

Logan Ave - Dunkerton Rd Transit Notes

Logan Ave - Brandon Rd Transit Notes

67

Property of
Black Hawk
County
Care of
County Engr.

67

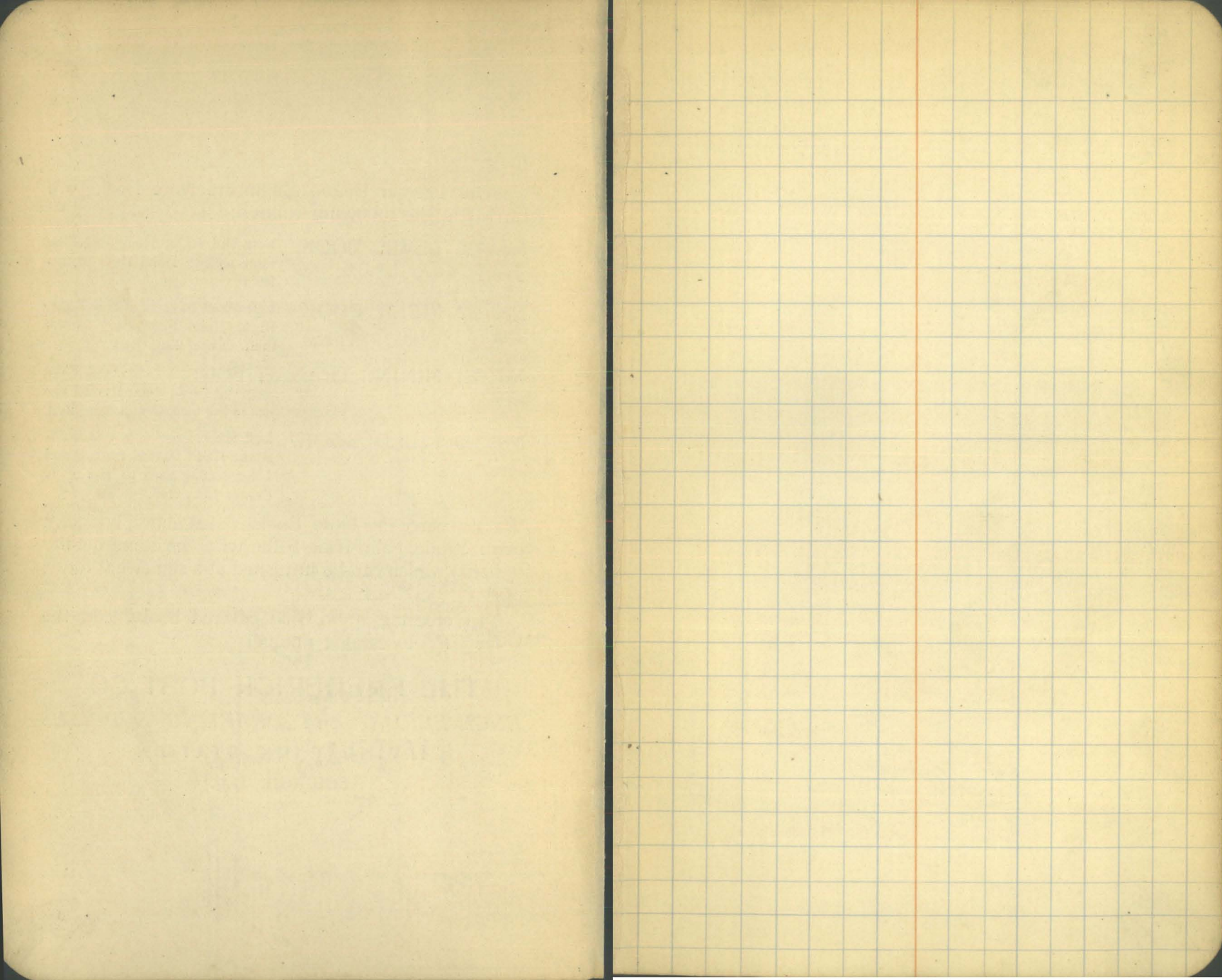
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- No. 380 LEVEL BOOK. Left and Right Hand Page the same as Left Hand Page of this Book.
- No. 382 FIELD BOOK. Left Hand Page as in this Book, Right Hand Page 4 x 4 to the inch, Center Line Red.
- No. 384 MINING TRANSIT BOOK. Left Hand Page as in this Book, Right Hand Page 8x8 to the inch, Center Line Red.
- No. 385 FIELD BOOK. Left Hand Page as in this Book, Right Hand Page 8 vertical and 4 horizontal lines to the inch, Center Line Red.

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THE FREDERICK POST CO.
ENGINEERING and DRAFTING SUPPLIES
IRVING PARK STATION
CHICAGO, ILL.



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Logan Ave. - Duxbury Rd.

Corner Stone Data.

5-8

Transit Notes Sta. 0+00 to 318+76.7

{ 9-44 }
{ 48-51 }

Laporte - Brandon Road.

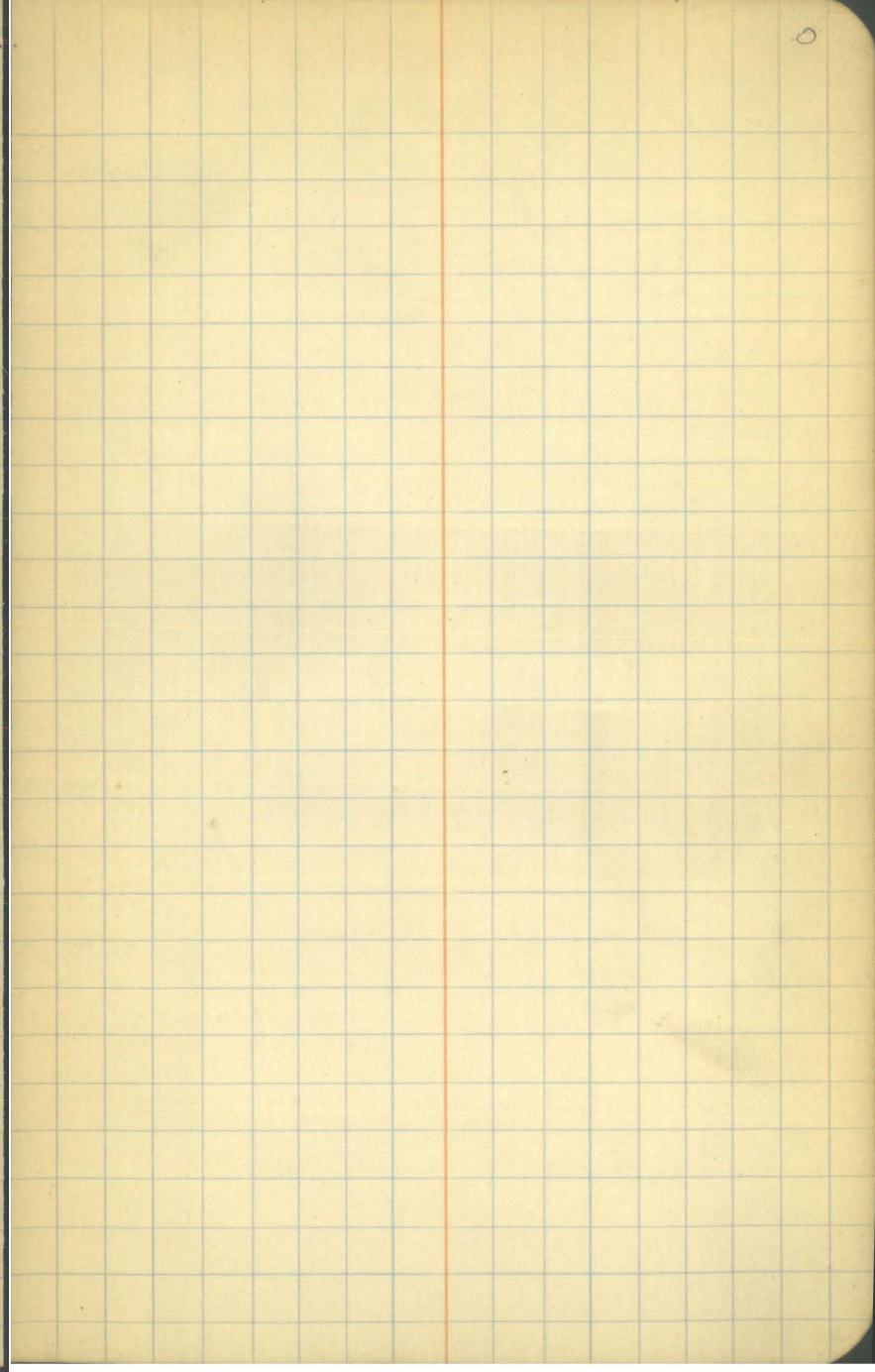
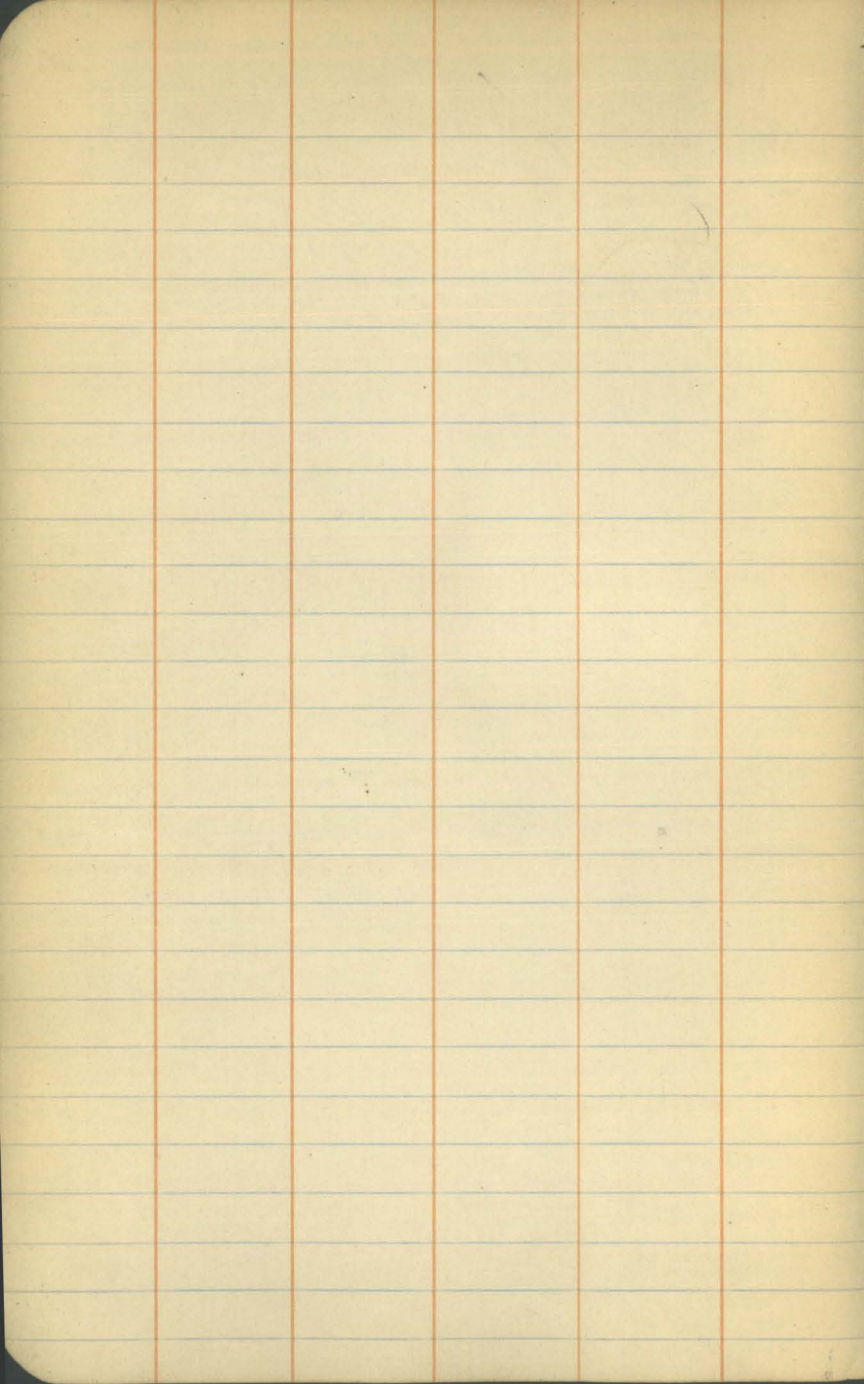
Transit Notes for "A" Line (Notes - A. & B. Lines)

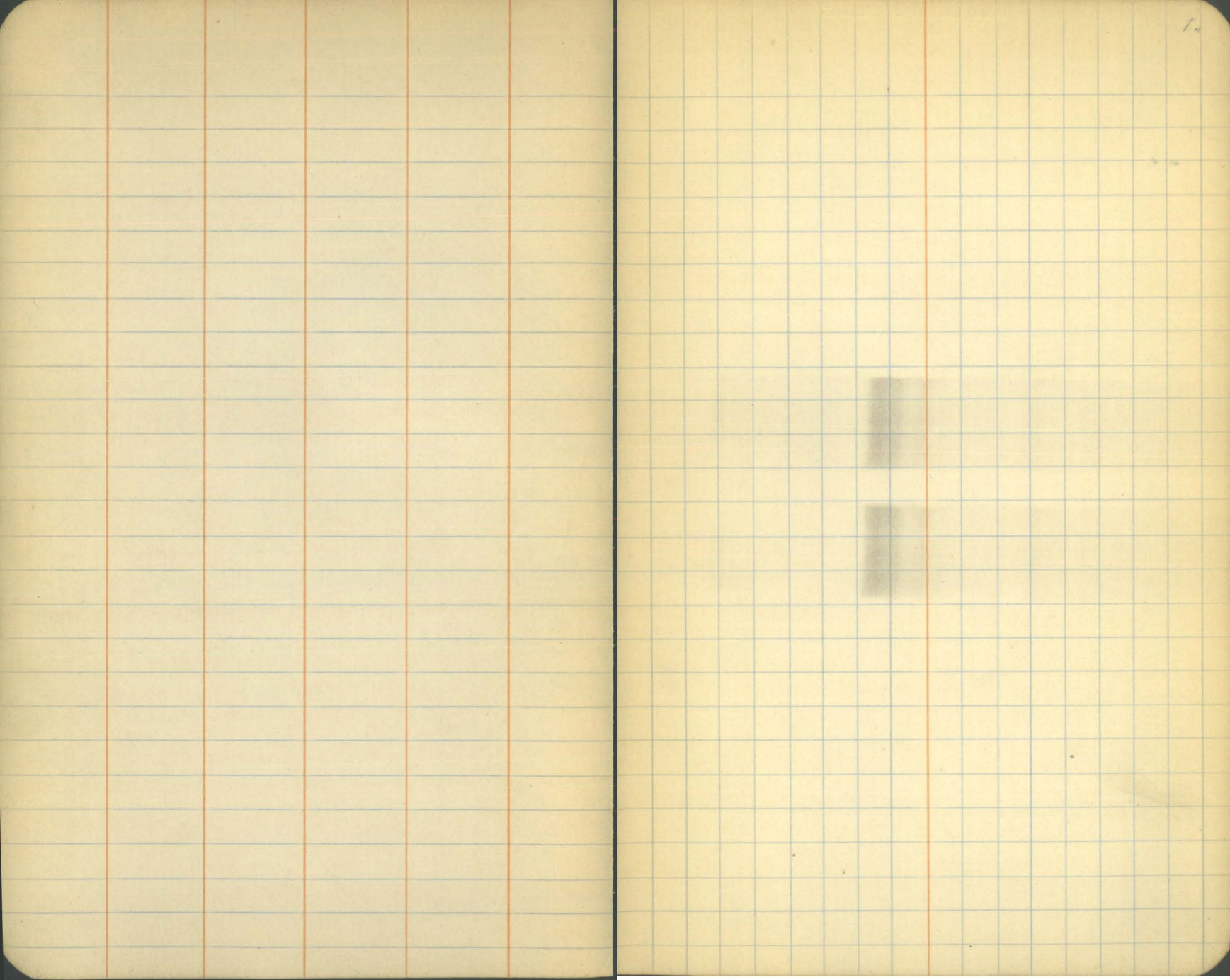
55-76

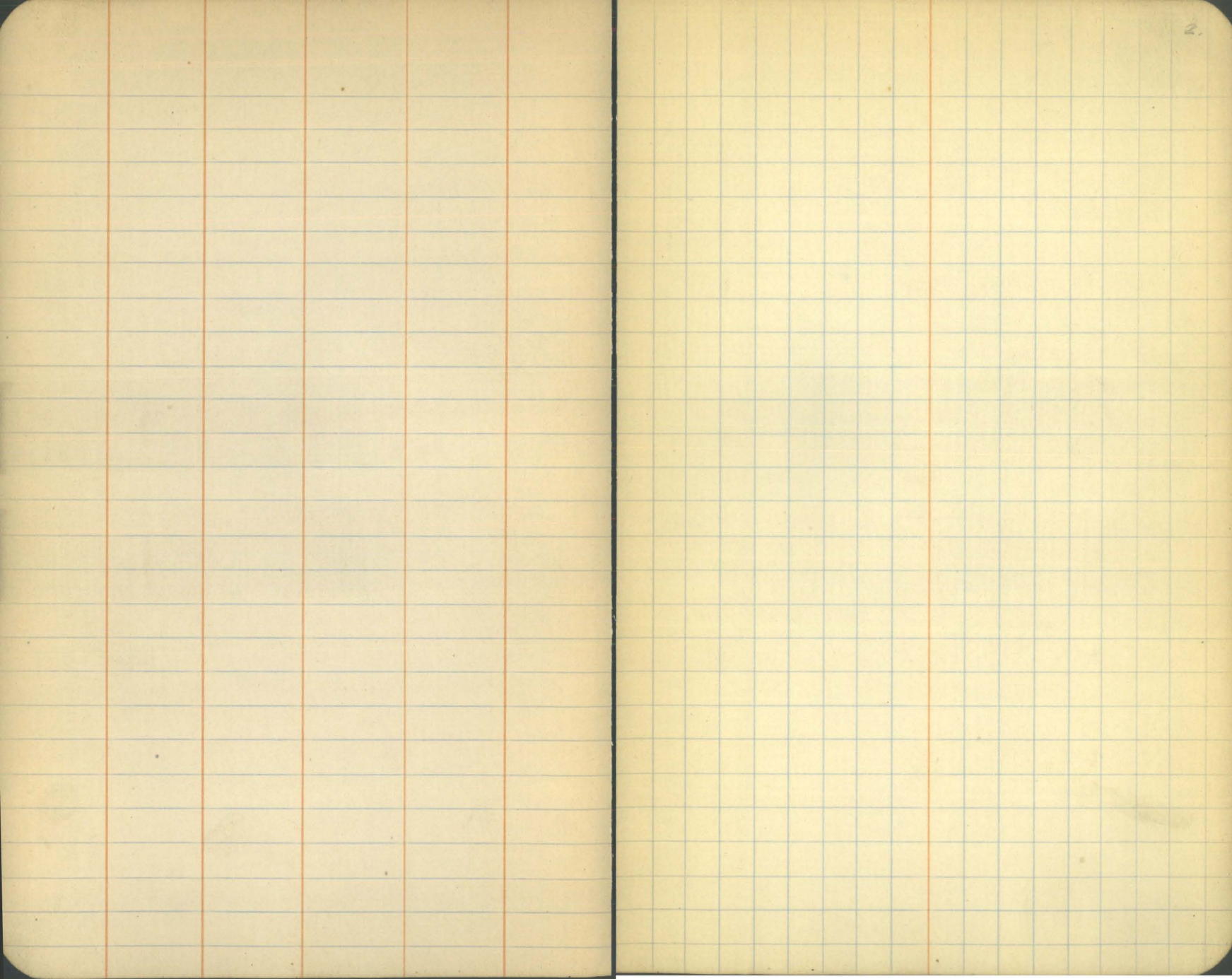
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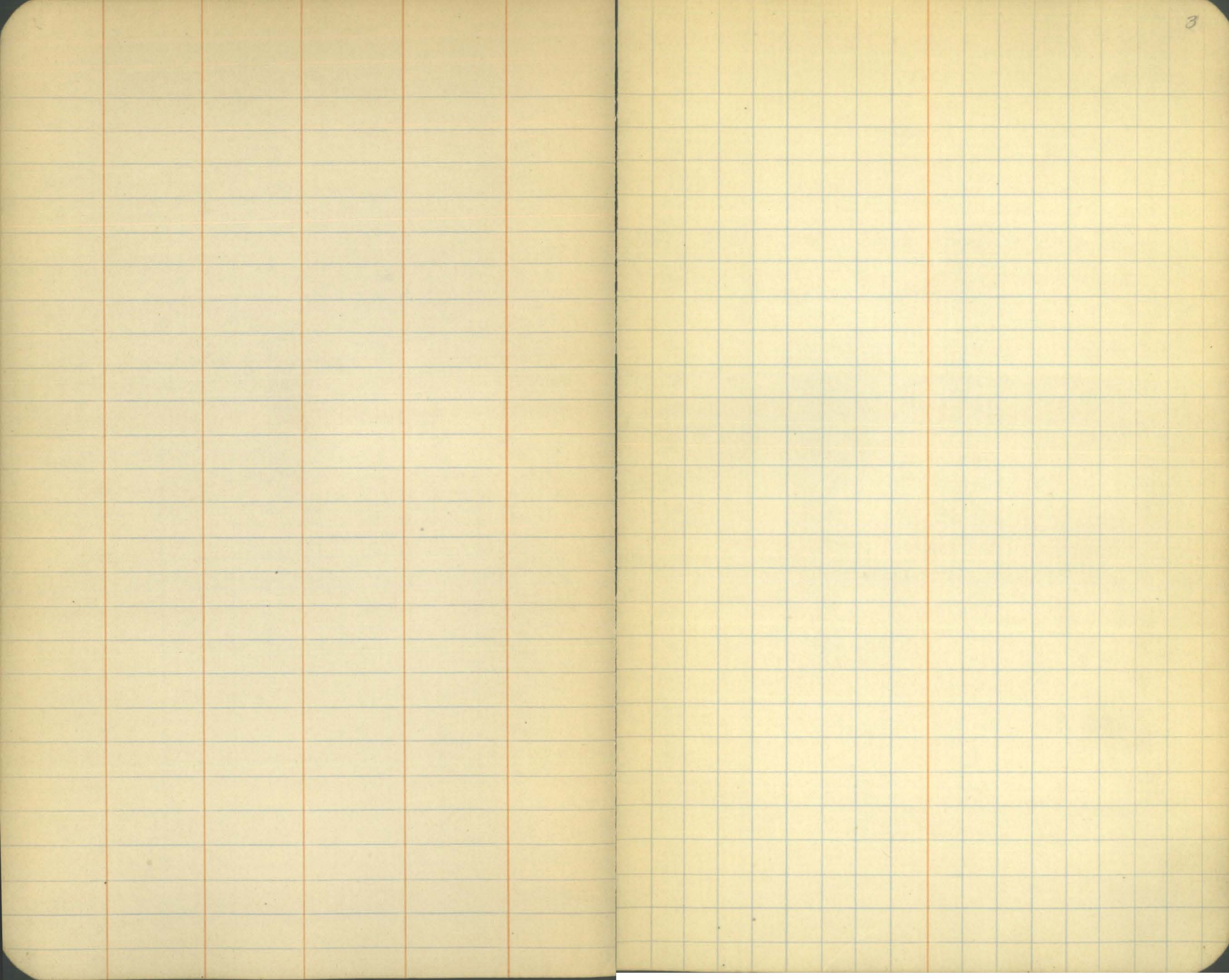
"C" "

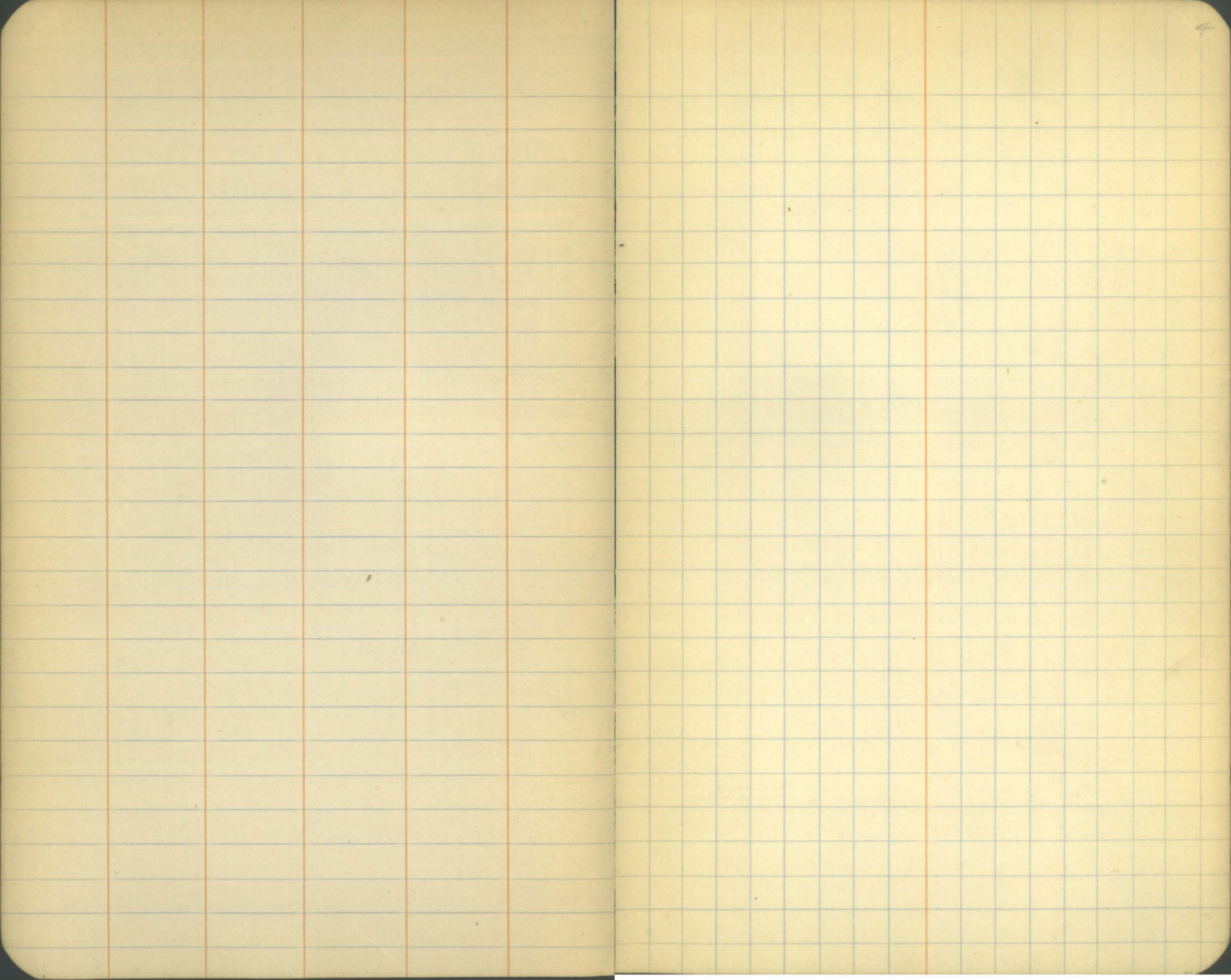
45-47











$R/L = \Delta = 0^\circ 46' - R/L$
Sta. = 292 + 08.0

Nail in stump
Hub out 33'

34.4' Stone used high point
Hub out 33'

First half
mile west of
Dawar-Dunkarton
corner.

3 center punch
marks in steel
corner post.

47.0'

56.8'

85
85
85

Nail in cottonwood

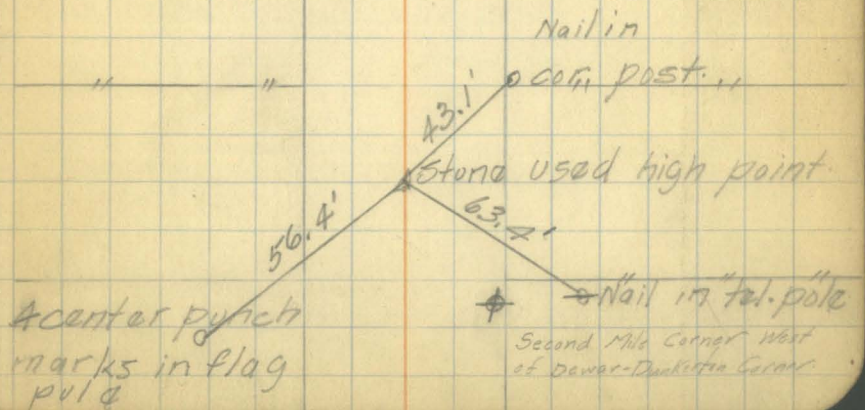
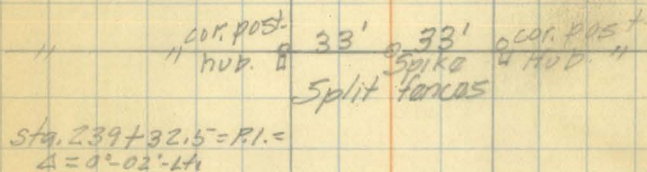
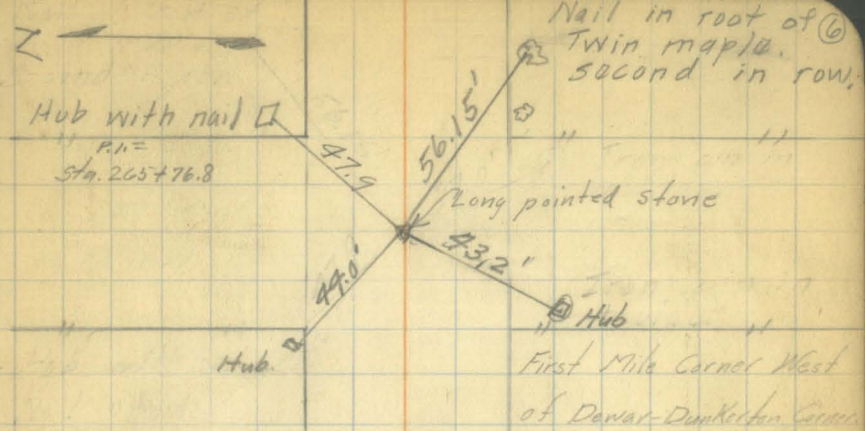
$R/L = \Delta =$
Sta. 317 + 76.7

Nail in hub

Dawar -
Dunkarton
corner.

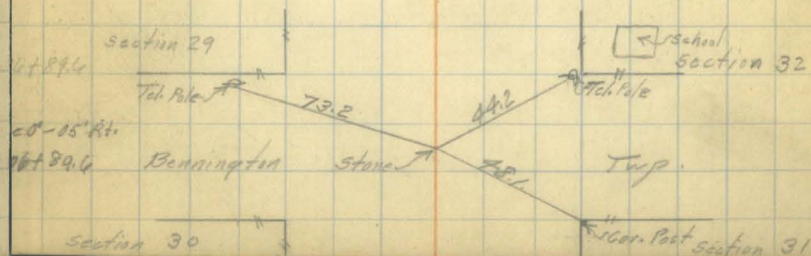
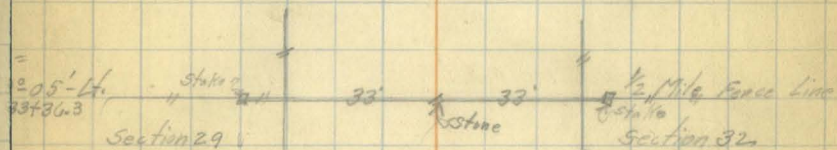
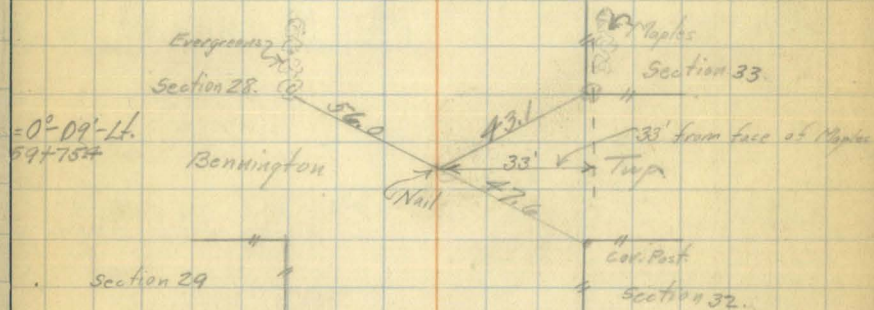
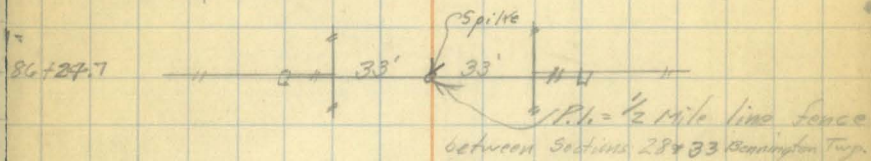
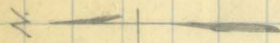
3 center punch
marks in steel
corner post

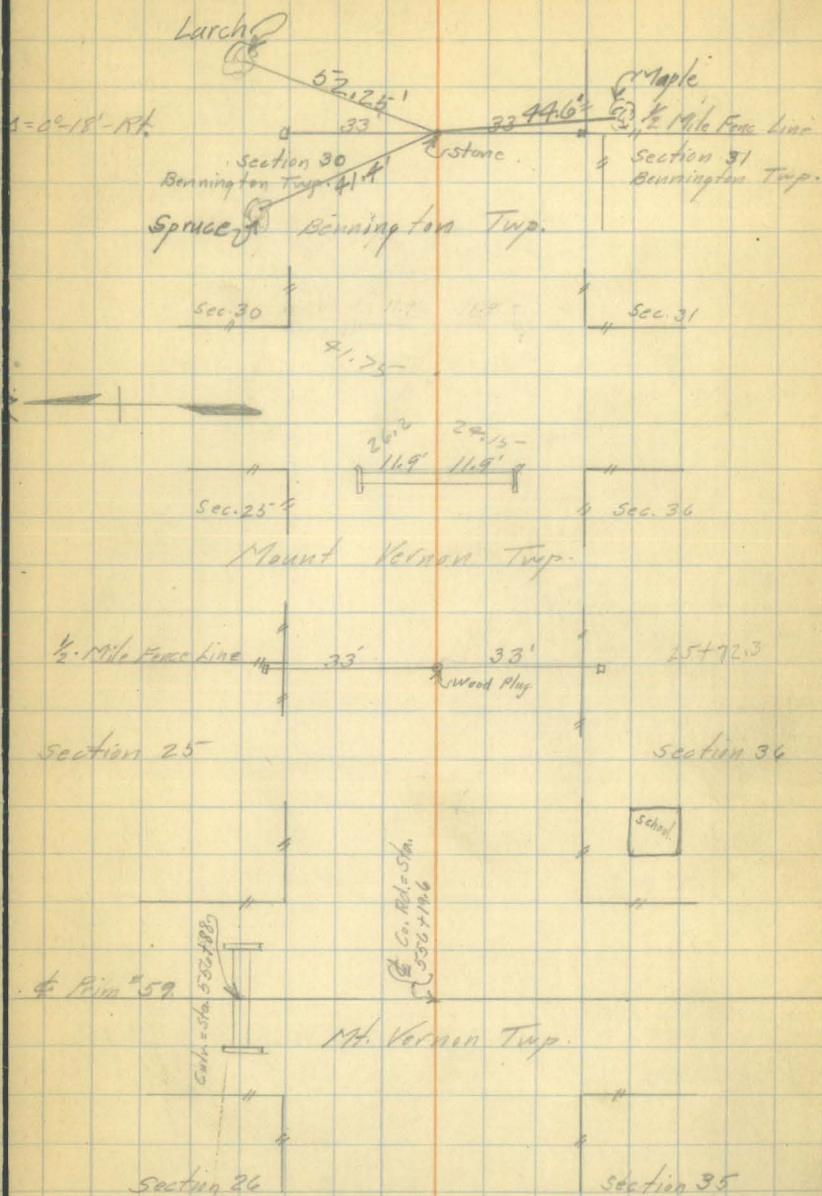
88.5'



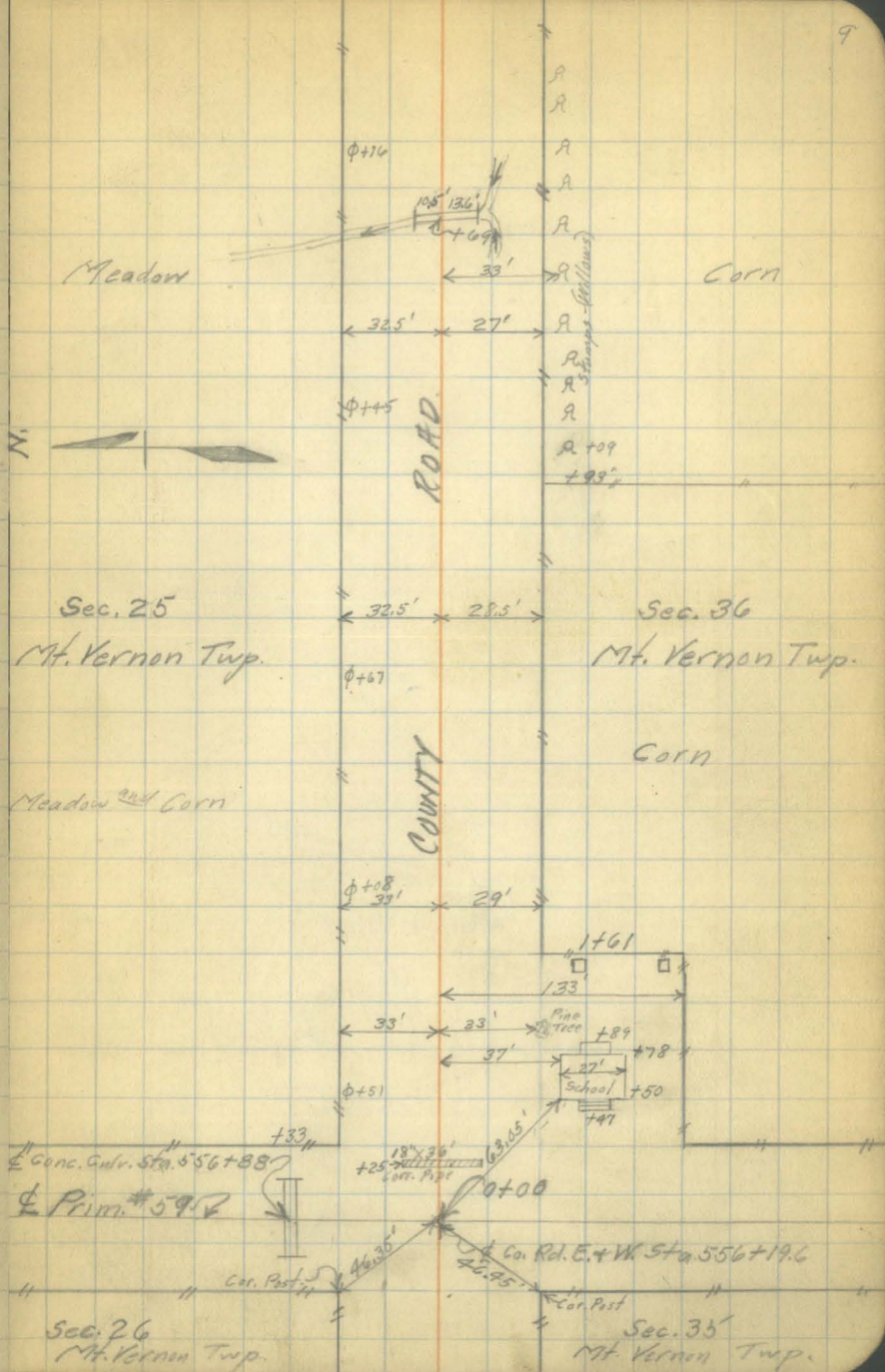
Stake 33' 33' Stake

P.O.T. = Near W Gate Post to
Farm Ent. N. Side Rd. - 1st Farm
W of 2nd 1/4 Cor. from Town Cor.





0.700



sta.

15+00

14+00 = P.O.T.

13+00

12+00

11+00

10+00

9+00

8+00

Pasture

Meadow.



Meadow

Corn

 $\phi+61$
 $\phi+88$ Iron stake

+35'

+36'

 $\phi+95$

32'

28'

 $\phi+95$

32'

28'

A+20

33'

 $\phi+85$

27.6'

24+00

23+00

22+00

21+00

20+00

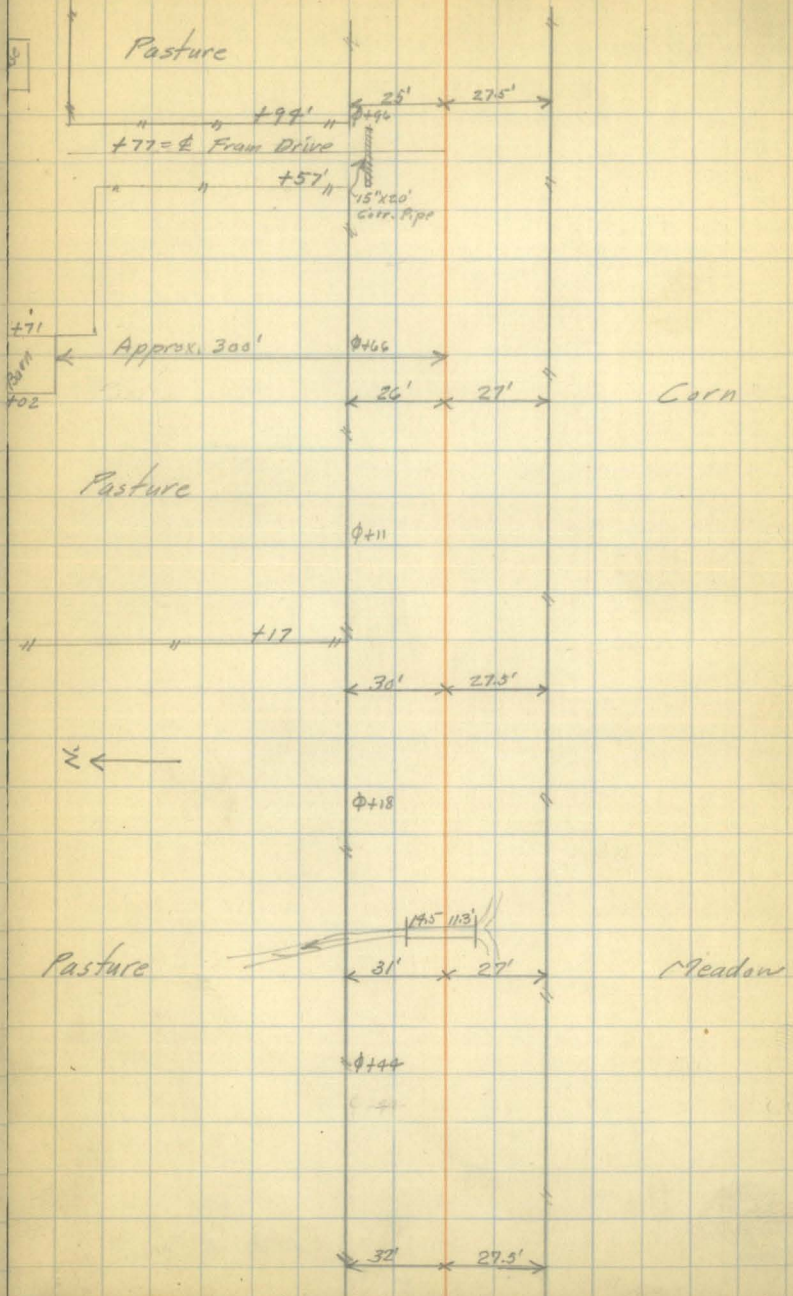
19+00

+28.5 = 2'x2'x26' Conc. Culr. (Good Condition)

18+00

17+00

16+00



33+00 = P.O.T.

32+00

31+00

30+00

29+00

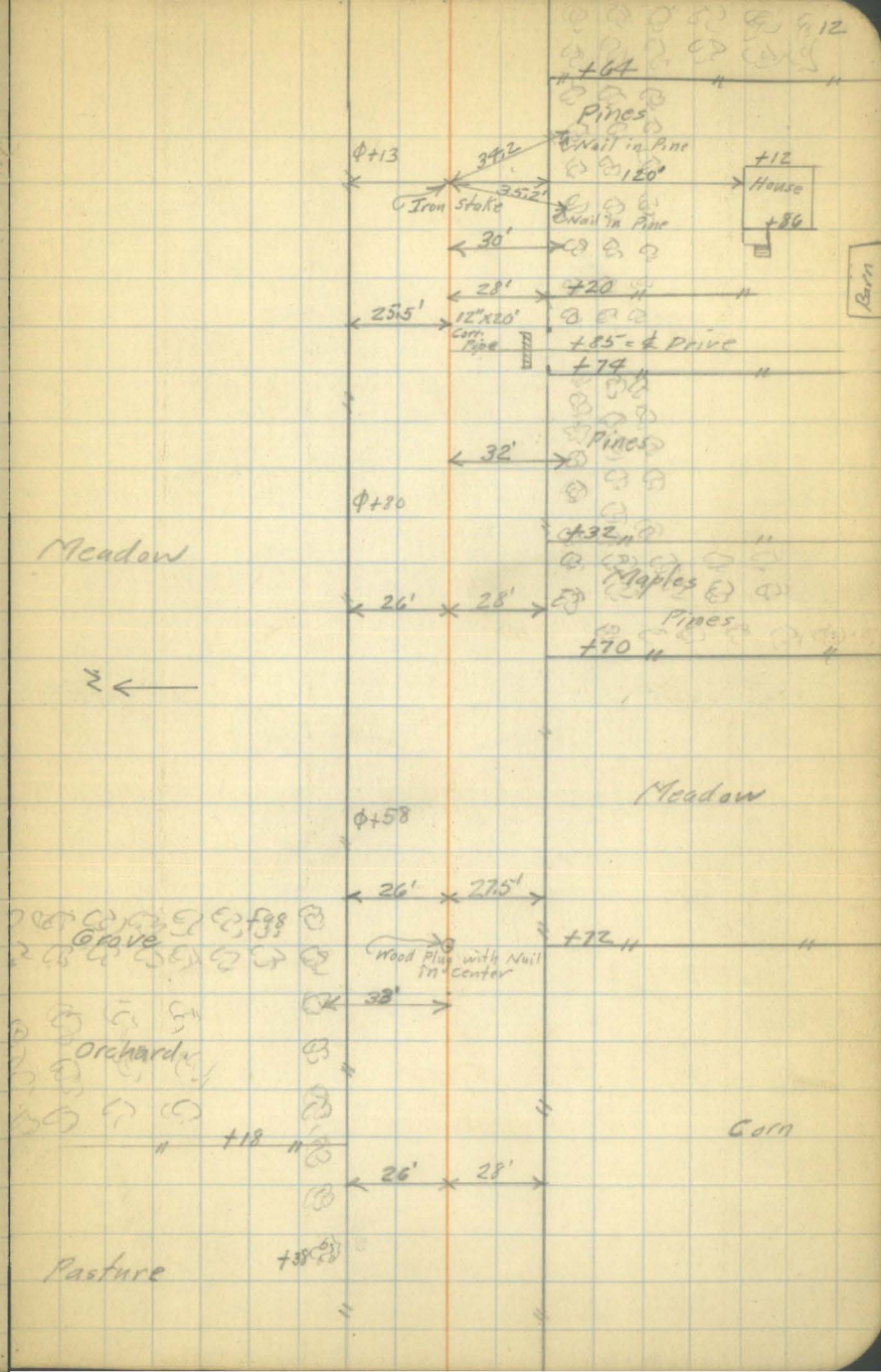
28+00

P.I. =
27+72.4 = $\Delta = 0^\circ 52' - Lt.$

27+00

26+00

25+00



38700

37400

35400

37400

Meadow

Meadow

$$N_i \rightarrow$$

Meadow

Corn

Meadow #

Approx. 110'

431

4. 70

Gravel

50700

79700

48+50

47 f00

46 + 00

45700

44 + 00

73 + 00

+81 = ~~6~~ Conc. Culr. 2' x 2' x 21'

42 + 00

Corn

$$N_1 \nearrow$$

479 £ Private

Garden

Meadow

Meadow

 $\phi + 19$ ϕ_{+10}

0457

426

25.5-

28'

 $26'$

28'

25'

28'

 $\approx 24.5^\circ$

27'

25'

28'

9.1 11.7;

58+00

57+00

56+00

55+00

54+00

 $PA = \Delta = 0^\circ 10' 17''$
 $33+17.0 = \pm$ Trp. Rds. N. & S.

53+00

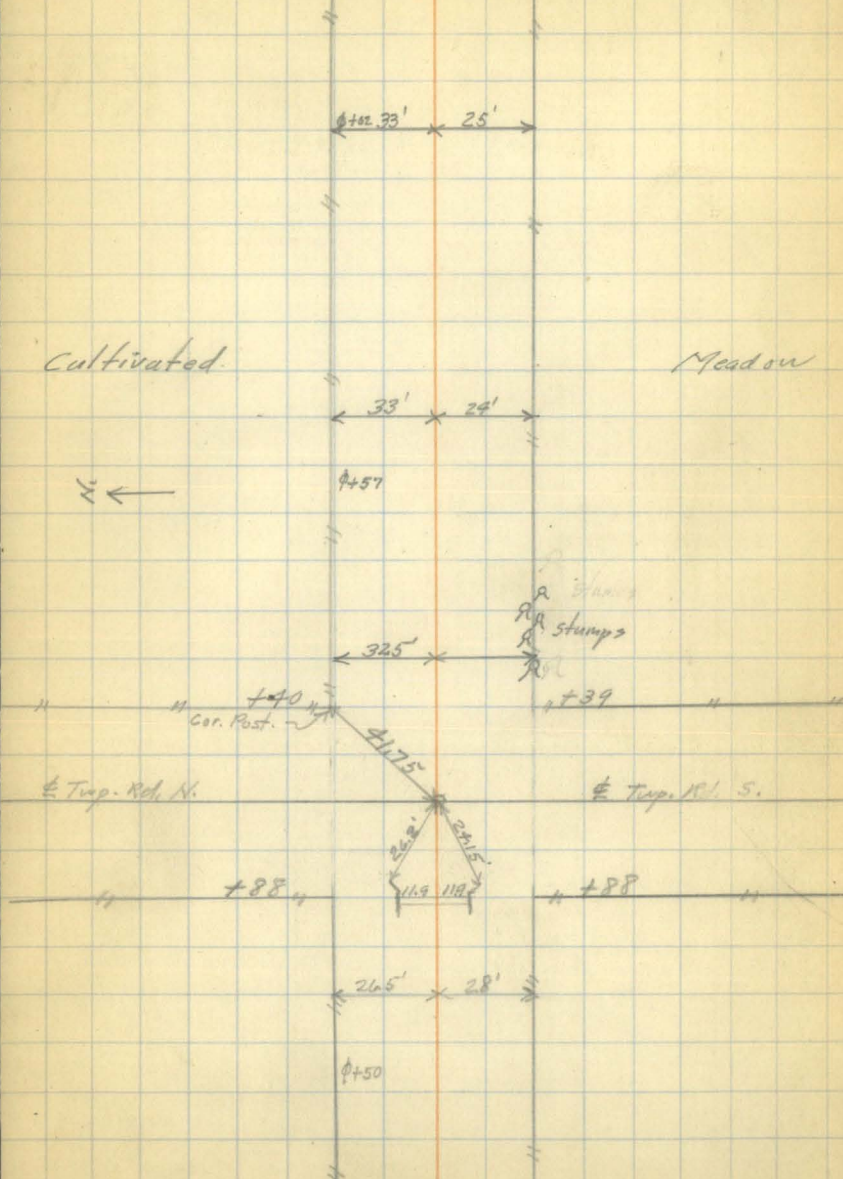
 $+880 = \pm$ Conc. Culv. 3'x2'x24' (Good Condition)

52+00

51+00

Cultivated

Meadow



67+00

66+00

65+00 = P.O.T.

64+00

63+00

62+00

61+00

60+00

59+00

Pasture

 $\phi+59$

Cultivated

+13

+20 Gate

+21

+14

33'

27'

 $\phi+35$

stake

33'

33'

stake

Iron Stake

33'

27'

 $\phi+89$

Meadow

33'

26'

Meadow

 $\phi+20$

33'

25.5'

75+00

74+00

Conc. Abut. 12" I-Beams (Good Condition)
 24'x18'-I-Beam-Conc. Floor. Channel Iron Hards.

73+00

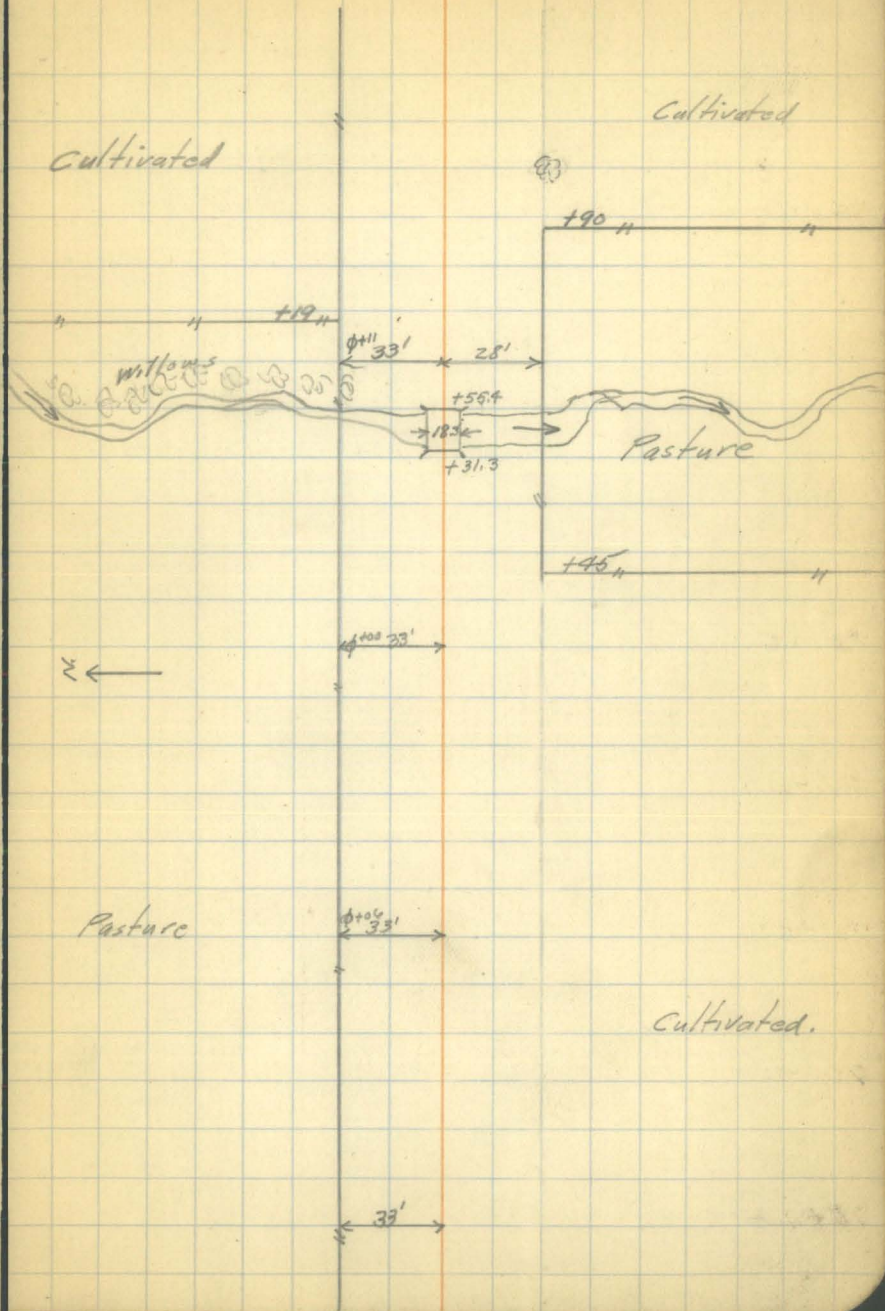
72+00

71+00

70+00

69+00

68+00



+59 ϕ

Drive = +18

Cultivated

+10
House
+67

Approx 150'

32.5'

Larch

+75 ϕ Gate

Maple

Grove

+40

Spruce

41.4'

44.6'

Distance

33'

39'

+36

Maples

+74

86'

+69
House
+43

Barry.

+16

+06 = ϕ Drive12" x 20"
Corr. Apr +58

Cultivated

+12

33'

83+00

82+00

81+00

80+41.0 = P.I. = $\Delta = 0^\circ - 18' - R.L.$

80+00

79+00

78+00

77+00

76+00

9/400

90700

89400.

30'x16' Wood Pole Bridge (Poor Condition)
Drainage Area = 600 Acres Flat

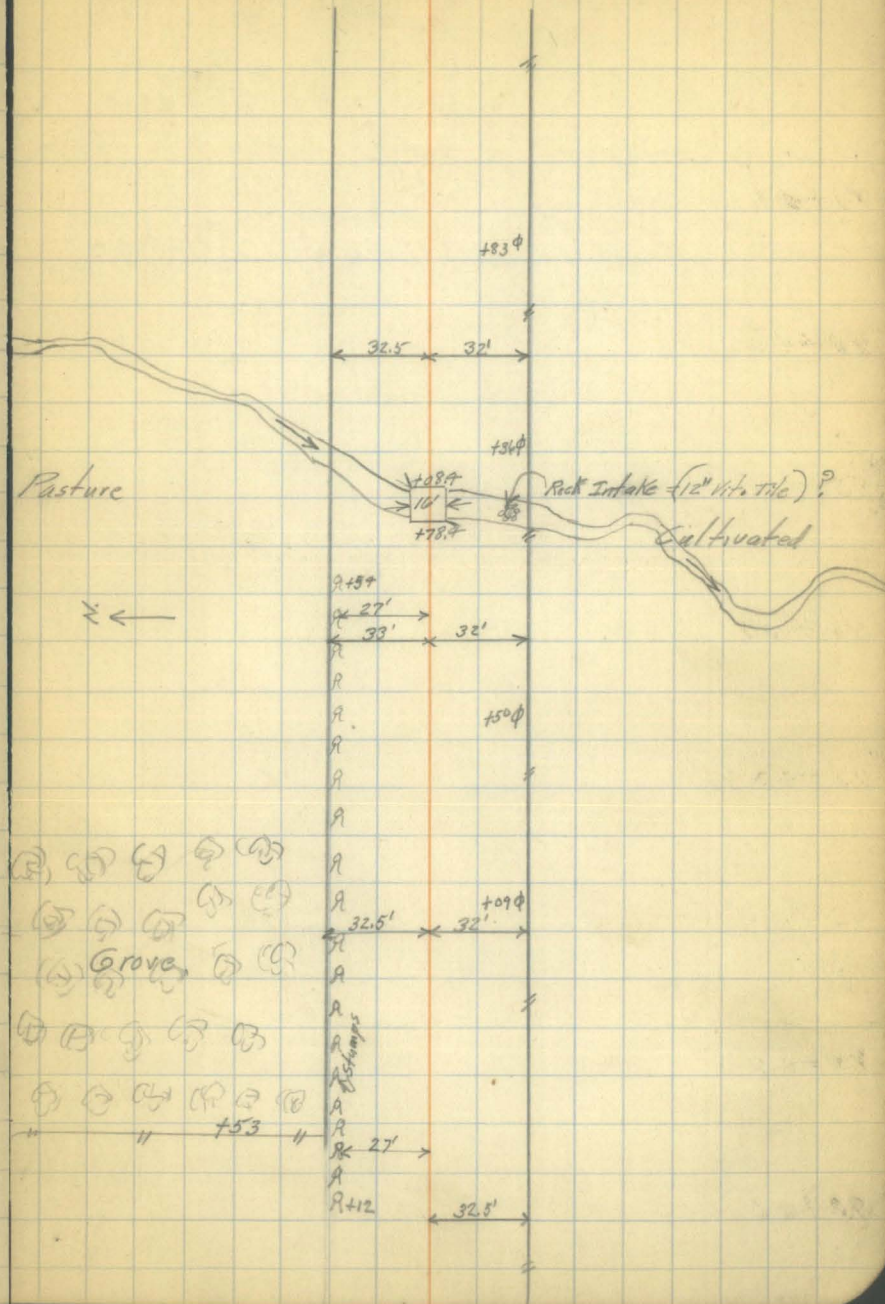
88400

87400

86 + 00

85400

84700



99+00

98+00

97+00

96+00

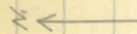
95+00

94+00

93+00

92+00

Winter Wheat.



11" 456 Gate

+65

15" x 20 Cor. Pipe

Pasture

+18 0

33.5'

+67 0

34'

+98 0

33'

+27 0

32.5' x 33'

Cultivated

$$107+00$$

$$\text{P.I.} = \Delta = 0^\circ 05' \text{ Rt.}$$

$$106+89.6 = \text{E Twp.}$$

106+00

105+00

+69. = 2'x2'x24' Conc. Culv. (Good Condition) Drains Approx. 30 Acres

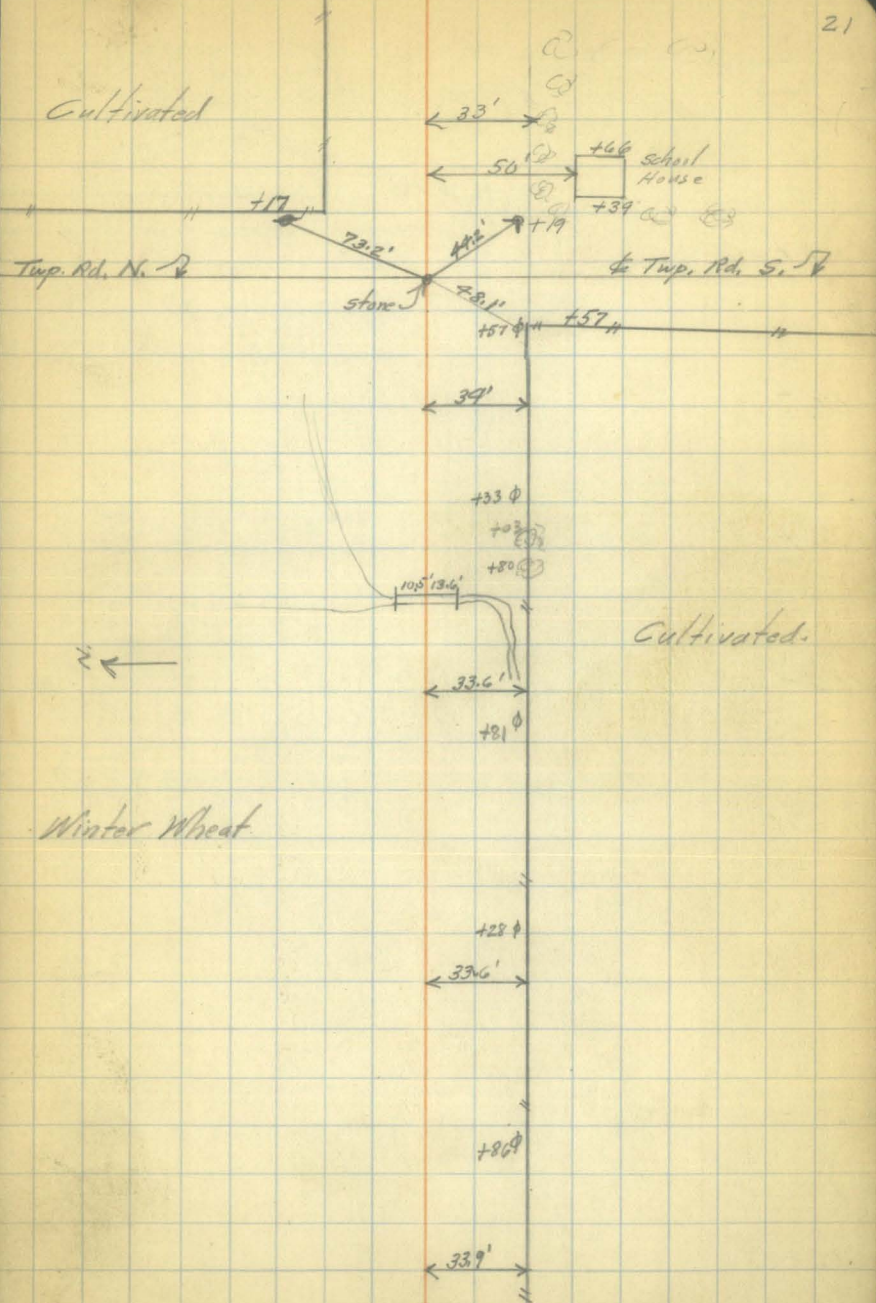
104+00

103+00

102+00

101+00

100+00



115+47.0 = 2'x2'x26' Cong. Culv. (Good Condition)

115+00

114+00

113+00

112+00

111+00

110+00

109+00

108+00

Cultivated

←

" "

Cultivated

11.7' 14.6'

26.5' 27'

26' 28'

+66

26' 29'

Cultivated

+37

25'

123+00

122+00

121+00

120+00

119+00

118+00

117+00

116+00

Meadow



28.5' 26'

Cultivated

28' 26'

+74

+42

27' 26.5'

Cultivated

Cultivated

27' 27'

131+00

130+00

129+00

128+00

127+00

126+00 = P.O.T.

125+00

124+00

←

Cultivated

Cultivated

Meadow

Hub. $\frac{1}{4}$ 27.5' 26' Hub.
 +89 33' 33' Iron Stake

← 28' 26' →

92 93 94 95 96 97
 98 99 100 101 102 103
 104 105 106 107 108 109
 110 111 112 113 114 115
 116 117 118 119 120 121
 122 123 124 125 126 127
 128 129 130 131 132 133
 134 135 136 137 138 139
 140 141 142 143 144 145
 146 147 148 149 150 151
 152 153 154 155 156 157
 158 159 160 161 162 163
 164 165 166 167 168 169
 170 171 172 173 174 175
 176 177 178 179 180 181
 182 183 184 185 186 187
 188 189 190 191 192 193
 194 195 196 197 198 199
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 218 219 220 221 222 223
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 254 255 256 257 258 259
 260 261 262 263 264 265
 266 267 268 269 270 271
 272 273 274 275 276 277
 278 279 280 281 282 283
 284 285 286 287 288 289
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 950 951 952 953 954 955
 956 957 958 959 960 961
 962 963 964 965 966 967
 968 969 970

139700

138700

137400

136700

135700

134 f0d

$$R.I. = \Delta = 0^{\circ} - 05' \angle f.$$

133 + 36.3

133700

132 + 00

Cultivated

Meadow

37.7

736 " Train 5th St " 18

Stone

St. Hub

ut 36

Cultivated

Cultivated

147+00

146+00

145+20.5 = 2'x2'x26' Conc. Culv. (Good Condition)

145+00

144+00

143+00

142+00

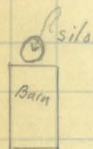
141+00

140+00

Pasture

←

Orchard



Drive +69.5

φ+03

A

25.5'

27'

325'

A

φ+20

10.5' 15.7'

Pasture

189

27'

32'

φ+27

26'

+13 "

141

27'

23.5'

31'

φ+28 28'

30'

Meadow

25'

29'

31'

163+00

162+00

161+00

160+00

21:40-0941.

159+75A & Twp. Rd.

159+00

158+00

157+00

156+00

" " +76 " "
 " " " "
 Young Orchard
 and
 Garden " "

" " +38 " "
 " Drive " +27

+25
 House
 +27
 587'
 44'
 Emergreen " +14
 " " " " " " " "

" Twp. Rd. N. " 159+75A "

Spoke

" Twp. Rd. S. "

" " +47 " "

" " " "

+39

285' 37'

Approx. 180'

+00

House

+78

+83

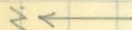
+40

28' 33'

171+00

+11 ϕ

170+00



32' x 31'

Cultivated

169+00

± Drive V

 +86
12' x 20'
Corr. Pipe
+05 ϕ

168+00

32.5' x 30.5'

Cultivated

+43 ϕ

167+00

+07 ϕ

166+00

33' x 29'

Pasture

165+00

+06 ϕ

164+00

33 x 29'

+05

Cultivated

∅
Pasture.

(6 steel 10" I-Beams)
28'x16' Wood Pile Bridge (Fair Condition)
Wood Handrails

179+00 Drainage Area = 350 Acres Rolling

178+00

177+00

176+00

175+00

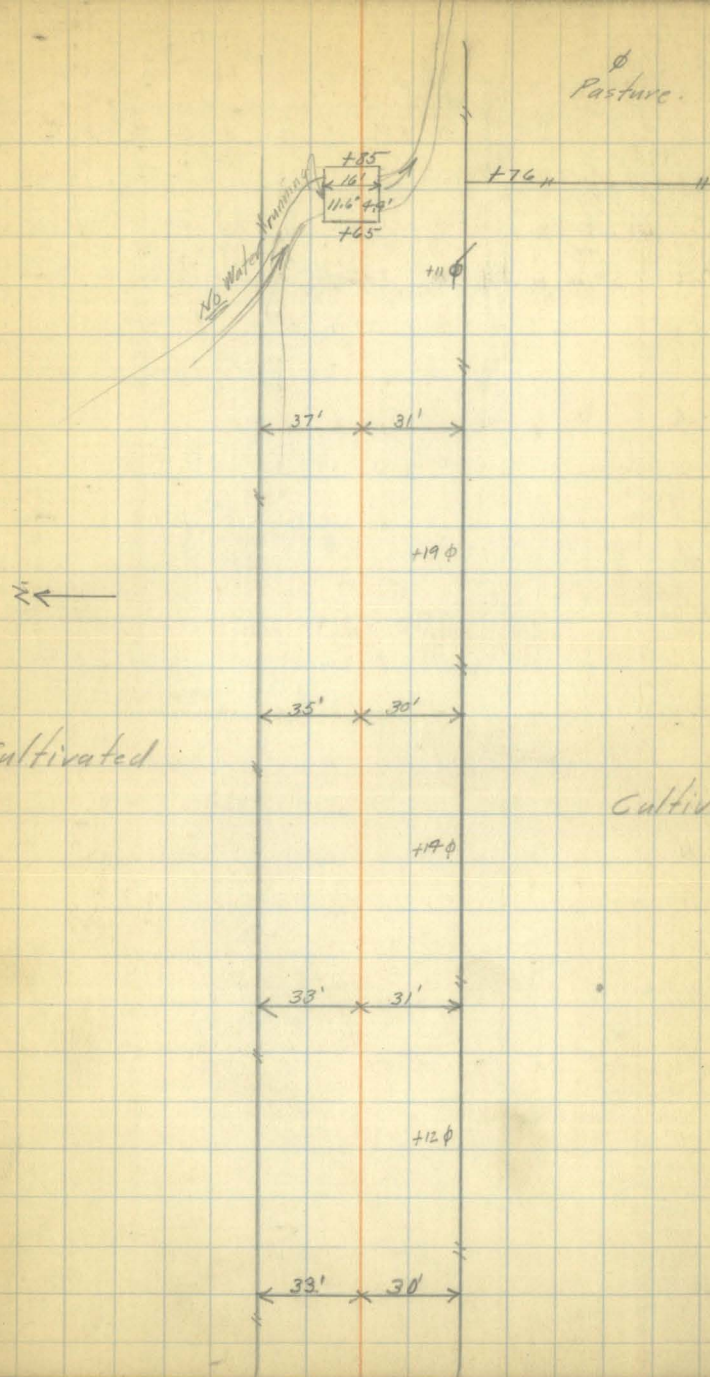
174+00

173+00

172+00

Cultivated

Cultivated



187+00
R.L. = A = 0°27' Rt.
186+24.7

189400

183400

182+00

181 + 00

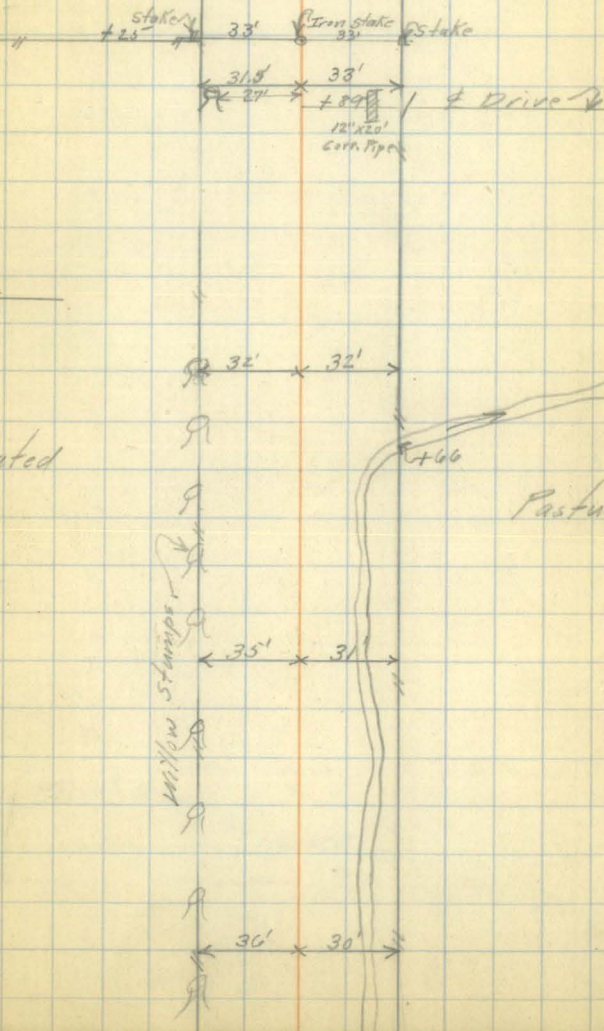
180400

Pasture

$$\mathcal{N}_1 \rightarrow$$

Cultivated

Pasture



195+00

194+00

193+00

192+00

191+00

190+00

189+94.5 = 6' Concr. Culv. 3'x2'x26' (Floor in Poor Condition)
Barrel & Wings O.K.

189+00

188+00

Garden

+54

Pasture

Cultivated

30' 31.5'

+73

12" x 20"

Corr. Pipe

+13 E. Field Ent.

+05

29' 32'

N. ←

Pasture

Pasture

Private 6" Concr. Tile

29' 32.5'

13.1 13.1

29' 33'

203+00

202+00

201+00

200+00

199+00

198+00

197+00

196+00

Cultivated

+040

Cultivated

N ←

30.5' 33'

31' 32.5'

+23

φ+08

+26φ +25'

Orchard & Pasture.

+02

32'

33'

Cultivated

House

Approx. 250'

E Drive

+154

+95

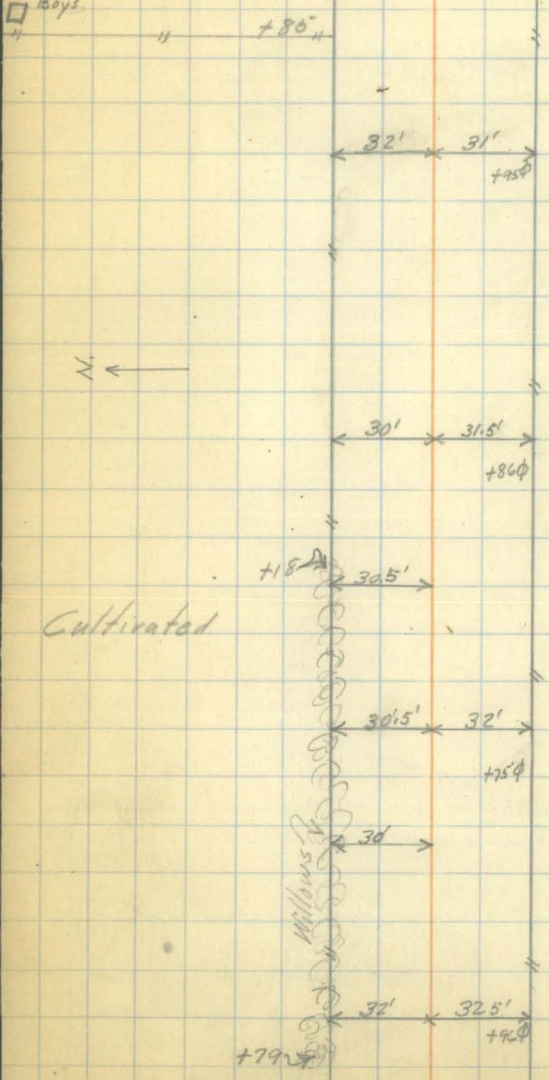
31.5' 31.5'

Garden

211+00
210+00
209+00
208+00
207+00
206+00
205+00
204+00

School Yard

Boys



218+00

217+00

216+00

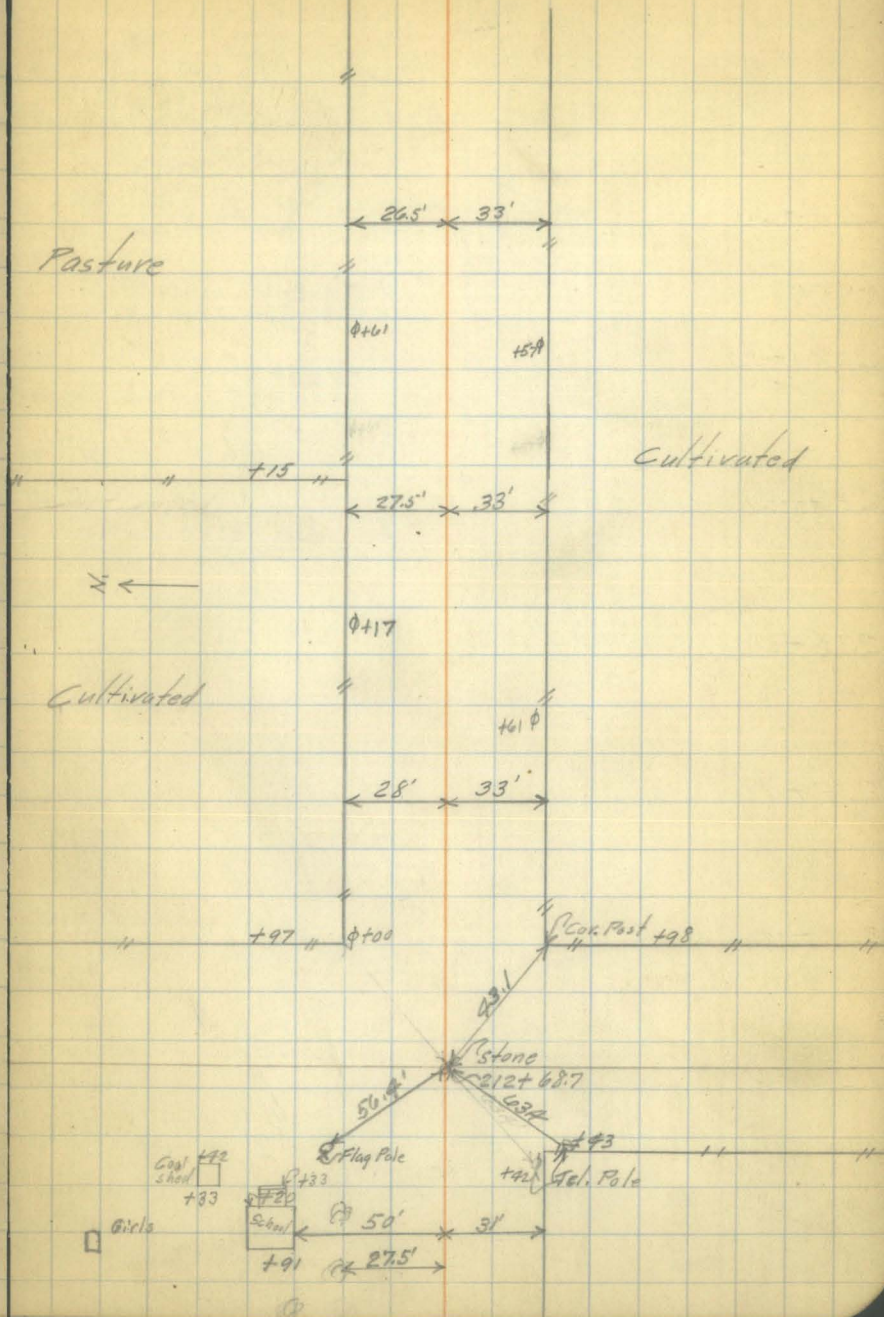
215+00

214+00

213+00

P.L. = $\Delta = 0^\circ - 25' - 14''$
212+68.7

212+00



226+00

225+00

224+00

223+00

222+00

221+00

+49 = 2 Twin 12'x6'x26'

220+00

219+00

Pasture



+09.5'

33'

27'

108

33.5'

+78

25.5'

33.5'



+25

Cultivated

Pasture

+58

33'

+37

+83

+56

+34

+103

34.5'

Pasture

+09

234+00

233+00

232+00

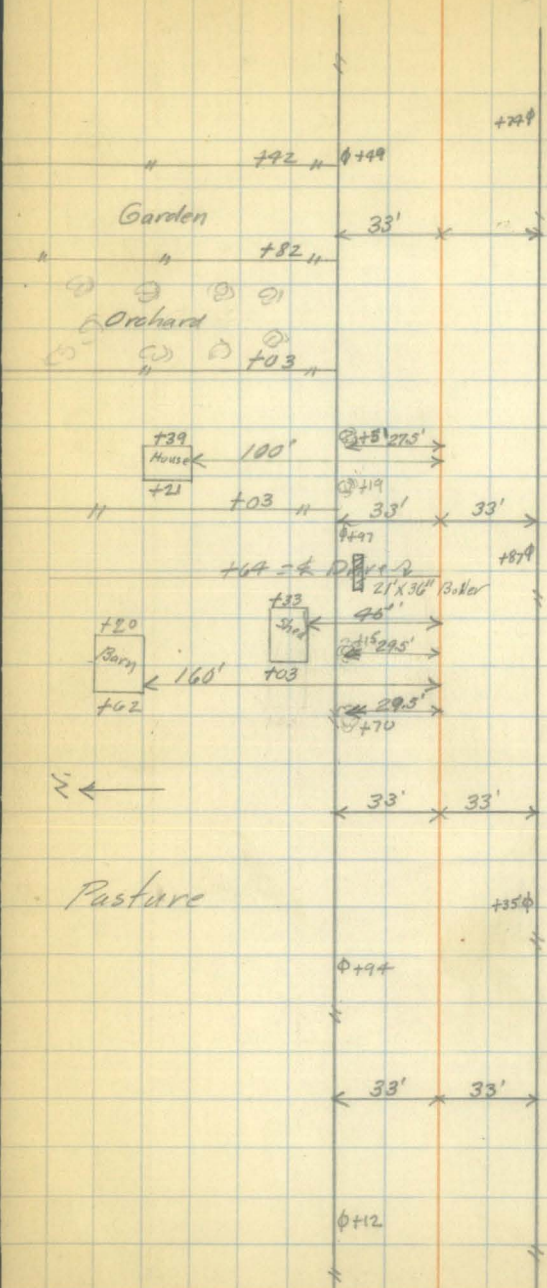
231+00

230+00

229+00

228+00

227+00



242+00

241+00

240+00

P.I. =
 $239 + 32.5 = \Delta = 0^{\circ} 02' 14''$

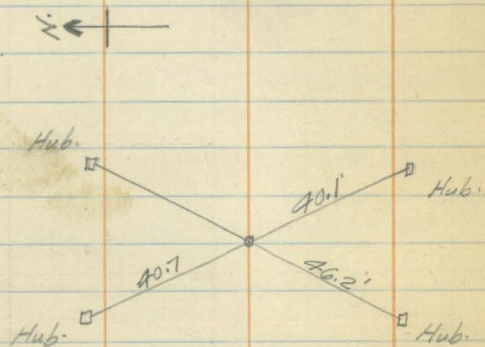
239+00

238+00

237+00

236+00

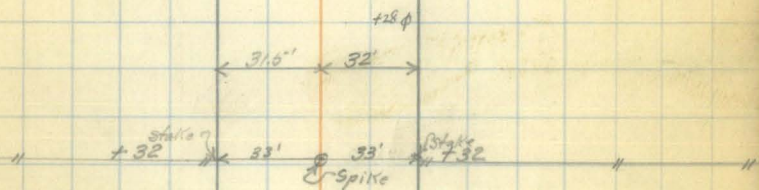
235+00



Cultivated

φ+09

Meadow



N ←

Cultivated

φ+20

+54φ

Cultivated



250+00

249+00

248+00

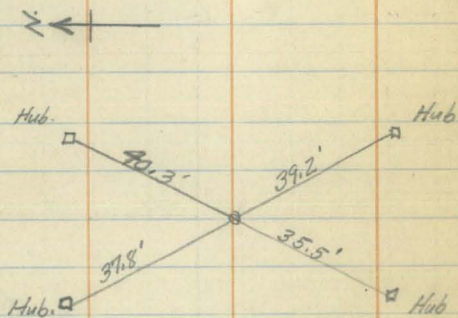
247+00

246+00 = P.O.T.

245+00

244+00

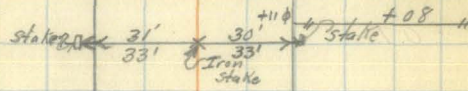
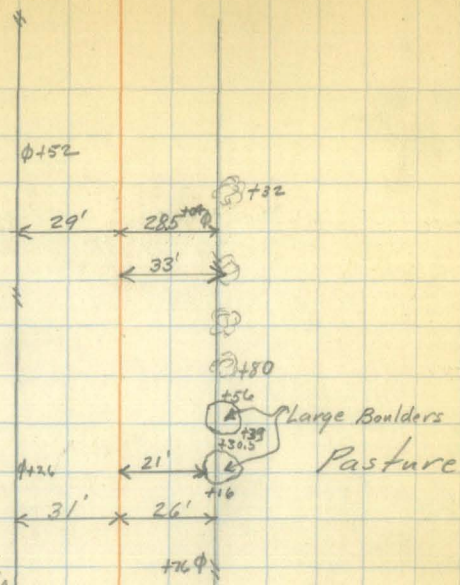
243+00



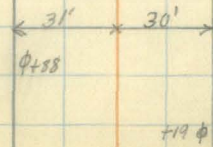
Cultivated

N. ←

Cultivated



Meadow



266+00

P.I. =
265+76.8 = Δ = 0° 05' - Lt.

265+00

264+00

263+00

262+00

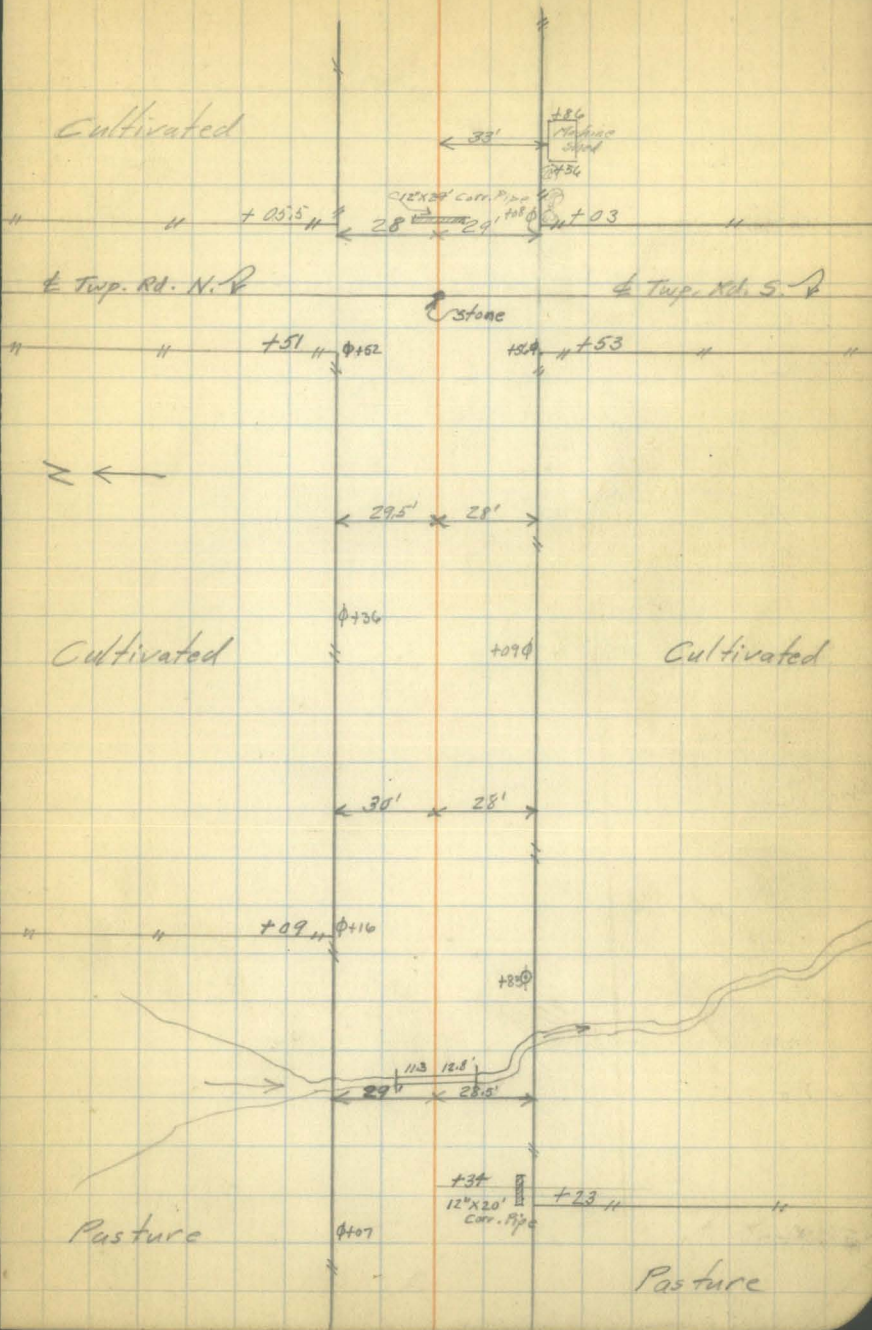
261+00

+06.5 = E Conc. Cul. 3'x2'x24' (Good Condition)

260+00

259+00

Cultivated





Meadow

29.5' x 27'

+62.0

30' x 28'

Cultivated

Cultivated

A+41

29.5' x 28'

X ←

+72

Garden

Stake

29'

26'

Iron Stake

33'

58'

+34.0

+19.5 Drive

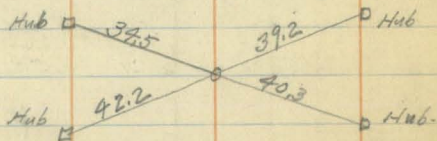
+71

House

+36

+41

X ←



268+00 = P.O.T.

267+00

282400

16' x 19'

+17.0 = $\pm$ Wood Pole Bridge (Fair Condition)

Drainage Area = 600 Acres Rolling.

281700

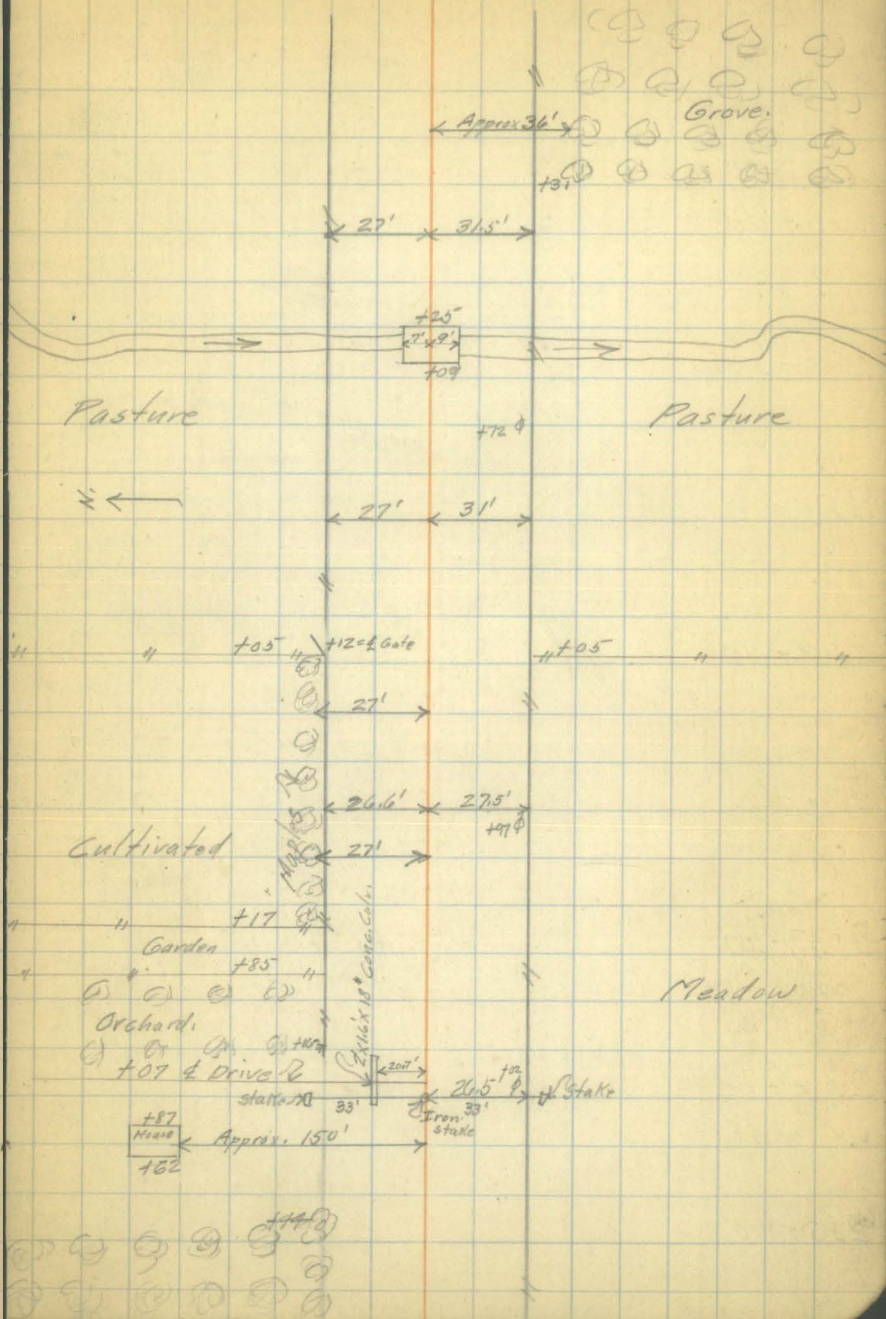
279400

278 + 00

277400

$$276 + 00 = P.O.T.$$

275+00



290+00

289+00

288+00

287+00

286+00

285+00

284+00

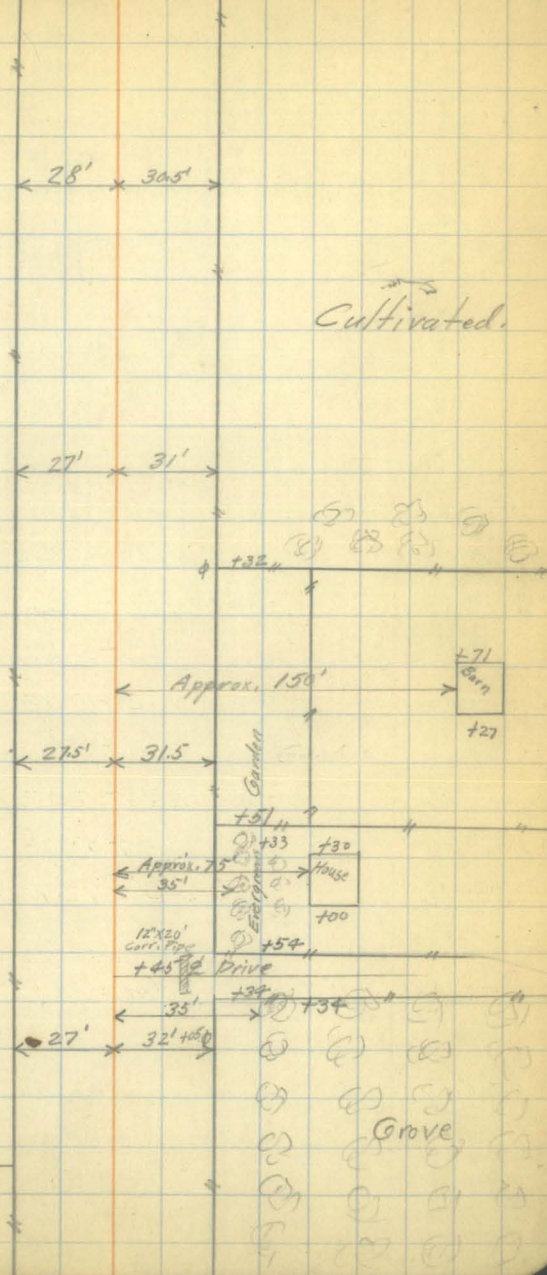
283+00

Cultivated.

Pasture

←

Pasture



March 1927
3-29-27
D. S. Butterfield
E. Mathews
G. L. Cavanaugh
Ed. Geren

Laporte-Brandon Road.
Line "C."

45

138+00

137+00

136+00

$A=16^{\circ}57' \text{ Rt.}$ $A=18^{\circ}39' \text{ Rt.}$

$B=6^{\circ}00' \text{ Rt.}$ $D=6^{\circ}00' \text{ Rt.}$

135+00

$F=142.5$ $T=156.1$

133+92.9

$L=282.5$ $L=309.4$

134+00

$E=12.7$

$P.C.=130+83.5=0^{\circ}00'$

133+00

$131+00=0^{\circ}30'$

$+50=2^{\circ}00'$

132+50

$132+00=3^{\circ}30'$

$+50=5^{\circ}00'$

$P.I.=A=18^{\circ}34' \text{ Rt.}$

132+39.6

$133+00=6^{\circ}30'$

$+50=8^{\circ}00'$

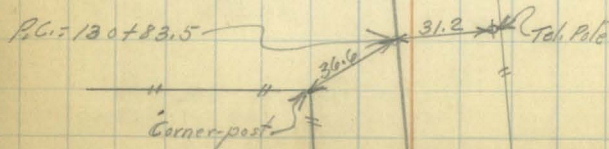
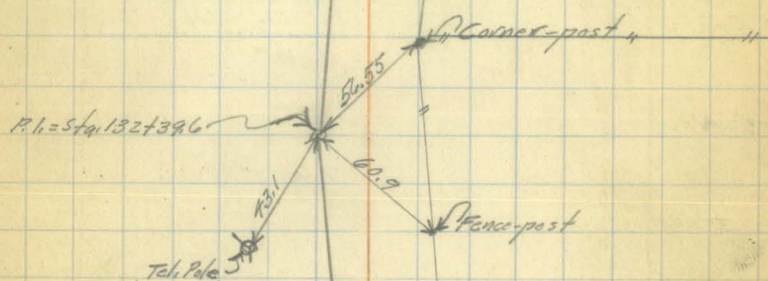
132+00

$P.T.=133+92.9=9^{\circ}17'$

131+

$P.C.=$

130+83.5



150+00

149+00

148+00

147+00
P.I. = $2 = 4^{\circ} 32' \text{ Lt.}$
146+35.2

146+00

145+00

144+00

143+00

142+00

141+00

140+00

139+00

46
" " " "
P.I. = Sta. 146+35.2 = "
 $\Delta = 4^{\circ} 32' \text{ Lt.}$

160+86 = N. End of Bridge

$$\Delta = \cancel{87.2} \text{ Lt. } 83^{\circ}-08' \text{ Lt.}$$

160+79.7 = P.T.

$$D = 28^{\circ}-00' \text{ Lt.}$$

416.9

$$T = \cancel{185.4} \quad 181.5$$

160+00
+ 82.0 = Crosses Fence

$$L = \cancel{201.3} \quad 296.9$$

Pl. 2
159+63.8 = $\Delta = 84^{\circ}-22' \text{ Lt.}$

$$E = \cancel{77.5} \quad 68.8$$

$$R = 204.6$$

159+00
+ 77.5 = Crosses Fence
77.5 = Calc.

$$P.C. = 157+83.1 = 0^{\circ}-00'$$

$$158+00 = 2^{\circ}-22'$$

158+00 = Crosses Fence

$$+50 = 9^{\circ}-22'$$

157+78.4 = P.C. = Fence
+ 36.1 = Fence.

$$159+00 = 16^{\circ}-22'$$

$$+50 = 23^{\circ}-22'$$

157+00

$$160+00 = 30^{\circ}-22'$$

156+00

$$+50 = 37^{\circ}-22'$$

$$P.T. = 160+80.0 = 41^{\circ}-34'$$

155+00

154+52.4 = P.O.T.

154+00

153+00

152+00

151+00

+87 ± Field End. P

+73

+69 Orchard

Old House

Evergreens

+74

+75

+76

+77

+78

+79

+80

+81

+82

+83

+84

+85

+86

+87

+88

+89

+90

+91

+92

+93

+94

+95

+96

+97

+98

+99

+100

+101

+102

+103

+104

+105

+106

+107

+108

+109

+110

+111

+112

+113

+114

+115

+116

+117

+118

+119

+120

+121

+122

+123

12" x 20"
Corr. Pipe

+640

+32

Cultivated

←
Pasture

32'

29'

30'

+560

32'

+32

Hub.

+05

+05

Hub.

+05

Hub.

+05

Hub.

+05

Hub.

+05

Hub.

+05

Hub.

+05

Pasture

+100

Cultivated

298+00

297+00

296+00

295+00

294+00

293+00

P.I. =
292+08.0 = Δ = 02 1/4" - R.L.

292+00

291+00

306700

305400

304700

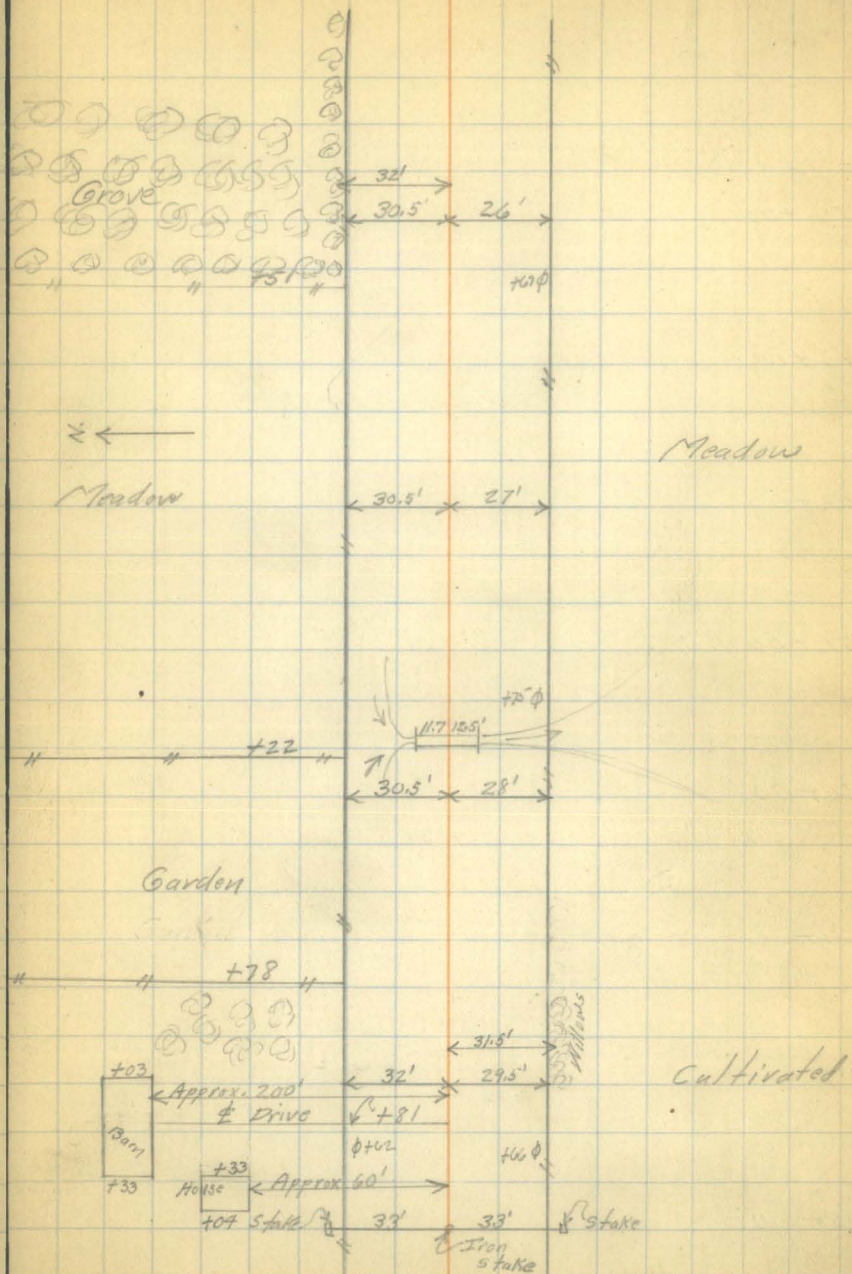
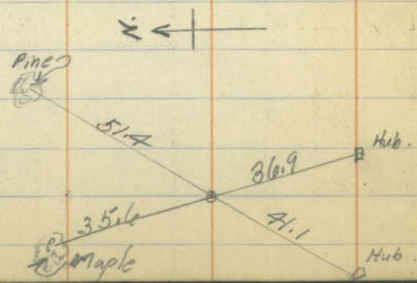
303 + 00

+3570 = ~~2~~ Conc. Culv. 2'x2'x24' - (Good Condition)

302700

301700

300400

$$299 + 00 = P.O.T.$$


314700

313 + 00

312700

311 + 00 = P.O.T.

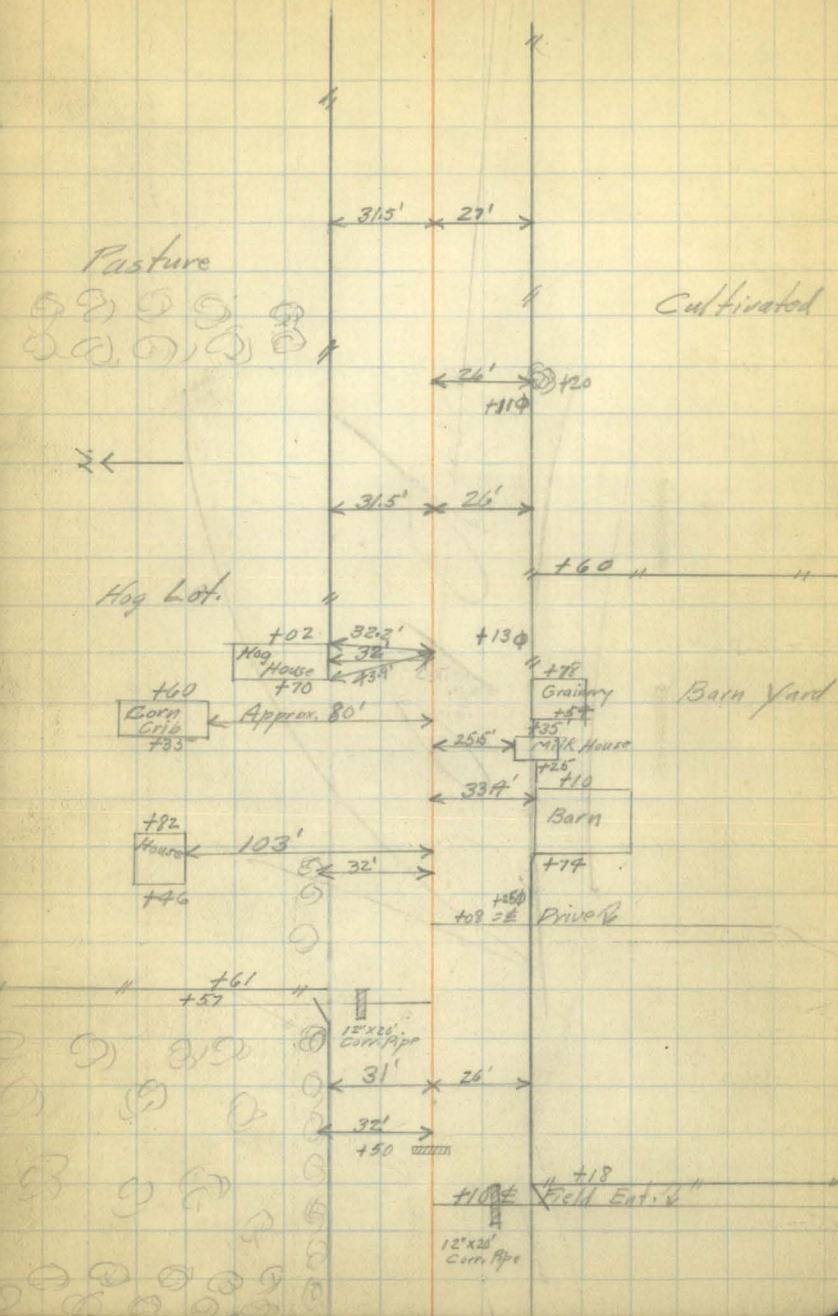
310400

309400

308400

+50 = £ 12" x 24' Corr Pipe

307400



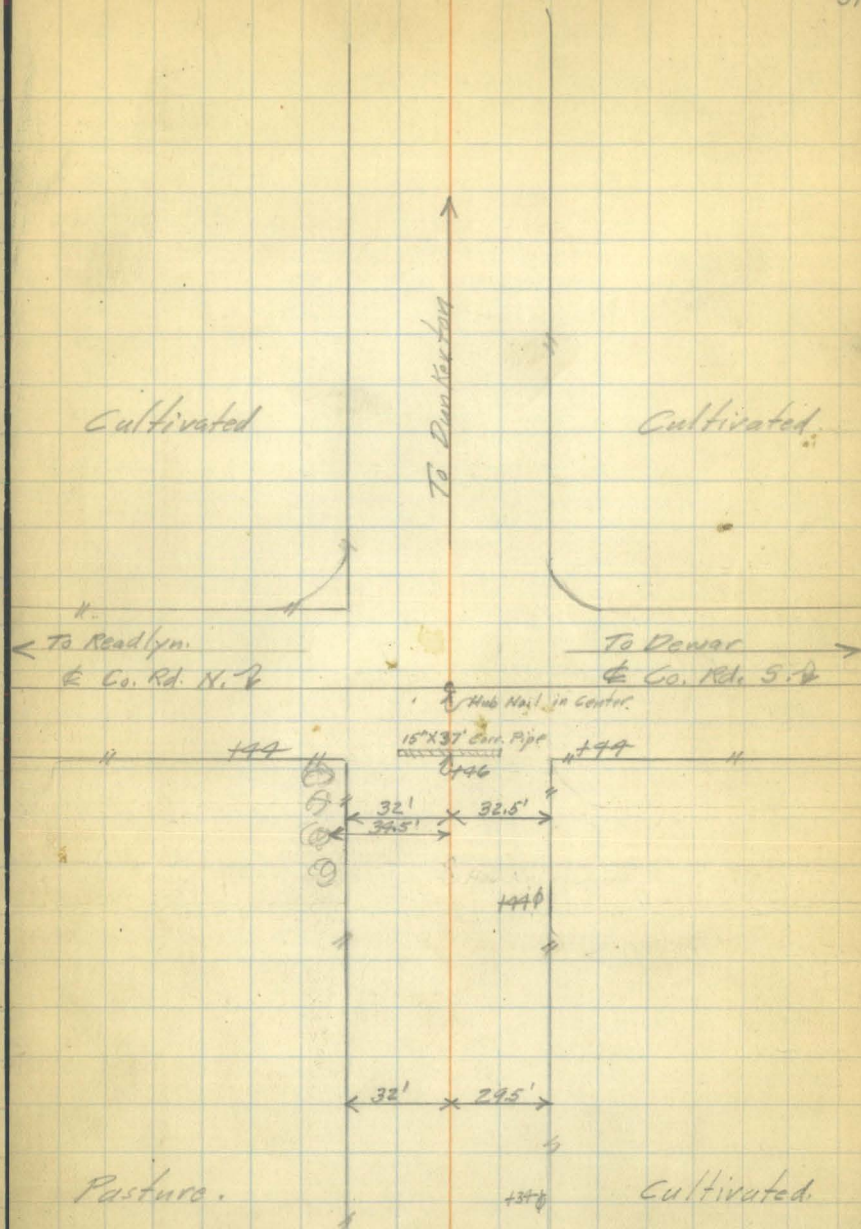
318+76.7 = E Dewar-Readlyn Co. Rd.

318+00

317+00

316+00

315+00



2-6

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1-11

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1-347

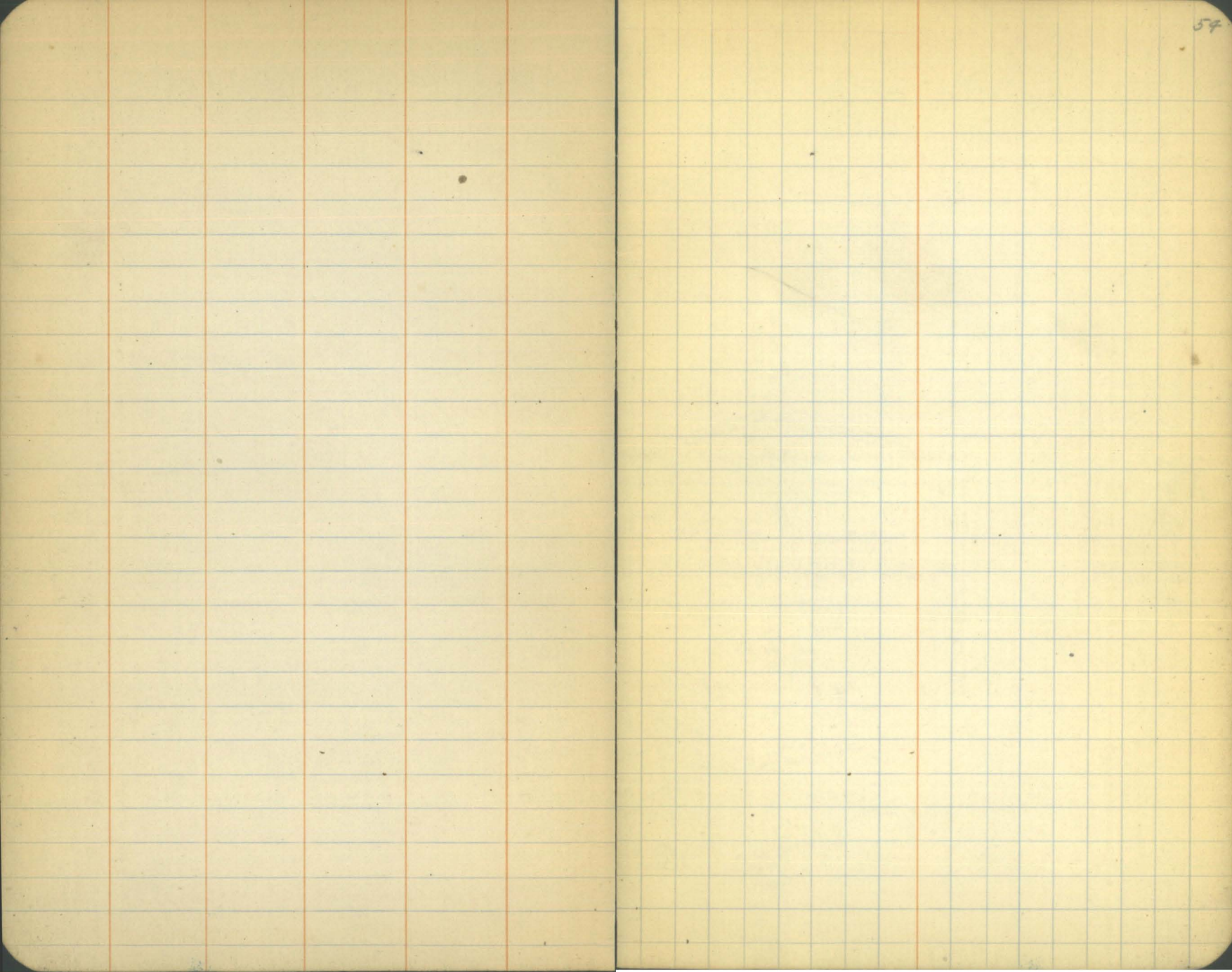
1-348

1-349

1-350

1-351

1-352



Sta.

6+00

5+00

4+00

3+00

2+00

1+00

+77 = E. Cor. Pipe 15" X 35'

0+00 = Cor. Stone & Rd. N.

Section 22

Cultivated

Field Entry +52

+20

+44

+65

To Laporte City

15" X 35'

+73

+15 = E. Cor.

+92

+32

Cattle Feed Yard

+36

+50

Wind Mill

+00

+43.9'

+67.7'

To Subilee

stone.

To Brandon

Sec. 23

Sec. 14

Barn	36
------	----

14700

13700

P.O.T. =
12 + 00

10 + 00

9 + 00

+550 $\frac{1}{2}$ Conc. Culv. 2'x2'x24'

Drain Approx. 80 Acres Rolling

 $\phi + 60$

436

719

f08

House

†74

☆ 75-7

43

f21 = $\pm$ Drive

#97

Field Ent. = +24

172

614

33'

33'

1

 $\phi + 65$

679

4

+76.

119

 $\Phi + 55^\circ$

Pastor &
of Imbo

+50 = 4' concrete culvert 3'x2'x20'
 150
 Drain approx. 140 Acres Rolling

21+00

20+00

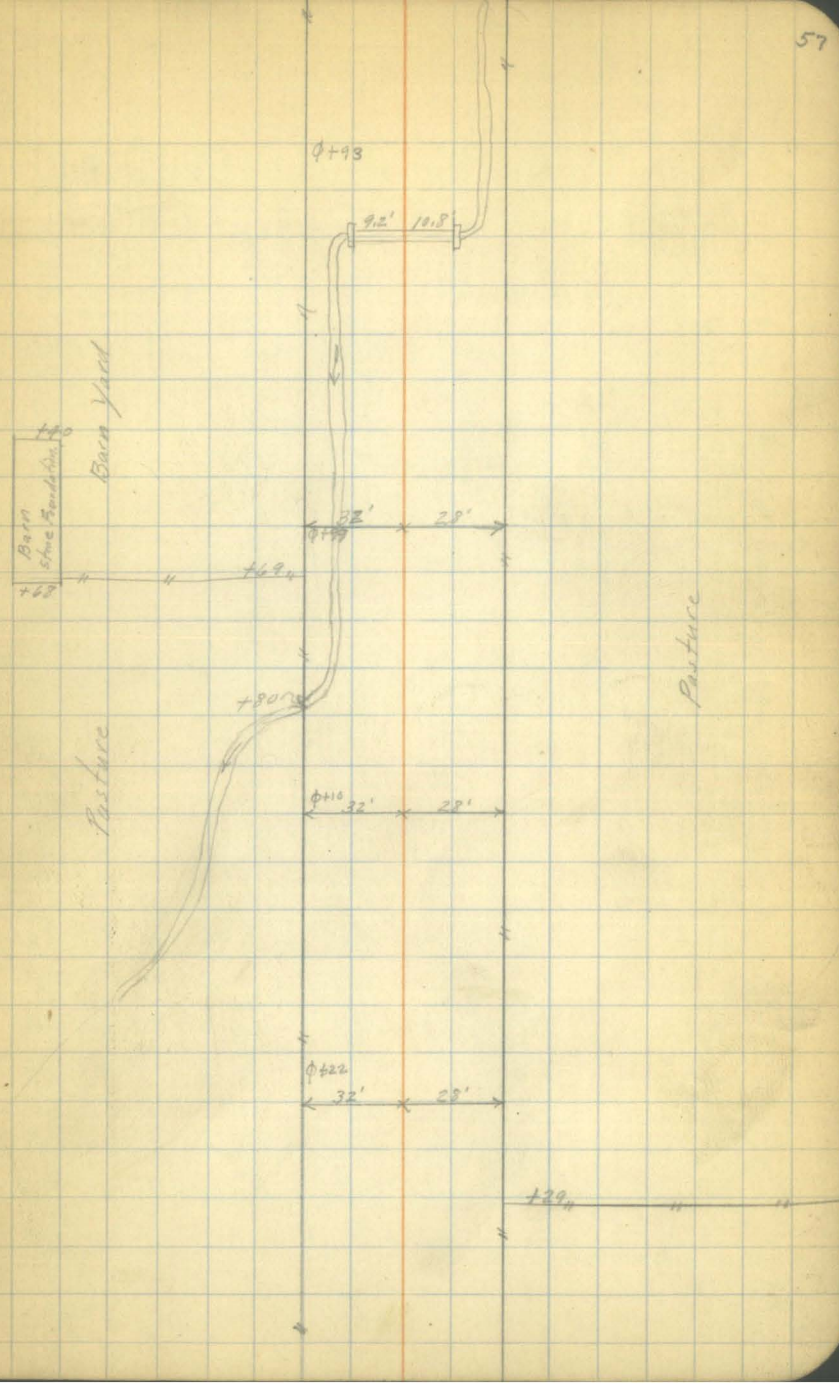
19+00

18+00

17+00

16+00

15+00



58

1.25.

0.43

415

 $\phi + 36$

+ 99

Stone

+77₁₀

32

 $\Phi + 61$

Garden

723

455	
2116	

3 P

4034

+39 "

162

438

 $+31 = \frac{1}{2} \text{ drive}$

35

 $\frac{1}{2} \times 121$

11

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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--	--

10

2 Drive

 $\angle 32$

1

unpublished

Pasture

5750

36+00

35+00

34+00

P.I. =
 33+00 = $\Delta = 0^\circ - 34' \text{ RT}$

32+00

31+00

30+00

29+00

4.0s

4.3s

4.5s

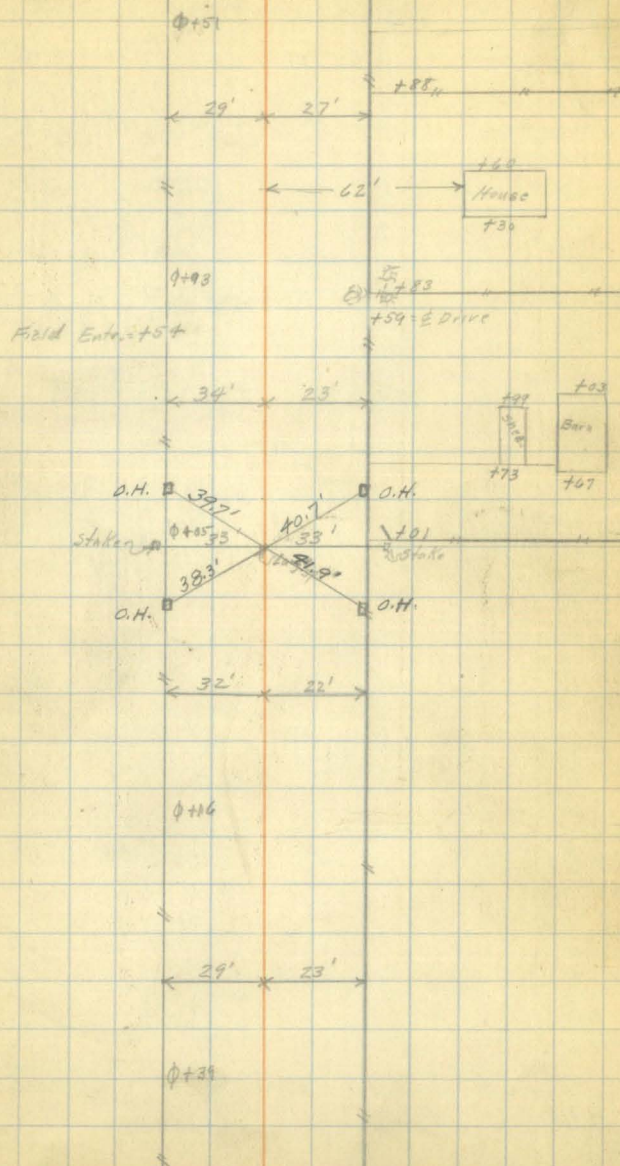
4.8's.

4.1s.

3.3s

2.6s

1.9s



44+00

43+00

42+00

41+00

+37.5 = * Conc. Culv. 2'x2'x24'
Drain Approx. 25 Acres Rolling

40+00

39+00

38+00

37+00

2.0s

2.3s

2.4s

2.7s

3.0s

2.9s

3.2s

3.5s

3.8s

+420

26'

25'

+438

27'

26'

+474

8.5'

15.5'

27'

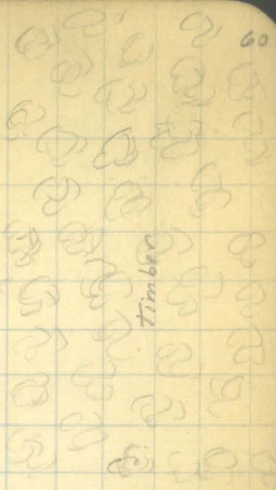
25'

+452

23'

19'

Field Entry = +493
+36



Pasture

Cultivated

Pasture

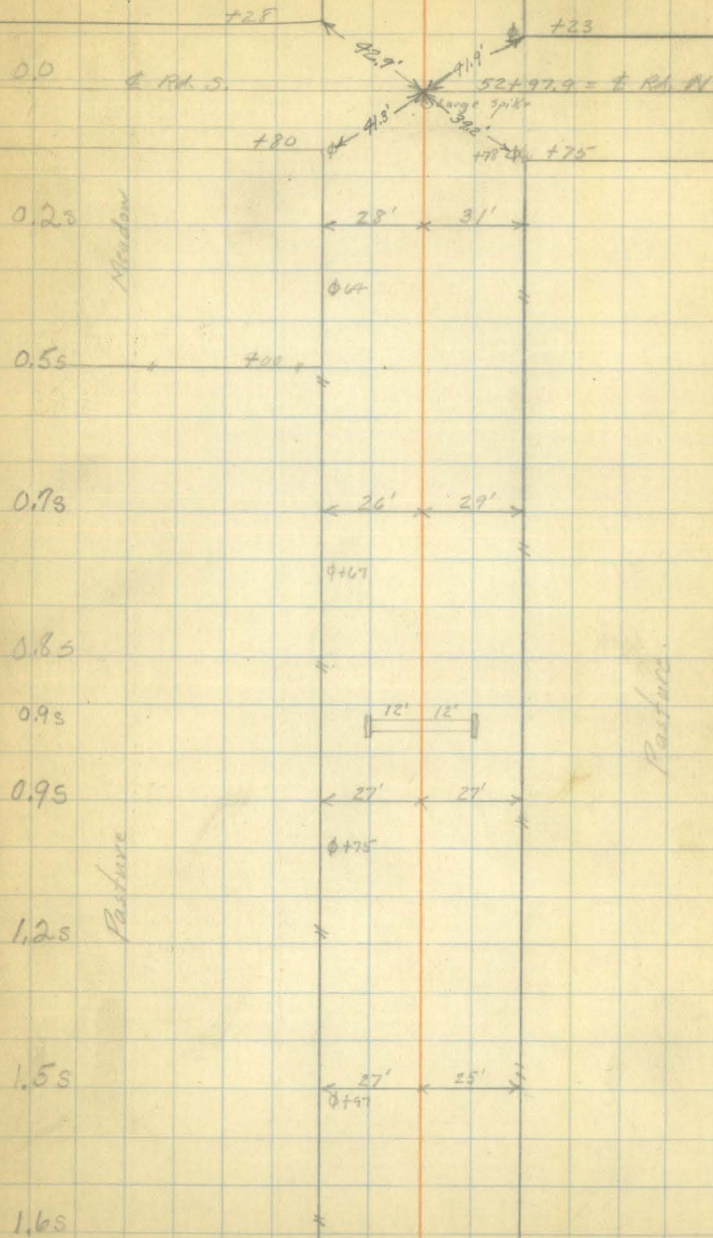
$$53 + 60$$
$$P.L. =$$
$$52 + 97.9 = \Delta = 0^\circ - 45' P.L.$$

+50.7 = $\pm$ Conc. Cntr. 3'x2'x24'

Drain Approx. 40 Acres Rolling.

46 + 00

45700



61+00

60+00

59+00

+26.5 = 8 Conc. Culv. 2'x2'x24'

58+00 Drain Approx. 10 Acres Rolling

57+00

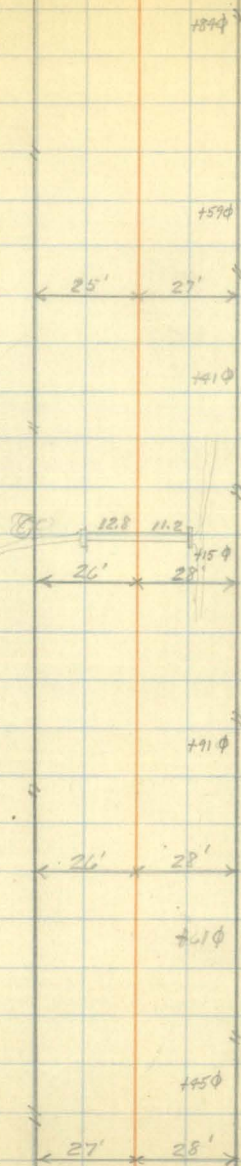
56+00

55+00

54+00

Meadow

Meadow



68+00

67+00

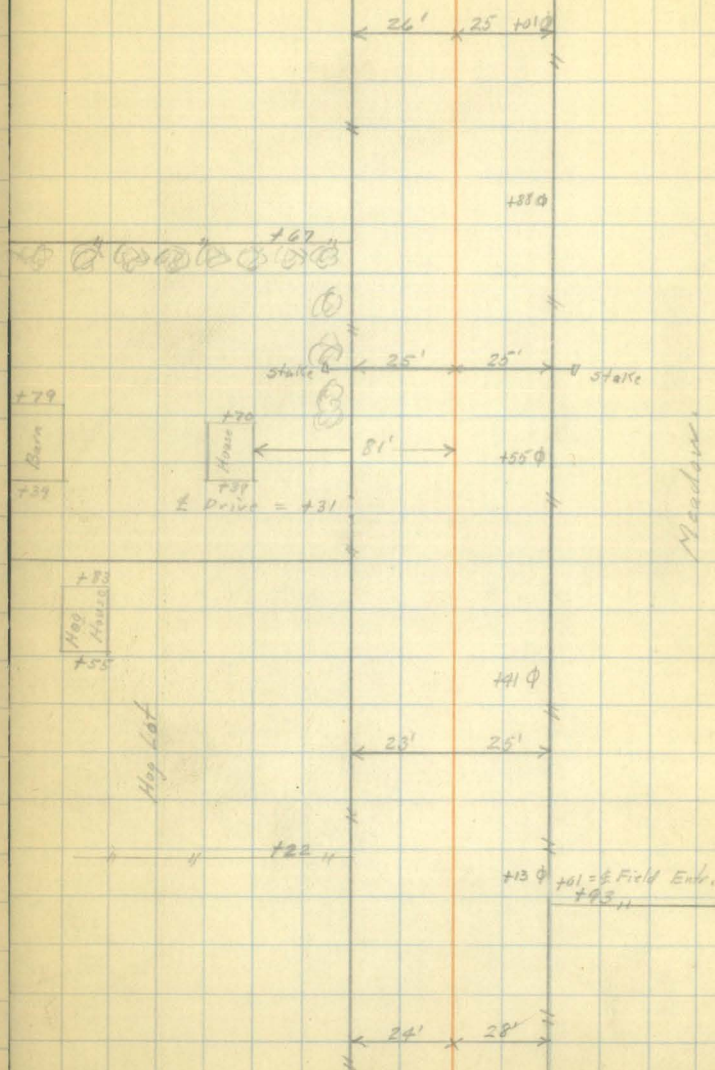
P.O.T. =
66+00

65+00

64+00

63+00

62+00



76+00

75+00

74+00

73+00

72+00

71+00

70+00

69+00

Meadow

Meadow



84+00

← 29' → 26' +0.6 φ

83+00

+88 φ

82+00

← 29' → 26' →

+65 φ

81+00

+98 φ

80+00

← 29' → 26' →

R1=

79+37.0 = Δ = 0°-05'24"

static 0 33' 30' +37 φ
 +30.7' Find Entry
 +20 φ

79+00

78+00

← 29' → 26' →
+95 φ

77+00

Meadow

Meadow

Meadow

92+00

26'

25'

+78 ϕ

+59

91+00

+55 ϕ

90+00

24'

26'

+32 ϕ 18 M.

89+00

Pasture

Meadow

88+00

24'

26' + 11 ϕ

87+00

+32 ϕ

+59

+42 - Field Edge

86+00

+94

24'

26'

+52 ϕ

85+00

100+00

99+00

98+00

+73 = 4 Cor. Cyl. 2'x2'x20'

DRAIN APPROX. 40 ACRES FLAT TO ROLLING

97+00

96+00

95+00

+66 = 2 Cor. Pipe 18"x20'

94+00

93+00

+82
Field Entr. = +76

+500

25'

25'

+250

+030

3'

15'

B.M.

+160

25'

25'

+570

F.B.M.

+290

25'

26'

+82
Field Entr. = +38

+170

Cultivated

Cultivated

108+00

107+00

106+50

PI =

105+77.3 = $\Delta = 10^\circ - 02' \text{ Lt.}$

$\Delta = 10^\circ - 02' \text{ Lt.}$

$D = 10^\circ - 30' \text{ Lt.}$

$T = 50.1$

$L = 100.3$

$R = 573.7$

$E = 2.20$

105+00

$PC = 105+27.2 = 0^\circ - 00'$

$105+50 = 1^\circ - 08'$

$106+00 = 3^\circ - 38'$

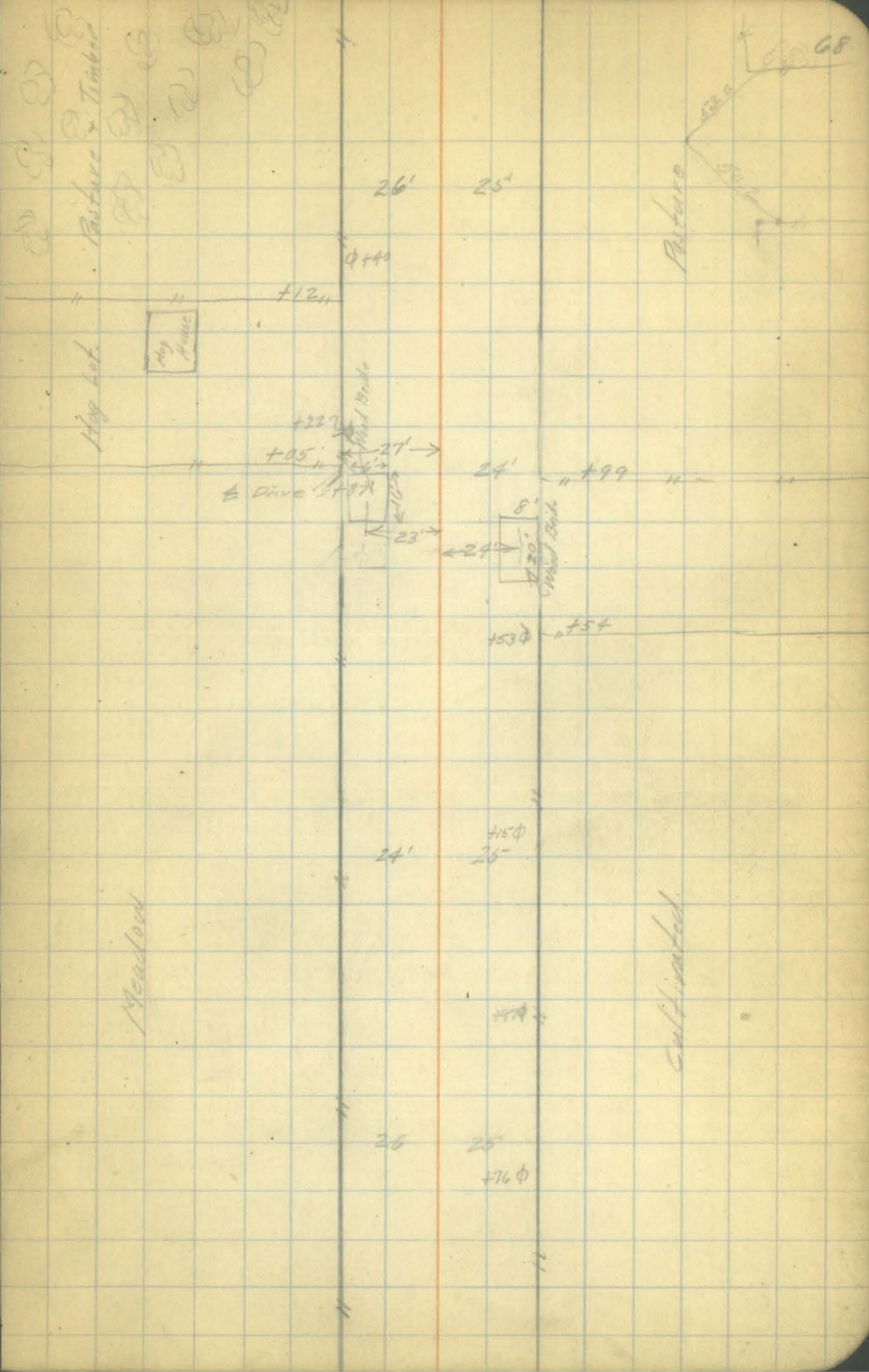
104+00

$PT = 106+27.3 = 5^\circ - 01'$

103+00

102+00

101+00



116+00

24'

26'

115+00

B.M. 2 $\phi+33$

114+00

25'

26'

113+00

 $\phi+30$

112+00

 $\phi+50$

111+00

+32 = $\frac{1}{2}$ Conc. Culv. 4' X 3' X 24' = Equalizer

110+00

26'

 $\phi+80$

25'

109+00

 $\phi+11$

Pasture

124+00

123+00

122+00

121+00

120+00

119+00

P.T. =

118+78.8

P.I. =

118+07.4 = $\Delta = 8^\circ - 10' Lt.$

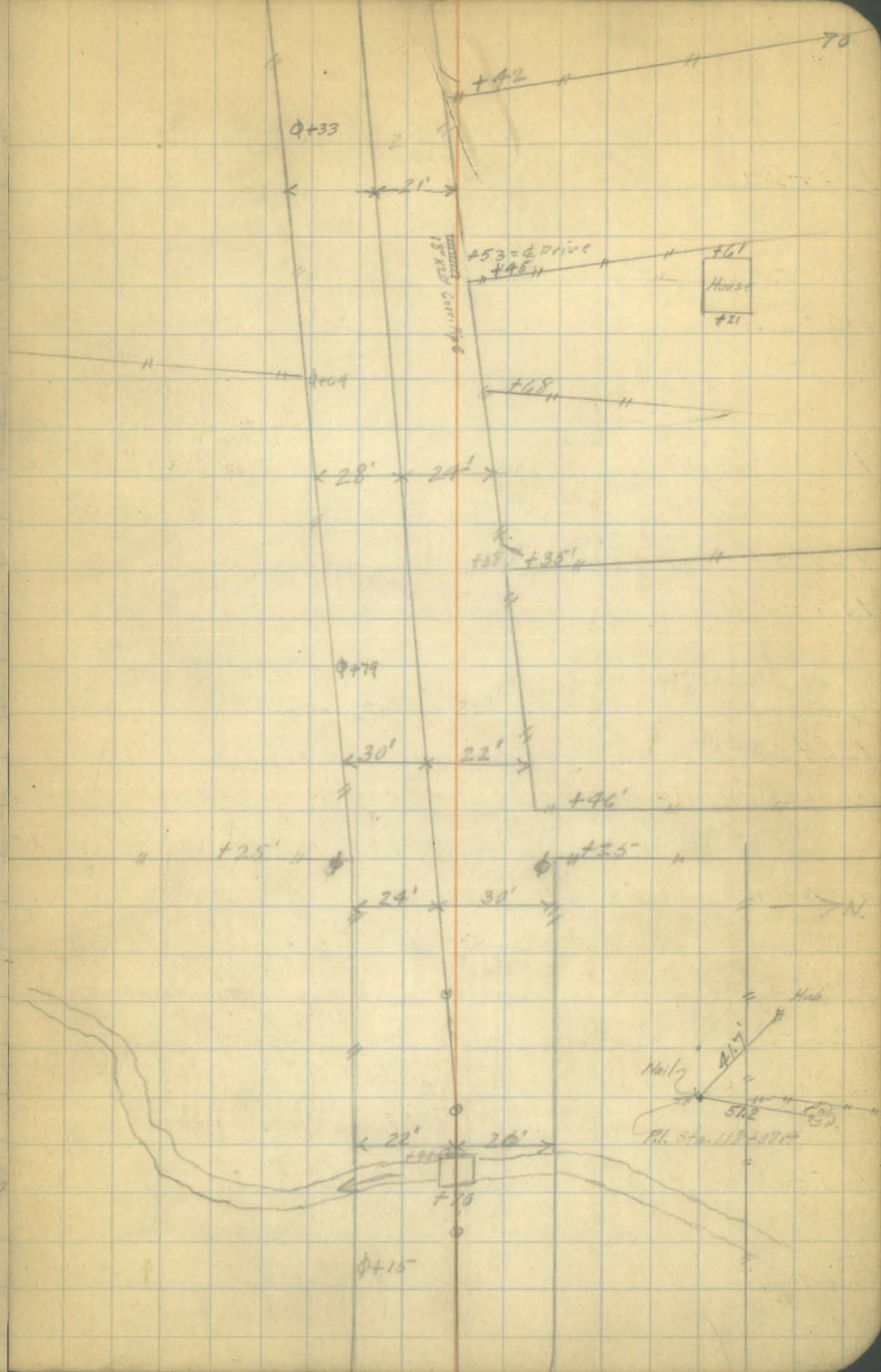
118+00

P.C. = +80 = 16' Wood Bridge Drains Approx 60 Acres Flat to Rolling

117+35.6

117+00

$\Delta = 8^\circ - 10' Lt.$	$\Delta = 8^\circ - 36' Lt.$
$D = 6^\circ - 00' Lt.$	$D = 6^\circ - 00' Lt.$
$T = 68.2$	$T = 71.8$
$L = 136.1$	$L = 143.33$
$E = 2.73$	$E = 2.70$



131+00

130+00

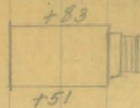
129+00

128+00

127+00

126+00

125+00 Drains Approx. 1800 Acres Flat to Rolling



+61 " +63

← 35' × 11' →

+75

← 34' × 14' →

+18

+23

← 16' →

+23

+24

Barri

Proposed Struct. 36' x 20' T-Beam Conc. Floor ~~999~~ Nails.

Proposed New Grade = 821.0

Page 71

Bottom Footing Elev. = 808.0

Book 67

Height Abut. = 13.0'

137+00 = 1°-47'

PC = 136+87.2 = 0°-00'

136+00

135+00

134+00

PC = 133+79.4 = 39°-57'

133+50 = 30°-50'

133+00 = 23°-50'

$\Delta = 69^{\circ}-55'$ LT

$D = 25^{\circ}-00'$ LT

$T_1 = 143.1$

$L_1 = 299.7$

$E = 45.54$

132+50 = 16°-50'

132+00 = 9°-50'

PI = 132+72.8

PC = 131+29.7

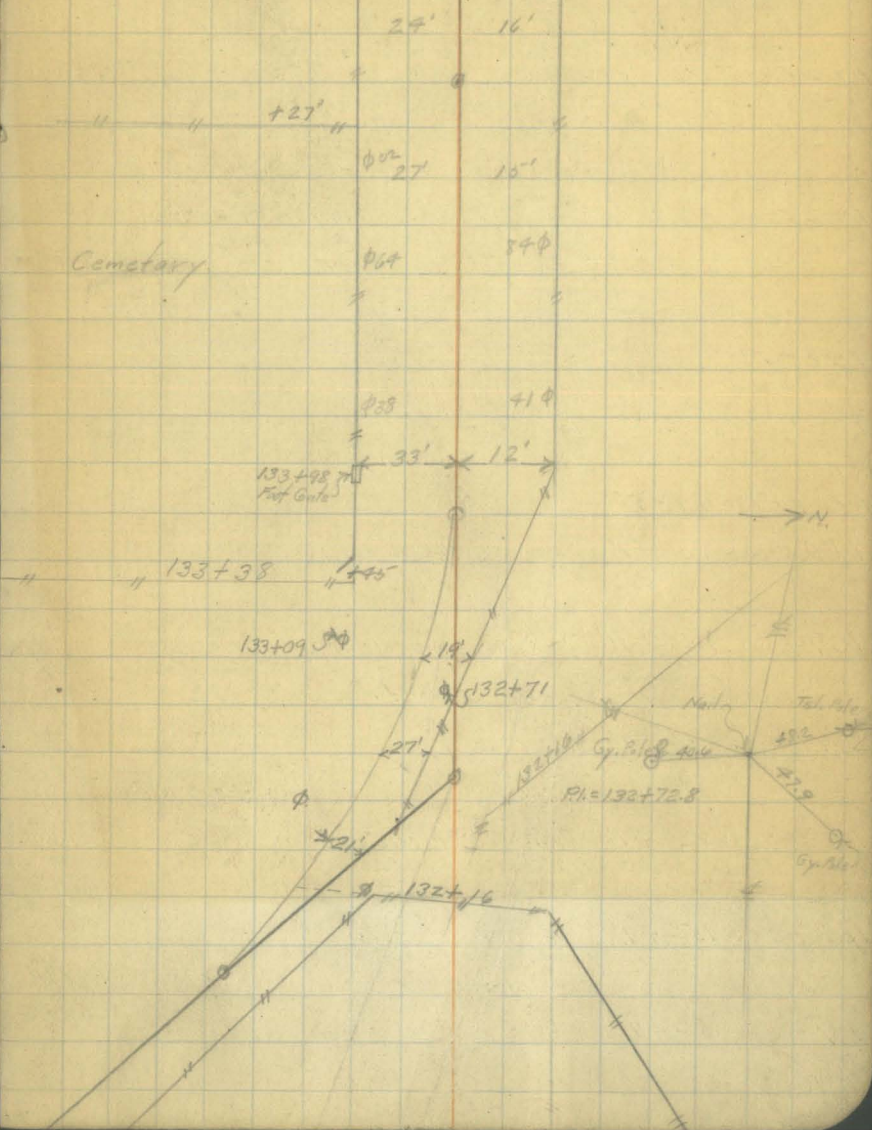
PT = 133+79.4

131+50 = 2°-50'

PC = 131+29.7 = 0°-00'

Curve Data of
beginning of "A" Line.

Cemetery



22.45 T.B.M.

144+00

143+00

Note: For fence distances see Prelim.

X-Sections Book #64

142+00

141+00

140+56.5 = E Conc. Culm 3'x2'x24'

P.T. = Drains Approx. 10 Acres Rolling

140+08.3 = 44°-58'

140+00 = 43°-47'

139+50 = 36°-47'

+10 = E crosses

Fence
 $\Delta = 89^{\circ}-54'$ Rt. $D = 28^{\circ}-00'$ Rt.

139+00 = 29°-47'

 $T_i = 209.3$ $L = 321.1$ $E = 84.2$

138+50 = 22°-47'

 $P.L. = 138+91.5$ $P.C. = 136+87.2$ $P.T. = 140+08.3$

138+00 = 15°-47'

+67 = E crosses fence

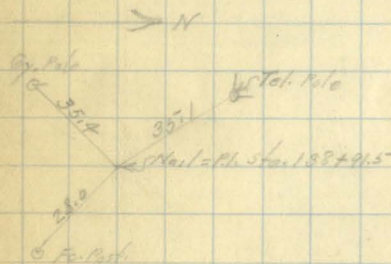
137+50 = 8°-47'

Void

Void

95°

47'9"



154+00

153+00

152+00

 $\Delta = 19^\circ 20' \text{ Rt.}$ $D_1 = 10^\circ 00' \text{ Rt.}$ $T_1 = 97.6$ $L = 193.3$ $E = 8.2$ $P.I. = 150+53.1$ $P.C. = 149+55.5$ $P.T. = 151+48.8$

P.T. =

151+48.8 = $9^\circ 40'$ 151+46.5 = $\frac{1}{2}$ Conc. Curve $3' \times 2' \times 24'$
Trains approx. 50 across flat to rolling.151+00 = $7^\circ 13'$ 150+50 = $4^\circ 43'$ 150+00 $2^\circ 13'$

P.C. =

149+55.5 = $0^\circ 00'$

149+00

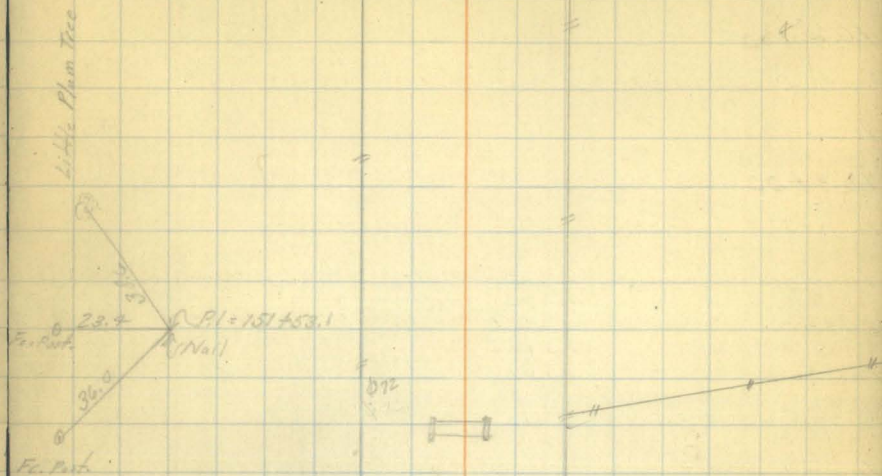
148+00

147+00

146+00

145+00

Void



Fence D: 150+74

Fence D: 150+35

Void

6+9°

22'

15'

16'

22'

16'

+67

71°

164+00

P.T. =
 $163+32.2 = 12^\circ-25'$
 $163+00 = 10^\circ-48'$

$\Delta = 24^\circ-50'$ Lt. P.I. = $162+10.1$
 $D = 10^\circ-00'$ Lt. P.C. = $160+84.0$
 $T = 126.1$ P.T. = $163+32.2$
 $L = 248.2$
 $E = 13.7$

+50 = $3^\circ-18'$

161+00 = $0^\circ-48'$
P.C. =
 $160+84.0 = 0^\circ-00'$

+59 = $\frac{1}{2}$ Crosses N. Fence of Old Road.

160+00

159+00

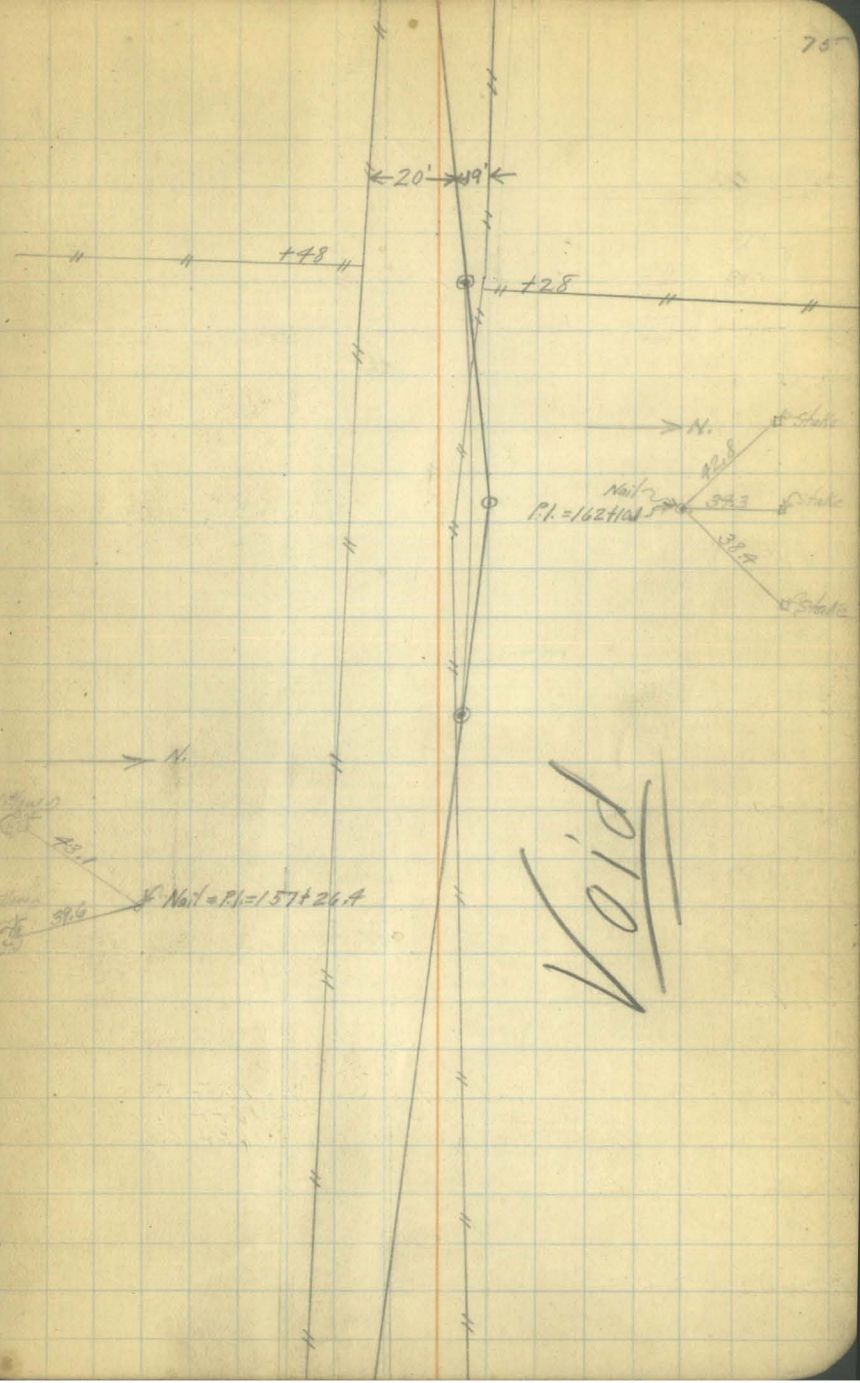
158+00
P.I. =
 $157+26.9 = \Delta = 3^\circ-56'$ Rt.

157+00

156+00

155+00

Void



Void

Void

167+00

+50

166+00

+50

165+00

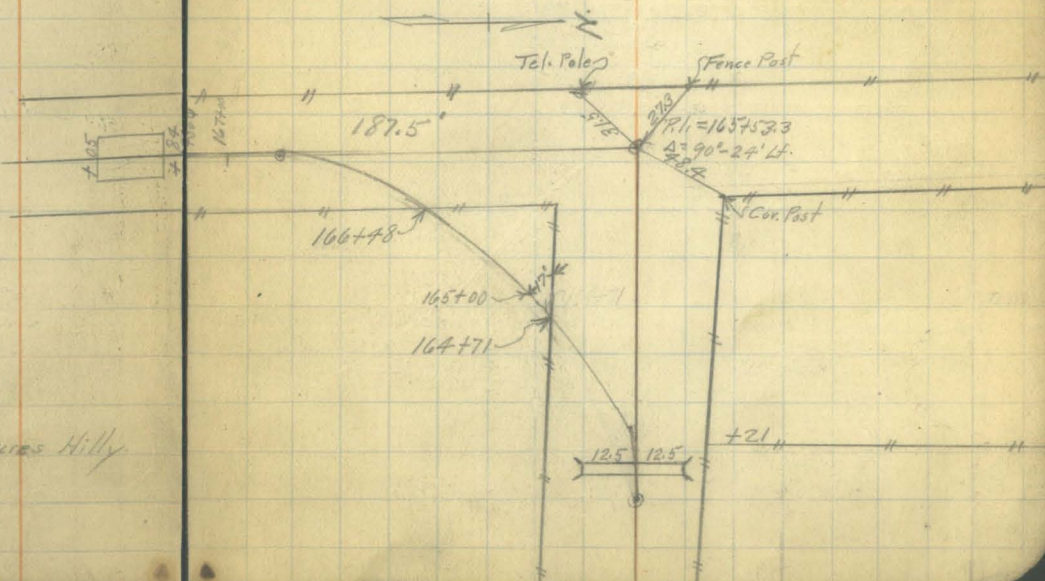
+50

164+17 = # Conc. Culv. 4'x2'x25' Drain Approx. 5' Across Hilly

P.C. = 164+10.6

$\Delta = 90^\circ - 24' \text{ Lt.}$
 $D = 40^\circ - 00' \text{ Lt.}$
 $T_1 = 142.7$
 $L_1 = 226.0$
 $E = 60.0$
 $R = 143.2$

P.I. = 165+53.3
 P.C. = 164+10.6
 P.T. = 166+36.6



E. K. Rice Gravel Pit.

Sec. 2-89-11 Bar.

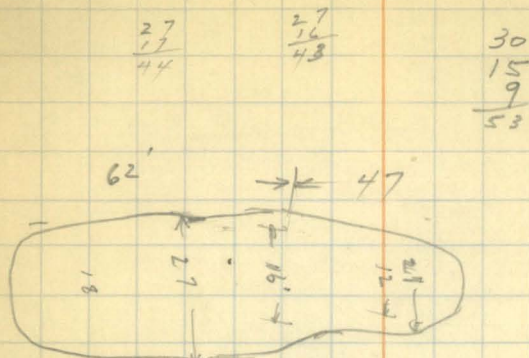
4.75
22
950
968
10415.50
5225.00

2.4
12
288
17
2016
288
489.6

2.4
47
108
96
112.8
19
10152
1128
2143.2
489
5225

27) 2857. (291.
54
245
243
27

291.
53
238.



Depth - 4.7 } 50' x 4.75' x 22'
4.8 }

2.4 x 12' x 17'

2.4 x 47' x 19

27
17
44

27
16
43

30
15
9
53

27
17
44

22
16
38

DIRECTIONS FOR USE OF TABLES

1. The distance of any point between the shoulder
space for any width of wheel, Table I, to I.
If ground is better over the car or bit or side
take it from the table, and multiply in
the column and take the number in feet.

IMPROVED TABLES AND INFORMATION

To find Tables and Tables for curves of
any other degree, multiply degree of curve and
add correction, Table I, to the number of corrections.
Tables of curve with a given I may be found
by dividing Table I by the degree of curve, or
given tangent, for example.

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

DIRECTIONS FOR USE OF TABLES

TABLE No. 1.

Distance of slope stake from side or shoulder stake for any width roadway, slope $1\frac{1}{2}$ to 1. If ground is nearly level, the cut or fill at side stake is located by the double entry method in left column and top row. The number in body of table in same row and column gives distance from side stake to slope stake. If ground is not level estimate the difference in elevation between the side stake and slope stake, lower target by this amount if cut, elevate if fill. Add this amount to cut or fill and find distance in table. Set up rod at this point, and line of sight should cut target. If it does not make the slight adjustment necessary.

TABLE No. 9.

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

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

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

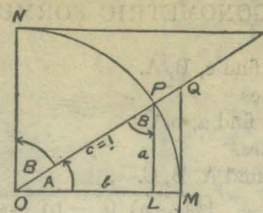


TABLE II

TRIGONOMETRIC FORMULÆ.

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

$$R = OB = c = 1$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

TABLE II—Continued
TRIGONOMETRIC FORMULAE (continued)

In any triangle:

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

Use Law of Lines.

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

Use Law of Lines.

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

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

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

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

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

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

Area of a triangle:

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

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

PRISMOIDAL FORMULA.

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

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

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

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

TABLE IV
USEFUL RELATIONS.

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

$$360^\circ = 21600' = 1296000''$$

$$\text{Radius} = \text{arc of } 57.2957790^\circ$$

$$\text{Arc of } 1^\circ (\text{radius} = 1) = .017453292$$

$$\text{Arc of } 1' (\text{radius} = 1) = .000290888$$

$$\text{Arc of } 1'' (\text{radius} = 1) = .000004848$$

$$\pi = 3.141592654$$

$$\frac{\pi}{4} = 0.785398163$$

$$\frac{\pi}{6} = 0.523598776$$

$$\sqrt{\frac{4}{\pi}} = 1.128379167$$

$$\frac{\pi}{6} = 0.523598776$$

$$\frac{4\pi}{3} = 4.188790205$$

$$\sqrt{\frac{1}{4}} = 0.564190$$

$$\sqrt[3]{\frac{6}{\pi}} = 1.240700982$$

$$\pi^2 = 9.869604401$$

$$\frac{1}{\pi^2} = 0.101321184$$

$$\sqrt{\pi} = 1.772453851$$

$$\frac{1}{\pi} = 0.3183099$$

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

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

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

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

Error in chaining of 0.01 feet in 100 feet:

Due to—

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

STADIA REDUCTION FORMULAE.

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

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

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

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

a = angle of elevation for mid Reading

TABLE V
CURVE FORMULAE FOR SIMPLE CURVES
COMPILED BY J. CALVIN LOCKE, C.E.

TABLE VI (continued)
SINES, COSINES, TANGENTS, COTANGENTS (continued)

deg	sin 0'	tan 0'	sin 10'	tan 10'	sin 20'	tan 20'	sin 30'	tan 30'	sin 40'	tan 40'	sin 50'	tan 50'	deg
46	7193	1.0355	7214	1.0416	7234	1.0477	7254	1.0533	7274	1.0599	7294	1.0661	43
47	314	.0724	333	.0786	353	.0850	373	.0913	392	.0977	412	.1041	42
48	431	.1106	451	.1171	470	.1237	490	.1303	509	.1369	528	.1436	41
49	547	.1504	566	.1571	585	.1640	604	.1708	623	.1778	642	.1847	40
50	660	1.1918	7679	1.1988	7698	1.2059	7716	1.2131	7735	1.2203	7753	1.2276	39
51	771	.2349	790	.2423	808	.2497	826	.2572	844	.2647	862	.2723	38
52	880	.2799	898	.2876	916	.2954	934	.3032	951	.3111	969	.3190	37
53	986	.3270	8004	.3351	8021	.3452	8039	.3514	8056	.3597	8073	.3680	36
54	8090	.3764	107	.3848	124	.3934	141	.4019	158	.4106	175	.4193	35
55	192	.4281	208	.4370	225	.4460	241	.4550	258	.4641	274	.4733	34
56	290	.4826	307	.4919	323	.5013	339	.5108	355	.5204	371	.5301	33
57	387	.5399	403	.5497	418	.5597	434	.5697	450	.5798	465	.5900	32
58	480	.6003	496	.6107	511	.6212	526	.6319	542	.6426	557	.6534	31
59	572	.6643	587	.6753	601	.6864	616	.6977	631	.7090	646	.7205	30
60	660	1.7321	8675	1.7437	8689	1.7556	8704	1.7675	8718	1.7797	8732	1.7917	29
61	746	.8040	760	.8165	774	.8291	788	.8418	802	.8546	816	.8676	28
62	829	.8807	843	.8940	857	.9074	870	.9210	884	.9347	897	.9486	27
63	910	.9626	923	.9768	936	.9912	949	2.0057	962	2.0204	975	2.0353	26
64	988	2.0503	9001	2.0655	9013	2.0809	9026	.0965	9038	.1123	9051	.1283	25
65	9063	.1445	075	.1609	088	.1775	100	.1943	112	.2113	124	.2286	24
66	135	.2460	147	.2637	159	.2817	171	.2998	182	.3183	194	.3369	23
67	205	.3559	216	.3750	228	.3945	239	.4142	250	.4342	261	.4545	22
68	272	.4751	283	.4960	293	.5172	304	.5386	315	.5605	325	.5826	21
69	336	.6051	346	.6279	356	.6511	367	.6746	377	.6985	387	.7228	20
70	397	2.7475	9407	2.7725	9417	2.7980	9426	2.8239	9436	2.8502	9446	2.8770	19
71	455	.9042	465	.9319	474	.9600	483	.9887	492	3.0178	502	3.0475	18
72	511	3.0777	520	3.1084	528	3.1397	537	3.1716	546	.2041	555	.2371	17
73	563	.2709	572	.3052	580	.3402	588	.3759	596	.4124	605	.4495	16
74	613	.4874	621	.5261	628	.5656	636	.6059	644	.6470	652	.6891	15
75	659	.7321	667	.7760	674	.8208	681	.8657	689	.9136	696	.9617	14
76	703	4.0108	710	4.0611	717	4.1126	724	4.1653	730	4.2193	737	4.2747	13
77	744	.3315	750	.3897	757	.4494	763	.5107	769	.5736	775	.6382	12
78	781	.7046	787	.7729	793	.8430	799	.9152	805	.9894	811	5.0658	11
79	816	.1446	822	5.2257	827	5.3093	833	5.3955	838	5.4845	843	.5764	10
80	848	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	13.187	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	995	31.242	996	34.368	997	38.189	997	42.964	998	49.104	1
89	998	57.290	999	68.750	999	85.940	999	114.58	1.000	171.88	1.000	343.77	0
deg	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	cos	cot

TABLE VII
RODS IN FEET AND INCHES

Rods	Feet Inches	Rods	Feet Inches	Rods	Feet Inches	Rods	Feet Inches	Rods	Feet Inches
1	16-6	21	346-6	41	676-6	61	1006-6	81	1336-6
2	33-0	22	363-0	42	693-0	62	1023-0	82	1353-0
3	49-6	23	379-6	43	709-6	63	1039-6	83	1369-6
4	66-0	24	396-0	44	726-0	64	1056-0	84	1386-0
5	82-6	25	412-6	45	742-6	65	1072-6	85	1402-6
6	99-0	26	429-0	46	759-0	66	1089-0	86	1419-0
7	115-6	27	445-6	47	775-6	67	1105-6	87	1435-6
8	132-0	28	462-0	48	792-0	68	1122-0	88	1452-0
9	148-6	29	478-6	49	808-6	69	1138-6	89	1468-6
10	165-0	30	495-0	50	825-0	70	1155-0	90	1485-0
11	181-6	31	511-6	51	841-6	71	1171-6	91	1501-6
12	198-0	32	528-0	52	858-0	72	1188-0	92	1518-0
13	214-6	33	544-6	53	874-6	73	1204-6	93	1534-6
14	231-0	34	561-0	54	891-0	74	1221-0	94	1551-0
15	247-6	35	577-6	55	907-6	75	1237-6	95	1567-6
16	264-0	36	594-0	56	924-0	76	1254-0	96	1584-0
17	280-6	37	610-6	57	940-6	77	1270-6	97	1600-6
18	297-0	38	627-0	58	957-0	78	1287-0	98	1617-0
19	313-6	39	643-6	59	973-6	79	1303-6	99	1633-6
20	330-0	40	660-0	60	990-0	80	1320-0	100	1650-0

TABLE VIII
LINKS IN FEET AND INCHES

Links	Feet Inches	Links	Feet Inches	Links	Feet Inches	Links	Feet Inches	Links	Feet Inches	Links	Feet Inches
1	0- 7.92	18	11-10.56	35	23- 1.20	52	34- 3.84	69	45- 6.48	86	56- 9.12
2	1- 3.84	19	12- 6.48	36	23- 9.12	53	34-11.76	70	46- 2.40	87	57- 5.04
3	1-11.76	20	13- 2.40	37	24- 5.04	54	35- 7.68	71	46-10.32	88	58- 0.96
4	2- 7.68	21	13-10.32	38	25- 0.96	55	36- 3.60	72	47- 6.24	89	58- 8.88
5	3- 3.60	22	14- 6.24	39	25- 8.88	56	36-11.52	73	48- 2.16	90	59- 4.80
6	3-11.52	23	15- 2.16	40	26- 4.80	57	37- 7.44	74	48-10.08	91	60- 0.72
7	4- 7.44	24	15-10.08	41	27- 0.72	58	38- 3.36	75	49- 6.00	92	60- 8.64
8	5- 3.36	25	16- 6.00	42	27- 8.64	59	38-11.28	76	50- 1.92	93	61- 4.56
9	5-11.28	26	17- 1.92	43	28- 4.56	60	39- 7.20	77	50- 9.84	94	62- 0.48
10	6- 7.20	27	17- 9.84	44	29- 0.60	61	40- 3.12	78	51- 5.76	95	62- 8.40
11	7- 3.12	28	18- 5.76	45	29- 8.40	62	40-11.04	79	52- 1.68	96	63- 4.32
12	7-11.04	29	19- 1.68	46	30- 4.32	63	41- 6.96	80	52- 9.60	97	64- 0.24
13	8- 6.96	30	19- 9.60	47	31- 0.24	64	42- 2.88	81	53- 5.52	98	64- 8.16
14	9- 2.88	31	20- 5.52	48	31- 8.16	65	42-10.80	82	54- 1.44	99	65- 4.08
15	9-10.80	32	21- 1.44	49	32- 4.08	66	43- 6.72	83	54- 9.36	100	66- 0.00
16	10- 6.72	33	21- 9.36	50	33- 0.00	67	44- 2.64	84	55- 5.28	101	66- 7.92
17	11- 2.64	34	22- 5.28	51	33- 7.92	68	44-10.56	85	56- 1.20	102	67- 3.84

TABLE IX. TANGENTS AND EXTERNALS TO A 1° CURVE

I	T	E	I=10°	I	T	E	I=20°	I	T	E	I=30°
1°	50.00	.218	+	11°	551.70	26.500	+	21°	1061.9	97.577	+
10°	58.34	.297	5° C.	10°	560.11	27.313	5° C.	10°	1070.6	99.155	5° C.
20°	66.67	.388	T	20°	568.53	28.137	T	20°	1079.2	100.75	T
30°	75.01	.491	.03	30°	576.95	28.974	.06	30°	1087.8	102.35	.10
40°	83.34	.606	E	40°	585.36	29.824	E	40°	1096.4	103.97	E
50°	91.68	.733	.001	50°	593.79	30.686	.006	50°	1105.1	105.60	.013
2°	100.01	.873	10° C.	12°	602.21	31.561	10° C.	22°	1113.7	107.24	10° C.
10°	108.35	1.024	T	10°	610.64	32.447	T	10°	1122.4	108.99	T
20°	116.68	1.188	.06	20°	619.07	33.347	.13	20°	1131.0	110.57	.19
30°	125.02	1.364	E	30°	627.50	34.259	E	30°	1139.7	112.25	E
40°	133.36	1.552	.003	40°	635.93	35.183	.011	40°	1148.4	113.95	.025
50°	141.70	1.752	T	50°	644.37	36.120	T	50°	1157.0	115.66	T
3°	150.04	1.964	10° C.	13°	652.81	37.070	10° C.	23°	1165.7	117.38	10° C.
10°	158.38	2.188	T	10°	661.25	38.031	T	10°	1174.4	119.12	T
20°	166.72	2.425	.06	20°	669.70	39.006	.13	20°	1183.1	120.87	.19
30°	175.06	2.674	E	30°	678.15	39.993	E	30°	1191.8	122.63	E
40°	183.40	2.934	.003	40°	686.60	40.992	.011	40°	1200.5	124.41	.025
50°	191.74	3.207	T	50°	695.06	42.004	T	50°	1209.2	126.20	T
4°	200.08	3.492	15° C.	14°	703.51	43.029	15° C.	24°	1217.9	128.00	15° C.
10°	208.43	3.790	T	10°	711.97	44.066	T	10°	1226.6	129.82	T
20°	216.77	4.099	.06	20°	720.44	45.116	.13	20°	1235.3	131.65	.19
30°	225.12	4.421	E	30°	728.90	46.178	E	30°	1244.0	133.50	E
40°	233.47	4.755	.003	40°	737.37	47.253	.011	40°	1252.8	135.35	.025
50°	241.81	5.100	T	50°	745.85	48.341	T	50°	1261.5	137.23	T
5°	250.16	5.459	15° C.	15°	754.32	49.441	15° C.	25°	1270.2	139.11	15° C.
10°	258.51	5.829	T	10°	762.80	50.554	T	10°	1279.0	141.01	T
20°	266.86	6.211	.06	20°	771.29	51.679	.13	20°	1287.7	142.93	.19
30°	275.21	6.606	E	30°	779.77	52.818	E	30°	1296.5	144.85	E
40°	283.57	7.013	.003	40°	788.26	53.969	.011	40°	1305.3	146.79	.025
50°	291.92	7.432	T	50°	796.75	55.132	T	50°	1314.0	148.75	T
6°	300.28	7.863	15° C.	16°	805.25	56.309	15° C.	26°	1322.8	150.71	15° C.
10°	308.64	8.307	T	10°	813.75	57.498	T	10°	1331.6	152.69	T
20°	316.99	8.762	.06	20°	822.25	58.699	.13	20°	1340.4	154.69	.19
30°	325.35	9.230	E	30°	830.76	59.914	E	30°	1349.2	156.70	E
40°	333.71	9.710	.003	40°	839.27	61.141	.011	40°	1358.0	158.72	.025
50°	342.08	10.202	T	50°	847.78	62.381	T	50°	1366.8	160.76	T
7°	350.44	10.707	15° C.	17°	856.30	63.634	15° C.	27°	1375.6	162.81	15° C.
10°	358.81	11.224	T	10°	864.82	64.900	T	10°	1384.4	164.86	T
20°	367.17	11.753	.06	20°	873.35	66.178	.13	20°	1393.2	166.95	.19
30°	375.54	12.294	E	30°	881.88	67.470	E	30°	1402.0	169.04	E
40°	383.91	12.847	.003	40°	890.41	68.774	.011	40°	1410.9	171.15	.025
50°	392.28	13.413	T	50°	898.95	70.091	T	50°	1419.7	173.27	T
8°	400.66	13.991	15° C.	18°	907.49	71.421	15° C.	28°	1428.6	175.41	15° C.
10°	409.03	14.582	T	10°	916.03	72.764	T	10°	1437.4	177.55	T
20°	417.41	15.184	.06	20°	924.58	74.119	.13	20°	1446.3	179.72	.19
30°	425.79	15.799	E	30°	933.13	75.488	E	30°	1455.1	181.89	E
40°	434.17	16.426	.003	40°	941.69	76.869	.011	40°	1464.0	184.08	.025
50°	442.55	17.065	T	50°	950.25	78.264	T	50°	1472.9	186.29	T
9°	450.93	17.717	15° C.	19°	958.81	79.671	15° C.	29°	1481.8	188.51	15° C.
10°	459.32	18.381	T	10°	967.38	81.092	T	10°	1490.7	190.74	T
20°	467.71	19.058	.06	20°	975.96	82.525	.13	20°	1499.6	192.99	.19
30°	476.10	19.746	E	30°	984.53	83.972	E	30°	1508.5	195.25	E
40°	484.49	20.447	.003	40°	993.12	85.431	.011	40°	1517.4	197.53	.025
50°	492.88	21.161	T	50°	1001.7	86.904	T	50°	1526.3	199.82	T
10°	501.28	21.887	15° C.	20°	1010.3	88.389	15° C.	30°	1535.3	202.12	15° C.
10°	509.68	22.624	T	10°	1018.9	89.888	T	10°	1544.2	204.44	T
20°	518.08	23.375	.06	20°	1027.5	91.399	.13	20°	1553.1	206.77	.19
30°	526.48	24.138	E	30°	1036.1	92.924	E	30°	1562.1	209.12	E
40°	534.89	24.913	.003	40°	1044.7	94.462	.011	40°	1571.0	211.48	.025
50°	543.29	25.700	T	50°	1053.3	96.013	T	50°	1580.0	213.86	T

$$T = R \tan \frac{1}{2} I$$

$$E = R \operatorname{exsec} \frac{1}{2} I$$

TABLE IX. TANGENTS AND EXTERNALS TO A 1° CURVE

I	T	E	I=40°	I	T	E	I=50°	I	T	E	I=60°
31°	1589.0	216.3	+	41°	2142.2	387.4	+	51°	2732.9	618.4	+
10°	1598.0	218.7	5° C.	10°	2151.7	390.7	5° C.	10°	2743.1	622.8	5° C.
20°	1606.9	221.1	T	20°	2161.2	394.1	T	20°	2753.4	627.2	T
30°	1615.9	223.5	.13	30°	2170.8	397.4	.17	30°	2763.7	631.7	.21
40°	1624.9	226.0	E	40°	2180.3	400.8	E	40°	2773.9	636.2	E
50°	1633.9	228.4	.023	50°	2189.9	404.2	.037	50°	2784.2	640.7	.056
32°	1643.0	230.9	10° C.	42°	2199.4	407.6	10° C.	52°	2794.5	645.2	10° C.
10°	1652.0	233.4	T	10°	2209.0	411.1	T	10°	2804.9	649.7	T
20°	1661.0	235.9	.06	20°	2218.6	414.5	.10	20°	2815.2	654.3	.14
30°	1670.0	238.4	E	30°	2228.1	418.0	E	30°	2825.6	658.8	E
40°	1679.1	241.0	.046	40°	2237.7	421.4	.075	40°	2835.9	663.4	.112
50°	1688.1	243.5	T	50°	2247.3	425.0	T	50°	2846.3	668.0	T
33°	1697.2	246.1	10° C.	43°	2257.0	428.5	10° C.	53°	2856.7	672.7	10° C.
10°	1706.3	248.7	T	10°	2266.6	432.0	T	10°	2867.1	677.3	T
20°	1715.3	251.3	.13	20°	2276.2	435.6	.17	20°	2877.5	682.0	.17
30°	1724.4	253.9	E	30°	2285.9	439.2	E	30°	2888.0	686.7	E
40°	1733.5	256.5	.046	40°	2295.6	442.8	.075	40°	2898.4	691.4	.112
50°	1742.6	259.1	T	50°	2305.2	446.4	T	50°	2908.9	696.1	T
34°	1751.7	261.8	15° C.	44°	2314.9	450.0	15° C.	54°	2919.4	700.9	15° C.
10°	1760.8	264.5	T	10°	2324.6	453.6	T	10°	2929.9	705.7	T
20°	1770.0	267.2	.06	20°	2334.3	457.3	.10	20°	2940.4	710.5	.14
30°	1779.1	269.9	E	30°	2344.1	461.0	E	30°	2951.0	715.3	E
40°	1788.2	272.6	.046	40°	2353.8	464.6	.075	40°	2961.5	720.1	.112
50°	1797.4	275.3	T	50°	2363.5	468.4	T	50°	2972.1	725.0	T
35°	1806.6	278.1	15° C.	45°	2373.3	472.1	15° C.	55°	2982.7	729.9	15° C.
10°	1815.7	280.8	T	10°	2383.1	475.8	T	10°	2993.3	734.8	T
20°	1824.9	283.6	.06	20°	2392.8	479.6	.10	20°	3003.9	739.7	.14
30°	1834.1	286.4	E	30°	2402.6	483.4	E	30°	3014.5	744.6	E
40°	1843.3	289.2	.046	40°	2412.4	487.2	.075	40°	3025.2	749.6	.112
50°	1852.5	292.0	T	50°	2422.3	491.0	T	50°	3035.8	754.6	T
36°	1861.7	294.9	15° C.	46°	2432.1	494.8	15° C.	56°	3046.5	759.6	15° C.
10°	1870.9	297.7	T	10°	2441.9	498.7	T	10°	3057.2	764.6	T
20°	1880.1	300.6	.06	20°	2451.8	502.5	.10	20°	3067.9	769.7	.14
30°	1889.4	303.5	E	30°	2461.7	506.4	E	30°	3078.7	774.7	E
40°	1898.6	306.4	.046	40°	2471.5	510.3	.075	40°	3089.4	779.8	.112
50°	1907.9	309.3	T	50°	2481.4	514.3	T	50°	3100.2	784.9	T
37°	1917.1	312.2	15° C.	47°	2491.3	518.2	15° C.	57°	3110.9	790.1	15° C.
10°	1926.4	315.2	T	10°	2501.2	522.2	T	10°	3121.7	795.2	T
20°	1935.7	318.1	.06	20°	2511.2	526.1	.10	20°	3132.6	800.4	.14
30°	1945.0	321.1	E	30°	2521.1	530.1	E	30°	3143.4	805.6	E
40°	1954.3	324.1	.046	40°	2531.1	534.2	.075	40°	3154.2	810.9	.112
50°	1963.6	327.1	T	50°	2541.0	538.2	T	50°	3165.1	816.1	T
38°	1972.9	330.2	15° C.	48°	2551.0	542.2	15° C.	58°	3176.0	821.4	15° C.
10°	1982.2	333.2	T	10°	2561.0	546.3	T	10°	3186.9	826.7	T
20°	1991.5	336.3	.06	20°	2571.0	550.4	.10	20°	3197.8	832.0	.14
30°	2000.9	339.3	E	30°	2581.0	554.5	E	30°	3208.8	837.3	E
40°	2010.2	342.4	.046	40°	2591.0	558.6	.075	40°	3219.7	842.7	.112
50°	2019.6	345.5	T	50°	2601.1	562.8	T	50°	3230.7	848.1	T
39°	2029.0	348.6	15° C.	49°	2611.2	566.9	15° C.	59°	3241.7	853.5	15° C.
10°	2038.4	351.8	T	10°	2621.2	571.1	T	10°	3252.7	858.9	T
20°	2047.8	354.9	.06	20°	2631.3	575.3	.10	20°	3263.7	864.3	.14
30°	2057.2	358.1	E	30°	2641.4	579.5	E	30°	3274.8	869.8	E
40°	2066.6	361.3	.046	40°	2651.5	583.8	.075	40°	3285.8	875.3	.112
50°	2076.0	364.5	T	50°	2661.6	588.0	T	50°	3296.9	880.8	T
40°	2085.4	367.7	30° C.	50°	2671.8	592.3	30° C.	60°	3308.0	886.4	30° C.
10°	2094.9	371.0	T	10°	2681.9	596.6	T	10°	3319.1	892.0	T
20°	2104.3	374.2	.80	20°	2692.1	600.9	1.02	20°	3330.3	897.5	1.27
30°	2113.8	377.5	E	30°	2702.3	605.3	E	30°	3341.4	903.2	E
40°	2123.3	380.8	.141	40°	2712.5	609.6	.227	40°	3352.6	908.8	.340
50°	2132.7	384.1	T	50°	2722.7	614.0	T	50°	3363.8	914.5	T

TABLE IX. TANGENTS AND EXTERNALS TO A 1° CURVE

I	T	E	I=70°	I	T	E	I=80°	I	T	E	I=90°
61°	3375.0	920.2	+ 5° C. T .25 E	71°	4086.9	1308.2	+ 5° C. T .30 E	81°	4893.6	1805.3	+ 5° C. T .36 E
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	.080	72°	4162.8	1352.6	.110	82°	4980.7	1862.2	.149
10'	3454.1	960.6		10'	4175.6	1360.1		10'	4995.4	1871.8	
20'	3465.4	966.5		20'	4188.5	1367.6		20'	5010.0	1881.5	
30'	3476.8	972.4		30'	4201.2	1375.2		30'	5024.8	1891.2	
40'	3488.3	978.3		40'	4214.0	1382.8		40'	5039.5	1900.9	
50'	3499.7	984.3		50'	4226.8	1390.4		50'	5054.3	1910.7	
63°	3511.1	990.2	10° C. T .51 E .159	73°	4239.7	1398.0	10° C. T .61 E .220	83°	5069.2	1920.5	10° C. T .72 E .299
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	15° C. T .76 E .240	74°	4317.6	1444.6	15° C. T .91 E .332	84°	5159.0	1980.4	15° C. T 1.09 E .450
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	20° C. T 1.02 E .321	75°	4396.5	1492.4	20° C. T 1.22 E .445	85°	5250.3	2041.7	20° C. T 1.45 E .603
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	25° C. T 1.54 E .403	76°	4476.5	1541.4	25° C. T 1.74 E .558	86°	5343.0	2104.7	25° C. T 1.97 E .756
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	30° C. T 1.84 E .485	77°	4557.6	1591.6	30° C. T 2.04 E .671	87°	5437.2	2169.2	30° C. T 2.24 E .910
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'	3840.4	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	35° C. T 2.14 E .518	78°	4639.8	1643.0	35° C. T 2.34 E .716	88°	5533.1	2235.5	35° C. T 2.54 E .914
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	40° C. T 2.24 E .568	79°	4723.2	1695.8	40° C. T 2.44 E .776	89°	5630.5	2303.5	40° C. T 2.64 E .984
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	45° C. T 2.34 E .618	80°	4807.7	1749.9	45° C. T 2.54 E .826	90°	5729.7	2373.3	45° C. T 2.74 E .1034
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	

T = R tan ½ I

E = R exsec ½ I

TABLE IX. TANGENTS AND EXTERNALS TO A 1° CURVE

I	T	E	I=100°	I	T	E	I=110°	I	T	E	I=120°
91°	5830.5	2444.9	+ 5° C. T .43 E .200	101°	6950.6	3278.1	+ 5° C. T .51 E .268	111°	8336.7	4386.1	+ 5° C. T .62 E .360
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	.200	102°	7075.5	3374.9	.268	112°	8494.6	4516.6	.360
10'	5950.5	2531.0		10'	7096.6	3391.2		10'	8521.3	4538.8	
20'	5967.9	2543.5		20'	7117.8	3407.7		20'	8548.1	4561.1	
30'	5985.3	2556.0		30'	7139.0	3424.3		30'	8575.0	4583.4	
40'	6002.7	2568.6		40'	7160.3	3440.9		40'	8602.1	4606.0	
50'	6020.2	2581.3		50'	7181.7	3457.6		50'	8629.3	4628.6	
93°	6037.8	2594.0	10° C. T .86 E .401	103°	7203.2	3474.4	10° C. T .103 F .536	113°	8656.6	4651.3	10° C. T 1.25 E .721
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	15° C. T 1.30 E .604	104°	7333.6	3576.8	15° C. T 1.56 E .806	114°	8822.9	4790.4	15° C. T 1.93 E 1.09
10'	6162.2	2684.7		10'	7355.6	3594.2		10'	8851.0	4814.1	
20'	6180.2	2697.9		20'	7377.8	3611.7		20'	8879.3	4837.8	
30'	6198.3	2711.2		30'	7399.9	3629.2		30'	8907.7	4861.7	
40'	6216.4	2724.5		40'	7422.2	3646.8		40'	8936.3	4885.7	
50'	6234.6	2737.9		50'	7444.6	3664.5		50'	8965.0	4909.9	
95°	6252.8	2751.3	20° C. T 1.45 E .809	105°	7467.0	3682.3	20° C. T 1.74 E .809	115°	8993.8	4934.1	20° C. T 2.52 E 1.46
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	20° C. T 1.60 E .809	106°	7603.5	3791.0	20° C. T 2.08 E 1.08	116°	9169.4	5082.7	20° C. T 3.16 E 1.83
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	1.74 E .809	107°	7743.2	3902.9	2.08 E 1.08	117°	9349.9	5236.2	2.52 E 1.46
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°	6591.1	3003.8	25° C. T 2.18 E 1.02	108°	7886.2	4018.2	25° C. T 2.61 E 1.36	118°	9535.7	5395.1	25° C. T 3.16 E 1.83
10'	6610.6	3018.4		10'	7910.4	4037.8		10'	9567.2	5422.1	
20'	6630.1	3033.9		20'	7934.6	4057.4		20'	9598.9	5449.2	
30'	6649.6	3049.7		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	1.02	109°	8032.7	4137.1	1.36	119°	9727.0	5559.4	1.83
10'	6728.4	3107.7		10'	8057.4	4157.3		10'	9759.4	5587.4	
20'	6748.2	3122.9		20'	8082.3	4177.5		20'	9792.0	5615.5	
30'	6768.1	3138.1		30'	8107.3	4197.9		30'	9824.8	5643.8	
40'	6788.1	3153.3		40'	8132.3	4218.4		40'	9857.7	5672.3	
50'	6808.2	3168.7		50'	8157.5	4239.0		50'	9890.8	5700.9	
100°	6828.3	3184.1	30° C. T 2.62 E 1.22	110°	8182.8	4259.7	30° C. T 3.14 E 1.63	120°	9924.0	5729.7	30° C. T 3.81 E 2.20
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 X.
MIDDLE ORDINATES OF RAILS
Length of Rail (feet)

C o /	R Feet	30 Inch	28 Inch	26 Inch	24 Inch	22 Inch	20 Inch	C o	R Feet	30 Inch	28 Inch	26 Inch	24 Inch	22 Inch	20 Inch
0-20	17189	.08	.07	.06	.05	.04	.03	8	716.8	1.88	1.64	1.42	1.20	1.01	.84
0-40	8594	.16	.14	.12	.10	.08	.07	9	637.3	2.12	1.84	1.60	1.35	1.14	.94
1-0	5730	.24	.20	.18	.15	.13	.10	10	573.7	2.36	2.05	1.78	1.50	1.27	1.04
1-20	4297	.31	.27	.23	.20	.17	.13	11	521.7	2.59	2.26	1.95	1.65	1.39	1.15
1-40	3438	.39	.34	.29	.25	.21	.17	12	478.3	3.83	3.47	3.15	2.81	2.46	2.16
2-0	2865	.47	.41	.35	.30	.25	.20	13	441.7	3.05	2.66	2.30	1.96	1.66	1.36
2-20	2456	.55	.48	.41	.35	.29	.23	14	410.3	3.30	2.87	2.48	2.10	1.78	1.46
2-40	2149	.63	.55	.47	.40	.33	.27	15	383.1	3.54	3.08	2.68	2.26	1.91	1.57
3-0	1910	.71	.62	.53	.45	.38	.31	16	359.3	3.76	3.28	2.83	2.40	2.04	1.67
3-20	1719	.78	.68	.59	.50	.42	.35	17	338.3	4.00	3.48	3.02	2.57	2.16	1.78
3-40	1563	.86	.75	.65	.55	.46	.38	18	319.6	4.21	3.67	3.18	2.70	2.28	1.87
4-0	1433	.94	.82	.71	.60	.50	.42	19	302.9	4.45	3.89	3.36	2.86	2.41	1.98
4-20	1323	1.02	.89	.77	.65	.55	.45	20	287.9	4.70	4.09	3.55	3.00	2.54	2.09
4-40	1228	1.10	.96	.83	.70	.59	.48	22	262.0	5.16	4.44	3.84	3.30	2.80	2.29
5	1146	1.18	1.03	.89	.75	.63	.52	24	240.5	5.64	4.92	4.20	3.59	3.04	2.50
6	955.3	1.41	1.23	1.06	.90	.76	.62	26	222.3	6.07	5.29	4.58	3.88	3.29	2.70
7	819.0	1.65	1.44	1.24	1.05	.89	.73								

TABLE XI.
SHORT RADIUS CURVES

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

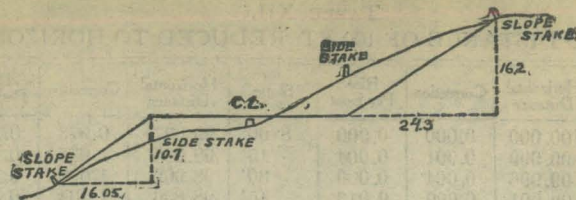
To find length of curve divide angle from P. C. to P. T. by central angle of chord, and multiply by length of chord.

TABLE XII.
INCLINED DISTANCE OF 100 FT. REDUCED TO HORIZONTAL

Slope	Horizontal Distance	Correction	Rise Per Foot	Slope	Horizontal Distance	Correction	Rise Per Foot
0°00'	100.000	0.000	0.000	8°00'	99.027	0.973	0.139
15'	99.999	0.001	0.004	15'	98.965	1.035	0.143
30'	99.996	0.004	0.009	30'	98.902	1.098	0.148
45'	99.991	0.009	0.013	45'	98.836	1.164	0.152
1 00	99.985	0.015	0.017	9 00	98.769	1.231	0.156
15	99.976	0.024	0.022	15	98.700	1.300	0.161
30	99.966	0.034	0.026	30	98.629	1.371	0.165
45	99.953	0.047	0.031	45	98.556	1.444	0.169
2 00	99.939	0.061	0.035	10 00	98.481	1.519	0.174
15	99.923	0.077	0.039	15	98.404	1.596	0.178
30	99.905	0.095	0.044	30	98.325	1.675	0.182
45	99.885	0.115	0.048	45	98.245	1.755	0.187
3 00	99.863	0.137	0.052	11 00	98.163	1.837	0.191
15	99.839	0.161	0.057	15	98.079	1.921	0.195
30	99.813	0.187	0.061	30	97.992	2.008	0.199
45	99.786	0.214	0.065	45	97.905	2.095	0.204
4 00	99.756	0.244	0.070	12 00	97.815	2.185	0.208
15	99.725	0.275	0.074	15	97.723	2.277	0.212
30	99.692	0.308	0.078	30	97.630	2.370	0.216
45	99.657	0.343	0.083	45	97.534	2.466	0.221
5 00	99.619	0.381	0.087	13 00	97.437	2.563	0.225
15	99.580	0.420	0.092	15	97.338	2.662	0.229
30	99.540	0.460	0.096	30	97.237	2.763	0.233
45	99.497	0.503	0.100	45	97.134	2.866	0.238
6 00	99.452	0.548	0.105	14 00	97.030	2.970	0.242
15	99.406	0.594	0.109	15	96.923	3.077	0.246
30	99.357	0.643	0.113	30	96.815	3.185	0.250
45	99.307	0.693	0.118	45	96.705	3.295	0.255
7 00	99.255	0.745	0.122	15 00	96.598	3.407	0.259
15	99.200	0.800	0.126	15	96.479	3.521	0.263
30	99.144	0.856	0.131	30	96.363	3.637	0.267
45	99.087	0.913	0.135	45	96.246	3.754	0.271

TABLE XIII.
MINUTES IN DECIMALS OF A DEGREE.

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



DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

SLOPE $1\frac{1}{2}$ 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.

12/20/26

Corr. Pipe at Laporte City.

- 14 — 15" X 20'
- 1 — 18" X 20'
- 2 — 24" X 19'
- 6 — 18" X 4' = Conc. Pipe

27.5
12
—
15.3

88+77
89+93
89+09.5
89+16.5
89+22