field Overhead (Section 15)	35,902.76
Total	1,407,518.85

16% X $1,407,518.85 = $ 225,203.02

Prorate to:

Plant Rental (31.53%)	Material & Supplies (24.97%)	Labor (43.50%)
$ 71,006.51	$ 56,233.20	$97,963.31

S U M M A R Y

Plant Rental	$222,892.11	- $ 71,006.51	=	$151,885.60
Material & Supplies	176,544.73	- 56,233.20	=	120,311.53
Labor	307,517.27	- 97,963.31	=	209,553.96
Amount chargeable to Shop		Total	=	481,751.09

SHOP & YARD

DESCRIPTION

This Item includes all costs of erecting, wrecking and operating the Machine Shop, Blacksmith Shop, Carpenter Shop and Yard during the life of the job.

SHOP COSTS PER MONTH

Plant Rental	Materials & Supplies	Labor
$11,193.30	$ 2,278.95	$12,245.25

The Yard charge is based on the cost of storing materials and supplies as well as the cost of the buildings used in this connection. The cost of handling materials is charged to the Shop. The buildings include the warehouse, steel and other material, Sheds, Garage, Mess Hall, etc., in all about 430,000 Cu. Ft. at 12¢ = $51,600.00

The Yard equipment consists of 2 derricks and gas hoists. The yard derricks are to be operated by men from the shop.

YEAR	MONTHS OPERATION	PLANT RENTAL	MATERIALS & SUPPLIES	LABOR
Shop 1939	4½	$50,369.85	$10,255.28	$ 55,103.63
Shop 1940	5½	61,563.15	12,534.22	67,348.87
Shop 1941	6	67,159.80	13,673.70	73,471.50
Yard 1939-41	16	7,036.80	25,000.00	26,600.00
TOTALS		$ 186,129.60	$ 61,463.20	$ 222,524.00

S U M M A R Y

PLANT RENTAL	$186,129.60
MATERIALS & SUPPLIES	61,463.20
LABOR	222,524.00
TOTAL	$ 470,116.80

SHOPS, GARAGE, ETC.
(3 Shift Operation)

OPERATION NO. 39

PLANT RENTAL

No. Units	Designation	Time (Cal. Days)	Rate Day	Amount (Total)
1	Anvil 600 lbs.	30	.30	9.00
1	Anvil 300 lbs.	30	.20	6.00
1	Boring Bar, Cylinder	30	1.00	30.00
4	Boring Machines, Air, Wood	30	.80	96.00
1	Charger, battery	30	.20	6.00
1	Compressor, Air, 105 C.F.	30	6.00	180.00
1	Crane, Truck, Utility, 5 ton	30	32.00	960.00
1	Crane, Truck, Wrecking	30	13.00	390.00
3	Drills, electric, Portable	30	1.00	90.00
1	Forge, electric, tools	30	.60	18.00
2	Forge, hand, portable & tools	30	.20	12.00
1	Graders, 12' blade	30	19.00	570.00
2	Grinders, bench	30	.15	9.00
2	Grinders, bit	30	1.80	108.00
1	Grinders, Pinhole	30	.15	4.50
1	Grinders, Portable	30	.30	9.00
1	Grinders, Valve	30	.30	9.00
1	Hammer, Caulking & Chipping, Air	30	.20	6.00
1	Hammer, Sheeting	30	.75	22.50
1	Hammer, Trip, Air	30	.40	12.00
1	Honing, Machine, cylinder	30	.20	6.00
2	Jacks, Floor, Walker	30	.30	18.00
6	Jacks, Hydraulic 10", 2 Ton	30	.10	18.00

PLANT RENTAL (Cont'd)

No. Units	Designation	Time (Cal. Days)	Rate/ Day	Amount (Total)
4	Jacks, Hydraulic, 60 Ton	30	1.00	120.00
6	Jacks, Locomotive, 5 Ton	30	.10	18.00
6	Jacks, Locomotive, 10 Ton	30	.20	36.00
6	Jacks, Norton, 25 Ton	30	.60	108.00
4	Jacks, Steamboat	30	.10	12.00
6	Jacks, Track, 5 Ton	30	.10	18.00
1	Lathe, Machine, Bench	30	.75	22.50
1	Lathe, Machine, 12"	30	2.00	60.00
1	Lathe, Machine, 30"	30	3.50	105.00
1	Lathe, Woodworkers & Tools	30	.20	6.00
1	Milling Machine, complete	30	5.00	150.00
1	Pipe-threading machine	30	4.00	120.00
1	Planer, wood working	30	.20	6.00
1	Press, Drill, Large	30	2.00	60.00
1	Press, Drill, Small	30	1.00	30.00
1	Press, Hydraulic, 120 Ton	30	4.00	120.00
2	Pumps, Fuel Oil Dispensing	30	.10	6.00
2	Pumps, Gasoline, Dispensing	30	.10	6.00
1	Pumps, Tanks, Pipe, Watersupply	30	4.00	120.00
12	Racks, Rigid	30	.05	18.00
1	Receiver, Air, 1000 C.F.	30	.40	12.00
1	Reliner, Brake	30	.20	6.00
6	Riveters, Air	30	.90	162.00
1	Roller, Road, 10 Ton, Self-propelled	30	12.60	378.00
1	Saw, Band	30	2.00	60.00
1	Saw, Hack, power 24"	30	.90	27.00

PLANT RENTAL (Cont'd)

No. Units	Designation	Time (Cal.Days)	Rate/ Day	Amount (Total)
1	Saw, Rig, portable	30	2.50	75.00
6	Saw, skill, electric	30	.50	90.00
1	Saw, woodworking	30	1.50	45.00
2	Sedans	30	3.13	187.80
1	Shaper, crank, 24"	30	2.00	60.00
2	Tanks, gasoline, 2,000 gal.	30	.30	18.00
2	Tanks, Fuel Oil, 2,000 gal.	30	.30	18.00
1	Telephone System	30	15.00	450.00
	Tools, Small, Drills, etc.	30	24.00	720.00
1	Trailer, 75 Ton	30	15.00	450.00
1	Trailer, 25 Ton	30	10.00	300.00
2	Trucks 1/2 Ton Pick-up	30	3.67	220.20
2	Trucks, 2 Ton Stake body	30	8.60	516.00
2	Trucks, 5 Ton Stake body	30	12.70	762.00
3	Trucks, Tank, F.O.1000 gal.	30	15.00	1,350.00
1	Trucks, Tank Gas 850 gal.	30	15.00	450.00
2	Trucks, Tank Sprin. 1000 gal.	30	15.00	900.00
1	Vulcanizer, Tire, elect.	30	.16	4.80
1	Welder, electric 300 Amp.	30	4.70	141.00
2	Welding, Cutting Outfit, gas.	30	1.00	60.00
		Total Cost per month		$ 11,193.30

SHOP, GARAGE, ETC.
(3 Shift Operation)

OPERATION NO. 39

MATERIALS & SUPPLIES (SEE SECTION11)

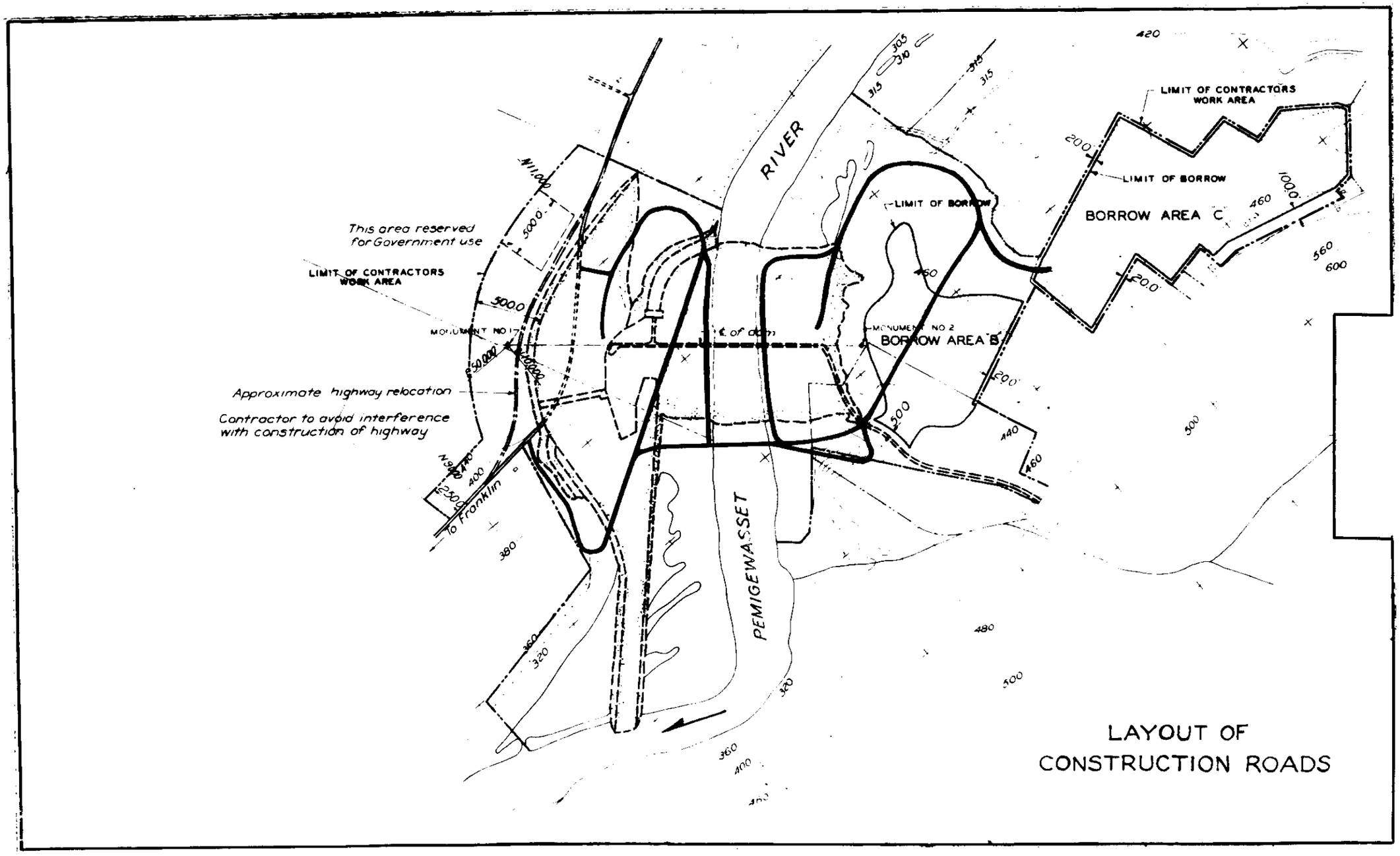
Designation	No. Units	Hours	Rate/Hr.	Amount
Graders, Road	1	420	$ 0.32	$ 134.40
Trucks, Stake, 5 Ton	2	420	.32	268.80
Trucks, Stake, 2 Ton	2	420	.22	184.80
Sedans	2	420	.06	50.40
Trucks, Tank	6	420	.32	806.40
Trucks, Pickup 1/2 Ton	2	525	.12	231.00
Crane Truck 5 Ton	1	420	.425	178.50
Crane Wrecking, 5 Ton Truck	1	420	.32	134.40
Air Compressor	1	525	.21	110.25
Electricity	8000 KWH	at	.02	160.00
Waste, etc.				20.00
	Total cost per month			$ 2,278.95

SHOP, GARAGE, ETC.
(3 Shift Operation)

OPERATION NO. 39

LABOR

No. Men	Designation	Days	Hrs./Day	Rate/Hr.	Amount
3	Shop Foremen	30	8	7.22 day	649.80
3	Carpenter Shop Foremen	30	8	6.38 "	574.20
3	Blacksmiths	25	7	1.00	525.00
3	Helpers	25	7	.70	367.50
15	Mechanics, Automotive	25	7	.90	2,362.50
3	Machinists	25	7	1.00	525.00
3	Machinist Helpers	25	7	.55	288.75
3	Gasoline & oil dispensers	25	7	.60	315.00
6	Carpenters (Shop)	25	7	.80	840.00
3	Operators, Crane	20	7-1/2	1.25	562.50
3	Switchboard Operators	30	8	.50	360.00
30	Truck Drivers	20	7-1/2	.60	2,700.00
3	Welders	25	7	1.00	525.00
3	Tractor Operators	20	7-1/2	.75	337.50
15	Laborers	25	7	.50	1,312.50
		Total cost per month			$ 12,245.25


LAYOUT OF
CONSTRUCTION ROADS
This area reserved for Government use
LIMIT OF CONTRACTORS WORK AREA
MONUMENT NO 17
Approximate highway relocation
Contractor to avoid interference with construction of highway
To Franklin
RIVER
PEMIGEWASSET
LIMIT OF BORROW
MONUMENT NO 2
BORROW AREA B
LIMIT OF CONTRACTORS WORK AREA
LIMIT OF BORROW
BORROW AREA C

CONSTRUCTION ROADS & BRIDGES

DESCRIPTION

This item includes the cost of all construction roads shown on the preceding map (Section 14B) and the construction trestle. The repair and maintenance costs will be included in the shop (Section 14A).

The cost of the cofferdam trestle is charged to Item No. 3 (Section 23).

(Roads)	PLANT RENTAL	MATERIAL & SUPPLIES	LABOR
L.B.	$ 20,279.00	$ 3,475.08	$13,133.82
R.B.	3,945.00	686.07	2,442.23
(Trestle)			
1939	2,469.90	61,554.62	8,345.70
1940	3,574.54	3,581.36	11,086.32
1941	2,966.74	500.00	5,838.80
	$33,235.18	$69,797.13	$40,846.87

SUMMARY

PLANT RENTAL	$ 33,235.18
MATERIAL & SUPPLIES	$ 69,797.13
LABOR	$ 40,846.87
TOTAL	$ 143,879.18

CONSTRUCTION ROADS
(Left Bank)

Quantity 145,000 c.y.

Operation No. 2
Date Aug. 1 to Sept. 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel 2 Yd. #5	1	45	3	$ 102.00	$ 4,590.00
Shovel 2 Yd. #4	1	24	3	102.00	2,448.00
Bulldozer, 90 H.P.	1	45	3	36.00	1,620.00
Bulldozer, 30 H.P.	1	45	3	15.00	675.00
Bulldozer, 90 H.P.	1	24	3	36.00	864.00
Bulldozer, 30 H.P.	1	24	3	15.00	360.00
Trucks, Dump, 4 Yd.	8	45	3	18.00	6,480.00
Trucks, Dump, 4 Yd.	6	24	3	18.00	2,592.00
Small Tools					650.00
				Total	$20,279.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel 2 Yd. #5	1	630	$ .55	$ 346.50
Shovel 2 Yd. #4	1	336	.55	184.80
Bulldozer, 90 H.P.	1	630	.48	302.40
Bulldozer, 30 H.P.	1	630	.23	144.90
Bulldozer, 90 H.P.	1	336	.48	161.28
Bulldozer, 30, H.P.	1	336	.23	77.28
Trucks, Dump, 4 Yd.	8	630	.32	1,612.80
Trucks, Dump, 4 Yd.	6	336	.32	645.12
			Total	$ 3,475.08

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	45	8	$7.22 day	$ 974.70
Foremen	3	45	8	5.16 "	696.60
Foremen	3	24	8	5.16 "	371.52
Operators, Shovel	3	30	7½	1.25	843.75
Operators, Shovel	3	16	7½	1.25	450.00
Oilers, Shovel	3	30	7½	.60	405.00
Oilers, Shovel	3	16	7½	.60	216.00
Operators, Tractor	3	30	7½	.75	506.25
Operators, Tractor	3	16	7½	.75	270.00
Truck Drivers	24	30	7½	.60	3,240.00
Truck Drivers	13	16	7½	.60	1,296.00
Laborers	24	30	7	.50	2,520.00
Laborers	24	16	7	.50	1,344.00
				Total	$ 13,133.82

CONSTRUCTION ROADS
(Right Bank)

Quantity 42,000 c.y.

Operation No. 8
Date Aug. 16-31, 1939

PLANT RENTAL

Designation	No. Units	Days	Shifts	Rate/Day	Amount
Shovel 2-1/2 Yd. No. 3	1	15	3	$ 111.00	$ 1,665.00
Trucks, Dump, 4 Yd.	4	15	3	18.00	1,080.00
Bulldozer, 90 H.P.	2	15	3	36.00	1,080.00
Small Tools					120.00
				Total	$ 3,945.00

MATERIALS & SUPPLIES (See Section 11)(11 Working Days)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel 2-1/2 Yd. No. 3	1	231	$ .73	$ 168.63
Trucks, Dump, 4 Yd.	4	231	.32	295.68
Bulldozer, 90 H.P.	2	231	.48	221.76
			Total	$ 686.07

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foreman, General	3	15	8	$7.22 day	$ 324.90
Foreman	3	15	8	5.16 "	232.20
Operators, Shovel	3	11	7½	1.25	309.38
Oilers, Shovel	3	11	7½	.60	148.50
Truck Drivers	12	11	7½	.60	594.00
Operators, Tractor	6	11	7½	.75	371.25
Laborers	12	11	7	.50	462.00
				Total	$ 2,442.23

BASIS OF ESTIMATE (Const'n Roads)

LEFT BANK

It is estimated that the shovels will handle at least 3000 yards on this work, in a 21-hour day and that an appreciable quantity of the material can be side cast and handled by the Bulldozers.

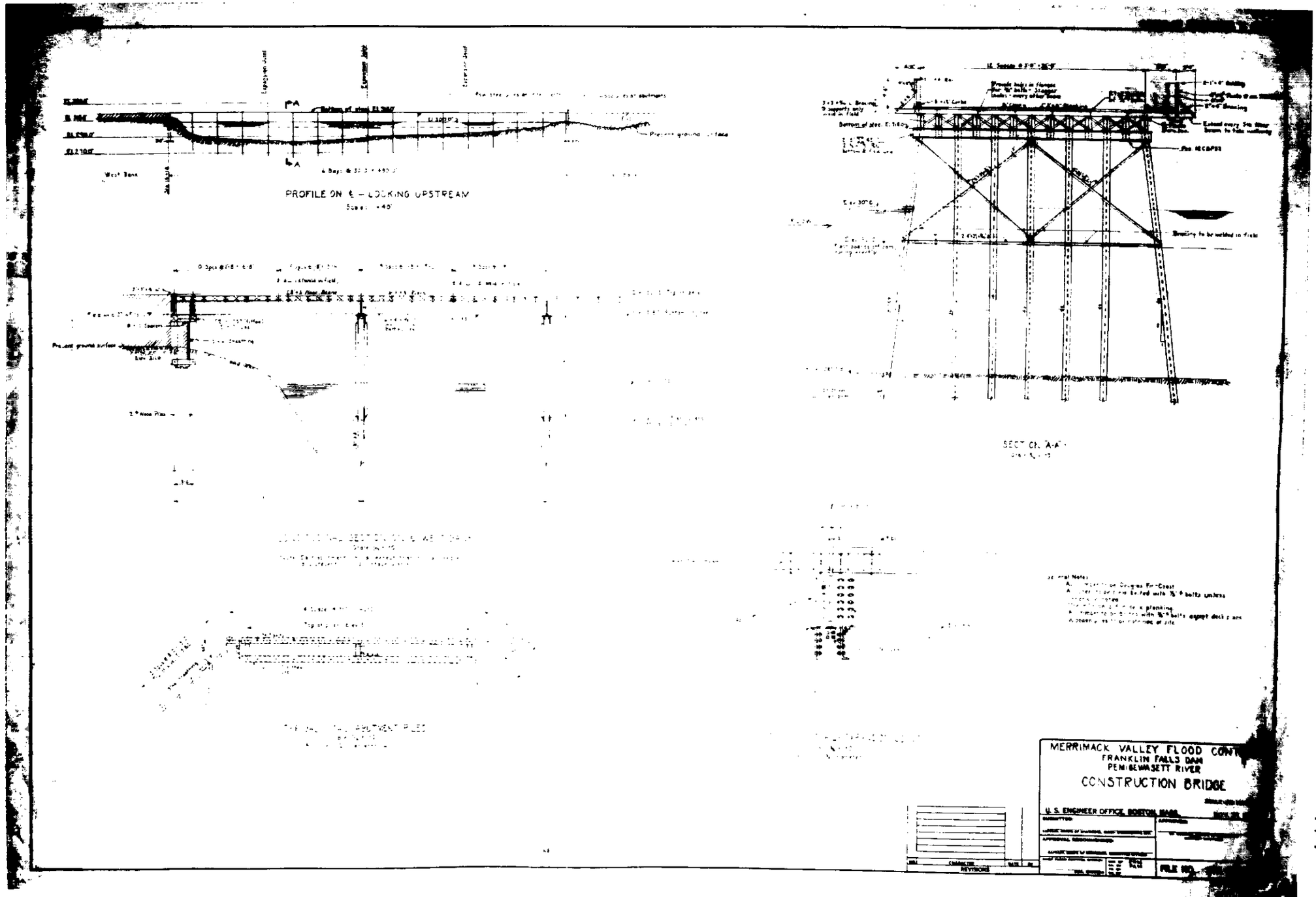
These roads will have to be heavily surfaced with gravel which is to be hauled by the trucks.

Shovel #4 operates August 1 to August 24.

Shovel #5 operates August 1 to September 15.

RIGHT BANK

On this work approximately 4000 cubic yards per day should be moved inasmuch as most of the material will be side cast and moved with the Bulldozer.


PROFILE ON ℄ – LOOKING UPSTREAM
West Bank
MERRIMACK VALLEY FLOOD CONT
FRANKLIN FALLS DAM
PEMIGEWASETT RIVER
CONSTRUCTION BRIDGE
U. S. ENGINEER OFFICE, BOSTON, MASS.

CONSTRUCTION TRESTLE
(Downstream)

Operation No. 1 (A)
Date Aug. 1-15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Crane, 1-1/4 Cu. Yds.	1	15	3	$ 64.00	$ 960.00
Compressor, Air, 315 c.f.	1	15	3	23.00	345.00
Boilers, Steam, Portable, 30 H.P.	1	15	3	3.66	54.90
Bulldozer, 30 H.P.	1	15	3	15.00	225.00
Hammer Pile Steam #3	1	15	3	9.00	135.00
Small Tools		15	3	30.00	450.00
Pipe, Valves, Hose & Fittings		15	3	20.00	300.00
Machines, Boring (Shop)					
				Total	$ 2,469.90

MATERIALS & SUPPLIES (See Section 11) 12 Working Days

Designation	No. Units.	No. Hrs.	Rate/Hr.	Amount
Crane, 1-1/4 Cu. Yds.	1	252	$ .39	$ 98.28
Boiler, Steam, Portable, 30 H.P.	1	252	.45	113.40
Compressor, Air, 315 c.f.	1	252	.565	142.38
Tractor, 30 H.P.	1	252	.23	57.96
Hammer, Pile, Steam, #3	1	252	.05	12.60
Steel, Structural, 662 Tons @ $80.00				52,960.00
Timber, 150,000 Ft. BM @ $45.00				6,750.00
Bolts, nails & hardware				1,420.00
			Total	$ 61,554.62

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foreman, General	3	15	8	$7.22 day	$324.90
Foreman, Carpenter	3	15	8	7.22 "	324.90
Foreman	3	15	8	5.16 "	232.20
Carpenters	12	12	7	.80	806.40
Helpers, Carpenter	12	12	7	.55	554.40
Operators, Tractor	3	12	7½	.75	202.50
Operators, Crane	3	12	7½	1.25	337.50
Oilers	3	12	7½	.60	162.00
Iron Workers	18	12	7	1.20	1,814.40
Operators, Pneumatic Tool	3	12	7	.65	163.80
Operators, Pile Hammer	3	12	7½	1.25	337.50
Firemen	3	12	7½	.60	162.00
Welders	3	12	7	1.00	252.00
Helpers, Welder	3	12	7	.60	151.20
Laborers	60	12	7	.50	2,520.00
				Total	$ 8,345.70

CONSTRUCTION TRESTLE
(Outlet Channel)

Operation No. 42

Date Nov. 6 to Dec. 18, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Crane No. 1 1-1/4 yd.	1	42	2	$48.00	$ 2,016.00
Boiler, portable, 30 H.P.	1	42	3	3.66	153.72
Pile Hammer, Hose, Pipe, Fittings, etc.	1	42	2	9.00	378.00
Bulldozer D4	1	42	2	11.25	472.50
Small Tools		42	2		554.32
				Total	$ 3,574.54

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Crane No. 1	1	448	$ .39	$ 174.72
Boiler 30 H.P.	1	1008	.45	453.60
Bulldozer D4	1	448	.23	103.04
Lumber 30,000 Ft. B.M. @ $45				1,350.00
Nails & Hardware				1,500.00
			Total	$ 3,581.36

LABOR

Designation	No. Mon.	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	2	42	8	$7.22 day	$ 606.48
Foremen	4	42	8	6.38 "	1,071.84
Crane Operators	2	28	8	1.25	560.00
Oilers	2	28	8	.60	268.80
Firemen	3	42	8	.60	604.80
Steam Fitters	2	28	8	1.00	448.00
Pile Driver Operators	2	28	8	1.25	560.00
Laborers	40	28	8	.50	4,480.00
Carpenters	12	28	8	.80	2,150.40
Tractor Operators	2	28	8	.75	336.00
				Total	$11,086.32

CONSTRUCTION TRESTLE
(Final Wrecking)

Operation No. 42(A)

Date Nov. 1 to Nov. 30, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Crane No. 5 2 Cu. Yd.	1	30	2	$76.50	$2,295.00
Boiler, Steam, 30 H.P.	1	30	3	3.66	109.80
Pile extractor (hammer)	1	30	2	6.00	180.00
Hose, pipe, fittings		30	2	3.00	90.00
Small Tools		30	2		291.94
				Total	$2,966.74

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Crane No. 5	1	320	$ .55	$ 176.00
Boiler	1	720	.45	324.00
			Total	$ 500.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	2	30	8	$7.22 day	$ 433.20
Foremen	4	30	8	6.38 "	765.60
Crane Operators	2	20	8	1.25	400.00
Oilers	2	20	8	.60	192.00
Firemen	2	20	8	.60	192.00
Steam Fitters	2	20	8	1.00	320.00
Pile Hammer Operators	2	20	8	1.25	400.00
Carpenters	12	20	8	.80	1,536.00
Laborers	20	20	8	.50	1,600.00
				Total	$5,838.80

BASIS OF ESTIMATE (Construction Trestle)

1939

It is estimated that the crane can drive two bents of 7 H Columns per 21-hour day and that sufficient deck can be laid to carry the crane forward at this rate. The deck to be about 2 days behind the crane.

1940

It is proposed to wreck the construction trestle and to reerect it in two parts, one half to be placed across the outlet discharge channel and the other half to be erected over the outlet approach channel.

Estimate is based on pulling two bents per day and driving one bent per day. The deck to be built by carpenters and laborers.

1941

This operation covers the final wrecking and disposal of the construction bridges. Removal must be completed before the dredge removes the small cofferdam in the spillway discharge channel. All transportation will be handled by, and charged to the shop.

D. O. Form 350

ILLUMINATION

DESCRIPTION

As more than 90 percent of all work is expected to proceed on a 3-shift schedule, an extensive flood-lighting system has been planned over the entire area of the damsite and borrow pits. The total direct field cost of installation, extensions, repairs, etc., is as follows:

	PLANT RENTAL	MATERIAL & SUPPLIES	LABOR
1939	$ 1,085.04	$ 20,122.80	$ 14,275.70
1940	1,096.92	13,251.20	12,863.40
1941	1,345.37	11,910.40	17,007.30
	$ 3,527.33	$ 45,284.40	$ 44,146.40

S U M M A R Y

PLANT RENTAL	$ 3,527.33
MATERIAL & SUPPLIES	$ 45,284.40
LABOR	$ 44,146.40
TOTAL	$ 92,958.13

ILLUMINATION

Operation No. 38

Date Aug. 1 to Dec. 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Truck, Pickup, 1/2 Ton	1	135	2	$2.75	$ 371.25
Small Tools		135	2		713.79
				Total	$ 1,085.04

MATERIALS & SUPPLIES

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Truck	1	1440	$ .12	$ 172.80
Flood Lights 140 @ $50.				7,000.00
Lumber 10 M.B.M. @ $45.				450.00
Poles 200 @ $6.00				1,200.00
Power 290,000 K.W.H. @ $.02				5,800.00
Repair parts, wire, insulators, etc.				5,500.00
			Total	$20,122.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen (Electrician)	3	15	8	$7.22 day	$ 324.90
Foremen	9	15	8	5.16 "	696.60
Electricians	9	10	7	1.00	630.00
Linemen	18	10	7	.85	1,071.00
Laborers	90	10	7	.50	3,150.00
Foremen (Electrician)	2	120	8	7.22 day	1,732.80
Foremen	2	120	8	5.16 "	1,238.40
Electricians	2	80	7	1.00	1,120.00
Linemen	2	80	7	.85	952.00
Laborers	12	80	7	.50	3,360.00
				Total	$14,275.70

ILLUMINATION

Operation No. 38

Date May 15 to Oct. 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Truck, Pickup, 1/2 Ton	1	165	2	$2.75	$ 453.75
Small Tools		165	2		643.17
				Total	$ 1,096.92

MATERIALS & SUPPLIES

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Truck	1	1760	$ .12	$ 211.20
Power 352,000 K.W.H. @ $.02				7,040.00
Repair Parts, poles, etc.				4,000.00
Wire, Insulators, Bulbs, etc.				2,000.00
			Total	$13,251.20

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen (Electrician)	2	165	8	$7.22 day	$ 2,382.60
Foremen	2	165	8	5.16 "	1,702.80
Electricians	2	110	7	1.00	1,540.00
Linemen	4	110	7	.85	2,618.00
Laborers	12	110	7	.50	4,620.00
				Total	$12,863.40

ILLUMINATION

Operation No. 38

Date April 22 to Oct. 21, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pickup Truck 1/2 Ton	1	180	2	$2.75	$ 495.00
Small Tools		180	2		850.37
				Total	$ 1,345.37

MATERIALS & SUPPLIES

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Truck	1	1920	$.12	$ 230.40
Power 384,000 K.W.H. @$.02				7,680.00
Repair & Spare Parts, etc.				4,000.00
			Total	$11,910.40

LABOR

Designation	No. Men	Days	Hrs/Day	Rate/Hr.	Amount
Foremen (Electrician)	3	15	8	$7.22 day	$ 324.90
Foremen	9	15	8	5.16 "	696.60
Electricians	3	10	7	1.00	210.00
Linemen	18	10	7	.85	1,071.00
Laborers	60	10	7	.50	2,100.00
Foremen (Electrician)	2	180	8	7.22 day	2,599.20
Foremen	2	180	8	5.16 "	1,857.60
Electricians	2	120	7	1.00	1,680.00
Linemen	2	120	7	.85	1,428.00
Laborers	12	120	7	.50	5,040.00
				Total	$17,007.30

BASIS OF ESTIMATE (Illumination)

1939

It is estimated that one Master Electrician, three foremen, three electricians, six linemen and thirty laborers on each of three shifts can install the lighting system in ten working days.

After the system is installed, a maintenance crew operating on a two-shift basis can keep the plant in operation.

1940

It is assumed that lights will be required for the entire time that the construction operations are in progress. The principal part of the system is assumed to be installed during 1939. During the season of 1940, only maintenance and extensions are contemplated.

1941

During this season, maintenance and extensions are provided for and a wrecking crew for the complete dismantling of the system at the close of operations has been provided.

All transportation of materials and supplies is assumed to be furnished by the shop.

ORGANIZATION

INSPECTION & FIELD OVERHEAD
(Gov't Plant &Hired Labor)

1 Sub-Area Engineer
Principal Superintendent
$5,600

1 Assistant
Associate Superintendent
$3,400

OPERATIONS

1 Senior Superintendent
$4,600

3 Superintendents
$3,800

3 Asst. Superintendents
$2,900 (Concrete)

3 Asst. Superintendents
$2,900 (Earth)

3 Asst. Superintendents
$2,900 (Rock)

1 Master Mechanic
$3,600

3 Mechanical Assistants
$2,900

3 Electrical Assistants
$2,600

ADMINISTRATION

1 Jr. Admin. Assistant
$2,600
1 Senior Clerk (Asst.)
$2,000

Mail & Records

1 Asst. Clerk $1,620

Correspondence

1 Asst. Clerk $1,620
6 Jr. Stenog's. $1,440

Transportation

1 Junior Clerk $1,440

Personnel

1 Clerk $1,800
4 Junior Clerks $1,440

Timekeepers

18 $1,440

Purchases

1 Clerk $1,800

ENGINEERING

1 Asst. Engineer $2,600

Drafting Room

1 Draftsman $1,800
1 Asst. Draftsman $1,620

Costs

1 Asst. Engineer $2,600
2 Jr. Engineers $2,000
2 Jr. Clerks $1,440

Safety

1 Assoc. Med. Off. $3,200
1 Jr. Engineer $2,000
1 Jr. Clerk $1,440
3 Nurses $1,800

PROPERTY

1 Senior Clerk
$2,000
3 Clerks
$1,800
3 Jr. Clerks
$1,440
2 Jr. Stenog's.
$1,440
1 Whse. Clerk
$1,800
3 Foremen
$1,620

INSPECTION

3 Asst. Engineers $2600
21 Inspectors GC $1800
1 Asst. Clerk $1620

Concrete Lab.

1 Jr. Engineer $2000
2 Eng'g Aides $1800

Soils Lab.

1 Jr. Engineer $2000
2 Eng'g Aides $1800

Surveys

1 Asst. Engineer $2600
2 Jr. Engineers $2000
2 Surveymen $1800
6 Rodmen $1260

FIELD OVERHEAD

(Govt. Plant & Hired Labor)

DESCRIPTION

The total cost of Field Overhead and Supervision is estimated by assuming 60% of the full crew during the 1939 constructing season and 100% during 1940 and 1941. 50% of the monthly cost is charged during the winter months.

MONTHLY COSTS

Plant Rental	Material & Supplies	Labor
$1,845.90	$1,367.00	$15,513.42

TOTAL COSTS

Dates	No. Months	P.R.	M. & S.	Labor	
Aug. 1, 1939 - Dec. 15, 1939	4-1/2	$4,983.93	$ 3,690.90	$41,886.23	(60%)
Dec. 16, " - May 15, 1940	5	4,614.75	3,417.50	38,783.55	(50%)
May 16, 1940 - Oct. 31, 1940	5-1/2	10,152.45	7,518.50	85,323.81	(100%)
Nov. 1, 1940 - May 31, 1941	7	6,460.65	4,784.50	54,296.97	(50%)
June 1, 1941 - Oct. 15, 1941	4-1/2	8,306.55	6,151.50	69,810.39	(100%)
Oct.16, 1941 - Nov. 30, 1941	1-1/2	1,384.43	1,025.25	11,635.06	(50%)
		$35,902.76	$26,588.15	$301,716.01	

S U M M A R Y

PLANT RENTAL	$ 35,902.76
MATERIAL & SUPPLIES	26,588.15
LABOR	301,716.01
TOTAL	$364,206.92

FIELD OVERHEAD

MONTHLY COST - GOVT. PLANT & HIRED LABOR

PLANT RENTAL

	No. Units	Cal. Days	Rate/Day	Amount
Sedans	6	30	3.13	$ 563.40
Pickup Trucks ½ Ton	8	30	3.67	880.80
Station Wagons	3	30	3.13	281.70
Office Equipment	1	30	4.00	120.00
			Total	$ 1,845.90

MATERIAL & SUPPLIES (See Sections 9 & 11)

	No. Units	No. Hrs.	Rate/Hr.	Amount
Sedans	6	525	$ .06	$ 189.00
Pickup Trucks	8	525	.12	504.00
Station Wagons	3	525	.12	189.00
Fuel Oil	1000 gal. at	.075		75.00
Electricity	3000 K.W.H. at	.02		60.00
Office Supplies	L.S.			250.00
Tel. & Tel.	L.S.			100.00
			Total	$ 1,367.00

LABOR

Designation	No. Men	Annual Rate	Amount
Principal Superintendent	1	$5,600	$ 466.67
Assoc. "	1	3,400	283.33
Senior "	1	4,600	383.33
Superintendents	3	3,800	950.01
Asst. Superintendents	9	2,900	2,175.03
Master Mechanic	1	3,600	300.00
Mechanical Assts.	3	2,900	725.01
Electrical "	3	2,600	650.01
Asst. Engineer	2	2,600	433.34
Jr. Engineer	3	2,000	500.01
Draftsman	1	1,800	150.00
Asst. Draftsman	1	1,620	135.00
Asso. Medical Officer	1	3,200	266.67
Nurses	3	1,800	450.00
Jr. Admin. Asst.	1	2,600	216.67
Senior Clerk	2	2,000	333.34
Clerks	6	1,800	900.00
Asst. Clerks	2	1,620	270.00
Jr. Clerks	11	1,440	1,320.00
Jr. Stenographers	8	1,440	960.00
Foremen (Warehouse)	3	1,620	405.00
Timekeepers	18	1,440	2,160.00
Laborers	12	1,080	1,080.00
		Total	$15,513.42

INSPECTION

(Govt. Plant & Hired Labor)

DESCRIPTION

The total inspection cost is based on the use of the maximum force during the construction periods except in 1939 when 60% is used. During the winter months, 50% of full crew and equipment is charged.

MONTHLY COSTS

Plant Rental	Material & Supplies	Labor
$314.40	$189.00	$4,868.35

TOTAL COSTS

Dates	No. Months	Plant Rental	Material & Supplies	Labor
Aug. 1, 1939 to Dec. 15, 1939	4½	$ 848.88	$ 510.30	$13,144.55 (60%)
Dec. 16, " " May 15, 1940	5	786.00	472.50	12,170.88 (50%)
May 16, 1940 " Oct. 31, "	5½	1,729.20	1,039.50	26,775.93(100%)
Nov. 1, " " May 31, 1941	7	1,100.00	661.50	17,039.23 (50%)
June 1, 1941 " Oct. 15, "	4½	1,414.80	850.50	21,907.58(100%)
Oct. 16, " " Nov. 30, "	1½	235.80	141.75	3,651.26 (50%)
		$6,115.08	$3,676.05	$94,689.43

S U M M A R Y

PLANT RENTAL	$ 6,115.08
MATERIALS & SUPPLIES	3,676.05
LABOR	94,689.43
Total	$104,480.56

INSPECTION

Monthly Cost - Govt. Plant & Hired Labor

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Station Wagons	1	30	3	$ 3.14	$ 94.20
Pickup Truck 1/2 Ton	2	30	3	3.67	220.20
				Total	$ 314.40

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Station Wagon	1	525	$ .12	$ 63.00
Pickup Truck	2	525	.12	126.00
			Total	$ 189.00

LABOR

Designation	No. Men	Annual Rate	Amount
Assistant Engineers	3	$ 2,600	$ 650.01
Junior "	2	2,000	333.34
Engineering Aides	4	1,800	600.00
Inspectors	21	1,800	3,150.00
Asst. Clerk	1	1,620	135.00
		Total	$4,868.35

SURVEYS

(Gov't Plant & Hired Labor)

DESCRIPTION

The total cost of the survey section is estimated on the basis of a full crew during the summer months and 20% maximum crew during the winter months. Stakes will be made in the shop.

MONTHLY COSTS

Plant Rental	Material & Supplies	Labor
$248.40	$126.00	$1,480.00

TOTAL COSTS

Dates	No. Months	P.R.	M. & S.	Labor
Aug. 1, 1939 - Dec. 15, 1939	4-1/2	$1,117.80	$ 567.00	$ 6,660.00 (100%)
Dec. 16, 1939 - May 15, 1940	5	248.40	126.00	1,480.00 (20%)
May 16, 1940 - Oct. 31, 1940	5-1/2	1,366.20	693.00	8,140.00 (100%)
Nov. 1, 1940 - May 31, 1941	7	347.76	176.40	2,072.00 (20%)
June 1, 1941 - Nov. 30, 1941	6	1,490.40	756.00	8,880.00 (100%)
		$4,570.56	$2,318.40	$27,232.00

S U M M A R Y

PLANT RENTAL .....$ 4,570.56

MATERIAL & SUPPLIES 2,318.40

LABOR 27,232.00

TOTAL $34,120.96

SURVEYS

Monthly Cost - Govt. Plant & Hired Labor

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Station Wagons	2	30	3	$ 3.14	$ 188.40
Surveying Instruments		30	3	2.00	60.00
				Total	$ 248.40

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Station Wagons	2	525	$ .12	$ 126.00
			Total	$ 126.00

LABOR

Designation	No. Men	Annual Rate	Amount
Assistant Engineer	1	$ 2,600	$ 216.67
Junior "	2	2,000	333.34
Surveymen	2	1,800	300.00
Rodmen	6	1,260	630.00
		Total	$ 1,480.00

ORGANIZATION

FIELD OFFICE OVERHEAD
(Contract Operation)

1 RESIDENT ENGINEER
Principal Engineer
$5600

3 ASST. RESIDENT ENGINEERS
Associate Engineers
$3400

ENGINEERING

1 Asst. Engineer (Civil) $2600

Drafting Room

1 Draftsman (Civil) $1800
4 Asst. Draftsmen (Civil) $1620

Costs

1 Asst. Engineer (Civil) $2600
2 Jr. Engineers (Civil) $2000
2 Jr. Clerks $1440

INSPECTION

3 Asst. Engineers (Civil) $2600
21 Inspectors (G.C.) $1800
1 Asst. Clerk $1620

Concrete Lab.

1 Jr. Engineer (Civil) $2000
2 Engineering Aides $1800

Soils

1 Jr. Engineer (Civil) $2000
2 Engineering Aides $1800

Surveys

1 Asst. Engineer (Civil) $2600
2 Jr. Engineers (Civil) $2000
2 Surveymen $1800
6 Rodmen $1260

ADMINISTRATIVE

1 Jr. Admin. Assistant $2600

Mail & Records

1 Clerk $1800
2 Jr. Stenographers $1440

Property

1 Asst. Clerk $1620

FIELD OFFICE OVERHEAD

(Contract Operation)

DESCRIPTION

The following costs are to be added to the lowest responsible bid.

MONTHLY COSTS

Surveys	Inspection	Supervision
$ 1,854.40	$ 5,371.75	$ 5,160.91

During the 1939 and 1942 construction seasons, 60% of the full crew is figured, and during the winter months 50% is used. The full crew is charged during the 1940 and 1941 construction periods.

	Surveys	Inspection	Supervision	
4½ months	$ 5,006.88	$ 14,503.73	$ 13,934.46	60%
5 "	4,636.00	13,429.37	12,902.28	50%
5½ "	10,199.20	29,544.63	28,385.01	100%
7 "	6,490.40	18,801.12	18,063.18	50%
4½ "	8,344.80	24,172.88	23,224.10	100%
7½ "	8,344.80	24,172.87	23,224.09	60%
Totals	$43,022.08	$124,624.60	$119,733.12	

Surveys	$ 43,022.08
Inspection	124,624.60
Supervision	119,733.12
Total	$287,379.80

FIELD OFFICE OVERHEAD
(Surveys)

MONTHLY COST - CONTRACT OPERATION

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Station Wagons	2	30	3	$3.14	$188.40
Surveying Instruments		30	3	2.00	60.00
				Total	$248.40

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Station Wagons	2	525	$.12	$126.00
			Total	$126.00

LABOR

Designation	No. Men	Annual Rate	Amount
Assistant Engineer	1	$2600	$ 216.67
Junior Engineers	2	2000	333.34
Surveymen	2	1800	300.00
Rodmen	6	1250	630.00
		Total	$1,480.00

FIELD OFFICE OVERHEAD
(Inspection)

MONTHLY COST - CONTRACT OPERATION

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Station Wagon	1	30	3	$3.14	$ 94.20
Pick-up Truck	2	30	3	3.67	220.20
				Total	$314.40

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Station Wagon	1	525	$.12	$ 63.00
Pick-up Truck	2	525	.12	126.00
			Total	$189.00

LABOR

Designation	No. Men	Annual Rate	Amount
Assistant Engineers	3	$2600	$ 650.01
Junior "	2	2000	333.34
Engineering Aides	4	1800	600.00
Inspectors	21	1800	3,150.00
Asst. Clerk	1	1620	135.00
		Total	$4,868.35

FIELD OFFICE OVERHEAD
(Superintendence)

MONTHLY COST - CONTRACT OPERATION

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Sedans	4	30	3	$3.14	$ 376.80
Pick-up Trucks	1	30	3	3.67	110.10
Office Equipment		30	3	2.00	60.00
				Total	$ 546.90

MATERIALS & SUPPLIES (See Sections 9 & 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Sedans	4	525	$.06	$ 126.00
Pick-up Trucks	1	525	.12	63.00
Electricity 2500 K.W.H. @ .02				50.00
Fuel Oil 800 gal. @ .075				60.00
Office Supplies	L.S.			150.00
Telephone & Telegraph	L.S.			50.00
			Total	$ 499.00

LABOR

Designation	No. Men	Annual Rate	Amount
Principal Engineer	1	$5600	$ 466.67
Associate Engineers	3	3400	849.99
Assistant "	2	2600	433.34
Junior "	2	2000	333.34
Draftsman	1	1800	150.00
Asst. Draftsmen	4	1620	540.00
Junior Adm. Assistant	1	2600	216.67
Clerk	1	1800	150.00
Asst. Clerks	1	1620	135.00
Junior Clerks	2	1440	240.00
Junior Stenographers	2	1440	240.00
Janitors	4	1080	360.00
		Total	$4,115.01

GRAVEL & BATCHING PLANT

This section includes the cost of stripping the borrow area, haul to the plant, and the cost of crushing, screening and washing. The summary of the total direct field costs and prorating same to the various Pay Items in proportion to the quantities in these Items, is as shown below, no distinction being made between the cost of sand and gravel.

SUMMARY

Year	Op. #	Plant Rental	Material & Supplies	Labor
1939	6(1)	$21,484.62	$ 3,822.00	$ 10,088.40
1939	"(2)	20,178.63	5,362.80	11,568.60
1940	8	4,392.29	504.00	1,445.85
"	27(1)	4,403.10	569.80	1,463.90
"	"(2)	17,670.87	3,418.80	9,413.40
"	"(3)	4,409.27	651.20	1,587.40
"	"(4)	5,519.96	1,608.84	3,598.02
1941	12(1)	10,745.63	2,102.10	5,110.50
"	"(2)	6,643.82	1,156.40	3,576.40
Totals		$95,448.19	$19,195.94	$47,852.47
Cost per c.y.		$.31708255	$.06376964	$.15896774

PRORATION

Item	Quantity	Plant Rental	Material & Supplies	Labor
21	115,000	$ 36,464.49	$ 7,333.51	$ 18,281.29
22	100	31.71	6.38	15.90
23	81,000	25,683.69	5,165.34	12,876.39
29	24,300	7,705.11	1,549.60	3,862.92
30	11,880	3,766.94	757.58	1,888.54
31	39,825	12,627.81	2,539.63	6,330.89
32	120	38.05	7.65	19.08
33	1,620	513.67	103.31	257.53
34	24,975	7,919.14	1,592.65	3,970.22
55	2,200	697.58	140.29	349.73
Totals	301,020	$95,448.19	$19,195.94	$47,852.47

GRAVEL & BATCHING PLANT

Operation No. 6, Sheet #1

Quantity 65,750 cu. yds., Gravel
57,625 " " Sand

Date August 16 - October 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers, 18-yd.	3	60	3	$ 63.00	$ 11,340.00
Bulldozer 90 HP	1	60	3	36.00	2,160.00
Gravel Plant	1	60	3	100.00	6,000.00
Pickup Truck 1/2-ton	1	60	3	3.67	220.20
Pump, 4" Pipe, Fitting, etc.	1	60	3	21.00	1,260.00
Small Tools		60	3		504.42
				Total	$ 21,484.62

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
LeTourneaus 18-yd.	3	840	$.48	$ 1,209.60
Bulldozer 90 HP	1	840	.48	403.20
Gravel Plant	1	840	2.25	1,890.00
Pickup Truck	1	840	.12	100.80
Pump, 4" High Pressure	1	840	.26	218.40
			Total	$ 3,822.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	60	8	$7.22 day	$ 1,299.60
Foremen	3	60	8	5.16 "	928.80
Tractor Operators	12	40	7-1/2	.75	2,700.00
Batcher Operators	6	40	7	.75	1,260.00
Mechanics	3	40	7	1.00	840.00
Pumpmen	3	40	7-1/2	.60	540.00
Laborers	18	40	7	.50	2,520.00
				Total	$ 10,088.40

BASIS OF ESTIMATE (Op. #6, Sheet #1, 1939)

It is estimated that the Gravel Plant will produce 1,650 cu. yds. of screened and washed gravel in 21 hours. At the same time it will produce 3,300 cu. yds. of sand.

The material in the pit is assumed to run 67% sand and 33% gravel.

The LeTourneau Scrapers (18-yd.) can operate as follows:

Loaded, 1000 feet in 3rd Gear	= 4.0	minutes
Empty, 1000 " " 6th "	= 2.1	"
Load, Dump and Turn	= 4.3	"
Total Time for one Round Trip	=10.4	"

Assuming 80% efficiency, each scraper will haul 1700 cu. yds. in one day and the 3 machines will handle 5100.

The extra Bulldozer is used as a booster in loading the scrapers.

Requirements for this period are derived from the following:

Op. #	Gravel	Sand
7(C)		9,500 c.y.
7(D)	25,300 c.y.	
12		48,000 " "
13	40,200 " "	
22	250 " "	125 " "
	65,750 c.y.	57,625 c.y.

65,750 c.y. ÷ 40 days = 1,640 c.y. per day.

GRAVEL & BATCHING PLANT

Operation No. 6, Sheet #2

Quantity 19,750 cu. yds., Gravel
9,875 " " Sand

Date Oct. 16 - Dec. 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers, 18-yd.	2	60	3	$ 63.00	$7,560.00
Bulldozer 90 HP	1	60	3	36.00	2,160.00
Gravel Plant	1	60	3	130.00	7,800.00
Boiler, 90 HP, Steam	1	60	3	10.00	600.00
Pickup Truck, 1/2-ton	1	60	3	3.67	220.20
Pump, 4", HP, Pipe, Fittings, etc.	1	60	3	21.00	1,260.00
Small Tools					578.43
				Total	$20,178.63

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Tractors, 90 HP	3	840	$ .48	$1,209.60
Gravel Plant	1	840	2.25	1,890.00
Boiler 90 HP	1	1440	1.35	1,944.00
Pump, 4" HP, Pipe, Fittings, etc.	1	840	.26	218.40
Pickup Truck, 1/2-Ton	1	840	.12	100.80
			Total	$5,362.80

LABOR

Designation	No. Men.	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	60	8	$7.22 day	$1,299.60
Tractor Operators	9	40	7-1/2	.75	2,025.00
Batcher Operators	6	40	7	.75	1,260.00
Mechanics	3	40	7	1.00	840.00
Pumpmen	3	40	8	.60	576.00
Firemen	3	60	8	.60	864.00
Steam Fitters	3	40	7	1.00	840.00
Steam Fitters, Helpers	3	40	7	.60	504.00
Laborers	24	40	7	.50	3,360.00
				Total	$11,568.60

BASIS OF ESTIMATE (Op. #6, Sheet #2, 1939)

It is estimated that one LeTourneau scraper will be used for supplying the plant with gravel and the other will haul to the plant one shift and strip two shifts.

The material is assumed to run 67% sand and 33% gravel.

The LeTourneaus can operate as follows:

Loaded, 1600 feet in 3rd Gear	= 6.5	minutes
Empty, 1600 " " 6th "	= 3.4	"
Load, Dump and Turn	= 4.1	"
Total Time for one Round Trip	= 14.0	"

Assuming 80% efficiency, one LeTourneau will move 1,260 cu. yds. in one day of 21 hours.

The scraper which is stripping will operate on about the same schedule but at somewhat lower efficiency.

The extra bulldozer is to be used as a booster to assist in loading the scrapers.

Requirements are as follows:

Op. #	Gravel	Sand
24	3170 c.y.	1585 c.y.
25	2640 " "	1320 " "
26	5670 " "	2835 " "
27	7444 " "	3722 " "
28	732 " "	366 " "
31	92 " "	46 " "
Total	19,748 " "	9874 " "

Inasmuch as 494 yds. of gravel will be required per day, one scraper will not haul quite enough so that the other one will have to haul about 220 yds. each day in addition to doing the stripping.

STRIPPING BORROW AREA "C"
(For Processed Material)

Operation No. 8

Date May 16-31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	Shifts	Rate/Day	Amount
LeTourneaus, 18-Yd.	4	15	3	$ 63.00	$ 3,780.00
Bulldozer, 90 H.P.	1	15	3	36.00	540.00
Small Tools					72.29
				Total	$ 4,392.29

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors, 90 H.P.	5	210	$ .48	$ 504.00
			Total	$ 504.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	15	8	$ 6.38 day	$ 287.10
Tractor Operators	15	10	7-1/2	.75	843.75
Laborers	9	10	7	.50	315.00
				Total	$ 1,445.85

BASIS OF ESTIMATE (Op. #8 - 1940)

It is assumed that this stripping will be excavated and deposited in the excavation made for gravel in Area "C" in 1939. This will make the haul approximately 1200 feet.

The LeTourneaus can operate as follows:

Loaded	1200 feet in 3rd Gear	= 4.8	minutes
Dump and Turn		= 1.6	"
Empty	1200 feet in 5th Gear	= 3.6	"
Loading Time		= 2.0	"
Total Time for 1 Round Trip		= 12.0	"

Assuming 80% mechanical efficiency one scraper of 18 cubic yard capacity will move 70 yards per hour or 70 x 21 = 1470 yards per day.

The 4 LeTourneaus will haul 5880 yards per day.

GRAVEL & BATCHING PLANT

Operation No. 27, Sheet #1

Quantity 7,550 Cu.Yds. Gravel
1,225 " " Sand

Date June 1-30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers, 18-yd.	2	30	1	$ 31.50	$ 1,890.00
Bulldozer 90 HP	1	30	1	18.00	540.00
Gravel Plant	1	30	1	50.00	1,500.00
Pickup Truck, 1/2-ton	1	30	1	1.83	54.90
Pump, 4" HP, Pipe Fittings, etc.	1	30	1	11.50	345.00
Small Tools					73.20
				Total	$ 4,403.10

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors 90 HP	3	140	$ .48	$ 201.60
Gravel Plant	1	140	2.25	315.00
Pickup Truck	1	140	.12	16.80
Pump, 4", HP.	1	140	.26	36.40
			Total	$ 569.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foreman, General	1	30	8	$7.22 Day	$ 216.60
Foreman	1	30	8	5.16 "	154.80
Tractor Operators	3	20	7-1/2	.75	337.50
Batcher Operators	1	20	7	.75	105.00
Mechanics	1	20	7	1.00	140.00
Pumpman	1	20	7-1/2	.60	90.00
Laborers	6	20	7	.50	420.00
				Total	$ 1,463.90

BASIS OF ESTIMATE (Op. #27 Sheet #1 - 1940)

It is estimated that the material in the pit will run about 67% sand and 33% gravel.

About 378 cubic yards of gravel are required per working day during the month of June. This means that 1134 cubic yards of material must be processed each day of 7 hours.

The LeTourneaus can operate as follows:

Loaded	1200 feet in 3rd Gear	= 4.8	minutes
Empty	1200 feet in 6th Gear	= 2.6	"
Load, Dump and Turn		= 3.0	"
Total Time for One Round Trip		= 10.4	"

Assuming 80% efficiency each scraper should handle 84 yards per hour or 84 x 7 = 588 cubic yards per day. Two scrapers should haul 588 x 2 = 1176 cubic yards in one day which is sufficient for this period.

Gravel and sand required for this period is based on the following:

			Required for June 1940	
Op. #	C.Y.		Gravel	Sand
28(a)	7345		2450 c.y.	1225 c.y.
35	20400		5100 "	——
		Total	7550 "	1225 "

GRAVEL & BATCHING PLANT

Operation No. 27, Sheet #2

Quantity 43,000 Cu. Yds., Gravel
16,400 " " Sand

Date July 1 - Aug. 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers, 18-yd.	2	60	3	$ 63.00	$ 7,560.00
Bulldozer 90 HP	1	60	3	36.00	2,160.00
Screening Plant	1	60	3	100.00	6,000.00
Pickup Truck, 1/2-ton	1	60	3	3.67	220.20
Pump, 4" HP, Pipe, Fittings, etc.	1	60	3	21.00	1,260.00
Small Tools					470.67
				Total	$ 17,670.87

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors 90 HP	3	840	$ 0.48	$ 1,209.60
Screening Plant	1	840	2.25	1,890.00
Pickup Truck, 1/2-ton	1	840	.12	100.80
Pump, 4", High Pressure	1	840	.26	218.40
			Total	$ 3,418.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foreman, General	3	60	8	$ 7.22 Day	$ 1,299.60
Foreman	3	60	8	5.16 "	928.80
Tractor Operators	9	40	7-1/2	.75	2,025.00
Batcher Operators	6	40	7	.75	1,260.00
Mechanics	3	40	7	1.00	840.00
Pumpmen	3	40	7-1/2	.60	540.00
Laborers	18	40	7	.50	2,520.00
				Total	$ 9,413.40

BASIS OF ESTIMATE (Op. #27, Sheet #2 - 1940)

The quantity of screened material required for July and August 1940, is based on the following:

		Required this Period	
Op. #	Cu. Yds.	Gravel	Sand
28 (A)	7,345	4,900 Cu. Yds.	2,450 Cu. Yds.
29	18,500	18,500	9,250
30	9,410	9,400	4,700
35	20,400	10,200	———
	Total	43,000 Cu. Yds.	16,400 Cu. Yds.

Assuming 40 working days during this period, about 1,075 cu. yds. of screened gravel will be required per day of 21 hours or approximately 3,225 cu. yds. of bank run material will be excavated, hauled and processed.

Scrapers should operate as follows:

Loaded	1200 feet in 3rd Gear =	4.9	minutes
Empty	1200 feet in 6th Gear =	2.6	"
Load, Dump and Turn	=	3.5	"
	Total Time =	11.0	"

At 80% efficiency, each scraper will excavate and haul approximately 1,640 cu. yds. in 21 hours.

One extra 90 HP Bulldozer will be used to assist in loading.

GRAVEL & BATCHING PLANT

Operation No. 27, Sheet #3

Quantity 5,670 Cu. Yds. Gravel
285 " " Sand

Date September 1-30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers, 18-yd.	2	30	1	$ 31.50	$ 1,890.00
Bulldozer 90 HP	1	30	1	18.00	540.00
Gravel Plant	1	30	1	50.00	1,500.00
Pickup Truck, 1/2-ton	1	30	1	1.83	54.90
Pump, 4" HP, Pipe, Fittings, etc.	1	30	1	11.50	345.00
Small Tools					79.37
				Total	$ 4,409.27

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors 90 HP	3	160	$ .48	$ 230.40
Gravel Plant	1	160	2.25	360.00
Pickup Truck	1	160	.12	19.20
Pump, 4", HP.	1	160	.26	41.60
			Total	$ 651.20

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foreman, General	1	30	8	$ 7.22 Day	$ 216.60
Foreman	1	30	8	5.16 "	154.80
Tractor Operators	3	20	8	.75	360.00
Batcher Operators	1	20	8	.75	120.00
Mechanics	1	20	8	1.00	160.00
Pumpmen	1	20	8	.60	96.00
Laborers	6	20	8	.50	480.00
				Total	$ 1,587.40

BASIS OF ESTIMATE (Op. #27, Sheet #3 - 1940)

About 280 Cu. Yds. of screened gravel per day are required for this item. This indicates that 3 x 280 = 840 yds. of pit run material must be handled per day of 8 hours.

The LeTourneaus can operate as follows:

Loaded	1500 feet in 2nd Gear	=	7.0 minutes
Empty	1500 feet in 5th Gear	=	4.2 "
Load, Dump and Turn		=	4.4 "
Total Time for 1 Round Trip		=	15.6 minutes

Assuming 80% mechanical efficiency each scraper will handle 55 Cu. Yds. per hour or 55 x 8 = 440 yards per day. 2 scrapers will haul 440 x 2 = 880 yards, which is sufficient for this time.

Requirements for this period are based on the following:

Op. #	Cu. Yds.	Gravel	Sand
28 (B)	570	570 Cu. Yds.	285 Cu. Yds.
35	20,400	5,100 " "	____
	Total	5,670 Cu. Yds.	285 Cu. Yds.

GRAVEL & BATCHING PLANT

Operation No. 27, Sheet #4

Quantity 8,850 Cu.Yd. Gravel
4,425 " " Sand

Date October 13-31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers, 18-Yd.	2	18	3	$ 63.00	$ 2,268.00
Bulldozer 90 HP	1	18	3	36.00	648.00
Screening Plant	1	18	3	100.00	1,800.00
Pickup Truck, 1/2-ton	1	18	3	3.67	66.06
Pump, 4" HP, Pipe, Fittings, etc.	1	18	3	21.00	378.00
Boiler 90 HP Steam	1	18	3	10.00	180.00
Small Tools					179.90
				Total	$ 5,519.96

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors 90 HP	3	252	$ .48	$ 362.88
Screening Plant	1	252	2.25	567.00
Pickup Truck	1	252	.12	30.24
Pump, 4" High Pressure	1	252	.26	65.52
Boiler 90 HP	1	432	1.35	583.20
			Total	$ 1,608.84

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	18	8	$7.22 Day	$ 389.88
Foremen	3	18	8	5.16 "	278.64
Tractor Operators	9	12	7-1/2	.75	607.50
Batcher Operators	6	12	7	.75	378.00
Mechanics	3	12	7	1.00	252.00
Pumpmen	3	12	8	.60	172.80
Laborers	24	12	7	.50	1,008.00
Firemen	3	18	8	.60	259.20
Steam Fitters	3	12	7	1.00	252.00
				Total	$ 3,598.02

BASIS OF ESTIMATE (Op. #27, Sheet #4 - 1940)

It is assumed that concrete will be placed between October 13 and October 31, 1940. Gravel is required for concrete only (Op. #31) during this period. Estimate is based on 12 working days @ 3 shifts

8850 ÷ 12 = 740 Cu. Yds. per day = Gravel required.

740 x 3 = 2,220 Cu. Yds. per day = Amount to be processed.

Scrapers should operate as follows;

Loaded	1500 feet in 3rd Gear	= 6.1	minutes
Return	1500 feet in 6th Gear	= 3.2	"
Load, Dump and Turn		= 4.7	"
	Total Time	= 14.0	"

At 80% efficiency each scraper should deliver 62 Cu. Yds. per hour or 1,300 Cu. Yds. in 21 hours. Two scrapers will be sufficient.

GRAVEL & BATCHING PLANT

Item No. Operation No. 12, Sheet #1

Quantity 40,000 c.y. Gravel
32,000 c.y. Sand

Date June 1-30, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18 c.y.	3	30	3	$ 63.00	$ 5,670.00
Bulldozer 90 HP	1	30	3	36.00	1,080.00
Screening Plant	1	30	3	100.00	3,000.00
Pickup Truck 1/2-Ton	1	30	3	3.67	110.10
Pump, 4" HP, Pipe Fittings, etc.	1	30	3	21.00	630.00
Small Tools					255.53
				Total	$10,745.63

MATERIALS & SUPPLIES (See Sec. No. 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors	4	462	$ .48	$ 887.04
Screening Plant	1	462	2.25	1,039.50
Pickup Truck	1	462	.12	55.44
Pump 4" High Pressure	1	462	.26	120.12
			Total	$ 2,102.10

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	30	8	$7.22 Day	$ 649.80
Foremen	3	30	8	5.16 "	464.40
Tractor Operators	12	22	7-1/2	.75	1,485.00
Batcher "	3	22	7	.75	346.50
Mechanics	3	22	7	1.00	462.00
Pumpmen	3	22	8	.60	316.80
Laborers	18	22	7	.50	1,386.00
				Total	$ 5,110.50

GRAVEL & BATCHING PLANT

Item No. Operation No. 12, Sheet No. 2

Quantity 12,700 c.y. Gravel Date Sept. 16 to Oct. 15, 1941
5,450 c.y. Sand

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18 c.y.	2	30	2	$ 47.25	$ 2,835.00
D8 Bulldozers 90 HP	1	30	2	27.00	810.00
Screening Plant	1	30	2	75.00	2,250.00
Pickup Truck 1/2-Ton	1	30	2	2.75	82.50
Pump, 4" HP, Pipe Fitting, etc.	1	30	2	16.25	487.50
Small Tools					178.82
				Total	$ 6,643.82

MATERIALS & SUPPLIES (See Sec. No. 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors 90 HP	3	280	$ .48	$ 403.20
Screening Plant	1	280	2.25	630.00
Pickup Truck	1	420	.12	50.40
Pump, 4" High Pressure	1	280	.26	72.80
			Total	$ 1,156.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	30	8	$7.22 Day	$ 649.80
Foremen	2	30	8	5.16 "	309.60
Tractor Operators	6	20	7-1/2	.75	675.00
Batcher Operators	6	20	7	.75	630.00
Mechanics	2	20	7	1.00	280.00
Pumpmen	2	20	8	.60	192.00
Laborers	12	20	7	.50	840.00
				Total	$ 3,576.40

BASIS OF ESTIMATE Op. #12 - 1941

June 1 to June 30

36,200 cu. yds. of this gravel is to be produced during this period and 3800 cu. yds. is assumed to be in the stockpile from the 1940 operations.

The capacity of the plant is assumed to be 1650 cu. yds. in 21 hours. Assume haul about 1200 feet. (See Basis of Estimate Op. #27, Sheet #2, 1940, this section). 40,000 c.y. of gravel and 32,000 c.y. of sand are required in 1941 before the plant resumes operation on September 16th.

Sept. 16 to Oct. 15

During this period sand and gravel are required for the concrete in Op. #30, about 125 c.y. of miscellaneous concrete and the remaining gravel in the 1 foot gravel filter upstream. Concrete will be placed 3 shifts per day, but the screening plant will operate at 2 shifts only. It has been shown in previous assumptions that the LeTourneaus can deliver 70 c.y. per hour. 2 scrapers operating 14 hours per day would deliver approximately 1950 c.y. which should screen out 650 c.y. gravel. Approximately 540 c.y. per day are required for concrete.

DRILLING & BLASTING

Quantity - 60,000 cu. yds.

DESCRIPTION

It is first assumed that the output of two 2-1/2 c.y. shovels (Nos. 2 & 3) is approximately 60,000 c.y. per month. Then the necessary plant required to drill this amount of rock is determined, and the cost computed on a monthly basis. As outlined in Section 6(A), it is intended to locate a stationary compressor plant on the west abutment between the walls of the stilling basin and the spillway discharge channel.

S U M M A R Y

	Cost per Month	Cost per cu. yd.
PLANT RENTAL	$ 5,046.00	$.0841
MATERIALS & SUPPLIES	11,425.00	.1904
LABOR	9,116.10	.1519
TOTAL.	$25,587.10	$.4264

DRILLING AND BLASTING

Quantity 60,000 c.y. Monthly Cost

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Compressors, 625 C.F.	1	30	3	$ 50.00	$1,500.00
Compressor, 625 C.F.	1	15	3	50.00	750.00
Wagon Drills	5	30	3	6.00	900.00
Jackhammer Drills	4	30	3	1.50	180.00
Hose, pipe, fittings, etc.		30	3	30.00	900.00
Drill Steel		30	3	12.00	360.00
Small Tools		30	3		456.00
				Total	$5,046.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Compressor 625 C.F.	1	420	$ 0.50	$ 210.00
Compressor 625 C.F.	1	210	.50	105.00
Dynamite 75,000 lbs. at $0.10				7,500.00
Exploders 7,000 at 0.07				490.00
Bits 8,000 at $.27 & 4,000 at $.24				3,120.00
			Total	$11,425.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	30	8	$7.22 Day	$649.80
Foremen	6	30	8	5.16 "	928.80
Drillers	27	20	7	.75	2,835.00
Compressor Operators	3	20	7-1/2	.85	382.50
Blasters	6	20	8	1.00	960.00
Laborers	48	20	7	.50	3,360.00
				Total	$ 9,116.10

BASIS OF ESTIMATE

(Drilling & Blasting)

This estimate is based on drilling and blasting 60,000 c.y. per month. The average depth of hole to be drilled is approximately 20 feet. By spacing holes from 6 to 6-1/2 feet on centers, about one cubic yard of solid rock will be broken per foot of hole drilled.

It is assumed that one wagon drill will drill 30 feet of hole in one hour. One bit will drill 2' of hole when new and 2' after each grinding. Assuming 3 regrinds, each bit will drill 8' of hole.

There are in reality two 625 C.F. compressors for the full time but one-half the cost of one of these is charged to "Line Drilling".

The wagon drills will drill the holes for the main blasts and the jackhammers will drill the block holes. One pound of dynamite is figured per c. y. to break the rock with one-fourth pound additional required for the block holes.

The Steel and Bits are calculated as follows:

1. 1-1/8" drill Steel; 560' for each wagon drill.
2. 7/8" drill Steel: 175' " " jackhammer
3. Bits 8,000 at $.27 = $2,160.00 per month (5 wagon drills)
4. Bits 4,000 at $.24 = 960.00 " " (4 jackhammers)

The bits are expendable but the steel must be considered as on a rental basis.

Cost of Drill Steel (Plant Rental)

Wagon Drills: 560' at $0.75 = $420 = $2.00/day (210 days)

Jackhammers: 175' at $0.60 = $105.00 = $0.50/day (210 days)

The cost of bits is taken as an average with the knowledge that the price varies from $0.22 to $0.32.

The cost of grinding bits and all transportation is charged to the Shop. (See Section 14A)

WELL POINT SYSTEM

DESCRIPTION

Due to the depth of most of the excavations it will be necessary to use two sets of well points, one above the other. The first set of points should be put down and the ground unwatered before excavation is commenced and then the material can be removed in the dry to a depth of about 18 feet. When this depth is reached the second set of points should be installed and the excavation can then be completed and the banks should remain stable.

Subsurface conditions at Franklin Falls Dam are such that a large amount of inflow of water may be anticipated and for this reason a rather large amount of pumping equipment has been provided for in this estimate. The estimated quantities of inflow which may be expected have been obtained from the Soils Section and have been calculated by them after careful investigation of the existing conditions.

In the river section the banks below water are apparently composed of fine sand and are, especially on the west side very steep. On account of this condition it is believed that it will be necessary to stabilize these banks by means of well points. Both banks, at the time of unwatering, are carrying a heavy surcharge due to the fact that the two terraces have been constructed to elevation 390, the previous year.

The costs used in this estimate are based upon figures obtained from reliable firms engaged in this field.

WELLPOINT SYSTEMS

COFFERDAM PUMPING

Plant Rental	$ 76,348.00	
Material & Supplies	3,369.60	
Labor	41,361.60	Total = $121,079.20

STILLING BASIN

	ROCK	EARTH	
Plant Rental	$ 3,800.00	$ 3,800.00	
Material & Supplies	2,200.00	2,200.00	
Labor	4,000.00	4,000.00	Total = $20,000.00

CONDUIT SECTION

	ROCK	EARTH	
Plant Rental	$ 2,717.00	$ 1,463.00	
Material & Supplies	1,573.00	847.00	
Labor	2,860.00	1,540.00	Total = $11,000.00

DISCHARGE CHANNELS

	ROCK	EARTH	
Plant Rental	$ 912.00	$16,000.00	
Material & Supplies	528.00	8,000.00	
Labor	960.00	17,600.00	Total = $44,000.00

OUTLET APPROACH CHANNEL

	ROCK	EARTH	
Plant Rental	$ 5,381.00	$ 1,345.00	
Material & Supplies	3,115.00	779.00	
Labor	5,664.00	1,416.00	Total = $17,700.00

DRAINAGE TRENCH

	EARTH	
Plant Rental	$12,400.00	
Material & Supplies	2,835.00	
Labor	11,865.00	Total = $27,100.00

The cost of the wellpoint systems has been distributed as shown above in order that a proper proportion may be assigned to both earth and rock excavation and to cofferdam pumping.

	ROCK EXCAVATION (Item No.12)	EARTH EXCAVATION (Item No. 6)	COFFERDAM PUMPING (Item No. 3)
Plant Rental	$12,810.00	$35,008.00	$76,348.00
Material & Supplies	7,416.00	14,661.00	3,369.60
Labor	13,484.00	36,421.00	41,361.60
	$33,710.00	$86,090.00	$121,079.20

SPRINKLING EMBANKMENT

DESCRIPTION

Due to the nature of the materials entering into the fill it will be necessary to provide for sufficient water to saturate the entire embankment except the impervious material in the core. Also it will be necessary to maintain the embankment in this condition during the working period so that pumping will have to be continuous except during such days as there is enough rain to approximately equal the amount of water required for saturation. The indications are that very little water will be required for the impervious core material.

It is proposed to bury the water mains in the foundation as shown on the accompanying sketch (see section 20C) and to take off risers sloping inward parallel with the slopes of the dam. These risers to be carried up with the embankment in about 4 foot lifts.

S U M M A R Y

PLANT RENTAL	$ 7,856.40
MATERIALS & SUPPLIES	10,109.68
LABOR	149,205.72
TOTAL	$157,171.80

SPRINKLING EMBANKMENT

DESCRIPTION

This Item includes the total cost of furnishing water to (1) the embankment, to insure the proper moisture content, (2) the dumped rock fill, (3) the sand filter in the embankment section and (4) various concrete items for washing the rock foundation. The cost of pumping and sprinkling, and prorating to the above items is as follows:

SUMMARY

	Plant Rental	Materials & Supplies	Labor
1939	$ 2,121.48	$ 7,608.40	$24,006.60
1940	3,275.13	1,490.40	63,450.12
1941	2,459.79	1,010.88	61,749.00
Total	$ 7,856.40	$10,109.68	$149,205.72

PRORATION

ITEM	QUANTITY	PER CENT	PLANT RENTAL	MATERIALS & SUPPLIES	LABOR
15	1,952,000	79	$ 6,206.56	$ 7,986.65	$117,872.52
16	300,000	4	314.26	404.39	5,968.23
18	575,000	12	942.77	1,213.16	17,904.69
23	40,000	1	78.56	101.09	1,492.06
29	18,000	1	78.56	101.09	1,492.05
30	8,800	1/2	39.28	50.55	746.03
31	29,500	1-1/2	117.85	151.65	2,238.09
34	18,500	1	78.56	101.10	1,492.05
	Total		$ 7,856.40	$10,109.68	$149,205.72

SPRINKLING EMBANKMENT

Operation No. 33

Date Sept. 1 - Oct. 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumps 6"	3	45	3	$ 5.60	$ 756.00
Pickup Truck, 1/2-Ton	1	45	3	3.67	165.15
Small Tools			3		1,200.33
				Total	$2,121.48

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Pumps 6"	2	960	$ .21	$ 403.20
Truck, Pickup, 1/2-Ton	1	960	.12	115.20
6" Pipe and Fittings, 3100 feet @ $1.30				4,030.00
4" Pipe and Fittings, 600 feet @ $0.75				450.00
2" Pipe and Fittings, 2700 feet @ $0.30				810.00
1-1/2" Rubber Hose, 3000 feet @ $0.40				1,200.00
Valves, Fittings, etc.				600.00
			Total	$7,608.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	6	45	8	$ 6.38 Day	$1,722.60
Pumpmen	6	40	8	.60	1,152.00
Laborers	120	40	8	.50	19,200.00
Plumbers	6	10	7	1.00	420.00
Plumbers' Helpers	36	10	7	.60	1,512.00
				Total	$24,006.60

SPRINKLING EMBANKMENT

ITEM NO. Operation No. 33

QUANTITY Date May 16 - Sept. 21, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumps, 6" H.P.	3	129	3	$ 5.60	$2,167.20
Pickup Truck, 1/2-Ton	1	129	3	3.67	473.43
Small Tools		129	3		634.50
				Total	$3,275.13

MATERIALS & SUPPLIES (See Sec. No. 11)
115 working days

Designation	No. Units	No. Hours	Rate/Hour	Amount
Pumps, 6" H.P.	2	2,760	$ .21	$1,159.20
Pickup Truck, 1/2-Ton	1	2,760	.12	331.20
			Total	$1,490.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	6	129	8	$6.38 Day	$4,938.12
Pumpmen	6	115	8	.60	3,312.00
Laborers	120	115	8	.50	55,200.00
				Total	$63,450.12

SPRINKLING EMBANKMENT

ITEM NO. Operation No. 33

QUANTITY Date June 16 - Sept. 15, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumps, 6" H.P.	3	90	3	$5.60	$ 1,512.00
Pickup Truck, 1/2-Ton	1	90	3	3.67	330.30
Small Tools		90	3		617.49
				Total	$ 2,459.79

MATERIALS & SUPPLIES (See Sec. No. 11)
78 working days.

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Pumps, 6" H.P.	2	1,872	$ .21	$ 786.24
Pickup Truck	1	1,872	.12	224.64
			Total	$ 1,010.88

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	90	8	$7.22 Day	$1,949.40
"	3	90	8	5.16 "	1,393.20
Pumpmen	6	78	8	.60	2,246.40
Laborers	180	78	8	.50	56,160.00
				Total	$61,749.00

BASIS OF ESTIMATE

(Sprinkling embankment)11939

Estimate based on pumping 40 days @ 24 hours per day, using 2 pumps with one stand-by unit.

It is estimated that the maximum amount of fill that will be placed in one day will be approximately 24,000 Cu. Yds. Inasmuch as it is required that the material be saturated for maximum compaction about 35% of 24,000 yds. of water will be required every 24 hours = 226,800 Cu. Ft. of water = 1,700,000 gallons per day. It is estimated that two 6" pumps will furnish this amount of water under 300' of head. One extra pump is recommended for a standby as this pumping must proceed continuously.

It is intended to bury the pipe lines and headers in the embankment adding sections as the fill progresses. (See sketch of pipe line layout).

1940 - 1941

During these seasons the small tool charge is figured @ 1% of the labor cost instead of 5% as usually assumed. It is also assumed that pumping and sprinkling will proceed continuously except on rainy days.

ROLLING AND COMPACTING EMBANKMENT

DESCRIPTION

This item includes the cost of spreading and rolling all compacted pervious, selected pervious, impervious, bank run sand and gravel and the sand filter within the embankment section. The total direct field costs and prorating same to the various items is as follows:

SUMMARY

	Plant Rental	Material & Supplies	Labor
1939	$ 7,700.33	$ 1,197.00	$ 7,000.65
1940	22,074.29	3,431.40	20,068.53
1941	15,353.71	2,633.40	13,062.15
Total	$45,128.33	$ 7,261.80	$40,131.33

PRORATION

Item	Quantity	%	Plant Rental	Material & Supplies	Labor
15	1,952,000	75	$33,846.24	$5,446.35	$30,098.50
16	300,000	23	10,379.52	1,670.21	9,230.20
23	40,000	2	902.57	145.24	802.63
Total			$ 45,128.33	$7,261.80	$40,131.33

ROLLING & COMPACTING

Operation No. 32

Date Sept. 1 - Oct. 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Bulldozers, 90 HP (Rolling)	3	45	3	$ 36.00	$4,860.00
Bulldozers, 30 HP	2	45	3	15.00	1,350.00
Rollers, Disc	2	45	3	6.00	540.00
" , Sheepsfoot	2	45	3	6.67	600.30
Small Tools					350.03
				Total	$7,700.33

MATERIALS & SUPPLIES (See Section 11)
30 working days.

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors & Rollers, 90 HP	3	630	$ .48	$ 907.20
Bulldozers, 30 HP	2	630	.23	289.80
			Total	$1,197.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	6	45	8	$7.22 day	$1,949.40
Operators, Tractor	15	30	7-1/2	.75	2,531.25
Laborers	24	30	7	.50	2,520.00
				Total	$7,000.65

ROLLING & COMPACTING

Operation No. 32

Date May 16 - Sept. 21, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Bulldozers (Rolling) D8, 90 HP.	3	129	3	$ 36.00	$13,932.00
Bulldozers, D4, 30 HP.	2	129	3	15.00	3,870.00
Rollers, Disc	2	129	3	6.00	1,548.00
Rollers, Sheepsfoot	2	129	3	6.67	1,720.86
Small Tools		129	3		1,003.43
				Total	$22,074.29

MATERIALS & SUPPLIES (See Sec. No. 11)
86 working days.

Designation	No. Units	No. Hours	Rate/Hour	Amount
Bulldozers, D8, 90 HP.	3	1,806	$ .48	$2,600.64
Bulldozers, D4, 30 HP.	2	1,806	.23	830.76
			Total	$3,431.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	6	129	8	$7.22 day	$5,588.28
Tractor Operators	15	86	7-1/2	.75	7,256.25
Laborers	24	86	7	.50	7,224.00
				Total	$20,068.53

ROLLING & COMPACTING

Operation No. 32

Date June 16 - Sept. 15, 1941.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Bulldozers, D8 (Rolling) 90 HP.	3	90	3	$ 36.00	$9,720.00
Bulldozers, D4, 30 HP.	2	90	3	15.00	2,700.00
Rollers, Disc	2	90	3	6.00	1,080.00
Rollers, Sheepsfoot	2	90	3	6.67	1,200.60
Small Tools					653.11
				Total	$15,353.71

MATERIALS & SUPPLIES 66 Working days.

Designation	No. Units	No. Hours	Rate/Hr.	Amount
Tractors, D8, 90 HP	3	1,386	$ .48	$ 1,995.84
Tractors, D4, 30 HP	2	1,386	.23	637.56
			Total	$ 2,633.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	90	8	$7.22 day	$1,949.40
Tractor Operators	15	66	7-1/2	.75	5,568.75
Laborers	24	66	7	.50	5,544.00
				Total	$ 13,062.15

BASIS OF ESTIMATE

(Rolling & Compacting)

One cubic yard of earth spread one foot in thickness = 27 Sq. Ft.

The gauge of the D8 Caterpillar Tractor is 78" and the treads are 24" wide.

Under the specifications the treads of the tractor must pass over the entire surface of the fill 6 times for each 1 foot of depth.

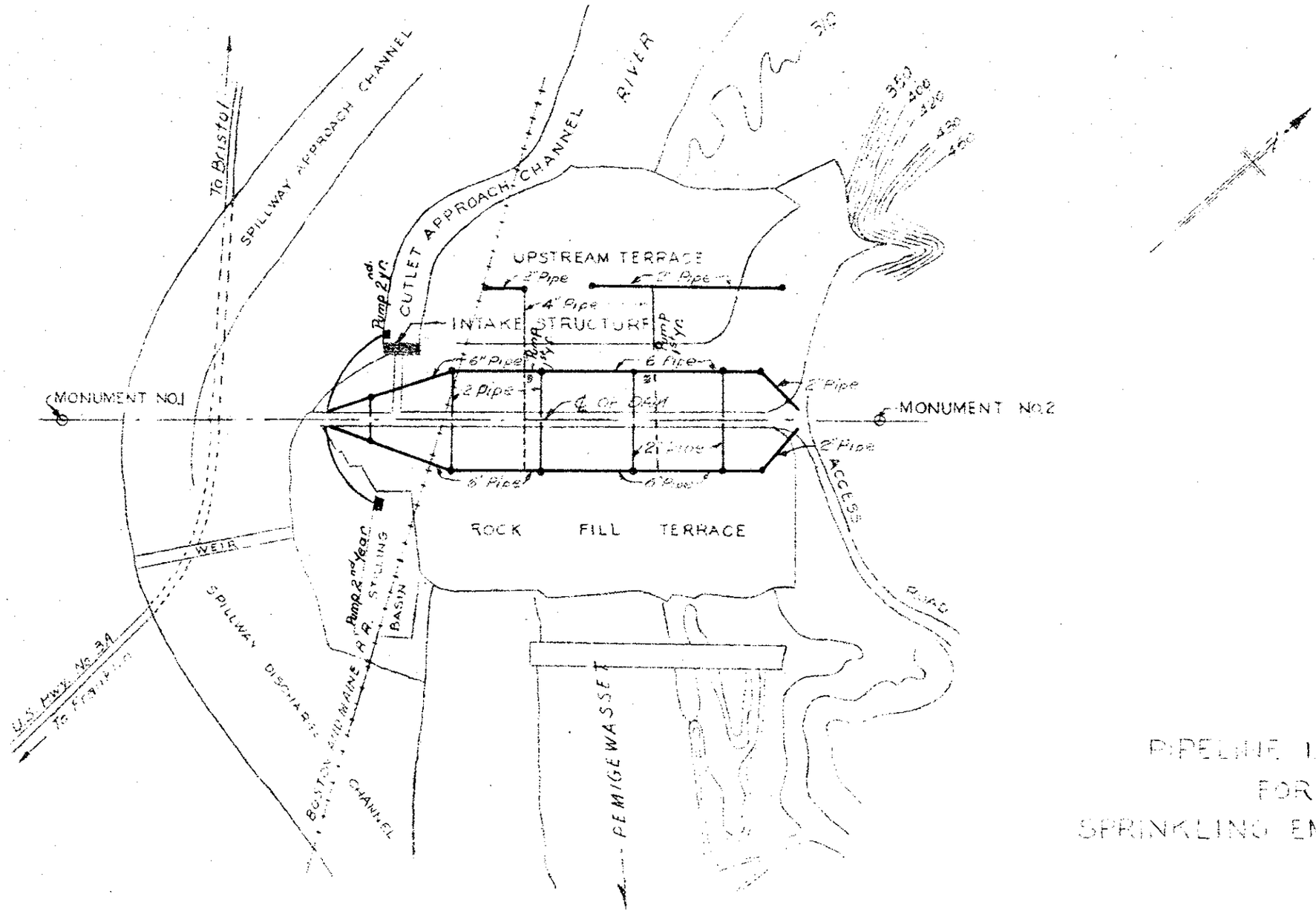
Each lin. ft. of the two treads = 2 x 2 = 4 Sq. Ft., and for each one foot of forward travel 4 Sq. Ft. of surface are rolled.

No. of trips	Sq. Ft. rolled per foot of travel
1	4
2	4
3	4
4	2-1/2
4 Trips of 1 foot forward motion =	14-1/2 Sq. Ft.

4 Trips of the tractor moving one foot will roll a surface 1 foot long and (say) 13-1/2 feet wide, one pass, and 4 trips 2 feet long will roll a strip 2 feet long and 13-1/2 feet wide = 27 sq. ft. one foot deep = 1 cu. yd. This means that one tractor moving 8 feet forward will roll 1 cu. yd. 1 pass and 1 tractor moving 6 x 8' = 48' will roll 1 cu. yd. 6 passes. This may be called 50 feet for pervious fill and 100 feet for impervious fill. (Impervious fill is rolled in 6" layers).

The tractor will travel 3.8 M.P.H. in 4th gear or 3.8 x 21 = 67.2 say 65 miles in 21 hours = 343,200 Lin. Ft. 343,200 ÷ 50 = 6840 cu. yds. of pervious fill per tractor per day. 343,200 ÷ 100 = 3432 cu. yds. of impervious fill per tractor per day.

Two Disc rollers are provided for pervious fill and two sheepsfoot rollers.in tandem are provided for this impervious material. The 30 HP tractors are provided to remove stone and objectionable material from the fill.



PIPELINE LAYOUT
FOR
SPRINKLING EMBANKMENT

Section 20 (c)

FIELD OFFICE

Item No. 1

DESCRIPTION

The Field Office has been estimated on the basis of the cost of similar structures in Manchester, New Hampshire.

The figure of 30¢ per cubic foot for the building is believed to be ample inasmuch as similar building has been done during 1939 in Manchester for about 24¢ per cubic foot. The higher price is allowed due to the remoteness of the work.

The heating plant is estimated at $3060.

27,110 Cu. Ft. x .30	=	$8,133.00
Heating Plant	=	3,060.00
Total		$11,193.00

S U M M A R Y

PLANT RENTAL.....	$ 233.00
MATERIALS & SUPPLIES	$ 6,300.00
LABOR	$ 4,660.00
TOTAL	$11,193.00

REMOVAL OF EXISTING STRUCTURES

ITEM NO. 2

DESCRIPTION

This work consists of removing the present buildings, the concrete highway on the west bank and some fences which are now on the property. The rails on the abandoned line of the Boston & Maine R.R. will probably be removed by the owners.

S U M M A R Y

PLANT RENTAL	$ 2,613.00
MATERIALS & SUPPLIES	$ 290.08
LABOR	$ 2,160.30
TOTAL	$ 5,063.38

REMOVAL OF EXISTING STRUCTURES

ITEM NO. 2

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel, 2 cu. yds.	1	10	2	$76.50	$ 765.00
Shovel, 1-1/4 cu. yds.(Crane)	1	10	2	48.00	480.00
Lima Tractor Trucks	3	10	2	24.00	720.00
Bulldozer, D8	1	10	2	27.00	270.00
Trucks, Dump, 4 yds.	2	10	2	13.50	270.00
Small Tools		10	2		108.00
				Total	$2,613.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel, 2 cu. yds.	1	98	$ .55	$ 53.90
Crane, 1-1/4 cu. yd.	1	98	.39	38.22
Lima Tractor Trucks	3	98	.30	88.20
Bulldozer, D8	1	98	.48	47.04
Trucks, Dump, 4 yd.	2	98	.32	62.72
			Total	$ 290.08

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen, General	2	10	8	$ 7.22 day	$ 144.40
Foremen	4	10	8	5.16 "	206.40
Shovel Operators	4	7	7-1/2	1.25	262.50
Tractor Operators	8	7	7-1/2	.75	315.00
Truck Drivers	4	7	7-1/2	.60	126.00
Laborers	40	7	7	.50	980.00
Oilers	4	7	7-1/2	.60	126.00
				Total	$ 2,160.30

COFFERDAM PUMPING

ITEM NO. 3

DESCRIPTION

It is proposed to do the unwatering of the different areas by means of wellpoints assisted, where necessary, by additional pumps. (See Section 19.).

In the river section it is proposed to stabilize the banks by the use of a double line of well points and to unwater the river bed by means of 12" centrifugal pumps, care to be used in lowering the water so that it may not be drawn down too rapidly and thus cause sloughing of the banks.

The following estimated cost of wellpoint systems is based upon information furnished by responsible firms in that field.

Year	Operation No.	Plant Rental	Materials & Supplies	Labor
1941	1	$ 910.04	$ 5,086.17	$ 2,781.93
1941	10 (1)	76,348.00	3,369.60	41,361.60
1941	10 (2)	3,566.40	168.00	1,243.80
	Totals	$ 80,824.44	$ 8,623.77	$45,387.33

S U M M A R Y

PLANT RENTAL ..... $ 80,824.44

MATERIALS & SUPPLIES ..... $ 8,623.77

LABOR ..... $ 45,387.33

TOTAL $134,835.54

COFFERDAM TRESTLE
(Upstream)

ITEM NO. 3 — Operation No. 1

Quantity — Date Apr. 22 to 30, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Crane No. 1 1-1/4 C.Y.	1	9	3	$ 64.00	$ 576.00
Boiler, Steam, 30 H.P.	1	9	3	3.66	32.94
Pile Hammer, double acting, 4000 ft. lbs.	1	9	3	8.00	72.00
Pipe, Hose, Valves and Fittings		9	3	10.00	90.00
Small Tools		9	3		139.10
				Total	$ 910.04

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Crane No. 1	1	168	$ .39	$ 65.52
Boiler, Steam, 30 HP.	1	147	.45	66.15
Pile Hammer, double acting, 4000 ft. lbs.	1	147	No charge	
Timber Piling, 2800 Lin. Ft. @ $0.40				1,120.00
Timber, 45,000 ft. B.M. @ $80.00				3,600.00
Bolts, 300 @ $0.20				60.00
Drift Pins, 830 @ $0.15				124.50
Boat Spikes, 500 @ $0.10				50.00
			Total	$ 5,086.17

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	9	8	$7.22 day	$ 194.94
Foremen, Carpenter	3	9	8	7.22 "	194.94
Carpenters	15	9	7	.80	756.00
Crane Operators	3	8	7-1/2	1.25	225.00
Oilers	3	8	7-1/2	.60	108.00
Leadsmen	3	7	7	.75	110.25
Steam Fitters	3	7	7	1.00	147.00
Laborers	30	9	7	.50	945.00
Firemen	3	7	8	.60	100.80
			Total		$ 2,781.93

COFFERDAM PUMPING

(Wellpoint System)

Item No. 3

Operation No. 10, Sheet #1

Date Apr. 16 to Aug. 15, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumps, Centrifugal 10"	6	120	3	$14.00	$ 10,080.00
Well Points	2000	120	3	.15	36,000.00
Pipe & Fittings					28,200.00
Small Tools					2,068.00
				Total	$ 76,348.00

MATERIALS & SUPPLIES (See Sec. 11) Pump 90 Days

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Pumps, Centrifugal, 10"	4	2,160	$ .39	$ 3,369.60
			Total	$ 3,369.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	120	8	$7.22 day	$ 2,599.20
Foremen	12	120	8	5.16 "	7,430.40
Pumpmen	12	90	8	.60	5,184.00
Plumbers	3	120	8	1.00	2,880.00
Helpers	12	120	7	.60	6,048.00
Laborers	48	90	7	.50	15,120.00
Laborers (Installation)	60	10	7	.50	2,100.00
				Total	$ 41,361.60

COFFERDAM PUMPING

(Dewatering)

Item No. 3 | Operation No. 10, Sheet #2

Quantity - 9,540,000 cu. ft. | Date May 10 to Aug. 9, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumps, Centrifugal, 12"	3	90	3	$ 11.32	$ 3,056.40
Pipe, Flume & Fittings		90		5.00	450.00
Small Tools		90			60.00
				Total	$ 3,566.40

MATERIALS & SUPPLIES (See Sec. 11) 6 days pumping.

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Pumps, Centrifugal 12"	3	96	$ .50	$ 144.00
" " "	1	48	.50	24.00
			Total	$ 168.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	10	8	$ 6.38 day	$ 191.40
Pumpmen	3	6	8	.60	86.40
Laborers (Regular crew)	18	6	7	.50	378.00
Laborers (install & dismantling)	42	4	7	.50	588.00
				Total	$1,243.80

BASIS OF ESTIMATE

Cofferdam Trestle

This estimate covers the cost of a timber trestle about 175 feet long, to be driven on the east side of the river and used for the construction of the closure section of the cofferdam.

It is estimated that two bents of this trestle can be driven in three shifts and that the stringers and caps can be put in place at the same time.

The power for the hammer will be furnished by a 30 H.P. boiler as it is much cheaper than to use compressed air.

A small locomotive type compressor can be attached to the boiler to furnish air to a receiver to operate the wood boring machines.

About 4 of the laborers will be working with the driver and the remainder with the carpenters.

Wellpoint System

It has been estimated that the maximum amount of water necessary to be pumped will be 20 c.f.s.

One 10" vacuum pump will pump a maximum of 10 c.f.s., but for the purpose of this estimate 6 c.f.s. is considered as the capacity.

Four pumps working will handle the 20 c.f.s. which is anticipated.

The wellpoints are figured at 20 feet long and are to be placed in two levels, one at approximately elev. 310 and the other at elev. 290.

In the cofferdams it is estimated that the points should be spaced 3 feet and as the length to be protected is about 525 feet at each dam, the 2 rows of points will contain 700 points.

Between the cofferdams, the distance is approximately 1300 feet and in this location it is estimated that the points should be spaced 4 feet. Thirteen hundred would be required, making a total of 2000 points and 7500 feet of 12" header pipe required for the system. About 1600 feet of open flume would be required for the discharge.

Two extra pumps are provided as standbys.

Dewatering

It is estimated that 9,450,000 cu. ft. of water will be impounded between the cofferdams.

The rated capacity of the 12-inch pumps is approximately 13-1/2 c.f.s. each (6000 gal/min).

The 3 pumps could unwater the area, in case of no inflow, in 2.7 days but this cannot be allowed as it would impair the stability of the banks.

Two days have been allowed for lowering the water for the first stage of wellpoints and 2 more days for the final drawdown after the lower points are in operation.

Transportation of material and equipment is charged to "Shop, Utilities & Yard."

STRIPPING DAMSITE

Item No. 4

Quantity - 250,000 cu. yds.

DESCRIPTION

Some portions of the dam site are very wet and for this reason the material cannot be handled with scrapers. In such localities it is proposed to do the stripping by means of dragline.

For the most part is is proposed to use scrapers for this work as they are much more efficient than other machinery for making thin cuts.

A portion of the stripped material is to be used for top soil on the finished work.

Year	Op. #	Plant Rental	Material & Supplies	Labor
1939	4	$ 10,765.00	$ 1,293.60	$ 5,651.70
"	5	8,775.00	1,085.70	4,245.75
"	10	3,735.00	443.10	1,798.35
"	20	880.00	100.80	310.17
1940	7	5,376.69	1,163.40	6,733.80
1941	5	6,715.64	786.24	1,472.76
Totals		$36,247.33	$ 4,872.84	$20,212.53

S U M M A R Y

Plant Rental ..... $ 36,247.33

Materials & Supplies ..... $ 4,872.84

Labor ..... $ 20,212.53

Total ..... $ 61,332.70

STRIPPING DAMSITE

(Left Terrace)

Item No. 4 | Operation No. 4

Quantity 40,000 Cu. Yds. | Date August 1 - 31, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel, 2-1/2 Yd. #2 (Dragline)	1	15	3	$111.00	$ 1,665.00
LeTourneaus, 18 Yd.	2	30	3	63.00	3,780.00
Bulldozer, 90 HP	2	30	3	36.00	2,160.00
Shovel, 1-1/4 Yd. #1 (Dragline)	1	15	3	64.00	960.00
Linn Tractor Trucks (9 c.y.)	2	30	3	32.00	1,920.00
Small Tools					280.00
				Total	$10,765.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel, 2-1/2 Yd. #2 (Dragline)	1	210	$ .73	$ 153.30
LeTourneaus, 18 Yd.	2	420	.48	403.20
Bulldozer, 90 HP	2	420	.48	403.20
Linn Tractor Trucks	2	420	.30	252.00
Shovel #1, 1-1/4 Yd.	1	210	.39	81.90
			Total	$ 1,293.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen, General	3	30	8	$ 7.22 Day	$ 649.80
Foremen	3	30	8	5.16 "	464.40
Operators, Shovel	3	20	7-1/2	1.25	562.50
Oilers, Shovel	3	20	7-1/2	.60	270.00
Operators, Tractor	18	20	7-1/2	.75	2,025.00
Laborers	24	20	7	.50	1,680.00
				Total	$ 5,651.70

BASIS OF ESTIMATE (Op. #4 - 1939)

It is estimated that the dragline will load about 1,000 yards per day due to mud and water, rocks and roots.

Two Linn Tractor Trucks are required to haul from the dragline.

The two LeTourneaus will operate as follows:

Loaded, 800 feet in 4th gear	=	2.8 minutes
Load, Dump and Turn	=	4.5 "
Empty, 800 feet in 6th gear	=	1.7 "
Total Haul Time for 1 Round Trip	=	9.0 "

Assuming 75% efficiency and 800 feet average haul, each scraper will move 90 yards per hour or 1,900 yards per day.

Both shovels will be rigged with dragline equipment. No. 2 will operate from August 1 to August 15 and No. 1 from August 16 to August 31.

STRIPPING DAMSITE

(Right Terrace)

Item No. 4 | Operation No. 5

Quantity 62,900 Cu. Yds. | Date August 1 - 31, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Dragline, 2-1/2 Cu.Yd., No. 3	1	15	3	$111.00	$ 1,665.00
Linns 9 Cu.Yd.	2	15	3	32.00	960.00
LeTourneaus 18 Cu.Yd.	2	30	3	63.00	3,780.00
Bulldozers 90 HP	2	30	3	36.00	2,160.00
Small Tools					210.00
				Total	$ 8,775.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Dragline, 2-1/2 Cu.Yd., No. 3	1	210	$ .73	$ 153.30
Linns 9 Cu. Yd.	2	210	.30	126.00
Tractors 90 HP	4	420	.48	806.40
			Total	$1,085.70

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen, General	3	30	8	$ 7.22 Day	$ 649.80
Foremen	3	15	8	5.16 "	232.20
Shovel Operators	3	10	7-1/2	1.25	281.25
Oilers	3	10	7-1/2	.60	135.00
Tractor Operators	12	20	7-1/2	.75	1,350.00
Tractor Operators (Linns)	6	10	7-1/2	.75	337.50
Laborers	12	10	7	.50	420.00
Laborers	12	20	7	.50	840.00
				Total	$4,245.75

BASIS OF ESTIMATE (Op. #5 - 1939)

It is estimated that the Dragline will handle about 1,000 yards per day, on account of mud, water, rocks and roots, or about 10,000 yards in the 10 days.

The LeTourneaus will move up to 1,900 yards each but due to poor digging conditions ample time has been allowed.

The Dragline will operate from August 1 to August 15 only.

STRIPPING DAMSITE

(Spillway Discharge Channel)

Item No. 4 | Operation No. 10

Quantity 30,000 c.y. | Date Sept. 1 to 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel, 2-1/2 Yd. No. 3	1	15	3	$ 111.00	$ 1,665.00
Linn Tractor Trucks 9 c.y.	3	15	3	32.00	1,440.00
Bulldozer 90 HP	1	15	3	36.00	540.00
Small Tools					90.00
				Total	$ 3,735.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel, 2-1/2 yd. No. 3	1	210	$ .73	$ 153.30
Linn Tractor Trucks	3	210	.30	189.00
Bulldozer 90 HP	1	210	.48	100.80
			Total	$ 443.10

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	15	8	$6.38 Day	$ 287.10
Operators Shovel	3	10	7-1/2	1.25	281.25
Oilers "	3	10	7-1/2	.60	135.00
Operators, Linn	9	10	7-1/2	.75	506.25
Operators, Tractor	3	10	7-1/2	.75	168.75
Laborers	12	10	7	.50	420.00
				Total	$ 1,798.35

BASIS OF ESTIMATE (Op. #10-1939)

It is estimated that this shovel will load 1000 yards per 7-1/2 hour shift or 30,000 yards in 10 working days.

No. of Linns Required	1000-foot Haul
Loaded 1000 feet @ 4 M.P.H.	= 2.8 minutes
Dump and Turn	= 1.9 "
Empty 600 feet @ 5 M.P.H.	= 1.4 "
Empty 400 feet @ 3 M.P.H.	= 1.5 "
Total Haul Time Round Trip	= 7.6 minutes
Loading Time	= 3.8 minutes

7.6 ÷ 3.8 = 2 + 1 = 3 Linns required to haul from 1 shovel.

Approximately half this material will be used in the downstream dike over the discharge channel and the remainder will be spoiled downstream near the approach to the construction trestle on the west bank.

STRIPPING DAMSITE
(Outlet Approach Channel)

Item No. 4 | Operation No. 20

Quantity 18,640 c.y. | Date Oct. 16 to 18, 1939.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18 yd.	4	3	3	$ 63.00	$ 756.00
Bulldozer D8	1	3	3	36.00	108.00
Small Tools					16.00
				Total	$ 880.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No.Hours	Rate/Hour	Amount
LeTourneaus 18 yd.	4	42	$ .48	$ 80.64
Bulldozer D8	1	42	.48	20.16
			Total	$ 100.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	3	8	$ 6.38 day	$ 57.42
Operators, Tractor	12	2	7-1/2	.75	135.00
" "	3	2	7-1/2	.75	33.75
Laborers	12	2	7	.50	84.00
				Total	$310.17

BASIS OF ESTIMATE (Op. #20 - 1939)

LeTourneau Operation

Haul 400 feet

Loaded, 400 feet in 2nd Gear	= 1.9	minutes
Load, Dump and Turn	= 4.9	"
Empty, 400 feet in 5th Gear	= 1.2	"
Total Time of Haul Round Trip	= 8.0	"

Assuming 80% efficiency each scraper will move 110 yds. per hour or 2300 yds. per day.

The 4 machines will handle 9000 yds. per day and will complete the job in two working days.

This material will be deposited over the 3' impervious blanket on the right terrace upstream.

STRIPPING DAMSITE
(Left Abutment)

Item No. 4 | Operation No. 7

Quantity 28,000 Cu. Yds. | Date May 16 to July 15, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 7 5/8 Yd.	1	60	3	$ 30.00	$ 1,800.00
Trucks, Dump 4 Yd.	3	60	3	18.00	3,240.00
Small Tools		60	3		336.69
				Total	$ 5,376.69

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovel No. 7	1	840	$ .425	$ 357.00
Trucks, Dump 4 Yd.	3	840	.32	806.40
			Total	$ 1,163.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	60	8	$5.16 Day	$ 928.80
Shovel Operators	3	40	7-1/2	1.25	1,125.00
Oilers	3	40	7-1/2	.60	540.00
Truck Drivers	9	40	7-1/2	.60	1,620.00
Laborers	18	40	7	.50	2,520.00
				Total	$ 6,733.80

BASIS OF ESTIMATE (Op. #7 - 1940)

This material is stripped from the slope of the bank on the east side and is hauled to the upstream cofferdam. Inasmuch as part of this material is 80 feet above the point of disposal it is necessary for the trucks to make a rather long haul.

Average haul is 1800 feet.

The 5/8 shovel is assumed to load 250 yards per shift.

The trucks can operate as follows:

Loaded 800 feet @ 5 M.P.H.	=	1.82 minutes
" 1000 " @ 4 M.P.H.	=	2.84 "
Dump and Turn	=	3.10 "
Empty 1000 feet @ 3 M.P.H.	=	3.79 "
Empty 800 " @ 6 M.P.H.	=	1.89 "
Total Haul Time 1 Round Trip	=	13.44 "
Loading Time	=	6.72 "

13.44 ÷ 6.72 = 2 + 1 = 3 Trucks Required

STRIPPING DAMSITE

(Spillway Approach Channel)

ITEM NO. 4 | Operation No. 5

Quantity 71,000 Cu. Yds. | Date May 1 to 9, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers, 18 C.Y.	10	9	3	$ 63.00	$5,670.00
Bulldozers D8 90 H.P.	3	9	3	36.00	972.00
Small Tools		9	3		73.64
			Total		$ 6,715.64

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
LeTourneau Scrapers 18 C.Y.	10	126	$ .48	$ 604.80
Bulldozers D8 90 H.P.	3	126	.48	181.44
		Total		$ 786.24

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	9	8	$7.22 day	$ 194.94
Foremen	3	9	8	5.16 "	139.32
Tractor Operators	30	6	7-1/2	.75	1,012.50
Laborers	6	6	7	.50	126.00
			Total		$ 1,472.76

BASIS OF ESTIMATE (Op. #5 - 1941)

In order to provide top soil for a portion of the seeded area it is proposed to stockpile 20,000 C.Y. of this material and to place the remaining 51,000 C.Y. in the upstream cofferdam. The stockpile to be located just upstream from the spillway approach channel.

The LeTourneaus can operate as follows:

Loaded 700 feet in 3rd Gear	=	2.8	minutes
" 300 " in 2nd Gear	=	1.4	"
" 500 " in 4th Gear	=	1.8	"
Dump and Turn	=	2.0	"
Empty 500 feet in 5th Gear	=	1.5	"
" 300 " in 1st Gear	=	2.0	"
" 700 " in 4th Gear	=	2.5	"
Loading Time	=	2.0	"

Total Time for 1 Round trip =16.0 minutes hauling to the upstream cofferdam.

Assuming 80% efficiency, one scraper will handle 54 C.Y. per hour or 1134 C.Y. per day.

Hauling to stockpile the scrapers can operate thus:

Loaded 1000 feet in 3rd Gear	=	4.0	minutes
Dump and Turn	=	1.5	"
Empty 1000 feet in 5th Gear	=	3.0	"
Loading Time	=	1.5	"

Total Time for 1 Round Trip = 10.0 minutes

Assuming 80% efficiency, one scraper will haul 86 C.Y. per hour or 86 x 21 = 1806 C.Y. per day.

With 8 scrapers hauling to the cofferdam and 2 hauling to the stockpile, the 71,000 C.Y. can be moved in 6 working days. Since two foremen are charged to this operation, none is used on Op. #6 - 1941, Section 25.

EARTH EXCAVATION

(Above elev. 301)

ITEM NO. 5

Quantity - 1,887,000 c.y.

DESCRIPTION

Due to the difficulty in separating the quantities in Items 5 and 6, it has been decided to estimate the cost of excavation of the total quantities of both items as dry excavation and then to deduct the amount in Item 6 and add thereto the cost of unwatering. This procedure gives the correct cost of each item and at the same time assigns to each its proper amount of yardage. The cost of excavation is assumed to be the same for both items after the material in Item 6 has been dewatered. It is quite obvious that there are a number of places where material excavated under Item 5 will be wet and that the arbitrarily established elevation of 301 bears very little relation to the actual surface of ground water in a number of localities.

The arrangement of the wellpoint systems and the costs assigned to them takes into consideration the conditions mentioned above and it is believed that the plan adopted gives approximately the costs which may be anticipated for the two items.

On the following sheet is shown the cost of the various operations of earth excavation and the proration of these costs to Items 5 and 6.

SUMMARY

PLANT RENTAL	$ 195,129.27
MATERIALS & SUPPLIES	28,295.28
LABOR	96,651.34
TOTAL	$ 320,075.89

EARTH EXCAVATION

Item No. 5

SUMMARY OF OPERATION COSTS IN ITEMS NOS. 5 AND 6

OP. NO.	QUANTITY (C.Y.)	PLANT RENTAL	MATERIAL & SUPPLIES	LABOR
		1939		
7A&B	30,700	$ 2,966.93	$ 491.40	$ 2,338.66
9	80,400	8,064.34	921.48	4,506.70
15	5,300	805.67	86.10	393.42
17	54,000	6,410.89	704.34	3,297.78
40	140,000	12,699.48	2,940.00	9,189.60
		1940		
3	61,370	$ 7,337.37	$ 810.60	$ 3,347.40
4	78,600	12,085.07	1,291.50	5,901.30
9	64,000	8,774.09	1,008.00	2,681.70
12	40,000	5,264.45	604.80	1,609.02
13	37,700	2,926.45	352.80	929.03
14	7,000	877.41	100.80	268.17
15	54,700	9,037.37	987.00	4,347.30
20	33,000	3,901.85	496.44	2,077.02
22	185,000	14,922.37	1,713.60	4,687.41
40	385,000	33,018.65	7,644.00	23,892.96
		1941		
4	23,450	$ 4,856.69	$ 547.68	$ 2,333.85
6	11,400	1,473.19	181.44	303.75
9	26,000	2,961.27	362.88	905.46
11(1)	102,000	7,731.52	1,800.75	11,830.35
11(2)		6,059.15	677.04	2,382.96
18A	143,700	16,248.50	1,814.40	4,210.02
18B	119,400	13,559.33	1,532.16	3,346.68
21(1)	195,200	16,301.66	1,834.56	4,733.19
21(2)	88,900	10,175.80	1,149.12	2,636.01
21(3)	117,700	10,175.80	1,149.12	2,636.01
25	107,100	10,108.67	1,128.96	3,453.36
29	231,300	21,381.21	2.419.20	6.424.20
40	197,000	19,285.47	4,410.00	18,509.40
41	29,400	2,136.50	216.30	1,329.90
	TOTALS	$ 271,547.15	$ 39,376.47	$ 134,502.61

The Costs from above are prorated to Items 5 and 6 as follows:

ITEM	QUANTITY (C.Y.)	PLANT RENTAL	MATERIALS & SUPPLIES	LABOR
5	1,887,000	$ 195,129.27	$ 28,295.28	$ 96,651.34
6	739,000	76,417.88	11,081.19	37,851.27
TOTALS	2,626,000	$ 271,547.15	$ 39,376.47	$ 134,502.61

EARTH EXCAVATION

(Drainage Trench, D.S.)

Item No. 5

Quantity 30,700 c.y.

Operation No. 7 (A) & (B)

Date Aug. 16-31, 1939.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Dragline 2-1/2 c.y. No. 2	1	15	3	$111.00	$1,665.00
Linn Tractor Trucks	2	15	3	32.00	960.00
Bulldozer 30 H.P.	1	15	3	15.00	225.00
Small Tools					116.93
			Total		$ 2,966.93

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Dragline 2-1/2 c.y. No.2	1	315	$ .73	$ 229.95
Linn Tractor Trucks	2	315	.30	189.00
Bulldozer 30 H.P.	1	315	.23	72.45
		Total		$ 491.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen (General)	3	15	8	$7.22 day	$ 324.90
Operators (Dragline)	3	15	7-1/2	1.25	421.88
Oilers (Dragline)	3	15	7-1/2	.60	202.50
Operators, Tractor	9	15	7-1/2	.75	759.38
Laborers	12	15	7	.50	630.00
			Total		$2,338.66

BASIS OF ESTIMATE (Op. #7(A) & (B) - 1939)

It is assumed that the 2-1/2 c.y. machine equipped with a 2 c.y. dragline bucket will excavate 2000 yds./day.

The average haul is 500 feet.

The number of Linns required is as follows:

Loaded 500 feet at 4 M.P.H.	=	1.4 minutes	
Dump and Turn	=	3.2 "	
Empty 500 feet at 4 M.P.H.	=	1.4 "	
Total time for Round Trip	=	6.0 "	
Loading Time 1.6 yds. per minute	=	5.6 "	(9 c.y.)

This indicates that 2 Linns (9 yd. cap.) are required.

The excavation includes 26,800 c.y. in the downstream drainage trenches.

Left bank	10,760 c.y.
Right bank	16,050 c.y.

Also included is 3900 c.y. in Core Trench "A" on the left bank.

This operation will probably be continuous until completed.

EARTH EXCAVATION

(Conduit Section & Right Terrace)

ITEM NO. 5 | Operation No. 9

QUANTITY 80,400 c.y. | Date Aug. 25-Sept.15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel, 2 c.y., No. 4	1	21	3	$ 102,00	$ 2,142.00
Shovel, 2-1/2 c.y. No. 2	1	15	3	111.00	1,665.00
Linn Tractor Trucks (9 c.y.)	2	9	3	32.00	576.00
Linn Tractor Trucks (9 c.y.)	4	12	3	32.00	1,536.00
Linn Tractor Trucks (9 c.y.)	4	15	3	32.00	1,920.00
Small Tools					225.34
			Total		$ 8,064.34

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel, 2 Yd., No. 4	1	315	$ .55	$ 173.25
Shovel, 2-1/2 Yd., No. 2	1	231	.73	168.63
Linn Tractor Trucks	2	126	.30	75.60
Linn Tractor Trucks	4	189	.30	226.80
Linn Tractor Trucks	4	231	.30	277.20
		Total		$ 921.48

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	21	8	$7.22 day	$ 454.86
Foremen	3	21	8	5.16 "	325.08
Operators, Shovel	3	15	7-1/2	1.25	421.88
Operators, shovel	3	11	7-1/2	1.25	309.38
Oilers	3	15	7-1/2	.60	202.50
Oilers	3	11	7-1/2	.60	148.50
Operators, Tractor	6	6	7-1/2	.75	202.50
Operators, Tractor	12	9	7-1/2	.75	607.50
Operators, Tractor	12	11	7-1/2	.75	742.50
Laborers	12	15	7	.50	630.00
Laborers	12	11	7	.50	462.00
			Total		$ 4,506.70

BASIS OF ESTIMATE (Co. #9 - 1939)

This material will be transported to both Terraces under the 3 foot impervious blanket.

Number of Linns (9 Yd.) required for hauling:

16,000 Yds. to West Terrace. Average Haul, 300 feet.

Loaded, 300 feet	at 3 M.P.H.	=	1.14	minutes
Dump and Turn		=	1.17	"
Empty, 300 feet	at 5 M.P.H.	=	0.69	"
Total Time for Round Trip		=	3.00	"
Loading Time		=	3.75	"

Required 2 Linns for 6 working days = 9 calendar days, or until September 3.

64,400 Yds. from Conduits to East Terrace under blanket, 2,300 feet.

Loaded, 800 feet	at 4 M.P.H.	=	2.2	minutes
" 400 "	at 5 M.P.H.	=	.9	"
" 1100 "	at 4 M.P.H.	=	3.1	"
Dump and Turn		=	1.4	"
Empty, 2300 feet	at 6 M.P.H.	=	4.4	"
Total Time for Round Trip		=	12.0	"
Loading Time		=	3.8	"

4 Linns Required to haul from No. 2 Shovel Sept. 1 to Sept. 15 and from No. 4 from Sept. 4 to Sept. 15.

It is assumed that No. 4 shovel will operate from Aug. 25 to Sept. 15 or about 15 working days and excavate 3,000 c.y. in 21 hours. Shovel No. 2 will operate from Sept. 1 to Sept. 15 or about 11 working days and excavate 3,200 c.y. in 21 hours.

15 x 3000	=	45,000 c.y.
11 x 3200	=	35,200 " "
Total	=	80,200 " "

Schedule of Equipment

Date	Shovel	Trucks	Working Days	Hours
Aug. 25 - Sept. 3	#4	2	6	126
Sept. 4 - Sept. 15	#4	4	9	189
Sept. 1 - Sept. 15	#2	4	11	231

EARTH EXCAVATION

(Stilling Basin to Left Terrace)

ITEM NO. 5 | Operation No. 15

QUANTITY 5,300 Cu. Yds. | Date Sept. 16-18, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel 2 Yd. No. 4	1	3	3	$ 102.00	$ 306.00
Linn Tractor Trucks, 9 Yd.	5	3	3	32.00	480.00
Small Tools					19.67
				Total	$ 805.67

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel 2 Yd. No. 4	1	42	$ .55	$ 23.10
Linn Tractor Trucks, 9 Yd.	5	42	.30	63.00
			Total	$ 86.10

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	3	8	$ 6.38 Day	$ 57.42
Operators, Shovel	3	2	7-1/2	1.25	56.25
Oilers, Shovel	3	2	7-1/2	.60	27.00
Operators, Linn	15	2	7-1/2	.75	168.75
Laborers	12	2	7	.50	84.00
					$ 393.42

BASIS OF ESTIMATE (Op. #15 - 1939)

This material will be required under the impervious blanket (below elevation 312).

It is estimated that the 2-Yd. shovel will load 900 yds. per 7 hour shift. The average haul is 2,300 feet.

Number of 9-Yd. Linn Tractor Trucks

Loaded	400 feet at 3 M.P.H.	=	1.5	minutes
"	1000 " at 8 "	=	1.4	"
"	900 " at 4 "	=	2.6	"
Dump and Turn		=	3.2	"
Empty	2300 feet at 6 "	=	4.3	"
Total Haul Time, Round Trip		=	12.0	"

900 c.y. ÷ 420 min. = 2.13 c.y./min.

9 c.y. ÷ 2.14 c.y./min. = 4.2 min. (Loading Time)

Four Linn Tractor Trucks will be required to haul the material and keep the shovel working steadily.

EARTH EXCAVATION

(Stilling Basin to Left Terrace)

ITEM NO. 5 | Operation No. 17

QUANTITY 54,000 C.Y. | Date Sept. 19 to Oct. 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel 2 yd. No. 4	1	27	3	$ 102.00	$ 2,754.00
Linn Tractor Trucks 9 yd.	4	18	3	32.00	2,304.00
" " " " "	3	9	3	32.00	864.00
Dump Trucks 4 c.y.	2	9	3	18.00	324.00
Small Tools		27	3		164.89
				Total	$ 6,410.89

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 4	1	378	$ .55	$ 207.90
Linn Tractor Trucks	4	252	.30	302.40
" " "	3	126	.30	113.40
Dump Trucks	2	126	.32	80.64
			Total	$ 704.34

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	27	8	$6.38 day	$ 516.78
Operator Shovel	3	18	7½	1.25	506.25
Oilers Shovel	3	18	7½	.60	243.00
Tractor Operators	12	12	7½	.75	810.00
" "	9	6	7½	.75	303.75
Truck Drivers	6	6	7½	.60	162.00
Laborers	12	18	7	.50	756.00
				Total	$3,297.78

BASIS OF ESTIMATE (Op. #17 - 1939)

This material is from the stilling basin and will be transported to the left terrace above elevation 315 in the embankment.

It is estimated that the 2 yd. shovel will load 1,000 yds. in 7 hours. = 1,000 c.y. ÷ 420 min. = 2.38 c.y./min.

The average Haul is 2,300 feet.

Hauling units to be 9 yd. Linn Tractor Trucks.

It is assumed that the Linns can operate on the following schedule:

Loaded	400	feet	at	3	M.P.H.	=	1.5 minutes
"	1,000	"	"	8	"	=	1.4 "
"	900	"	"	4	"	=	2.6 "
Dump and Turn						=	2.2 "
Empty 2,300 feet at 8					"	=	3.3 "
Total Haul Time, 1 Round Trip						=	11.0 "
Loading Time (9 c.y. ÷ 2.38 c.y./min)						=	3.8 "

11 ÷ 3.8 = 2.9 + 1 = 3.9, say 4 Linns required for 1 Shovel.

Although 4 Tractor Trucks are required, only 3 are available after Oct. 6. Two 4 c.y. Dump Trucks will be used from Oct. 7 to 15 incl. in addition to the 3 tractor trucks.

EARTH EXCAVATION
(Outlet Discharge Channel)

ITEM NO. 5 | Operation No. 40

Quantity 140,000 Cu. Yds. | Date Oct. 1 to Nov. 30, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Dredge, Hydraulic, 12"	1	60	3	$ 200.00	$ 12,000.00
Boat, Outboard Motor	1	60	3	2.00	120.00
Barge	1	60	3	2.00	120.00
Small Tools		60	3		459.48
				Total	$ 12,699.48

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Dredge	1	1200	$ 2.40	$ 2,880.00
Boat	1	1200	.05	60.00
			Total	$ 2,940.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	60	8	$ 7.22 day	$ 1,299.60
Engineers (Diesel)	3	50	8	.85	1,020.00
Mechanics	3	50	7	1.00	1,050.00
Mechanical Helpers	3	50	7	.55	577.50
Electricians	3	50	7	.85	892.50
Cutter Head Men	3	50	8	1.00	1,200.00
Laborers	18	50	7	.50	3,150.00
				Total	$ 9,189.60

BASIS OF ESTIMATE (Dredge) (Op. #40 - 1939)

1939-1940

It is assumed that the dredge will be built on the site of the work and that it will handle approximately 3,000 cu. yds. per day for 25 days per month of 30 days, operating 24 hours per day.

It is also assumed that the plant rental of $200 per day will cover the cost of the dredge as well as pontoons, pipeline and appurtenances.

During both these seasons the excavated material will be pumped to the spoil area west of the discharge channel.

1941

It is proposed to excavate the muck from the river channel with the dredge and deposit the material over the blanket on both terraces between the embankment section of the dam and the upstream cofferdam. After completion of the muck excavation, the dredge will remove a small portion of the downstream cofferdam. After the dredge moves out of the area, Shovels No. 2 and No. 3 equipped as draglines, Linn Tractor Trucks and LeTourneau Scrapers are proposed to close the cofferdam and clean up the area to prepare it for the main fill. After completion of the above operation the dredge will be tied up until about Sept. 1st when it will start excavation in the Spillway Discharge Channel. Approximately 197,000 c.y. remain in this area to be removed by this method.

Spillway Discharge Channel	120,000	c.y.
Lower Spillway Dis. Channel	49,800	"
Small Cofferdam	27,200	"
Total	197,000	"

EARTH EXCAVATION
(Stilling Basin)

ITEM NO. 5

Quantity 61,370 c.y.

Operation No. 3

Date May 15 to 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovels 2-1/2 yd. Nos. 2 and 3	2	15	3	$ 111.00	$ 3,330.00
Linn Tractor Trucks	8	15	3	32.00	3,840.00
Small Tools					167.37
				Total	$ 7,337.37

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovels 2-1/2 yds. Nos. 2 and 3	2	210	$ .73	$ 306.60
Linn Tractor Trucks	8	210	.30	504.00
			Total	$ 810.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	15	8	$ 7.22 day	$ 324.90
Operators, Shovel	6	10	7-1/2	1.25	562.50
Oilers, "	6	10	7-1/2	.60	270.00
Operators, Linn	24	10	7-1/2	.75	1,350.00
Laborers	24	10	7	.50	840.00
				Total	$ 3,347.40

BASIS OF ESTIMATE (Op. #3 - 1940)

It is estimated that one $2\frac{1}{2}$ yd. shovel will load 3,070 yds. in one day of 21 hours.

It is assumed that the Linns will operate as follows: Haul = 2,300 feet.

Loaded	400	feet	at	3	M.P.H.	= 1.5	Minutes
"	1,000	"	"	8	"	= 1.4	"
"	800	"	"	3	"	= 3.0	"
Dump and Turn						= 1.5	"
Empty	800	"	"	5	"	= 1.8	"
"	1,400	"	"	8	"	= 2.0	"
Total Haul Time Round Trip						=11.2	
Loading Time						= 3.70	

11.2 ÷ 3.70 = 3 + 1 = 4 Linns Required for each Shovel.

This material is assumed to be excavated from the Stilling Basin and deposited in the fill on the Left Bank below elevation 350.

EARTH EXCAVATION
(Spillway Discharge Channel)

ITEM NO. 5 | Operation No. 4

Quantity 78,600 Cu. Yds. | Date May 15 to June 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 4 2 Yd.	1	45	3	$ 102.00	$ 4,590.00
Linn Tractor Trucks	5	45	3	32.00	7,200.00
Small Tools		45	3		295.07
				Total	$12,085.07

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 4, 2 Yd.	1	630	$ .55	$ 346.50
Linn Tractor Trucks	5	630	.30	945.00
			Total	$ 1,291.50

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	45	8	$6.38 day	$ 861.30
Shovel Operators	3	30	7-1/2	1.25	843.75
Oilers	3	30	7-1/2	.60	405.00
Tractor Operators	15	30	7-1/2	.75	2,531.25
Laborers	12	30	7	.50	1,260.00
				Total	$ 5,901.30

BASIS OF ESTIMATE (Op. #4 - 1940)

This material contains some boulders and the haul is rather long and for this reason the shovel and Linns are used instead of scrapers.

The capacity of the shovel would be at least 3,000 yds. per day in ordinary digging but due to the conditions 2,620 yds. is considered a better figure.

The Linn Tractor Trucks (9 yd.) can operate as follows:

Loaded	600	feet	at	4	M.P.H.	=	1.70	minutes
"	500	"	"	3	"	=	1.89	"
"	1,000	"	"	6	"	=	1.89	"
"	600	"	"	4	"	=	1.70	"
Dump and Turn						=	2.71	"
Empty	600	feet	"	6	M.P.H.	=	1.13	"
"	1,500	"	"	10	"	=	1.71	"
"	600	"	"	3	"	=	2.27	"
Total Haul Time 1 Round Trip						=	15.00	"
Loading Time						=	4.33	"

15 ÷ 4.33 = 3.4642 + 1 = 5 Linns Required, 9 cu. yd. capacity

This material is assumed to be excavated from the Spillway Discharge Channel and to be deposited in the Left Terrace.

EARTH EXCAVATION
(Spillway Discharge Channel)

ITEM NO. 5 | Operation No. 9

Quantity 64,000 c.y. | Date June 1 to June 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18 Yd.	4	30	3	$ 63.00	$ 7,560.00
Bulldozer D8	1	30	3	36.00	1,080.00
Small Tools					134.09
				Total	$ 8,774.09

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No.Hrs.	Rate/Hr.	Amount
LeTourneau Scrapers 18 Yd.	4	420	$ .48	$ 806.40
Bulldozer D8	1	420	.48	201.60
			Total	$ 1,008.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	30	8	$6.38 day	$ 574.20
Tractor Operators	15	20	7-1/2	.75	1,687.50
Laborers	6	20	7	.50	420.00
				Total	$ 2,681.70

BASIS OF ESTIMATE (Op. #9 - 1940)

This material is to be excavated from the Spillway Discharge Channel and deposited on the Left Terrace both up and downstream, to elevation 350.

The LeTourneaus can operate as follows:

Loaded	600	feet	in	3rd	Gear	=	2.5 minutes
"	400	"	"	2nd	"	=	1.9 "
"	1,400	"	"	4th	"	=	5.0 "
"	400	"	"	2nd	"	=	2.0 "
Dump and Turn						=	1.9 "
Empty	800	feet	in	5th	Gear	=	2.4 "
"	1,400	"	"	6th	"	=	3.0 "
"	600	"	"	6th	"	=	1.3 "
Loading Time						=	2.0 "
Total Time 1 Round Trip						=	22.0 "

One Scraper working at 80% efficiency will move 840 cu. yds. per day and the 4 scrapers will handle 840 x 4 = 3,360 cu. yds. per day. Say 3,200.

EARTH EXCAVATION
(Spillway Discharge Channel)

ITEM NO. 5 | Operation No. 12

Quantity 40,000 Cu. Yds. | Date July 1 to 18, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers, 18 Yd.	4	18	3	$ 63.00	$ 4,536.00
Bulldozer D8	1	18	3	36.00	648.00
Small Tools		18	3		80.45
				Total	$ 5,264.45

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Tractor D8	5	252	$ .48	$ 604.80
			Total	$ 604.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	18	8	$ 6.38 day	$ 344.52
Tractor Operators	15	12	7-1/2	.75	1,012.50
Laborers	6	12	7	.50	252.00
				Total	$ 1,609.02

BASIS OF ESTIMATE (Co. #12 - 1940)

The LeTourneau Scrapers can operate on the following Schedule:

Loaded	400	feet	in	4th	Gear	=	1.4	minutes
"	400	"	"	2nd	"	=	1.9	"
"	1,000	"	"	4th	"	=	3.5	"
"	1,000	"	"	2nd	"	=	4.8	"
Dump and Turn						=	1.7	"
Empty	2,400	feet	in	6th	Gear	=	5.1	"
"	400	"	"	3rd	"	=	1.6	"
Total Haul Time 1 Round Trip						=	20.0	"
Loading Time						=	2.00	"
Total Time for 1 Round Trip						=	22.00	"

Assuming 80% efficiency of operation, one 18 cu. yd. scraper will move 840 cu. yds. in 21 hours.

This material is assumed to be excavated from the Spillway Discharge Channel and deposited in the fill on the left terrace between elevation 350 and elevation 380.

EARTH EXCAVATION
(Access Road)

ITEM NO. 5 — Operation No. 13

Quantity 37,700 C.Y. — Date July 19 to 28, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18 Yd.	4	10	3	$ 63.00	$ 2,520.00
Bulldozer D^8	1	10	3	36.00	360.00
Small Tools		10	3		46.45
				Total	$ 2,926.45

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Tractors D^8	5	147	$ .48	$ 352.80
			Total	$ 352.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	10	8	$6.38 day	$ 191.40
Tractor Operators	15	7	7-1/2	.75	590.63
Laborers	6	7	7	.50	147.00
				Total	$ 929.03

BASIS OF ESTIMATE (Op. #13 - 1940)

The LeTourneaus can operate on the following schedule:

Loaded 800 feet in 3rd Gear	=	3.3 minutes
Dump and Turn	=	2.5 "
Empty 400 feet in 1st Gear	=	2.7 "
" 800 " " 4th "	=	2.7 "
Total Haul Time 1 Round Trip	=	11.2 "
Loading Time	=	2.0 "
Total Time 1 Round Trip	=	13.2 "

Assuming 80% mechanical efficiency, each 18 cu. yd. scraper would move 66 x 21 = 1,386 cu. yds. in 1 day, say 1,350 c.y. 1,350 x 4 x 7 = 37,800 c.y.

This material is to be excavated from the section of the construction Road and placed in the Left abutment of the dam.

EARTH EXCAVATION
(Access Road)

ITEM NO. 5 | Operation No. 14

Quantity - 7,000 Cu. Yds. | Date July 29 - 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18-Yd.	4	3	3	$ 63.00	$ 756.00
Bulldozer	1	3	3	36.00	108.00
Small Tools					13.41
				Total	$ 877.41

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hr.	Amount
Tractors	5	42	$ .48	$ 100.80
			Total	$ 100.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	3	8	$ 6.38 Day	$ 57.42
Tractor Operators	15	2	7-1/2	.75	168.75
Laborers	6	2	7	.50	42.00
				Total	$ 268.17

BASIS OF ESTIMATE (Op. #14 - 1940)

This material is used in grading the Access Road.

The 18 yd. LeTourneaus can operate as follows:

Loaded 700 feet in 2nd Gear	=	3.3 minutes
Dump and Turn	=	2.0 "
Empty 1,000 feet in 4th Gear	=	3.5 "
Loading Time	=	2.2 "
Total Time 1 Round Trip	=	11.0 "

Assuming 70% mechanical efficiency, one scraper will move 68 cu. yds. per hour or 1,420 c.y. per day. Approx. 2 days will be required as considerable grading will be necessary.

EARTH EXCAVATION
(Spillway Discharge Channel)

ITEM NO. 5 | Operation No. 15

Quantity - 54,700 Cu. Yds. | Date July 1 - 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 4 2-Yd.	1	30	3	$ 102.00	$ 3,060.00
Linn Tractor Trucks 9-Yd.	6	30	3	32.00	5,760.00
Small Tools		30	3		217.37
				Total	$ 9,037.37

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 4	1	420	$ .55	$ 231.00
Linn Tractor Trucks 9-Yd.	6	420	.30	756.00
			Total	$ 987.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	30	8	$ 7.22 Day	$ 649.80
Shovel Operators	3	20	7-1/2	1.25	562.50
Oilers	3	20	7-1/2	.60	270.00
Tractor Drivers	18	20	7-1/2	.75	2,025.00
Laborers	12	20	7	.50	840.00
				Total	$ 4,347.30

BASIS OF ESTIMATE (Co. #15 - 1940)

This material to be excavated from below the weir section and deposited in the Left Terrace from elevation 350 to 390.

The Linn Tractor Trucks, 9 yd can operate as follows:

Loaded	400	feet	at	4	M.P.H.	=	1.14	minutes
"	400	"	"	2	"	=	2.27	"
"	1,000	"	"	6	"	=	1.89	"
"	1,400	"	"	2	"	=	7.95	"
Dump and Turn						=	1.69	"
Empty	2,400	feet	at	6	M.P.H.	=	4.54	"
"	400	"	"	3	"	=	1.52	"
Total Haul Time, 1 Round Trip						=	21.00	"
Loading Time						=	4.14	"

21 ÷ 4.14 = 5.07 + 1 = 6 9 yd. Linns Required.

The shovel can load 3,000 yds. per day, but in this case only 2,735 yds. are required.

EARTH EXCAVATION
(Spillway Approach Channel)

ITEM NO. 5 | Operation No. 20

Quantity - 33,000 Cu. Yds. | Date July 1 - 18, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 3 2-1/2 Yd.	1	18	3	$ 111.00	$ 1,998.00
Linn Tractor Trucks 9-Yd.	2	18	3	32.00	1,152.00
Trucks, Dump, 4-Yd.	2	18	3	18.00	648.00
Small Tools		18	3		103.85
				Total	$ 3,901.85

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 3 2-1/2 Yd.	1	252	$ .73	$ 183.96
Linn Tractor Trucks 9-Yd.	2	252	.30	151.20
Trucks, Dump 4-Yd.	2	252	.32	161.28
			Total	$ 496.44

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	18	8	$ 6.38 Day	$ 344.52
Shovel Operators	3	12	7-1/2	1.35	337.50
Oilers	3	12	7-1/2	.60	162.00
Tractor Operators	6	12	7-1/2	.75	405.00
Truck Drivers	6	12	7-1/2	.60	324.00
Laborers	12	12	7	.50	504.00
				Total	$ 2,077.02

BASIS OF ESTIMATE (Co. #20 - 1940)

This material is to be excavated from the line of the wall on the east side of the spillway and to be placed in the fill adjacent below elevation 330.

It is estimated that the shovel will load 3,000 cu. yds. in 21 hours. (2,750 per day required for 12 days).

The Linn Tractor Trucks can operate as follows:

Loaded	300	feet	at 3	M.P.H.	=	1.14	Minutes
"	300	"	" 4	"	=	0.85	"
Dump and Turn					=	2.19	"
Empty	300	"	" 5	"	=	0.68	"
"	300	"	" 3	"	=	1.14	"
Total Haul Time for 1 Round Trip					=	6.00	"
Loading Time					=	4.12	"

6 ÷ 4.12 = 1.45 + 1 = 2.45 Say 3 Linns Required.

As only 2 Linns are available at this time 2 - 4 yd. Trucks are added to take the place of one Linn.

EARTH EXCAVATION
(Outlet Approach Channel)

ITEM NO. 5 | Operation No. 22

Quantity 185,000 C.Y. | Date Aug. 1 - Sept. 21, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18-Yd.	4	51	3	$ 63.00	$ 12,852.00
Bulldozer D8	1	51	3	36.00	1,836.00
Small Tools					234.37
				Total	$ 14,922.37

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors D8	5	714	$ .48	$ 1,713.60
			Total	$ 1,713.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	51	8	$ 7.22 Day	$ 1,104.66
Tractor Operators	15	34	7-1/2	.75	2,868.75
Laborers	6	34	7	.50	714.00
				Total	$ 4,687.41

BASIS OF ESTIMATE (Op. #22 - 1940)

This material is to be excavated from the Outlet Approach Channel and deposited in the fill on the West Terrace.

The first stage of this work is placing 130,000 cu. yds. up to elevation 365.

On this part of the work the Scrapers can operate as follows:

Loaded	500	feet	in	2nd	Gear	=	2.4 minutes
"	200	"	"	1st	"	=	1.3 "
"	300	"	"	3rd	"	=	1.2 "
Dump and Turn						=	1.1 "
Empty	1,000	feet	in	5th	"	=	3.0 "
Loading Time						=	2.0 "
Total Time for 1 Round Trip						=	11.0 "

Assuming 80% efficiency each scraper will move 80 yds. per hour or 1,680 yds. per day. 4 x 1,680 = 6720 yds. for 4 Scrapers. 130,000 ÷ 6720 = 19.3 say 20 days.

The second stage is placing 55,000 yards above elev. 365.

Loaded	500	feet	in	2nd	Gear	=	2.4 minutes
"	450	"	"	1st	"	=	3.0 "
"	950	"	"	2nd	"	=	4.5 "
"	300	"	"	3rd	"	=	1.2 "
Dump and Turn						=	1.7 "
Empty	1,400	feet	in	5th	Gear	=	4.2 "
Loading Time						=	2.0 "
Total Time for 1 Round Trip						=	19.0 "

Assuming 80% efficiency 1 scraper will move 46 cu. yds. per hour or 966 cu. yds. per day. 4 x 966 = 3864 yds. per day for 4 scrapers. 55,000 ÷ 3864 = 14.2 say 14 days.

The total time required to move the 185,000 cu. yds. is 20 + 14 = 34 working days or 51 calendar days.

EARTH EXCAVATION
(Lower Discharge Channel)

ITEM NO. 5 | Operation No. 40

Quantity 385,000 Cu. Yds. | Date May 28- October 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Dredge, Hydraulic 12"	1	156	3	$200.00	$ 31,200.00
Boat, Outboard Motor	1	156	3	2.00	312.00
Barge, 12' x 30'	1	156	3	2.00	312.00
Small Tools		156	3		1,194.65
				Total	$ 33,018.65

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Dredge	1	3,120	$ 2.40	$ 7,488.00
Boat 7 HP	1	3,120	$ .05	156.00
			Total	$ 7,644.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	156	8	$ 7.22 Day	$ 3,378.96
Engineers	3	130	8	.85	2,652.00
Mechanics	3	130	7	1.00	2,730.00
Mechanics Helpers	3	130	7	.55	1,501.50
Electricians	3	130	7	.85	2,320.50
Cutter Head Men	3	130	8	1.00	3,120.00
Laborers	18	130	7	.50	8,190.00
				Total	$ 23,892.96

NOTE: For basis of estimate see operation #40 - 1939

EARTH EXCAVATION
(Outlet Approach Channel)

Item No. 5 — Operation No. 4

Quantity 23,450 Cu. Yds. — Date April 22 to May 6, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Dragline No. 3 2 c.y.	1	15	3	$ 111.00	$ 1,665.00
Dragline No. 2 2 c.y.	1	9	3	111.00	999.00
Linn Tractor Trucks 9 c.y.	2	15	3	32.00	960.00
Linn Tractor Trucks 9 c.y.	2	9	3	32.00	576.00
D8 Bulldozer 90 H.P.	1	15	3	36.00	540.00
Small Tools		15	3		116.69
				Total	$ 4,856.69

MATERIALS & SUPPLIES (See No. 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Dragline No. 3	1	210	$ .73	$ 153.30
Dragline No. 2	1	126	.73	91.98
Linn Tractor Trucks	2	210	.30	126.00
Linn Tractor Trucks	2	126	.30	75.60
Bulldozer	1	210	.48	100.80
			Total	$ 547.68

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	15	8	$ 6.38 day	$ 287.10
Shovel Operators	3	10	7½	$1.25	281.25
Shovel Operators	3	6	7½	1.25	168.75
Oilers	3	10	7½	.60	135.00
Oilers	3	6	7½	.60	81.00
Tractor Operators (Linn)	6	10	7½	.75	337.50
" " "	6	6	7½	.75	202.50
" " (D8)	3	10	7½	.75	168.75
Laborers	12	10	7	.50	420.00
Laborers	12	6	7	.50	252.00
				Total	$ 2,333.85

BASIS OF ESTIMATE (Co. #4 - 1941)

This material has to be excavated largely from under water and for this reason it is thought advisable to make liberal allowance in the time for the operation.

These $3\frac{1}{2}$ yard machines are assumed to be using 2 cu. yd. drag buckets. They will load and swing 180° in 58 seconds.

No. 3 Dragline is assumed to work from April 22 to May 6 and No. 2 to work from April 28 to May 6.

The Linns can operate as follows:

Loaded 300 feet at 3 M.P.H.	= 1.14	minutes
Dump and turn	= 3.72	"
Empty 300 feet at 3 "	= 1.14	"
Total Haul Time 1 Round Trip	= 6.00	"
Loading Time	= 6.00	"
Total Time for 1 Round Trip	= 12.00	"

6 ÷ 6 = 1 + 1 = 2 Linns required to serve each Dragline.

This material is to be excavated from the plug in the Outlet Approach Channel and deposited in the upstream cofferdam.

EARTH EXCAVATION

(Spillway Approach Channel)

Item No. 5 | Operation No. 6

Quantity 11,400 Cu. Yds. | Date May 1 to 9, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18 c.y.	2	9	3	$ 63.00	$ 1,134.00
Bulldozer D8 90 H.P.	1	9	3	36.00	324.00
Small Tools					15.19
				Total	$ 1,473.19

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Le Tourneau Scrapers	2	126	$ .48	$ 120.96
Bulldozer	1	126	.48	60.48
			Total	$ 181.44

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Tractor Operators	6	6	7½	$ .75	$ 202.50
Tractor Operators	3	6	7½	.75	101.25
				Total	$ 303.75

Note: For Basis of Estimate see Op. #5 - 1941 Section 24.

EARTH EXCAVATION
(Spillway Discharge Channel)

Item No. 5

Quantity 26,000 c.y.

Operation No. 9

Date May 10 to 15, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18 c.y.	6	6	3	$ 63.00	$ 2,268.00
Bulldozers D8 90 H.P.	3	6	3	36.00	648.00
Small Tools		6	3		45.27
				Total	$ 2,961.27

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors D8 90 H.P.	9	84	$ .48	$ 362.88
			Total	$ 362.88

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	6	8	$ 7.22 day	$ 129.96
Tractor Operators	27	4	7½	.75	607.50
Laborers	12	4	7	.50	168.00
				Total	$ 905.46

BASIS OF ESTIMATE (Op. #9 - 1941)

This earth is to be excavated from the Spillway Discharge Channel, well below the weir, and is to be hauled to the Down Stream Cofferdam.

The best equipment available at this time is LeTourneau Scrapers, 18 c.y. capacity.

One extra bulldozer is used to load the LeTourneaus, and two are used on the fill.

The scrapers can operate as follows:

Loaded	300 feet in 3rd Gear	=	1.2	minutes
"	400 " " 1st "	=	2.7	"
"	700 " " 4th "	=	2.4	"
Load, Dump and Turn		=	6.3	"
Empty	1,100 feet in 6th Gear	=	2.4	"
"	300 " " 1st "	=	2.0	"
Total Time for one Round Trip		=	17.0	"

Assuming 80% mechanical efficiency, each scraper will be able to handle 51 c.y. per hour or 1,071 c.y. in 1 day.

On account of the fact that dumping conditions may be far from ideal a longer time is allowed for dumping.

Six Scrapers will move approximately 26,000 c.y. in 4 working days.

EARTH EXCAVATION

(Muck excav. River Section)

Item No. 5

Quantity 102,000 Cu. Yds.

Operation No. 11, Sheet #1

Date May 1 - June 4, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Dredge, Hydraulic, 12	1	35	3	$ 200.00	$ 7,000.00
Boat, Outboard motor	1	35	3	2.00	70.00
Barge	1	35	3	2.00	70.00
Small Tools		35	3		591.52
				Total	$ 7,731.52

MATERIALS & SUPPLIES (See Sec. 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Dredge	1	735	$ 2.40	$ 1,764.00
Boat	1	735	.05	36.75
			Total	$ 1,800.75

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	35	8	$ 7.22 day	$ 758.10
Engineers (Diesel)	3	35	8	.85	714.00
Mechanics	3	35	7	1.00	735.00
Mechanics Helpers	6	35	7	.55	808.50
Electrician	3	35	7	.85	624.75
Cutter head men	3	35	8	1.00	840.00
Laborers	60	35	7	.50	7,350.00
				Total	$ 11,830.35

Note: For Basis of Estimate see Op. #40 - 1939

REPLACE COFFERDAM

and

CLEAN UP RIVER SECTION

Operation No. 11 Sheet No. 2

Item No. 5

Date June 4 to 9, 1941

Quantity

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Draglines Nos. 2 and 3	2	6	3	$ 111.00	$ 1,332.00
Linn Tractor Trucks 9 c.y.	6	6	3	32.00	1,152.00
LeTourneau Scrapers 18 c.y.	8	6	3	63.00	3,024.00
Bulldozers 90 H.P.	2	6	3	36.00	432.00
Small Tools		6	3		119.15
				Total	$ 6,059.15

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Draglines	2	84	$ .73	$ 122.64
Linn Tractor Trucks	6	84	.30	151.20
Tractors	10	84	.48	403.20
			Total	$ 677.04

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	6	8	$ 7.22 day	$ 129.96
Shovel Operators	6	4	7½	1.25	225.00
Oilers	6	4	7½	.60	108.00
Tractor Operators	48	4	7½	.75	1,080.00
Laborers	60	4	7	.50	840.00
				Total	$2,382.96

Note: For Basis of Estimate see Op. #40 - 1939

EARTH EXCAVATION
(Soillway Discharge Channel)

ITEM NO. 5

Quantity 143,700 Cu. Yds.

Operation No. 18A

Date June 13 - 30, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18-Yd.	13	18	3	$ 63.00	$ 14,742.00
Bulldozers D8 90 HP	2	18	3	36.00	1,296.00
Small Tools					210.50
				Total	$ 16,248.50

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors D8 90 HP	15	252	$ .48	$ 1,814.40
			Total	$ 1,814.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	18	8	$ 7.22 Day	$ 389.88
Foremen	3	18	8	5.16 "	278.64
Tractor Operators	45	12	7-1/2	.75	3,037.50
Laborers	12	12	7	.50	504.00
				Total	$ 4,210.02

BASIS OF ESTIMATE (Op. #18A - 1941)

The excavated material from the spillway discharge channel can be moved most economically to the river section of the dam because in this way it has to be elevated the least.

It is assumed that the material can be handled by means of LeTourneau Scrapers of 18 cu. yd. capacity.

Two extra bulldozers are provided to act as boosters to assist in loading.

The LeTourneaus can operate as follows:

Loaded	300	feet	in 3rd	Gear	=	1.2	minutes
"	400	"	" 2nd	"	=	1.9	"
"	500	"	" 4th	"	=	1.8	"
"	1,000	"	" 3rd	"	=	4.0	"
Return	1,900	"	" 5th	"	=	5.6	"
"	300	"	" 2nd	"	=	1.4	"
Load, Dump and Turn					=	4.1	"
Total Time for one Round Trip					=	20.0	"

Assuming 80% mechanical efficiency each scraper should move 44 cu. yds. per hour or 21 x 44 = 924 cu. yds. per day. Thirteen scrapers would handle 144,000 c.y. in 12 days of 21 hours.

EARTH EXCAVATION
(Spillway Approach Channel)

ITEM NO. 5 | Operation No. 18B

Quantity 119,400 Cu. Yds. | Date July 1-12, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18-Yd.	16	12	3	$ 63.00	$ 12,096.00
Bulldozers D8 90 HP	3	12	3	36.00	1,296.00
Small Tools		12	3		167.33
				Total	$ 13,559.33

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors D8 90 HP	19	168	$ .48	$ 1,532.16
			Total	$ 1,532.16

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	12	8	37.22 Day	$ 259.92
Foremen	3	12	8	5.16 "	185.76
Tractor Operators	57	8	7-1/2	.75 "	2,565.00
Laborers	12	8	7	.50	336.00
				Total	$ 3,346.68

BASIS OF ESTIMATE (Op. #18B - 1941)

This material is assumed to be excavated from the weir section and hauled to the river section upstream from the core. It is necessary to remove this earth as soon as possible so as to uncover the rock which has to be excavated from the weir.

It is assumed that the material can be handled by means of LeTourneau Scrapers.

They are assumed to be loaded by means of bulldozer used as a booster. Three bulldozers are required for this purpose.

The scrapers can operate on the following schedule:

Loaded	200	feet	in 1st	Gear	=	1.3	minutes
"	1,000	"	" 4th	"	=	3.5	"
"	300	"	" 2nd	"	=	1.4	"
"	600	"	" 3rd	"	=	2.4	"
Return	300	"	" 5th	"	=	0.9	"
"	100	"	" 1st	"	=	0.7	"
"	200	"	" 5th	"	=	0.6	"
"	300	"	" 3rd	"	=	1.2	"
"	1,200	"	" 4th	"	=	4.2	"
Load, Dump and Turn					=	3.8	"
Total Time for one Round Trip					=	20.0	"

Assuming 80% mechanical efficiency, one scraper should move 44 cu. yds. per hour or 21 x 44 = 924 cu. yds. per day.

Sixteen scrapers will be required about 8 days.

EARTH EXCAVATION
(Spillway Approach Channel)

ITEM NO. 5

Quantity 195,200 Cu. Yds.

Operation No. 21 Sheet No. 1

Date July 13 - August 3, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18-Yds.	11	21	3	$ 63.00	$ 14,553.00
Bulldozers D8 90 HP	2	21	3	36.00	1,512.00
Small Tools		21	3		236.66
				Total	$ 16,301.66

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors D8 HP	13	294	$ .48	$ 1,834.56
			Total	$ 1,834.56

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	21	8	$ 7.22 Day	$ 454.86
Foremen	3	21	8	5.16 "	325.08
Tractor Operators	39	14	7-1/2	.75	3,071.25
Laborers	18	14	7	.50	882.00
				Total	$ 4,733.19

BASIS OF ESTIMATE (Op. #21 Sheet #1 - 1941)

This material is assumed to be excavated from the Spillway Approach Channel and to be hauled to the river section of the dam via the bridge over the Outlet Approach Channel.

Hauling is assumed to be done by 18 c.y. LeTourneau Scrapers powered by D8 tractors of 90 horsepower.

The LeTourneaus can operate as follows:

Loaded	750	feet	in 4th Gear	=	2.7	minutes
"	950	"	" 3rd "	=	3.8	"
Return	500	"	" 6th "	=	1.1	"
"	100	"	" 3rd "	=	0.4	"
"	200	"	" 6th "	=	0.4	"
"	400	"	" 4th "	=	1.4	"
"	300	"	" 6th "	=	0.6	"
Load, Dump and Turn				=	3.6	"
Total Time for one Round Trip				=	14.0	"

Assuming 80% mechanical efficiency, each scraper should handle 62 cu. yds. per hour. 62 x 21 = 1,302 cu. yds. per day of 21 hours.

This haul is assumed to be from the upstream half of the Spillway Approach Channel.

The material is all compacted pervious required in the embankment area of the River Section between elevation 320 and 350.

Eleven LeTourneaus will move 11 x 1300 = 14,300 cu. yds. per day. 14 days x 14,000 = 196,000 cu. yds.

EARTH EXCAVATION
(Spillway Approach Channel)

ITEM NO. 5 | Operation No. 21 Sheet No. 2

Quantity 88,900 Cu.Yds. | Date Aug. 4 to Aug. 12, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18-Yds.	16	9	3	$ 63.00	$ 9,072.00
Bulldozers D8 90 HP	3	9	3	36.00	972.00
Small Tools		9	3		131.80
				Total	$10,175.80

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors D8 90 HP	19	126	$ .43	$ 1,149.12
			Total	$ 1,149.12

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	9	8	$7.22 Day	$ 194.94
Foremen	3	9	8	5.16 "	139.32
Tractor Operators	57	6	7-1/2	.75	1,923.75
Laborers	18	6	7	.50	378.00
				Total	$ 2,636.01

BASIS OF ESTIMATE (Op. #21 Sheet #2 - 1941)

This material is to be excavated from the Spillway Approach Channel and hauled via the bridge over the Outlet Approach Channel to the river section between elevations 350 and 365.

Hauling to be performed by means of 13 cu. yd. LeTourneau Scrapers powered by D8 Tractors.

The LeTourneau Scrapers can operate as follows:

Loaded	450	feet	in 4th Gear	= 1.6	minutes
"	350	"	" 3rd "	= 1.4	"
"	250	"	" 4th "	= 0.9	"
"	250	"	" 1st "	= 1.6	"
"	200	"	" 3rd "	= 0.8	"
Return	700	"	" 5th "	= 2.1	"
"	350	"	" 2nd "	= 1.7	"
"	450	"	" 5th "	= 1.4	"
Load, dump and Turn				= 4.5	"
Total Time for one Round Trip				=16.0	"

Assuming 75% mechanical efficiency for the equipment each scraper will handle at least 50 cu. yds. per hour or 1,050 cu. yds. per day.

Using 16 scrapers, it appears that 16 x 1050 = 16,800 cu. yds. per day. 83,900 ÷ 16,800 = 5.3 say 6 working days.

Three D3 bulldozers are assumed to be used as boosters for the purpose of assisting in loading the 13 cu. yd. Scrapers.

EARTH EXCAVATION
(Spillway Approach Channel)

ITEM No. 5 | Operation No. 21 Sheet No. 3

Quantity 117,700 Cu. Yds. | Date Aug. 13 - Aug. 21, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18-Yds.	16	9	3	$ 63.00	$ 9,072.00
Bulldozers D8 90 HP	3	9	3	36.00	972.00
Small Tools					131.80
				Total	$10,175.80

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors D8	19	126	$ .48	$ 1,149.12
			Total	$ 1,149.12

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foreman	3	9	8	$7.22 day	$ 194.94
Foremen	3	9	8	5.16 "	139.32
Tractor Operators	57	6	7-1/2	.75	1,923.75
Laborers	18	6	7	.50	378.00
				Total	$ 2,636.01

This material is to be excavated from the Spillway Approach Channel and hauled to the river section of the dam from elevation 365 to 390.

It is assumed that the hauling will be done by means of 18 cu. yd. LeTourneau Scrapers powered by D8 Tractors.

The LeTourneaus can operate as follows:

Loaded	300	feet	in	3rd	Gear	=	1.2	minutes
"	200	"	"	2nd	"	=	0.9	"
"	1,000	"	"	3rd	"	=	4.0	"
Return	300	"	"	6th	"	=	0.7	"
"	300	"	"	1st	"	=	2.0	"
"	900	"	"	6th	"	=	2.0	"
Load, Dump and Turn						=	4.2	"
Total Time for one Round Trip						=	15.0	"

Assuming 80% efficiency for the equipment, one scraper will haul 58 cu. yds. per hour or 58 x 21 = 1218 cu. yds. per day.

16 LeTourneaus x 1218 = 19,488 Say 19,500 cu. yds. per day total output.

117,700 ± 19,500 = 6.04 Say 6 working days.

EARTH EXCAVATION

(Spillway Approach Channel)

Item No. 5 — Operation No. 25

Quantity 107,100 cu. yd. — Date Aug. 22 to Sept. 15 1941

PLANT RENTAL

Designation	No. Units	Cal Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 18 cu.yd.	6	24	3	$ 63.00	$ 9,072.00
Bulldozer D8 90 H.P.	1	24	3	36.00	864.00
Small Tools		24	3		172.67
				Total	$ 10,108.67

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Tractors D8	7	336	$ .48	$ 1,128.96
			Total	$ 1,128.96

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	24	8	$7.22 day	$ 519.84
Foremen	3	24	8	5.16 "	371.52
Tractor Operators	21	16	7½	.75	1,890.00
Laborers	12	16	7	.50	672.00
				Total	$ 3,453.36

BASIS OF ESTIMATE (Op.#25 - 1941)

This compacted pervious material is to be excavated from the Spillway Approach Channel and hauled to the entire length of the dam from elevation 390 to 416.

Hauling to be done by 15 cu. yd. LeTourneau Scrapers powered by D8 tractors, with one 90 H.P. tractor to assist in loading.

The LeTourneaus can operate as follows:

Loaded	500	feet	in 3rd Gear	= 7.0	minutes
"	100	"	" 1st "	= 0.7	"
"	1,200	"	" 5th "	= 3.6	"
Return	1,200	"	" 6th "	= 2.6	"
"	600	"	" 4th "	= 2.1	"
Load Dump and Turn				= 4.0	"
Total Time for one Round Trip				=15.0	"

Assuming 80% mechanical efficiency, each scraper will haul 53 cu. yds. per hour or 53 x 21 = 1213 cu. yds. per day. 107,100 ÷ (16 x 1213) = 5.5 Say 6 scrapers required to move 107,100 cu. yds. in 16 working days.

EARTH EXCAVATION
(Spillway Approach Channel)

ITEM NO. 6 | Operation No. 29

Quantity 231,300 Cu. Yds. | Date Aug. 22 - Sept. 21, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneau Scrapers 13-Yds.	10	30	3	$ 63.00	$ 17,000.00
Bulldozers D8 90 HP	2	30	3	36.0	2,160.00
Small Tools		30	3		321.21
				Total	$ 21,331.21

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hr.	Amount
Tractors D8 90 HP	12	420	$ .46	$ 2,419.20
			Total	$ 2,419.20

LABOR

Designation	No. Men	Days	Hrs/Day	Rate/Hour	Amount
Foremen	3	30	8	$7.22 Day	$ 649.80
Foremen	3	30	8	5.16 "	464.40
Tractor Operators	36	20	7-1/2	.75	4,050.00
Laborers	18	20	7	.50	1,260.00
				Total	$ 6,424.20

This dumped material is uncompacted fill upstream in the river section between the dam proper and the cofferdam up to elevation 340.

The excavation comes from the upstream portion of the Spillway Approach Channel.

It is proposed to move this material by means of 13 cu. yd. Le Tourneau Scrapers powered by D8 Tractors. D8 Bulldozers to be used as boosters in loading.

The LeTourneaus can operate as follows:

Loaded	700	feet in	3rd	gear	= 2.[illegible]	minutes
"	350	"	" 4th	"	= 1.3	"
"	250	"	" 2nd	"	= 1.2	"
Return	200	"	" 2nd	"	= 1.0	"
"	100	"	" 1st	"	= 0.7	"
"	300	"	" 4th	"	= 1.1	"
"	400	"	" 2nd	"	= 1.9	"
"	300	"	" 6th	"	= 0.7	"
Load, Dump and Turn					= 4.3	"
Total Time for one Round Trip					=15.0	"

Assuming 80% mechanical efficiency, each scraper will move 53 cu. yds. per hour or 1213 cu. yds. per day. Ten scrapers will handle 10 x 213 = 12,130 cu. yd. per day. 231,300 ÷ 12,130 = 13.99 say 20 working days on account of the fact that this is the last of the excavation and the cleaning up is somewhat slower than the remainder of the work.

EARTH EXCAVATION

(Spillway Discharge Channel)

Item No. 5

Quantity 197,000 Cu. Yds.

Operation No. 40

Date Sept. 1 to Dec.1, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Dredge, Hydraulic 12"	1	90	3	$ 200.00	$ 13,000.00
Boat, Outboard Motor	1	90	3	2.00	180.00
Barge	1	90	3	2.00	180.00
Small Tools					925.47
				Total	$ 19,285.47

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Dredge	1	1800	$ 2.40	$ 4,320.00
Boat	1	1800	.05	90.00
			Total	$ 4,410.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	90	8	$ 7.22 day	$ 1,949.40
Engineers (Diesel)	3	75	8	.85	1,530.00
Mechanics	3	75	7	1.00	1,575.00
Mechanics Helpers	3	75	7	.55	866.25
Electricians	3	75	7	.85	1,338.75
Cutter Head Men	3	75	8	1.00	1,800.00
Laborers	36	75	7	.50	9,450.00
				Total	$18,509.40

Note: For Basis of Estimate see Op. #40 - 1939

EARTH EXCAVATION

(Downstream Cofferdam)

Item No. 5

Quantity 29,400 Cu. Yds.

Operation No. 41

Date Oct. 16 - 31, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Dragline No. 4	1	15	3	$ 102.00	$ 1,530.00
Bulldozer, D3, 90 HP	1	15	3	36.00	540.00
Small Tools		15	3		66.50
				Total	$ 2,136.50

MATERIALS & SUPPLIES (See Sec. 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Dragline, 2 cu. yds.	1	210	$ .55	$ 115.50
Bulldozer, 90 HP	1	210	.43	100.30
			Total	$ 216.30

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	15	8	$ 7.22 day	$324.90
Shovel Operators	3	10	7-1/2	1.25	281.25
Oilers	3	10	7-1/2	.60	135.00
Tractor Operators	3	10	7-1/2	.75	168.75
Laborers	12	10	7	.50	420.00
				Total	$1,329.90

BASIS OF ESTIMATE (Op. #41 - 1941)

Due to the fact that this excavation will be done by casting and that the swing will be probably no more than 100°, it is estimated that a 2 cu. yd. dragline will handle 1,000 cu. yds. per shift, or 3,000 cu. yds. per day.

28,400 ÷ 3,000 = 9.3 say 10 working day.

The material in the downstream cofferdam is to be excavated down to elevation 301 and is to be deposited in the river bed. Plans call for the downstream cofferdam to be built to elevation 312 only, but it has been planned in this estimate to go to elevation 315, and the quantity in this operation is on that basis.

EARTH EXCAVATION

(Below elev.301)

Item No. 6

Quantity - 739,000 cu. yd.

DESCRIPTION

All material under this item is earth below elevation 301 and is wet excavation. Due to the difficulty in separating the quantities from those in Item No. 5, it has been decided to first calculate the costs as though the material were all dry and then to add to the quantities in Item No. 6 the costs of the wellpoint systems and the pumping which are applicable to this item.

The amounts of the costs for the actual excavation in Item No. 6 as well as in Item No. 5 are arrived at by proration of the total costs of excavation in both items according to the total number of cubic yards of excavation in each item. This prorating is shown on the summary sheet of Item No. 5.

	PLANT RENTAL	M. & S.	LABOR
Operation Costs (See Section 25)	$ 76,417.33	$11,081.19	$37,351.27
Wellpoint System(" " 19)	35,008.00	14,661.00	36,921.00
Totals	$111,425.33	$25,742.19	$74,272.27

S U M M A R Y

PLANT RENTAL	$111,425.33
MATERIALS & SUPPLIES	25,742.19
LABOR	74,272.27
TOTAL	$ 211,440.34

STRIPPING BORROW AREAS "A", "B" AND "C"

Item No. 7

Quantity - 215,000 cu. yds.

DESCRIPTION

This stripping consists of removing all top soil, surface rock and other objectionable material from Borrow Areas "A", "B" and "C".

The cost of stripping the portion of Borrow Area "C" which is used for concrete material is charged to the cost of processed sand and gravel. (See section 17).

OPERATION COSTS

Year	Op. No.	Plant Rental	Material & Supplies	Labor
1939	3(1)	$ 4,975.00	$ 604.30	$ 2,316.90
"	"(2)	7,465.00	907.20	3,475.35
"	11	2,690.00	496.65	2,256.61
1940	2(1)	2,353.35	399.00	1,369.90
"	2(2)	7,959.45	1,033.00	3,129.02
1941	15	3,053.05	499.30	2,255.96
	Totals	$ 23,505.35	$ 3,995.45	$ 15,303.74

S U M M A R Y

PLANT RENTAL	$ 23,505.35
MATERIALS & SUPPLIES	3,995.45
LABOR	15,303.74
TOTAL	$ 47,305.04

STRIPPING BORROW AREA "C"

Item No. 7 | Operation No. 3 Sheet #1

Quantity 44,000 Cu. Yds. | Date Aug. 1 to 31, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Le Tourneau Scrapers 15 c.y.	2	30	3	$ 63.00	$ 3,780.00
Bulldozer D8 - 90 H.P.	1	30	3	36.00	1,080.00
Small Tools					115.00
				Total	$ 4,975.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour		Amount
Le Tourneau Scrapers	2	420	.43		$ 403.20
Bulldozer D8 90 H.P.	1	420	.48		201.60
				Total	$ 604.30

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	30	8	$ 5.16 day	$ 464.40
Tractor Operators	9	20	7½	.75	1,012.50
Laborers	12	20	7	.50	840.00
				Total	$2,316.90

STRIPPING BORROW AREA "B"

Item No. 7 | Operation No. 3, Sheet #2

Quantity 30,000 Cu. Yds. | Date Sept. 1 - Oct. 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
LeTourneaus (13 c.y.)	2	45	3	$ 63.00	$ 5,670.00
Bulldozers (90 HP)	1	45	3	36.00	1,620.00
Small Tools					175.00
			Total		$ 7,465.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
90 HP Tractors	3	630	$ .43	$ 907.20
			Total	$ 907.20

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	45	8	$5.16 day	$ 696.60
Laborers	12	30	7	.50 Hr.	1,260.00
Tractor Operators	9	30	7-1/2	.75 "	1,513.75
			Total		$ 3,475.35

BASIS OF ESTIMATE

(Stripping Borrow Area "C")

This 44,000 c.y. of stripping really applies to both bankrun material and also to a small amount of the material for concrete. In order to reduce computations this entire amount is included in pay item No. 7 and the small discrepancy is made up in the calculations covering the materials for concrete.

It is assumed that the maximum average haul on this material is 1,500 feet.

The LeTourneaus can operate as follows:

Loaded 1,500 feet in 3rd Gear	= 6.0	minutes
Dump and Turn	= 2.3	"
Empty 1,500 feet in 6th Gear	= 3.2	"
Loading Time	= 2.0	"
Total Time for 1 Round Trip	=14.0	"

Assuming 70% mechanical efficiency due to the fact that this is the starting of this kind of work, the scrapers will handle about 1,130 c.y. per day each. 1130 x 2 x 20 = 45,200 c.y. can be hauled in the one month. This is slightly in excess of the 44,000 c.y. called for, but is a conservative estimate.

(Stripping Borrow Area "B")

At 70% efficiency each scraper will move 1,200 c.y. per day a distance of 1,500 feet. Inasmuch as part of this material is hauled less than 1,500 feet, it is considered that 30,000 c.y. can be handled by the two 13 c.y. scrapers in one and one-half months, or approximately 30 working days.

STRIPPING

(Borrow Area "A")

ITEM NO. 7 — Operation No. 11

QUANTITY 22,000 Yds. — Date September 1-15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel 1-1/4 Yd. No. 1	1	15	3	$ 64.00	$ 960.00
Trucks, Dump 4 Yd.	4	15	3	13.00	1,030.00
Bulldozer 90 HP	1	15	3	36.00	540.00
Small Tools					110.00
				Total	$2,690.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel 1-1/4 Yd. No. 1	1	231	$ .39	$ 90.09
Trucks, Dump, 4 Yd.	4	231	.32	295.68
Bulldozer 90 HP	1	231	.48	110.88
			Total	$ 496.65

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foreman, General	3	15	8	$7.22 Day	$ 324.90
Foreman	3	15	8	5.16 "	232.20
Operators, Shovel	3	11	7-1/2	1.25	309.38
Oilers	3	11	7-1/2	.60	148.50
Operators, Tractor	3	11	7-1/2	.75	185.63
Truck Drivers	12	11	7-1/2	.60	594.00
Laborers	12	11	7	.50	462.00
				Total	$2,256.61

STRIPPING

(Borrow Area "A")

Item No. 7 | Operation No. 2 Sheet #1

Quantity 20,000 c.y. | Date May 15 to June 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 1 1½ yd.	1	45	1	$ 21.33	$ 959.85
Trucks, Dump, 4 Yd.	4	45	1	6.00	1,080.00
Bulldozer D4	1	45	1	5.00	225.00
Small Tools					93.50
				Total	$2,358.35

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 1 1½ yd.	1	210	$ .39	$ 81.90
Trucks Dump 4 yd.	4	210	.32	268.80
Bulldozer D4	1	210	.23	48.30
			Total	$399.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	45	8	$7.22 Day	$ 324.90
Shovel Operator	1	30	7½	1.25	281.25
Oiler	1	30	7½	.60	135.00
Bulldozer Operator	1	30	7½	.75	168.75
Truck Drivers	4	30	7½	.60	540.00
Laborers	4	30	7	.50	420.00
				Total	$1,869.90

STRIPPING

(Borrow Area "A")

ITEM NO. 7 — Operation No. 2 Sheet #2

Quantity 30,000 C.Y. — Date Aug. 1 - Sept. 21, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 3 2-1/2-Yds.	1	51	1	$ 55.50	$ 2,830.50
Trucks, Dump, 4-Cu.Yd.	3	51	1	9.00	3,672.00
Bulldozer D3 - 90 HP	1	51	1	18.00	918.00
Bulldozer D4 - 30 HP	1	51	1	7.50	382.50
Small Tools		51	1		156.45
				Total	$7,959.45

MATERIAL & SUPPLIES (See Section 11) 34 Working Days

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel 2-1/2 Cu.Yd.	1	272	$ .73	$ 198.56
Trucks 4-Cu.Yd.	3	272	.32	696.32
Bulldozer D3 90 HP	1	272	.48	130.56
Bulldozer D4 30 HP	1	272	.23	62.56
			Total	$1,088.00

LABOR

Designation	No. Men	Days	Hrs/Day	Rate/Hour	Amount
Foremen	1	51	8	$7.22 Day	$ 368.22
Shovel Operators	1	34	8	1.25	340.00
Oilers	1	34	8	.60	163.20
Truck Drivers	3	34	8	.60	1,305.60
Tractor Operators	2	34	8	.75	408.00
Laborers	4	34	8	.50	544.00
				Total	$3,129.02

STRIPPING

(Borrow Area "A")

ITEM NO. 7 | Operation No. 15

Quantity 20,000 Cu. Yds. | Date May 19 - June 9, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 1 1-1/4 C.Y.	1	21	2	$ 48.00	$ 1,008.00
Trucks, Dump, 4-C.Y.	4	21	2	13.50	1,134.00
Bulldozer D8 90 HP	1	21	2	27.00	567.00
Bulldozer D4 30 HP	1	21	2	11.25	236.25
Small Tools		21	2		112.80
			Total		$3,058.05

MATERIAL & SUPPLIES (See Section 11) 14 Days

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 1	1	210	$ .39	$ 81.90
Trucks	4	210	.32	268.80
Bulldozer D8	1	210	.48	100.80
Bulldozer D4	1	210	.23	48.30
			Total	$ 499.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	2	21	8	$7.22 Day	$ 303.24
Foremen	2	21	8	5.16 "	216.72
Shovel Operators	2	14	8	1.25	280.00
Oilers	2	14	8	.60	134.40
Tractor Operators	4	14	8	.75	336.00
Truck Drivers	8	14	8	.60	537.60
Laborers	8	14	8	.50	448.00
				Total	$2,255.96

BASIS OF ESTIMATE

(Stripping Borrow Area "A")

Op. #11 - 1939

It is estimated that the shovel will load 2,000 yards in one day. The bulldozer to push the material down the hill to the shovel.

It is planned to waste all material in the immediate vicinity. Four trucks will be sufficient to handle all the shovel can load.

Op. #2 - 1940

From May 15 to June 30, Shovel No. 1 will operate 2 shifts per day loading core material and one shift stripping. For this reason the plant rental is charged at one-third the 3-shift rate (See Op. #1 - 1940, Section 28). The shovel is estimated to load approximately 670 c.y. per shift. From Aug. 1 to Sept. 21, Shovel No. 3 is assumed will load about 900 c.y. per 8-hour shift.

Op. #15- 1941

From May 19 to June 9, Shovel No. 1 will operate 2 shifts per day at 7½ hours each, and is estimated to load about 1,450 c.y. per day. The bulldozers will move the material off the top of the slope. The shovel will load into 4 c.y. trucks, and since the haul is comparatively short, four will probably be sufficient.

EXCAVATION AND HAUL, BORROW AREA "A"

Item No. 8

Quantity - 300,000 cu. yds.

DESCRIPTION

This Item is impervious material to be used in the core and blanket at the dam.

The borrow pit is located about 3½ miles west of the damsite and is reached by a good concrete road. The laws of the State of New Hampshire will permit only loads which do not exceed 26,000 pounds on two axles and 38,000 on three axles. This law makes it necessary to use 4 cu. yd. trucks for hauling this material instead of larger units, which would have been more economical.

10% has been allowed for shrinkage due to hauling and compacting.

OPERATION COSTS

Year	Op. No.	Quantities	Plant Rental	Material & Supplies	Labor
1939	16	74,200	$ 18,242.57	$ 4,030.74	$ 11,451.45
1940	1	26,200	8,443.14	1,604.40	5,359.80
"	16	25,600	8,076.16	1,517.60	4,473.20
"	23	33,500	13,554.66	1,904.00	4,873.22
1941	16	21,800	5,664.23	1,138.20	3,349.64
"	20	115,100	30,148.46	6,493.41	17,909.28
"	26	39,100	13,333.37	2,735.04	7,467.36
	TOTALS		$ 97,462.59	$ 19,423.39	$ 54,883.95

S U M M A R Y

PLANT RENTAL . . . . . .$ 97,462.59

MATERIALS & SUPPLIES . . . . .$ 19,423.39

LABOR . . . . . .$ 54,883.95

TOTAL . . .$171,769.93

EXCAVATION & HAUL

(Borrow Area "A")

Item No. 8 — Operation No. 16

Quantity 74,200 c.y. — Date Sept. 16 to Oct. 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel 1¼ yd. No. 1	1	30	3	$64.00	$ 1,920.00
Shovel 2 yd. No. 5	1	15	3	102.00	1,530.00
Trucks Dump 4 yd.	15	30	3	18.00	8,100.00
Trucks Dump 4 yd.	21	15	3	18.00	5,670.00
Bulldozer D4	1	30	3	15.00	450.00
Small Tools					572.57
				Total	$18,242.57

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel 1¼ yd. No. 1	1	462	$ .39	$ 180.18
Shovel 2 yd. No. 5	1	210	.55	115.50
Trucks Dump 4 yd.	15	462	.32	2,217.60
Trucks Dump 4 yd.	21	210	.32	1,411.20
Bulldozer D4	1	462	.23	106.26
			Total	$4,030.74

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	30	8	$7.22 day	$ 649.80
Foremen	3	30	8	5.16 "	464.40
Operators, Shovel	3	22	7½	1.25	618.75
Operators, Shovel	3	10	7½	1.25	281.25
Oilers, Shovel	3	22	7½	.60	297.00
Oilers, Shovel	3	10	7½	.60	135.00
Operators, Bulldozer	3	22	7½	.75	371.25
Truck Drivers	63	10	7½	.60	2,835.00
Truck Drivers	45	22	7½	.60	4,455.00
Laborers	12	22	7	.50	924.00
Laborers	12	10	7	.50	420.00
				Total	$11,451.45

BASIS OF ESTIMATE (Op. #16 - 1939)

It is estimated that the 2 yd. shovel will load 1,000 yds. per 7 hour shift and the $1\frac{1}{4}$ yd. shovel 700 yds. or 2,000 yds. per day.

NO. OF TRUCKS REQUIRED - Haul 4.3 miles

Loaded 3.6 miles	at 20 M.P.H.	= 10.8 minutes			
" .4 "	at 10 "	= 2.4 "			
" .3 "	at 5 "	= 3.6 "			
Dump and Turn		= 1.7 "			
Empty .3 miles	at 8 "	= 2.3 "			
" .4 "	at 10 "	= 2.4 "			
" 3.6 "	at 20 "	= 10.8 "			
Total Haul Time; Round Trip		= 34.0 "			
Loading Time 2 yd. Shovel		= 1.7 "			
" " $1\frac{1}{4}$ yd. "		= 2.5 "			

34 ÷ 1.7 = 20 + 1 = 21 - 4 yd. Trucks required for the 2 yd. shovel.

34 ÷ 2.5 = 13.6 = 14 + 1 = 15 - 4 yd. Trucks required for the $1\frac{1}{4}$ yd. Shovel.

1 - 2 yd. Shovel and 21 Trucks working 10 days = 30,000 cu. yds.

1 - $1\frac{1}{4}$ yd. " " 15 " " 22 " = 44,000 " "

Total Capacity of equipment in time allowed = 74,000 " "

Shovel No. 1 operates from Sept. 16 to Oct. 15

" " 5 " " " 16 to Sept. 30

Note: Some of the 21 trucks working with the 2-yd. shovel, in order to complete the necessary number of round trips, must decrease their traveling time (by increasing traveling speed) by no more than one minute per trip.

EXCAVATION AND HAUL

(Borrow Area "A")

Item No. 8

Quantity 26,200 Cu. Yds.

Operation No. 1

Date May 15 - June 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel, No. 1, 1-1/4 c.y.	1	45	2	$ 42.67	$ 1,920.15
Trucks, Dump, 4 yd.	4	45	2	12.00	2,160.00
" " " "	6	45	2	13.50	3,645.00
Bulldozer, D4, 30 HP	1	45	2	10.00	450.00
Small Tools					267.99
				Total	$ 8,443.14

MATERIALS & SUPPLIES (See Sec. 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel, No. 1	1	420	$ .39	$ 163.80
Trucks, Dump, 4 yd.	10	420	.32	1,344.00
Bulldozer, D4	1	420	.23	96.60
			Total	$ 1,604.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	2	45	8	$ 7.22 day	$ 649.80
Shovel Operators	2	30	7-1/2	1.25	562.50
Oilers	2	30	7-1/2	.60	270.00
Truck Drivers	20	30	7-1/2	.60	2,700.00
Tractor Operators	2	30	7-1/2	.75	337.50
Laborers	8	30	7	.50	840.00
				Total	$ 5,359.80

BASIS OF ESTIMATE (Op. #1 - 1940)

This operation is part of a combined excavation and stripping item and for that reason the plant rental charge is only 2/3 of the regular 3 shift charge. The other 1/3 is charged to stripping which is proceeding on the other shift, (See Section 27). Six Dump Trucks are charged at the regular rate. Approx. 875 cu. yds. of material per day are required at this time so the loading time has been increased to 4 minutes.

Ten trucks are used as shown on the following schedule:

Loaded	3.6	miles	at	20	M.P.H.	= 10.8	minutes
"	.4	"	at	10	"	= 2.4	"
"	.3	"	at	5	"	= 3.6	"
Dump and Turn						= 1.7	"
Empty	.3	miles	at	8	"	= 3.3	"
"	.4	"	at	10	"	= 2.4	"
"	3.6	"	at	20	"	= 10.8	"
Total Haul Time for 1 Round Trip						= 34.0	"
Loading Time						= 4.0	"
Total Time (Round Trip)						= 38.0	"

14 x 60 = 840 minutes of operation per day.

840 ÷ 38 = 22 Trips per truck per day.

22 X 4 = 88 c.y. " " " "

875 ÷ 88 = Say 10 = No. of Trucks required.

EXCAVATION AND HAUL

(Borrow Area "A")

Item No. 8

Quantity 25,600 c.y.

Operation No. 16

Date July 1 to 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel, No. 1, 1-1/4 yd.	1	30	2	$ 48.00	$ 1,440.00
Trucks, Dump, 4 yd.	15	30	2	13.50	6,075.00
Bulldozer, D4	1	30	2	11.25	337.50
Small Tools					223.66
				Total	$ 3,076.16

MATERIALS & SUPPLIES (See Sec. 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel, No. 1, 1-1/4 yd.	1	280	$ .39	$ 109.20
Trucks, Dump, 4 yd.	15	230	.32	1,344.00
Bulldozer, D4	1	280	.23	64.40
			Total	$ 1,517.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	2	30	8	$ 7.22 day	$ 433.20
Shovel Operators	2	20	7-1/2	1.25	375.00
Oilers	2	20	7-1/2	.60	180.00
Truck Drivers	30	20	7-1/2	.60	2,700.00
Tractor Operators	2	20	7-1/2	.75	225.00
Laborers	8	20	7	.50	560.00
				Total	$4,473.20

BASIS OF ESTIMATE (Op. #16 - 1940)

This material to be excavated from borrow pit "A" west of Webster Lake and placed in the core of the dam. (25,600 ÷ 20 = 1,280 c.y. req'd per day)

Approximately 17,400 yds. goes to the Left Bank and 3,200 to the right.

The 4 yd. Trucks can operate on the following schedule:

Loaded 3.6 miles	at 20 M.P.H.	= 10.8 minutes			
" .4 "	at 10 "	= 2.4 "			
" .3 "	at 5 "	= 3.6 "			
Dump and Turn		= 2.0 "			
Empty .3 miles	at 8 "	= 2.3 "			
" .4 "	at 10 "	= 2.4 "			
" 3.6 "	at 20 "	= 10.8 "			
Total Haul Time, 1 Round Trip		= 34.3 "			
Loading Time		= 2.7 "			
Total Time (Round Trip)		= 37.0 "			

14 x 60 = 840 minutes of operation per day.

340 ÷ 37 = 22.6 say 22 trips per truck per day.

22 x 4 = 88 c.y. per truck per day

1,280 ÷ 88 = 14.5 say 15 trucks required

EXCAVATION AND HAUL

(Borrow Area "A")

Item No. 8 | Operation No. 23

Quantity 33,500 Cu. Yds. | Date Aug. 1 - Sept. 21, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel, No. 3, 2-1/2 c.y.	1	51	1	$ 55.50	$ 2,330.50
Trucks, Dump, 4 c.y.	22	51	1	9.00	10,098.00
Bulldozer, D4	1	51	1	7.50	382.50
Small Tools					243.66
			Total		$13,554.66

MATERIALS & SUPPLIES (See Sec. 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel, No. 3, 2-1/2 c.y.	1	238	$ .73	$ 173.74
Trucks, Dump, 4 yd.	22	238	.32	1,675.52
Bulldozer	1	238	.23	54.74
		Total		$ 1,904.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	51	8	$ 7.22 day	$ 368.22
Shovel Operators	1	34	7-1/2	1.25	318.75
Oilers	1	34	7-1/2	.60	153.00
Tractor Operator	1	34	7-1/2	.75	191.25
Truck Drivers	22	34	7-1/2	.60	3,366.00
Laborers	4	34	7	.50	476.00
			Total		$4,373.22

BASIS OF ESTIMATE (Op. #23 - 1940)

It is assumed that the shovel will load 140 cu. yds. per hour. (33,500 ÷ 34 = 980 c.y. required per day).

The trucks can operate on the following schedule:

Loaded	3.6	miles	at 20	M.P.H.	= 10.8	minutes
"	.4	"	at 10	"	= 2.4	"
"	.3	"	at 5	"	= 3.6	"
Dump and Turn					= 1.8	"
Empty	.3	miles	at 8	"	= 2.3	"
"	.4	"	at 6	"	= 4.0	"
"	3.6	"	at 20	"	= 10.8	"
Total Haul Time 1 Round Trip					= 35.7	"
Loading Time					= 1.7	"
Total Time (Round Trip)					= 37.4	" say 38 min.

7 X 60 = 420 minutes of operation per day

420 ÷ 38 = 11 trips per truck per day

11 x 4 = 44 c.y. per truck per day

980 ÷ 44 = Say 22 Trucks required

EXCAVATION AND HAUL

(Borrow Area "A")

Item No. 8

Quantity 21,800 Cu. Yds.

Operation No. 16

Date June 10 - 30, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel, No. 1, 1-1/4 c.y.	1	21	2	$ 48.00	$ 1,008.00
Trucks, Dump, 4 c.y.	15	21	2	13.50	4,252.50
Bulldozer, D4, 30 HP	1	21	2	11.25	236.25
Small Tools					167.48
				Total	$ 5,664.23

MATERIALS & SUPPLIES (See Sec. No. 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel, No. 1	1	210	$ .39	$ 31.90
Trucks	15	210	.32	1,008.00
Bulldozer, D8	1	210	.23	48.30
			Total	$ 1,138.20

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	2	21	8	$ 7.22 day	$ 303.24
Shovel Operators	2	14	8	1.25	280.00
Oilers	2	14	8	.60	134.40
Truck Drivers	30	14	8	.60	2,016.00
Tractor Operators	2	14	8	.75	168.00
Laborers	8	14	8	.50	448.00
				Total	$ 3,349.64

BASIS OF ESTIMATE (Op. #16 - 1941)

This core material is to be excavated from the pit in Borrow Area "A" west of Webster Lake and hauled in 4 cu. yd. dump trucks to the core and blanket of the dam.

It is assumed that the No. 1 Shovel $1\frac{1}{4}$ c.y. will excavate approximately 100 cu. yds. per hour in this material.

The trucks can operate as follows:

Loaded	3.6	miles	at 22	M.P.H.	=	9.8	minutes
"	.4	"	at 10	"	=	2.4	"
"	.3	"	at 5	"	=	3.6	"
Dump and Turn					=	2.0	"
Return	.3	miles	at 8	"	=	2.3	"
"	.4	"	at 10	"	=	2.4	"
"	3.6	"	at 22	"	=	9.8	"
Total Haul Time 1 Round Trip					=	32.3	"
Loading Time					=	2.3	"

32.3 ÷ 2.3 = 14 + 1 = 15 Trucks required to serve the shovel with no lost time.

This work to be prosecuted on a basis of two 8-hour shifts per day. Equipment working $7\frac{1}{2}$ hours.

21,800 c.y. of material is required

1,560 c.y. is the capacity of the shovel per day.

21,800 ÷ 1,560 = 14 working days are required to complete the work. The 21,800 c.y. of material will raise the core to elevation 312 in the river section.

EXCAVATION AND HAUL

Borrow Area "A"

Item No. 8 River Section elev. 312 to 390 Operation No. 20

Quantity 115,100 cu. yds. Date July 1 to Aug. 21, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 1 1¼ cu. yd.	1	12	3	$ 64.00	$ 768.00
Shovel No. 5 2 " "	1	51	3	102.00	5,202.00
Trucks, Dump, 4 cu. yd.	15	12	3	18.00	3,240.00
Trucks, Dump, 4 " "	21	51	3	18.00	19,278.00
Bulldozer D4	1	51	3	15.00	765.00
Small Tools		51	3		895.46
				Total	$30,148.46

MATERIALS & SUPPLIES (See Section)

35 Working Days

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 1	1	189	$ .39	$ 73.71
Shovel No. 5	1	735	.55	404.25
Trucks	15	189	.32	907.20
Trucks	21	735	.32	4,939.20
Bulldozer D4	1	735	.23	169.05
			Total	$ 6,493.41

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	51	8	$ 7.22 day	$ 1,104.66
Foremen	3	51	8	5.16 "	789.48
Shovel Operators	3	9	7½	1.25	253.13
Oilers	3	9	7½	.60	121.50
Truck Drivers	45	9	7½	.60	1,822.50
Shovel Operators	3	35	7½	1.25	984.38
Oilers	3	35	7½	.60	472.50
Truck Drivers	63	35	7½	.60	9,922.50
Tractor Operators	3	35	7½	.75	590.63
Laborers	12	9	7	.50	378.00
Laborers	12	35	7	.50	1,470.00
				Total	$17,909.28

BASIS OF ESTIMATE (Op. #20 - 1941)

This impervious material is to be loaded from Borrow Area "A" west of Webster Lake and hauled to the core and blanket in the river section of the dam in 4 cu. yd. dump trucks. Material is required between elevation 312 to 390.

It is assumed that Shovel No. 5 will load 3,000 cu. yds. per day and that No. 1 will handle 2,000. Both shovels will be required only until July 12.

The trucks can operate on the following schedule:

Loaded	3.6	miles	at 20	M.P.H.	= 10.8	minutes
"	.4	"	at 10	"	= 2.4	"
"	.3	"	at 5	"	= 3.6	"
Dump and Turn					= 1.7	"
Return	.3	miles	at 8	"	= 2.3	"
"	.4	"	at 10	"	= 2.4	"
"	3.6	"	at 20	"	= 10.8	"
Total Haul Time for 1 Round Trip					= 34.0	"
Loading Time, Shovel No. 5					= 1.7	"
Loading Time, Shovel No. 1					= 2.5	"

34 ÷ 1.7 = 20 + 1 = 21 Trucks required for Shovel No. 5

34 ÷ 2.5 = 13.6 say 14 + 1 = 15 Trucks required for shovel No. 1

EXCAVATION AND HAUL

(Borrow Area "A")

Item No. 8 | Operation No. 26

Quantity 39,100 cu. yds. | Date Aug. 22 - Sept. 15, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 5 2 cu. yd.	1	24	3	$ 111.00	$ 2,664.00
Trucks, Dump, 4 " "	23	24	3	18.00	9,936.00
Bulldozer D4 - 30 H.P.	1	24	3	15.00	360.00
Small Tools		24	3		373.37
			Total		$13,333.37

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 5	1	336	$ .55	$ 184.80
Trucks	23	336	.32	2,472.96
Bulldozer D4	1	336	.23	77.28
			Total	$2,735.04

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	24	8	$ 7.22 day	$ 519.84
Foremen	3	24	8	5.16 "	371.52
Shovel Operators	3	16	7½	1.25	450.00
Oilers	3	16	7½	.60	216.00
Tractor Operators	3	16	7½	.75	270.00
Truck Drivers	69	16	7½	.60	4,968.00
Laborers	12	16	7	.50	672.00
			Total		$ 7,467.36

BASIS OF ESTIMATE (Op. #26 - 1941)

This material is required between elevation 390 and 416 and is to be excavated from Borrow Area "A" and hauled in 4 cu. yd. trucks to the core of the dam.

Approximately 2,500 cu. yd. per day will be required.

The trucks can operate as follows:

Loaded	3.6 miles	at 20 M.P.H.	=	10.8	minutes
"	.4 "	at 10 "	=	2.4	"
"	1200 feet	at 15 "	=	.9	"
"	1400 "	at 3 "	=	5.3	"
"	800 "	at 10 "	=	.9	"
"	900 "	at 8 "	=	1.3	"
Dump and Turn			=	2.5	"
Return	1,700 feet	at 10 "	=	1.9	"
"	900 "	at 6 "	=	1.7	"
"	1,200 "	at 20 "	=	.7	"
"	.4 miles	" 5 "	=	4.8	"
"	3.6 "	"20 "	=	10.8	"
Total Haul Time for 1 Round Trip			=	44.0	"
Loading Time			=	2.0	"
Total Time (Round Trip)				46.0	"

21 x 60 = 1,260 minutes of operation per day

1260 ÷ 46 = say 27 trips per truck per day

27 X 4 = 108 c.y. " " " "

108 X 16 = 1728 " " " (in 16 days)

39,100 ÷ 1,728 = 22.6 (say) 23 Trucks required.

EXCAVATION AND HAUL, BORROW AREA "B".

Item No. 9

Quantity - 550,000 cu. yds.

DESCRIPTION

This material is sand and gravel and is used largely as selected pervious fill in the embankment section of the dam.

It is proposed to do the excavation by means of power shovels and to haul, for the most part, with Linn Tractor Trucks. The Linns were selected both on account of their ability to negotiate heavy grades and to take advantage of their tractor action in rolling the sand fill which is to form the major portion of the embankment. These units are capable of speeds up to 12 miles per hour and are diesel powered.

OPERATION COSTS

Year	Op. No.	Quantities	Plant Rental	Material & Supplies	Labor
1939	13	30,000	$ 3,539.92	$ 367.50	$ 1,798.35
1940	5	45,600	6,371.35	661.50	3,237.03
"	17	28,900	4,030.25	430.50	2,004.90
"	24	93,300	15,363.52	1,677.90	7,390.41
1941	17	110,900	15,536.23	1,730.32	7,065.69
"	22A	151,200	13,909.07	2,105.04	6,901.44
"	22B	54,700	7,310.78	841.68	4,295.52
"	27	47,000	6,601.37	683.30	6,267.36
		Totals	$ 73,163.04	$ 8,503.74	$ 33,960.70

S U M M A R Y

PLANT RENTAL . . . . . $ 73,163.04

MATERIALS & SUPPLIES . . . . . $ 8,503.74

LABOR . . . . . $ 33,960.70

TOTAL. $125,627.48

EXCAVATION & HAUL

(Borrow Area "B")

Item No. 9 — Operation No. 18

Quantity 30,000 Cu. Yds. — Date Oct. 1 to 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel 2 yd. No. 5	1	15	3	$ 102.00	$ 1,530.00
Linn Tractor Trucks	4	15	3	32.00	1,920.00
Small Tools		15	3		89.92
			Total		$ 3,539.92

MATERIALS & SUPPLIES (See Section 11)

10 Working Days

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel 2 yd. No. 5	1	210	$ .55	$ 115.50
Linn Tractor Trucks	4	210	.30	252.00
			Total	$ 367.50

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	15	8	$ 6.33 day	$ 287.10
Shovel Operators	3	10	7½	1.25	281.25
Oilers	3	10	7½	.60	135.00
Tractor Operators	12	10	7½	.75	675.00
Laborers	12	10	7	.50	420.00
				Total	$1,798.35

BASIS OF ESTIMATE (Op. #18 - 1939)

It is estimated that the 2 cu. yd. shovel will load 1,000 cu. yds. in 7 hours.

Linn Tractor Trucks (9 cu. yd.) are proposed for hauling. Average haul, 2,300 feet.

The Linns could operate on the following schedule:

Loaded 1000 feet at 8 M.P.H.				= 1.4	minutes
"	900	"	at 6 "	= 1.7	"
"	400	"	at 3 "	= 1.5	"
Dump and Turn				= 2.0	"
Empty 1,300 feet at 4 M.P.H.				= 3.6	"
"	1,000	"	at 10 "	= 1.1	"
Total Haul Time, 1 Round Trip				=11.3	"
Loading Time				= 3.8	"

11.3 ÷ 3.8 = 3 + 1 = 4 Linns Required for 1 Shovel

(This material is "Selected Pervious" and will be hauled to the Left Terrace).

EXCAVATION AND HAUL

(Borrow Area "B")

Item No. 9 | Operation No. 5

Quantity 45,600 c.y. | Date May 15 to June 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 5 2 yd.	1	27	3	$102.00	$ 2,754.00
Linn Tractor Trucks 9 yd.	4	27	3	32.00	3,456.00
Small Tools		27	3		161.85
			Total		$ 6,371.85

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour		Amount
Shovel No. 5 2 yd.	1	378	$	.55	$ 207.90
Linn Tractor Trucks 9 yd.	4	378		.30	453.60
			Total		$ 661.50

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	27	8	$ 6.38 day	$ 516.78
Shovel Operators	3	18	7½	1.25	506.25
Oilers	3	18	7½	.60	243.00
Tractor Operators	12	18	7½	.75	1,215.00
Laborers	12	18	7	.50	756.00
			Total		$3,237.03

BASIS OF ESTIMATE (Op. #5 - 1940)

This operation is proceeding at the same time as Op. No. 6 (See Section 30) and it is necessary to move from Borrow Area "B" to "C" several times during the 45 days that this work is in progress.

The Linns can operate on the following schedule:

Loaded 600 feet at 6 M.P.H.	= 1.13	minutes
" 1300 " at 4 "	= 3.69	"
Dump and Turn	= 2.10	"
Empty 800 feet at 6 "	= 1.51	"
" 500 " at 3 "	= 1.89	"
" 600 " at 10 "	= 0.68	"
Total Haul Time for 1 Round Trip	=11.00	"
Loading Time = Say	5.00	"
Total	16.00	"

1260 ÷ 16 = 78 Trips per day (each)

78 x 9 = Say 700 c.y. " "

45600 ÷ 700 = 65 Truck days

65 ÷ 18 = 3.6 say 4 Trucks required.

EXCAVATION AND HAUL

(Borrow Area "B")

Item No. 9 | Operation No. 17

Quantity 28,900 Cu. Yds. | Date July 1 to 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 5 2 yd.	1	15	3	$ 102.00	$ 1,530.00
Linn Tractor Trucks 9 yd	5	15	3	32.00	2,400.00
Small Tools		15	3		100.25
				Total	4,030.25

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 5 2 cu. yd.	1	210	$ .55	$ 115.50
Linn Tractor Trucks 9 yd	5	210	.30	315.00
		Total		$ 430.50

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	15	8	$ 7.22 day	$ 324.90
Shovel Operators	3	10	7½	1.25	281.25
Oilers	3	10	7½	.60	135.00
Tractor Operators	15	10	7½	.75	843.75
Laborers	12	10	7	.50	420.00
				Total	$2,004.90

BASIS OF ESTIMATE (Op. #17 - 1940)

The shovel is working alternately one day in Borrow Pit "B" and the next in "C" (See Op. #18 - 1940, Section 30).

This material is hauled to the Left Terrace (elev. 350 to 390) and the Right Terrace (elev. 320 to 330).

12,500 cu. yds. goes to the Left Terrace

16,400 " " " " " Right "

It is estimated that the No. 5 Shovel will load 2,900 cu. yds. in 3 shifts of 7 hours each.

The Linns (9 yd.) can operate from shovel to dam as follows:

LEFT BANK

Loaded 800 feet at 8 M.P.H.	= 1.14	minutes
" 1400 " " 5 "	= 3.18	"
Dump and Turn	= 1.79	"
Empty 1400 feet at 4 "	= 3.98	"
" 800 " " 10 "	= .91	"
Total Haul Time, 1 Round Trip	= 11.00	"
Loading Time for 9 yds.	= 3.9	"

11 ÷ 3.9 = 2.8 say 3 + 1 = 4 Linns Required for the Left Terrace.

RIGHT BANK

Loaded 800 feet at 8 M.P.H.	= 1.14	minutes
" 900 " at 6 "	= 1.70	"
" 1000 " at 8 "	= 1.42	"
" 500 " at 4 "	= 1.42	"
Dump and Turn	= 1.44	"
Empty 500 feet at 4 "	= 1.42	"
" 1000 " at 10 "	= 1.14	"
" 1200 " at 4 "	= 3.41	"
" 800 " at 10 "	= 0.91	"
Total Haul time for 1 Round Trip	= 14.00	"
Loading Time, 9 cu. yds.	= 3.9	"

14 ÷ 3.9 = 3.6 say 4 + 1 = 5 Linns Required for the Right Terrace

EXCAVATION AND HAUL

(Borrow Area "B")

Item No. 9 | Operation No. 24

Quantity 93,300 Cu. Yds. | Date Aug. 1 to Sept. 21, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 5 2 yd	1	51	3	$ 102.00	$ 5,202.00
Linn Tractor Trucks 9 yd	6	51	3	32.00	9,792.00
Small Tools					369.52
				Total	$15,363.52

MATERIALS & SUPPLIES (See section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 5	1	714	$ .55	$ 392.70
Linn Tractor Trucks	6	714	.30	1,285.20
			Total	$ 1,677.90

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	51	8	$ 7.22 day	$ 1,104.66
Shovel Operators	3	34	7½	1.25	956.25
Oilers	3	34	7½	.60	459.00
Tractor Drivers	13	34	7½	.75	3,442.50
Laborers	12	34	7	.50	1,428.00
				Total	$ 7,390.41

BASIS OF ESTIMATE (Op. #24 - 1940)

This material to be hauled from Borrow Area "B" to the west terrace, upstream and downstream.

It is assumed that the shovel will load 2,750 c.y. in 21 hours.

The Linn Tractor Trucks can operate as follows:

Loaded	800	feet	at	3	M.P.H.	= 1.14	minutes
"	900	"	"	6	"	= 1.70	"
"	1000	"	"	8	"	= 1.42	"
"	500	"	"	2	"	= 2.84	"
"	200	"	"	6	"	= 0.33	"
Dump and Turn						= 3.55	"
Empty	1,700	"	"	8	"	= 2.41	"
"	1,200	"	"	3	"	= 4.55	"
"	300	"	"	10	"	= 0.91	"
Total Haul Time for 1 Round Trip						=18.90	"
Loading Time						= 4.12	"
				Total Time		23.02	" Say 23 minutes

1,260 ÷ 23 = 54.7 say 54 trips per day

54 x 9 = " 435 c.y. " "

2,750 ÷ 435 = 5.7 say 6 Trucks required

EXCAVATION & HAUL

(Borrow Area "B")

Item No. 9 | Operation No. 17

Quantity 110,900 cu. yds. | Date June 22 to July 12, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 2 2½ c.y.	1	21	3	$ 111.00	$ 2,331.00
Shovel No. 4 2 c.y.	1	21	3	102.00	2,142.00
Shovel No. 5 " "	1	9	3	102.00	918.00
Linn Tractor Trucks 9 c.y.	12	21	3	32.00	8,064.00
" " " " "	6	9	3	32.00	1,728.00
Small Tools					353.28
			Total		$ 15,536.28

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No.Hrs.	Rate/Hr.	Amount
Shovel No. 2	1	294	$ .73	$ 214.62
Shovel No. 4	1	294	.55	161.70
Shovel No. 5	1	126	.55	69.30
Linn Tractor Trucks	12	294	.30	1,058.40
Linn Tractor Trucks	6	126	.30	226.80
			Total	$ 1,730.82

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	21	8	$7.22 day	$ 454.86
Foremen	3	21	8	5.16 day	325.08
Shovel Operators	6	14	7½	1.25	787.50
Oilers	6	14	7½	.60	378.00
Shovel Operators	3	6	7½	1.25	163.75
Oilers	3	6	7½	.60	81.00
Tractor Operators	36	14	7½	.75	2,835.00
" "	18	6	7½	.75	607.50
Laborers	24	14	7	.50	1,176.00
Laborers	12	6	7	.50	252.00
			Total		$ 7,065.69

BASIS OF ESTIMATE (Op. #17- 1941)

This selected pervious material is assumed to be excavated from Borrow Area "B" and to be hauled to the river section down stream from the core.

The shovels are assumed to be able to load approximately 3,260 cu. yds. of this material each in 21 hours.

The transportation to be by 9 cu. yd. Linn Tractor Trucks operating on the following schedule:

Loaded 800 feet at 8 M.P.H.	= 1.14	minutes
" 1300 " at 6 "	= 2.46	"
" 500 " at 3 "	= 1.90	"
Dump and Turn	= 2.06	"
Return 2300 feet at 4 "	= 6.53	"
" 800 " " 10 "	= 0.91	"
Total Haul Time 1 Round Trip	= 15.00	"
Loading Time	= 3.43	"
Total Time for one Round Trip	= 18.43	"

15 ÷ 3.5 = 4.3 + 1 = 5.3 = 6 Linns required for each shovel.

Shovels No. 2 & No. 4 Operate from June 22 to July 12

Shovel " 5 Operates " " 22 to June 30

At 20 minutes per trip, each truck will deliver: 21 x 3 x 9 = Say 560 c. y. per day. 3,260 ÷ 560 = 5.8 say 6 Trucks req'd.

EXCAVATION AND HAUL

(Borrow Area "B")

Item No. 9 | Operation No.22A

Quantity 151,200 cu. yds. | Date July 13 to Aug. 3 - 1941

PLANT RENTAL

Designation	No. Units	Cal Days	No. Shifts	Rate/Day	Amount
Shovel No. 2	1	21	3	$111.00	$ 2,331.00
Shovel No. 4	1	21	3	102.00	2,142.00
Linn Tractor Trucks 9 c.y.	10	21	3	32.00	6,720.00
LeTourneau Scrapers 18 c.y.	5	21	3	63.00	6,615.00
Bulldozers DS 90 H.P.	1	21	3	36.00	756.00
Small Tools		21	3		345.07
			Total		$13,909.07

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 2	1	294	$ .73	$ 214.62
Shovel No. 4	1	294	.55	161.70
Linn Tractor Trucks	10	294	.30	882.00
Tractors	6	294	.48	846.72
			Total	$ 2,105.04

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	21	8	$7.22 day	$ 454.36
Foremen	3	21	8	5.16 "	325.08
Shovel Operators	6	14	7½	1.25	787.50
Oilers	6	14	7½	.60	378.00
Tractor Operators	48	14	7½	.75	3,780.00
Laborers	24	14	7	.50	1,176.00
				Total	$ 6,901.44

BASIS OF ESTIMATE (Op. #22A - 1941)

The material to be placed between elev. 320 and 350. This selected pervious material is to come from Borrow Area "B", and is to be hauled by way of the access road to the river section of the dam. The return haul is down the downstream side of the dam and back via construction road No. 2.

The excavation to be done by shovels and haul by 9 cu. yd. Linn Tractors and 15 cu. yd. LeTourneaus.

The Linn Tractor Trucks can operate as follows: -

Loaded	750	feet	at 6	M.P.H.	= 1.42 minutes
"	850	"	at 10	"	= 0.97 "
"	400	"	at 3	"	= 1.52 "
"	400	"	at 6	"	= 0.76 "
Dump and Turn					= 4.31 "
Return	400	feet	at 6	"	= 0.76 "
"	500	"	at 10	"	= 0.57 "
"	1400	"	at 4	"	= 3.98 "
"	300	"	at 10	"	= 0.91 "
Total Haul Time 1 Round Trip					=15.2 "
Loading Time					= 3.8 "

15.2 ÷ 3.8 = 4 + 1 = 5 Linn Tractor Trucks for shovel #4. Use 5 Linns with #2 also.

The LeTourneau Scrapers can operate as follows:

Loaded	750	feet	in 4th Gear		= 2.7 minutes
"	850	"	" 5th	"	= 2.5 "
"	400	"	" 3rd	"	= 1.6 "
"	400	"	" 4th	"	= 1.4 "
Return	400	"	" 5th	"	= 1.2 "
"	500	"	" 6th	"	= 1.1 "
"	1400	"	" 5th	"	= 4.2 "
"	300	"	" 6th	"	= 1.7 "
Load, Dump and Turn					= 2.6 "
Total Time for one Round Trip					=19.0 "

Assuming 30% efficiency, 1 scraper will handle 955 c.y. per day.

The 2½ c.y. shovel assumed to load 3,400 c.y. per day.

EXCAVATION AND HAUL

Borrow Area "B"

Item No. 9 | Operation No. 22 B

Quantity 54,700 c.y. | Date Aug. 4 to Aug. 21 - 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 4 2 cu. yd.	1	18	3	$102.00	$ 1,836.00
Shovel, Hired 1¼ cu. yd.	1	18	3	64.00	1,152.00
Linn Tractor Trucks 9 cu. yd.	8	18	3	32.00	4,608.00
Small Tools					214.78
				Total	$ 7,810.78

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hrs.	Amount
Shovel No. 4	1	252	$ .55	$ 138.60
Shovel, Hired	1	252	.39	98.28
Linn Tractor Trucks	8	252	.30	604.80
			Total	$ 841.68

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hrs.	Amount
Foremen	3	13	8	$7.22 day	$ 389.33
Foremen	3	18	8	5.16 "	278.64
Shovel Operators	6	12	7½	1.25	675.00
Oilers	6	12	7½	.60	324.00
Tractor Operators	24	12	7½	.75	1,620.00
Laborers	24	12	7	.50	1,008.00
				Total	$4,295.52

BASIS OF ESTIMATE (Op. #22B - 1941)

This selected pervious material is to be excavated from Borrow Area "B" and hauled to the river section of the dam from elevation 350 to 390.

It is assumed that the 2 yd. shovel will handle 2,300 cu. yds.per day.

Hauling to be performed by means of 9 cu. yd. Linn Tractor Trucks.

It is shown on Op. #27 that the Linn Tractor Trucks can make one round trip in 12 minutes and that the loading time is 3.8 minutes. Also that 5 Linns are required for Shovel No. 4.

Due to the fact that all available excavating equipment is working full time and to the fact that this 54,700 cu. yds. must be placed in 12 working days, it will be necessary to rent one $1\frac{1}{4}$ cu. yd. shovel for the period of 18 calendar days or 12 working days, to load about 1,700 c.y. per day.

The loading time for the $1\frac{1}{4}$ cu. yd. shovel is 6.7 minutes.

$12 \div 6.7 = 1.8 + 1 = 2.8$ Say 3 Linns required to haul from the $1\frac{1}{4}$ cu. yd. shovel.

EXCAVATION AND HAUL

(Borrow Area "B")

Item No. 9 | Operation No. 27

Quantity 47,000 cu. yds. | Date Aug. 22 to Sept. 15, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 4 2 cu. yd.	1	24	3	$102.00	$ 2,448.00
Linn Tractor Trucks 9 cu. yd.	5	24	3	32.00	3,840.00
Small Tools		24	3		313.37
			Total		$ 6,601.37

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 4	1	336	$ .55	$ 184.80
Linn Tractor Trucks	5	336	.30	504.00
			Total	$ 688.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	24	8	$7.22 day	$ 519.84
Foremen	3	24	8	5.16 "	371.52
Shovel Operators	3	16	7½	1.25	450.00
Oilers	3	16	7½	.60	216.00
Tractor Operators	15	16	7½	.75	1,350.00
Laborers	60	16	7	.50	3,360.00
			Total		$ 6,267.36

BASIS OF ESTIMATE (Op. #27 - 1941)

This sand and gravel, and selected pervious fill is from Borrow Area "B" and is to be hauled in 9 yd. Linn Tractor Trucks to both sides of the dam from elevation 390 to 416.

It is assumed that the 2 yd. shovel will load 2,950 cu. yds. of this material per day, but in this case somewhat less than this amount is required.

The Linns can operate as follows:

Loaded	900	feet	at 6	M.P.H.	= 1.70	minutes
"	700	"	at 8	"	= 0.99	"
"	900	"	at 4	"	= 2.56	"
Return	900	"	at 6	"	= 1.70	"
"	800	"	at 8	"	= 1.14	"
"	900	"	at 10	"	= 1.03	"
Dump and Turn					= 2.88	"
Total Haul Time for 1 Round Trip					12.00	"
Loading Time					= 3.84	"

12 ÷ 3.8 = 3.16 + 1 = 4.16 Say 5 Linns are required.

At 16 minutes per trip each truck can make 78 trips per day and would deliver about 700 cu. yds. Five trucks would be needed, otherwise the shovel would be required to lose time between each truck.

EXCAVATION AND HAUL, BORROW AREA "C"

Item No. 10

Quantity - 185,000 cu. yds.

DESCRIPTION

All concrete material and other processed material is supposed to come from this area. The stripping of the area is taken care of in two different ways. The stripping charge for all processed material is absorbed in the cost of the Screening Plant (See Section 17) while the remainder is paid for in Item No. 7.

The excavation and haul to the gravel plant is to be done by 18 cu. yd. LeTourneau Scrapers while the remainder of the material which is to be hauled to the dam is assumed to be loaded by power shovels and hauled by 4 yd. trucks or by Linn Tractor Trucks.

OPERATION COSTS

Year	Op. No.	Quantities	Plant Rental	Material & Supplies	Labor
1940	6	28,900	$ 4,834.03	$ 516.60	$ 2,360.52
"	18	28,900	4,518.68	493.50	2,173.65
"	25(1)	24,500	6,649.03	521.22	2,420.63
"	25(2)	12,000	3,139.14	297.84	1,342.70
1941	2	11,000	1,273.49	136.92	629.88
"	3(1)	9,600	1,303.85	197.40	796.92
"	3(2)	24,500	4,003.09	445.20	1,821.72
"	23	56,100	9,372.64	1,960.14	7,132.71
	Totals		$ 36,093.95	$ 4,568.82	$ 18,678.73

S U M M A R Y

PLANT RENTAL	$ 36,093.95
MATERIALS & SUPPLIES	4,568.82
LABOR	18,673.73
TOTAL	$ 59,341.50

EXCAVATION AND HAUL

(Borrow Area "C")

ITEM NO. 10 | Operation No. 6

Quantity 23,900 Cu.Yds. | Date May 15 - June 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 5 2-Yd.	1	18	3	$102.00	$ 1,836.00
Linn Tractor Trucks 9-Yd.	5	18	3	32.00	2,830.00
Small Tools					118.03
			Total		$ 4,834.03

MATERIAL & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 5 2-Yd.	1	252	$ .55	$ 138.60
Linn Tractor Trucks	5	252	.30	378.00
		Total		$ 516.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	18	8	$6.38 day	$ 344.52
Shovel Operators	3	12	7-1/2	1.25	337.50
Oilers	3	12	7-1/2	.60	162.00
Tractor Operators	15	12	7-1/2	.75	1,012.50
Laborers	12	12	7	.50	504.00
			Total		$2,360.52

BASIS OF ESTIMATE (Op. #6 - 1940)

This operation is assumed to proceed at the same time as Op. No. 5. (See Section 29). The equipment being moved from time to time as the demand for the different materials indicates.

The Linns (9 yd.) can operate as follows:

Loaded	3,900	feet	at	6	M.P.H.	= 7.37	minutes
"	800	"	"	4	"	= 2.28	"
Dump and Turn						= 1.95	"
Empty	800	"	"	4	"	= 2.28	"
"	500	"	"	3	"	= 1.39	"
"	3,400	"	"	12	"	= 3.23	"
Total Haul Time 1 Round Trip						=19.00	"
Loading Time						= 4.70	"

19 ÷ 4.7 = 4.04 + 1 = 5 Linns Required

EXCAVATION AND HAUL

(Borrow Area "C")

Item No. 10 | Operation No. 18

Quantity 28,900 Cu. Yds. | Date July 1 to 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 5 2 cu. yd.	1	15	3	$ 102.00	$ 1,530.00
Linn Tractor Trucks 9 yd.	6	15	3	32.00	2,880.00
Small Tools					108.68
			Total		$ 4,518.68

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 5	1	210	$ .55	$ 115.50
Linn Tractor Trucks	6	210	.30	378.00
		Total		$ 493.50

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	15	8	$ 7.22 day	$ 324.90
Shovel Operators	3	10	7⅓	1.25	281.25
Oilers	3	10	7½	.60	135.00
Tractor Operators	18	10	7⅓	.75	1,012.50
Laborers	12	10	7	.50	420.00
			Total		$2,173.65

EXCAVATION AND HAUL

(Borrow Area "C")

Item No. 10 | Operation No. 18

Quantity 28,900 Cu. Yds. | Date July 1 to 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 5 2 cu. yd.	1	15	3	$ 102.00	$ 1,530.00
Linn Tractor Trucks 9 yd.	6	15	3	32.00	2,880.00
Small Tools					108.68
			Total		$ 4,518.68

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 5	1	210	$ .55	$ 115.50
Linn Tractor Trucks	6	210	.30	378.00
		Total		$ 493.50

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	15	8	$ 7.22 day	$ 324.90
Shovel Operators	3	10	7½	1.25	281.25
Oilers	3	10	7½	.60	135.00
Tractor Operators	18	10	7½	.75	1,012.50
Laborers	12	10	7	.50	420.00
			Total		$2,173.65

BASIS OF ESTIMATE (Op. #18-1940)

The shovel is working alternately on this operation and on Op. #17 (See section 29).

This sand and gravel is to be placed in the filters, under the rock on both slopes, 24,800 yds. to East Terrace and 4,100 yds. to the West Terrace.

It is estimated that the No. 5 Shovel will load 2,390 yds. in 3 shifts of 7 hours each.

The Linns can operate as follows:

EAST TERRACE

Loaded	3,600	feet	at 3	M.P.H.	= 5.21	minutes
"	1,400	"	" 5	"	= 3.18	"
Dump and Turn					= 1.53	"
Empty	1,400	"	" 4	"	= 3.98	"
"	3,600	"	" 10	"	= 4.10	"
Total Haul Time, 1 Round Trip					=18.00	"
Loading Time for 9 cu. yds.					= 3.92	"

18 ÷ 3.92 = 4.60 + 1 = 5.60 = 6 Linns Required for East Terrace.

WEST TERRACE

Loaded	3,600	feet	at 8	M.P.H.	= 5.21	minutes
"	900	"	" 6	"	= 1.70	"
"	1,000	"	" 8	"	= 1.42	"
"	500	"	" 4	"	= 1.42	"
Dump and Turn					= 2.18	"
Empty	500	"	" 4	"	= 1.42	"
"	1,000	"	"10	"	= 1.14	"
"	1,200	"	" 4	"	= 3.41	"
"	3,600	"	"10	"	= 4.10	"
Total Haul Time 1 Round Trip					=22.00	"
Loading Time for 9 cu. yds.					= 3.92	"

22 ÷ 3.92 = 5.62 + 1 = 6.62 = 7 Linns Required on West Terrace

EXCAVATION AND HAUL

(Borrow Area "C")

Item No. 10 | Operation No. 25 Sheet #1

Quantity 24,500 c.y. | Date Aug. 1 to Sept. 21, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 1 1¼ yd.	1	51	1	$ 32.00	$ 1,632.00
Linn Tractor Trucks 9 yd.	6	51	1	16.00	4,896.00
Small Tools					121.03
				Total	$ 6,649.03

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 1 1¼ yd.	1	238	$ .39	$ 92.82
Linn Tractor Trucks	6	238	.30	428.40
			Total	$ 521.22

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	1	51	8	$ 6.38 day	$ 325.38
Shovel Operators	1	34	7½	1.25	318.75
Oilers	1	34	7½	.60	153.00
Tractor Operators	6	34	7½	.75	1,147.50
Laborers	4	34	7	.50	476.00
				Total	$2,420.63

BASIS OF ESTIMATE (Op. #25 - Sh. 1 - 1940)

The sand and gravel to be hauled from Borrow Area "C" to the west terrace up to 390.

It is assumed that the shovel will load 103 cu. yds. per hour.

It is also assumed that the Linn Tractor Trucks (9 yd.) can operate as follows:

Loaded	3,600	feet	at	8	M.P.H.	= 5.10	minutes
"	900	"	"	6	"	= 1.70	"
"	1,000	"	"	8	"	= 1.42	"
"	500	"	"	2	"	= 2.84	"
"	200	"	"	6	"	= 0.38	"
Dump and Turn						= 3.50	"
Empty	1,700	"	"	8	"	= 2.41	"
"	1,200	"	"	3	"	= 4.55	"
"	3,600	"	"	10	"	= 4.10	"
Total Haul Time, 1 Round Trip						=26.00	"
Loading Time						= 5.25	"

26 ÷ 5.25 = 4.9 + 1 = 5.9 say 6 Linns Required to handle the output of the shovel.

EXCAVATION AND HAUL

(Borrow Area "C")

Item No. 10 | Operation No. 25 Sheet No. 2

Quantity 12,000 cu. yds. | Date Aug. 28 to Sept. 21, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 1 1¼ yd.	1	24	1	$ 32.00	$ 768.00
Linn Tractor Trucks 9 yd.	6	24	1	16.00	2,304.00
Small Tools		24	1		67.14
				Total	$3,139.14

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 1	1	136	$ .39	$ 53.04
Linn Tractor Trucks 9 yd.	6	136	.30	244.80
			Total	$ 297.84

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	1	24	8	$ 6.38 day	$ 153.12
Shovel Operators	1	17	8½	1.25	130.63
Oilers	1	17	8½	.60	86.70
Tractor Operators	6	17	8½	.75	650.25
Laborers	4	17	8	.50	272.00
				Total	$1,342.70

BASIS OF ESTIMATE (Op. #25, Sheet #2 - 1940)

This material is to be hauled from Borrow Area "C" to a stockpile on the right bank upstream from the dam and is to be used in the spring of 1941 to construct the upstream Cofferdam.

The shovel is assumed to load the material at the rate of 88 yds. per hour, or 1.47 cu. yds. per minute.

It is assumed that the Linns can operate as follows:

Loaded	3,600	feet	at	8	M.P.H.	= 5.11	minutes
"	900	"	"	6	"	= 1.70	"
"	1,700	"	"	5	"	= 3.86	"
"	200	"	"	2	"	= 1.14	"
"	200	"	"	3	"	= 0.76	"
Dump and Turn						= 2.62	"
Empty	1,800	"	"	6	"	= 3.40	"
"	1,400	"	"	3	"	= 5.31	"
"	3,600	"	"	10	"	= 4.10	"
Total Haul Time 1 Round Trip						=28.00	"
Loading Time						= 6.11	"
Total Time for 1 Round Trip						=34.11	"

28 ÷ 6.1 = 4.6 + 1 = 5.6. 6 Linns are required to keep the shovel busy.

LOAD & HAUL SAND & GRAVEL

(From Stock Pile)

Item No. 10 | Operation No. 2

Quantity 11,000 cu. yds. | Date Apr. 22 to 27, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 2 $2\frac{1}{2}$ c.y.	1	6	3	$ 111.00	$ 666.00
Linn Tractor Trucks 9 c.y.	3	6	3	32.00	576.00
Small Tools		6	3		31.49
			Total		$1,273.49

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 2	1	84	$ .73	$ 61.32
Linn Tractor Trucks	3	84	.30	75.60
			Total	$ 136.92

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	6	8	$ 5.16 day	$ 92.88
Shovel Operators	3	4	$7\frac{1}{2}$	1.25	112.50
Oilers	3	4	$7\frac{1}{2}$	.60	54.00
Tractor Operators	9	4	$7\frac{1}{2}$	.75	202.50
Laborers	12	4	7	.50	168.00
			Total		$ 629.88

BASIS OF ESTIMATE (Op. #2 - 1941)

This material is to be hauled from the stockpile to the upstream cofferdam (See Op. #25 Sheet #2 - 1940).

It is estimated that the shovel will load 2,750 cu. yds. per day.

Inasmuch as the Linns will have to back into dump, more time than is usual is allowed for the dump and turn.

The Linns can operate as follows:

Loaded 600 feet at 4 M.P.H.	= 1.70	minutes
Dump and Turn	= 4.17	"
Empty 600 feet at 6 M.P.H.	= 1.13	"
Total Haul Time 1 Round Trip	= 7.00	"
Loading Time	= 4.14	"
Total Time for 1 Round Trip	=11.14	"

7.00÷ 4.14 = 1.69 + 1 = 2.69 = Say 3 Linn Tractor Trucks of 9 cu.yd. capacity are required to keep the 2½ c.y. shovel busy.

EXCAVATION AND HAUL

(Borrow Area "C")

Item No. 10 | Operation No. 3 Sheet #1

Quantity 9,600 cu. yds. | Date April 28 to 30, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovels No. 4 & 5 2 c.y.	2	3	3	$ 102.00	$ 612.00
Linn Tractor Trucks	12	3	3	32.00	1,152.00
Small Tools					39.35
			Total		$1,803.35

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovels	2	42	$ .55	$ 46.20
Linn Tractor Trucks 9 c.y.	12	42	.30	151.20
			Total	$ 197.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	3	8	$ 6.33 day	$ 57.42
Shovel Operators	6	2	7½	1.25	112.50
Oilers	6	2	7½	.60	54.00
Tractor Operators	36	2	7½	.75	405.00
Laborers	24	2	7	.50	163.00
			Total		$ 796.92

BASIS OF ESTIMATE (Op. #3 Sheet #1 - 1941)

This material is assumed to come from the further limits of Borrow Area "C" and to be hauled by way of construction road No. 3 to the coffer-dam upstream.

It is assumed that the shovels are capable of loading 2,400 c.y. of sand and gravel per day each.

The Linn Tractor Trucks can operate as follows:

Loaded	2,000	feet	at	10	M.P.H.	= 2.23	minutes
"	2,400	"	"	6	"	= 4.54	"
"	300	"	"	4	"	= 2.27	"
Dump and Turn (back into dump)						= 3.94	"
Empty	800	feet	at	8	M.P.H.	= 1.14	"
"	2,400	"	"	4	"	= 6.82	"
"	2,000	"	"	10	"	= 2.23	"
Total Haul Time for 1 Round Trip						=23.27	"
Loading Time						= 4.73	"
Total Time for one Round Trip						=28.00	"

1,260 ÷ 28 = 45 trips per day = say 400 cu. yds. for each Linn.

12 x 400 = 4,800 c.y. for 12 Linns. 6 with each shovel

EXCAVATION AND HAUL

(Borrow Area "C")

Item No. 10 | Operation No. 3 Sheet No. 2

Quantity 24,500 cu. yds. | Date May 1 to 6, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovels, Nos. 4 & 5 2 c.y.	2	6	3	$ 102.00	$ 1,224.00
Linn Tractor Trucks 9 c.y.	14	6	3	32.00	2,688.00
Small Tools		6	3		91.09
				Total	$ 4,003.09

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovels	2	84	$ .55	$ 92.40
Linn Tractor Trucks	14	84	.30	352.80
			Total	$ 445.20

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	6	8	$ 6.38 day	$ 114.84
Foremen	3	6	8	5.16 "	92.88
Shovel Operators	6	4	7½	1.25	225.00
Oilers	6	4	7½	.60	108.00
Tractor Operators	42	4	7½	.75	945.00
Laborers	24	4	7	.50	336.00
				Total	$1,821.72

BASIS OF ESTIMATE (Op. #3 - Sheet #2 - 1941)

This sand and gravel is assumed to come from the most remote part of Borrow Area "C" and to be hauled by way of construction Road No. 2 to the downstream Cofferdam.

It is estimated that the shovels will each load 3,060 cu. yds. of material in one day.

The Linn Tractor Trucks can operate as follows:

Loaded	3,600	feet	at 8	M.P.H.	= 5.12	minutes
"	900	"	" 6	"	= 1.70	"
"	300	"	" 2	"	= 1.70	"
Dump and Turn (Back into turn)					= 3.72	"
Empty	300	feet	at 4	M.P.H.	= 0.85	"
"	1,400	"	" 3	"	= 5.31	"
"	3,600	"	" 10	"	= 4.10	"
Total Haul Time for 1 Round Trip					=22.50	"
Loading Time					= 3.70	"
Total Time for one Round Trip					=26.20	"

1260 ÷ 26.2 = 48 Round Trips per day.

48 x 9 x 14 = 6,048 cu. yds. per day with 14 Linns hauling from the two shovels. In 4 days they will haul 6,048 x 4 = 24,192 cu. yds. and it is estimated that they can bring this up to the 24,500 cu. yds.

EXCAVATION AND HAUL

(Borrow Area "C")

ITEM NO. 10 — Operation No. 23

Quantity 56,100 Cu. Yds. — Date July 13 to Aug. 21, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 1 1-1/4 cu.yds.	1	39	3	$ 64.00	$ 2,496.00
Trucks, Dump, 4 Cu. Yds.	10	39	3	18.00	7,020.00
Small Tools		39	3		356.64
				Total	$ 9,872.64

MATERIALS & SUPPLIES (See Sec. 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovel No. 1	1	546	$ .39	$ 212.94
Trucks, Dump, 4 yd.	10	546	.32	1,747.20
			Total	$ 1,960.14

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	39	8	$ 7.22 day	$ 844.74
Foremen	3	39	8	5.16 "	603.72
Shovel Operators	3	26	7-1/2	1.25	731.25
Oilers	3	26	7-1/2	.60	351.00
Truck Drivers	30	26	7-1/2	.60	3,510.00
Laborers	12	26	7	.50	1,092.00
				Total	$7,132.71

BASIS OF ESTIMATE (Op. #23 - 1941)

This bank run sand and gravel is to come from Borrow Area "C" and be hauled by 4 yd. trucks to the river section of the dam to be used under the gravel in the filters on the slopes up to elevation 390.

It is assumed that No. 1 shovel can load 2,154 cu. yds. of this material in 21 hours.

The 4 yd. trucks can operate according to the following schedule via Construction Road No. 2 and the access road:

Loaded	4,000	feet	at	10	M.P.H.	= 4.56	minutes
"	300	"	"	12	"	= .76	"
"	100	"	"	2	"	= .56	"
"	200	"	"	4	"	= .57	"
"	400	"	"	3	"	= 1.52	"
"	400	"	"	6	"	= .76	"
Dump and Turn						= 3.12	"
Return	1,000	feet	at	6	M.P.H.	= 1.89	"
"	1,400	"	"	4	"	= 3.98	"
"	4,000	"	"	20	"	= 2.23	"
Total Haul Time for one Round Trip						=20.00	"
Loading Time						= 2.34	"

20 ÷ 2.34 = 3.547 + 1 = 9.5 Say 10 trucks required

ROCK EXCAVATION

(Above elev. 301)

Item No. 11

Quantity - 315,000 c.y.

DESCRIPTION

This item includes all rock in the Outlet and Spillway Channels and the Grout Cap Trench, above elev. 301. The rock is assumed to be loosened by drilling and blasting and loaded by $2\frac{1}{2}$ c.y. power shovels into 9 c.y. Linn Tractor Trucks or 4 c.y. Dump Trucks.

On the following sheet is shown the total cost of the various operations of Rock Excavation and the proration of these costs of Items No. 11 and No. 12.

S U M M A R Y

Plant Rental	$ 102,290.51
Materials & Supplies	68,566.49
Labor	85,913.14
Total . .	$ 256,770.14

ROCK EXCAVATION

Item No. 11

COST OF DRILLING & BLASTING IN ITEMS NOS. 11 & 12
(See Section 18)

PLANT RENTAL	390,000	cu.	yds.	at	.0841	= $32,799.00
MATERIALS & SUPPLIES	"	"	"	"	.1904	= 74,256.00
LABOR	"	"	"	"	.1519	= 59,241.00

The following table shows the costs of loading, hauling, drilling and blasting all material contained in Items Nos. 11 and 12.

Year	Op.No.	Quantities	Plant Rental	Materials & Supplies	Labor
1939	14	42,145	$ 8,253.39	$ 870.24	$ 4,627.77
"	19	29,800	7,337.37	810.60	3,347.40
1940	10	39,620	11,736.77	1,296.96	5,295.36
"	11	10,200	2,934.95	324.24	1,338.96
"	19 Sheet 1	28,200	7,353.62	810.60	3,672.30
"	19 " 2	1,700	685.72	53.52	214.30
"	21	12,000	2,601.23	330.96	1,384.68
"	26	31,440	6,896105	828.66	3,480.90
1941	8	8,600	2,204.95	243.18	1,079001
"	19 Sheet 1	9,000	2,195.05	374.22	1,241.01
"	19 " 2	12,000	2,939.93	324.24	1,438.68
"	19 " 3	43,200	8,934.37	1,026.90	4,807.44
"	24	84,100	19,484.42	2,206.68	10,188.40
"	28	41,300	10,288.57	1,134.84	5,011.44
Drilling and Blasting			32,799.00	74,256.00	59,241.00
Totals			$ 126,645.39	$ 84,891.84	$ 106,368.65

Proration of above costs to Items Nos. 11 and 12.

	Quantities	Plant Rental	Material & Supplies	Labor
Item No. 11	315,000	$ 102,290.51	$ 68,566.49	$85,913.14
" " 12	75,000	24,354.88	16,325.35	20,455.51
Totals	390,000	$ 126,645.39	$ 84,891.84	$106,368.65

ROCK EXCAVATION

(Conduit Section to D. S. Ballast)

ITEM NO. 11 — Operation No. 14

QUANTITY 42,145 C.Y. (Solid) — Date Sept. 16 - Oct. 6,1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel, 2-1/2 c.y. Nos.2 & 3	2	21	3	$ 111.00	$ 4,662.00
Linns, 9 c.y.	5	21	3	32.00	3,360.00
Small Tools					231.39
				Total	$ 8,253.39

MATERIALS & SUPPLIES (See Section 11)
14 working days.

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovels, 2-1/2 c.y.Nos.2 & 3	2	294	$ .73	$ 429.24
Linns, 9 c.y.	5	294	.30	441.00
			Total	$ 870.24

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen, General	3	21	8	$ 7.22 day	$ 454.86
Foremen	6	21	8	5.16 "	650.16
Operators, shovel	6	14	7-1/2	1.25	737.50
Oilers, "	6	14	7-1/2	.60	378.00
Tractor Operators	15	14	7-1/2	.75	1,181.25
Laborers	24	14	7	.50	1,176.00
				Total	$4,627.77

BASIS OF ESTIMATE (Op. #14 - 1939)

It is estimated that one 2-1/2 c.y. shovel will load 500 c.y. (solid rock) or 750 c.y. (loose) per 7 hour shift.

Number Tractor Trucks required (9 c.y.):

500 feet Haul to Right Bank

1700 " " " Left "

Right Bank

Loaded 500 feet at 3 M.P.H.		= 1.9	minutes
Dump & Turn		= 2.1	"
Empty	6 "	= 1.0	"
	Haul Time	5.0	"
	Loading Time	5.0	"

2 Linns will be required on right bank.

Left Bank

Loaded 1700 feet at 3 M.P.H.		= 6.4	minutes
Dump & Turn		2.2	"
Return	8 M.P.H.	= 2.4	"
	Haul Time	11.0	"

3 Linns will handle the rock to the left bank with about 1/2 minute lost time for the shovel between loads.

42,145 c.y. (solid measurement) will probably expand to approximately 63,200 c.y. loose.

14 working days are assumed

ROCK EXCAVATION

(Weir Section to Left Terrace, D.S.)

Item No. 11 | Operation No. 19

Quantity 29,800 c.y. (Solid) | Date Oct. 7 to 21, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovels Nos. 2 & 3 3½ yd.	2	15	3	$ 111.00	$ 3,330.00
Linn Tractor Trucks	8	15	3	32.00	3,840.00
Small Tools		15	3		167.37
				Total	$ 7,337.37

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovels	2	210	$ .73	$ 306.60
Linn Tractor Trucks	8	210	.30	504.00
			Total	$ 810.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foreman	3	15	8	$ 7.22 day	324.90
Shovel Operators	6	10	7½	1.25	562.50
Oilers	6	10	7½	.60	270.00
Tractor Drivers	24	10	7½	.75	1,350.00
Laborers	24	10	7	.50	840.00
				Total	$ 3,347.40

BASIS OF ESTIMATE (Op. #19 - 1939)

It is estimated the $2\frac{1}{2}$ yd. shovels will load approximately 750 cu. yds. in 7 hours or 500 cu. yds. of solid rock.

It is estimated that it will require 5 minutes to load a 9 cu. yd. Linn Tractor Truck.

Investigation shows that Linns will haul this particular rock for 2¢ per yard less than 4 yd. trucks.

The Linns could operate on the following schedule:-

Loaded	700	feet	at 4	M.P.H.	= 1.99	minutes
"	1500	"	" 6	"	= 2.84	"
"	400	"	" 3	"	= 1.52	"
Dump and Turn					= 2.54	"
Empty	2,000	feet	at 3	"	= 2.34	"
"	600	"	" 3	"	= 2.27	"

Total Haul Time, Round Trip = 14.00 "

Loading Time 9 cu. yds. = 5.00 "

14 ÷ 5 = 3 + 1 = 4 Linn Tractor Trucks required for each shovel.

ROCK EXCAVATION

(Stilling Basin)

Item No. 11 | Operation No. 10

Quantity 39, 620 c.y. (solid) | Date June 1 to 24, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovels 2½ yd. Nos. 2 & 3	2	24	3	$ 111.00	$ 5,328.00
Linn Tractor Trucks 9 yd.	8	24	3	32.00	6,144.00
Small Tools					264.77
				Total	$11,736.77

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovel 2½ yd.	2	336	$ .73	$ 490.56
Linn Tractor Trucks	8	336	.30	806.40
			Total	$ 1,296.96

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	24	8	$ 6.38 day	$ 459.36
Operators, shovel	6	16	7½	1.25	900.00
Oilers, Shovel	6	16	7½	.60	432.00
Operators, Linn	24	16	7½	.75	2,160.00
Laborers	24	16	7	.50	1,344.00
				Total	$ 5,295.36

BASIS OF ESTIMATE (Op. #10, 1940)

It is estimated that one $2\frac{1}{3}$ yd. shovel will load 440 yds. (solid) or 660 yds. (loose) per 7 hour shift.

Length of Haul = 2,000 feet

Linn Tractor Trucks (9yd.) to be used as shown below:-

Loaded	400	feet	at 2	M.P.H.	= 2.3	minutes
"	1000	"	" 4	"	= 2.8	"
"	600	"	" 2	"	= 3.4	"
Dump and Turn					= 2.8	"
Empty	600	feet	at 5	"	= 1.4	"
"	1400	"	" 8	"	= 2.0	"
Total Haul Time Round Trip					=14.7	"
Loading Time for 9 yds.					= 6.1	"

14.7 ÷ 6.1 = 2.4 = 3 + 1 = 4 Linns Required for each Shovel.

Of this material 5000 yds. will be left in the pit for use as riprap.

ROCK EXCAVATION

(Spillway Discharge Channel)

Item No. 11 | Operation No. 11

Quantity 10,200 c.y. (solid) | date June 25 to 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovels Nos. 2 & 3 2½ yd.	2	6	3	$ 111.00	$ 1,332.00
Linn Tractor Trucks 9 yd	8	6	3	32.00	1,536.00
Small Tools					66.95
				Total	$ 2,934.95

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovels Nos. 2 & 3 2½ yd.	2	84	$ .73	$ 122.64
Linn Tractor Trucks	8	84	.30	201.60
			Total	$ 324.24

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	6	8	$ 7.22 day	$ 129.96
Shovel Operators	6	4	7½	1.25	225.00
Oilers	6	4	7½	.60	108.00
Tractor Operators	24	4	7½	.75	540.00
Laborers	24	4	7	.40	336.00
				Total	$ 1,338.96

BASIS OF ESTIMATE (Op. #11 - 1940)

This material comes from just below the wier section of the spillway discharge channel and is to be used in the rock shell upstream and downstream on the left terrace below elev. 350.

The Linn Tractor Trucks (9 yd) can operate as follows:

Loaded	500	feet	at 5	M.P.H.	= 1.14	minutes
"	400	"	" 3	"	= 1.52	"
"	1,000	"	" 6	"	= 1.39	"
"	400	"	" 4	"	= 1.14	"
"	200	"	" 2	"	= 1.13	"
"	300	"	" 4	"	= 0.85	"
Dump and Turn					= 1.09	"
Empty	2,300	feet	at 6	"	= 4.35	"
"	500	"	" 3	"	= 1.39	"
Total Haul Time 1 Round Trip					= 15.00	"
Loading Time					6.00	"

15 ÷ 6 = 2.5 (say 3) + 1 = 4 Linns required for each shovel

ROCK EXCAVATION

(Spillway Discharge Channel)

Item No. 11 | Operation No. 19 Sheet #1

Quantity 23,200 c.y. (solid) | Date July 1 to 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 2 2½ Cu. Yd.	1	30	3	$ 111.00	$ 3,330.00
Linn Tractor Trucks 9 yd.	4	30	3	32.00	3,840.00
Small Tools		30	3		183.62
				Total	$ 7,353.62

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovel No. 2	1	420	$ .73	$ 306.60
Linn Tractor Trucks	4	420	.30	504.00
			Total	$ 810.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	30	8	$ 7.22 day	$ 649.30
Shovel Operators	3	20	7½	1.25	562.50
Oilers	3	20	7½	.60	270.00
Tractor Operators	12	20	7½	.75	1,350.00
Laborers	12	20	7	.50	340.00
				Total	$ 3,672.30

BASIS OF ESTIMATE (Op. #19 Sheet #1 - 1940)

This rock is to be excavated from the discharge channel and hauled to the upstream and downstream shell on the East Terrace from elev. 350-390.

It is estimated that the No. 2 shovel will load 500 cu. yds. of solid rock or 750 cu. yds. of loose rock in one 7-hour shift.

The Linn Tractor Trucks can operate as follows:

Loaded	400	feet	at 5	M.P.H.	= 0.91	minutes
"	400	"	" 3	"	= 1.52	"
"	1,000	"	" 6	"	= 1.39	"
"	1,200	"	" 3	"	= 4.55	"
Dump and Turn					= 2.30	"
Empty	2,400	feet	at 3	"	= 3.41	"
"	400	"	" 3	"	= 1.52	"
Total Haul Time for 1 Round Trip					=16.10	"
Loading Time					= 5.36	"

16.10 ÷ 5.36 = 3 + 1 = 4 Linns Required

ROCK EXCAVATION

(Spillway Discharge Channel)

Item No. 11 | Operation No. 19 Sheet No. 2

Quantity 1700 cu. yds. (Solid) | Date Aug. 1 to 5, 1940

PLANT RENTAL

Designation	No. Units	Cal Days	No. Shifts	Rate/Day	Amount
Shovel No. 2	1	5	1	$ 55.00	$ 275.00
Linn Tractor Trucks 9 yd.	5	5	1	16.00	400.00
Small Tools					10.72
				Total	$ 685.72

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovel No. 2	1	24	$ .73	$ 17.52
Linn Tractor Trucks	5	24	.30	36.00
			Total	$ 53.52

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	1	5	8	$ 6.38 day	$ 31.90
Shovel Operators	1	3	8	1.25	30.00
Oiler	1	3	8	.60	14.40
Tractor Operators	5	3	8	.75	90.00
Laborers	4	3	8	.50	48.00
				Total	$ 214.30

BASIS OF ESTIMATE (Op. #19, Sheet #2 - 1940)

This rock is to be excavated and hauled to a stock pile on the left bank, to be used in the spring of 1941 for construction of the upstream cofferdam.

The 2½ yd. shovel is assumed to load 107 cu. yds. per hour of loose rock, or 1.78 cu. yds. per minute.

The 9 cu. yd. Linn Tractor Trucks can operate as follows:

Loaded	400	feet	at 3	M.P.H.	= 1.52	minutes
"	400	"	" 2	"	= 2.27	"
"	2,000	"	" 6	"	= 3.78	"
"	300	"	" 2	"	= 1.70	"
"	200	"	" 4	"	= 0.57	"
Dump and Turn					= 2.69	"
Empty	2,900	feet	at 6	"	= 5.48	"
"	400	"	" 2	"	= 2.27	"
Total Haul Time for 1 Round Trip					=20.28	
Loading Time					= 5.07	
Total Time for 1 Round Trip					=25.35	

20.28 ÷ 5.07 = 4 + 1 = 5 Linns required

ROCK EXCAVATION

(Spillway Approach Channel)

Item No. 11 | Operation No. 21

Quantity 12,000 c.y. (Solid) | Date July 19 to 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 3 2½ yd.	1	12	3	$ 111.00	$ 1,332.00
Linn Tractor Trucks 9 yd.	2	12	3	32.00	768.00
Trucks, Dump 4 cu. yd.	2	12	3	18.00	432.00
Small Tools		12	3		69.23
				Total	$ 2,601.23

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No.Hrs.	Rate/Hour	Amount
Shovel No. 3	1	168	$ .73	$ 122.64
Linn Tractor Trucks 9 yd	2	168	.30	100.80
Trucks	2	168	.32	107.52
			Total	$ 330.96

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	12	8	$6.38 day	$ 229.68
Shovel Operators	3	8	7½	1.25	225.00
Oilers	3	8	7½	.60	108.00
Tractor Operators	6	8	7½	.75	270.00
Truck Drivers	6	8	7½	.60	216.00
Laborers	12	8	7	.50	336.00
				Total	$1,384.68

BASIS OF ESTIMATE (Op. #21 - 1940)

This rock to be excavated from the foundation of the retaining wall along the east side of the Spillway Approach Channel and is to be hauled to the shell, down stream, on the west terrace.

The Linn Tractor Trucks can operate as follows:

Loaded 300 feet at 4 M.P.H.	= 0.85	minutes
" 500 " " 5 "	= 1.14	"
Dump and Turn	= 1.66	"
Empty 800 feet at 6 M.P.H.	= 1.51	"
" 400 " " 2 "	= 2.27	"
" 300 " " 6 "	= 0.57	"
Total Haul Time 1 Round Trip	= 8.00	"
Loading Time	= 5.04	"

Three Linns are required to keep the shovel working, but since only two are available at this time 2 - 4 c.y. Dump Trucks will be used with the two Linns.

It is assumed that the shovel can load 1,500 yds. of rock in 21 hours (solid) 2,250 loose.

ROCK EXCAVATION

(Outlet Approach Channel)

Item No. 11 | Operation No. 26

Quantity 31,440 c.y. (solid) | Date Sept. 22 to Oct. 6, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovels Nos. 2 & 3 - 2½ yd.	2	15	3	$ 111.00	$ 3,330.00
Linn Tractor Trucks 9 yd.	6	7	3	32.00	1,344.00
Linn Tractor Trucks	8	8	3	32.00	2,048.00
Small Tools					174.05
				Total	$ 6,896.05

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovels Nos. 2 & 3	2	231	$ .73	$ 337.26
Linn Tractor Trucks	6	105	.30	189.00
Linn Tractor Trucks	8	126	.30	302.40
			Total	$ 828.66

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	15	8	$ 7.22 day	$ 324.90
Shovel Operators	6	11	7½	1.25	618.75
Oilers	6	11	7½	.60	297.00
Tractor Operators	18	5	7½	.75	506.25
Tractor Operators	24	6	7½	.75	810.00
Laborers	24	11	7	.50	924.00
				Total	$ 3,480.90

BASIS OF ESTIMATE (Op. #26 - 1940)

This rock to be excavated from the bottom of the Outlet Approach channel and hauled to the shell of the West Terrace both upstream and downstream up to elevation 390.

It is estimated that the shovels will load approximately 1,500 cu. yds. of rock (solid) in one day each.

(1) 22,200 cu. yds. (loose) are required below elev. 365.

(2) 15,400 " " are required above elev. 365.

(3) 9,500 " " are required for riprap in approach channel.

These 3 operations require different hauling treatment and the Linns can operate as follows:

No. 1

Loaded 400 feet at 2 M.P.H.	= 2.27	minutes
" 400 " " 4 "	= 1.14	"
" 250 " " 2 "	= 1.42	"
" 300 " " 5 "	= .68	"
Dump and Turn	= 1.94	"
Empty 1350 feet at 6 M.P.H.	= 2.55	"
Total Haul Time for 1 Round Trip	=10.00	"
Loading Time	= 5.10	"

10 ÷ 5.1 = 2 + 1 = 3 Linns Required for Each Shovel.

No. 2

Loaded 500 feet at 2 M.P.H.	= 2.34	minutes
" 500 " " 3 "	= 1.90	"
" 900 " " 4 "	= 2.56	"
" 500 " " 6 "	= 0.95	"
Dump and Turn	= 2.29	"
Empty 1,300 feet at 6 "	= 2.46	"
Total Haul Time 1 Round Trip	=13.00	"
Loading Time	= 5.90	"

13 ÷ 5.9 = 2.2 + 1 = 3.2 Say 4 Linns Required for each shovel.

No. 3

Loaded 1000 feet at 2 M.P.H.	= 5.68	minutes
" 500 " " 4 "	= 1.42	"
Dump and Turn	= 3.06	"
Empty 1500 feet at 6 M.P.H.	= 2.84	"
Total Haul Time for 1 Round Trip	=13.00	"
Loading Time	= 4.76	"

13 ÷ 4.76 = 2.8 + 1 = 3.8 say 4 Linns Required for each shovel.

3 x 2 = 6 Linns required for No.1 - 5 working days

4 x 2 = 8 " " " No.2 - 4 working days

4 x 2 = 8 " " " No.3 - 2 working days

ROCK EXCAVATION

(Spillway Approach Channel)

Item No. 11 — Operation No. 8

Quantity 3,600 cu. yds. (solid) — Date May 7 to 15, 1941.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 3 $2\frac{1}{2}$ c.y.	1	9	3	$ 111.00	$ 999.00
Linn Tractor Trucks 9 c.y.	4	9	3	32.00	1,152.00
Small Tools		9	3		53.95
			Total		$2,204.95

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 3	1	126	$ .73	$ 91.98
Linn Tractor Trucks 9 c.y.	4	126	.30	151.20
			Total	$ 243.18

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	9	8	$ 6.33 day	$ 172.26
Shovel Operators	3	6	$7\frac{1}{2}$	1.25	168.75
Oilers	3	6	$7\frac{1}{2}$	.60	81.00
Tractor Operators	12	6	$7\frac{1}{2}$	.75	405.00
Laborers	12	6	7	.50	252.00
			Total		$1,079.01

BASIS OF ESTIMATE (Op. #3 - 1941)

This rock is to be excavated from the Spillway Wier Section and hauled to the closure section of the upstream cofferdam and to cover the upstream slope of the cofferdam.

It is estimated that the 2½ c.y. shovel will load approximately 1500 c.y. of solid rock or 2,250 c.y. of loose rock in one day. In this case a somewhat more liberal allowance has been made.

The Linn Tractor Trucks can operate as follows:

Loaded	1200	feet	at	5	M.P.H.	= 2.72	minutes
"	300	"	"	3	"	= 1.14	"
"	700	"	"	4	"	= 1.99	"
Dump and Turn (Backing into Dump)						= 4.20	"
Empty	700	feet	at	5	M.P.H.	= 1.59	"
"	300	"	"	2	"	= 1.70	"
"	400	"	"	4	"	= 1.14	"
"	300	"	"	3	"	= 1.14	"
Total Haul Time 1 Round Trip						=15.62	"
Loading Time						= 5.25	"
Total Time for 1 Round Trip						=20.87	"

15.62 ÷ 5.25 = 3 + 1 = 4 Linns are required.

ROCK EXCAVATION

(Spillway Discharge Channel)

Item No. 11 — Operation No. 19 Sheet No. 1

Quantity 9,000 cu. yds. (solid) — Date June 22 to 30, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 3 2½ cu. yd.	1	9	3	$ 111.00	$ 999.00
Trucks, Dump, 4 cu. yd.	7	9	3	13.00	1,134.00
Small Tools		9	3		62.05
			Total		$2,195.05

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovel No. 3	1	126	$ .73	$ 91.98
Trucks	7	126	.32	282.24
			Total	$ 374.22

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	9	8	$ 6.33 day	$ 172.26
Shovel Operators	3	6	7½	1.25	168.75
Oilers	3	6	7½	.60	81.00
Truck Drivers	21	6	7½	.60	567.00
Laborers	12	6	7	.50	252.00
				Total	$1,241.01

BASIS OF ESTIMATE (Op. #19 Sheet #1 - 1941)

This rock is to be excavated from the Spillway Discharge Channel and placed in the rock fill downstream in the river section and also in the shell of the dam to elev. 320.

It is estimated that the 2½ c.y. shovel can load 1,500 c.y. of solid rock or 2,250 c.y. of loose rock per day.

The only hauling equipment available at this time is 4 c.y. dump trucks.

These trucks can operate as follows:

Loaded	300	feet	at	4	M.P.H.	= 0.85	minutes
"	400	"	"	2	"	= 2.27	"
"	500	"	"	6	"	= 0.95	"
"	500	"	"	3	"	= 1.90	"
Dump and Turn						= 2.02	"
Return	700	feet	at	6	M.P.H.	= 1.32	"
"	700	"	"	8	"	= 0.99	"
"	300	"	"	2	"	= 1.70	"
Total Haul Time 1 Round Trip						=12.00	"
Loading Time						= 2.24	"
Total Time for 1 Round Trip						=14.24	"

12 ÷ 2.24 = 5.36 + 1 = 6.36 say 7 trucks are required to serve the No. 3 Shovel.

At the start this hauling will be difficult as the trucks will have to pass over the gravel filter but after a small amount of rock is deposited they can back out on the dump. As soon as the first of the selected pervious fill is in place, on July 6, the Linns will be available for rock.

ROCK EXCAVATION

(Spillway Discharge Channel)

Item No. 11 | Operation No. 19 Sheet No. 2

Quantity 12,000 cu. yds. (solid) | Date July 1 to 12, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovels No. 3 2½ c.y.	1	12	3	$ 111.00	$ 1,332.00
Linn Tractor Trucks 9 cu.yd	4	12	3	32.00	1,536.00
Small Tools					71.93
				Total	$ 2,939.93

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovels	1	168	$ .73	$ 122.64
Linn Tractor Trucks	4	168	.30	201.60
			Total	$ 324.24

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	12	8	$ 6.38 day	$ 229.68
Shovel Operators	3	8	7½	1.25	225.00
Oilers	3	8	7½	.60	108.00
Tractor Operators	12	8	7½	.75	540.00
Laborers	12	8	7	.50	336.00
				Total	$1,438.68

BASIS OF ESTIMATE (Op. #19 - Sheet #2 - 1941)

This rock is to be excavated from the Spillway Discharge Channel and to be hauled to the rock fill downstream in the river section of the dam and also to the shell up to elevation 320.

It is estimated that the $2\frac{1}{3}$ yd. shovel can excavate and load 1,500 cu. yds. of solid or 2,250 cu. yds. of loose rock in one day of 21 hours.

9 cu. yd. Linn Tractor Trucks are available for hauling and can operate on the following schedule:

Loaded	400	feet	at 4	M.P.H.	= 1.14	minutes
"	400	"	" 2	"	= 2.27	"
"	500	"	" 6	"	= 0.95	"
"	600	"	" 4	"	= 1.70	"
Dump and Turn					= 2.29	"
Return	1500	feet	at 3	"	= 2.13	"
"	400	"	" 3	"	= 1.52	"
Total Haul Time 1 Round Trip					=12.00	"
Loading Time					= 5.04	"
Total Time for 1 Round Trip					=17.04	"

12 ÷ 5 = 2.4 + 1 = 3.4 Say 4 Linns required for each shovel

ROCK EXCAVATION

(Spillway Discharge Channel)

Item No. 11 — Operation No. 19 Sheet No. 3

Quantity 43,200 cu. yds. (solid) — Date Sept. 25 to Oct. 15, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovels Nos. 2 & 3 2½ cu. yd.	2	21	3	$ 111.00	$ 4,662.00
Linn Tractor Trucks 9 cu.yd.	6	21	3	32.00	4,032.00
Small Tools					240.37
				Total	$ 8,934.37

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovels Nos. 2 & 3	2	315	$ .73	$ 459.90
Linn Tractor Trucks	6	315	.30	567.00
			Total	$1,026.90

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	21	8	$ 7.22 day	$ 454.86
Foremen	3	21	8	5.16 "	325.08
Shovel Operators	6	15	7½	1.25	843.75
Oilers	6	15	7½	.60	405.00
Tractor Operators	18	15	7½	.75	1,518.75
Laborers	24	15	7	.50	1,260.00
				Total	$ 4,807.44

BASIS OF ESTIMATE (Op. #19 - Sheet #3 - 1941)

This rock is to be excavated from the Spillway Discharge Channel and is to be hauled to the rock fill in the river section downstream.

It is assumed that these $2\frac{1}{2}$ cu. yd. shovels will load approximately 1500 cu. yds. of solid rock each in 21 hours.

The rock is assumed to swell 50% when blasted and excavated.

Hauling to be done by 6 cu. yd. Linn Tractor Trucks, Diesel powered.

The Linns can operate as follows:

Loaded	300	feet	at 4	M.P.H.	= 0.85	minutes
"	400	"	" 3	"	= 1.52	"
"	500	"	" 6	"	= 0.95	"
"	400	"	" 4	"	= 1.14	"
Dump and Turn					= 1.42	"
Return	400	feet	at 4	"	= 1.14	"
"	900	"	" 8	"	= 1.28	"
"	300	"	" 2	"	= 1.70	"
Total Haul Time for 1 Round Trip					=10.00	"
Loading Time					= 5.00	"

10 ÷ 5 = 2 + 1 = 3 Linns required for each shovel.

ROCK EXCAVATION

(Spillway Channel)

Item No. 11 — Operation No. 24.

Quantity 34,100 cu. yd. (solid) — Date July 13 to Sept. 3, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No.3 2½ cu. yd.	1	51	3	$ 111.00	$ 5,661.00
Shovel No.2 2½ cu. yd.	1	30	3	111.00	3,330.00
Linn Tractor Trucks 9 cu.yd	4	21	3	32.00	2,688.00
" " " " " "	8	24	3	32.00	6,144.00
" " " " " "	6	6	3	32.00	1,152.00
Small Tools		51	3		509.42
			Total		$19,484.42

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovel No. 3	1	735	$ .73	$ 536.55
Shovel No. 2	1	441	.73	321.93
Linn Tractor Trucks	4	294	.30	352.80
" " "	8	336	.30	306.40
" " "	6	105	.30	189.00
		Total		$2,206.68

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	51	8	$7.22 day	$ 1,104.66
Foremen	3	51	8	5.16 "	789.48
Shovel Operators	3	35	7½	1.25	984.38
Oilers	3	35	7½	.60	472.50
Shovel Operators	3	21	7½	1.25	590.63
Oilers	3	21	7½	.60	283.50
Tractor Operators	12	14	7½	.75	945.00
Tractor Operators	24	16	7½	.75	2,160.00
Tractor Operators	13	5	7½	.75	506.25
Laborers	12	35	7	.50	1,470.00
Laborers	12	21	7	.50	882.00
			Total		$ 10,138.40

BASIS OF ESTIMATE (Op. #24 - 1941)

70,000 cu. yds. of this rock is to be excavated from the Spillway Discharge Channel and 14,100 from the Spillway Approach Channel and is to be hauled to the rock shell in the River Section up to 390.

Shovel No. 2 works from Aug. 3 to Sept. 3 and

Shovel No. 3 from July 13 to Sept. 3.

The shovels will load 1,500 cu. yds. per day, solid.

The Linns can operate on the following schedules:

From Spillway Discharge Channel (July 13 to Aug. 27)

Loaded	400	feet	at 6	M.P.H.	= 0.76	minutes
"	400	"	" 3	"	= 1.52	"
"	600	"	" 6	"	= 1.13	"
"	400	"	" 3	"	= 1.52	"
"	400	"	" 4	"	= 1.14	"
Dump and Turn					= 2.01	"
Return	1400	feet	at 6	M.P.H.	= 2.65	"
"	400	"	" 2	"	= 2.27	"
Total Haul Time 1 Round Trip					=13.00	"
Loading Time					= 5.0	"

13 ÷ 5 = 2.6 + 1 = 3.6 Say 4 Linns required for each shovel.

From Spillway Approach Channel (Aug 25 to Sept. 3)

Loaded	500	feet	at 5	M.P.H.	= 1.14	minutes
"	100	"	" 2	"	= 0.56	"
"	1,000	"	" 8	"	= 1.42	"
"	200	"	" 6	"	= 0.38	"
Return	500	"	" 8	"	= 0.71	"
"	200	"	" 2	"	= 1.14	"
"	1,100	"	" 6	"	= 2.08	"
Dump and Turn					= 2.57	"
Total Time for 1 Round Trip					=10.00	"
Loading Time					= 5.0	"

10 ÷ 5 = 2 + 1 = 3 Linns required for each shovel

ROCK EXCAVATION

(Spillway Approach Channel)

Item No. 11 | Operation No. 23

Quantity 41,300 cu. yds. (solid) | Date Sept. 4 to 24, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 2 2½ cu. yds.	1	21	3	$ 111.00	$ 2,331.00
Shovel No. 3 2½ cu. yds.	1	21	3	111.00	2,331.00
Linn Tractor Trucks 9 cu.yds.	8	21	3	32.00	5,376.00
Small Tools					250.57
				Total	$10,288.57

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
Shovels Nos. 2 & 3	2	294	$ .73	$ 429.24
Linn Tractor Trucks	8	294	.30	705.60
			Total	$1,134.84

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	21	8	$7.22 day	$ 454.36
Foremen	3	21	8	5.16 "	325.08
Shovel Operators	6	14	7½	1.25	787.50
Oilers	6	14	7½	.60	378.00
Tractor Operators	24	14	7½	.75	1,890.00
Laborers	24	14	7	.50	1,176.00
				TOTAL	$ 5,011.44

BASIS OF ESTIMATE (Op. #23- 1941)

This rock excavation comes from the Spillway Approach Channel (wier section) and is to be hauled to the shell of the dam on both slopes between elevation 390 and 416.

It is assumed that the $2\frac{1}{2}$ cu. yd. shovels can excavate 1,500 cu. yds. solid, each in 21 hours.

The hauling equipment is 9 cu. yd. Linn Tractor Trucks.

The Linns can operate as follows:

Loaded	600	feet	at	4	M.P.H.	= 1.70	minutes
"	200	"	"	2	"	= 1.14	"
"	1,200	"	"	6	"	= 2.27	"
Dump and Turn						= 3.77	"
Return	1400	feet	at	8	"	= 1.99	"
"	600	"	"	6	"	= 1.13	"
Total Haul Time for 1 Round Trip						=12.00	"
Loading Time						= 5.13	"

12 ÷ 5.1 = 2.4 + 1 = 3.4 Say 4 Linn Tractor Trucks required for each shovel.

ROCK EXCAVATION

(Below elev. 301)

Item No. 12

Quantity 75,000 cu. yds.

DESCRIPTION

This item comprises the excavation of all rock below elevation 301 in the Intake Structure, Approach Channel, Conduits, Discharge Channel, Stilling Basin and Spillway Channel.

The calculation of costs of loading, hauling, drilling and blasting are shown under Item No. 11 (See Section 31) and detailed costs of drilling and blasting are given in Section 18.

OPERATION COSTS

	PLANT RENTAL	MATERIALS & SUPPLIES	LABOR
Loading, hauling, drilling and blasting from No. 11	$ 24,354.33	$ 16,325.35	$ 20,455.51
Unwatering (See Section 19)	12,810.00	7,416.00	13,484.00
TOTALS	$ 37,164.33	$ 23,741.35	$ 33,939.51

S U M M A R Y

PLANT RENTAL	$ 37,164.33
MATERIALS & SUPPLIES	23,741.35
LABOR	33,939.51
TOTAL	$ 94,845.74

STRUCTURE BACKFILL, UNCOMPACTED.

Item No. 13

Quantity - 10,600 cu. yds.

DESCRIPTION

This uncompacted backfill is to be placed along the right side of the west wall of the Outlet Approach Channel and the same side of the east wall of the Spillway Channel.

It is proposed to dump the material and place it with a bulldozer.

S U M M A R Y

Plant Rental	$ 232.00
Materials & Supplies	40.32
Labor.	328.38
Total.. . .	$ 600.70

STRUCTURE BACKFILL

(Uncompacted)

Item No. 13

Quantity 10,600 cu. yds.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day		Amount
Bulldozer D8 - 90 H.P.	1	6	3	$ 36.00	$	216.00
Small Tools		6	3			16.00
			Total		$	232.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour		Amount
Bulldozer D-8	1	84	$ .48	$	40.32
		Total		$	40.32

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour		Amount
Foremen	3	6	8	$ 5.16 day	$	92.88
Operators, Tractor	3	4	7½	.75		67.50
Laborers	12	4	7	.50		168.00
			Total		$	328.38

STRUCTURE BACKFILL, COMPACTED

Item No. 14

Quantity - 12,700 cu. yds.

DESCRIPTION

This Structure Backfill is to be compacted in layers of 4 inches where it cannot be rolled. It is proposed to secure the material from excavation and to place it largely with bulldozers after it is dumped as nearly in place as is possible. Compaction to be secured by means of air tampers.

It is estimated that one man will tamp one cubic yard in ten minutes.

The material will be dumped as close as possible and pushed into place with bulldozers and by hand labor.

This work will be intermittent and will be supervised by the nearest foreman.

Air will be taken from the mains of the compressor plant.

Small tools are calculated at 1% instead of the usual 5%.

S U M M A R Y

PLANT RENTAL	$ 319.61
MATERIALS & SUPPLIES	28.98
LABOR.	3,461.25
Total	$3,809.84

STRUCTURE BACKFILL

COMPACTED

Item No. 14

Quantity 12,700 Cu. Yds.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Bulldozer D4	1	9	3	$ 15.00	$ 135.00
Tampers, Air, and Hose	2	75	3	1.00	150.00
Small Tools					34.61
				Total	$ 319.61

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Bulldozer D4	1	126	$ .23	$ 28.98
			Total	$ 28.98

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Bulldozer Operators	3	6	7⅓	$ .75	$ 101.25
Tamper "	6	50	7	.60	1,260.00
Laborers	12	50	7	.50	2,100.00
				Total	$ 3,461.25

ROLLED FILL, PERVIOUS

Item No. 15

Quantity - 1,952,000 cu. yds.

DESCRIPTION

This item comprises the wetting and rolling of the pervious material entering into the embankment.

It is proposed to do the wetting by means of pumps and hose and the rolling by means of disk and sheepsfoot rollers and tractors.

The detailed calculations developing the costs for this work are to be found in Sections 20A and 20B. The totals are as follows:

	Plant Rental	Materials & Supplies	Labor
Wetting Embankment (Section 20A)	$ 6,206.56	$ 7,986.65	$ 117,872.52
Rolling " (" 20B)	33,846.24	5,446.35	30,098.50
Totals	$40,052.80	$ 13,433.00	$ 147,971.02

S U M M A R Y

Plant Rental	$ 40,052.80
Materials & Supplies	13,433.00
Labor.	147,971.02
Total.	$201,456.82

ROLLED FILL, IMPERVIOUS

ITEM NO. 16

Quantity - 300,000 Cu. Yds.

DESCRIPTION

This Item covers the cost of wetting and rolling the impervious material composing the core and blanket of the dam.

As in the case of Item 16, the wetting is assumed to be done by means of pumps and the rolling to be done by sheepsfoot rollers and tractors.

For the detailed calculations of the costs pertaining to this Item see Sections 20A and 20B. The totals are as follows.

		PLANT RENTAL	MATERIAL & SUPPLIES	LABOR
Wetting Embankment	(Section 20A)	$ 314.26	$ 404.39	$5,968.23
Rolling "	(Section 20B)	10,379.52	1,670.21	9,230.20
	Totals	$10,693.78	$2,074.60	15,198.43

S U M M A R Y

PLANT RENTAL.	$ 10,693.78
MATERIAL & SUPPLIES	$ 2,074.60
LABOR..	$ 15,198.43
TOTAL	$ 27,966.81

DUMPED ROCK FILL

Item No. 18

Quantity - 575,000 cu. yds.

DESCRIPTION

This Item consists of placing the loose rock fill on both slopes of the dam and in the fill at the downstream toe as well as in the closure section of the upstream cofferdam. The detailed cost of furnishing water for washing and sluicing the rock fill is shown in Section 20(A).

The total direct field cost is as follows:

Year	Op. No.	Quantities	Plant Rental	Material & Supplies	Labor
1939	34	108,000	$ 5,906.81	$ 967.68	$14,456.16
1940	34	167,200	10,720.05	1,774.08	24,321.00
1941	7	2,550	539.61	55.80	292.17
"	34	299,800	16,448.28	2,669.94	36,645.69
	Wetting	575,000	942.77	1,213.16	17,904.69
			$ 34,557.52	$ 6,680.66	$ 93,619.71

S U M M A R Y

PLANT RENTAL	$ 34,557.52
MATERIALS & SUPPLIES.	6,680.66
LABOR	93,619.71
TOTAL	$134,857.89

BASIS OF ESTIMATE (Dumped Rock Fill)

It is estimated that one foreman and 20 laborers can handle the output of one shovel with the assistance of 2, 90 H.P. Bulldozers.

Dumped Rock Fill is being placed as excavation progresses. During periods when both large shovels are excavating rock four 90 H.P. Bulldozers will be used on the rock dump. Two Bulldozers will be sufficient when only one shovel is being used.

Dates and time are based on the following: (See Section 6B)

Year	Op. No.	Cal. Days	C.Y.	Shovels Used	Bulldozers Required
1939	14	21	63,200	2	4
"	19	15	44,800	2	4
	(Total)	36	108,000		4
1940	10	24	54,000	2	4
"	11	6	15,300	2	4
" "	(19 (21	(18 (12	60,300	(1 (2	(2 (4
"	26	15	37,600	2	4
	Total	(57 (18	167,200		(4 (2
1941 "	(7 (8	9	15,300	1	2
"	19	(21 (21	96,300	(1 (2	(2 (4
"	24	(21 (30	126,200	(1 (2	(2 (4
"	23	21	62,000	2	4
	Total	(51 (72	299,800		(2 (4

Shovel #1 with Crane Boom will also be used on Op. #8 placing rock on slope of cofferdam.

DUMPED ROCK FILL

Item No. 18 | Operation No. 34

Quantity 108,000 cu. yds. | Date Sept. 16 to Oct. 21,1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
RD-8 Bulldozers	4	36	3	$ 36.00	$ 5,184.00
Small Tools					722.81
			Total		$ 5,906.81

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hours	Rate/Hour	Amount
RD-8 Bulldozers	4	504	$ .48	$ 967.68
		Total		$ 967.63

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	12	36	8	$6.38 day	$ 2,756.16
Tractor Operator	12	24	7½	.75	1,620.00
Laborers	120	24	7	.50	10,080.00
			Total		$14,456.16

DUMPED ROCK FILL

Item No. 13 | Operation No. 34

Quantity 167,200 cu. yds. | Date June 1 to July 31) Sept. 22 to Oct. 6) 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Bulldozers 90 H.P.	4	57	3	$ 36.00	$ 8,208.00
Bulldozers 90 H.P.	2	18	3	36.00	1,296.00
Small Tools		75	3		1,216.05
				Total	$ 10,720.05

MATERIAL & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Bulldozers 90 H.P.	4	798	$ .45	$ 1,532.16
Bulldozers 90 H.P.	2	252	.48	241.92
			Total	$ 1,774.08

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	6	75	8	$6.38 day	$ 2,871.00
Tractor Operators	12	38	7½	.75	2,565.00
Tractor Operators	6	12	7½	.75	405.00
Laborers	120	38	7	.50	15,960.00
Laborers	60	12	7	.50	2,520.00
				Total	$ 24,321.00

LOAD & HAUL ROCK

(From Stockpile)

Item No. 18 | Operation No. 7

Quantity 2,550 cu. yds. | Date May 7 to 9, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 2, 2½ c.y.	1	3	3	$ 111.00	$ 333.00
Linn Tractor Trucks, 9 c.y.	2	3	3	32.00	192.00
Small Tools					14.61
			Total		$ 539.61

MATERIALS & SUPPLIES

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 2	1	42	$ .73	$ 30.66
Linn Tractor Trucks	2	42	.30	25.20
			Total	$ 55.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	3	8	$6.38 day	$ 57.42
Shovel Operator	3	2	7½	1.25	56.25
Oilers	3	2	7½	.60	27.00
Tractor Operators	6	2	7½	.75	67.50
Laborers	12	2	7	.50	84.00
			Total		$ 292.17

BASIS OF ESTIMATE

(Load & Haul from Stockpile)

This rock is to be loaded and hauled from the stockpile to the upstream cofferdam.

Loading conditions from a stockpile are never very satisfactory and for this reason a liberal allowance has been made for the time of loading.

The Linns can operate as follows:

Loaded 400 feet at 3 M.P.H.	= 1.52	minutes
Dump and Turn (Back into dump)	= 6.34	"
Empty 400 feet at 4 M.P.H.	= 1.14	"
Total Haul Time 1 Round Trip	= 9.00	"
Loading Time	= 9.00	"
Total Time for one Round Trip	=13.00	"

DUMPED ROCK FILL

Item No. 13 | Operation No. 34

Quantity 299,800 c.y. | Date May 7 to May 15) 1941
June 22 to Oct. 15)

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel #1 (Crane)	1	9	3	$ 64.00	$ 576.00
D8 Bulldozers 90 H.P.	2	51	3	36.00	3,672.00
" " " "	4	72	3	36.00	10,368.00
Small Tools					1,832.28
			Total		$ 16,448.28

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hour	Amount
Shovel #1 - 1¼ c.y.	1	126	$ 0.39	$ 49.14
D8 Bulldozers 90 H.P.	2	714	0.48	685.44
" " " "	4	1008	0.48	1,935.36
			Total	$ 2,669.94

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	6	123	8	$ 6.38	$ 4,708.44
Shovel Operators	3	6	7⅓	1.25	168.75
" Oilers	3	6	7⅓	.60	81.00
Tractor Operators	6	34	7⅓	.75	1,147.50
" "	12	48	7⅓	.75	3,240.00
Laborers	60	34	7	.50	7,140.00
"	120	48	7	.50	20,160.00
			Total		$36,645.69

HAND LAID RIPRAP

Item No. 19

Quantity - 13,200 c.y.

DESCRIPTION

This item covers the cost of placing one and two man stone on the slopes of the Outlet Channel. Estimate is based on placing approximately 3 c.y. per shift per man. Transportation costs are charged to "Rock Excavation" (See Item No. 11 - Section 31)

PLANT RENTAL

Small Tools, etc. $ 775.15

LABOR

NO. Men	Designation	Days	Hrs./Day	Rate/Hr.	Amount
3	Foremen	30	8	$6.33 day	$ 574.20
6	"	30	8	5.16 "	923.50
200	Laborers	20	7	.50	14,000.00
			Total		$15,503.00

S U M M A R Y

PLANT RENTAL	$ 775.15
LABOR	15,503.00
Total . . .	$ 16,278.15

DERRICK STONE

Item No. 20

Quantity - 2,600 cu. yds.

DESCRIPTION

This Item comprises the placing of the derrick stone riprap in the Outlet Discharge Channel.

The material is assumed to come from the Stilling Basin Excavation.

Estimate is based on handling 15. c.y. per hour with the crane equipped with chain dogs and rock grab.

S U M M A R Y

PLANT RENTAL	$ 1,260.03
MATERIALS & SUPPLIES	146.16
LABOR.	1,201.63
TOTAL	$ 2,607.92

DERRICK STONE RIPRAP

Item No. 20

Quantity 2,600 cu. yds. Date Sept. 25 to Oct. 6, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Crane No. 1 $1\frac{1}{4}$ cu. yd.	1	12	3	$64.00	$ 768.00
Bulldozer D8	1	12	3	36.00	432.00
Small Tools		12	3		60.00
			Total		$1,260.00

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Crane No. 1 $1\frac{1}{4}$ c.y.	1	168	$ .39	$ 65.52
Bulldozer D8	1	168	.48	80.64
			Total	$ 146.16

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	12	8	$6.38 day	$ 229.68
Crane Operator	3	8	$7\frac{1}{2}$	1.25	225.00
Oilers	3	8	$7\frac{1}{2}$	.60	108.00
Tractor Operator	3	8	$7\frac{1}{2}$	.75	135.00
Laborers	18	8	7	.50	504.00
			Total		$ 1,201.68

GRAVEL FOR FILTERS AND BACKING

Item No. 21

Quantity 115,000 cu. yds.

DESCRIPTION

This item covers the cost of furnishing and placing screened gravel to be deposited on slopes and under the rock fill. This material is assumed to be hauled from a gravel crushing and screening plant located near the southwest corner of Borrow Area "C".

The cost of the gravel is shown in detail in Section 17.

OPERATION COSTS

Year	Op. No.	Quantities	Plant Rental	Materials & Supplies	Labor
1939	7(R)	25,300	$ 2,435.37	$ 355.95	$ 2,097.37
"	13	40,200	3,335.93	453.60	3,358.62
1940	35	20,400	3,539.83	739.20	9,597.60
1941	14	23,600	4,232.09	507.78	2,201.76
"	35	13,000	5,376.92	1,109.64	11,693.33
Gravel (Section 17)		115,000	36,464.49	7,333.51	13,231.29
		Totals	$ 56,135.13	$ 10,499.63	$ 47,235.02

S U M M A R Y

PLANT RENTAL	$ 56,135.13
MATERIALS & SUPPLIES	10,499.63
LABOR	47,235.02
TOTAL	$ 113,919.83

GRAVEL FOR FILTERS

(Drainage Trench, Backfill)

Item No. 21 | Operation No. 7 (D)

Quantity 25,300 c.y. | Date Aug. 22 to Sept. 12, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Linn Tractor Trucks 9 yd.	3	21	3	$ 32.00	$ 2,016.00
Bulldozer 30 H.P.	1	21	3	15.00	315.00
Small Tools		21	3		104.37
				Total	$ 2,435.37

MATERIALS & SUPPLIES (See Section 11) 15 Working Days

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Linn Tractor Trucks	3	315	$ .30	$ 283.50
Bulldozer 30 H.P.	1	315	.23	72.45
			Total	$ 355.95

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foreman General	3	21	3	$7.22 day	$ 454.86
Operators, Tractor	3	15	7½	.75	253.13
" "	9	15	7½	.75	759.38
Laborers	12	15	7	.50	630.00
					$ 2,097.37

BASIS OF ESTIMATE (Op. #7 (D) 1939)

This gravel to be hauled direct from the plant in 9-yd. Linns.

Average Maximum Haul to Right Bank = 3700 feet.

Average Maximum Haul to Left Bank = 2800 feet.

The number of Linns required to haul the output of the Gravel Plant is shown as follows:

		Rt. Bank	Lt. Bank
Loaded 1600 feet at 8 MPH	=	2.24 min.	2.24 min.
" 900 " " 6 "	=	1.71 "	1.71 "
" 300 " " 3 "	=		1.14 "
" 300 " " 8 "	=	1.12 "	
" 400 " " 3 "	=	1.52 "	
Empty 1200 " " 6 "	=	2.28 "	
" 1200 " " 4 "	=		3.36 "
" 900 " " 4 "	=	2.52 "	
" 1600 " "10 "	=	1.76 "	1.76 "
Total Haul Time 1 Round Trip	=	13.15 "	10.21 "
Dump and Turn	=	1.85 "	1.79 "
Total Time for One Round Trip	=	15.00 "	12.00 "

Loading time at Gravel Plant = 6.7 minutes.

Average hauling time approximately 13-1/2 minutes.

Total time for round trip approximately 20 minutes.

Each Linn will haul 27 cubic yards/hour or 567 cubic yards/day. Three Linns would deliver 1700 cubic yards/day or the total output of the gravel plant.

GRAVEL FOR FILTERS

(From Processing Plant)

ITEM NO. 21 | Operation No. 13

QUANTITY 40,200 Cu. Yds. | Date Sept. 12 - Oct. 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Linn Tractor Trucks, 9 Yd.	3	33	3	$ 32.00	$ 3,168.00
Small Tools					167.93
				Total	$ 3,335.93

MATERIALS & SUPPLIES (See Section 11)
24 Working days.

Designation	No. Units	No. Hours	Rate/Hour	Amount
Linn Tractor Trucks, 9 Yd.	3	504	$ .30	$ 453.60
			Total	$ 453.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foreman	3	33	8	$6.38 day	$ 631.62
Operators, Tractor	9	24	7-1/2	.75	1,215.00
Laborers	18	24	7	.50	1,512.00
				Total	$3,358.62

BASIS OF ESTIMATE (Op. #13 - 1939)

This material is for the Filter Treatment downstream, both Terraces.

It is assumed that all the gravel produced by the plant during this period will be hauled by the three Linns.

On Op. #7 (D) 1939 it is shown that three 9 Yd. Linns will haul the entire output of the plant to the points where this gravel is to be delivered.

This operation covers cost of hauling only. The cost of producing the gravel is shown in Section 17.

GRAVEL FOR FILTERS

Item No. 21 | Operation No. 35

Quantity 20,400 cu. yds. | Date June 1 to Sept. 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Trucks, Dump, 2 cu. yd.	2	120	3	$ 14.00	$ 3,360.00
Small Tools					479.88
				Total	$ 3,839.88

MATERIALS & SUPPLIES

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Trucks, Dump 2 cu. yd.	2	1680	$ .22	$ 739.20
			Total	$ 739.20

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	120	8	$5.16 day	$ 1,857.60
Truck Drivers	6	80	7½	.75	2,700.00
Laborers	18	80	7	.50	5,040.00
				Total	$ 9,597.60

BASIS OF ESTIMATE (Op. #35 - 1940)

This material is to be used in the filter under the rock shell on the upstream slope.

It is assumed that the trucks will be loaded at the Gravel Plant where storage is available for 300 yds. of gravel. The loading time is assumed to be 1 minute.

The trucks going to the Left Bank as follows:

Loaded	1,600	feet	at	10	M.P.H.	= 1.82	minutes
"	1,500	"	"	6	"	= 2.84	"
Dump and Turn						= 4.73	"
Empty	1,000	"	"	6	"	= 1.89	"
"	500	"	"	3	"	= 1.90	"
"	1,600	"	"	10	"	= 1.82	"
Total Haul Time 1 Round Trip						=15.00	"
Loading Time						= 1.00	"
Total Time for 1 Round Trip						=16.00	"

Each Truck can haul 6 yds. per hour or 126 yds. per day.

The Trucks can operate to the Right Bank as follows:

Loaded	1,600	feet	at	20	M.P.H.	= 0.91	minutes
"	900	"	"	6	"	= 1.70	"
"	1,000	"	"	15	"	= 0.76	"
"	300	"	"	2	"	= 1.70	"
"	150	"	"	1	"	= 1.70	"
Lost Time waiting for Tractor						= 1.00	"
Loaded	300	feet	at	4	M.P.H.	= 0.85	"
Dump and Turn						= 2.22	"
Empty	750	feet	at	6	"	= 1.42	"
"	1,000	"	"	20	"	= 0.57	"
"	1,400	"	"	3	"	= 5.31	"
"	1,500	"	"	20	"	= 0.86	"
Total Haul Time for 1 Round Trip						=19.00	"
Loading Time						= 1.00	"
Total time for 1 Round Trip						=20.00	"

On this schedule the 2 trucks will haul the necessary 255 cu. yds. per day of 21 hours.

GRAVEL FOR FILTERS

Item No. 21 | Operation No. 14

Quantity 23,800 c.y. | Date June 13 to 21, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 4 2 c.y.	1	9	3	$ 102.00	$ 918.00
Linn Tractor Trucks 9 c.y.	10	9	3	32.00	2,880.00
Bulldozer D-8 90 H.P.	1	9	3	36.00	324.00
Small Tools					110.09
				Total	$ 4,232.09

MATERIALS & SUPPLIES

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 4	1	126	$ .55	$ 69.30
Linn Tractor Trucks	10	126	.30	378.00
Bulldozer D-8	1	126	.48	60.48
			Total	$ 507.78

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	9	8	$7.22 day	$ 194.94
"	3	9	8	5.16 "	139.32
Shovel Operator	3	6	7½	1.25	168.75
" Oiler	3	6	7½	.60	81.00
Tractor Operators	33	6	7½	.75	1,113.75
Laborers	24	6	7	.50	504.00
				Total	$ 2,201.76

BASIS OF ESTIMATE (Op. #14 - 1941)

This material is from the gravel plant (1,600 c.y. per day) and from the stock pile (approximately 2,500 c.y. per day).

Hauling will be done by Linn Tractor Trucks operating on the following schedule:

Loaded	1,600	feet at	8	M.P.H.	=	2.27	min.
"	1,400	"	" 6	"	=	2.65	"
"	600	"	" 3	"	=	2.27	"
Dump and Turn					=	2.09	"
Empty	600	feet at	4	"	=	1.70	"
"	1,900	"	" 3	"	=	7.20	"
"	1,600	"	" 10	"	=	1.82	"
Total Haul Time					=	20.00	"
Loading Time for Shovel						3.70	" = 23.7 min.
" " " Plant						7.1	" = 27.1 "

From Plant:

1260 ÷ 28 = 45 Trips per day

45 x 9 = 405 c.y.

1600 ÷ 405 = Say 4 Tractors required.

From Shovel:

1260 ÷ 24 = 52 Trips per day

52 x 9 = say 470 c.y. " "

2500 ÷ 470 = say 3 Tractors required.

This material is to be used in the downstream filter under the rock ballast in the river section.

Section 41

GRAVEL FOR FILTERS

Item No. 31 | Operation No. 35

Quantity 18,000 cu. yds. | Date May 7 to May 15) June 22 to Sept. 21) 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 7 5/8 cu. yds.	1	84	3	$ 30.00	$ 2,520.00
Trucks, Dump, 2 cu. yd.	2	99	3	14.00	2,772.00
Small Tools					584.92
				Total	$ 5,876.92

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 7	1	1176	$ .425	$ 499.80
Trucks	2	1386	.22	609.84
			Total	$ 1,109.64

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hour	Amount
Foremen	3	99	8	$ 6.38 day	$ 1,894.86
Foremen	3	99	8	5.16 "	1,532.52
Shovel Operators	3	56	7½	1.25	1,575.00
Oilers	3	56	7½	.60	756.00
Truck Drivers	6	66	7½	.60	1,782.00
Laborers	18	66	7	.50	4,158.00
				Total	$ 11,698.38

BASIS OF ESTIMATE (Op. #35 - 1941)

This gravel is used as a filter on the upstream side of the dam and in the closure section of the cofferdam. The material is to be stock piled by the gravel plant to provide the quantity needed during such time as the plant is not running.

Loading to be done with the 5/8 cu. yd. Speeder Shovel, except when gravel plant is operating and hauling to be done by 2, 4-wheel drive, 2 cu. yd. dump trucks.

During June and after Sept. 15, the Gravel Plant will be in operation. Trucks will load directly from the hopper at that time.

The trucks can operate on the following schedule when making the most difficult part of the haul:

Loaded	1,600	feet	at	15	M.P.H.	=	1.22	minutes
"	900	"	"	6	"	=	1.70	"
"	1,000	"	"	8	"	=	1.42	"
"	400	"	"	2	"	=	2.27	"
"	800	"	"	6	"	=	1.51	"
Dump and Turn						=	1.95	"
Return	800	feet	at	8	M.P.H.	=	1.14	"
"	400	"	"	6	"	=	0.76	"
"	1,000	"	"	10	"	=	1.14	"
"	1,400	"	"	4	"	=	3.98	"
"	1,600	"	"	20	"	=	0.91	"
Total Haul Time for 1 Round Trip						=	18.00	"
Loading Time						=	2.00	"
Total Time for 1 Round Trip						=	20.00	"

1,260 ÷ 20 = 63 round trips per day

63 x 2 x 2 = 252 cu. yds. hauled per day by two 2 cu. yd. trucks which is about the amount of this material required.

EIGHT-INCH GRAVEL DRAINS

Item No. 22

Quantity 7,700 Lin. Ft.

DESCRIPTION

These gravel drains are to be placed between the concrete and the rock both in case of vertical walls and under slabs.

The work must necessarily proceed intermittently and will be more expensive than a continuous operation; therefore additional time has been allowed.

It is estimated that the crew as shown will complete about 70 feet per hour.

OPERATION COSTS

	Quantity	Plant Rental	Material & Supplies	Labor
8" Gravel Drain	7,700 Lin.Ft.	$ 251.42	$ 205.84	$1,248.38
Cost of Gravel	(Section 17)	31.71	6.38	15.90
	Totals	$ 283.13	$ 212.22	$1,264.28

S U M M A R Y

PLANT RENTAL	$ 283.13
MATERIALS & SUPPLIES	212.22
LABOR.	1,264.28
TOTAL.	$ 1,759.63

EIGHT INCH GRAVEL DRAINS

Item No. 22

Quantity 7,700 Lin. Ft.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Truck, Dump, 4 cu. yd.	1	21	1	$ 9.00	$ 189.00
Small Tools		21	1		62.42
				Total	$ 251.42

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Truck	1	112	$ .32	$ 35.84
Lumber, 2000 Ft. B.M. at $45.00				90.00
Burlap, 2000 sq. yds. at .04				80.00
			Total	$ 205.84

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foreman	1	21	8	$6.38 day	$ 133.98
Carpenter	1	14	8	.80	89.60
Carpenter Helper	1	14	8	.55	61.60
Truck Driver	1	14	8	.60	67.20
Laborers	16	14	8	.50	896.00
				Total	$1,248.38

SAND FOR FILTERS

Item No. 23

Quantity - 81,000 Cu. Yds.

DESCRIPTION

This item comprises the furnishing and placing of processed sand for the filters in the foundation treatment. About 40,000 Cu. Yds. of this material has to be wet and rolled. The material is assumed to be hauled from the gravel plant located near the southwest corner of Borrow Area "C", and will be spread by the rolling crews.

Ten per cent has been allowed for shrinkage due to losses and compaction.

OPERATION COSTS

Year	Op. No.	Quantity	Plant Rental	Materials & Supplies	Labor
1939	7(C)	9,500	$ 799.19	$ 100.80	$ 623.76
"	12	48,000	4,016.04	554.40	3,520.80
1941	13	32,000	4,909.10	656.25	2,901.93
Cost of Sand (Section 17)			25,683.69	5,165.34	12,876.39
Wetting	("	20A)	78.56	101.09	1,492.06
Rolling	("	20B)	902.57	145.24	802.63
		Totals	36,389.15	6,723.12	22,217.57

S U M M A R Y

PLANT RENTAL	$ 36,389.15
MATERIALS & SUPPLIES	6,723.12
LABOR.	22,217.57
TOTAL.	$ 65,329.84

SAND FOR FILTERS

(Drainage Trench, Backfill)

Item No. 23 | Operation No. 7 (C)

Quantity 9500 Cu. Yds. | Date Aug. 22-Sept. 3, 1939

PLANT RENTAL

Designation		No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Linn Tractor Trucks	9 yd.	2	12	3	$ 32.00	$ 768.00
Small Tools						31.19
					Total	$ 799.19

MATERIALS & SUPPLIES (See Section 11)
8 Working days

Designation		No. Units	No. Hours	Rate/Hour	Amount
Linn Tractor Trucks	9 yd.	2	168	.30	$ 100.80
				Total	$ 100.80

LABOR

Designation	No. Men	Days	Hrs./ Day	Rate/Hour	Amount
Foreman	3	12	8	$5.16 day	$ 185.76
Tractor Operators	6	8	7½	.75	270.00
Laborers	6	8	7	.50	168.00
				Total	$ 623.76

BASIS OF ESTIMATE (Op. #7(c) 1939)

This sand is to be hauled from the processing plant and the Linns will load directly from the sand conveyor.

The Linns can operate on the following schedule:

East Side

Loaded	1,600	feet	at 8	M.P.H.	= 2.27	minutes
"	400	"	at 6	"	= 0.76	"
"	800	"	at 3	"	= 3.03	"
Dump and Turn					= 2.36	"
Empty	600	feet	at 5	"	= 1.36	"
"	600	"	" 2	"	= 3.40	"
"	1,600	"	" 10	"	= 1.82	"
Total Haul Time 1 Round Trip					= 15.00	"
Loading Time					= 3.33	"
Total Time for 1 Round Trip					= 18.33	"

West Side

Loaded	1,600	feet	at 8	M.P.H.	= 2.27	minutes
"	200	"	" 6	"	= 1.70	"
"	800	"	" 8	"	= 1.14	"
"	800	"	" 4	"	= 2.27	"
Dump and Turn					= 1.97	"
Empty	800	"	" 6	"	= 1.51	"
"	800	"	" 10	"	= 0.91	"
"	1,200	"	" 4	"	= 3.41	"
"	1,600	"	" 10	"	= 1.82	
Total Haul Time 1 Round Trip					=17.00	"
Loading Time					= 3.33	"
Total Time for 1 Round Trip					=20.33	"

20.33 + 18.33 = 38.66 ÷ 2 = 19 min. average time of 1 Round Trip.

1,260 ÷ 19 = 66.3 say 66 Round Trips per day. Using two Linns at 9 c.y. each 66 x 2 x 9 = 1188 c.y. per day. 9,500 ÷ 1,188 = say 8 days required

Section 43

SAND FOR FILTERS

(From Processing Plant)

ITEM NO. 27 | Operation No. 12

QUANTITY 48,000 Cu. Yds. | Date Sept. 1-30, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Linn Tractor Trucks	4	30	3	$ 32.00	$ 3,840.00
Small Tools					176.04
				Total	$ 4,016.04

MATERIALS & SUPPLIES (See Section 11) 22 Working Days

Designation	No. Units	No. Hours	Rate/Hour	Amount
Linn Tractor Trucks	4	462	$ .30	$ 554.40
			Total	$ 554.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foreman, General	3	30	8	$7.22 day	$ 649.80
Operators, Tractor	12	22	7-1/2	.75	1,485.00
Laborers	18	22	7	.50	1,386.00
					$3,520.80

BASIS OF ESTIMATE (Op. #12 - 1939)

This material is for Filter Treatment Downstream, both Terraces.

In order to deliver 48,000 yds. of sand in 22 working days, 2,180 yds. per day must be hauled.

The average haul to the Left Bank is 2,600 feet and to the Right Bank 3,500 feet.

The number of Linns required are shown in the following computations:

		Left Bank	Right Bank
Loaded 1,600 feet at 6 M.F.H.	=	3.02 minutes	3.02 minutes
" 700 " " 4 "	=	1.99 "	1.99 "
" 300 " " 3 "	=	1.14 "	
" 900 " " 6 "	=		1.70 "
" 300 " " 3 "	=		1.14 "
Dump and Turn	=	3.52 "	3.52 "
Empty 1,200 feet at 6 M.F.H.	=		2.28 "
" 300 " " 6 "	=	.57 "	
" 700 " " 3 "	=	2.65 "	2.65 "
" 1,600 " " 8 "	=	2.27 "	2.27 "
Total Haul Time Round Trip	=	15.16 "	18.57 "
Loading Time	=	3.33 "	3.33 "
Total Time		18.49 "	21.90 "

Average round trip time = 1/2 (18.49 + 21.90) = 20.2 min.

Trucks must complete 1/9 (2180) = 242 Trips per day

Each truck can complete 1250 ÷ 20.2 = 62.5, say 62 trips per day

Therefore number of trucks required = 242 ÷ 62 = 3.9, use 4 Linns.

SAND FOR FILTERS

River Section

Item No. 23

Quantity 32,000 Cu. Yds.

Operation No. 13

Date: June 10 to 21, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 4 2 c.y.	1	3	3	$ 102.00	$ 306.00
Linn Tractor Trucks 9 c.y.	14	3	3	32.00	1,344.00
Shovel No. 7 5/8 c.y.	1	9	3	30.00	270.00
Linn Tractor Trucks 9 c.y.	8	9	3	32.00	2,304.00
Bulldozers D8 90 H.P.	2	3	3	36.00	216.00
Bulldozers D8 90 H.P.	1	9	3	36.00	324.00
Small Tools		12	3		145.10
				Total	$ 4,909.10

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 4	1	42	$ .55	$ 23.10
Linn Tractor Trucks	14	42	.30	176.40
Shovel No. 7	1	126	.425	53.55
Linn Tractor Trucks	8	126	.30	302.40
Bulldozers	2	42	.48	40.32
Bulldozers	1	126	.48	60.48
			Total	$ 656.25

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	12	8	$ 7.22 day	$ 259.92
Foremen	3	12	8	5.16 "	185.76
Shovel Operators	3	2	7½	1.25	56.25
Oilers	3	2	7½	.60	27.00
Shovel Operators	3	6	7½	1.25	168.75
Oilers	3	6	7½	.60	81.00
Tractor Operators	48	2	7½	.75	540.00
Tractor Operators	27	6	7½	.75	911.25
Laborers	24	8	7	.50	672.00
				Total	$ 2,901.93

BASIS OF ESTIMATE (Op. #13 - 1941)

This filter sand is to be loaded both from the conveyor of the screening plant and by shovel No. 7 (5/8 cu. yd. capacity) during the time that gravel is being hauled (See Op. #14 - 1941 Section 41). For 3 days prior to the start of the gravel haul, No. 4 shovel will load sand from the stock pile.

From June 10 to 12, No. 4 shovel will load 6,000 cu. yds. and the Gravel Plant will load an additional 6,000 cu. yds. making 12,000 c.y. of sand in place when the gravel haul starts. During the time that the gravel is being hauled, 8 Linns will haul sand from the Plant and from the stock pile.

The Linn Tractor Trucks can operate as follows:

Loaded	1,600	feet	at 8	M.P.H.	= 2.27	minutes
"	1,400	"	" 6	"	= 2.65	"
"	600	"	" 7	"	= 2.27	"
Dump and Turn					= 2.09	"
Empty	600	feet	at 4	M.P.H.	= 1.70	"
"	1,900	"	" 3	"	= 7.20	"
"	1,600	"	" 10	"	= 1.82	"
Total Haul Time 1 Round Trip					=20.00	"
Loading Time No. 4 Shovel					= 3.7	"
" " No. 7 "					=10.9	"
" " Gravel Plant					= 3.5	"

32,000 c.y. - 12,000 c.y. from No. 4 Shovel & Plant June 10 to 12 = 20,000 c.y. from the No. 7 Shovel and the Plant June 13 to 21.

SCHEDULE OF EQUIPMENT & PLANT

Shovel #4 operates June 10 to 12 & 14 Linns = 2 working days

" #7 " " 13 to 21 & 8 " = 6 " "

LINE DRILLING FOR ROCK EXCAVATION

Item No. 24

Quantity - 68,000 Sq. Ft.

DESCRIPTION

Line drilling is to be done where concrete comes in contact with rock excavation.

It is proposed to do this work by means of wagon drills and drifters on quarry bars. Holes to be spaced 3" on centers.

It has been estimated that the wagon drills will drill at the rate of 15 feet per hour and the jack hammers 10 feet. Bits are estimated to drill 8 feet with 3 regrinds. The cost of grinding bits and all transportation is charged to the Shop (See Section 14A).

For rental charge on drill steel, see section 18.

It will be noted on Line Drilling in the Core Trench the Compressor Operator is charged at half time, since two compressors will be supervised by the one operator.

OPERATION COSTS

Plant Rental	Material & Supplies	Labor
$ 465.61	$ 192.00	$ 672.21
10,969.19	4,976.10	17,783.85
$ 11,434.80	$ 5,168.10	$ 18,456.06

S U M M A R Y

PLANT RENTAL	$ 11,434.80
MATERIALS & SUPPLIES	$ 5,168.10
LABOR	$ 18,456.06
TOTAL.....	$ 35,058.96

LINE DRILLING

(Core Trench)

Item No. 24 — Operation No. 21

Quantity 3,000 Sq. Ft. — Date Sept. 16 to 21, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Compressor 625 C.F.	1	6	3	$ 50.00	$ 300.00
Jackhammers	6	6	3	1.50	54.00
Drill Steel	6	6	3	.50	18.00
Hose, pipe, fittings etc.		6	3	10.00	60.00
Small Tools					33.61
				Total	$ 465.61

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No.Hrs.	Rate/Hr.	Amount
Compressor 625 cu. ft.	1	84	$ .50	$ 42.00
Rock Bits 600 at $ .25				150.00
			Total	$ 192.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	6	8	$ 7.22 day	$ 129.96
Compressor Operator	1½	4	7½	.85	38.25
Drillers	18	4	7	.75	378.00
Laborers	9	4	7	.50	126.00
				Total	$ 672.21

LINE DRILLING FOR ROCK EXCAVATION

Item No. 24

Quantity 65,000 Sq. Ft.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Compressors 315 cu. ft.	2	105	3	$ 23.00	$ 4,830.00
Wagon Drills	5	105	3	6.00	3,150.00
Drill Steel	5	105	3	2.00	1,050.00
Hose, pipe, fittings, etc.		105	3	10.00	1,050.00
Small Tools		105	3		889.19
				Total	$ 10,969.19

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Compressors	2	1,470	$ .565	$ 1,661.10
Rock Bits 6500 at $.24				1,560.00
" " 6500 at $.27				1,755.00
			Total	$ 4,976.10

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	105	8	$7.22 day	$ 2,274.30
Foremen	6	105	8	5.16 "	3,250.80
Compressor Operators	6	70	7½	.85	2,677.50
Drillers	15	70	7½	.75	5,906.25
Laborers	15	70	7	.50	3,675.00
				Total	$ 17,783.85

DRILLING 3" HOLES IN ROCK FOR GROUTING

Item No. 35

Quantity - 5,700 Lin. Ft.

DESCRIPTION

This drilling is called for in the grout cap trench and under the foundations of the spillway and approach channel walls. On account of the size of the holes it is proposed to use wagon drills wherever possible.

Due to the fact that much of this work will have to be done in more or less difficult positions the drills are figured at only 10 feet per hour. Drill steel is figured at $2.00 per day per wagon drill. (See Section 18).

S U M M A R Y

PLANT RENTAL	$ 944.49
MATERIALS & SUPPLIES	$ 359.38
LABOR	$ 1,609.83
Total	$ 2,913.70

DRILLING 3" HOLES IN ROCK FOR GROUTING

Item No. 25

Quantity 5,700 Lin. Ft.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Compressors 315 c.f.	2	9	3	$ 23.00	$ 414.00
Wagon Drills	5	9	3	6.00	270.00
Drill Steel		9	3	10.00	90.00
Pipe, Hose, Fittings, etc.		9	3	10.00	90.00
Small Tools		9	3		80.49
				Total	$ 944.49

MATERIALS & SUPPLIES (See Section 11) 6 Working Days

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Compressors	2	126	$ .565	$ 142.38
Bits 700 at $.31				217.00
			Total	$ 359.38

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	9	8	$ 6.38 day	$ 172.26
Foremen	3	9	8	5.16 "	139.32
Compressor Operators	6	6	7½	.60	162.00
Drillers	15	6	7½	.75	506.25
Laborers	30	6	7	.50	630.00
				Total	$1,609.83

DRILLING $2\frac{1}{2}$" HOLES IN ROCK FOR ANCHORS

Item No. 26

Quantity - 3,000 Lin. Ft.

DESCRIPTION

This work consists of drilling $2\frac{1}{2}$" holes in the rock walls and floor of the Stilling Basin, Approach Channel and Discharge Channel for the anchors. It is estimated that these holes will be $2\frac{1}{4}$" at bottom. Estimate is based on each jackhammer drilling two 6 foot holes per hour. One bit is figured for each 6 foot hole with an allowance of about 10% for loss and breakage. A large percentage of these holes will be drilled from a scaffold.

SUMMARY

PLANT RENTAL	$ 371.23
MATERIALS & SUPPLIES	$ 329.74
LABOR	$ 1,124.52
TOTAL.	$ 1,825.49

DRILLING 2½" HOLES IN ROCK FOR ANCHORS

Item No. 26

Quantity 3,000 Lin. Ft.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Compressor 315 c.f.	1	18	1	$ 11.50	$ 207.00
Jackhammer Drills	3	18	1	.75	40.50
Pipe, Hose & Fittings		18	1	3.00	54.00
Drill Steel	3	18	1	.25	13.50
Small Tools		18	1		56.23
				Total	$ 371.23

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Compressor	1	96	$ .565	$ 54.24
Bits 550 at $.31				170.50
Lumber 2000 Ft. B.M. at $45.00				90.00
Nails & Hardware				15.00
			Total	$ 329.74

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	18	8	$6.38 day	$ 114.84
Foremen	1	18	8	5.16 "	92.88
Compressor Operator	1	12	8	.60	57.60
Drillers, Jackhammer	3	12	8	.75	216.00
Carpenters	2	12	8	.80	153.60
Helpers	2	12	8	.55	105.60
Laborers	8	12	8	.50	384.00
				Total	$1,124.52

PRESSURE GROUTING

Item No. 27

Quantity - 2,300 Cu. Ft.

DESCRIPTION

This item consists of depositing cement grout, under pressure, in the foundation under the Grout Cap Trench, the Spillway Approach walls and Outlet Approach Walls as well as in anchor holes.

Estimate is based on depositing about 11 cu. ft. per hour. Provision is made for cleaning the holes with air and water and the scaffolds which will be necessary when grouting the anchor holes.

S U M M A R Y

PLANT RENTAL	$ 820.59
MATERIALS & SUPPLIES	$ 274.24
LABOR.	$ 1,969.80
TOTAL	$ 3,064.63

PRESSURE GROUTING

Item No. 27 | Operation No. 23

Quantity 2,300 cu. ft. | Date: Oct. 1 to 9, 1939
Various dates 1940
Various dates 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Grout Pump	1	15	3	$ 10.00	$ 150.00
Grout Mixer 10 cu. ft.	1	15	3	6.34	95.10
Compressor 315 cu. ft.	1	15	3	23.00	345.00
Hose, Pipe, Fittings, etc.	1	15	3	5.00	75.00
Pump 2" Reciprocating	1	15	3	1.00	15.00
Truck, Dump, 2 Cu. Yd.	1	6	1	7.00	42.00
Small Tools					98.49
				Total	$ 820.59

MATERIALS & SUPPLIES (See Section 11) 10 Working Days

Designation	No. Units	No.Hrs.	Rate/Hr.	Amount
Grout Pump	1	210	$ .07	$ 14.70
Grout Mixer	1	210	.115	24.15
Compressor	1	210	.565	118.65
Pump 2"	1	210	.07	14.70
Truck Dump 2 cu. yd	1	32	.22	7.04
Lumber 2000 Ft. B.M. at $45.				90.00
Nails & Hardware L.S.				5.00
			Total	$ 274.24

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	15	8	$6.38 day	$ 287.10
Grout Pump Operator	3	10	7½	.75	168.75
Grout Mixer Operator	3	10	7½	.75	168.75
Compressor Operators	3	10	7½	.60	135.00
Pump Operator	3	10	7½	.60	135.00
Truck Drivers	1	4	8	.60	19.20
Carpenters	2	10	8	.80	128.00
Helpers	2	10	8	.55	88.00
Laborers	24	10	7	.50	840.00
				Total	$1,969.80

FURNISHING CEMENT

ITEM NO. 28

Quantity 87,000 Bbls.

DESCRIPTION

This Item comprises furnishing all cement and delivering the same to the batching plant which is assumed to be located at the gravel plant near the Southwest corner of Borrow Area "C".

OPERATION COSTS

Year	Op. No.	Quantities	Plant Rental	Material & Supplies	Labor
1939	36	24,000 Bbls.	$ 2,911.99	$ 55,389.08	$3,429.72
1940	36-1	2,950 "	733.69	6,769.30	273.80
1940	36-2	36,900 "	2,737.98	84,855.00	4,359.60
1940	36-3	700 "	75.96	1,609.80	79.26
1940	36-4	9,950 "	706.66	22,856.90	1,023.16
1941	28	12,500 "	940.83	29,177.20	816.60
		87,000 Bbls.	$8,107.11	$200,657.28	$9,982.14

SUMMARY

S U M M A R Y

PLANT RENTAL.	$ 8,107.11
MATERIALS & SUPPLIES.	$ 200,657.28
LABOR	$ 9,982.14
TOTAL	$ 218,746.53

FURNISHING CEMENT

Item No. 28 | Operation No. 36

Quantity 24,000 Bbls. | Date Sept. 22 to 24) Oct. 16 to Dec.15) 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Trucks, Trailer, cement	2	63	2	$ 9.00	$ 1,134.00
Cement Silo	1	63	3	12.00	756.00
Cement Pump & Pipe	1	63	2	9.00	567.00
Car Puller, Capstan	1	63	2	1.50	94.50
Cement Elevator	1	63	2	3.00	189.00
Small Tools		63	2		171.49
				Total	$ 2,911.99

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Trucks, Trailer, Cement	2	588	$ .61	$ 717.36
Cement Pump	1	160	.50	80.00
Car Puller	1	588	.03	17.64
Cement Elevator	1	588	.16	94.08
Cement 24,000 bbls. at $2.27				54,480.00
			Total	$55,389.08

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	2	63	8	$7.22 day	$ 909.72
Truck Drivers	4	42	7½	.60	756.00
Laborers	12	42	7	.50	1,764.00
				Total	$ 3,429.72

BASIS OF ESTIMATE (Op. #36 - 1939)

It is estimated that the cement pump will handle 150 Bbls. of cement from car to silo in 1 hour.

One car of 300 Bbls. can be unloaded in 2 hours.

The silo has a capacity of 5,000 Bbls.

The cement Trucks (50 Bbls.) can be loaded in 10 minutes.

Hauling Time outbound	= 30	"
Unloading Time	= 10	"
Hauling Time Inbound	= 20	"
Total Time for 1 Round Trip	= 70	"

One truck will make 6 round trips in 7 hours and will haul 300 Bbls. Two trucks will haul 1,200 Bbls. in one day of two 7-hour shifts.

It is estimated that one cu. yd. of Class "A" concrete will require $5\frac{1}{2}$ sacks of cement and Class B $4\frac{1}{2}$ sacks.

Concrete Placed 1939

Op. # 23	250	c.y.		
" " 24	3,170	"		
" " 25	2,640	"		
" " 26	5,670	"		
" " 27	7,444	"		
" " 28	732	"		
" " 31	92	"		
Total	19,998	say	20,000	c.y.
Class "A"			3,700	"
" "B"			16,300	"

Cement Required

Class "A" (3700 c.y. x 5.5 sacks/c.y.) ÷ 4 sacks/Bbl.	=	5,100 Bbls.
" "B" (16300 " x 4.5 " ") ÷ 4 " "	=	18,400 "
Pressure Grouting	=	200 "
Total = say		24,000 Bbls.

FURNISHING CEMENT

Item No. 28 | Operation No. 36 Sheet #1

Quantity 2,950 Bbls. | Date June 1 to 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Trucks, Trailer, Cement	1	30	1	$ 6.00	$ 180.00
Cement Silo	1	30	2	9.00	270.00
Cement Pump	1	30	1	6.00	180.00
Car Puller	1	30	1	1.00	30.00
Cement Elevator	1	30	1	2.00	60.00
Small Tools					13.69
				Total	$ 733.69

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate /Hr.	Amount
Trucks, Trailer, Cement	1	56	$ .61	$ 34.16
Cement Pump	1	56	.50	28.00
Car Puller	1	56	.03	1.68
Cement Elevator	1	56	.16	8.96
Cement, 2950 Bbls. at $2.27				6,696.50
			Total	$6,769.30

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	10	8	$7.22 day	$ 72.20
Truck Drivers	1	7	8	.60	33.60
Laborers	6	7	8	.50	168.00
				Total	$ 273.80

BASIS OF ESTIMATE (Op. #36 Sheet #1, 1940)

It is assumed that there is at least space for 500 Bbl. storage at the batching plant for cement.

The cement trucks can operate as follows:

Loaded	3,000	feet	at	10	M.P.H.	= 3.42	minutes
"	2,000	"	"	2	"	= 11.36	"
"	8,000	"	"	20	"	= 4.56	"
"	2,800	"	"	12	"	= 2.66	"
Loading Time						= 9.33	"
Unloading Time						= 10.00	"
Empty 15,800 feet at 15 M.P.H.						= 12.00	"
Total Time for 1 Round Trip						= 53.33	"

The Truck can make 60 x 8 = 480 ÷ 53.33 = 9 round trips in 8 hours. 9 x 50 = 450 Bbls. per day.

The requirement during June is 421 Bbls. per day.

2,950 ÷ 450 = 6.55 say 7 days required.

Since the material is required for the entire period covered by this operation, Plant Rental is therefore charged for the full 30 days.

Concrete placed in 1940

Op. # 28 (A)	7,345	c.y.
" " 28 (B)	570	"
" " 29	18,500	"
" " 30	9,410	"
" " 31	8,850	"
Total	44,675	"

Cement required

(44,675 c.y. x 4.5 sacks/c.y.) ÷ 4 sacks/Bbl.	= 50,300	Bbls.
Pressure Grouting	= 200	"
Total	50,500	"

Requirements for June
(7,345 ÷ 3) x (4.5 ÷ 4) = 2750 + 200 = 2,950 Bbls.

FURNISHING CEMENT

Item No. 28 | Operation No. 36 Sheet #2

Quantity 36,900 Bbls. | Date July 1 - Aug. 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Truck, Trailer, Cement	1	60	3	$ 12.00	$ 720.00
Cement Silo	1	60	3	12.00	720.00
Cement Pump	1	60	3	12.00	720.00
Car Puller	1	60	3	2.00	120.00
Cement Elevator	.1	60	3	4.00	240.00
Small Tools	1	60	3		217.98
				Total	$2,737.98

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Trucks	1	840	$ .61	$ 512.40
Cement Pump	1	840	.50	420.00
Car Puller	1	840	.03	25.20
Cement Elevator	1	840	.16	134.40
Cement, 36,900 Bbls. at $2.27				83,763.00
			Total	$84,855.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	60	8	$ 7.22 day	$ 1,299.60
Truck Drivers	3	40	7½	.60	540.00
Laborers	18	40	7	.50	2,520.00
				Total	$ 4,359.60

BASIS OF ESTIMATE (Op. #36 Sheet #2, 1940)

36,900 ÷ 40 = 922 Bbls. required per working day.

It is assumed that there is storage for 500 Bbls. of cement at the batching plant.

The Truck will operate as follows:

Loaded	3,000	feet	at	8	M.F.H.	=	4.26 minutes
"	2,000	"	"	2	"	=	11.36 "
"	8,000	"	"	15	"	=	6.08 "
"	2,800	"	"	8	"	=	3.98 "
Loading Time						=	9.32 "
Unloading Time						=	10.00 "
Empty	15,800	feet	at	10	M.F.H.	=	18.00 "
Total Time for 1 Round Trip						=	63.00 "

1,260 ÷ 63 = 20 round trips at 50 bbls. = 1000 Bbls. per day.

Cement requirements for July and August:

Op. # 28A	7345 x 2/3	=	say	4,900 c.y.
" 29		=		18,500 "
" 30		=		9,400 "
	Total	=		32,800 "

(32,800 c.y. x 4.5 sacks/ c.y.) ÷ 4 sacks/Bbl. = 36,900 Bbls.

FURNISHING CEMENT

Item No. 28 | Operation No. 36 Sheet #3

Quantity 700 Bbls. | Date Sept. 1 to 3, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Truck, Cement, Trailer	1	3	1	$ 6.00	$ 18.00
Cement Silo	1	3	2	9.00	27.00
Cement Pump	1	3	1	6.00	18.00
Car Puller	1	3	1	1.00	3.00
Cement Elevator	1	3	1	2.00	6.00
Small Tools					3.96
				Total	$ 75.96

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Trucks	1	16	$ .61	$ 9.76
Cement Pump	1	16	.50	8.00
Car Puller	1	16	.03	.48
Cement Elevator	1	16	.16	2.56
Cement, 700 bbls. at $2.27				1,589.00
			Total	$ 1,609.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	3	8	$7.22 day	$ 21.66
Truck Drivers	1	2	8	.60	9.60
Laborers	6	2	8	.50	48.00
				Total	$ 79.26

BASIS OF ESTIMATE (Op. #36 Sheet #3, 1940)

As storage is provided for 500 Bbls. of cement at the batching plant, this month's cement can be hauled in two days of 7 hours each.

The Truck can operate as follows:

Loaded	3,000	feet	at	6	M.P.H.	=	5.67 minutes
"	2,000	"	"	2	"	=	11.36 "
"	8,000	"	"	10	"	=	9.12 "
"	2,800	"	"	8	"	=	3.98 "
Loading Time						=	10.44 "
Unloading Time						=	10.00 "
Empty 15,800 feet at 10 M.P.H.						=	18.00 "
Total Time for 1 Round Trip						=	68.57 " say 70 min.

8 x 60 = 480 ÷ 70 = say 7 round trips in 1 day of 8 hours

7 x 50 = 350 Bbls. per day = 700 Bbls. in 2 days.

Cement requirements for Sept.

Op. #28B = 570 c.y.

(570 x 4.5) ÷ 4 = 640 Bbls. Say 700

FURNISHING CEMENT

Item No. 28 | Operation No. 36 Sheet #4

Quantity 9,950 Bbl. | Date Oct 12 - 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Trucks, Trailer, Cement	1	19	2	$ 9.00	$ 171.00
Cement Silo	1	19	3	12.00	228.00
Cement Pump	1	19	2	9.00	171.00
Car Puller	1	19	2	1.50	28.50
Cement Elevator	1	19	2	3.00	57.00
Small Tools		19	2		51.16
				Total	$ 706.66

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Trucks	1	208	$ .61	$ 126.88
Cement Pump	1	208	.50	104.00
Car Puller	1	208	.03	6.24
Cement Elevator	1	208	.16	33.28
Cement, 9950 Bbls. at $2.27				22,586.50
			Total	$ 22,856.90

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	2	19	8	$ 7.22 day	$ 274.36
Truck Drivers	2	13	8	.60	124.80
Laborers	12	13	8	.50	624.00
				Total	$ 1,023.16

BASIS OF ESTIMATE (Co. #36 Sheet #4, 1940)

9,950 ÷ 13 = 765 Bbls. of cement are required per day.

The cement silo at the batching plant will hold at least 500 Bbls.

The truck can operate as follows:

Loaded	3,000	feet	at	8	M.P.H.	=	4.36	minutes
"	3,000	"	"	3	"	=	11.36	"
"	8,000	"	"	18	"	=	5.04	"
"	2,800	"	"	8	"	=	3.98	"
Unloading Time						=	10.00	"
Loading Time						=	11.85	"
Empty 15,800 feet at 12 M.P.H.						=	13.51	"
Total Time for 1 Round Trip						=	60.00	"

8 round trips in 8 hours = 8 x 50 = 400 Bbls. in 1 shift or 800 Bbls. in one day of 16 hours.

9,950 ÷ 800 = 12.4 say 13 days required.

Cement requirements for October:

Co. #31 = 8,850 c.y.

(8,850 x 4.5) ÷ 4 = 9,956 Bbls. say 9,950.

FURNISHING CEMENT

Item No. 28 | Operation No. 36

Quantity 12,500 Bbls. | Date Sept. 16 to Oct. 15, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Trucks, Trailer, Cement	2	30	1	$ 6.00	$ 360.00
Cement Silo	1	30	2	9.00	270.00
Cement Pump	1	30	1	6.00	180.00
Car Puller	1	30	1	1.00	30.00
Cement Elevator	1	30	1	2.00	60.00
Small Tools		30	1		40.83
				Total	$ 940.83

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Trucks	2	420	$ .61	$ 512.40
Cement Pump		420	.50	210.00
Car Puller		420	.03	12.60
Cement Elevator		420	.16	67.20
Cement 12,500 Bbls. at $2.27				28,375.00
			Total	$ 29,177.20

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	30	8	$ 7.22 day	$ 216.60
Truck Drivers	2	20	7½	.60	180.00
Laborers	6	20	7	.50	420.00
				Total	$ 816.60

BASIS OF ESTIMATE (Op. #36 - 1941)

The cement is to be hauled by truck from Franklin to the batching plant a distance of 15,800 feet via a paved road except about half a mile near the plant which would be gravel surface.

Fifty Bbl. trailer trucks are proposed and are available from Conchas Dam at very small cost as well as the cement silo, cement pump, cement elevator and car puller.

About 625 Bbls. a day are required for this part of the operations.

The trucks can operate as follows:

Loaded	3,000	feet	at	6	M.P.H.	=	5.68 minutes
"	2,000	"	"	2	"	=	11.36 "
"	8,000	"	"	15	"	=	6.08 "
"	2,800	"	"	10	"	=	3.20 "
Unloading Time						=	10.00 "
Return 15,800 feet at 15 M.P.H.						=	12.01 "
Loading Time						=	11.67 "
Total Time for one Round Trip						=	60.00 "

In 7 hours one truck would haul 7 x 50 = 350 Bbls. and 2 trucks would haul 350 x 2 = 700 Bbls. which is more than is required.

Cement requirements for 1941:

Total cement required	87,000 Bbls.
Required in 1939 = 24,000 Bbls.	
" " 1940 = 50,500 "	74,500 "
" " 1941 =	12,500 "

CONCRETE

(Intake Structure, Bridge Piers and Conduit Transition)

Item No. 29

Quantity - 18,000 cu. yds.

DESCRIPTION

This Item covers the furnishing, placing, finishing and curing of all concrete in the Intake Structure, Bridge Pier and Abutment and Conduit Transition.

It is proposed to batch the concrete at the gravel plant, haul and mix it in 4 cu. yd. transit mixers and deposit it in the forms by means of a Pumpcrete machine.

For detailed calculations of cost of sand and gravel see Section 17 and for costs of water for washing rock surfaces see Section 20A.

OPERATION COSTS

Year	Op. No.	Quantity	Plant Rental	Material & Supplies	Labor
1939	25	2,640 c.y.	$ 2,335.09	$ 1,162.00	$ 5,104.14
"	27	7,444 "	7,171.62	21,739.70	30,241.16
1940	28A	7,345 "	9,547.08	12,889.19	45,156.00
"	28B(1)	480 "	1,820.94	1,127.68	2,608.80
"	28B(2)	90 "	354.52	546.80	729.16
	Aggregates	24,300 "	7,705.11	1,549.60	3,862.92
	Water		78.56	101.09	1,492.05
		Totals	$29,012.92	$39,116.06	$89,194.23

S U M M A R Y

PLANT RENTAL	$ 29,012.92
MATERIALS & SUPPLIES	39,116.06
LABOR.	89,194.23
TOTAL	$ 157,323.21

CONCRETE

(Intake & Transition Inverts)

Item No. 29 | Operation No. 25

Quantity 2,640 cu. yds. (Class "A") | Date Oct. 25 to 31, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Transit Mixers	4	6	3	$ 30.00	$ 720.00
Pumpcrete #200	1	6	3	90.00	540.00
Vibrators	6	6	3	3.33	119.88
Boiler, steam 90 H.P.	1	20	3	10.00	200.00
Pipe, Tarpaulins, etc.		20	3	25.00	500.00
Small Tools		12	3		255.21
				Total	$ 2,335.09

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Transit Mixers	4	84	$ .43	$ 144.48
Pumpcrete	1	84	.50	42.00
Vibrators	6	84	.005	2.52
Boiler, steam 90 H.P.	1	480	1.35	648.00
Lumber 5,000 Ft. B.M. at $45				225.00
Nails & Hardware L.S.				100.00
			Total	$ 1,162.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	12	8	$ 7.22 day	$ 259.92
"	6	12	8	6.38 "	459.36
" Carpenter	3	6	8	7.22 "	129.96
Carpenters	12	4	7	.80	268.80
" Helpers	12	4	7	.55	184.80
Laborers	66	8	7	.50	1,848.00
Mixer Operators	12	4	7½	1.00	360.00
Pumpcrete Operators	3	4	7½	1.25	112.50
Firemen	3	20	8	.60	288.00
Laborers (Curing)	12	20	7	.50	840.00
Steam Fitters (Curing)	3	2	7	1.00	42.00
" " Helpers	12	2	7	.60	100.80
Finishers	6	4	7	1.25	210.00
				Total	$ 5,104.14

Note: For Basis of Estimate see Op. #24 - 1939 Section 50.

CONCRETE

(Transition & Gate House below elev. 334)

Item No. 39 | Operation No. 27

Quantity 7,444 cu. yds. | Date Nov. 12 to Dec. 3, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Transit Mixers 4 yd.	3	22	3	$ 30.00	$ 1,980.00
Pumpcrete #200 & Pipe	1	22	3	90.00	1,980.00
Vibrators	6	22	3	3.33	439.56
Boiler, Steam 90 H.P.	1	36	3	10.00	360.00
Pipe, Fittings & Tarpaulin		36	3	25.00	900.00
Small Tools		22	3		1,512.06
				Total	$ 7,171.62

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Transit Mixers 4 yd.	3	315	$ .43	$ 406.35
Pumpcrete #200	1	315	.50	157.50
Vibrators	6	315	.005	9.45
Boiler Steam 90 H.P.	1	864	1.35	1,166.40
Lumber 200,000 ft.B.M. at $65.00				13,000.00
Masonite 50,000 sq. ft. at .08				4,000.00
Nails & Hardware L.S.				3,000.00
			Total	$ 21,739.70

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	22	8	$ 7.22 day	$ 476.52
"	6	22	8	6.38 "	842.16
" Carpenter	6	60	8	7.22 "	2,599.20
Carpenters	48	40	7	.80	10,752.00
" (Helpers)	48	40	7	.55	7,392.00
Mixer Operators	9	15	7½	1.00	1,012.50
Pumpcrete Operators	3	15	7½	1.25	421.88
Firemen	3	36	8	.60	518.40
Laborers (Placing)	66	15	7	.50	3,465.00
" (Curing)	12	36	7	.50	1,512.00
Steamfitters	3	10	7	1.00	210.00
" Helpers	6	10	7	.60	252.00
Finishers	6	15	7	1.25	787.50
				Total	$ 30,241.16

BASIS OF ESTIMATE (Op. #27 - 1939)

It is assumed that the pumpcrete will be moved to a point near the upstream end of the conduit section. This would indicate a haul of 4,000 feet for the concrete from the batching plant.

It is assumed that 4 board feet of lumber will be required for forms for each sq. ft. of surface to be formed.

The Transit Mixers should operate on the following schedule:

Loaded	1,600	feet	at	15	M.F.H.	=	1.28	Min.
"	900	"	"	6	"	=	1.71	"
"	800	"	"	12	"	=	0.72	"
"	700	"	"	4	"	=	1.96	"
Discharge and turn						=	5.35	"
Empty	1500	feet	at	10	M.F.H.	=	1.65	"
"	900	"	"	3	"	=	3.42	"
"	1600	"	"	20	"	=	0.91	"
Loading and lost time						=	10.00	"
Total time for one round trip						=	27.00	"
							Say 30 minutes	

2 trips per hour = 168 cu. yd. per day X 3 mixers = 504 cu. yd. (say 500)

7,444 ÷ 500 = say 15 working days required.

It is estimated that there will be 7 sq. ft. of formed surface per cu. yd. of concrete. 7,444 X 7 Sq. Ft. per cu. yd. = 52,100 sq. Ft. (say 50,000)

50,000 X 4 = 200,000 ft. B.M. of lumber.

Due to the intricate nature of the forms in the Intake Structure, it is estimated that carpenter labor will amount to approximately 40 cents per sq. ft. This would indicate about $20,000 for carpenter labor.

CONCRETE

(Intake Structure above Elev. 334)

Item No. 39 — Operation No. 28A

Quantity 7,345 cu. yds. — Date June 1 to Aug. 31, 1940.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumpcrete No. 160 & Pipe	1	90	3	$ 34.00	$ 3,060.00
Transit Mixers 4 c.y.	2	54	3	30.00	3,240.00
Hoist, gas, blocks, cable etc.	1	90	3	3.00	270.00
Vibrators	4	54	3	3.33	719.28
Small Tools		90	3		2,257.80
				Total	$ 9,547.08

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Pumpcrete No. 160	1	756	$ .26	$ 196.56
Transit Mixers	2	756	.43	650.16
Hoist, Gasoline 25 H.P.	1	1,890	.115	217.35
Vibrators	4	756	.005	15.12
Lumber 120,000 Ft. B.M. at $45				5,400.00
Masonite 40,000 Sq. Ft. at $.08				3,200.00
Burlap 6,000 yds. at $0.35				210.00
Nails & Hardware L.S.				3,000.00
			Total	$ 12,889.19

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen General	3	90	8	$7.22 day	$ 1,949.40
" Carpenter	3	90	8	7.22 "	1,949.40
"	6	90	8	6.38 "	3,445.20
Carpenters	30	60	7	.80	10,080.00
" Helpers	30	60	7	.55	6,930.00
Hoist Operators	3	60	7	1.00	1,260.00
Mixer	6	36	7½	1.00	1,620.00
Pumpcrete Operators	3	36	7½	1.00	810.00
Laborers	66	36	7	.50	8,316.00
Finishers	12	60	7	1.25	6,300.00
Laborers (Curing)	6	104	8	.50	2,496.00
				Total	$45,156.00

BASIS OF ESTIMATE (Co. #28A - 1940)

It is proposed to pour concrete 2 days (3 shifts) in 5 allowing 2 days for setting and one day for raising forms.

The forms are figured to be used three times on the inside of the structure and on the outside the form is figured to be only 6 feet high and to be moved up as on dam construction.

The Transit Mixers can operate upon the following schedule:

Loaded 1,600 feet at 15 M.P.H.	=	1.22	minutes
" 900 " " 6 "	=	1.70	"
" 1,700 " " 8 "	=	2.42	"
" 500 " " 3 "	=	1.90	"
Discharge and Turn	=	10.08	"
Empty 500 feet at 4 M.P.H.	=	1.42	"
" 1,700 " " 10 "	=	1.94	"
" 900 " " 3 "	=	3.41	"
" 1,600 " " 30 "	=	0.91	"
Total Haul Time 1 Round Trip	=	25.00	"
Loading Time	=	5.00	"
Total Time for 1 Round Trip	=	30.00	"

The 2 mixers will haul 16 cu. yds. per hour on the above schedule.

It is estimated that the pumpcrete will handle 15 cu. yds. of concrete per hour, but due to the height of the structure about 200 c.y. per day is estimated.

The total estimated square feet of forms is 120,000.

The water for curing will be furnished from the system used for wetting the embankment.

CONCRETE

(Bridge Pier)

Item No. 29 — Operation No. 28B, Sheet #1

Quantity 480 cu. yds. — Date Sept. 1 to 21, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumpcrete #160 & Pipe	1	21	2	$ 25.50	$ 535.50
Transit Mixers 4 yd.	2	21	2	22.50	945.00
Vibrators	4	21	2	2.50	210.00
Small Tools		21	2		130.44
				Total	$1,820.94

MATERIALS & SUPPLIES (See Section No. 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Pumpcrete	1	112	$ .26	$ 29.12
Transit Mixers	2	112	.43	96.32
Vibrators	4	112	.005	2.24
Lumber 12,000 Ft. B.M. at $45.00				540.00
Masonite 2,000 sq. ft. at $.08				160.00
Nails & Hardware L.S.				300.00
			Total	$ 1,127.68

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	2	21	8	$ 7.22 day	$ 303.24
Foremen Carpenter	2	21	8	7.22 "	303.24
Foremen	2	21	8	5.16 "	216.72
Pumpcrete Operator	2	7	8	1.00	112.00
Mixer Operators	4	7	8	1.00	224.00
Carpenters	6	14	8	.80	537.60
Laborers	24	7	8	.50	672.00
Finishers	2	12	8	1.25	240.00
				Total	$ 2,608.80

BASIS OF ESTIMATE (Op. #28B Sheet #1, 1940)

It is proposed to pour this pier in seven pours at 2 shifts per day. Between each pour will be 2 days for the concrete to set and for the carpenters to erect forms. This calls for 21 days of operation in all.

The forms are quite intricate and for this reason about 20¢ per sq. ft. has been allowed for carpenter labor.

The Transit Mixers can operate at the rate of two round trips per hour which will more than handle the amount of concrete required. (See Op. #28A - 1940).

It is estimated that the #160 pumpcrete can handle 15 cu. yds. of concrete per hour.

CONCRETE

(Bridge Abutment)

Item No. 29 — Operation No. 28B Sheet No. 2

Quantity 90 cu. yds. — Date Sept. 22 to 30, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumpcrete #160	1	9	1	$ 17.00	$ 153.00
Transit Mixers	1	9	1	15.00	135.00
Vibrators	2	9	1	1.67	30.06
Small Tools					36.46
				Total	$ 354.52

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Pumpcrete #160	1	24	$ .26	$ 6.24
Transit Mixer	1	24	.43	10.32
Vibrators	2	24	.005	.24
Lumber 6000 Ft. B.M. at $45				270.00
Masonite 2000 Sq. ft. at .08				160.00
Nails & Hardware L.S.				100.00
			Total	$ 546.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	9	8	$ 7.22 day	$ 64.98
Foremen, Carpenter	1	9	8	7.22 "	64.98
Pumpcrete Operator	1	3	8	1.00	24.00
Mixer Operator	1	3	8	1.00	24.00
Carpenters	8	6	8	.80	307.20
Laborers	12	3	8	.50	144.00
Teamsters	2	5	8	1.25	100.00
				Total	$ 729.16

BASIS OF ESTIMATE (Op. #28B Sheet #2 - 1940)

It is proposed to make three pours of this abutment or three days of 8 hours each.

As with the pier, there will be 2 days between pours to allow the concrete to set and the forms and steel to be placed.

Due to the shape of the structure, the cost of labor on the forms has been estimated at about 20¢ per sq. ft. of formed surface.

The Transit Mixer can handle 8 yds. per hour which will be sufficient.

The pumpcrete is assumed to have a capacity of 15 cu. yds. per hour.

CONCRETE

(Conduits)

Item No. 30

Quantity - 8,800 cu. yds.

DESCRIPTION

This Item includes furnishing, placing, finishing and curing all concrete in the Conduits.

The cost of aggregates is shown in Section No. 17 and the cost of water for washing rock surfaces in Section No. 20A.

OPERATION COSTS.

Year	Op. No.	Quantity	Plant Rental	Material & Supplies	Labor
1939	24	3,170 c.y.	$ 2,651.94	$ 1,311.65	$ 6,141.65
"	26	5,670 "	4,627.57	14,300.40	19,336.14
	Aggregates	11,880 "	3,766.94	757.58	1,888.54
	Water		39.28	50.55	746.03
		Totals	$ 11,085.73	$ 16,420.18	$ 28,112.36

S U M M A R Y

PLANT RENTAL	$ 11,085.73
MATERIALS & SUPPLIES	16,420.18
LABOR.	28,112.36
TOTAL.	$ 55,618.27

CONCRETE

(Conduit Invert)

Item No. 30 | Operation No. 24

Quantity 3,170 (Class "B") cu. yds. | Date Oct. 16 to 24, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Transit Mixers 4 yd.	4	7	3	$ 30.00	$ 840.00
Pumpcrete No. 200 & Pipe	1	7	3	90.00	630.00
Vibrators	6	7	3	3.33	139.86
Boiler, steam 90 H.P.	1	21	3	10.00	210.00
Tarpaulin, Pipe & Fittings		21	3	25.00	525.00
Small Tools		15	3		307.08
				Total	$2,651.94

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Transit Mixers 4 yd.	4	105	$ .43	$ 180.60
Pumpcrete No. 200	1	105	.50	52.50
Vibrators	6	105	.005	3.15
Boiler, Steam 90 H.P.	1	504	1.35	680.40
Lumber 6000 Ft. B.M. at $45				270.00
Nails & Hardware L.S.				125.00
			Total	$ 1,311.65

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	15	8	$ 7.22 day	$ 324.90
Foremen	6	15	8	6.38 "	574.20
" (Carpenter)	3	7	8	7.22	151.62
Carpenters	12	5	7	.80	336.00
" Helpers	12	5	7	.55	231.00
Laborers	66	10	7	.50	2,310.00
Mixer Operators	12	5	7½	1.00	450.00
Pumpcrete Operators	3	5	7½	1.25	140.63
Firemen	3	21	8	.60	302.40
Laborers (Curing)	12	21	7	.50	882.00
Steam Fitters (Curing)	3	3	7	1.00	63.00
" " Helpers	9	3	7	.60	113.40
Finishers	6	5	7	1.25	262.50
				Total	$ 6,141.65

BASIS OF ESTIMATE (Op. #24 - 1939)

It is estimated that approximately 650 cu. yds. per day of concrete will be placed.

The Transit Mixers will operate as follows:

Loaded	1,600	feet	at	15	M.P.H.	=	1.28	minutes
"	900	"	"	6	"	=	1.71	"
"	800	"	"	10	"	=	0.88	"
"	700	"	"	4	"	=	1.96	"
Discharge & Turn						=	5.00	"
Empty	1,500	feet	at	10	M.P.H.	=	1.65	"
"	900	"	"	4	"	=	2.52	"
"	1,600	"	"	20	"	=	.91	"
Load and Lost Time						=	11.09	"
Total Time for Round Trip						=	27.00 say 30 min.	

1260 min. ÷ 30 = 42 round trips per day 21 hours.

At 4 yds. per trip = 168 cu. yds. per Truck per day.

3,170 ÷ 5 = 634 cu. yds. required per day.

634 ÷ 168 = 3.8 say 4 Mixers required.

It is assumed that the #200 Pumpcrete will handle up to 50 yds per hour, if necessary.

Curing and protecting concrete is assumed at approximately 14 days.

This concrete will be placed between sta. 17+32.5 and sta. 21 + 25.

CONCRETE

(Conduit Above Invert)

Item No. 30 | Operation No. 26

Quantity 5,670 cu. yds. | Date Nov. 1 to 12, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Transit Mixers	4	12	3	$ 30.00	$ 1,440.00
Pumpcrete #200 & Pipe	1	12	3	90.00	1,080.00
Vibrators	6	12	3	3.33	239.76
Boiler, steam, 90 H.P.	1	26	3	10.00	260.00
Pipe, Fittings & Tarpaulin		26	3	25.00	650.00
Small Tools		12	3		957.81
				Total	$ 4,627.57

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No.Hrs.	Rate/Hr.	Amount
Transit Mixers	4	168	$ .43	$ 288.96
Pumpcrete #200	1	168	.50	84.00
Vibrators	6	168	.005	5.04
Boiler, Steam, 90 H.P.	1	624	1.35	842.40
Lumber 200,000 Ft. B.M. at $45				9,000.00
Masonite 26,000 Sq. Ft. at $.08				2,080.00
Nails & Hardware L.S.				2,000.00
			Total	$ 14,300.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	12	8	$ 7.22 day	$ 259.92
Foremen	6	12	8	5.16 "	371.52
Foremen Carpenter	6	60	8	7.22 "	2,599.20
Carpenters	30	39	7	.80	6,552.00
Carpenters Helpers	30	39	7	.55	4,504.50
Mixer Operators	12	8	$7\frac{1}{2}$	1.00	720.00
Pumpcrete Operators	3	8	$7\frac{1}{2}$	1.25	225.00
Firemen	3	26	8	.60	374.40
Laborers	66	8	7	.50	1,848.00
Laborers (Curing)	12	26	7	.50	1,092.00
Steamfitters "	3	8	7	1.00	168.00
" Helpers(Curing)	6	8	7	.60	201.60
Finishers	6	8	7	1.25	420.00
				Total	$ 19,336.14

BASIS OF ESTIMATE (Op. #26 - 1939)

Due to the length of time the forms of the arch are required to remain in place, it is not economical to use steel forms for this work. It is estimated that it will be necessary to construct a timber form for the entire length of one conduit and to move it to the other side as soon as the specifications allow wrecking.

It is estimated that the labor for erecting and removing the form the first time will cost 12¢ per sq. ft. for the walls and 24¢ per sq. ft. for the arch, and it is estimated that to re-erect and wreck the form will cost one-half as much as to build it originally. The average cost of carpenter labor per sq. ft. of form would be 22¢.

Due to the difficulty in pouring this concrete and to the weather conditions to be anticipated at the time of year, it is estimated that about 700 cu. yds. per day will be the average output.

The pumpcrete will be located near the downstream end of the Conduit Section and the average haul will be 3,600 feet from the batching Plant.

The Transit Mixers are estimated to operate on the following schedule:

Loaded	1,600	feet	at	15	M.P.H.	= 1.28	minutes
"	900	"	"	6	"	= 1.71	"
"	800	"	"	10	"	= 0.88	"
"	300	"	"	4	"	= 0.84	"
Discharge and Turn						= 7.09	"
Empty	1,100	feet	at	8	"	= 1.54	"
"	900	"	"	4	"	= 2.52	"
"	1,600	"	"	20	"	= .91	"
Load and Lost Time						= 10.23	"
Total Time for one Round Trip						= 27.00	"

Each Mixer will haul 46 batches of 4 yds. each per day and four Mixers will haul 4 x 4 x 46 = 736 cu. yds. per day. Placing concrete will take approximately 8 days.

CONCRETE

(Outlet Approach Channel Walls, Spillway Walls and Weir)

Item No. 71

Quantity - 29,500 cu. yds.

DESCRIPTION

This Item includes furnishing, placing, finishing and curing of all concrete entering into the above named structures.

The cost of aggregates is shown in Section No. 17 and the cost of water for washing rock surfaces is shown in Section No. 20A.

OPERATION COSTS

Year	Op. No.	Quantities	Plant Rental	Material & Supplies	Labor
1940	30	9,410 c.y.	$ 5,949.71	$ 11,186.50	$ 22,402.65
"	31	8,850 "	6,722.34	14,433.45	23,954.33
1941	30	10,780 "	9,663.34	15,270.60	24,478.86
	Aggregates	39,825 "	12,627.81	2,539.63	6,330.89
	Water		117.85	151.65	2,238.09
		Totals	$ 35,081.05	$ 43,581.83	$ 79,404.82

S U M M A R Y

PLANT RENTAL	$ 35,081.05
MATERIALS & SUPPLIES	43,581.83
LABOR	79,404.82
TOTAL	$ 158,067.70

CONCRETE

(Spillway Wall)

Item No. 31 | Operation No. 30

Quantity - 9,410 cu. yds. | Date Aug. 10 to 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumpcrete #200 & Pipe	1	21	3	$90.00	$ 1,890.00
Transit Mixers 4 cu. yd.	4	21	3	30.00	2,520.00
Vibrators	6	21	3	3.33	419.58
Small Tools		21	3		1,120.13
				Total	$ 5,949.71

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Pumpcrete	1	294	$ .50	$ 147.00
Transit Mixers	4	294	.43	505.68
Vibrators	6	294	.005	8.82
Lumber 150,000 Ft. BM at $45.00				6,750.00
Masonite 20,000 Sq. Ft. at $.08				1,600.00
Burlap 5,000 Sq. yds. at $.035				175.00
Nails and Hardware				2,000.00
			Total	$11,186.50

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	30	8	$ 7.22 day	$ 649.80
"	6	21	8	5.16 "	650.16
" Carpenter	3	21	8	7.22 "	454.86
" "	6	21	8	6.38 "	803.88
Carpenters	66	14	7	.80	5,174.40
Helpers (Carpenter)	72	14	7	.55	3,880.80
Pumpcrete Operators	3	14	7½	1.25	393.75
Mixer Operators	12	14	7½	1.00	1,260.00
Finishers	6	14	7	1.25	735.00
Laborers	120	20	7	.50	8,400.00
				Total	$22,402.65

BASIS OF ESTIMATE (Op. #30 - 1940)

It is assumed that the pumpcrete will be set up in the spillway and that the transit mixers will travel by way of construction roads Nos. 1 and 2 and the concrete highway.

It is estimated that carpenter work on forms will amount to approximately 24¢ per sq. ft. of form.

The Transit Mixers can operate as follows:

Loaded	1,600	feet	at	15	M.P.H.	= 1.22	minutes
"	900	"	"	6	"	= 1.70	"
"	1,800	"	"	15	"	= 1.37	"
"	1,200	"	"	3	"	= 4.55	"
"	1,100	"	"	15	"	= 0.84	"
Discharge						= 5.66	"
Empty	4,100	"	"	20	"	= 2.34	"
"	1,200	"	"	4	"	= 3.41	"
"	1,600	"	"	20	"	= 0.91	"
Total Haul Time, 1 Round Trip						= 22.00	"
Loading and Lost Time						= 8.00	"
Total Time for 1 Round Trip						= 30.00	"

Each Mixer will haul 8 cu. yds. per hour or 168 yds. per day. Four mixers will haul 4 x 8 x 21 = 672 cu. yds. per day.

9,410 ÷ 672 = 14 working days.

The labor foreman and laborers are provided for 6 days extra to clean up the rock under the wall.

Volume in Spillway Channel (East Wall)

Station	to	Station	C.Y.
20 + 00		27 + 25	9725.8
23 + 55		23 + 85	317.0 (Not placed until 1941)
			9408.8 (Say 9410)

CONCRETE

(Outlet Approach Channel Walls)

Item No. 31 | Operation No. 31

Quantity 8,850 Cu. Yds. | Date Oct. 12 to 31, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Transit Mixers 4 cu. yd.	4	19	3	$ 30.00	$ 2,280.00
Pumpcrete #200 & Pipe	1	19	3	90.00	1,710.00
Vibrators	6	19	3	3.33	379.62
Boiler, Steam, 90 H.P.	1	33	3	10.00	330.00
Pipe, Tarpaulin, Burlap etc.		33	3	25.00	825.00
Small Tools					1,197.72
				Total	$ 6,722.34

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Transit Mixers 4 cu. yd.	4	273	$ .43	$ 469.56
Pumpcrete #200	1	273	.50	136.50
Vibrators	6	273	.005	8.19
Boiler, Steam, 90 H.P.	1	792	1.35	1,069.20
Lumber 150,000 Ft. B.M. at $45.00				6,750.00
Masonite 45,000 Sq. Ft. at $.08				3,600.00
Nails & Hardware				2,400.00
			Total	$ 14,433.45

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	23	8	$7.22 day	$ 498.18
Foremen	6	19	8	5.16 "	588.24
" Carpenter	3	36	8	7.22 "	779.76
" "	6	24	8	6.38 "	918.72
Carpenters	45	24	7	.80	6,048.00
Helpers (Carpenter)	45	24	7	.55	4,158.00
Mixer Operators	12	13	7½	1.00	1,170.00
Pumpcrete Operators	3	13	7½	1.25	365.63
Laborers	120	17	7	.50	7,140.00
Firemen	3	33	8	.60	475.20
Finishers	6	14	7	1.25	735.00
Laborers	6	33	8	.50	792.00
Steamfitters	3	4	7	1.00	84.00
Steamfitters' Helpers	12	4	7	.60	201.60
				Total	$ 23,954.33

BASIS OF ESTIMATE (Op. #31 - 1940)

It is estimated that the cost of carpenter labor for the construction of the forms on these walls will be approximately 19¢ per sq. ft.

It is proposed to use the form lumber three times and to make use of some salvage from other parts of the work. The No. 200 Pumpcrete would be located about 200' upstream from the intake structure on the river side of the approach channel.

The total distance of haul on concrete would be 4,200 feet. The Transit Mixers could operate as follows:

Loaded	1,600	feet	at 15	M.P.H.	=	1.28 minutes
"	900	"	" 6	"	=	1.71 "
"	800	"	" 12	"	=	0.72 "
"	900	"	" 4	"	=	2.52 "
Discharge and Turn					=	5.23 "
Empty	200	feet	at 4	M.P.H.	=	0.56 "
"	1,500	"	" 10	M.P.H.	=	1.65 "
"	900	"	" 3	"	=	3.42 "
"	1,600	"	" 20	"	=	.91 "
Loading and Lost Time					=	10.00 "
Total Time for One Round Trip					=	28.00 "

1260 ÷ 28 = 45 Round Trips per day

4 mixers x 4 cu. yds. x 45 trips = 720 cu. yds. per day.

8,850 ÷ 700 = 13 working days.

There are approximately 108,600 sq. ft. to be formed, but the forms will be moved up at least 3 times on the average so that it is believed that the number of feet of new form to be built should not exceed 60,000 at approximately $.19 to $.20 for carpenter labor.

The 120 laborers are carried 4 extra days to clean up the rock excavation.

CONCRETE

(Spillway Weir & East Wall)

Item No. 31 | Operation No. 30

Quantity 10.780 cu. yds. | Date Sept. 15 to Oct. 15, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumpcrete #200 & Pipe	1	30	3	$ 90.00	$ 2,700.00
Transit Mixers, 4 cu. yd.	4	30	3	30.00	3,600.00
Boiler, Steam, 90 H.P.	1	44	3	10.00	440.00
Vibrators	6	30	3	3.33	599.40
Pipe, Tarpaulin, Burlap etc.		44	3	25.00	1,100.00
Small Tools					1,223.94
				Total	$ 9,663.34

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Pumpcrete #200	1	420	$ .50	$ 210.00
Transit Mixers	4	420	.43	722.40
Vibrators	6	420	.005	12.60
Boiler	1	1,056	1.35	1,425.60
Lumber 180,000 Ft. B.M. at $45.00				8,100.00
Masonite 30,000 Sq. Ft. at $.08				2,400.00
Nails & Hardware				2,400.00
			Total	$15,270.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	30	8	$ 7.22 day	$ 649.80
"	6	30	8	5.16 "	928.80
" Carpenter	3	36	8	7.22 "	779.76
Carpenters	48	24	7	.80	6,451.20
Helpers (Carpenter)	24	24	7	.55	2,217.60
Pumpcrete Operators	3	20	7½	1.25	562.50
Mixer Operators	12	20	7½	1.00	1,800.00
Finishers	6	20	7	1.25	1,050.00
Laborers	96	24	7	.50	8,064.00
Firemen (Curing)	3	44	8	.60	633.60
Laborers "	6	44	8	.50	1,056.00
Steamfitters	3	4	7	1.00	84.00
Steamfitters' Helpers	12	4	7	.60	201.60
				Total	$24,478.86

BASIS OF ESTIMATE (Op. #30 - 1941)

This concrete is to be hauled via Construction Road No. 2 & No. 1 to the weir and east Spillway Wall.

The 4 cu. yd. Transit Mixers can operate on the following schedule:

Loaded	1,600	feet	at	8	M.P.H.	=	2.27	Minutes
"	900	"	"	6	"	=	1.70	"
"	1,200	"	"	8	"	=	1.70	"
"	800	"	"	10	"	=	0.91	"
"	1,200	"	"	3	"	=	4.55	"
"	200	"	"	4	"	=	0.57	"
Discharge						=	9.86	"
Return	3,400	"	"	12	"	=	3.24	"
"	1,400	"	"	4	"	=	3.98	"
"	1,600	"	"	15	"	=	1.22	"
Total Haul Time for 1 Round Trip						=	30.00	"
Loading Time						=	7.00	"
Total Time for 1 Round Trip						=	37.00	"

1,260 ÷ 37 = 34.05 say 34 round trips per mixer per day. 4 x 4 x 34 = 544 cu. yds. per day with 4 mixers working.

10,780 ÷ 544 = 19.8, say 20 working days are required.

Carpenter labor is estimated at 16¢ per sq. ft. of forms. Approximately 58,000 sq. ft. of surface.

It is proposed to use laborers for 4 days to clean the rock surface.

CONCRETE IN BRIDGE DECK

Item No. 32

Quantity - 90 cu. yds.

DESCRIPTION

This Item includes all concrete in the Service Bridge Deck.

The detailed cost of sand and gravel is shown in Section 17.

OPERATION COSTS

	Quantities	Plant Rental	Material & Supplies	Labor
Concrete	90 c.y.	$ 173.62	$ 790.82	$ 1,962.48
Aggregates	120 "	38.05	7.65	19.08
Totals		$ 211.67	$ 798.47	$ 1,981.56

S U M M A R Y

PLANT RENTAL	$ 211.67
MATERIALS & SUPPLIES	798.47
LABOR	1,981.56
TOTAL	$ 2,991.70

CONCRETE IN BRIDGE DECK

Item No. 32

Quantity 90 cu. yds.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pumpcrete No. 160 & Pipe	1	1	2	$ 25.50	$ 25.50
Transit Mixers 4 cu. yd.	2	1	2	22.50	45.00
Electric Vibrators	2	1	2	2.50	5.00
Small Tools		1	2		98.12
				Total	$ 173.62

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Pumpcrete No. 160	1	14	$ .26	$ 3.64
Transit Mixers	2	14	.43	12.04
Vibrators	2	14	.005	.14
Lumber 15,000 Ft. B.M. at $45.00				675.00
Nails and Hardware				100.00
			Total	$ 790.82

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	2	1	8	$ 7.22 day	$ 14.44
Carpenter Foremen	2	6	8	7.22 "	86.64
Carpenters	30	6	8	.80	1,152.00
Carpenter Helpers	16	6	8	.55	422.40
Pumpcrete Operators	2	1	7	1.00	14.00
Mixer Operators	4	1	7	1.00	28.00
Finishers	4	1	7	1.25	35.00
Laborers	20	3	7	.50	210.00
				Total	$ 1,962.48

CONCRETE

(Steps, Trash Bars, Grout Recesses, and Miscellaneous Work)

Item No. 33

Quantity - 1,200 cu. yds.

DESCRIPTION

This item includes all concrete in the Steps, Trash Bars, Grout Recesses and Miscellaneous Work. All this work will be carried on intermittently as it is largely of a special nature.

OPERATION COSTS

Year	Op. No.	Quantities	Plant Rental	Material & Supplies	Labor
1939	22	250 c.y.	$ 235.15	$ 25.04	$ 307.32
"	28	732 "	1,171.25	656.88	1,543.44
"	31	92 "	138.97	255.40	619.44
1941	Misc. Concrete	126 "	131.28	101.90	630.44
(Section 17)	Aggregates	1,620 "	513.67	103.31	257.53
	Totals		$ 2,190.32	$ 1,142.53	$ 3,358.17

S U M M A R Y

PLANT RENTAL	$ 2,190.32
MATERIALS & SUPPLIES	1,142.53
LABOR	3,358.17
TOTAL	$ 6,691.02

CONCRETE

(Grout Can)

Item No. 33 | Operation No. 22

Quantity 250 cu. yds. | Date Sept. 22 to 24, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Transit Mixers 4 yd.	3	3	1	$ 15.00	$ 135.00
Pumpcrete #160 & Pipe	1	3	1	17.00	51.00
Vibrators	3	3	1	1.67	15.03
Tarpaulins					18.75
Small Tools					15.37
				Total	$ 235.15

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Transit Mixers	3	16	$ .43	$ 20.64
Pumpcrete #160	1	16	.26	4.16
Vibrators	3	16	.005	.24
			Total	$ 25.04

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	1	6	8	$ 7.22 day	$ 43.32
Pumpcrete Operators	1	2	8	1.00	16.00
Mixer Operators	3	2	8	1.00	48.00
Laborers	10	5	8	.50	200.00
				Total	$ 307.32

BASIS OF ESTIMATE (Op. #22 - 1939)

This concrete can be placed in the trench by use of the pumpcrete for the more inaccessible parts, and by dumping direct from the mixer at other points.

It is believed that the weather will be such that no heat will be required at this time.

Provision is made to protect the finished concrete by Tarpaulins until it is set and then to cover with earth kept wet from the nearby pipe line.

The foreman and laborers are provided for 3 extra days to clean the rock surface, set the pipes, and cover the finished concrete.

The pumpcrete is assumed to handle 15 yds. per hour.

The transit mixers should operate on the following schedule between the batching plant and the job:

Loaded 1,600 feet at 15 M.P.H.	=	1.22	minutes
" 900 " " 6 "	=	1.70	"
" 1,000 " " 10 "	=	1.14	"
" 300 " " 4 "	=	0.85	"
Discharge and Turn	=	12.14	"
Empty 1,300 feet at 10 M.P.H.	=	1.48	"
" 900 " " 4 "	=	2.56	"
" 1,600 " " 20 "	=	0.91	"
Loading and Lost Time	=	8.00	"
Total Time for One Round Trip	=	30.00	"

480 ÷ 30 = 16 Trips per day (one shift)

16 x 2 x 4 = 128 yds. can be hauled in 8 hours by two 4 yd. transit mixers, but considering the condition of the haul road at this time, the assumption is made that three will be required. A small amount of the concrete will be dumped directly into the trench.

CONCRETE

(Grout Recesses)

Item No. 33 | Operation No. 28

Quantity 732 cu. yds. | Date Dec. 4 to 15, 1939.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Transit Mixers	2	12	1	$ 15.00	$ 360.00
Pumocrete #160 & Pipe	1	12	1	17.00	204.00
Vibrators	2	12	1	1.67	40.08
Boiler 90 H.P.	1	14	3	10.00	140.00
Pipe, Tarpaulins, etc.		14	3	25.00	350.00
Small Tools					77.17
				Total	$1,171.25

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Transit Mixers	2	56	$ .43	$ 48.16
Pumocrete #160	1	56	.26	14.56
Boiler	1	336	1.35	453.60
Vibrators	2	56	.005	.56
Lumber 2,000 Ft. B.M. at $45.00				90.00
Nails & Hardware L.S.				50.00
			Total	$ 656.88

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	12	8	$ 7.22 day	$ 86.64
Pumocrete Operator #160	1	8	7½	1.00	60.00
Mixer Operators	2	8	7½	1.00	120.00
Carpenters	3	8	7	.80	134.40
Carpenter Helpers	3	8	7	.55	92.40
Laborers	12	9	7	.50	378.00
Firemen	3	14	8	.60	201.60
Steam Fitter	3	14	7	1.00	294.00
Helpers (Steam Fitter)	3	14	7	.60	176.40
				Total	$1,543.44

BASIS OF ESTIMATE (Op. #28 - 1939)

The No. 160 Pumpcrete will handle 15 cu. yds. of Class A concrete per hour.

It is assumed that a 6" hose will be used on the end of the pumpcrete pipe to prevent dropping the concrete.

The Transit Mixers are assumed to operate on the following schedule from the batching plant:

Loaded	1,600	feet	at	15	M.P.H.	=	1.22	minutes
"	900	"	at	6	"	=	1.71	"
"	1,000	"	"	10	"	=	1.14	"
"	500	"	"	4	"	=	1.42	"
Discharge and Turn						=	9.33	"
Empty	1,500	feet	at	10	M.P.H.	=	1.71	"
"	900	"	"	4	"	=	2.56	"
"	1,600	"	"	20	"	=	.91	"
Loading Time and Lost Time per trip						=	10.00	"
Total Time for one Round Trip						=	30.00	"

Each mixer would deliver 8 c.y. per hour.

Two will be needed to haul 15 c.y. per hour.

15 x 7 = 105 c.y. per day of 7 hours.

732 ÷ 105 = 7 days, say 8.

Heat will be supplied by the boiler on Op. #27 - 1939 until about Dec. 15, and therefore will not be charged on this Operation until after that date.

CONCRETE

(Trash Bars)

Item No. 33

Quantity 92 cu. yd.

Operation No. 31

Date Dec. 16, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Transit Mixers 4 yd.	2	1	2	$ 22.50	$ 45.00
Pumpcrete #160 & Pipe	1	1	2	25.50	25.50
Vibrator	1	1	2	2.50	2.50
Boiler, 90 H.P.	1	1	3	10.00	10.00
Pipe, Tarpaulin etc.		1	3	25.00	25.00
Small Tools					30.97
				Total	$ 138.97

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Transit Mixers 4 yd.	2	16	$ .43	$ 13.76
Pumpcrete	1	16	.26	4.16
Vibrators	1	16	.005	.08
Boiler 90 H.P.	1	24	1.35	32.40
Lumber 4,000 Ft. B.M. at $45.00				180.00
Nails & Hardware				25.00
			Total	$ 255.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	2	3	8	$ 7.22 day	$ 43.32
Mixer Operators	4	1	8	1.00	32.00
Pumpcrete Operator	2	1	8	1.00	16.00
Carpenter Foreman	2	3	8	$ 7.22 day	43.32
Carpenters	6	3	8	.80	115.20
Helpers (Carpenter)	12	3	8	.55	158.40
Laborers	12	3	8	.50	144.00
Firemen	3	1	8	.60	14.40
Steam Fitters	3	1	8	1.00	24.00
Steam Fitters Helpers	6	1	8	.60	28.80
				Total	$ 619.44

BASIS OF ESTIMATE (Op. #31 - 1939)

It is estimated that the concrete can be placed by a puncrete and hose at the rate of 7 yds. per hour which is the capacity of one trash bar. A small man can use a vibrator suspended inside the form to consolidate the concrete.

The Transit Mixers are assumed to operate as follows:

Loaded	1,600	feet	at	15	M.P.H.	=	1.22	Minutes
"	900	"	"	6	"	=	1.70	"
"	1,000	"	"	10	"	=	1.14	"
"	500	"	"	4	"	=	1.42	"
Discharge and Turn						=	25.34	"
Empty	1,500	feet	at	10	M.P.H.	=	1.71	"
"	900	"	"	4	"	=	2.56	"
"	1,600	"	"	20	"	=	0.91	"
Loading and Lost Time						=	10.00	"
Total Time for 1 Round Trip						=	46.00	"

Two Transit Mixers (4 yd.) required to place 8 yds. per hour.

The equipment will easily fill the 13 Trash Bars in one day of two 8 hour shifts.

The boiler is charged for only one day and the remainder of the curing will be done with steam from the grout recesses.

MISCELLANEOUS CONCRETE

Item No. 33

Quantity 126 cu. yds.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Transit Mixer 4 yd.	1	4	1	$ 15.00	$ 60.00
Concrete Carts 1/6 yd.	6	4	1	.10	2.40
Pumpcrete No. 160 & Pipe	1	1	1	17.00	17.00
Vibrators	2	4	1	1.67	13.36
Truck Dump 2 yd.	1	1	1	7.00	7.00
Small Tools		4	1		31.52
				Total	$ 131.28

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Transit Mixer	1	24	$ .43	$ 10.32
Pumpcrete	1	8	.26	2.08
Vibrators	2	24	.005	.24
Truck Dump 2 yd.	1	8	.22	1.76
Lumber 1500 Ft. B.M. at $45.00				67.50
Nails & Hardware L.S.				20.00
			Total	$ 101.90

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	4	8	$ 6.38 day	$ 25.52
Carpenter, Foreman	1	6	8	7.22 "	43.32
Mixer Operator	1	3	8	1.00	24.00
Pumpcrete Operator	1	1	8	1.00	8.00
Carpenters	4	4	8	.80	102.40
Carpenter Helpers	4	4	8	.55	70.40
Laborers	16	3	8	.50	192.00
Truck Drivers	1	1	8	.60	4.80
Finishers	4	4	8	1.25	160.00
				Total	$ 630.44

CONCRETE

(Stilling Basin)

Item No. 34

Quantity - 18,500 c.y.

DESCRIPTION

This Item includes furnishing, placing, finishing and curing all concrete in the Stilling Basin. The cost of aggregate is shown in Section 17, and water in Section 20(A).

OPERATION COSTS

	QUANTITY	PLANT RENTAL	MATERIAL & SUPPLIES	LABOR
On. #29, 1940	18,500 c.y.	$ 10,444.27	$ 10,103.50	$ 29,501.01
Aggregates	24,975 "	7,919.14	1,592.65	3,970.22
Water		78.56	101.10	1,492.05
	Totals	$ 18,441.97	$ 11,797.25	$ 34,963.28

S U M M A R Y

PLANT RENTAL	$ 18,441.97
MATERIALS & SUPPLIES	11,797.25
LABOR	34,963.28
TOTAL. . .	$ 65,202.50

CONCRETE

(Stilling Basin)

Item No. 34 — Operation No. 29

Quantity 18,500 cu. yds. — Date July 1 to Aug. 9, 1940.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Transit Mixers 4 yd.	4	39	3	$ 30.00	$ 4,680.00
Pumpcrete #200 & Pipe	1	39	3	90.00	3,510.00
Vibrators	6	39	3	3.33	779.22
Small Tools		39	3		1,475.05
				Total	$ 10,444.27

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Transit Mixers	4	546	$ .43	$ 939.12
Pumpcrete #200	1	546	.50	273.00
Vibrators	6	546	.005	16.38
Lumber 100,000 Ft. B.M. at $45.				4,500.00
Masonite 30,000 Sq. Ft. at $.08				2,400.00
Burlap 5000 yds. at $.035				175.00
Nails & Hardware L.S.				1,800.00
			Total	$ 10,103.50

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	3	39	8	$ 7.22 day	$ 844.74
Foremen	6	48	8	5.16 "	1,486.08
Foremen Carpenters	3	34	8	7.22 "	736.44
Carpenters	45	23	7	.80	5,796.00
Carpenter Helpers	30	23	7	.55	2,656.50
Pumpcrete Operators	3	26	7½	1.25	731.25
Mixer Operators	12	26	7½	1.00	2,340.00
Laborers	120	32	7	.50	13,440.00
Finishers	6	28	7	1.25	1,470.00
				Total	$ 29,501.01

BASIS OF ESTIMATE (Op. #29 - 1940)

It is estimated that carpenter labor on forms will cost about 14¢ per sq. ft. of surface formed.

There are approximately 65,600 sq. ft. of forms required.

It is estimated that 3 sq. ft. of lumber will be required per sq. ft. of surface, but 1 sq. ft. will be available as salvage from other parts of the job so that approximately 100,000 ft. B.M. will be required.

It is proposed to locate the #200 Pumpcrete on the river side of the Stilling Basin. The Transit Mixers operate on the following schedule:

Loaded	1,600	feet	at	15	M.P.H.	=	1.28	minutes
"	900	"	"	4	"	=	2.52	"
"	1,000	"	"	8	"	=	1.40	"
Discharge and Turn						=	6.07	"
Empty	1,000	feet	at	8	M.P.H.	=	1.40	"
"	900	"	"	3	"	=	3.42	"
"	1,600	"	"	20	"	=	.91	"
Loading and Lost Time						=	10.00	"
Total Time for one Round Trip						=	27.00	"

1,260 ÷ 27 = 46 Round Trips per day 46 x 4 = 184 cu. yds./day

4 x 184 = 736 cu. yds. per day for 4 mixers. 18,500 ÷ 736 = say 26 days required.

All transportation and handling forms are taken care of in the Shop costs. (See Section 14A)

Labor is charged at 6 extra days to clean off the rock foundation.

REINFORCING STEEL

Item No. 35

Quantity - 2,051,000 lbs.

DESCRIPTION

This item includes the furnishing, placing, cutting and bending of all reinforcing steel on the project.

Estimate is based on one man placing and tying 700 to 750 lbs. in 7 hours. Labor is provided for unloading from the cars and to assist in placing. Transportation and crane work is furnished by the Shop. Ten pounds of tie wire is provided per ton of steel.

OPERATION COSTS

Year	Op. No.	Quantities	Plant Rental	Materials & Supplies	Labor
1939	37	1,233,800 lbs.	$ 925.98	$ 37,063.60	$ 18,519.60
1940	37	772,800 "	740.66	23,216.00	14,813.28
1941	37	44,400 "	79.74	1,350.40	1,594.80
Totals		2,051,000	$1,746.38	$ 61,630.00	$ 34,927.68

S U M M A R Y

PLANT RENTAL.....	$ 1,746.38
MATERIALS & SUPPLIES.....	61,630.00
LABOR.....	34,927.68
TOTAL.....	$ 98,304.06

PLACING REINFORCING STEEL

Item No. 35 | Operation No. 37

Quantity 1,233,800 lbs. | Date Oct. 13 to Dec. 12, 1939.

PLANT RENTAL

Designation	Cal. Days	No. Shifts		Amount
Small Tools	60	3		$ 925.98
			Total	$ 925.98

MATERIALS & SUPPLIES (See Section 9)

Designation		Amount
Reinforcing Steel 1,233,800 lbs. at $.03		$ 37,014.00
Tie Wire 620 lbs. at $.08		49.60
	Total	$ 37,063.60

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	60	8	$ 7.22 day	$ 1,299.60
Steel Placers	42	40	7	1.25	14,700.00
Laborers	18	40	7	.50	2,520.00
				Total	$ 18,519.60

PLACING REINFORCING STEEL

Item No. 35 | Operation No. 37

Quantity 772,800 lbs. | Date June 1 to Aug. 31) Oct. 13 to Oct. 31) 1940

PLANT RENTAL

Designation	Cal. Days	No. Shifts	Amount
Small Tools	108	3	$ 740.66
		Total	$ 740.66

MATERIALS & SUPPLIES (See Section 9)

Designation	Amount
Steel, 772,800 Lbs. at $.03	$ 23,184.00
Tie Wire, 400 Lbs. at $.08	32.00
Total	$ 23,216.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	108	8	$ 7.22 day	$ 2,339.28
Steel Placers	15	72	7	1.25	9,450.00
Laborers	12	72	7	.50	3,024.00
				Total	$ 14,813.28

PLACING REINFORCING STEEL

Item No. 35 | Operation No. 37

Quantity 44,400 lbs. | Date Sept. 16 to Oct. 15, 1941

PLANT RENTAL

Designation	Cal. Days	No. Shifts	Amount
Small Tools	30	3	$ 79.74
		Total	$ 79.74

MATERIALS & SUPPLIES (See Section 9)

Designation	Amount
Reinforcing Steel 44,400 lbs. at $.03	$ 1,332.00
Tie Wire 230 lbs. at $.08	18.40
Total	$ 1,350.40

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	30	8	$ 7.22 day	$ 649.80
Steel Placers	3	20	7	1.25	525.00
Laborers	6	20	7	.50	420.00
				Total	$ 1,594.80

SERVICE BRIDGE METAL

Item No. 36

Quantity - 168,000 lbs.

DESCRIPTION

This item includes the furnishing and erection of all structural steel in the service bridge, except the rail.

It is proposed to assemble the trusses on the ground, and hoist into place with one of the large cranes. The crane will operate 6 days, at one shift per day. The 315 c.f. compressor will operate three 7-hour shifts. Sufficient labor has been provided to unload the steel from the cars. Transportation is provided by the shop.

The following assumptions are made:

One man will drive 30 rivets per hour

" " " paint 1 ton steel per hour

" " " unload 3 " " " day

SUMMARY

PLANT RENTAL	$ 811.03
MATERIALS & SUPPLIES	$ 7,610.09
LABOR	$ 2,120.50
TOTAL	$10,541.62

SERVICE BRIDGE METAL

Item No. 36 — Operation No. 41

Quantity - 168,000 Lbs. — Date Oct. 1 to 15, 1940

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Crane No. 2	1	6	1	$ 55.50	$ 333.00
Compressor 315 c.f.	1	15	3	23.00	345.00
Paint Spray Gun	1	9	2	3.00	27.00
Small Tools		15	3		106.03
Riveting Hammers	3	6	3	(Charged to Shop)	
				Total	$ 811.03

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Crane No. 2	1	28	$ .73	$ 20.44
Compressor	1	210	.565	118.65
Structural Steel 168,000 lbs. at $.042				7,056.00
Paint 50 gal. at $3.50				175.00
" 50 gal. at $3.00				150.00
Lumber 2000 Ft. B.M. at $45.00				90.00
			Total	$ 7,610.09

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	15	8	$ 7.22 day	$ 324.90
Foremen	3	15	8	5.16 "	232.20
Crane Operator	1	4	8	1.25	40.00
Oiler	1	4	8	.60	19.20
Compressor Operator	3	10	7½	.60	135.00
Riveters	9	4	7	1.00	252.00
Painters	2	6	7	.80	67.20
Laborers	30	10	7	.50	1,050.00
				Total	$ 2,120.50

WROUGHT IRON AND STEEL TRASH BARS

Item No. 37

Quantity - 169,000 lbs.

DESCRIPTION

This item comprises the furnishing and erecting all metal in the trash bars located at the entrance to the gates.

This estimate is based on placing the thirteen bars in 3 8-hour shifts, after they have been assembled in the shop. The welder, welding machine and all transportation is charged directly to the shop.

S U M M A R Y

PLANT RENTAL	$ 239.30
MATERIALS & SUPPLIES	13,537.52
LABOR	345.92
TOTAL.	$ 14,122.74

WROUGHT IRON & STEEL TRASH BARS

Item No. 37 | Operation No. 30

Quantity 169,000 lbs. | Date Dec. 12 to 15, 1939.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Crane No. 2	1	4	1	$ 55.50	$ 222.00
Small Tools					17.30
				Total	$ 239.30

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No.Hrs.	Rate/Hr.	Amount
Crane No. 2	1	24	$ .73	$ 17.52
Iron & Steel 169,000 lbs. at $.08				13,520.00
			Total	$13,537.52

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	4	8	$ 7.22 day	$ 28.88
Foremen	1	4	8	5.16 day	20.64
Crane Operator	1	3	8	1.25	30.00
Oiler	1	3	8	.60	14.40
Mechanics	4	3	8	1.00	96.00
Laborers	13	3	8	.50	156.00
				Total	$ 345.92

CAST IRON CONDUIT LINERS

Item No. 38

Quantity - 624,000 lbs.

DESCRIPTION

This item includes the furnishing and erecting, in place, all Cast Iron in the Conduit Liners. Assumption is made that the No. 7 Shovel equipped as a Crane will unload the material from the cars and the No. 2 will place and align about two plates per hour.

SUMMARY

PLANT RENTAL	$ 771.81
MATERIALS & SUPPLIES	81,176.92
LABOR	916.24
TOTAL	$ 82,864.97

CAST IRON CONDUIT LINERS

Item No. 38 | Operation No. 29

Quantity 624,000 lbs. | Date Nov. 4 to 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Crane No. 2	1	12	1	$ 55.50	$ 666.00
Crane No. 7	1	4	1	15.00	60.00
Small Tools					45.81
				Total	$ 771.81

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Crane No. 2	1	64	$ .73	$ 46.72
Crane No. 7	1	24	.425	10.20
Cast Iron, 624,000 lbs. at $.13				81,120.00
			Total	$81,176.92

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	16	8	$ 7.22 day	$ 115.52
Foremen	1	12	8	5.16 "	61.92
Crane Operators	1	8	8	1.25	80.00
Crane Operators	1	3	8	1.25	30.00
Oilers	1	8	8	.60	38.40
Oilers	1	3	8	.60	14.40
Laborers	12	12	8	.50	576.00
					$ 916.24

WATER-LEVEL RECORDER SYSTEM

Item No. 39

Quantity - Lump Sum

DESCRIPTION

This work consists of furnishing and installing complete all parts of the Water-Level Recording System including float, tape, pulleys, recording gauge, etc.

It is believed that all this work will be done by a subcontractor with his own specialists.

PLANT RENTAL

Small Tools	$ 4.40

MATERIALS & SUPPLIES

Recording Gauge, pulleys, Float, etc.	$ 279.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	2	8	$ 1.50	$ 24.00
Mechanics	4	2	8	1.00	64.00
			Total		$ 88.00

S U M M A R Y

PLANT RENTAL	$ 4.40
MATERIALS & SUPPLIES	279.00
LABOR	88.00
Total	$ 371.40

SHEET METAL

Item No. 40

Quantity - 14,000 lbs.

DESCRIPTION

This item consists of furnishing and installing in place, all sheet metal called for on the plans. The work will necessarily proceed intermittently as other items of the work are in progress.

PLANT RENTAL

Small Tools & Equipment $ 66.83

MATERIAL & SUPPLIES

Sheet Metal, 14,000 lbs. at $.14 $ 1,960.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foreman, General	1	30	8	$ 7.22 day	$ 216.60
Sheet Metal Workers	4	20	8	1.00	640.00
Laborers	6	20	8	.50	480.00
				Total	$ 1,336.60

S U M M A R Y

PLANT RENTAL	$ 66.83
MATERIALS & SUPPLIES	1,960.00
LABOR	1,336.60
Total	$ 3,363.43

MISCELLANEOUS METAL

Item No. 41

Quantity - 105,000 lbs.

DESCRIPTION

This item consists of furnishing and installing all miscellaneous metal such as Cast Iron and Steel Pipe etc., as shown on the plans, and not included in any specific item. The work will proceed intermittently.

PLANT RENTAL

Small Tools & Equipment	$ 521.10

MATERIAL & SUPPLIES

Metal, 105,000 lbs. at $.08	$ 8,400.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foreman General	1	100	8	$ 7.22 day	$ 722.00
Pipe Fitter	1	100	8	1.00	800.00
Mechanic	1	100	8	1.00	800.00
Steel Placer	1	100	8	1.12½	900.00
Laborers	18	100	8	.50	7,200.00
				Total	$ 10,422.00

S U M M A R Y

PLANT RENTAL	$ 521.10
MATERIALS & SUPPLIES	8,400.00
LABOR	10,422.00
TOTAL.	$ 19,343.10

COPPER WATER STOPS

Item No. 42

Quantity - 6,000 lbs.

DESCRIPTION

This item includes the furnishing and placing of all Copper Water Stops to be used in the expansion joints of the concrete structures.

PLANT RENTAL

Small Tools	$ 17.28

MATERIAL & SUPPLIES

Sheet Copper 20 oz. 6000 lbs. at $.33	$ 1,980.00

LABOR

Designation	No. Men	Hrs.	Rate/Hr.	Amount
Sheet Metal Worker	1	96	1.00	$ 96.00
Carpenters	2	96	.80	153.60
Laborers	2	96	.50	96.00
			Total	$ 345.60

S U M M A R Y

PLANT RENTAL	$ 17.28
MATERIALS & SUPPLIES	1,980.00
LABOR	345.60
TOTAL	$ 2,342.88

HAND RAIL, STILLING BASIN

Item No. 43

Quantity - 300 Lin. Ft.

DESCRIPTION

This item consists of furnishing all materials and erecting in place the pipe hand rail on the walls of the Stilling Basin. The painting of the rail is also part of the item. Estimate is based on installing approximately 60 lin. ft. per day with the crew, as shown.

S U M M A R Y

PLANT RENTAL.	$	21.09
MATERIALS & SUPPLIES.		747.67
LABOR		301.70
TOTAL	$	1,070.46

HAND-RAIL

(Stilling Basin)

Item No. 43

Quantity 300 Lin. Ft.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Spray Gun, Paint	1	4	1	$ 1.50	$ 6.00
Small Tools					15.09
				Total	$ 21.09

MATERIALS & SUPPLIES

Designation	Amount
Pipe Std. Gen. W. I. 2" 900 ft. at $ .3123	$ 281.07
" " " " " 2½" 330 " at .5347	176.45
M. I. Railing L's 2½" X 2" 4 at .93	3.72
" " Side Outlet L's 2½"X 2" 2 at 1.86	3.72
" " T's 2½" X 2" 65 at $1.21	78.65
" " Crosses X's 2½" X 2" 60 at $1.63	97.80
" " Side Outlet T's 2½" X 2" 2 at $2.25	4.50
Std. M.I. Comp. Flg. 2½" X 7" 66 at $1.12	73.92
Galv. Cap. Screw 5/8" X 1½" 264 at .06	15.84
Paint 4 gals at $3.00	12.00
Total	$ 747.67

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	5	8	$7.22 day	$ 36.10
Plumbers (Pipefitters)	6	5	8	1.00	240.00
Painter	1	4	8	.80	25.60
				Total	$ 301.70

SERVICE BRIDGE RAILING

Item No. 44

Quantity - L.S.

DESCRIPTION

This item includes the furnishing and erecting, in place, the Hand Railing of the Service Bridge. Electric Welder, transportation, etc., are charged directly to the Shop (See Section 14A).

PLANT RENTAL

Spray Gun, Paint	6 days at $1.50	$ 9.00
Small Tools		42.07
	Total	$ 51.07

MATERIALS & SUPPLIES

Steel	21,230 lbs. at $ .10	$ 2,123.00
Welding Rod	150 " at $ .12	18.00
Paint	16 gal. at $3.00	48.00
	Total	$ 2,189.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	15	8	$ 6.38 day	$ 95.70
Painter	1	4	8	.80	25.60
Steel Erectors	4	10	8	1.25	400.00
Laborers	8	10	8	.50	320.00
				Total	$ 841.30

S U M M A R Y

PLANT RENTAL	$ 51.07
MATERIALS & SUPPLIES	2,189.00
LABOR	841.30
Total	$ 3,081.37

18" CORRUGATED IRON PIPE

Item No. 45

Quantity - 270 Lin. Ft.

DESCRIPTION

This item includes furnishing and placing all 18" Corrugated Metal Culverts. Transportation of material is handled by the Shop.

PLANT RENTAL

Small Tools etc.	$	8.96

MATERIAL & SUPPLIES

18" Corrugated Iron Pipe 270 ft. at $2.85	$	769.50

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.		Amount
Foreman	1	3	8	$ 6.38 day	$	19.14
Laborers	20	2	8	.50		160.00
					$	179.14

S U M M A R Y

PLANT RENTAL	$	8.96
MATERIALS & SUPPLIES		769.50
LABOR		179.14
Total	$	957.60

PIEZOMETER AND SETTLEMENT GAUGES

Item No. 46

Quantity - L. S.

DESCRIPTION

This item comprises the furnishing and placing of the Piezometer and Settlement gauges together with all appurtenant pipes and connections as shown on the plans.

S U M M A R Y

PLANT RENTAL	$ 501.10
MATERIALS & SUPPLIES	3,158.15
LABOR	7,990.00
TOTAL	$ 11,649.25

PIEZOMETER AND SETTLEMENT GAUGES

Item No. 46

Quantity - L.S.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Pump H.P. 4"	1	16	1	$ 5.50	$ 88.00
Hose 2", 100' with reducer & Fittings		16	1	.85	13.60
Small Tools					399.50
				Total	$ 501.10

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Pump H.P. 4"	1	88	$ .26	$ 22.88
Pipe, Fittings etc. (See List of Material)				3,135.27
			Total	$3,158.15

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foreman	1	270	8	$ 5.16 day	$1,393.20
Plumber	1	5	8	1.00	40.00
Plumbers Helper	1	5	8	.60	24.00
Pumpman	1	11	8	.60	52.80
Laborers	9	180	8	.50	6,480.00
				Total	$7,990.00

BASIS OF ESTIMATE (Item #46)

The estimate is based upon raising the height of the vertical pipes in 5' lifts. Digging down to the capped pipe, making the connection, and then backfilling and tamping the hole.

1 Foreman & 4 laborers jetting	11 Days
1 " " 8 " Excavate & Backfill	180 "
1 " 6 laborers, 1 plumber & 1 helper digging and connecting	5 "
1 Foreman, 4 laborers on Aux. and Obs. wells	3 "
2 " setting covers	2 "
1 Foreman, 4 laborers on miscellaneous work	3 "

Stake Truck from Shop and charged to "Shop, Utilities & Yard."

List of Materials

Settlement Gauges

6" Bell C.I. Pipe, 16 pcs. 5' at 55¢	=	$44.00
6" C.I. Covers, 16 pcs. at 60¢	=	9.60
1" W.I. bars 190 " at $.7353	=	139.70
1" Sleeve nuts " " at $.05	=	9.50
1" Nuts 32 " at $.0625	=	2.00
24" x 24" x ½" plates 16 pcs. at 65¢	=	10.40
Threading bars 190 pcs. at $.10	=	19.00
		$234.20

Observation Wells

610'-3" H.W.I. Pipe at $.8951	=	$546.01
44 -3" Cuplings at $.56	=	24.64
12 -3" Pipe Caps at $.38	=	4.56
		$575.21

Auxiliary Wells

210'-4" H.W.I. at $1.3035	=	$273.74
20 -4" Cuplings at $1.03	=	20.60
12 -4" Pipe Caps at $.61	=	7.32
		$301.66

Piezometers

2616' - 1½" H.W.I. Pipe at $.3263	=	$ 853.60
750' - 2" H.W.I. " at $.4515	=	338.63
530 - 1½" Cuplings at $.14	=	74.20
6 - 15" x 15" x ½" Plates, 190 lbs. at $.0485	=	9.22
126 - 12"x12"x14 gage 400 lbs at $.0496	=	19.84
2900' - 1" Pipe at $.2274	=	659.46
150 - 1" Cuplings at $.23	=	34.50
25 - 2"x1" Reducers at $.75	=	18.75
25 - 1" L's at $.28	=	7.00
25 - 1" Caps at $.12	=	3.00
12 - 1" Br. Collars at $.50	=	6.00
		$2,024.20

S U M M A R Y

Settlement Gauges	$ 234.20
Observation Wells	575.21
Auxiliary "	301.66
Piezometers	2,024.20
Total	$ 3,135.27

TILE GAGES

Item No. 47

Quantity - 120 lin. ft.

DESCRIPTION

This item includes furnishing and setting in place the Tile Gages on the Outlet Wall and Intake Structure. Estimate is based on setting 20 sq. ft. per 8 hour shift, with the crew as shown below.

PLANT RENTAL

Small Tools & Equipment	$ 34.56

MATERIAL & SUPPLIES

Tile Gage	120 lin. ft. at $5.30	$636.00
Expanded Metal	360 s.f. at $.03	10.80
Lumber	500 ft. B.M. at $45.00	22.50
Sand	6 c.y. at $.75	4.50
	Total	$673.80

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Tile Setters	2	16	8	$ 1.50	$384.00
" " Helpers	2	16	8	.95	243.20
Laborer	1	16	8	.50	64.00
				Total	$691.20

S U M M A R Y

PLANT RENTAL	$ 34.56
MATERIALS & SUPPLIES	673.80
LABOR	691.20
TOTAL	$1,399.56

OPERATING HOUSE SUPERSTRUCTURE

Item No. 48

Quantity - Lump Sum

DESCRIPTION

This item covers the furnishing and placing of all structural steel and masonry above elevation 416 and all finish above elevation 404, including insulation, stairs, sash, partitions and painting.

S U M M A R Y

PLANT RENTAL	$ 2,488.73
MATERIALS & SUPPLIES	44,249.64
LABOR	32,521.25
TOTAL.	$ 79,259.62

OPERATING HOUSE SUPERSTRUCTURE

Item No. 48 Date June to Oct., 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Lumber Clamps	2	75	1	$ L.S.	$ 200.00
Light Traveler & Long Boom	1	85	1	L.S.	500.00
Mortar Mixer 10 S	1	90	1	3.17	285.30
Small Tools		90	1		1,426.63
Breast Derricks	2	30	1	L.S.	75.00
Concrete Buggies & Accessories	6	3	1	.10	1.80
				Total	$2,488.73

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Mortar Mixer	1	720	$ .115	$ 82.80
See detailed List				44,166.84
			Total	$44,249.64

LABOR

Designation		Amount
Skilled & Semi-Skilled	(See Detailed List)	$ 23,440.50
Common	(" " ")	5,092.00
Sub-Contract	(" " ")	3,988.75
	Total	$ 32,521.25

OPERATING HOUSE SUPERSTRUCTURE

Item No. 48 Date June to Oct. 1941.

MATERIALS & SUPPLIES

Designation	Units	Quantity	Rate	Amount
Lumber 1" x 4" to 6" x 6"	F.B.M.	600	$ 70.00	$ 42.00
Lumber 1" x 4" to 6" x 6"	F.B.M.	21,000	50.00	1,050.00
Lumber 1" x 4" to 6" x 6"	F.B.M.	117,000	45.00	5,265.00
Lumber 1" x 4" to 6" x 6"	F.B.M.	11,400	40.00	456.00
Paper - Sisalkraft (or equal)	Rolls	8	5.00	40.00
Cement - Portland (Standard)	Bbl.	350	2.13	745.50
Cement - Stainless White	Bbl.	8	6.30	50.40
Lime - Pulverized	Tons	21	11.50	241.50
Sand - (Mortar type)	C.Y.	158	0.65	102.70
Gravel - (3/4" stone)	C.Y.	118	0.75	88.50
Brick - Face	M	176,000	40.00	7,040.00
" - Common (Sand or Water)	M	154,000	24.50	3,773.00
Tile, Flue - T.C. 9" x 13"	L.F.	200	0.36	72.00
Stone - Limestone	C.F.	2,381.34	2.25	5,358.01
Anchors and Dowels - Bronze	Pcs.	844	L.S.	635.00
Steel Rods - Reinforcements	c/lbs	12,300	3.14-3.44	399.00
Steel Rods - Accessories	-	-	10%	40.00
Exp. Joints - Rubber	-	-	L.S.	113.21
Hardware: Nails, Spikes, Bolts, Screws			L.S.	318.00
Brushes and Acids (cleaning Brick)		-	L.S.	80.00
Sills and Panels - Aluminum	lbs.	258.+	L.S.	193.10
Brackets - Steel-welded (Instr)	pcs.	2	L.S.	23.00
Sheet Metal - Vent Op. frame and Drs.		-	L.S.	110.15
Threshold - Cast Iron	pcs.	1	L.S.	65.00
Wheel Guards	"	2	L.S.	141.00
Paint - Graphite, Leads & Oils	Gal.	139.5	1.55-6.00	378.04
			Sub-Total	$ 26,820.11

SUB-CONTRACTS

	Units	Quantity	Rate	Amount
Insulation - 2" Cork Roof	s.f.	3,670	L.S.	550.00
Insulation - 2" Cork Walls	s.f.	1,500	L.S.	375.00
Flashings - Lead Coated Copper (W&R)	s.f.	4,410	L.S.	2,404.00
Conductors -Lead Coated Copper (W&R)	L.F.	66	L.S.	65.00
Scuttle & Hdw. Lead Coated Copper (W&R)	Pcs.	1	L.S.	92.00
Roofing - Tar & Gravel (20 yr. Bond)	Sqs.	33.5	L.S.	300.00
Metal Trim - Windows, Base, Cors. etc.	-	-	L.S.	304.73
Caulking - Elastic Compound	L.F.	830	L.S.	35.00
Glass - "B", D.T., F.D.	s.f.	892	L.S.	235.00
Steel - Structural	lbs.	154,000	0.04	6,160.00
Steel Stairs	-	-	L.S.	320.00
Steel Sash	-	-	L.S.	1,300.00
Steel Partitions	-	-	L.S.	2,826.00
Steel Doors	-	-	L.S.	2,380.00
			Sub-Total	$ 17,346.73

General Contract	$26,820.11
Sub-Contracts	17,346.73
Total	$ 44,166.84

Total $ 44,166.84

Section 68

OPERATING HOUSE SUPERSTRUCTURE

Item No. 48 Date June to Oct., 1941

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Carpenter Foreman, General	1	90	-	$ 7.22 day	$ 649.80
Carpenters	6	42	8	.80	1,612.80
Carpenters	8	4	8	.80	204.80
Carpenters	1	32	8	.80	204.80
Mason Foreman	1	78	-	10.00 day	780.00
Brick Masons	20	52	8	1.25	10,400.00
Brick Masons	3	24	8	1.25	480.00
Brick Masons	1	3	8	1.25	30.00
Brick Masons Helpers	20	52	8	.60	4,992.00
Brick Masons Helper	1	12	8	.60	57.60
Stone Masons	2	19	8	1.25	380.00
Stone Masons Helpers	2	12	8	.75	144.00
Stone Masons Helpers	4	24	8	.60	460.80
Mortar Mixer	1	72	8	.75	432.00
Cement Finisher	1	11	8	1.25	110.00
Derrick Engineer	1	78	8	1.00	624.00
Rodman (Reinf. rod. placer)	1	3	8	.80	19.20
Metal Worker	1	3	8	1.25	30.00
Plumber	1	1	8	1.00	8.00
Painter Foreman General	1	35	-	7.22 day	252.70
Painters	9	9	8	.80	518.40
Painters	6	14	8	.80	537.60
Painters	4	20	8	.80	512.00
Skilled and Semi-Skilled Sub-Total					$23,440.50
Laborers	10	55	8	.50	2,200.00
Laborers	8	72	8	.50	2,304.00
Laborers	3	49	8	.50	588.00
Unskilled or Common - Sub-Total					$5,092.00
				Total	$28,532.50

LABOR (Sub-Contract)

Insulation Roof	$ 240.00
Flashings	568.00
Conductors	30.00
Scuttle	41.00
Roofing	178.00
Insulation Walls	375.00
Metal Trim	270.00
Caulking	68.75
Glazing	100.00
Structural Steel	1,550.00
Steel Stairs	80.00
Steel Sash	200.00
Steel Partitions	168.00
Steel Doors	120.00
Total	$ 3,988.75

BASIS OF ESTIMATE (Item No. 48)

The superstructure represents an assembly of finished products for which estimates were secured for all items from several responsible concerns. The estimates of cost were verified from the factory or point of origin; five were received in writing; the balance by telephone. All of these data are on file. The figures of cost (as of January 1939) were used in building up the estimate with its ramification of uses and labor required in its use.

Actual quantities were obtained in the same manner and system used by nationally recognized builders, and checked with large local concerns.

The estimate for skilled and unskilled labor was based upon the above system, employing efficient skilled workmen, and making allowance for the peculiar or limited manner of procedure.

The mortar requirements for brick and stone work are based upon "bag-cement" price, because of the small quantities of mortar required at frequent intervals, with sand and gravel based on costs at the project plant.

Out of the 37 items of various materials, or assembly thereof, 14 items are based upon subcontractor's furnishing both materials and labor for complete erection.

The above applies also to pay items Nos. 39, 49, 50, 51, 52, 53 and 54.

GATES GUIDES AND HOISTS

Item No. 49

Quantity - Lump Sum

DESCRIPTION

This item comprises the furnishing complete and the installation in place of the Gates, Guides and Hoists as shown on the plans. It is proposed to set the gates when the intake structure has reached elev. 334, but the hoists will not be installed until after the service bridge is completed. Transportation costs, except labor, is included in the operation of the Shop (See Section 14A).

OPERATION COSTS

Year	Item	Quantity	Plant Rental	Material & Supplies	Labor
1939	Gates & Guides	8	$ 1,632.70	$ 165,161.28	$ 2,413.92
1941	Hoists	6	111.86	20,000.00	2,237.28
	Totals		$ 1,744.56	$ 185,161.28	$ 4,651.20

SUMMARY

PLANT RENTAL	$ 1,744.56
MATERIALS & SUPPLIES.	185,161.28
LABOR	4,651.20
TOTAL	$ 191,557.04

GATES AND GUIDES

Item No. 49 | Operation No. 35

Quantity - 573,000 lbs. | Date Dec. 4 to 15, 1939

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Crane No. 3 $2\frac{1}{2}$ yd.	1	12	3	$111.00	$ 1,332.00
Tractor D4	1	12	3	15.00	180.00
Small Tools					120.70
25 Ton Trailer (From Shop)					
5 Ton Truck (From Shop)					
				Total	$ 1,632.70

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Crane No. 2	1	168	$ .73	$ 122.64
Tractor D4	1	168	.23	38.64
Gates and Guides L.S.				165,000.00
			Total	$ 165,161.28

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	12	8	$25.00 day	$ 300.00
Foremen	3	12	8	7.22 "	259.92
Crane Operators	3	8	$7\frac{1}{2}$	1.25	225.00
Oilers	3	8	$7\frac{1}{2}$	.60	108.00
Tractor Operators	3	8	$7\frac{1}{2}$	.75	135.00
Riggers	3	8	7	1.25	210.00
Mechanics	6	8	7	1.00	336.00
Laborers	30	8	7	.50	840.00
				Total	$ 2,413.92

GATE HOISTS

Item No. 49 Date 1941

PLANT RENTAL

Designation	Cal. Days	No. Shifts	Amount
Small Tools	16	1	$ 111.86
		Total	$ 111.86

MATERIALS & SUPPLIES

Designation		Amount
8 Hoists Complete L. S.		$ 20,000.00
	Total	$ 20,000.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	24	8	$ 7.22 day	$ 173.28
Mechanics	4	16	8	1.00	512.00
Hoistman	1	16	8	1.00	128.00
Mason	1	8	8	1.25	80.00
Riggers	2	16	8	1.25	320.00
Laborers	16	16	8	.50	1,024.00
				Total	$ 2,237.28

CRANE

Item No. 50

Quantity - Lump Sum

DESCRIPTION

This item includes furnishing and erecting in place, the 50-Ton Traveling Crane, including the track, cables and other appurtenances. Cartage and all transportation is charged to the Shop Expense. (See Section 14A).

PLANT RENTAL

Small Tools, etc.	$ 90.83

MATERIALS & SUPPLIES

Traveling Crane (72,000 lbs.)	$ 11,614.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foreman	1	30	8	$7.22 day	$ 216.60
Rigger	1	20	8	1.00	160.00
Mechanics	4	20	8	1.00	640.00
Laborers	10	20	8	.50	800.00
				Total	$ 1,816.60

S U M M A R Y

PLANT RENTAL	$ 90.83
MATERIALS & SUPPLIES	11,614.00
LABOR	1,816.60
TOTAL	$ 13,521.43

GASOLINE-ELECTRIC GENERATING UNIT

Item No. 51

Quantity - Lump Sum

DESCRIPTION

This Item includes the design, installation and erection of the above unit complete with meters, gages, etc. Cartage is covered in the Shop cost. (See Section 14A)

PLANT RENTAL

Small Tools, etc.	$ 20.98

MATERIAL & SUPPLIES

Generating Unit (Complete)	$ 4,954.00
Freight	100.00
Miscellaneous Equipment and Fittings	270.25
Total	$ 5,324.25

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foreman (General)	1	3	8	$ 7.22 day	$ 21.66
Rigger	1	2	8	1.25	20.00
Mechanics	2	2	8	1.00	32.00
Mason	1	1	8	1.25	10.00
Electricians	2	6	8	1.00	96.00
Laborers	10	6	8	.50	240.00
				Total	$ 419.66

S U M M A R Y

PLANT RENTAL.	$ 20.98
MATERIALS & SUPPLIES	5,324.25
LABOR.	419.66
Total	$ 5,764.89

MISCELLANEOUS OPERATING HOUSE EQUIPMENT AND PIPING

Item No. 52

Quantity - Lump Sum

DESCRIPTION

This item includes the furnishing and placing of all the various Miscellaneous Operating House Equipment and Piping which is not included in the foregoing items.

S U M M A R Y

PLANT RENTAL	$ 111.80
MATERIALS & SUPPLIES	4,645.00
LABOR	2,236.00
TOTAL.	$6,992.80

MISCELLANEOUS OPERATING HOUSE EQUIPMENT

Item No. 52

Quantity - L.S. Date 1941

PLANT RENTAL

Small Tools, etc.		$ 111.80
	Total	$ 111.80

MATERIALS & SUPPLIES

Materials as per list attached		$ 4,645.00
	Total	$ 4,645.00

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Plumbers foreman	1	36		$ 8.00 day	$ 288.00
Plumbers	2	35	8	1.00	560.00
Plumbers Helper	2	35	8	.60	336.00
Carpenter	1	9	8	.80	57.60
Laborers	2	15	8	.50	120.00
"	4	2	8	.50	32.00
"	1	10	8	.50	40.00
			General Contract Total		$ 1,433.60
Pumps Motors, Tanks (Water & Gasoline)				L.S.	308.00
Radiators (Elec.) & Controls				L.S.	105.60
Liquidometer				L.S.	55.00
Insulation				L.S.	333.80
			Sub-Contract Total		$ 802.40
			Grand Total		$ 2,236.00

MATERIALS & SUPPLIES

Item No. 52 Date 1941

GENERAL CONTRACT

Designation	Unit	Quantity	Rate	Amount
Pipe: Copper "Type L" Hard 2"	L.F.	65	$.52-5/8	$ 34.21
" " " " 1¼"	L.F.	54	$.29-7/8	16.13
" " " " 1"	L.F.	156	$.22-1/8	34.52
" " " K Soft 1"	L.F.	108	$.26-3/4	28.89
" " " L Hard 3/4"	L.F.	5	$.16-1/4	0.81
" " " " " 1/2"	L.F.	115	$.11-1/4	12.94
" " " " " 3/8"	L.F.	18	$.08	1.44
" " " K Soft 3/8"	L.F.	58	$.10½	6.09
Fittings, Valves, Traps, Drains, etc. (Copper)	--		L.S.	428.08
Pipe: Wrought Iron, curved & St. 6"	L.F.	256	L.S.	503.16
Flanges, fittings & screen	-	-	L.S.	297.96
Pipe: Cast Iron XH 4"	L.F.	380	0.36	136.80
" " " 3"	L.F.	16	0.264	4.22
" " " 2"	L.F.	44	0.17	7.48
Fittings, Traps, Floor Drains, etc.	-	-	L.S.	156.72
Plumbing Fixtures, etc.	-	-	L.S.	140.00
Gasoline Tank & Accessories	-	-	L.S.	117.00
	General Contract Total			$ 1,926.45

SUB-CONTRACT

Designation	Unit	Quantity	Rate	Amount
Pumps, Motors, Tanks & Controls	-	-	L.S.	$ 1,758.00
Radiators (Elec.) T. & H. Controls, Hangers, etc.			L.S.	449.25
Liquidometer	-	-	L.S.	45.00
Insulation, Cork				466.30
	Sub-Contract Total			$ 2,718.55

Grand Total $ 4,645.00

Section 72

ELECTRICAL CONDUITS AND SUPPORTS

Item No. 53

Quantity - Lump Sum

DESCRIPTION

This Item covers the furnishing and installation in place of all electrical Conduits and Supports not otherwise provided for.

S U M M A R Y

PLANT RENTAL	$ 142.89
MATERIALS & SUPPLIES	2,843.36
LABOR	2,857.80
	$ 5,844.05

ELECTRICAL CONDUITS & SUPPORTS

Item No. 53

Quantity L.S. Date 1941

PLANT RENTAL

Designation		Amount
Small Tools etc.		$ 142.89
	Total	$ 142.89

MATERIALS & SUPPLIES

Designation	Rate/Hour	Amount
Galv. Conduit - 3/4" to 3" incl.	L.S.	$ 686.58
W. I. Pipe Conduit - 1" to 2½" incl.	"	308.75
Cypress - creosoted 2" x 12" - 3,000 F.B.M. (Milled)		600.00
Miscellaneous Conduit Fittings etc.		105.71
Boxes, covers, etc.		772.00
Hanger Assembly (Bridge)		160.00
Misc. Items & Cost & Supplies		210.32
	Total	$ 2,843.36

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foreman (Electrical)	1	90	8	$ 7.22 day	$ 649.80
Electricians	4	29	8	0.85	788.80
Electricians	2	32	8	0.85	435.20
Electrician Helpers	4	29	8	0.55	510.40
Electrician Helpers	2	32	8	0.55	281.60
Laborers	4	12	8	.50	192.00
				Total	$ 2,857.80

ELECTRIC POWER AND LIGHTING SYSTEM

Item No. 54

Quantity - Lump Sum

DESCRIPTION

This item comprises the furnishing and erecting in place of the Electric Power and Lighting System for the entire dam. All cartage and transportation are charged to and handled by the Shop. (See Section 14A).

S U M M A R Y

PLANT RENTAL	$ 245.00
MATERIALS & SUPPLIES	11,129.59
LABOR	4,899.80
TOTAL	$ 16,274.39

ELECTRIC POWER & LIGHTING SYSTEM

Item No. 54 Date 1941

PLANT RENTAL

Small Tools		$ 245.00
	Total	$ 245.00

MATERIALS & SUPPLIES

Electric Cable, Wire & Accessories		$ 2,906.59
Panels, Switch, Cut-outs, Covers, etc.		664.17
Switchboards		3,800.00
Light Fixtures (Int. & Ext.)		677.62
Lanterns on Bridge Pier		950.00
Street Luminaires, Posts, Etc.		1,996.83
Lamp, Splicing Ch. & Misc.		134.38
	Total	$ 11,129.59

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen, General	1	30	8	$7.22 day	$ 216.60
Foremen	2	30	8	5.16 "	309.60
Electricians	8	22	8	.85	1,196.80
Helpers (Electrician)	10	22	8	.55	968.00
Linemen	3	22	8	.85	448.80
Laborers	20	22	8	.50	1,760.00
				Total	$ 4,899.80

GRAVEL SURFACING FOR ROADWAY

Item No. 55

Quantity - 8,000 sq. yds.

DESCRIPTION

This Item includes the furnishing and placing of the sand and gravel on the roadway ready to receive the bituminous treatment.

The sand and gravel are assumed to be hauled from the plant, and the cost of same is shown in Section 17.

OPERATION COSTS

		PLANT RENTAL	MATERIAL & SUPPLIES	LABOR
Surfacing	8,000 Sq. Yds.	$ 389.08	$ 85.05	$ 581.67
Sand & Gravel	2,200 Cu. Yds.	697.58	140.29	349.73
	Totals	$ 1,086.66	$ 225.34	$ 931.40

S U M M A R Y

PLANT RENTAL	$ 1,086.66
MATERIALS & SUPPLIES.	225.34
LABOR	931.40
TOTAL.	$ 2,243.40

GRAVEL SURFACING FOR ROADWAY

Item No. 55

Quantity 8,000 sq. yds.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Trucks, Dump 4 yd.	5	3	3	$ 18.00	$ 270.00
Shovel 5/8 yd.	1	3	3	30.00	90.00
Small Tools					29.08
				Total	$ 389.08

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Trucks, Dump, 4 yd.	5	42	$ .32	$ 67.20
Shovel 5/8 yd.	1	42	.425	17.85
			Total	$ 85.05

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	3	3	8	$7.22 day	$ 64.98
Foremen	3	3	8	5.16 "	46.44
Truck Drivers	15	2	7½	.60	135.00
Shovel Operators	3	2	7½	1.25	56.25
Oilers	3	2	7½	.60	27.00
Laborers	36	2	7	.50	252.00
				Total	$ 581.67

BASIS OF ESTIMATE (Item No. 55)

It is estimated that the 5/8 cu. yd. shovel will load 4 cu. yds. of gravel in 4 minutes.

The 4 cu. yd. trucks can operate on the following schedule from the plant to the job:

Loaded 4,000 feet at 5 M.P.H.	=	9.08	minutes
Dump and Turn	=	2.88	"
Return empty 4,000 feet at 15 "	=	3.04	"
Total Haul Time for 1 Round Trip	=	15.00	"
Loading Time	=	4.00	"
Total Time for 1 Round Trip	=	19.00	"

15 ÷ 4 = 3.75 say 4 + 1 = 5 Trucks required to serve the shovel.

Each truck will haul 1260 ÷ 19 = 66 loads or 4 x 66 = 264 cu. yds. per day. 5 x 264 = 1320 cu. yds. per day for 5 trucks.

The shovel will load about 1260 yds. per day.

Figuring loss and shrinkage, approximately 2,200 cu. yds. will be required for this item.

2,200 ÷ 1,260 = 1.8 say 2 working days.

BITUMINOUS SURFACE TREATMENT FOR ROADWAY

Item No. 56

Quantity - 6,000 Gal.

DESCRIPTION

This item comprises the furnishing, spreading, rolling and placing of the bituminous binder for the gravel surfaced roadway across the top of the dam and from the dam to the highway.

The asphalt spreader is assumed to be rented, since its use is required for only a short period of time.

S U M M A R Y

PLANT RENTAL	$ 149.44
MATERIALS & SUPPLIES	1,001.04
LABOR	268.72
TOTAL	$ 1,419.20

BITUMINOUS SURFACE FOR ROADWAY

Item No. 56

Quantity 6,000 Gal.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Tar Spreader (Rented)	1	2	1	$ 50.00	$ 100.00
Trucks, Dump, 4 yd.	2	2	1	9.00	36.00
Small Tools		2	1		13.44
				Total	$ 149.44

MATERIALS & SUPPLIES

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Tar Spreader	1	16	$ .35	$ 5.60
Trucks, Dump, 4 yd.	2	16	.32	10.24
Tar, 6,100 gal. at $.15				915.00
Gravel, 100 Cu. Yds. at $.54				54.00
Sand 30 Cu. Yds. at $.54				16.20
			Total	$1,001.04

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	2	2	8	$7.22 day	$ 28.88
Foremen	2	2	8	5.16 "	20.64
Truck Drivers	2	2	8	.60	19.20
Tar Spreader Operator	2	2	8	1.25	40.00
Laborers	20	2	8	.50	160.00
				Total	$ 268.72

HIGHWAY GUARD RAIL

Item No. 57

Quantity - 5,000 Lin. Ft.

DESCRIPTION

This Item covers the furnishing of all materials and the erecting in place of the Highway Guard Rail along the access road and on top of the dam. Transportation of all material is included in the Shop cost (See Section 14A).

S U M M A R Y

PLANT RENTAL	$ 59.82
MATERIALS & SUPPLIES.	$ 1,795.20
LABOR	$ 1,196.30
TOTAL.	$ 3,051.32

HIGHWAY GUARD RAIL

Item No. 57

Quantity 5,000 Lin. Ft.

PLANT RENTAL

Small Tools		$ 59.82
	Total	$ 59.82

MATERIALS & SUPPLIES

Designation	No. Units	Unit Price	Amount
Concrete Posts	505	$ 1.20	$ 606.00
Concrete Braces	14	1.20	16.80
Clevices	28	1.00	28.00
Eye Bolts	28	.25	7.00
Hook Bolts	1010	.08	80.80
Tie Rods	14	1.90	26.60
Wire Rope	10,000 Lin.Ft.	.10	1,000.00
Paint	10 gal.	3.00	30.00
		Total	$ 1,795.20

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	15	8	$7.22 day	$ 108.30
Mechanics	2	10	8	1.00	160.00
Painters	2	10	8	.80	128.00
Laborers	20	10	8	.50	800.00
				Total	$ 1,196.30

COBBLE GUTTERS

Item No. 58

Quantity - 2,300 Lin. Ft.

DESCRIPTION

This Item includes the furnishing of all materials and the placing of the Cobble Gutters as shown on the plans.

Estimate is based on the following:

2 men will load 1 c.y. per hour.

2 " " place 1 c.y. per hour.

1 man will excavate 60 ft. trench per day.

171 Cu. Yds. Gravel at 3.54	$ 92.34
Material & Supplies	21.32
Total	$ 113.66

S U M M A R Y

PLANT RENTAL	$ 98.59
MATERIALS & SUPPLIES.	113.66
LABOR	411.72
Total.	$ 623.97

COBBLE GUTTERS

Item No. 58

Quantity 2,300 Lin. Ft.

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day		Amount
Shovel 5/8 yd.	1	1	1	$ 15.00	$	15.00
Trucks, Dump, 4 yd.	3	1	1	9.00		27.00
Trucks, Dump, 4 yd.	2	2	1	9.00		36.00
Small Tools						20.59
				Total	$	98.59

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.			Amount
Shovel 5/8 yd.	1	8	$ .425		$	3.40
Trucks Dump 4 yd.	3	8	.32			7.68
" " "	2	16	.32			10.24
				Total	$	21.32

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.		Amount
Foremen, General	1	6	8	$ 7.22 day	$	43.32
Operator, Shovel	1	1	8	1.25		10.00
Oiler, Shovel	1	1	8	.60		4.80
Truck Drivers	3	1	8	.60		14.40
" "	2	2	8	.60		19.20
Laborers	20	4	8	.50		320.00
				Total	$	411.72

12" TILE DRAINS

ITEM NO. 59

Quantity - 170 Lin. Ft.

DESCRIPTION

This item includes furnishing and placing all 12" tile drains as shown on the plans. Estimate is based on laying 10 to 12 lin. ft. per hour.

PLANT RENTAL

Small Tools, etc.	$ 4.00

MATERIAL & SUPPLIES

12" Vitrified Clay Pipe 170 lin. ft. at $.65	$ 110.50

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Pipe Layer	1	2	8	1.00	$ 16.00
Laborers	8	2	8	.50	64.00
				Total. . . .	$ 80.00

S U M M A R Y

PLANT RENTAL	$ 4.00
MATERIALS & SUPPLIES.	110.50
LABOR	80.00
TOTAL	$ 194.50

TOP SOIL

Item No. 60

Quantity - 25,000 Cu. Yds.

DESCRIPTION

This Item includes the furnishing, placing, fine grading and rolling of the top soil called for in the specifications.

Estimate is based on loading 1,500 c.y. each working day (2 shifts), rolling 1/2 Acre per shift with 2 men, and fine grading 6 c.y. of top soil per hour per man. To secure 25,000 c.y., it is assumed necessary to handle about 30,000 c.y. to cover loss and shrinkage. Most of the top soil is expected to be secured from the stripped material.

Tractor operators will be taken from Shop labor.

S U M M A R Y

PLANT RENTAL	$ 4,888.44
MATERIALS & SUPPLIES	915.20
LABOR	5,518.80
TOTAL.	$ 11,322.44

TOP SOIL

Item No. 60 | Operation No. 31

Quantity 30,000 cu. yds. | Date Aug. 22 - Sept. 21, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Shovel No. 1 1¼ cu. yd.	1	30	2	$ 48.00	$ 1,440.00
Bulldozer D4	1	30	2	11.25	337.50
Trucks, Dump, 4 cu. yd.	7	30	2	13.50	2,835.00
Small Tools					275.94
				Total	$ 4,888.44

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Shovel No. 1	1	320	$ .39	$ 124.80
Bulldozer	1	320	.23	73.60
Trucks	7	320	.32	716.80
			Total	$ 915.20

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	2	30	8	$ 6.38 day	$ 382.80
Shovel Operators	2	20	8	1.25	400.00
Oilers	2	20	8	.60	192.00
Truck Drivers	14	20	8	.60	1,344.00
Laborers	40	20	8	.50	3,200.00
				Total	$ 5,518.80

SEEDING

Item No. 61

Quantity - 30 Acres

DESCRIPTION

This item includes the furnishing and sowing as well as covering and rolling of all seed called for in the specifications.

Estimate is based on the following:

Seeding: 2 men at 8 days

Raking and rolling: 30 men at 20 days

Bulldozer: 9 days (Sept. 22 to 30)

S U M M A R Y

PLANT RENTAL	$ 280.13
MATERIALS & SUPPLIES.	731.04
LABOR	2,812.60
TOTAL	$ 3,823.77

SEEDING

Item No. 61 | Operation No. 31

Quantity 30 Acres | Date Sept. 1 to 30, 1941

PLANT RENTAL

Designation	No. Units	Cal. Days	No. Shifts	Rate/Day	Amount
Bulldozer D^4	1	9	1	$ 15.00	$ 135.00
Spring Tooth Harrow	1	9	1	.50	4.50
Small Tools		9	1		140.63
				Total	$ 280.13

MATERIALS & SUPPLIES (See Section 11)

Designation	No. Units	No. Hrs.	Rate/Hr.	Amount
Bulldozer D^4	1	48	$ .23	$ 11.04
Grass Seed 1500 lbs. at $.33				495.00
Fertilizer 11¼ tons at $20.00				225.00
			Total	$ 731.04

LABOR

Designation	No. Men	Days	Hrs./Day	Rate/Hr.	Amount
Foremen	1	30	8	$ 7.22 day	$ 216.60
Tractor Operators	1	6	8	.75	36.00
Laborers	32	20	8	.50	2,560.00
				Total	$ 2,812.60