San Diego and
Coronado
Waterworks

Pipe Lines from Old Town to University
Heights.

Transit

2

F.B. 60

Return to City Engineers Office
City Hall, San Diego, Cal.

Table showing the difference of latitude and departure in running 80 chains at any course from 1 to 60 minutes.

Minutes.	Lks.	Minutes.	Lks.	Minutes.	Lks.
1	2⅓	21	49	41	95⅔
2	4⅔	22	51⅓	42	98
3	7	23	53⅔	43	100⅓
4	9⅓	24	56	44	102⅔
5	11⅔	25	58⅓	45	105
6	14	26	60⅔	46	107⅓
7	16⅓	27	63	47	109⅔
8	18⅔	28	65⅓	48	112
9	21	29	67⅔	49	114⅓
10	23⅓	30	70	50	116⅔
11	25⅔	31	72⅓	51	119
12	28	32	74⅔	52	121⅓
13	30⅓	33	77	53	123⅔
14	32⅔	34	79⅓	54	126
15	35	35	81⅔	55	128⅓
16	37⅓	36	84	56	130⅓
17	39⅔	37	86⅓	57	133
18	42	38	88⅔	58	135⅓
19	44⅓	39	91	59	137⅔
20	46⅔	40	93⅓	60	140

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DEC 1964

Table for Running on Slopes.

In the following table the first column shows the angle, the second, the number of links to be added to a chain on the slopes, to make one chain, horizontal measurement.

Angle.	Cor. in links	Angle.	Cor. in links.	Angle.	Cor. in links.	Angle.	Cor. in links.
°		°		°		°	
4	0·24	11	1·88	18	5·14	25	10·54
5	0·38	12	2·24	19	5·76	26	11·26
6	0·55	13	2·63	20	6·42	27	12·24
7	0·76	14	3·06	21	7·11	28	13·37
8	0·98	15	3·53	22	7·85	29	14·34
9	1·24	16	4·02	23	8·64	30	15·47
10	1·55	17	4·56	24	9·47	35	22·07

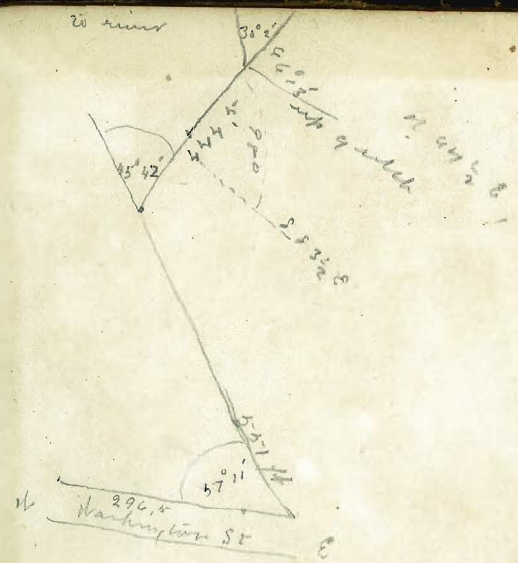
Return to City Engineers Office
City Hall, San Diego, Cal.

127+20 to 131+63.4
= 444 ft.

40.341
37
282387
121023
14.92617
1492
1477.69

3740
1480.

23937.79
1477.69
22460.10



Jan 8 1888

Commence at N E cor of Dove &

Washington St.

Thence East on North side of Washington St.

N 70 1/4 E 102 ft to cor to Blk 51

296 5/10 ft to point in center of gulch

N 47 1/2 W 551 ft to point on bank west side of gulch

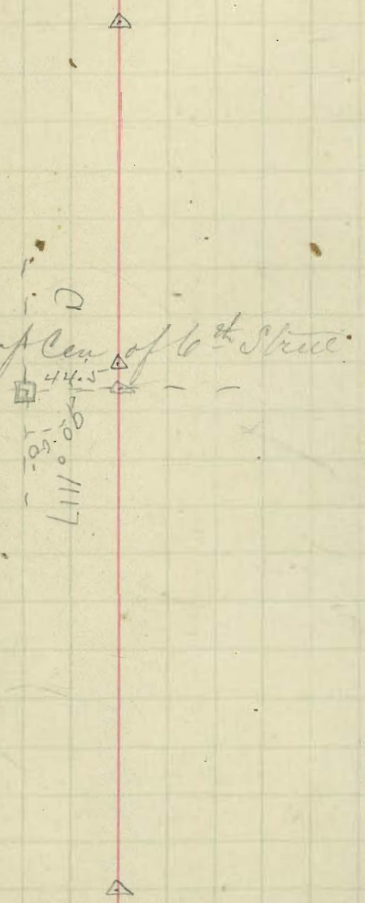
N 1 3/4 W 444,5 to point in gulch

N 31 3/4 W to river

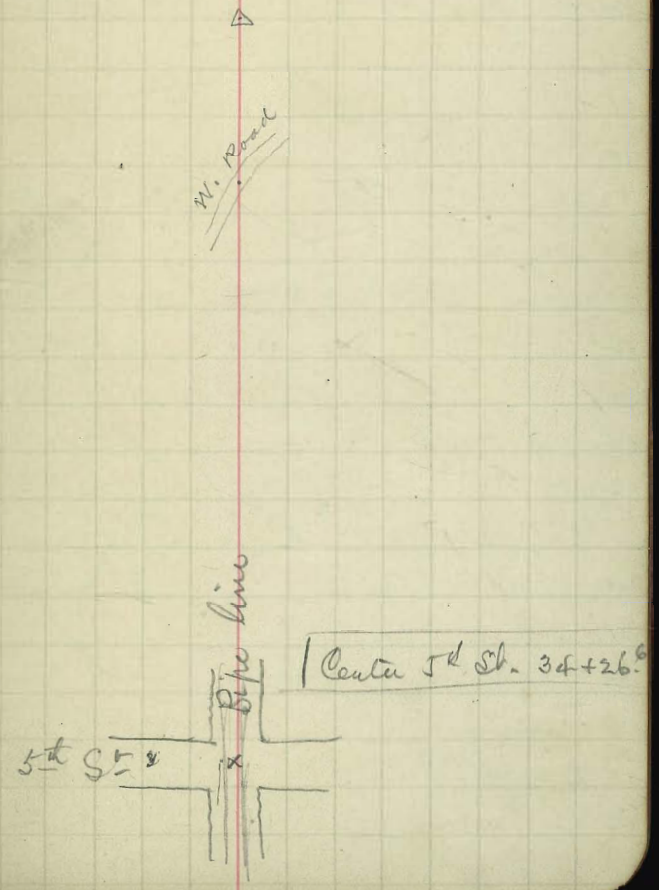
On base line along
center of blk —

400 ft to center of top of
low swag
550 to station end of line
running east —
Thence at right angles to
South 150 ft to Sta.
Thence east

17	+86.2	P.I.	90°.00	L.		
16						
15						
14						
13						
12						
11						
10	+53.7	P.I.	89°.35	R.		
	+47.7					
9						
8						
7						
6						
5						
4						
3						
2						
1						
0						



36
35
+64.2 P.I. 89°32' L
34
33
32
31 +75
30
29
28
27
26
25
24
23
22
21
20
19 +33.7
18
17



54						
53						
⁜ +65.2	P.I.	89°.50'	L			
51						
50 +50						
49						
+11.6	P.I.	90°.00'	R			
48						
47						
46						
45						
44						
43						
+37.5	P.I.	5°.53'	R			
42						
41						
40						
39						
+25	P.I.	83°.53'	R			
38						
37						

48.116
432.375
874.1

Along Washington St.

⁜ = 52 + 26.1 (equation)

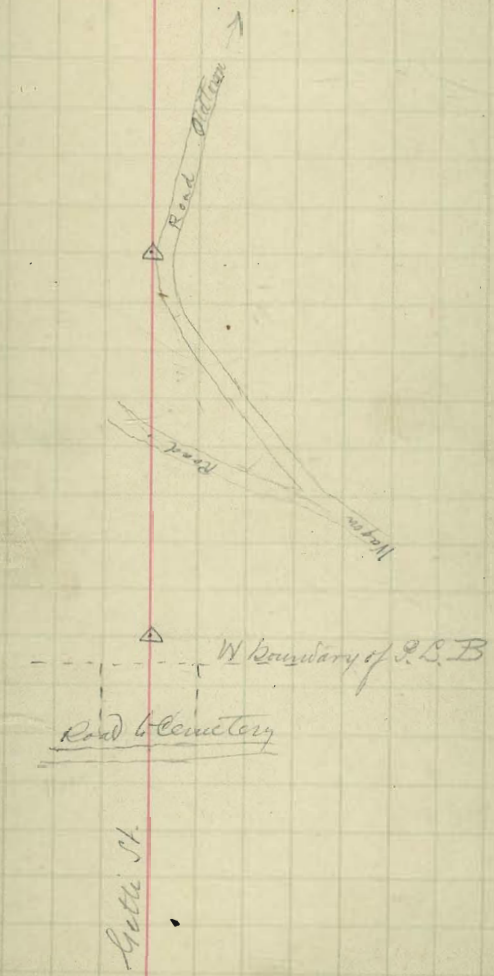
Along Dore St. W. Road

Along Douglas St.

72	+90					
71						
70						
69						
68						
67						
66						
65						
	+64.4					
64						
63						
62						
61						
60						
59						
	+61.8	P.I.	89°53'	L		
58						
57						
56						
	112	P.I.	90·08	R		
55						

Along Eagle St.

93						
92						
91						
90						
89	P.I.	25°.00′	L			
88						
87						
86						
85 +20						
84						
83						
82						
81	P.I.	31°.55′	R			
80 +41						
79						
78 +75						
77						
76						
75						
74						
73						

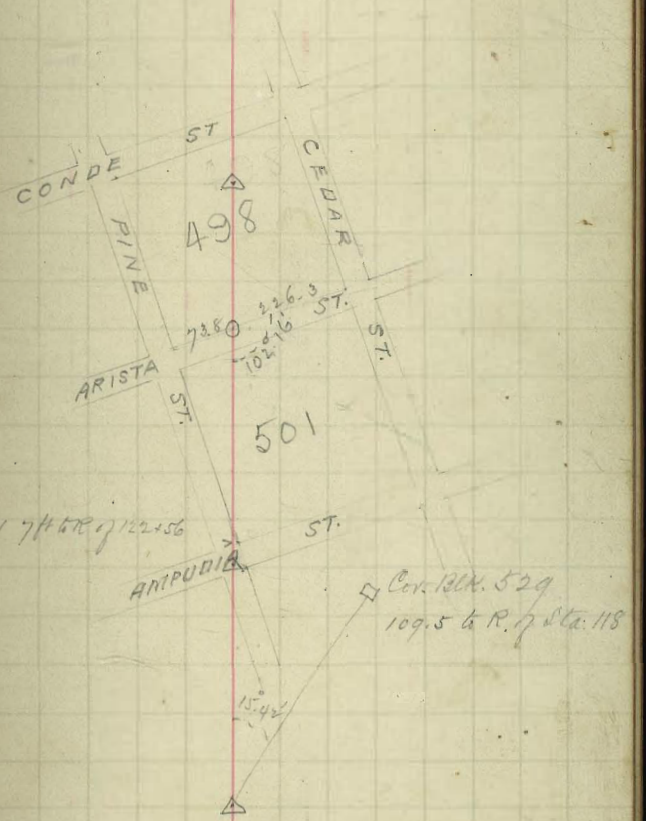


113						
112						
111						
110						
109						
108						
107						
106						
105	Rl.	35°.50	R			
104						
103						
102						
101						
100						
+50	Rl.	18°.10	R			
99						
98 +50						
97						
96						
95 +50						
94						

105

32

450					
128					
127					
+13.7					
126					
125					
124					
123	+106	P.I.	1.05	L	
122	+56				
121	+55.3	P.I	2.12	R	Stand Pipe
120		P.I.	1.07	Left.	
119					
118					
117		P.I.	12.20	L	
116					
115					
114					



Alteration of Pipe line from Station 105 thru' Streets of Old Town –

134			
133			
122			
121			
120			
119			
118 +00.3	P.I.	87° 52'	L
117			
116			
115 +50.9	P.I.	88° 15'	R
114			
113			
112			
111 +29.3	P.I.	21° 38'	L
110			
109			
108			
107			
106			
105	P.I.	32° 56'	R

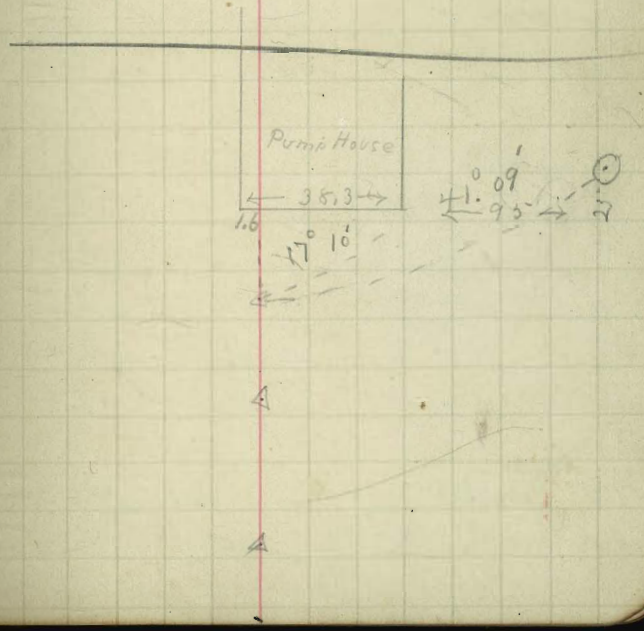
PINE STREET

Brickmill on 99+50

180 / 94.27 / 85.33

140	△ P.I.	22° 12′	Right	
139				
138				
137				VERT. ANGLE 24° 40′ down
136				
+30	P.I.	8° 00′	Left	
135				
134				
+39.5				
133				
132				
+63.4				
131				
+50				
130				
129				
+50	△ P.I.	31° 16′	Right	
128				
127				
126				
125				

+69 = Pump house
145
+50 Δ
144
+17.8 = P.I. 15° 40' Left
143
142
+92.8 = P.I 25° 16' Left
141



308 14
306 46
1.68

28
280
7.8
1.1428

Pipe Line starting at Zero & running E thro. University Tract.

B.M.	4.56	(on Station 0.)			282.80	✕
3+50		287.36	5.0		282.4	
4			4.3		283.1	
5			2.6		284.8	
6	9.18			1.27	286.09	
7		295.27	7.7		287.6	
8			6.6		288.7	
9			5.5		289.8	
10			4.3		291.0	✕
11			3.0		292.3	
12			1.8		293.5	
13	10.00			1.08	294.19	
14		304.19	8.8		295.4	
15			7.8		296.4	
16			6.9		297.3	
17			6.0		298.2	
18			5.0		299.2	
19			4.0		300.2	
20	1.48			3.26	300.93	✕
BM		308.41		2.27	306.14	
	31.22			7.88		

+1.1428

+1.0

Grade	cut	Stakes to be marked in feet & inches.	
Sta 3. 280.0		FT	INS:
280.6	1.8	1	9
281.1	2.0	2	0
282.3	2.5	2	6
283.4	2.7	2	8
284.6	3.0	3	0
285.7	3.0	3	0
286.9	2.9	2	11
288.0	3.0	3	0
289.0	3.3	3	4
290.0	3.5	3	6
291.0	3.2	3	3
292.0	3.4	3	5
293.0	3.4	3	5
294.0	3.3	3	4
295.0	3.2	3	3
296.0	3.2	3	3
297.0	3.2	3	3
298.0	2.9	~~2~~	~~11~~

R.R. bench cor. block 196 Elev. 306.46

B line from sta 0.
See last page

0	4.52				282.80	
1		287.32	4.2		283.1	
1+50			4.7		282.6	
2			6.2		281.1	
3			4.7		282.6	
4			4.2		283.1	
4+50			3.5		283.8	
	Change of line					
0	4.56				282.80	
1		287.36	4.6		282.8	280
+50			4.8		282.6	
2			5.3		282.1	
3			4.7		282.7	280
+50			3.8		283.6	280.7
4			4.2		283.6	281.14
+50			3.5		283.9	281.71

Grade		
280		
	3 1/4	3 1/4
	2 6	2 7 1/4
	1 1	1 11/4
280.	2 6	2 7
281.14	2 0	2 0
281.71	2 1	2 1 1/4
	2 8	2 9 1/2
	2 6	2 7
	2 1	2 1 1/2
	2 7	2 8 1/2
	2 9	2 11
	2 2	2 2 1/2
	2 2	

Feby 21st

Pipe Line Levels along University Avenue

		HI	R	El		Grade	Cut	Inches
18 =				299.2		296.0	3.2	
BM	2.64			306.14				
18+65.5		308.78	9.6	299.2		296.0	3.2	
+72.5			9.6	299.2		296.0	3.2	
+88.5			9.4	299.4		296.0	3.4	
19 =				296.6		296.0	3.6	
19+04.5			9.2	299.6				
+20.5			9.6	299.2		296.24	3.0	
+36.5		308.8	8.1	300.7		296.4	4.3	
+52.5			8.0	300.8		296.6	4.2	
+68.5			7.86	301.0		296.8	4.2	
+84½			7.46	301.3		297.0	4.3	
20+00.5			7.38	301.4		297.2	4.2	
20+16½			7.33	301.5		297.4 ~~298.4~~	4.1	
21			6.07	302.7		298.4	4.3	
22			5.6	303.2		299.6	3.6	
23			4.4	304.4		300.8	3.6	
24			3.3	305.5		302.0	3.5	
25			2.00	306.8		303.2	3.6	
26	8.42	315.45	1.75	307.00	307.03	304.4	2.6	
27			7.4	308.0		305.6	2.4	
28			5.93	309.5		306.8	2.7	

Abandoned see next page

Feby 21 '20

Pipe Line Levels along University Avenue

	+	H.I.	−	R	El	Bm		
29		315.45		4.4	311.05		308.0	3.0
30	11.36	325.61	1.20	1.2	314.2	314.25	311.0	3.2
31				6.26	319.3		316.25	3.0
32	9.68	333.84	1.45	1.45	324.2	324.1	321.5	2.7
33				4.15	329.7		326.75	3.0
34	11.96	344.56	1.24	9.61	334.9	332.6	332.0	2.9
35				5.43	339.1		336.0	3.1
36				2.00	342.5		339.3	3.2
37				1.70	342.8		South Side of Campus Avenue	
38	6.68	349.47		1.77		342.79	S.W. Cor of Campus Ave & Boulevard	
39				2.48		346.99	= BM 100 I water works	
40								

Abandoned see next page

PIPE LINE ELEVATIONS - UNIVERSITY AVENUE

Feby 27th 1888

Sta. S	+	H.I.	−	R	El.	Bm		Cut	Cut in Inches
						294.19	TP. 13		
18		308.67							
18				9.5	299.2		296.0	3.2	3'.2½"
+65.5				8.8	299.9		296.66	3.24	3'.3"
88.5				8.7	300.0		296.9	3.1	3'.1¼"
19. = 19+04.5		(308.7)		8.4	300.3		297.0	3.3	3'3½"
19+20.½				7.9	300.8		297.2	3.6	3'7."
+36½				7.4	301.3		297.36	3.94	3' ~~[illegible]~~ 11"
+52½				7.3	301.4		297.52	3.9	3'10¾"
+68½				7.1	301.6		297.7	3.9	3'10¾"
+84½				6.7	302.0		297.84	4.16	4'.2"
20 = 20+00.½				6.7	302.0		298.0	4.0 ⊙	4.0
+16½				6.6	302.1		298.2	3.9	3'10¾"
21				5.3	303.4		299.16	4.24	3'.3"
22				4.9	303.8		300.33	3.47	3'.6"
23				3.7	305.0		301.50	3.5	3'.6"
24	7.22	313.26	2.63	2.63	306.1	306.04	302.66	3.44	3'.5¼"
25				5.8	307.5		303.83	3.67	3'.8"
26		(313.3)		5.6	307.7		305.00	2.7	2'.8½"
27				4.6	308.7		306.26	2.44	2'.5¼"
28				3.1	310.2		307.43	2.77	2.9¼"
29			1.58	1.6	311.7	311.68	308.5	3.2 ⊙	3.2½"

PIPE LINE ELEVATIONS UNIVERSITY AVENUE

3205
5.6
3149

Febry 22nd 1888

	+	HI	−	R				Cut	Inches
29 P.P	+8.79	320.47				311.68			
30				5.6	314.9		311.7	3.2 ⊙	3'2.1/2"
31			0.50	0.5	320.0	399.97	316.85	3.15	3.2"
31 T.P	9.40	329.37							
32				4.6	324.8		322.0	2.8	2'9 1/2
	11.43	339.72	1.08			328.29			
33				9.4	330.3		327.15	3.15	3'2'
34	~~+00~~			4.2	335.5		332.3	3.2 ⊙	3.2 1/2"
35	00.1			+00.1	339.7	339.73	336.5	3.2 ⊙	3 2 1/2"
	9.69	349.42							
36				6.2	343.2		340.2	3.0 ⊙	3'.00
+25				6.0	343.4				
			1.85		347.57				

South Line Campos Avenue

347.57 = El B No 1, WATER WORKS

R R Bench Cor Block 190 Tally Cor on Fillmore avenue = ~~306.78~~

306.46. Water Line Elevation 306.78

Sta	Elev.	Grade		
37	344.3	341.0		
38	344.7	341.1		
39	344.6	341.2		
40	344.6	341.3		
41	344.9	341.4		
(P.S.) 42	343.79	341.5		
43	343.9	341.6		
44	344.5	341.7		
45	344.2	341.9	Sta 45. P.I. 55° 47'L	to 52+58.1 tack in Sill of Water Tank
46	344.4	342.		
47	347.5	342.8		
48	347.8	343.7		
(P.S.) 49	349.44	344.5		
50	348.4	345.3		
51	349.1	346.2		
52	350.5	347.		
B.M. "A"	351.09	Nail in Sill of Tank	University Heights	

			Rods			B.M.
0	343.24		11.0	355.24	4.80	340.44
+50	341.21	2.72	4.75	345.96		
1	339.66		6.20			
+50	336.46		9.50			
2	334.85	1.81	11.11	336.66		
+12	333.66		3.0			
+50	325.75	1.60	10.91	327.35		
+85	321.65		5.70			
3	317.81		10.05			
+85	316.31		11.04			
+50	317.13		10.22			
4	316.65		10.70			
+50	314.85	2.16	12.50	317.81		
+78.15	317.96		5.65			Edge of Road
5	310.71		6.80			
+50	310.51		6.50			
+80	310.51		6.50			
6	305.84		11.17			
+25	308.91		8.10			
+50	310.31		6.70			
7	308.17		8.84			
+50	303.81	0.76	13.20	304.07		
8	301.67		2.40			

8 + 50	298.32		5.75	304.07	
+ 90	294.12		9.95		
9 + 04	291.07		13.00		
+ 09					
9 + 50	295.22		8.85		
+ 80	297.77		6.30		
10	296.82		7.25		
+ 35	298.77		5.30		
+ 50	297.27		6.80		
+ 70	299.77		4.30		
11	299.97		4.10		
+ 20	299.27		4.80		
+ 50	301.57		2.50		
80	302.46		1.61		
12	302.47	10.40	1.60	312.87	
+ 50	306.77		6.10		
+ 75	305.17		7.70		
13	307.72		5.15		

+25	306.97		5.90	312.87		
+50	308.82		4.05			
+75	310.52		2.35			
1+90	309.72		3.15			
14	311.65		1.22			
+56						

May 3rd

Herrold.

Locations of Pipe Line from sta 134 + 50

133 + 39.3		B.S.				
134 + 5.0		△	27° 30'	<		
135						
+ 5.0						
136						
+ 6.0		P.T.				
137						
+ 5.0						
138						
+ 5.0						
139						
+ 5.0						
140						
+ 4.0		P.T.				

Levels from Sta 131+68 ½

B.S.	+	H.I.	−	Elev.
Bmid				266.71
	1.10	267.81		
TP			11.95	255.86
	1.10	256.96		
131+68½			8.88	248.08
18 R			12.20	244.76
TP			11.69	245.27
	0.10	245.37		
132			12.50	232.87
TP			11.29	234.08
	0.52	234.60		
+39½			9.80	224.80
TP			11.94	222.66
	1.10	223.76		
+60			5.20	218.56
TP			11.60	212.16
	0.80	212.96		
134			8.00	204.96
TP			11.04	201.92
	0.10	202.02		
+20			6.20	195.82

B	+	HI	—	Elv		
		202.16				
TP			11.62	190.54		
	0.55	190.99				
100			9.10	181.89		
TP			11.82	179.17		
	0.16	179.33				
200			6.50	172.83		
TP			11.27	168.06		
	0.72	168.78				
TP			11.21	157.57		
	1.78	158.35				
TP			11.27	147.08		
	0.47	147.55				
136			4.50	143.05		
150			11.50	136.55		
TP			11.13	126.42		
	0.28	126.70				
TP			11.75	125.95		
	0.81	125.76				
137			2.40	123.36		
TP			12.11	113.65		

Δ	+	HS	—	El		
TP				113.65		
	0.4	114.05				
TP			12.03	102.02		
	1.06	103.08				
138			10.40	92.68		
TP			11.51	91.57		
	2.21	93.78				
150			14.10	79.68		
139			6.20	87.58		
TP			11.30	82.48		
	2.90	85.38				
130			10.4	74.98		
110			13.20	72.08		
TP			12.15	73.23		
	1.51	74.74				
141			12.50	62.24		
142			12.90	62.04		
142			13.20	61.54		
TP			11.50	62.94		
	0.50	63.44				
140			3.40	60.04		

S	+	HS	—	FS		
		63.44				
+175			5.35	58.09		
144			6.30	57.14		
+50			12.15	51.29		
BM(15) TP			11.54	51.90		
	0.98	52.88				
+75			10.70	42.18		
TP			11.89	40.99		
	10.37	41.26				
TP			11.50	29.86		
	0.01	29.87				
125			7.50	22.37		
TP			11.14	18.73		
	1.22	19.95				
BM(16) (on Lap)			2.22	17.73		
(on Door of Engine house)			8.00	11.95		

Near 0 144+50

Continued from end of book

Stn.	B.S.	H. of I.	Int.	F.S.	Red. Lev.	
T.P.	1.41	200.89		11.71	189.18	
135			8.2		192.69	
+20 T.P.	0.0	189.00		11.89	189.00	
+30 △			4.78		184.22	T.P. on plug
T.P.	0.78	177.88		11.90	177.10	
T.P.	1.93	167.85		11.96	165.92	
T.P.	1.95	157.83		11.97	155.88	
136			9.5		148.33	
T.P.	0.17	146.17		11.83	146.00	
T.P.	2.28	136.75		11.70	134.47	
136+80			8.25		128.50	
T.P.	1.21	126.66		11.30	125.45	
"	1.40	116.36		11.70	114.96	
"	0.52	105.27		11.61	104.75	
"	1.41	94.81		11.87	93.40	
138 △			4.80		90.01	on plug
T.P.	0.0	83.29		11.52	83.29	
"	0.75	82.63		11.41	71.88	
138+50			7.2		65.4	
139			3.6		69.0	

Sta	B.S.	H of I.	Int	F.S.		
		72.63				
140			14.70	57.93		
+80			14.60	58.0		
141			10.2	62.4		
T.P.	1.49	72.30		1.82	70.81	
141+82.2			0.0	72.3		
142			4.9	67.4		
T.P.	-0.19	60.43		11.68	60.62	
143			4.65	55.78		on flag
T.P.	0.07	48.78		11.72	48.71	
144			7.6	41.18	41.2	
	0.38	37.24		11.92	36.86	
+40			0.01	37.2		
				8.63	28.61	

on S end of Cap E end of Bridge.
Floor of Engine House about
7 feet lower than this.

Sta

1+50 △
4+50 △ } Between Plug Lines 0° 17' or 1½ ft below line of Slotter or 7½ between center of ditch

18+65.8 P.C 7° 07' chord 16' a Center of
△ = 67° 02' ditch is 3' longer R. T 85.4
R = 129.0
20+165 ~~20+165~~ P.T.

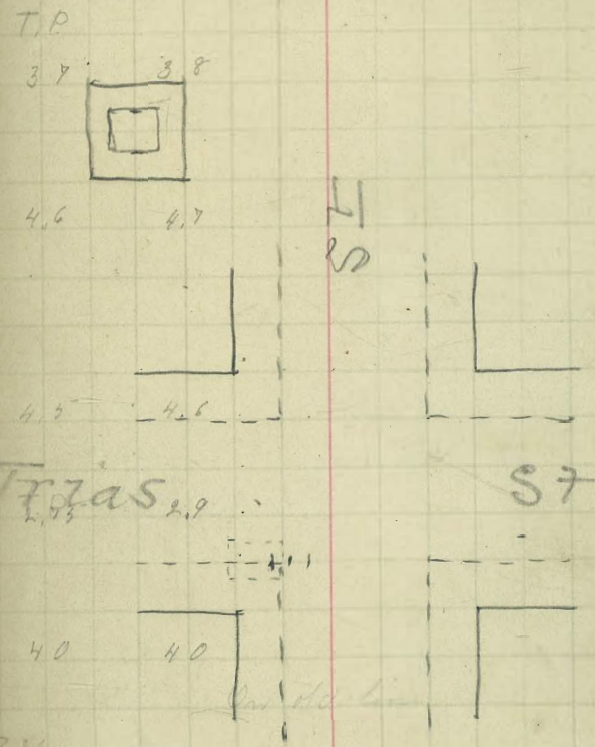
Thence along University an 10' E. of center

Levels of Alteration from Sta 105.

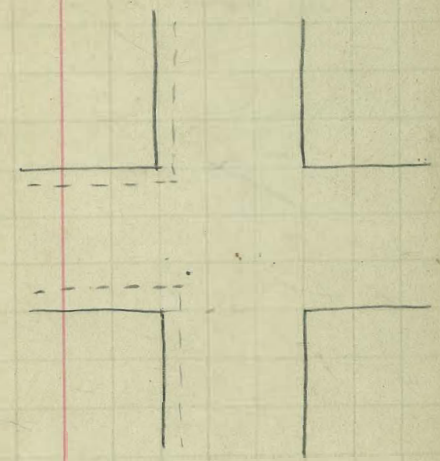
Sta	B.S.	H.I.	Int.	F.S.	Red. Lev.			
								in
105	5.61	273.50			267.89	263.33	4.6	4.7
+50			4.9		268.7			
+75			4.5		269.0			
106			5.4		268.1	263.00	5.1	5.1
+25			4.8		269.2			
+50			6.2		267.3			
107			6.4		267.1	262.67	4.4	4.3
108			7.4		266.1	262.33	3.8	3.9
+75			8.4		265.1		Center of road	
109			8.4		265.1	262.0	3.1	3.1
+30			7.8		265.7			
110			9.3		266.2	261.0	3.2	3.2
+40			8.8		264.7			
+65			11.3		262.2			
111			11.0		262.5	260.0	2.5	2.6
+29.3 △	6.88	269.26		11.12	262.38		T.P. on plug	
112			7.3		262.0	259.0	3.0	3.0
113			8.6		260.7	258.0	2.7	2.8
+50			9.7		259.6	257.5	2.1	2.1
114			8.2		261.1	258.0	3.1	3.1

121 + 17.3
38
121 .55 3
1 .55 3
142.106

Sta.	B.S.	H.I.	Int.	F.S.	Red. Lev.	
114+50		269.26	7.78		261.48	
115			6.6		262.7	268.0
+50			5.0		264.3	
+70			3.2		266.1	
116			4.7		264.6	260.0
+40			3.9		265.4	
+55			2.9		266.4	
+65			4.0		265.3	
117			3.8		265.5	266.0
+80			3.6		265.7	
118+00			4.51		264.75	262.0
+20			2.6		266.7	
+40			3.6		265.7	
119			2.3		267.0	263.0
(117)			1.17		268.09	
	7.32	274.18		2.40	266.86	
+80			5.9		268.3	
120			4.4		269.8	264.0
+15			5.4		268.8	
+50			4.7		269.5	



Stn	B.S.	H.of.I.	Int.	F.S.	Red.Lev			
120+65		274.18	5.1		269.1			
+80			3.80		270.4			
121			4.0		270.2	2650	5.2	5.2
+17			3.10		271.1			
+35			3.9		270.3			
+60			3.7		270.5			
+80			2.7		271.5			
122			3.4		270.8	2660	4.8	4.9
123			5.1		268.1			
+15			4.9		269.3			
+25			4.8		269.4			
124			6.5		267.7			
+25			5.9		268.4			
+50			7.3		266.9			
125			8.4		265.8			
126			11.9		262.3			
T.P.	1.78	264.81		11.15	263.03			
+40			3.3		261.5			
+85			4.1		260.7			
127			4.7		260.1			



16
8
12.8
33.55
152
56
2 3 2.75

Stn	B.S.	H. of I.	Int	F.S.	Red. Lev.
127+20		264.81	5.02		259.79
+60			9.5		255.3
T.P.	1.52	256.55		9.78	255.03
+80			6.49		250.06
128			10.11		246.44
T.P.	1.99	247.73		10.81	245.74
+50 T.P.	12.09	255.20		4.62	243.11
(26+137)			9.33		245.87
131+63.4			6.07		249.13
T.P.	1.35	244.85		11.70	243.50
132			+0.5		245.35
133			10.80		234.05
T.P.	0.28	234.39		10.74	234.11
+39.5			9.19		225.20
T.P.	0.11	222.60		11.90	222.49
+70			3.8		
T.P.	0.76	212.50		10.86	211.74
134			7.1	5.4	205.4
T.P.	0.22	200.89		11.93	200.67
+50					

See back

T.P.

Stand Pipe

On top of Anlage
Old line

T.P.

Elevation

15 ft. left of Stn. 133

118+003
3
121.003

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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	8
1	99.98	1.75	99.98	2.18	99.97	2.62	99.95	3.05	8
2	99.94	3.49	99.92	3.93	99.91	4.36	99.88	4.80	8
3	99.86	5.23	99.84	5.67	99.81	6.10	99.79	6.54	8
4	99.76	6.98	99.73	7.41	99.69	7.85	99.66	8.28	8
5	99.62	8.72	99.58	9.15	99.54	9.58	99.50	10.02	8
6	99.45	10.45	99.41	10.89	99.36	11.32	99.31	11.75	8
7	99.25	12.19	99.20	12.62	99.14	13.05	99.09	13.49	8
8	99.03	13.92	98.97	14.35	98.90	14.78	98.84	15.21	8
9	98.77	15.64	98.70	16.07	98.63	16.50	98.56	16.93	8
10	98.48	17.36	98.40	17.79	98.33	18.22	98.25	18.65	7
11	98.16	19.08	98.08	19.51	97.99	19.94	97.90	20.36	7
12	97.81	20.79	97.72	21.22	97.63	21.64	97.53	22.07	7
13	97.44	22.50	97.34	22.92	97.24	23.34	97.13	23.77	7
14	97.03	24.19	96.92	24.62	96.81	25.04	96.70	25.46	7
15	96.59	25.88	96.48	26.30	96.36	26.72	96.25	27.14	7
16	96.13	27.56	96.00	27.98	95.88	28.40	95.76	28.82	7
17	95.63	29.24	95.50	29.65	95.37	30.07	95.24	30.49	7
18	95.11	30.90	94.97	31.32	94.83	31.73	94.69	32.14	7
19	94.55	32.56	94.41	32.97	94.26	33.38	94.12	33.79	7
20	93.97	34.20	93.82	34.61	93.67	35.02	93.51	35.43	6
21	93.36	35.84	93.20	36.24	93.04	36.65	92.88	37.06	6
22	92.72	37.46	92.55	37.86	92.39	38.27	92.22	38.67	6
23	92.05	39.07	91.88	39.47	91.71	39.87	91.53	40.27	6
24	91.35	40.67	91 18	41.07	91.00	41.47	90.81	41.87	6
25	90.63	42.26	90.45	42.66	90.26	43.05	90.07	43.44	6
26	89.88	43.84	89.69	44.23	89.49	44.62	89.30	45.01	6
27	89.10	45.40	88.90	45.79	88.70	46.17	88.50	46.56	6
28	88.29	46.95	88.09	47.33	87.88	47.72	87.67	48.10	6
29	87.46	48.48	87.25	48.86	87.04	49.24	86.82	49.62	6
30	86.60	50.00	86.38	50.38	86.16	50.75	85.94	51.13	5
31	85.72	51.50	85.49	51.88	85.26	52.25	85.04	52.62	5
32	84.80	52.99	84.57	53.36	84.34	53.73	84.10	54.10	5
33	83.87	54.46	83.63	54.83	83.39	55.19	83.15	55.56	5
34	82.90	55.92	82.66	56.28	82.41	56.64	82.16	57.00	5
35	81.92	57.36	81.66	57.71	81.41	58.07	81.16	58.42	5
36	80.90	58.78	80.64	59.13	80.39	59.48	80.13	59.83	5
37	79.86	60.18	79.60	60.53	79.34	60.88	79.07	61.22	5
38	78.80	61.57	78.53	61.91	78.26	62.25	77.99	62.59	5
39	77.71	62.93	77.44	63.27	77.16	63.61	76.88	63.94	5
40	76.60	64.28	76.32	64.61	76.04	64.94	75.76	65.28	4
41	75.47	65.61	75.18	65.93	74.90	66.26	74.61	66.59	4
42	74.31	66.91	74.02	67.24	73.73	67.56	73.43	67 88	4
43	73.14	68.20	72.84	68.52	72.54	68.84	72.24	69.15	4
44	71.93	69.47	71.63	69.78	71.33	70.09	71.02	70.40	4
45	70.71	70.71							
Degrees.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Degrees.
	DEGREES.		¼ DEGREE.		½ DEGREE.		¾ DEGREE.		

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	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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	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
		100.00	0.44	100.00	0.87	99.99	1.31	8
	1.75	99.98	2.18	99.97	2.62	99.95	3.05	8
	3.49	99.92	3.93	99.91	4.36	99.88	4.80	8
	5.23	99.84	5.67	99.81	6.10	99.79	6.54	8
6	6.98	99.73	7.41	99.69	7.85	99.66	8.28	8
52	8.72	99.58	9.15	99.54	9.58	99.50	10.02	8
.45	10.45	99.41	10.89	99.36	11.32	99.31	11.75	8
9.25	12.19	99.20	12.62	99.14	13.05	99.09	13.49	8
99.03	13.92	98.97	14.35	98.90	14.78	98.84	15.21	8
98.77	15.64	98.70	16.07	98.63	16.50	98.56	16.93	8
98.48	17.36	98.40	17.79	98.33	18.22	98.25	18.65	7
98.16	19.08	98.08	19.51	97.99	19 94	97.90	20.36	7
97.81	20.79	97.72	21.22	97.63	21.64	97.53	22.07	7
97.44	22.50	97.34	22.92	97.24	23.34	97.13	23.77	7
97.03	24.19	96.92	24.62	96.81	25.04	96.70	25.46	7
96.59	25.88	96.48	26.30	96.36	26.72	96.25	27.14	7
96.13	27.56	96.00	27.98	95.88	28.40	95.76	28.82	7
95.63	29.24	95.50	29.65	95.37	30.07	95.24	30.49	7
95.11	30.90	94.97	31.32	94.83	31.73	94.69	32.14	7
94.55	32.56	94.41	32.97	94.26	33.38	94.12	33.79	7
93.97	34.20	93.82	34.61	93.67	35.02	93.51	35.43	6
93.36	35.84	93.20	36.24	93.04	36.65	92.88	37.06	6
92.72	37.46	92.55	37.86	92.39	38.27	92.22	38.67	6
92.05	39.07	91.88	39.47	91.71	39.87	91.53	40.27	6
91.35	40.67	91 18	41.07	91.00	41.47	90.81	41.87	6
90.63	42.26	90.45	42.66	90.26	43.05	90.07	43.44	6
89.88	43.84	89.69	44.23	89.49	44.62	89.30	45.01	6
89.10	45.40	88.90	45.79	88.70	46.17	88.50	46.56	6
88.29	46.95	88.09	47.33	87.88	47.72	87.67	48.10	6
87.46	48.48	87.25	48.86	87.04	49.24	86.82	49.62	6
86.60	50.00	86.38	50.38	86.16	50.75	85.94	51.13	5
85.72	51.50	85.49	51.88	85.26	52.25	85.04	52.62	5
84.80	52.99	84.57	53.36	84.34	53.73	84.10	54.10	5
83.87	54.46	83.63	54.83	83.39	55.19	83.15	55.56	5
82.90	55.92	82.66	56.28	82.41	56.64	82.16	57.00	5
81.92	57.36	81.66	57.71	81.41	58.07	81.16	58.42	5
80.90	58.78	80.64	59.13	80.39	59.48	80.13	59.83	5
79.86	60.18	79.60	60.53	79.34	60.88	79.07	61.22	5
78.80	61.57	78.53	61.91	78.26	62.25	77.99	62.59	5
77.71	62.93	77.44	63.27	77.16	63.61	76.88	63.94	5
76.60	64.28	76.32	64.61	76.04	64.94	75.76	65.28	4
75.47	65.61	75.18	65.93	74.90	66.26	74.61	66.59	4
74.31	66.91	74.02	67.24	73.73	67.56	73.43	67 88	4
73.14	68.20	72.84	68.52	72.54	68.84	72.24	69.15	4
71.93	69.47	71.63	69.78	71.33	70.09	71.02	70.40	4
70.71	70.71							
Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	
DEGREES.		¾ DEGREE.		½ DEGREE.		¼ DEGREE.		Degrees.

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