INDEX

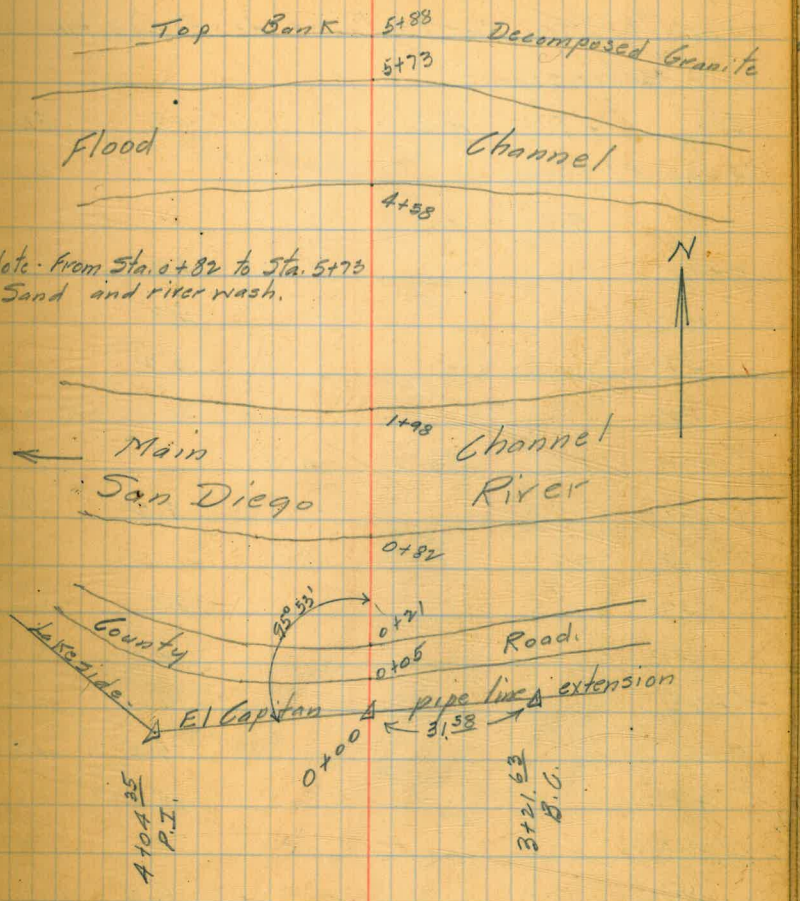
INDEX (cont.)

Index (Contd).

Cross Section of San Diego River at proposed site of pumping plant and sump opposite Sta. 3+53 Lakeside-El Capitan pipe line extension.

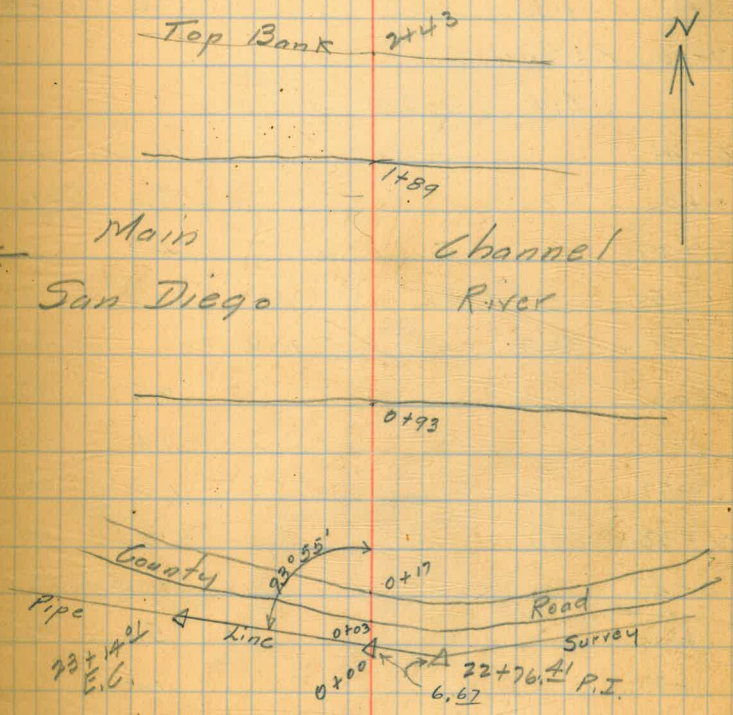
Sta.	+S	H.I	-S.	Elev.
3+00 P.L. Survey				100.0
	5.00	105.00		
0+00			4.7	100.3
+05			8.9	96.1
+21			8.8	96.2
T.P.	0.2	93.1	12.1	92.9
+61			5.7	87.4
+82			15.3	77.8
1+33			16.5	76.6
+60			15.3	77.8
+98			14.4	78.7
2+44			9.9	83.2
3+00			6.7	86.4
+15			4.7	88.4
4+00			2.7	90.4
T.P.	5.2	95.8	2.5	90.6
+55			5.8	90.0
+58			8.2	87.6
+80			8.6	87.2
5+73			6.7	89.1
+88			0.5	95.3

9/28/31
Converse
Remmen
Mattoon



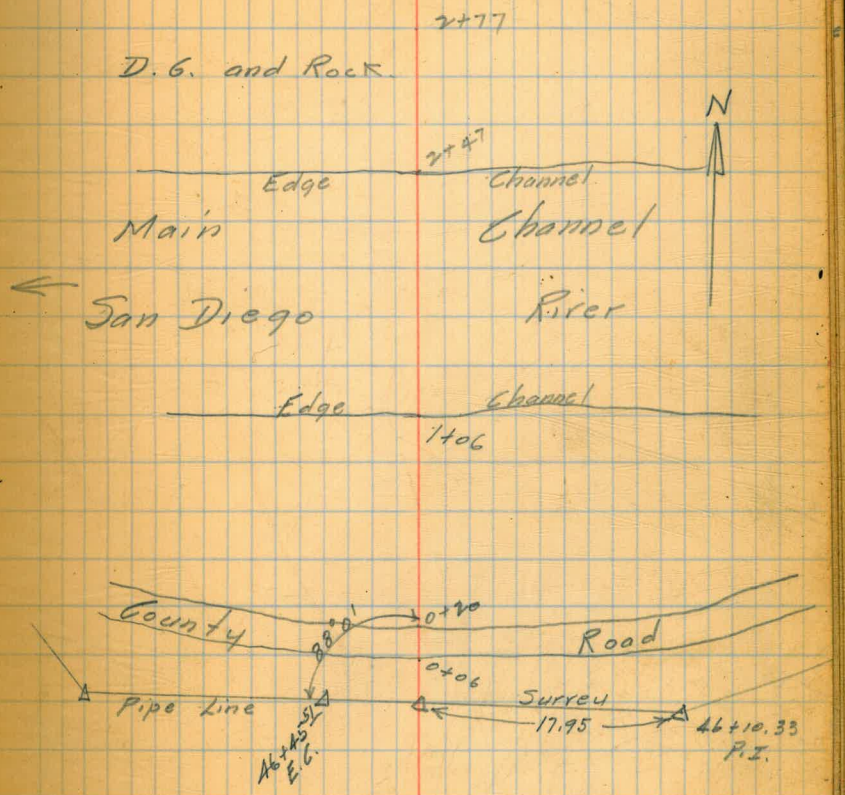
Cross Section of San Diego River at proposed site of pumping plant and sump, opposite Sta: 22+83 Lakeside-El Capitan pipe line extension

Sta.	+S	H.I.		-S.	Elev.
24+00	P.I. Survey				100.0
	9.1	109.1			
0+00				4.9	104.2
+02				5.8	103.3
+17				5.2	103.9
+78				10.0	99.1
T.P.	1.0	98.3	11.8		97.3
+68				9.2	89.1 ~~79.1~~
T.P.	4.1	84.7 ~~83.7~~	8.7		89.6 ~~79.6~~
+78				8.9	84.8 ~~74.8~~
+93				12.8	80.9 ~~70.9~~
1+25				15.0	78.7 ~~68.7~~
+66				15.5	78.2 ~~68.2~~
+89				15.0	78.7 ~~68.7~~
2+03				9.0	84.7 ~~74.7~~
+20				5.5	88.2 ~~78.2~~
+28				7.9	85.8 ~~75.8~~
+43				3.0	90.7 ~~80.7~~



Cross Section of San Diego River at proposed site of pumping plant and sump opposite Sta. 46+78 Lakeside - El Capitan pipe line extension.

Sta.	+S.	H.I.		-S.	Elev.
47+00	P.L. Survey				100.0
	5.4	105.4			
0-41				0.5	104.9
0+00				5.0	100.4
0+27				4.7	100.7
+59				10.7	94.7
T.P.	7.9	101.8	11.5		93.9
1+00				8.5	93.3
+06				11.4	90.4
+77				11.5	90.3
2+33				12.1	89.7
+47				11.4	90.4
+64				5.6	96.2
+77				0.0	101.8



Alternate Line from Sta. 132+87.09
to Sta. 169+36.47 - West End El Monte Park
Lakeside-El Capitan pipe line extension
(Level notes on pages 13-15)

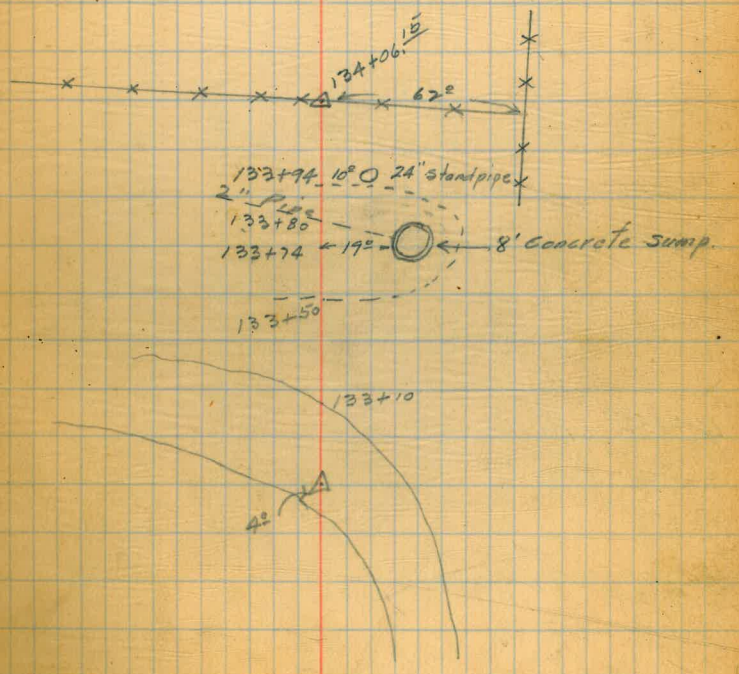
	Angle	Mag. Bearing	
140+67.03	P.O.T.		
		S. 39° W	S. 39° 09' W
134+06.15	Δ 1° 17' L		660.88
		S. 40° 27' W	
= 132+87.09	P.O.T. Alternate		
132+87.09	P.I. Location		119.06
		S. 40° 27' W	
171+39.97	Δ		

(See Book #326. Page 38.)

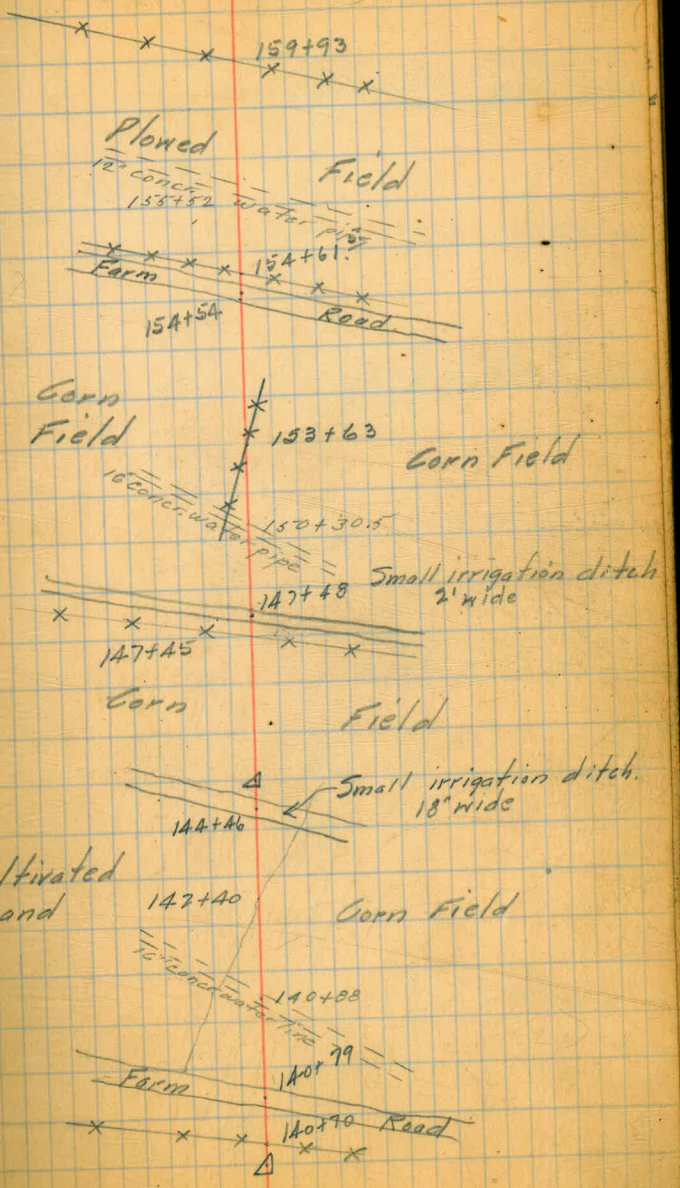
9/29/31
Converse
Remmen
Mattoon
Clear & Cool.

(7)

Farm Land
Not in Cultivation



Angle	Mag	Bearing
144+52.0	P.O.T.	
		S.34°09'W
140+67.03		384.97



Angle Mag Bearing

169+36.47 = Origional Line - Ahead
164+36.90 = Alternate Line - Back

S. 52° 43' W

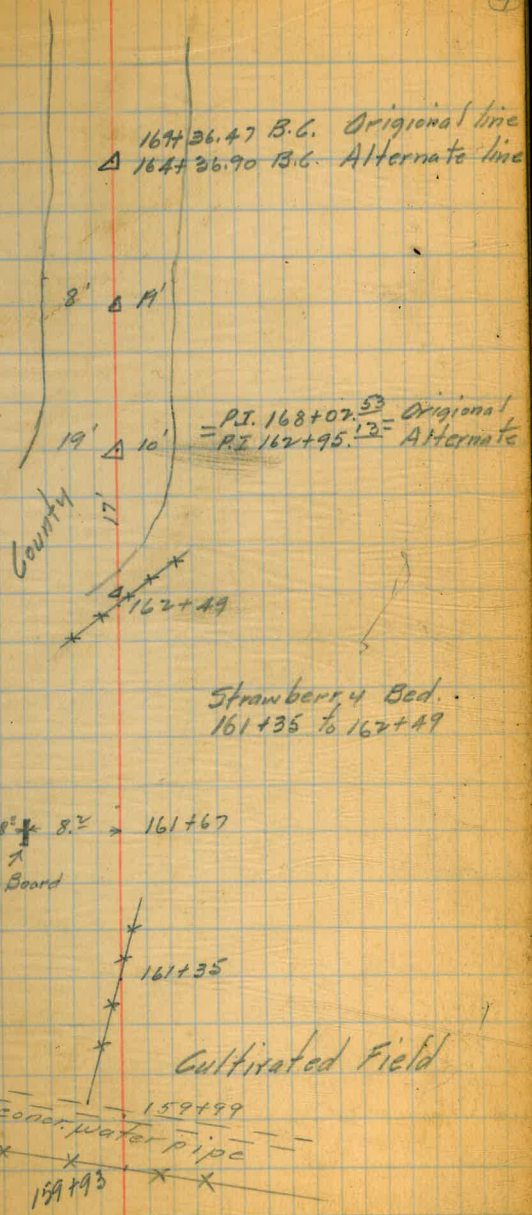
163+37.19 E.C.

Δ = 13° 34'
D = 16°
R = 359.26
T = 42.73
L = 84.79

162+95.13 Δ 13° 34' R

162+52.40 Δ B.C.

164+36.47 B.C. Origional line
Δ 164+36.90 B.C. Alternate line



Lakeside - El Capitan pipe line extension
Alternate line from Sta. 147+12.35 P.O.T.
on 1st Alternate Line to Sta 167+19.43
on origional location line
(Level notes on pages 16-17)

S. 29°30'W S. 29°50'W.

147+89.99 E.C.

Δ = 9°19'
D = 12°
R = 478.34
T = 38.98
L = 77.64

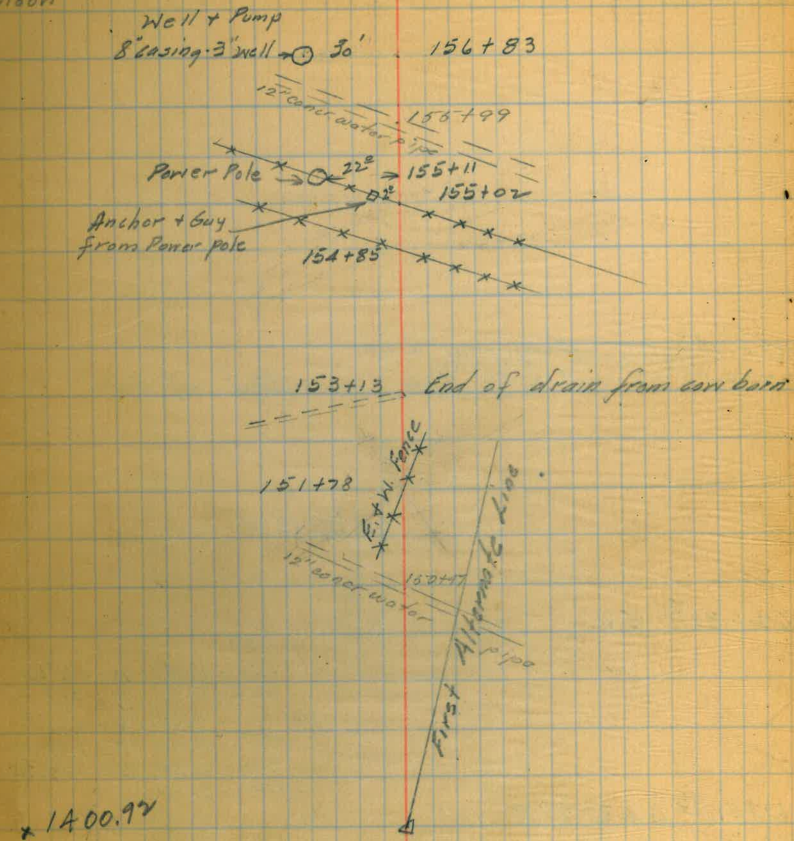
147+51.33 P.I. 9°19' L
147+51.33 P.O.T.

147+12.35 B.C.

S. 39°09'W

144+52.0 P.O.T.

9/30/31
Converse
Remmen
Mattoon



Δ = 147+12.35 B.C. = 2nd Alternate
147+12.35 P.O.T. 1st Alternate

P.I. 161+51.93

160+69 - 12' R.

62-55

117-50

177-50

169+19.43 = B.C. Origional Line
163+20.67 = Alt. #2. Line End of Line

Equation 167+19.43 Origional
163+20.67 Alt. #2.

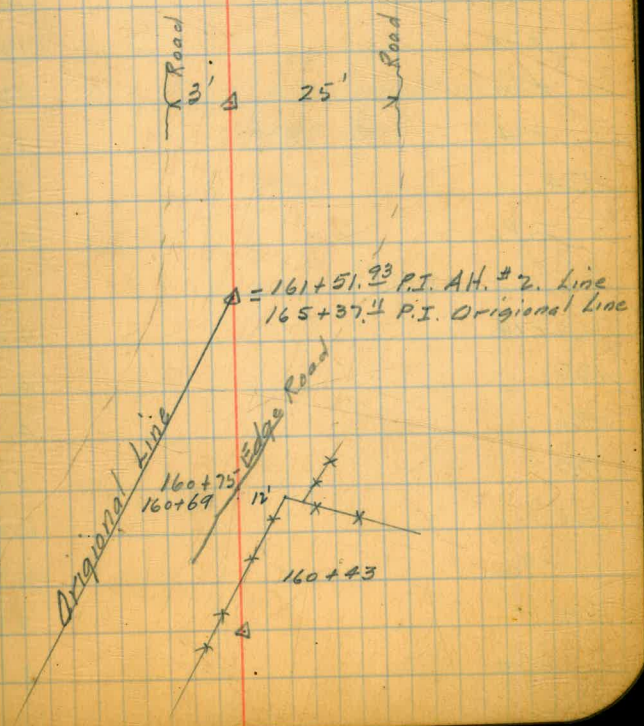
N. 86-15 W

162+38.50 E.C.

161+51.93 Δ 63° 55' R

160+38.26
+50 - 1°48' Δ = 63°55'
+75 - 5-48 D = 32°
161 - 9-48 R = 181.4
+25 - 13-48 T = 113.17
+50 - 17-48 L = 199.74
+75 - 21-48
162 - 25-48
+25 - 29-48
+38.5 - 31-57½

160+38.76 B.C.



Profile Levels on Alternate Line

from Sta. 132+87.09 to Sta: 169+36.47

(Transit notes P. 7-9 this book)

9/29/31

Converse
Remmen
Mattoon

B.M. #14			503.62	From Back 3.16 (HH)
	3.21	506.83		
132+23.37			5.0	501.8
+65			5.0	01.8
+75			6.7	00.1
132+87.09			6.7	00.6
133.			5.4	01.4
+15			5.5	01.3
+50			4.6	02.2
+71			13.4	493.4
+80			7.0	499.8
+94			4.7	02.1
134			3.9	0.29
T.P.			4.17	502.66
	3.50	506.16		
+15			4.0	02.2
135			4.3	01.9
136			4.9	01.3
137			5.1	01.1
138			6.2	500.0
+90			6.3	499.9
139			7.3	98.9
+20			8.7	97.5

Road

Not for profile. Top 2" pipe above ground in large hole.

		506.16			
140			9.7	497.0	
T.P.			9.78	496.88	Peg At Sta. Stake 140
	7.58	504.46			
140+88				494.95	Top of 16" concr. water line
141			7.0	97.5	
142			8.1	96.4	
+ 50			8.5	96.0	
143			5.4	99.1	
144			5.7	98.8	
+57			5.5	99.0	
145			6.2	98.3	
146			6.8	97.7	
T.P.			6.77	497.71	Peg at Sta. Stake 146
	3.44	501.15			
147			3.6	97.6	
148			4.4	96.8	
149			5.4	95.8	
150			5.9	95.3	
150+30.5				494.2	Top of 16" concr. water pipe
151			5.7	95.5	
152			6.3	94.9	
T.P.			6.34	494.84	Peg 2' R. Sta. Stake 152
	4.66	499.50			
153			5.1	94.4	
154			5.4	94.1	
155			6.1	93.4	
155+52				491.9	Top 12" concr. water pipe
156			6.5	93.0	

		499.50		
157			6.7	492.8	
158			7.2	92.3	Peg at Sta. Stake 158.
T.P.			6.96	492.54	
	5.10	497.64			
159			5.4	492.2	
159+99			490.7		Top 16" concr. water pipe
160			5.9	91.7	
161			6.0	91.6	
			5.95	491.69	Top concrete wall around well 18'L. Sta. 161+67
162			6.5	91.1	
+45			6.2	91.4	
+52±			3.0	94.6	B.C.
T.P.			0.56	497.08	Near 162+60
	11.04	508.12			
+80			2.3	505.8	Edge of County road - Top.
163			2.5	05.6	
+37.19	E.C.		3.3	04.8	In County Highway
+50			3.5	04.6	
164			4.6	03.5	
+36.90	End of Alternate Line		4.8	03.3	= Sta. 169+36.47 Origional Line.

Profile Levels.

2nd. Alternate Line from Sta. 147+12.35
1st. Alt. Line to Sta. 167+19.43 Origional line.
(Transit notes on Pages 11-12)

Sept. 30. 1931
Converse
Remmen
Mattoon

T.P.			497.14	Peg at Sta. 146 on 1st. Alt. Line.
	4.89	502.63		
147+12.35	B.C.		5.4 497.2	Start of 2nd. Alt. Line
+50			5.2 97.4	
147+89.99	E.C.		5.9 96.7	
148			5.9 96.7	
149			6.7 95.9	
150			7.2 95.4	
150+17			494.1	Top of 16" water pipe.
T.P.			7.28 95.35	
	5.10	500.75		
151			5.0 95.8	
152			5.3 95.2	
153			5.4 95.1	
153+12			493.9	Top 12" concr. sewer pipe.
154			6.2 94.3	
155			5.7 94.8	
155+99				Top 12" concr. water pipe
156			6.1 94.4	
T.P.			5.84 494.61	
	11.06	505.67		
157			11.8 493.9	
158			12.2 93.5	
159			12.5 93.2	
160			12.2 93.5	
+38.76	B.C.		11.0 94.7	
+50			10.8 94.9	

		506.67		
	+75	9.5	496.2	Top Bank - edge County Highway B.M. #17 0.86
161		8.8	96.9	
	+25	8.1	97.6	
	+50	7.6	98.1	
	+75	7.4	98.3	
162		6.9	98.8	
	+25	6.3	99.4	
	$+38\frac{50}{}$ E.C.	5.5	500.2	
163		2.3	03.4	
	$+20\frac{67}{}$ End of Line	1.6	04.1	
	T.P.	8.59	497.08	Peg on 1st. Alt. Line near Sta. 162+60
	B.M #17	0.86	504.81	Elev. 504.89

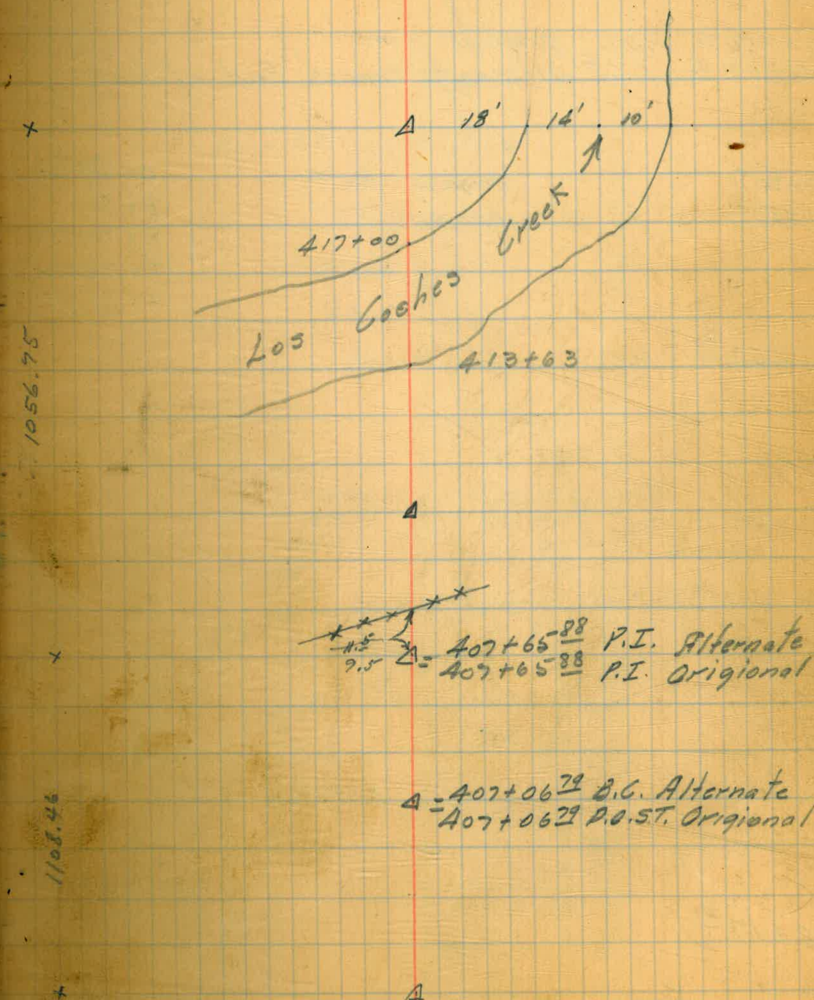
Lakeside - El Capitan pipe line extension.
Alternate Line from Sta. 407+06.79 to Sta. 423+56.07

Station		Mag. B.	Bearing	
		N.60°20'W	N.59°43½'W	
418+17.21	Δ 3°55½' R			
		N.63°W	N.63°39'W	
408+19.55	E.C.			
				Δ = 36°05' D = 32° R = 181.40 T = 59.09 L = 112.76
407+65.88	Δ 36°05' R.			
407+06.79	B.C.			
			S.80°16'W	
396+57.42				

See Book #326. Page 76.

Sept. 30. 1931.
Converse
Remmen
Mattoon

7 51
3°55-30
1 51



S.80°23½'W

See Book #376. Page 79.

423+56.07 P.O.T. Original Line
422+08.84 E.C. = Alternate Line End of Line

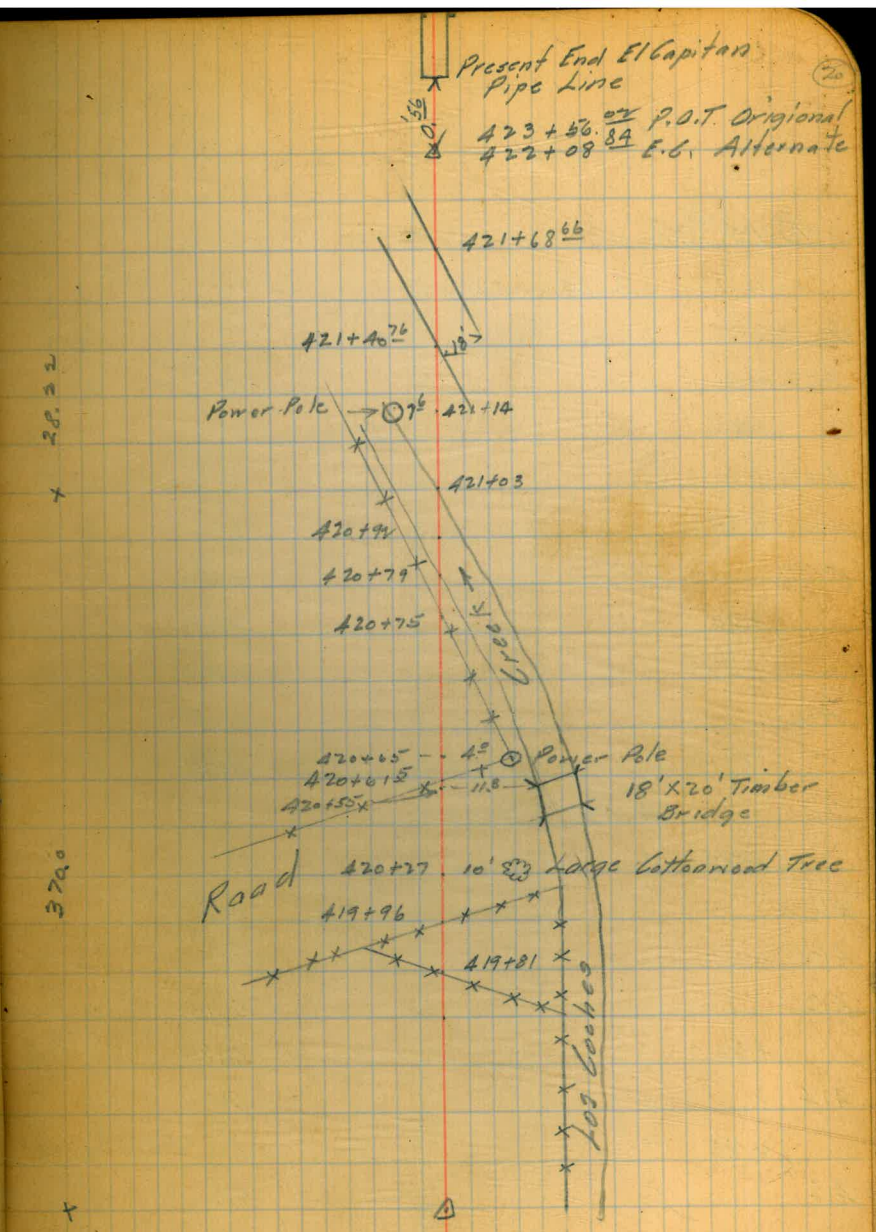
423+27.80 Original P.O.T.
421+87.21 Δ 39°53' L. Alternate P.I. =

Δ = 39°53'
D = 80°
R = 77.786
T = 28.22
L = 49.85

421+58.99 B.C.

N.59°43½'W

418+17.21



Lakeside-El Capitan pipe line extension

Profile Levels on Alternate Line Starting at Sta. 407+06.79

(Transit notes on pages 19-20)

Oct. 1. 1931
Converse
Remmen
Mattoon

B.M. #38			416.89		
	2.14	419.03			
407+06.79			0.9	418.1	Start of Line
407+66			2.6	16.4	In County Road
+76			2.8	16.2	← Edge
408			4.7	14.3	
+20			6.0	13.0	
409			10.9	08.1	
+70			11.3	07.7	
+85			12.0	07.0	
410			11.3	07.7	
T.P.			11.76	407.77	Peg at Sta. Stake +410.
	4.37	412.09			
+75			3.9	08.2	
411			4.0	08.1	
412			4.5	07.6	
413			5.1	07.0	
+30			4.8	07.3	
414			5.8	06.3	
+75			6.0	06.1	
415			7.6	04.5	
+10			7.9	04.2	
+40			6.1	06.0	
+63			6.9	06.2	Top Bank

		412.09		
	+70		7.1	405.0
416			7.6	04.5
	T.P.		7.57	404.52
		5.81	410.33	
	+90		6.3	404.0
417			6.1	04.2
	+11		5.7	04.6
	+50		5.6	04.7
	+85		4.9	05.4
418			4.9	05.4
	+17.21		5.2	05.1
419			5.2	05.1
		Not for profile	8.7	01.6
	+35		5.4	04.9
	+85		5.0	05.3
420			6.3	04.0
	+05		5.8	04.5
	+10		6.8	03.5
	+20		6.1	04.2
	+38		6.1	04.2
	+55		6.9	03.4
	+79		7.0	01.3
	+94		10.3	400.0
421			8.2	402.1
	T.P.		6.87	403.46

Peg at Sta. stake 416
Los Coches Creek. Flat, sandy wash at this point

P.I.

Bottom Los Coches creek 30' R. 419

Bottom small cross drain ditch

F. N. 75. Road

Bottom Los Coches Creek

Peg at 421+03

			103.46	
	3.77	107.23		
421	+20		3.7	103.5
	+77		4.9	02.3
	+41		5.0	02.2
	+59		4.9	02.3
	+77 ±		5.0	02.2
422			5.4	01.8
	+08 84	E.C. End of Line	5.8	01.4
	B.M.		7.17	100.11

So. Edge Pavement

B.C.

No. Edge Pavement

= 423+56 07 P.O.T. on Original Line

County B.M. # 21. Elev. 100.22

La Keside - El Capitan pipe line extension
Cross-Sections for Yardage Estimates

Oct. 1, 1931
Converse
Remmen
Mattoon

Sta.	Elev.	L.		C.	R.		
102+00		16.6		17.0	15.7		15.0
		+0.6 / 6.0			-0.3 / 2.0		-1.0 / 15.0 ✓
101+75		21.5	19.0	17.0	15.5		
		+5.5 / 10.0	+3.0 / 5.0		-0.5 / 10.0		✓
101+67	From 101+75	22.2	18.3	16.5	15.6		15.7
		+6.7 / 10.0	+2.3 / 1.0	+0.5 / 0.0	-0.4 / 3.0	-0.6 / 10.0	✓
101+50		22.8	19.3	17.4	16.4	15.6	15.3 15.6
		+4.7 / 10.0	+0.7 / 2.0		-0.7 / 1.0	-3.0 / 3.0	-3.3 / 6.0 -3.0 / 10.0 ✓
101+40	From 101+75		22.3	18.7	17.0	15.6	15.6
			+4.7 / 10.0	+1.1 / 0.0	-0.6 / 3.0	-2.0 / 7.0	-2.0 / 10.0 ✓
101+15			20.3	17.6	16.1		16.0
			+2.9 / 10.0		-1.5 / 6.0		-1.6 / 10.0 ✓
101		17.1	17.5	17.2	17.1	16.3	16.5
		+1.9 / 10.0	+0.3 / 4.0		-0.1 / 4.0	-0.9 / 5.0	-0.7 / 10.0 ✓

100+50	From 101+00
100 +15	From 100+00
100	
99+90.	From 100+00
99 +66	From 100+00
99 +35	From 99+00
99+00	
98+80	From 99+00

21.6	18.7	17.7	17.4	15.6	15.7	
+4.4	+1.5	+0.5	+0.7	-1.6	-1.5	✓
10.0	3.0	0	1.0	3.0	10.0	
24.5	18.9	18.3	15.1	13.3		
+5.6	-0.6	-3.5	-3.6			✓
10.0	2.0	5.0	10.0			
24.9	18.9	15.2	13.2			
+6.0	-3.7	-3.7				✓
10.0	5	10.0				
28.0	21.0	19.6	19.2	15.8	13.2	
+6.1	-2.1	+0.7	+0.3	-3.4	-3.7	✓
10	3	0	1	3	10.0	
21.7	19.8	18.0	16.1	13.2	13.4	
+2.8	+0.9	-0.9	-2.5	-3.7	-3.5	✓
10.0	5	0	3	4.0	10.0	
19.5	17.0	16.4	16.0	16.4		
+2.0	-0.5	-1.1	-1.5	-1.1		✓
10	3	0	4	10		
21.7	19.0	17.8	16.8	17.0		
+4.2	+1.5		-0.7	-0.5		✓
10	3		4	10		
20.6	18.8	17.8	17.1	17.3		
+3.0	1.3	0.5	-0.4	-0.2		✓
10	4	0	5	10		

Station	Remarks								
98+50	From 99+00	21.3 +3.8/10	19.0 +1.5/2	5188 +1.3/00	18.1 +0.6/5	18.3 +0.8/10			✓
98+00		23.0 +1.4/10	22.0 +0.4/6	5216	21.7 -0.2/5	20.5 -1.1/6	20.6 -1.0/10		✓
97+50	From 97+00		25.6 +1.2/10	5251 +0.1/00	24.9 +0.5/3	23.5 -0.9/4	23.9 -0.5/10		✓
97+00			25.1 +0.7/10	5249	23.5 -0.9/3		23.4 -1.0/10		✓
96+62	From 97+00		24.4 0.0/10	5233 -1.1/00	22.8 -1.6/10				✓
96+42	From Hub 96+22.30 3.8	27.1 +1.0/10	24.6 -1.5/3	5239 -2.2	22.8 -3.3/10				✓
96+22[30]		28.2 +2.1/10	27.7 +1.6/7	5261	25.6 -0.5/6	23.7 -2.4/10	23.0 -3.1/14		✓
95+94			28.5 +0.9/10	5276	27.4 -0.2/2	26.1 -1.5/6	24.8 -2.8/8	25.1 -2.5/12	✓

95+65

+1.7 (10) +0.7 (6) 528.0 −1.1 (5) −1.1 (10) ✓

95 +45 From 95+00

25.1 −0.7 (10) −1.0 (00) 527.8 24.7 −1.1 (10) ✓

95 +28 From 95+00

27.2 +1.4 (10) 26.2 +0.4 (3) −0.6 (00) 25.2 −0.5 (10) ✓

95+00

26.9 +1.1 (10) 525.8 0.0 (10) ✓

94 +56 From 95+00

30.6 +4.8 (10) 530.1 +4.3 (00) 30.0 +4.2 (2) +3.5 (6) 29.3 +3.3 (10) 29.1 ✓

94 +27.41 E.C.

28.2 +1.2 (10) 28.2 +1.2 (2) 527.0 −0.2 (12) ✓

94 + 10 From 93+89

29.3 +1.2 (10) −0.2 (00) 527.4 25.9 −2.2 (14) ✓

93+89

28.7 +0.6 (10) 528.1 27.5 −0.6 (3) 24.1 −2.7 (5) 23.1 −3.0 (14) ✓

			528.1						
93+69	From 93+89	(26.9) −1.2/10	(26.6) −1.5/4	(525.2) −2.9/00	(23.7) −4.4/7	(23.6) −4.5/13			✓
93 +43		+4.2/10	+1.5/3	522.3	−0.7/5	−0.7/12			✓
93 +25		(25.9) +3.8/10	(23.1) +1.0/3	522.1	(22.0) −0.1/1	(20.3) −1.8/3	(20.4) −1.7/11		✓
93 +00		(26.3) +5.0/10	(24.0) +2.7/7	521.3	(20.6) −0.7/3	(18.5) −2.8/6	(18.6) −2.7/12		✓
92 +75		(26.6) +5.4/10	(22.5) +1.3/3	521.2	(19.3) −1.9/5	(18.1) −3.1/6	(18.0) −3.2/19	(15.4) −5.8/24	✓
92 +50		(26.2) +5.6/10	(22.2) +1.6/5	520.6	(17.6) −3.0/5	(17.6) −3.0/17	(15.6) −5.0/24		✓
92 +22		(25.6) +5.5/10	(21.9) +1.8/2	520.1	(17.8) −2.3/3	(17.6) −2.5/16	(15.2) −4.9/20		✓
91 +92			(26.6) +6.0/10	520.6	(17.4) −3.2/5	(17.5) −3.1/14	(14.0) −6.6/18		✓

91 +63

91 +44

91 +18

90 +92

90 +75 From 90+92

90 +50 From 90+00

90 +00

89 +68

29.2 245 522.5 21.4 18.0 18.3 13.8
+6.7/10 +2.0/4 -1.1/2 -4.5/5 -4.2/17 -8.7/21 ✓

30.6 26.5 524.3 23.0 18.5 19.3 14.2
+6.3/10 +2.2/3 -1.3/2 -5.8/6 -5.0/19 -10.1/23 ✓

34.1 527.1 25.6 19.8 20.1 14.8
+7.0/10 -1.5/4 -7.3/7 -7.0/18 -12.3/23 ✓

35.2 30.6 527.2 20.9 21.0 15.8
+8.0/10 +3.6/4 -6.3/5 -6.7/17 -11.4/23 ✓

34.6 31.3 528.2 21.3 20.1 20.3 16.1
+7.4/10 +4.1/5 +1.0/00 -5.9/1 -6.8/4 -6.7/17 -11.1/22 ✓

+4.3/10 -0.3/5 -5.2 -5.4/14 -9.0/19

+9.7/10 +8.0/7 +7.3/5 -0.3/15 -4.6/21

46.1 43.5 530.4 39.7 31.1 31.0 29.0
+7.7/10 +3.1/5 -1.7/3 -9.0/7 -9.4/19 -11.4/23 ✓

Station	Remarks	Cross-section	
89 +57	From 89+68	+7.3/10 · +3.9/5 · +1.9/00 · +1.3/1.0 · -8.5/7 · -8.5/19 · -12.2/24	✓
89+00		+7.0/10 · +3.6/3 · -5.0/3 · -4.9/16 · -9.1/22	✓
88 +80	From 89+00	+9.0/10 · +3.4/2.5 · -1.2/00 · -2.3/3 · -2.8/6 · -2.7/17 · -8.0/26	✓
88 +50	not plotted	+6.0/10 · +3.3/4.0 · -0.6/1 · -6.4/5 · -6.5/19 · -11.4/25	
88 +25	From 88+00	0.0/10 · -4.1/3 · -4.3/1.0 · -7.7/00 · -11.0/2 · -14.2/6 · -13.5/20 · -18.8/26	✓
88 +20	From 88+0.0	+1.2/10 · -3.1/2 · -4.1/00 · -10.0/3 · -13.5/6 · -13.2/21 · -19.5/27	✓
88 +00		+6.0/15 · +4.0/7.0 · +2.3/3.5 · -2.7/4 · -11.3/8 · -11.0/20 · -16.0/25	✓
+75	not plotted	+6.8/15 · +5.0/12 · +2.8/7 · -1.5/2.5 · -8.0/5 · -12/8 · -11.5/23 · -16.5/29	

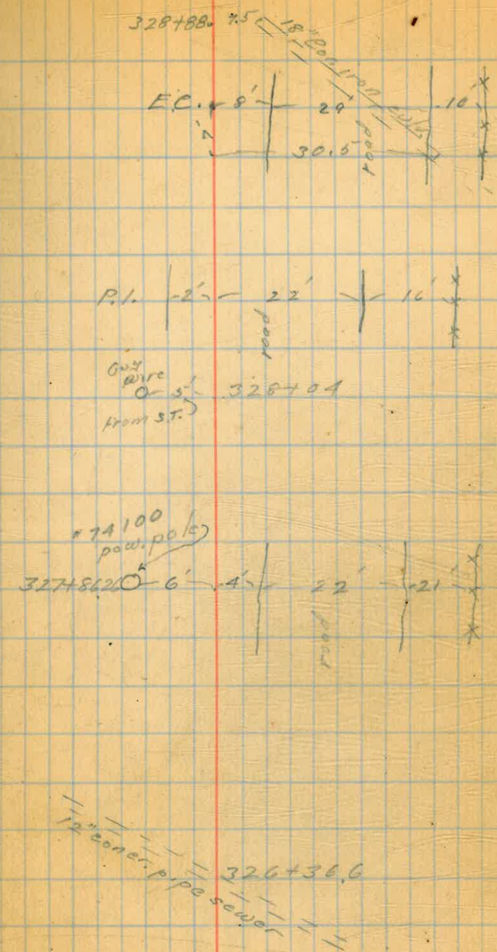
Line change from sta. 326+15.92 to sta. 354+50.70.

Sta.	Angle	Mag. B	Calc. B.		
		S24°W	S24°00'W		
328+74.56	E.C.				
				Δ 17°56'L	533.22
				D.24°	
328+37.79	55°52'30" 17°56'L			T 37.95	×
				L 74.72	
				R.240.49	
327+99.84	B.C.				51.53
		S 40° W	S41°56'W		
327+86.26	10°00' 5°00'L				+
					170.34
		S.46° W	S46-56W		
326+15.92	1°00' 0°30'L				×
			S47-26W		

Converse
Hill
Simpson
Remmen

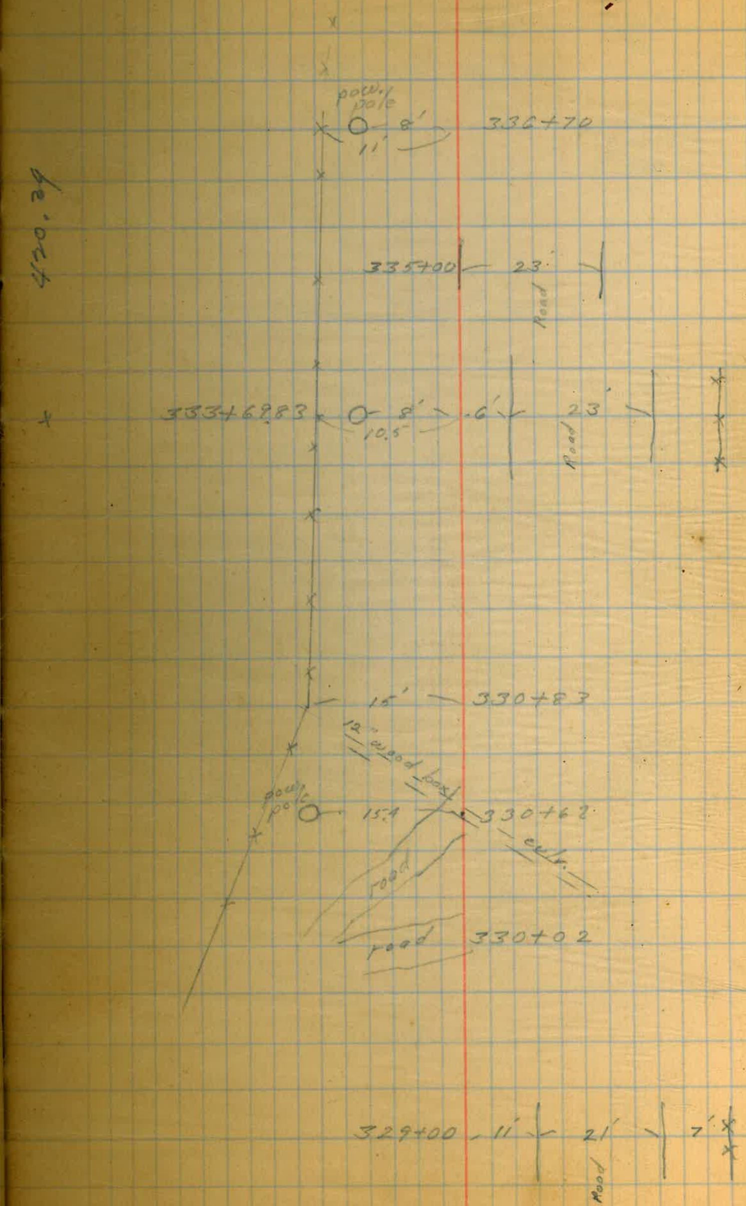
10/9/31 Part cloudy - cool

Continued from Book #326. Page 70.

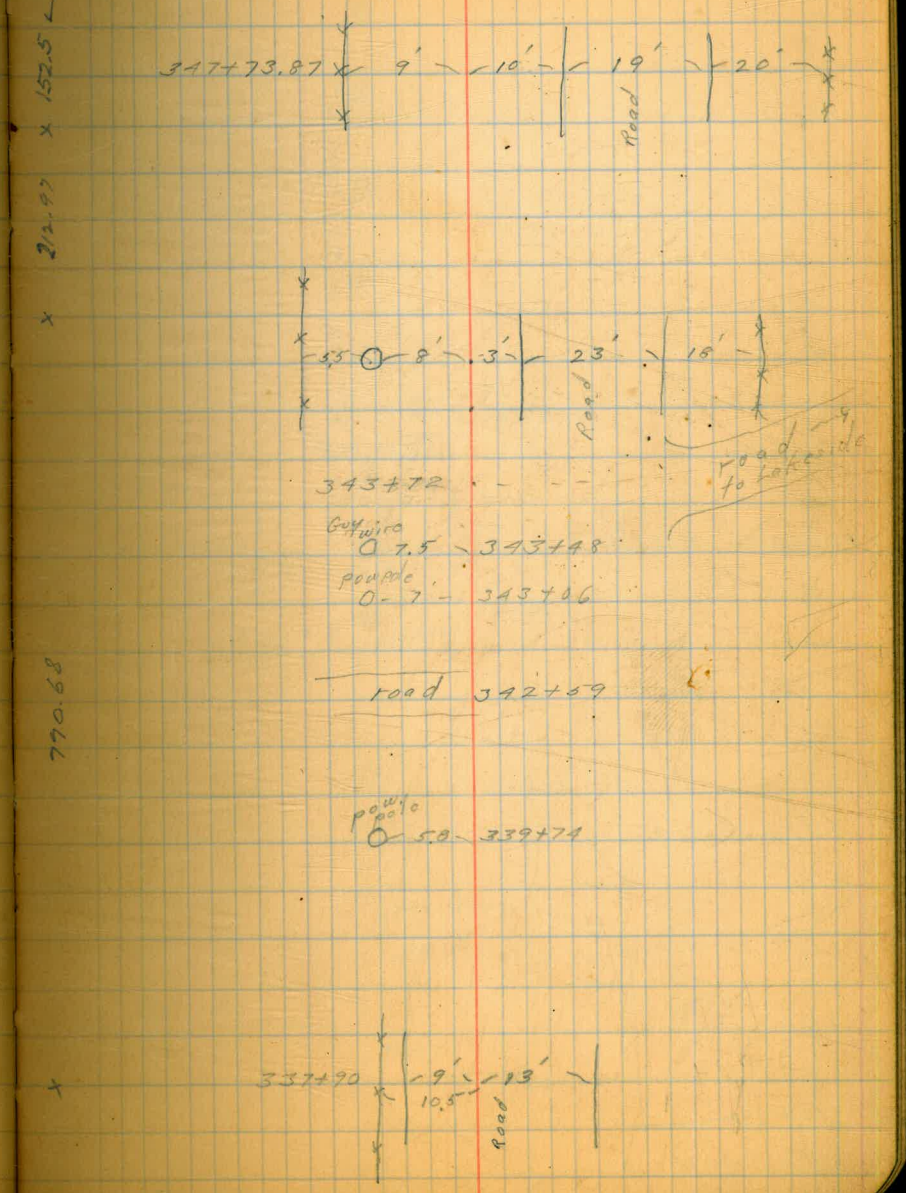


P.C.T. on original line

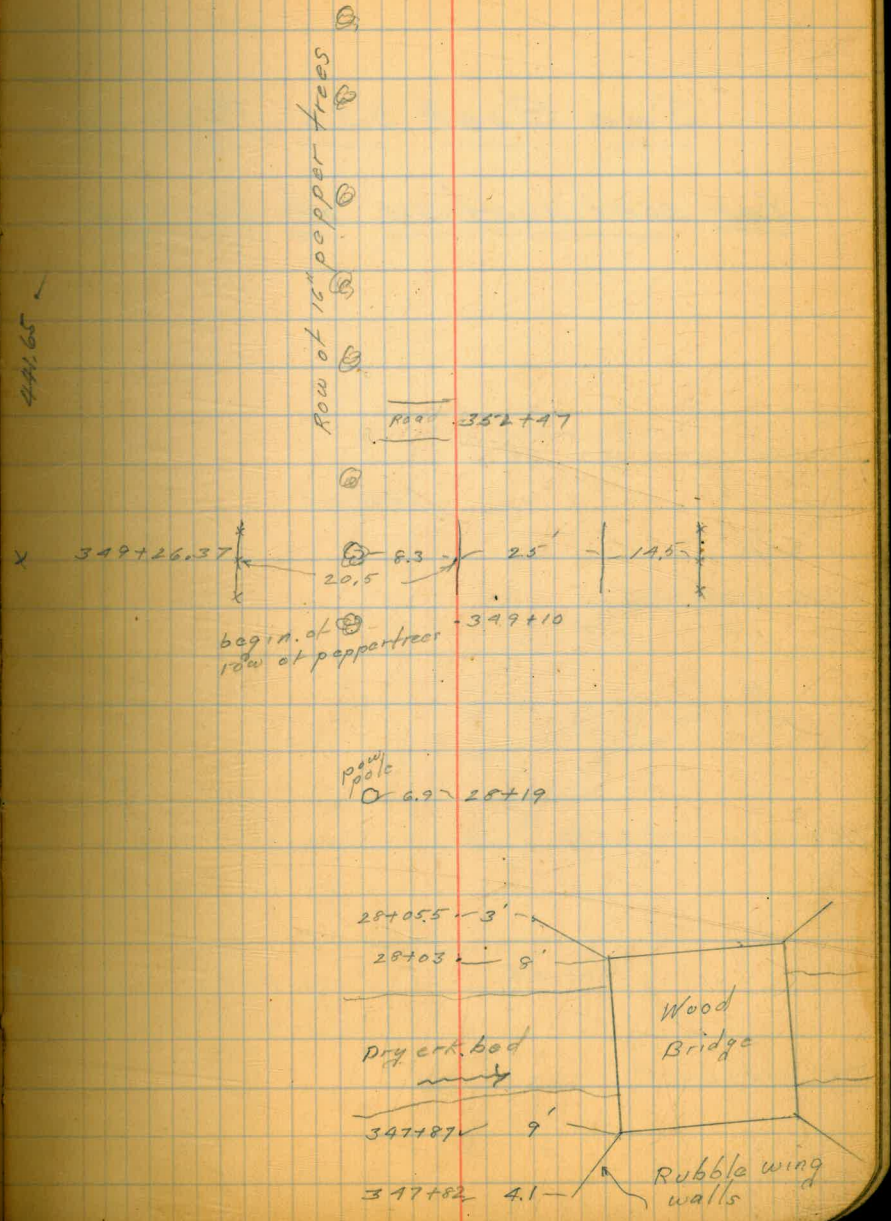
Sta.	Angle	Mag B.	Calc. B.
333+69.83	2°03'-30" 1°02'R	S26-30W	S25-02W
329+00			



Sta.	Angle	Mag. B.	Calc. B.
		S 30° W	S 29-09' W
347+73.87	S 10°00'30" R		
		S 26-30 W	S 24°09' W
345+60.9	2°-43'-30" 1°22' L		
343+72			
			S 25°-31' W
337+90.22	0°-5-8' 0°29' R		



Sta.	Angle	Mag. B.	Calc. B
			S 25-36 W
	7°06'30"		
349+26.37	3°33' L		



Sta. Angle Mag.B. Cole.B.

See Book 326 - Page 70

for continuation of Survey

353+46.08 } EQUATION
= 354+50.70 }

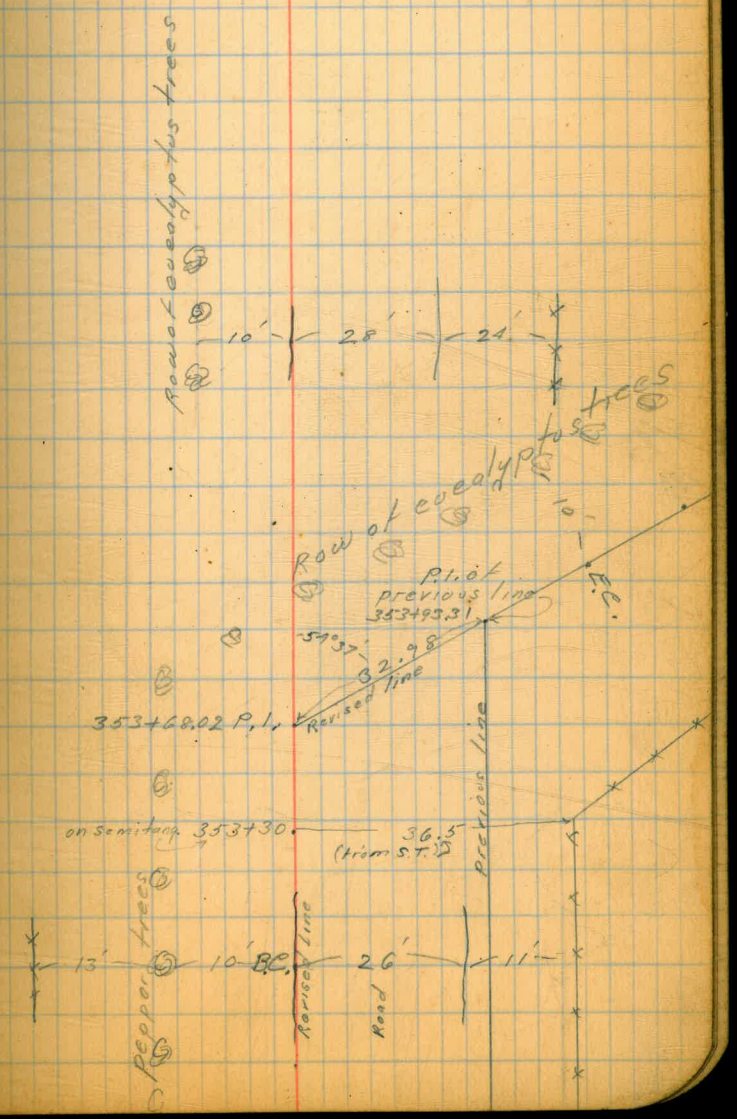
S80-13W

354+45.04 EC.

P.I. 353+68.02
EC. 27°18½' Δ 54°37'R
+25 24.06 D 32°
353+4 20.06 T 93.66
+75 16.06 L 170.69
+50 12.06 R 181.4
+25 8.06
353 4.06'

353+68.02 54°37'R

352+74.36 B.C.



Profile levels over Line change from sta. 326+15.92 to sta. 334+50.70

B.M.	6.80	446.77		439.97
326+15.92			2.7	44.1
			5.0	41.8
+36.5			3.15	43.62
+72			1.1	45.7
327			1.5	45.3
			5.1	41.4
+17			2.4	44.1
+32			3.8	43.0
+86			4.8	42.0
			5.3	41.5
328			5.1	41.7
+38			3.5	41.3
+65			4.1	42.7
+75			1.0	42.8
T.P.			3.98	442.79
	10.81	453.60		
329			11.1	42.2
+60			10.1	43.5
+70			8.1	45.2
330			7.1	46.5
			9.6	44.0
+50			4.7	48.9
+65			5.1	48.2
+65			6.9	46.7
+65			7.2	46.4

Cont. from Book 316 - Page 39

Road at 326+16

Top of 12" concr. sewer pipe from barn

Road at 327

Road at 327+86

on E.C. hub 328+71.56

Road at 330

Flow line E. end of wood box culvert

" " W. " " " " "

		463.60			
330+80			5.2	458.4	
331			3.7	49.9	
			5.0	48.6	Road at 331
	+25		2.2	51.4	
	+57		1.7	51.9	
T.P.			0.18	453.42	
	9.83	463.25			
	+75		9.6	53.7	
332			8.9	54.4	
			9.8	53.5	Road at 332
333			4.8	58.5	
			5.2	58.1	" " 333
	+28		3.5	59.8	
	+70		2.0	61.3	
			2.2	61.1	" " 333+70
B.M. 32			1.19	461.76	Spike in Pow. Pole "76774 at sta. 333+70 El. 461.77
				461.77	
	10.50	472.27			
334			9.5	62.8	
			10.0	62.3	Road at 334
	+30		8.1	64.2	edge of road
335			5.5	66.8	Road
T.P.			0.21	472.06	
	11.68	483.74			
336			12.3	71.4	
	+50		9.6	74.1	
337			7.0	76.7	

		483.74		
337+50			4.8	478.9
338			3.9	79.8
339			5.3	78.4
+25			5.9	77.8
340			9.0	74.7
T.P.			9.60	474.14
	0.74	474.88		
+70			2.8	72.1
341			4.3	70.6
342			7.8	67.1
343			10.2	64.7
344			11.0	63.9
T.P.			10.98	463.90
	1.59	465.49		
+50			1.9	463.6
345			3.3	62.2
+61			5.0	60.5
346			5.4	60.1
347			6.3	59.2
+68			6.3	59.2
+74			7.2	58.3
+88			9.9	55.6
+94			9.6	56.9
348			8.3	57.2
+07			6.7	58.8

Bottom of dry creek bed.
" " " "

		465.19		
348+20			6.2	459.3
BM "33			5.33	460.16 460.15
	6.79	466.94		
349			8.5	58.4
+26			8.4	58.5
350			7.8	59.1
351			6.7	60.2
352			5.0	61.9
+74			3.8	63.1
353			3.6	63.3
+25			3.6	63.3
+50			3.7	63.2
+75			4.2	62.7
354			4.9	62.0
+25			5.2	61.7
+45			6.3	60.6
354+50.70			6.3	60.6
= 351+96.08 } Equation			7.2	59.7

Cont. in Book "316
Page 62

El. 460.15
Spike in pow. pole "74390 7'L. of 348+20

Check on ground at sta. 355

Alt. from P.I. sta 36+83.39 on Loc. line to sta. 47+54.59.

12/7/51 clear

Alignment

Sta.	Angle	Mag B.	Calc B.	
		N82°W	N82-30W	
37+46.67	7°-39' 3°45' L			
		N79°W	N78°45'W	
37+44.56	E.C.			Δ 25°00' L
				D 20°
				T 63.83
36+83.39	49°59'30" 25°00' L			L 125.00
				R 287.94
36+19.56	B.C.			
			N53-45W	
36+10.33				

Conrose
H.H.
Simpson
Loudon

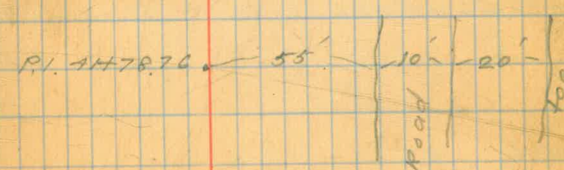
37+47.41 — 13' — Road 12' — 10' — toe (Chan.)

P.I. at Loc. line sta. 36+83.39

Sta.	Angle	Mag. B	Calc B.
40+92.03	P.O.T.		
		S88°W.	S87-50W
40+46.28	E.C.		Δ 9°40'L
			D 8°
			T. 60.51
39+85.96	19°20' 9°40'L		L 120.83
			R. 716.78
39+25.15	B.C.		

P.I. 39+89.27 ~ 42' ~ 9' Road 10' 20'

Sta.	Angle	Mag. B	Calc. B.	
42+90.44	P.O.T.			
		N67-30W	N66-20W	
42+31.25	E.C.			
				Δ 25°-50'R
				D 24°
41+78.76	51°40'30" 25°50'R			T. 55.15
				L 107.64
				R. 240.19
41+23.61	B.C.			



12/8/31

Sta.	Angle	Mag.B.	Calc.B.	
			N62°19'W	
47+55.12	Loc. line	N63-30'W	~~N62°20'W~~	
47+54.63	E.C.			
				Δ16°41'R
	~~33°19'~~			D.16°
47+03.04	~~16°39'00"~~			T52.68
used	16°41'R			
				L104.27
				R359.26
46+50.36	B.C.			
		N80°W	N79°00'W	
45+67.94	E.C.			
				Δ12°10'L
	25°-20'			D8°
44+89.17	12°10'L			T79.56
				L158.33
				R.716.78
44+09.61	B.C.			

Converse
Hill
Simpson
Louden

47+03.04 — 12' — | 11' | — 60' — Toe (Chan.)
Road

P.I. 44+89.17 — 13' — | 13' | — 12' — | Toe
Road

Alt. from P.I. sta. 50+95.47 on 12/8/31
Loc line to sta. 60+37.51.
Alignment

Sta.	Angle	Mag.B.	Calc.B.	
			N63-37'W	
54+99.71	E.C.			
				Δ 20°24' L
				D.16°
54+36.85	40°48' 20°24' L			T 64.64
				L 127.50
				R 359.26
53+72.21	B.C.			
		N45° W	N43-13'W	
51+24.16	E.C.			
				Δ 19°06' R
				D.12°
50+95.47	38°12' 19°06' R			T 80.48
				L 159.17
				R 478.34
49+64.99	B.C.			
			N62-19'W	
48+76.30	P.O.T.			

Rain
Converse
Hill
Simpson
Louden

P.I. 54+36.85 – 21' – 10' – 8' – toe Chan.

P.I. on Loc. line sta. 50+95.47

		N 72°-50' W	
60+32.97 B.C. Loc. line			
60+37.51			
59+79.28	E.C.		
			Δ 35°50' L
			D 32°
59+24.58	36°50' L		T 60.40
			L 115.10
			R 181.4
58+64.18	B.C.		
		N 36°-30' W N. 36-00 W	
57+82.19	E.C.		
			Δ 27°37' R
			D 16°
	55°-13'30"		
56+97.89	27°37' R		T 88.30
			L 172.60
			R. 359.26
56+09.59	B.C.		

P.I. 56+97.89 — 57' — \| 17' \| — 25' — \| Road \| Xoe Chan.

Levels over Alt. line from sta. 36+50 on Loc. line to sta. 47+55 — 12/8/31

Rain — Converse, Hill - notes, Simpson - $\bar{\wedge}$, Louden - rod

B.M. #5	10.41	551.21 ✓		540.80	Nail in 10" cottonwood 17'R sta. 37+50
36+50			12.5	38.7 ✓	
+70			11.0	40.2 ✓	
+75			8.8	42.4 ✓	
+63			8.5	42.7 ✓	foot of large boulder
+80			+3.0	54.2 ✓	top " " "
37			6.8	44.4 ✓	foot " " "
+05			4.2	47.0 ✓	
T.P.			1.30	549.91 ✓	
	8.92	558.83			
37+46			7.1	51.7 ✓	
+73			7.2	51.6 ✓	
38+00			5.3	53.5 ✓	
+30			6.0	52.8 ✓	
+50			7.2	51.6 ✓	
39			5.6	53.2 ✓	
+50			5.4	53.4 ✓	
+85			2.1	56.1 ✓	
T.P.			2.21	556.62 ✓	
	1.80	558.42 ✓			
40+20			2.3	56.1 ✓	
+46			4.6	53.8 ✓	
41			4.5	53.9 ✓	
+35			6.9	51.5 ✓	
+57			9.2	49.2 ✓	

		558.42		
41+78			6.9	51.5 ✓
42+15			9.4	49.0 ✓
+32			8.8	49.6 ✓
+72			6.4	52.0 ✓
+96			7.5	50.9 ✓
43+05			11.3	47.1 ✓
T.P.			10.84	547.58 ✓
	1.45	549.03 ✓		
+27			6.3	42.7 ✓
+70			7.9	41.1 ✓
+85			6.3	42.7 ✓
44			7.2	41.8 ✓
+60			7.9	41.1 ✓
+75			7.9	41.1 ✓
+95			8.9	40.1 ✓
45 +06			11.0	38.0 ✓
T.P.			11.17	537.86 ✓
	3.17	541.03 ✓		
+68			4.5	36.5 ✓
46			4.5	36.5 ✓
47			5.0	36.0 ✓
+63			4.9	36.1 ✓
BM "G"			1.31	539.72 ✓

Levels over Alt. Line from sta. 50+00 on Loc. line to sta. 60+37. 12/8/31

B.M. 6	0.91	540.60		539.69
T.P.			3.86	536.74
7	2.61	539.35		
50+00			4.8	31.6
+15			4.1	31.9
51+25			4.6	31.8
+2			2.7	36.7
+50			5.1	31.3
53			6.3	33.1
+23			9.0	30.4
T.P.			2.13	537.22
	10.18	547.40		
+50			6.3	41.1
54			2.1	45.3
+35			3.5	43.9
55			5.1	42.3
56			4.9	42.5
+36			7.2	40.2
+57			12.1	35.3
T.P.			6.34	540.86
	2.37	543.23		
57			5.9	37.3
B.M. 7			6.01	537.22
+82			6.8	36.4
+95			11.6	31.6

Rain Converse
Hill - notes
Simpson - ↑
Loeden - rod

5-1

		533.23		
58			9.2	34.0 ✓
	+25		5.0	38.2 ✓
	+50		4.7	38.5 ✓
59			5.5	37.7 ✓
	TP		11.66	531.57 ✓
		4.10	535.67 ✓	
	+25		0.8	34.9 ✓
	+61		1.3	34.4 ✓
	+79		4.2	31.5 ✓
60+19			1.6	34.1 ✓
60+37.31			2.1	33.6 ✓
60+32.97				
			3.7	532.0 ✓

Check on sta 59+75 Loc. Proc

Borings in Lake Lindo on pipe line location.

7/15/35 - hot
Hill
Soper
Remmen

B.M.	5.17	405.39			400.22
T.P.	11.04	416.22	0.21		405.18
T.P.	1.52	416.60	1.14		415.08
T.P.	0.35	410.20	6.75		409.85
	2.69	400.36	12.53		397.67
7+45			9.7	390.7	
			14.1		
			15.8		
7+90			10.0	390.36	
8+35			9.7	390.7	
T.P.	11.49	410.65	12.0		399.16
T.P.	4.58	402.56	12.67		397.98
16+00	near W. shore		11.9	390.7	
18+50	—		11.9	390.7	
21+50	near E. shore		11.8	390.8	

Lake about dry at this end.

County B.M. W. of Lakeside

Elev. lake surface at shore
Black silt & clay
Red sandy clay
Bot. of lake - Black silt & clay for 8.3 (lengthened)
Black silt & clay for 8'

Bot. of lake - Black silt & clay 3' - grey clay to 8'.
" " " " " " " " " "
" " " " " " 8' last 1' slightly gravely

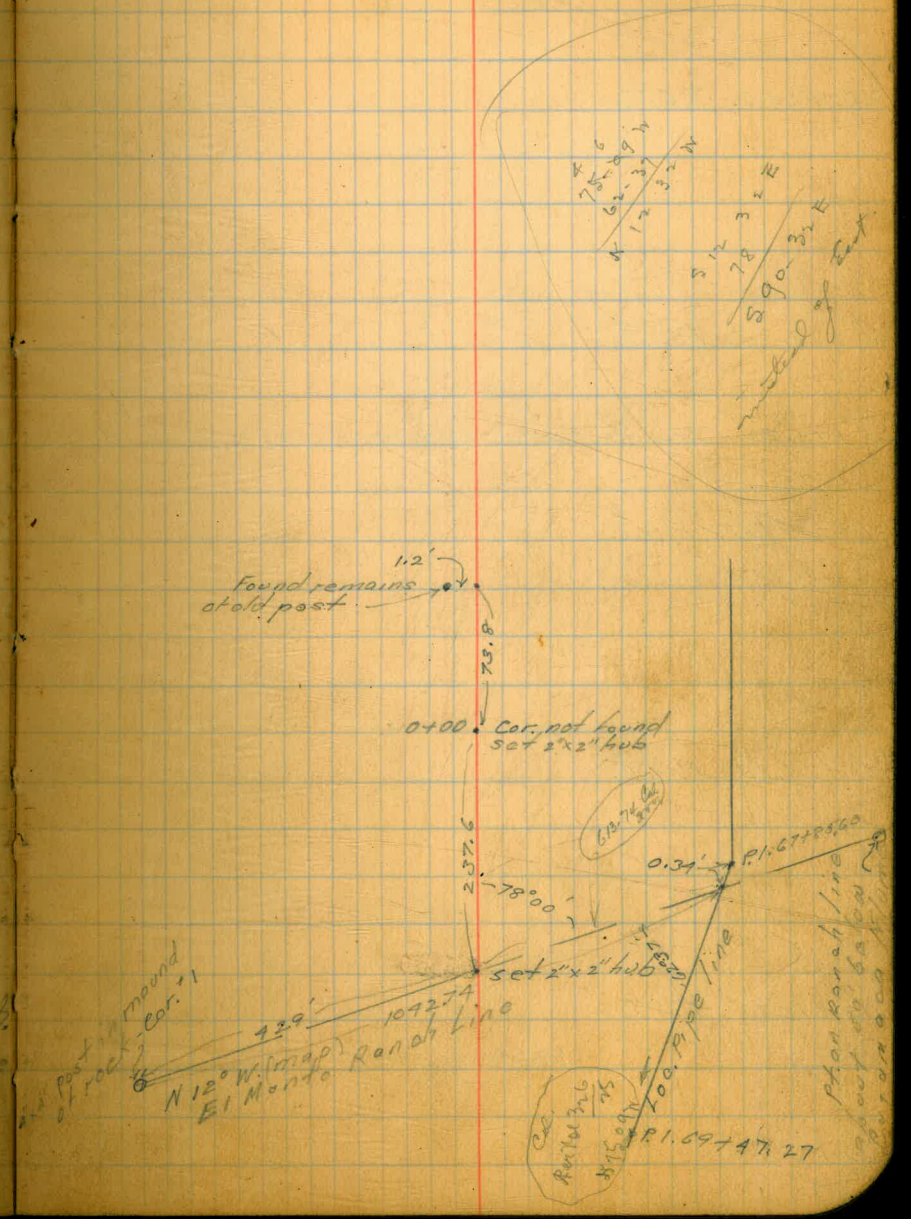
East from El Monte Ranch line on Section line between Sections 1 & 12 and 6 & 7.

Sta.	Angle	Mag. B.	Calc. B.
		N 89° E	East
11+21.6	C.L.	P.O.T.	
8+00		P.O.T.	
0+00			
		N. 89° E	East

Set hub on El Monte Ranch line 429.' S 12° E. from cor. 1 as shown on sketch. Fore-sighted on iron pipe on ranch line about 50' below Cuyamaca Flume. Turned left 78° for Easterly course.

Converse
Hill
Simpson
Louden

12/10/31
Part cloudy



1-28
28-58-38
1-27-18

Sta.	Angle	Mag. B	Calab
		N89°E	East
32+61.66	P.O.T.		
25+90.83	P.O.T.		
25+74.33	Fie to cor's bet. Sec's 6 & 7 and 1 & 12		
18+40.07	P.O.T.		
15+14.73	P.O.T.		
13+16.73	P.O.T.		
		N89°E	East

Found stone marked C.C. on E. face, I on N. face + IIIII on S face. = Cor. bet. Sec's 6 & 7.

S 89°05' 405.84

25+71.33

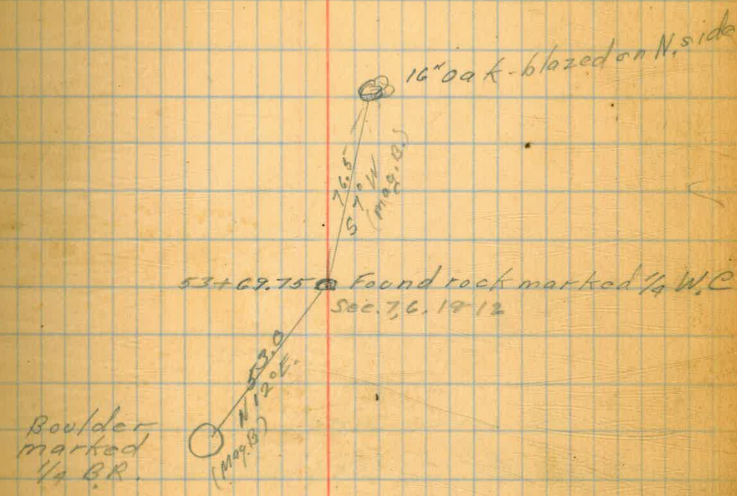
170.08

Found mound of rocks with lath in center. = cor. bet. sec's 1 & 12 (Cromwell survey 1902)

Sta.	Angle	Mag.B	Calc.B
53+69.75	W.C.		
			S 23°59'E
49+15.58	132°02' 66°01'R		
41+20.21	P.O.T.		
38+61.49	P.O.T.		
		N89°E	East

12/11/31
Rain

Converse
Hill
Simpson
Louden



Note Transit line only was carried Northerly to 1/4 cor. bet. Secs. 7 & 12. - 1/4 cor. found. See tie page 61.

Found 2" iron pipe, with wood plug & tack, in mound of rock. White stake marked Sec. 12. Backsighted on line fence 1/2 mile distant.

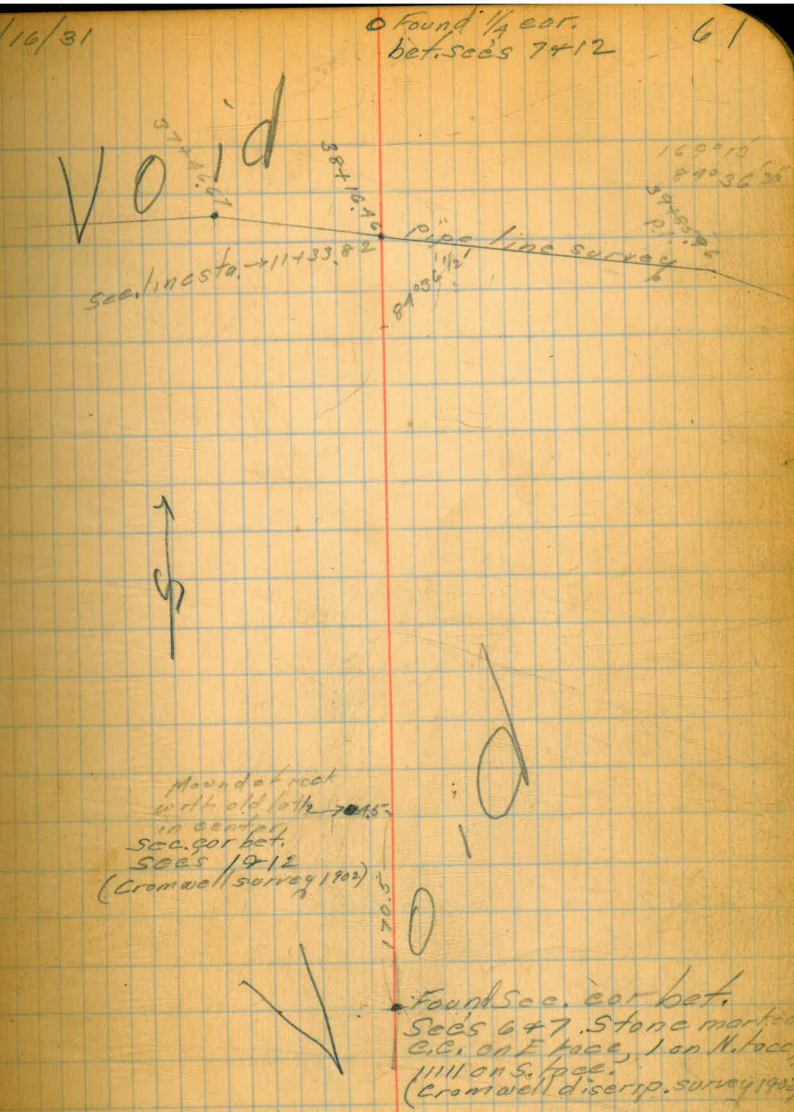
12	7
13	18

Tie to Pipe line from Sec. cor's bet. Sec's 6+7 and 1+12.

11+33.82 Tie to pipe line survey on Rangeline

0+00 9°22' 4°41'12 Backsight on sta. 25+71.33 - page 58

Set up transit at Sec. cor. bet. Sec's 6+7 (discribed by Cromwell in survey of 1902) Fore-sighted on 1/4 cor. between Sec's 7+12. Made tie to Sec. cor. bet. Sec's 1+12 and tie to pipe line survey.

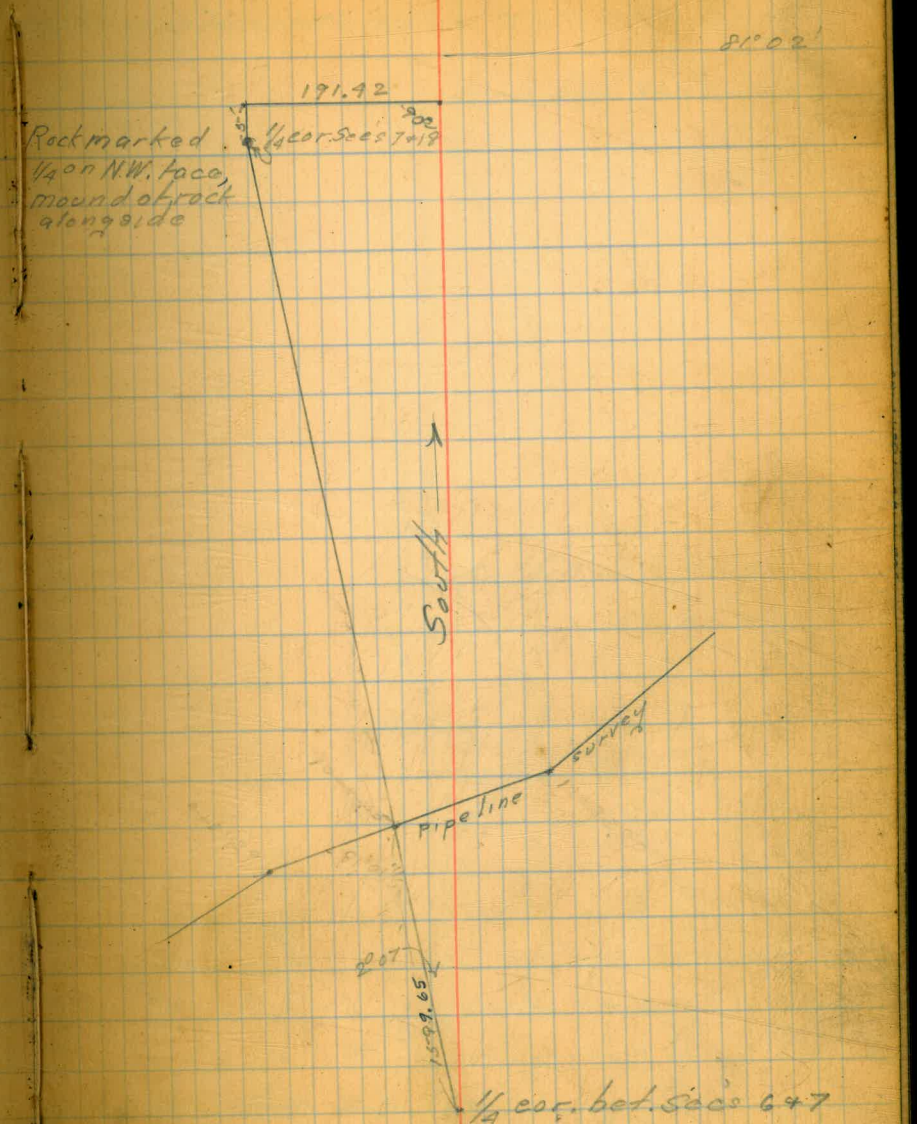


Tie to Pipe line from 1/4 cor. bet. Sec's. 6+7

15+95.53 Tie to Pipe line.

N. 2° 47 W

0+00

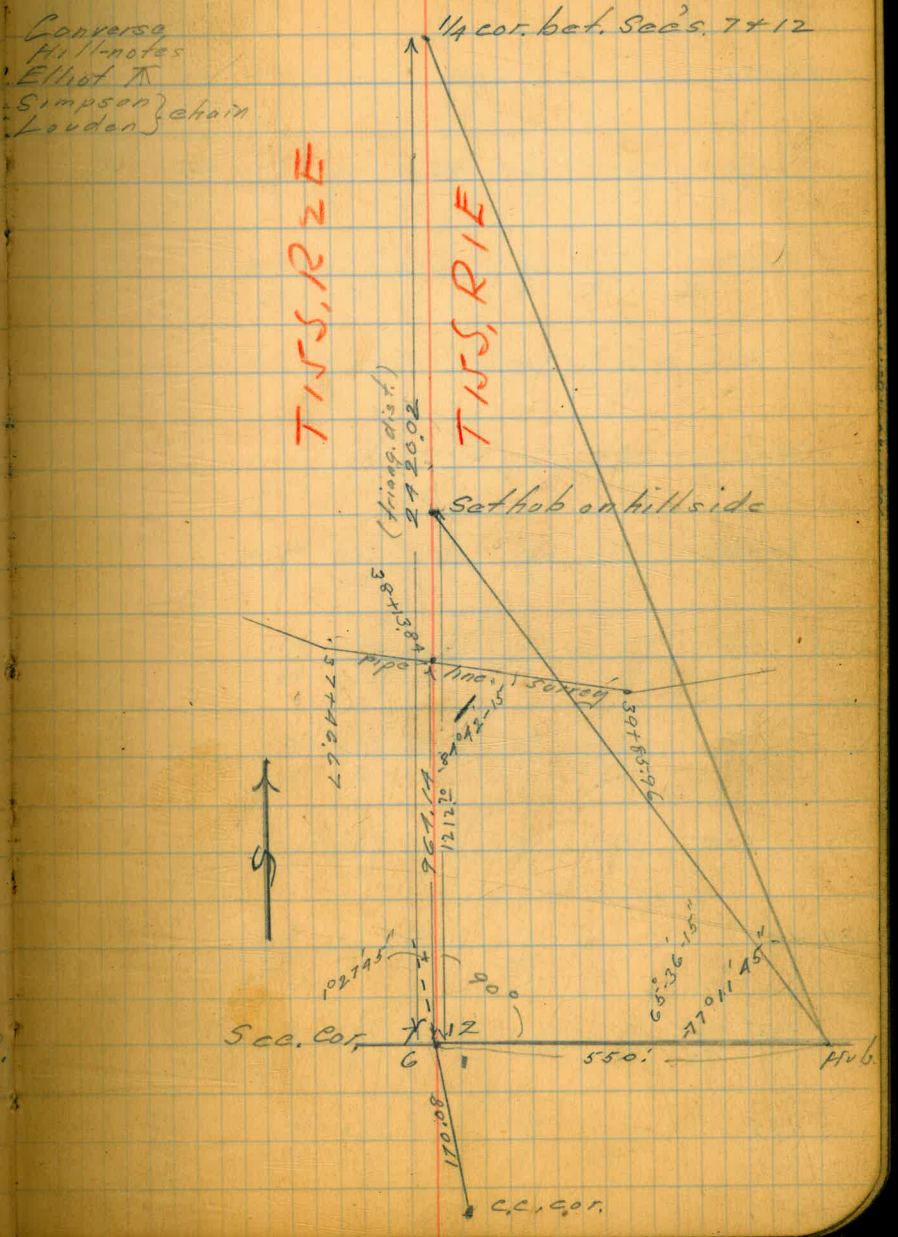


Sec. Alternate Line Range 44+45 - -

Tie to Pipe Line and Triangulation

to 1/4 cor. bet. Sec's. 7+12 from Sec. Cor. bet. Sec's 1-12-6+7

Converse
Hill-notes
Elliot
Simpson } chain
Louden }



Set up transit on Sec. cor. between Sec's 1-12-6+7, foresighted on 1/4 cor. bet. Sec's. 7+12, set off base line perp. to Range line for triangulation. Made tie to Pipe line survey.

Converse
Hill
Elliott
Simpson
Howden

- Dec. 22, 1931

36 +50

+75

+83

+90

37 +05

+46

38 +00

+30

+50

39 +00

+50

+85

X Sections for estimate purposes of
Alt. Line Sta. 36+50 to 47+55

Lt. Rt.

Same as original line

+19.2 +18.4 +10.2 +4.1 542.4 +3.7 -4.1 -9.2
25 22 9 6 4 4 19 29 ✓

+17.6 +11.1 542.7 -4.1 -4.5 -9.8
25 12 ℄ 10 21 30 ✓

Large boulder contains about 10 C.Y. ✓

+17.8 +6.4 547.0 -5.7 -8.4 -8.8 -13.2
25 10 ℄ 5 14 25 32 ✓

+13.2 +8.5 551.7 -6.2 -12.9 -14.2 -14.3 -16.4
25 15 ℄ 10 16 18 29 34 ✓

+11.3 +6.2 553.5 -4.3 -7.8 -13.7
25 13 ℄ 9 16 25 ✓

+11.2 +8.3 552.8 -10.7 -12.6
25 16 ℄ 17 25 ✓

+12.2 +6.7 551.6 -8.8 -11.7
25 15 ℄ 16 25 ✓

+11.5 +6.3 553.2 -12.5
25 13 ℄ 25 ✓

+9.4 +8.2 553.4 -4.1 -7.2 -9.9 -10.2
25 22 10 17 23 25 ✓

+11.6 +4.4 556.4 -2.9 -12.3
25 13 8 25 ✓

X Sections for estimate of Alt. Line
Sta 36+50 to 47+55

	Lt.				Rt.		
40+20	+13 5/25		556.1 ℄		-11 4/25		✓
+46	+12 3/25		553.8 ℄		-11 7/25		✓
41+00	+13 5/25		553.9 ℄		-7 2/14	-16 0/25	✓
+35	+14 8/25	+4 7/8	551.5 ℄		-5 4/10	-11 5/25	✓
+57	+15 8/25	+13 0/22	+3 4/6	549.2 ℄	-4 4/8	-9 0/25	✓
+78	+13 0/25	+4 3/9	551.5 ℄		-7 2/13	-10 2/25	✓
42+15	+13 0/25	+7 0/9	549.0 ℄		-4 4/19	-6 6/25	✓
+32	+12 6/25	+3 8/9	549.6 ℄		-4 0/25		✓
+72		+2 4/25	552.0 ℄		-5 6/25		✓
+90		+6 5/25	550.9 ℄		-3 3/15	-6 0/25	✓
43+05	+6 8/25	+3 0/10	+0 8/6	547.1 ℄	-5 6/25		✓

End day Dec 22, 1931

Converse
Elliott Notes
Simpson
Lowden

Dec 23, 1931

43+27

+70

+85

44+00

+50

+75

+95

45 +06

+68

46 +00

47 +00

X Sections for estimate purposes
Alternate Line Sta 36+50 to 47+55

Lt				Rt		
		+6 0/25	542.7 ℄	-5 3/25		✓
		+46/25	541.1	-4 0/25		✓
+5	+4 1/20	+3 8/12	542.7 ℄	-4 7/20	-5 2/25	✓
		+8 1/25	541.8	-4 3/25		✓
		+3 2/25	541.1 ℄	-2 5/25		✓
		+28/25	541.1 ℄	-15/16	-3 1/19	-3 8/25 ✓
	+4 2/25	+2 4/18	540.1	-1 1/9	-2 9/15	-2 6/25 ✓
		+54/25	+2 6/9 538.0	-0 8/25		✓
		+14/25	536.5 ℄	0 0/25		✓
		+08/25	536.5 ℄	-0 2/25		✓

Dec 23, 1931

51+25

52+00

+50

53+00

+23
+28

+50

54+00

+35

55+00

56+00

+36

+65

X Sections for estimate purposes
Alt. Line Sta 50 to 60+37

+38/25 +17/17 534.8 -14/11 -1/25 ✓

+34/25 536.8 -23/12 -41/15 -45/25 ✓

+109/25 +59/16 +12/6 534.3 -11/7 -22/10 31/22 44/25 ✓

+140/25 +110/18 533.1 -26/5 -31/22 -37/25 ✓

+63/25 530.4 -03/19 -24/25 ✓

+72/25 +61/13 541.1 -123/11 -119/23 -131/25 ✓

+41/25 545.3 -59/12 -168/16 -168/25 ✓

+39/25 543.9 -41/19 -154/25 ✓

+42/25 542.3 -50/25 ✓

+86/25 542.5 -21/11 -63/25 ✓

+76/25 +45/13 540.2 -66/25 ✓

+40/25 534.9 -21/25 ✓

Dec 23, 1931

X Sections for estimate purposes

57+00

+82

+95

58+25

+50

59+00

+25

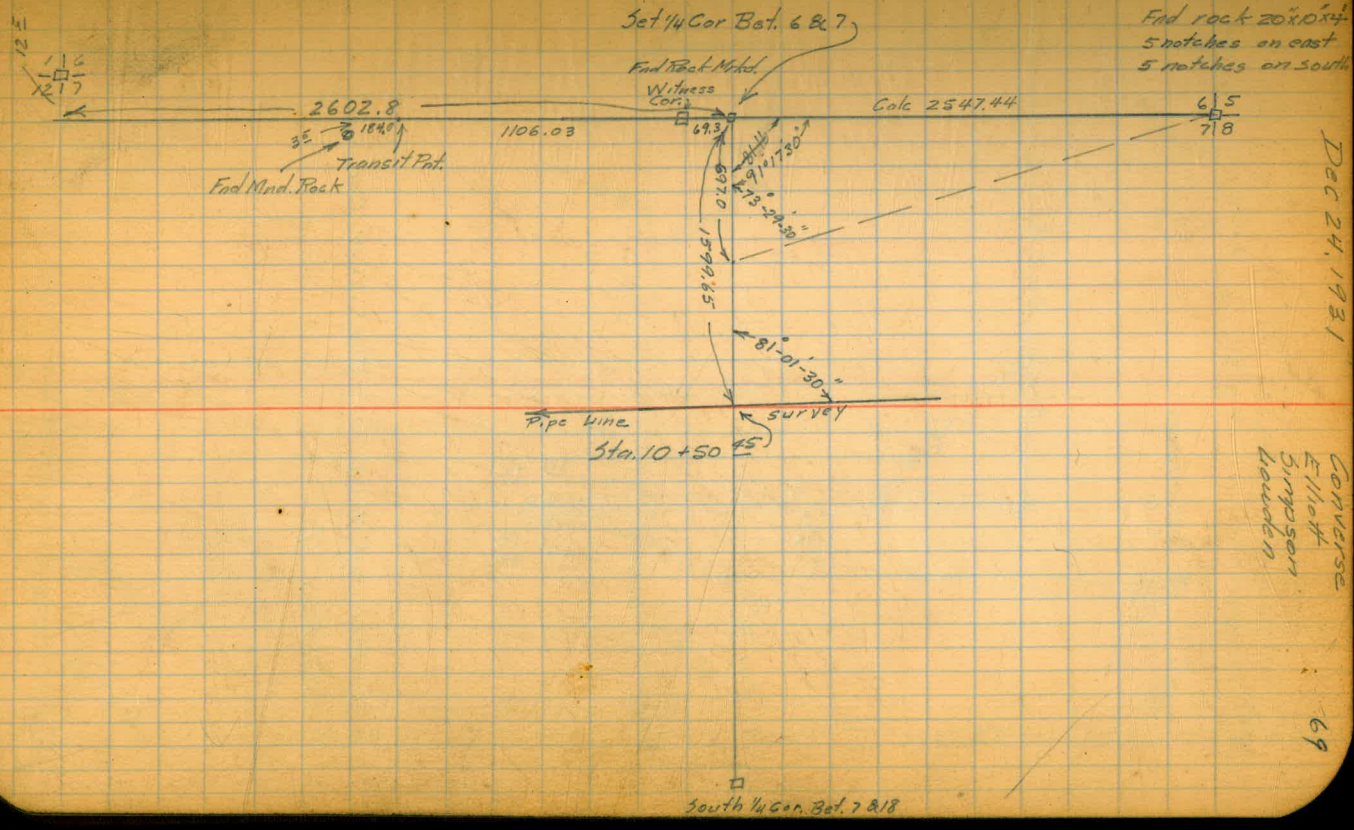
+61

+79

60+19

60+37 31 =
60+32 27

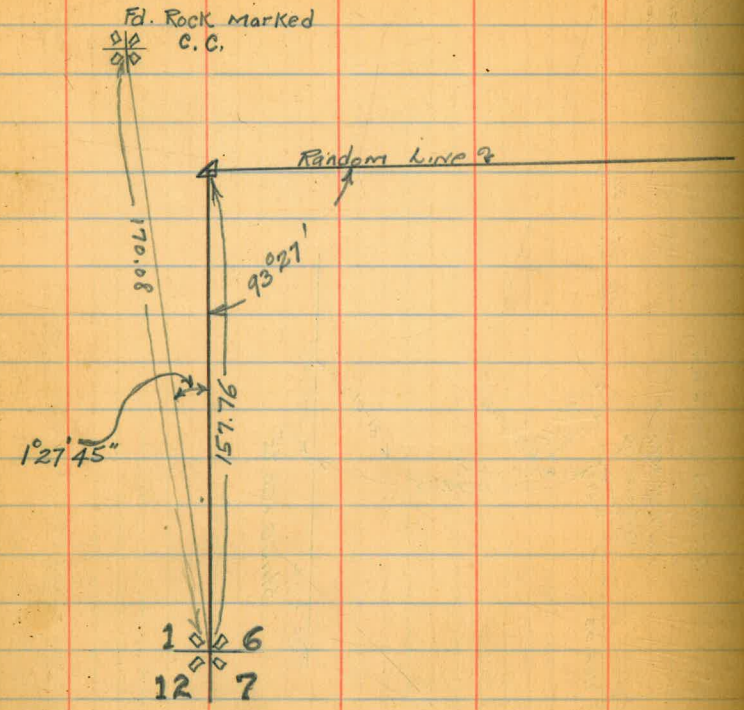
Left									Right
		+2 5/25	537.3 ℄	-3 8/25					✓
		+2 2/25	536.4 ℄	-4 9/25					✓
	+6 6/25	+2 8/9	531.6 ℄	-0 3/25					✓
		+3 5/25	538.2 ℄	-3 0/17	-6 1/25	-7 0 Road/29			✓
		+4 4/25	538.5 ℄	-4 6/16	-7 1 Road/22	-6 7/25			✓
+7 3/25	+5 6/20	+3 3/10	537.7 ℄	-3 3/7	-5 8/9	-6 2/20	-10 4/25		✓
+11 5/25	+10 7/20	+7 3/14	534.9 ℄	-1 0/2	-3 6/4	-3 7/16	8 0/23		✓
+15 7/25	+12 4/17	+7 8/13	+2 5/5	534.4 ℄	-3 4/2	-3 4/12	-5 5/17		✓
	+18 3/25	+9 0/10	+4 0/3	531.5 ℄	-0 8/2	-1 2/14	-2 2/17	-2 8/25	✓
+17 0/25	+15 3/23	+10 5/15	+4 6/8	534.1 ℄	-1 1/2	-3 8/3	-3 7/18	-4 5/25	✓
+18 4/25	+16 1/21	+13 0/15	+6 7/12	+3 0/5	533.6 ℄	-2 9/3	-2 8/18	-4 0/25	✓



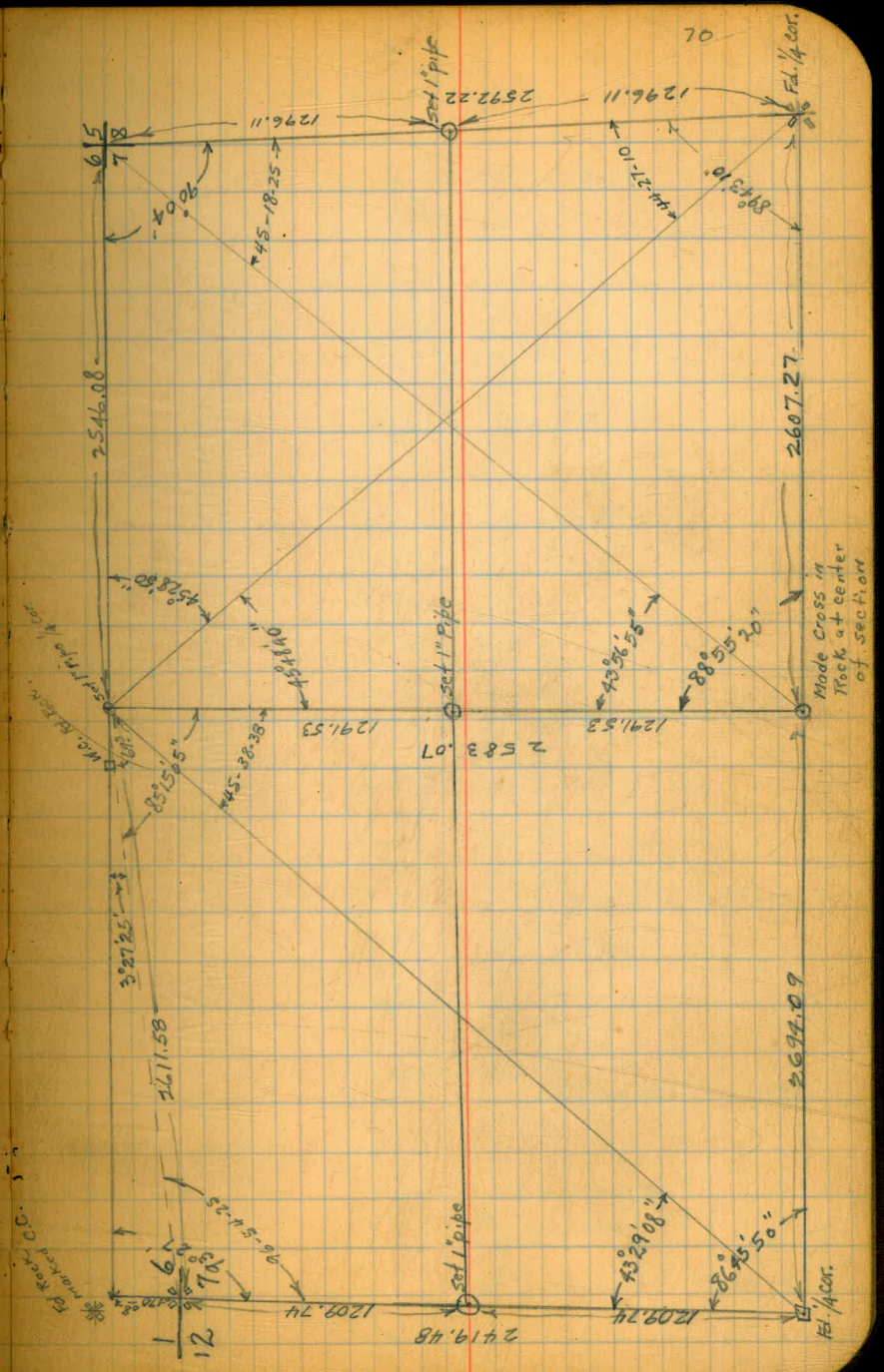
Dec 24, 1931

Converse
Elliott
Simpson
Draughon

69

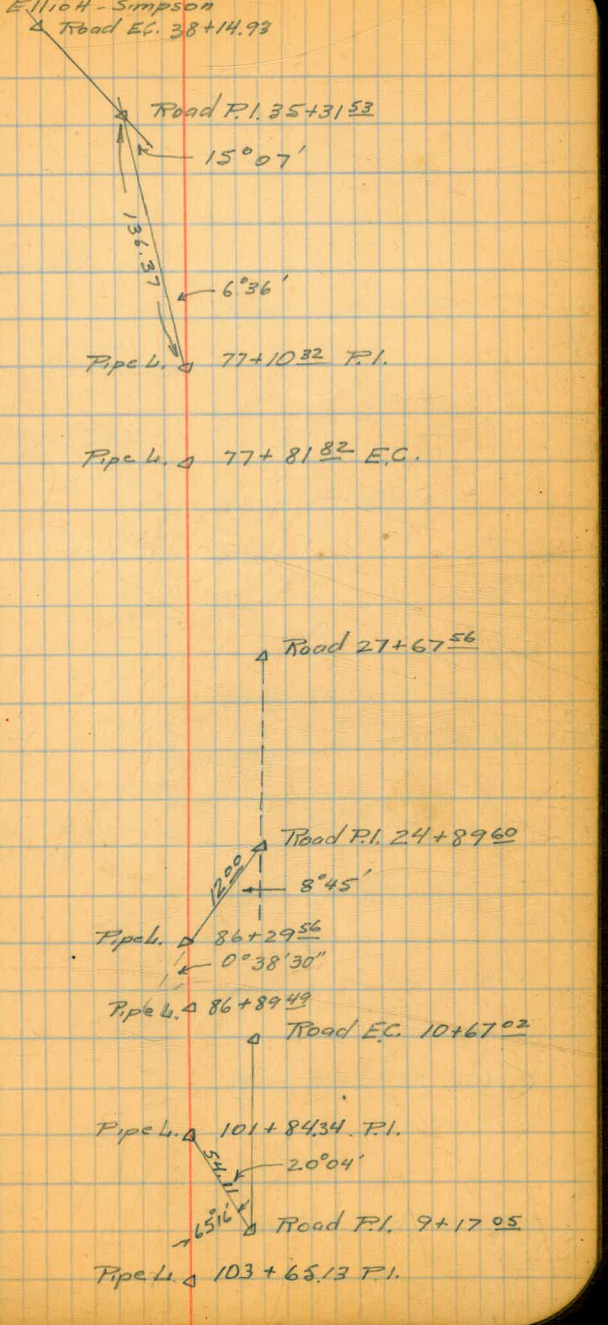


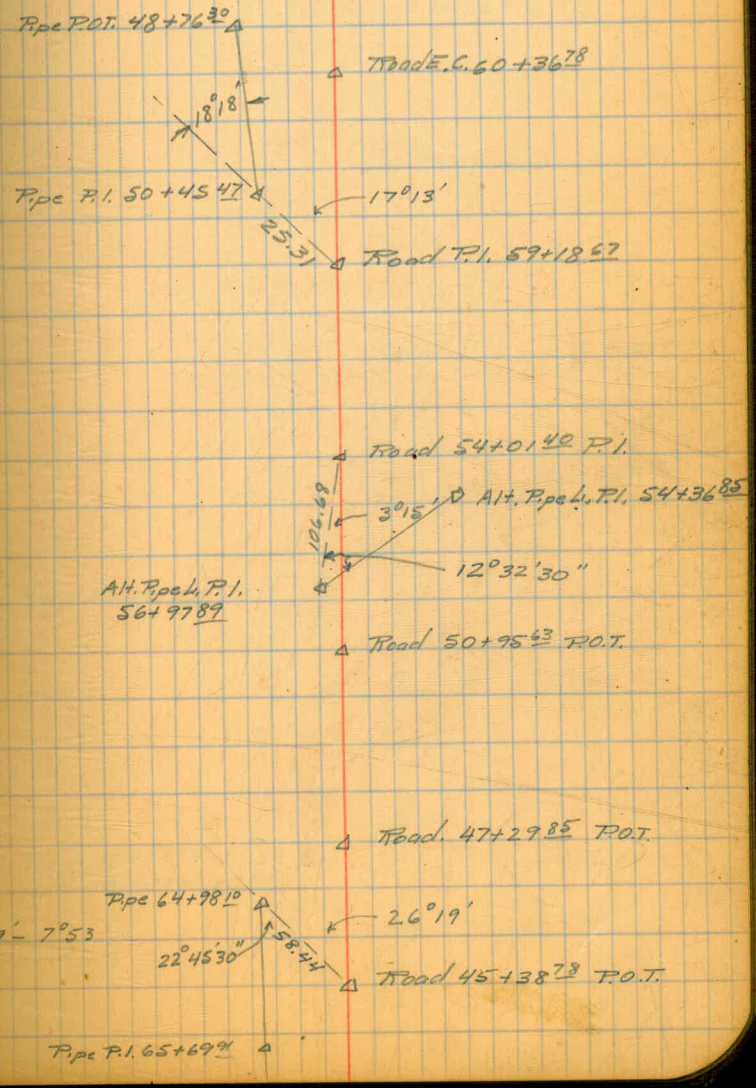
Detail of Ties at The N.W. Cor of Section 7.

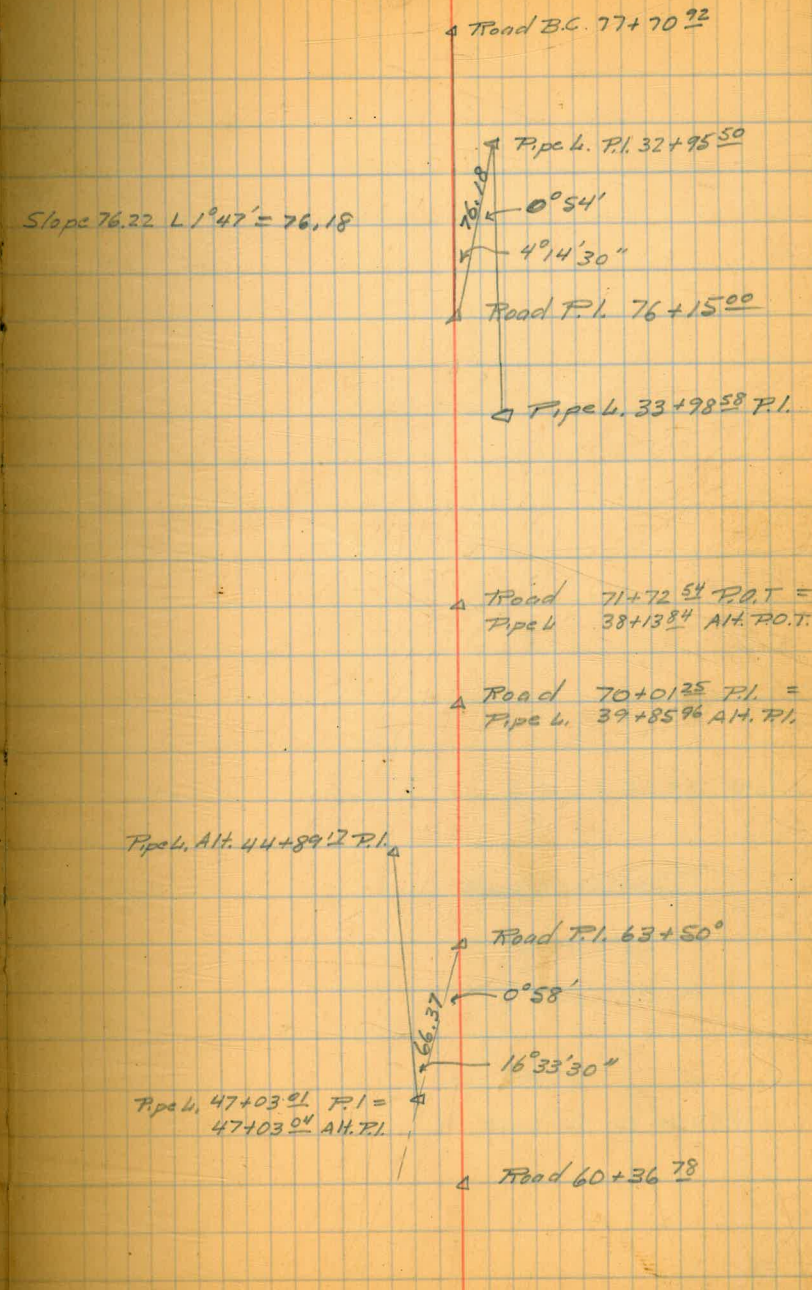


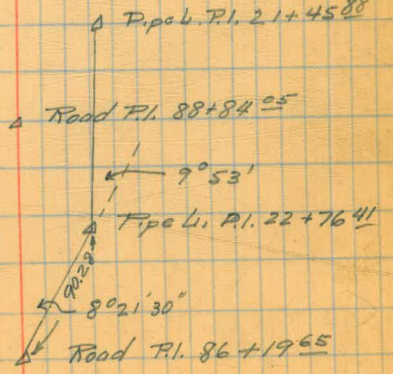
April 25 - 1932

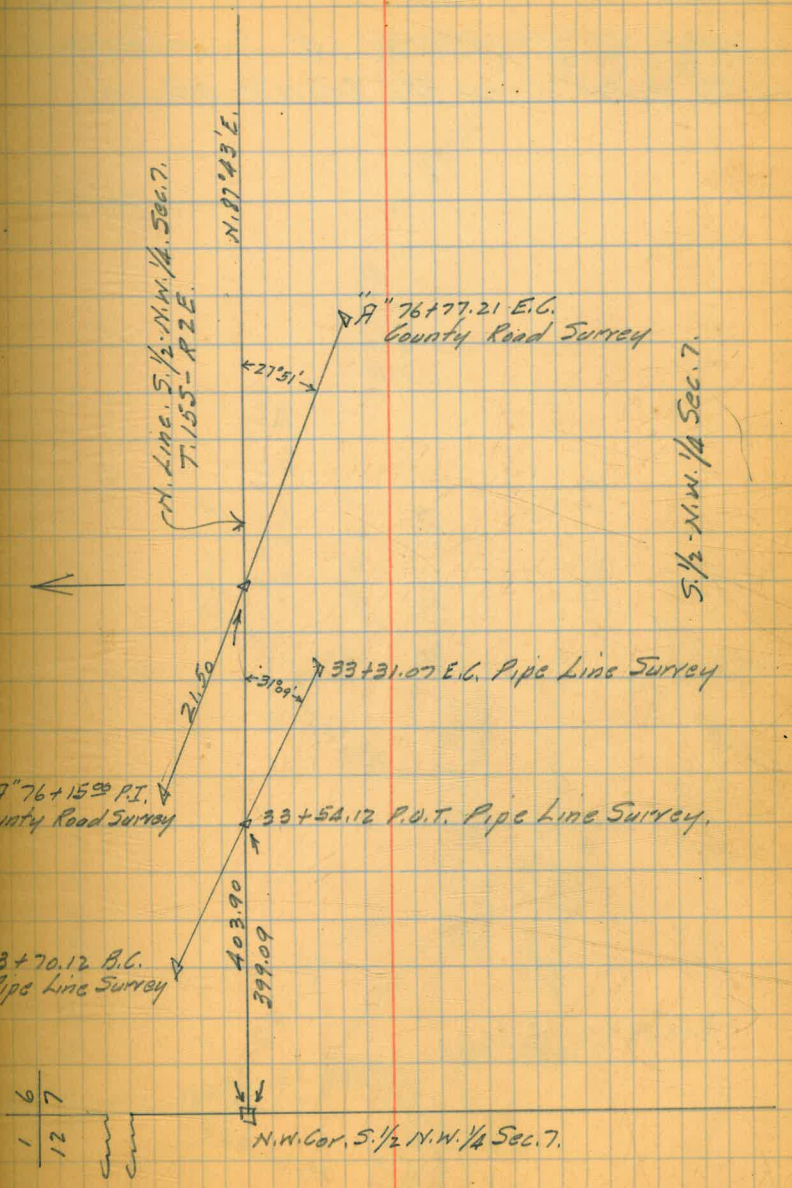
Converse
Elliott - Simpson




Pipe P.O.T. 48+76.30
Road E.C. 60+36.78
18°18'
Pipe P.I. 50+45.47
17°13'
25.31
Road P.I. 59+18.67
Road 54+01.40 P.I.
Alt. Pipe L. P.I. 54+36.85
106.69
3°15'
12°32'30"
Alt. Pipe L. P.I.
56+97.89
Road 50+95.43 P.O.T.
Road. 47+29.85 P.O.T.
Pipe 64+98.10
2.6°19'
Slope 59' - 7°53
22°45'30"
58.44
Road 45+38.78 P.O.T.
Pipe P.I. 65+69.91

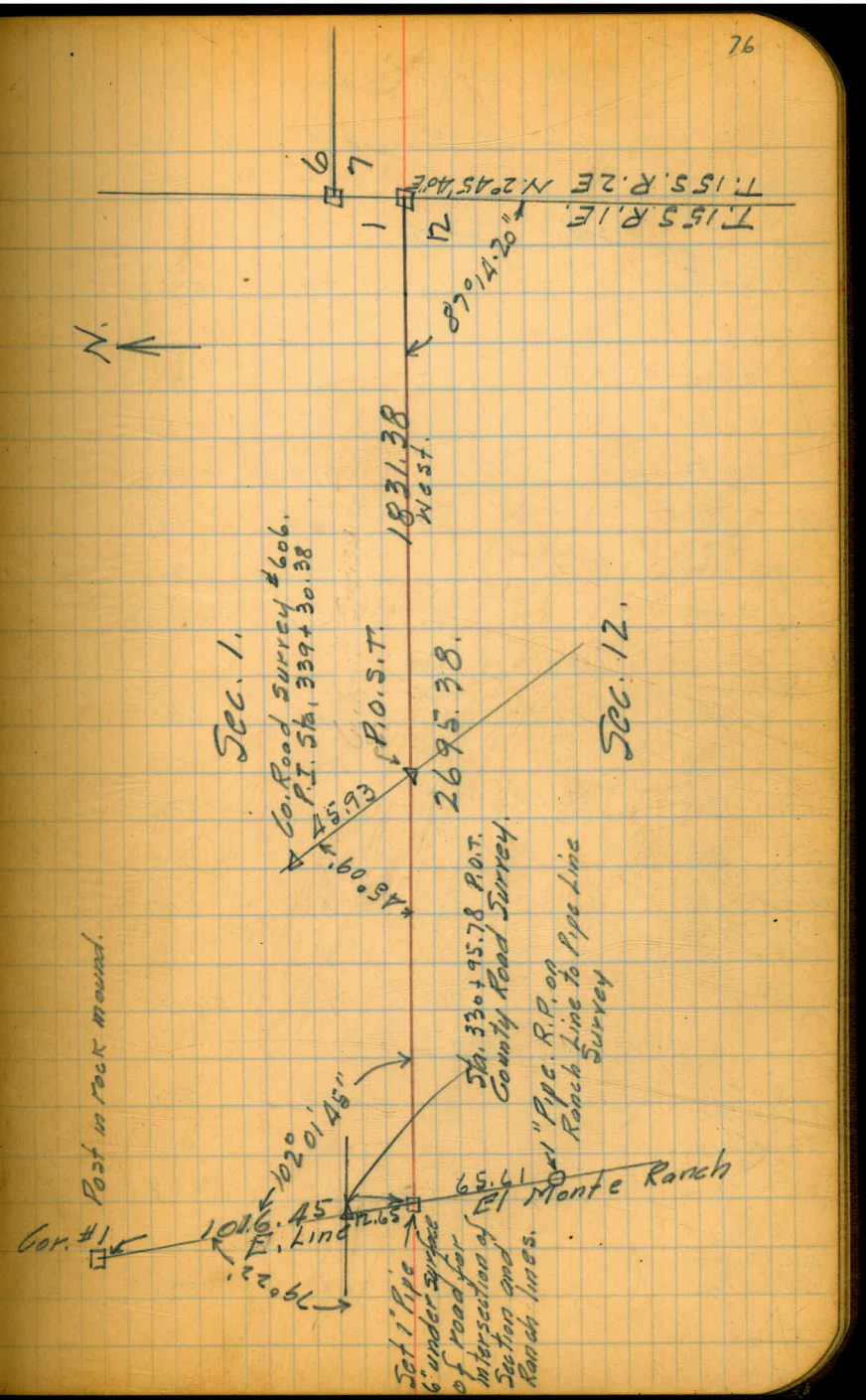

Road B.C. 77+70 92
Pipe L. P.I. 32+95 50
Slope 76.22 L 1°47' = 76,18
76.18
0°54'
4°14'30"
Road P.I. 76+15 00
Pipe L. 33+98 58 P.I.
Road 71+72 54 P.O.T. =
Pipe L 38+13 84 AH. P.O.T.
Road 70+01 25 P.I. =
Pipe L. 39+85 96 AH. P.I.
Pipe L. AH. 44+89 12 P.I.
Road P.I. 63+50°
0°58'
66.37
16°33'30"
Pipe L. 47+03 91 P.I. =
47+03 04 AH. P.I.
Road 60+36 78


P.pe L. P.I. 21+45.88
Road P.I. 88+84.05
9°53'
Pipe L. P.I. 22+76.41
92.28
8°21'30"
Road P.I. 86+19.65


N. 87°23' E.
"A" 76+77.21 E.C.
County Road Survey
27°51'
CN. LINE. S. ½ N.W. ¼ Sec. 7.
T. 15 S. - R. 2 E.
S. ½ - N.W. ¼ Sec. 7.
24.50
31°04'
33+31.07 E.C. Pipe Line Survey
"A" 76+15.99 P.I.
County Road Survey
33+54.12 P.O.T. Pipe Line Survey.
403.90
399.09
33+70.12 B.C.
Pipe Line Survey
1 6
12 7
N.W. Cor. S. ½ N.W. ¼ Sec. 7.

Resurvey of Sec. Line between Sections 1 and 12. T. 15 S. R. 1 E to intersection with east line El Monte Ranch.

No 512
Use 60.6.



Jan 2 1932

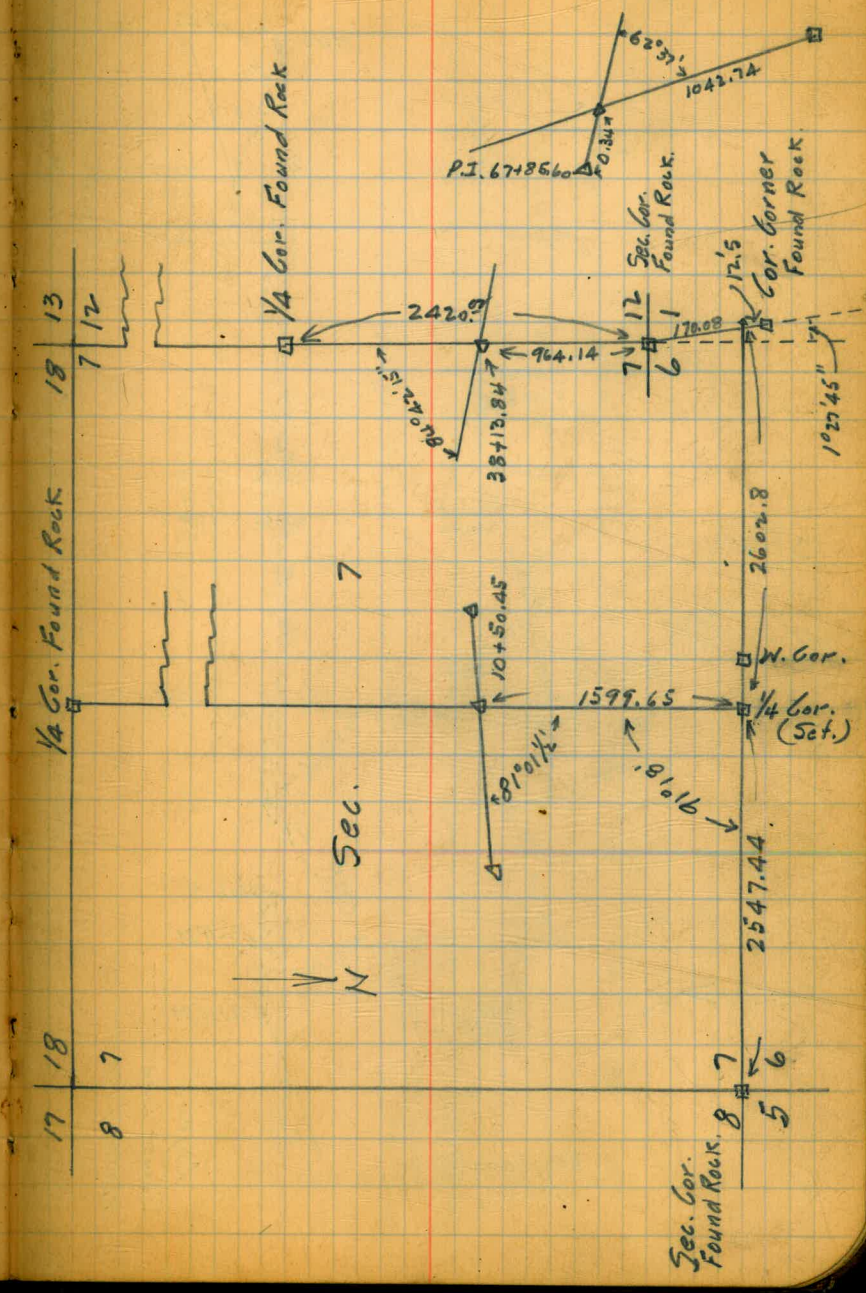
El Capitan-City Camp

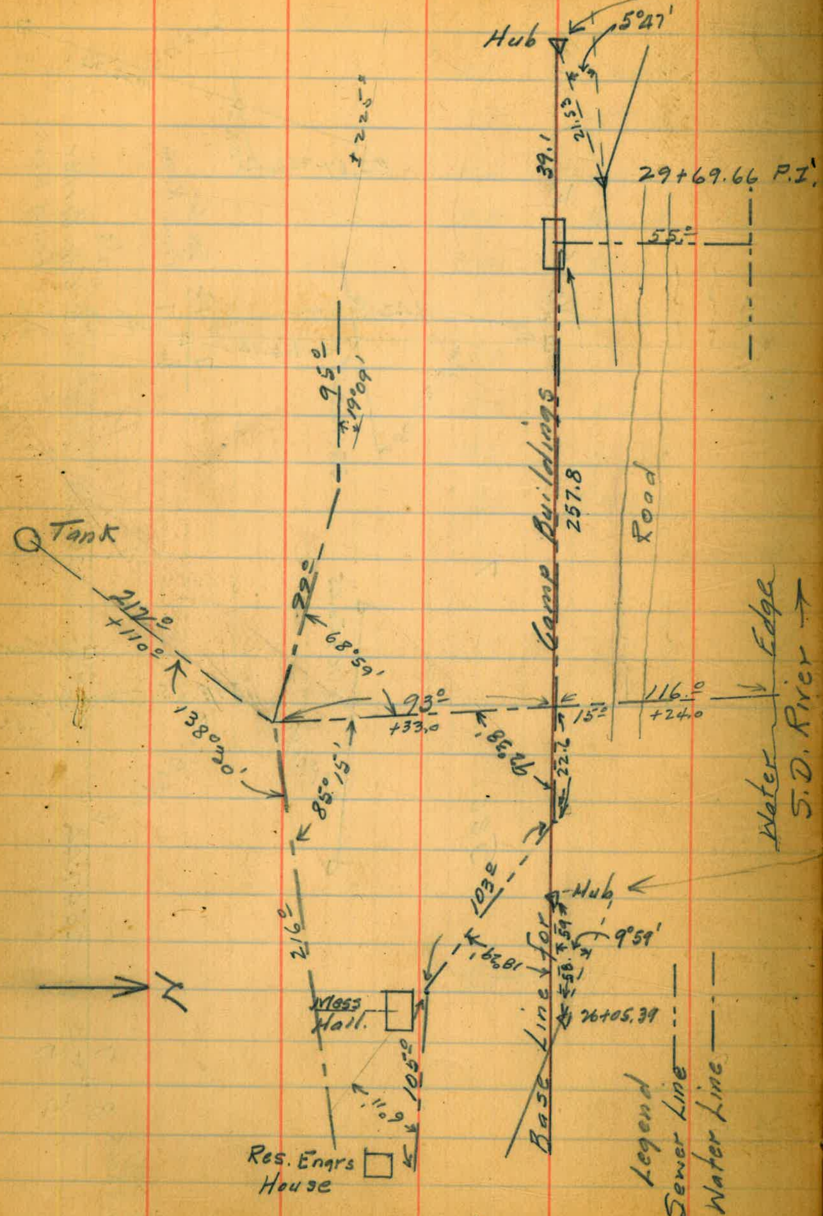
Converse
Elliott Notes
Simpson
Lowden

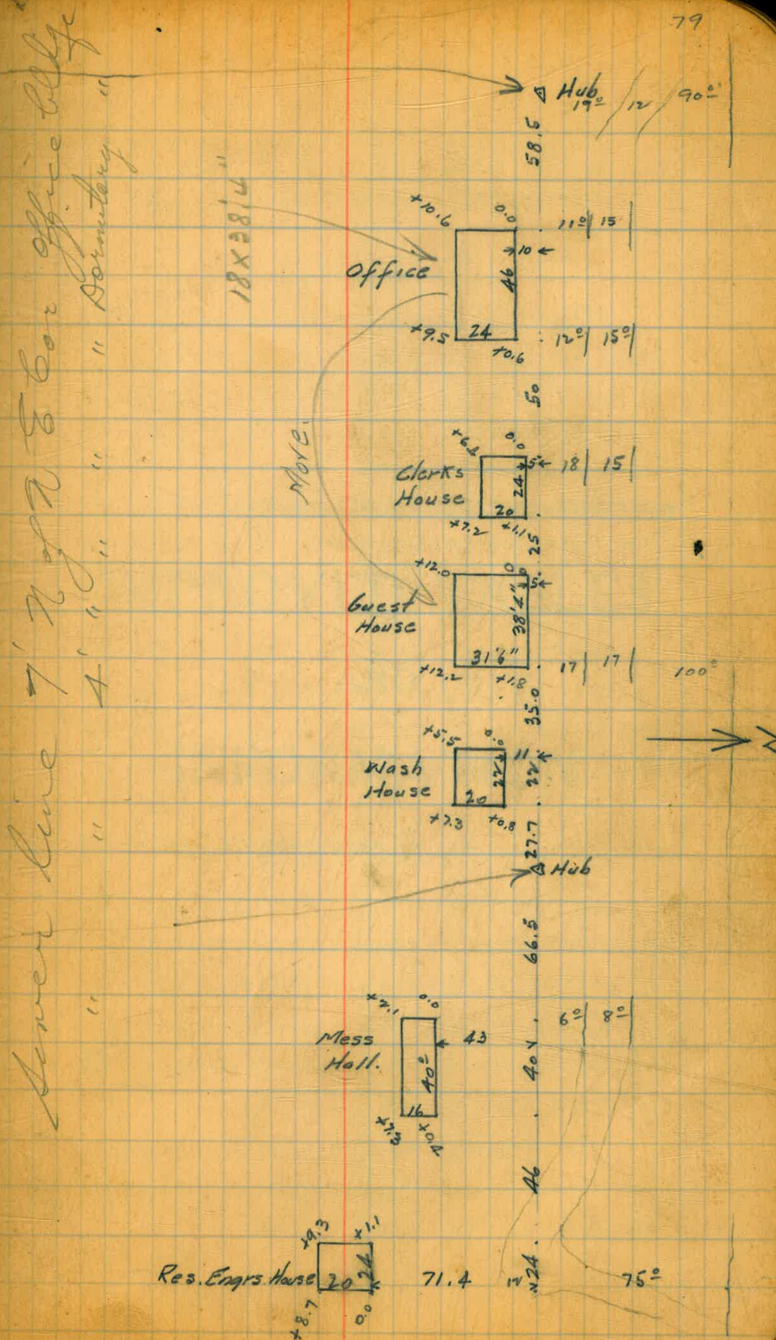
Levels of Proposed Sewer Line

B.M. #4				568.88
	12.90	581.78		
N.E. Cor. of Res. Eng. House			1.8	580.0
0+00			6.6	75.2
0+35			8.9	72.9
0+82			11.9	69.9
Δ 1+05			12.8	69.0
N.W. Cor. Mess House			10.1	71.7
T.P.			13.10	568.68
	5.05	573.73		
Bottom Draw 1+28			8.9	64.8
1+55			8.4	65.3
1+80			9.1	64.6
Δ 2+08			12.3	61.4
Water Line Crossing 2+30			13.0	60.7
N.W. Cor. Wash House			9.1	64.6
T.P.			11.81	561.92
	1.10	563.02		
2+53			4.5	58.5
N.W. Corner Dormitory			4.6	58.4
3+00			5.7	57.3
3+50			7.0	56.0
N.W. Corner Clerks Hse.			6.0	57.0

		563.0±		
4+00 N.W. Cor.			8.2	554.8
Office			5.8	557.2
4+50			8.6	54.4
4+66			8.8	54.2
T.P.			9.01	554.01
	0.13	554.14		
S. edge Rd. 4+77			3.4	50.7
N. edge Rd. +95			3.5	50.6
5+14			9.6	44.5
5+20			10.2	543.9




Hub
5°47'
21.53
39.1
29+69.66 P.I.
55°
Tank
217°
+11.0°
22°
68°59'
95°
93°
+33.0
138°20'
85°15'
116.°
+24.0
15°
Camp Buildings
257.8
Road
Water Edge
S.D. River →
22.2
103°
Hub
9°59'
216°
Mess Hall.
105°
Base Line for
26+05.39
Res. Engrs House
Legend
Sewer Line
Water Line


Sewer line 7' N of N E cor office bldg
" 4' " " " Dormitory "
18x38'4"
Hub
19°
90°
58.5
Office
24
46
10
11°
15
12°
15°
50
Clerks House
24
20
18
15
25
Guest House
38'4"
31'6"
17
17
100°
35.0
Wash House
22
20
11
27.7
Hub
66.5
Mess Hall.
43
40°
16
6°
8°
40.1
46
Res. Engrs House
20
24
71.4
75°
Move

IMPROVED TABLES
AND
INFORMATION

DIRECTIONS FOR USE OF TABLES

TABLE No. 1.

Distance of slope stake from side or shoulder stake for any width roadway, slope 1½ to 1. If ground is nearly level, the cut or fill at side stake is located by the double entry method in left column and top row. The number in body of table in same row and column gives distance from side stake to slope stake. If ground is not level estimate the difference in elevation between the side stake and slope stake, lower target by this amount if cut, elevate if fill. Add this amount to cut or fill and find distance in table. Set up rod at this point, and line of sight should cut target. If it does not make the slight adjustment necessary.

TABLE No. 9.

To find Tangent and External for curve of any other degree, divide by degree of curve and add correction found in column of corrections.

Degree of curve with a given I may be found by dividing tangent, (or external), opposite I by given tangent, (or external).

The distance from a point on the tangent to the curve is very nearly the square of the tangent length divided by twice the radius.

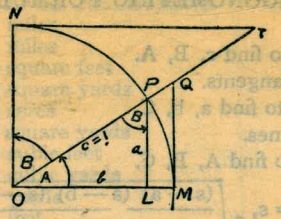


TABLE II

TRIGONOMETRIC FORMULÆ.

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

$R = OB = c = 1$

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

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

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

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

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

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

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

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

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

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

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

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

$$\text{Law of Sines} \quad \frac{\sin A}{a} = \frac{\sin B}{B} = \frac{\sin C^1}{C}$$

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

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

Table II—Continued
TRIGONOMETRIC FORMULAE (continued)

In any triangle:

Given a, b, C; to find c, B, A.

Use Law of Tangents.

Given A. B. c; to find a, b, C.

Use Law of Sines.

Given a, b, c; to find A, B, C.

$$\text{Let } \frac{a+b+c}{2} = s, \quad \sqrt{\frac{(s-a)\,(s-b)\,(s-c)}{s}} = r$$

$$\cos \tfrac{1}{2} A = \sqrt{\frac{s(s-a)}{bc}}$$

$$\tan \tfrac{1}{2} A = \frac{r}{s-a}$$

$$\tan \tfrac{1}{2} B = \frac{r}{s-b}$$

$$\tan \tfrac{1}{2} C = \frac{r}{s-c}$$

Area of a triangle:

Area $= \tfrac{1}{2}$ ab Sin C

Area $= \sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

PRISMOIDAL FORMULA.

$$\text{Vol.} = \frac{h}{6}(B+b+4M)$$

h = altitude: b. B = bases; M = midsection

Table III
INCHES AND FRACTIONS OF AN INCH IN DECIMALS OF A FOOT

	0	1	2	3	4	5	6	7	8	9	10	11	
1/16	.0052	.0885	.1719	.2552	.3385	.4219	.5052	5885	.6719	.7552	.8385	.9219	1/16
1/8	.0104	.0938	.1771	.2604	.3438	.4271	.5104	.5938	.6771	.7604	.8438	.9271	1/8
3/16	.0156	.0990	.1823	.2656	.3490	.4323	.5156	.5990	.6823	.7656	.8490	.9323	3/16
1/4	.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542	.9375	1/4
5/16	.0260	.1094	.1927	.2760	.3594	.4427	.5260	.6094	.6927	.7760	.8594	.9427	5/16
3/8	.0313	.1146	.1979	.2813	.3646	.4479	.5313	.6146	.6979	.7813	.8646	.9479	3/8
7/16	.0365	.1198	.2031	.2865	.3698	.4531	.5365	.6198	.7031	.7865	.8698	.9531	7/16
1/2	.0417	.1250	.2083	.2917	.3750	.4583	.5417	.6250	.7083	.7917	.8750	.9583	1/2
9/16	.0469	.1302	.2135	.2969	.3803	.4635	.5469	.6302	.7135	.7969	.8802	.9635	9/16
5/8	.0521	.1354	.2188	.3021	.3854	.4688	.5521	.6354	.7188	.8021	.8854	9688	5/8
11/16	.0573	.1406	.2240	.3073	.3906	.4740	.5573	.6406	.7240	.8073	.8906	.9740	11/16
3/4	.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958	.9792	3/4
13/16	.0677	.1510	.2344	.3177	.4010	.4844	.5677	.6510	.7344	.8177	.9010	.9844	13/16
7/8	.0729	.1563	.2396	.3229	4063	.4896	.5729	.6563	.7396	.8229	.9063	9896	7/8
15/16	.0781	.1615	.2448	.3281	.4115	.4948	.5781	.6615	.7448	.8281	.9115	.9948	15/16
1	.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167	1.000	1
	0	1	2	3	4	5	6	7	8	9	10	11	

Table IV
USEFUL RELATIONS

Lineal feet	×.00019	= miles
Lineal yards	×.0006	= miles
Square inches	×.007	= square feet
Square feet	×.111	= square yards
Square yards	×.0002067	= acres
Acres	×4840	= square yards
Cubic inches	×.00058	= cubic feet
Cubic feet	×.03704	= cubic yards
Links	×.22	= yards
Links	×.66	= feet
Feet	×1.5	= links

360° = 21600′ = 1296000″

Radius = arc of 57.2957790°

Arc of 1° (radius = 1) = .017453292

Arc of 1′ (radius = 1) = .000290888

Arc of 1″ (radius = 1) = .000004848

$\pi = 3.141592654$	$\sqrt{\frac{1}{4}} = 0.564190$
$\frac{\pi}{4} = 0.785398163$	$\sqrt[3]{\frac{6}{\pi}} = 1.240700982$
$\frac{\pi}{6} = 0.523598776$	$\pi^2 = 9.869604401$
$\sqrt{\frac{4}{\pi}} = 1.128379167$	$\frac{1}{\pi^2} = 0.101321184$
$\frac{\pi}{6} = 0.523598776$	$\sqrt{\pi} = 1.772453851$
$\frac{4.\pi}{3} = 4.188790205$	$\frac{1}{\pi} = 0.3183099$

Curvature of Earth's surface = about 0.7 feet in 1 mile

Curvature in feet = 0.667 (Dist. in miles)^2

Difference between arc and chord length, 0.05 feet in 11½ miles

Probable error of a single observation $= 0.6754\sqrt{\frac{Mv^2}{n-1}}$

Error in chaining of 0.01 feet in 100 feet:
Due to—

1. Length of tape error of 0.01 feet
2. Alignment. One end 1.4 feet out of line
3. Sag of tape at centre of 0.61 feet.
4. Temperature difference of 15°
5. Difference of pull of 15 lbs.

STADIA REDUCTION FORMULÆ.

Horizontal Distance $= R - R \sin^2 a + C \cos a$

Vertical Distance $= R \tfrac{1}{2} \sin 2a + C \sin a$

$$R = \text{Reading} \times \frac{\text{distance from Object glass to cross hairs}}{\text{distance between cross hairs}}$$

C = distance from Object glass to cross hairs + distance from Object glass to center of instrument.

a = angle of elevation for mid Reading

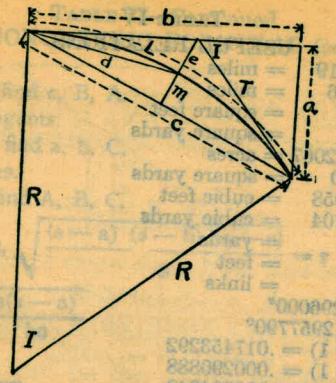


Table V

CURVE FORMULAE FOR SIMPLE CURVES

Compiled by J. Calvin Locke, C.E.

(1) $c = \sqrt{2Ra}$ (2) $c = \sqrt{a^2+b^2}$

(3) $c = \sqrt{2R\,(R-\sqrt{(R+b)\,(R-b)}} = \sqrt{2R(R-\sqrt{R^2-b^2})}$

(4) $c = 2\sqrt{m\,(2R-m)}$

(5) $c = 2R \sin \frac{1}{2} I$ (6) $c = 2T \cos \frac{1}{2} I$

(7) $e = R \operatorname{exsec} \frac{1}{2} I$

(8) $e = R \tan \frac{1}{2} I \tan \frac{1}{4} I$ (9) $e = T \tan \frac{1}{4} I$

(10) $b = \sqrt{a\,(2R-a)}$

(11) $b = \sqrt{\left(c+\frac{c^2}{2R}\right)\left(c-\frac{c^2}{2R}\right)} = \sqrt{c^2-\frac{c^4}{4R^2}}$

(12) $b = R \sin I$ (13) $b = a \cot \frac{1}{2} I$

(14) $R = \frac{a^2+b^2}{2a} = \frac{c^2}{2a}$ (15) $R = \frac{d^2}{2m} = \frac{c^2+4m^2}{8m}$

(16) $d = \sqrt{R\,(2R-\sqrt{(2R+c)\,(2R-c)}} = \sqrt{R(2R-\sqrt{4R^2-c^2})}$

(17) $d = \sqrt{2Rm}$ (18) $d = 2R \sin \frac{1}{4} I$ (19) $m = \frac{d^2}{2R}$

(20) $m = R \mp \sqrt{\left(R+\frac{c}{2}\right)\left(R-\frac{c}{2}\right)} = R \mp \sqrt{R^2-\frac{c^2}{4}}$

(21) $m = R \operatorname{vers} \frac{1}{2} I$ (22) $m = R \sin \frac{1}{2} I \tan \frac{1}{4} I$ (23) $m = \frac{1}{2} c \tan \frac{1}{4} I$

(24) $a = \frac{c^2}{2R}$ (25) $a = R - \sqrt{(R+b)\,(R-b)} = R - \sqrt{R^2-b^2}$

(26) $a = 2R\,(\sin^2 \frac{1}{2} I)^2$ (27) $a = R \operatorname{vers} I$ (28) $a = R \sin I \tan \frac{1}{2}$

(29) $a = b \tan \frac{1}{2} I$ (30) $a = T \sin I$ (31) $T = R \tan \frac{1}{2} I$

(32) $I = \frac{L}{R} \times 57.295780$ (33) $R = \frac{L}{I} \times 57.295780$

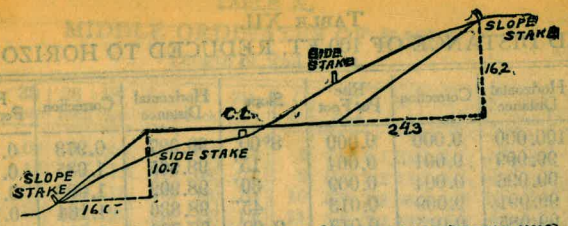
(34) $L = IR \times 0.01745329$ (35) $L = \frac{8d-c}{3}$

(36) Area Seg. $= \frac{LR - R^2 \sin I}{2} = \frac{LR - Rb}{2}$

Table VI

SINES, COSINES, TANGENTS. COTANGENTS

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.
0	0000	0000	0029	0029	0058	0058	0087	0087	0116	0116	0145	0145	89
1	175	0175	0204	0204	0233	0233	0262	262	291	291	320	320	88
2	349	349	378	378	407	407	436	437	465	466	494	495	87
3	523	524	552	553	581	582	610	612	640	641	669	706	86
4	698	699	727	729	756	758	785	787	814	816	843	864	85
5	872	875	901	904	929	934	958	963	987	992	1016	1022	84
6	1045	1051	1074	1080	1103	1110	1132	1139	1161	1169	190	198	83
7	219	228	248	257	279	287	305	317	334	346	363	376	82
8	392	405	421	435	449	465	478	495	507	524	536	554	81
9	564	584	593	614	622	644	650	673	679	703	708	733	80
10	736	763	765	793	794	823	822	853	851	883	880	914	79
11	908	944	937	974	965	2004	994	2035	2022	2065	2051	2095	78
12	2079	2126	2108	2156	2136	186	2164	217	193	247	221	278	77
13	250	309	278	339	306	370	334	401	363	432	391	462	76
14	419	493	447	524	476	555	504	586	532	617	560	648	75
15	588	679	616	711	644	742	672	773	700	805	728	836	74
16	756	867	784	899	812	931	840	962	868	994	896	3026	73
17	924	3057	952	3089	939	3121	3007	3153	3035	3185	3062	217	72
18	3090	249	3118	281	3145	314	173	346	201	378	228	411	71
19	256	443	283	476	311	508	338	541	365	574	393	607	70
20	420	640	448	673	475	706	502	739	529	772	557	805	69
21	584	839	611	872	638	906	665	939	692	973	719	4006	68
22	746	4040	773	4074	800	4108	827	4142	854	4176	881	210	67
23	907	245	934	279	961	314	987	348	4014	383	4041	417	66
24	4067	452	4094	487	4120	522	4147	557	173	592	200	628	65
25	226	663	253	699	279	734	305	770	331	806	358	841	64
26	384	877	410	913	436	950	4462	986	488	5022	514	5059	63
27	540	5095	566	5132	592	5169	617	5206	643	243	669	280	62
28	695	317	720	354	746	392	772	430	797	467	823	505	61
29	848	543	874	581	899	619	924	658	950	696	975	735	60
30	5000	774	5025	5812	5050	851	5075	890	5100	930	5125	969	59
31	150	6009	175	6048	200	6088	225	6128	250	6168	275	6208	58
32	299	249	324	289	348	330	5373	371	398	412	422	453	57
33	446	494	471	536	495	577	519	619	544	661	568	703	56
34	592	745	616	787	640	830	664	873	688	916	712	959	55
35	736	7002	760	7046	783	7089	807	7133	831	7177	854	7221	54
36	878	265	901	310	925	355	948	400	972	445	995	490	53
37	6018	536	6041	581	6065	627	6088	673	6111	720	6134	766	52
38	157	813	180	860	202	907	225	954	248	8002	271	8050	51
39	293	8098	316	8146	338	8195	361	8243	383	292	406	342	50
40	428	391	450	441	472	491	494	541	517	591	539	642	49
41	561	693	583	744	604	796	626	847	648	899	670	952	48
42	691	9004	713	9057	734	9110	756	9163	777	9217	799	9271	47
43	820	325	841	380	862	435	884	490	905	545	926	601	46
44	947	657	967	713	988	770	7009	827	7030	884	7050	942	45
45	7071	1.0000	7092	1.0058	7112	1.0117	133	1.0176	153	1.0235	173	1.0295	44
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.



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.

To find

+

32.26
34.50
2.24

400.22
397.98
2.24

31.63
31.58
53.21

62 06½
32 51 3

1252.14

9945
2
19890
99.39
298.29

568.88
12.90
581.78
13.10
568.68
5.05
573.73
11.81
561.92
1.10
563.02
9.01
554.01

39 - 09.5
13 - 36.5
S 52 - 44 W

9969
2166
12 + 21.35

9.7
32 | 309
288
210

94.69

4187.1721
408 + 19.85
997.66
59.09
1056.75

90.00
66.01
S 23° 59 E

5173
2640
2533
1266.5

1595.53
4.12
1599.65
1266.5
333.

2.16

15459

95159
75
475795
666113
[illegible]
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40.3
16.8
28.5

43.9
28.5
15.4
6.38
520
118

63 - 39
3 55½
67 34½
39 53
179 60
10 2 29½
S 72 32½ W

98.325
1.18
786600
98325
98325
116.02350

5958
4504
55 01.6.2
53 53 92
5 0.70

223 - 47
85 15
138 - 32

565
27.8
28.7

S - 80 - 16 W
36 05
179 60
116 21
63 39
3 55½
S 59 - 43½ W
39 53
179 60
99 36½
S 80 23½ W

10 + 85.78
35.33
10 + 50.45

84 42
82 - 30
N 2 - 12 E

105
12
93

11.33
1.05
5665
11330
11,8965

31.69
1.05
15845
31690
332745

10°30' - 118
.18
23.6

269
40.8
2152
10760
109.752

269
21.1
269
269
.538
56.759