159

FIELD BOOK

S 1135

PLEASE RETURN TO
GEAUGA COUNTY ENGINEER
COURT HOUSE
CHARDON, O.
PHONE 250-X

Phelps Creek transit notes
page 1

Nauvoo Ditch transit notes
page 6 Levels P. 40

Lateral No. 1 on Phelps creek
page 14 Levels P.

Lateral on Nauvoo Ditch Transit Notes
page 13 Levels P. 47

Pease Creek Ditch Page 58

Pease Ditch. Locations Page 77

SHAW'S
PIONEERS
SINCE 1831

Field Book
No. S 1135

MADE IN 88 LEAVES

A Product of Wilson-Jones Co.
Made in U. S. A.

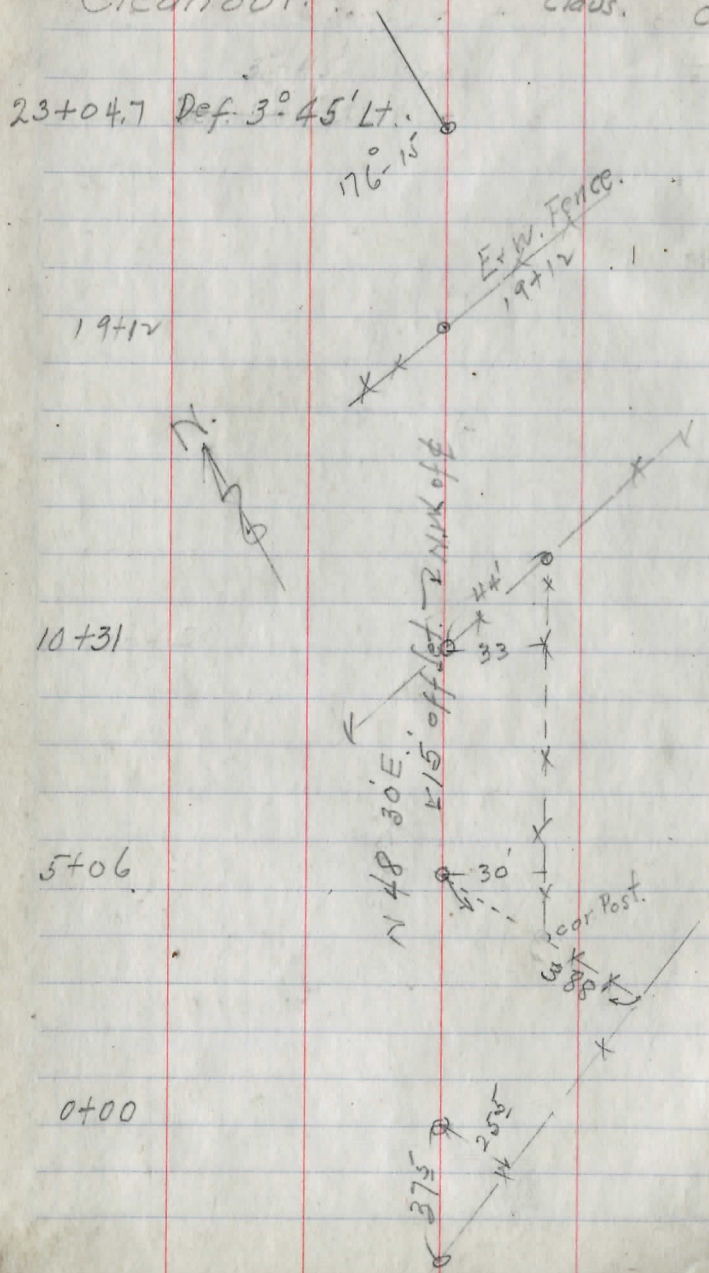
159

Grades on Phelps Creek fr. S.R. #528 to Nauvoo Rd. for St. Pg 56.

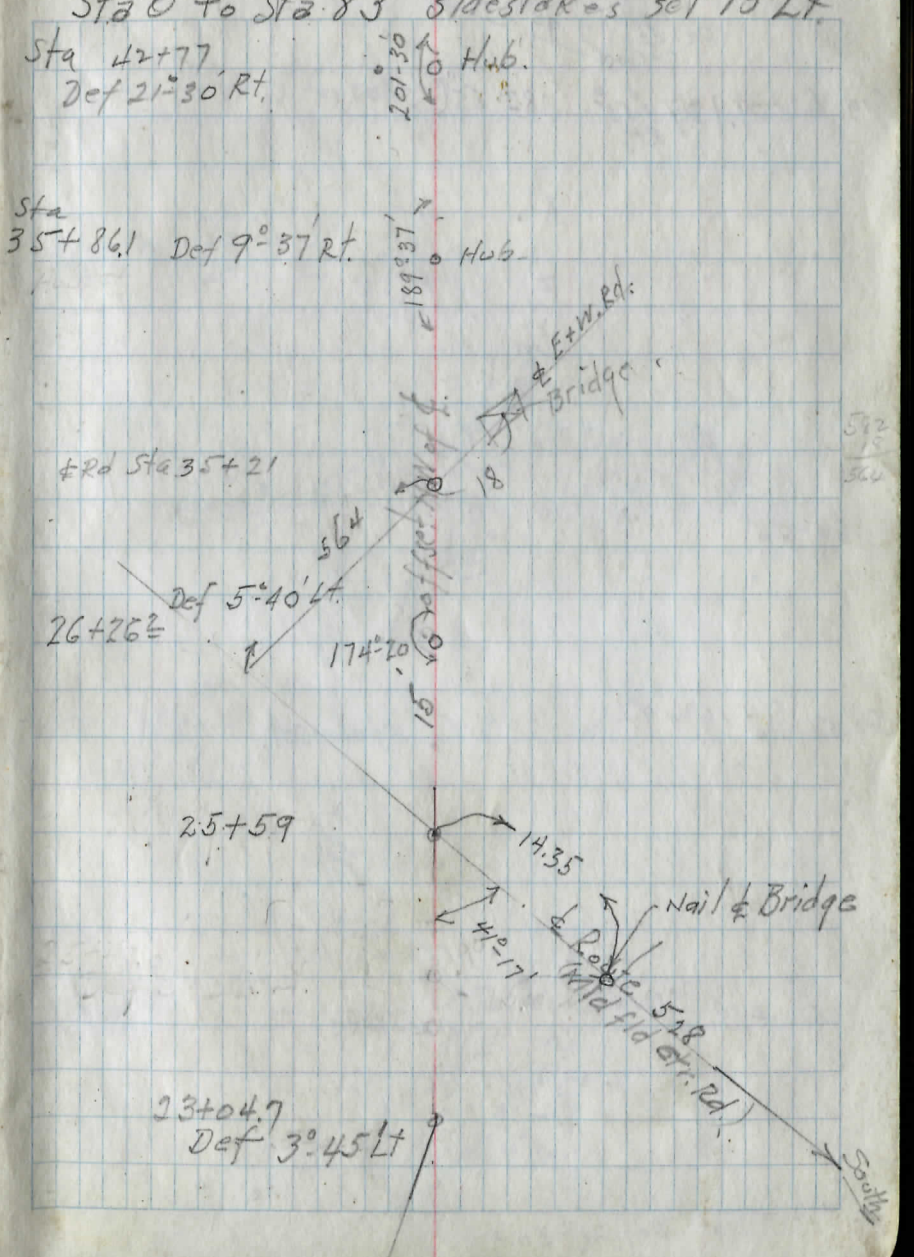
PAPER AND LITHOGRAPHING
GUARANTEED WATERPROOF

Phelps Creek Cleanout.

Graber 7-19-24
Richards T 75°
Claus. Clear



Sta 0 to Sta 83 sidestakes set 15' Lt.



7-20-24

63+38

E & W Fence.

Fence cor.

99'

Sta 62+38.9 Def 2°-55' Rt.

182°-55' stake

N & S. Fence

161°-12'

60+35

Sta 54+00 Def 16°-49' Lt

163°-11'

stake set.

50+34 Def 33°-08' Lt.

146°-52'

15 offset line NW of ℄

stake

S. S. Lateral 42+40

146°-52'
293°-44'

42+77.0 Def 21°-30' Rt.

Hub.

7-21-24 cut brush on line.

7-22-38
Graber Richards Inst
Claus. Ch.

84+0 last Sta. set

81+50 Def 11°-39' Lt.

168°-21'

Eley's N. Line 7

70°-37'

81+21

617.0

Sta 75+00 Def 0°49' Lt.

179°-11'

Hub. Set.

15' offset line NW of ℄.

72+14

Fence E & W

Sta. 69+00 0°-30' Def Rt

180°-30'

Hub set.

7-26-38
7-27-38

Graber
Richards (AM)
Deitz
Claus

Sta 83 to end Sidestakes set 15' Rt.

97+76.6 — 180° — Mag North 0°2' W obs

97+70.6 = ℄ Rd. (Peters Alley) conc Slab — 15' — 86°12'

92+0 Def 7°05' Lt — 172-55

~~305-50~~

90+0 — 180° — stake

86+0 Def 1°46' Lt. — 178°14

℄ Ditch ← 15

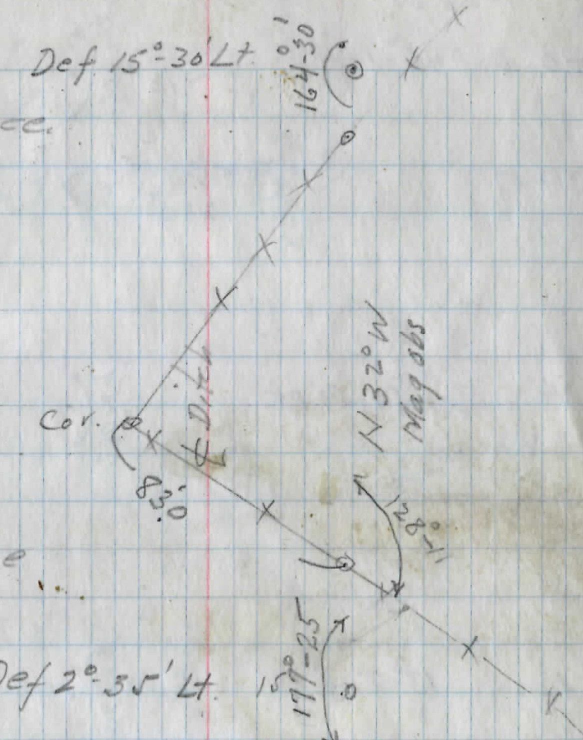
83+0 Def 2°41' Lt — 15' — 15' — 87°19' — 90° — 83:

200'± Slab

7-28-38

117+20 Def 15°30' Lt — 164°30'

113+87 Fence.



112+65 Fence

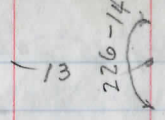
112+50 Def 2°35' Lt — 15 — 177°25'

110+37.7 Def 29°31' Lt — 150°29' — 15 — ℄

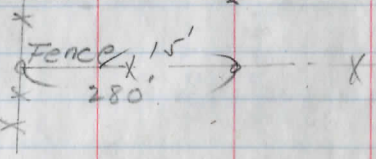
104+00 — 180° — 15

7-28-38

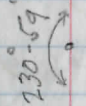
132+0 Def 46°-14' Rt



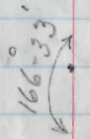
131+47

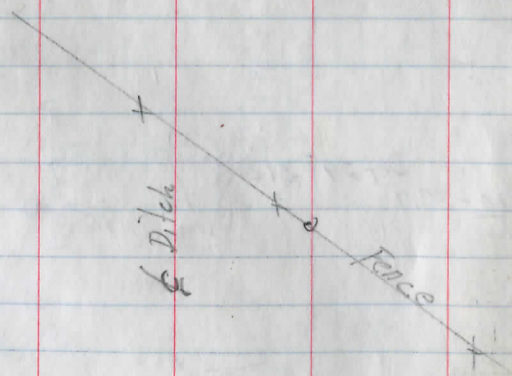


128+94 Def 50°-59' Rt



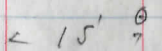
126+20 13°-27' Lt



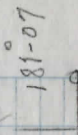


118+07 fence

117+20

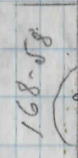


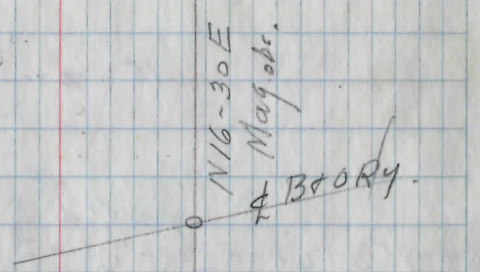
157+0 Def 1°-07' Rt



149+74 Fence

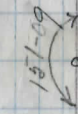
149+0 Def 11°-02' Lt.





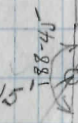
143+70

140+54 Def 28°-52' Lt

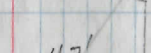


℄ Ditch

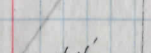
Def 8°-45' Rt.
135+0 = Jct. of Nauvoo
Produced N Ely.



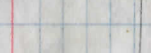
134



133



132+0



7-29-38

174+70 Fence

173+623 Def 32°-34' Rt — 212-34' — Hub.

15'

164+953 Def 25°-23' Rt — 205°-23' — stake.

164+57.3 = ℄ Rd — Bridge ctr. — 18' — (Barnes, Cor. E.) — S 1°-57' E

℄ Ditch

158+92 Fence

Lane.

15'

157+0 Def 1°-07' Rt — 181°-07' — stake.

185+724 Def 51°-12' Rt — 231°-12' — stake.

15'

184+25 — 15'

184+08.5 Def 42-33 Lt — 27' — 137°-27' — stake.

184+0 — 15'

℄ Ditch

181+60 — 15' — N 62° E

181+483 Def 41°-35' Lt — 25' — 138°-25' — stake.

181+30 — 15'

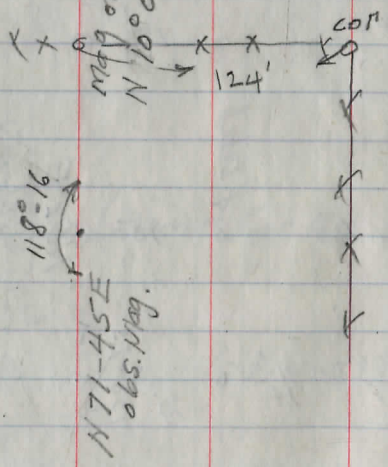
177+73.2 — 15' — 220°-29' — Hub.

Def. 40°-29' Rt.

197+0

195+39 E&W. Fence

194+66 E-W. Fence



193+54.1 Deg 61° 44' Lt
= Jct of Lateral.

186+0 N+S. Fence

180+72.4

Aug 3 1938

Nauvoo Ditch. Cleanout.

24+67.8 Def 52°-0' Rt

Sidestakes set 15' Rt.

17+0 Def 0°5' Lt

16+33 Fence. South

15+0 Def 0°50' Lt

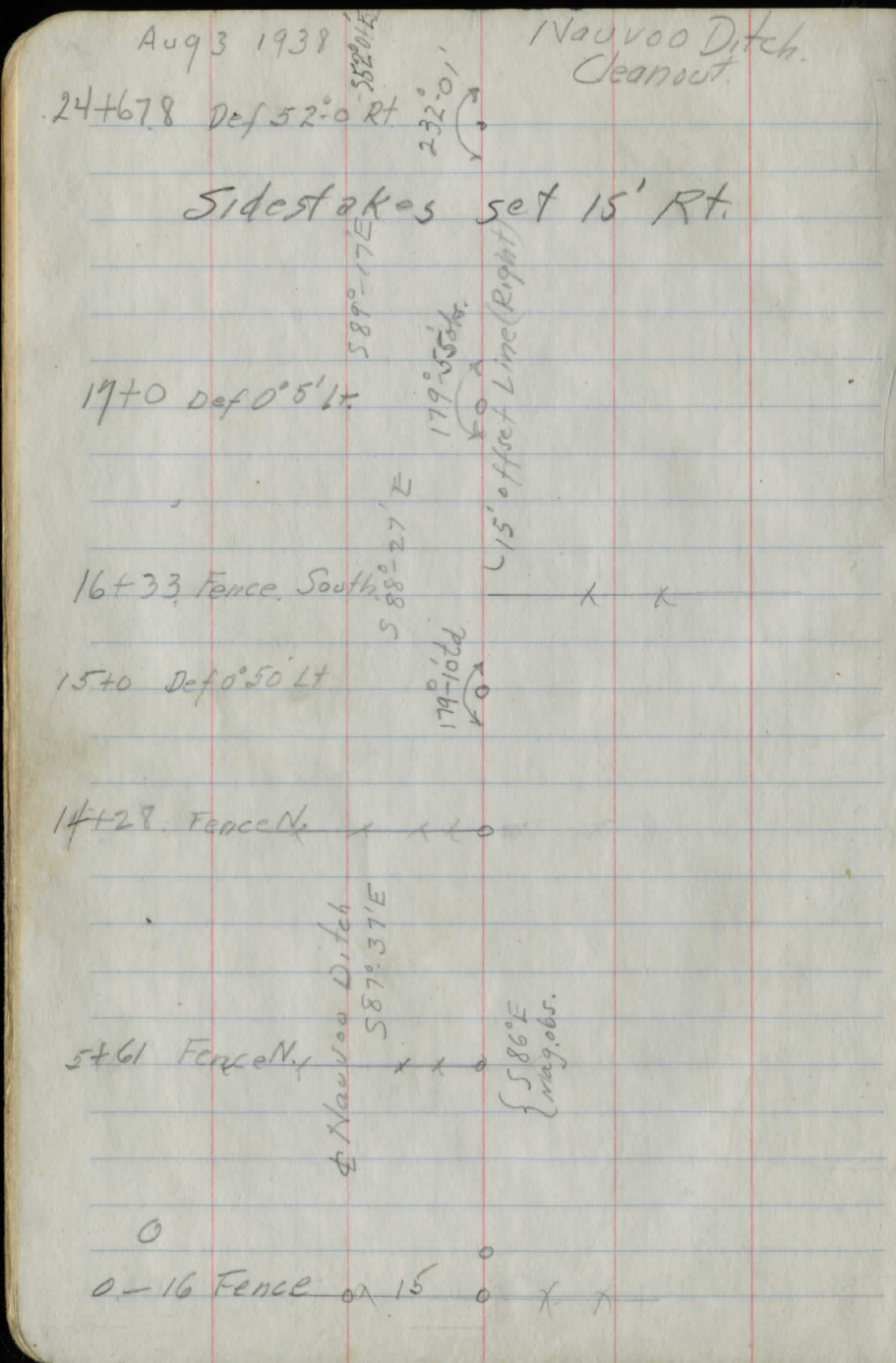
14+28. Fence N.

5+61 Fence N.

℄ Nauvoo Ditch

0

0-16 Fence



N66°49'E

33+65.25 Def 76°-10' Lt

33+50 = Lateral ℄

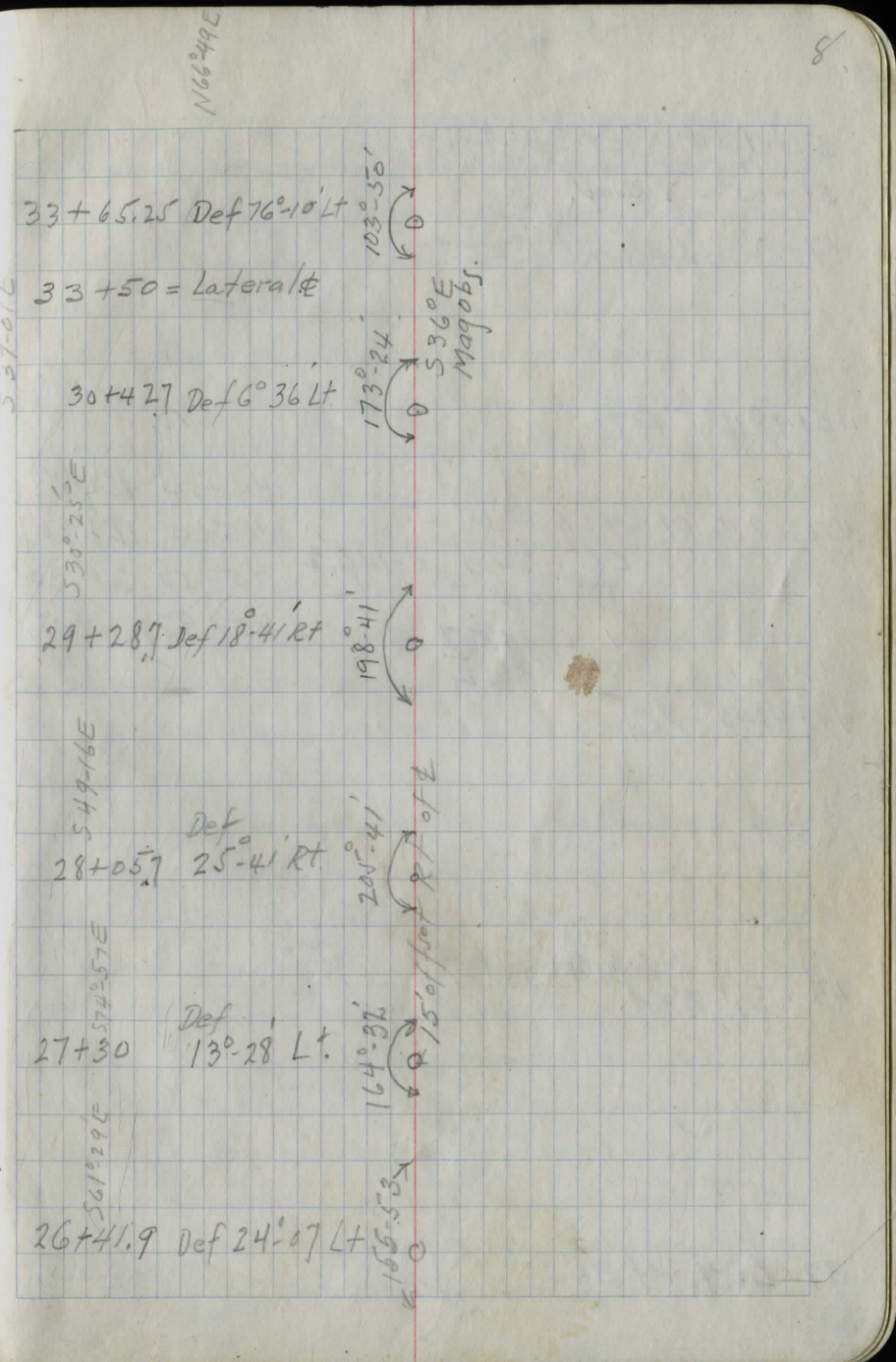
30+27 Def 6°-36' Lt

29+28.7 Def 18°-41' Rt

28+05.7 Def 25°-41' Rt

27+30 Def 13°-28' Lt.

26+41.9 Def 24°-07' Lt



8-8-38

51+11.60 Def 3°31 Rt.

51+05 = ℄ Road.

47+12 = Lateral East

45+98.15 PT.

45+30.65 = PI. Def 62°-15' Lt

Ext = 24.0 R = 146.2

D = 40°

L = 155.7

T = 88.2

44+42.45 PC.

44+50	1°-30'
45+0	11°-30
45+50	21-30
45+97.7	31-07

bridge

44+31.1 ℄ Rd.

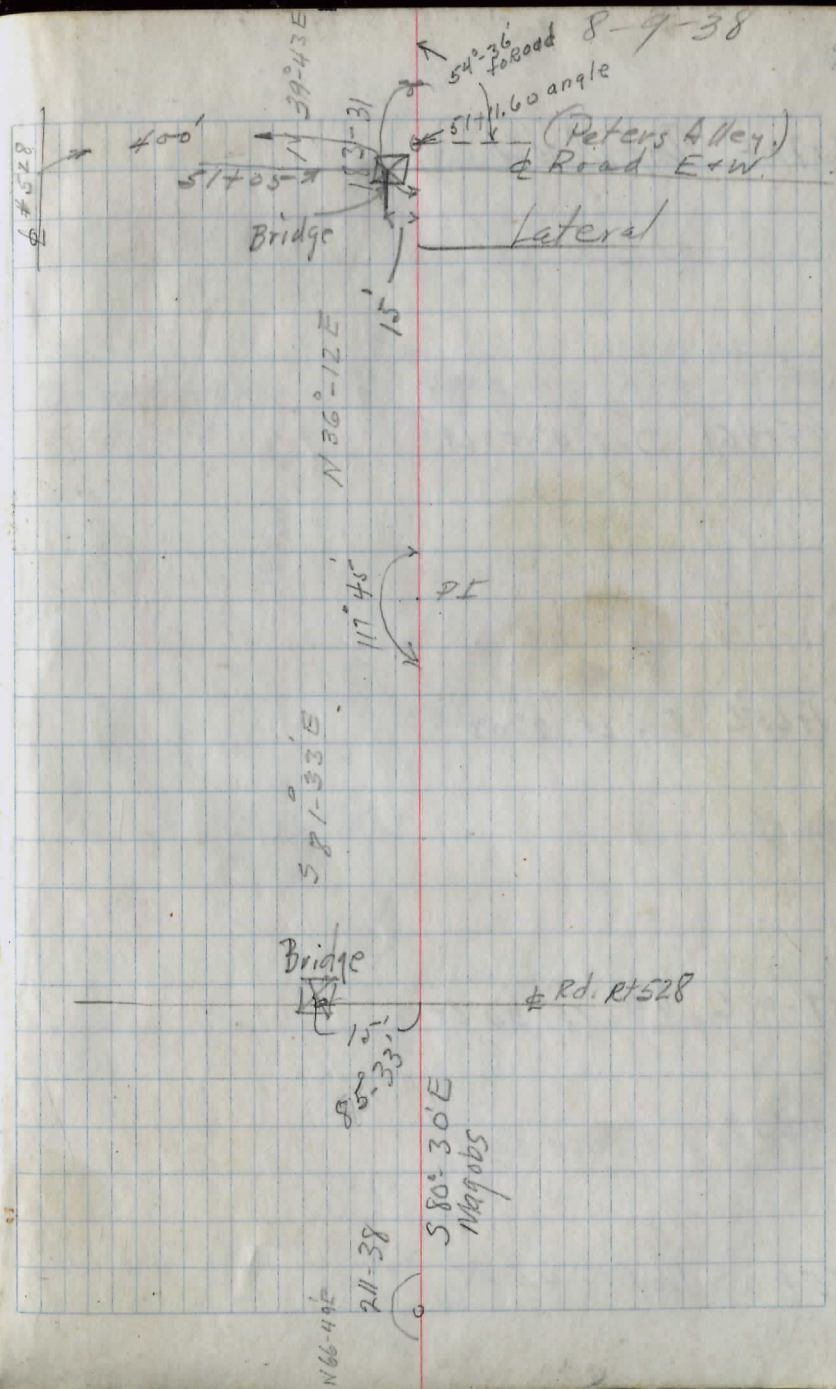
37+62.7 Def 31°-38' Rt.

21-38

423-19

8-9-38

9



8-9-38

69+724 Def 11°-20' Lt

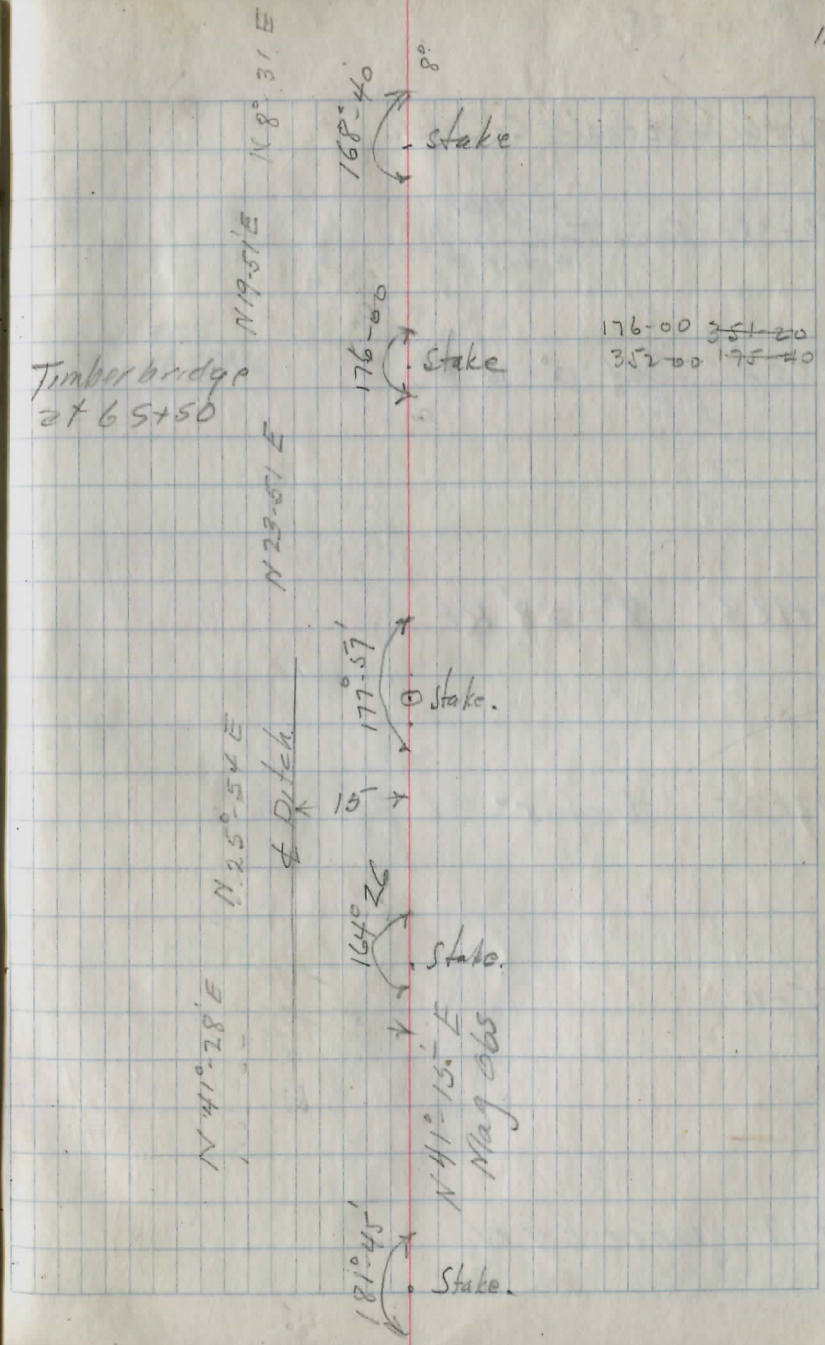
65+461 Def 4°-00 Lt

61+656 Def Lt 2°-03'

57+09.6 Def 15°-34' Lt

56+85 = Fence East

55+0 Def 1°-45' Rt.



8-10-38

81+61 = ℄ Phelps Cr. Ditch

80+38 = Fence (Huntsbg Twp. Line) Middf.

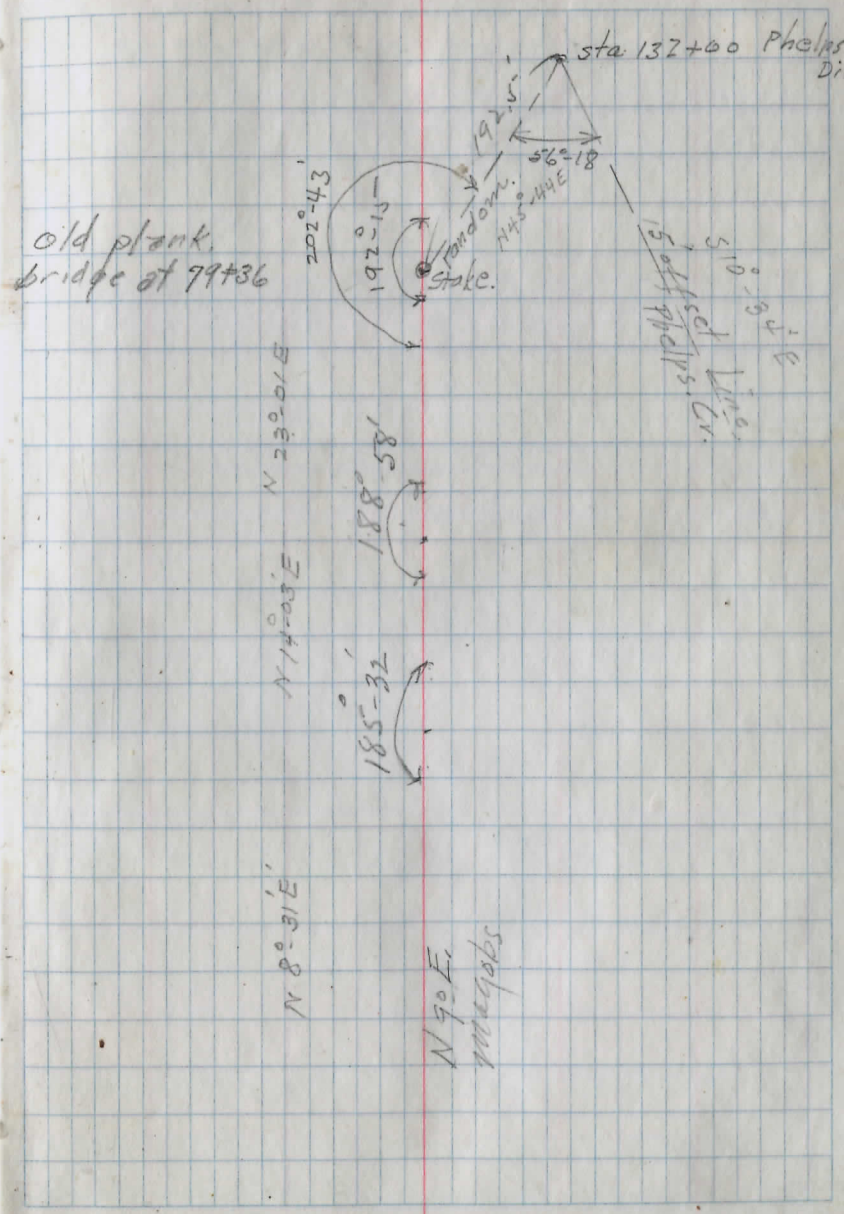
79+32.6 Def 12°-15' Rt

78+18.8 8°-58' Rt

77+25 Def 5°-32' Rt

75+0

72+17 Fence E & W.



8-12-38 Nauvoo Lateral

Sidestakes set 10' Rt. ℄

15+60.80

10+00 Def 20°-20' Lt

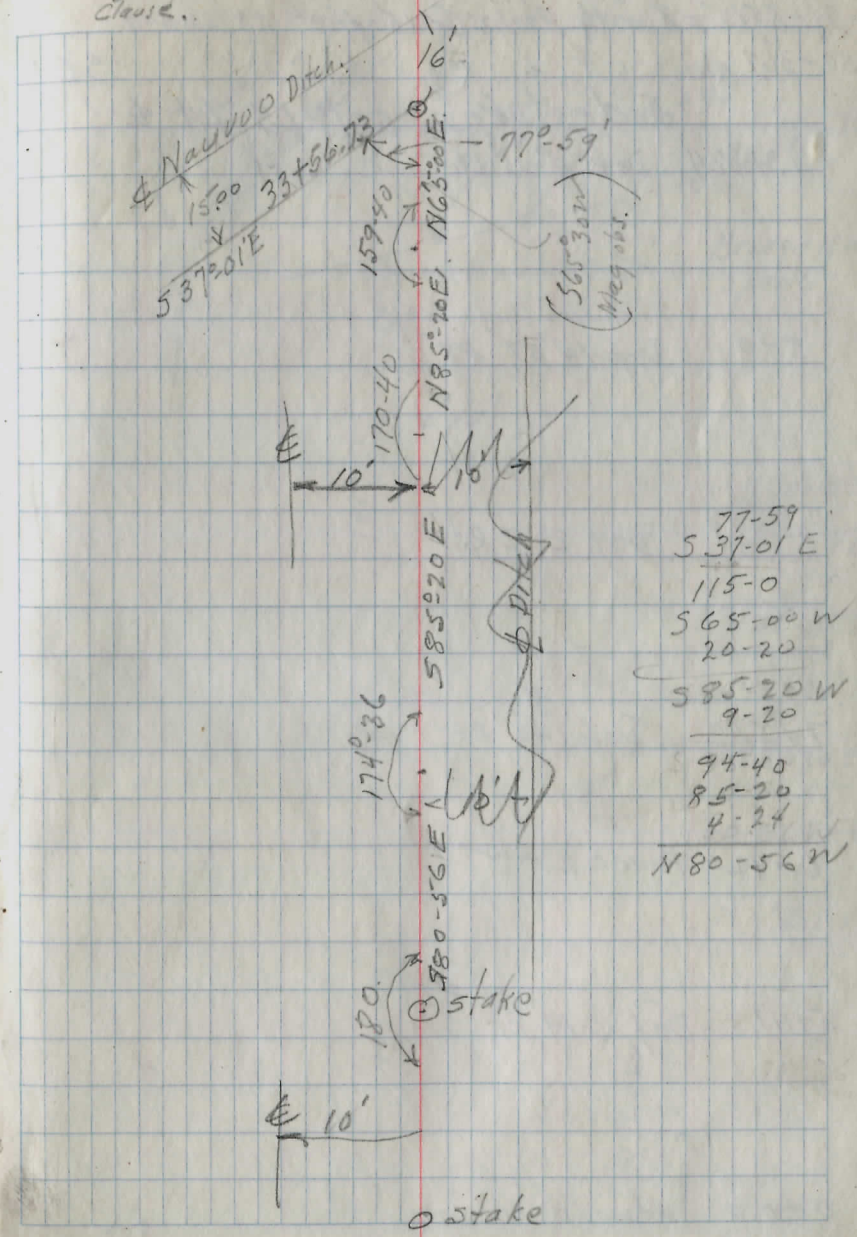
9+60 Def 9°-20 Lt

7+80 Def 4-24 Lt

4+80

0+00

Graber
Richards
Dietz
Clause



Phelps Cr. Lateral.

21+85.15 = X with Phelps Cr. 15 offset extended
50+36.7 on " " " " " SE¼

Sidestakes set 15' Lt. ℄

13+32.4 Def 4°-15' Lt

9+0 Def 14°-07' Rt

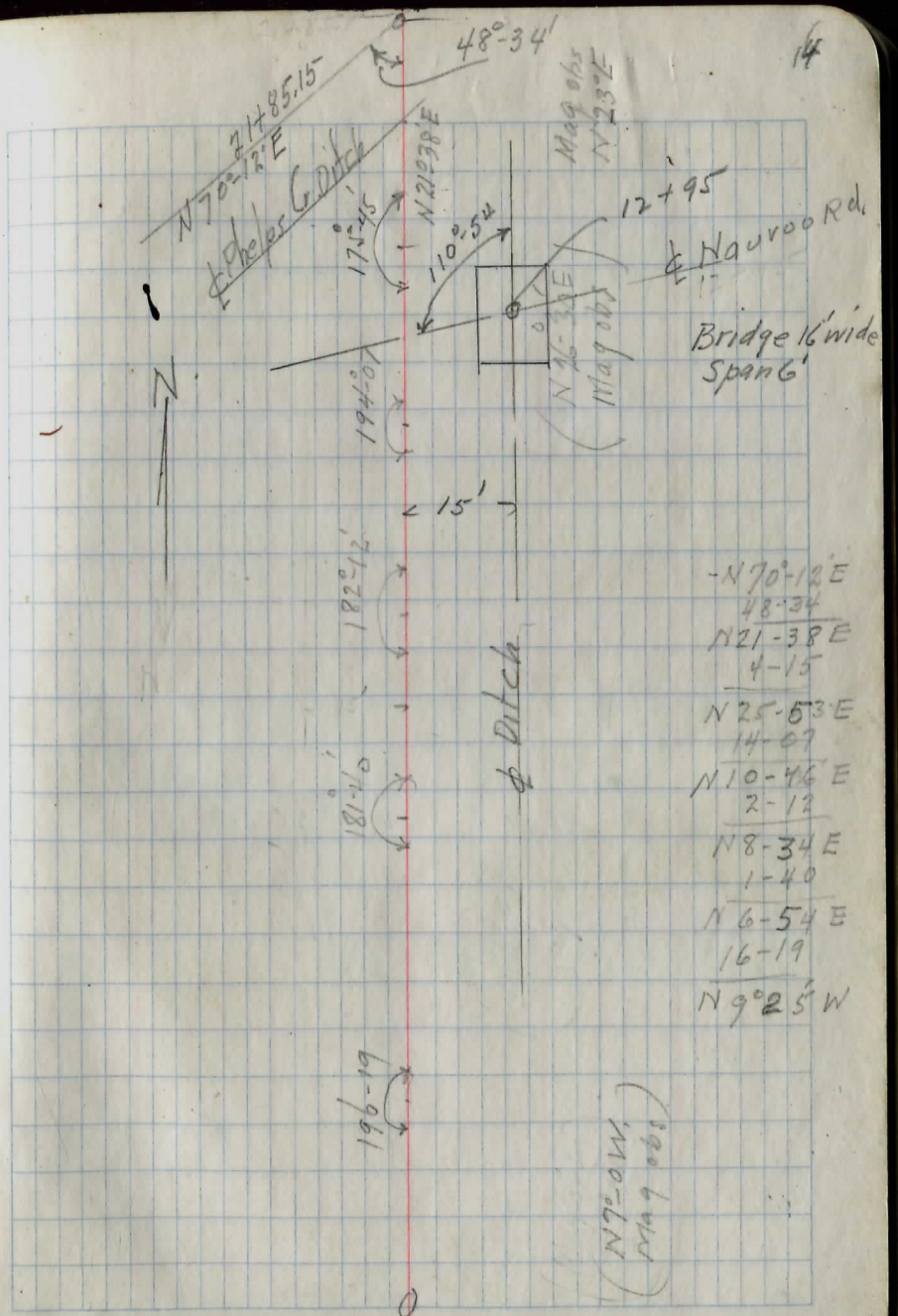
8+38.8 Def 2°-12' Rt

7+51.3 Def 1°40' Rt

6+92 Fence E+W

5+11.1 Def 16-19' Rt

0+0.0 Atwood N. Line



8-13-38 Graber Dietz Richards Clause

Sta	+	HI	−	El	
B.M.#20	4.56	1102.07			1097.51
166+0			9.68	1092.39	
	4.18	1096.57			
	3.14	1095.10	4.61	1091.96	
			6.35	1088.75	
	7.59	1096.34			
B.M.#21			3.02	1093.32	
TP	3.20	1092.75	6.79	1089.55	
	4.95	1094.04	3.56	1089.19	
B.M.#22			2.20	1091.84	
TP.	4.82	1093.41	5.45	1088.59	
	3.53	1092.11	4.83	1088.58	
	4.72	1091.19	5.64	1086.47	
B.M.#23			1.30	1089.89	
	1.86	1090.49	2.56	1088.63	
	4.35	1089.99	4.85	1085.64	
B.M.#24			1.62	1088.37	
			6.6	1083.4	

BMS. Phelps Creek N of Barnes Cor Rd E.

B.M. USGS Plate Br. on Barnes Cors Rd

Top stake.

Hub. 169+0

" 171

" 173

W. Root 30" Maple. 30' Rt Sta. 174+40

Hub 176

" 178

BM 32" oak. 179+70 50' Rt.

Hub 181+48

Stk 5+72

Hub 184

NE Root 20" Beech 30' Rt Sta 189

Hub 191

" 195

NE Root 24" Beech 10 Rt 196+20

PHELPS CREEK 8-1338 Graber Richards Dietz Clause

Sta	+	HI	−	El.	
B.M.	1.62	1089.99			1088.37
197					
196					
195			~~4.35~~	~~1085.64~~	
195 T.P.	4.73	1090.37	4.35	1085.64	
194					
193+54					
193					
192					
191					
T.P.	3.21	1091.83	1.75	1088.62	
190					
189 + T.P.			5.38	1086.45	
B.M.	5.78	1092.23			
188					
187					
186					
185+78 & T.P.			3.65	1088.58	
	4.93	1093.51			
185					
184					
183			−3.68	1089.83	
~~182~~	4.32	1094.15	~~3.68~~	~~1089.83~~	
182					

Profile & Sections.

15' Rt	℄	Lt
N.E. Root 24" Beech 20' E. Sta 196+20		
4.23	6.6	
5.12	6.8	
4.35		
	5.9	195
0/4.28 6/4.5 8/6.0	15/6.9	23/5.7 26/3.6
4.20	6.3	
	6.1	in Lat. 15 S 193+54
	5.5	" " 100' " "
2.59	6.5	
0/2.15 9/3.3 12/5.7	6.0	22/5.8 34/1.2
1.75		
	7.8	191+0
5.97	8.1	
5.38	7.6	
NE Root 20" Beech 38' E. Sta 189		
0.0/5.83 5.0/7.2 10/7.9	7.9	17/7.3 23/3.9 30/3.9
6.42	7.8	
4.02	7.4	
4.30	7.9	
0/5.30 9/6.1 14/7.9	8.4	23/7.8 26/6.9 35/7.0
4.22	8.7	
3.68 T.P.	8.6	
4.44	9.1	

	+	HI	−	Elev.	
		1094.15			
181+48					
181					
180					
179 & TP			4.90	1089.25	
	5.29	1094.54			
178+0			5.41	1089.13	
177+73					
177					
176 & TP			5.05	1089.49	
	7.00	1096.49			
175+0					
			3.23	1093.26	1093.32
	3.23	1096.55			
174					
173+62					
173					
172 & TP					
	6.40	1097.39	5.56	1090.99	
171					
170					
169					
168					
167 & TP			4.75	1092.64	
	7.82	1100.46			

Rt — Lt

-5 0

0/4.6 3 Hub 5.63 (5.54) 3/7.4 12/7.7 15/8.5 (8.7) − 23/7.8 33/7.7 38/5.1

4.65 8.7

4.90

9.3 = 179+98

5.41 8.9

6.89 9.4

3.45 8.3

0/5.05 5/6.2 11/7.6 15/7.9 24/7.7 30/4.1

6.48 10.0

= BM

5.46 10.1

6.72 9.8

7.80 10.8

5.56 10.0

-2/4.6 0/5.78 6/7.7 9/9.2 15/9.6 18/9.3 22/7.7 35/3.7

5.29 9.7

5.40 9.4

6.28 8.9

4.75 8.8

P	+	HI	−	El	
	1	1100.46			−7/64
166					
165 + BM #20					
			2.93	1097.53	1097.51
			3.15	1097.31	
	1.72	1099.03			
164					
163					
162 + TP			6.76	1092.37	
	9.27	1101.64			
161					
160					
159 + TP			8.5±	1093.1±	
	5.4±	1098.2±			
158					
157					
156					
155 + TP			7.11	1091.43	
155	7.39	1098.8±			
BM #19			3.36	1095.46	
	3.36	1098.8±			
154					
153 + TP			6.0±	1092.80	
	5.78	1098.58			
152					

Rt				Lt			
	0						22
−3/8.9	8.58	14/10.7	17/10.6	29/10.6	37/5.5		Iron Truss Bridge Span 398' Width 14.0' Stone Abuts.
	9.88			11.2			
				11.3 FL. N.S Bridge			
B.M. Plate on S.W. Cor Bridge							
				3.15 on Str. Bridge Floor.			
	6.35			10.3			
	6.95			9.3			
	6.76						
				12.1 = ctr dist to 162+0			
−5/8.6	406/9.83	7/11.6		15/11.8	25/11.6	32/8.2	
	9.20			13.1			
	8.5±			13.0			
	6.13			9.6			
	6.38			8.4			
	5.65			9.5			
	7.11						
	7.39			8.7			
	Spike N. Root 24" Elm 100' Rt 155+0						
	4.35			10.5			
−8/11.0	−3/4.0	hub 4.03	1/6.7	7/8.3	10.0	25/8.6	38/3.6
	3.87			9.1			

8-16-38 sta 155 to 98

Graber
Richards
Dietz
Clause.

	+	HI	-	El		Rt		Lt		
151		1098.58				3.48	8.2			
150						5.07	9.4			
149 + TP.			3.63	1094.95		3.63				
	5.71	1100.66								
149						5.71	10.7			
148						6.58	12.2			
147						6.78	9.8			
BM # 18	5.28	1102.92	3.02	1097.64	1097.64	BM 30" Elm. 100' Rt Spike W. Root				
146						8.98	12.3			
145						~~8.64~~	10.9			
144						140/6.20 6/6.9 13/10.8	15/17.2	25/12.4	34/11.0	45/6.6
143						7.46	12.8			
142						8.10	11.0			
141			~~7.95~~	~~1094.97~~		7.95	11.3	1091.6		
	4.61	1101.58	7.95	1094.97						
			3.41	1098.17	1098.43	Old B.M. Butternut stump 25' Lt Sta 141 approx				
140+54						5.80	9.9			
140						7.32	9.4			
139						-8/6.2 -2/9.2 8.98 8/9.6	9.4	18/9.2	26/6.1	40/3.7
138						5.44	10.7			
137						4.53	9.5	1092.1		
136						3.50	10.1	1091.5		
135+0 + TP.			4.60	1096.98		4.60	7.3			

		HI		
	7.60	1104.58	1096.98	
134				
B.M.#17			6.31 1098.57	1098.27
	6.31	1104.58		
133				
132				
131				
130			6.60 1097.98	
	6.71	1104.98		1098.27
			6.95 1098.03	
	7.05	1105.18		
129				
128				
127				
126+				
126.4 TP.			6.56 1098.62	
	6.56	1105.18		
B.M.#16			4.80 1100.38	
	4.80	1105.18		
125				
124				
123				
122 & TP.			6.65 1098.53	
	7.13	1105.66		

Rt Lt 24

6.13 11.8 1092.8 31.5 base Line to hub 15' E.E.

B.M. 30" Elm. 60' Rt & Spike W. Root Sta 134+0

5.78 12.0 1092.6 28.7' base Line to hub 15' E & Ditch

8.50 11.1 1093.5

7.59 10.9 1093.7

6.60 9.5

on BM

8.72 11.3

4.75 10.8

406/8.00 2/5.2 14/9.4 17/10.2 21/10.9 26/10.4 30/7.4 49/5.3

6.75 10.2

6.56 9.1

12" Elm 100' Rt Sta 126+0 Spike SE Root.

8.50 9.0

7.11 10.3

6.89 8.8

6.65 8.7

Sta.	+	HI	−	El		RT		LT
		1105.66						
121						−4/4.2 hub/7.59 3/8.4 11/9.1	15/8.9	18/8.4 22/6.9 38/4.8
120						7.01	9.8	
119						8.06	8.9	
118			7.10	1098.56		7.10	8.6	
	8.02	1106.58						
117+20						5.25	9.8	
117						6.75	9.5	
116						hub/5.10 6/8.0 11/9.3	15/9.1	21/8.5 29/4.4
115						7.51	8.2	
114						4.51	8.7	
B.M.#15			3.12	1103.46		Spike S.W. Root 20" Hickory 40' Rt Sta 114+0		
	3.20	1106.66						
113						7.28	8.5	
112+50						4.93	9.2	
112						5.05	8.6	
111						4.95	8.9	
110+37			3.66	1103.00		3.66		
	5.21	1108.21						
110+37						5.21	8.5	
			4.15	1104.07	1104.28	old BM. Hick Root 50' Lt. of Sta 110.		
110						5.78 5/6.1 13/8.7	9.1	17/8.4 29/5.0
109						4.85	8.4	
108						4.92	9.5	

Sta.	+	H.I.	−	EL
107+00 T.P.		1108.21	4.10	1104.11
	4.23	1108.34		
106				
105				
104				
103 + T.P.			3.76	1104.58
103	6.40	1110.98		
B.M. #14			5.45	1105.53
102	5.45	1110.98		
101				
100				
99 + T.P.			6.63	1104.35
	7.15	1111.50		
98				
B.M. #13			2.88	1108.62

. .	RT	LT.
4.10	8.5	
5.93	8.8	
-3/3.7 4.52 3/6.2 7/6.6 8/7.7	11/8.1	13/7.3 15/6.7 21/5.8 33/4.1 38/3.0
3.88	7.8	
3.76		
6.40	9.8	

Spike w. Root 15" thick 50' Rt of Sta 103+40.

. .	RT	LT.
4.95	10.0	
4.89	8.4	
bub/6.26 3/6.4 6/8.9	15/9.6	21/8.7 30/5.7 34/7.0
6.63	9.3	
5.30	8.2	

X on N.W. cor. Conc Wall. N W cor Bridge Peters Alley. Sta 97+75

8-17-38

X-Sec Peters Alley at Phelps Creek

	+	H.I.		
B.M. #13	3.66	1112.28		1108.62
0+0 = pt 300' W of ℄ Bridge.				
1+0				
2+0				
2+50				
3+0				
3+0 =℄ Bridge.			4.8	1107.5
3+50				
4+0				
4+50				
5+0				
5+50				
6+0				

Conc. Slab bridge opening 5'X18'
parapet wall 1' high 5' Wing walls.

H.W. Mark = 1107
Ditches to 400' E of Bridge need Willows removed.

Lt. N ℄ Rt. S

27

B.M. on Bridge = X NW Cor.

16/2.8	19/4.9	9/4.7	8/3.7	2.7	11/3.1	14/4.6	15/4.5	17/2.7	20/1.6	
23/5.6	13/6.1	11/7.0	10/6.8	8/5.5	4.9	10/5.6	11/6.3	12/6.6	14/7.1	23/5.5
22/7.2	13/6.9	12/7.9	10/7.9	8/6.9	6.2	11/6.9	14/7.5	13/7.5	14/6.7	22/6.6
					6.6					
		Fl. 10.7			4.8		Fl. 10.7			
					6.6					
12/7.4	14/7.2	13/8.7	11/8.9	9/7.3	7.1	10/7.7	12/8.4	18/9.3	23/9.0	26/8.4
23/6.9	14/6.8	14/8.4	10/8.3	8/6.7	6.3	11/7.0	13/8.2	14/8.3	16/9.1	21/8.9
25/6.4	20/6.2	14/8.2	11/7.1	8/6.3	6.0	10/6.2	13/7.8	16/8.8	20/8.8	24/7.0

25/6.7

8-17-38 Phelps Cr.

	+	H.I.	−	El.	
B.M.#13	3.66	1112.28			1108.62
97					
96			6.09		
T.P.			6.09	1106.19	
	10.83	1117.02			
95					
94					
93					
92			7.07	1109.95	
	4.09	1114.14			
91					
90					
89 + TP			5.00	1109.14	
	4.14	1113.28			
B.M.#12			4.55	1108.73	
	4.55	1113.28			
88					
87 + TP			4.86	1108.42	
	4.65	1113.07			
86					
85					
	5.39 to hub 87+0	1113.81		1108.42 = Hub 87+0	
84					

Phelps Creek

	Rt	Lt.
B.M. x N.W. Cor Bridge		
	7.69	10.2
	6.76	9.1
	13 / 4.1	hub 87+0 / 11.60
	7 / 12.9	15 / 13.8
	20 / 12.8	30 / 7.2
	10.62	13.2
	11.63	13.1
	7.07	14.0
	4.77	10.5
	hub 87+0 / 4.92	6 / 5.6
	10 / 7.9	15 / 9.7
	18 / 10.8	22 / 9.7
	37 / 9.0	
	5.00	10.5
Spike W. Root 15" Elm. 20' Rt of ℄		Sta 88+50
	4.78	9.9
	4.86	10.1
	4.22	7.9
	hub 87+0 / 4.50	10 / 5.2
	13 / 7.7	17 / 11.5
	22 / 7.6	25 / 6.0
	30 / 3.8	
	4.74	8.9

	+	HI 1113.81	−	El
83 +TP			415	1109.66
83	308	1112.74		
82				
81 +50 TP on hub			3.59	1109.15
8↓	4.80	1113.95		
80				
79 +TP			3.42	1110.53
78	5.22	1115.75		
			4.70	1111.05
New BM #11			5.52	1110.23
	5.52	1115.75		
77				
76				
75 +TP			5.28	1110.47
	5.12	1115.59		
74				
73				
72				
7↓			4.10	1111.49
	6.80	1118.29		
71				
70				
69				
68 +TP			6.13	1112.16
	5.69	1117.85		

~~1111.53~~

East Rt	℄ Ditch	West Lt
415		
308	8.0	
218	6.2	
3.59		
	7.7	4.14 hub

27/5.2 23/6.1 20/7.5 15/8.2 13/7.8 12/6.5 7/3.5 3.38

East Rt	℄ Ditch	West Lt
		3.42
	7.8	
	9.4	6.01

Approx. Old BM on 6" Hick 35' Rt 79+0

Spike N.W. Root 15' Elm 30' Rt ℄ Sta 77+25

East Rt	℄ Ditch	West Lt
	9.7	5.60
	9.0	4.14 hub

25/5.2 21/6.8 16/9.4 15/9.3 12/9.3 10/6.7 5/5.6 5.28

East Rt	℄ Ditch	West Lt
	9.4	5.08
	9.2	5.29
	7.9	4.10
	11.1	7.27 hub

26/6.6 20/9.0 15/9.1 13/8.9 11/7.5 9/6.6 4/4.7 4.32

East Rt	℄ Ditch	West Lt
	9.0	5.46
	8.9	6.13

	+	HI	−	E'
		1117.85		
67				
66				
65				
4.0				
BM 64+50			3.57	1114.28
	3.57	1117.85		
64				
63			3.05	1114.80
62				
	6.62	1121.42		
61				
60				
59				
58 + TP			5.15	1116.27
	4.87	1121.14		
BM #9			4.24	1116.90
	4.24	1121.14		
57				
56				
55				
54+TP			4.95	1116.19
	5.62	1121.81		

	Rt				Lt
		9.0			5.48
		8.7			4.49
—	30/3.7	27/7.0	15/6.7	10/7.0	7/5.0	4.32 hub	—

B.M. Spike W. Root 24" Elm. 25' Lt Cr. &

		7.1					4.64	
		6.9					3.76	
		6.7					3.05	
		10.4					5.77	= 1116.65
	27/6.8	20/9.7	15/7.5	11/11.0	7/9.4	4/8.1	7.33 hub	
		9.3					5.10	
		9.1					5.15	

Spk E Root 30" Elm. 50' Lt. &. 57+20

		9.1					4.32	
		8.9					3.56	
Left	—	20/5.9	15/8.1	11/9.5	7/8.2	3/6.8	6.27 hub	
		8.8					4.95	

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	+	HI	−		
		1121.81			
53					
52					
51					
50+34					
50+0			2.67	1119.14	
	4.47	1123.61			
49					
B.M. #8			5.76	New B.M. 1117.85	1118.28
			5.46	1118.15	
48					
47					
46					
45			4.59	1119.02	
	4.16	1123.18			
44					
43+0 Stake out					
42+77					
42					
B.M. #7 41+35			4.25	New B.M. 1118.93	
	5.18	1124.11			
41					
40					
39					
38					
37			3.69	1118.22 1120.42	

Rt							Lt	
		9.2					5.55	
		8.5					4.32	
		8.6					3.68 hub	1118.13
		8.4					3.69	
32/3.0	22/7.0	15/7.4	11/7.0	7/4.3	3/3.3		2.67	
		9.5					6.52	

Approx old B.M. New B.M. Spike w. Root 12" Hick 30' E Sta 48+20
Approx Old B M on Red Oak root

Rt							Lt
		9.6					5.21
		8.7					5.30
		9.0					6.97
26/4.9	18/8.0	15/8.2	11/8.1	5/6.5			hub 4.59
		7.7					4.30
		7.7					3.46
		7.7					4.02

B.M. 14" Elm. 20' W. (spike E Root)

Rt								Lt
			8.3					5.13
30/4.3	23/5.1	19/7.6	15/8.0	12/7.8	6/5.2	3/4.3		hub 4.03
			7.5					5.16
			7.7					3.78
			7.2					3.69

+	HI	−	8-18-38
5.85	1126.27		1120.42
		3.15	1123.12
B.M. 6	3.15	1126.27	

0+00 = pt 300' W ℄ Bridge

1+0

2+0

2+50

2+90

3+0

3+20

3+50

4+0

5+0

6+0

Conc. slab culvert, 11' clear span

3.15 1123.12

X Sec. Navajo Rd 32
300' Each side Bridge (Phelps C.)

X10. 59
Lt Rt

B.M. X NW Cor. Conc. Wall N. Side Bridge

℄

16/6.0 5/7.3 14/7.3 11/6.3 5.9 14/6.5 17/7.8 18/8.0 21/5.9

17/6.3 15/7.2 14/7.6 12/6.5 6.2 12/6.8 14/8.1 16/8.2 19/5.9

16/6.4 14/7.3 13/7.3 12/6.4 5.9 11/6.6 15/8.0 16/8.0 18/6.6

5.1

13/7.9 13/8.6 Ditch

4.6 = Top Opening 9.4 FL. 1123.52 3.75 10.0 FL. 4.4 = Top Opg

13/7.8 Ditch 13/8.0

4.8

14/5.6 13/6.3 12/6.4 10/5.3 4.8 9/5.8 12/6.7 13/6.7 14/6.0

21/3.2 13/5.0 13/6.0 12/5.9 10/5.0 4.2 9/4.8 13/6.1 14/6.1 23/2.5

21/3.8 15/5.6 11/6.9 11/6.5 10/5.5 5.2 9/5.6 12/6.7 13/6.7 12/5.7 36/4.0

11 openings

B.M.

Sta.	B.S.	H.I.	F.S.	Elev.
		1126.27		
36				
35				
34				
33 & TP			5.74	1120.53
	5.58	1126.11		
BM #5 32+25			4.29	1121.82
	4.29	1126.11		
32				
31				
30+0			~~4.83~~	~~1119.28~~
29+0 + TP			3.86	1122.25
	6.10	1128.35		
28				
27				
26+26				
26+0				
BM #4 25+60 TP			3.40	1124.95
			1.48	1126.87
			3.25	1125.10	1124.78?

Rt. — Lt.

30/5.9 24/6.6 20/8.9 14/9.6 9.1 15/8.9 6/6.5 5.13 4.46 6.40

9.4 5.21

8.7 5.74

BM. spike W. Root 30" Oak. 10' N of ℄

8.2 5.18

7.6 4.62

30/4.3 24/6.6 15/7.3 13/7.0 6/5.0 4.46 4.83

7.4 3.86

9.0 5.88

9.1 6.25

8.3 4.93

7.9 4.91

BM. X NE Cor. E Wall Bridge

on 18" maple root 684' S of X road 30' W ℄ Rd. #528

on 30" maple 23+0 ±

8.3 FL, E side Br

3.8 ℄ Br. Floor

8.7 F.L. W Side

4.9 Top opening

	+	HI	−	El
	5.50	1130.45		1124.95
25				
24				
23			5.49	1124.96
22				
21 +TP			5.90	1124.55
	5.01	1129.56		
20				
18+50 BM #3			4.44	1125.12
	4.44	1129.56		
19				
18				
17				
16 +TP			3.60	1125.96
	4.32	1130.28		
15				
14				
13				
12				
11 +TP			5.89	1124.39
	9.70	1134.09		
10				
9				

BM. on Br.

Rt				Lt
24/7.0	15/9.5	10/10.3	5/9.9	4ub/7.72
	9.7			5.29
	9.8			5.09

on Big maple (30") root. old scar?

	9.5			5.88
	9.2			5.90
27/4.6	19/7.8	15/5.0	17/7.9	6/5.0	hub. 4.04

Sgk. SE. Root 12" Elm. 60 N. of ℄ Ditch

	8.1			3.90
	7.8			3.68
	7.3			3.48
	7.5			3.60
25/5.6	20/7.2	15/7.7	11/7.2	6/5.4	hub. 5.48
				1124.80
	6.8			4.54
	6.8			3.87
	6.5			3.90
	6.7			5.89
27/6.0	20/8.9	15/9.4	17/8.9	5/6.3	hub 6.08

	+	HI	−	El
9		1134.09		
8				
BM Sta 7+0		"	4.82	1129.27
	4.82	1134.09		
7+0				
6+0 & TP			4.15	1129.94
	5.62	1135.56		
5				
4				
3				
2				
1+0 = TP			2.49	1133.07
	3.66	1136.73		
B.M. #1 Sta 0+20			3.05	1133.68
	3.05	1136.73		
0				

5.8		5.03
8.1		4.05

Tw. Elm. 40' N & Spike SE Root.

7.6		4.35
8.1		4.15

24 / 5.4	18 / 7.9	15 / 8.8	13 / 7.9	6 / 6.0	Ave. 5.60

8.1		4.20
8.2		3.96
6.5		3.32
6.2		2.49

Spk S. Root 16" Oak. 40' N & Ditch -

26 / 2.7	17 / 5.0	15 / 5.4	6 / 5.6	Ave. 2.78

1132.3

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Check Levels 0+00 to 25+47

BM		H.I	–	El	1133.68
	3.05	1136.73			
			5.47	1131.26	
	1.90	1134.16			
BM 7+0			4.90	1129.26	1129.27
TP			6.43	1127.73	
	4.61	1132.34			
TP (Sta 12 Hub)			5.95	1126.39	
	3.96	1130.35			
TP Sta 16 Hub			4.34	1126.01	
	4.12	1130.13			
BM. 18+50			4.95	1125.18	1125.12
21+0 Hub	~~5.53~~	~~1131.71~~	5.53	1124.60	
	4.88	1129.48			
BM 25+60			4.46	1125.02	1124.90

Secs on Rt + #1
#528 at Phelps Cr.

3.86 1128.81 1124.95

0

0+00

1+0

2+0

2+80

3+90

3+0 = ℄ Bridge

4+0

5+0

6+0

W. Lt E Rt

37

B.M. 25+60 on Bridge

14 / 6.0 — 4.2 — 15 / 6.2

15 / 6.3 — 4.6 — 15 / 6.6

15 / 6.9 — 4.3 — 19 / 6.9

7.7 Ditch. Ditch. 7.6 8.3 F-L, Tile.

1125.6

4.2

1½ tile under Drain

℄ Dr. 14 / 4.8 — 4.5 — 15 / 6.6

14 / 6.0 — 4.5 — 14 / 6.2

14 / 6.9 — 4.8 — 14 / 6.8

B.M. Levels along Rt 528
Phelps Cr. to Nauvoo.

	+	HI	−	EL.	BM. H
B.M.	3.90	1128.85			1124.95
			5.64	1123.21	
	4.32	1127.53			
			5.01	1122.52	
	4.29	1126.81			
			5.30	1121.51	
	4.04	1125.55			
			4.96	1120.59	
	4.30	1124.89			
BM.			3.30	1121.59	1121.74
	3.50	1124.09			
			6.70	1117.39	
	5.92	1123.31			
			2.75	1120.56	
	2.06	1122.62			
			5.14	1117.48	
	6.98	1124.46			
			3.04	1121.42	1121.68
T.P.			4.02	1120.44	
	4.13	1124.57			
			5.10	1119.47	
	3.56	1123.03			
			5.47	1117.56	
	1.80	1119.36			
			8.26	1111.11	1111.27

on NE Cor Br. Phelps Cr.

B.M. 101+35 Root 10" Maple, solitary

B.M.

	+	HI	BM's Nauvoo Ditch Sta 0+0 to 4+0		
	2.22	1113.44			1111.22
			5.01		1108.43
	5.01	1113.44			
TP Hub 41+0			7.81	1105.63	
	4.30	1109.93			
TP Hub 35+0			5.01	1104.92	
	6.73	1111.65	3.57	1108.08	1108.08
	3.57	1111.65			
Sta TP Hub			0.64	1111.01	
	4.47	1115.48			
			4.13	1111.35	
	0.34	1111.79			
			2.36	1109.43	1109.43
27+0 Hub	2.36	1111.79	4.51	1107.28	
	4.30	1111.58			
17+0 Hub			4.72	1106.86	
	4.15	1111.01			
12+0 Hub			4.33	1106.68	
	4.80	1111.48			
			2.79	1108.69	
	2.79	1111.48			
7+0 Hub			4.41	1107.07	
	4.45	1111.72			
			4.09	1107.63	
Hub 2+0	5.38	1113.01			
			2.00	1111.01	1111.01

BM 2 nails in stump 129' S. Nauvoo Ditch
BM X N.W. Cor. Bridge " " " 4+528

BM. 50" Trip Elm. 30' Rt 34+50 Spike N. Root

BM. Spike S Root 36" Elm. 100' N. of Sta 25+0

BM. Spk NE Root 30" Map. 10' N & Sta 9+30

Spk. S. Root 30" Elm. 25' N & Sta 0+00

Nauvoo Ditch Levels 3-19-38

	2.00	1113.01	—	1111.01
6+00				
1+0				
2+0				
3				
4 +TP			5.78	1107.23
	4.35	1111.58		
5+0				
6				
7				
8 +TP			4.60	1106.98
	4.13	1111.11		
9				
BM 973			2.49	1108.62
	2.49	1111.11		
10				
11				
12				
13 +TP			4.45	1106.56
14	4.51	1111.07		
14				
BM 1440			4.25	1106.82
15				

Lt					Rt
24/36	17/52	15/60	13/55	6/35	hub 3.70
		6.2			4.30
		6.3			5.38
		6.4			5.63
		6.5			5.78
24/47	19/48	15/54	13/49	10/40	hub 4.32
		5.4			4.57
		5.4			4.53
		5.6			4.60
		5.2			4.21
20/42	19/51	15/56		12/46	hub 4.28
		5.5			4.21
		5.7			4.45
		5.8			4.45
		5.7			4.60
BM Bjok SE Root 10' Tw. Maple 10' N &					
23/51	19/58	15/63	12/56	8/47	hub 4.42

1107.05
1107.07

Station	+	HI	−	Elev.		LT	Rt
	4.25	1111.07			1106.82		
16						6.0	4.33
17 + TP			4.35	1106.72		5.8	4.35
	4.42	1111.14					
18						5.9	4.43
19						5.9	4.60
20						— 21/4.8 20/6.0 15/6.4 12/6.4 10/4.8	hub 4.24 —
21						6.4	4.01
22						6.4	4.05
23 + TP			4.07	1107.07		6.2	4.07
	6.80	1113.87					
23+40						9.1	
24						8.5	6.09
24+68							5.56
BM			4.62	(1109.25)	1109.43 use		
	4.62	1114.05					
25						36/6.2 27/4.6 17/8.2 15/8.7 12/8.6	3/3.2 hub 3.00 −4/4.4
26						9.0	2.80
26+42 ange. + TP			2.59	1111.46			2.59
	5.14	1116.60					
27						11.7	4.83
27+30							4.52
28						12.0	5.25

	+	HI	−	El		Lt	Rt.
		1116.60					
28 + TP			5.25	1111.35			
	4.22	1115.57					
29							
29+29							
30							
30 +27							
31 + TP			4.50	1111.07			
	1.33	1112.40					
32							
33							
33+65 Sct. Lat.							
34							
35			4.26	1108.14	1108.08		
	4.26	1112.40					
35							
36 + TP			7.28	1105.12			
	6.08	1111.20					
37							
37+63							
38							
39							
40			6.77	1104.43			
	6.78	1111.21					

Lt			Rt.			
		11.1		4.33		
				4.00		
36/6.8	29/5.0	17/10.7	15/11.2	11/11.0	2/4.9	4.84	−7/7.5
				4.64		
		11.7		4.50		
		8.6		3.72		
		8.7		6.60		
		8.7		5.96		
		8.8		5.49		

B M Triple Elm.

31/7.4	26/6.2	21/8.7	15/8.7	11/8.3	8/6.6	1/6.8	Hub 7.39
							7
			8.9				7.29
							4
			7.9				4.87
							4.49
			8.1				4.90
			8.5				5.96 Hub
	25/6.9	22/7.4	8/8.2		9/7.7	4/6.6	6.77

8-22-38

	+	HI	−	Graber Richards Clause
		1111.21		
41				
42				
43				
			7.74	1108.47	1108.43
	4.32	1112.75		
			1.52	1111.23	1111.22
44				
44+50				
45				
45+50				
46				
47 + TP			7.45	1105.30
	4.95	1110.25		
48				
49				
50				
BM			2.57	1107.68
	3.20	1110.88		

51 in road use BM for grade setting

52

Lt		Rt	43
	8.7	5.52	
	8.4	4.67	
	8.9	6.40	

BM on Bridge

BM on stump. (3 nails)

	10.2	7.25
	10.6	F.L. West
	11.45	℄ Rd. # 528
	10.6	F.L. East
		6.05
24/7.3 20/9.8	15/8.8 9/9.1 8/8.1 2/7.6	7.16
	10.0	6.72
	10.8	7.45
	11.1	7.45
	8.7	6.30
	9.2	5.03
22/5.6 19/8.4	13/9.7 11/8.7	4/5.4 hub 5.18

X on SE Cor. S Wall of Bridge. 5.10

9.8	F.L.S.
10.2	" N
4.38	℄ Bridge
10.5	5.39

	+	HI	−	
		1110.88		
53				
54				
55 + TP			8.16	1102.72
	4.95	1107.67		
56				
57				
57+10				
58				
59				
60 + TP			5.54	1102.13
	4.93	1107.06		
59+80 BM			4.43	1102.63
61	4.43	1107.06		
61+66				
62				
63				
64				
65				
65+46 + TP			5.89	1101.17
	4.45	1105.62		
66				
67				
68				
69				

Lt					Rt	44
		11.2			7.18	
		10.7			7.40	
30/8.2	26/8.8	15/11.2	13/10.3	7/7.7	8.16	
		8.2			5.56	
		7.7			4.73	
					4.73	
		7.6			5.35	
		7.7			6.25	
35/6.1	29/4.2	23/7.4	15/8.1	11/8.1	5/4.3	hub 5.54 — 3/6.8
Spk W. Root 20" Maple 25' Et & 59+80						
		7.6			4.42	
					4.53	
		8.1			4.68	
		8.4			8.02	
		8.6			5.47	
33/6.2	26/8.4	15/8.7		7/8.4	4/6.9	hub 7.35
					5.89	
		7.2			4.52	
		7.6			4.57	
		8.6			2.54	
		8.4			3.34	

		1105.62		
BM 69+70			3.56	1102.06
	5.32	1107.38		
69+72.4				
70				
71				
72				
73				
74 + 78			7.45	1099.93
	4.45	1104.38		
75				
76				
77				
77+25				
78				
78+19				
79 + 78			5.20	1099.18
	4.70	1103.88		
79+33				
80+0				
81				
81+70 Vct.				
BM			5.46	1098.42 1098.27

Lt Rt 45

Spike W. Root 14" Beech 30' Rt ℄

						5.42	
—	29 / 4.9	21 / 9.2	15 / 10.4	10 / 9.3	3 / 5.2	hub 5.03	5 / 6.6 —
			10.9			6.34	
			10.0			7.30	
			9.1			7.45	
			9.6			7.45	
—	25 / 3.1	18 / 6.0	15 / 7.0	8 / 6.4	3 / 3.7	hub 3.38	4 / 4.3 —
			7.2			3.82	
			7.1			4.25	
						4.75	
			7.9			2.87	
						3.10	
			8.9			5.20	
						4.62	
—	34 / 7.1	28 / 6.1	23 / 8.3	12 / 8.5	5 / 7.7	1 / 5.9	hub 5.74 — 3 / 6.2
			9.3			7.22	
			11.2				

Spk W. Root 30" Elm Sta 134 Rhclps Ct.

8-22-38

X Sec Road Sta 51+0 at Nauvoo Ditch
(Peters Alley)

	3.97	1107.68
0+00 = ℄ Rt #528		
1+0		
2+0		
3+0		
3+70		
4+0 = ℄ Bridge		
+40		
5+0		
6+0		
BM	3.97	1107.68

Lt
No.

Rt
50.

BM X on Bridge Wall 51+0

3.27

20 16 13 12 10 0 8 10 11 13
4.8 5.4 6.1 6.0 5.3 4.7 4.9 5.8 5.5 4.6

17 13 12 8 0 7 9 11 12
5.7 7.3 7.1 6.3 5.8 6.3 7.1 7.3 6.9

16 14 12 9 0 7 9 10 11
7.1 7.9 8.0 6.9 6.7 7.3 8.0 8.1 7.4

Ditch 7.9 6.6 8.7 Ditch

FL. 10.8

opening 13.5 span. Top opening

4.9 10.8 FL 6.1

6.4

16 14 13 10 0 8 10 12 14
6.7 7.4 7.3 6.3 6.0 6.2 7.0 7.5 6.8

16 14 13 10 0 8 11 12 13 12
4.5 6.3 6.7 5.3 4.8 5.2 6.4 6.4 4.6 2.1

Levels on Nauvoo Lateral #1

BM	2.02	1110.10			1108.08
15+61					
15					
14					
13					
12			2.16	1107.94	
	2.93	1110.87			
11					
10					
9+60					
9					
8+TP			2.65	1108.22	
	4.46	1112.68			
7+80					
7					
6					
5					
4+80					
4					
3+TP			4.13	1108.55	
	4.49	1113.04			
2					

Staked 10' offset Right

47

Lt						Rt	
						3.84	
2.6 / 4.9	2.0 / 4.0	6.6 / 1.5 / 6.0	1.0 / 6.2	8 / 6.1	4 / 3.6	Inv. 3.65	5 / 3.9
						1106.45	
		6.3				3.79	
		6.3				2.69	
		6.0				2.16	
		6.2				2.50	
2.9 / 4.0	2.2 / 3.6	1.6 / 6.3	1.0 / 6.3	8 / 6.1	3 / 4.3	Inv. 4.30	
						3.52	
		6.5				4.35	
		6.3				2.65	
						4.21	
		7.5				4.14	
		8.0				5.20	
2.5 / 5.0	1.9 / 3.8	1.4 / 7.0	4.0 / 7.5	8 / 7.0	3 / 4.3	Inv. 6.42	4 / 5.2
						5.42	
		7.5				3.83	
		6.8				4.13	
		6.7				3.85	
		6.7				3.85	

		1113.04		
1+0				
0+0				
BM.			1.51	1111.53
	1.51	1113.04		
TP			3.40	1109.64
	1.23	1110.87		
			4.04	1106.83	1106.8

27/5.7	19/4.3	12/6.6	7.0 / 10/6.8		7/6.3	3/4.5	3.48 / 4.36

Spike NW. Root 10" Hick. 100' So. of 0+00

	4.90	1122.75		1117.85	
Hub 51+0 Phelps Cr.			4.58	1118.17	1118.13
21+85					
21					
20					
19			5.15	1117.60	
18 & T.P.	5.92	1123.52			
17					
16					
15					
14					
13+33					
13+0					
			3.20	1120.32	
	3.20	1120.52			
	~~4.40~~	~~1124.72~~		1120.32	
	4.20	1124.72			
12					
11					

Lt Staked 15' offset Rt

49

B.M. Hick 48+20

check

			9.5			
	5.61		8.2			
Hub	4.95	9/5.6 / 7.9	14/7.6	19/7.7	22/6.0	29/5.3
	5.95		7.8			
	5.13		7.2			
	5.28		7.7			
	5.10		7.3			
	4.37	5/4.7	10/6.7 / 11/7.2	15/6.6	19/6.7	24/4.7
	4.54		6.7			
	4.32					
	3.38					
			6.9 Fl. N.			

B Mon Bridge

B Mon Br. 7.1 Fl. 5.0.

3.0 = ℄ Br Top.

4.1 Top opening

5.25	7.0
4.85	6.7

8-22-38

HI

	1	1124.72		
10+0				
9			367	1121.05
	488	1125.93		
8+39				
8+0				
7+51				
7+0				
6				
5+11				
5+0			259	1123.34
	478	1128.12		
BM.			299	1125.13
	299	1128.12		
4				
3				
2				
1				
BM			231	1125.81
	~~231~~	~~1128.12~~		
0	239	1128.18		112581
0				

W Lt

E Rt

60

base 4.23	5 4.7	11 6.0	15 6.7	20 6.2	23 5.2
367		6.5			
439					
562		7.0			
442					
505		6.6			
443		6.5			
290					
259	5 3.1	11 5.7	15 6.2	20 5.9	25 3.8

Spike E. Root 20" Map. 90' W. Sta 6+30

482	8.3
508	7.9
495	7.4
426	6.6

BM 12" Elm 40' W of 0+00, Spike N. Root

BM.

410	4 3.7	9 5.6	15 6.0	20 6.0	26 3.0

+	HI	−		
	1128.18			
		3.07	1128.11	1125.13
1.90	1127.03			
		7.20	1119.83	1120.30
5.20	1125.03			112
		4.67	1120.36	1120.30
4.67	1124.97			
		5.03	1119.94	
5.47	1125.41			
		2.47	1122.94	1123.12

BM. Bridge Sta 13+40

1123.12

X-Sec. Navvoo. Rd. Phelps Cr. Lateral

	H.I.	
4.67	1124.97	1120.30

0+00. = ft. 300 W & Bridge

1+0

2

2+80

3+20

4+0

5+0

6+0

No Lt. 50 Rt

14/5.8	13/6.2	12/6.6	7/5.3	0/4.8	10/5.3	12/6.4	15/6.1	17/5.3
14/5.2	11/6.9	10/6.8	8/5.5	0/5.3	9/5.4	13/6.9	15/6.6	17/5.2
13/5.9	11/7.0	10/7.0	7/5.6	5.1	8/5.5	13/7.1	14/7.1	15/6.6

Ditch. 7.1

Ditch 6.6

5.9 Ditch.

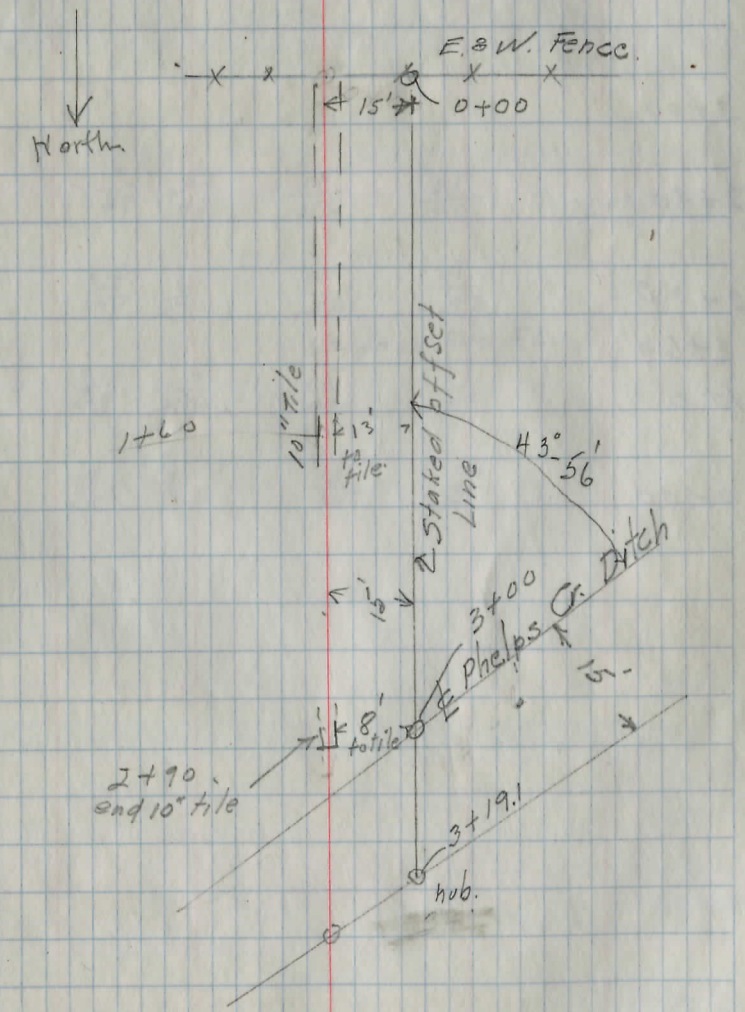
6.3 Ditch

16/4.7	13/5.4	11/5.2	8/4.2	4.1	8/4.3	13/5.4	15/5.6	17/4.6
14/4.1	12/5.1	11/5.1	8/3.9	0/3.7	10/4.0	14/5.2	15/5.2	17/4.0
12/3.8	12/4.2	11/4.3	7/3.2	0/2.8	9/3.3	13/4.8	14/4.8	17/3.8

11232

8-23-38 Phelps Creek Lateral.
at Sta 15+00.

Graber
Richards
Clause.



X-Sec Phelps Cr. Lateral at Sta 15+0 — 8-23-38

B M	4.87	1129.99			1125.12
			5.16	1124.83	1124.80

3+00

2+90

2+00

1+60

1+0

0+00

Lt W. — Rt E — 5's

B.M. SE Root Elm. Sta 18+50 Phelps Cr.
Check hub Sta 15+0 " "

7.1

0 / 4.8	6 / 4.8	15 / 5.2	21 / 7.0	7.6 = FL. 10" Tile
hub. / 4.7	6 / 5.1	15 / 5.0	28 / 5.3	
		6.2 on 10" Tile FL.		
hub / 3.9	6 / 4.2	15 / 4.2	28 / 4.4	
hub. / 2.5	8/26	15 / 3.5	28 / 3.1	

9-24-41
Pomeroy
Rich. Randles

Grades on Phelps Creek for State Hwy.

B.M.	3.29	1128.24			1124.95
Sta.	Grade	Rod	Ground	Stake	& Cuts
26+0	1118.50	9.74	7.8	4.49	C-5'-3"
27+0	1118.36	9.88	8.3	5.38	C-4'-6"
28+0	1118.22	10.02	8.6	4.77	C-5'-3"
29+0	1118.08	10.16	9.4	4.66	C-5'-6"
30+0	1117.94	10.30	9.1	5.55	C-4'-9"
T.P.	3.17	1125.86	5.55	1122.69	
31+0	1117.80	8.06	7.4	2.81	C-5'-3"
32+0	1117.66	8.20	8.2	4.95	C-3'-3"
B.M.			4.09	1121.77	1121.82
33+0	1117.52	8.34	8.2	4.34	C-4'-0"
T.P.	5.15	1126.17	4.84	1121.02	
34+0	1117.38	8.79	8.8	3.53	C-5'-3"
34+95	1117.24	8.93	8.95	4.43	C-4'-6"
B.M.			3.05	1123.12	1123.12

Stakes set 20' Lt.

Grade = -.14%

Richards Clause
1/10/41

Grades on Phelps Creek N of Nevada Rd

B.M. #6	1.80	1124.92			1123.12
Sta.	Grade	Rod	Ground	Stake	& Cuts
35+0	1117.24				
36+0	1117.06	7.87	7.3	3.62	4' 3"
37+0	1116.86	8.06	8.0	3.56	4'6"
38+0	1116.67	8.25	8.5	3.75	4'-6"
39+0	1116.48	8.44	8.5	5.44	3'-0"
T.P.	3.57	1123.04	5.45	1119.47	
40+0	1116.29	6.75	6.8	3.25	3'-6"
41+0	1116.10	6.94	7.3	3.44	3'-6"
42+0	1115.91	7.13	7.3	2.88	4'-3"
B.M. #7			4.11	1118.93	1118.93

Stakes set 20' Lt.
Grade = -.19%

Oct. 17. 1938

Pease Creek Ditch

Graber
Richards
& Havetert

Stations on Ditch Line. Staked on 15 offset. Right.

14+57.8 ℄ S. Hambden.

14+45.67 Def 5°-10 Rt

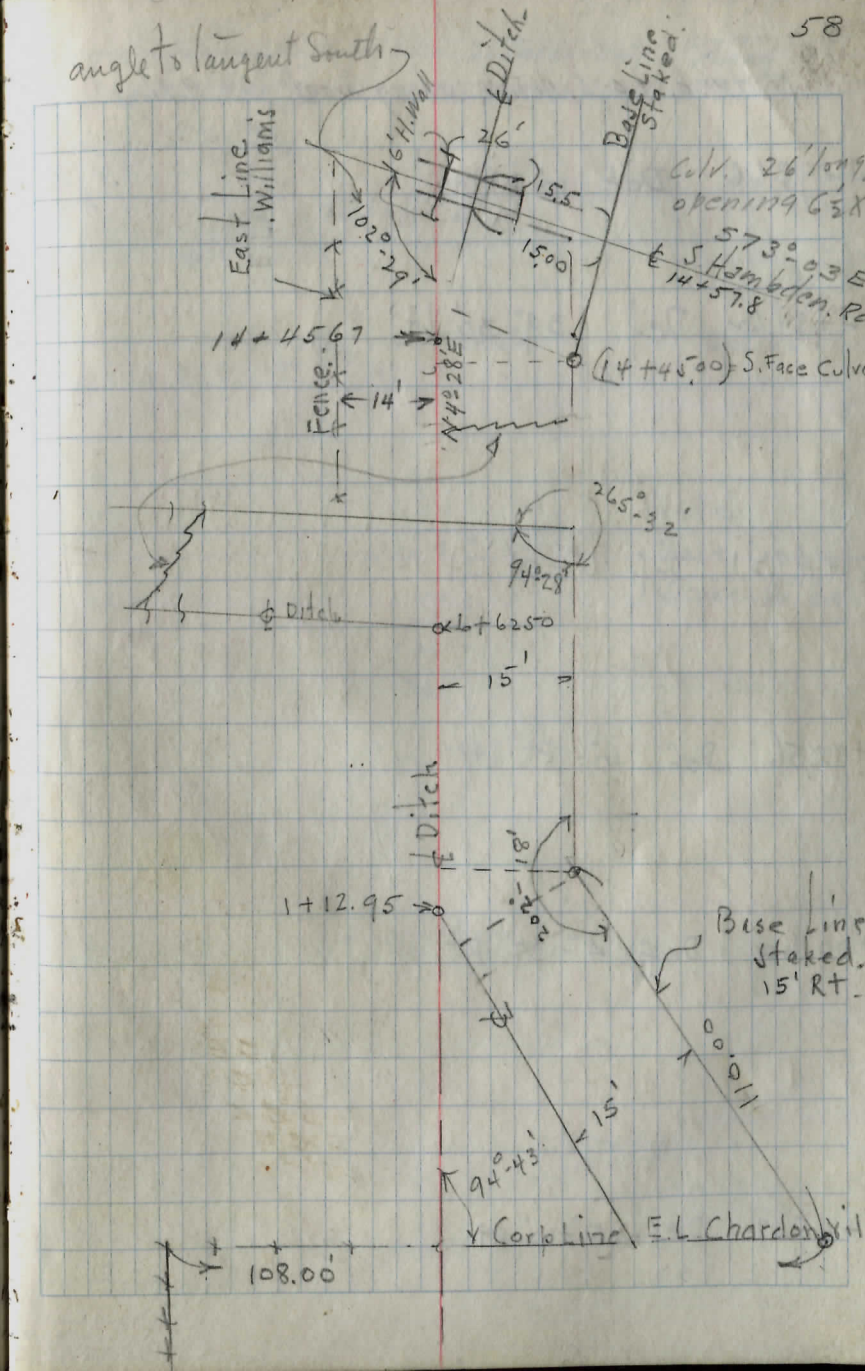
6+62.50 Def 85°-32 Lt.

6+48.50 = Williams E. Line.

3+44 = Williams West Line

1+12.95 Def 22°-18' Rt.

0+00 = E Corporation Line Chardon Village.



N Hamb. to S. Hamb. along Grant S = 991'

24+98.66 Def 10°-13' Lt

22+94.62 Def 39°-30' Lt

21+49.21 Def 6°-01 Lt

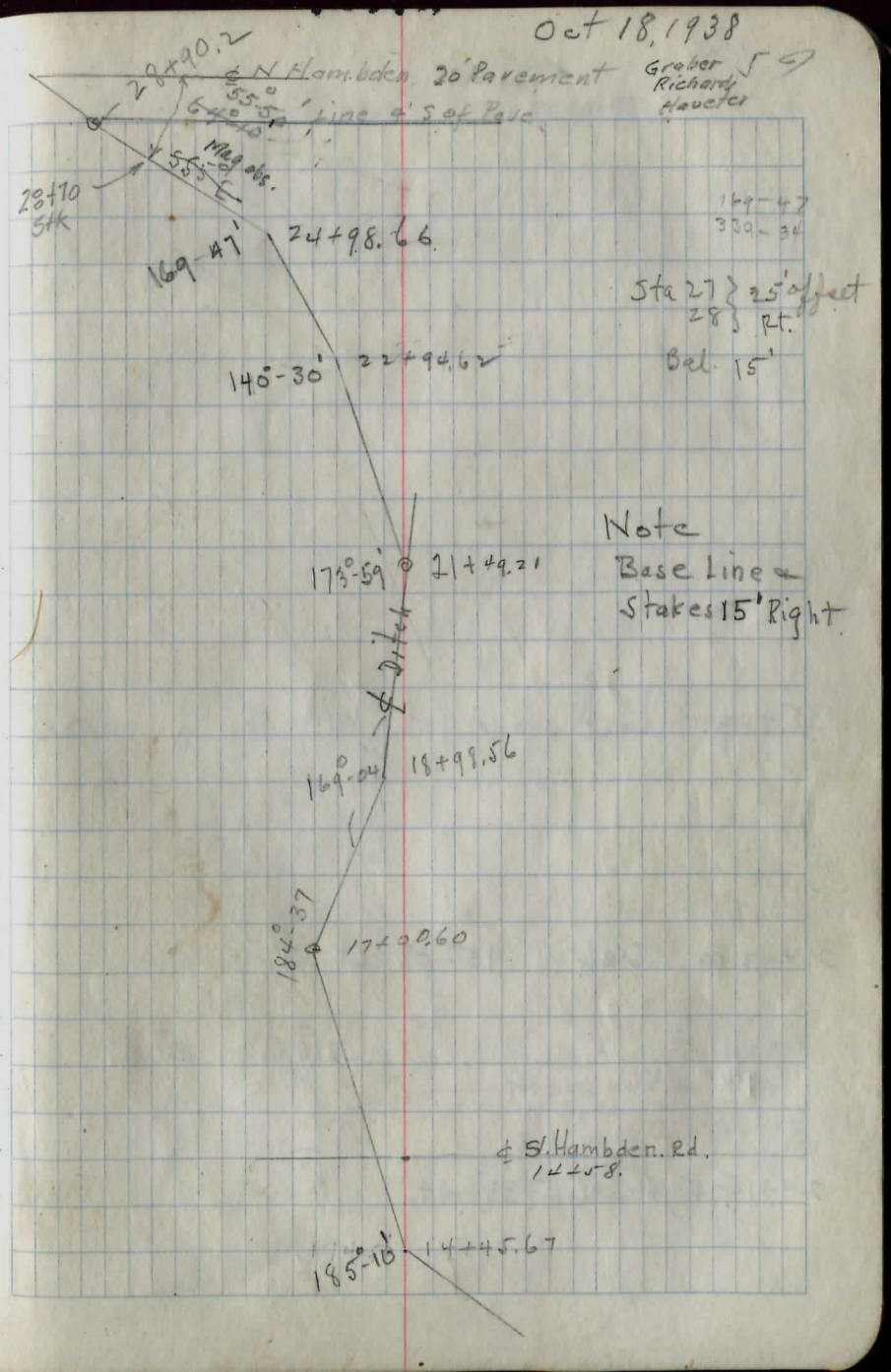
18+98.56 Def 10°-56' Lt.

17+00.60 Def 4°-37' Rt.

14+45.67 Def 5°-10' Rt.

Oct 18, 1938

Graber
Richards
Haveter



Note
Base Line
Stakes 15' Right

35+01.99

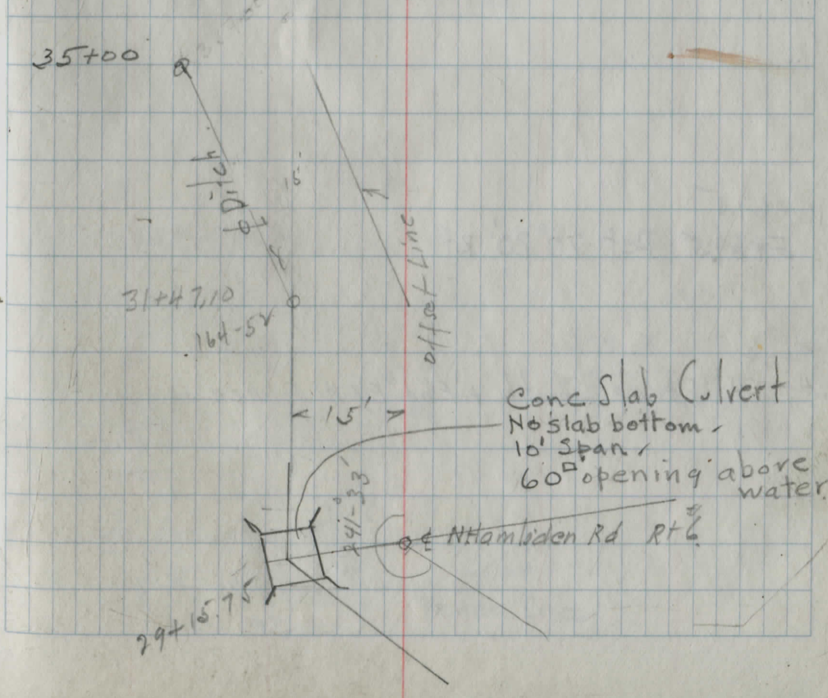
35+00. Last stake set. 10/19-38

31+47.10 Def. 15°-08 Lt

224.41 220.57

29+60 stk

29+15.75 Def 61°-33' Rt.



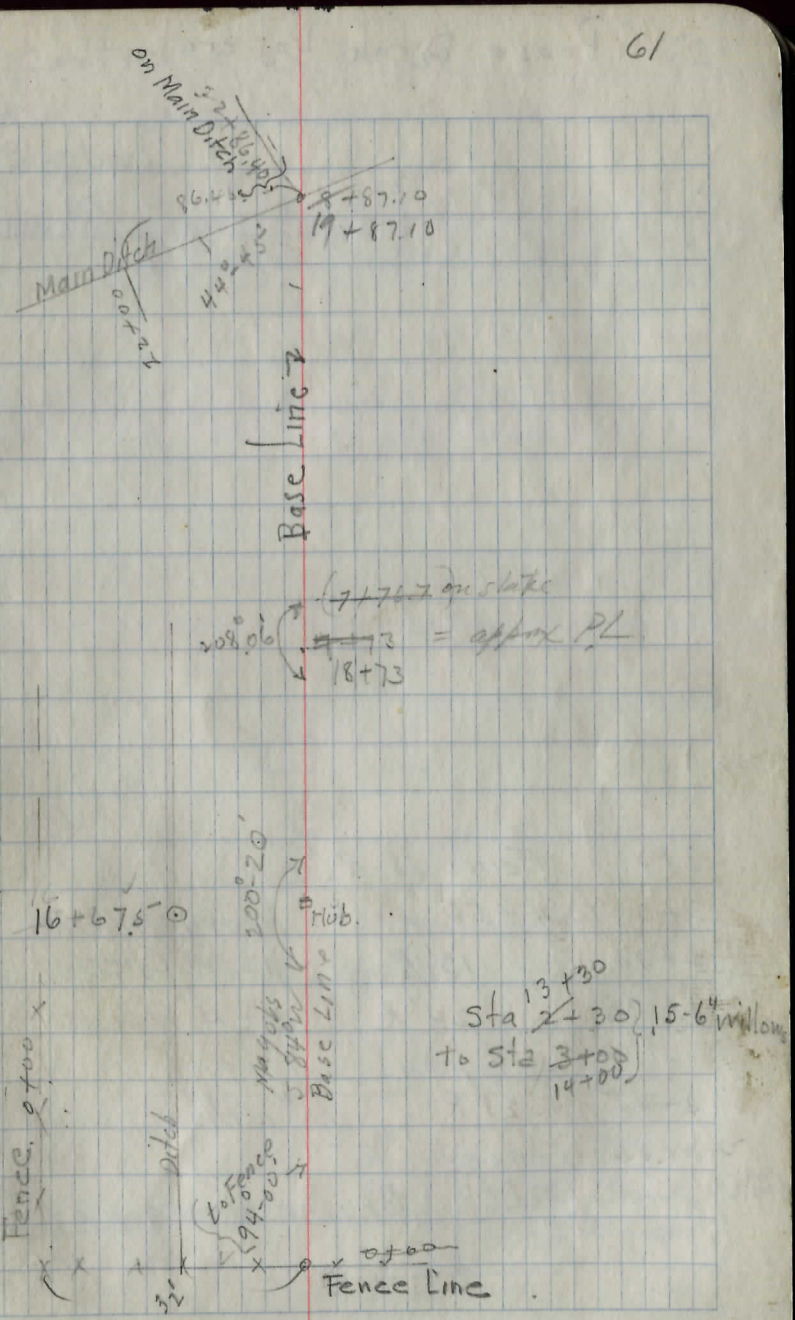
Pease Ditch Lateral.
Tree Locations Page 76. & 62

19+87.10 of 15' base
~~8+87.10~~ = X, with Main ditch Base Line (15ft. Rt)

18+76.5
~~7+76.75~~ Def 28°-0' Rt.

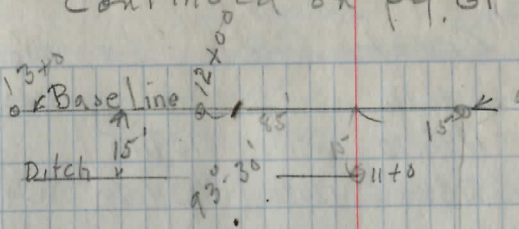
16+67.5
~~5+67.5~~ Def 20°20' Rt

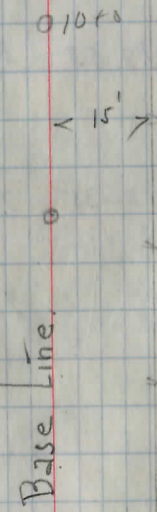
15+74
~~4+24~~ Fence South + End E & W Fence



Pease Ditch Lateral.

Continued on pg. 61





3+70 - Fence 18' R.

3+70 to 4+50 Heavy Brush

2+70 13' R 12 W. Cher.

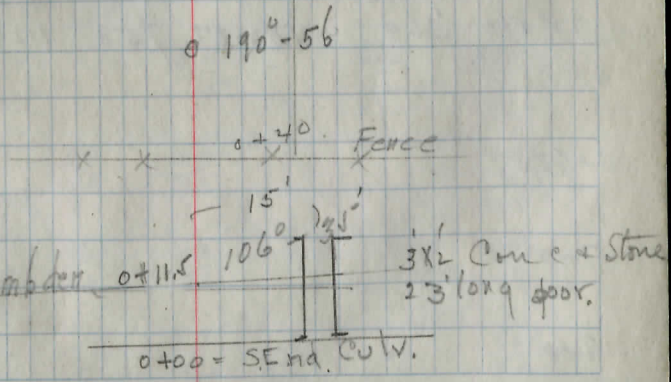
1+98 24' R 4- 15" Willows

1+45 21' R 10" Willow

0+40 Fence 18' R.

0+40 to 1+70 Brush. Heavy

2+80



Pease Creek Ditch Levels

BM #2	0.54	141.12			1140.58
	9.55	1146.70	3.97	1137.15	
T.P. BM #1	4.35	1138.85	12.20	1134.50	1134.50 BM
0-75					1133.4
0+0	= E. Corp. Line Chardon Hill.				1133.0
1+0 4TP	4.77	1138.53	5.09	1133.76	1131.3
2+0					1130.5
T.P. H06.3+45	5.00	1136.35	7.18	1131.35	
3+0					1128.8
3+45 to 3+55 24" Pipe 10' of 18" Pipe Next West					1128.1
4+0					1127.4
5+0					1126.8
T.P. 5+0	3.60	1132.37	7.58	1128.77	
6+0					1127.2
6+62.5					1127.3
7+0					1127.0
8+0					1126.6
T.P. Stake 8+0	4.38	1132.47	4.20	1128.17	

Oct 18 1938 Graber Richards R. Haveter

63

Lt Sections from base line = 0 Rt

S. Hamden St 250' W of Corp Line (S. Root 15" Maple)

0+25 4.0' N & Spike E Root 12" Elm

Level — 5.4 | 5.8/13 | 6.5/11 | 5.4/8 | 4.70/0

Level — 5.3/20 | 7.2/15 | 5.6/12 | 4.70/0

5.9/30 | 4.1/25 | 6.2/20 | 8.0/15 | 7.9/12 | 5.7/8 | 5.02/0

4.8/30 | 4.1/25 | 6.4/18 | 7.6/15 | 4.8/10 | 4.80/0

8.2/15 FL 24" P. 3+44 = W. St W. Line

5.3/23 | 5.7/20 | 8.9/15 | 7.0/10 | 6.07/0

— 7.4/19 | 9.5/15 | 7.7/12 | 7.58/0

— 4.3/20 | 5.1/15 | 4.4/12 | 4.71/0

5.3/30 | 5.2/20 | 4.9/15 | 4.42/0

— 4.9/22 | 5.3/15 | 4.9/12 | 4.73/0

4.8/22 | 5.7/15 | 5.6/11 | 4.9/6 | 4.68/0

	+	HI	−		Profile Bottom
		1132.47			
9+0					1127.3
10+0					1127.3
11+0					1126.9
12+0					1126.4
13 TP	8.38	1135.89	4.96	1127.51	
13+0					1126.4
14+0					1126.4
P					1125.6
BM #3	4.60	1135.89	4.60	1131.29	
	8.13	1141.77	2.25	1133.64	
			1.20	1140.57	1140.58
BM #3	1.80	1133.09		1131.29	
15+0					1127.1
16+0					1126.6
TP 16+0 [?]	4.49	1132.70	4.88	1128.21	
17+0					1125.7
18+0					1126.2

Lt. Rt

5.1/25 5.2/15 5.8/18 5.1/4 5.0/0

— 4.9/25 — 4.5/21 5.2/18 5.2/15 5.3/7 4.6/4 4.10/0

4.9/25 5.6/15 5.0/4 4.98/0

— 4.4/25 5.1/22 6.1/15 5.2/9 3.6/4 4.12/0

7.5/28 9.0/23 9.5/15 8.8/12 8.38/0

— 7.5/26 9.0/24 9.5/15 8.8/10 8.0/7 7.68/0

C.45 Top of H. 1125.6 10.3 FL So 4.3 ¢ Rd. Gravel 1126.3 9.6 FL N.

150' W of 14+50 Spike SE Root 24" Elm 35' N ¢ S. Hambden

B.M.#2 250' W Corp. Line (S Hambden)

Profile S. Ditch S Hambden Rd W. of Culvert ¢ Culv = 0+00

0+0 = Main ditch 0+0/7.7 0+20/5.3 1+0/4.3 2+0/2.9 2+66/1.7 = FL 15" Cor. I.P.

— 3.7/30 3.9/25 5.4/20 6.0/15 5.9/9 3.9/4 4.19/0

4.8/27 6.1/20 7.2/19 6.5/15 4.6/10 4.89/0

5.0/24 6.5/20 7.0/15 6.5/12 4.4/6 4.86/0

4.9/25 6.5/21 7.1/18 6.5/15 5.4/12 5.22/0

	+	H.I.	−		
19+0		1132.70			1125.2
20					1125.2
TP. 20+0	4.95	1131.50	6.15	1126.55	
21+0					1125.2
22+0					1124.1
22+94.6					1124.2
TP. 22+94.6	5.62	1131.12	6.00	1125.50	
BM #4	3.99	1131.12	3.99	1127.13	
24+0					1123.6
T.P. 25+0	6.04	1132.12	5.04	1126.08	
25+0					1125.4
26+0					1124.1
27+0					1123.3
28+0					1123.9
B.M. #8		1131.41	0.71	1131.41	
	9.37	1140.78			
			0.46	1140.32	1140.39

Lt Rt 65

—	5.3/22	6.9/20	7.5/16	6.9/13	5.6/9	5.72/0	
—	5.3/25	7.4/21	8.0/18	7.5/15		5.1/10	6.15/0
—	4.4/27	6.5/23	7.0/21	6.3/18		4.0/10	4.95/0
—	4.1/22	7.1/19	7.4/16		7.3/13	4.8/7	5.55/0
	5.3/27	7.3/23	7.8/20	7.3/16		6.0/11	6.00/0

Spike E Root 12" Quad. Elm. 50' W℄ 23+0

							5.20/0
—	5.1/23	7.2/17		7.6/13	6.3/11	4.9/5	5.72/0
—	6.2/33	8.6/23			8.0/19	6.1/13	6.04/0
—	6.0/26	8.1/20	8.7/18	8.0/15		5.7/8	5.84/0
Level —	5.9/20	8.8/15	9.2/13	9.1/10		6.3/6	6.52/0 — 25' Rt
	5.7/40	6.0/30	5.4/20	8.2/16	8.5/12	8.8/8	7.0/6	7.02/0 — 25' Rt

1122.4 9.7 Ft. So. 1.1 ℄ Pavement 1122.9 9.2 Ft. N.

BM #8 = X on top SE Wingwall Culv. N Hambden.

BM #5 on Stump 38' W Corp line N. Hambden 30' N ℄ State Hwy BM.

	1.99	1133.40		1131.41	
30+0					1122.1
31+0					1121.1
32 T.P.	4.76	1128.64	9.50	1123.90	
32+0					1122.3
33+0					1121.3
34+0					1120.6
35+0					1120.7
	0.18	1128.64	0.18	1128.46	
T.P.	6.31	1131.77	3.18	1125.06	
			0.36	1131.41	

8.0/25 10.4/22 11.3/18 10.8/16 8.6/10 8.85/0

8.2/21 12.0/15 12.3/12 11.9/9 9.4/7 8.96/0

4.7/22 6.0/19 6.3/15 7.5/12 7.1/9 5.0/6 5.42/0 4.74/0

5.7/21 7.3/15 7.4/12 6.5/9 5.42/0

5.7/20 7.8/16 8.0/14 6.6/12 5.8/6 5.53/0

5.4/23 6.7/19 1120.7 7.9/15 7.2/12 6.70/0

Spike in Stump. 15' W Sta 35+0.

Check F.L. Co/r. S. Hamboden 11-9-38 at Pease Ditch

	+	H.I.			
	4.9r	1136.21		1131.29	
			11.1	1125.11	Fl. So
			11.2	1125.0	FL. No
			6.9		Top o/p N
			6.8		" " So

X Sec on Lateral Peque Ditch

BM #4	4.07	H.I. 1131.20			1127.13
	035-	1130.05	150	1129.70	
BM #7	2.95	1130.05	2.95	1127.10	
			4.5		
TP 11+0	432	1129.94	4.43	1125.62	
~~0+00~~ Section 100' E of Sta 12+0				1124.6	
~~1+0~~ 12+0				1124.9	
T.P.	426	1129.88	432	1125.62	
~~2+0~~ 13+0				1124.8	
	438	1129.68	4.38	1125.30	
~~3+0~~ 14+0				1124.4	
~~4+0~~ 15+0				1124.5	
TP.	479	1129.94	453	1125.15	
~~5+0~~ 16+0				1124.1	
TP	430	1130.32	3.92	1126.02	
~~6+0~~ 17+0				1124.2	
TP	466	1131.40	3.58	1126.74	
~~7~~ 18+0				1124.0	
TP	519	1131.11	5.48	1125.92	
~~8+0~~ 19+0				1123.9	
19+00 Set of Baselines			4.07	1127.04	1127.13
~~8 87.12~~ 19+87.1					

BM on Quad Elm

Horiz. Spike So Side 10" Elm 150' N.E. of 11+00

0-100

	4.4/18	5.1/15	5.1/12	4.4/7	4.39/0
	4.0/17	5.3/13	5.2/10	4.4/7	4.32/0
	4.3/18	5.4/13	5.1/10	4.3/6	4.13/0
30' to Fence	4.3/20		5.2/15	5.1.3/10	4.6/5-
	4.3/18	5.1/15-	5.0/10	4.4/5-	4.32/0
	4.6/21	5.2/18	5.8/15-	5.3/11	4.7/8
					4.53/0
	4.5/20	6.1/14	5.6/11	4.4/6	4.46/0
	5.1/24	7.0/18	7.0/15-	4.7/9	4.66/0
	4.7/27	6.8/24	7.2/19	6.9/16	4.8/12
BM #4					5.16/0
To other ditch main line	5.9/18	6.9/14	7.0/10	5.9/4	5.37/0

Pease Ditch Lateral, No. from So. Hambden Rd.

	+	HI	−	
	7.90	1139.19		1131.29
	8.70	1144.04	3.85	1135.34
BM #6	2.65	1144.17	2.52	1141.52
				1140.0
0+00 = 5 end Culvert, So. Hambden				1136.6
0+23				
1+0				1137.5
2+0				1136.5
2+0 TP	4.41	1140.53	8.05	1136.12
3+0				1134.8
4+0				1133.5
5+0				1132.7
6+0				1132.1
TP 6+0	1.63	1133.54	8.62	1131.91
7+0				1130.5
8+0				1129.5
9+0				1127.3
10+0				± 1125.9
Continued Pg. 69			6.30	1127.24

1127.18

70

BM 3 15 E/m.

Spike N. Side 10" Maple S. Side S. Hambden 60' W. 0+00
4.2 E3. Hambden

7.6 Fl. So. 6.4 Top of. So.

1136.5 7.7 Fl. No. 6.1 Top of No.

7.30/0 6.7/4 8.1/17 6.9/20 6.1/21 6.9/24

8.05/0

8.05/0 7.6/12 8.6/18 7.8/22 7.0/25 8.0/29

4.94/0 4.6/8 5.1/11 5.7/14 5.1/17 Fence

6.79/0 6.3/11 7.2/14 6.5/17

7.74/0 7.4/12 7.8/14 7.4/16 8.2/20

8.62/0 8.7/9 8.9/12 8.4/15

3.04/0 3.0/11 3.6/13 3.7/16 Fence

4.42/0 4.2/10 5.2/12 4.0/16

6.58/0 6.0/10 6.6/12 6.2/16 Fence

7.66/0 7.4/14 7.4/10 7.6/18 Fence

= B.M. on Elm. East

11/8/40 Pomeroy Richards Clause
Light snow -22°

Grades - Pease Creek Ditch

Sta.	+	H.I.	−	Elev	Grade
BM			2.82	11 31.23	1131.29
15+0			4.55	29.50	1123.0
16+0			5.15	28.90	1122.9
17+00.60			5.75	28.30	1122.8
18+0			6.35	27.70	1122.7
T.P.	6.95	1134.05 ✓	3.80	27.10 ✓	
18+98.56			3.80	27.10	1122.6
20+0			3.9	27.00	1122.5
21+0			4.0	26.90	1122.4
21+49.21			4.05	26.85	1122.35
22+0			4.60	26.30	1122.3
22+94.62			5.44	25.46	1122.21
		1130.90			

Spike S.E. Root 24" Elm 150' W of Sta 14+50

C 6.5 ✓

C 6.0 ✓

C 5.5 ✓

C 5.0 ✓

C 4.5 ✓

C 4.5 ✓

C 4.5 ✓

C 4.5 ✓

C 4.0 ✓

C 3.25 ✓

Sta.	+	H.I.	−	E	G.
B.M.		30.90 ✓	3.77	11 27.16	(1127.13)
T.P.	4.63	30.93 ✓	5.58	1126.30 ✓	
23+0			5.58	26.30	1122.2
24+0			5.68	26.20	1122.10
24+96.66			5.78	26.10	1122.0
26+0			5.38	26.50	1121.9
T.P.	6.08	31.88 ✓	9.28	1125.80 ✓	
27+0	off = 25'		9.28	25.80	1121.8
28+0	" = 25'		9.38	25.70	1121.70
28+70			8.95	26.13	1121.63
T.P.	3.60	1135.08 ✓		1131.48 ✓	
29+60			2.91	27.04	1121.54
		1129.95			

Spike E. Root Quad Elm 50' W of 23+0

C 4.1 ✓ = C4'-1"

C 4.1 ✓ = C4'-1"

C 4.1 ✓ = C4'-1"

C 4.6 ✓ = C4'-7"

C 4.0

C 4.0

C 4.5 ✓

Col. E Root

C 5.50 ✓

30+0			4.95	25.00	1121.5
31+0			5.05	24.90	1121.40
31+47.10			5.60	24.35	1121.35
32+0			5.65	24.30	1121.30
T.P.	0.66	1129.95 ✓	11.44	1129.29 ✓	
T.P			9.25	1131.48 ✓	
B.M.	0.34	1140.73 ✓			1140.39

C 3.50 ✓

C 3.50 ✓

C 3.0 ✓

C 3.0 ✓

Cor. E. Abut. & Wing
Spike in 18" Stump 30' W. of Corp. line
N. side N. Hamboden St.

4/26/40 Pomeroy - Richards

Check Profile Reese Ditch.

B.M.	4.51	1135.80 ✓		1131.29	(14+50)	
off F.L. (So.)			12.4	23.4 ✓		
F.L. "			11.09	24.71 ✓		
F.L. (N)			11.00	24.80 ✓		
off F.L. (N)			12.1	23.7 ✓		
15+0			11.3	24.0 ✓	23.0	1.0 H
+35			11.65	24.15 ✓		
16+0			12.01	23.79 ✓	22.9	.89H
+40			11.96	23.84 ✓		
17+0			12.14	23.66 ✓	22.8	.86H
T.P.	3.14	1131.49 ✓	7.45	1128.35 ✓		
18+0			7.91	23.58 ✓	22.7	.88H
19+0			8.09	23.40 ✓	22.6	.80H
20+0			8.15	23.34 ✓	22.5	.84H
21+0			8.49	23.00 ✓	22.4	.60H
22+0			8.52	22.97 ✓	22.3	.67H
B.M.	3.29	1130.42 ✓	4.33	1127.16 ✓	(1127.13)	
23+0			7.82	22.60 ✓	22.2	.40 H
24+0			8.12	22.30 ✓	22.1	.20 H
25+0			8.12	22.30 ✓	22.0	.30 H
+50			7.71	22.71 ✓	21.95	.76 H
26+0			7.96	22.46 ✓	21.9	.56H
+20			7.85	22.57 ✓	21.88	.69H
27+0			8.28	22.14 ✓	21.8	.34H
T.P.	4.56	1130.94 ✓	4.04	1126.38 ✓		

		1130.94 ✓			
28 to			9.09	21.85 ✓	21.7
F.L. (So)			9.20	21.74 ✓	21.5
T.P.	4.95	1131.89 ✓	4.00	1126.94 ✓	
F.L. (N)			10.46	21.43 ✓	21.5
30 to			10.38	21.51 ✓	21.5
31 to			10.83	21.06 ✓	21.4
32 to			10.90	20.99 ✓	21.3
33 to			11.20	20.69 ✓	21.2
T.P.	4.89	1128.93 ✓	7.25	1124.04 ✓	
34 to			8.38	20.55 ✓	21.1
35 to			8.40	20.53 ✓	21.0
36 to			9.26	19.67 ✓	
37 to			9.83	19.10 ✓	
38 to			10.1	18.83 ✓	
T.P.			0.54	1128.39	(1128.46)

.154

Spike 150' West of 35 to

Tree Location on Pease Lateral

24" Quad elm	21	~~8+40~~	19+40
8" elm	2	~~8+35~~	19+35
2-15" Elms	23'	~~8+0~~	19+0
7-6" Elms	21	~~7+77~~	18+77
10" Quad elm	21'	7+50	18+50
10" elm	13'	~~7+30~~	18+30
30" Quad elm	22'	~~6+70~~	17+70

Locations Pease Ditch Main Line

Locations from 15' offset line

5-6" Will.	8.	19+50
50" Willow	10'	17+45
4-6" Will.	13'	16+80
40" Willow	10'	16+27
15" Map.	30	14+80
15" Map.	5	14+80

8'

S.L, S Hembden

Post Fence

40'

Twin 60" willow

Fence E & W

7"

12+45

12" willow	8'	10+30
		9+20 lateral to west
3-8" willows	10'	8+10

5+0

10'

offset line

3+57 Fence So.

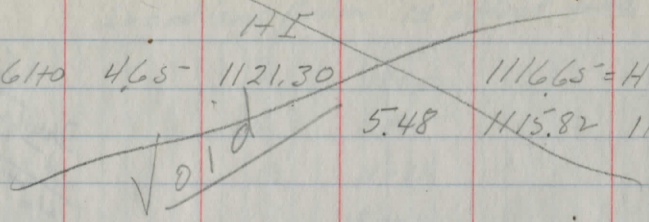
12" Willow	12	2+20
12" Willow.	14'	2+10
3-8" Willows.	12'	2+05
12" Willow	15	1+05
40" Stump	10'	0+18

30 tree
10
45

20" will stump.	15'	25+60
75" willow stump	15'	25+0
		24+70
12-6" elms.	18' 24	10
		24+30
4-30" willows		24+21
15" elm.	5'	23+55
12" elm.	6'.	23+50
10" ash	10'	23+0
10" ash	5'	23+0
10" Willow	5'	22+80
10" Willow	3'	22+70
30" Quad elm	24.	22+25
12" elm	23	22+10
36" Quad elm	23'	21+90
40" willow	12'	21+0
15" trip elm	22'	20+0
8" willow	10'	19+30

✓

B.M. Check Phelps Ca. Ditch



Approx on old B.M. 5' E of fence running N. from 6 to 0
Cut on E root. 15" Elm.

BM's - Chardon Vill - Hambden Ditch.

#1 Maple N. Side S Hambden St 250' W. Corp Line 1140.58
Stump 30' W Corp L. N.S. N Hambden 1140.39

BM. E Root 18" Maple 30' W. of ℄ 1127.01
684' S. of 1st X Road N of Thane Atwood's.

Old Br. Floor on R#528 (Sta Ditch 25+47) 1125.70

BM. X on W. Parapet at first. 1123.73
X Road on R#528 N of Thane Atwood.

BM. USGS Plate SW. Wing Bridge 1097.51
2200'± E of Barnes Corners.

Nauvoo 2 Nails in W Root 12" Map 23'E℄ 1111.22 = Sta 137 on R#528.
Sta 44± 129 S of Send Bridge.

Phelps Creek.
Old Fig Hick Stump 141± 1098.43

BM. N.W. Root 30" R. Oak 25'E℄ 48+0 1120.06
BM. on Hick 48+50 1118.28

137
52
85

Nauvoo Fault 0+00 80' So Hick
9+00 150' So Oak

Phelps 70 trees

6000 x 50 grubbing @ $30 000
sq yd = ~~27000~~ 33 000

check old ditch if ever cleaned out
from ~~Sta~~ 186 to end
See if ditch can be started at
136 or 140
Check location 132 & 136
Lateral - 16 trees Grubbing 600 x 20 = $12000
1300 sq yd.
Nauvoo.
Find bridge at 79+36
Check alignment at 65 with original
55 trees.
Grubbing 4000 x 15¢ $60000
6600 sq yd.

Lower grade if possible
Lateral - 7 trees no grubbing

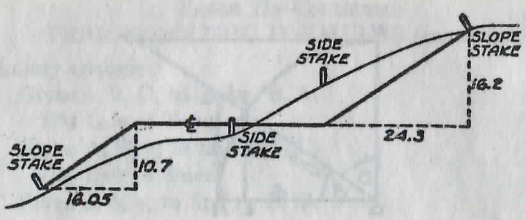


Table I.—Distances from Side Stakes for Cross-Sectioning

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.

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.

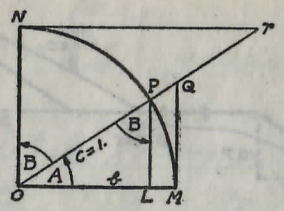


Table II

TRIGONOMETRIC FORMULAE

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

$R = OB = c = 1$

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

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

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

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

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

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

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

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

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

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

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

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

Law of Sines $\dfrac{\sin A}{a} = \dfrac{\sin B}{B} = \dfrac{\sin C^1}{C}$

Law of Cosines $c^2 = a^2 + p^2 - 2\,ab \cos C$

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

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.

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

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

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

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

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

Area of a triangle:

$$\text{Area} = \tfrac{1}{2}\,ab \sin C$$

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

PRISMOIDAL FORMULA

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

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

Table III

Minutes in Decimals of a Degree

1′	.0167	11′	.1833	21′	.3500	31′	.5167	41′	.6833	51′	.8500
2	.0333	12	.2000	22	.3667	32	.5333	42	.7000	52	.8667
3	.0500	13	.2167	23	.3833	33	.5500	43	.7167	53	.8833
4	.0667	14	.2333	24	.4000	34	.5667	44	.7333	54	.9000
5	.0833	15	.2500	25	.4167	35	.5833	45	.7500	55	.9167
6	.1000	16	.2667	26	.4333	36	.6000	46	.7667	56	.9333
7	.1167	17	.2833	27	.4500	37	.6167	47	.7833	57	.9500
8	.1333	18	.3000	28	.4667	38	.6333	48	.8000	58	.9667
9	.1500	19	.3167	29	.4833	39	.6500	49	.8167	59	.9833
10	.1667	20	.3333	30	.5000	40	.6667	50	.8333	60	.10000

Table IV

Inches in Decimals of a Foot

1/16 .0052	3/32 .0078	1/8 .0104	3/16 .0156	1/4 .0208	5/16 .0260	3/8 .0313	1/2 .0417	5/8 .0521	3/4 .0625	7/8 .0729

1 .0833	2 .1667	3 .2500	4 .3333	5 .4167	6 .5000	7 .5833	8 .6667	9 .7500	10 .8333	11 .9167

Table V.—Radii, Ordinates and Deflections

Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot	Deg.	Radius	Mid. Ord.	Tan. Offset	Def. for 1 Foot
0° 10′	34377.5	.036	.145	0.05′	7°	819.02	1.528	6.105	2.10′
20	17188.8	.073	.291	0.10	20′	781.84	1.600	6.395	2.20
30	11459.2	.109	.436	0.15	30	764.49	1.637	6.540	2.25
40	8594.42	.145	.582	0.20	40	747.89	1.673	6.685	2.30
50	6875.55	.182	.727	0.25					
					8	716.78	1.746	6.976	2.40
1	5729.65	.218	.873	0.30	20	688.16	1.819	7.266	2.50
10	4911.15	.255	1.018	0.35	30	674.69	1.855	7.411	2.55
20	4297.28	.291	1.164	0.40	40	661.74	1.892	7.556	2.60
30	3819.83	.327	1.309	0.45					
40	3437.87	.364	1.454	0.50	9	637.28	1.965	7.846	2.70
50	3125.36	.400	1.600	0.55	20	614.56	2.037	8.136	2.80
					30	603.80	2.074	8.281	2.85
2	2864.93	.436	1.745	0.60	40	593.42	2.110	8.426	2.90
10	2644.58	.473	1.891	0.65					
20	2455.70	.509	2.036	0.70	10	573.69	2.183	8.716	3.00
30	2292.01	.545	2.181	0.75	30	546.44	2.292	9.150	3.15
40	2148.79	.582	2.327	0.80	11	521.67	2.402	9.585	3.30
50	2022.41	.618	2.472	0.85	30	499.06	2.511	10.02	3.45
					12	478.34	2.620	10.45	3.60
3	1910.08	.655	2.618	0.90	30	459.28	2.730	10.89	3.75
10	1809.57	.691	2.763	0.95	13	441.68	2.839	11.32	3.90
20	1719.12	.727	2.908	1.00	30	425.40	2.949	11.75	4.05
30	1637.28	.764	3.054	1.05	14	410.28	3.058	12.18	4.20
40	1562.88	.800	3.199	1.10	30	396.20	3.168	12.62	4.35
50	1494.95	.836	3.345	1.15					
					15	383.07	3.277	13.05	4.50
4	1432.69	.873	3.490	1.20	30	370.78	3.387	13.49	4.65
10	1375.40	.909	3.635	1.25	16	359.27	3.496	13.92	4.80
20	1322.53	.945	3.718	1.30	30	348.45	3.606	14.35	4.95
30	1273.57	.982	3.926	1.35	17	338.27	3.716	14.78	5.10
40	1228.11	1.018	4.071	1.40	18	319.62	3.935	15.64	5.40
50	1185.78	1.055	4.217	1.45	19	302.94	4.155	16.51	5.70
5	1146.28	1.091	4.362	1.50	20	287.94	4.374	17.37	6.00
10	1109.33	1.127	4.507	1.55	21	274.37	4.594	18.22	6.30
20	1074.68	1.164	4.653	1.60	22	262.04	4.814	19.08	6.60
30	1042.14	1.200	4.798	1.65	23	250.79	5.035	19.94	6.90
40	1011.51	1.237	4.943	1.70	24	240.49	5.255	20.79	7.20
50	982.64	1.273	5.088	1.75					
					25	231.01	5.476	21.64	7.50
6	955.37	1.309	5.234	1.80	26	222.27	5.697	22.50	7.80
10	929.57	1.346	5.379	1.85	27	214.18	5.918	23.35	8.10
20	905.13	1.382	5.524	1.90	28	206.68	6.139	24.19	8.40
30	881.95	1.418	5.669	1.95	29	199.70	6.360	25.04	8.70
40	859.92	1.455	5.814	2.00	30	193.18	6.583	25.88	9.00

Note. Chord Deflection =2 times tangent deflection.

Table VI.—Tangents and Externals to a 1° Curve

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
1°	50.00	.22	11°	551.70	26.50	21°	1061.9	97.57
10′	58.34	.30	10′	560.11	27.31	10′	1070.6	99.16
20	66.67	.39	20	568.53	28.14	20	1079.2	100.75
30	75.01	.49	30	576.95	28.97	30	1087.8	102.35
40	83.34	.61	40	585.36	29.82	40	1096.4	103.97
50	91.68	.73	50	593.79	30.68	50	1105.1	105.60
2	100.01	.87	12	602.21	31.56	22	1113.7	107.24
10	108.35	1.02	10	610.64	32.45	10	1122.4	108.90
20	116.68	1.19	20	619.07	33.35	20	1131.0	110.57
30	125.02	1.36	30	627.50	34.26	30	1139.7	112.25
40	133.36	1.55	40	635.93	35.18	40	1148.4	113.95
50	141.70	1.75	50	644.37	36.12	50	1157.0	115.66
3	150.04	1.96	13	652.81	37.07	23	1165.7	117.38
10	158.38	2.19	10	661.25	38.03	10	1174.4	119.12
20	166.72	2.43	20	669.70	39.01	20	1183.1	120.87
30	175.06	2.67	30	678.15	39.99	30	1191.8	122.63
40	183.40	2.93	40	686.60	40.99	40	1200.5	124.41
50	191.74	3.21	50	695.06	42.00	50	1209.2	126.20
4	200.08	3.49	14	703.51	43.03	24	1217.9	128.00
10	208.43	3.79	10	711.97	44.07	10	1226.6	129.82
20	216.77	4.10	20	720.44	45.12	20	1235.3	131.65
30	225.12	4.42	30	728.90	46.18	30	1244.0	133.50
40	233.47	4.76	40	737.37	47.25	40	1252.8	135.35
50	241.81	5.10	50	745.85	48.34	50	1261.5	137.23
5	250.16	5.46	15	754.32	49.44	25	1270.2	139.11
10	258.51	5.83	10	762.80	50.55	10	1279.0	141.01
20	266.86	6.21	20	771.29	51.68	20	1287.7	142.93
30	275.21	6.61	30	779.77	52.89	30	1296.5	144.85
40	283.57	7.01	40	788.26	53.97	40	1305.3	146.79
50	291.92	7.43	50	796.75	55.13	50	1314.0	148.75
6	300.28	7.86	16	805.25	56.31	26	1322.8	150.71
10	308.64	8.31	10	813.75	57.50	10	1331.6	152.69
20	316.99	8.76	20	822.25	58.70	20	1340.4	154.69
30	325.35	9.23	30	830.76	59.91	30	1349.2	156.70
40	333.71	9.71	40	839.27	61.14	40	1358.0	158.72
50	342.08	10.20	50	847.78	62.38	50	1366.8	160.76
7	350.44	10.71	17	856.30	63.63	27	1375.6	162.81
10	358.81	11.22	10	864.82	64.90	10	1384.4	164.86
20	367.17	11.75	20	873.35	66.18	20	1393.2	166.95
30	375.54	12.29	30	881.88	67.47	30	1402.0	169.04
40	383.91	12.85	40	890.41	68.77	40	1410.9	171.15
50	392.28	13.41	50	898.95	70.09	50	1419.7	173.27
8	400.66	13.99	18	907.49	71.42	28	1428.6	175.41
10	409.03	14.58	10	916.03	72.76	10	1437.4	177.55
20	417.41	15.18	20	924.58	74.12	20	1446.3	179.72
30	425.79	15.80	30	933.13	75.49	30	1455.1	181.89
40	434.17	16.43	40	941.69	76.86	40	1464.0	184.08
50	442.55	17.07	50	950.25	78.26	50	1472.9	186.29
9	450.93	17.72	19	958.81	79.67	29	1481.8	188.51
10	459.32	18.38	10	967.38	81.09	10	1490.7	190.74
20	467.71	19.06	20	975.96	82.53	20	1499.6	192.99
30	476.10	19.75	30	984.53	83.97	30	1508.5	195.25
40	484.49	20.45	40	993.12	85.43	40	1517.4	197.53
50	492.88	21.16	50	1001.7	86.90	50	1526.3	199.82
10	501.28	21.89	20	1010.3	88.39	30	1535.3	202.12
10	509.68	22.62	10	1018.9	89.89	10	1544.2	204.44
20	518.08	23.38	20	1027.5	91.40	20	1553.1	206.77
30	526.48	24.14	30	1036.1	92.92	30	1562.1	209.12
40	534.89	24.91	40	1044.7	94.46	40	1571.0	211.48
50	543.29	25.70	50	1053.3	96.01	50	1580.0	213.86

Table VI.—Tangents and Externals to a 1° Curve

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
31°	1589.0	216.3	41°	2142.2	387.4	51°	2732.9	618.4
10′	1598.0	218.7	10′	2151.7	390.7	10′	2743.1	622.8
20	1606.9	221.1	20	2161.2	394.1	20	2753.4	627.2
30	1615.9	223.5	30	2170.8	397.4	30	2763.7	631.7
40	1624.9	226.0	40	2180.3	400.8	40	2773.9	636.2
50	1633.9	228.4	50	2189.9	404.2	50	2784.2	640.7
32	1643.0	230.9	42	2199.4	407.6	52	2794.5	645.2
10	1652.0	233.4	10	2209.0	411.1	10	2804.9	649.7
20	1661.0	235.9	20	2218.6	414.5	20	2815.2	654.3
30	1670.0	238.4	30	2228.1	418.0	30	2825.6	658.3
40	1679.1	241.0	40	2237.7	421.4	40	2835.9	663.4
50	1688.1	243.5	50	2247.3	425.0	50	2846.3	668.0
33	1697.2	246.1	43	2257.0	428.5	53	2856.7	672.7
10	1706.3	248.7	10	2266.6	432.0	10	2867.1	677.3
20	1715.3	251.3	20	2276.2	435.6	20	2877.5	682.0
30	1724.4	253.9	30	2285.9	439.2	30	2888.0	686.7
40	1733.5	256.5	40	2295.6	442.8	40	2898.4	691.4
50	1742.6	259.1	50	2305.2	446.4	50	2908.9	696.1
34	1751.7	261.8	44	2314.9	450.0	54	2919.4	700.9
10	1760.8	264.5	10	2324.6	453.6	10	2929.9	705.7
20	1770.0	267.2	20	2334.3	457.3	20	2940.4	710.5
30	1779.1	269.9	30	2344.1	461.0	30	2951.0	715.3
40	1788.2	272.6	40	2353.8	464.6	40	2961.5	720.1
50	1797.4	275.3	50	2363.5	468.4	50	2972.1	725.0
35	1806.6	278.1	45	2373.3	472.1	55	2982.7	729.9
10	1815.7	280.8	10	2383.1	475.8	10	2993.3	734.8
20	1824.9	283.6	20	2392.8	479.6	20	3003.9	739.7
30	1834.1	286.4	30	2402.6	483.8	30	3014.5	744.6
40	1843.3	289.2	40	2412.4	487.2	40	3025.2	749.6
50	1852.5	292.0	50	2422.3	491.0	50	3035.8	754.6
36	1861.7	294.9	46	2432.1	494.8	56	3046.5	759.6
10	1870.9	297.7	10	2441.9	498.7	10	3057.2	764.6
20	1880.1	300.6	20	2451.8	502.5	20	3067.9	769.7
30	1889.4	303.5	30	2461.7	506.4	30	3078.7	774.7
40	1898.6	306.4	40	2471.5	510.3	40	3089.4	779.8
50	1907.9	309.3	50	2481.4	514.3	50	3100.2	784.9
37	1917.1	312.2	47	2491.3	518.2	57	3110.9	790.1
10	1926.4	315.2	10	2501.2	522.2	10	3121.7	795.2
20	1935.7	318.1	20	2511.2	526.1	20	3132.6	800.4
30	1945.0	321.1	30	2521.1	530.1	30	3143.4	805.6
40	1954.3	324.1	40	2531.1	534.2	40	3154.2	810.9
50	1963.6	327.1	50	2541.0	538.2	50	3165.1	816.1
38	1972.9	330.2	48	2551.0	542.2	58	3176.0	821.4
10	1982.2	333.2	10	2561.0	546.3	10	3186.9	826.7
20	1991.5	336.3	20	2571.0	550.4	20	3197.8	832.0
30	2000.9	339.3	30	2581.0	554.5	30	3208.8	837.3
40	2010.2	342.4	40	2591.0	558.6	40	3219.7	842.7
50	2019.6	345.5	50	2601.1	562.8	50	3230.7	848.1
39	2029.0	348.6	49	2611.2	566.9	59	3241.7	853.5
10	2038.4	351.8	10	2621.2	571.1	10	3252.7	858.9
20	2047.8	354.9	20	2631.3	575.3	20	3263.7	864.3
30	2057.2	358.1	30	2641.4	579.5	30	3274.8	869.8
40	2066.6	361.3	40	2651.5	583.8	40	3285.8	875.3
50	2076.0	364.5	50	2661.6	588.0	50	3296.9	880.8
40	2085.4	367.7	50	2671.8	592.3	60	3308.0	886.4
10	2094.9	371.0	10	2681.9	596.6	10	3319.1	892.0
20	2104.3	374.2	20	2692.1	600.9	20	3330.3	897.5
30	2113.8	377.5	30	2702.3	605.3	30	3341.4	903.2
40	2123.3	380.8	40	2712.5	609.6	40	3352.6	908.8
50	2132.7	384.1	50	2722.7	614.0	50	3363.8	914.5

Table VI.—Tangents and Externals to a 1° Curve

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

Table VI.—Tangents and Externals to a 1° Curve

Central Angle	Tangent	External	Central Angle	Tangent	External	Central Angle	Tangent	External
91°	5830.5	2444.9	101°	6950.6	3278.1	111°	8336.7	4386.1
10′	5847.5	2457.1	10′	6971.3	3294.1	10′	8362.7	4407.6
20	5864.6	2469.3	20	6992.0	3310.1	20	8388.9	4429.2
30	5881.7	2481.5	30	7012.7	3326.1	30	8415.1	4450.9
40	5898.8	2493.8	40	7033.6	3342.3	40	8441.5	4472.7
50	5916.0	2506.1	50	7054.5	3358.5	50	8468.0	4494.6
92	5933.2	2518.5	102	7075.5	3374.9	112	8494.6	4516.6
10	5950.5	2531.0	10	7096.6	3391.2	10	8521.3	4538.8
20	5967.9	2543.5	20	7117.8	3407.7	20	8548.1	4561.1
30	5985.3	2556.0	30	7139.0	3424.3	30	8575.0	4583.4
40	6002.7	2568.6	40	7160.3	3440.9	40	8602.1	4606.0
50	6020.2	2581.3	50	7181.7	3457.6	50	8629.3	4628.6
93	6037.8	2594.0	103	7203.2	3474.4	113	8656.6	4651.3
10	6055.4	2606.8	10	7224.7	3491.3	10	8684.0	4674.2
20	6073.1	2619.7	20	7246.3	3508.2	20	8711.5	4697.2
30	6090.8	2632.6	30	7268.0	3525.2	30	8739.2	4720.3
40	6108.6	2645.5	40	7289.8	3542.4	40	8767.0	4743.6
50	6126.4	2658.5	50	7311.7	3559.6	50	8794.9	4766.9
94	6144.3	2671.6	104	7333.6	3576.8	114	8822.9	4790.4
10	6162.6	2684.7	10	7355.6	3594.2	10	8851.0	4814.1
20	6180.2	2697.9	20	7377.8	3611.7	20	8879.3	4837.8
30	6198.3	2711.2	30	7399.9	3629.2	30	8907.7	4861.7
40	6216.4	2724.5	40	7422.2	3646.8	40	8936.3	4885.7
50	6234.6	2737.9	50	7444.6	3664.5	50	8965.0	4909.9
95	6252.8	2751.3	105	7467.0	3682.3	115	8993.8	4934.1
10	6271.1	2764.8	10	7489.6	3700.2	10	9022.7	4958.6
20	6289.4	2778.3	20	7512.2	3718.2	20	9051.7	4983.1
30	6307.9	2792.0	30	7534.9	3736.2	30	9080.9	5007.8
40	6326.3	2805.6	40	7557.7	3754.4	40	9110.3	5032.6
50	6344.8	2819.4	50	7580.5	3772.6	50	9139.8	5057.6
96	6363.4	2833.2	106	7603.5	3791.0	116	9169.4	5082.7
10	6382.1	2847.0	10	7626.6	3809.4	10	9199.1	5107.9
20	6400.8	2861.0	20	7649.7	3827.9	20	9229.0	5133.3
30	6419.5	2875.0	30	7672.9	3846.5	30	9259.0	5158.8
40	6438.4	2889.0	40	7696.3	3865.2	40	9289.2	5184.5
50	6457.3	2903.1	50	7719.7	3884.0	50	9319.5	5210.3
97	6476.2	2917.3	107	7743.2	3902.9	117	9349.9	5236.2
10	6495.2	2931.6	10	7766.8	3921.9	10	9380.5	5262.3
20	6514.3	2945.9	20	7790.5	3940.9	20	9411.3	5288.6
30	6533.4	2960.3	30	7814.3	3960.1	30	9442.2	5315.0
40	6552.6	2974.7	40	7838.1	3979.4	40	9473.2	5341.5
50	6571.9	2989.2	50	7862.1	3998.7	50	9504.4	5368.2
98	6591.2	3003.8	108	7886.2	4018.2	118	9535.7	5395.1
10	6610.6	3018.4	10	7910.4	4037.8	10	9567.2	5422.1
20	6630.1	3033.1	20	7934.6	4057.4	20	9598.9	5449.2
30	6649.6	3047.9	30	7959.0	4077.2	30	9630.7	5476.5
40	6669.2	3062.8	40	7983.5	4097.1	40	9662.6	5504.0
50	6688.8	3077.7	50	8008.0	4117.0	50	9694.7	5531.7
99	6708.6	3092.7	109	8032.7	4137.1	119	9727.0	5559.4
10	6728.4	3107.7	10	8057.4	4157.3	10	9759.4	5587.4
20	6748.2	3122.9	20	8082.3	4177.5	20	9792.0	5615.5
30	6768.1	3138.1	30	8107.3	4197.9	30	9824.8	5643.8
40	6788.1	3153.3	40	8132.3	4218.4	40	9857.7	5672.3
50	5808.2	3168.7	50	8157.5	4239.0	50	9890.8	5700.9
100	6828.3	3184.1	110	8182.8	4259.7	120	9924.0	5729.7
10	6848.5	3199.6	10	8208.2	4280.5	10	9957.5	5758.6
20	6868.8	3215.1	20	8233.7	4301.4	20	9991.0	5787.7
30	6889.2	3230.8	30	8259.3	4322.4	30	10025.0	5817.0
40	6909.6	3246.5	40	8285.0	4343.6	40	10059.0	5846.5
50	6930.1	3262.3	50	8310.8	4364.8	50	10093.0	5876.1

Table VII.—Corrections for Tangents and Externals

These corrections are to be added to the approximate values, found by dividing the tangent, or external, for a 1° curve (Table VI) by the degree of curve, in order to obtain the true tangents, or externals. Intermediate values may be obtained by interpolation.

For Tangents Add

Central Angle	Degree of Curve													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.03	.06	.09	.13	.16	.19	.22	.25	.28	.31	.34	.38	.42	.46
15°	.04	.10	.14	.19	.24	.29	.34	.39	.45	.51	.53	.58	.63	.68
20°	.06	.13	.19	.26	.32	.39	.45	.51	.58	.65	.72	.79	.84	.90
25°	.08	.16	.24	.33	.40	.49	.58	.67	.75	.83	.90	.99	1.06	1.14
30°	.10	.19	.29	.39	.49	.59	.69	.79	.89	.99	1.09	1.20	1.29	1.39
35°	.11	.22	.34	.47	.58	.69	.70	.81	.92	1.04	1.29	1.42	1.54	1.66
40°	.13	.26	.40	.53	.67	.80	.93	1.06	1.20	1.34	1.49	1.64	1.79	1.94
45°	.15	.30	.44	.60	.76	.91	1.06	1.21	1.37	1.52	1.70	1.87	2.04	2.21
50°	.17	.34	.51	.68	.85	1.02	1.19	1.36	1.54	1.72	1.91	2.10	2.29	2.48
55°	.19	.38	.57	.76	.95	1.14	1.32	1.52	1.72	1.92	2.14	2.35	2.56	2.77
60°	.21	.42	.63	.84	1.05	1.27	1.49	1.71	1.94	2.17	2.38	2.60	2.83	3.07
65°	.23	.46	.69	.93	1.16	1.40	1.64	1.88	2.13	2.38	2.63	2.88	3.13	3.39
70°	.25	.51	.76	1.02	1.28	1.54	1.80	2.06	2.33	2.60	2.88	3.16	3.44	3.72
75°	.27	.56	.83	1.12	1.40	1.69	1.98	2.27	2.57	2.87	3.16	3.47	3.78	4.09
80°	.30	.61	.91	1.22	1.53	1.84	2.15	2.46	2.78	3.10	3.44	3.78	4.12	4.46
85°	.33	.66	1.00	1.33	1.68	2.02	2.36	2.70	3.05	3.40	3.77	4.14	4.55	4.89
90°	.36	.72	1.09	1.45	1.83	2.20	2.57	2.94	3.32	3.70	4.10	4.50	4.91	5.32
95°	.39	.79	1.19	1.55	2.00	2.40	2.80	3.20	3.61	4.02	4.40	4.98	5.38	5.83
100°	.43	.86	1.30	1.74	2.18	2.62	3.06	3.50	3.95	4.40	4.88	5.37	5.85	6.34
110°	.51	1.03	1.56	2.08	2.61	3.14	3.67	4.21	4.76	5.31	5.86	6.43	7.01	7.60
120°	.62	1.25	1.93	2.52	3.16	3.81	4.45	5.11	5.77	6.44	7.12	7.80	8.50	9.22

For Externals Add

Central Angle	Degree of Curve													
	5°	10°	15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	65°	70°
10°	.001	.003	.004	.006	.007	.008	.009	.011	.012	.014	.015	.017	.018	.020
15°	.003	.007	.010	.014	.018	.023	.027	.029	.032	.035	.039	.043	.047	.051
20°	.006	.011	.017	.022	.028	.034	.038	.045	.051	.057	.063	.070	.076	.083
25°	.009	.018	.027	.036	.046	.056	.065	.074	.083	.093	.106	.120	.127	.135
30°	.013	.025	.038	.051	.065	.078	.090	.103	.116	.129	.149	.170	.179	.188
35°	.018	.035	.054	.072	.086	.109	.131	.153	.175	.197	.213	.230	.247	.264
40°	.023	.046	.070	.093	.117	.141	.172	.203	.234	.265	.277	.290	.315	.341
45°	.030	.060	.093	.119	.153	.184	.216	.254	.289	.325	.351	.378	.411	.445
50°	.037	.075	.116	.151	.189	.227	.266	.305	.345	.384	.425	.467	.508	.550
55°	.046	.093	.142	.188	.236	.283	.332	.381	.420	.479	.530	.582	.641	.700
60°	.056	.112	.168	.225	.283	.340	.398	.457	.516	.575	.636	.697	.774	.851
65°	.067	.135	.204	.273	.343	.412	.483	.554	.625	.697	.711	.845	.922	1.01
70°	.080	.159	.240	.321	.403	.485	.568	.652	.735	.819	.906	.994	1.08	1.17
75°	.095	.182	.286	.383	.480	.578	.678	.777	.877	.977	1.07	1.18	1.29	1.39
80°	.110	.220	.332	.445	.558	.671	.787	.903	1.02	1.13	1.25	1.38	1.50	1.62
85°	.128	.259	.391	.524	.657	.790	.926	1.06	1.20	1.34	1.47	1.62	1.76	1.91
90°	.149	.299	.450	.603	.756	.910	1.07	1.22	1.38	1.54	1.70	1.87	2.03	2.20
95°	.174	.350	.522	.706	.985	1.06	1.25	1.43	1.62	1.80	1.99	2.18	2.38	2.58
100°	.200	.401	.604	.809	1.01	1.22	1.43	1.64	1.85	2.06	2.28	2.50	2.73	2.96
110°	.268	.536	.806	1.08	1.35	1.63	1.91	2.20	2.48	2.76	3.05	3.35	3.66	3.96
120°	.360	.721	1.08	1.45	1.82	2.19	2.57	2.95	3.33	3.72	4.11	4.50	4.91	5.32

Table VIII.—Corrections for Sub-Chords and Long Chords

D	FOR SUB-CHORDS ADD 10	20	30	40	50	60	70	80	90	Excess of Arc per 100 ft.
4°	.00	.00	.01	.01	.01	.01	.01	.01	.00	.02
6	.00	.01	.01	.02	.02	.02	.02	.01	.01	.05
8	.01	.02	.02	.03	.03	.03	.03	.02	.01	.08
10	.01	.02	.03	.04	.05	.05	.05	.04	.02	.13
12	.02	.04	.05	.06	.07	.07	.07	.05	.03	.18
14	.02	.05	.07	.08	.09	.10	.09	.07	.04	.25
16	.03	.06	.09	.11	.12	.12	.12	.09	.05	.33
18	.04	.08	.11	.14	.15	.16	.15	.12	.07	.41
20	.05	.10	.14	.17	.19	.20	.18	.15	.09	.51
22	.06	.12	.17	.21	.23	.24	.22	.18	.10	.62
24	.07	.14	.20	.25	.28	.28	.26	.21	.12	.74
26	.09	.17	.24	.29	.32	.33	.31	.25	.15	.86
28	.10	.19	.27	.34	.37	.38	.36	.29	.17	1.00
30	.11	.22	.31	.39	.43	.44	.41	.33	.19	1.15
32	.13	.25	.36	.44	.49	.50	.47	.38	.22	1.31
34	.15	.28	.40	.50	.55	.57	.53	.43	.25	1.48
36	.17	.32	.45	.56	.62	.64	.59	.48	.28	1.66
38	.18	.36	.51	.62	.70	.71	.66	.53	.31	1.86
40	.21	.40	.56	.69	.77	.79	.73	.59	.35	2.06
42	.23	.44	.62	.76	.85	.87	.81	.65	.38	2.28
44	.25	.48	.68	.84	.94	.96	.89	.72	.42	2.50
46	.27	.52	.75	.92	1.02	1.05	.98	.78	.46	2.74
48	.30	.57	.81	1.00	1.12	1.14	1.06	.86	.50	2.99
50	.32	.62	.89	1.09	1.21	1.24	1.15	.93	.55	3.24
52	.35	.67	.96	1.18	1.31	1.35	1.25	1.01	.59	3.52
54	.38	.73	1.04	1.28	1.42	1.46	1.35	1.09	.64	3.80
56	.41	.78	1.12	1.38	1.53	1.57	1.46	1.17	.69	4.09
58	.44	.84	1.20	1.48	1.65	1.69	1.57	1.26	.74	4.40
60	.47	.91	1.29	1.59	1.76	1.81	1.68	1.35	.80	4.72

D	LONG CHORDS 200	300	400	500
1	199.99	299.97	399.92	499.85
2	199.97	299.88	399.70	499.39
3	199.93	299.73	399.32	498.63
4	199.88	299.51	398.78	497.57
5	199.81	299.24	398.10	496.20
6	199.73	298.90	397.26	494.53
7	199.63	298.51	396.28	492.57
8	199.51	298.05	395.14	490.31
9	199.38	297.54	393.86	487.75
10	199.24	296.96	392.42	484.90
12	198.90	295.63	389.12	478.34
14	198.51	294.06	385.22	470.65
16	198.05	292.25	380.76	461.86
18	197.54	290.21	375.74	452.02
20	196.96	287.94	370.17	441.15
22	196.32	285.44	364.06	429.30
24	195.63	282.71	357.43	416.53
26	194.87	279.76	350.30	402.89
28	194.06	276.59	342.69	388.43
30	193.18	273.20	334.61	373.20
32	192.25	269.61	326.08	357.28
34	191.26	265.81	317.12	340.73
36	190.21	261.80	307.77	323.61
38	189.10	257.60	298.03	305.99
40	187.94	253.21	287.94	287.94
42	186.72	248.63	277.51	269.54
44	185.44	243.87	266.78	250.85
46	184.10	239.93	255.78	231.95
48	182.71	233.83	244.51	212.92

Note.—When a chord of less than 100 ft. is used the corrections given in the above table should be added to the nominal length of chord to get the length which should be used in order that the 100 ft. points will check with those obtained by using the standard 100 ft. chord. Thus in locating a 14° curve by 25 ft. chords measure 25'.06 for each chord. Long chords are useful in passing obstacles.

Table IX.—Middle Ordinates for Rails in Feet

Deg. of Curve	LENGTH OF RAILS 32	30	28	26	24	22	20	Deg. of Curve	LENGTH OF RAILS 32	30	28	26	24	22	20
1°	.022	.020	.016	.013	.011	.009	.008	16°	.356	.313	.273	.236	.200	.170	.139
2	.045	.038	.034	.029	.025	.021	.017	17	.378	.333	.290	.252	.213	.180	.148
3	.037	.058	.051	.044	.037	.031	.026	18	.400	.351	.306	.265	.225	.190	.156
4	.089	.079	.069	.060	.050	.042	.035	19	.423	.371	.324	.280	.238	.201	.165
5	.112	.099	.086	.074	.063	.053	.044	20	.445	.392	.341	.296	.250	.212	.174
6	.134	.117	.102	.088	.076	.064	.052	21	.466	.410	.357	.309	.262	.222	.182
7	.156	.137	.120	.104	.088	.074	.061	22	.487	.430	.375	.325	.275	.233	.191
8	.179	.158	.137	.119	.100	.085	.070	23	.509	.450	.390	.338	.287	.243	.199
9	.201	.175	.153	.133	.112	.095	.078	24	.531	.469	.408	.354	.299	.253	.208
10	.223	.196	.171	.148	.125	.106	.087	25	.552	.486	.424	.367	.311	.263	.216
11	.245	.216	.188	.163	.139	.117	.096	26	.573	.506	.441	.382	.323	.274	.225
12	.268	.236	.206	.179	.151	.128	.105	27	.594	.524	.457	.396	.335	.284	.233
13	.290	.254	.222	.192	.163	.138	.113	28	.618	.545	.475	.411	.348	.294	.242
14	.312	.275	.239	.207	.175	.148	.122	29	.638	.564	.491	.424	.361	.303	.250
15	.334	.295	.257	.223	.188	.159	.131	30	.660	.583	.508	.438	.374	.313	.259

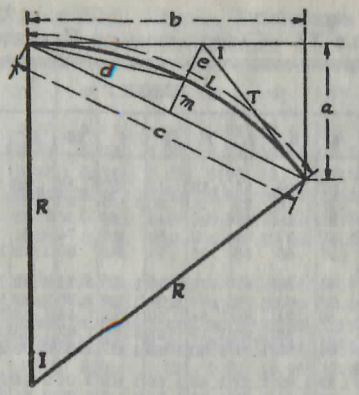


Table X
CURVE FORMULAE FOR SIMPLE CURVES
Compiled by J. Calvin Locke, C.E.

(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. $= \frac{LR - R^2 \operatorname{Sin} I}{2} = \frac{LR - Rb}{2}$

Table XI.—Calculation of Earthwork

Width	HEIGHT														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	.02	.04	.06	.07	.09	.11	.13	.15	.17	.18	.20	.22	.24	.26	.28
2	.04	.07	.11	.15	.18	.22	.26	.30	.33	.37	.41	.44	.48	.52	.56
3	.06	.11	.17	.22	.28	.33	.39	.44	.50	.56	.61	.67	.72	.78	.83
4	.07	.15	.22	.30	.37	.44	.52	.59	.67	.74	.81	.89	.96	1.04	1.11
5	.09	.19	.28	.37	.46	.56	.65	.74	.83	.93	1.02	1.11	1.20	1.30	1.39
6	.11	.22	.33	.44	.56	.67	.78	.89	1.00	1.11	1.22	1.33	1.44	1.55	1.67
7	.13	.26	.39	.52	.65	.78	.91	1.04	1.16	1.30	1.42	1.55	1.68	1.81	1.94
8	.15	.30	.44	.59	.74	.89	1.04	1.19	1.33	1.48	1.63	1.78	1.92	2.08	2.22
9	.17	.33	.50	.67	.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50
10	.18	.37	.56	.74	.93	1.11	1.30	1.48	1.67	1.85	2.04	2.22	2.41	2.59	2.78
11	.20	.41	.61	.82	1.02	1.22	1.43	1.63	1.83	2.04	2.24	2.44	2.65	2.85	3.06
12	.22	.44	.67	.89	1.11	1.33	1.56	1.78	2.00	2.22	2.44	2.67	2.89	3.11	3.33
13	.24	.48	.72	.96	1.20	1.44	1.68	1.92	2.16	2.41	2.65	2.89	3.13	3.37	3.61
14	.26	.52	.78	1.04	1.30	1.55	1.81	2.08	2.33	2.59	2.85	3.11	3.37	3.63	3.89
15	.28	.56	.83	1.11	1.39	1.67	1.94	2.22	2.50	2.78	3.06	3.33	3.61	3.89	4.17
16	.30	.59	.89	1.18	1.48	1.78	2.07	2.37	2.67	2.96	3.26	3.56	3.85	4.15	4.44
17	.31	.63	.94	1.26	1.57	1.89	2.20	2.52	2.83	3.15	3.46	3.78	4.09	4.41	4.72
18	.33	.67	1.00	1.33	1.67	2.00	2.33	2.67	3.00	3.33	3.67	4.00	4.33	4.67	5.00
19	.35	.70	1.06	1.41	1.76	2.11	2.46	2.82	3.17	3.52	3.87	4.22	4.57	4.92	5.28
20	.37	.74	1.11	1.48	1.85	2.22	2.59	2.96	3.33	3.70	4.07	4.44	4.81	5.18	5.56
21	.39	.78	1.17	1.55	1.94	2.33	2.72	3.11	3.50	3.89	4.28	4.67	5.06	5.44	5.83
22	.41	.81	1.22	1.63	2.04	2.44	2.85	3.26	3.67	4.07	4.48	4.89	5.30	5.70	6.11
23	.43	.85	1.28	1.70	2.13	2.56	2.98	3.41	3.83	4.26	4.68	5.11	5.54	5.96	6.39
24	.44	.89	1.33	1.78	2.22	2.67	3.11	3.56	4.00	4.44	4.89	5.33	5.78	6.22	6.67
25	.46	.92	1.39	1.85	2.31	2.78	3.24	3.70	4.17	4.63	5.09	5.56	6.02	6.48	6.94
26	.48	.96	1.44	1.92	2.41	2.89	3.37	3.85	4.33	4.82	5.30	5.78	6.26	6.74	7.24
27	.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50
28	.52	1.04	1.55	2.07	2.59	3.11	3.63	4.15	4.67	5.18	5.70	6.22	6.74	7.26	7.78
29	.54	1.07	1.61	2.15	2.68	3.22	3.76	4.30	4.83	5.37	5.91	6.44	6.98	7.52	8.06
30	.56	1.11	1.67	2.22	2.78	3.33	3.89	4.44	5.00	5.55	6.11	6.67	7.22	7.78	8.33
31	.57	1.15	1.72	2.30	2.87	3.44	4.02	4.59	5.17	5.74	6.32	6.89	7.46	8.04	8.61
32	.59	1.18	1.78	2.37	2.96	3.56	4.15	4.74	5.33	5.92	6.52	7.11	7.70	8.30	8.89
33	.61	1.22	1.83	2.44	3.05	3.67	4.28	4.89	5.50	6.11	6.72	7.33	7.94	8.55	9.17
34	.63	1.26	1.89	2.52	3.15	3.78	4.40	5.04	5.67	6.29	6.93	7.56	8.18	8.81	9.44
35	.65	1.30	1.94	2.59	3.24	3.89	4.53	5.18	5.83	6.48	7.13	7.78	8.42	9.08	9.72
36	.67	1.33	2.00	2.67	3.33	4.00	4.66	5.33	6.00	6.67	7.33	8.00	8.67	9.33	10.00
37	.68	1.37	2.06	2.74	3.42	4.11	4.79	5.48	6.17	6.85	7.54	8.22	8.91	9.59	10.28
38	.70	1.41	2.11	2.82	3.52	4.22	4.92	5.63	6.33	7.03	7.74	8.44	9.15	9.85	10.56
39	.72	1.44	2.17	2.89	3.61	4.33	5.05	5.78	6.50	7.22	7.95	8.67	9.39	10.11	10.83
40	.74	1.48	2.22	2.96	3.70	4.44	5.18	5.92	6.67	7.41	8.15	8.89	9.63	10.37	11.11

Table gives cu. yds. in 1 ft. of a triangle of given width and height. Corrections for tenths of width are one tenth the values found under each height considering the widths from 1 to 9 as tenths and similarly the corrections for tenths of height are one tenth the figures opposite width considering the heights from 1 to 9 as tenths. Thus if w = 16.2 and h = 5.3, cu. yds. = 1.48 + .028 + .089 = 1.597 cu. yds. or practically 160 cu. yds. per 100 ft. If w exceeds 40 ft., use one-half and multiply result by 2, if both w and h are large use one-half of each and multiply result by 4. Any cross-section may be divided into triangles by the following rule. To the triangle of the sum of the outside cuts (or fills) = h, and ½ the roadbed = w, add the triangles formed by taking the distance out to each break in turn (= w's) by the difference between the cuts (or fills) on each side of it (= h's) always subtracting the outer from the inner.

Table XII. Stadia Reductions

Vertical Heights

Minutes	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°
0....	0.00	1.74	3.49	5.23	6.96	8.68	10.40	12.10	13.78	15.45	17.10
2....	0.06	1.80	3.55	5.28	7.02	8.74	10.45	12.15	13.84	15.51	17.16
4....	0.12	1.86	3.60	5.34	7.07	8.80	10.51	12.21	13.89	15.56	17.21
6....	0.17	1.92	3.66	5.40	7.13	8.85	10.57	12.26	13.95	15.62	17.26
8....	0.23	1.98	3.72	5.46	7.19	8.91	10.62	12.32	14.01	15.67	17.32
10....	0.29	2.04	3.78	5.52	7.25	8.97	10.68	12.38	14.06	15.73	17.37
12....	0.35	2.09	3.84	5.57	7.30	9.03	10.74	12.43	14.12	15.78	17.43
14....	0.41	2.15	3.90	5.63	7.36	9.08	10.79	12.49	14.17	15.84	17.48
16....	0.47	2.21	3.95	5.69	7.42	9.14	10.85	12.55	14.23	15.89	17.54
18....	0.52	2.27	4.01	5.75	7.48	9.20	10.91	12.60	14.28	15.95	17.59
20....	0.58	2.33	4.07	5.80	7.53	9.25	10.96	12.66	14.34	16.00	17.65
22....	0.64	2.38	4.13	5.86	7.59	9.31	11.02	12.72	14.40	16.06	17.70
24....	0.70	2.44	4.18	5.92	7.65	9.37	11.08	12.77	14.45	16.11	17.76
26....	0.76	2.50	4.24	5.98	7.71	9.43	11.13	12.83	14.51	16.17	17.81
28....	0.81	2.56	4.30	6.04	7.76	9.48	11.19	12.88	14.56	16.22	17.86
30....	0.87	2.62	4.36	6.09	7.82	9.54	11.25	12.94	14.62	16.28	17.92
32....	0.93	2.67	4.42	6.15	7.88	9.60	11.30	13.00	14.67	16.33	17.97
34....	0.99	2.73	4.48	6.21	7.94	9.65	11.36	13.05	14.73	16.39	18.03
36....	1.05	2.79	4.53	6.27	7.99	9.71	11.42	13.11	14.79	16.44	18.08
38....	1.11	2.85	4.59	6.33	8.05	9.77	11.47	13.17	14.84	16.50	18.14
40....	1.16	2.91	4.65	6.38	8.11	9.83	11.53	13.22	14.90	16.55	18.19
42....	1.22	2.97	4.71	6.44	8.17	9.88	11.59	13.28	14.95	16.61	18.24
44....	1.28	3.02	4.76	6.50	8.22	9.94	11.64	13.33	15.01	16.66	18.30
46....	1.34	3.08	4.82	6.56	8.28	10.00	11.70	13.39	15.06	16.72	18.35
48....	1.40	3.14	4.88	6.61	8.34	10.05	11.76	13.45	15.12	16.77	18.41
50....	1.45	3.20	4.94	6.67	8.40	10.11	11.81	13.50	15.17	16.83	18.46
52....	1.51	3.26	4.99	6.73	8.45	10.17	11.87	13.56	15.23	16.88	18.51
54....	1.57	3.31	5.05	6.79	8.51	10.22	11.93	13.61	15.28	16.94	18.57
56....	1.63	3.37	5.11	6.84	8.57	10.28	11.98	13.67	15.34	16.99	18.62
58....	1.69	3.43	5.17	6.90	8.63	10.34	12.04	13.73	15.40	17.05	18.68
60....	1.74	3.49	5.23	6.96	8.68	10.40	12.10	13.78	15.45	17.10	18.73

Horizontal Corrections

Dist.	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°
100...	0.0	0.0	0.1	0.3	0.5	0.8	1.1	1.5	1.9	2.5	3.0
200...	0.0	0.1	0.2	0.5	1.0	1.5	2.2	3.0	3.9	4.9	6.0
300...	0.0	0.1	0.4	0.8	1.5	2.3	3.3	4.5	5.8	7.4	9.1
400...	0.0	0.1	0.5	1.1	2.0	3.0	4.4	6.0	7.8	9.8	12.1
500...	0.0	0.2	0.6	1.4	2.5	3.8	5.5	7.5	9.7	12.3	15.1
600...	0.0	0.2	0.7	1.6	2.9	4.6	6.5	8.9	11.6	14.7	18.1
700...	0.0	0.2	0.8	1.9	3.4	5.3	7.6	10.4	13.6	17.2	21.1
800...	0.0	0.2	1.0	2.2	3.9	6.1	8.7	11.9	15.5	19.6	24.2
900...	0.0	0.3	1.1	2.4	4.4	6.8	9.8	13.4	17.5	22.1	27.2
1000...	0.0	0.3	1.2	2.7	4.9	7.6	10.9	14.9	19.4	24.5	30.2

Table XII. Stadia Reductions

Vertical Heights

Minutes	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°
0	18.73	20.34	21.92	23.47	25.00	26.50	27.96	29.39	30.78	32.14
2	18.78	20.39	21.97	23.52	25.05	26.55	28.01	29.44	30.83	32.18
4	18.84	20.44	22.02	23.58	25.10	26.59	28.06	29.48	30.87	32.23
6	18.89	20.50	22.08	23.63	25.15	26.64	28.10	29.53	30.92	32.27
8	18.95	20.55	22.13	23.68	25.20	26.69	28.15	29.58	30.97	32.32
10	19.00	20.60	22.18	23.73	25.25	26.74	28.20	29.62	31.01	32.36
12	19.05	20.66	22.23	23.78	25.30	26.79	28.25	29.67	31.06	32.41
14	19.11	20.71	22.28	23.83	25.35	26.84	28.30	29.72	31.10	32.45
16	19.16	20.76	22.34	23.88	25.40	26.89	28.34	29.76	31.15	32.49
18	19.21	20.81	22.39	23.93	25.45	26.94	28.39	29.81	31.19	32.54
20	19.27	20.87	22.44	23.99	25.50	26.99	28.44	29.86	31.24	32.58
22	19.32	20.92	22.49	24.04	25.55	27.04	28.49	29.90	31.28	32.63
24	19.38	20.97	22.54	24.09	25.60	27.09	28.54	29.95	31.33	32.67
26	19.43	21.03	22.60	24.14	25.65	27.13	28.58	30.00	31.38	32.72
28	19.48	21.08	22.65	24.19	25.70	27.18	28.63	30.04	31.42	32.76
30	19.54	21.13	22.70	24.24	25.75	27.23	28.68	30.09	31.47	32.80
32	19.59	21.18	22.75	24.29	25.80	27.28	28.73	30.14	31.51	32.85
34	19.64	21.24	22.80	24.34	25.85	27.33	28.77	30.19	31.56	32.89
36	19.70	21.29	22.85	24.39	25.90	27.38	28.82	30.23	31.60	32.93
38	19.75	21.34	22.91	24.44	25.95	27.43	28.87	30.28	31.65	32.98
40	19.80	21.39	22.96	24.49	26.00	27.48	28.92	30.32	31.69	33.02
42	19.86	21.45	23.01	24.55	26.05	27.52	28.96	30.37	31.74	33.07
44	19.91	21.50	23.06	24.60	26.10	27.57	29.01	30.41	31.78	33.11
46	19.96	21.55	23.11	24.65	26.15	27.62	29.06	30.46	31.83	33.15
48	20.02	21.60	23.16	24.70	26.20	27.67	29.11	30.51	31.87	33.20
50	20.07	21.66	23.22	24.75	26.25	27.72	29.15	30.55	31.92	33.24
52	20.12	21.71	23.27	24.80	26.30	27.77	29.20	30.60	31.96	33.28
54	20.18	21.76	23.32	24.85	26.35	27.81	29.25	30.65	32.01	33.33
56	20.23	21.81	23.37	24.90	26.40	27.86	29.30	30.69	32.05	33.37
58	20.28	21.87	23.42	24.95	26.45	27.91	29.34	30.74	32.09	33.41
60	20.34	21.92	23.47	25.00	26.50	27.96	29.39	30.78	32.14	33.46

Horizontal Corrections

District	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°
100	3.6	4.3	5.1	5.9	6.7	7.6	8.5	9.5	10.6	11.7
200	7.3	8.6	10.1	11.7	13.4	15.2	17.1	19.1	21.2	23.4
300	10.9	13.0	15.2	17.6	20.1	22.8	25.6	28.6	31.8	35.1
400	14.6	17.3	20.2	23.4	26.8	30.4	34.2	38.2	42.4	46.8
500	18.2	21.6	25.3	29.3	33.5	38.0	42.7	47.7	53.0	58.5
600	21.8	25.9	30.4	35.1	40.2	45.6	51.3	57.3	63.6	70.2
700	25.5	30.2	35.4	41.0	46.9	53.2	59.8	66.8	74.2	81.9
800	29.1	34.6	40.5	46.8	53.6	60.8	68.4	76.4	84.8	93.6
900	32.8	38.9	45.5	52.7	60.3	68.4	76.9	85.9	95.4	105.3
1000	36.4	43.2	50.6	58.5	67.0	76.0	85.5	95.5	106.0	117.0

Table XIII.—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.

Table XIII.—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
	60′	60′	50′	50′	40′	40′	30′	30′	20′	30′	10′	10′	
Deg.	cos	cot	cos	cot	cos	cot	cos	cot	cos	cot	cos	cot	Deg.

197 last

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