

300 A



LIETZ

SINCE 1882

ECONOMY FIELD BOOK

No. 8152-05

INDEX

1	CHET FISCHER	15-139-29
2	EVELYN HOLMES	28-140-29
3		
4	LARRY SHORT	CARTWAY 36-141-31
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14		
15	USFS " "	
16	BIA VERMILLION LK	35-762 R16
17	BIA NETT LK	
21	USFS BURROWS	

R. HOLMS

28-140-29

$\pi @ D$ AS DI

51-31-06

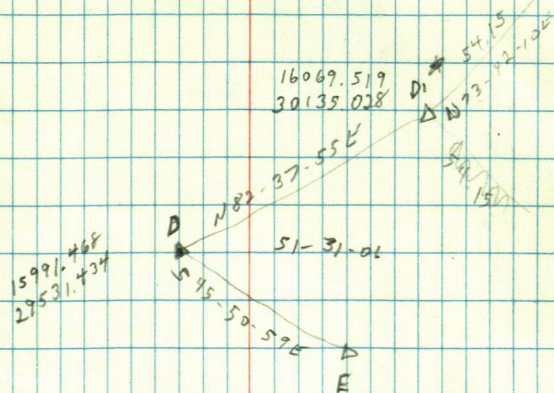
91-10

608.25
165.545

608.62

E 103-02-12 51-34-06

ORIG BT 8' NP N60E 17.2 FT



92-16.40 599.18 598.633

90-42 220.57 220.57
-3.58

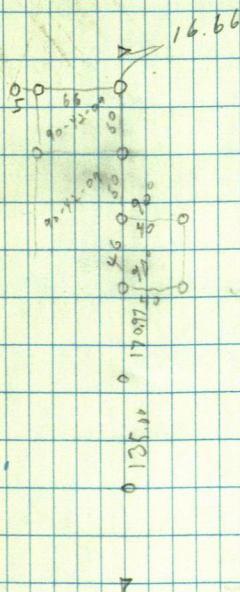
87-28 355.58 355.23
-3.26

89-51 104.62 103.073
+2.25

106-57 61.67 58.99
1.01

87-22-5. 254.46 251.76

90- 154.00 154.00
-1.57



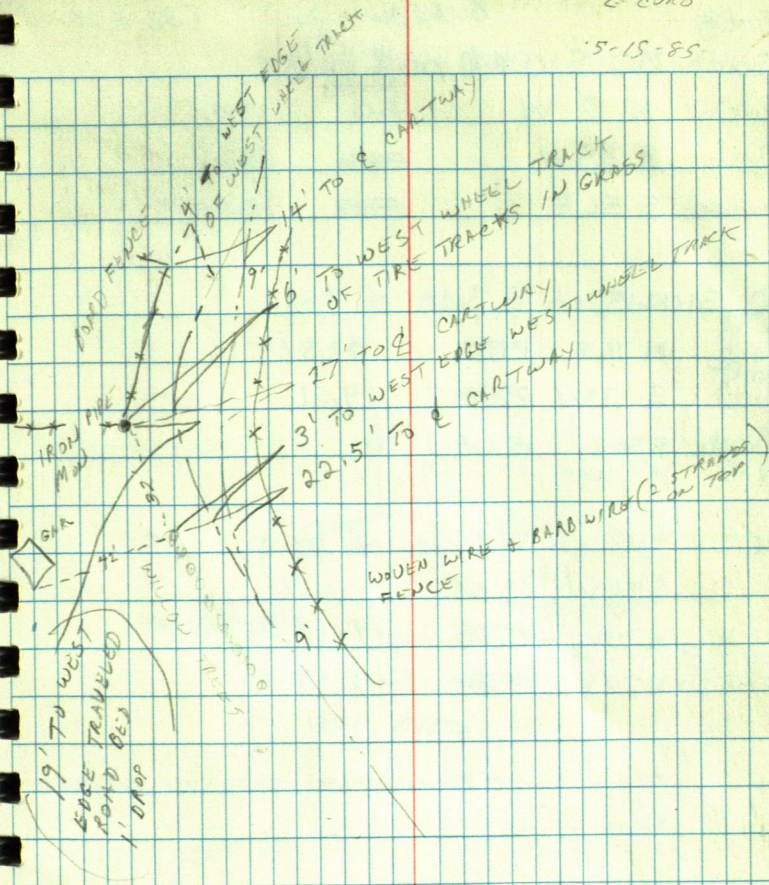
170.97
46
214.92
35
351.97

LARRY SHORT

E. CURIO

5-15-85

4



4-5-88

BURROWS LR

T58 R25

5

South MC S10 ~~W~~ on X $\frac{1}{4}$ line

10" Birch	N 12 W	30.00 30.00	37.12
14" Birch	S 89 W	35.31 35.31	35.31
5" Basswood	S 56 E	37.12	30.00

MC S10 & 15 on E Side of Bay

old BT 7" Birch	N 76 E	14.01 22.51	22.51
old BT 9" Birch	S 17 W	22.51 14.01	14.01
7" Birch	S 50 E	15.64	
S16 N	Y' W 55 Y		

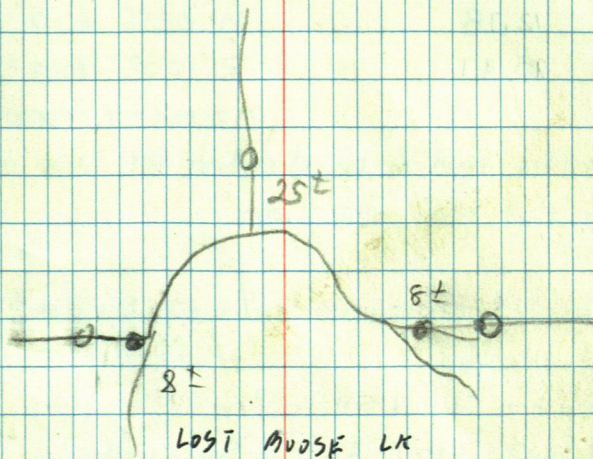
MC S10 & 15 on W Side of Bay

7" Birch	S 58 W	29.65	
8" Birch	N 75 W	41.18	14.14
old BT 9" Birch	N 24 W	14.14 41.18	41.18

SW $\frac{1}{4}$ S11 needs to be stamped, direction, distance, and BT tags made.

S $\frac{1}{16}$ S11 & 12 needs to be stamped, direction, distance, and BT tags made

W $\frac{1}{4}$ S9 & 10 direction



Tom
Mike

BURROWS

4-11-88

W $\frac{1}{16}$ Sec 11 & 14

12" pop 29.23 S 20 W

16" pop 42.16 N 79 W

7" pop 57.47 S 83 E

W $\frac{1}{4}$ Sec 11 & 14

4" pop 12.78

12" pop 25.47

W $\frac{1}{16}$ S11 & 14 need to be direction. BT tags are
put up but need direction

W $\frac{1}{4}$ S11 & 14 same as W $\frac{1}{16}$ of S11 & 14

Line between SW $\frac{1}{16}$ S11 & S $\frac{1}{16}$ S11 & 12 p & p

Line between S10, 11, 14, & 15 & S $\frac{1}{16}$ S11 & 14 p & p

Line between S $\frac{1}{16}$ S11 & 10 and S10, 11, 14, 15 p & p

Line between W $\frac{1}{4}$ S9 & 10 & C $\frac{1}{4}$ S10 p & p

line between S2, 3, 9, 10 & N $\frac{1}{16}$ S10 & 3

Line between S $\frac{1}{16}$ S10 & 15 & ~~SE $\frac{1}{16}$~~ SW $\frac{1}{16}$ S10 ~~p & p~~ ^{not painted} and signed

but is posted and blazed

4/13/88

Tom & Mike
W $\frac{1}{4}$ S9 & 10

~~old BT 5" Birch~~

~~old BT Norway~~

~~old BT 5" Maple~~

7" Birch 8.60

6" Birch 22.50 N

6" Birch 30.21 S

MONUMENT IS LOOSE

4/19/88

Tom
Mike

boards

C 1/16

S11

12" Bass N38W 6.21

7" 1/2" Bass S86E 40.67

16" X Elm N67E 31.60

C 1/4 S11

12" Spruce N62E 65.94

10" Nor N22W 24.50

18" Nor S64W 33.64

4/20/88

C 1/16 S11

8" Pop N42W 37.00

12" Pop S58W 22.57

15" Pop S1E 30.53

4/21/88

Tom
Mike

S 1/16 S11 & 12

10" Birch N84W ~~32.26~~ 31.2610" Maple N73E ~~5.30~~ 4.3016" Pop. S56W ~~8.99~~ 7.99

N 1/16 S1+2

12" Pop S64E 28.94

8" Pop S58W 20.13

6" Spruce N35W 24.52

4/26/82 Torn
F^{1/4} S2435

20" Nor N39E 43'53" 43.48
14" Pop N89E 93'33" 93.31
5" Bass S26E 32'13/4" 32.62
SW^{1/4} S2

8" Pop 13'3" N72E 13.25
10" Pop 35'83/100 N13W 35.70
10" Birch 32'1" S51W 32.08
4/27/82 Torn Mike

NE^{1/4} S2
12" Pop N74W 15'5" 15.50
12" Pop N68E 22'1" 22.08
10" Birch S44E 27'12" 27.04

14" ASP South 2.73

C^{1/4} S2
8" Birch N78W 17'9" 17.75
16" Birch N81E 43'23/4" 43.23
8" Bass N22W 25'23/4" 25.19
4/28/82 Torn Mike

CN^{1/4} S2
10" Birch N15E 39'83/4" 39.68
10" Birch + S24E 12'83/4" 12.73
8" Pop N574W 30'5" 30.42
4/29/82 Torn Mike

CW^{1/4}
12" Birch N6W 11'93/4" 12.81 15.65
14" Pop S41W 15'9" 17.75
5" Bass N58E 29'23/2" 19.21 29.16

BORNDY LK

.083
5.75

415

581

415

.083 7.25

3

249

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8.25

2200

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2.5

415

146

3/16

20.75

18

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5/2/88 Tom

BURROWS

S 11, 12, 13, 414

6 "Tam N 43 W 16' 2" 16.17

8 "Tam S 84 W 15' 2 1/2" 15.21

8 "Tam S 54 E 26' 7" 26.58

10 "Tam N 50 E 27' 8" 27.66

SE 1/6 S 11

6 "Tam S 78 E 25' 7 3/4" 25.64

4 "Tam S 3 E 26' 1/4" 26.02

6 "Tam S 84 W 52' 7 1/2" 52.62

E 1/4 S 11 1/2

16 "Nor S 82 W 57' 2 1/4" 57.19

10 "Pop N 51 W 15' 11 1/4" 15.93

8 "Pop N 39 E 13' 6 1/2" 13.54

5/3/88 Tom

W 1/4 S 9 1/2

8 "Birch S 3 E 30.21

10 "Birch S 53 W 8.60

8 "Birch N 14 W 22.50

10 "Birch N 73 E 8.60

6 "Made S 10 W 17.30

24 "Nor N 62 W 67.50

old Signs

Not RemensORED

S 1/4 S 11 1/2 14

4" Pop N 69 E 12.78

12" Pop S 35 E 25.47

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5/1/88 Tom

3022065

E 1/16 S3542

S 1/16 S241

8" Birch S56W 14' 5" 19.42

10" Birch N32W 23' 2 3/4" 23.23

8" Birch S80E 2' 7" 0" 7.00

CN 1/16 S11

10" Birch S52W 19' 3 1/4" 19.27

12" Pop N21W 22' 3 1/4" 22.27

14" Birch S64E 25' 3 1/2" 25.29

S 1/16 S10+11, check if set & tied out

MC West of Above, check same ← need

E 1/4 S10+11, tie out

~~S 1/16 S10+11, tie out~~

1320'

4'

.083

660'

2'

.083

330'

1'

.415

165'

1/2'

.083

2.75

4.15

5.81

166

22825

.083

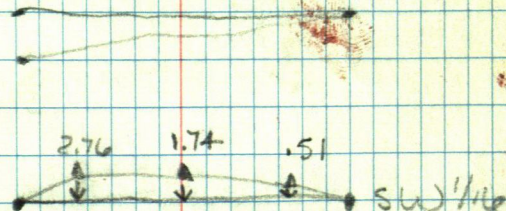
3.25

4.15

166

249

26975



N 1/4 S2435, check if tied out

MC West of S 1/16 S241 what to stamp on

EN 1/16 S10, need to set

SW 1/16 S10, need to set

~~W 1/16 S14+15, tie out~~

~~W 1/4 S11+12, tie out~~

~~S10, 11, 14+15, tie out~~

~~S43, 10+9, check if tied out~~

E 1/16 S10+16, need to set

Tom

BURROWS

5/6/88

59, 10, 14, 15

8 "OAK S31E 33'5³/₄" 33.48

6" maple S38W 42'7" 42.58

8" maple N52W 57'5¹/₄" 57.44

~~W 1/4 S10411~~

SMC SEC 2

4' SPRUCE N 60 W 8.58

.083	.083	.083
5.75	7	5.25
415	.581	415
581		166
415		415
4725		43515

2 1/4 miles to post + paint
4 monuments to set + tie out
Stamp MC West of S 1/4 S 142

6/9/88

T. Kuchefski
T. Fredrickson

12

57-41-31

115-22-45

57-41-31

115-22-54

431.17

115-22-45

115-22-54

431.17

57-41-31

57-41-31

400.02

57-41-14

57-41-23

31.15

S 1/16 10-11

8' RD S 45 E ~~41.57~~ 41.76

8' POP N 66 E 18.54

12' " N 86 W 39.21

P ST. POST 3.5 S 3' W

NO BT TAGS & SIGNS

LN TO CK PRINTED BUT NOT POSTED

SMC W OF S 1/16 510-511

8' DIR N 20 E 18.07

10' DIR N 70 E 16.00

12' POP S 63 E 27.34

SIGN POST 3' E

10' TO WATER

N 1/16 510-11

14' WP ~~N 41 E~~ 57.68 (1978)12' WP ~~S 47 E~~ 54.22 "

18' NP S 41 W 117.72 "

8' STL PD 3' S 3' W

SMC W OF S 1/16 512-51

12' WP N 25 E 38.72

7' MAPLE S 80 E 26.20

30' WP S 60 W 46.90

12' WATE
SIGN POST 3' W

NO BT +

NEED POST SET

+ SIGNS
+ STAMP MON

7/8/88

T. Kucharski
T. FREDRICKSON

15

T @ 8C BS 5 1/4

287.60

89-71-12

327.34

337.335

89-41-42

0-00-02

287.18

1.05
offset

89-17-23

324.87

324.845

90-40-21

328.34

328.317

88-47-12

347.24

349.161

90-36-00

441.33

441.307

92-32-45

189.90

189.712

92-27-09

233.18

233.265

89-65-09

337.62

337.519

VERMILIAN LK

E. L. L. L.
T. KUCHERSKY

16

7-19-80

BIA

SEC 35-62-16

K @ 2 BS 1

0-0-10
180-0-15 58-46-513 58-47-01
235-47-21 58-47-060-0-3
180-0-6 58-46-493 58-46-52
238-47-06 58-47-00

K @ 3 BS 2

0-0-7
180-0-15 100-44-514 100-44-58
280-45-09 100-44-5490-22-15 273.45
87.347 273.44289-32-26 583.98
177.996 583.963

K @ 4 BS 3

0-0-0
180-00-15 52-09-425 52-09-42
232-09-47 52-09-32

90-36-57

94-33-09 129.44
39.455 129.074232-02-29
6 52-02-40 232-02-25

90-59-13

329.63
100.442 329.4820-00-11
180-00-13 52-09-3552-09-46
5 232-09-49 52-09-36232-02-29
6 52-02-46 232-02-18

232-02-33

K @ 5 BS 4

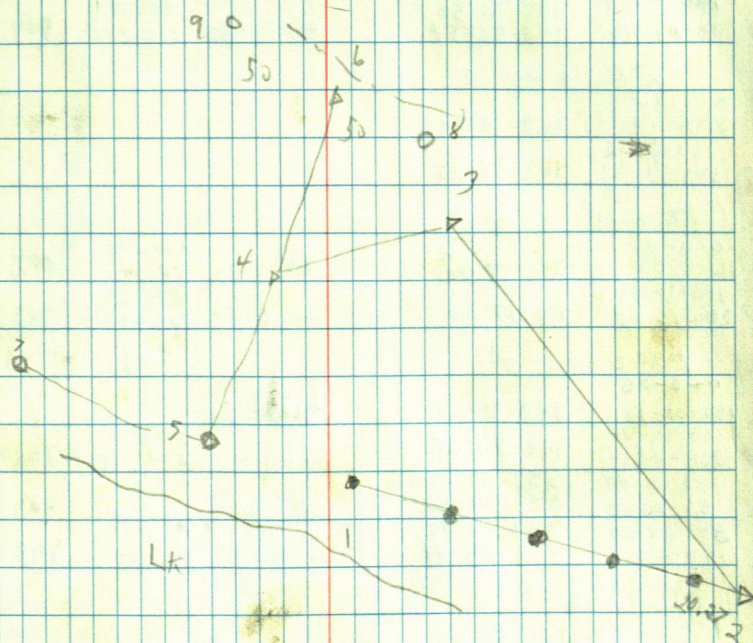
0-00-20
7 301-47-54

100.00

K @ 6 BS 4

5 292-30-00

9 111-05-42



7/20/88

Nett Lake

W. Guro
T. Kuchefski

17

K @ 2 BS 1

0-01-34		90-42-20	410.09	410.061
180-01-52			124.948	
188-23-50	188-22-16		102.81	
8-23-56	188-22-04	87-54-42	31.337	102.742
198-54-27	198-52-53		409.37	
18-54-40	198-52-54	89-30-50	124.726	409.354

K @ 4 BS 2

0-0-34	
180-0-40	163-38-38
163-39-42	
343-39-25	163-38-45

K @ 5 BS 4

0-0-20		89-06-20	177.29	177.271
180-0-30	110-17-25		54.04	
110-17-45			342.69	
290-17-55	110-17-25	89-6-50	104.452	342.648

K @ 7 BS 5

0-0-05		91-08-04		
180-00-18	148-44-31		902.07	
148-44-36	148-44-37	90-51-07	274.949	901.963
338-44-55	233-04-35		503.57	
233-04-40	233-04-42	88-47-04	153.500	503.474
53-05-00	353-24-45		193.92	
353-24-50	353-24-44	91-00-10	59.104	193.885
173-25-02				

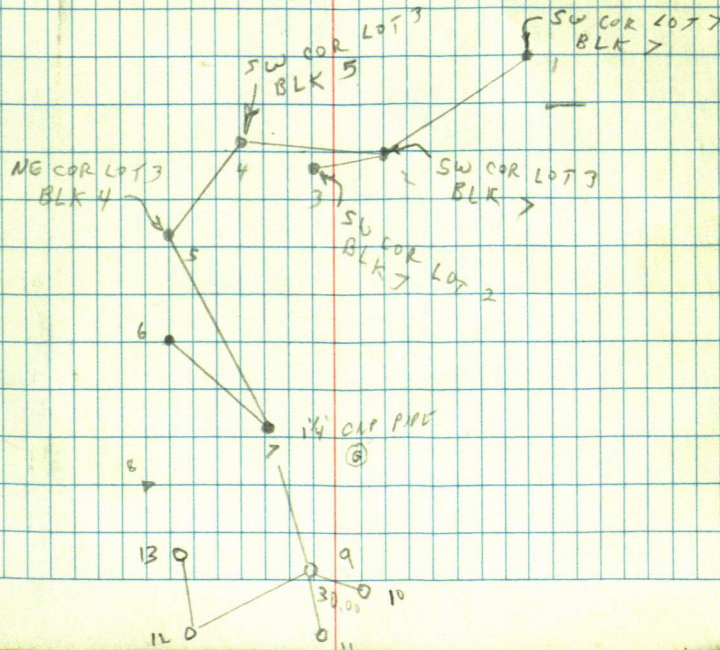
K @ 9 BS 7

0-0-33	105-48-37
120-0-42	

10 105-49-00		90-29-35	30.00	269.699
153-51-27	153-50-54		269.70	
333-51-44	153-51-02		82.211	
207-21-14	207-20-41	91-51-46	141.85	141.776
12 27-21-33	207-20-51		43.237	

K @ 12 BS 9

0-2-54		91-51-46		
13 305-40-46	305-37-52		100.00	



T @ 8 BS >

0-0-20

180-0-25

140-36-58

140-36-36

15 320-27-18 140-36-45

187-28-07

187-27-47

16 7-28-27 187-28-02

94-29-57

194.22

193.62

59.198

241.63

241.026

94-03-42

73.651

T @ 15 BS &

192-42-56

17 35-35-42

192-42-51

94-37-26

137.79

42.062

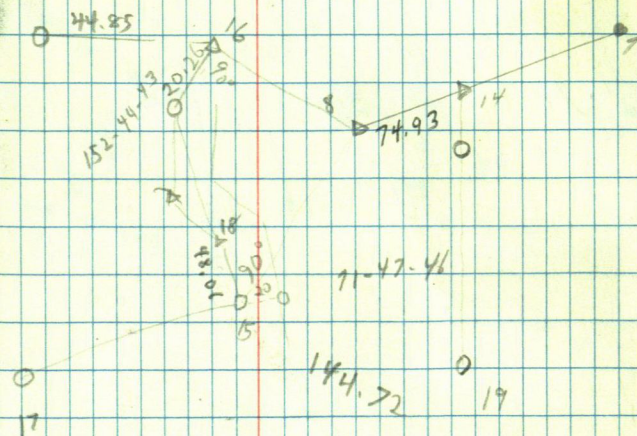
137.544

18 294-29-50

48.06

T @ 14 BS >

19



$\pi @ 20 \text{ BS } 2$

163-15-20

21 326-30-36 163.15-18

$\pi @ 21 \text{ AS } 28$

184-06-09

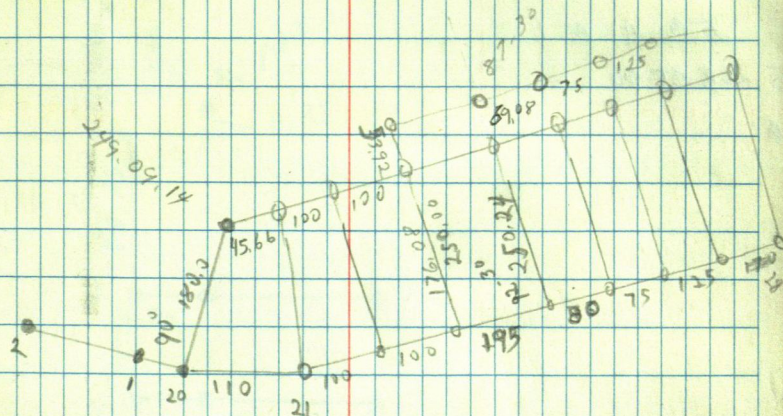
90-16-28

843.74
257.171

843.725
16.27

20 8-12-06 184-06-04

859.99



18.14

232.05 @ 87.25

59.02
75
134.08

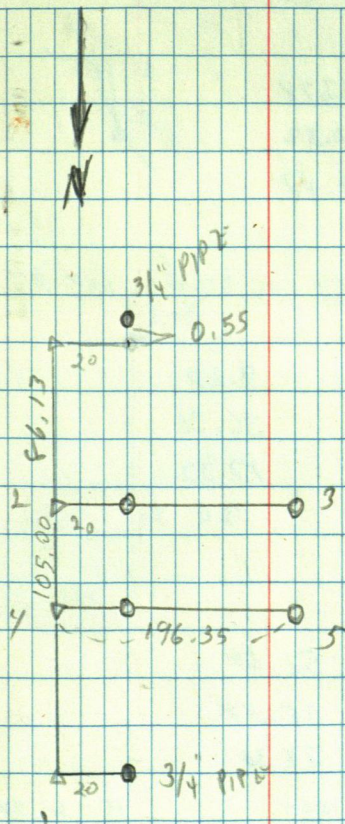
NO 2 BS1

269-45-37

3 179-30-50 269-45-25 89-50-03 196.24 59.61 196.23

NO 4 BS1

5 268-05-00



BURROWS

E 1/16 10-15

11" POP S15 W 23.78

6" POP S60 E 10.52

8" POP N40 E 8.47

8' SIGN POST N 3'

(NO BT'S & SIGNS SET)

SW 1/16 S10

6" MAPLE S25 E 9.27

6" MAPLE N20 E 36.36

6" BIRCH N85 W 17.33

SW 2.2 E 3.0 S0

C1/4 S10

10" POP S70 W 52.69

11" POP N29 E 35.58

5" MAPLE S82 E 29.30

NO BT'S TAGS + NO SIGNS

15' W TO E

8' POST 3' S 3' W

CN 1/16 S10

5" MAPLE S70 E 33.73

5" " N55 W 43.79

6" MAPLE N60 E 23.77

SIGN POST 3' S 3' E

	XMAS	PT RD	
	BS	FS	
BM #1	0.47		
TP	14.17	0.33	ROCK
1+00		13.69	
2+00		5.11	
2+61.83		9.36	
TP	12.35	3.16	3+00
4+00		5.65	
TP	7.93	4.02	5+00
6+00		6.71	
TP	9.42	4.47	7+00
8+00		5.72	
TP	5.99	3.18	9+00
BM #2		3.28	

SEPT. 12, 1989

D. FARNOW - J. WATSON

Cool - SUNNY

22

PI	TIES	
STA		
6+22.19		PI #1
14" JACK PINE	S 16° W	72.48'
8" POPLAR	N 82° W	62.45'
9" POPLAR	N 22° W	39.83
13+04.18		PI #2
17" POPLAR	N 34° E	44.72
14" OAK	N 88° E	43.70
7" OAK	S 19° E	40.97
21+15.82		PI #3
(PULLED OUT BY GRADER - NEEDS TO BE RESET) RESET 11/2/89		
16" OAK	N 10° W	89.71
12" NORWAY PINE	S 85° W	25.40
18" JACK PINE	S 59° W	48.35
34+75.84		PI #4
(NEEDS TO BE SET) FOUND IN PLACE 11/2/89 OK		
18" NORWAY PINE	S 69° E	31.48
12" NORWAY PINE	N 80° E	23.90
20" NORWAY PINE	N 32° E	42.48

STA

41+52.37

PI #5

24" NORWAY PINE S 9° W

49.60.95

12" BIRCH S 75° W

40.80

8" NORWAY PINE N 63° W

49.50

50+63.25

PI #6

8" SPRUCE N 10° W 19.80

10" OAK N 85° E 28.22

18" BALSAM S 2° E 16.67

1/4 CORNER

9" NORWAY PINE N 50° W 76.50

15" JACK PINE N 82° E 52.83

10" NORWAY PINE S 2° E 71.11

PI #7

12" OAK N 74° W 18.0

14" OAK S 70° E 13.52

14" OAK S 79° E 37.89

PI #8

12" POPULAR N 14° W 44.66

14" SPRUCE N 57° W 46.51

12" SPRUCE S 76° W 39.26

USES

SUGAR LAKE

PRTLY CLAY

HUMID

E. CURO
D. FARNUM

24

6-21-89

@ 10 AM SUGAR LK AREA

FIND BLM BT'S @ S¹/₄ SEC 28 DO NOT
DIG UP MON IN RD.

GO TO N¹/₄ FIND MON. AND BLM BT'S
IN CEDAR + TAM. BOG W OF RD 130' ±
CK FOR ORIG. BT'S NO SIGN

WE GO TALK WITH A MR. YODER
HE SHOWS US LOCATION OF WHERE BLM
HAD A MON WHEN HE MOVED IN BUT
THEY LATER MOVED IT HE SHOWS
US THE NEW LOCATION,

DALE + I GO SEARCH SHORE LINE FOR
THE ORIG. BT'S THE ICE IN YEARS
PAST HAS PUSHED THE ORIG. SHORE
LINE UNDER THE PRESENT ICE RIDGE
AS THE TREES ARE GROWING OUT OF THE
BOTTOM OF THE BANK - IN THE LAKE

WE CAREFULLY SEARCH ABOUT
400 FT OF SHORE LINE - FIND A
TACK IN POST WITH FLAGGING ON IT
POSSIBLY BLM TACK - I HAVE SEEN
THEM IN OTHER SURVEYS BY BLM,
WE ALSO FIND REMAINS OF OLD
FENCE @ TACK IN POST BUT IT
DOESN'T GO VERY FAR OR IN ANY
TRACEABLE DIRECTION,

WE QUIT @ 4 PM - TO LATE
TO START TRAV.

HARD RAIN ON WAY TO OFF.

USFS

SUGAR LAKE

TO SUGAR LK @ 10 AM

LOCATE S $\frac{1}{4}$ SEC 28 DIG UP MON
COPPERWELD ROD 1 $\frac{1}{2}$ " TOP

SEARCH FOR R. MAINS TRAV. POINTS
IN ROAD FIND 1 OTHERS SEEM TO BE
GONE MAYBE ROAD GRADER GOT THEM

SET UP NEW TRAV. FROM S $\frac{1}{4}$
TO N $\frac{1}{4}$

A MR. JACOBSON STOPS + SHOWS
US A SCARED SPRUCE TREE THAT BLM
ORIG. MARKED + DESTROYED LATER HE
SHOWS ME WHERE THERE WAS AN
OLD SCRIBED SQUARE STAKE THAT HAD
BEEN THERE FOR YEARS AT LEAST
40 HE SHOWED IT TO THE BLM
CREW + THEY PULLED IT OUT +
SET AN AL. MON IN ITS PLACE
+ MARKED BT'S IN 1976 SURVEY
WE SEARCHED FOR ORIG. BT'S

PARTLY CLOUDY

80° HUMID

E. CURD
F. WATSCHEK 25
6-29-89

BUT NO LUCK. MR. JACOBSON SHOWS
US A PIPE AT THE NE COR OF SEC
28. A 3 $\frac{1}{2}$ " X 3 $\frac{1}{4}$ " CONDUIT STUCK IN
THE GROUND A FEW INCHES HE SAYS
THAT BLM SET AN AL. MON HERE
IN 1976 BUT PULLED IT OUT + MOVED
IT SW 360°

BLM NOTES SAY THEY FOUND ORIG
STUMP HOLES WHERE THEY RESET
MON.

MR. JACOBSON SAYS THAT IN ABOUT
1950 HE LOGGED OFF THE WHOLE
AREA + BULLDOZED THE WHOLE
AREA UP SO THERE IS NO POSSIBLE
WAY BLM COULD HAVE FOUND STUMP
HOLES IN 1983

WE MEASURED OUT @ RECORD BEARING
AND DIST. FROM THE CONDUIT AND MADE
A CAREFULL SEARCH OF THE AREAS BUT
NO LUCK. QUIT @ 4:45 PM

USFS

SUGAR LK

28-143-25

HOT 90°

HUMID

E. CURR
J. WATSCAKE 26
7-5-89

AT SUGAR LK @ 10 AM MEET
CURT KRAUSE & GARY WE GO TO
N¹/₄ LOOK @ DOWNED TREE THAT
BLM CALLED ORIG. BT. IT IS NOT
THE RIGHT KIND OF TREE, CALLED
FOR AND THERE IS A 10" JAM GROW-
ING WHERE THE NOTES CALL FOR A
SPRUCE

WE GO TO BLM 1983 NE COR AND
PULL BRNG & DIST + SEARCH FOR
THE STUMP HOLDS BLM SAYS
THEY FOUND BUT IN DIGGING DOWN
IN THOSE SPOTS WE CAN'T FIND
ANY ROTTED WOOD OF ANY KIND S.
WE GIVE UP HERE + GO BK TO N¹/₄
AREA.

A LAND OWNER ON VERMILLION LK STOPS
HE SHOWS US W¹/₄ COR. THERE IS
TWO OTHER PIPE IN AREA WE PULL
ORIG. BT CALLS BUT FIND NOTHING.

I WILL HAVE TO TALK WITH MIKE H.

JIM + I GO AND RECHECK N SHORE
OF SUGAR LK FOR MC -28-27
I BELIEVE ICE TOOK OUT EVERY
THING ON ORIG. SHORE. WE LOOK
WEST FROM BLM'S TACK WHICH
IS ON E SIDE OF A SWAMPY AREA
+ ON THE WEST SIDE - ABOUT 120 FT
± FROM BLM TACK THERE IS A
BIG HILL SO THERE IS NO WAY THE
ORIG. SURVEYOR COULD HAVE WENT
10 CH. WEST FROM THIS POINT.

CORNER SEARCH

USFS

TERRY FREEMAN + I DIG OUT CORPS.
NOTES ON VERMILION LH AT COURT
HOUSE FIND GARY STEVENSON'S + TERRY'S
WORK SHEET ON THE SURVEY BY
THE CORP. OF ENGINEERS, IN 1900
THIS IS WHERE BLM GOT THE
INFORMATION ON THE BT'S THAT
THE CORP. FOUND IN 1900. THEY
DIDN'T FIND ANYTHING IN 1983
THEY JUST DON'T SAY SO.

I FIND IN RESEARCHING MY OLD
FIELD BOOKS OF MY GRANDFATHERS
WHERE DONNER - A SURVEYOR
WHO WORKED FOR MY GRANDFATHER
FOUND THE N¹/₄ OF SEC 21, HE
TRAV. SOUTH ON E OF 21 + LOOKED
FOR N¹/₄ 28 BUT DIDN'T FIND IT
HE CONTINUED SOUTH TO S¹/₄ OF
28 WHICH HE FOUND. HE THEN
SET A SQUARE-SCRIBED POST
ON LINE BETWEEN THE N¹/₄ 21
+ S¹/₄ 28 AT MIDPOINT AND

E. CURRO

27

JULY 10-89

CALLED IT THE N¹/₄ 28, THIS
IS WHERE THE OLD SCRIBED STAKE
AT THE N¹/₄ 28 CAME FROM +
WAS NOT SET BY PROPER SURVEY
METHODS FOR ESTABLISHING A
1/4 COR. SO IT CAN'T BE ACCEPTED
FOR THE N¹/₄ 28.

Bushy (Gutter) S.R. Hartell

6019 York Ave North

Minneapolis, Minn

55429

Jul. (612) 561-8319.

566-8855

Rm 166

110

100

100

200

25

75

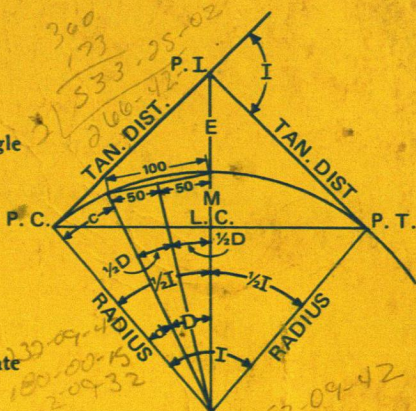
125

171

533-5900

CURVE FORMULAE

D=Degree of Curve
 1°=1-Degree of Curve
 2°=2-Degree of Curve
 P.C.=Point of Curve
 P.T.=Point of Tangent
 P.I.=Point of Intersection
 I=Intersection of Angle, Angle
 Between Two Tangents
 L=Length of Curve,
 from P.C. to P.T.
 T=Tangent Distance
 E=External Distance
 R=Radius
 L.C.=Length of Chord
 M=Length of Middle Ordinate
 c=Length of Sub-Chord
 d=Angle of Sub-Chord



$$R = \frac{L.C.}{2 \sin^{1/2} I}, T = R \tan^{1/2} I = \frac{L.C.}{2 \cos^{1/2} I}$$

$$\frac{L.C.}{2} = R \sin \frac{I}{2}, D 1^\circ = R = 5730, D 2^\circ = \frac{5730}{2}, D = \frac{5730}{R}$$

$$M = R (1 - \cos^{1/2} I), = R - R \cos \frac{I}{2}$$

$$\frac{E + R}{R} = \sec \frac{I}{2}, \frac{R - M}{R} = \cos \frac{I}{2}$$

$$c = 2 R \sin^{1/2} d, d = \frac{c}{2 R}$$

$$L.C. = 2 R \sin^{1/2} I, E = R (\sec^{1/2} I - 1), = R \sec \frac{I}{2} - R$$

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	1.0000

Inches in Decimals of a Foot

$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729
1	2	3	4	5	6	7	8	9	10	11
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167