FIELD BOOK

385

1088B

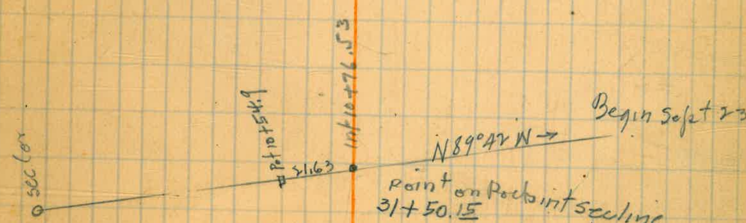
Index

See page 53 Book #2

Traverse of Chocolate Creek

See Book 175 pg. 53
W. H.

39+00	
S5°25 W	135.0
37+65	
S36°37 W	125.0
36+40	
S64°50 W	111.0
35+29	
S43°07 W	119.0
34+10	
S47°21 W	142.0
32+70	
S45°39 W	130.0
31+40°	



Beginning Monday Sept 26 - 1921

Traverse of Chocolate Creek

S17°32'E		
50+60		1460
S16°50'E		
47+45		1345
S20°25'W		
46+20		1250
S38°54'W		
44+80		1460
S33°20'W		
43+07		1730
S4°10'E		
40+70		1370
S4°02'W		
		1700

Traverse of Chocolate Creek

57+85	End of Chocolate Stream Traverse	
S51°28'W		235.0
55+50		
S78°06'W		110.0
54+40		
S59°03'W		125.0
53+15		
S5°10'E		115.0
52+00		

N 36°23'E 22.84 to
Hub Sta 675 (160') Contour
from Sta 57+85

End Sept 26. 1921

setup Sta 675 (160' Contour
B.S Sta 57+85 Stream Travers
-se (N 36°23'E) Tunned to
Sta 674 (160' Contour)
Which is N 67°04'E

set on 3+78.9 = (Sta 665 Contour line
to Sta 664 (N63°25E)
(46e

3+78.9 = (665-) (160' Contour)

S34°59'W

2+75

S11°52'W

1+25

S28°37'E

Chocolate branch = 0+00

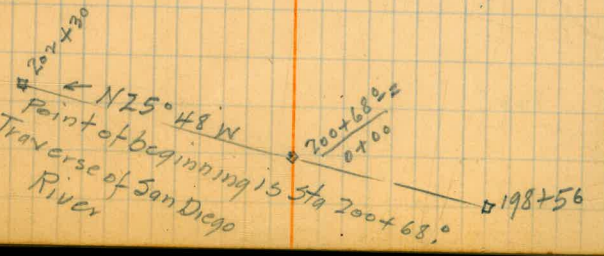
South Fork Wednes. Sept. 28-41 Williams Harper Hodgert

South Fork.

Traverse of South Fork stations set every 200ft beside ▲

S5°00 E	120.°
1+40	
S40°06 E	173.°
7+67	
S77°47 E	115.°
6+57	
N70°15 E	172.°
5+30	
N59°45 E	150.°
2+80	
N63°55 E	280.0
200+68.° / 0+00	

Cor mag. 15°20 E



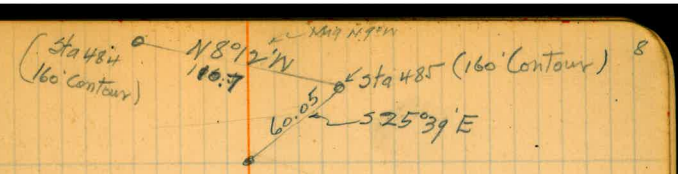
21+20		
S66°56E	200.0	
19+20		
N41°39E	62.0	
18+58		
N56°45'E	308.0	
15+50		
N85°00E	150.0	✓
14+00		
S63°04'E	220.0	
11+80		
S35°29E	170.0	
10+60		

28+30		
N 38°17 E	80.°	
27+50		
N 51°14 E	70.°	
26+80		✓
N 74°18 E	137.°	
25+43		Δ
24+50 P.O.T		
S 68°75 E	188.°	
23+55		
S 77°28 E	175.°	
22+30		
S 74°79 E	110.°	

begin Sept 29-71

N 86°50' E	150.°
37+34	
N 55°21' E	115.°
36+19	
N 78°57' E	115.°
35+04	
S 89°10' E	708.°
37+96	
S 76°37' E	317.°
29+79	
N 76°15' E	79.°
29+00	
N 49°10' E	70.°

46+19.1	Point on large boulder
46+07 POT	
N79°30E	124.1
44+95	
N85°57E	160.°
43+35	
S74°08E	90.°
42+65	
S89°49E	90.°
41+75	
S73°04E	113.°
40+62	
N89°44E	178.°
38+84	



48+76

48+71.° Pot int of 160' Contour

S57°35'E 160.°

47+16

N8+°55E 96.9

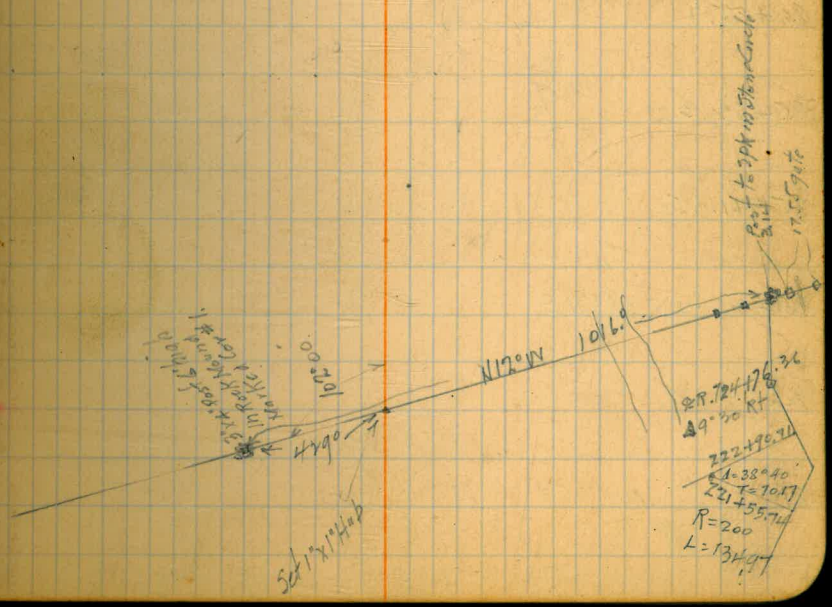
Sept 29-1971

48+71.° Int (160' Contour)

Traverse of San Diego River from El Monte Ranch Cor.

78	P.O.T.		
77+19.2	P.O.T.		
	S88°11'E	2638.4	
76+34.4	P.O.T.		
60+17.3			
58+70.3	P.O.T.	N82°36E	797.1
52+75.2			
	S84°11.E	776.3	
44+08.9			
	S78°10E	689.9	
37+59.0			
	S54°30E	759.0	
30+00.0			
	S78°40E	830.8	
21+69.2			
	S53°10E	1858.45	
3+10.75			
	East	310.75	
0+00			

Int. Axis No 1 Dam Site

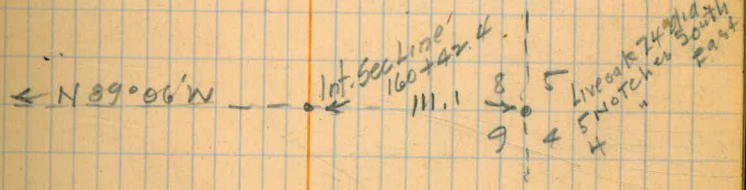


98+04.1		
96	N80°10'E	238.9
95+65.2		
93		
90		
88+85.6 Pot.	S43°24E	909.5
87		
86+58.7		
85+67.3 Pot		
85+41.25 Pot		
85+28 Pot	S88°11'E	✓
84		
81		

118+80.°			
117	N78°55'E	460.°	
114+20°			
114			
	N76°07 E	370.°	
111			
110+50			
108	N83°56 E	300.°	✓
107+50.°			
105			
102	S84°71E	640.°	✓
101+10.°			
99	N84°23E	305.9	✓

144	N6°24E	477.4	
142+10.°		x	
141	N28°04E	400.°	✓
138+10.°		x	
138			
135			
	N55°55E	830.°	✓
132			
129+80		x	
129			
126	S49°27E	720.°	✓
123			
122+60.°		x	
120	S89°08E	380.°	✓

168.	N85°34E	650.°
165+80.°		
165	N52°27E	330.°
164+50.°		
162		
	N17°04E	440.°
159		
158+10.°		
156		
	N6°14E	700.°
153		
151+10.°		
150		
	N11°37E	427.6
147		
146+82.4		



194+50.		
195	N43°01E	190.°
197+60.		
194		
	N65°19'E	600.°
189		
186+60.		
186		
183	N88°48'E	660.°
180+00.		
	N80°57E	300.°
177+00.		
	S88°47E	300.°
174+00.		
	N72°11'E	170.°
172+30		
171		

210	N42°05E	430.°
207+30.°		
207	N31°18E	170.°
205+60.°		
	N58°09E	109.°
204+51.°		
203	N14°59W	221.°
202+30.°		
200+68.°		
	N25°48W	374.°
200		
198+56.°		
	N12°20W	121.°
197+35.°		
197	N26°47W	90.8
196+44.2		
	N11°00E	194.2

237+85°			
235	N1°48'E	255°	
230+30°			
	N25°23'W	178°	✓
228+57°			
228	N22°35'W	337°	✓
225+70°			
225	N8°55'W	370°	✓
222+00°			
219	N11°07'E	460°	
217+40°			
216			
	N31°44'E	580°	
213			
211+60°			

250+70.°		
249	N2°30E	270.°
248+00.°		
246		
	N40°14W	315.°
243		
242+75.°		
240	N51°58W	315.°
239+60.°		
	N10°59W	180.°
237+80.°		
237	N18°47E	125.°
236+55.°		
	N6°01W	220.°
234+35.°		
234	N20°11E	150.°

273	N7°06'W	800°
270		
268+60°		
267		
264	N19°44E	800°
261		
260+60°		
258	N9°35'W	410°
256+50°		
255	N45°35'W	240°
254+10°		
	N17°26'W	190°
252+20°		
251		
	N14°36'E	150°

298+40.		
297	N8°00E	210.
296+30.		
	N46°49E	230.
294+00.		
291	N39°00E	450.
289+50.		
288		
	N2°28W	670.
285		
282+80.		
282		
	N16°21E	670.
279		
276+60.		
276		
274+30 Pot	N7°06W	.

325+85°		
324		
321	N5°33E	905.°
318		
316+80°		
315		
	N8°51'W	700.°
312		
309+80°		
309		
306	N21°13'W	775.° ✓
303		
302+05°		
300	N2°54'W	365.°

348+95°		
348	N31°59'E	355.°
345+40°		
345	N21°36'E	210.°
343+30°		
342	N30°43E	384.°
339+46°		
339	N3°44'W	286.°
336+60°		
336		
333		
330	N23°20E	1075.0
327		

366 +55°

366

N42°28 E 3000°

365+45 Pot.

363+55°

363 N2°10 W 240°

361+15°

360 N14°22W 220°

358 +95°

357

N47°52E 720°

354

351+75°

351 N20°03E 120°

350+55°

N56°13E 160°

386+35.°		
385	N30°04E	185.°
384+55.°		
384	N24°41E	150.°
383+05.°		
381		
378	N64°20E	655.°
376+50.°		
375	N16°27E	220.°
374+30.°		
	N20°14E	230.°
372+00.°		
	N14°04E	155.°
370+45		
369	N8°17E	390.°

405+75°		
405	N14°50'E	235.°
403+40°		
402	N22°09E	177.°
401+63°		
	N3°40 E	263.°
399+00.°		
	N8°59'W	240.°
396+60.°		
396	N22°50'W	260.°
394+00°		
393		
	N18°41'W	550.°
390		
388+50°		
387		
	N8°15'W	215.°

H26		
H24 +35 Pot	N50°53E	610°
H23		
H21 +50°		
H20	N55°58E	290°
H18 +60°		
H17	N71°57E	180°
H16 +80°		
H14	N22°55E	530°
H11 +50°		
H11	N18°20E	260°
H08 +90°		
H08	N1°50E	315°

H 50 + 71.° Int 160 Contour

H 50 + 00.° Pot N 77° 56 E 264.5

H 47 + 56.5

N 29° 13' E 130.6

H 46 + 25.9

N 33° 08 E 214.6

H 46 + 11.3

N 20° 42 E 169.5

H 45 + 41.8

N 39° 46 E 224.4

H 40 + 17.6

N 52° 27 E 217.4

H 38 + 00.°

N 60° 36 E 180.°

H 36 + 20.°

H 35 + 07.77 Pot. N 52° 34 E 230.°

H 33 + 90.°

N 60° 48 E 190.°

H 32 + 00.°

N 73° 02 E 275.°

H 29 + 75.°

N 39° 28 E 165.°

H 27 + 60.°

H 47 + 56.5

A 19 + 80.8 =

P.o.t

A 17 + 70.° N 77° 00 E 510.8

A 14 + 70.°

P.o.t

A 12 + 18.° N 61° 02 E 557.°

A 9 + 18.°

P.o.t

A 8 + 48.° N 45° 18 E 370.°

A 5 + 48.°

N 2° 58 W 197.°

A 3 + 51.°

N 11° 35' E 159.°

A 1 + 92.°

N 1° 42' E 124.°

A 0 + 68.°

N 55° 35 E 68.°

A 94 x Line A H 29 + 75 = A 0 + 00

El Capitan Dam Site Aug 17/23
Topography Extended Charles Hoopes
BM No 20 Bolt in Oak Tree 571.46 U.S.G.S
-Crest of Dam 753.17 = 200 above Str. Bed
Spillway 753.17 - 15
Bed of Str on Axis 553.17
Axis = Williams Survey
Topog (Az = B.S. = 0°. Read with clock)

Sta.	Az	Rds	Rd ra	~~o~~	Elev	Dist
					571.46	
			+2.75	574.21		
A			-5.00		569.21	
A-B	259° 21	2.59	-3.97		570.24	259
			+5.92	575.13		
B	247° 30	3.32	-2°50		559.0	329
		5.91				
	284° 45	4.00	-1°05		567.7	400
	297° 00	4.75	+4°00			473
	305° 00	5.30	+2°00		593.	530
B to C	Prolong	3.68	-1.70		573.43	356

A = P.O.T Williams Line top Bank South River
(N 75° 15' E) A-B-C (600)

Bottom Rd
99.76 × 33 = 29928, 29928, 329208
04.94 × 33 = 1482, 1482, 16.302
575.13 − 16.30 = 558.83

Ground
01.86 × 4 = 7.44
575.13 − 7.44 = 567.69

99.5 × 4.75 = 4975, 6965, 3980, 472.625
.07 × 575.13, 33, 608
4.75 × .07 = 33.25
264, 528
3.5 × 5.3 = 105, 175, 18.55
575.13 + 18 = 593.13

Sta	A.Z	RDS	Rd Va	⊖	Elev	Dist
C			9.10	578.31	573.43	
	280° 40	3.6	+0°45		583.40	
	289° 00	2.05	-4°10'		563.4	204
	303° 30	4.30	+5°00		615.6	426.5
	304°-40'	3.60	+1°-10		571.00	3.60
	302°30	2.00	-4°10		564.00	199.0
	260°-20'	0.60	-2°35		575.46	60.00
	257°-40	1.40	+12°20		607.7	133.6

573.43
4.9
578.33

Lev. B.S. on A

01.7
3.6
402
41
5.12

578.31
5.12
583.43

9.9.5
205
4975
1990
2039.75

7.25
205
3725
1450
14.8725

578.3
14.9
563.4

99.2
4.3
2976
3968
426.56

8.58
4.3
2604
3472
37.3224
578.31
615.63

303
180
123

578.31
7.2
571

2.
3.6
2
7.2

99.5
199.0

7.25
2
14.50

578.31
14.5
564.0

95.44
14
38176
9544
1336.16

21.
1.2
84
21
29.4

578.31
29.4
607.7

Sta	Az	Rds	Rd va	⊖	Elev	Dist
C				578.31	573.43	
	122°-30	0.50	-14°30			46.85
C to D	δ 21°31 Rt	2.05	-3.00		575.31 ✓	2050
			+6.60	580.03 ~~575.80~~	573.43	
D			-4.80		575.23 ~~571.00~~	
	285° 00	3.60	-5.00		575.03 ~~570.80~~	
	285 ✓ 00	3.00	-11.00		569.03 ~~572.80~~	
Bed of Str			-21.0		559.03 ~~554.80~~	
	321° 30'	3.40	-10.50		569.53 ~~565.30~~	340.
	321-30	-2.90	-17.50		562.53 ~~558.30~~	
Bed Str	321-30	~~2.60~~ 2.40	-20.5		559.53 ~~555.30~~	
		1.80	-17.5		562.53 ~~558.30~~	
Δ to E in Rd	δ Rt 8°-03	1.51	-7.50		572.53 ~~568.30~~	
Tp			-0.45		579.58 ~~575.35~~	
			+0.90	580.48 ~~576.25~~		
Tp on Bldr			-3.10		577.38 ~~573.15~~	
			+6.15	583.53 ~~579.30~~		
Tp			-2.95		580.58 ~~576.35~~	
			+1.55	582.13 ~~577.90~~		
Tp			-11.65		570.48 ~~566.25~~	
			+2.80	573.28 ~~569.05~~		
			-1.95		571.33 ~~567.10~~	BM = 571.46 O.K.

9.37
.5
46.85

179-60
57-30
122-30
24.24
.5
121 20
578.31
12.12
566.19

575.3
9.8
57 6

Hpon C

Completed + checked
12⁰⁰ M Aug 18th to sta E

Contd from Sta E in P.M Aug 18th/23

Sta	Az	Rds.	Rd VA	—	Elev	Dist
D'					575.30	
E			+2.15	577.45		
	160° 00	4.00	-2.50		574.95	
	160°	3.50				
	160°	2.40	-1°20		571.90	
	160°	~~1.70~~				
	160°	1.70	-1°40			
	160° 00	0.50	-14°00		565.6	
Bd Str	160° 00		-18.5		559.00	
~~270~~	270° 00	0.50	0.00		577.50	
E to F	269°-00	1.50	+12°15		606.50	143.25
F to E BS.		1.52	-15°00		605.7	142.06

to +10' on Rd

02.33
2.4
932
466
5.592

577.45
56
571.85

to +10 on Rd

2.9
1.7
203
29
4.93

577.45
49
572.55

577.45
11.75
565.80

23.5
.5
11.75

Bed of Str

to +2 on Rd

~~95.5~~
1.5
4775
955
143.25

20.7
1.5
1035
207
31.05

577.45
31.05
608.50
2
606.50

93.3
15.2
1476
4665
433
142026

25.0
15.2
500
1250
250
360.00

572.53
38
510.53
48
505.7

Sta	Δ	RDS	Rd VA	⊙	Elev	Dist
F			4.8	610.80	606.00	
F to G	214°05	0.22	+0.20		611.00	0.22
					606.00	
G			+9.00	615.00	611.00	
	115°40	3.75	24°10		750.00	312.00
Bottom Flume	115°40	3.80	+24°10		752.00	316.00
G to H	217°35	3.65	+8°18		648.8	360
	121°00	6.80	+22°50		858	577.1
E Trestle	154°00	4.70	+18°36			422
					752.00	bott flume
					734.00	last Rail

to +5.0 on Rd

83.24 × 3.75 = 41620 + 58268 + 24972 = 312.1500

43.24 × 3.8 = 16592 + 24972 = 31.6312

37.35 × 3.75 = 18675 + 26145 + 11205 = 140.0625

37.35 × 3.8 = 29880 + 11205 = 141.930

615 + 140 = 755 → 750

615 + 142 = 757 → 752

to +6.0 on Rd

98.80 × 3.65 = 49400 + 59280 + 29640 = 360.6200

10.91 × 3.65 = 5455 + 6546 + 3273 = 39.8215

615.00 − 39.80 = 654.80 − 6 = 648.8

84.94 × 6.8 = 67952 + 50964 = 577.5912

35.76 × 6.8 = 2.8608 + 21456 = 24.3168

615.00 − 243 = 858

to +5 on Rd Bottom Raise

89.83 × 4.7 = 62881 + 35932 = 422.211

30.23 × 4.7 = 21161 + 12092 = 142.081

615 + 142 = 757 → 752 + 18 = 734

Sta	Az	Rds	V.A. Rd	⊙	Elev	Dist
H'	92° 10	4.10	+15° 16	653.8	~~753~~	381.0

To 5 on Rd

93.
4.1
93
372
381.3

25.4
4.1
25.4
1016
104.14

648.8
5
653.8
104.2
758.0
5
753

Fin work 4:30 P.M Aug 18/23

Sunday Aug 19/23

Sta	Az	Rds	Rd V.A.	⊙	Elev	Dist
D			4.60	579.90	575.30	
D to X	294° 52	1.25	+3° 48		583.5	1.25
			4.70	588.00		
	142° 00	1.80	+11° 00			173.0

To 5 on Rd

106.6
1.3
198
66
8.58

8.58
579.90
588.48
5
583.5

100 on Rd

98.25
18
77000
9825
173.250

19
1.5
132
19
34.2

588
34
622
10
622

(1) On Mt North Com on Wms Axis +160 C

int 160 C = 713.17

Sta						
Sta 0			4.55	717.72		
Roof Tunnel	203° 20	1.55	+9° 20		733.3	
℄ ✓	255° 30	1.55	+7° 30			
	202° 15'	3.80	+14° 20			

to X on Rd

97.37
1.6
584.22
4737
155.792

16.00
1.6
96
16
25.6

717.72
25.6
743.3
10
733.3

91.6
1.6
5460
910
145.60

28.7
1.6
1722
287
45.92

717.72
45.9
671.8

94.2
3.8
7520
2820
357.20

24.
3.5
192
72
91.2

717.7
91
80.8

Sta	Az	RDS	Va Rd	⊖	Elev	Dist
0	210° 35	5.40	+11°40	717.72	826	518
	257° 40'	2.50	-14°00		659.4	235
	214° 06'	5.90	+13°10		848.60	560.5
	241° 20	4.25	-2°30		699	4.25
	219°40	7.00	+12°20		865.4	667
R	245° 05	5.20				
Wms No 4 BSon 1					713.17	
			4.00	717.17		
to Y	189° 20	2.25	+19°10		783.9	190.7
to ⊕ Flume	283° 30					
to sta A	325° 19					

44
96
54
384
450
5184

25.5
20
5.4
80
100
1080

717.70
108
825.70

941/2 2/2
47
188
255

23.5 1/2 2/2
117
470
54.7

717.7
59.3
659.0

95
54
855
475
560.5

22.2
5.9
1998
1110
130.98

717.7
130.9
848.6

99.8
4.3
2994

4.34
4.3
1308
1744
1867.48

717.7
18.7
699.0

95.3
7
667.1

21.1
147.7

717.7
147.7
865.4

to +30 on R2
89.22
3.25
44610
17844
16844
190.745.0

2.25
31
225
175
69.75

717.17
69.75
786.92
3
783.9

Sta	Az	RDS	Vt Rd	⊙	Elev	Dist
Y.			+4.80'	787.70	783.90	
	70° 30'	3.60	+1°40		901.8	319
		~~3.40~~				
	87° 45'	3.40	+2°20		~~895.5~~	299
	125° 00	2.60	+2°40		881.7	207
	158° 15'	5.60	+2°10		1103	459
	209° 30'	2.90	-2°40		774.2	

Field Work Camp
Sunday Aug 19/23 at 12 30 P.M.
Office work in P.M.

88.7
3.6
5322
2661
319.32

31.7
3.6
1902
951
114.12

787.7
114.1
901.8

to +3 on Rd

87.9
3.4
3516
2637
298.86

32.6
3.4
1304
978
110.84

787.7
110.8
898.5
3
895.5

10 on Rd

79.8
2.6
4788
1596
207.48

40
2.6
240
80
104.0

787.7
104
891.7
10
884.7

81.9
5.6
4914
4095
459.64

28.5
5.6
2310
1925
215.60

87
787.7
215.6
1103.3

4.65
29
4195
930
134.95

787.7
13.5
774.2

Aug 20 / 23

Topog Contd

Sta	Az	RDs	VA RD	⊖	Elev	Dist
A BS on SWM Ax			+4.70	573.90	569.20	
	159° 30	4.70	+13° 30		679.0	445
	175° 50'	4.20	+9° 45		644.0	407
		4.				
	186° 30	4.70	+8° 10		640	376
	203° 45	5.20	+2° 50		600	520
"J"	115° 22'	7.30	+6° 16'		573.50	730
"I"	113° 08	2.55	+4.36		554.10	255
	79° 20	2.6	-4.20		569.90	
			+4.80	554.90		
			7.20		551.70	
"J"			+4.90	578.20	573.30	

94.6
4.7
6722
3784
44562

22.7
4.7
1589
898
10564

573.9
105.7
679.5

97.1
4.3
19412
38854
407822

16.7
4.2
3334
6668
70.14

573.9
70.1
644.8

8.6
4.7
376

14
4.7
98
56
65.8

573.9
66
640

5
5.2
5
26.0

573.9
26
600

+4 on Rd

47
7.3
1411
3291
3431

573.90
3.43
570.47
573.30

Bed of River

7.9
2.5
3958
15832
19775

573.90
19.80
554.10

Ain Rd

Topog Cont'd

Sta "J"	Az	RDs	Rd VA	⊙	Elev	Dist
		8.70		579.20	573.30	
	298°-16		+16°50		820	797.0
	282°-30	11.8	+20°18			1038
	276°.00	11.60	+18°30		926	1043
	272°-30	11.0	+18°00			1035
	268°25	12.5	+18°35		1054	1122
	264°40	11.4	+17°30		906.4	1037
	261°40	11.7	+17°30		914	1060
	259°55	11.4	+17°00		958	1235

91.61 × 8.7 = 797.007

27.72 × 8.7 = 241.064

88.0 × 11.8 = 1038.40

32.5 × 11.8 = 383.50

89.93 × 11.6 = 1043.188

30 × 11.6 = 348.0

90 × 11.5 = 1035.0

89.81 × 12.2 = 1122.5

91.0 × 11.4 = 1037.40

28.7 × 11.4 = 327.18

91.0 × 11.7 = 1064.70

28.7 × 11.7 = 335.79

91.5 × 13.2 = 1235.7

28.0 × 13.2 = 369.6

Topog Contd

Sta	Az	Rds	VA	HD	Elev	Dist
	257°20	11.4	+7°10	579.20	900.8	1040
	254°22	11.4	+6°30		898	1048
	253°10	11.60	+6°30		894	1067
	248°20	11.5	+5°50		888	1090
	243°30	13.0	+4°20		890	1222
	235°40	5.1	+6°30		636.0	493
	261°00	3.6	+8°10		603.0	

Fin 12:00 M Aug 20/23

91.2
11.4
3652
913
913
1040.82

579.2
321.5
960.7

28.2
11.4
1128
282
282
321.48

11.4
92
228
1026
1048.8

579
308
687

27.0
11.4
1080
270
270
307.80

11.6
92
232
1044
1067.2

579
313
892

27.0
11.6
1620
270
270
313.20

92.6
11.8
7408
926
926
1092.68

579
310
889

26.3
11.8
2104
263
263
310.34

94
13
282
94
1222

579
312
891

24
13
72
24
312

98.7
5.1
493.5
4935
9337

579
57.6
636.6

11.3
5.1
113
565
57.63

+40m Rd

10.7
3.6
642
321
3852

579
28.5
607.5
4
603.5

Topog Contd
Com. 100 RM Aug 20/23

Sta	Az	Rds	VA Rd	⊖	Elev	Dist
			+4.90	578.20	573.30	
"J"						
~~0°00'~~	0°-00'		-5.50		572.70	52
rock	165°.00	1.70	-5.00		573.20	
rock	166°-15	2.10	-5.00		573.20	
	166°-15	2.75	-6.80		571.40	
		2.20	-14.00		554.20	
		1.90	-18.50		554.70	
		2.20	-15.00		573.20	
	128°.00	3.20	-18.00		560	
	121°40	3.70	-16.0°		562.20	
"J" to K	72°-50	4.80	-6.90		571.30	
	88°-00	9.20	+5°00		658.00	913
	77°-30	8.30	+7°00		678.00	817
Flume		9.00				
Flume	69°50	9.00	+11°05		748	867
Flume flow	51°40	8.80	+12°15		754	840

99.2
9.2
1984
8928
9126.4

8.7
9.2
174
783
80.04

578.30
80.
658

98.5
8.3
2955
7880.
817.55

578.2
100
678

12
8.3
36
96
99.6

96.3
9
866.7

18.9
9
170.1

578
170
748

+4 on Rod

95.5
8.8
7640
7640
840.40

578
183
761
4
1664
757

20.8
88
1664
1664
183.04

8.8
20
176.0
578
176
754

11.20

Topog Cont'd

Sta	Adj	RDS	BV Pd	⊖	Elev	Dist
"J"	37° 10'	9.10	-11.10	578.2		873
	40° 45	7.70	+10.46		720	743
	55° 35'	6.5	+6.00		643	643
"K"			+4.8	576.16	571.31	
		1.5	-7.40			
		1.25	-10.30			
	24° 00	2.6	-10.00		566	
	72° 00	2.50	-6.40		569.7	

Topog Completed
Aug 20/23 4.30 P.M

-20 to ranne

96
9.1
96
864
873.6

578
173.
751
20
730

19
91
19
171
1729

96.5
7.7
67555
6755
743.05

18.3
7.7
1281
1281
141.91

578
142
720

991
62
49
594
643

65
578
643

10.
6.

576
19
557

13
1.5
65
13
195

18.1
14
4
18
22

576
22
554

Aug 21/23

El Capitan Dam, Locations of "Gopher" Holes And Prospect Tunnels

Roof of Tunnels Located. floor is − 7' 2"

Sta	Az	Rds	Rd VA	⊖	Elev	Dist
✓ A - C / T	259° 20	6.29	+4.80	576.30	571.50	590.0
	34° 40	1.35	+2°.00		(Floor) 574.30	
To C ↓ T			+5°°	578.4	573.4	
	36°-00	6.00	+1° 10'		580.0	
✓ C to E	201° 45	2.05				205.0
✓ E	188°-00	1.50	+4.9	577.4	572.5	150.0
✓ N Bank	174° 05	7.10	-0.7		576.7	710.0
↓ bet F. Tun			+4.8	571.5		
✓ S Bank	123°-07	4.00	-1.1		570.4	400.0
↓			+4.9	575.3		
✓ N. Bank	~~+~~	4.10	-4.0		566.3	410.0
↓			+4.8	571.1		line along N Bank
✓ N Bank	208° 55	4.90	-0.4		570.7	490.0
		←	+4.8	575.5		
✓ S Bank	206° 51'	5.80	+2°31		590.8	580.0
↓			+4.8	595.6	—	
✓ Bed Str	109° 50	5.20	-2°30		568.0	520.0

576.30
3.72
580.02
2
578

13.5
3.5
675
305
37.25

B.S. on Williams Axis South Az C

to 2 on Rd com tunnel = 15' S of Power Tunnel

to X on Rod on Roof

475.5
35.3
510.8

475.5
35.3
442.2

4.36
5.8
3488
2180
25.288

4.36
5.2
872
2180
22672

604.8
22.6
582.2
5
577

to X on Rd

5 on Rd

4.5
18.5

Sta	Az	RDS	VA Rd	—o—	Elev	Dist	
Bed Str	178° 30		+4.6	572.6	568.0	460.0	To 4 on Rd
N Bank "P"	251° 55	6.20	+4° 00		612.0	617	H to R bed Str
Sta			+4.8	616.8			
P to "R"	251° 55	6.20	-2° 30		579.8	619	To 10 on Rod

4.30 P.M Aug 21/23

Loc Trav + Quantity Survey Cont'd Aug 22/23

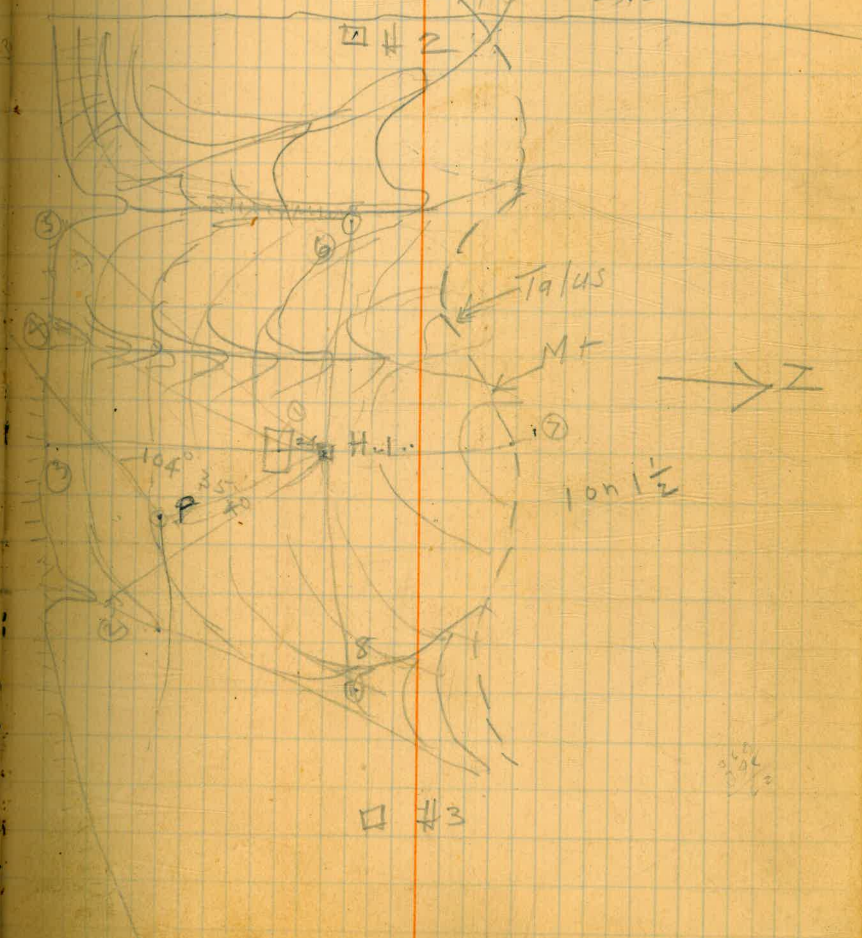
Sta	Az	RDS	VA Rd	—o—	Elev	Dist
"P"					612.0	
			+4.8	616.8		
P to H1	104°-35	0.40	+14° 35		607.1	1.0 on rd 37.4
top hole			-9.50		607.3	40.0
bottom of hole			-16.50		600.3	40.0
②	348° 15	2.50	-9° 50		574.8	242.5
③	23° 00	2.10	-11 30		575.9	201.6
④	66° 00	2.80	-8° 40		575.1	273.6
⑤	85° 00	3.00	-5° 30		588.3	297.0
⑥	126° 25	150	+0° 40		618.6	149.8
⑦	193°-00	2.30	+13° 20		668.3	218.8
⑧	280°-00	3.00	-9.0		607.8	300.0
H1 to H-3	266°-45	5.00	+1° 30	H.I. 611.6	607.1 624.8	499.5
H1 to H 2	106°-35	6.60	+0° 40		620.0	559.9

581.8
43.4
625.2
4

67
7
6.2
43.4

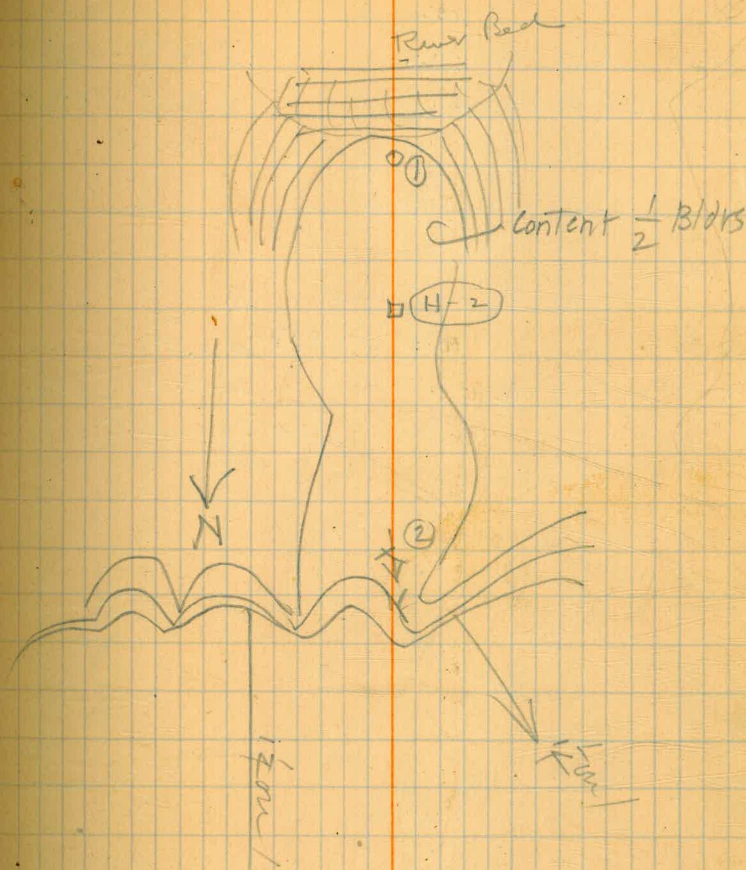
626.8
27.3
599.5
579.5

4.4
6.2
8 8
26 4
27.2 8



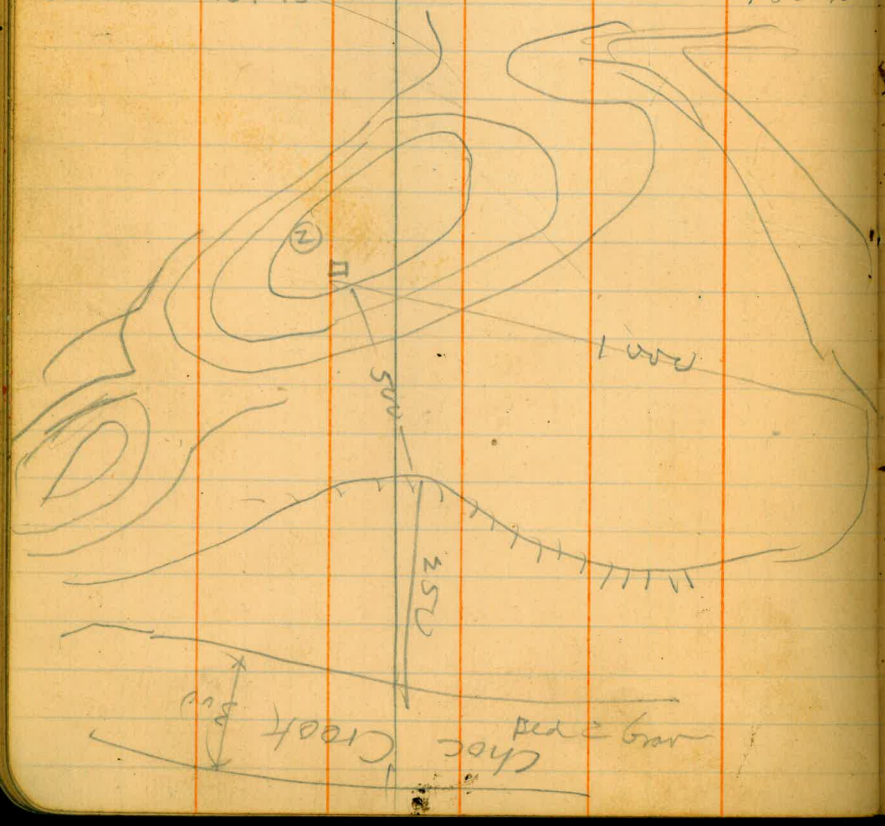
.035
2.0
7.000

Sta	Az	RDS	VA Rd	⊖	Elev	Dist
At BS-H1 H-2			+5.00	625	Grat Hole -620	sta 15' N of c Hole
Grat H=sta						
Bottom Hole -5						1550 Elev = ⊖ at H-2
(1)	110° 45'	1.55			625	
(2)	292° 00	2.00	+2° 00		632	7

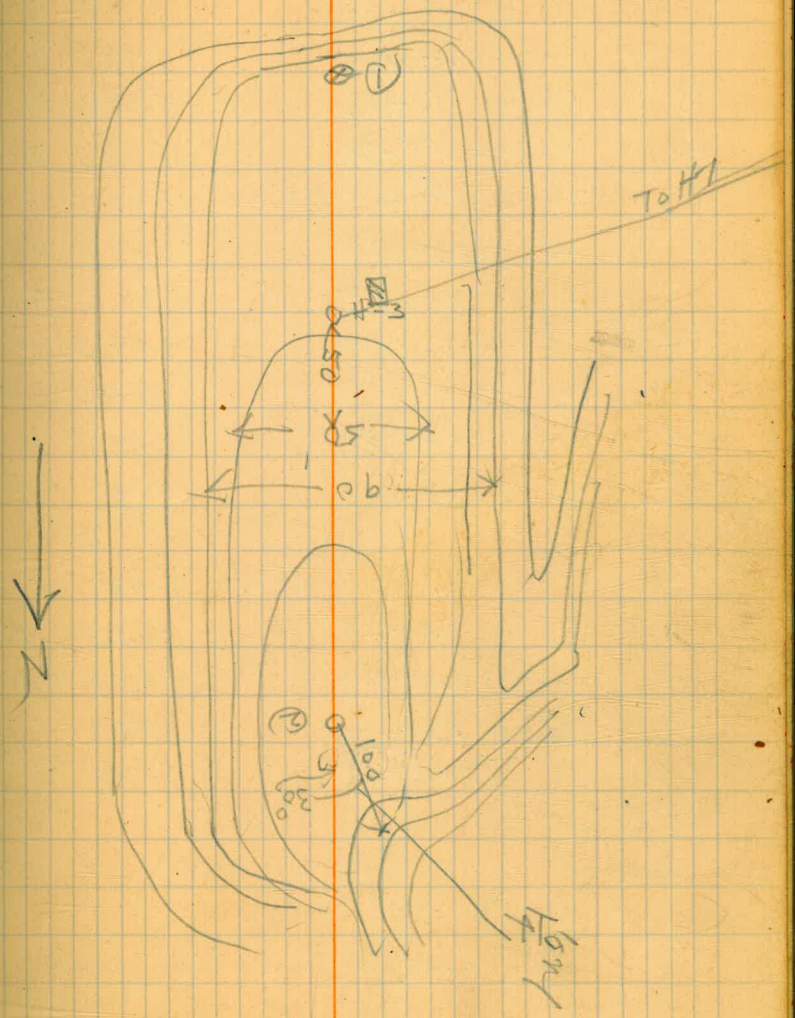


Sta	Rg	Rds	Vt Rd	⊖	Elev	Dist
H-3			4.9	629.7		135 on H-1
①	314°00	2.00	-15.0		614.7	200.0
②	119°-30	2.00	+2°30		638.5	199.6

Topog H-3



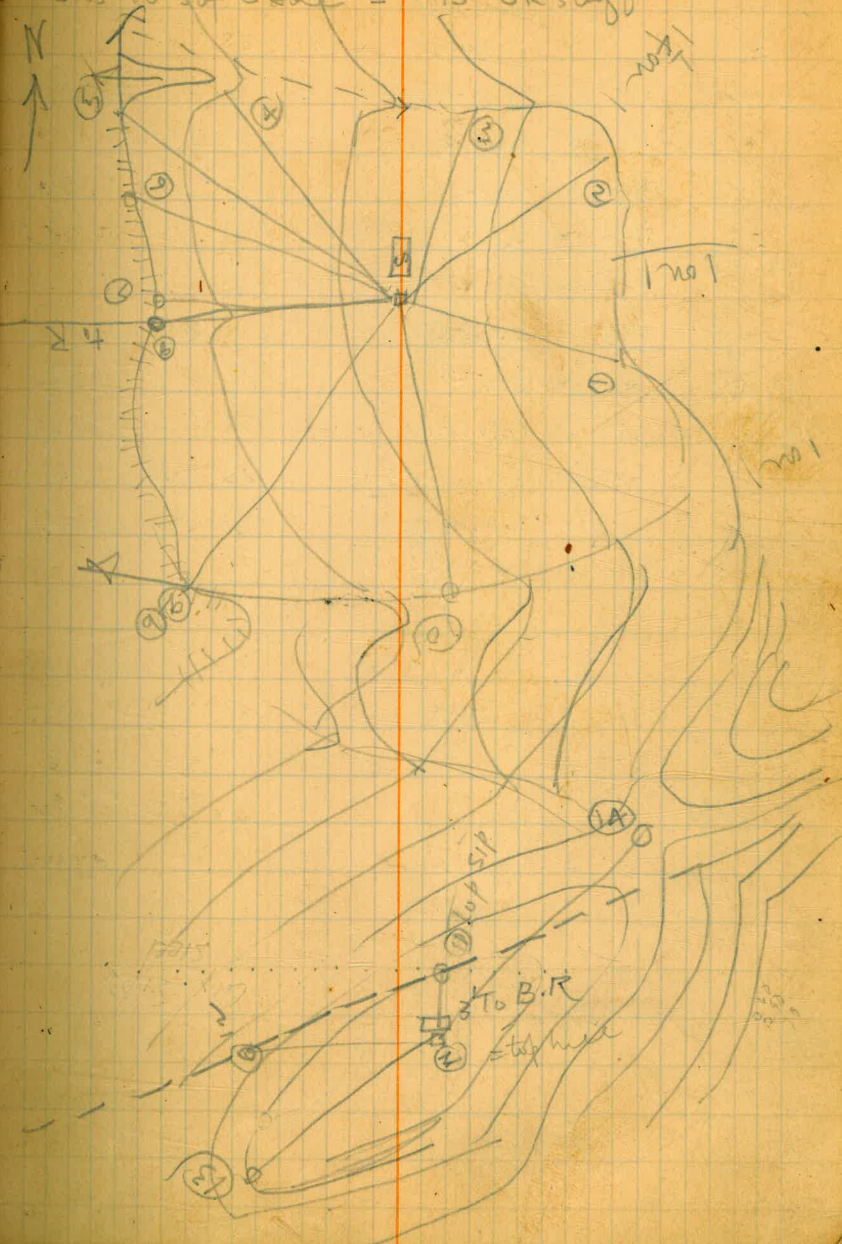
H3 = 20' Ef hse & 5' N Hole 8' deep



Sta	Az	Rds	VA Rd	⊖	Elev	Dist
"S"			+4.9	630	625.0	BS on R
①	217° 30	2.8	+5°00		654.4	277.8
②	165° 00	2.4	+6°00		644.9	237.4
③	118° 45	2.4	+0°30		632.1	239.9
④	89°-00	3.00	-18.5		612.5	300.0
⑤	52°-35	4.80	-6°15		578.2	474.2
⑥	45°-30	6.40	-6°15		560.9	632.3
⑦	23°-40	6.40	-6°10		561.5	632.3
⑧	3°-30	7.00	-5°50		559.3	692.3
⑨	350° 55	7.50	-4°50		567.0	744.7
⑩	306°-15	3.70	-4°30		601.2	367.8
S to Z	290° 40	10.00	+1°30		680.0	= Z 999.0
Ⓩ						
		~~0~~	5.00	685.0	680	
⑪	23° 30	0.90	-13.5		662.5	90.0
⑫	298° 35	1.20	-11.4		673.6	120.0
⑬	230° 30	0.90	-10.0		675.0	90.0
⑭	66°-25	2.6	-11.0		674.0	In Calcd 260.0
Z to N						BS on S

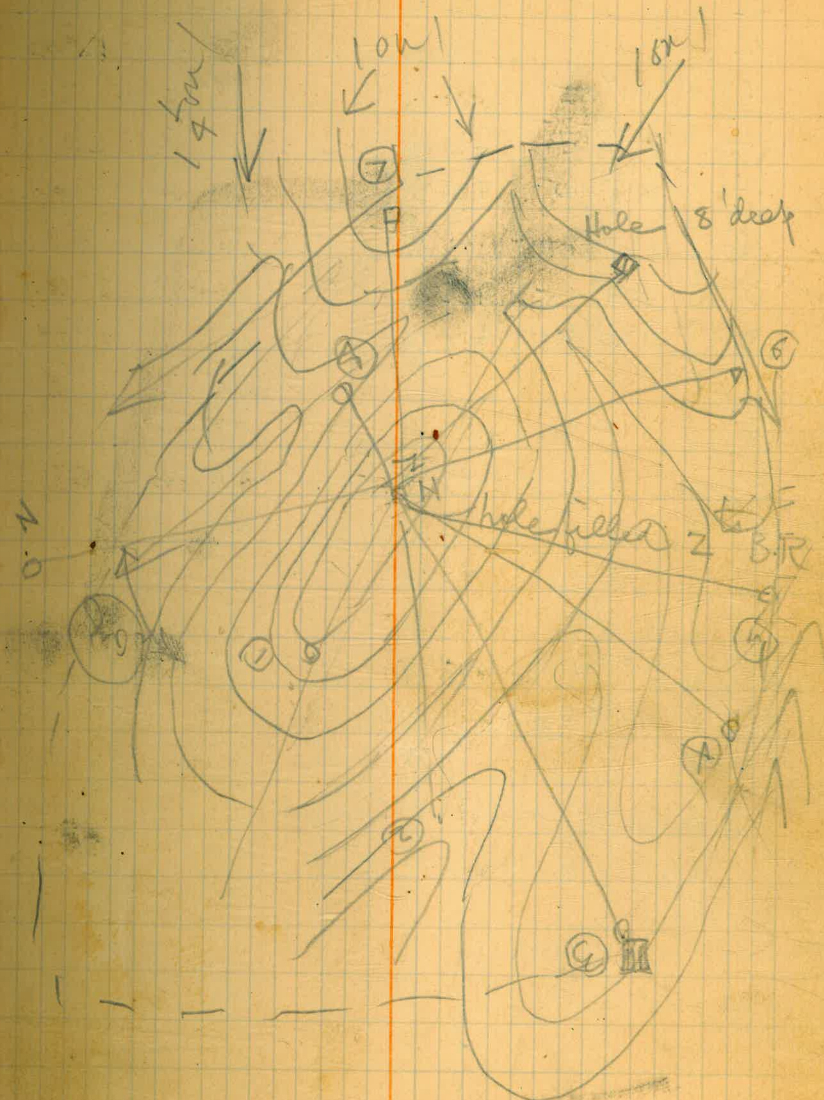
Fin work 12^00 M Aug 22/23

S is 10' S of c Hole = -15' OK stuff



Sta	Oz	RdS	VA Rd	⊖	Elev	Dist
Z			14.9	690.0	685.0	
Z to N	166° 45	11.00	-13.0		687.0	1000.0
(N)		~~[illegible]~~	+4.9		694.9	
(1)	39° 00	1.20	-7.5		682.5	120.0
(2)	74° 34	4.00	-7° 03		641.2	394.0
(3)	112° 10	5.80	-6° 00		629.7	574.5
(4)	132° 35	4.40	-6° 00		644.2	435.2
(5)	190° 50	5.20	-0° 30		644.8	519.9
Hole	217° 40	4.90	-1.30		688.7	490.0
7	247° 00	5.40	+4° 00		727.6	537.3
4	246° 00	2.50	-1° 30		683.5	249.7

15
95
55



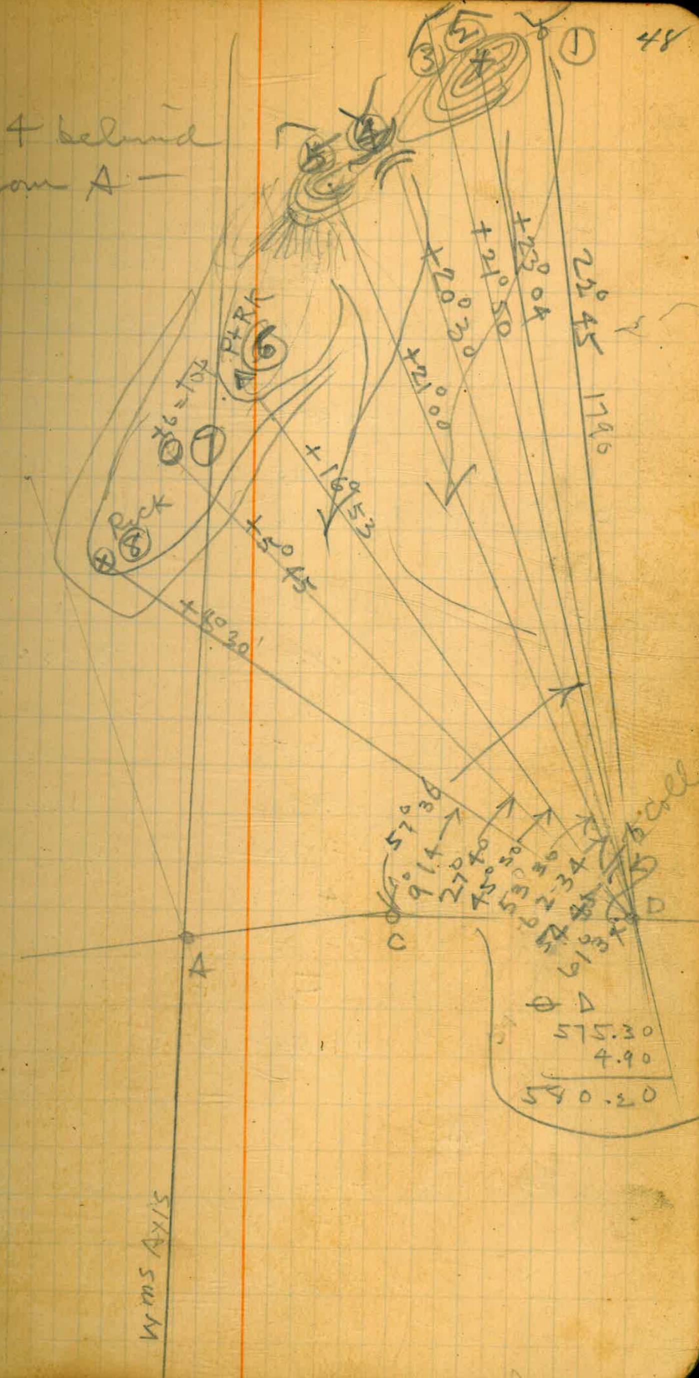
Aug 22/23

Topog contd above spill

Sta	Az	ρ	Va Ra	⊖	Elev	(BS on Δ)
C			4.80	478.20	573.40	Δ
1	111° 55		+23° 33			
2	117° 50		+23° 40			
3	117° 10		+22° 50			
4	120° 20		+21° 35			
5	121° 45		+22° 05			
6	130° 45		+18° 16			
8	192° 00		+10° 35			
A (BS on C)			4.80	573.00	569.20	
1	75° 20		+23° 10			
	76° 41		+23° 30			
6	78° 00		+18° 40			
8	100° 20		+18° 19			

Fin Work 4:00 P.M. Aug 22
moved to Mission Gorge

col 4 behind
⊙ 5 from A —



254

Mission Gorge Aug 23/23

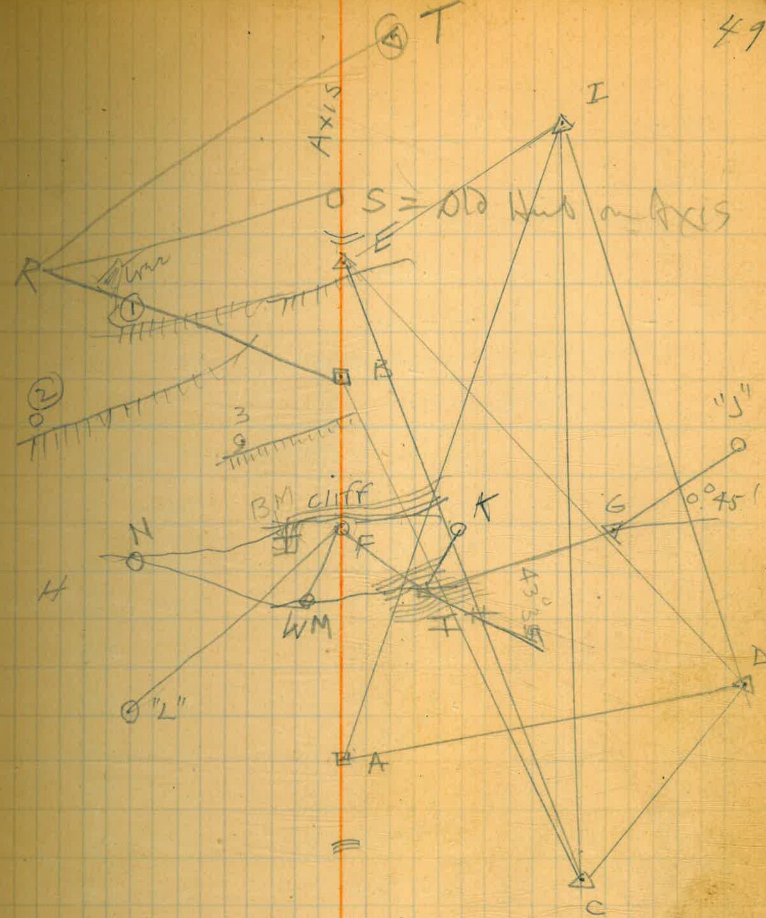
Set Flags etc

Aug 24/23

"A" Hub 1.25 W of Wh stk

0°00' = N W on Axis

Angle	Stad	Rod V A	⊖	Elev	Point
0°00		+4.45	314.45	310.00	[illegible]
0°00	5.28	-26°45		103.33	Cliff Bottom
0°-05 Rt	9.50	+17°10			E
15°05 Lt	8.80	+5°30			①
22°25 Lt	7.20	+1°45			②
0°00	6.65	-3.65		310.85	B
81°00 Rt		+3°50'			D
9°35 Lt	5.60	-9°-15			③
		-0.45		314.00	Top W Post-S
0°00	5.20	-27°10		103.33	F
58°10' Rt	7.90	-14°-36			G
4°10' Lt	5.10	-26°28		104.00	BM
0°00' = Axis	S.	"F"			
		+4.50	107.80		
		+33°22'			
64°18' Lt	3.05	+2°00			H 2 on Rd
90°31 Rt	0.28	+0.85		107.00	B.M
		A+H	B S on F (Rd 5.00)		
0°00 / 0 8 Lt	305	-1°-30			Sta F
43°27	3.75	-3.00			Sta G



F is 8.8 off ↑ on N. Side

Along Axis South

A + H

Grd wh stk N side < to sta. E

209°30'8 Lt +21°30 ⊖ = 5.00

At St "G"

Angle	Stad.	Rod VA	⊖	Elev	Point
0°00		+4.60			
0°00	3.75	-6.60			H
19° 06' L		+14° 20			Top WSIT South

Fin 12:00 PM Aug 24

C. Smith Quit Work. Gave Time

Topog Trav Mission Gorge
130 P.M Aug 24

Sta	Az	RD's	VA Rd	⊖	Elev	Dist
BM			+0.75	107.35	106.60	
S. Side on Ans	0°00	1.00	-4.70		102.90	100
	11°50'	1.05	-4.70		102.85	
	19°30	1.10	-4.70		102.85	
	39°-25	1.40	-4.90		102.45	
	52°-00	1.65	-5.00		102.35	
	58°-20	2.30	-5.30		102.05	
	68°-30	3.60	-5.40		101.95	
	292°00	1.25	-4.85		103.35	
H	295-40	3.05	+2°00		116.00	

Fin 4.45 P.M Aug 24/23

Fred Shaw brought by Wms in eve.

2.62
3.05
1310
786
7.9.9.10

121.0 ⊖ H
3
118 = Elev G

116.0
5
121.0 = ⊖ H
8
113
10
103 = Elev F

⊖A = 314.45
24.39
79
21951
17073
192.681

314.45
192.38
121.77

314 = W Sit

24
7.9
216
168
189.0

314
189.6
124.4
4.6
119.8

93.87
7.9
84483
63709
741.573

75.8
3.2
1516
2274
242.56

42.9
8
858
1287
137.28
107
234

168.
107
275

107.35
10.64
117.99
18
135.99

3.49
3.05
17445
1047
10.6445

37.
34
148
120
268

Control

107.35
10.50
117.85
2
115.85

3.5
3
10.5

Topog Contd

Hoopes - Shaw - Warner
Aug 25/23

Sta	Az.	DS	V∠ Rd		Elev	
"F"	294° 00	2.40	+4° 50	107.8	128	
	305° 45	2.20	+8° 50		141	215
	326° 00	2.50	+21° 00		191	218
	0° 00	2.40	+24° 00		197	200
	25° 00	2.10	+20° 30		176	184
	52° 00		-1			
	52° 00	2.60	-10° 00		152	253
RD	24° 00	4.20	+23° 30		260	353
RD	64° 00	10.7	+9° 50		287	1038
	51° 30	4.50	+12° 00		197.8	430
	51° 00	5.20	+13° 40		227	491

103.3
4.5
107.8

51.

97.6 / 2.2 / 195 2 / 1952 / 214.72

15.2 / 2.2 / 304 / 304 / 33.44

8.4 / 2.4 / 336 / 168 / 20.16 / 107 8 / 280

3.6' / 359 / 05 / 54

107.8 / 33.4 / 141 2

87.2 1/2 / 436 / 1744 / 216.8

33.5 / 2.2 / 167 / 670 / 83.7

107 / 87 / 191

83.5 / 2.4 / 3340 / 1670 / 200.40

107.8 / 89.2 / 197.0

37.2 / 2.4 / 1488 / 744 / 89.28

87.7 / 87 / 1754 / 1841.7

107. / 69 / 176

32.8 / 2.1 / 32.8 / 656 / 68.88

97 / 2.6 / 592 / 194 / 253.2

107.8 / 44 / 151.8

17 / 2.6 / 102 / 34 / 44.2

RD 17

84 / 4.2 / 168 / 336 / 352.8

107.8 / 154 / 261

36.6 / 4.2 / 732 / 1464 / 153.72

1038 / 17 / 7266 / 1038 / 17646 / 107.52 / 2564.

107 / 97 / 749 / 963 / 1037.9

107.8 / 179 / 286.8

16.8 / 10.7 / 1176 / 168 / 179.76

95.7 1/2 / 4788 / 3828 / 4300

107.8 / 9

20 1/2 / 10

16.8 / 10.4 / 672 / 168 / 174.72 / 107

94.4 / 512 / 18888 / 4720 / 490.88

107 / 120 / 227.

23 / 5.2 / 46 / 115 / 119.6

Sta	Az	Rds	VA Rd	⊖	Elev	Dist
F				107.8		
Ldg	63°30	5.80	+19°40		184	569
	71°00	6.20	+4°10		150	618
F						
B.M			+0.9	107.5	106.6	
I	341°50	0.90				
I			+1.5	108.10	106.6	BM
	23°23	0.95	-5.00		103.1	
	30°15	1.10	-4.80		104.20	
	308°00	2.90	+7°40		146	284
	326°30	2.60	+17°26		182	237
old T point	334°30	2.50	+20°04		189.0	220
	6°27	2.90	+26°55		224	230
	20°30	3.10	+30°50		244	228
	346°15	1.80	+11°00		142	173.5

98.2 × 5.8 = 7856 + 4910 = 569.56

107.8 + 76.6 = 184.4

13.2 × 5.8 = 1056 + 660 = 76.56

107.8 + 43 = 150.5

7

6.2 × 7 = 43.4

1.90 × 6 = 11.40

108.1 + 11.4 = 119.5

+3° - 30

108 + 16 = 124

6.41 × 22 = 32 + 128 = 16.0

98.2 × 2.9 = 8838 + 1964 = 284.78

359-60 − 334-30 = 25-30

108 + 38 = 146

13.2 × 2.9 = 1188 + 264 = 38.28

360 − 8 = 352

360 − 326 = 34

5 on Ra

91 × 2.6 = 546 + 182 = 236.6

108 + 74 = 182

28.5 × 26 = 1710 + 570 = 74.10

(187.89)

88.2 × 2.2 = 441 + 1764 = 220.5

108.10 + 80.5 = 188.6

32.2 × 2.2 = 161 + 644 = 80.5

79.5 × 2.9 = 7155 + 1590 = 230.55

108 + 116 = 224

2.9 × 40 = 116.

359-60 − 346-15 = 13-45

73.7 × 3.1 = 737 + 2211 = 228.47

108 + 136 = 244

44 × 3.1 = 44 + 132 = 136.4

96.4 × 1.8 = 7712 + 964 = 173.52

108 + 34 = 142

18.7 × 1.8 = 1496 + 187 = 33.66

Sta	Az	Rds	VA RD	⊖	Elev	Dist
BM			+14.40	120.60	106.60	
# Bsm F				120.60		
	74° 30	2.90	+5° 32			148
	87° 00	3.20	+5° 30			
	97° 05	3.50	+4° 45		130	
Fin Field Work		4°° P.M.	Aug	25/23	to Town	

Sunday Aug. 26/23

Bsta # A4 "6"

		+6.60	122.60	116.00	
		-4.6		118.00	
66° 25	3.20	+18° 35		218 –	287
53° 30	3.40	+12° 50		196	323
54° 30	5.40	+17° 30		477	486
44° 00	5.10	+14° 30		246	478
92° 35	6.90	+25° 45		390	559
94° 45	5.50	+25° 50		336	445

Sta.	Ag	Rds	VA Rd	-o-	Elev	
At G				122.60		
	134° 30	6.00	+21° 00		323	522
	146° 15	4.5	+11° 00		196	436
	134° 18	3.8	+12° 40		201	362
	133° 00	2.6	+4° 10		140	
	133° 15		-6.00		116.60	
		1.00	-12.00		110.6	
			-4.60		118.0	
	83° 40'	2.00	+2° 30		130	
	60-30	1.00	-8.5		141	
G to J	161°-15	1.65	-6.30		116.00	
At J BSm G			+2.00	120.00	116.00	
to Tank post South (314)	348° 00	9.05	+12° 00		313.00	(314)
	92°-30	1.9	+7° 04		143	
	89° 15	3.5	+13° 16	~~332~~	198	332
	92° 30	4.1	+17° 15		236	374
	92° 00	4.9	+18		264	441
	~~80° 50~~					
	80°-50	3.6	+21° 45		244	312

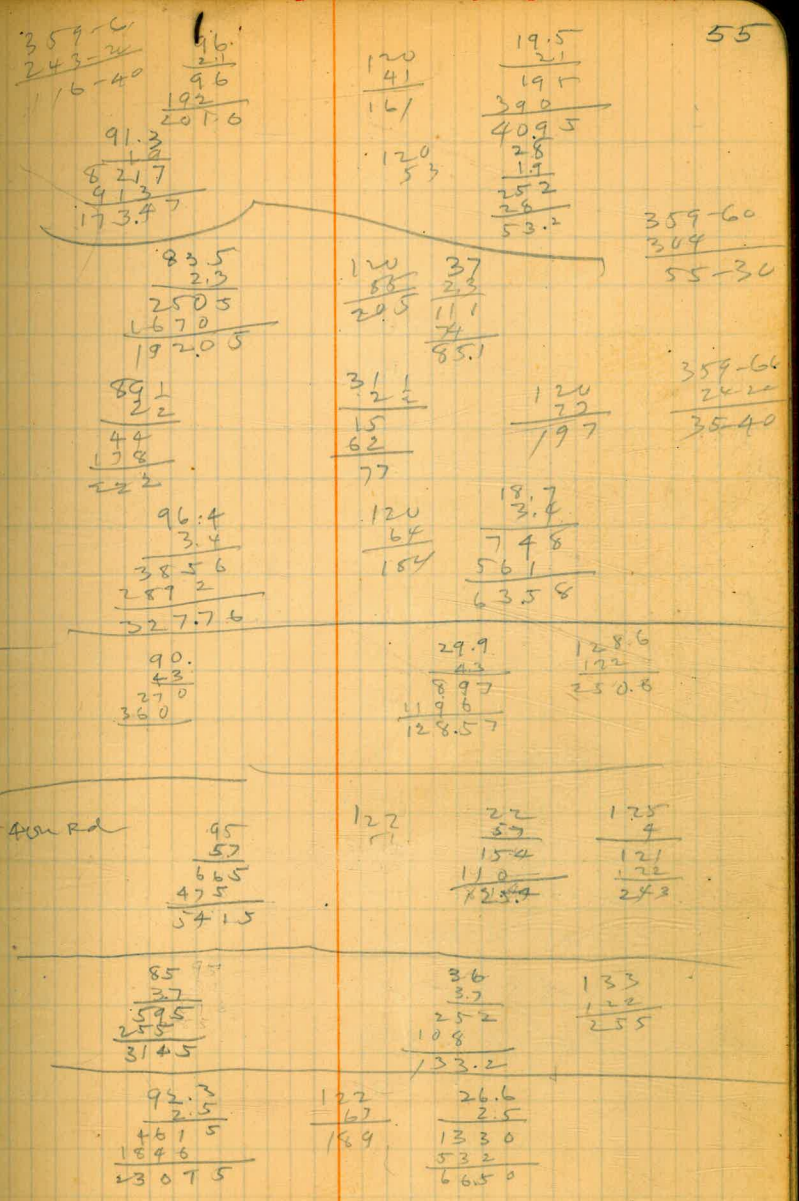
87 × 6 = 522
33.5 × 6 = 201.0; + 122 = 323
76 + 120 = 196
97 × 4.5: 48 / 388 / 436
17 × 4.5: 68 / 68
95.2 × 3.8: 7616 / 2856 / 361.76
21.4 × 3.8: 1712 / 642 / 81.32
120 + 81 = 201
122 + 19 = 141
122 − 12 = 110
2.3 × 2.6: 438 / 146 / 16.98
122 − 12 = 110
21.26 × 9.05: 10630 / 19134 / 192.4030
122 − 88 = 120.8 (?)
4.4 × 88
184.6 × 1.65 (?): 304.6
9.05 × 2.04: 3620 / 1810 / 184.6
120 + 193 = 313
12.2 × 1.9: 1098 / 122 / 23.18
23.2 + 120
94.81 × 32 (?): 474 / 2844 / 3318
22.21 × 3.2 (?): 111 / 666 / 77.7 (?)
120 + 21 (?)
91.2 × 4.1: 912 / 3648 / 373.92
28.3 × 4.1: 283 / 1132 / 116.03
116 + 120 = 236
90 × 4.9: 810 / 360 / 441.0
144 + 120 = 264
29.4 × 4.9: 2646 / 1176 / 144.06
86.3 × 3.6: 5178 / 2589 / 311.68
34.4 × 3.6: 206.4 / 1032 / 123.84
123 + 120 = 243

Stg "S"	Az	PDs	Rd VA	⊙	Elev	Dist
				120.00		
	243° 20	2.10	+11° 30		161	202
off Paper	233° 50	1.90	+17° 10		173	173
	280° 00	2.30	+24° 00		205	192
	304° 30	2.50	+19° 12		197	222
	324° 20	3.4	+11° 00		184	328

Fin work 4.30 P.M Aug 26/
Fred Shaw To City

Topog Contd Mon. Aug 27/23

BS on E H to K	76° 40	1.05				
				122.00		
A to K. BS on H Adraw N side Rd	308° 55	4.30	+18° 22		250	387
Rd	280° 00	5.70	+13° 00		~~243~~	542
Rd	348° 30	3.70	+23° 04		255	315
	32° 45	2.55	+16° 04		189	231



Sta	Adj	RDs	VA Rd	⊙	Elev	
BM			+1.00	107.60	106.60	
Bs on Axes						
A to F				107.60		
RD.	0° 00	3.80	+26° 00		255	308
RD + Draw	30° 00	4.50	+22° 12		264	345
RD ~~Curve~~ P.C.	49° 30	6.00	+15° 22		261	558
P.C. to L INRd	57° 12	7.40	+13° 25		270	700
F to M	56° 12	2.05	-4.80		102.80	
Bs on F				106.6 = BM		
AM		2.05	+0.40	107.0		
on sand	242° 40	1.60	-5.3		102.7	
M to N	221° 40	4.65	-6.0		101.0	
	232° 00	4.00	+7° 02		155	394
	241° 30	3.80	+14° 12		198	357
	239° 35	3.50	+11° 15		173	336
	246° 10	3.00	+14° 50		182	280
	250° 00	2.60	+20° 10		161	229
	268° 30	2.40	+30° 32		212	178
360 / 36	306° 50	2.80	+30° 15		250	210
Bs on M	324° 00	1.90	+19° 30		167	162
A to N			+2.90		102.80	
N				105.70		
			-4.80		100.90	close N

source RD

Sta	Az	RDS	VA Rd	θ	Elev	Dist
At N (BS on M)				105.70		
	13° 00	2.60				
	139° 00	1.30	-5.20		100.50	
	144° 30	2.70	-5.50		100.20	
	174° 30	1.10	-3.50		102.20	
N to O	175° 10	1.10				
At O (BS on N)					102.80	
O			+5.70	108.50		
	102° 00	2.80	+15 30		181	260
O to P	134° 00	2.00	-6.5		102.00 / 102.80	
At P (BS on O)			2.60	105.40	Elev. O	
	330° 00	3.50	+12° 40		182	332

Fin 4 30 P.M Aug 27 Hooks Water

Aug 28th 1923

Sta	Az	RDS	VA Rd	θ	Elev	Dist
At B					310.0	
			+4.00	314.00 θ = 314.00		At Sta Top Wh Slt
A To Top Wh Slt			-0° 03			
Gr at Hub S. side			-0° 32			
Sand + Can Cdg			-30° 00			
Creek S on A x			+5° 00			
B to R	88° 50	1.95	+7° 50		335.30	191
B to S	180° 00	1.95	+30° 35 = slope		395	5 on Rd R / 4.0 on Rd S

5 on

93
28
744
186
2604

108
73
181
1
171

26
28
208
52
72.8

95 1/2
3 1/2
47
285
333

22 1/2
3 1/2
11
66
77

105
77
182

10 on Rod
1.95
98
1560
1755
191.10

314
26
370
335

13.5
19.5
675
1215
135
263.25

74

43.8
19.5
2190
3942
438
854.10

314
85
399

26.3
314
340.3
5
335.3

Sta	Az	Rds	VA Rd	⊖	Elev	Dist
BS on B / At R		1.95	-9°00	340.00	335.00	190
			-7°49			
R to C	61°27		+6°12			
R to D	13°50		+2°30			
R to A	75°00		-2°30			
Pt on Axis	339°10	2.10	+2°35		349.5	
	322°15	1.20	+4°10		348.7	
364 / 34 / 21						
	284°15	1.00	+8°00		354	98
	275°00	1.40	+13°40		370	133
outline of ledge 1 mile - 65	237°00	1.40	+6°20		355	138
R to S (Pt on Axis)	322°40	2.60	+13°40		398	245
BS to R. / At S top 6' ledge			-15°20	402.5	398.0	
	60°30	0.80	+2°30			
S to T	175°55	1.30	+16°05	441.9	437.0	120

⊖ At R = 4.9 — top stk = 4.6

Ground at sta
top with stk

97.6 × 19.5 = 1903.20

15.45 × 1.95 = 30.1275

4.5 × 2.1 = 9.45

340 + 9 = 349.5

7.25 × 1.2 = 8.700

98.8 × 1.4 = 138.32

25.5 × 2.6 = 66.30

402.5 + 66.3 = 436.2

340 + 30 = 370

95 × 1.4 = 133.0

21.4 × 1.4 = 29.96

11 × 1.4 = 15.4

340 - 85 = 255

335 + 66 = 401 + 4.5 = 396.5

2 on Rd

94.4 × 2.6 = 245.44

22.3 × 2.6 = 57.98

23 × 2.6 = 59.8

340 + 60 = 400 — 398

23 × 2.6 = 59.8; 340 + 60 = 400

92.3 × 1.3 = 119.99

26.6 × 1.3 = 34.58

402.5 + 34.6 = 437.1

437 + 4.9 = 441.9

Sta	Az	Rds	Rd VA	⊖	Elev	
At T (BS on S)				441.8		
T to U	192° 10'	2.40	+12°42		488.4	228.5
At U (BS on T)	0° 00	2.40	+12° 44	492.6	488.2	
	183° 30	1.10	-4.50		488.00	
Draw Rd	152° 20	3.00	+9° 40		537.5	291
Point	166° 20	4.20	+7° 00		543	414
U to V	76° 30	2.70	+2° 20		501.4	
Fin at 12.15 P.M. Aug 28						
At V (BS on U)	0° 00	2.70	+0° 45	506.90	501.40	
	8° 00	2.25	-10.50		496.40	
	31° 45	2.40	-9° 30		468	234
	75° 00	1.90	-17° 05		454	173
	66° 35	3.30	-13° 32		432	316
	99° 15	1.30	-21° 00		463	113
	141° 30	1.50	-15° 30		468	139
	140° 10	2.60	-11° 35		455	250
V to W	121° 40	4.30	-13° 00		412	408.5

437 + 4 = 441; 441 + 1 = 442

95.2 × 24 = 2284.8

441.8 + 51.6 = 493.4; 493.4 − 5 = 488.4

21.5 × 24 = 51.60

492.6 − 4.5 = 488.2

To 5 on Rd U

To 4 on Rd T

To 5 on Rd

492.6 + 49.8 = 542.4 → 537.5

16.6 × 3 = 49.8

98.5 × 4.2 = 413.70

492.6 + 50.8 = 543.4

12.1 × 4.2 = 50.82

1.28 × 2.7 = 3.456

2 on Rd V

492.6 + 10.8 = 503.4; 503.4 − 2 = 501.4

2.7 × 4 = 10.8

501.4 + 5.5 = 506.9

1 5 on Rd

97.3 × 2.4 = 233.52

16.3 × 2.4 = 39.12

506.9 → 507; 507 − 39 = 468

91.2 × 1.9 = 173.28

506.9 → 507; 507 − 53 = 454

28 × 1.9 = 53.2

99.5 × 3.3 = 315.85

22.8 × 3.3 = 75.24

507 − 75 = 432

96 × 2.6 = 249.6

87 × 1.3 = 113.1

33.5 × 1.3 = 43.55

507 − 44 = 463

507 − 39 = 468

507 − 52 = 455

95 × 4.3 = 408.5

507 − 95 = 412

22 × 4.3 = 94.6

Sta	Az	Rds	Rd Vd	⊖	Elev	Dist
At W (BS on V ✓)	0°00	4.30	+11°42	415.80		
	283°22	1.05	+4°18		423	
	181°25	1.50	-13°00		383	142
	208°30	2.30	-7°50		385	225
W to X (BS on V ✓)	185°30	4.45 ~~3.80~~	-7°35		353	441
	164°00	3.80 ~~3.0~~	-14°10		326	357
	140°00	3.00	-14°00		346	282
	134°00	6.60	-12°30		272	629
	131°50	1.80	-15°45		369	167
	102°00	2.00	-9°10		385	195
At X (BS to W)	0°00	1	+7°26			442
At SIK	62°00		-1°40			

Fin work 5⁰⁰ P.M Aug 28

96, 4.3, 288, 384, 4128 — 501.4, 85.6, 415.8, 4.8, 411 — 19.9, 4.3, 597, 796, 85.57 — 501.4, 86, 415.4, 4.8, 410.6

94.9½, 474, 949, 1423 — 415.8, 41.6, 33, 383 — 22½, 21, 22, 33

98, 3, 294, 196, 2254 — 416, 31, 385 — 13.5, 405, 270, 31.05 — 415.8, 57, 358.8

To 5 on Rod — 416, 58, 358, 353 — 98½, 4½, 49, 392, 441 — 58 — 13½, 4½, 57 — 415.80, 57, 458.5

94, 38, 752, 282, 3572 — 416, 40, 326 — 23.7, 3.8, 1896, 711, 90.06 — 314

94, 282 — 416, 70, 346 — 23.5, 705

5 on Rd — 95.3, 6.6, 5718, 62898 — 416, 139, 277, 272 — 21.1, 6.6, 1266, 139.26

92.6, 1.8, 7408, 926, 16668 — 416, 47, 369 — 26, 1.8, 208, 46.8 — 412, 56, 356, 354, 4.8, 349.2

97.5, 2, 1950 — 416, 31, 385 — 15.7, 2, 31.4

2 on Rd — 11.30 — 98.3½, 4½, 49.1, 393.2, 442 — 57.6, 381.4, 4.8, 376.6 — 12.8½, 4½, 64, 512, 57.6 — 441, 57.6, 383.4, 4.8, 378.6

31.4, 13, 327 — 408, 57.6, 3504, 3484, 344 — .0116, 1130, 348, 13.1090 — 358.8, 57.6, 301.2, 2, 299.2

Aug 29

Stg		Az	VA RDS	VA RD	⊖	Elev	Dist	
At R	Bs B			+5.40	340.40	335.0		
R to Y		229° 0.0	2.02	-16°00		351.0		Ground
At Y	Bs R	0° 00		+5.30	356.30			
		83° 30	1.05	-13° 30		334	95	
		77° 30	2.60	-12° 36	5 on Rd	295	247	
		95° 45	4.00	-11° 40	10 on Rd	261	380	
		132° 30	1.60	-11° 30		330	155	
		136° 45	2.40	-9° 30		317	233	
		122° 15	3.70	-11° 35	10 on Rd	272	355	
		112° 00	4.20	-12° 05	10 on Rd	262	403	
Y to X		163° 30	4.90	-9.00		347		
Y to Z		137° 40	4.10	-6° 16		316		

Fin N Side Gorge 12 15 P.M Aug 29

10 on Rd Y

94.6

340.4 / 21 / 361.4 / 10 / 351.4

10.4 / 20.2 / 208 / 21.0.08

22.7 / 356.30 / 22.7 / 333.6

95.3 / 2.6 / 5718 / 1906 / 54778 / 95.2 / 4 / 350.8

356 / 56 / 300

21.3 / 2.6 / 1278 / 426 / 55338

21.4 / 4 / 85.6

352 / 80 / 272

97 / 1.6 / 582 / 97 / 1552

16.3 / 1.6 / 978 / 163 / 26.08

356 / 24 / 320

97.3 / 2.4 / 3892 / 1946 / 233.52

356 / 39 / 317

16.3 / 24 / 652 / 326 / 39.12

320

96 / 3.7 / 672 / 288 / 3552

356 / 74 / 282 / 10 / 272

74

356 / 40 / 316

96 / 4.2 / 192 / 384 / 4032

356 / 54 / 272 / 12 / 262

20 / 4.2 / 40 / 80 / 84.0

410 / 41 / 45.

11

Topog S Side. Mission Gorge
Com. 1.30 P.M Aug 29

Sta	Az	Rds	va	⊖	Elev	Dist
BS on A at AX	0°00	1.25	+20°	265.00	261.1	110
B	180°-00				310	
	272°05	5.30	-13.00		252.00	
156.7 / 9.3	265°05	8.50	+0°31	10 m Rd	247.00	
	222°40	11.55	+4°12		350	
))))	213°30	9.30	+6°00		358	920
	206°20	8.30	+8°30		386	812
	201°00	7.80 ~~6.80~~	+9°20		390	760
	192°00	6.80	+8°30		364	665
					261.10 AX	
At L BS on AX		5.80	+14.00	275.00	270.00	
L to ①	160°30	1.80	+1°18			
At ① BS on L			+13.20	283.20	270.00	
			-5.00		278.20	
	184°00	1.10	+0.50		283.78	
	160°00	0.50	-3.70		279.50	
✓	119°00	0.40	-10.00		273.20	

Fin work 4.45 P.M Aug 29

Elev A = 310

2 on Rd

87.74 ¼ — 2193 — 8774 — 109.67
32.8 ¼ — 82 — 328 — 41.0 — 31
310 — 41 — 312 — 41 — 271 — 266
.91 — .82 — .4 — 72 — 7.6
265 — 76 — 189
310 — 41 — 9
265 — 7.6 — 257.4
99.5 — 11.6 — 5970 — 995 — 995 — 115420
7.3 — 11.6 — 7.3 — 348 — 812 — 84.68
265 — 85 — 350
98.9 — 9.3 — 2967 — 8901 — 91977
93 — 265 — 93 — 358
110
97.8 — 8.3 — 3004 — 7824 — 81244
265 — 121 — 386
14.6 — 8.3 — 438 — 1168 — 121.18
265 — 125 — 390
97.4 — 7.8 — 7792 — 6818 — 75972
116 — 7.8 — 128 — 112 — 1248
265 — 99 — 364
97.8 — 6.8 — 7824 — 5868 — 665.04
14.6 — 6.8 — 1168 — 876 — 99.28

S. Side Mission Gorge — Hoopes, Warner

Aug 30/1923 7.30 A.M.

Sta.	Az	RDS / VA RD	⊖	Elev

Warner Quit

Geo Watson on Job at noon Aug. 30/23

Balance of Work Plane Table

Com. S of Rd in A.M. Aug 31/23

Point	Read	Angle	⊖	Elev	Dist
Point on A	1.			310.00	
At (5)	1.92	-23°00	386+0		163
386 / 50 / 336	1.40	-22°02		336	120
	0.90	-19°-44		356	79
old 0+00	0.58	-18°-23			53
To B		-5°-16 / -5°-14	386.00 ✓	310	830
To S		+0°-45	386.00	398	980
	1.40	-6°35		360	138
	2.70	-7°48		351	259
	260			356	254
	1.65	+8°50		400	169

84.73 × 1.92 = 162.6816

310 + 79 = 389

3597 × 192 = 69.0624

398 − 17.6 = 380.4

980 × .018 = 17.640

10 on Rd

10 on Rd

10 on Rd

30°20 − 7-20 = 23

30°20 − 8-18 = 22-02

39-80 − 10-36 = 29-44

62.55 + 15 = 77.55; 314 + 77 = 391

32.58 × 1.92 = 62.5536

398 − 12.7 = 385.3

20-30 − 10-02 = 10-28

15 on Rd

30°00 − 23-25 = 6-35

10 on Rd

98.7 × 1.4 = 138.18

386 − 26 = 360

11.4 × 1.4 = 15.96

386 − 76 = 310

30-00 − 23-12 = 7-48

98 × .27 = 25.86

8.4 × 1.6 = 13.44

386 − 35 = 351

30-00 − 23-30 = 6-30

386 + 13.5 = 399.5

386 − 30 = 356

10 on Rod

165 × 8.4 = 1386.0

33°-80 − 29-30 = 4-50

386 + 24 = 410

15.2 × 1.6 = 24.32

37°-80 − 29-30 = 8-50

386 + 14 = 400

97.6 × 165 = 16104.0

	Rd	At 6 VA	⊙	Elev	Dist
to 5'	165	-4° 54	406.00	402.5	164
	160	-7° 30		395	156
	210	-8° 00		376	205
	65	-15° 40		389	60
	260	-8° 45		367	254
	320	-8° 25'		360	313
	580	-7° 35		316	566
	800	-4° 24		344	
	290	-9° 24		360	181
	520	-8° 30		330	508
to 7	1.90	+13° 24		439.00	182
At 7		+8° 25			

64

10 on Rd

10 on Rd

At 7 Elev = 439.

Pivot	Rd	Angle	~~Elev~~	Elev	DIST
	13.0	-7° 49	~~420.00~~	270	1020
to B		-7° 45	444.00	310	985
To C	190	+8° 42		+lag = 470 462	
to 8	200	+8° 15		462	196
	At 8		466.0	462	
to B		-8° 26		310	1060
	0.50	-12.40		454.60	
	0.60	-11.60		454.40	
	0.45	-5 60		460.40	
	1.30	-12.00		454.00	
(9)	110	-11.40		454.60	
	~~At~~ (9)		458.7	454.60	
	250	-7° 10		427.7	245
	130	-9° 55		436	126
	460	-7° 36		399	450
	350	-6° 43		409	

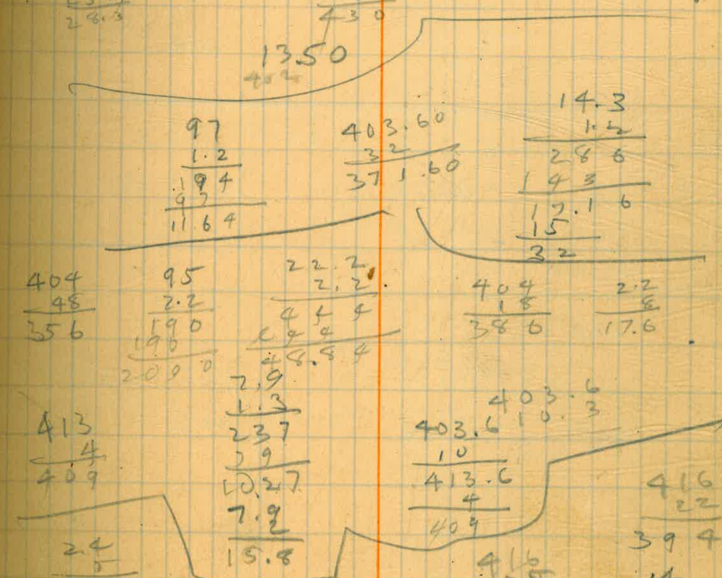
Sept 18th 1923

At (10)

Point	Rod	VAngle	⊖	Elev	Dist
B		+0° 50	292	310.00	1158
C		+7° 41		470.00	1335
(11)		−3° 48		269.00	348
5		+4° 52		398	1248
At Sta		−4.2	292.0	287.8	
(15)	4.20	+3° 13	40 on Rd 7	311.80	418
		At 15 —		311.80	
Back to (11)	4.20	−3° 50	316.00	292.5	418
	2.15	+2° 00			
	3.30	+4° 52		344	
↓	2.70	−7.00		309.00	
to (16)	5.90	+2° 30	50 on Rd	337 ~~342~~	
		At 16		336.0	
		+4.00			
Back to 15	5.90	−2° 15	60 on Rd 340.00	311.80	
to C		+7° 10	340.00	470.00	1040
	1.40	+3° 10		349	
	1.40	−9° 00		318	
	1.70	−1° 30	10 on Rd		
	1.40	−8.00		332.00	
	0.50	−13.50		326.50	

Point	Rod	At 16 Angle	⊖	336 Elev	Dist
	2.		340.00		
Rd ✓	2.80	+3° 16		356	
	2.20	-7.00		333	
	2.20	+0.00		341	
	2.80	-5.00		334	
	3.40	+1.0		341	
	3.50			350	
		+4° 50		15 on Rd 398	865
	740	+5° 16			
(20)	740	+5° 30		410	
		At Saddle 402		398	
(21)	450	+3° 36'		5 on Rd 425	
	400	-2.00		400	
	450	+1° 45		433	
		At 21	403.60	400	
	120	-8° 20		15 on Rd 371	116
	190.	-3.00		400.60	
	220	-13° 13		356	200
	300	-4° 40		386	
(22)	790	+0° 45		40 on Rd 409	
		At 22	416	411.5	
	2.40	-2° 55		10 on Rd	
	1.40			371	
		At 22	416	411.5	
(25)	0.50	-6.20		398.6	
	3.10				

1350



AA 25

Point	Rod	Angle	⊙	Elev	Dist
	3.10	-13° 00	404.80	337	294
	1.90	-6.20		398.60	
		Sept 2d Sunday 1921			
		At Sta 25			
			~~404.00~~	~~400~~	
	520	-2° 35		~~81~~	
to 30	790	-7° 40			766
At 30	790	+7° 06	300.00	296	
		-12.50		287.50	
				5 on Rd	
to Sta	290	+1° 24		300	
AA Sta			304.5		
	280		29	5 on Rd	
	180	-13° 55		255	169
	550	-8° 48		~~243~~	540

29 0
16 45
13

95
31
95
285
294 5

22
31
22
66
692

404
23
381

397
104
293

405
68
337

045
5.2
90
225
2340

98
7.9
801
686
7661
296

13.22
7.9
11898
92574
104472

404
104
300

397
97
300

12.26
79
11034
8582
96854

1322
408
30
408
102
306

Elev Flag C = 470

305
300

2.73
2.8
2384
546
7844

304.5
7.8
2963
291

2.49
2.9
2196
2688
5076

304.5
7.8
3123
5
3073

39 - 80
16 - 30
13 - 55

94.2
1.8
7536
942
16956

304.5
42
262
5
257

23.3
1.8
1864
233
41.94

29 - 40
20 - 52
28 - 100
20 - 52
8 - 48

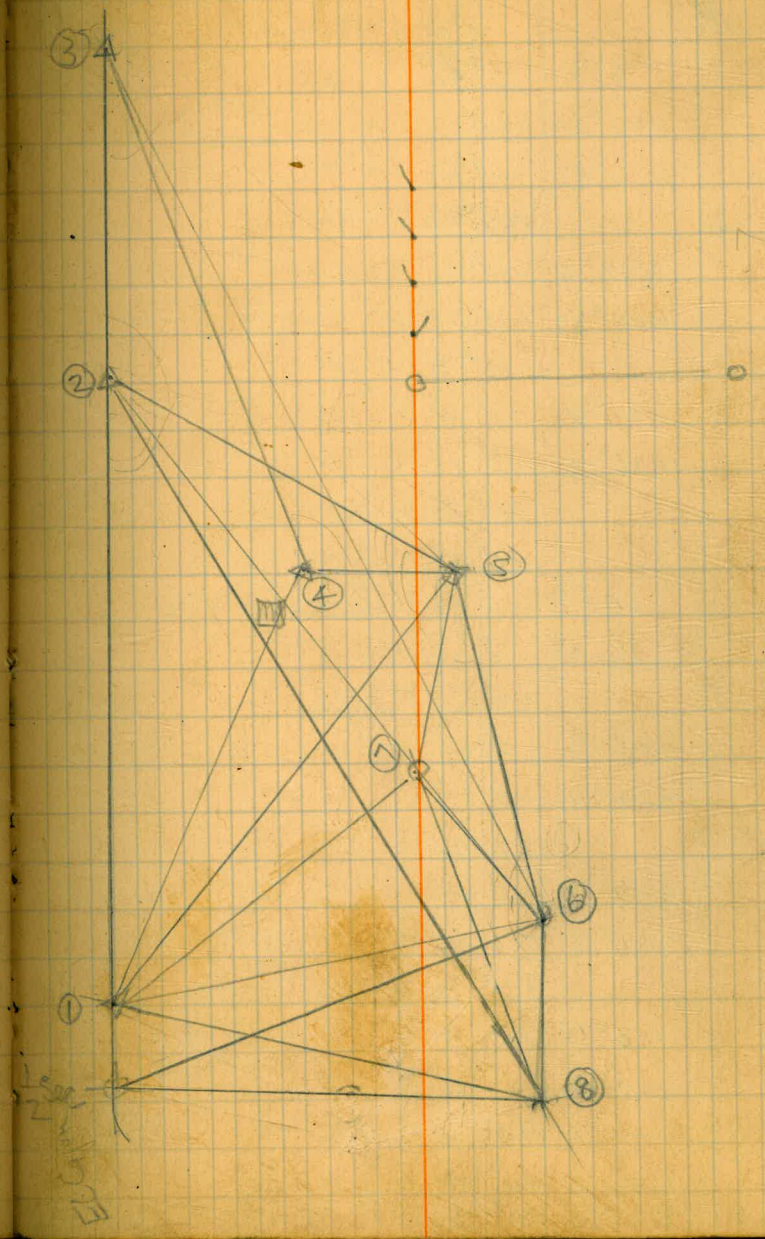
981
52
49
490
539

305
52
223

151
52
7
75
52

305
82
223

Tan	vern	A I	M	Dist
	At 3			
Angle	Read	Angle	Va	Line Dist
4-3-1		31°49'		
	63°39'	31°49'		
	95°30	31°50'		
6-3-1		32°9'		
	64°18'	32°9'		
	96°31'	32°9'40"		
	At-2			
5-2-1 / 3-2-1		63°50'		2-3 5559.9
	127°40'	63°50'		
	191°30'	63°50'		
8-2-1		36°05'		
	72°10'	36°05'		
	108°15'	36°05'		
				2-5 9079
	At 4			
3-4-1		130°00'		
	260°00'	130°00'		5-6 1048.8
	390°00'	130°00'		
3-4-5	1	129°07'		
	258°13'	129°06'30"		
	387.20	129.06'90"		



Angle	Read	Angle	Va	Line	Dist
		At 5			
2-5-1		90° 56'			
	181° 54	90° 57'			
	272° 48'	90° 56'			
2-5-6		138° 32			
	277° 4	138° 32'			
	415° 37	138° 32' 30"			
4-5-1		72° 4'			
	144° 8	72° 4'			
	216° 12	72° 4'			
		At 6	HI 4.5		
2-6-1		80° 39'	6-8		
	161° 16	80° 39'	+ 1° 25' ground		
	241 56	80° 38' 46"	6-1		
5-6-1		99° 54'	+ 9° 30' ground		
	199° 46	99° 53'			
	299° 41	99° 53' 10"			
3-6-ELJ.		128° 45'			
	257° 32	128° 46'			
	386° 16	128° 46'			
8-6-1		75° 8'			
	150° 16	75° 8'			
	225° 24	75° 8'			
3-6-1		90° 4			
	180° 8	90° 4'			
	270° 12	90° 4'			

Angle	Read	Angle	Va	Line	Dist
		At 8			
2-8-1		64° 6'		6-8	5438
	128° 12	64° 6'			
	192° 18	64° 6'	HI 4.0 8-1		
6-8-1		82° 52	8° 10' Ground		
	165° 44	82° 52'			
	248° 36	82° 52'			
3-8-1		70° 50'			
	141° 40	70° 50'			
	212° 30	70° 50'			
3-8-ELC		125° 56			
	251° 52'	125° 56'			
	377 48'	125° 56'			
		At 7			
5-7-6		110° 32			
	221° 4	110° 32'			
	331° 46	110			
5-7-8		180° 51'			
	271° 40	135° 50'			
	407° 30	135 50'			
		At 6			
5-6-Sec		102° 18			
	204° 36	102° 18'			
	306° 54	102° 18'			
2-6-Sec		83° 5			
	166° 10	83° 5'			
	249° 15	83° 5'			

Dam Site #2 Log of Holes

	Elev 100% BR	Elev Bed Rock by GC	Total Depth	Ground Elev.	Elev. Bot.	Elev. 50% Core
#1		511.0	103.0	568.5	465.5	
#15		554.7	90.0	554.7	464.7	
#14	453.9	504.0	125.0	553.9	428.9	
#16		552.6	no log	552.6	No log	
#13	491.4	500.0	95.0	555.4	460.4	
#3	575.0	575.0	170.0	651.3	~~481.3~~ 477.3	
#5		626.0	253.0	757.0	504.0	
#11		690.0 700 JW	177.0	783.6	606.6	
#6		703.0	239.0	838.8	599.8	
#7		768.0	227.0	875.9	648.9	
#9		757.0	349.0	978.4	629.4	
#8		740.0	266.0	870.9	604.9	
#10	797.1	816.0	160.0	941.7	781.7	
#12	590.3	630.0	189.0	727.3	538.3	
#2				652.0		

Angle	Read	Angle	Vo	Line	Dist
		A+8			
6-8-Sec.		85° 44			
	171° 28	85° 44'			
	257° 14	85° 43' 40'			
28-Sec		67° 00'			
	134 -	67 00°			
	201	67° 00'			
28-Sec		66-58			

3+00
3+00
3+00
1+48

3 0 0
1 5 2
1 4 8

IMPROVED TABLES

AND

INFORMATION

TABLE IX. TANGENTS AND EXTERNALS TO A 1° CURVE

I	T	E	I=70°	I	T	E	I=80°	I	T	E	I=90°
61°	3375.0	920.2	+	71°	4086.9	1308.2	+	81°	4893.6	1805.3	+
10′	3386.3	925.9	5° C.	10′	4099.5	1315.6	5° C.	10′	4908.0	1814.7	5° C.
20′	3397.5	931.6	T	20′	4112.1	1322.9	T	20′	4922.5	1824.1	T
30′	3408.8	937.3	.25	30′	4124.8	1330.3	.30	30′	4937.0	1833.6	.36
40′	3420.1	943.1	E	40′	4137.4	1337.7	E	40′	4951.5	1843.1	E
50′	3431.4	948.9		50′	4150.1	1345.1		50′	4966.1	1852.6	
62°	3442.7	954.8	.080	72°	4162.8	1352.6	.110	82°	4980.7	1862.2	.149
10′	3454.1	960.6		10′	4175.6	1360.1		10′	4995.4	1871.8	
20′	3465.4	966.5		20′	4188.5	1367.6		20′	5010.0	1881.5	
30′	3476.8	972.4		30′	4201.2	1375.2		30′	5024.8	1891.2	
40′	3488.3	978.3		40′	4214.0	1382.8		40′	5039.5	1900.9	
50′	3499.7	984.3		50′	4226.8	1390.4		50′	5054.3	1910.7	
63°	3511.1	990.2	10° C.	73°	4239.7	1398.0	10° C.	83°	5069.2	1920.5	10° C.
10′	3522.6	996.2	T	10′	4252.6	1405.7	T	10′	5084.0	1930.4	T
20′	3534.1	1002.3	.51	20′	4265.6	1413.5	.61	20′	5099.0	1940.3	.72
30′	3545.6	1008.3	E	30′	4278.5	1421.2	E	30′	5113.9	1950.3	E
40′	3557.2	1014.4	.159	40′	4291.5	1429.0	.220	40′	5128.9	1960.2	.299
50′	3568.7	1020.5		50′	4304.6	1436.8		50′	5143.9	1970.3	
64°	3580.3	1026.6		74°	4317.6	1444.6		84°	5159.0	1980.4	
10′	3591.9	1032.8		10′	4330.7	1452.5		10′	5174.1	1990.5	
20′	3603.5	1039.0		20′	4343.8	1460.4		20′	5189.3	2000.6	
30′	3615.1	1045.2		30′	4356.9	1468.4		30′	5204.4	2010.8	
40′	3626.8	1051.4		40′	4370.1	1476.4		40′	5219.7	2021.1	
50′	3638.5	1057.7	15° C.	50′	4383.3	1484.4	15° C.	50′	5234.9	2031.4	15° C.
65°	3650.2	1063.9	T	75°	4396.5	1492.4	T	85°	5250.3	2041.7	T
10′	3661.9	1070.2	.76	10′	4409.8	1500.5	.91	10′	5265.6	2052.1	1.09
20′	3673.7	1076.6	E	20′	4423.1	1508.6	E	20′	5281.0	2062.5	E
30′	3685.4	1082.9	.240	30′	4436.4	1516.7	.332	30′	5296.4	2073.0	.450
40′	3697.2	1089.3		40′	4449.7	1524.9		40′	5311.9	2083.5	
50′	3709.0	1095.7		50′	4463.1	1533.1		50′	5327.4	2094.1	
66°	3720.9	1102.2		76°	4476.5	1541.4		86°	5343.0	2104.7	
10′	3732.7	1108.6		10′	4489.9	1549.7		10′	5358.6	2115.3	
20′	3744.6	1115.1		20′	4503.4	1558.0		20′	5374.2	2126.0	
30′	3756.5	1121.7		30′	4516.9	1566.3		30′	5389.9	2136.7	
40′	3768.5	1128.2	20° C.	40′	4530.4	1574.7	20° C.	40′	5405.6	2147.5	20° C.
50′	3780.4	1134.8	T	50′	4544.0	1583.1	T	50′	5421.4	2158.4	T
67°	3792.4	1141.4	1.02	77°	4557.6	1591.6	1.22	87°	5437.2	2169.2	1.45
10′	3804.4	1148.0	E	10′	4571.2	1600.1	E	10′	5453.1	2180.2	E
20′	3816.4	1154.7	.321	20′	4584.8	1608.6	.445	20′	5469.0	2191.1	.603
30′	3828.4	1161.3		30′	4598.5	1617.1		30′	5484.9	2202.2	
40′	3840.5	1168.1		40′	4612.2	1625.7		40′	5500.9	2213.2	
50′	3852.6	1174.8		50′	4626.0	1634.4		50′	5517.0	2224.3	
68°	3864.7	1181.6		78°	4639.8	1643.0		88°	5533.1	2235.5	
10′	3876.8	1188.4		10	4653.6	1651.7		10′	5549.2	2246.7	
20′	3889.0	1195.2	25° C.	20′	4667.4	1660.5	25° C.	20′	5565.4	2258.0	25° C
30	3901.2	1202.0	T	30′	4681.3	1669.2	T	30′	5581.6	2269.3	T
40′	3913.4	1208.9	1.28	40′	4695.2	1678.1	1.53	40′	5597.8	2280.6	1.83
50′	3925.6	1215.8	E	50′	4709.2	1686.9	E	50′	5614.2	2292.0	E
69°	3937.9	1222.7	.403	79°	4723.2	1695.8	.558	89°	5630.5	2303.5	.756
10′	3950.2	1229.7		10′	4737.2	1704.7		10′	5646.9	2315.0	
20′	3962.5	1236.7		20′	4751.2	1713.7		20′	5663.4	2326.6	
30′	3974.8	1243.7		30′	4765.3	1722.7		30′	5679.9	2338.2	
40′	3987.2	1250.8		40′	4779.4	1731.7		40′	5696.4	2349.8	
50′	3999.5	1257.9		50′	4793.6	1740.8		50′	5713.0	2361.5	
70°	4011.9	1265.0	30° C.	80°	4807.7	1749.9	30° C.	90°	5729.7	2373.3	30° C.
10′	4024.4	1272.1	T	10′	4822.0	1759.0	T	10′	5746.3	2385.1	T
20′	4036.8	1279.3	1.54	20′	4836.2	1768.2	1.84	20′	5763.1	2397.0	2.20
30′	4049.3	1286.5	E	30′	4850.5	1777.4	E	30′	5779.9	2408.9	E
40′	4061.8	1293.6	.485	40′	4864.8	1786.7	.671	40′	5796.7	2420.9	.910
50′	4074.4	1300.9		50′	4879.2	1796.0		50′	5813.6	2432.9	

T = R tan ½ I E = R exsec ½ I

TABLE IX. TANGENTS AND EXTERNALS TO A 1° CURVE

I	T	E	I=100°	I	T	E	I=110°	I	T	E	I=120°
91°	5830.5	2444.9	+	101°	6950.6	3278.1	+	111°	8336.7	4386.1	
10′	5847.5	2457.1	5° C.	10′	6971.3	3294.1	5° C.	10′	8362.7	4407.6	+
20′	5864.6	2469.3	T	20′	6992.0	3310.1	T	20′	8388.9	4429.2	5° C.
30′	5881.7	2481.5	.43	30′	7012.7	3326.1	.51	30′	8415.1	4450.9	T
40′	5898.8	2493.8	E	40′	7033.6	3342.3	E	40′	8441.5	4472.7	.62
50′	5916.0	2506.1		50′	7054.5	3358.5		50′	8468.0	4494.6	E
92°	5933.2	2518.5	.200	102°	7075.5	3374.9	.268	112°	8494.6	4516.6	.360
10′	5950.5	2531.0		10′	7096.6	3391.2		10′	8521.3	4538.8	
20′	5967.9	2543.5		20′	7117.8	3407.7		20′	8548.1	4561.1	
30′	5985.3	2556.0		30′	7139.0	3424.3		30′	8575.0	4583.4	
40′	6002.7	2568.6		40′	7160.3	3440.9		40′	8602.1	4606.0	
50′	6020.2	2581.3		50′	7181.7	3457.6		50′	8629.3	4628.6	
93°	6037.8	2594.0	10° C.	103°	7203.2	3474.4	10° C.	113°	8656.6	4651.3	10° C.
10′	6055.4	2606.8	T	10′	7224.7	3491.3	T	10′	8684.0	4674.2	T
20′	6073.1	2619.7	.86	20′	7246.3	3508.2	.103	20′	8711.5	4697.2	1.25
30′	6090.8	2632.6	E	30′	7268.0	3525.2	E	30′	8739.2	4720.3	E
40′	6108.6	2645.5	.401	40′	7289.8	3542.4	.536	40′	8767.0	4743.6	.721
50′	6126.4	2658.5		50′	7311.7	3559.6		50′	8794.9	4766.9	
94°	6144.3	2671.6		104°	7333.6	3576.8		114°	8822.9	4790.4	
10′	6162.2	2684.7		10′	7355.6	3594.2		10′	8851.0	4814.1	
20′	6180.2	2697.9		20′	7377.8	3611.7		20′	8879.3	4837.8	
30′	6198.3	2711.2		30′	7399.9	3629.2		30′	8907.7	4861.7	
40′	6216.4	2724.5		40′	7422.2	3646.8		40′	8936.3	4885.7	
50′	6234.6	2737.9	15° C.	50′	7444.6	3664.5	15° C.	50′	8965.0	4909.9	15° C.
95°	6252.8	2751.3	T	105°	7467.0	3682.3	T	115°	8993.8	4934.1	T
10′	6271.1	2764.8	1.30	10′	7489.6	3700.2	1.56	10′	9022.7	4958.6	1.93
20′	6289.4	2778.3	E	20′	7512.2	3718.2	E	20′	9051.7	4983.1	E
30′	6307.9	2792.0	.604	30′	7534.9	3736.2	.806	30′	9080.9	5007.8	1.09
40′	6326.3	2805.6		40′	7557.7	3754.4		40′	9110.3	5032.6	
50′	6344.8	2819.4		50′	7580.5	3772.6		50′	9139.8	5057.6	
96°	6363.4	2833.2		106°	7603.5	3791.0		116°	9169.4	5082.7	
10′	6382.1	2847.0		10′	7626.6	3809.4		10′	9199.1	5107.9	
20′	6400.8	2861.0		20′	7649.7	3827.9		20′	9229.0	5133.3	
30′	6419.5	2875.0		30′	7672.9	3846.5		30′	9259.0	5158.8	
40′	6438.4	2889.0	20° C.	40′	7696.3	3865.2	20° C.	40′	9289.2	5184.5	20° C.
50′	6457.3	2903.1	T	50′	7719.7	3884.0	T	50′	9319.5	5210.3	T
97°	6476.2	2917.3	1.74	107°	7743.2	3902.9	2.08	117°	9349.9	5236.2	2.52
10′	6495.2	2931.6	E	10′	7766.8	3921.9	E	10′	9380.5	5262.3	E
20′	6514.3	2945.9	.809	20′	7790.5	3940.9	1.08	20′	9411.3	5288.6	1.46
30′	6533.4	2960.3		30′	7814.3	3960.1		30′	9442.2	5315.0	
40′	6552.6	2974.7		40′	7838.1	3979.4		40′	9473.2	5341.5	
50′	6571.9	2989.2		50′	7862.1	3998.7		50′	9504.4	5368.2	
98°	6591.2	3003.8		108°	7886.2	4018.2		118°	9535.7	5395.1	
10′	6610.6	3018.4		10′	7910.4	4037.8		10′	9567.2	5422.1	
20′	6630.1	3033.1	25° C.	20′	7934.6	4057.4	25° C.	20′	9598.9	5449.2	25° C.
30′	6649.6	3047.9	T	30′	7959.0	4077.2	T	30′	9630.7	5476.5	T
40′	6669.2	3062.8	2.18	40′	7983.5	4097.1	2.61	40′	9662.6	5504.0	3.16
50′	6688.8	3077.7	E	50′	8008.0	4117.0	E	50′	9694.7	5531.7	E
99°	6708.6	3092.7	1.02	109°	8032.7	4137.1	1.36	119°	9727.0	5559.4	1.83
10′	6728.4	3107.7		10′	8057.4	4157.3		10′	9759.4	5587.4	
20′	6748.2	3122.9		20′	8082.3	4177.5		20′	9792.0	5615.5	
30′	6768.1	3138.1		30′	8107.3	4197.9		30′	9824.8	5643.8	
40′	6788.1	3153.3		40′	8132.3	4218.4		40′	9857.7	5672.3	
50′	6808.2	3168.7		50′	8157.5	4239.0		50′	9890.8	5700.9	
100°	6828.3	3184.1	30° C.	110°	8182.8	4259.7	30° C.	120°	9924.0	5729.7	30° C.
10′	6848.5	3199.6	T	10′	8208.2	4280.5	T	10′	9957.5	5758.6	T
20′	6868.8	3215.1	2.62	20′	8233.7	4301.4	3.14	20′	9991.0	5787.7	3.81
30′	6889.2	3230.8	E	30′	8259.3	4322.4	E	30′	10025.0	5817.0	E
40′	6909.6	3246.5	1.22	40′	8285.0	4343.6	1.63	40′	10059.0	5846.5	2.20
50′	6930.1	3262.3		50′	8310.8	4364.8		50′	10093.0	5876.1	

T = R tan ½ I E = R exsec ½ I

Table X.

MIDDLE ORDINATES OF RAILS

Length of Rail (feet)

C ° ′	R Feet	30 Inch	28 Inch	26 Inch	24 Inch	22 Inch	20 Inch	C °	R Feet	30 Inch	28 Inch	26 Inch	24 Inch	22 Inch	20 Inch
0–20	17189	.08	.07	.06	.05	.04	.03	8	716.8	1.88	1.64	1.42	1.20	1.01	.84
0–40	8594	.16	.14	.12	.10	.08	.07	9	637.3	2.12	1.84	1.60	1.35	1.14	.94
1–0	5730	.24	.20	.18	.15	.13	.10	10	573.7	2.36	2.05	1.78	1.50	1.27	1.04
1–20	4297	.31	.27	.23	.20	.17	.13	11	521.7	2.59	2.26	1.95	1.65	1.39	1.15
1–40	3438	.39	.34	.29	.25	.21	.17	12	478.3	3.83	2.47	2.15	1.81	1.54	1.26
2–0	2865	.47	.41	.35	.30	.25	.20	13	441.7	3.05	2.66	2.30	1.96	1.66	1.36
2–20	2456	.55	.48	.41	.35	.29	.23	14	410.3	3.30	2.87	2.48	2.10	1.78	1.46
2–40	2149	.63	.55	.47	.40	.33	.27	15	383.1	3.54	3.08	2.68	2.26	1.91	1.57
3–0	1910	.71	.62	.53	.45	.38	.31	16	359.3	3.76	3.28	2.83	2.40	2.04	1.67
3–20	1719	.78	.68	.59	.50	.42	.35	17	338.3	4.00	3.48	3.02	2.57	2.16	1.78
3–40	1563	.86	.75	.65	.55	.46	.38	18	319.6	4.21	3.67	3.18	2.70	2.28	1.87
4–0	1433	.94	.82	.71	.60	.50	.42	19	302.9	4.45	3.89	3.36	2.86	2.41	1.98
4–20	1323	1.02	.89	.77	.65	.55	.45	20	287.9	4.70	4.09	3.55	3.00	2.54	2.09
4–40	1228	1.10	.96	.83	.70	.59	.48	22	262.0	5.16	4.44	3.84	3.30	2.80	2.29
5	1146	1.18	1.03	.89	.75	.63	.52	24	240.5	5.64	4.92	4.20	3.59	3.04	2.50
6	955.3	1.41	1.23	1.06	.90	.76	.62	26	222.3	6.07	5.29	4.58	3.88	3.29	2.70
7	819.0	1.65	1.44	1.24	1.05	.89	.73								

Table XI.

SHORT RADIUS CURVES

Radius Feet	Chord Feet	Central Angle	Deflection Angle	Deflection for 1 Foot
35	10	16-26	8-13	49.3
45	10	12-46	6-23	38.3
50	15	17-16	8-38	34.5
60	15	14-22	7-11	28.8
75	15	11-30	5-45	23.0
100	20	11-30	5-45	17.3
120	20	9-34	4-47	14.3
150	20	7-39	3-49	11.5
190	25	7-32	3-46	9.15
200	25	7-10	3-35	8.6
225	25	6-25	3-12	7.7
240	25	5-58	2-59	7.2
250	25	5-44	2-52	6.9
275	25	5-12	2-36	6.2
288	50	9-58	4-59	6.0
300	50	9-32	4-46	5.7
350	50	8-12	4-06	4.9
376	50	7-40	3-50	4.6
400	50	7-10	3-35	4.3
410	50	7-00	3-30	4.2

To find length of curve divide angle from P. C. to P. T. by central angle of chord, and multiply by length of chord.

Table XII.

INCLINED DISTANCE OF 100 FT. REDUCED TO HORIZONTAL

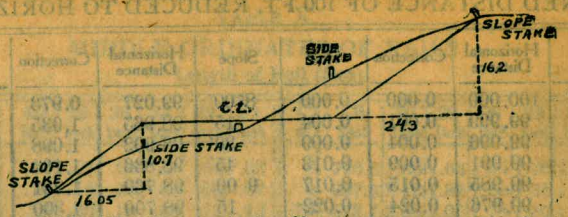
Slope	Horizontal Distance	Correction	Rise	Slope	Horizontal Distance	Correction	Rise
0°00′	100.000	0.000	0.000	8°00′	99.027	0.973	0.139
15′	99.999	0.001	0.004	15′	98.965	1.035	0.143
30′	99.996	0.004	0.009	30′	98.902	1.098	0.148
45′	99.991	0.009	0.013	45′	98.836	1.164	0.152
1 00	99.985	0.015	0.017	9 00	98.769	1.231	0.156
15	99.976	0.024	0.022	15	98.700	1.300	0.161
30	99.966	0.034	0.026	30	98.629	1.371	0.165
45	99.953	0.047	0.031	45	98.556	1.444	0.169
2 00	99.939	0.061	0.035	10 00	98.481	1.519	0.174
15	99.923	0.077	0.039	15	98.404	1.596	0.178
30	99.905	0.095	0.044	30	98.325	1.675	0.182
45	99.885	0.115	0.048	45	98.245	1.755	0.187
3 00	99.863	0.137	0.052	11 00	98.163	1.837	0.191
15	99.839	0.161	0.057	15	98.079	1.921	0.195
30	99.813	0.187	0.061	30	97.992	2.008	0.199
45	99.786	0.214	0.065	45	97.905	2.095	0.204
4 00	99.756	0.244	0.070	12 00	97.815	2.185	0.208
15	99.725	0.275	0.074	15	97.723	2.277	0.212
30	99.692	0.308	0.078	30	97.630	2.370	0.216
45	99.657	0.343	0.083	45	97.534	2.466	0.221
5 00	99.619	0.381	0.087	13 00	97.437	2.563	0.225
15	99.580	0.420	0.092	15	97.338	2.662	0.229
30	99.540	0.460	0.096	30	97.237	2.763	0.233
45	99.497	0.503	0.100	45	97.134	2.866	0.238
6 00	99.452	0.548	0.105	14 00	97.030	2.970	0.242
15	99.406	0.594	0.109	15	96.923	3.077	0.246
30	99.357	0.643	0.113	30	96.815	3.185	0.250
45	99.307	0.693	0.118	45	96.705	3.295	0.255
7 00	99.255	0.745	0.122	15 00	96.593	3.407	0.259
15	99.200	0.800	0.126	15	96.479	3.521	0.263
30	99.144	0.856	0.131	30	96.363	3.637	0.267
45	99.087	0.913	0.135	45	96.246	3.754	0.271

For each foot take one one-hundredth of each reading.

Table XIII.

MINUTES IN DECIMALS OF A DEGREE.

0 30″	.00833	10′ 30″	.17500	20′ 30″	.34167	30′ 10″	.50833	40′ 30″	.67500	50′ 10″	.84167
1 00	.01667	11 00	.18333	21 00	.35000	31 00	.51667	41 00	.68333	51 00	.85000
30	.02500	30	.19167	30	.35833	30	.52500	30	.69167	30	.85833
2 00	.03333	12 00	.20000	22 00	.36667	32 00	.53333	42 00	.70000	52 00	.86667
30	.04167	30	.20833	30	.37500	30	.54167	30	.70833	30	.87500
3 00	.05000	13 00	.21667	23 00	.38333	33 00	.55000	43 00	.71667	53 00	.88333
30	.05833	30	.22500	30	.39167	30	.55833	30	.72500	30	.89167
4 00	.06667	14 00	.23333	24 00	.40000	34 00	.56667	44 00	.73333	54 00	.90000
30	.07500	30	.24167	30	.40833	30	.57500	30	.74167	30	.90833
5 00	.08333	15 00	.25000	25 00	.41667	35 00	.58333	45 00	.75000	55 00	.91667
30	.09167	30	.25833	30	.42500	30	.59167	30	.75833	30	.92500
6 00	.10000	16 00	.26667	26 00	.43333	36 00	.60000	46 00	.76667	56 00	.93333
30	.10833	30	.27500	30	.44167	30	.60833	30	.77500	30	.94167
7 00	.11667	17 00	.28333	27 00	.45000	37 00	.61667	47 00	.78333	57 00	.95000
30	.12500	30	.29167	30	.45833	30	.62500	30	.79167	30	.95833
8 00	.13333	18 00	.30000	28 00	.46667	38 00	.63333	48 00	.80000	58 00	.96667
30	.14167	30	.30833	30	.47500	30	.64167	30	.80833	30	.97500
9 00	.15000	19 00	.31667	29 00	.48333	39 00	.65000	49 00	.81667	59 00	.98333
30	.15833	30	.32500	30	.49167	30	.65833	30	.82500	30	.99167
10 00	.16667	20 00	.33333	30 00	.50000	40 00	.66667	50 00	.83333	60 00	1.00000

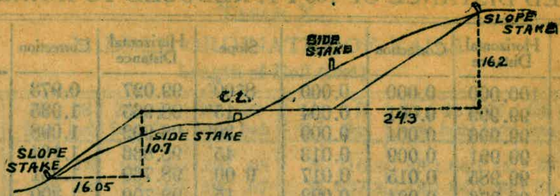


DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING.

SLOPE 1½ TO 1. ROADWAY OF ANY WIDTH.

	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	0 00	0 15	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	0
1	1.50	1 65	1 80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	1
2	3.00	3.15	3.30	3 45	3.60	3 75	3.90	4.05	4.20	4 35	2
3	4.50	4 65	4.80	4.95	5 10	5 25	5 40	5.55	5.70	5.85	3
4	6.00	6 15	6.30	6.45	6.60	6.75	6.90	7.05	7.20	7.35	4
5	7 50	7.65	7.80	7.95	8.10	8.25	8.40	8.55	8.70	8.85	5
6	9 00	9 15	9.30	9.45	9.60	9.75	9.90	10.05	10.20	10.35	6
7	10.50	10 65	10.80	10.95	11.10	11.25	11.40	11.55	11 70	11.85	7
8	12.00	12 15	12.30	12.45	12.60	12.75	12.90	13.05	13.20	13.35	8
9	13 50	13 65	13 80	13 95	14.10	14.25	14.40	14 55	14.70	14.85	9
10	15.00	15 15	15 30	15 45	15.60	15.75	15.90	16.05	16.20	16 35	10
11	16 50	16 65	16 80	16.95	17 10	17.25	17.40	17.55	17.70	17.85	11
12	18 00	18.15	18.30	18 45	18.60	18 75	18.90	19.05	19.20	19 35	12
13	19 50	19 65	19.80	19.95	20.10	20.25	20 40	20.55	20.70	20.85	13
14	21.00	21 15	21.30	21.45	21 60	21.75	21.90	22 05	22 20	22 35	14
15	22 50	22 65	22 80	22 95	23.10	23.25	23.40	23.55	23.70	23.85	15
16	24.00	24 15	24 30	24 45	24.60	24.75	24 90	25 05	25.20	25.35	16
17	25.50	25 65	25.80	25 95	26.10	26 25	26 40	26.55	26.70	26.85	17
18	27.00	27 15	27.30	27 45	27.60	27.75	27.90	28.05	28 20	28.35	18
19	28 50	28 65	28 80	28.95	29.10	29.25	29.40	29.55	29.70	29.85	19
20	30 00	30 15	30.30	30.45	30.60	30.75	30.90	31.05	31.20	31.35	20
21	31 50	31 65	31.80	31.95	32 10	32 25	32.40	32.55	32 70	32 85	21
22	33 00	33 15	33 30	33 45	33.60	33 75	33.90	34.05	34.20	34.35	22
23	34 50	34 65	34.80	34.95	35.10	35 25	35 40	35.55	35.70	35 85	23
24	36.00	36 15	36.30	36 45	36.60	36.75	36.90	37.05	37 20	37.35	24
25	37.50	37.65	37 80	37.95	38.10	38.25	38.40	38.55	38.70	38.85	25
26	39 00	39 15	39.30	39 45	39 60	39.75	39.90	40.05	40.20	40.35	26
27	40 50	40 65	40 80	40.95	41.10	41.25	41 40	41.55	41.70	41.85	27
28	42 00	42 15	42.30	42.45	42.60	42 75	42.90	43.05	43.20	43.35	28
29	43 50	43 65	43.80	43 95	44.10	44 25	44 40	44.55	44.70	44 85	29
30	45 00	45 15	45.30	45 45	45.60	45.75	45 90	46.05	46 20	46.35	30
31	46.50	46.65	46.80	46 95	47.10	47.25	47.40	47.55	47.70	47.85	31
32	48 00	48.15	48.30	48 45	48.60	48 75	48.90	49.05	49 20	49.35	32
33	49.50	49 65	49.80	49.95	50.10	50.25	50.40	50.55	50 70	50.85	33
34	51 00	51.15	51.30	51.45	51.60	51.75	51 90	52.05	52.20	52.35	34
35	52 50	52.65	52.80	52.95	53.10	53.25	53.40	53.55	53.70	53.85	35
36	54 00	54.15	54.30	54.45	54.60	54.75	54.90	55.05	55.20	55.35	36
37	55 50	55 65	55.80	55.95	56.10	56.25	56.40	56.55	56.70	56.85	37
38	57 00	57.15	57 30	57 45	57.60	57 75	57.90	58.05	58.20	58 35	38
39	58 50	58.65	58 80	58 95	59.10	59 25	59.40	59 55	59.70	59.85	39
40	60 00	60 15	60 30	60 45	60 60	60.75	60 90	61.05	61 20	61.35	40
41	61.50	61 65	61 80	61 95	62 10	62 25	62.40	62 55	62 70	62.85	41
42	63 00	63.15	63 30	63 45	63 60	63 75	63 90	64 05	64 20	64.35	42
43	64.50	64 65	64 80	64.95	65.10	65 25	65 40	65.55	65.70	65.85	43
44	66 00	66 15	66 30	66.45	66.60	66 75	66.90	67.05	67.20	67.35	44
45	67 50	67 65	67 80	67 95	68.10	68.25	68.40	68.55	68.70	68.85	45
46	69 00	69 15	69 30	69.45	69.60	69.75	69.90	70.05	70.20	70.35	46
47	70 50	70 65	70 80	70 95	71.10	71.25	71 40	71.55	71.70	71.85	47
48	72.00	72 15	72.30	72.45	72.60	72.75	72.90	73 05	73.20	73 35	48
49	73 50	73 65	73.80	73.95	74.10	74.25	74.40	74.55	74.70	74.85	49
50	75.00	75.15	75.30	75.45	75.60	75.75	75.90	76.05	76.20	76.35	50

Computed by L. Leland Locke.



DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING.

SLOPE 1½ TO 1. ROADWAY OF ANY WIDTH.

	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	
0	0 00	0 15	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.85	0
1	1.50	1 65	1 80	1.95	2.10	2.25	2.40	2.55	2.70	2.85	1
2	3.00	3.15	3.30	3 45	3.60	3 75	3.90	4.05	4.20	4 35	2
3	4.50	4 65	4.80	4.95	5 10	5 25	5 40	5.55	5.70	5.85	3
4	6.00	6 15	6.30	6.45	6.60	6.75	6.90	7.05	7.20	7.35	4
5	7 50	7.65	7.80	7.95	8.10	8.25	8.40	8.55	8.70	8.85	5
6	9 00	9 15	9.30	9.45	9.60	9.75	9.90	10.05	10.20	10.35	6
7	10.50	10 65	10.80	10.95	11.10	11.25	11.40	11.55	11 70	11.85	7
8	12.00	12 15	12.30	12.45	12.60	12.75	12.90	13.05	13.20	13.35	8
9	13 50	13 65	13 80	13 95	14.10	14.25	14.40	14 55	14.70	14.85	9
10	15.00	15 15	15 30	15 45	15.60	15.75	15.90	16.05	16.20	16 35	10
11	16 50	16 65	16 80	16.95	17 10	17.25	17.40	17.55	17.70	17.85	11
12	18 00	18.15	18.30	18 45	18.60	18 75	18.90	19.05	19.20	19.35	
13	19 50	19 65	19.80	19.95	20.10	20.25	20 40	20.55	20.70		
14	21.00	21 15	21.30	21.45	21 60	21.75	21.90	22.05			
15	22 50	22 65	22 80	22 95	23.10	23.25					
16	24.00	24 15	24 30	24 45	24.60						
17	25.50	25 65	25.80								
18	27.00	27 15									
19	28 50	28 65									
20	30 00										
21											

310 hub at grnd
B-M

100

310

Test holes

Campbell Standard Oil

N 4° W
N 16° E
4
12

0+65
3+00
3+00
24+24
4.07

(5-6)
3+00 + 5°
3+00 + 13° 15'
3+00 + 13°
1+64 - 12

3)407 30
135

N 12
54-
346-30
15-30

1+11
00
3+01
1101 8
3+43 8

3)140
46

3)150

3)212 30
70

3)270 12
90 4