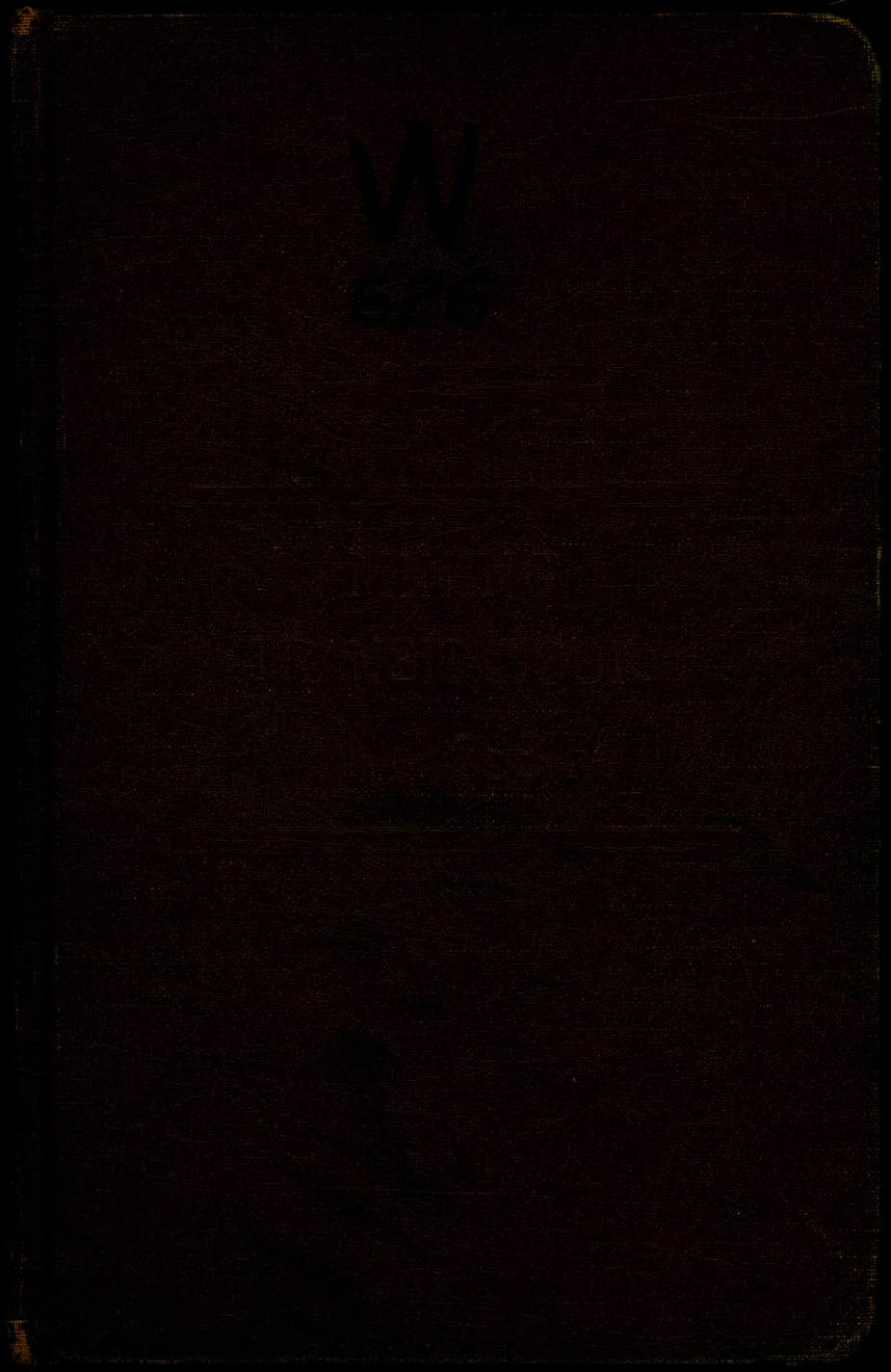
VM
526

TRAVERSE TABLE FOR TRANSIT BOOK.

From 1° to 90° for a distance of 100.

Degrees.	DEGREES.		¼ DEGREE.		½ DEGREE.		¾ DEGREE.		Degrees.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
0			100 00	0 44	100.00	0.87	99.99	1.31	89
1	99.98	1 75	99 98	2 18	99 97	2.62	99 95	3.05	88
2	99.94	3.49	99 92	3.93	99 91	4 36	99.88	4.80	87
3	99.86	5.23	99 84	5 67	99 81	6.10	99.79	6.54	86
4	99 76	6.98	99 73	7.41	99.69	7.85	99.66	8?28	85
5	99 62	8.72	99.58	9.15	99 54	9.58	99.50	10 02	84
6	99.45	10.45	99.41	10 89	99.36	11.32	99.31	11.75	83
7	99 25	12.19	99 20	12.62	99.14	13.05	99.09	13.49	82
8	99.03	13.92	98.97	14.35	98.90	14.78	98.84	15.21	81
9	98.77	15.64	98.70	16.07	98.63	16 50	98 56	16.93	80
10	98 48	17.36	98.40	17.79	98.33	18.22	98.25	18.65	79
11	98 16	19.08	98 08	19 51	97.99	19 94	97.90	20.36	78
12	97.81	20.79	97.72	21.22	97.63	21 64	97.53	22.07	77
13	97.44	22.50	97.34	22.92	97.24	23.34	97.13	23.77	76
14	97.03	24.19	96.92	24 62	96.81	25 04	96 70	25.46	75
15	96.59	25 88	96.48	26.30	96.36	26.72	96.25	27.14	74
16	96.13	27.56	96.00	27 98	95.88	28 40	95 76	28.82	73
17	95.63	29.24	95.50	29.65	95.37	30 07	95.24	30.49	72
18	95.11	30 90	94.97	31.32	94.83	31.73	94.69	32.14	71
19	94.55	32.56	94.41	32.97	94.26	33.38	94.12	33.79	70
20	93,97	34.20	93.82	34.61	93.67	35.02	93.51	35 43	69
21	93,36	35.84	93.20	36.24	93.04	36.65	92.88	37.06	68
22	92.72	37.46	92.55	37.86	92.39	38.27	92.22	38 67	67
23	92.05	39.07	91.88	39 47	91.71	39.87	91.53	40.27	66
24	91.35	40.67	91.18	41.07	91.00	41.47	90.81	41.87	65
25	90.63	42.26	90.45	42.66	90.26	43.05	90.07	43.44	64
26	89.88	43.84	89 69	44.23	89.49	44.62	89.30	45.01	63
27	89.10	45.40	88.90	45.79	88.70	46.17	88.50	46.56	62
28	88.29	46.95	88.09	47.33	87.88	47.72	87 67	48.10	61
29	87.46	48.48	87.25	48 86	87.04	49.24	86.82	49.62	60
30	86.60	50.00	86.38	50.38	86.16	50.75	85.94	51.13	59
31	85.72	51.50	85.49	51.88	85.26	52.25	85.04	52.62	58
32	84.80	52 99	84.57	53.36	84.34	53.73	84.10	54.10	57
33	83.87	54.46	83.63	54.83	83.39	55.19	83.15	55.56	56
34	82.90	55.92	82.66	56.28	82.41	56.64	82.16	57.00	55
35	81.92	57.36	81.66	57.71	81.41	58.07	81.16	58.42	54
36	80.90	58.78	80.64	59.13	80.39	59.48	80.13	59.83	53
37	79.86	60.18	79.60	60 53	79.34	60.88	79.07	61 22	52
38	78.80	61.57	78.53	61.91	78.26	62.25	77.99	62.59	51
39	77.71	62.93	77.44	63.27	77.16	63.61	76.88	63.94	50
40	76.60	64.28	76.32	64.61	76.04	64.94	75.76	65.28	49
41	75.47	65.61	75.18	65.93	74.90	66.26	74.61	66.59	48
42	74.31	66.91	74.02	67.24	73.73	67.56	73.43	67.88	47
43	73.14	68.20	72.84	68.52	72.54	68.84	72.24	69.15	46
44	71.93	69.47	71.63	69.78	71.33	70.09	71.02	70.40	45
45	70.71	70.71							
Degrees.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Degrees.
	DEGREES.		¾ DEGREE.		½ DEGREE.		¼ DEGREE.		

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MADE IN
U. S. A.

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Quality Evidenced Since 1882.

Standard Tripod Connection

LIETZ STANDARD ENGINEERS' TRANSIT
With U Shaped Standards

No. 5E with 6¼″ limb. No. 11E with 5″ limb.

Furnished with either Internal or External Focusing Telescope.

Defense Public Works
and
City of San Diego.

Please return to M.T. Shelton
% Defense Public Works
Civic Center
San Diego.

TABLE OF STADIA REDUCTIONS

For a Constant of 100.

ROD VERTICAL.

Min.	0°		1°		2°		3°	
	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff Elev.	Hor Dist.	Diff. Elev.
0'	100.00	.00	99.97	1.74	99.88	3.49	99.73	5.23
2	100.00	.06	99.97	1.80	99.87	3 55	99.72	5.28
4	100.00	.12	99.97	1.86	99.87	3.60	99.71	5.34
6	100.00	.17	99.96	1.92	99.87	3.66	99.71	5.40
8	100.00	.23	99.96	1.98	99.86	3.72	99.70	5.46
10	100.00	.29	99.96	2.04	99.86	3.78	99.69	5.52
12	100.00	35	99.96	2.09	99.85	3.84	99.69	5.57
14	100.00	.41	99.95	2.15	99.85	3.90	99.68	5.63
16	100.00	.47	99.95	2.21	99.84	3.95	99.68	5.69
18	100.00	.52	99.95	2.27	99.84	4.01	99.67	5.75
20	100.00	.58	99.95	2.33	99.83	4.07	99.66	5.80
22	100.00	.64	99.94	2.38	99.83	4.13	99.66	5.86
24	100.00	.70	99.94	2.44	99.82	4.18	99.65	5.92
26	99.99	.76	99.94	2.50	99.82	4.24	99.64	5.98
28	99.99	.81	99.93	2.56	99.81	4.30	99.63	6.04
30	99.99	.87	99.93	2.62	99.81	4.36	99.63	6.09
32	99.99	.93	99.93	2.67	99.80	4.42	99.62	6.15
34	99.99	.99	99.93	2.73	99.80	4.48	99.62	6.21
36	99.99	1.05	99.92	2.79	99.79	4.53	99.61	6.27
38	99.99	1.11	99.92	2.85	99.79	4 59	99.60	6.33
40	99.99	1.16	99.92	2.91	99.78	4.65	99.59	6.38
42	99.99	1.22	99.91	2.97	99.78	4.71	99.59	6.44
44	99.98	1.28	99.91	3.02	99.77	4.76	99.58	6.50
46	99.98	1.34	99.90	3.08	99.77	4.82	99.57	6.56
48	99.98	1.40	99.90	3.14	99.76	4.88	99.56	6.61
50	99.98	1.45	99.90	3.20	99.76	4.94	99.56	6.67
52	99.98	1.51	99.89	3.26	99.75	4.99	99.55	6.73
54	99.98	1.57	99.89	3.31	99.74	5.05	99.54	6.78
56	99.97	1.63	99.89	3.37	99.74	5:11	99.53	6.84
58	99.97	1.69	99.88	3.43	99.73	5.17	99.52	6.90
60	99.97	1.74	99.88	3.49	99.73	5.23	99.51	6.96
c= .75	.75	.01	.75	.02	.75	.03	.75	.05
c=1.15	1.15	.01	1.15	.03	1.15	.05	1.15	.07
c=1.90	1.90	.02	1.90	.05	1.90	.08	1.90	.12

Min.	4°		5°		6°		7°	
	Hor. Dist.	Diff. Elev.	Hor. Dist.	Diff. Elev.	Hor. Dist	Diff. Elev.	Hor Dist.	Diff Elev.
0'	99.51	6.96	99.24	8.68	98.91	10.40	98.51	12.10
2	99.51	7.02	99.23	8.74	98.90	10.45	98.50	12.15
4	99.50	7.07	99.22	8.80	98.88	10.51	98.48	12.21
6	99.49	7.13	99.21	8.85	98.87	10.57	98.47	12.26
8	99.48	7.19	99.20	8.91	98.96	10.62	98.46	12.32
10	99.47	7.25	99.19	8.97	98.85	10.68	98.44	12.38
12	99.46	7.30	99.18	9.03	98.83	10.74	98.43	12.43
14	99.46	7.36	99.17	9.08	98.82	10.79	98.41	12.49
16	99.45	7.42	99.16	9.14	98.81	10.85	98.40	12.55
18	99.44	7.48	99.15	9.20	98.80	10.91	98.39	12.60
20	99.43	7.53	99.14	9.25	98.78	10.96	98.37	12.66
22	99.42	7.59	99.13	9.31	98.77	11.02	98.36	12.72
24	99.41	7.65	99.11	9.37	98.76	11.08	98.34	12.77
26	99.40	7.71	99.10	9.43	98.74	11.13	98.33	12.83
28	99.39	7.76	99.09	9.48	98.73	11.19	98.31	12.88
30	99.38	7.82	99.08	9.54	98.72	11.25	98.29	12.94
32	99.38	7.88	99.07	9.60	98.71	11.30	98.28	13.00
34	99.37	7.94	99.06	9.65	98.69	11.36	98.27	13.05
36	99.36	7.99	99.05	9.71	98.68	11.42	98.25	13.11
38	99.35	8.05	99.04	9.77	98.67	11.47	98.24	13.17
40	99.34	8.11	99.03	9.83	98.65	11.53	98.22	13.23
42	99.33	8.17	99.01	9.88	98.64	11.59	98.20	13.28
44	99.32	8.22	99.00	9.94	98.63	11.64	98.19	13.33
46	99.31	8.28	98.99	10.00	98.61	11.70	98.17	13.39
48	99.30	8.34	98.98	10.05	98.60	11.76	98.16	13.45
50	99.29	8.40	98.97	10.11	98.58	11.81	98.14	13.50
52	99.28	8.45	98.96	10.17	98.57	11.87	98.13	13.56
54	99.27	8.51	98.94	10.22	98.56	11.93	98.11	13.61
56	99.26	8.57	98.93	10.28	98.54	11.98	98.10	13.67
58	99.25	8.63	98.92	10.34	98.53	12.04	98.08	13.73
60	99.24	8.68	98.91	10.40	98.51	12.10	98.06	13.78
c= .75	.75	.06	.75	.07	.75	.08	.74	.10
c=1.15	1.15	.09	1.14	.11	1.14	.13	1.14	.15
c=1.90	1.89	.15	1.89	.18	1.89	.21	1.88	.25

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INDEX:—

Page. Sorrento Line Unit No 1.

Unit #6 Harbor Drive

PAGE

Index Continued
Unit No 5, Chollas Line

Survey for 18" C.I. Pipe Line across Sorrento Slough

Station Distance Deflection

S 41½ E Mag.
(No Variation Allowed)

10+73.95 — 7°27½ R 3° Ext.

260.95

8+13.00 — 13°22½' R 4° Ext

5+71.40 — 9°28 R 3° Ext.

314.10

2+57.30 — 4°36 R 6° External

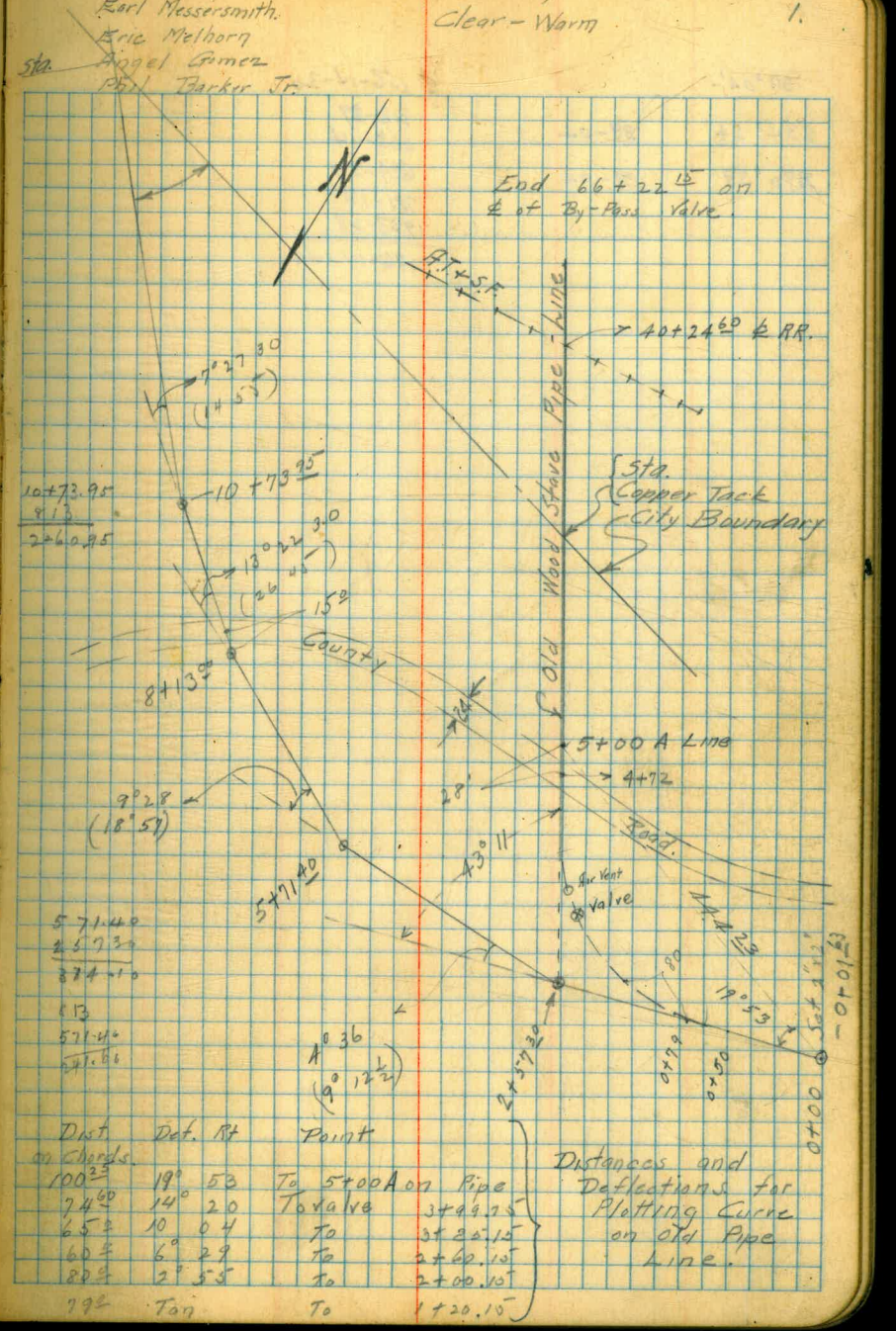
257.30

0+00

R.S. Barker, Sr.
Earl Messersmith.
Eric Melhorn
Angel Gomez
R.S. Barker Jr.

Oct. 27, 1941.
Clear – Warm

1.



5 71.40
2 57.30
314.10

8 13
5 71.40
547.66

Dist on Chords.	Def.	Rt	Point	
100.23	19°	53	To 5+00A on Pipe	3+49.75
74.60	14°	20	To Valve	3+25.15
65.2	10°	04	To	2+60.15
60.2	6°	29	To	2+00.15
80.2	2°	53	To	1+20.15
792	Tan		To	

Distances and Deflections for Plotting Curve on old Pipe Line.

39°04'-

234° 24' 39-04

390°39' 39-04

156-14-30
312-29
468-44
629-59
781-13
937-28
156-14-40

LEVELS ON 18" SORRENTO

STA.	B.S.	H.I.	F.S.	ELEV.	
				2.03	City B.M.
⊼ #1	11.22	13.25			
T.P. #1			6.40	6.85	
⊼ #2	7.78	14.63			
T.P. #2			7.00	7.63	
⊼ #3	2.40	10.03			
T.P. #3			5.55	4.48	
⊼ #4	3.01	7.49			
T.P. #4			2.69	4.80	
⊼ #5	3.04	7.84			
T.P. #5			3.59	4.25	
⊼ #6	4.80	9.05			
T.P. #6			3.04	6.01	
⊼ #7	4.16	10.17			
T.P. #7			2.16	8.01	
⊼ #8	6.75	14.76			
T.P. #8			4.67	10.09	
⊼ #9	2.82	12.91			
T.P. #9			5.25	7.66	
⊼ #10	4.86	12.52			
T.P. #10			4.39	8.13	
⊼ #11	5.27	13.40			
T.P. #11			4.04	9.36	

Proper Stationing of Sorrento P.L.

236+16 I - C.I. Pipe Begaxi = 3+00

240+55 - G.V.

240+60 MH

248+42 - B.O

289+80 - MH

291+98 - Meter

292+64 △ Rt.

301+83 - B.O.

305+38 △ Lt.

305+51 I - Ventura Meter

LEVELS ON 18" SORRENTO

STA	B.S.	H.I.	F.S.	ELEV.	
				2.03	City B.M.
⊼ #1	11.22	13.25			
T.P. #1			6.40	6.85	
⊼ #2	7.78	14.63			
T.P. #2			7.00	7.63	
⊼ #3	2.40	10.03			
T.P. #3			5.55	4.48	
⊼ #4	3.01	7.49			
T.P. #4			2.69	4.80	
⊼ #5	3.04	7.84			
T.P. #5			3.59	4.25	
⊼ #6	4.80	9.05			
T.P. #6			3.04	6.01	
⊼ #7	4.16	10.17			
T.P. #7			2.16	8.01	
⊼ #8	6.75	14.76			
T.P. #8			4.67	10.09	
⊼ #9	2.82	12.91			
T.P. #9			5.25	7.66	
⊼ #10	4.86	12.52			
T.P. #10			4.39	8.13	
⊼ #11	5.27	13.40			
T.P. #11			4.04	9.36	

⊼ Messersmith
ϕ Melhorn

PIPE LINE

Oct. 28, 1941

Brass Plug in South end R.R. bridge, South wing of south abutment. This is concrete bridge over old highway.

T.P. #2 Bolt in Southwest inbutment on R.R. Bridge on Sorrento Creek Elev 7.63

T.P. #4 Singal # 2462 on Northwest cor. of Base of Singal Elev. 4.80

T.P. #8 Singal # 2461 on Southeast cor. of Base of Singal = Elev. 10.09

T.P. #9 on top of Pile. Southeast end of R.R. Bridge Bridge # Oa 248 = Elev. 7.66

T.P. #10 on top of Pile. Southwest end of R.R. Bridge Bridge # OB 248 = Elev. 8.13

Levels on 18" Sorrento Pipe Line

Sta.	B.S.	H.I.	F.S.	Elev.
⊼ #12	4.28	13.64		
T.P. #12			2.79	10.85
⊼ #13	4.06	14.91		
T.P. #13			11.44	3.47
⊼ #14	4.25	7.72		
T.P. #14			7.15	0.57
⊼ #15	6.50	7.07		
TP #15			5.87	1.20
⊼ #16	5.93	7.13		
TP #16			5.95	1.18
⊼ #17	6.04	7.22		
T.P. #17			5.43	1.79
⊼ #18	5.25	7.04		
T.P. #18			5.43	1.61
⊼ #19	6.17	7.78		
T.P. #19			0.41	7.37
⊼ #20	3.51	10.88		
T.P. #20			7.34	3.54
⊼ #21	3.84	7.38		
T.P. #21			3.18	4.20
⊼ #22	3.73	7.93		
T.P. #22			5.39	2.54

⊼ Nessersmith
ϕ Melhorn
Oct. 28, 1941

T.P. #12 Singal # 2472 on Northwest cor. of Base. = Elev. 1085

T.P. #13 Nail in tie, Sta. 51+00 in old R.R. Rideaway
Elev. 3.47

T.P. #14 Nail in fence east of old Rideaway abt 44+00

T.P. #15 Nail in fence East of old Rideaway abt 38+00

T.P. #16 Nail in fence East of old Rideway abt 31+50

T.P. #17 Blue Top At 25+00 ℄ old Rideaway

T.P. #18 Blue Top At 16+50 ℄ old Rideaway

T.P. #19 Blue Top At 8+50 ℄ old Rideaway

T.P. #20 Nail in Tel. Pole # 652

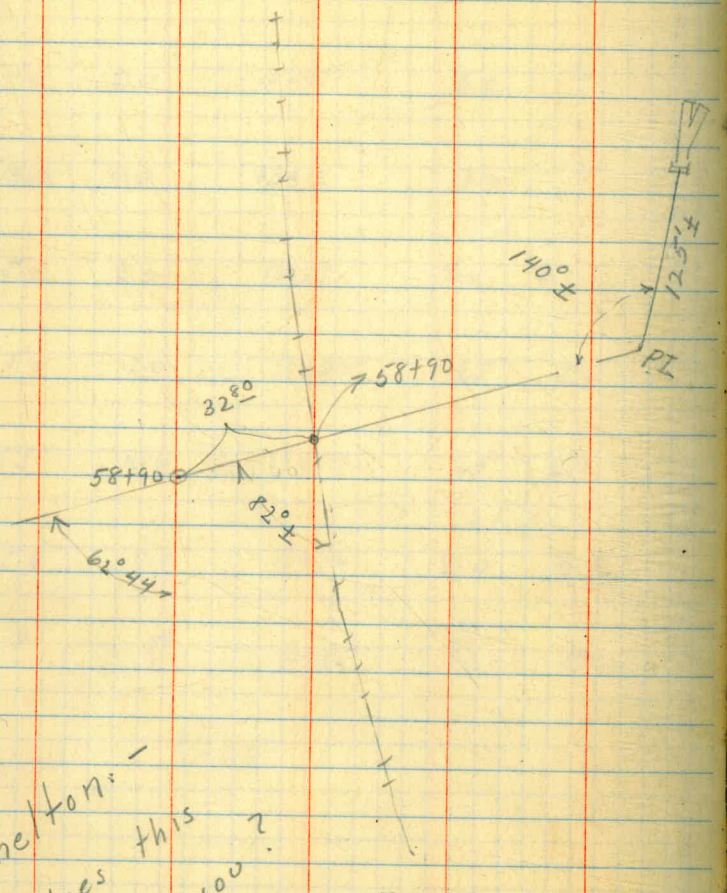
T.P. #21 Nail in Tel. Pole # 645

T.P. #22 Nail in Tel. Pole # 640

LOCATION OF PILING

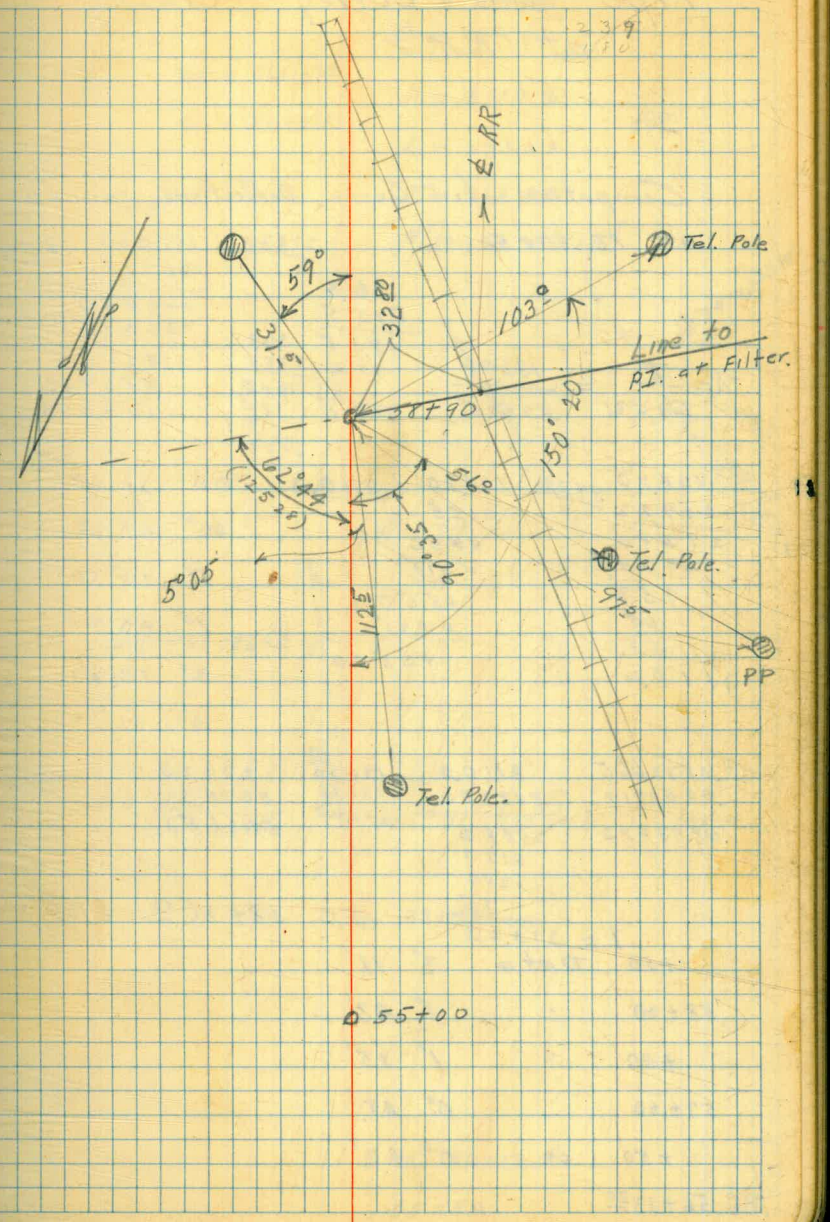
Left			Right	
?	?	12+83	?	5.5
5.0	2.0	12+97	3.0	?
5.0	2.0	13+12	3.0	?
5.0	2.0	13+27	3.0	6.0
5.0	2.0	13+42	2.5	5.5
5.5	2.0	13+57	2.0	6.0
5.0	2.0	13+72	3.0	6.0
?	?	13+85	?	5.0

Location of Tel + Power Poles at RR Xing



Shelton:

How does this look to you?



Pipe Line Survey - Crossing at R.R.

Oct 30, 1941.

P.S. Barker, Sr.

P.S. Barker, Jr.

Foster Greeley

8.

Computions for Curve Deflections for Curve at P.I. 57+50

$R = \frac{T}{\tan 2°31} = \frac{136.70}{.04395}$

136.70 | .04395 | 13170 | 3110.3 | 00 | 20.05
25722 | 13185 | 4850 | 00° | 47.68
27340 | 4850 | 4395 | 1° | 15.31
2734 | 4395 | 45500 | 1° | 42.94
957 | 45500 | 43950 | 2° | 10.57
68 | 43950 | 15500 | 2° | 31
3 | 15500
3110.2

.0872665 + .0005818 = .0878483

3110.3 × 8487780 = 24882 + 2177 + 249 + 15

136.70 + 136.70 = 273.40

273.23 + 56130 = 58+86.53

E.C. 58+86.53 = Def 2°31

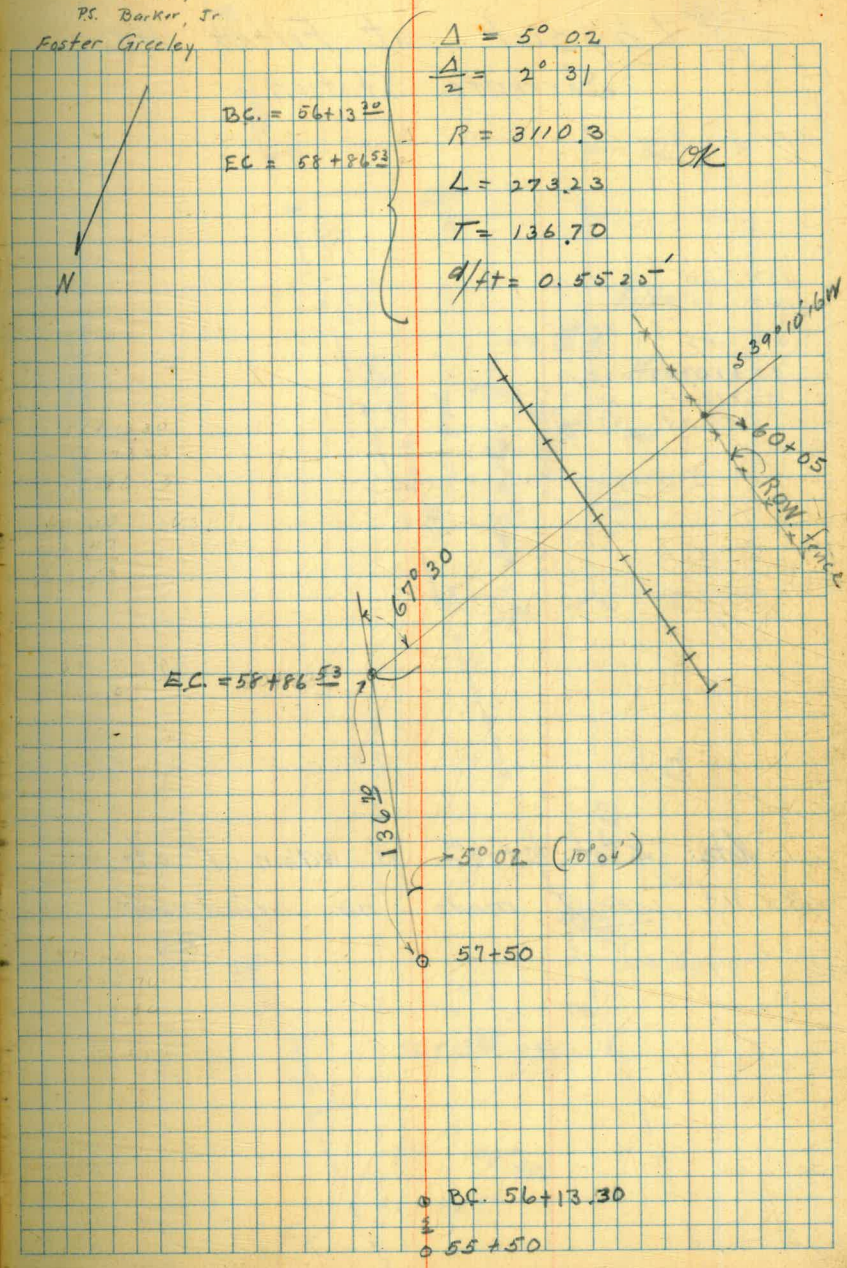
L = 273.23

+50	Def =	2° 11'
58+00	"	1° 43'
+50	"	1° 15'
57+00	"	0° 48'
+50	"	0° 20'
BC 56+13.30	"	

27323 | 151,000 | .5525
13661.5
143850
136615
723500
547646
177040

36.3 × 5525 = 181.5 + 182 + 8 = 20.05

369 × 5255 = 1845 + 185 + 8 = 20.38

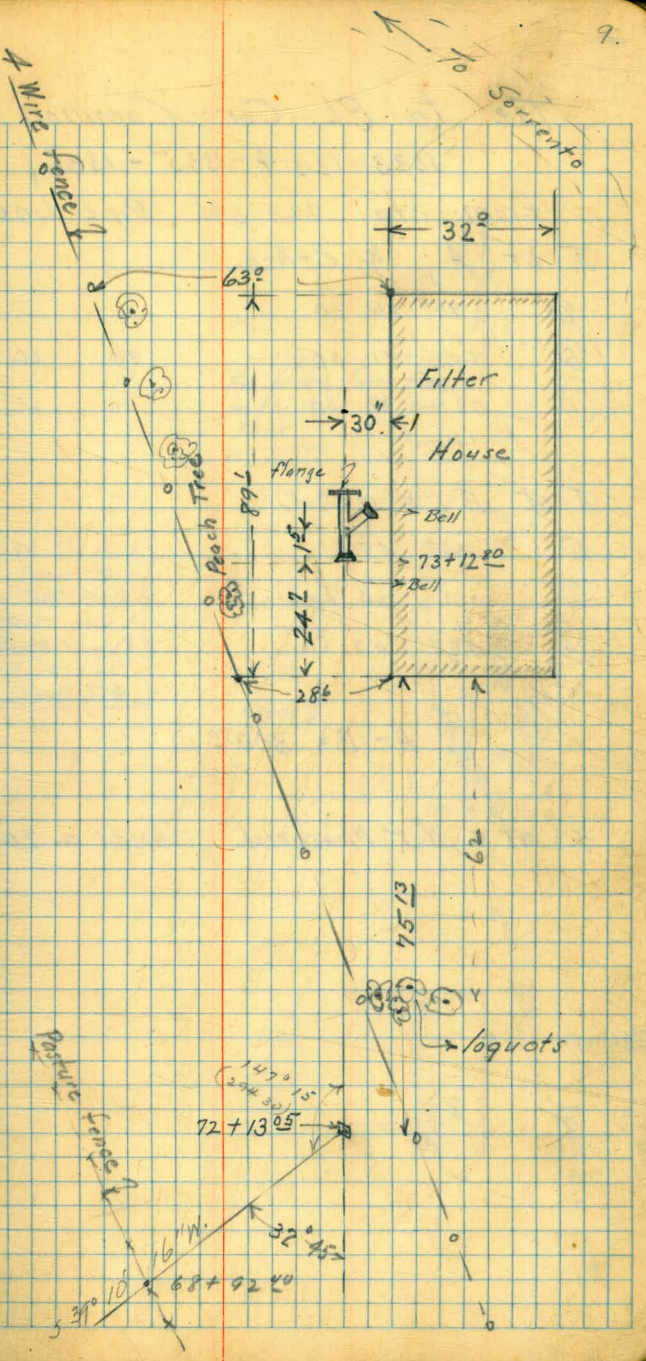


Layout at Filter Ho.
Sorrento Station

179 60 — 11 15
147 15 —
32 45 — 33 45

73+12.80 — 75.13
72+13.05 — 24.70
99.75 — 99.83

Note: ℄ at 72+13.05 is within 1° of 3 x 11 1/4° so I made no adjustment.
PS:B



Tie to PL. Cor. Common to
1333-1334-1335-1336,
from Sta. 72+13.05 Pipe Line Survey.

∡ at A; ∡ C-A-B.

①	90°	26	30			
⑥	542	41	30	90	26	55
⑩	604	29	30	90	26	57

∡ at B; ∡ A-B-C

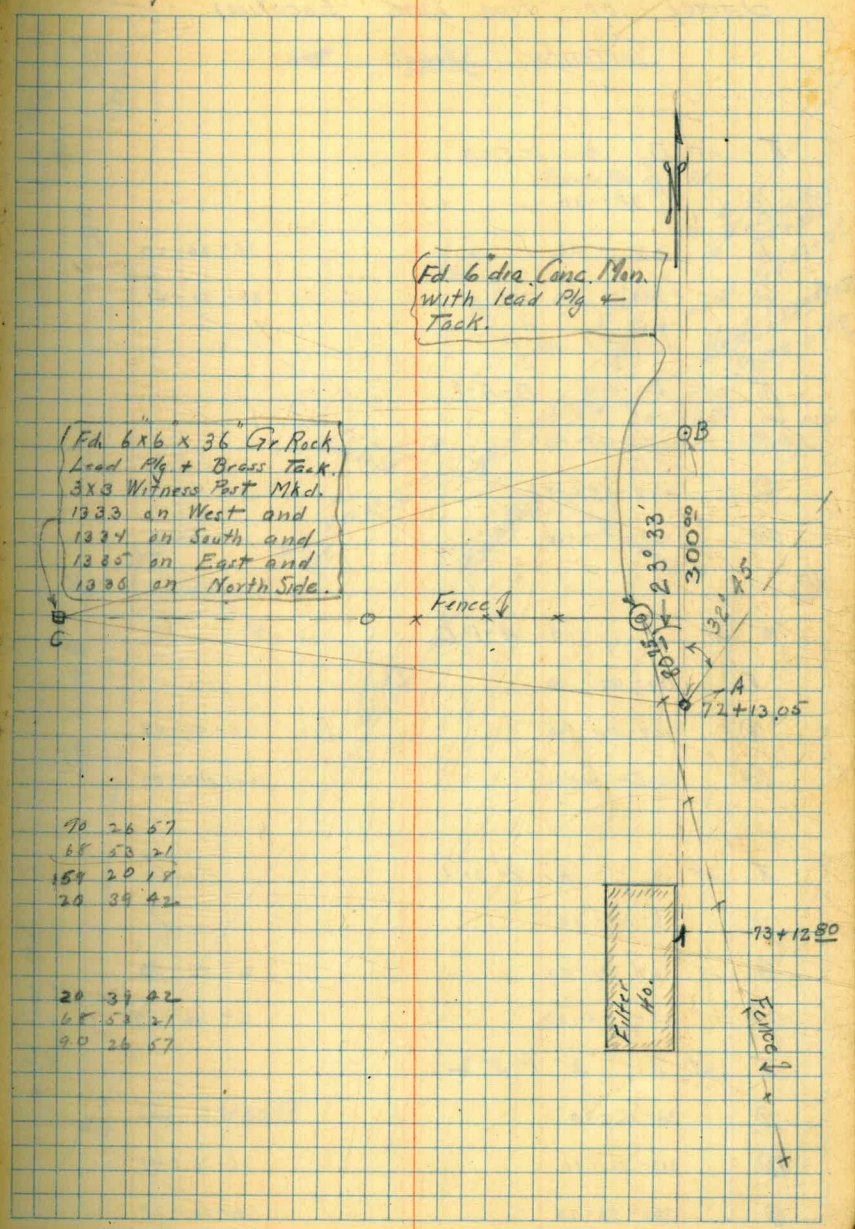
①	68°	54				
⑥	413	20	00	68	53	20
⑩	688	53	30	68	53	21

A-B = 300.00

∡ at C Not Measured. Should = 20° 39' 42"

Oct. 30th
R.S. Barker
& Party

10.



90 26 57
68 53 21
159 20 18
20 39 42

20 39 42
68 53 21
90 26 57

Survey of Pipe Line Location
Sorrento Slough.

π at D; ∠ 1-D-A

①	38-30	
⑥	231-02	38-30-20
⑩	385-08 30	38-30-21

π at A; ∠ D-A-1

①	20-48-40	
⑥	124-54-00	20-49-00
⑩	208-10-00	20-49-00

π at 1; ∠ A-1-D

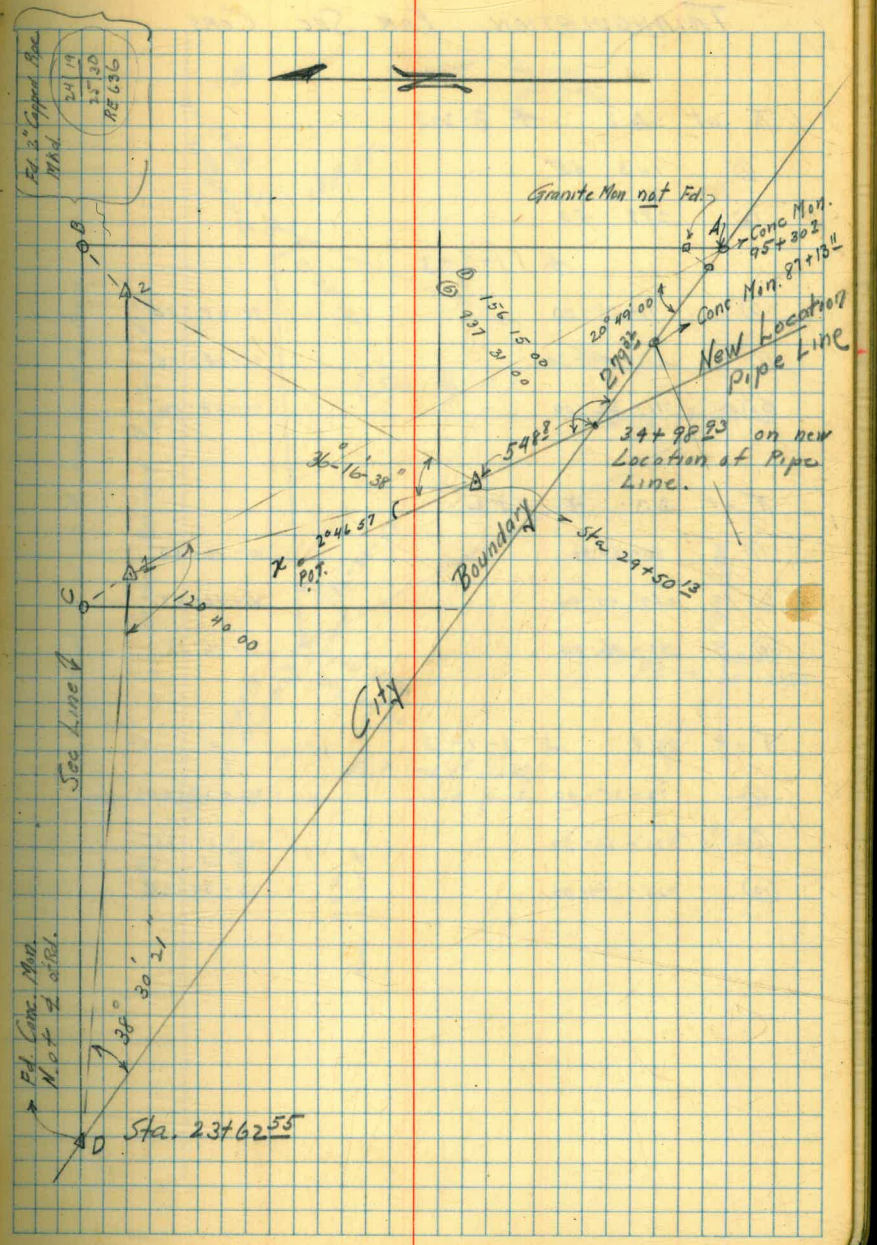
①	120-40-00	
⑥	724-00-40	120-40-07
⑩	1206-41-00	120-40-00

π at 3; ∠ x-3-1

①	2-47-00	
⑥	16-42-00	2-47-00
⑩	27-49-30	2-46-57

π at 3; ∠ 1-3-2

①	36-16-30	
⑥	212-40-40	36-16-47
⑩	362-46-20	36-16-38



Triangulation For Sec. Cors.

At Δ 2 ∠ B-2-3

①	143 55	
②	287 50	

∠ 1-2-3

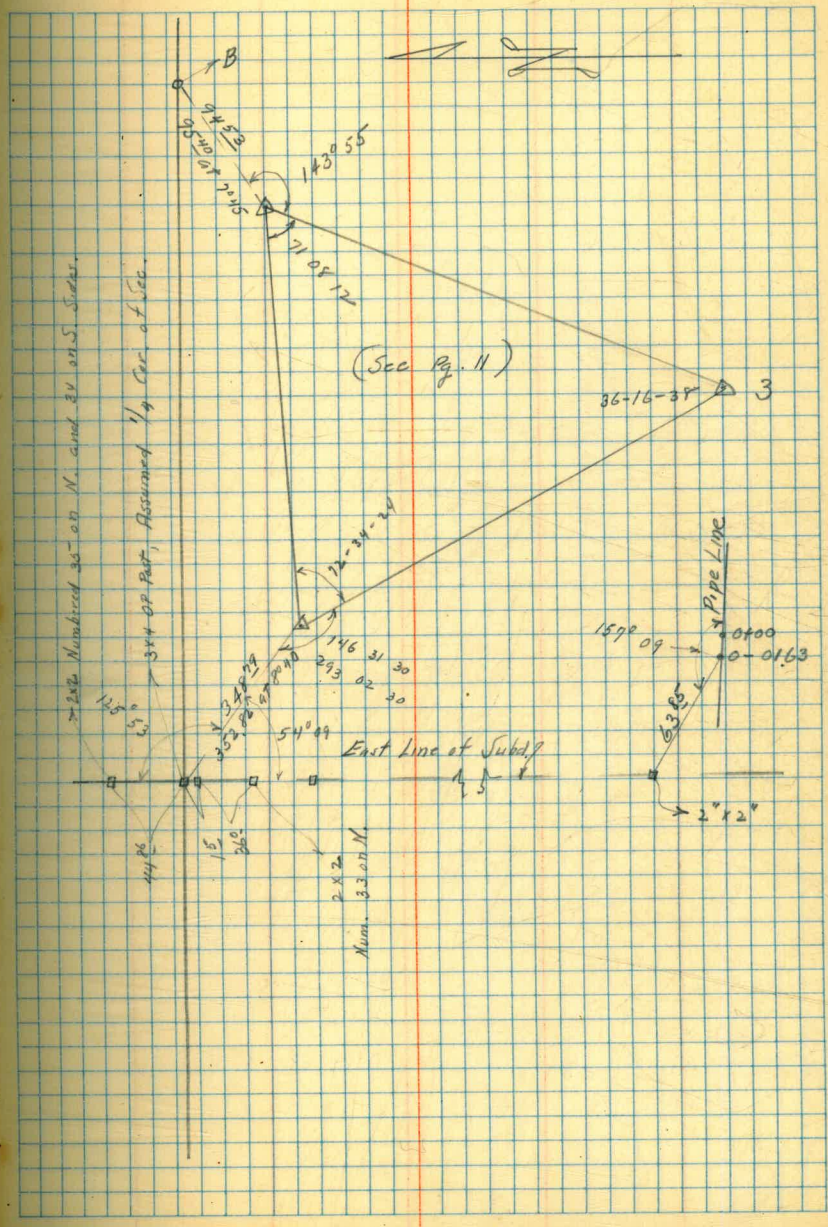
①	71-08-00	71 08-00
⑥	426-49-30	71-08-16
⑩	711-22-00	71-08-12

At Δ 3; ∠ 1-3-2

①	36-16-30	36-16-30
⑥	217-40-40	36-16-47
⑩	362-46-20	36-16-38

At Δ 1 ∠ 2-1-3

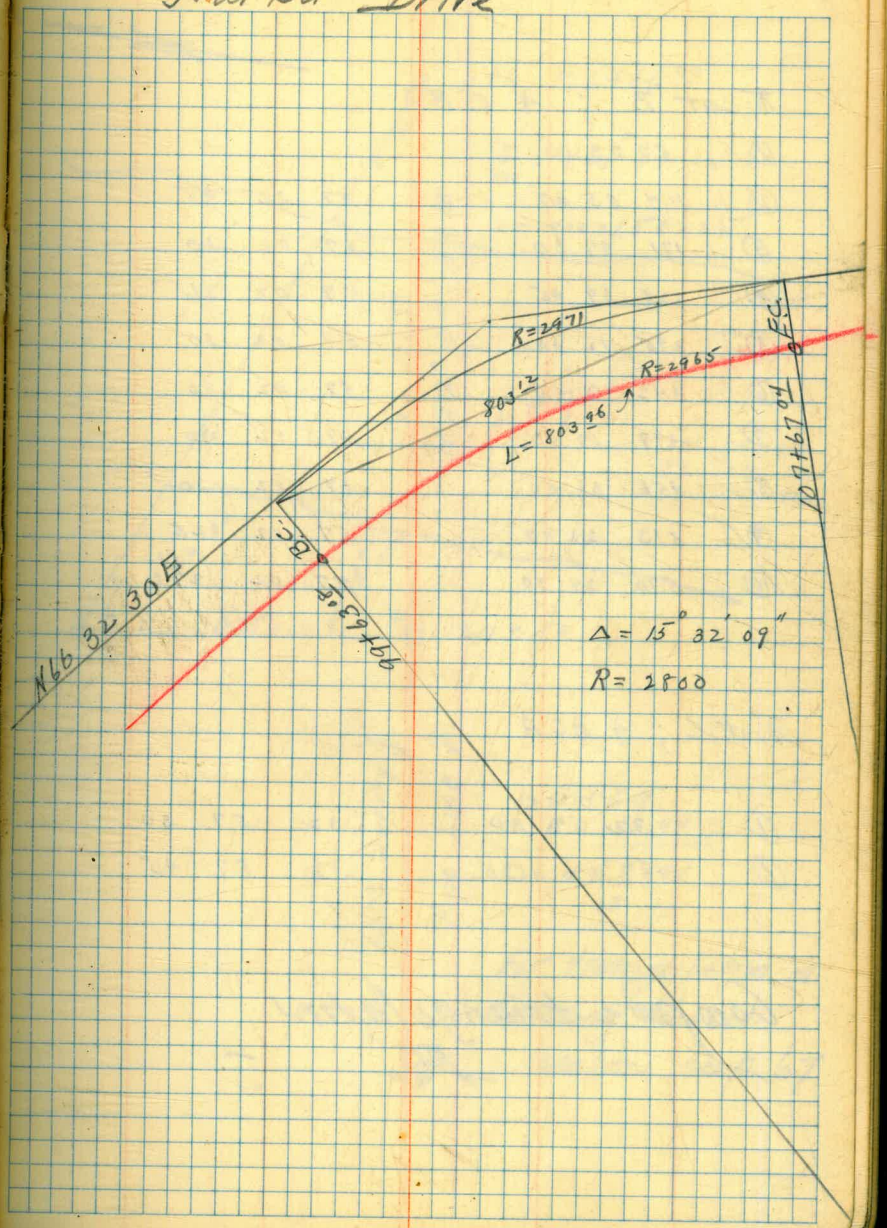
①	72-35-00	72-35-00
⑥	435-26-30	72-34-20
⑩	725-44-00	72-34-24



Unit #6.

107 + 67.04
+ 50
107 + 00
+ 50
106 + 00
+ 50
105 + 00
+ 50
104 + 00
+ 50
103 + 00
+ 50
102 + 00
+ 50
101 + 00
+ 50
100 + 00
99 + 63.05

Harbor Drive



360
193

∡ at B ; ∡ CBA

①	57° 03' 00"	
②	114 05 30	57 02 45
③	171 07 30	57 02 30
④	228 09 45	57 02 26
⑤	285 12 30	57 02 30
⑥	342 15 00	57 02 30
⑦	399 17 30	57 02 30
⑧	456 20 00	57 02 30
⑨	513 22 00	57 02 25
⑩	570 24 30	57 02 27

∡ at C ; ∡ BCA

①	32 57 30	32 57 30
⑥	197 46 30	32 57 45

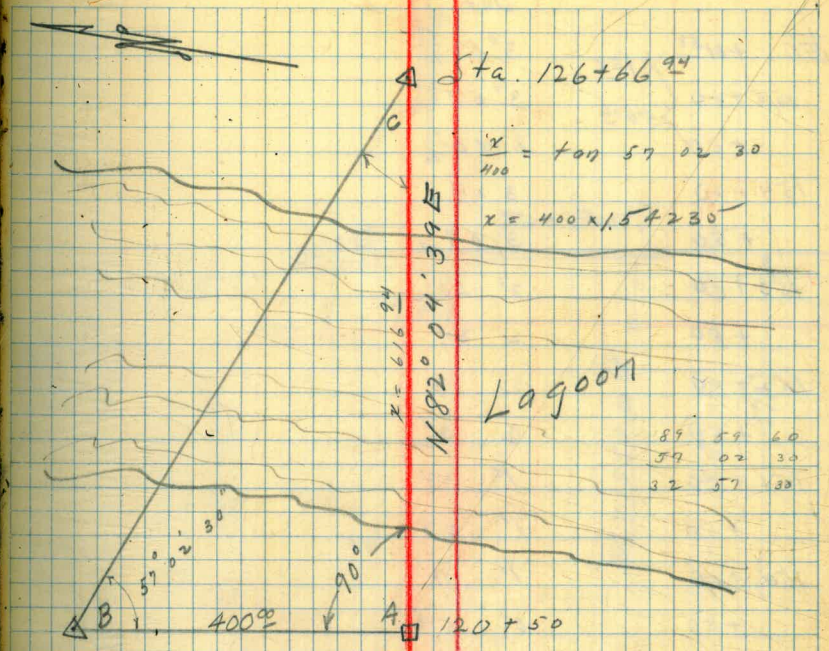
Compare triangulation

F.B —

Nov. 7, 1941

P.S. Barker & Party.

19



Pipe Line Survey

Pipe Line

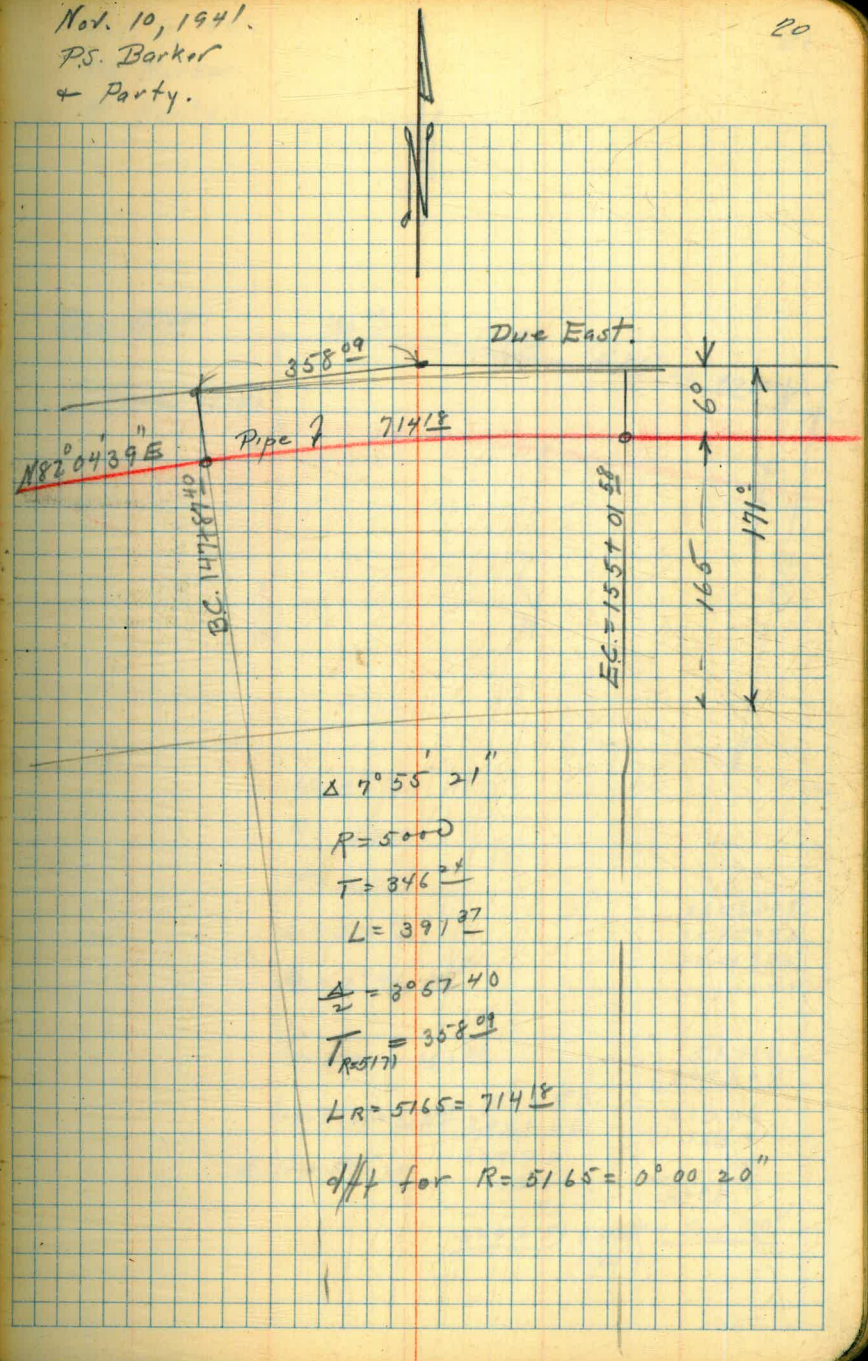
120 + 50
6 16.94
126 + 66.94
38.06

For triangulation at Crossing Revised location, see p. 67

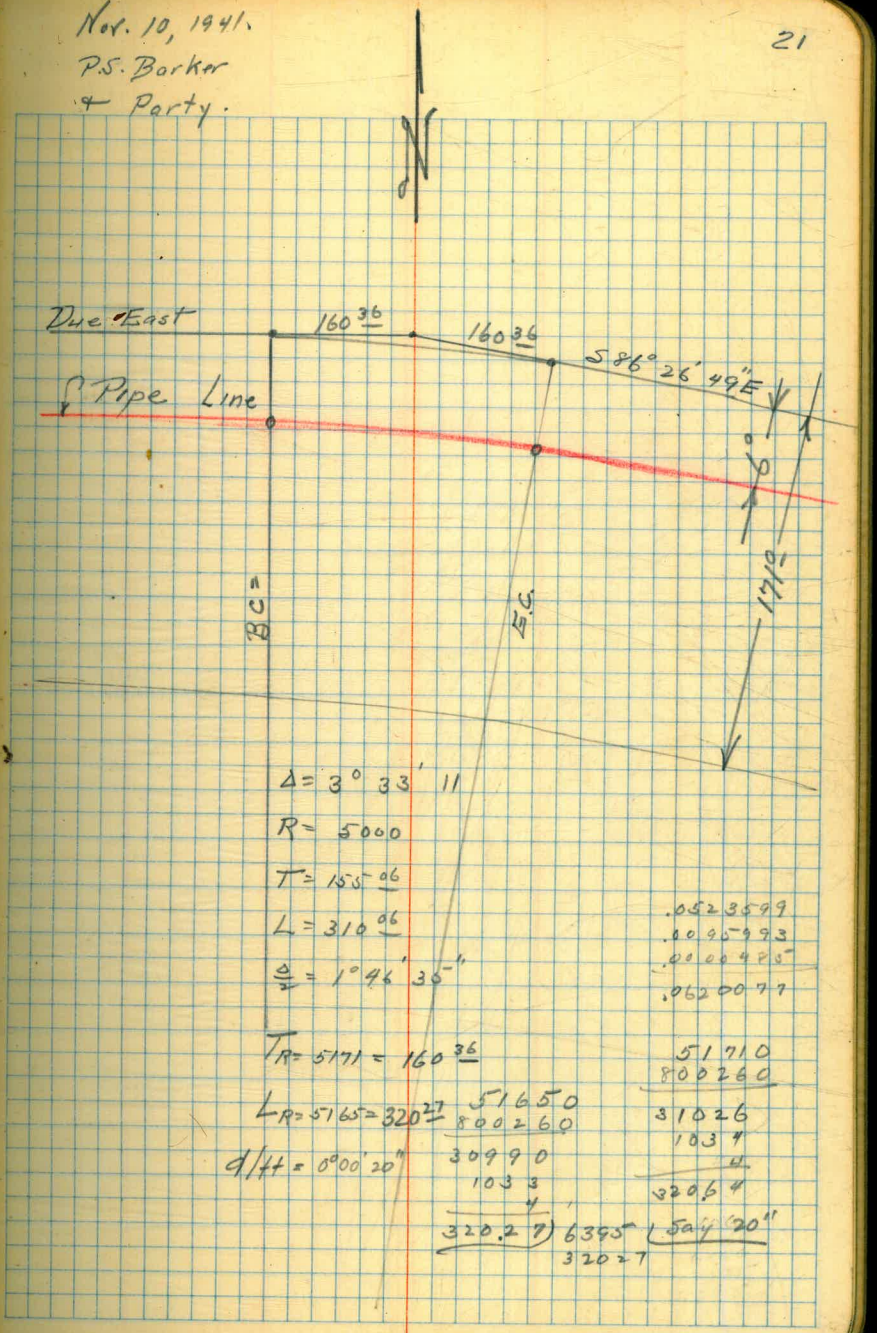
6°

Nov. 10, 1941.
P.S. Barker
+ Party.

		Def.
E.C. +01	58	3° 57½
155 +00	158	3° 57'
+50	50 06	3 40½
154 +00		3 24
+50		3 07
153 +00		2° 50½
+50		2 34
152 +00		2 17
+50		2 01½
151 +00		1° 44
+50		1° 27
150 +00		1° 11
+50		0° 54
149 +00		0° 37½
+50	50.06	0° 21
148 +00	1260	0 04
B.C. 147 +87	40	



Nov. 10, 1941.
P.S. Barker
+ Party.



(CHOLLA STATION)

RELOCATION OF 36" WATER ON OTAY LINE

STAS 800+67.7 to

Δ AT 805+50	0°44' Rt.	N 78°45' W
Δ² AT 801+91.92	1°30' Rt.	N 80° 15' W

Note. Original location was planned to be 8' N'ly (to Rt) of offset line. A relocation moves this to a further 12.5 feet, or 20.5 feet from original staked offset line.

NOV 13, 1941

P.S. BARKER & PARTY

CLOUDY - COOL

LIETZ 5839

3 J.T.O.

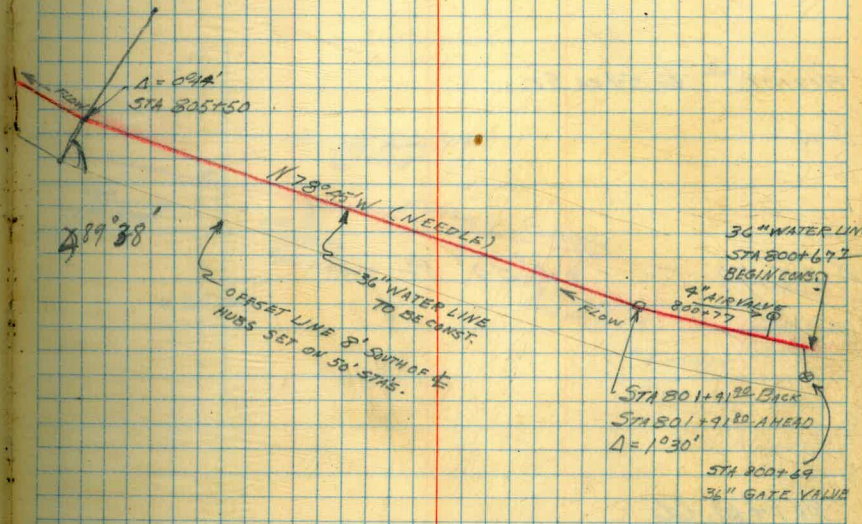
39 31 F

74 35 F

801+41.9

800 67.7

74.2



CONTINUED NEXT PAGE

See p 50 for relocation of Line 800+67 - 803+14

OTAY 36" WATER LINE
(CHOLLA STATION)

817+01.60 ℄ 54th ST.

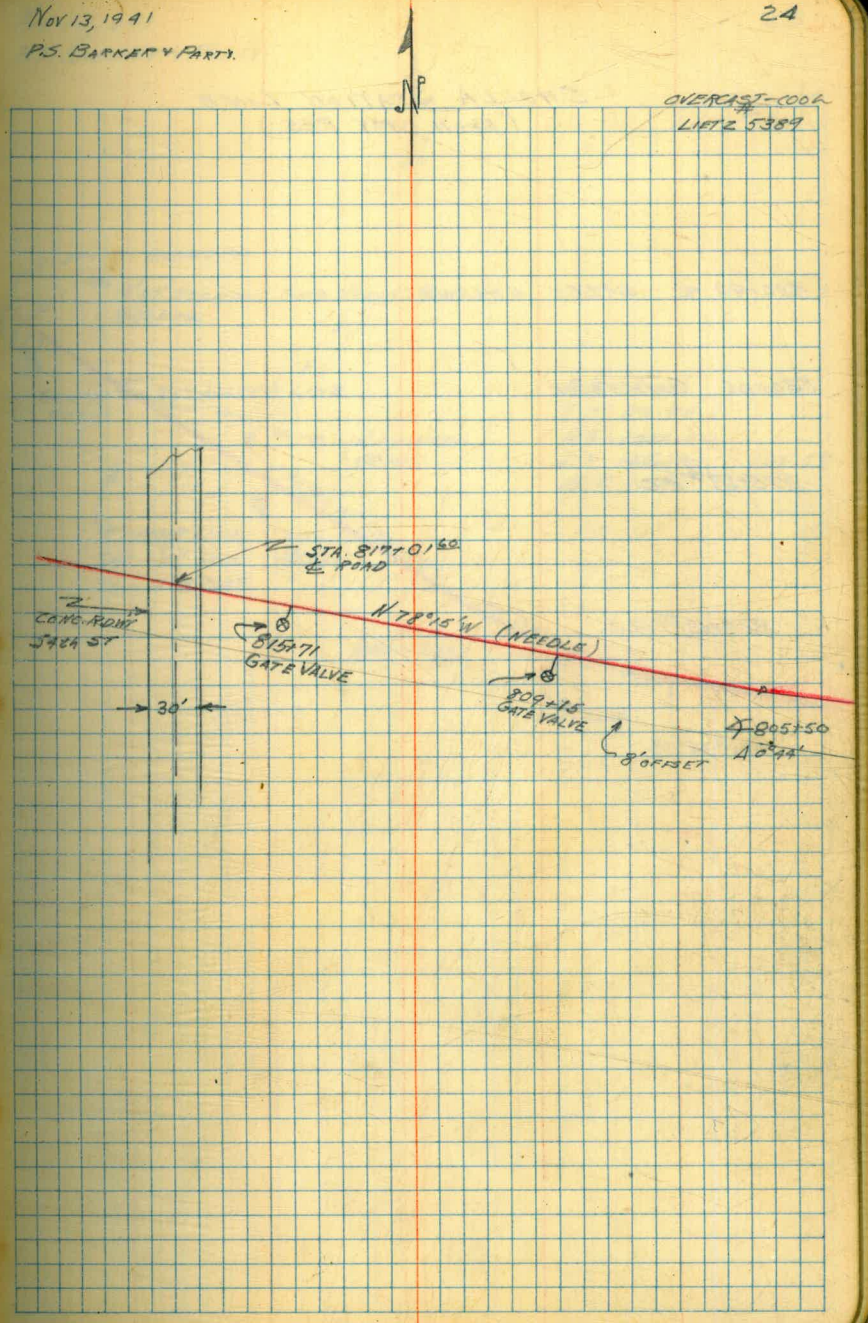
℄ 805+50 0°54' RT.

817+01.66

Nov 13, 1941
P.S. BARKER & PARTY.

24

OVERCAST - COOL
LIETZ 5389



CHOLLA STATION LINE
(FROM OTAY RES.)

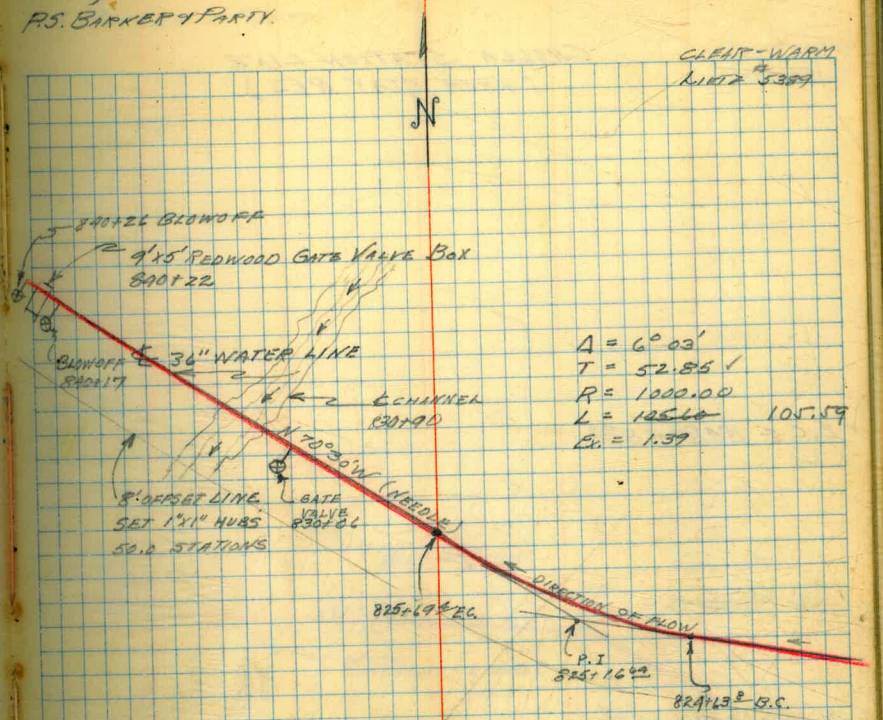
830+90 ℄ GREEN CHANNEL

830+06 GATE VALVE

825+69.4 E.C

824+63.8 B.C.

Nov 19, 1941
P.S. BARKER & PARTY.



CHOLLA STATION LINE
(FROM OTAY RES.)

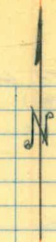
E.C = 848+48[87]

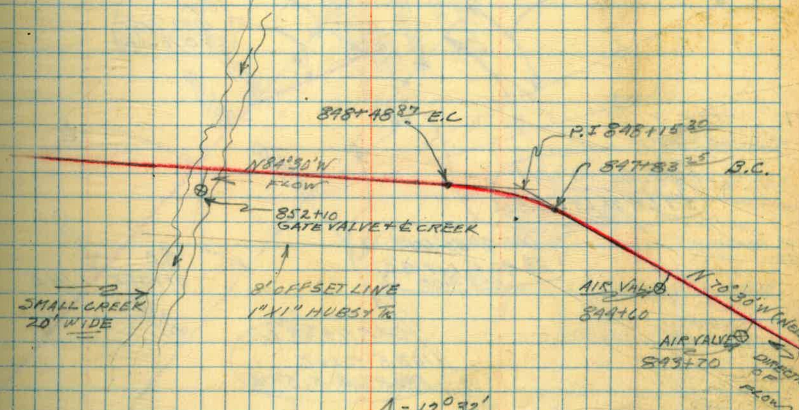
B.C = 847+83[25]

$\Delta = 12°32'$

Nov 14, 1941
P.S. BARKER + PARTY

CLEAR-WARM
LIETZ #5389



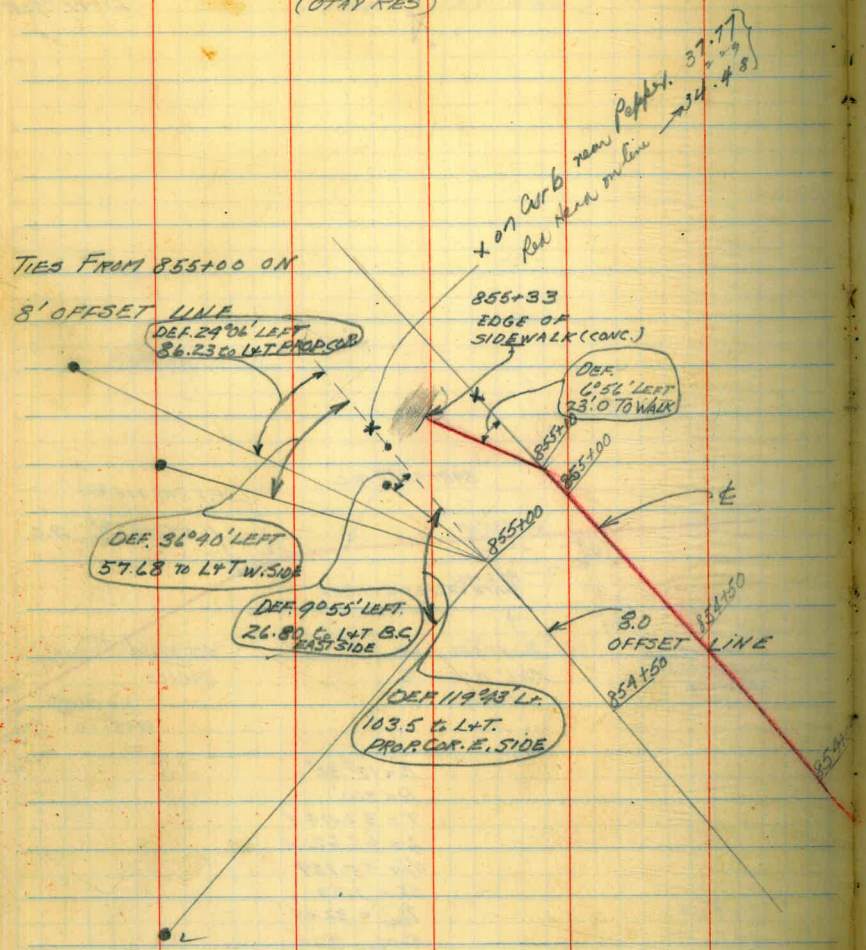


$\Delta = 12°32'$
$R = 300'$
$T = 32.94$ ✓
$L = 65.62$ ✓
$d/a = 5.729$
$Ex = 1.79$
$T_{off} = 32.05$
Rad_{off} 292'

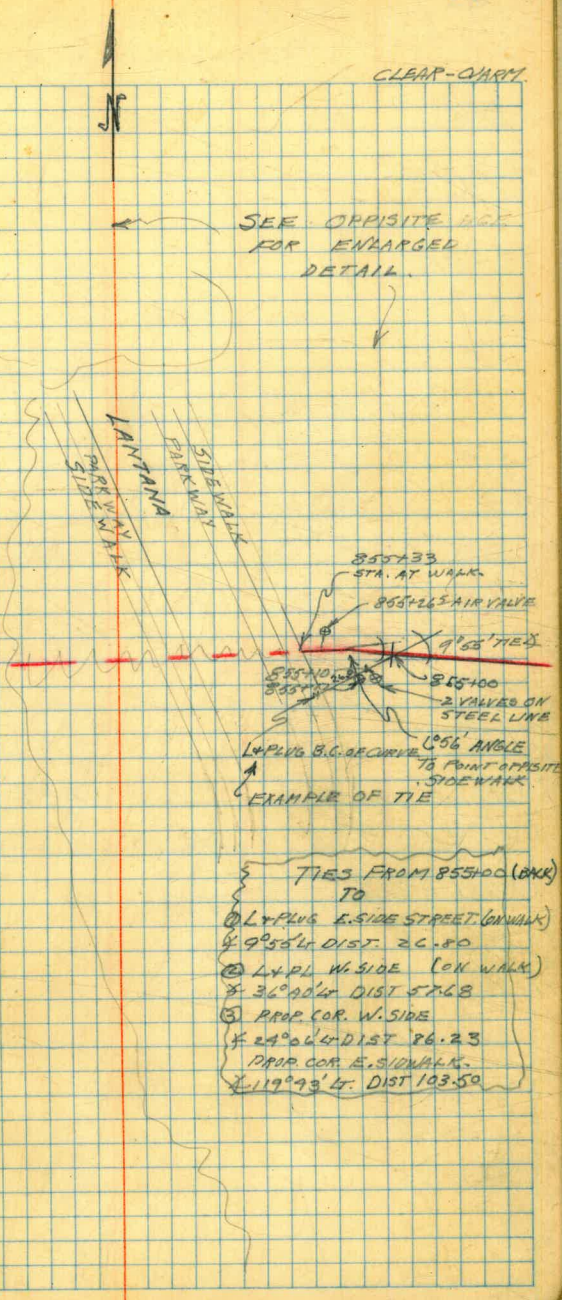
855+40
848+15
7 25

8.0 0.903090
7 25 2.860338
0° 38' 8.042752

CHOLLA STA. LINE
(OTAY RES)



CLEAR-CHART



TIES FROM 855+00 (BACK)
TO
① L+PLUG E. SIDE STREET (ON WALK)
℄ 9°55' Lt DIST. 26.80
② L+PL W. SIDE (ON WALK)
℄ 36°40' Lt DIST 57.68
③ PROP COR. W. SIDE
℄ 24°06' Lt DIST 86.23
PROP COR E. SIDEWALK.
℄ 119°43' Lt. DIST 103.50

CHOLLA STA. LINE

RELOCATION OF 36" WATER (OTAY)

STA	B.S	H.I.	F.S	ROD	ELEV.
B.M.#126					304.77
℄ #1	4.32	309.09			
T.P. #1			1.05		308.04
℄ #2	12.66	320.70			
T.P. #2			1.28		319.42
℄ #3	12.73	332.15			
T.P. #3			0.39		331.76
℄ #4	12.23	343.99			
B.M. #1			1.28		342.71
800+67.2 ℗		"		4.0	340.0
" " ℄				4.1	339.9
801+00 ℗				8.5	335.5
" " ℄				8.8	335.2
T.P. #4			12.45		331.54
℄ #5	0.65	332.19			
801+31 ℗				1.6	330.6
" " ℄				4.6	327.6
801+41.2 ℗				3.7	328.5
" " ℄				5.7	326.5
801+50 ℗				4.8	327.4
" " ℄				5.0	327.2
802+00 ℗				9.7	322.5
" " ℄				10.4	321.8

CONTIN. ON NEXT PAGE.

42.59 11.45

NOV. 13, 1941
P.S. BARKER & PARTY
CLEAR-COOL

℄ MESSERSMITH
ROD. MELHORN 29

304.77
+ 42.59
347.36
16 #5
330.91
1.28
332.19

NO. EAST COR. OF CONC. BOX STA. 800+67.2

TOP OF OLD PIPE

332.19

CHOLLA STA. LEVELS (CONT.)

STA	B.S.	H.I.	F.S.	ROD	ELEV.	
802+50 ⑧				12.8	319.4	
" " ℄				13.0	319.2	
T.P. #5			12.78		319.41	
⊼ #6	1.91	321.32				
803+00 ⑧				4.8	316.5	
" " ℄				5.2	316.1	
803+50 ⑧				5.5	315.8	
" " ℄				9.5	311.8	TOP OF PIPE
804+00 ⑧				9.4	311.9	
" " ℄				9.7	311.6	
T.P. #6			12.75		308.57	
⊼ #7	1.02	309.59				
804+50 ⑧				2.1	307.5	
" " ℄				2.4	307.2	
805+00 ⑧				8.2	301.4	
" " ℄				8.7	300.9	
T.P. #7			12.31		297.28	
⊼ #8	1.65	298.93				
805+50 ⑧				3.5	295.4	
" " ℄				6.4	292.5	
805+50				3.7	295.2	TOP OF PIPE
805+68 ⑧				6.7	292.2	TOE OF SLOPE
" " ℄				9.2	289.7	(ALONGSIDE)
" "				4.0	294.9	TOP OF PIPE

Nov 13, 1941
P.S. BARKER & PARTY
CLEAR-COOL

T. MESSERSMITH
R30 MEL HORN

30

CHOLLA LINE LEVELS (CONT)

STA.	B.S.	H.I.	F.S.	ROD	ELEV	
		298.93				
805+78 ℞				9.8	289.1	BOTTOM DITCH
" " ℄				9.0	289.9	BOTTOM DITCH
" "				4.0	294.9	TOP OF PIPE
806+00 ℞				8.6	290.3	
" " ℄				8.7	290.2	(ALONGSIDE)
" "				3.7	295.2	TOP OF PIPE
806+15 ℞				9.0	289.9	TOE SLOPE
" " ℄				6.4	292.5	
" "				3.4	295.5	TOP OF PIPE
806+50 ℞				4.2	294.7	
" " ℄				5.2	293.7	
" "				2.9	296.0	TOP OF PIPE
T.P. #8			1.70		297.23	
T #9	11.95	309.18				
807+00 ℞				11.9	297.3	
" " ℄				10.8	298.4	
807+50 ℞				7.4	301.8	
" " ℄				6.8	302.4	
808+00 ℞				2.9	306.3	
" " ℄				5.3	303.9	
808+50 ℞				2.6	306.6	
" " ℄				4.1	304.8	
" "				6.2	303.0	TOP OF PIPE

Nov 13, 1941
P.S. BARKER & PARTY
CLEAR-COOL

T MESSERSMITH
ROD. MELHORN

CHOLLA LINE LEVELS

STA	B.S	H.I.	F.S	ROD	ELEV.
		309.18			
809+50 ℄				3.4	305.8
" " ℄				5.6	304.2
T.P. #9			4.49		304.69
					304.77
T #10	2.82	(From B.M.) 307.59.			
810+00 ℄				2.5	305.1
" " ℄				2.6	305.0
810+50 ℄				2.4	305.2
" " ℄				3.1	304.5
" "				4.8	302.8 Top Pipe
811+00 ℄				2.6	305.0
" " ℄				2.4	305.2
811+50 ℄				3.7	303.9
" " ℄				3.8	303.8
812+00 ℄				4.8	302.8
" " ℄				5.2	302.4
812+50 ℄				5.5	302.1
" " ℄				5.7	301.9
812+30				7.55	300.04 Top Pipe
813+00 ℄				5.0	302.6
" " ℄				5.2	302.4
813+50 ℄				3.6	304.0
" " ℄				3.4	304.2
814+00 ℄				1.1	306.5

Nov 13, 1941
P.S. BARKER + PARTY
CLEAR-COOL

T MESSERSMITH
ROD MELHORN

B.M. # 126 GIVEN AS CITY B.M.

307.59

Sta.	B.S.	H.I.	F.S.	Rod	Elev.
814+00 ℄				1.0	306.6
T.P.# 10			1.03		306.56
⊼ # 11	11.88	318.44			
814+50 Ⓔ				7.3	311.1
" ℄				7.5	310.9
814+56				8.35	310.09 Top Pipe
815+00 Ⓔ				2.4	316.0
" " ℄				2.5	315.9
T.P.# 11			1.40		317.04
⊼ # 12	8.94	325.98			
815+50 Ⓔ				6.1	319.9
" " ℄				7.4	318.6 Top Pipe
816+00 Ⓔ				6.1	319.9
" " ℄				6.2	319.8
816+50 Ⓔ				5.8	320.2
" " ℄				6.1	319.9
817+01 Co Ⓔ				5.0	321.0 & Rod Read
" " ℄				5.1	320.9
817+50 Ⓔ				4.6	321.4
" " ℄				5.4	320.6
818+00 Ⓔ				5.9	320.1
" " ℄				5.8	320.2
B.M.# 2			2.92		323.06
		325.98			
818+50 Ⓔ				8.4	317.6

On ℄ of offset Hub at 14+00 Marked Blue

325.98

Sta.	B.S.	H.I.	F.S.	Rod	Elev.
818+50 ℄				8.6	317.4
T.P. #12			12.40		313.58
ℼ #13	1.17	314.75			
819+00 Ⓔ				2.2	312.6
" " ℄				1.5	313.3
" "				3.3	311.5 Top Pipe
819+50 Ⓔ				8.4	306.4
" " ℄				8.4	306.4
T.P. #13			12.75		302.00
ℼ #14	0.73	302.73			
820+00 Ⓔ				3.6	299.1
" " ℄				3.2	299.5
820+15				5.8	296.9 Top Pipe
820+50 Ⓔ				9.6	293.1
" " ℄				10.2	292.5
T.P. #14			11.99		290.74
ℼ #15	0.28	291.02			
821+00 Ⓔ				3.4	287.6
" " ℄				3.1	287.9
821+50 Ⓔ				6.8	284.2
" " ℄				6.2	284.8
822+00 Ⓔ				10.2	280.8
" " ℄				9.7	281.3
822+50 Ⓔ				12.4	278.6
" " ℄				11.8	279.2

291.02

Sta.	B.S.	H.I.	F.S.	Rod	Elev.
J.P. #15			11.20		279.82
BM #16	2.01	281.83			
823+00 ℄				4.8	277.0
" " ℄				3.7	278.1
823+50 ℄				5.9	275.9
" " ℄				5.5	276.3
824+00 ℄				6.4	276.4
" " ℄				5.8	276.0
824+35				7.9	273.9 Top Pipe
824+50 ℄				6.2	275.6
" " ℄				6.1	275.7
B.C. 824+63.30 ℄				6.1	275.7
" " ℄				5.9	275.9
825+00 ℄				5.4	276.4
" " ℄				5.1	276.7
825+16.44 ℄				5.2	276.6
" " ℄				5.5	276.3
825+50 ℄				5.4	276.4
" " ℄				5.3	276.5
E.C. 825+69.40 ℄				4.9	276.9
" " ℄				4.8	277.0 Top Pipe
826+00 ℄				5.2	276.6
" " ℄				4.4	277.4 Top Pipe
B.M. #127			2.50		279.33
B.M. #3			3.59		278.24

15 May 1942

Details of B.M.s from Otay Res 2'-0" Main Pipe Line WD 197 File No - 2230-D Sheet 3½

279.32 = Top of NW. at Sta 826+22

281.83

Sta.	B.S.	H.I.	F.S.	Rod	Elev.
826+50 ℄				6.8	275.0
" " ℄				6.0	275.8
T.P. #16			8.54		273.29
π #17	0.51	273.80			
827+00 ℄				4.6	269.2
" " ℄				4.8	269.0
827+50 ℄				13.2	260.6
" " ℄				13.2	260.6
T.P. #17			12.59		261.21
π #18	0.30	261.51			
827+57				2.5	259.0 Top Pipe
828+00 ℄				10.1	251.4
" " ℄				10.4	251.1
T.P. #18			12.04		249.47
π #19	0.72	250.19			
828+50 ℄				7.2	243.0
" " ℄				10.5	239.7 Top Pipe
T.P. #19			12.48		237.71
π #20	0.86	238.57			
829+00 ℄				12.4	226.2 Toe Slope
" " ℄				12.1	226.5
T.P. #20			12.44		226.13
π #21	1.55	227.68			
829+50 ℄				6.9	220.8
" " ℄				7.2	220.5

227.68

Sta.	B.S.	H.I.	F.S.	Rod	Elev.
830+00 ℄				9.5	218.2
" " ℄				10.2	217.5
830+50 ℄				9.9	217.8 Creek Bank
" " ℄				11.0	216.7 Creek Bank
T.P. # 21			9.85		217.83
℔ # 22	5.90	223.73			
830+70 ℄				8.9	214.8 Water Edge
" " ℄				8.2	215.5 Top Pipe
831+00 ℄				8.9	214.8 Top Steel Pipe
" " ℄				8.8	214.9 Top Pipe
831+10 ℄				8.9	214.8 Water Edge
" " ℄				8.6	215.1 Top Pipe
831+15 ℄				5.7	218.0 Creek Bank
831+50 ℄				5.0	218.7
" " ℄				5.4	218.3
832+00 ℄				5.9	217.8
" " ℄				5.7	218.0
832+50 ℄				4.4	219.3
" " ℄				6.9	216.8 Top Pipe
833+00 ℄				5.4	218.3
" " ℄				5.8	217.9
833+50 ℄				3.6	220.1
" " ℄				4.0	219.7
T.P. #22			3.61		220.12
℔ #23	12.56	232.68			

232.68

Sta.	B.S.	H.I.	F.S.	Rod	Elev.
834+00 ℄				9.0	223.7
" " ℄				9.2	223.5
834+50 ℄				4.8	227.9
" " ℄				5.6	227.1
835+00 ℄				0.9	231.8
" " ℄				1.3	231.4
T.P. # 23			0.89		231.79
℄ # 24	12.64	244.43			
835+50 ℄				6.5	237.9
" " ℄				5.9	238.5
T.P. # 24			0.27		244.16
℄ # 25	11.73	255.89			
836+00 ℄				5.9	250.0 Type Steel Pipe
" " ℄				6.3	249.6
T.P. # 25			0.25		255.64
℄ # 26	12.10	267.74			
T.P. # 26			0.24		267.50
℄ # 27	12.03	279.53			
836+50 ℄				10.0	269.5
" ℄				9.9	269.6 Wood Pipe Line
T.P. # 27			0.14		279.39
℄ # 28	12.89	292.28			
837+00 ℄				7.0	285.3
" " ℄				6.6	285.7

279.5
9.9
269.6

292.28

Sta.	B.S.	H.I.	F.S.	Rod	Elev.
T.P. #28			0.36		291.92
⊼ #29	11.84	303.76			
837+50 ℞				10.6	293.2
" " ℄				10.8	293.0
838+00 ℞				6.0	297.8
" " ℄				6.1	297.7
838+50 ℞				1.2	302.6
" " ℄				0.4	303.4
T.P. #29			1.24		302.52
⊼ #30	12.51	315.03			
839+00 ℞				5.2	309.8
" " ℄				4.2	310.8
T.P. #30			0.89		314.14
⊼ #31	10.20	324.34			
839+50 ℞				8.7	315.6
" " ℄				8.5	315.8
840+00 ℞				5.9	318.4
" " ℄				5.4	318.9
B.M. #128					319.77
Deff.			4.50		319.84
B.M. #4			3.42		320.92
		324.34			
840+50 ℞				5.7	318.6
" " ℄				4.7	319.6
841+00 ℞				8.1	316.2

Top of Air Valve 840+16

This Air Valve has evidently been moved to Sta 840+03± and the El. Changed. (J.R. Hale 5-16-42)

324.34

Sta.	B.S.	H.I.	F.S.	Rod	Elev.
841+00 ℄				7.6	316.7
841+10				9.7	314.6 Wood Pipe Line
841+50 Ⓔ				8.4	315.9
" " ℄				11.5	312.8
842+00 Ⓔ				10.0	314.3
" " ℄				12.8	311.5 Wood Pipe Line
T.P. #31			9.97		314.37
T #32	4.59	318.96			
842+50 Ⓔ				5.9	313.1
" " ℄				7.8	311.2 Wood Pipe Line
843+00 Ⓔ				5.1	313.8
" " ℄				6.8	312.2 Wood Pipe Line
843+50 Ⓔ				4.2	314.8
" " ℄				6.2	312.8 Wood Pipe Line
B.M. #129					314.73
Diff			4.08		314.88
		318.96			
844+00 Ⓔ				4.6	314.4
" " ℄				6.0	313.0 W. P. L.
844+50 Ⓔ				3.9	315.1
" " ℄				6.0	313.0 W. P. L.
845+00 Ⓔ				5.1	313.9
" " ℄				7.3	311.7 W. P. L.
845+50 Ⓔ				5.5	313.5
" " ℄				8.7	310.3 W. P. L.

Top of Air Valve Ch. Sta. 843+68

318.96

Sta.	B.S.	H.I.	F.S.	Rod	Elev.
B.M.#5			4.52		314.44
846+00 ℄		318.96		8.3	310.7
" " ℄				11.8	307.2 W.P.L.
T.P. #32			12.95		306.01
⊼ #33	0.97	306.98			
846+50 ℄				1.6	305.4
" " ℄				5.2	301.8 W.P.L.
T.P. #33					294.00
⊼ #34	2.29	296.29			
847+00 ℄				0.7	295.6
" " ℄				5.3	291.0 W.P.L.
847+50 ℄				7.9	288.4
" " ℄				8.7	287.6 W.P.L.
B.C. 847+85.23 ℄				7.2	289.1
" " ℄				8.5	287.8 W.P.L.
848+00 ℄				6.9	289.4
" " ℄				8.3	288.0 W.P.L.
E.C. 848+48.87 ℄				9.1	287.2
" " ℄				9.3	287.0 W.P.L.
T.P. #34			12.55		283.74
⊼ #35	0.27	284.01			
849+00 ℄				3.6	280.4
" " ℄				4.0	280.0 W.P.L.
T.P. #35			12.95		271.06
⊼ #36	0.15	271.21			

271.21

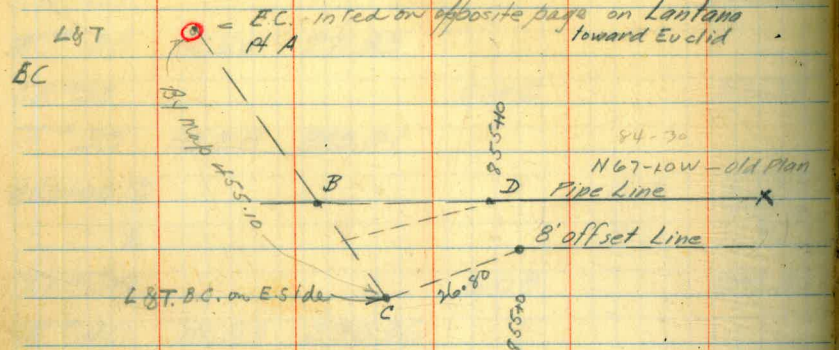
Sta.	B.S.	H.I.	F.S.	Bod	Elev.
849+50 ℄				5.5	265.7
" " ℄				7.9	263.3
T.P.#36			11.62.		259.59
T.P.#37	0.90	260.49			
850+00 ℄				7.3	253.2
" " ℄				8.0	252.5
850+50 ℄				10.3	250.2
" " ℄				10.7	249.8
851+00 ℄				11.0	249.5
" " ℄				11.5	249.0
851+50 ℄				11.5	249.0
" " ℄				12.0	248.5
851+94 ℄				12.0	248.5 Edge Bank
" " ℄				11.6	248.9
852+00 ℄				14.4	246.1
" " ℄				13.3	247.2 W.P.L.
852+10 ℄				15.8	244.7 Bottom Creek
" " ℄				12.8	247.7 W.P.L.
852+15 ℄				14.3	246.2
" " ℄				12.5	248.0 W.P.L.
852+20 ℄				11.9	248.6 Edge Bank
" " ℄				12.1	248.4
852+50 ℄				1.2	259.3
" " ℄				4.6	255.9 W.P.L.

260.49

Sta.	B.S.	H.I.	F.S.	Rod	Elev.
T.P.#37					259.35
⊼ #38	12.60	271.95			
T.P.#38			0.42		271.53
⊼ #39	12.38	283.91			
853+00 Ⓡ				6.4	277.5
" " ℄				6.1	277.8 W.P.L.
T.P.#39			0.08		283.83
⊼ #40	12.53	296.36			
T.P.#40			0.83		295.53
⊼ #41	12.80	308.33			
853+50 Ⓡ				10.0	298.3
" " ℄				9.0	299.3 W.P.L.
T.P.#41			0.46		307.87
⊼ #42	11.99	319.86			
854+00 Ⓡ				2.5	317.4
" " ℄				3.2	316.7
T.P.#42			0.32		319.54
⊼ #43	12.68	332.22			
854+50 Ⓡ				4.1	328.1
" " ℄				6.4	325.8 W.P.L.
T.P.#43			0.17		332.05
⊼ #44	9.89	341.94			
855+00 Ⓡ				4.8	337.1
" " ℄				10.3	331.6 W.P.L.
B.M.#6			1.67		340.27

Level Notes checked - 800+67 to here - 11-19-41 - C.V.G.

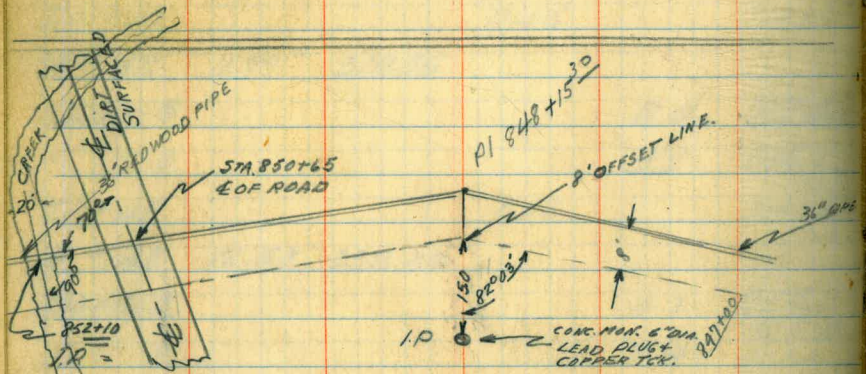
Field Ties needed



Produce back tangent from 855+10 to intersection two L&T on N.E. Side LANTANA ST.

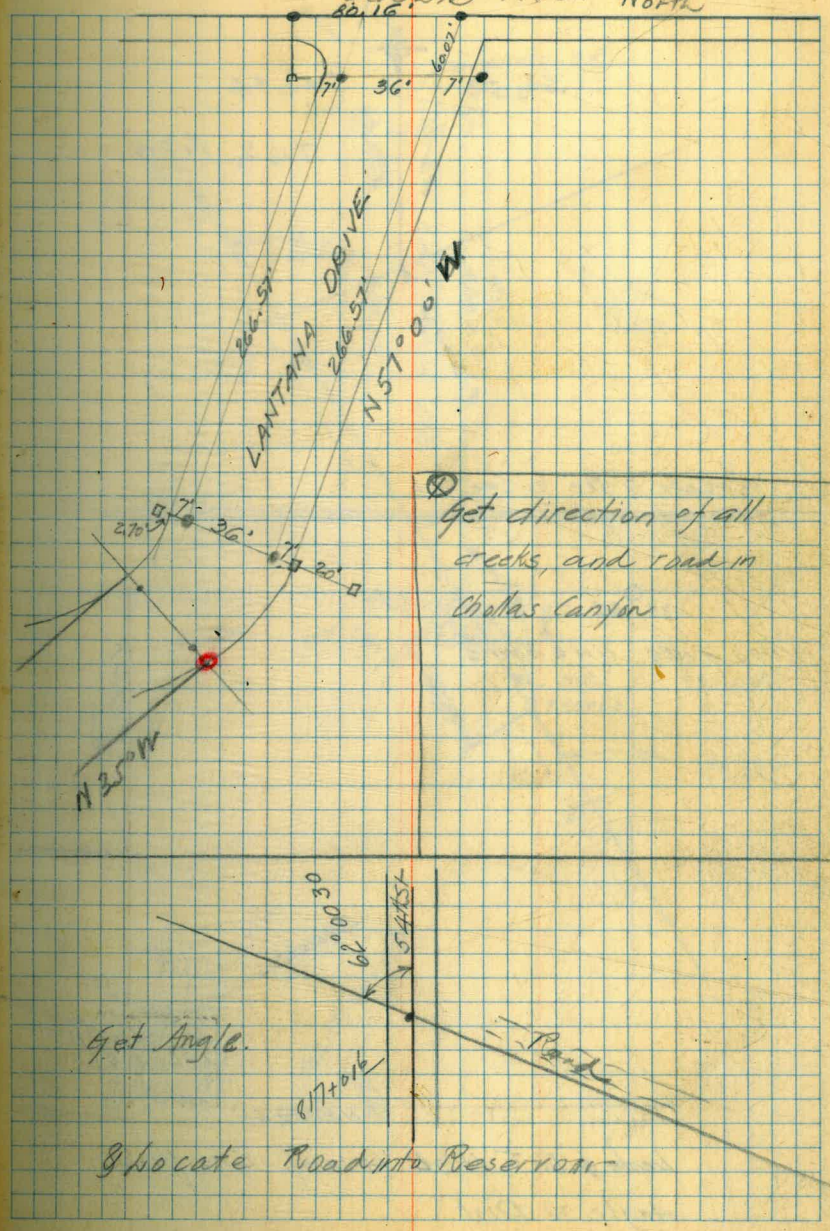
Read Angle A B X

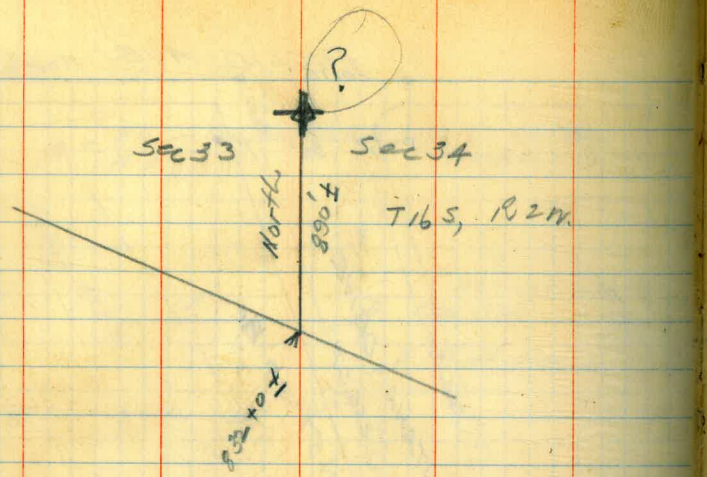
Measure B.-C. & B-D



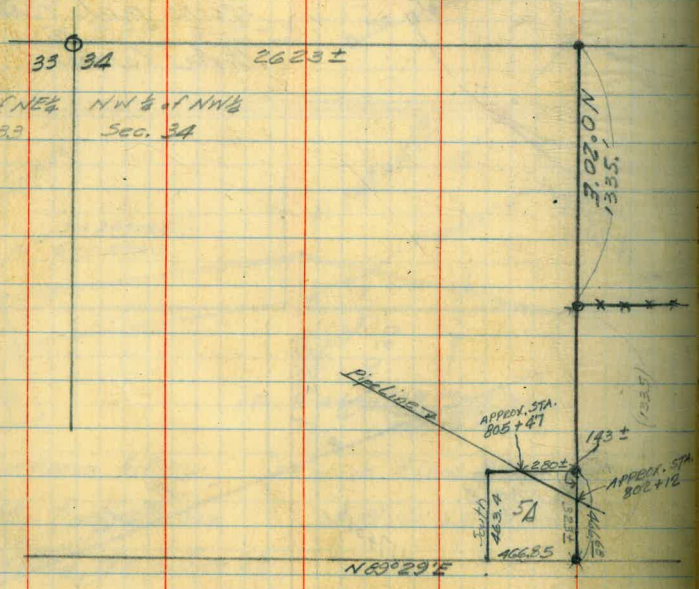
{ S.E Cor. Fairhaven Acres
SW " Oak Park Annex
NW " NE¼, NE¼ Sec 23 }
also on E. Line Minona Ave.
& S.W. Cor Lot 90, Oak Park Annex

Note, distance quite uncertain. from plat only.

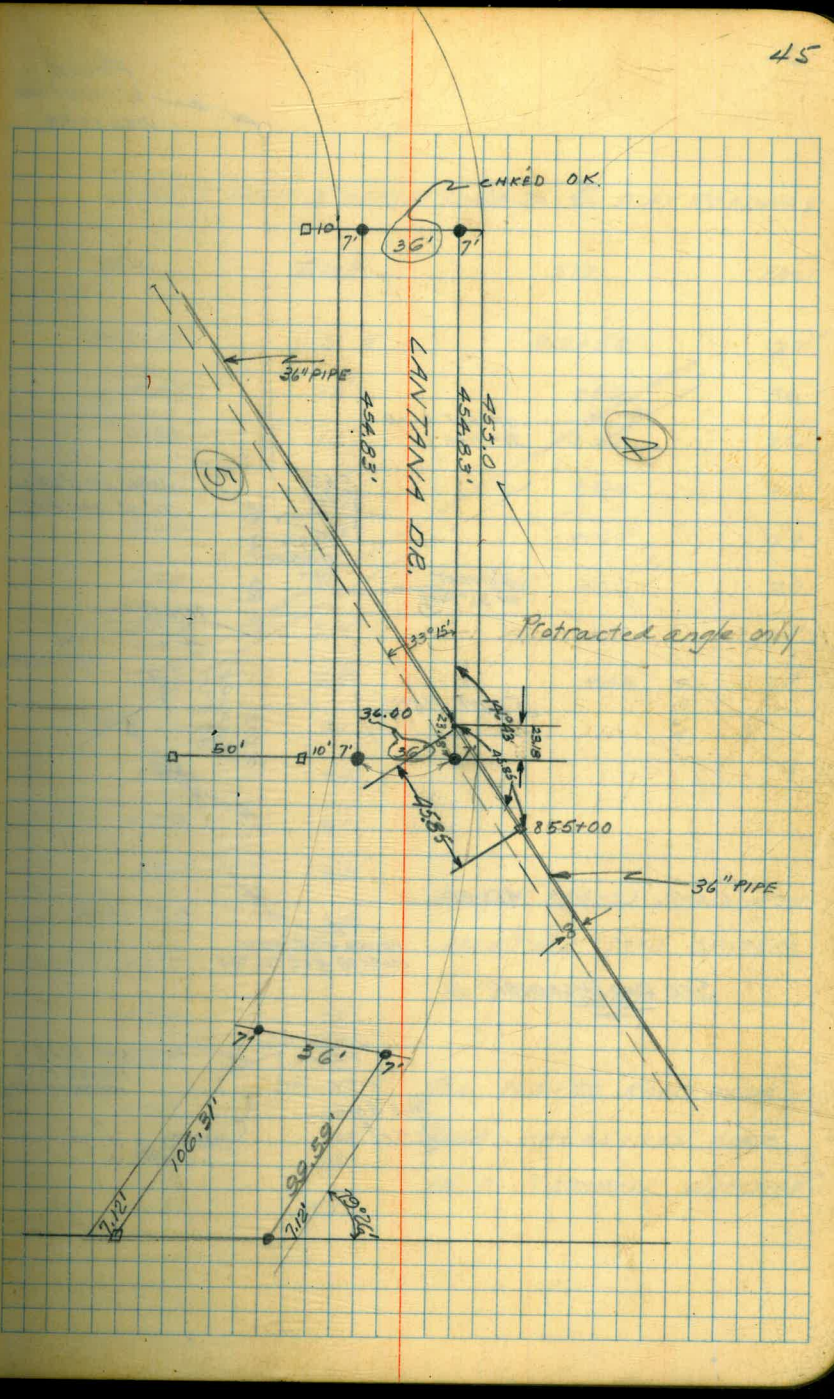


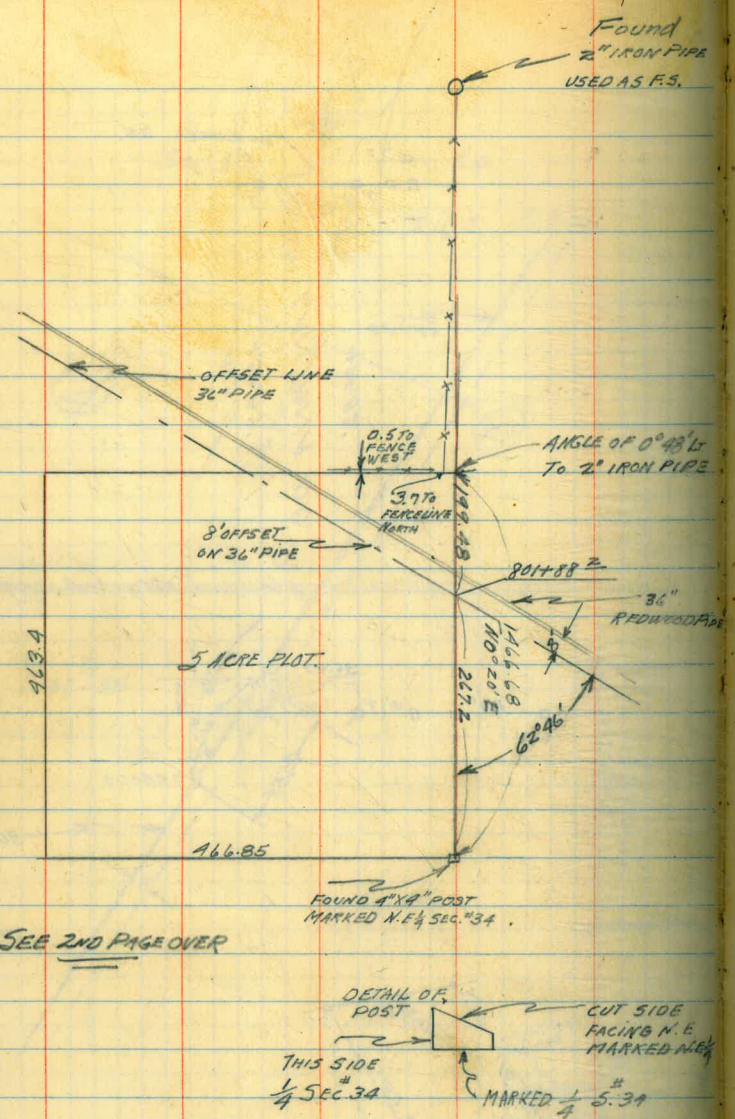


Locate & tie to Sec. Cor.



Locate & Tie to N & E Line of 5 Ac. piece
Angle & Dist.





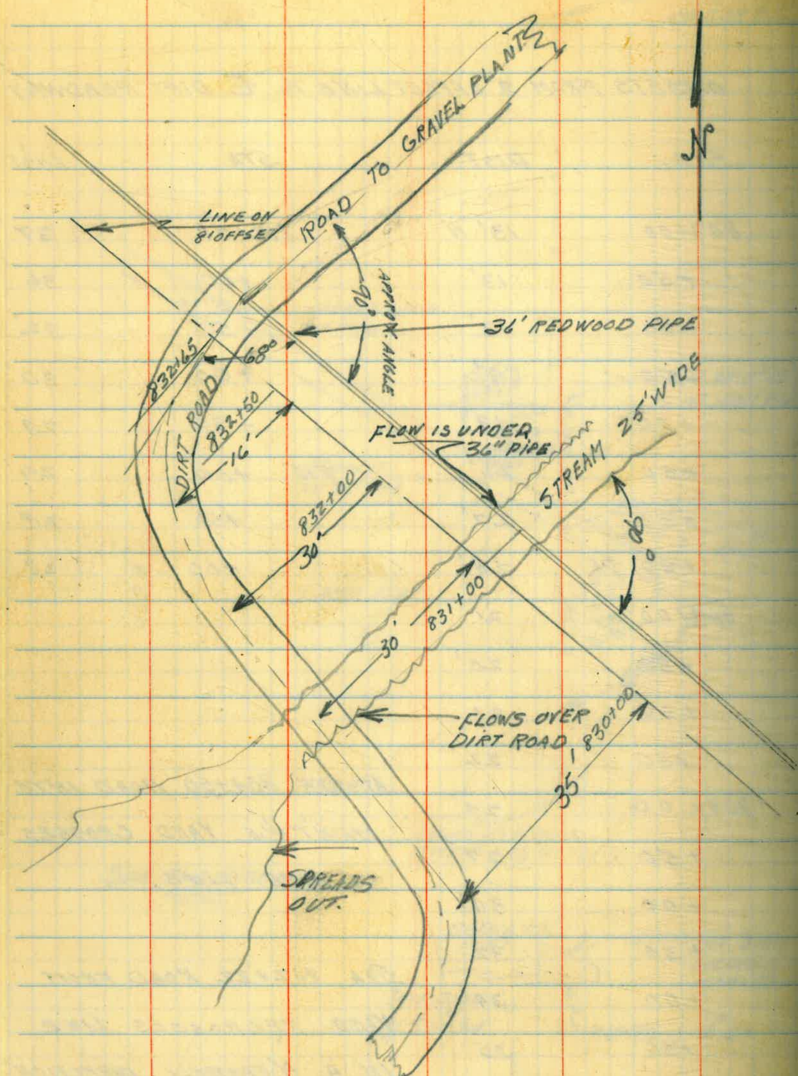
SEE 2ND PAGE OVER

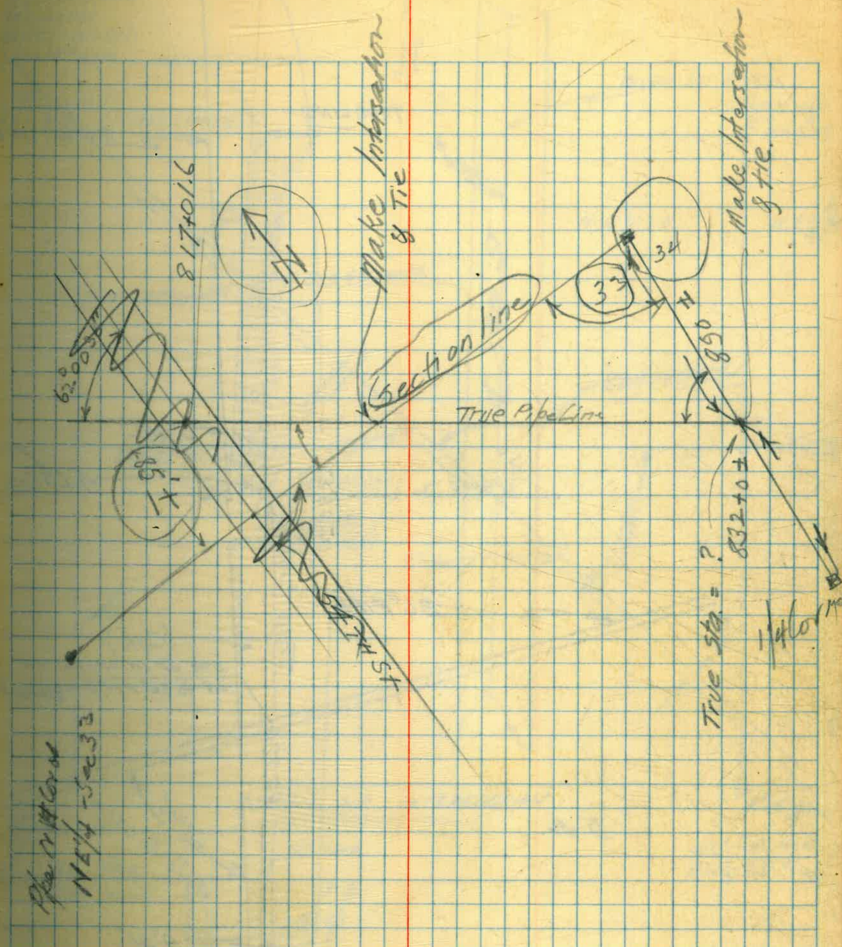
OFFSETS FROM 8' OFFSET LINE TO ℄ DIRT ROADWAY

STA.	DIST	STA.	DIST
803+00	13' N	812+50	37'
+50	13'	+00	36'
+00	13'	+50	32'
+50	9'	+00	30'
+00	19'	+50	29'
+50	26'	815 +00	29'
+00	27'	+50	28
+50	28'	+00	28
807+00	21'		
+50	20'		
+00	21		
+50	22'		
809+00	24'		
+50	27'		
+00	30'		
+50	32'		
+00	34		
+50	35		
812 +00	35		

AT STA 804+50 ROAD INTO MAINT'NCE YARD CROSSES 36" PIPE LINE.

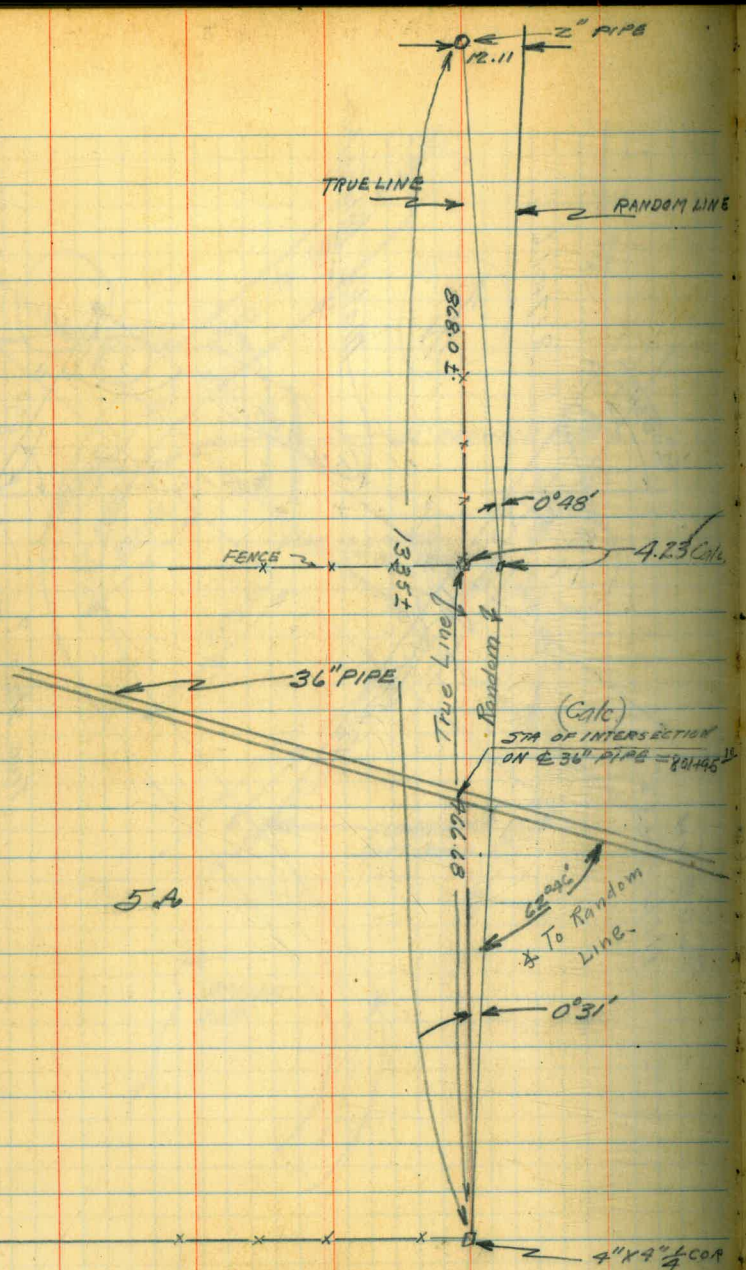
STA 802+22 ROAD FROM YARD RECROSSES LINE IN A NEASTERLY DIRECTION

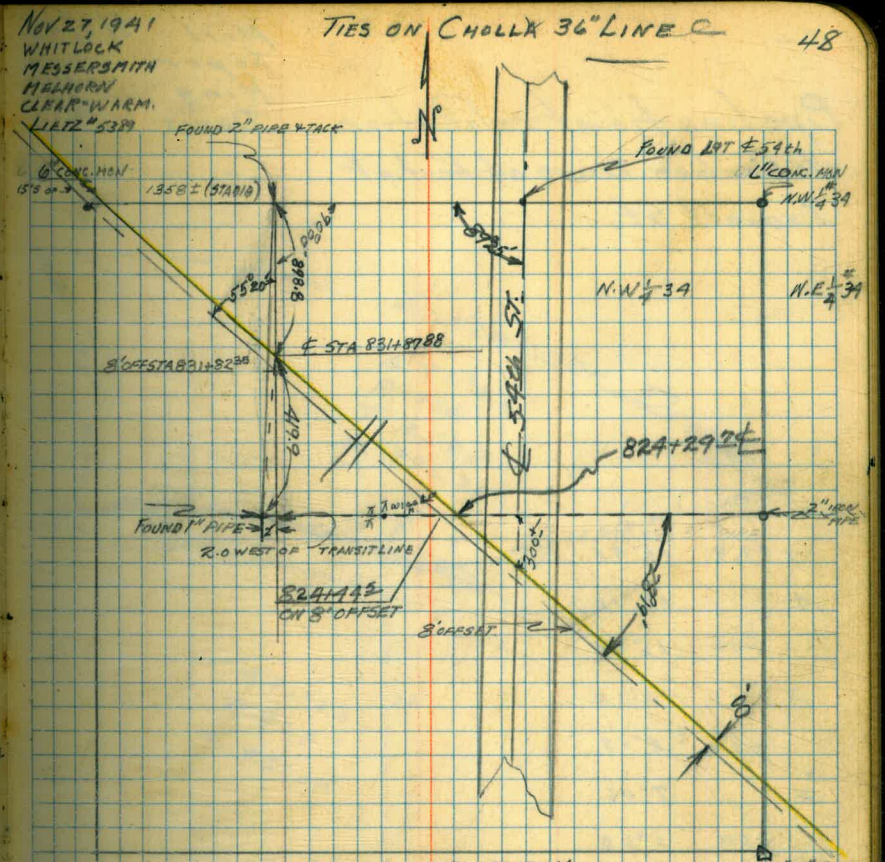

ROAD TO GRAVEL PLANT
N
LINE ON 8' OFFSET
APPROX. ANGLE 90°
36' REDWOOD PIPE
832+65
68°
DIRT ROAD
832+50
16'
FLOW IS UNDER 36" PIPE
STREAM 25' WIDE
832+00
30'
90°
831+00
30'
FLOWS OVER DIRT ROAD
830+00
35'
SPREADS OUT.


817+01.6
N
Make Intersection & Tie
Section line
33
34
850
Make Intersection & Tie.
True PipeLine
85'±
True sta. = ? 832+0±
1/4 cor
Pipe in NE1/4 Sec 33

Nov 27, 1941
WHITLOCK
MESSERSMITH
MELHORN
CLEAR-WARM.
LIETZ "5379

TIES ON CHOLLA 36" LINE C



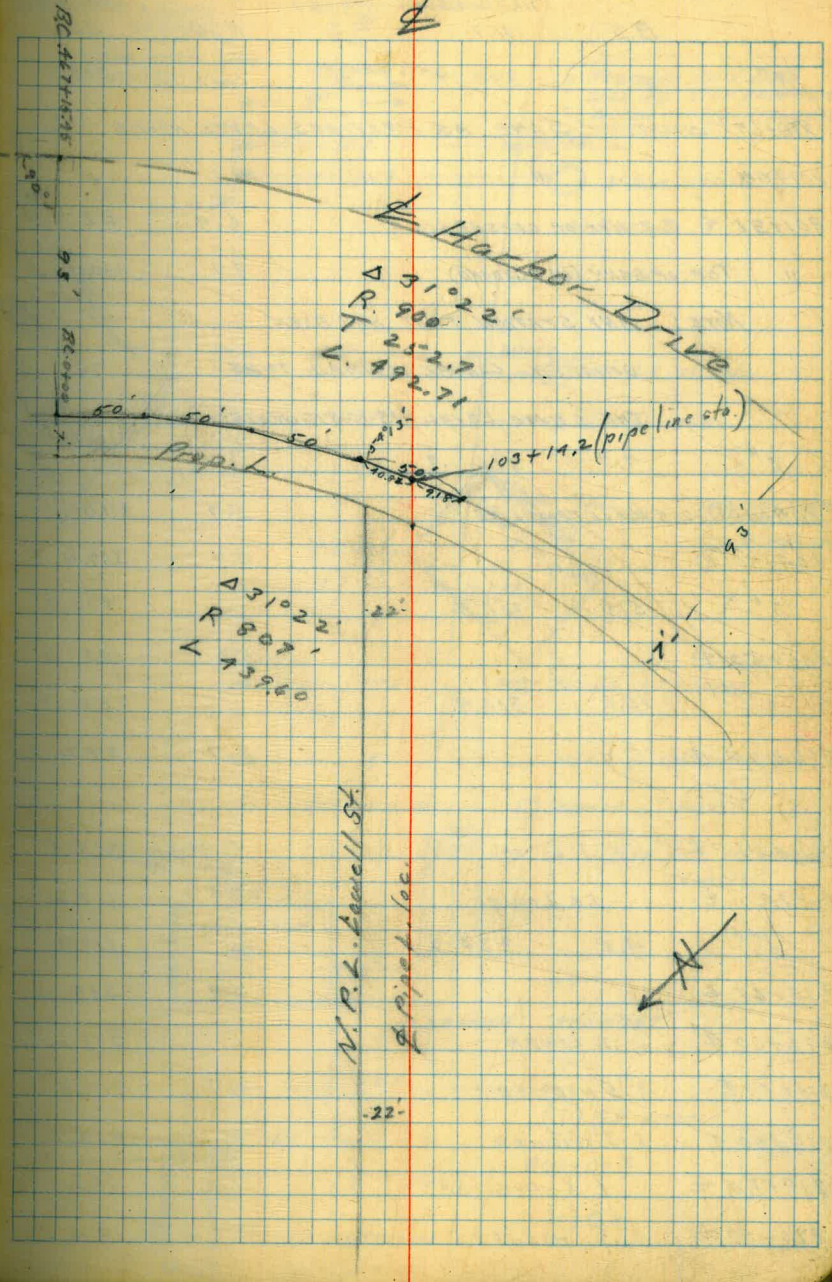


Hill
Soper
King
Davis

7/7/42

Pipeline tie at relocation of Harbor Drive at foot of Lowell St.

+41.8	15°41' E.C.
4	14°12'
+50	12°26'
3	10°39'
+50	8°53'
2	7°06'
+50	5°20'
1 +00	3°33'
+50	1°47'
0+00	B.C.



RELOCATION OF CHOLLA PIPE LINE

HAND LEVEL NOTES

	B.S	H.I	F.S	ROD	ELEV
Δ^{H1}	5.2	333.7			328.5
800+67 $\frac{2}{3}$ START. SAME AS PREVIOUS LEVEL NOTES					
801+00	"	"			
801+31 ℄ 9.2 NOR OF OFFSET LINE				6.4	327.3
" TOP OF BANK (NAT. GROUND)				3.7	330.0
NOTE: ANY STATION THAT HAS BEEN OMITTED CAN BE ASSUMED TO BE THE SAME LEVEL AS ORIG. NOTES.					
Δ^{H2}	4.8	316.7			
804+00 ℄ 12.5 NOR OF TRAN. LINE				5.7	311.0
804+50 ℄				9.7	307.0
Δ^{H3}	5.5	300.9			295.4
805+50 ℄				5.7	295.2
Δ^{H4}	10.6	300.9			290.3
806+00 ℄				8.7	292.2
815+00 ℄	0.1 LOWER				315.8
815+50 ℄	1.0 LOWER				317.6
Δ^{H5}	4.8	324.7			319.9
815+75 ℄				6.9	313.0
816+00 ℄	0.2 LOWER				319.6
818+50 ℄	0.5 HIGHER				317.9
819+00 ℄	0.3 HIGHER				313.5
819+50 ℄	1.5 HIGHER				307.9
820+00 ℄	0.5 HIGHER.				310.6

DEC. 1, 1941
WHITLOCK
MELHORN
CLEAR-WARM.

802+18
Δ=1°
10.75 N. OF STEEL ℄

801+95
RADIUS 12 FEET

EXISTING STEEL LINE
REDWOOD LINE
8'
PROPOSED PIPE LINE TO BE 4.5 N. OF REDWOOD ℄ WHEN STRAIGHTENED OUT.

10.2
12'
801+88
Δ=1°
1' DIAM. EUCALYP.
24'
804+80
2'-⊕ 4" TREE

11'
9.65
13'
4=1°
801+58
1.5 DIA. EUCAL.
14'
6" EUCAL. TREE

SHINGLED FRAME TOILET WITH 6" CONC. FOUNDATION
6.4 + 10.2
801+30
9.1
801+28
Δ=1°
12'
12.5
801+22 6" EUCTER.
13'
801+13 6" EUCALYPTUS TREE
8.55
801+05 6" EUCALYP.
+98
Δ=1°
0.58 PER 30' OF PIPE (APPROX)

A.V. +86.00
7.5
CONC. VALVE BOX
6.4
4'
800+78
AIR VALVE 800+76 ℄

14.5
G.V. 800+71
G.V.
5.5
AIR VALVE +68.00
800+67 ℄
Δ=1°
2'
CONC. VALVE BOX

	B.S.	H.I.	F.S.	ROD	ELEV
		CHOLLA PIPE LINE.			
↗ HUB	7.7	304.1			296.9
820+15 ℄	BOTTOM DITCH.			9.5	294.6
"	TOP. BANK			4.7	299.4

THESE TWO SHOTS ARE NOT REPRESENTITIVE OF THE NAT. GROUND
BOT AMETAKEN IN AN EXCAVATED AREA 10'LONG X 10'WIDE

824+00 ℄	1.0 HIGHER.	277.0

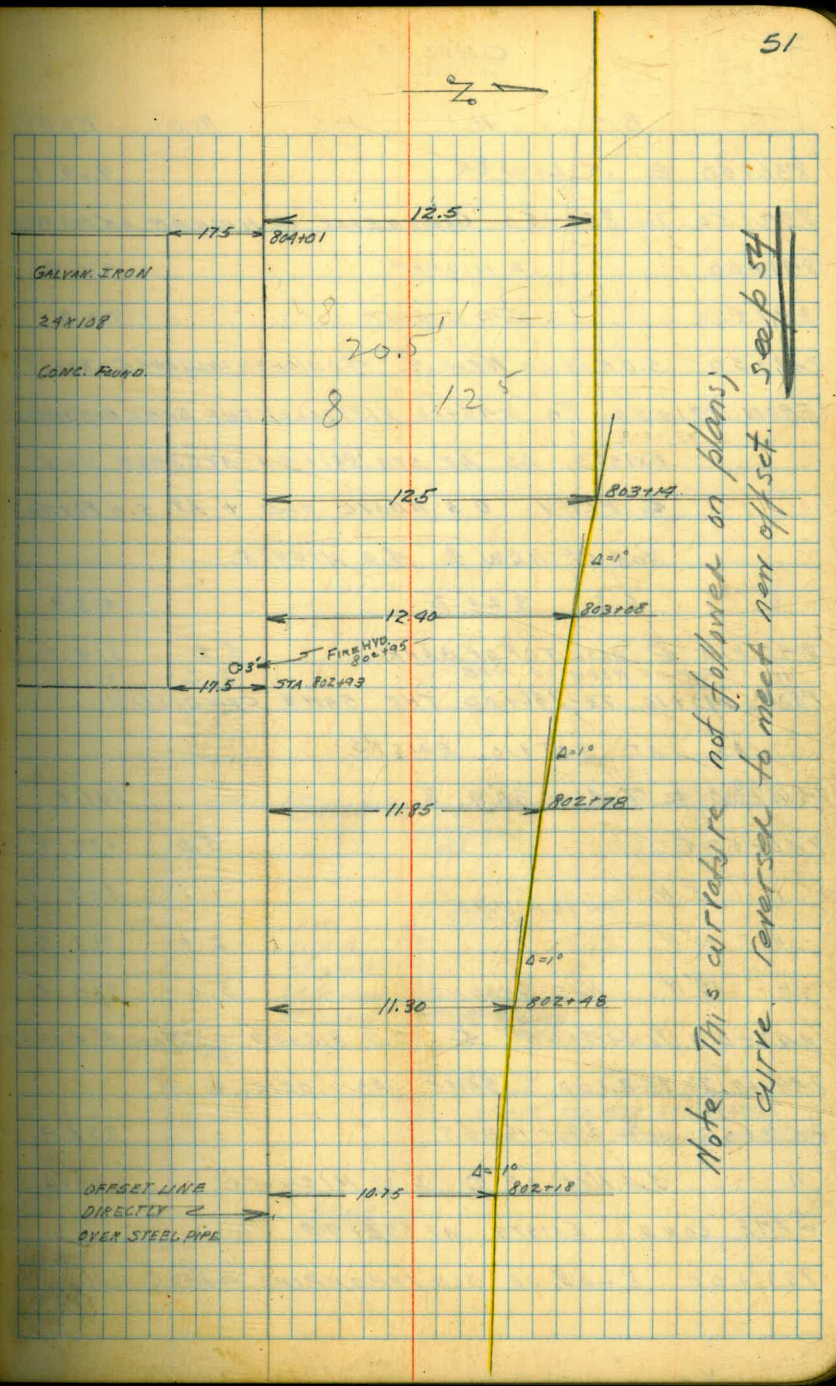
FROM 824+50 to
825+25 NEW ℄ IS ON AN AVERAGE .5 HIGHER THAN ORIG.
825+50 SAME.
FROM 825+75 TO
826+50 NEW ℄ 0.5 HIGHER.
826+50 TO 828+50 SAME AS ORIG.

828+50 ℄	3.3 HIGHER.	293.0

829+00 TO
829+40 LARGE EXCAVATION 4'ON EACH SIDE OF REDWOOD PIPE AVERAGE DEPTH 5.0 AVERAGE BOTTOM ELEV = 216.0
830+50 TO 831+10 AVERAGE ELEV OF STREAM BED = 213.9
831+50 same

↗ HUB	5.3	224.6	219.3
832+50 ℄		5.6	219.0
"	BOTTOM OF DITCH	7.8	216.8

℄ FROM 832-835 SAME ELEV BUT CONSIDERABLE MORE BRUSH & WILLOWS ARE UPON SAME, THAN ON ORIG. ℄



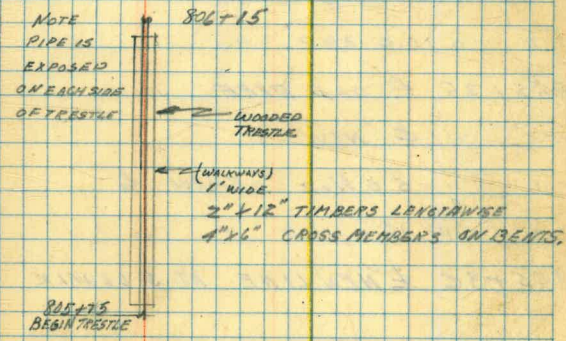
Note. This curvature not followed on plans; curve reversed to meet new offset. See p 54

CHOLLA

	B.S	H.I	F.S	ROD	ELEV
836+50	℄ .5 LOWER				269.1
837+50	TO 840+50 GROUND ELEV .2 HIGHER ON THE AVER.				
841+00		.2 HIGHER			316.9
841+50	312.8	0.4 HIGHER			313.2
841+50	5.0 NOR OF NEW ℄ .4 OHIGHER THAN ORIG ℄				316.8
FROM 841+50 TO 845+10 VIRTUALLY THE SAME CONDITION EXISTS AS AT STA 841+50 AVERAGE NEW ℄ ELEV 0.5 ABOVE OLD & AT 5.0 FARTHER NOR OF NEW ℄ 4.0 HIGHER.					
T H8		6.3	320.2		313.9
845+10	℄ ALSO TOP OF BANK			5.5	314.7
"	TOP OF REDWOOD PIPE			8.6	311.6
FROM 845+10 TO 846+00 THE SAME CONDITION AS AT 845+10 EXISTS					
T H9		7.4	309.2		301.8
846+50	℄			5.0	304.2
"	5'N. ON TOP PILE			1.1	308.1
"	10'N			2.0	307.2
"	15'N. NAT. GROUND			3.6	305.6
847+00	TO 849+60 ℄ 0.5 HIGHER — 5.NOF ℄ 4.0 4 HIGH				
849+60	TO 852+00 SAME AS ORIG. ℄				
852+50	℄ 3.0 HIGHER				258.9
"	5.0 NOR. OF ℄ 5.0 HIGHER				260.9
SAME COND EXISTS AT 852+75					
853+00	ELEV OF OLD TOP OF PIPE = NEW ℄ ELEV.				

BALLENGE OF ALIGNMENT 4.5 NOR. OF ORIGINAL

STEEL.



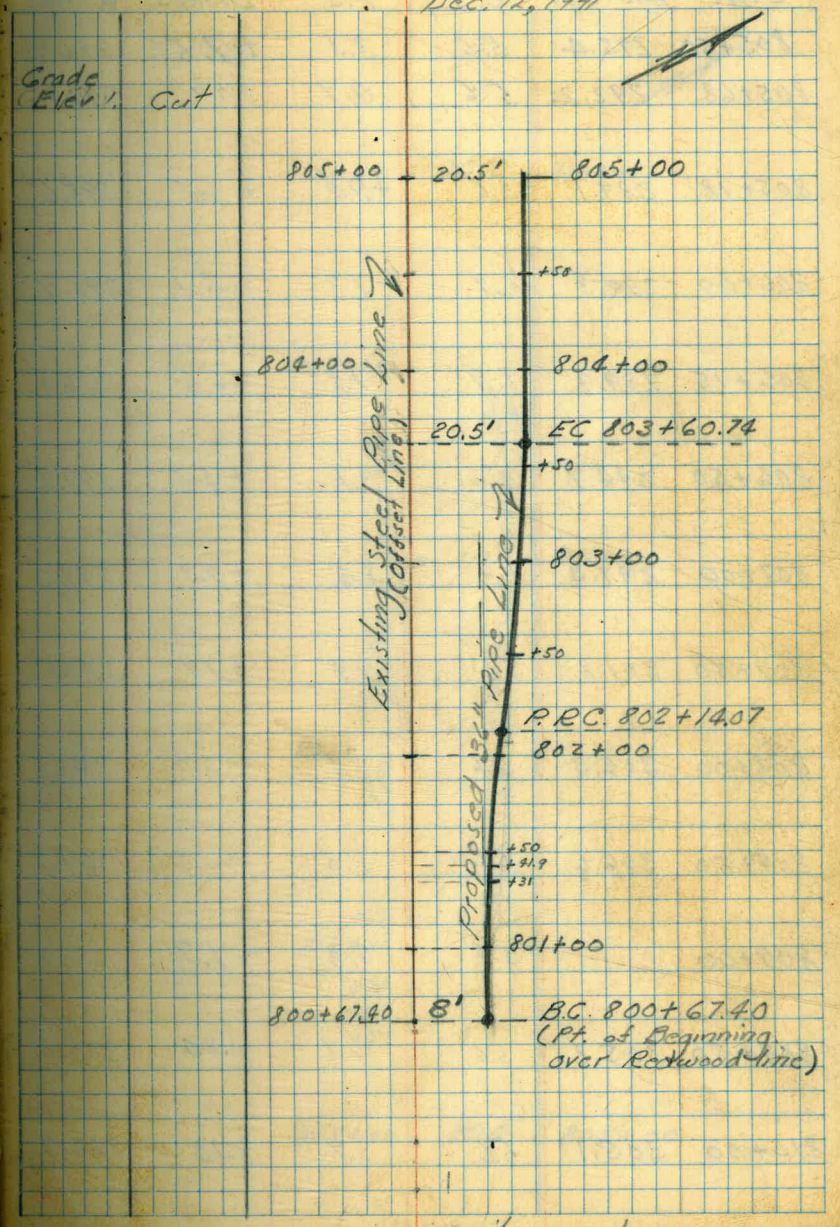
STA	B.S	H.I	F.S	ROD	ELEV
853+50 ℄		0.6 HIGHER			299.9
853+90 TO					
854+50 ℄		1.0 HIGHER	5.0 NOR	2.0 HIGHER	
T #10	13.0	341.1			328.1
854+60 ℄				13.3	327.8
" " 5.0 NOR				12.8	328.3
" " 10.0 NOR				13.5	327.6
" " 15.0 NOR.				14.0	327.1
T #10	4.4	337.5			337.1
855+00 ℄				7.0	330.5
" " 5.0 NOR. OF ℄				2.7	334.8
" " 10.0 NOR. " "				4.5	333.0
" " 15.0 NOR. " "				7.5	330.0
855+15 ℄ OLD PIPE				7.8	329.7
" " ℄ NEW				5.5	332.0
" " 5.0 NOR OF NEW ℄				1.5	336.0
" " 10.0 NOR. "				3.1	334.4
855+25 ℄ OLD PIPE				4.2	333.3
" " ℄ NEW "				3.0	334.5
" " 5.0 NOR OF NEW ℄				2.0	335.5
" " 10.0 NOR " "				3.0	334.5
855+36 ℄ NEW LINE AT SIDEWALK				2.9	334.6

* Messersmith
ϕ Melhorn
Dec. 12, 1941

LEVELS ON FINAL PIPE LOCATION

(20.5' North of Transit Line)

STA.	OFFSET HUB ELEV.	B.S.	F.S.	Diff. ±	Elev. Ground @ Pipe
Pt. of Begin. 800+67.1	340.0	5.6	5.7	-.10	339.90
801+00	335.5	5.6	5.5	+.10	335.6
801+31	330.6	5.6	8.1	-2.5	328.1
801+41.9	328.5	5.6	5.8	-.20	328.3
801+50	327.4	5.6	5.6	.00	327.4
802+00	322.5	5.6	5.9	-.30	322.2
802+50	319.4	5.6	5.7	-.10	319.3
803+00	316.5	5.6	5.6	0.0	316.5
803+50	315.8	5.6	7.0	-1.4	314.4
804+00	311.9	5.6	6.1	-.50	311.4
804+50	307.5	5.6	6.0	-.40	307.1
805+00	301.4	5.6	6.3	-.70	300.7



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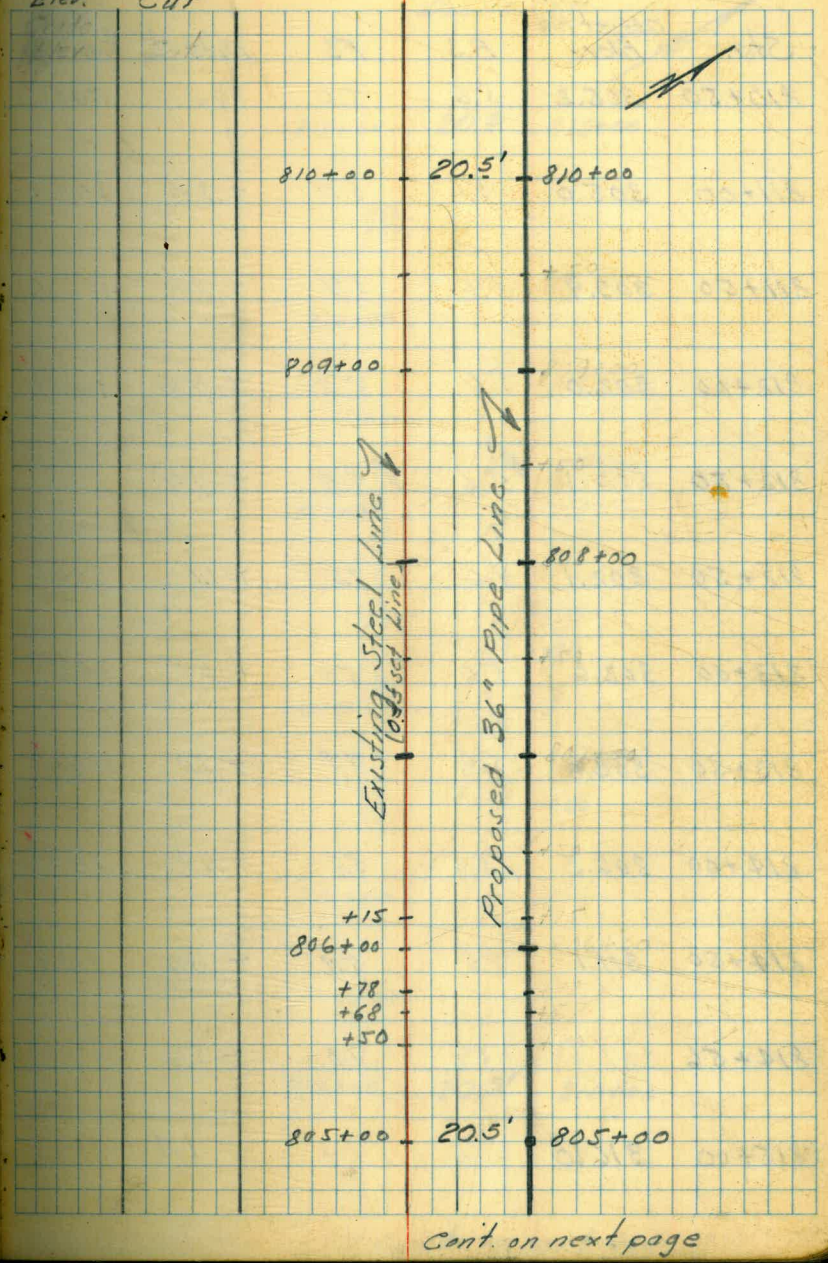
Sta.	Offset Hub Elev	B.S.	F.S.	Diff. ±	Elev. Ground & Pipe
805+50	295.4	5.6	3.1	+2.5	296.9
805+68	292.2	5.6	0.9	+4.7	296.9
805+78	289.1	5.6	+.90	+ 6.5	295.6
806+00	290.3	7.4	-1.3	+ 6.1	296.4
806+15	289.9	7.9	-1.3	+6.6	296.5
806+50	294.7	5.6	3.1	+ 2.5	297.2
807+00	297.3	5.6	3.6	+2.0	299.3
807+50	301.8	5.6	4.9	+.70	302.5
808+00	306.3	5.6	8.1	- 2.5	303.8
808+50	306.6	5.6	7.5	- 1.9	304.7
809+00		5.6	7.3	- 1.7	
809+50	305.8	5.6	6.4	-.80	305.0
810+00	305.1	5.6	5.4	+.20	305.3



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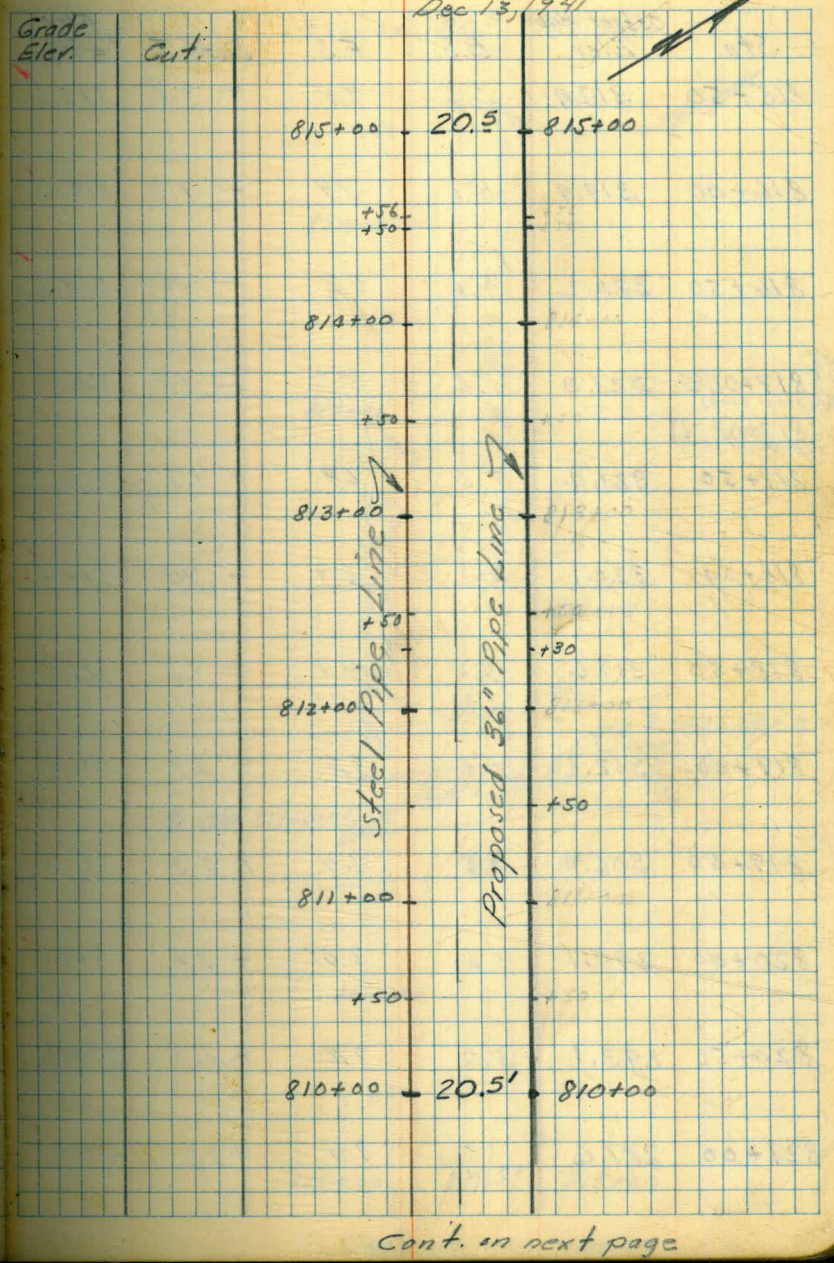
π Messersmith
ϕ Melhorn
Dec 13, 1941

Sta.	Offset Hub Elev.	B.S.	F.S.	Diff. ±	Elev. Ground & Pipe
810+50	305.2	5.6	5.6	0.0	305.2
811+00	305.0	5.6	5.4	+.20	306.2
811+50	303.9	5.6	5.4	+.20	304.1
812+00	302.0	5.6	5.2	+.40	302.4
812+80		5.6	4.2	+1.4	
812+50	302.1	5.6	4.5	+1.1	303.2
813+00	302.6	5.6	5.4	+.20	302.8
813+50	304.0	5.6	4.9	+.70	304.7
814+00	306.5	5.6	5.0	+.60	307.1
814+50	311.1	5.6	5.9	−.30	310.8
814+56		5.6	7.0	−1.4	
815+00	316.0	5.6	7.3	−1.7	314.3



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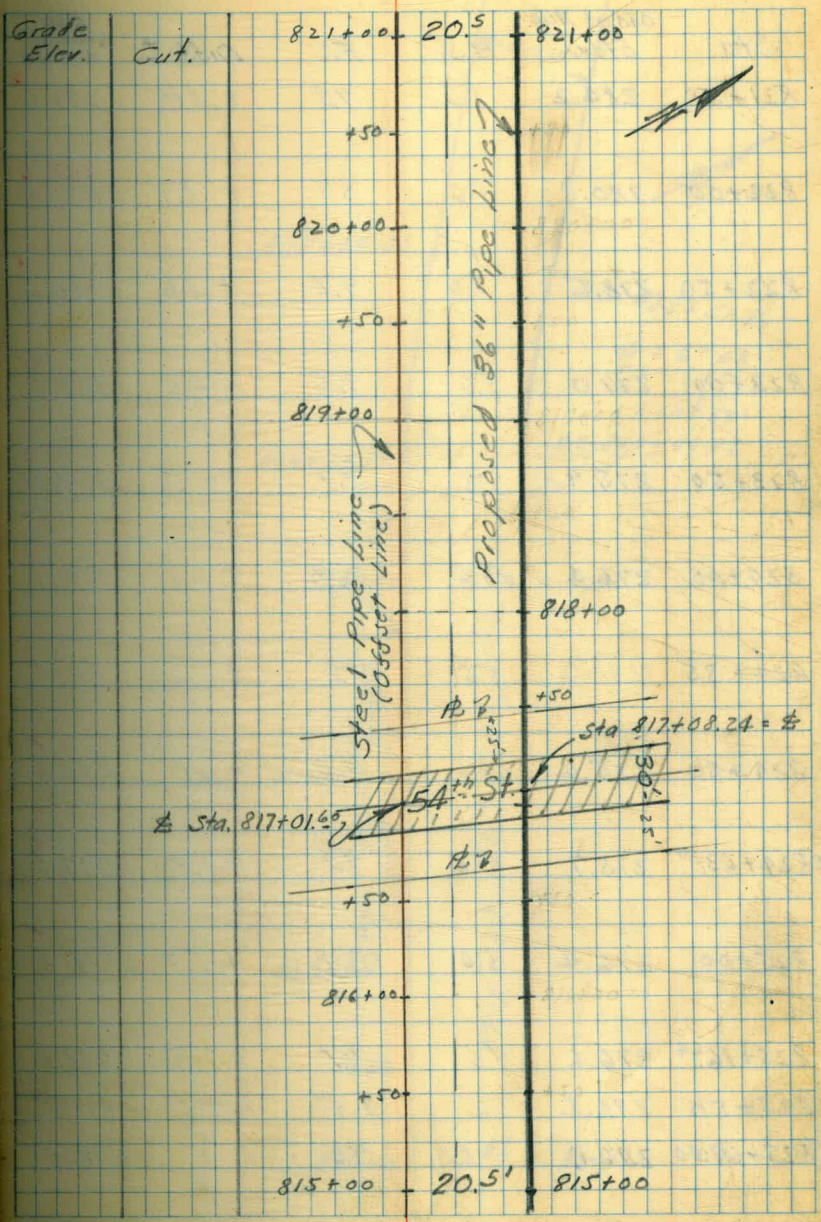
Sta	Offset Hub Elev.	B.S.	F.S.	Diff. ±	Elev. Ground & Pipe
815+50	319.9	5.6	9.4	− 3.8	316.1
816+00	319.9	5.6	7.4	− 1.8	318.1
816+50	320.2	5.6	6.2	− .60	319.6
℄ St. 817+01.60 (Steel Line) (817+08.24 Proposed Line)	321.0	5.6	5.7	− .10	320.9
817+50	321.4	5.6	6.9	− 1.3	320.1
818+00	320.1	5.6	6.3	− .70	319.4
818+50	317.6	5.6	4.8	+ .80	318.4
819+00	312.6	5.6	3.2	+ 2.4	315.0
819+50	306.4	5.6	3.4	+ 2.2	308.6
820+00	299.1	5.6	3.0	+ 2.6	301.7
820+50	293.1	5.6	3.8	+ 1.8	294.9
821+00	287.6	5.6	3.4	+ 2.2	289.8



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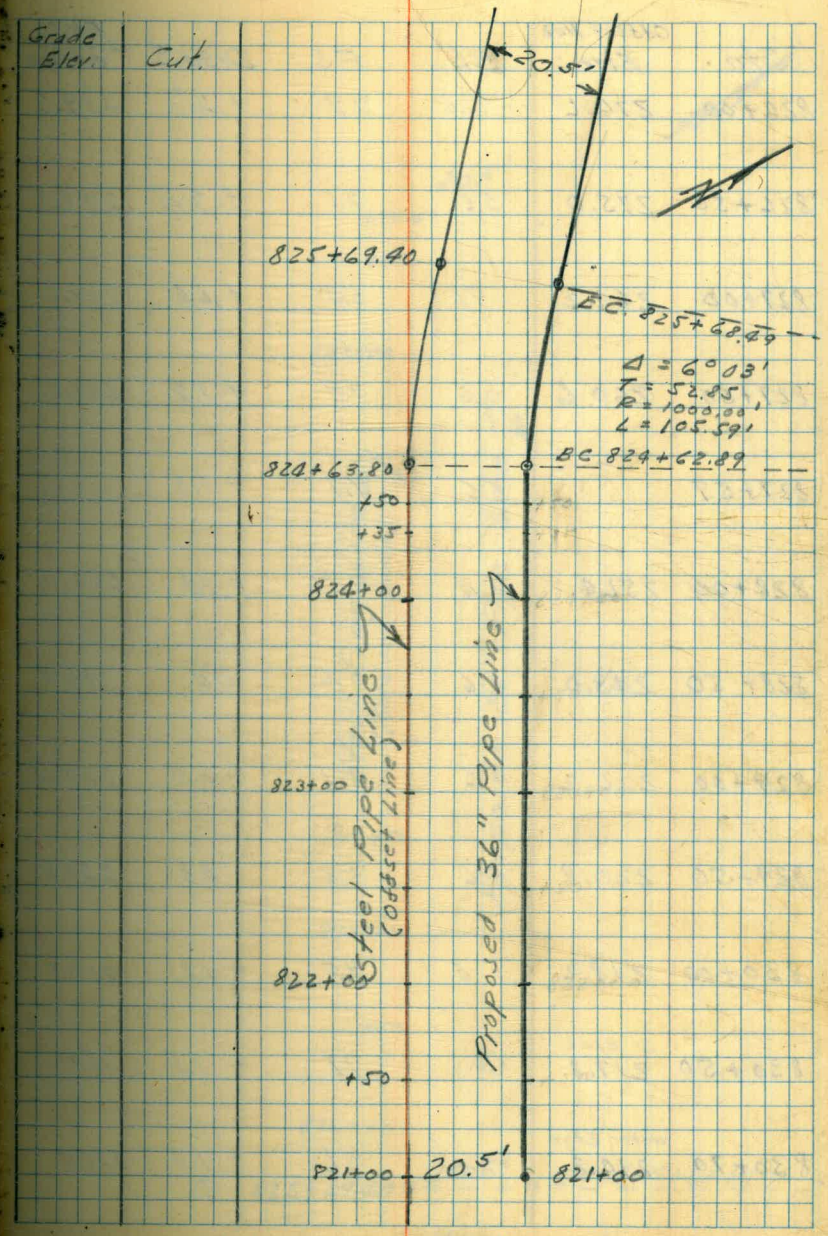
Sta	Offset Hub Elev.	B.S.	F.S.	Diff. ±	Elev Ground & Pipe
821+50	284.2	5.6	4.2	+ 1.4	285.6
822+00	280.8	5.6	3.9	+ 1.7	282.51 ~~282.5~~
822+50	278.6	5.6	4.0	+ 1.6	280.2
823+00	277.0	5.6	3.6	+ 2.0	279.0
823+50	275.9	5.6	4.1	+ 1.5	277.4
824+00	276.4	5.6	3.9	+ 1.7	278.1
824+35		5.6	4.4	+ 1.2	
824+50	275.6	5.6	4.0	+ 1.6	277.2
BC 824+63.80	275.7	5.6	4.2	+ 1.4	277.1
825+00	276.4	5.6	3.8	+ 1.8	278.2
825+16.64	276.6	5.6	4.1	+ 1.5	278.1
825+50	276.4	5.6	3.5	+ 2.1	278.5
EC 825+69.40	276.9	5.6	4.0	+ 1.5	278.4



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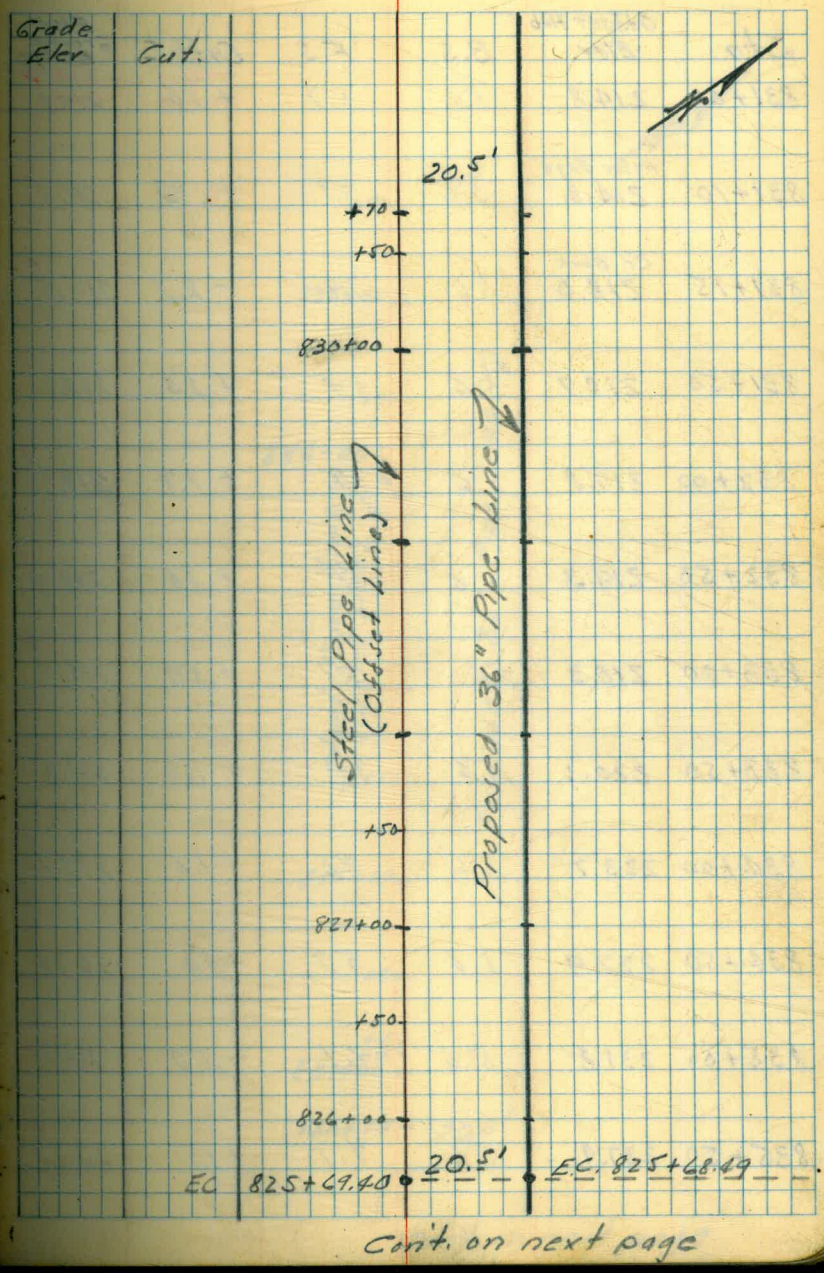
Sta.	Offset Hub Elev.	B.S.	F.S.	Diff. +	Elev. Ground & Pipe
826+00	276.6	5.6	2.9	+ 2.7	279.3
826+50	275.0	5.6	2.1	+ 3.5	278.5
827+00	269.2	5.6	5.0	+ .60	269.8
827+50	260.6	5.6	4.4	+ 1.2	261.8
827+57		5.6	4.1	+ 1.5	
828+00	251.4	5.6	4.7	+ .90	252.3
828+50	243.0	5.6	5.6	.00	243.0
829+00	226.2	5.6	3.1	+ 2.5	228.7
829+50	220.8	5.6	5.6	.00	220.8
830+00	218.2	5.6	4.5	+ 1.1	219.3
830+50	Cr Bank 217.8	5.6	7.1	- 1.5	216.3
830+70	water Edge 214.8	5.6	4.6	+ 1.0	215.8



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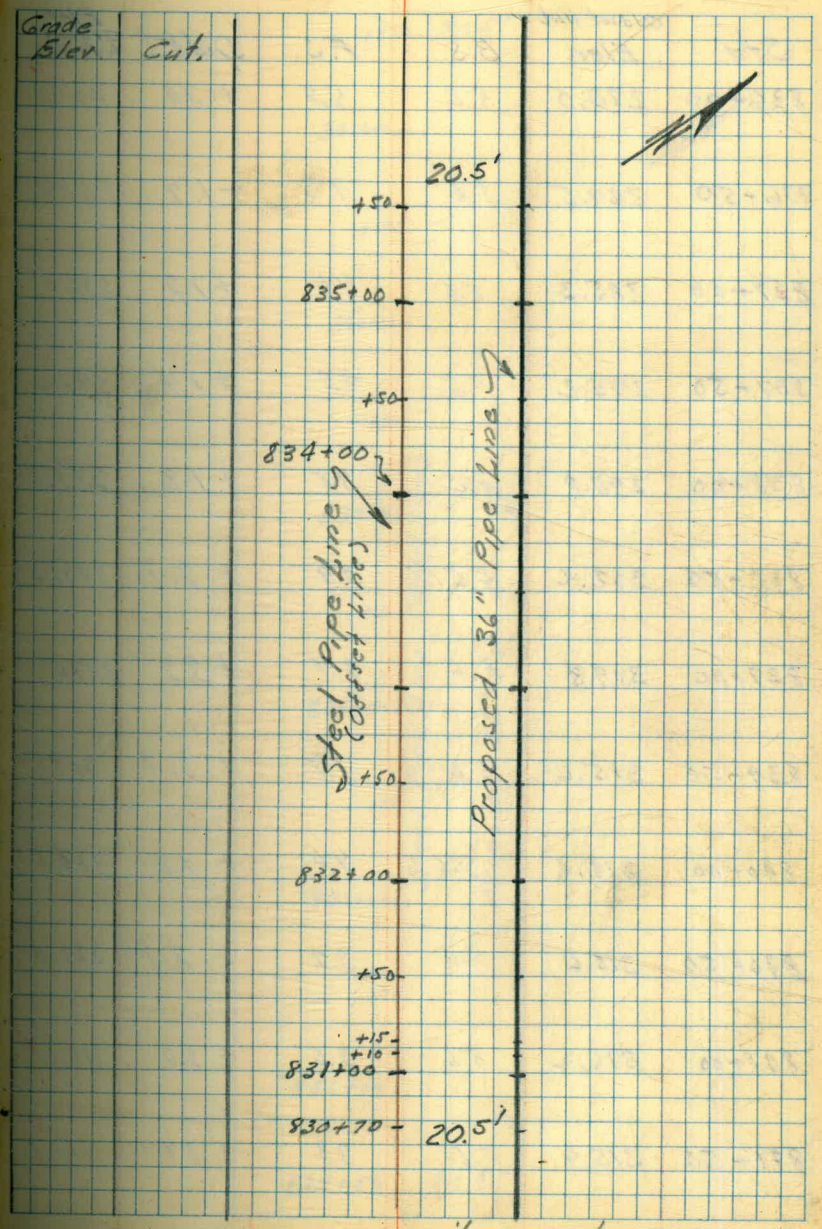
Sta.	Offset Hub Elev.	B.S.	F.S.	Diff. ±	Elev. Ground & Pipe
				−0.1	214.7
831+00	214.8	5.6	5.7	~~+.10~~	~~214.7~~
831+10	Water Edge 214.8	5.6	4.9	+0.70	215.5
831+15	Cr. Bank 218.0	5.6	7.8	−2.2	215.8
831+50	218.7	5.6	5.4	+.20	218.9
832+00	217.8	5.6	3.9	+1.7	219.5
832+50	219.3	5.6	5.5	+.10	219.4
833+00	218.3	5.6	5.1	+.50	218.8
833+50	220.1	5.6	3.8	+1.8	221.9
834+00	223.7	5.6	4.6	+1.0	224.7
834+50	227.9	5.6	5.7	−.10	227.8
835+00	231.8	5.6	6.1	−.50	231.3
835+50	237.9	5.6	4.1	+1.5	239.4



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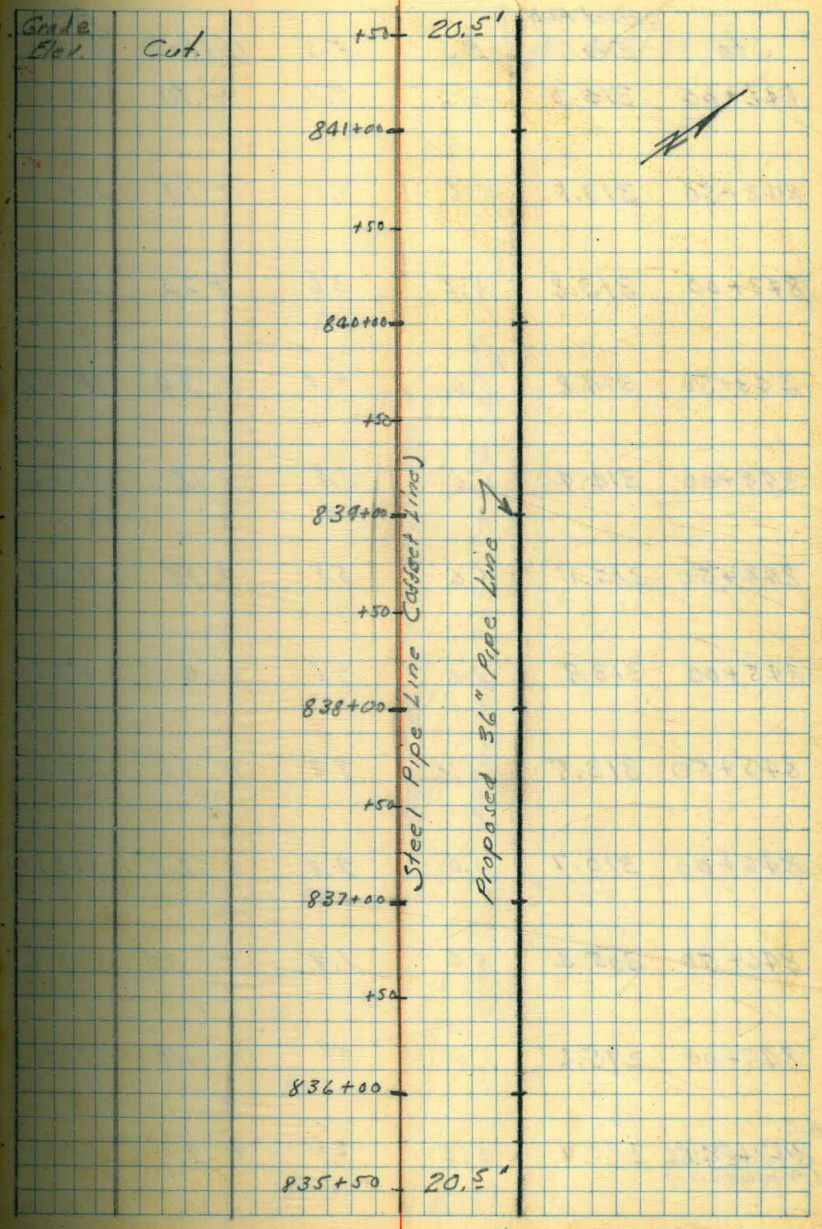
Sta.	Offset Hub Elev.	B.S.	F.S.	Diff. ±	Elev. Ground & Pipe
836+00	250.0	5.6	5.2	+0.40	250.4
836+50	269.5	5.6	7.3	−1.7	267.8
837+00	285.3	5.6	4.4	+1.2	286.5
837+50	293.2	5.6	4.2	+1.4	294.6
838+00	297.8	5.6	3.8	+1.8	299.6
838+50	302.6	5.6	2.9	+2.7	305.3
839+00	309.8	5.6	2.4	+3.2	313.0
839+50	315.6	5.6	1.7	+3.9	319.5
840+00	318.4	5.6	4.0	+1.6	320.0
840+50	318.6	5.6	3.2	+2.4	321.0
841+00	316.2	5.6	3.6	+2.0	318.2
841+50	315.9	5.6	3.8	+1.8	317.7



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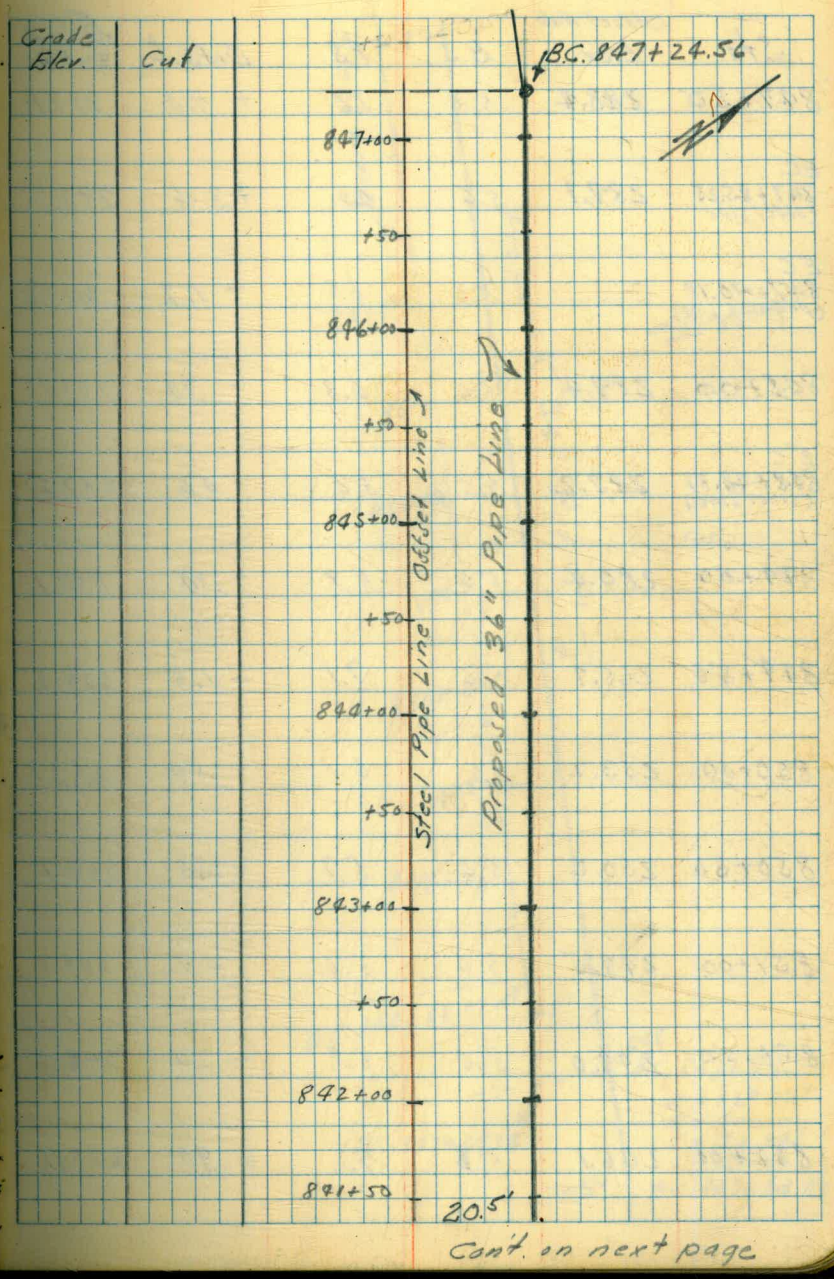
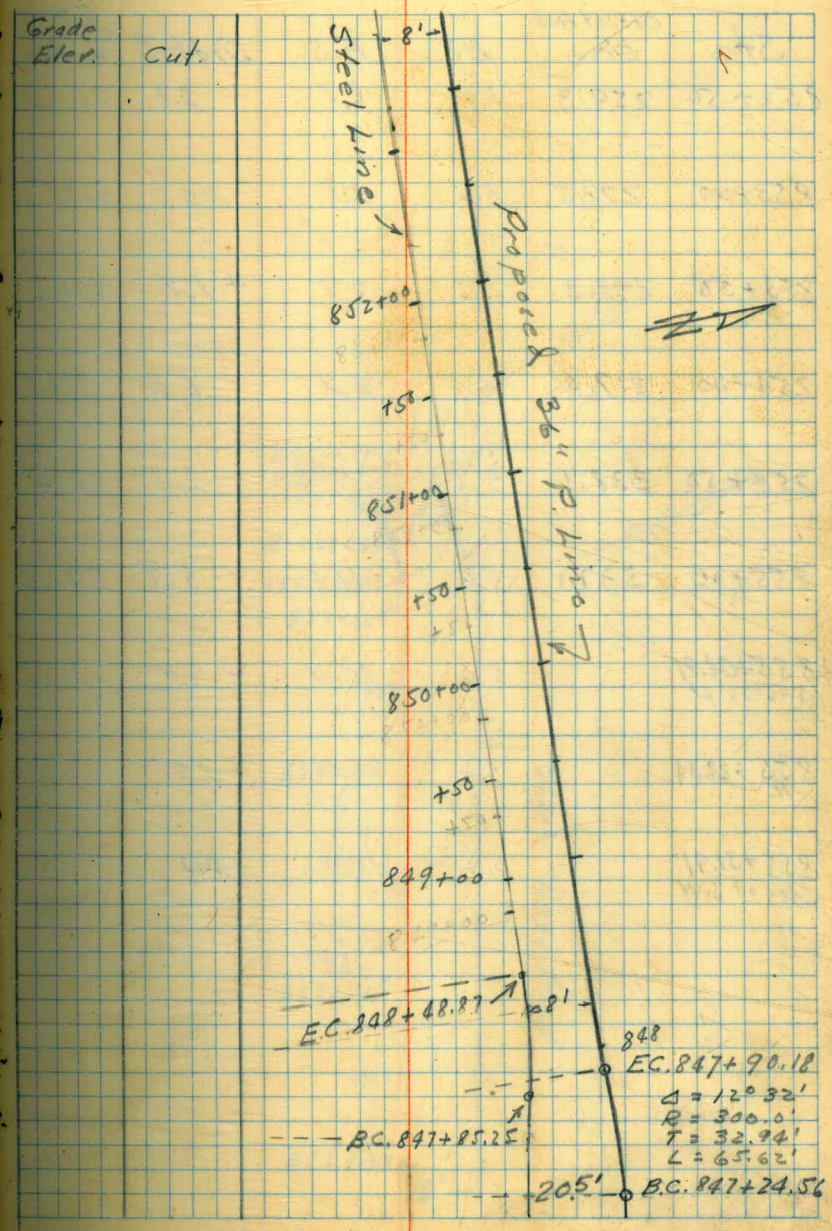
Sta	Offset Hub Elev.	B.S.	F.S.	Diff. ±	Elev Ground & Pipe
842+00	314.3	5.6	4.7	+ .90	315.2
842+50	313.1	5.6	4.5	+ 1.1	314.2
843+00	313.8	5.6	3.6	+ 2.0	315.8
343+50	314.8	5.6	4.8	+ .80	315.6
844+00	314.4	5.6	3.8	+ 1.8	316.2
844+50	315.1	5.6	5.5	+ .10	315.2
845+00	313.9	5.6	4.0	+1.6	315.5
845+50	313.5	5.6	4.8	+ .80	314.3
846+00	310.7	5.6	2.8	+ 2.8	313.5
846+50	305.4	5.6	1.8	+ 3.8	309.2
847+00	295.6	5.6	4.9	+ .70	296.3
B.C 847+24.56 (Proposed Line)		5.6	3.4	+ 2.2	



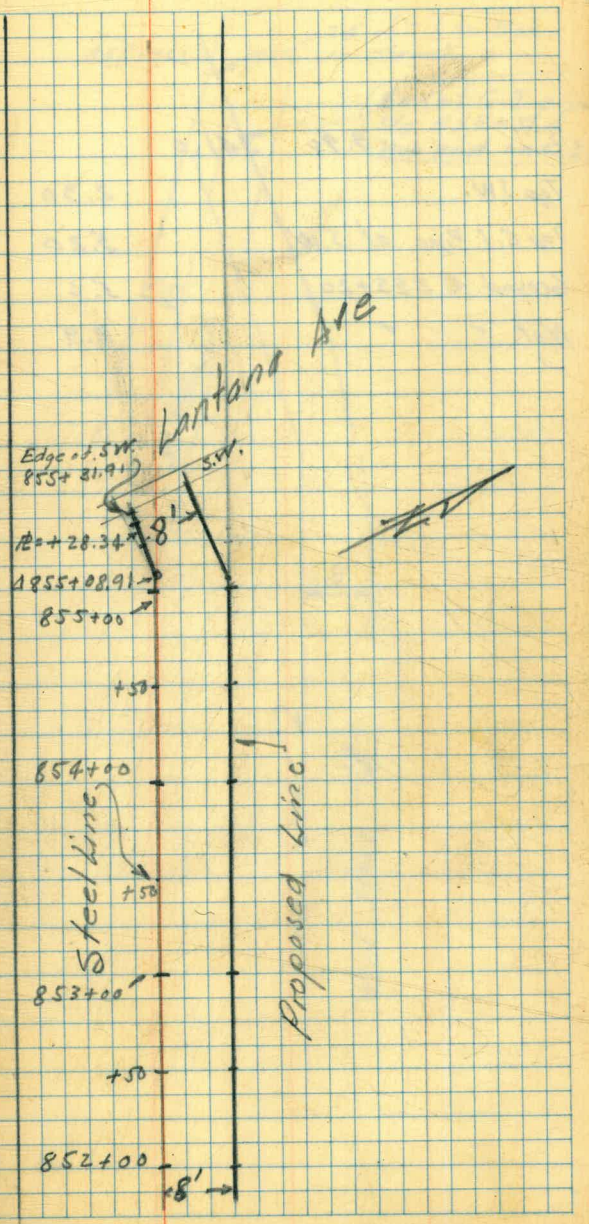
Cont. on next page

Sta	Offset Hub Elev.	B.S.	F.S.	Diff. ±	Elev Ground & Pipe
847+50	288.4	5.6	1.6	+ 4.0	292.4
B.C. 847+85.25 (steel Line	289.1	5.6	2.0	+3.6	292.7
E.C. 847+90.18 (Proposed Line)		5.6	6.8	− 1.2	291.5
848+00	289.4	5.6	6.3	− .70	288.7
E.C 848+48.87 (steel Line)	287.2	5.6	5.6	00	287.2
849+00	280.4	5.6	5.9	− .30	280.1
849+50	265.7	5.6	7.1	− 1.5	264.2
850+00	253.2	5.6	6.1	− .50	252.7
850+50	250.2	5.6	5.7	− .10	250.1
851+00	249.5	5.6	5.6	00	249.5
851+50	249.0	5.6	5.8	− .20	248.8
852+00	246.1	5.6	4.7	+ .90	247.0

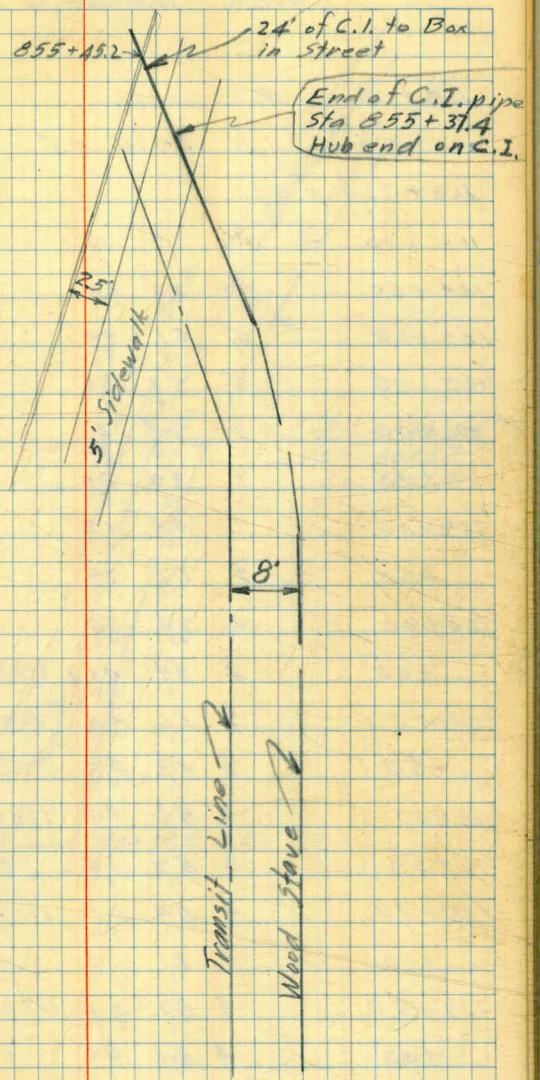


Sta.	Offset Hub Elev.	BS	F.S.	Diff. ±	Elev. Ground & Pipe
852+50	259.3	5.6	8.7	− 3.1	256.2
853+00	277.5	5.6	5.6	.00	277.5
853+50	298.3	5.6	3.7	+1.9	300.2
254+00	317.4	5.6	6.2	− .60	316.8
254+50	328.1	5.6	7.9	− 2.3	325.8
855+00	337.1	5.6	11.5	− 5.9	331.2
△855+08.91 △=6°56' Lt.		5.6	10.0	− 4.4	
855+28.34 ℄		5.6	5.5	+.10	
855+31.91 Edge of S.W		5.6	5.4	+.20	

Grade Elev	Cut.



			337.1	Hub 855+00
	3.90	341.0		
Top S.W.		2.30	338.7	
Top C.I. Pipe at S.W.		5.20	335.8	F.L. 333.3
Ground @ 855+20		5.6	335.4	
Nat. ✓	✓	2.3	338.7	



LINE CHANGE - HARBOR DRIVE

104+08 d_1 = 20.26"

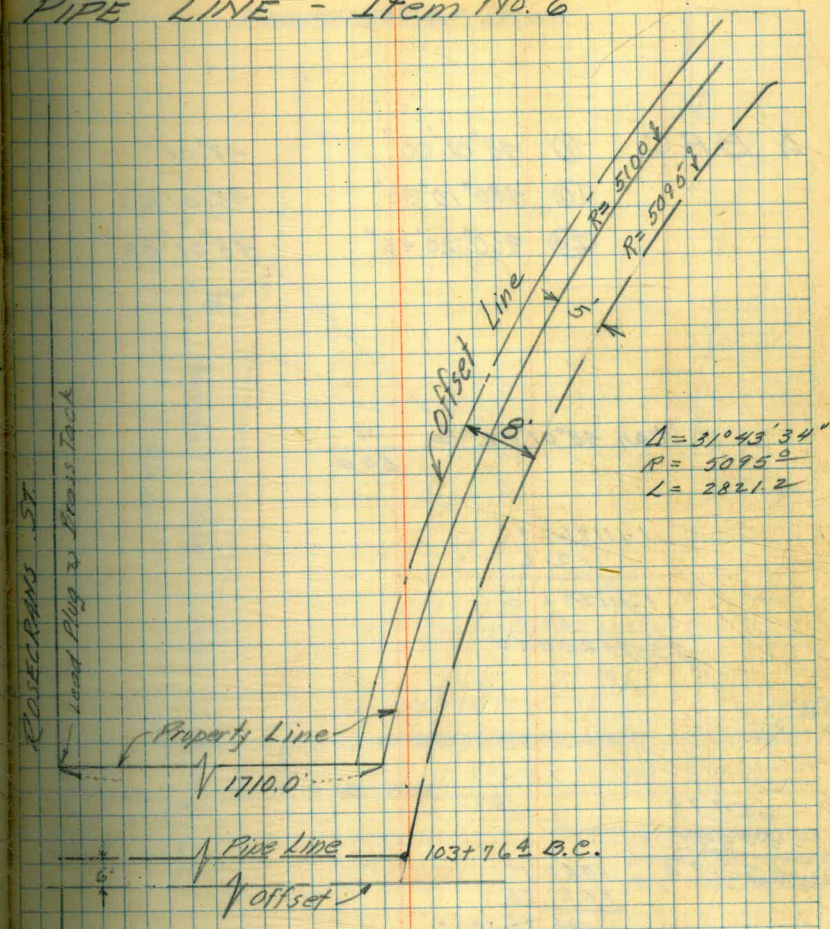
31.6 d_{50} = 0° 16' 33" = 1013"

103+76.4 = B.C.

104+00	= 0°	08 16	00 52		
104+50	0°	24 16	52 52		
105+00	0°	41 16	44 52		
105+50	0°	58 16	36 52		
106+00	1	15 16	28 52		
+50	1	32 16	20 52		
107+00	1	49 16	12 52		
+50	2	06 16	04 52		
108+00	2	22 16	56 52		
+50	2	39 16	48 52	113+50	5-28-28
109+00	2	56 16	40 52	114+00	5-45-20
+50	3	13 16	32 52	+50	6-02-12
110+00	3	30 16	24 52	115+00	6-19-04
+50	3	47 16	16 52	+50	6-35-56
111+00	4	04 16	08 52	116+00	6-52-48
+50	4	21 16	00 52	+50	7-09-40
112+00	4	37 16	52 52	117+00	7-26-32
+50	4	54 16	44 52	+50	7-43-24
113+00	5	11 16	36 52		7-60-12

CONT. ON NEXT

PIPE LINE - Item No. 6



∡ B.A.C. (1) 48°01'00" 48°01'

(10) 480°10'30" 48°01'03"

(20) 960°20'45" 48°01'02"

$\tan 48°01'02 = \frac{x}{500}$

1.1112624
216
1.1112840
500
555.9420000

694.79
555.94
1250.73

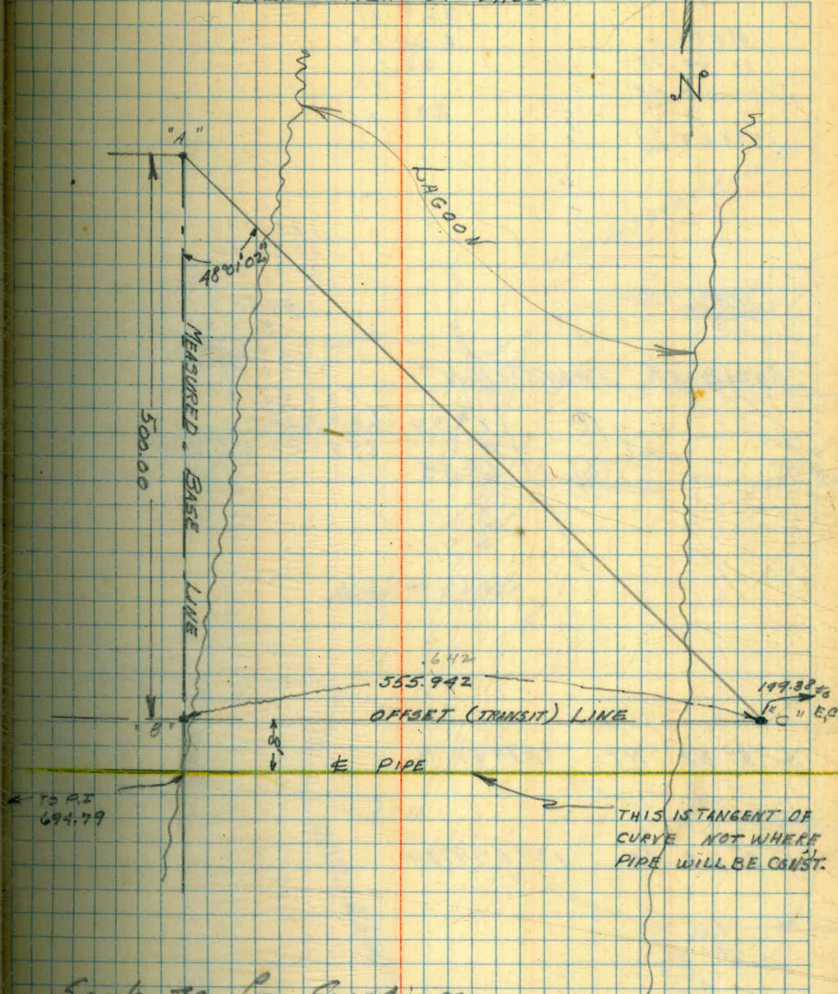
1450.11
1250.73
199.38 to go.

1112624
3065503
216

JAN. 28, 1942
WHITLOCK
MESSERSMITH
MELHORN.
CLEAR-WARM

TRIANGULATION

MEASUREMENT OF LAGOON



See p 70 for Soundings.

555.64
199.38
755.02

JAN 29, 1942
WHITLOCK
MESSERSMITH
MELHORN

148+50
136+41
12+09
6 00
2 02
20 11

139+97.6
20 29 87
15+27+97
2 24
15+27+99 24

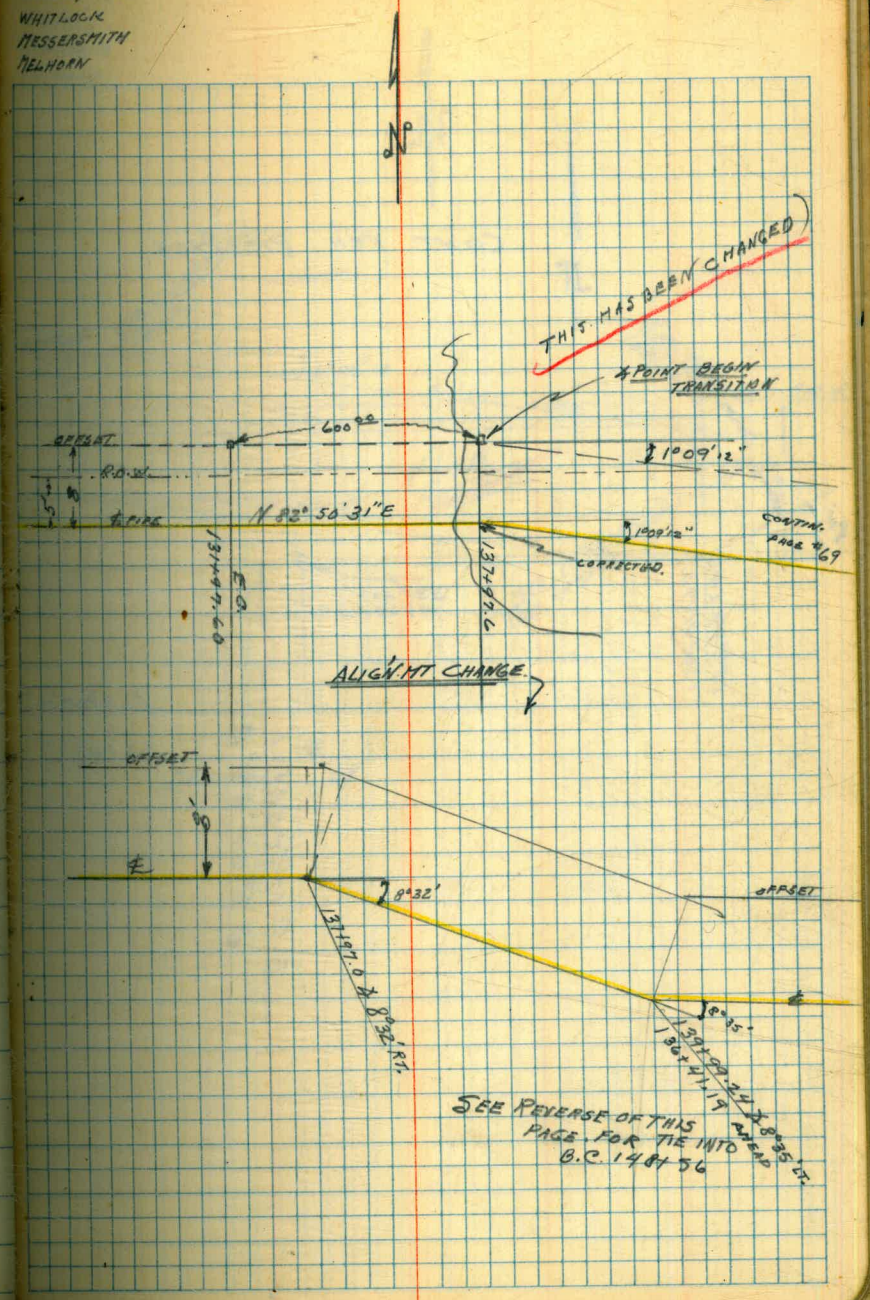
.1221730
0026180
0001406
.1249416
5165
6247080
7496496
1249416
6247080
64532336 40

ANGLE AT TRANSITION

① 1°09'
⑥ 6°55'

℄ 8°32' RT 137+97.0

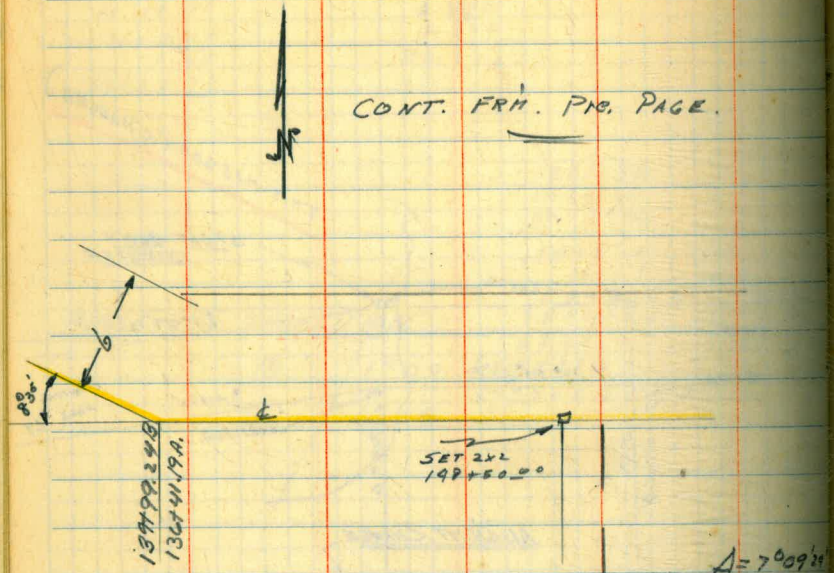
℄ 8°35' LT 139+99.24



SEE REVERSE OF THIS PAGE FOR TIE INTO B.C. 148+56

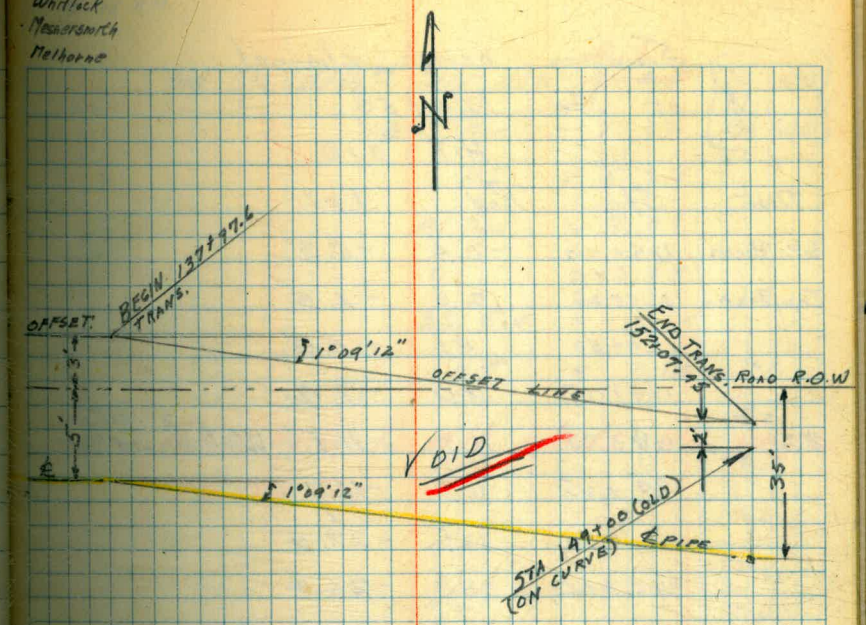
JAN. 28, 1942
Whitlock
Messersmith
Melborne

CONT. FRM. PRE. PAGE.



B.C. 145+56.31
S 7°09'29" E

Δ = 7°09'29"
L = 645.27



SEE PAGE # 68

Sounding across channel

℄ at Sta. 124+50

H.I. = 0.10

Dist.	Sta.	Rod	Elev.	
Ext. Berm	124+23	-0.4	-0.3	
Top Bank.	124+26	2.6	-2.5	
	124+50	5.1	-5.0	
20	124+75	8.0	-7.9	
27	124+97	11.1	-11.1	Water 2:15 P.M. Surface
W.S. 28	125+25	16.8	-16.7	
25	+50	22.6	-22.5	
25	125+75	26.9	-26.8	
25	126+00	27.7	-27.6	
25	+25	26.7	-26.6	
25	+50	26.4	-26.3	
	+75	26.2	-26.1	
	127+00	26.1	-26.0	
	+25	26.1	-26.0	
	+50	26.1	-26.0	
	+75	25.6	-25.4	
	128+00	25.1	-25.0	
	+25	23.5	-23.4	
	+50	22.1	-22.0	
	+75	20.0	-19.9	
	129+00	18.0	-17.9	
	+25	13.0	-12.9	

Jan 29, 42.
2:15 P.M.

Old Sta 126+66.9 Elev. Hub ~~2.45~~ 4.1 {Pg. 50 Bk 600}

B.S. Rod = 2.82

HI = 5.27

F.S. Rod = 7.81

Ø = -2.54

B.S. Rod = 2.64

H.I = 0.10

Add +1.6 to all Elevs. on page 70 & 71

SOUNDINGS WERE TAKEN WITH A METAL TAPE WITH A 2½ LB WEIGHT ATTACHED. WHEN LOWERED TO THE BOTTOM IT APPEARED TO SETTLE 2 to 6 INCHES IN LOOSE SAND OR SILT. THE ACTUALL SOIL ANALISIS OF THIS BOTTOM HAS NOT BEEN ASCERTAINED BUT IT HAS THESE APPEARENT PROPERTIES

MAJOR CONT SAND OF #14 – #28 MESH

MINOR " SILT – (INDETERMINABLE)

AND 10% (APPROX) MARINE LIFE SHELL NONE OF WHICH IS OVER #4 MESH.

THE POSSIBILITY OF THE EXISTANCE OF CLAYS IS A PROBIBILITY TO BE DETERMINED WITH FURTHER INVESTIGATION.

Allen Whitlock

HI = 0.10

W.S.	129+30	11.0	-10.9	Water Surface 33
	129+50	8.7	- 8.6	
	129+75	5.4	- 5.3	
Toe Berm	+90	2.9	- 2.8	
Top Berm				

Elevs. from Book 600/55

BC	147+87.40	ELEV =	1.9 ✓
148+50	Hub	"	2.4 ✓
149+00	Hub		2.7 ✓
150+00	Hub.		2.5 ✓

5.94 — 5.4
5.09 — 3.1
.85

10.9 - 1.5 = 9.3

JAN 30, 1942
WHITLOCK
BARKER.

HARBOR DRIVE LEVELS.
(NEW LOCATION) TURNS

STA	+	H.I	−	F.S	ELEV.
B.M. #1	5.38	7.78 ✓			2.40
148+50 ℄			5.4	2.4	
℄			5.5	2.3 ✓	
148+00 ℄			5.8	2.0	
℄			5.9	1.9 ✓	
147+50 ℄			5.8	2.0	
℄			5.7	2.1 ✓	
147+00 ℄			5.8	2.0	
℄			5.8	2.0 ✓	
146+50 ℄			5.6	2.2	
℄			5.6	2.2 ✓	
146+00 ℄			5.3	2.5	
℄			5.3	2.5 ✓	
145+50 ℄			5.5	2.3	
℄			5.4	2.4 ✓	
145+00 ℄			5.9	1.9	
℄			5.8	2.0 ✓	
144+50 ℄			6.4	1.4	
℄			6.1	1.7 ✓	
144+00 ℄			6.6	1.2	
℄			6.6	1.2 ✓	
T.P. #1		7.78		6.57	1.21 ✓
B.M. #2	4.77	5.98 ✓			
143+50 ℄			4.9	1.1	
℄			4.8	1.2	✓

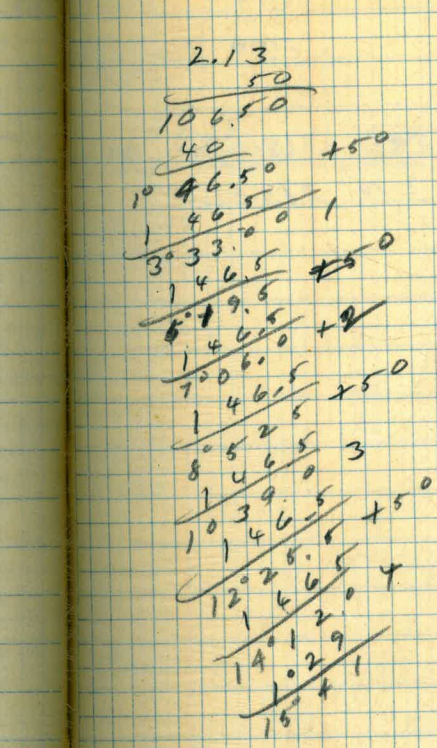
STA	+	H.I	−	TURNS F.S.
Λ #2		5.98 ✓		
143+00 ℄			4.8	1.2
℄			4.8	1.2 ✓
142+50 ℄			5.3 OK	0.7
℄			4.4	1.6 ✓
142+00 ℄			4.7	1.3
℄			4.7	1.3 ✓
141+50 ℄			4.8	1.2
℄			4.9	1.1 ✓
141+00 ℄			4.9	1.1
℄			4.8	1.2 ✓
140+50 ℄			5.1	0.9
℄			5.0	1.0 ✓
140+00 ℄			5.1	0.9
℄			5.0	1.0 ✓
139+50 ℄			5.5	0.5
℄			5.0	1.0 ✓
139+00 ℄			5.1	0.9
℄			5.2	0.8 ✓
138+50 ℄			4.8	1.2
℄			4.7	1.3 ✓
138+00 ℄			4.8	1.2
℄			4.7	1.3 ✓
137+50 ℄			5.1	0.9
℄			5.1	0.9 ✓

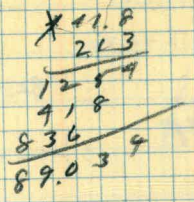
STA	+	H.I	−	F.S.	ELEV
$\Delta^{\#2}$		5.98 ✓			
137+00 ⑥			5.0	1.0 ✓	
℄			4.9	1.1	
140+00.44 = 136+41.19 ⑧			5.2	0.8	
℄			5.0	1.0 ✓	
139+50 ⑧			5.1	0.9	
℄			5.0	1.0 ✓	
139+00 ⑧			4.7	1.3	
℄			4.8	1.2 ✓	
138+50 ⑧			5.0	1.0	
℄			4.9	1.1 ✓	
137+97.6 ⑧ ℄ PT.			5.3	0.7 ✓	
℄			5.4	0.6	
T.P. #2				5.30	0.68 ✓
$\Delta^{\#3}$	7.40	8.08 ✓			
137+50 ⑧			7.5	0.6	
℄			7.4	0.7 ✓	
137+00 ⑧			7.6	0.5	
℄			7.4	0.7 ✓	
136+50 ⑧			7.4	0.7	
℄			7.5	0.6 ✓	
136+00 ⑧			7.7	0.4	
℄			7.7	0.4 ✓	
135+50 ⑧			7.6	0.5	
℄			7.7	0.4 ✓	

STA	+	H.I	−	F.S	ELEV
T #3		8:08 ✓			
135+00 Ⓑ			7.4	0.7	
℄			7.4	0.7	✓
134+50 Ⓑ			7.1	1.0	
℄			7.1	1.0	✓
134+00 Ⓑ			6.9	1.2	
℄			6.6	1.5	✓
133+50 Ⓑ			6.2	1.9	
℄			6.1	2.0	✓
133+00 Ⓑ			5.4	2.7	
℄			5.6	2.5	✓
132+50 Ⓑ			5.3	2.8	
℄			5.4	2.7	✓
131+97.2 Ⓑ E.C.			5.7	2.4	
℄			5.8	2.3	✓
131+50 Ⓑ			5.8	2.3	
℄			5.8	2.3	✓
131+00 Ⓑ			5.5	2.6	
℄			5.4	2.7	✓
130+50 Ⓑ			6.1	2.0	
℄			6.0	2.1	✓
130+05 Ⓑ TOE			6.3	1.8	
130+01 Ⓑ TOP			4.5	3.6	
℄			4.5	3.6	✓

STA	+	H I	−	F S	ELEV
Δ#3		8.08			
		CORRECT ELEV.			
T.P. USED FOR SOUNDINGS				4.18	3.90 ✓
129+93	⑧	TOP. BERM.	4.4	3.7	
℄			4.4	3.7 ✓	
129+90	⑧	BOTTOM	9.5	-1.4	
℄			9.6	-1.6 ✓	
129+75	⑧		12.0	-3.9	
℄			11.9	-3.8 ✓	
129+50	⑧		14.8	-6.7	
℄			14.7	-6.6 ✓	
129+40	⑧	WATER EDGE	17.2	-9.1 ✓	

✓ Jr Rod





4.6	323.0			318.4
7.4	323.0			315.6
4.5	323.05			318.6
7.15	323.05			315.9
		323.02		
B.M #28			3.48	319.55
840+04			3.10	319.93
800+674		334.00		
3666	801+			
801+40.6		327.33		
+20	32			
801+40.73				
801+77.40				
802+14.07				
+56.73				
+87.39				
803+24.05				
803+60.74				

140°

$\frac{T}{R}$ = Tan 20°

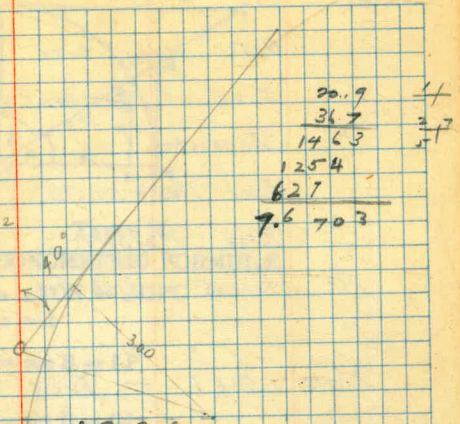
T = 300 x .364 = 109.2

for flange of 4"GV

1903

3.13.98

1.05



319.84
3.48
323.32
3.10
320.22
313.98

319.93
3.95
6.05

20.9
36.7
1463
1254
621
7.6 703

Spot Piles + get Elev.
Water level elev.
Elev of Embankment above Marsh
Sorrento
Earl Messersmith.
Eric Melhorn
Mr. Stevens - With City Engrs Office.

Main 5161 — Fred Pyle.

City B.M. El. 2.03 at Sorrento R.R. Bridge
S. end of S. wing of S. abutment
Brass Plug. 2.03

U.S. I (C.S.H.O.) above Mean Sea level
About 1.6 Miles So along the AT+SF RR
from the Sta at Del Mar, at an
overhead highway crossing 63' west of
the ℄ of the track + in line with
the 3rd bent from the N end. A Steel
pin, set in the top of a 12"x12" conc.
post; El. 42.070

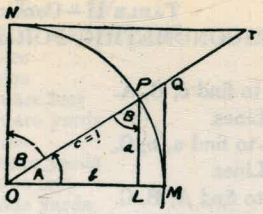


TABLE II

TRIGONOMETRIC FORMULÆ.

$\angle A = \angle MOP \qquad \angle B = \angle PON = \angle OPL$

$R = OB = c = 1$

$$\sin A = \frac{a}{c} = \frac{a}{1} = a = \cos B = LP$$

$$\cos A = \frac{b}{c} = \frac{b}{1} = b = \sin B = OL$$

$$\tan A = \frac{a}{b} = \frac{MQ}{OM} = \frac{MQ}{1} = MQ = \cot B = MQ$$

$$\cot A = \frac{NT}{ON} = \frac{NT}{1} = NT = \tan B = NT$$

$$\sec A = \frac{OQ}{OM} = \frac{OQ}{1} = OQ = \csc B = OQ$$

$$\csc A = \frac{OT}{ON} = \frac{OT}{1} = OT = \sec B = OT$$

$$\text{vers } A = \frac{LM}{OP} = LM = \text{covers } B \#$$

$$\text{covers } A = \frac{OP - LP}{OP} = OP - LP = \text{vers } B$$

$$\text{exsec } A = PQ = \text{coexsec } B$$

$$\text{coexsec } A = PT = \text{exsec } B$$

$$\sin \tfrac{1}{2} A = \sqrt{\frac{1 - \text{Cos } A}{2}} \qquad \cos \tfrac{1}{2} A = \sqrt{\frac{1 + \text{Cos } A}{2}}$$

$$\sin 2A = 2 \sin A \cos A \qquad \cos 2A = \cos^2 A - \sin^2 A$$

$$\text{Law of Lines} \quad \frac{\sin A}{a} = \frac{\sin B}{B} = \frac{\sin C'}{C}$$

$$\text{Law of Cosines} \quad c^2 = a^2 + b^2 - 2ab \cos C$$

$$\text{Law of Tangents} \quad \frac{a+b}{a-b} = \frac{\tan \tfrac{1}{2}(A+B)}{\tan \tfrac{1}{2}(A-B)}$$

Table VI (continued)

SINES, COSINES, TANGENTS, COTANGENTS (continued)

deg.	sin 0′	tan 0′	sin 10′	tan 10′	sin 20′	tan 20′	sin 30′	tan 30′	sin 40′	tan 40′	sin 50′	tan 50′	deg.
46	7193	1.0355	7214	1.0416	7234	1.0477	7254	1.0533	7274	1.0599	7294	1.0661	43
47	314	.0724	333	.0786	353	.0850	373	.0913	392	.0977	412	.1041	42
48	431	.1106	451	.1171	470	.1237	490	.1303	509	.1369	528	.1436	41
49	547	.1504	566	.1571	585	.1640	604	.1708	623	.1778	642	.1847	40
50	660	1.1918	7679	1.1988	7698	1.2059	7716	1.2131	7735	1.2203	7753	1.2276	39
51	771	.2349	790	.2423	808	.2497	826	.2572	844	.2647	862	.2723	38
52	880	.2799	898	.2876	916	.2954	934	.3032	951	.3111	969	.3190	37
53	986	.3270	8004	.3351	8021	.3452	8039	.3514	8056	.3597	8073	.3680	36
54	8090	.3764	107	.3848	124	.3934	141	.4019	158	.4106	175	.4193	35
55	192	.4281	208	.4370	225	.4460	241	.4550	258	.4641	274	.4733	34
56	290	.4826	307	.4919	323	.5013	339	.5108	355	.5204	371	.5301	33
57	387	.5399	403	.5497	418	.5597	434	.5697	450	.5798	465	.5900	32
58	480	.6003	496	.6107	511	.6212	526	.6319	542	.6426	557	.6534	31
59	572	.6643	587	.6753	601	.6864	616	.6977	631	.7090	646	.7205	30
60	660	1.7321	8675	1.7437	8689	1.7556	8704	1.7675	8718	1.7797	8732	1.7917	29
61	746	.8040	760	.8165	774	.8291	788	.8418	802	.8546	816	.8676	28
62	829	.8807	843	.8940	857	.9074	870	.9210	884	.9347	897	.9486	27
63	910	.9626	923	.9768	936	.9912	949	2.0057	962	2.0204	975	2.0353	26
64	988	2.0503	9001	2.0655	9013	2.0809	9026	.0965	9038	.1123	9051	.1283	25
65	9063	.1445	075	.1609	088	.1775	100	.1943	112	.2113	124	.2286	24
66	135	.2460	147	.2637	159	.2817	171	.2998	182	.3183	194	.3369	23
67	205	.3559	216	.3750	228	.3945	239	.4142	250	.4342	261	.4545	22
68	272	.4751	283	.4960	293	.5172	304	.5386	315	.5605	325	.5826	21
69	336	.6051	346	.6279	356	.6511	367	.6746	377	.6985	387	.7228	20
70	397	2.7475	9407	2.7725	9417	2.7980	9426	2.8239	9436	2.8502	9446	2.8770	19
71	455	.9042	465	.9319	474	.9600	483	.9887	492	3.0178	502	3.0475	18
72	511	3.0777	520	3.1084	528	3.1397	537	3.1716	546	.2041	555	.2371	17
73	563	.2709	572	.3052	580	.3402	588	.3759	596	.4124	605	.4495	16
74	613	.4874	621	.5261	628	.5656	636	.6059	644	.6470	652	.6891	15
75	659	.7321	667	.7760	674	.8208	681	.8657	689	.9136	696	.9617	14
76	703	4.0108	710	4.0611	717	4.1126	724	4.1653	730	4.2193	737	4.2747	13
77	744	.3315	750	.3897	757	.4494	763	.5107	769	.5736	775	.6382	12
78	781	.7046	787	.7729	793	.8430	799	.9152	805	.9894	811	5.0658	11
79	816	.1446	822	5.2257	827	5.3093	833	5.3955	838	5.4845	843	.5764	10
80	9848	5.6713	9853	5.7694	9858	5.8708	9863	5.9758	9868	6.0844	9872	6.1970	9
81	877	6.3138	881	6 4348	886	6.5606	890	6.6912	894	.8269	899	.9682	8
82	903	7.1154	907	7.2687	911	7.4287	914	7.5958	918	7.7704	922	7.9530	7
83	925	8.1443	929	8.3450	932	8.5555	936	8.7769	939	9.0098	942	9.2553	6
84	945	9.5144	948	9.7882	951	10.078	954	10.385	957	10.711	959	11.059	5
85	962	11.430	964	11.826	967	12.250	969	12.706	971	13.197	974	13.727	4
86	976	14.300	978	14.924	980	15.605	981	16.350	983	17.169	985	18.075	3
87	986	19.081	988	20.206	989	21.470	990	22.903	992	24.542	993	26.432	2
88	994	28.636	9995	31.242	9996	34.368	997	38.189	997	42 964	9998	49.104	1
89	9998	57.290	9999	68.750	9999	85.940	9999	114.58	1.000	171.88	1.000	343.77	0
deg.	60′ cos	60′ cot	50′ cos	50′ cot	40′ cos	40′ cot	30′ cos	30′ cot	20′ cos	20′ cot	10′ cos	10′ cot	deg.

TABLE VII

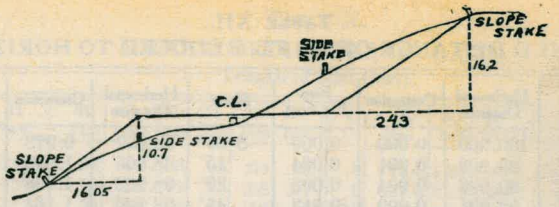
RODS IN FEET, 10THS AND 100THS OF FEET

Rods	Feet	Rods	Feet	Rods	Feet	Rods	Feet	Rods	Feet
1	16.50	21	346.50	41	676.50	61	1006.50	81	1336.50
2	33.00	22	363.00	42	693.00	62	1023.00	82	1353.00
3	49.50	23	379.50	43	709.50	63	1039.50	83	1369.50
4	66.00	24	396.00	44	726.00	64	1056.00	84	1386.00
5	82.50	25	412.50	45	742.50	65	1072.50	85	1402.50
6	99.00	26	429.00	46	759.00	66	1089.00	86	1419.00
7	115.50	27	445.50	47	775.50	67	1105.50	87	1435.50
8	132.00	28	462.00	48	792.00	68	1122.00	88	1452.00
9	148.50	29	478.50	49	808.50	69	1138.50	89	1468.50
10	165.00	30	495.00	50	825.00	70	1155.00	90	1485.00
11	181.50	31	511.50	51	841.50	71	1171.50	91	1501.50
12	198.00	32	528.00	52	858.00	72	1188.00	92	1518.00
13	214.50	33	544.50	53	874.50	73	1204.50	93	1534.50
14	231.00	34	561.00	54	891.00	74	1221.00	94	1551.00
15	247.50	35	577.50	55	907.50	75	1237.50	95	1567.50
16	264.00	36	594.00	56	924.00	76	1254.00	96	1584.00
17	280.50	37	610.50	57	940.50	77	1270.50	97	1600.50
18	297.00	38	627.00	58	957.00	78	1287.00	98	1617.00
19	313.50	39	643.50	59	973.50	79	1303.50	99	1633.50
20	330.00	40	660.00	60	990.00	80	1320.00	100	1650.00

TABLE VIII

LINKS IN FEET, 10THS AND 100THS OF FEET

Links	Feet	Links	Feet	Links	Feet	Links	Feet	Links	Feet	Links	Feet
1	0.66	18	11.88	35	23.10	52	34.32	69	45.54	86	56.76
2	1.32	19	12.54	36	23.76	53	34.98	70	46.20	87	57.42
3	1.98	20	13.20	37	24.42	54	35.64	71	46.86	88	58.08
4	2.64	21	13.86	38	25.08	55	36.30	72	47.52	89	58.74
5	3.30	22	14.52	39	25.74	56	36.96	73	48.18	90	59.40
6	3.96	23	15.18	40	26.40	57	37.62	74	48.84	91	60.06
7	4.62	24	15.84	41	27.06	58	38.28	75	49.50	92	60.72
8	5.28	25	16.50	42	27.72	59	38.94	76	50.16	93	61.38
9	5.94	26	17.16	43	28.38	60	39.60	77	50.82	94	62.04
10	6.60	27	17.82	44	29.04	61	40.26	78	51.48	95	62.70
11	7.26	28	18.48	45	29.70	62	40.92	79	52.14	96	63.36
12	7.92	29	19.14	46	30.36	63	41.58	80	52.80	97	64.02
13	8.58	30	19.80	47	31.02	64	42.24	81	53.46	98	64.68
14	9.24	31	20.46	48	31.68	65	42.90	82	54.12	99	65.34
15	9.90	32	21.12	49	32.34	66	43.56	83	54.78	100	66.00
16	10.56	33	21.78	50	33.00	67	44.22	84	55.44	101	66.66
17	11.22	34	22.44	51	33.66	68	44.88	85	56.10	102	67.32



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.

847+85 25

847+83 25

.192
19
.384
45
3825
1
3836
2920
6755
685
13605
1357.0
1358

831+82.85
4.4
831+86.75 ℄

908.52
899.0 ℄
129°40

168
87
255
355
639
418.9

Defense Public Works

9.18
back from 200
937.28
156-14-40

89 25 15
2 | 178 50 30
3.45

900
93
807

.5410521 1° 30
.0119264
.5529785
807
.5570849
15° (41)
387084958
44238280
44625364

15
60
900
41
941

2.109
50
105450
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2.108
446.254 | 941000
892508
485920
446254
3866600
3570032
2965680

1.4
1.41 50
70.50
1°20 1/2

.5410521
0063995
5474516
807
3832161 2
43796128
439.603 3

4.12
801+88.2
2.78
801+95.1
5474516
807
3832161 2
43796128
441.79

2.122
2.149
19
21 13
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23
8
810
800
2.141
2.1
18.9

4418

8°30'
112.3
800
1123
687.7

.01396
129°40'
.01396
1335
9980
4188
4188
1396
18.66660

900
2141 50
107.050
62
1°47'

687.4
96 268
103+14.2

817+51 60

2.143 50
107150
1°47'

1335
467
868

18.66
.467
13062
11196
7464
1335 | 18714.22 | 6.52
8010
7042
6675
3672

3.84

Euclid
Balance

2.142
43966 | 9410
8782
6280
5396
8840
17584
12560
8792
3768

18.66
275
9330
13062
3732
5131.50 | 3.84
4005
11265
10680
5850