

W
414

EUGENE DIETZGEN CO.

DRAWING MATERIALS, MATHEMATICAL and
SURVEYING INSTRUMENTS

Chicago New York San Francisco New Orleans Pittsburg Toronto

Distances from Center of Roadway for Cross-Sectioning
Roadway 16 feet wide. Side Slopes 1 on 1.
For Single Track Embankment.

H	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	H
0	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	0
1	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	1
2	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	2
3	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	3
4	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	4
5	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	5
6	14.0	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	6
7	15.0	15.1	15.2	15.3	15.4	15.5	15.6	15.7	15.8	15.9	7
8	16.0	16.1	16.2	16.3	16.4	16.5	16.6	16.7	16.8	16.9	8
9	17.0	17.1	17.2	17.3	17.4	17.5	17.6	17.7	17.8	17.9	9
10	18.0	18.1	18.2	18.3	18.4	18.5	18.6	18.7	18.8	18.9	10
11	19.0	19.1	19.2	19.3	19.4	19.5	19.6	19.7	19.8	19.9	11
12	20.0	20.1	20.2	20.3	20.4	20.5	20.6	20.7	20.8	20.9	12
13	21.0	21.1	21.2	21.3	21.4	21.5	21.6	21.7	21.8	21.9	13
14	22.0	22.1	22.2	22.3	22.4	22.5	22.6	22.7	22.8	22.9	14
15	23.0	23.1	23.2	23.3	23.4	23.5	23.6	23.7	23.8	23.9	15
16	24.0	24.1	24.2	24.3	24.4	24.5	24.6	24.7	24.8	24.9	16
17	25.0	25.1	25.2	25.3	25.4	25.5	25.6	25.7	25.8	25.9	17
18	26.0	26.1	26.2	26.3	26.4	26.5	26.6	26.7	26.8	26.9	18
19	27.0	27.1	27.2	27.3	27.4	27.5	27.6	27.7	27.8	27.9	19
20	28.0	28.1	28.2	28.3	28.4	28.5	28.6	28.7	28.8	28.9	20
21	29.0	29.1	29.2	29.3	29.4	29.5	29.6	29.7	29.8	29.9	21
22	30.0	30.1	30.2	30.3	30.4	30.5	30.6	30.7	30.8	30.9	22
23	31.0	31.1	31.2	31.3	31.4	31.5	31.6	31.7	31.8	31.9	23
24	32.0	32.1	32.2	32.3	32.4	32.5	32.6	32.7	32.8	32.9	24
25	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	33.8	33.9	25
26	34.0	34.1	34.2	34.3	34.4	34.5	34.6	34.7	34.8	34.9	26
27	35.0	35.1	35.2	35.3	35.4	35.5	35.6	35.7	35.8	35.9	27
28	36.0	36.1	36.2	36.3	36.4	36.5	36.6	36.7	36.8	36.9	28
29	37.0	37.1	37.2	37.3	37.4	37.5	37.6	37.7	37.8	37.9	29
30	38.0	38.1	38.2	38.3	38.4	38.5	38.6	38.7	38.8	38.9	30
31	39.0	39.1	39.2	39.3	39.4	39.5	39.6	39.7	39.8	39.9	31
32	40.0	40.1	40.2	40.3	40.4	40.5	40.6	40.7	40.8	40.9	32
33	41.0	41.1	41.2	41.3	41.4	41.5	41.6	41.7	41.8	41.9	33
34	42.0	42.1	42.2	42.3	42.4	42.5	42.6	42.7	42.8	42.9	34
35	43.0	43.1	43.2	43.3	43.4	43.5	43.6	43.7	43.8	43.9	35
36	44.0	44.1	44.2	44.3	44.4	44.5	44.6	44.7	44.8	44.9	36
37	45.0	45.1	45.2	45.3	45.4	45.5	45.6	45.7	45.8	45.9	37
38	46.0	46.1	46.2	46.3	46.4	46.5	46.6	46.7	46.8	46.9	38
39	47.0	47.1	47.2	47.3	47.4	47.5	47.6	47.7	47.8	47.9	39
40	48.0	48.1	48.2	48.3	48.4	48.5	48.6	48.7	48.8	48.9	40

Example—If point is 22.6 ft. above grade, how far should it be from center line to be a slope stake point? Ans. from Table 30.6. For same slopes but other widths of roadbed, correct above figures by one-half difference in width of roadbed; thus in example above, for 20 ft. roadbed distance will be $30.6 + (20 - 16) \div 2$ or 2 ft. added to 30.6 = 32.6. For slopes of 1 on 1½ see inside of back cover.

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Pg. 1-13 Tunnel Portal Entrance Portal 1-13

6 " Pilot

18-22 Outlet Tower Shaft Ex 18-22

22-23 " " " to Tun Lining

23-24 " " " Backfill.

33-36 Spillway Ogee Concr Ex.

37-41 " " Below floor

42-43 " Side Lining Warped Sec.

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EL CAPITAN DAM

Excavation in tunnel entrance
approach and portal structure.

— PORTAL STRUCTURE —

Below elev 563

Sta	End Area of Rock Section sq. ft.	Cu. Yd. Rock
0+14	31	
	31	4.59
0+10	31	
0+10	36	
		8.00
0+04	36	
0+04	377	
		55.85
0+00	377	
0+00	202.3	
		243.54
0-41.33	115.9	

311.98

Computed from planimeter measurements
of cross-sections plotted from field notes
in Field Books # 330 pg. 19-23 & pg. 45-49 and

331 pg. 56-58

Comp. by R.E.L

checked by J.W.W

Sta	End Area of Rock Section sq. ft.	Cu. Yd. Rock
0-41.33	128.7	
		25.38
0-47	113.0	
0-47	336.2	
		37.56
0-50	340	

62.94

Sta.	End Area of Rock Section sq. ft.	Cu. Yd. Rock	End Area of Earth Section sq. ft.	Cu. Yd. Earth
0+23.5	0		0	
		0.83		12.64
0+20	6.4	6.4	195	
		13.18		47.83
0+15.8	163		420	
		16.31		26.79
0+14	326.4		406	
		60.12		67.81
0+10	485.2		509.4	
		141.32		142.58
0+04	786.7		773.8	
0+04	940.3		762.5	
		133.02		115.89
0+00	855.5		802.0	
0+00	1460.5		856.0	
		256.51		175.76
0-05	1309.8		1042.2	
		641.79		

Sta.	End Area of Rock Section sq. ft.	Cu. Yd. Rock	End Area of Earth Section sq. ft.	Cu. Yd. Earth
0-05	1309.8		1042.2	
		235.01		197.47
0-10	1228.3		1090.5	
		414.93		423.74
0-20	1012.3		1197.7	
		344.78		457.63
0-30	849.5		1273.5	
		280.91		480.91
0-40	667.4		1323.4	
		175.52		391.05
0-48	517.4		1316.2	
0-48	515.8		1447.6	
		38.63		105.56
0-50	527.1		1402.4	
Total for portal structure		2486.0		2645.66
		1489.78		

— APPROACH —

sta	End Area of Rock Section sq. ft.	Cu Yd Rock	End Area of Earth Section sq. ft.	Cu Yd Earth
0-50	314.3	58.20	1281.5	1225.65
0-60	0			
0-75			1365.9	
			1217.87	
0-100			1264.7	
			281.23	
0-106			1266.4	
0-108			1252.1	93.28
				792.04
0-125			1263.8	
				137.60
0-128			1212.9	
				736.95
0-145			1128.0	
				524.55
0-158			1050.9	

sta	End Area of Earth Section sq. ft.	Cu Yd Earth
		115.45
0-161	1027.2	
		514.16
0-175	956	
		659.04
0-195	823.4	
		263.23
0-204	756	
		226.55
0-212	773.2	
		267.48
0-222	671.2	
		582.00
0-258	201.8	
		80.53
0-275	54	
		20.00
0-295	0	
		7737.51
		58.20

Total rock = 2544 y³
 Earth = 2645.66 y³
 Total = 10383 y³

7737.51 Cu yds Earth
 58.20 " " Rock

EL CAPITAN DAM
Excavation in tunnel exit
approach and portal structure

— PORTAL STRUCTURE —

Rock below Elev 542.

Sta	End Area	Cu. Yd.
11+67.77	222.7	
		42.53
11+72.77	236.6	
11+72.77	134.8	
		154.16
12+00.02	170.7	
12+00.02	212.6	
		70.31
12+08.77	221.3	
12+08.77	164.4	
		6.07
12+09.77	163.7	
12+09.77	685	
12+12.77	613	76.67
12+12.77	695	
		<u>349.74</u>

See also on Reel -

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Computed from planimeter measurements of
cross sections plotted from field notes in
Field Books # 331 pp. 52-55 & pp. 66 & 69-75
comp. by R.E.L. Checked by J.W.W

— PORTAL STRUCTURE —

Sta	Area Rock End Ft.	Cu Yd Rock	End Area earth	Cu Yd earth	(above Elev 542)
11+47.77				0	
					72.36
11+59.77			325.6		
					34.45
11+61.77	0		604.5		
		0.84			23.79
11+62.77	45.1		680.3		
11+62.77	145.1		780.2		
		48.49			131.23
11+66.77	509.4		991.4		
		24.79			36.66
11+67.77	829.4		988.2		
		186.44			179.26
11+72.77	1184.2		947.7		
		539.70			449.41
11+82.77	1730.2		1479.0		
		800.26			927.16

sta.	End Area Rock	Cu. Yd. Rock	End Area Earth	Cu. Yd. Earth.
11+82.77	1730.2		1479.00	
		800.20	927.16	
		605.41	597.90	
11+92.77	1539.0		1749.6	
		551.41	699.60	
12+02.77	1438.6		2028.2	
		313.93	461.16	
12+08.77	1320.3		1757.7	
		173.64	263.76	
12+12.77	1023.8		1803.1	
		2444.65	2949.58	
Below El 542		349.74		
		2794.39		

- APPROACH -

sta.	End Area Rock	Cu. Yd. Rock	End Area Earth	Cu. Yd. Earth.
12+12.77	1023.8		1803.1	
12+22.77	682	315.89	1633	636.33
		525.08		1289.62
12+45.77	550.8		1394.8	
		147.38		410.16
12+53.77	443.9		1373.8	
		290.58		1047.12
12+74.77	293.2		1318.7	
		145.76		648.93
12+88.77	268.9		1184.2	
		153.90		782.59
13+07.77	168.5		1040	
		6480		43742
13+19.77	123.1		928.3	
		57.61		471.17
13+34.77	84.2		767.9	
		41.80		470.28
13+53.77	34.5		568.6	
		18.58		529.41
13+82.77	0		417.2	
		1761.38		6723.03

Sta	End Area Rock	Cu. Yd. Rock	End Area Earth	Cu. Yd. Earth
13+82.77	0		417.2	6723.03 574.5
14+27.77			272.2	7514
14+35.77			234.9	127.70
14+57.77			196	258.40
15+30			0	
	1761.38		7758.77	
	2794.39		2949.58	
	<u>4555.77</u>		<u>10708.35</u>	

EL CAPITAN DAM

Excavation in pilot tunnel of
the diversion tunnel (Item 1A)
Sta 0+00 is upstream portal face
Sta 11+72.77 is downstream portal face.

Sta.	Sta.	Size of opening	Length	Cu. ft.	Cu. Yd.
0+00	2+53	13'x14'	253'	46,046	
2+53	7+20	13'x15'	467'	91,065	
7+20	7+60	13'x18'	40'	9,360	
7+60	8+56	13'x15'	96'	18,720	
8+56	9+64	15'x18'	108'	29,160	
9+64	9+74	13'x15'	10'	1,950	
9+74	11+72.77	13'x14'	198.77'	36,176	
			<u>1172.77</u>	<u>232,477</u>	8,610

Copied from Estimates Nos A & 5

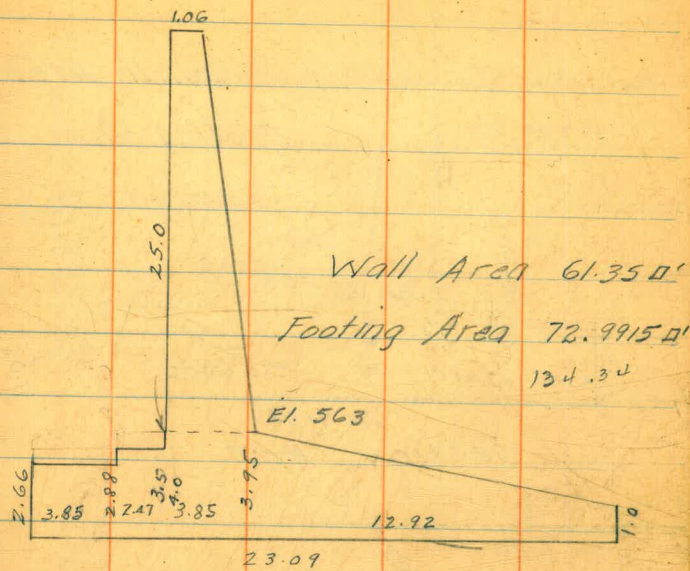
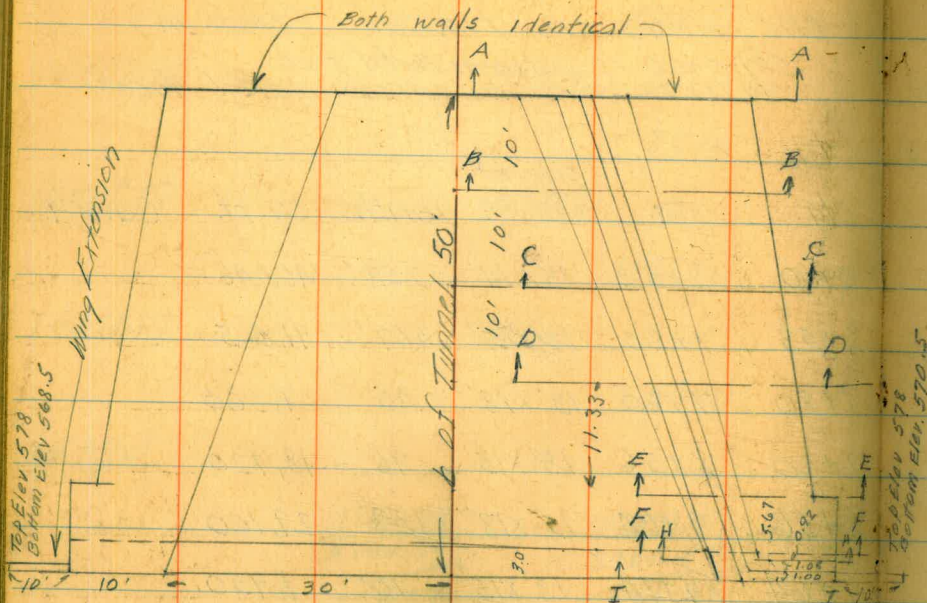
R. E. L

EL CAPITAN DAM

Concrete in tunnel entrance
portal structure.

Ref. W.D 390 and Field Book

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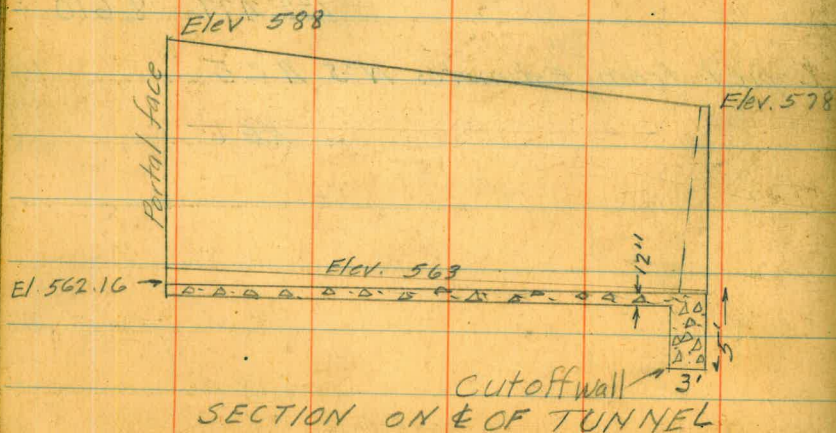
Wall Area 61.35 sq'

Footing Area 72.9915 sq'

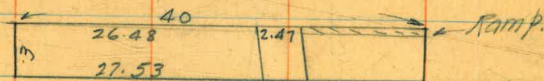
134.34

EI. 563

SECTION A-A



EAST CUTOFF WALL

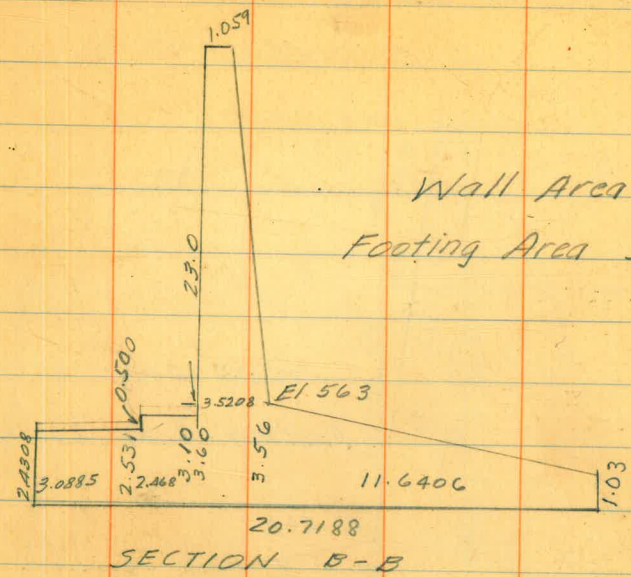


$$\begin{array}{r} 26.48 \\ 27.53 \\ \hline 27.00 \times 3 \times 1 = 81.00 \\ 27.00 \times 3 \times 0.5 = 3.705 \\ \hline 84.705 \\ \text{Ramp from } \rightarrow 0.533 \\ \text{F-F to G-G} \\ \hline 85.232 \end{array}$$

Gross Vol $40 \times 3 \times 5 = 600$ Cuft.

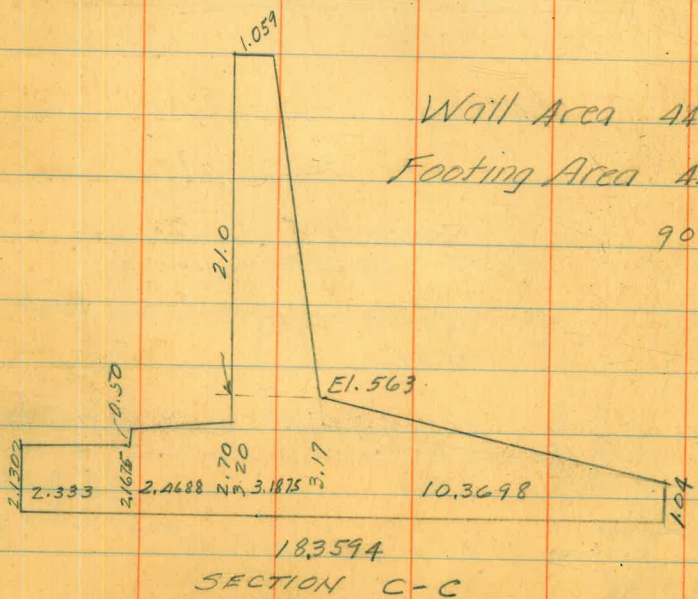
Less $\frac{85.232}{85.232}$

Vol. of $\frac{1}{2}$ of cutoff wall $\rightarrow 519.768$



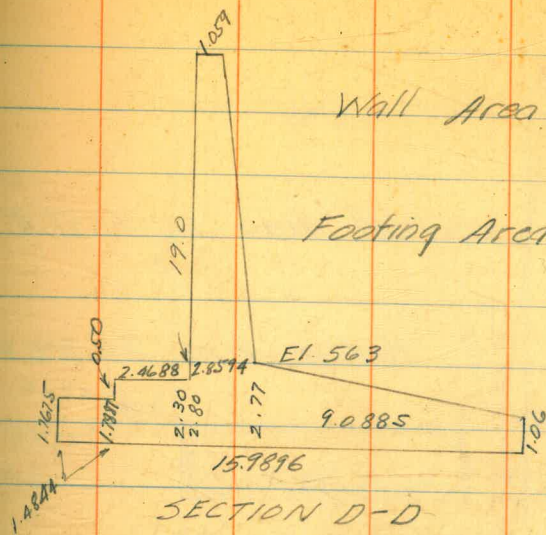
Wall Area 52.668 \square'
 Footing Area 54.6082 \square'
 107.276

20.7188
 SECTION B-B



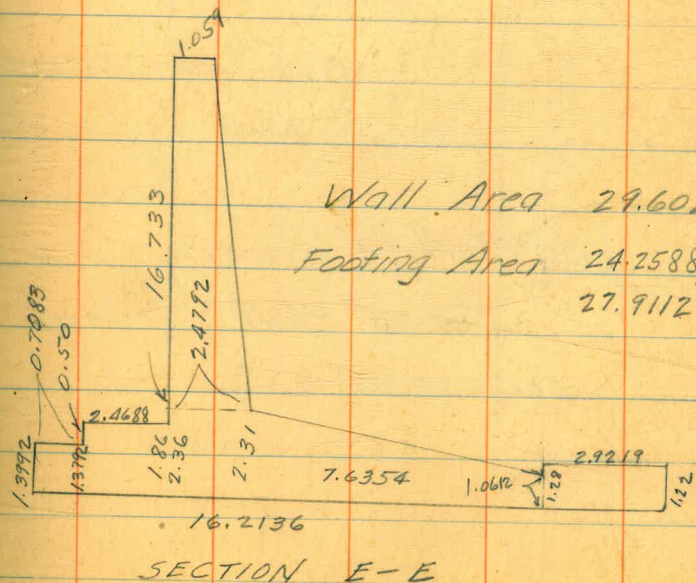
Wall Area 44.5872 \square'
 Footing Area 45.6170
 90.2042

18.3594
 SECTION C-C



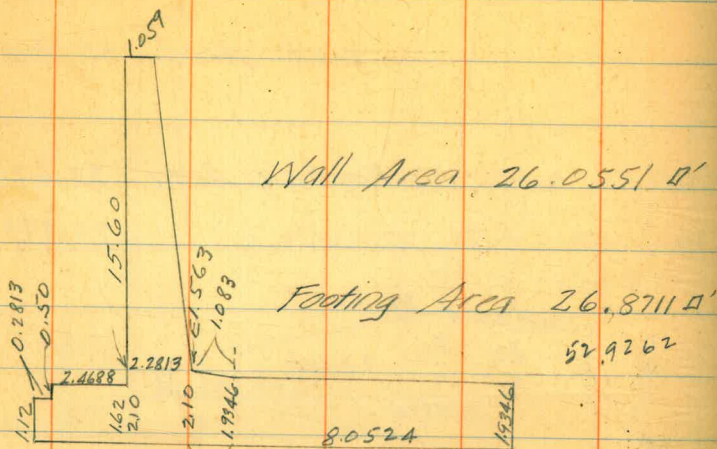
Wall Area 37.2248 \square'
 Footing Area 33.6717 \square'
 70.8965

15.9896
 SECTION D-D

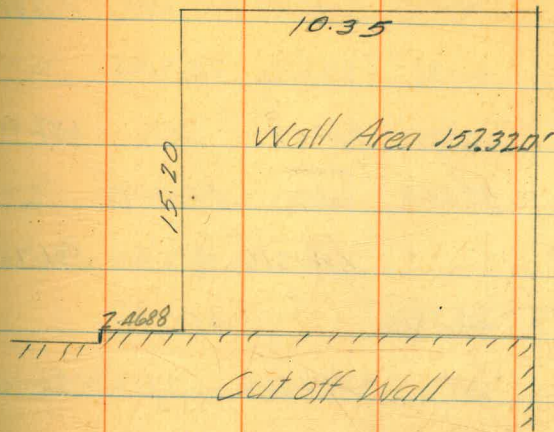


Wall Area 29.6074 \square'
 Footing Area 24.2588 \square'
 27.9112 \square'

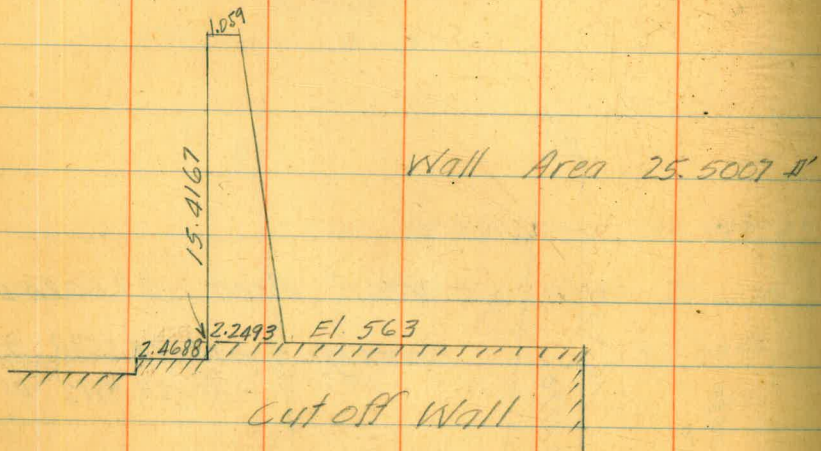
16.2136
 SECTION E-E



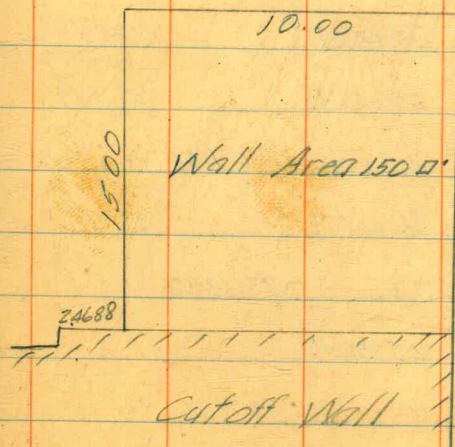
SECTION F-F



SECTION H-H

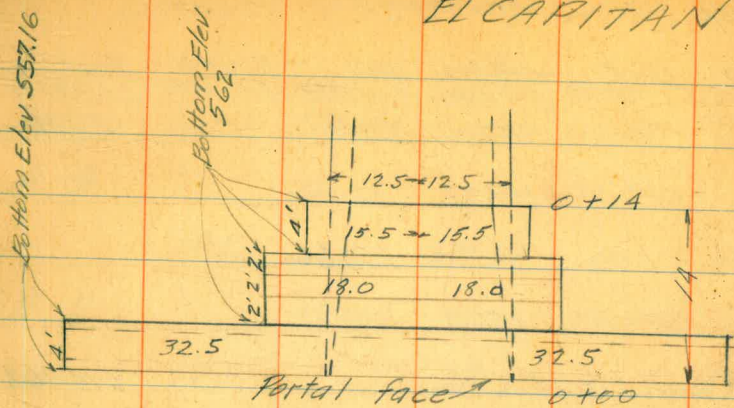


SECTION G-G

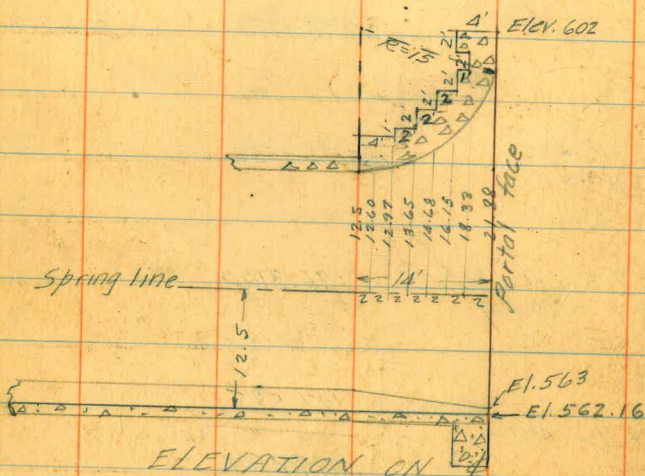


SECTION I-I

EL CAPITAN DAM



PLAN OF INTAKE



ELEVATION ON

Concrete in intake and portal structure "

Gross Volume of Portal Collars

Station	Dimensions	Volume (Cu. ft.)
0+00 - 0+04	65 x 44.84 x 4	11,658.40
Less	65 x 2 x 1	130.00
		<u>11,528.40</u>
0+04 - 0+06	36 x 34 x 2	2,448.00
0+06 - 0+08	36 x 32 x 2	2,304.00
0+08 - 0+10	36 x 30 x 2	2,160.00
0+10 - 0+14	31 x 29 x 4	<u>3,596.00</u>
		<u>22,036.40</u>

Subtractive Vol. below spring line
4024.244

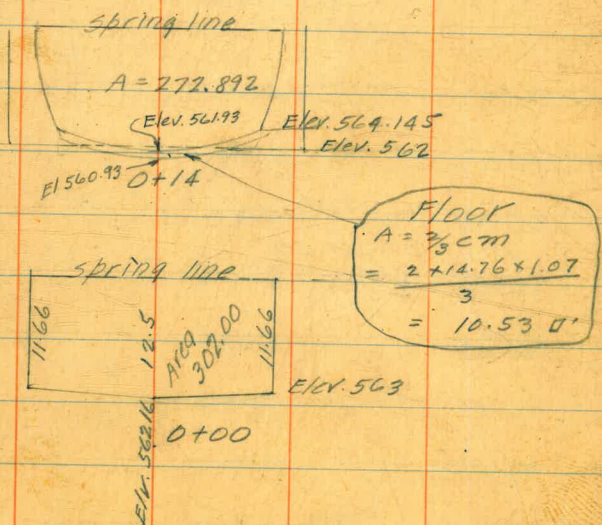
$$272.892 \times 14 = 4024.244 \text{ Cu. ft.}$$

272.892

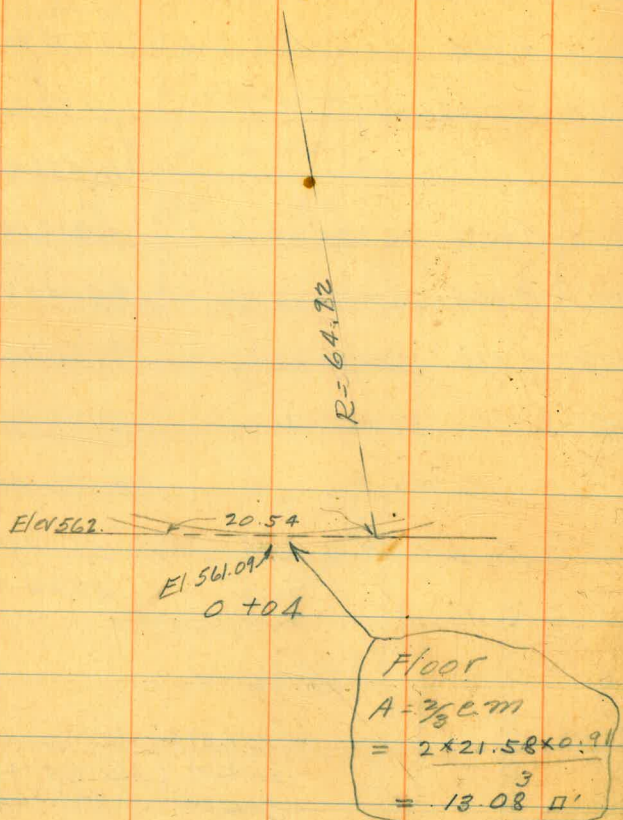
302

21574.892

287.446 x 14 = 4024.244 Cu. ft.



Floor
 $A = \frac{2}{3} cm$
 $= \frac{2 \times 14.76 \times 1.07}{3}$
 $= 10.53 \text{ sq'}$



Floor Vol. below elev. 562
 $\frac{10.53 + 13.08}{2} \times 10 = 118.055 \text{ Cu ft.}$

Subtractive Volume above spring line
 (see pg. 11)

		0+14 $\frac{245.44}{2}$ 122.72
		0+12 247.94
		0+10 257.19
		0+08 274.19
		0+06 299.94
		0+04 336.69
		0+02 390.44
		0+00 $\frac{479.94}{2}$ 239.97
2169.08 x 2 = 4338.16 Cu ft.		2169.08

Cut Off Wall

End area "A" = 295.0624

" B = 290.8054

$\frac{585.8678}{2} \times 3 = 878.8017 = 32.5482 \text{ cu yds}$

Volume in Entrance Portal footing = 32.55 cu yds

Floor Area

at "A" 55.0624 sq'

2.4688 sq'

Area at "A" = 57.5312 sq'

57.5312

29.5312

80.1624

$\frac{80.1624}{2} \times 50 = 2015.6 \text{ cu ft} =$

$= 74.6518 \text{ cu yds}$

at Portal Face 20.0624 sq'

2.4688

22.5312

Volume in Entrance Portal floor = 74.65 cu yds

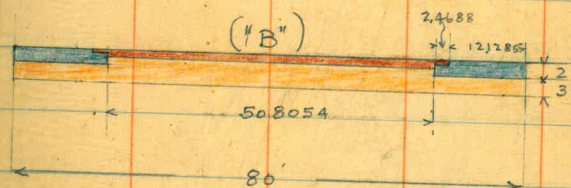
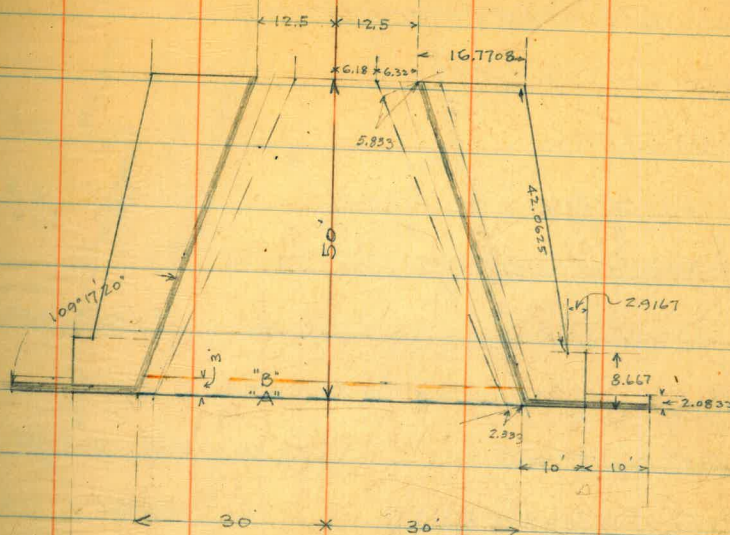
Note - Totals below include all concrete east of 0+14.

SUMMARY

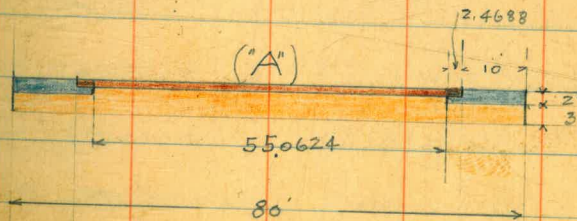
Walls	176.93	Cubic Yds.
Footings & Cutoff	187.69	
Portal structure	506.44	
Floor	79.02	
Total in entr Portal	950.08	
Plus 130 = 4.8y ³	4.8	
See page 11. Portal floor	86.20	
Portal structure	868.68	

Less invert 0+00 to 0+14
 Area floor 0+00 = 22.531
 " " 0+14 = 22.003
 $\frac{44.534}{2}$
 $22.267 \times 14 = 311.738$
 $\frac{311.738}{27} = 11.55 \text{ y}^3$
 $11.55 + 70.65 = 82.20 \text{ y}^3$ Total floor

EL CAPITAN DAM Entrance Portal Footing



"B" Areas 80 x 3 = 240.0000
 50.8054 x 1 = 50.8054
 Area cutoff wall at "B" = 290.8054 sq'



"A" Areas 80 x 3 = 240.0000
 55.0624 x 1 = 55.0624
 Area cutoff wall at "A" = 295.0624 sq'

0 10 20 30 40 50 Scale

Tunnel/Outlet Approach Concrete

Apron Cut Off Wall

$$69.03 \times 3 \times 9' = 69.030 \text{ y}^3 \checkmark$$

$$\text{Floor } (50+25) \times 40 \times 1 = 1500 \text{ ft}^3 = 55.555 \text{ y}^3 \checkmark$$

$$\text{Sump } 38.5 \text{ ft}^3 = 1.425 \text{ y}^3 \checkmark$$

South Wall footing under floor Section

$$38.763 \times 4.25 \times 3.25 = 19.830 \text{ y}^3 \checkmark$$

South Wall footing under Ret. Wall and Counterforts

$$35.2344 \times 12.75 \times 3.25 = 54.075 \text{ y}^3 \checkmark$$

$$\left(\frac{10.1354 + 7.1680}{2} \right) \times \left(\frac{9.75 \times 3.25}{27} \right) = 10.154 \text{ y}^3 \checkmark$$

$$\left(\frac{11.8646 + 10.3021}{2} \right) \times \left(\frac{5 \times 3.25}{27} \right) = 6.670 \text{ y}^3 \checkmark$$

South Retaining Wall

$$33.33 \times (1+1.5) = 41.66 \text{ ft}^2$$

$$29 \times (1+1.5) = 36.25 \text{ ft}^2$$

$$\left(\frac{41.66 + 36.25}{2} \right) \times 41.9063 = 60.461 \text{ y}^3 \checkmark$$

$$\frac{36.25 \times 18.765}{27} = 25.194 \text{ y}^3 \checkmark$$

$$\text{Counterforts } \frac{(11.25 \times 33.75) \times \frac{2}{27}}{2} = 14.062 \text{ y}^3 \checkmark$$

$$\frac{(11.25 \times 33.56) \times \frac{2}{27}}{2} = 13.983 \text{ y}^3 \checkmark$$

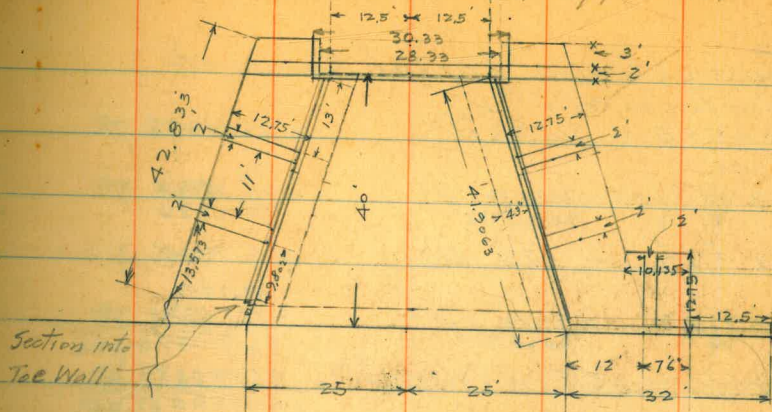
$$\frac{(11.25 \times 31.89) \times \frac{2}{27}}{2} = 13.287 \text{ y}^3 \checkmark$$

$$\frac{(11.25 \times 30.42) \times \frac{2}{27}}{2} = 12.675 \text{ y}^3 \checkmark$$

$$\frac{(11.25 \times 29) \times \frac{2}{27}}{2} = 12.083 \text{ y}^3 \checkmark$$

Tunnel Outlet approach

14



$$\text{Counterforts } \frac{(11.13 \times 33.37) \times \frac{2}{27}}{2} = 13.760 \text{ y}^3 \checkmark$$

$$\frac{(11.13 \times 33.37) \times \frac{2}{27}}{2} = 13.760 \text{ y}^3 \checkmark$$

North Retaining Wall footings under floor section

$$38.7736 \times 4.25 \times 3.25 = 19.836 \text{ y}^3 \checkmark$$

$$\left(\frac{37.5937 + 37.801}{2} \right) \left(\frac{12.75 \times 3.25}{27} \right) = 57.855 \text{ y}^3 \checkmark$$

$$\left(\frac{10.3021 + 11.8646}{2} \right) \left(\frac{5 \times 3.25}{27} \right) = 6.670 \text{ y}^3 \checkmark$$

North Retaining Wall

$$33.37 (1+1.5) = 41.71 \text{ ft}^2$$

$$34 (1+1.5) = 42.50 \text{ ft}^2$$

$$\left(\frac{41.71 + 42.50}{2} \right) \times 37.801 = 58.949 \text{ y}^3 \checkmark$$

section into west toe wall

$$34 \times 1.35 \times 1 = 1.574 \text{ y}^3 \checkmark$$

$$\text{Total concrete } 540.888 \text{ y}^3$$

$$\text{Less floor } 55.555 \text{ y}^3$$

$$\text{approach concrete } 484.333 \text{ y}^3$$

Tunnel Outlet Portal Concrete

Cut off at face of Portal			
$28.33 \times 5 \times 5 = 708.75 \text{ ft}^3$	$= 26.2340 \text{ y}^3$		26.2340
Portal Wall			
$28.33 \times 35.83 \times 2 = 2030.128 \text{ ft}^3$	$= 75.1898 \text{ y}^3$		77.2884 ✓
36.83×2086.788	$= 77.2884$		
$30.33 \times 3 \times 2 = 182 \text{ ft}^3$	$= 6.7407 \text{ y}^3$		6.7407
$28.33 \times 28 \times 3 = 2380 \text{ ft}^3$	$= 91.2856 \text{ y}^3$		91.2856 ✓
29×2464.71	$= 88.1481 \text{ y}^3$		201.5487 ✓
	$= 196.3126 \text{ y}^3$		
Less Waterway $518.328 \times 5 = 2591.64 \text{ ft}^3$	$= 95.9866 \text{ y}^3$		95.9867 ✓
	$= 100.3260 \text{ y}^3$		105.5620 ✓
Less Invert $5 \times 22.003 = 110.015 \text{ ft}^3$	$= 4.0750 \text{ y}^3$		4.0746
Total Tunnel Outlet Portal Wall	96.2510 y^3		101.4874 ✓
5' of Invert	4.0750 y^3		

Summary. Portal structure concrete

Includes all tunnel concrete west of 11+67.77.

485.333 y³

101.487

586.820 y³

1.425 Sump in portal floor.

585.395 y³ Total Item 29.

Portal structure floor.

55.555 y³

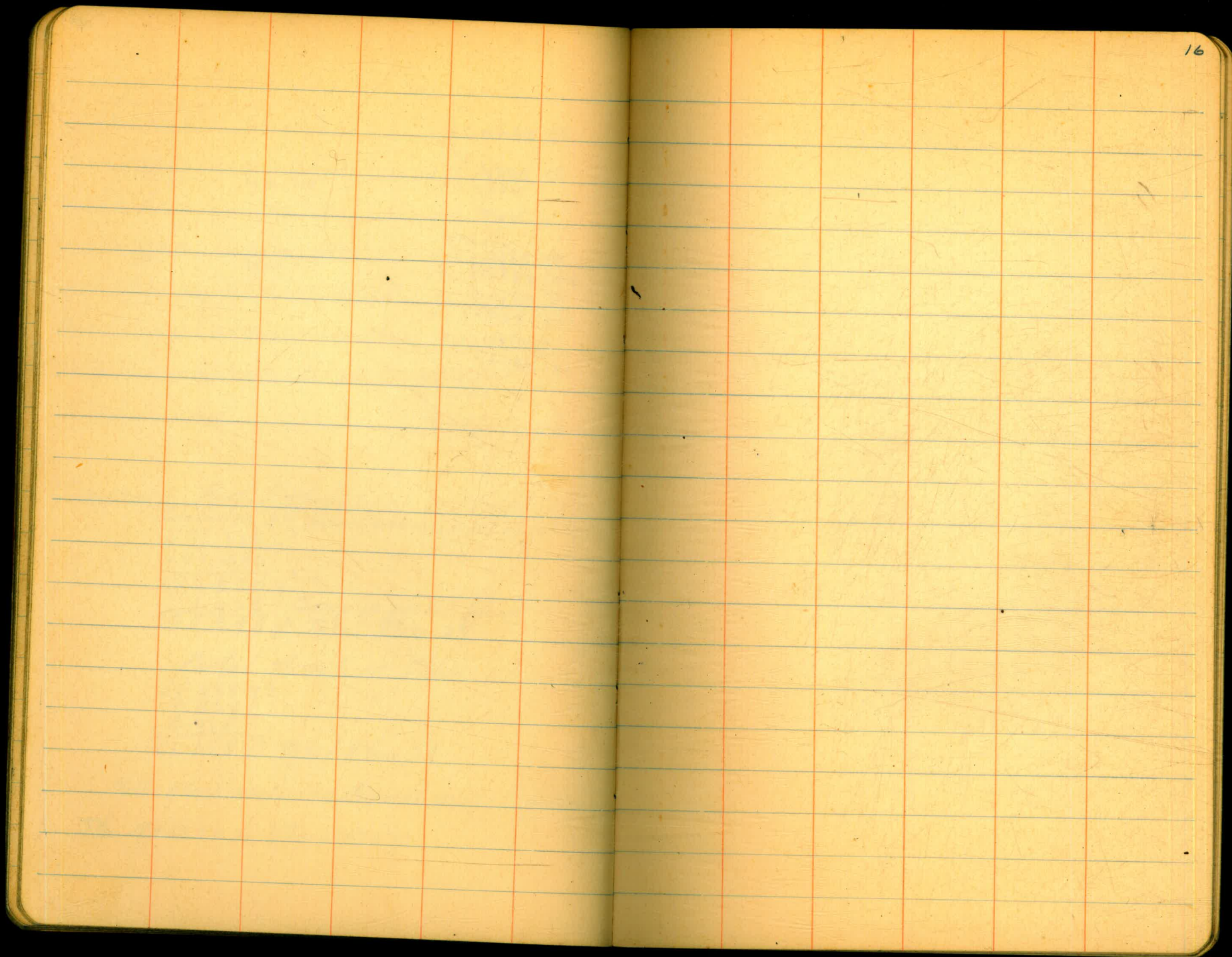
1.425

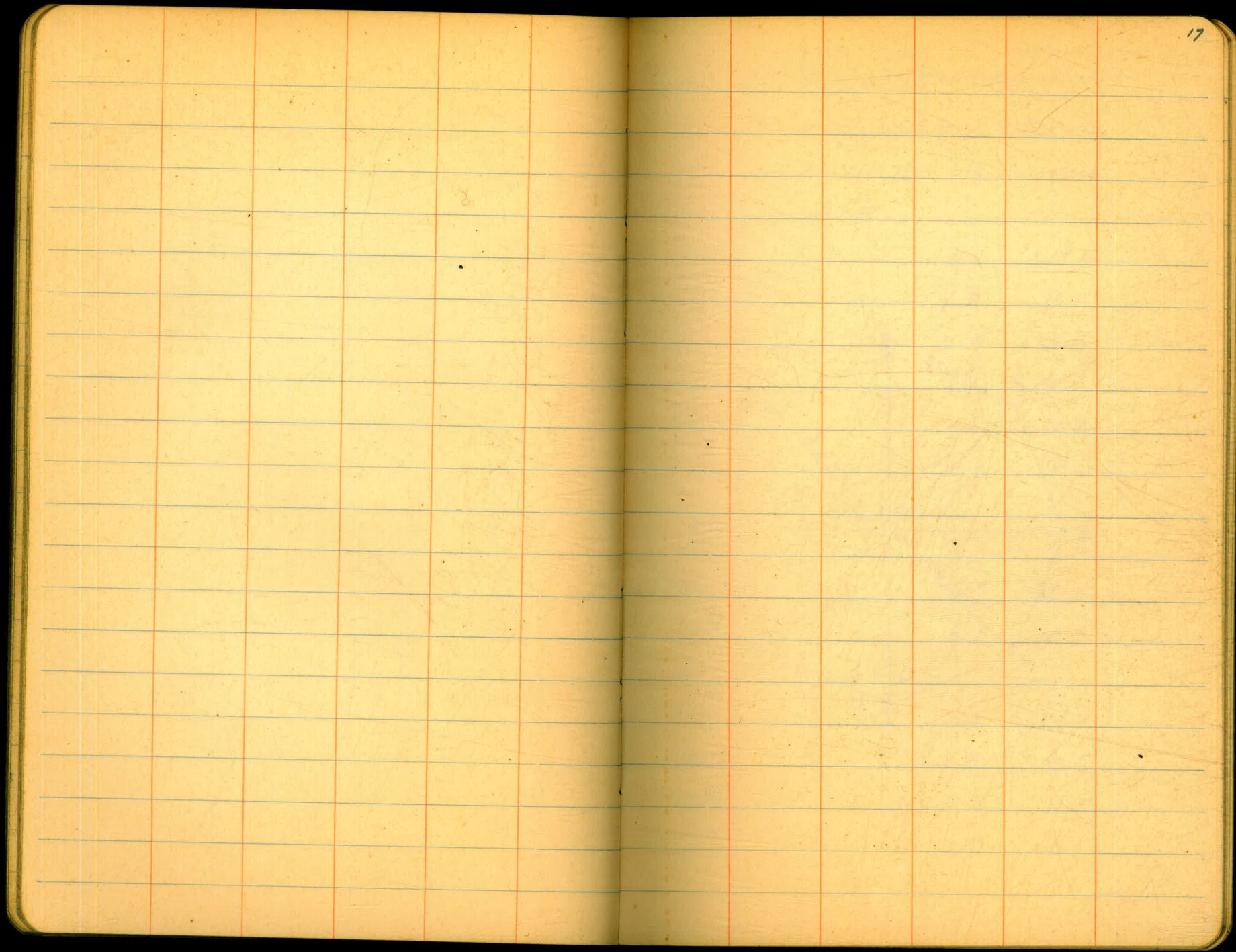
4.075

61.055 y³ Total Item 28.

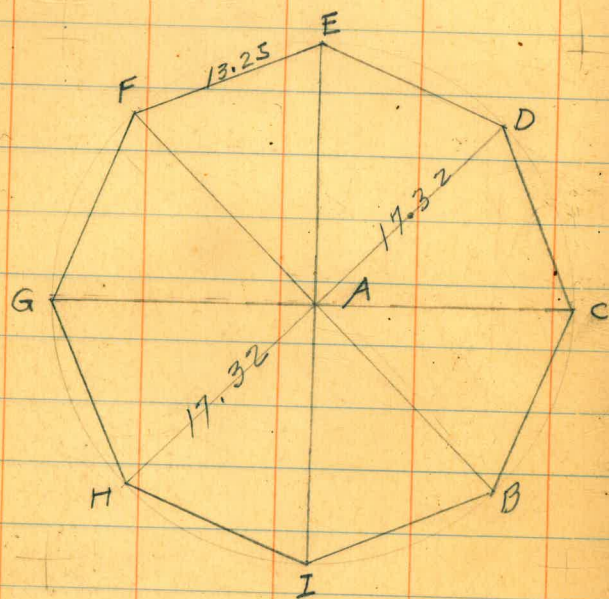
Note. Floor includes tunnel invert from

Sta. 11+67.77 to Sta. 11+72.77.





OUTLET TOWER SHAFT EXCAVATION



X sections top of outlet tower
shaft Feb 25-33 Simpson super
Remman. 18

BM	12.28	614.28	602.00
	5.68	618.78	1.18
			613.10

A-B

A=0+00	0.4	618.4
+02 ⁵	0.8	18.0
+03	3.2	15.4
+07	1.7	17.1
+14	4.5	14.3
+17 ³	4.3	14.5

A-C

0+01	4.2	14.6
+10	6.3	12.5
+17 ³	8.1	10.7

A-D

0+01	4.5	14.3
+06	5.3	13.5
+10 ⁵	7.8	11.0
+17 ³	10.7	08.1

618.78

A-E

0+02	49	613.9
+10	7.5	11.3
+17 ³	9.9	08.9

A-F

0+04	1.7	17.1
+05	5.4	13.4
+12	4.6	14.2
+17 ³	5.5	13.3
T.P.	8.82	625.44
	2.16	616.62

A-G

0+05	3.6	21.8
+12	6.8	18.6
+17 ³	5.9	19.5

A-H

0+05	0.4	25.0
+07 ⁵	+0.3	25.7
+12 ⁵	2.0	23.4
+14 ⁵	5.6	19.8
+17 ³	+0.9	26.3

625.44

A-I

0+05	3.6	621.8
+11	7.1	18.3
+17 ³	6.2	19.2

Original ground to Elev. 605

$$\begin{array}{r}
 \begin{array}{c}
 \text{A-B} \\
 \hline
 \begin{array}{c}
 \frac{c13.4}{0} \quad \frac{c13.0}{2.5} \quad \frac{c10.4}{3.0} \quad \frac{c12.1}{7} \quad \frac{c9.3}{14} \quad \frac{c9.5}{17.3}
 \end{array}
 \end{array}
 \end{array}$$

Area

191.55

$$\begin{array}{r}
 \begin{array}{c}
 \text{A-C} \\
 \hline
 \frac{c13.4}{0} \quad \frac{c9.6}{1} \quad \frac{c7.5}{10} \quad \frac{c5.7}{17.3}
 \end{array}
 \end{array}$$

136.70

$$\frac{1560.85}{8 \times 17.3} = 11.27 =$$

Average cut

Average cut

$$\begin{array}{r}
 \begin{array}{c}
 \text{A-D} \\
 \hline
 \frac{c13.4}{0} \quad \frac{c9.5}{1} \quad \frac{c8.5}{6} \quad \frac{c6.0}{10.5} \quad \frac{c3.1}{17.3}
 \end{array}
 \end{array}$$

119.40

$$\text{Area of base} = 848.32 \text{ ft}^2$$

$$\begin{array}{r}
 \begin{array}{c}
 \text{A-E} \\
 \hline
 \frac{c13.4}{0} \quad \frac{c8.9}{2} \quad \frac{c6.3}{10} \quad \frac{c3.9}{17.3}
 \end{array}
 \end{array}$$

120.4

$$848.32 \times 11.27 =$$

27

$$\begin{array}{r}
 \begin{array}{c}
 \text{A-F} \\
 \hline
 \frac{c13.4}{0} \quad \frac{c12.1}{4} \quad \frac{c8.4}{5} \quad \frac{c9.2}{12} \quad \frac{c8.3}{17.3}
 \end{array}
 \end{array}$$

169.25

354.1 Cubic Yds.

$$\begin{array}{r}
 \begin{array}{c}
 \text{A-G} \\
 \hline
 \frac{c13.4}{0} \quad \frac{c16.8}{5} \quad \frac{c13.6}{12} \quad \frac{c14.5}{17.3}
 \end{array}
 \end{array}$$

256.40

$$\begin{array}{r}
 \begin{array}{c}
 \text{A-H} \\
 \hline
 \frac{c13.4}{0} \quad \frac{c20}{5} \quad \frac{c20.7}{7.5} \quad \frac{c18.4}{12.5} \quad \frac{c19.8}{14.5} \quad \frac{21.3}{17.3}
 \end{array}
 \end{array}$$

315.85

$$\begin{array}{r}
 \begin{array}{c}
 \text{A-I} \\
 \hline
 \frac{c13.4}{0} \quad \frac{16.8}{5} \quad \frac{13.3}{11} \quad \frac{14.2}{17.3}
 \end{array}
 \end{array}$$

252.40

Total Area 1560.85

X-sections bottom of shaft
After completion.

B.M	-350	559.0	562.5
A-B			
A =	0+00	6.5	552.5
	+17	4.9	54.1
	+17 ³	3.5	55.5
A-C			
	0+16 ⁵	5.7	53.9
	0+17 ³	3.5	55.5
A-F			
	0+16 ⁵	4.7	54.3
	0+17 ³	3.5	55.5
A-G			
	0+02	5.6	53.4
	+16	4.4	54.6
	+17 ³	3.5	55.5
A-H			
	0+09	4.9	54.1
	+17	5.4	53.6
	+17 ³	3.5	55.5

	559.0		
A-I			
	0+16	5.4	553.6
	+17 ³	3.5	55.5
Excavation From Elev 605 to bottom.			
A-B			
	52.5	50.9	49.5
	0	17	17.3
	878.9	15.06	
Area.			
			893.96
A-C			
	52.5	51.7	49.5
	0	16.5	17.3
	859.65		
Area			
			900.13
A-D			
	52.5	52.6	49.5
	0	16.5	17.3
	867.07	40.84	
Area			
			907.91
A-E			
	52.5	51.1	49.5
	0	16.5	17.3
	854.70	40.24	
Area			
			894.94
A-F			
	52.5	50.7	49.5
	0	16.5	17.3
	856.35	40.08	
Area			
			896.43
A-G			
	52.5	51.6	49.5
	0	2	16
	124.10	76.84	64.93
Area			
			934.03
A-H			
	52.5	50.9	49.5
	0	9	17
	165.3	409.2	151.3
Area			
			889.63
A-I			
	52.5	51.4	49.5
	0	16	17.3
	831.20	65.58	
Area			
			896.78
			7213.81

Outlet tower shaft excav
(cont)

Total Area = 7213.81

Average height = $\frac{7213.81}{8 \times 17.32}$

= 52.06'

Area of base = 848.32 sq'

Vol. = $\frac{848.32 \times 52.06}{27}$

= 1635.68 Cu.Yd.

From P. 20

354.10

Total shaft excav. 1719.78 Cu.Yd.

193.35

9.63

1922.76

EXCAVATION BETWEEN
TOWER SHAFT AND TUNNEL

LINING

Elev.	Perimeter Reading	Area	Mean	Height	Cu. Ft.
561	3595	524.98			
			520.38	1	520.38
562	3532	515.78			
			508.77	1	508.77
563	3436	501.76			
			478.90	2	957.80
565	3123	456.05			
			420.57	5	2102.85
570	2637	385.08			
			376.90	3	1130.70
573	2525	368.72			

5220.50

193.35 Cu.Yd.

Note: Areas were measured by
planimeter from drawing to scale
of 1" = 3'

Ref. W.D. 423 W.D. 414 W.D. 383

EXCAVATION FOR ENTRANCE
ADDIT

Elev 561 to Elev 573

16.1 x 6 x 12 = 1159.2 Cu. Ft.

Note - This quantity included in 193.35 y³
on previous page.

Elev 573 to Elev 576

14.45 x 6 x 3 = 260.1 Cu. Ft.
= 9.63 Cu. Yd.

OUTLET TOWER BACK-

FILL Elev 561.5 to Elev 605

Volumes displacing backfill

Concrete on south Elev 561.5
to Elev 573

Bottom area = 155.96 sq'

Top " = 159.46 sq'

Mean " = 157.71

height = 11.5 ft.

157.71 x 11.5 = 1813.66 Cu. Ft.

Well displacement Elev 561.5
to Elev 576

Bottom area = 42.20 sq'

Top " = 43.08 sq'

Mean " = 42.64

Height = 14.5'

42.64 x 14.5 = 618.28 Cu. Ft.

Elev 576 to Elev 605

Bottom area = 37.24 sq'

Top " = 41.18 sq'

Height = 29.1'

(Backfill cont)

$$39.21 \times 29 = 1173.09 \text{ Cu. Ft.}$$

Displacement of barrel of
tower Elev 561.5 to Elev 605

$$\frac{\pi}{3} [(10.05)^2 + (9.40)^2 + (10.05 \times 9.40)]$$

$$= 12,929.37 \text{ Cu. Ft.}$$

Volume of octagon shaft.

El. 561.5 to Elev 605

$$\text{Area of base} = 848.32 \pi$$

$$\text{Height} = 43.5'$$

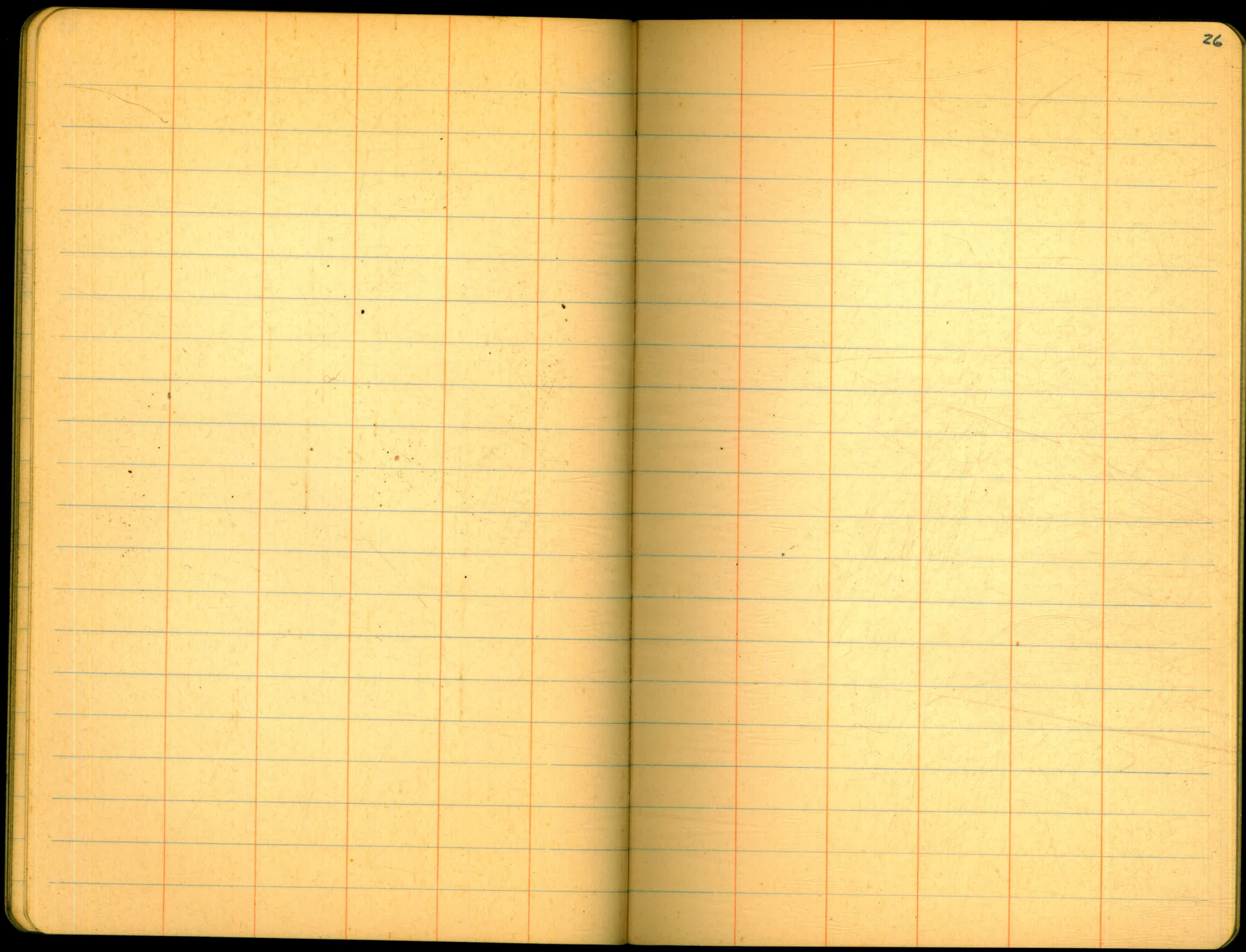
$$848.32 \times 43.5 = 36,901.92 \text{ Cu. Ft.}$$

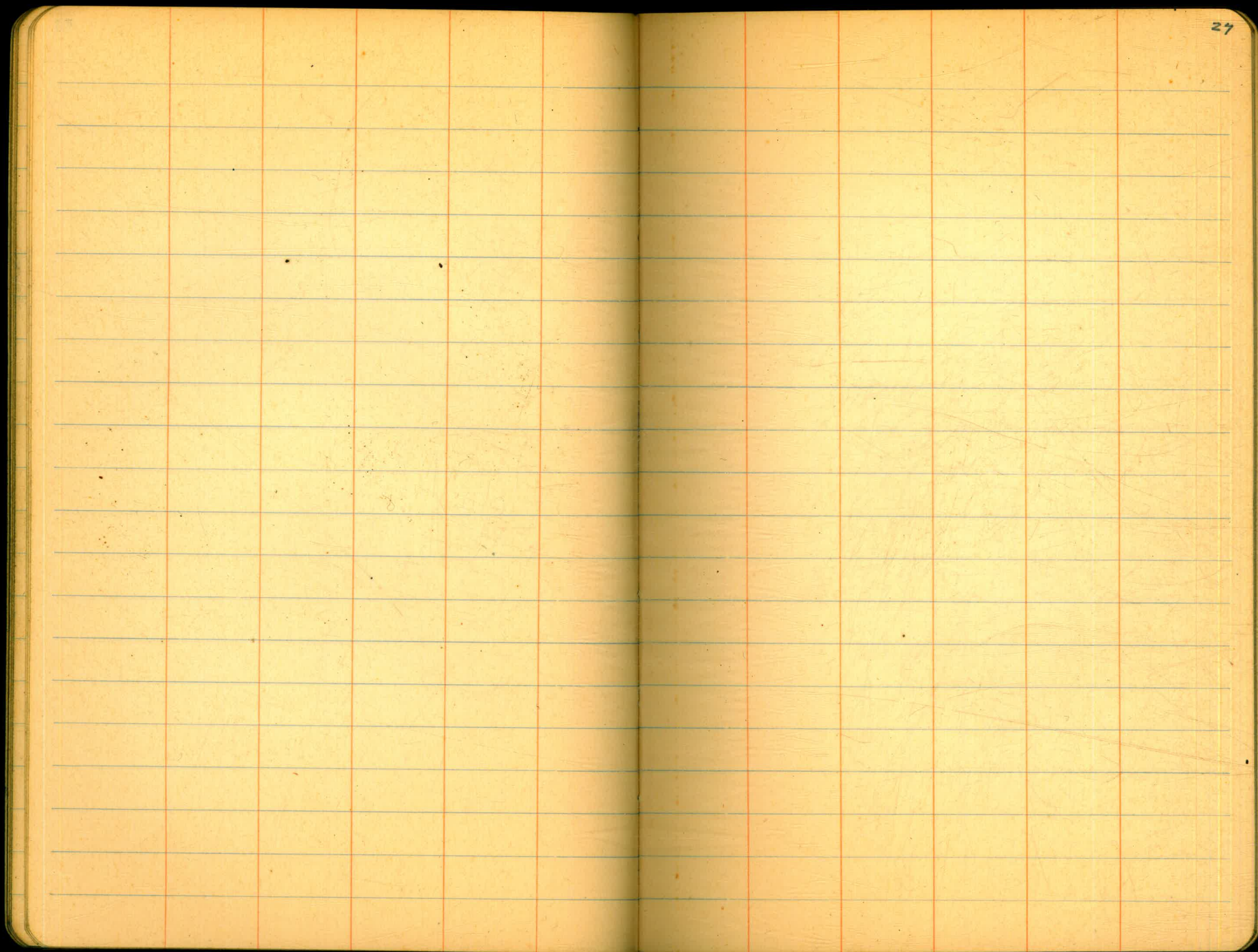
$$\text{Less total displacement} \quad \underline{16,534.40}$$

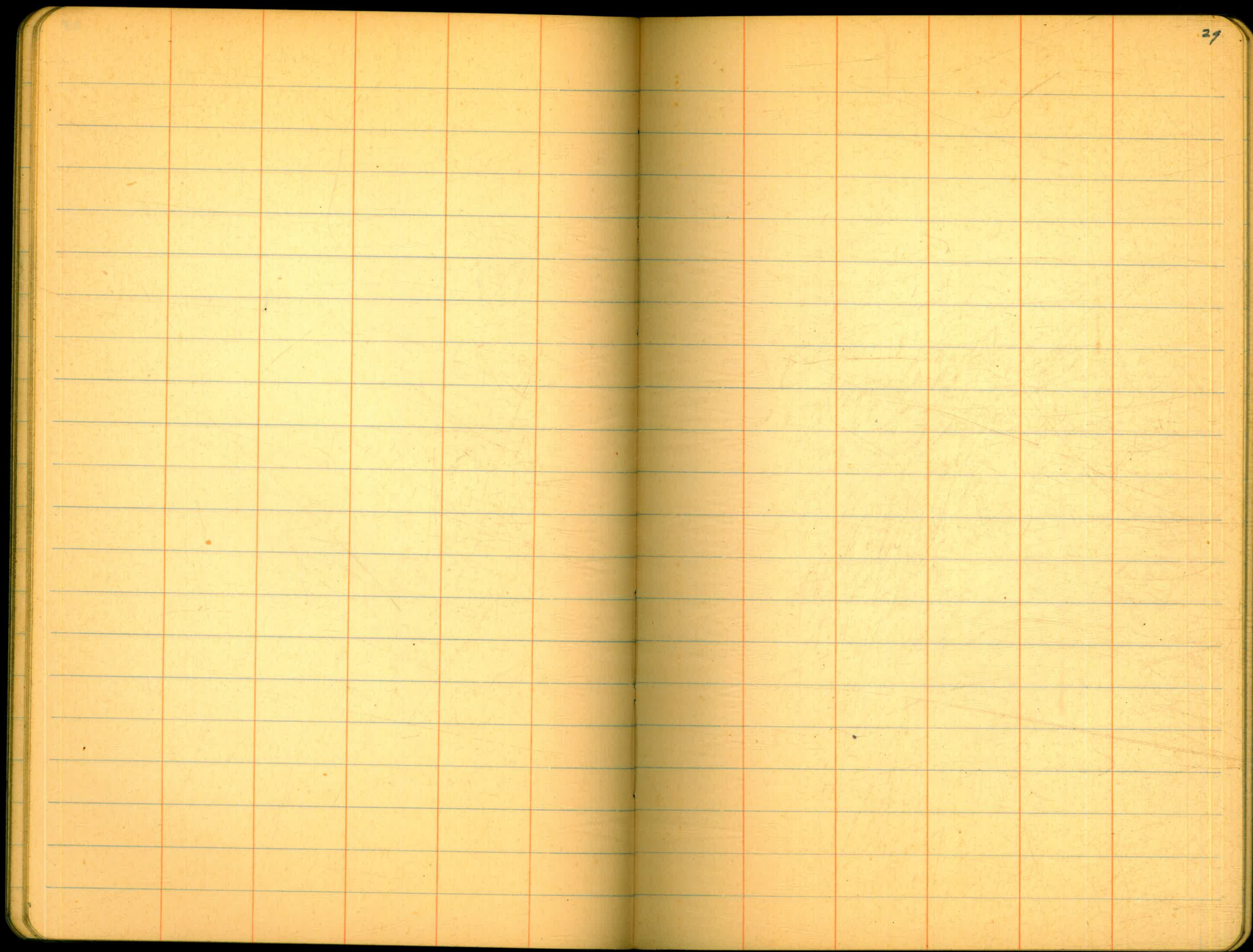
$$20,367.52$$

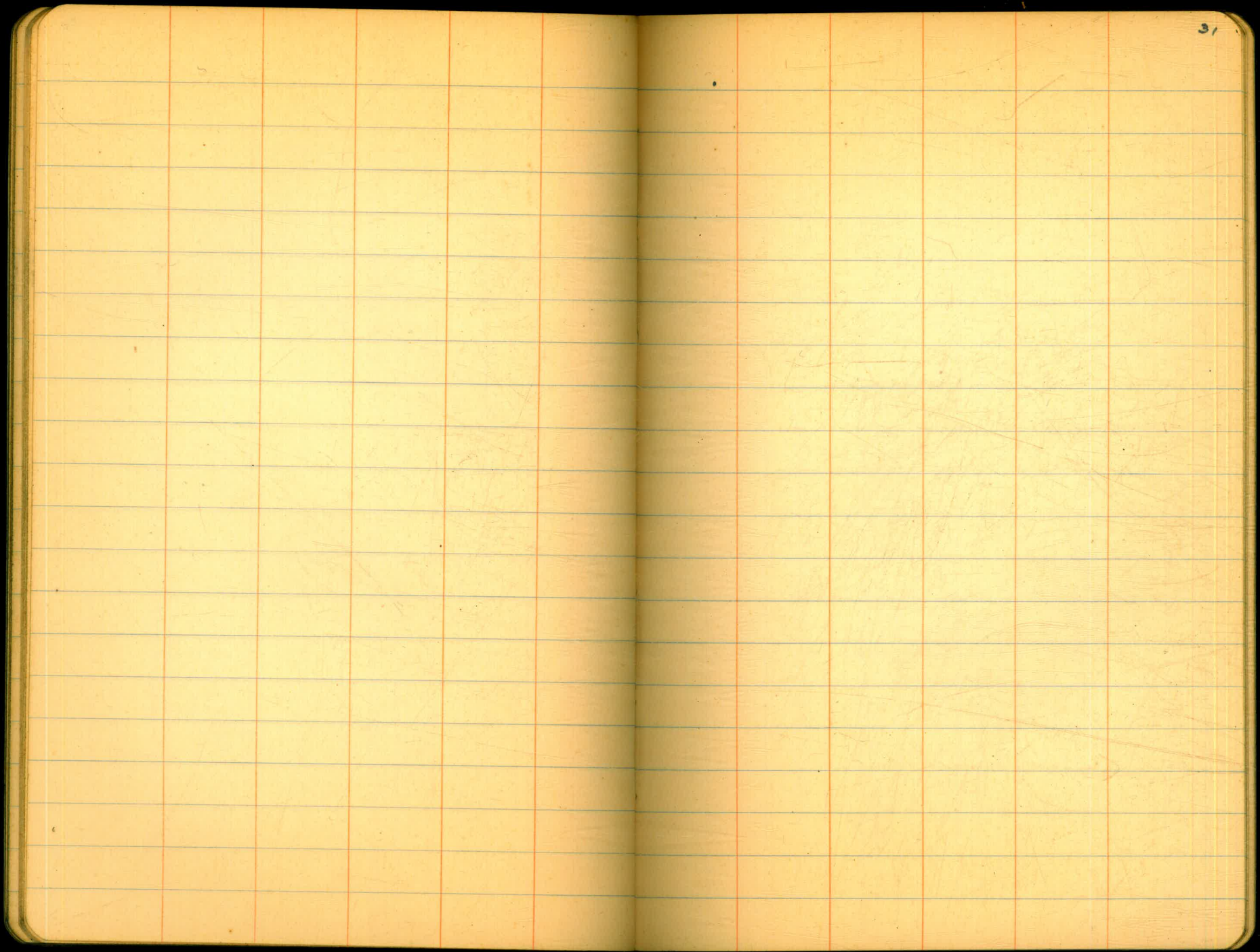
$$= 754.35 \text{ Cu. Yd.}$$

OUTLET TOWER CONCR. ETC



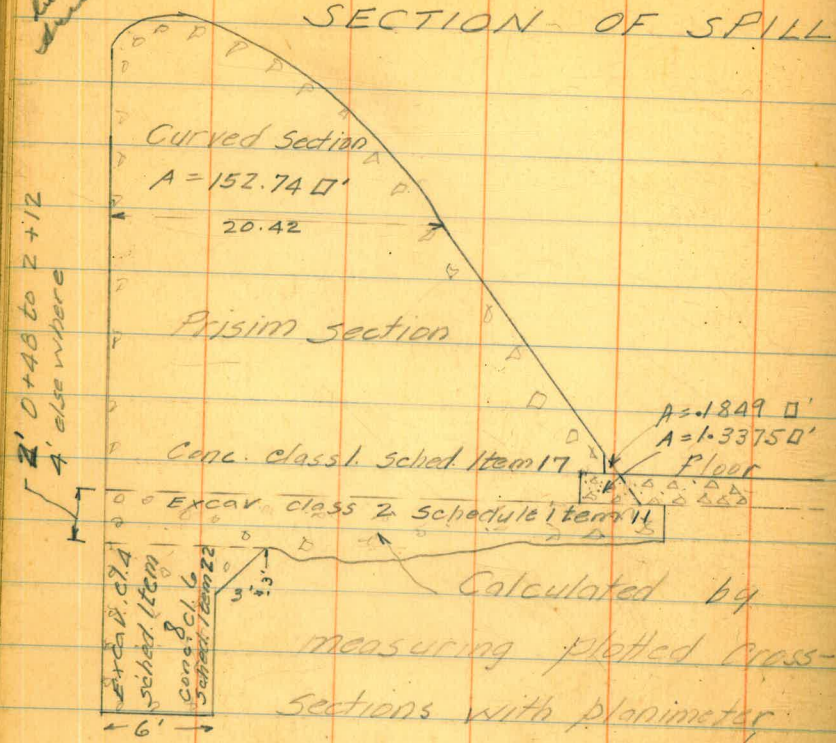






Note 11/2/54
 Exc. - 2072 cu yd
 to be checked from plan
 shown on p. 27.

CONCRETE AND
 EXCAVATION IN OGEE
 SECTION OF SPILLWAY



Calculated by
 measuring plotted cross-
 sections with planimeter

Concrete cl. 6 schedule Item 22
 Excavation cl. 4 schedule Item 8

Sta.	Area	Mean Dist.	Cu.Ft.
0+00	57.9'		
		58.8'	8'
+08	59.7'		470.40'
		59.4'	12'
+20	59.1'		712.80'
		60.0'	6'
+26	60.9'		360.00'
		58.5'	5'
+31	56.1'		292.50'
		54.6'	11'
+42	53.1'		600.60'
		53.1'	4'
+46	53.1'		212.40'
		57.6'	2'
+48	62.1'		115.20'
		65.1'	16'
+64	68.1'		1041.60'
		66.9'	10'
			669.00'

Sta	Area	Mean	dist.	Cu. Ft.
0+74	65.7			
		65.1	8	520.80
+82	64.5			
		67.8	14	949.20
+96	71.1			
		67.5	24	1620.00
1+20	63.9			
		63.9	9	575.10
+29	63.9			
		63.6	11	699.60
+40	63.3			
		61.8	15	929.00
+55	60.3			
		59.4	13	772.20
+68	58.5			
		61.2	24	1468.80
+92	63.9			
		65.7	24	1576.80
2+16	67.5			
		66.6	24	1598.40

Sta	Area	Mean	dist.	Cu. Ft.
2+40	65.7			
		72.3	24	1735.20
+64	78.9			
		69.6	6	417.60
+70	60.3			
		60.3	6	361.80
+76	60.3			
		63.3	7	443.10
+83	66.3			
		66.0	5	330.00
+88	65.7			
		65.4	5	327.00
+93	65.1			
		64.5	7	457.50
3+00	63.9			
		62.7	12	752.40
+12	61.5			
		57.6	7	403.20
+19	53.7			
		52.8	4	211.20

Sta	Area	Mean	dist	Cu.ft.
3+23	51.9			
		51.0	4	204.00
+27	50.1			
		50.1	4	200.40
+31	50.1			
		51.6	9	464.40
+40	53.1			
		52.5	6	315.00
+46	51.9			
		51.3	4	205.20
+50	50.7			
		52.2	10	522.00
+60	53.7			
		55.5	2	111.00
+62	57.3			
		54.9	6	329.40
+68	52.5			
		53.4	6	320.40
+74	54.3			
		53.1	4	212.40

Sta	Area	Mean	dist	Cu.ft.
3+78	51.9			
		52.2	5	261.00
+83	52.5			
		51.6	5	258.00
+88	50.7			
		51.6	11	567.60
+99	52.5			
		53.1	5	265.50
+104	53.7			
		50.7	4	202.80
+108	47.7			
		46.8	5	234.00
+113	45.9			
		50.4	7	352.80
+120	54.9			
		56.4	12	676.80
+132	57.9			
		59.7	11	656.70
+143	61.5			
		62.1	3	186.30

Sta	Area	Mean	dist.	Cu. Ft.
A+46	62.7			
		61.8	4	247.20
+50	60.9			
		59.7	6	358.20
+56	58.5			
		58.8	4	235.20
+60	59.1			
		58.2	6	349.20
+66	57.3			
		57.6	4	230.40
+70	57.9			
		55.5	5	277.50
+75	53.1			
		51.6	5	258.00
+80	50.1			
		52.8	5	264.00
+85	55.5			
		54.0	10	540.00
+95	52.5			
		51.6	9	464.40

36

Sta	Area	Mean	dist.	Cu. Ft.	Cu. Yd.
5+04	50.7				
5+04	297.8				
		292.2	6	1753.20	
+10	286.6				

Superseded by calculated sheets

32,138.40	1190.31
32144.40	1190.53

Concrete class 1 (Schedule Item 17) below line of floor subgrade produced across ages. This same Volume is excavation class 2 (Sched. Item 11)

Sta	Area	Mean dist	CuFt	Sta	Area	Mean dist	CuFt
0+48	70.6			0+48	70.6		
		69.0	16				1104.00
+64	67.4			+64	67.4		
		71.25	10				712.50
+74	75.1			+74	75.1		
		76.5	8				612.00
0+00	79.1			+82	77.9		
		82.35	8				658.80
+08	85.6			+96	83.1		
		92.65	12				1111.80
+20	99.7			+20	60.5		
		94.55	6				567.30
+26	89.4			+29	55.3		
		100.85	5				504.25
+31	112.3			+40	56.9		
		103.55	11				1139.05
+42	94.8			+55	63.0		
		95.85	4				383.40
+46	96.9					62.35	8.10.55
		83.75	2			60.75	789.75
				+68	58.5		
						68.80	1651.20
					61.7	67.2	1612.80

Sta	Area	Mean	dist	Cu. Ft.
1+92	75.9	68.8	24	1651.20
2+16	61.7	62.95	24	1510.80
+40	64.2	55.3	24	1327.20
+64	46.4	57.1	6	342.60
+70	67.8	100.7	6	604.20
+76	133.6	136.4	7	954.80
+83	139.2	155.55	5	777.75
+88	171.9	166.65	5	833.25
+93	161.4	161.0	7	1127.00
3+00	160.6	142.25	12	1707.00

Sta	Area	Mean	dist	Cu. Ft.
3+12	123.9	134.8	7	943.60
+19	145.7	141.65	4	566.60
+23	137.6	136.0	4	544.00
+27	134.4	132.15	4	528.60
+31	129.9	128.7	9	1158.30
+40	127.5	124.3	6	745.80
+46	121.1	119.85	4	479.40
+50	118.6	^{108.15} 108.65	10	^{1081.50} 1086.50
+60	97.7	96.05	2	192.10
+62	94.4	94.0	6	564.00

Sta	Area	Mean	dist	Cu.ft.
3+68	93.6	92.8	6	556.80
+74	92.0	95.45	4	381.80
+78	98.9	90.0	5	450.00
+83	81.1	79.9	5	399.50
+88	78.7	87.35	11	960.85
+99	96.0	95.4	5	477.00
A+04	94.8	92.2	4	368.80
+08	89.6	90.6	5	453.00
+13	91.6	99.7	7	697.90
+20	107.8	113.45	12	1361.40

Sta	Area	Mean	dist	Cu.ft.
4+32	119.1	125.15	11	1376.65
+43	131.2	136.25	3	408.75
+46	141.3	131.2	4	524.80
+50	121.1	122.1	6	732.60
+56	123.1	123.1	4	492.40
+60	123.1	129.35	6	776.10
+66	135.6	142.45	4	569.80
+70	149.3	147.9	5	739.50
+75	146.5	143.9	5	719.50
+80	141.3	136.85	5	684.25

Sta	Area	Mean dist.	Cu.ft.	Cu.Yd.
4+85	132.4			
		133.0	10	1330.00
+95	133.6			
		155.0	9	1395.00
5+04	176.4			
5+04	114.2			
		115.6	6	693.60
+100	117.0			
				48,445.50
				1794.28
				48,499.70
				1796.28

Curved section

510 x 152.74 = 77,897.40

Prism section 0+00 to 4+80

480/6 x [171.13 + 4(353.32) + 564.68] = 171,927.20

4+80 to 4+95

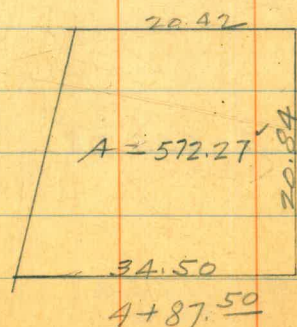
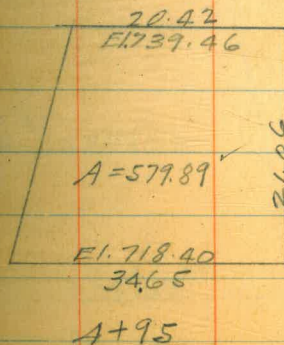
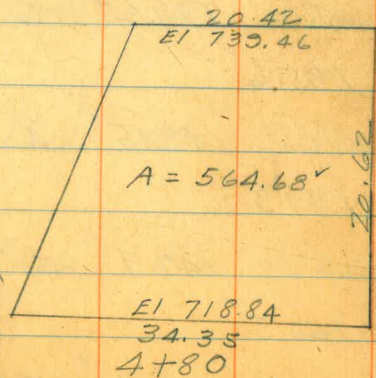
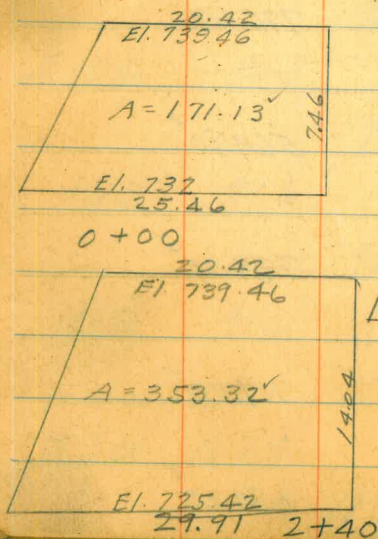
15/6 x [564.68 + 4(572.27) + 579.89] = 8,584.05

4+95 to 5+10

15/6 x [579.89 + 4(593.08) + 606.38] = 8,896.50

267,305.15

(over)



Less piece of floor and triangular piece left

267,305.²⁰ Cu.ft.
 $1.5224 \times 510 = \underline{776.²²42}$
 266,528.⁹⁸73

= 9,871.4⁴ Cu.Yd.

From Page 40 $1,794.28$ " "

$11,665.74$ " "

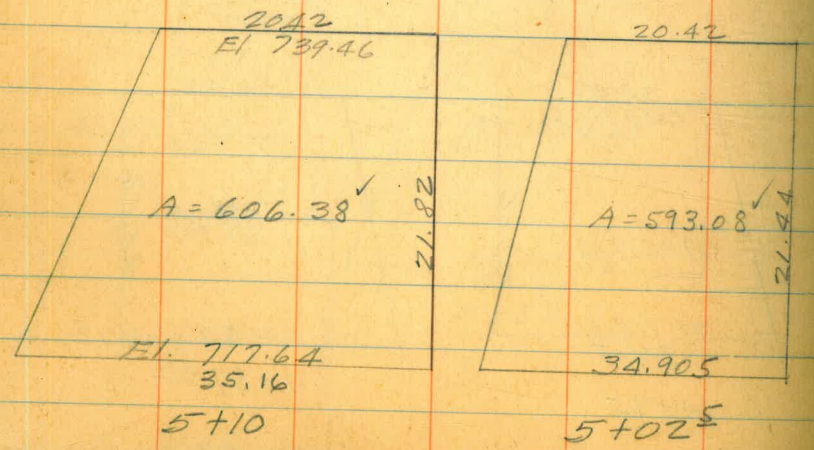
back of 0+00 19.05

$11,684.76$ " "

Mass concrete Class 1 (Schedule Item 17) back of 0+00 in ogee. Areas measured by planimeter from cross-sections (Ref. book 451 P.47)

0+00	377.5	260.8'	1.5'	391.20'
0-1 ^E	144.1			
0-2 ^E	46.4	95.25'	1'	95.25'
		23.2'	1.2'	27.84'
0-3 ^I	0.0			
				514.29' =

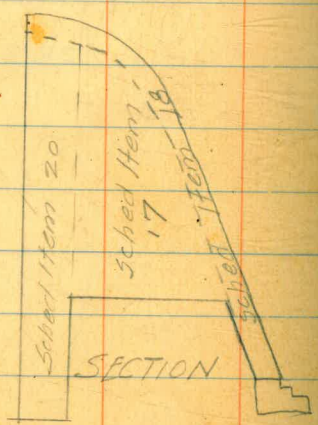
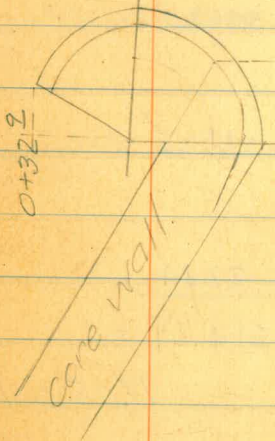
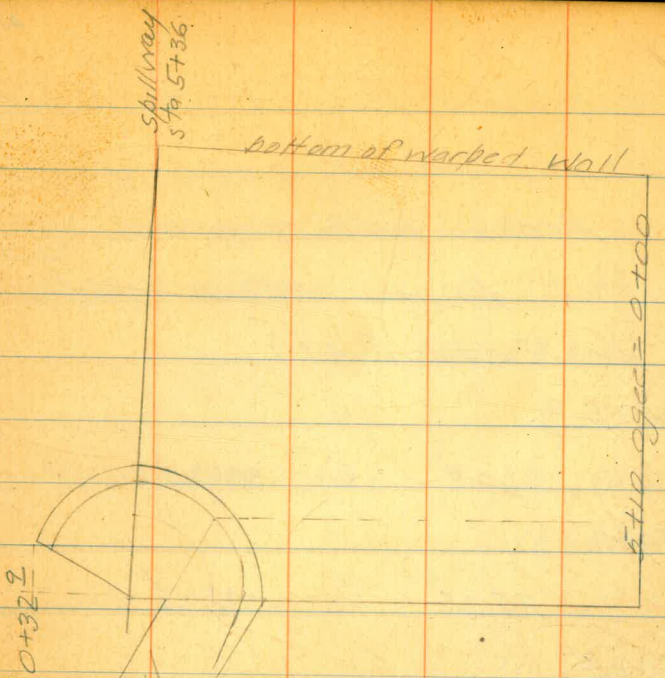
19.05⁴ Cu.Yd.



SPILLWAY SIDELINING IN
WARPED SECTION STA 5+10 TO 5+36

Schedule Item 18

Sta	area	mean dist.	cu. ft
0+00	97.58		
	97.58	3'	292.74 ✓
0+03	97.58		
0+03	104.85		
	108.47 ✓	3'	325.41 ✓
0+06	112.09		
	114.51 ✓	2'	229.02 ✓
0+08	116.93		
	118.34 ✓	2'	236.68 ✓
0+10	119.75		
	122.57 ✓	2'	245.14 ✓
0+12	125.40		
	126.41 ✓	2'	252.82 ✓
0+14	127.42		
	129.23 ✓	2'	258.46 ✓
0+16	131.04		
	132.45 ✓	1 ³ '	172.18 ✓
0+17 ³	133.87		

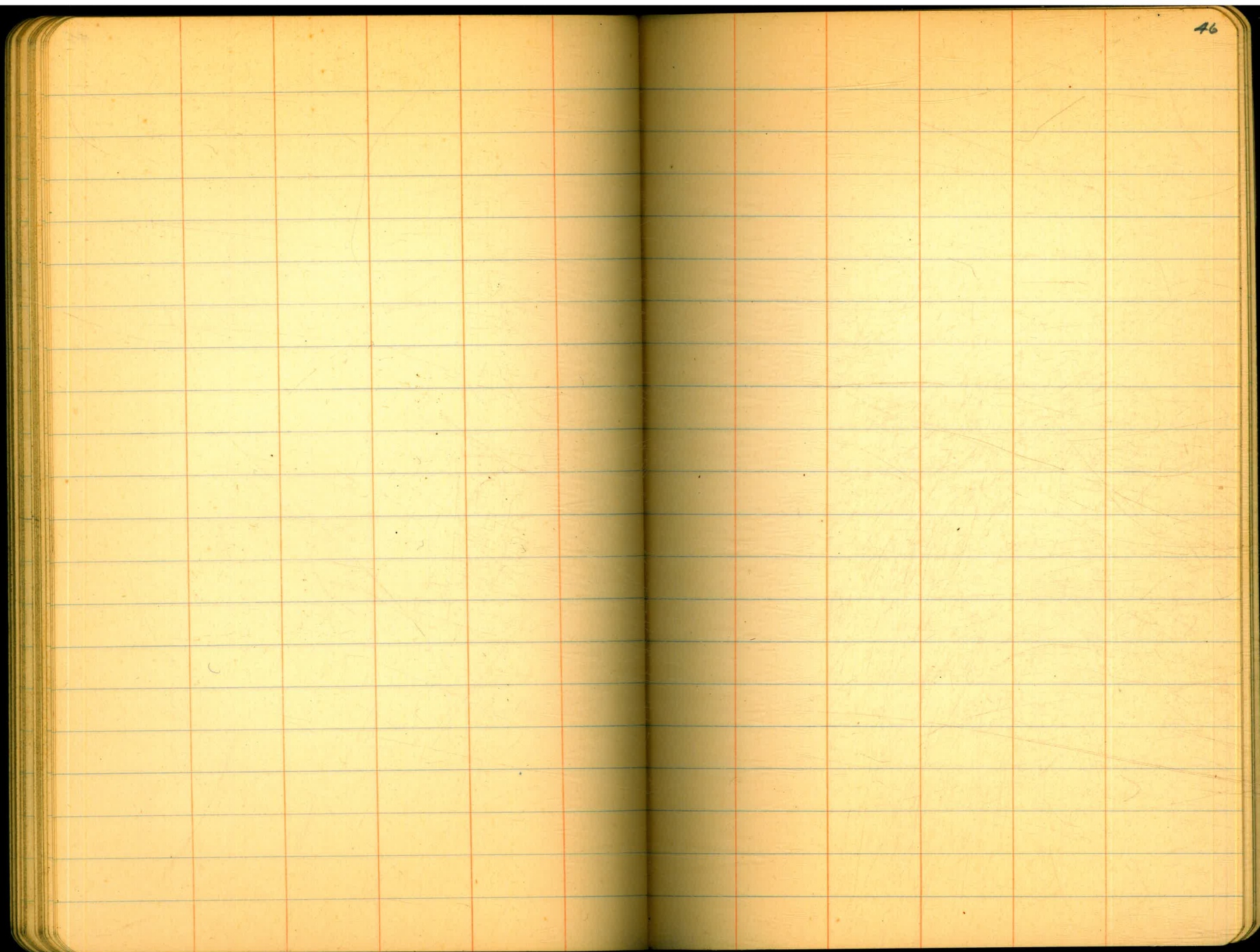


Areas measured by planimeter
from plotted cross-sections

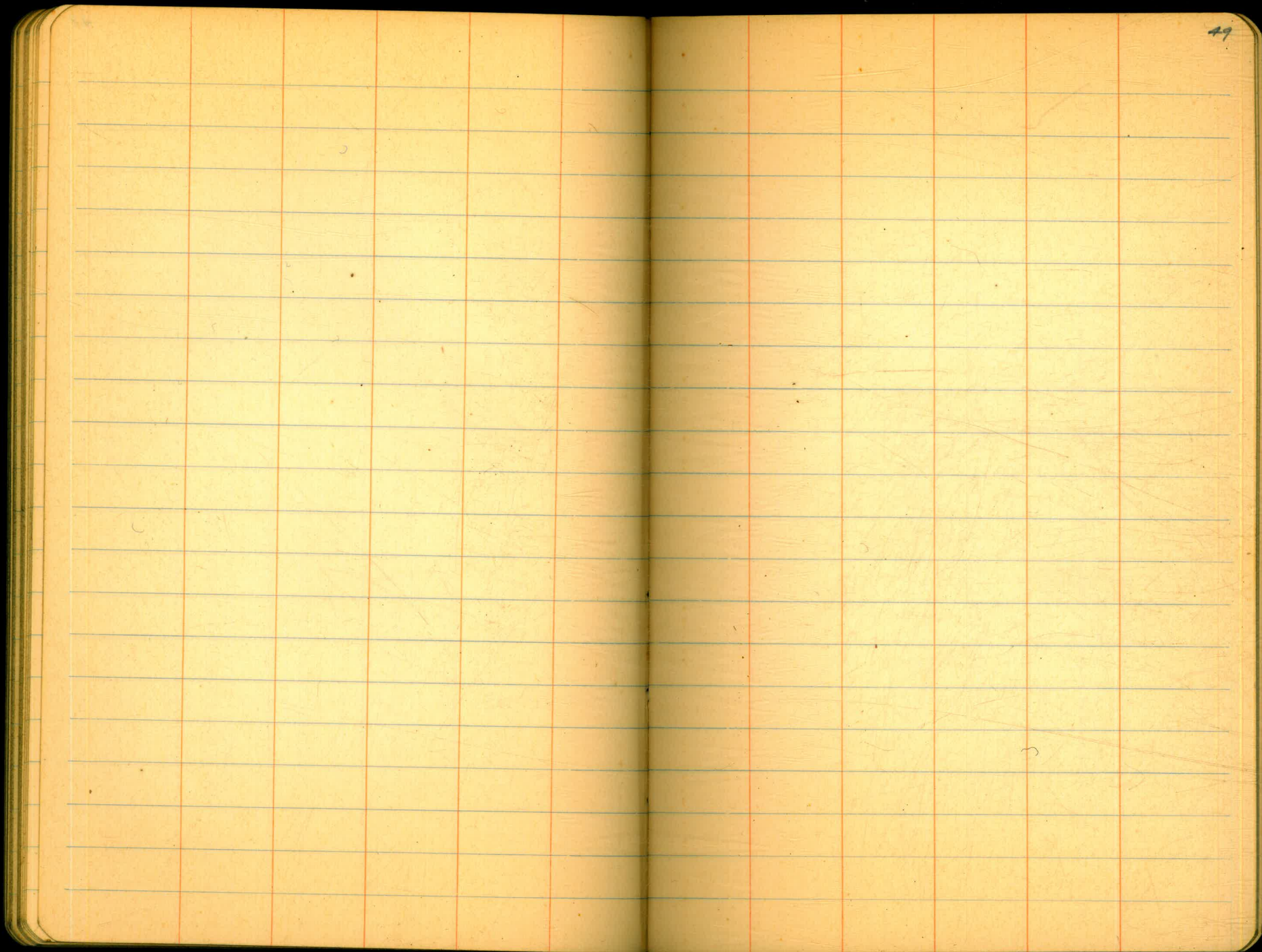
sta.	area	mean	dist	cu. ft.
0+17 ³	133.87			
		132.45	1 ²	158.94 ✓
0+18 ⁵	131.04			
		130.64	0 ⁶	78.38 ✓
0+19 ¹⁰	130.24			
		126.81	2 ⁹	367.75 ✓
0+22	123.38			
		123.58	1 ⁴	173.01 ✓
0+23 ⁴	123.79			
		122.39	1	122.39 ✓
0+24 ⁴	121.00			
		64.61	1 ⁴	71.07 ✓
0+25 ⁵	8.22			
		7.61	0 ⁵	3.80 ✓
0+26	7.00			
		7.35	1 ³	8.82 ✓
0+27 ²	7.70			
		8.40	2 ³	19.32 ✓
0+29 ⁵	9.10			

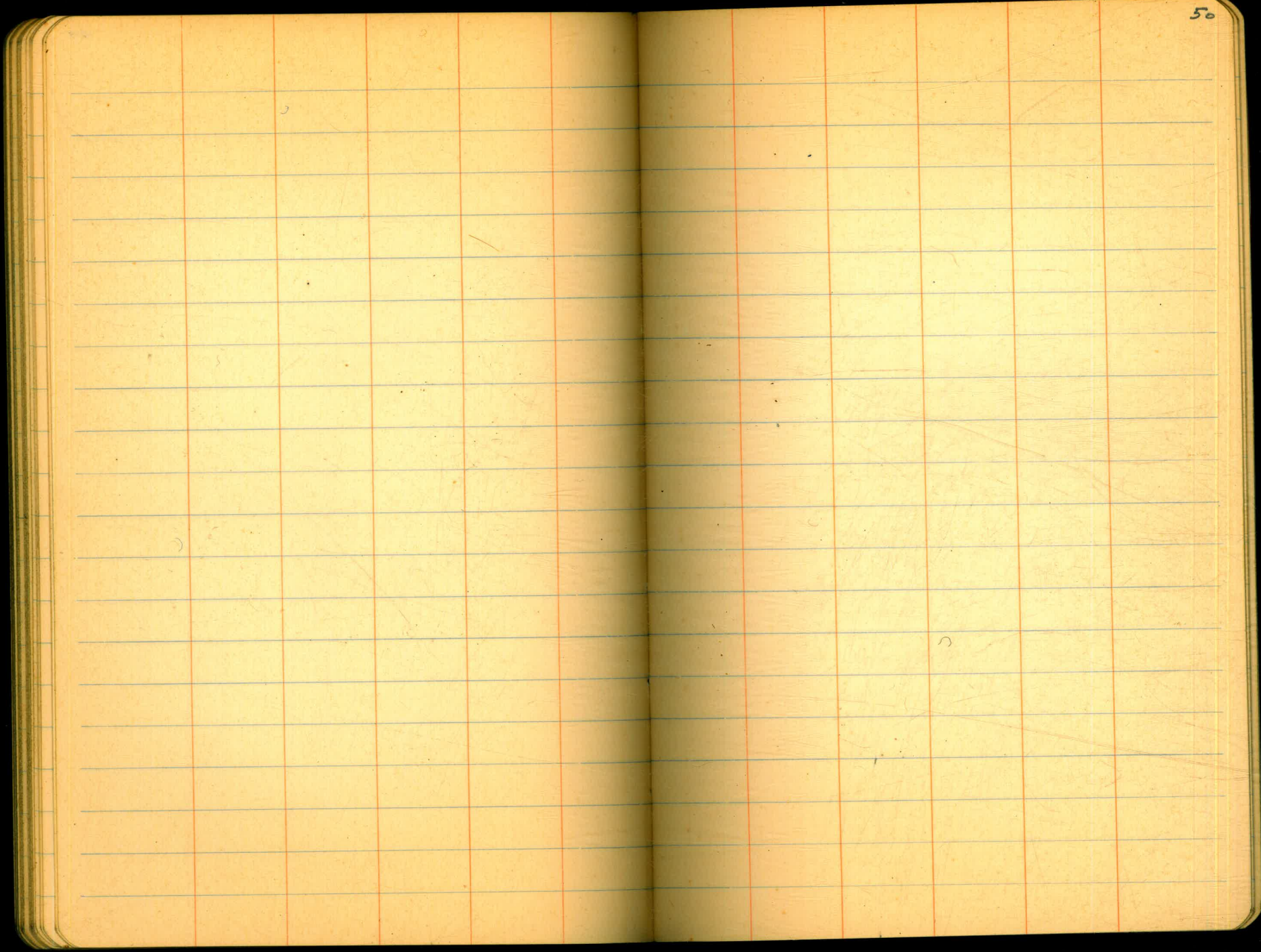
sta	area	mean	dist	cu. ft.
0+29 ⁵	9.10			
		13.82	2 ⁴	33.17 ✓
0+31 ⁹	18.55			
		9.27	1	9.27 ✓
0+32 ⁹	0.00			

3058.37 ✓ =
 113.27 ✓ Cu. Yd.
 G.W.G. ✓



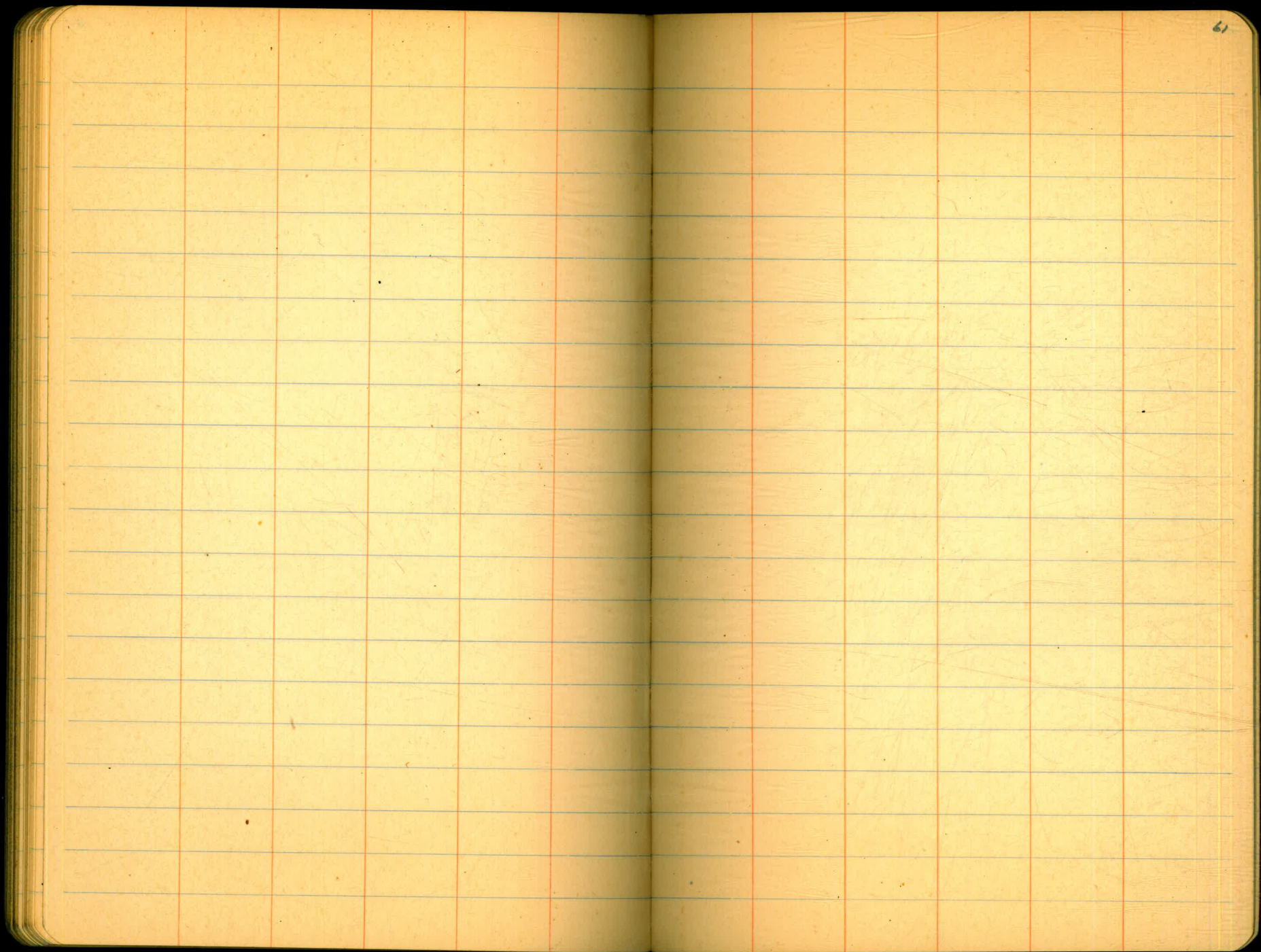
The image shows an open notebook with two facing pages. The pages are cream-colored and feature a grid of light blue horizontal lines and vertical red margin lines. The notebook is bound in the center, and the pages have rounded corners. The number '47' is printed in the top right corner of the right page. The pages are otherwise blank, with some minor smudges and faint pencil marks visible.

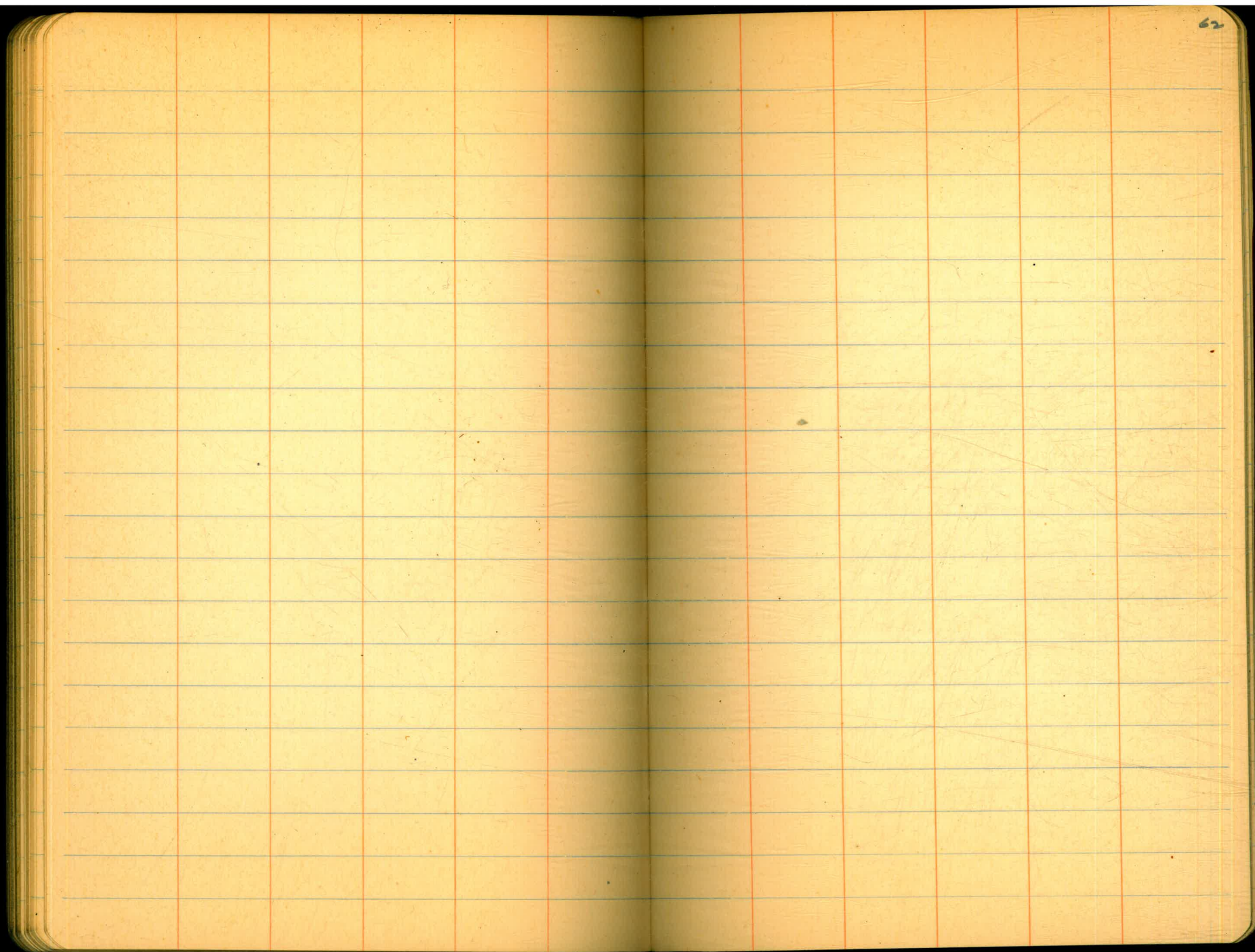




The image shows an open notebook with two facing pages. Both pages are cream-colored and feature light blue horizontal ruling. Vertical red lines create margins on both sides of each page. The notebook is bound in the center, and the pages appear slightly aged. The number '52' is printed in the top right corner of the right page.

This image shows a blank, aged ledger page with a grid of 12 columns and 20 rows. The paper is yellowed with age and has a faint number '57' in the top right corner. The grid is formed by blue horizontal lines and red vertical lines. The columns are of varying widths, with the first column being the widest and the last column being the narrowest. The page is otherwise empty of any text or markings.





62

The image shows an open notebook with two facing pages. The pages are cream-colored and feature light blue horizontal ruling. Vertical red lines create a margin on each page, with one red line on the left and one on the right. The right page is numbered '63' in the top right corner. The notebook is bound in the center, and the pages appear slightly aged with some minor discoloration and faint smudges.

