

Considered: _____

WATER PERMIT NO. 5470-3

Phone: 303 236-5321

Name of Applicant: U.S. Fish and Wildlife Service

Post Office Address: PO Box 25486, Denver Federal Center, Denver CO 80225

Amount of Water Claimed: 65 acre-feet Total Acres: NA

Source of Water Supply: Unnamed Tributary-Big Slough, Tributary to Bois Des Sioux R.

Water to be used for: waterfowl production County: Roberts

About 5 miles North of New Effington

PROOF OF PUBLICATION: Received _____ Not Received _____

APPLICATION: Approved _____ Subject to _____

F.F.& C/.L. Adopted _____ Not Approved _____ Deferred _____

PRIORITY Date Received: 8-27-90 Fee: \$150 Remarks _____

Corrected Application Received 9-4-90 Period of Annual Use Jan 1 - Dec 31

WATER QUALITY APPROVAL RECEIVED NA APPROVED/CONDITIONAL (Circle one)

WI-1 Description same as Application YES _____ NO _____ REMARKS _____

Diversion Point: NE 1/4 SW 1/4 28-129-50

Land to be Irrigated: NA

		28			

Well Log: Driller: NA Licensed YES _____ NO _____

Depth of Well: _____ REMARKS _____

Type of Map: topo PREPARED BY: William A Godby Reviewed and the Number

Assigned on 9-13-90 By Karen Schlaak

Pub Day - Wed

 Mail to: Water Rights Div.
 DWNR, Foss Bldg.
 Pierre, SD 57501
 (605) 773-3352

67

No. 5470-3	Hydrologic Unit 09020101
Map No. _____	Basin Minn - Whetstone
Newspaper Rosholt Review, Box 136	57260

NAVRATIL WPA

Application For Permit To Appropriate Water Within The State Of South Dakota

Check use of water: Industrial ☐ Commercial ☐ Municipal ☐ Other Common Distribution System ☐
 Rural Water System ☐ Suburban Housing ☐ Geothermal Heat ☐ Institutional ☐ Recreational ☐
 Domestic ☐ (above 18gpm) Other ☒

Type of Application: Check one or more of the following


 New ☒ Vested Right ☐ Future Use ☐ Change Use ☐
☐ Amend Permit No. _____ with old priority date retained

☐ Change diversion point(s) ☐ Add diversion point(s) ☐ Other ☐
☐ Application to: Change diversion point(s) ☐ Add diversion point(s) ☐ on Permit No. _____

☐ Construction to use water reserved by Future Use Permit No. _____

United States of America

 1. Name of Applicant Fish and Wildlife Service Phone No. (303) 236-5321

 Post Office Address P.O. Box 25486, Denver Federal Center, Denver State Colorado 80225
 (Street, RR or Box) Zip Code

 2. Amount of water claimed (c.f.s.) 65 acre-feet (33 AF storage plus 32 AF seasonal use)

 3. Source of water supply Unnamed Tributary - Big Slough, Tributary to Bois Des Sioux River

 4. Location of point of diversion SE 1/4 NE 1/4 SW 1/4 Section 28, T129N R50W

 _____ County Roberts

 5. Counties where water will be used Roberts

 6. Annual period during which water is to be used January 1 - December 31

7. Give a brief description of proposed project. When available include any preliminary engineering report or other reports or information that will help explain the project. (Attach sheet if more space is needed)

Ducks Unlimited and the Fish and Wildlife Service will construct a small dam to impound 33 acre-feet to enhance an existing wetland for waterfowl production purposes. Engineering drawings detailing the project are attached.

Attachments: Attach Form 2A if diversion from a well or dugout, or if storage of water, is proposed. Attach map (see instruction)

STATE OF ~~SOUTH DAKOTA~~ ^{SS} Colorado
 County of Jefferson

I, John L. Spinks, Jr. the applicant, certify that I have read the foregoing application, have examined the attached map and that the matters therein stated are true and that I intend, and am able to complete the necessary construction.

Signed

REGIONAL DIRECTOR

 Subscribed and sworn to before me this 20th day of August 1990
Susan E. Craddock
 Notary Public (or other qualified officer)

My Commission Expires Aug 5, 1993

**SOUTH DAKOTA
WATER PERMIT No. 5470-3**

Date of first receipt of application August 27, 1990.

Date of return to applicant for corrections, amendments or changes
August 27, 1990.

Date of receipt of corrected application September 4, 1990.

The Water Management Board approved Water Permit Application No. 5470-3 on December 5, 1990 for U.S. Fish and Wildlife Service, P.O. Box 25486, Denver Federal Center, Denver, CO 80225 authorizing the construction of the water use system and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 5470-3 appropriates and authorizes impoundment of up to 65 acre-feet of water annually by construction a dam (33 acre feet in storage) in the Navratil Waterfowl Production Area. The dam site is to be located in the NE1/4 SW1/4 Section 28 T129N, R50W.
2. The water appropriated shall be used for the purpose of providing waterfowl production and may not exceed the amount of water needed for beneficial use for wildlife propagation purposes.
3. The water is to be used during the following described annual period: January 1 - December 31.
4. The date from which applicant may claim right is August 27, 1990.
5. One-fifth of the construction is to be completed on or before June 5, 1993.
6. All construction is to be completed on or before December 5, 1995.
7. Water is to be put to beneficial use on or before December 5, 1999.
8. Water rights obtained in compliance with the laws of the State of South Dakota may not be unlawfully impaired by this appropriation.

WATER MANAGEMENT BOARD

By: _____

John H. H. H.
Chief Engineer, Water Rights Division
Department of Water and Natural Resources

MAR 25 1991

(date)

Supplemental Information

(type or print in ink)

1. Well Information - Proposed construction

- a) Drill Hole Diameter _____ Depth _____
- b) Casing Type _____ Diameter _____ Thickness _____
- c) Screen Type _____ Diameter _____ Thickness _____
- d) Gravel Pack Thickness _____ Length of Gravel Pack _____
- e) Depth to Top of Water Bearing Material _____
- f) Depth of Water (ground surface to water level) _____
- g) Distance to nearest existing domestic well:
- On applicants property _____ On property owned by others _____

2. Dugout Information Estimates

- a) Surface Dimensions _____ Depth _____
- b) Depth to water (ground surface to water level) _____

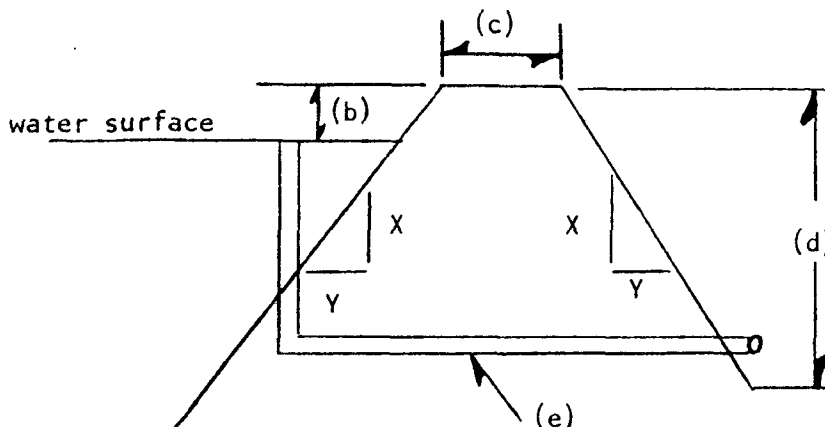
3. Water Storage Dams

If the proposed water use system contains one or more storage dams, please furnish the information requested below. The locations of each dam should be shown on the map submitted with the application.

- a) If a private engineering firm or government agency was involved in the design of this dam please give their name and address

Ducks Unlimited, Inc.
6115 East Main Avenue
Bismarck, ND 58501

- b) Freeboard 5 feet
- c) Crest Width 12 feet
 Crest Length 374 feet
- d) Height 8 feet
- e) Outlet Dimensions:
 Pipe diameter 48 inches
 Spillway width 80 feet
- f) X & Y Slope
 Upstream 3:1
 Downstream 3:1



Surface Area of Impoundment 13.5 acres

Storage 33.0 acre feet

Drainage area above dam 5.8 sq. miles

Signature of Applicant

REGIONAL DIRECTOR



Water Flood Application No. 120-000-2

Flooded Area in National WPA

Checkered Area - Taken From Site Plan top map submitted by DA

Elevation	Digitized Area (Acres)	L.H.	Sheet No. 2 Average	Sheet No. 2 L.H.	Total (Ac-FT)
1081.5	0	0	0.0	0.0	0.0
1082.0	0.57	0.5	2.18	2.15	0.5 0.10
1083.0	3.76	1.0	6.94	2.18	1.95 2.05
1084.0	10.12	2.0	11.63	6.74	6.68 9.27
1085.0	1.95	1.0	11.63	11.03	11.01 20.20
1086.0	13.57	1.0	11.63	12.74	12.74 32.45
1087.0	15.25	1.0	11.63	14.41	14.41 46.89
1088.0	16.93	1.0	11.63	16.15	16.15 63.02
1089.0	18.61	1.0	11.63	17.87	17.87 80.58
1090.0	20.29	1.0	11.63	19.59	19.59 99.74
1091.0	21.98	1.0	11.63	21.12	21.11 121.05

* Calculated values match Sheet No. 2 values, accept area-capacity data

Method A: Average Area Method Method B: Formula method

$$V_{avg} = \frac{A_1 + A_2}{2} \times L.H.$$

$$V_{form} = \left[\frac{(A_1 + A_2) + \sqrt{A_1 A_2}}{3} \right] \times L.H.$$

where A_1 = area in ft²

A_2 = area in ft²

L.H. = change in height

FEL = Full storage level = 1086.0 ft

- 1086.0 ft storage = 33% size increase

Top of Dam = 1086.0 ft

- 1086.0 ft storage = 121 → 121.7 acres ft

Emergency Spilling crest = 1082.0 ft

Low level Drawdown = 1082.0 ft (20' drop)

Drainage Basin Area = 3,457 acres ± 5.7 mi² (Digitized from USGS Quad maps)

Subsided Basin Area = 5.2 mi²

Drainage Basin = 3.2 mi²

Determinative Design Flood - use design flood

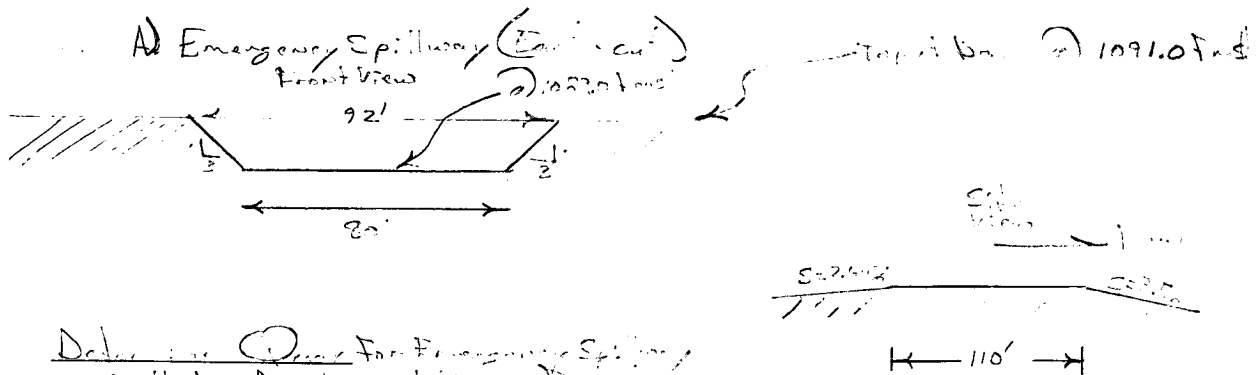
Drainage Area = 5.7 mi², Channel = 20.8 ft/mi, Soil index = 3.33 inches (see point out for minimum design flood)

Category 3 dam - design flood 7450 = 1082.0 ft → 25 year frequency = design flood
intermediate storage = 33 acres ft, effective height = 1089.0 - 1081.5 = 7.5

Downstream discharge capacity of L.A.

Consists of two outlet facilities

- A. Emergency Spillway (Earth cut)
- B. CMP through embankment



Downstream Capacity For Emergency Spillway
Method: Broad crest channel Formula

$$Q = CLH^{3/2}$$

where: C = Discharge Coef. ≈ 3.06
 L = Length of weir
 H = Head (ft)
 $L_{\text{weir}} = 864'$
 $H = 2.01'$

$$Q = 3.06(864)(2.01)^{3/2} = 744 \text{ cfs}$$

B) Determining Downstream Capacity of CMP. Study is being done to determine if the CMP can be used as a spillway. Emergency spillway capacity is being determined for the CMP.

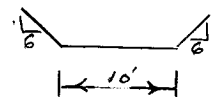
Check downstream channel capacity

Method: VSC (Velocity-Slope-Cross-section)

Assumptions

Manning's $n = 0.035$, Slope = 0.002 (Top map), Trapezoidal shape (not to scale)

See printout for results



5470-3 Victim's Wife's Name: [illegible]

September 25, 1992

3/3

Review of [illegible]
Plans and Specifications

[Signature]

74:02:08:09 Safety, [illegible]

- (1) Topo map? yes
- (2) [illegible] yes
- (3) X-section? yes
- (4) Area Cap? [illegible] yes
- (5) [illegible] yes
- (6) [illegible] yes
- (7) [illegible] yes
- (8) [illegible]

At [illegible] [illegible] [illegible] [illegible] [illegible]

RUN
Hello, this program estimates peak discharges and runoff volumes for 2, 5, 10, 25, 50, and 100 year floods based upon equations specified in USGS publication: Techniques for Estimating Flood Peaks Volumes, and Hydrographs on Small Streams, September 1980, Water Resources Investigations 80-80. Input data needed to run this program are: drainage basin size (sq. mi.), soil infiltration index (see Figure 13 in publication), and main channel slope in feet per mile.

9/17/90
D. Brown
Page No. 1

THIS SIDE UP

WHAT IS THE DRAINAGE BASIN NAME?
? WPA 5470-3
ENTER THE DRAINAGE BASIN AREA (SQ. MI.)
? 5.7
ENTER THE SOIL INFILTRATION INDEX FROM FIGURE 13
? 13.33
DO YOU WISH TO DETERMINE THE PEAK DISCHARGE? (Y/N)
? Y
ENTER SLOPE ALONG MAIN CHANNEL (FT/MILE)
? 20.8

THE ESTIMATED PEAK DISCHARGE FOR 2, 5, 10, 25, 50, AND 100 YEAR FLOODS FOR WPA 5470-3 DRAINAGE ARE:

Q2 = 46.0329 CFS
Q5 = 124.0718 CFS
Q10 = 215.4159 CFS
Q25 = 378.8602 CFS
Q50 = 542.1867 CFS
Q100 = 738.1831 CFS

THE ESTIMATED RUNOFF VOLUME FOR 2, 5, 10, 25, 50, AND 100 YEARS FLOODS FOR WPA 5470-3 DRAINAGE ARE:

V2 = 55.68866 ACRE-Feet
V5 = 101.7776 ACRE-Feet
V10 = 144.893 ACRE-Feet
V25 = 219.5457 ACRE-Feet
V50 = 289.0563 ACRE-Feet
V100 = 374.7115 ACRE-Feet

THE ACCURACY OF THE ESTIMATED PEAK DISCHARGES AND RUNOFF VOLUMES ARE SUBJECT TO THE LIMITATIONS AS SPECIFIED IN THE ABOVE USGS PUBLICATION

Peak-discharge relation	Standard error of estimate (%) Average Range	Runoff volume relation	Standard error of estimate (%) Average Range
Q2	106 (+152,-60)	V2	96 (+136,-58)
Q10	90 (+124,-55)	V10	92 (+128,-56)
Q25	90 (+125,-56)	V25	90 (+125,-56)
Q50	93 (+130,-56)	V50	89 (+123,-55)
Q100	98 (+139,-58)	V100	89 (+123,-55)

DO YOU WISH TO GENERATE A SYNTHETIC HYDROGRAPH FOR WPA 5470-3 DRAINAGE BASIN? (Y/N).
? Y

ENTER THE NUMERICAL FLOODING FREQUENCY, i.e. for a 25 year flood enter the value 25.0
? 2

THE 2 YEAR SYNTHETIC HYDROGRAPH FOR THE WPA 5470-3 DRAINAGE IS AS FOLLOWS:

TIME (MINUTES)	DISCHARGE (CFS)
0	0
162.9907	4.296404
271.6511	9.973794
380.3116	19.18037
543.3023	37.59353
597.6325	43.73125
651.9626	46.0329
706.293	45.26568
760.6231	42.19683
815.044	39.15417

THIS SIDE UP

1249.595 17.64595
1629.907 9.206579
2173.209 3.989518
2716.511 1.53443
3259.814 .3836075
3803.116 0

DO YOU WISH TO GENERATE ANOTHER SYNTHETIC HYDROGRAPH? (Y/N)
? Y
ENTER THE NUMERICAL FLOODING FREQUENCY, i.e. for a 25 year
flood enter the value 25.0
? 5

THE 5 YEAR SYNTHETIC HYDROGRAPH FOR THE WPA 5470-3
DRAINAGE IS AS FOLLOWS:

TIME (MINUTES)	DISCHARGE (CFS)
0	0
110.5206	11.58004
184.201	26.88223
257.8815	51.6966
368.4021	101.3253
405.2423	117.8582
442.0825	124.0718
478.9227	122.004
515.7629	113.7325
663.1237	78.57882
847.3247	47.56087
1105.206	24.81437
1473.608	10.75289
1842.01	4.135728
2210.412	1.033932
2578.815	0

DO YOU WISH TO GENERATE ANOTHER SYNTHETIC HYDROGRAPH? (Y/N)
? Y
ENTER THE NUMERICAL FLOODING FREQUENCY, i.e. for a 25 year
flood enter the value 25.0
? 10

THE 10 YEAR SYNTHETIC HYDROGRAPH FOR THE WPA 5470-3
DRAINAGE IS AS FOLLOWS:

TIME (MINUTES)	DISCHARGE (CFS)
0	0
90.6221	20.10548
151.0368	46.67343
211.4516	89.7566
302.0737	175.9229
332.281	204.6451
362.4884	215.4159
392.6958	211.8256
422.9032	197.4645
543.7326	136.43
694.7695	82.57608
906.221	43.08317
1208.295	18.66937
1510.368	7.180528
1812.442	1.795132
2114.516	0

DO YOU WISH TO GENERATE ANOTHER SYNTHETIC HYDROGRAPH? (Y/N)
? Y
ENTER THE NUMERICAL FLOODING FREQUENCY, i.e. for a 25 year
flood enter the value 25.0
? 25

THE 25 YEAR SYNTHETIC HYDROGRAPH FOR THE WPA 5470-3
DRAINAGE IS AS FOLLOWS:

TIME (MINUTES)	DISCHARGE (CFS)
0	0
78.0747	75.76022

THIS SIDE UP

130.1245	82.08638
182.1743	157.2584
260.249	309.4025
286.2739	359.9172
312.2988	378.8602
338.3237	372.5459
364.3486	347.2885
468.4482	239.9448
598.5726	145.2298
780.747	75.77205
1040.996	32.83455
1301.245	12.62867
1561.494	3.157169
1821.743	0

DO YOU WISH TO GENERATE ANOTHER SYNTHETIC HYDROGRAPH? (Y/N)
 ? Y
 ENTER THE NUMERICAL FLOODING FREQUENCY, i.e. for a 25 year
 flood enter the value 25.0
 ? 50

THE 50 YEAR SYNTHETIC HYDROGRAPH FOR THE WPA 5470-3
 DRAINAGE IS AS FOLLOWS:

TIME (MINUTES)	DISCHARGE (CFS)
0	0
71.82867	50.60409
119.7144	117.4738
167.6002	225.9111
239.4289	442.7858
263.3718	515.0774
287.3147	542.1866
311.2576	533.1502
335.2005	497.0045
430.972	343.3849
550.6864	207.8382
718.2866	108.4373
957.7155	46.98951
1197.144	18.07289
1436.573	4.518223
1676.002	0

DO YOU WISH TO GENERATE ANOTHER SYNTHETIC HYDROGRAPH? (Y/N)
 ? Y
 ENTER THE NUMERICAL FLOODING FREQUENCY, i.e. for a 25 year
 flood enter the value 25.0
 ? 100

THE 100 YEAR SYNTHETIC HYDROGRAPH FOR THE WPA 5470-3
 DRAINAGE IS AS FOLLOWS:

TIME (MINUTES)	DISCHARGE (CFS)
0	0
68.39073	68.89709
113.9845	159.9397
159.5784	307.5763
227.9691	602.8496
250.766	701.274
273.5629	738.1831
296.3598	725.8801
319.1567	676.6679
410.3443	467.516
524.3289	282.9702
683.9073	147.6366
911.8763	63.97587
1139.845	24.60611
1367.815	6.151526
1595.784	0

DO YOU WISH TO GENERATE ANOTHER SYNTHETIC HYDROGRAPH? (Y/N)
 ? N

IF YOU WISH TO RUN THIS PROGRAM AGAIN, TYPE RUN.
 HAVE A NICE DAY!

THIS SIDE UP

RUN
Hello, this program estimates peak discharges and runoff volumes for 2, 5, 10, 25, 50, and 100 year floods based upon equations specified in USGS publication: Techniques for Estimating Flood Peaks Volumes, and Hydrographs on Small Streams, September 1980, Water Resources Investigations 80-80. Input data needed to run this program are: drainage basin size (sq. mi.), soil infiltration index (see Figure 13 in publication), and main channel slope in feet per mile.

9/17/90
David
Brown

Page No. 4

WHAT IS THE DRAINAGE BASIN NAME?

? WPA 5470-3

ENTER THE DRAINAGE BASIN AREA (SQ. MI.)

? 5.7

ENTER THE SOIL INFILTRATION INDEX FROM FIGURE 13

? 3.33

DO YOU WISH TO DETERMINE THE PEAK DISCHARGE? (Y/N)

? Y

ENTER SLOPE ALONG MAIN CHANNEL (FT/MILE)

? 10

THE ESTIMATED PEAK DISCHARGE FOR 2, 5, 10, 25, 50, AND 100 YEAR FLOODS FOR WPA 5470-3 DRAINAGE ARE:

Q2 = 33.35189 CFS
Q5 = 91.21927 CFS
Q10 = 157.221 CFS
Q25 = 274.4929 CFS
Q50 = 389.9604 CFS
Q100 = 527.0539 CFS

THE ESTIMATED RUNOFF VOLUME FOR 2, 5, 10, 25, 50, AND 100 YEARS FLOODS FOR WPA 5470-3 DRAINAGE ARE:

V2 = 55.68866 ACRE-Feet
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Q10	90 (+124, -53)	V10	92 (+128, -56)
Q25	90 (+125, -56)	V25	90 (+125, -56)
Q50	93 (+130, -56)	V50	89 (+123, -55)
Q100	98 (+139, -58)	V100	89 (+123, -55)

DO YOU WISH TO GENERATE A SYNTHETIC HYDROGRAPH FOR WPA 5470-3 DRAINAGE BASIN? (Y/N).

? N

IF YOU WISH TO RUN THIS PROGRAM AGAIN, TYPE RUN.

HAVE A NICE DAY!

OK

Adjusted
For
Pointing

THIS SIDE UP

THIS SIDE UP

THIS SIDE UP

THIS SIDE UP

RUN
THIS PROGRAM CALCULATES THE DISCHARGE FROM A TRAPAZODIAL
SPILLWAY WHEN THE SLOPE, FLOW DEPTH, SIDE SLOPES, AND
THE BOTTOM WIDTH ARE KNOWN.
WHAT IS THE DAM NAME?
? 5470-3

WHAT IS THE SIDE SLOPE X:Y WITH Y=1?
? 6

WHAT IS THE BOTTOM WIDTH OF THE SPILLWAY?
? 10

WHAT IS THE SLOPE OF THE SPILLWAY CHANNEL?
? 1.002

WHAT IS THE MANNINGS N?
? 1.035

WHAT IS THE DEPTH OF FLOW?
? 1

DO YOU WISH THIS ROUTED TO THE PRINTER?
? Y

manning's n= .035

velocity= 1.528228

flow= 24.45165 cfs

5470-3

FLOW DEPTH= 1 FT

AREA= 16 FT^2

WETTED PERIMETER= 22.16552

HYDRAULIC RADIUS= .7218418

MANNINGS N= .035

VELOCITY= 1.528228 FT/SEC

FLOW= 24.45165 CFS

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?
? Y

BACKWATER ANALYSIS INDICATES AN ENTRANCE WATER

DEPTH OF 1.036265 FEET

DO YOU WISH ANOTHER CALULATION VARYING ONLY FLOW DEPTH?
? Y

WHAT IS THE DEPTH OF FLOW?
? 2

DO YOU WISH THIS ROUTED TO THE PRINTER?
? Y

manning's n= .035

velocity= 2.239947

flow= 98.55766 cfs

5470-3

FLOW DEPTH= 2 FT

AREA= 44 FT^2

WETTED PERIMETER= 34.33104

HYDRAULIC RADIUS= 1.281639

MANNINGS N= .035

VELOCITY= 2.239947 FT/SEC

FLOW= 98.55766 CFS

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?
? Y

BACKWATER ANALYSIS INDICATES AN ENTRANCE WATER

DEPTH OF 2.077909 FEET

DO YOU WISH ANOTHER CALULATION VARYING ONLY FLOW DEPTH?
? Y

WHAT IS THE DEPTH OF FLOW?
? 3

DO YOU WISH THIS ROUTED TO THE PRINTER?
? Y

manning's n= .035

velocity= 2.815357

flow= 236.49 cfs

5470-3

FLOW DEPTH= 3 FT

AREA= 84 FT^2

WETTED PERIMETER= 46.49658

HYDRAULIC RADIUS= 1.806585

MANNINGS N= .035

VELOCITY= 2.815357 FT/SEC

FLOW= 236.49 CFS

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?
? Y

BACKWATER ANALYSIS INDICATES AN ENTRANCE WATER

DEPTH OF 3.123078 FEET

DO YOU WISH ANOTHER CALULATION VARYING ONLY FLOW DEPTH?
? Y

WHAT IS THE DEPTH OF FLOW?
? 4

DO YOU WISH THIS ROUTED TO THE PRINTER?
? Y

manning's n= .035

velocity= 3.324119

THIS SIDE UP

THIS SIDE UP

5470-3
FLOW DEPTH= 4 FT
AREA= 136 FT^2
WETTED PERIMETER= 58.6621
HYDRAULIC RADIUS= 2.318362
MANNINGS N= .035
VELOCITY= 3.324119 FT/SEC
FLOW= 452.0802 CFS
DO YOU WANT A BACKWATER ANALYSIS COMPUTED?
? Y
BACKWATER ANALYSIS INDICATES AN ENTRANCE WATER
DEPTH OF 4.17158 FEET

DO YOU WISH ANOTHER CALCULATION VARYING ONLY FLOW DEPTH?
? Y
WHAT IS THE DEPTH OF FLOW?

? 5
DO YOU WISH THIS ROUTED TO THE PRINTER?
? Y

manning's n= .035
velocity= 3.790676
flow= 758.1353 cfs

5470-3
FLOW DEPTH= 5 FT
AREA= 200 FT^2
WETTED PERIMETER= 70.82763
HYDRAULIC RADIUS= 2.823757
MANNINGS N= .035
VELOCITY= 3.790676 FT/SEC
FLOW= 758.1353 CFS

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?
? N

DO YOU WISH ANOTHER CALCULATION VARYING ONLY FLOW DEPTH?
? N

OK
RUN

THIS PROGRAM CALCULATES THE DISCHARGE FROM A TRAPAZODIAL
SPILLWAY WHEN THE SLOPE, FLOW DEPTH, SIDE SLOPES, AND
THE BOTTOM WIDTH ARE KNOWN.

WHAT IS THE DAM NAME?

? 5470-3
WHAT IS THE SIDE SLOPE X:Y WITH Y=1?

? 6
WHAT IS THE BOTTOM WIDTH OF THE SPILLWAY?

? 20
WHAT IS THE SLOPE OF THE SPILLWAY CHANNEL?

? .002
WHAT IS THE MANNINGS N?

? .035
WHAT IS THE DEPTH OF FLOW?

? 1
DO YOU WISH THIS ROUTED TO THE PRINTER?

? Y
manning's n= .035
velocity= 1.647843
flow= 42.84393 cfs

5470-3
FLOW DEPTH= 1 FT
AREA= 26 FT^2
WETTED PERIMETER= 32.16552
HYDRAULIC RADIUS= .8083189
MANNINGS N= .035
VELOCITY= 1.647843 FT/SEC
FLOW= 42.84393 CFS

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?
? Y

BACKWATER ANALYSIS INDICATES AN ENTRANCE WATER
DEPTH OF 1.042164 FEET

DO YOU WISH ANOTHER CALCULATION VARYING ONLY FLOW DEPTH?

? Y
WHAT IS THE DEPTH OF FLOW?

? 2
DO YOU WISH THIS ROUTED TO THE PRINTER?

? Y
manning's n= .035
velocity= 2.42479
flow= 155.1866 cfs

5470-3
FLOW DEPTH= 2 FT
AREA= 64 FT^2
WETTED PERIMETER= 44.33105
HYDRAULIC RADIUS= 1.443684
MANNINGS N= .035
VELOCITY= 2.42479 FT/SEC
FLOW= 155.1866 CFS

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?

Page No. 7

THIS SIDE UP

THIS SIDE UP

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?

? Y.
BACKWATER ANALYSIS INDICATES AN ENTRANCE WATER
DEPTH OF 2.091298 FEET

DO YOU WISH ANOTHER CALCULATION VARYING ONLY FLOW DEPTH?

? Y
WHAT IS THE DEPTH OF FLOW?

? 3
DO YOU WISH THIS ROUTED TO THE PRINTER?

? Y
mannings n= .035
velocity= 3.030524
flow= 345.4797 cfs
5470-3

FLOW DEPTH= 3 FT
AREA= 114 FT^2
WETTED PERIMETER= 56.49658
HYDRAULIC RADIUS= 2.017822
MANNINGS N= .035
VELOCITY= 3.030524 FT/SEC
FLOW= 345.4797 CFS

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?

? Y
BACKWATER ANALYSIS INDICATES AN ENTRANCE WATER
DEPTH OF 3.14261 FEET

DO YOU WISH ANOTHER CALCULATION VARYING ONLY FLOW DEPTH?

? Y
WHAT IS THE DEPTH OF FLOW?

? 4
DO YOU WISH THIS ROUTED TO THE PRINTER?

? Y
mannings n= .035
velocity= 3.554051
flow= 625.513 cfs
5470-3

FLOW DEPTH= 4 FT
AREA= 176 FT^2
WETTED PERIMETER= 68.6621
HYDRAULIC RADIUS= 2.563277
MANNINGS N= .035
VELOCITY= 3.554051 FT/SEC
FLOW= 625.513 CFS

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?

? Y
BACKWATER ANALYSIS INDICATES AN ENTRANCE WATER
DEPTH OF 4.196138 FEET

DO YOU WISH ANOTHER CALCULATION VARYING ONLY FLOW DEPTH?

? YU
WHAT IS THE DEPTH OF FLOW?

? 5
DO YOU WISH THIS ROUTED TO THE PRINTER?

? Y
mannings n= .035
velocity= 4.027718
flow= 1006.929 cfs
5470-3

FLOW DEPTH= 5 FT
AREA= 250 FT^2
WETTED PERIMETER= 80.82763
HYDRAULIC RADIUS= 3.093002
MANNINGS N= .035
VELOCITY= 4.027718 FT/SEC
FLOW= 1006.929 CFS

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?

? Y
BACKWATER ANALYSIS INDICATES AN ENTRANCE WATER
DEPTH OF 5.251902 FEET

DO YOU WISH ANOTHER CALCULATION VARYING ONLY FLOW DEPTH?

? Y
WHAT IS THE DEPTH OF FLOW?

? 4.5
DO YOU WISH THIS ROUTED TO THE PRINTER?

? Y
mannings n= .035
velocity= 3.795922
flow= 802.8375 cfs
5470-3

FLOW DEPTH= 4.5 FT
AREA= 211.5 FT^2
WETTED PERIMETER= 74.74486
HYDRAULIC RADIUS= 2.829626
MANNINGS N= .035
VELOCITY= 3.795922 FT/SEC
FLOW= 802.8375 CFS

DO YOU WANT A BACKWATER ANALYSIS COMPUTED?

DO YOU WISH A BACKWATER ANALYSIS COMPUTED?
Y.
BACKWATER ANALYSIS INDICATES AN ENTRANCE WATER
DEPTH OF 4.723743 FEET

Page No. 8

DO YOU WISH ANOTHER CALCULATION VARYING ONLY FLOW DEPTH?
N

OK

THIS SIDE UP

THIS SIDE UP

type natratil.out

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*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* FEBRUARY 1981
* REVISED 01 JUN 88
*
* RUN DATE 09/20/1990 TIME 10:42:53
*
*****
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*****
*
* U.S. ARMY CORPS OF ENGINEERS
* THE HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 551-1748
*
*****
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X   X XXXXXXX XXXX   X
X   X X   X   X   XX
X   X X   X   X   X
XXXXXX XXXX X   XXXX X
X   X X   X   X   X
X   X X   X   X   X
X   X XXXXXXX XXXX   XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1

HEC-1 INPUT

PAGE 1

LINE	ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1	ID USF&WL NATRATIL ROBERTS CO. SECTION 28,129,50
2	ID 25 YEAR STORM
3	IT 10 300
4	JR 0
5	KK BASIN HYDROLOGY
6	BA 5.8
7	PB 4.25
8	PC 0 .07 .15 .24 .32 .43 .53 .66 .82 1.08
9	PC 2.19 2.65 2.90 3.09 3.26 3.39 3.53 3.63 3.73 3.83
10	PC 3.94 4.0 4.07 4.14 4.25
11	LU .5
12	UC 1.5 .9 .9
13	KK
14	RS 1 STOR 0
15	SV 1 3 9 20 32 47 65 81 100
16	SE 1082 1083 1084 1085 1086 1087 1088 1089 1090
17	SL 1080.5 37.7 .71 .5
18	SS 1089.0 80 2.86 1.5
19	ST 1091 374 1.5
20	ZZ

```
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*
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*
* U.S. ARMY CORPS OF ENGINEERS
* THE HYDROLOGIC ENGINEERING CENTER
*
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* FEBRUARY 1981 *
 * REVISED 01 JUN 88 *
 * *
 * RUN DATE 09/20/1990 TIME 10:42:53 *
 * *

* THE HYDROLOGIC ENGINEERING CENTER *
 * 609 SECOND STREET *
 * DAVIS, CALIFORNIA 95616 *
 * (916) 551-1748 *
 * *

USF&WL NATRATIL ROBERTS CO. SECTION 28,129,50
 25 YEAR STORM

IT HYDROGRAPH TIME DATA
 NMIN 10 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0300 STARTING TIME
 NQ 101 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 1 0 ENDING DATE
 NDTIME 1940 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .17 HOURS
 TOTAL TIME BASE 16.67 HOURS

ENGLISH UNITS
 DRAINAGE AREA SQUARE MILES
 PRECIPITATION DEPTH INCHES
 LENGTH, ELEVATION FEET
 FLOW CUBIC FEET PER SECOND
 STORAGE VOLUME ACRE-FEET
 SURFACE AREA ACRES
 TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION

*** ***

 * *
 5 KK * BASIN * HYDROLOGY
 * *

SUBBASIN RUNOFF DATA

6 BA SUBBASIN CHARACTERISTICS
 TAREA 5.80 SUBBASIN AREA

PRECIPITATION DATA

7 PB STORM 4.25 BASIN TOTAL PRECIPITATION

8 PI INCREMENTAL PRECIPITATION PATTERN
 .07 .08 .09 .08 .11 .10 .13 .16 .26 1.11
 .46 .25 .19 .17 .13 .14 .10 .10 .10 .11
 .06 .07 .07 .11

11 LU UNIFORM LOSS RATE
 STRTL .50 INITIAL LOSS
 CNSTL .00 UNIFORM LOSS RATE
 RTIMP .00 PERCENT IMPERVIOUS AREA

12 UC CLARK UNITGRAPH
 TC 1.50 TIME OF CONCENTRATION
 R .90 STORAGE COEFFICIENT

SYNTHETIC ACCUMULATED-AREA VS. TIME CURVE WILL BE USED

UNIT HYDROGRAPH PARAMETERS
 CLARK TC= 1.50 HR, R= .90 HR
 SNYDER TP= 1.26 HR, CP= .70

UNIT HYDROGRAPH
 34 END-OF-PERIOD ORDINATES

100.	365.	721.	1115.	1513.	1845.	2047.	2119.	2042.	1795.
1491.	1238.	1028.	854.	709.	589.	489.	406.	337.	280.
233.	193.	161.	133.	111.	92.	76.	63.	53.	44.
36.	30.	25.	21.						

HYDROGRAPH AT STATION BASIN

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	*	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1	0300	1	.00	.00	.00	0.	*	1	1130	52	.00	.00	.00	.00	24.	
1	0310	2	.07	.07	.00	0.	*	1	1140	53	.00	.00	.00	.00	18.	
1	0320	3	.08	.08	.00	0.	*	1	1150	54	.00	.00	.00	.00	13.	
1	0330	4	.09	.09	.00	0.	*	1	1200	55	.00	.00	.00	.00	9.	
1	0340	5	.08	.08	.00	0.	*	1	1210	56	.00	.00	.00	.00	7.	
1	0350	6	.11	.11	.00	0.	*	1	1220	57	.00	.00	.00	.00	4.	
1	0400	7	.10	.07	.03	3.	*	1	1230	58	.00	.00	.00	.00	2.	
1	0410	8	.13	.00	.13	24.	*	1	1240	59	.00	.00	.00	.00	0.	
1	0420	9	.16	.00	.16	85.	*	1	1250	60	.00	.00	.00	.00	0.	
1	0430	10	.26	.00	.26	211.	*	1	1300	61	.00	.00	.00	.00	0.	
1	0440	11	1.11	.00	1.11	511.	*	1	1310	62	.00	.00	.00	.00	0.	
1	0450	12	.46	.00	.46	1069.	*	1	1320	63	.00	.00	.00	.00	0.	
1	0500	13	.25	.00	.25	1826.	*	1	1330	64	.00	.00	.00	.00	0.	
1	0510	14	.19	.00	.19	2697.	*	1	1340	65	.00	.00	.00	.00	0.	
1	0520	15	.17	.00	.17	3603.	*	1	1350	66	.00	.00	.00	.00	0.	
1	0530	16	.13	.00	.13	4425.	*	1	1400	67	.00	.00	.00	.00	0.	
1	0540	17	.14	.00	.14	5051.	*	1	1410	68	.00	.00	.00	.00	0.	
1	0550	18	.10	.00	.10	5436.	*	1	1420	69	.00	.00	.00	.00	0.	
1	0600	19	.10	.00	.10	5550.	*	1	1430	70	.00	.00	.00	.00	0.	
1	0610	20	.10	.00	.10	5380.	*	1	1440	71	.00	.00	.00	.00	0.	
1	0620	21	.11	.00	.11	5043.	*	1	1450	72	.00	.00	.00	.00	0.	
1	0630	22	.06	.00	.06	4677.	*	1	1500	73	.00	.00	.00	.00	0.	
1	0640	23	.07	.00	.07	4316.	*	1	1510	74	.00	.00	.00	.00	0.	
1	0650	24	.07	.00	.07	3975.	*	1	1520	75	.00	.00	.00	.00	0.	
1	0700	25	.11	.00	.11	3661.	*	1	1530	76	.00	.00	.00	.00	0.	
1	0710	26	.00	.00	.00	3372.	*	1	1540	77	.00	.00	.00	.00	0.	
1	0720	27	.00	.00	.00	3096.	*	1	1550	78	.00	.00	.00	.00	0.	
1	0730	28	.00	.00	.00	2825.	*	1	1600	79	.00	.00	.00	.00	0.	
1	0740	29	.00	.00	.00	2554.	*	1	1610	80	.00	.00	.00	.00	0.	
1	0750	30	.00	.00	.00	2279.	*	1	1620	81	.00	.00	.00	.00	0.	
1	0800	31	.00	.00	.00	2005.	*	1	1630	82	.00	.00	.00	.00	0.	
1	0810	32	.00	.00	.00	1738.	*	1	1640	83	.00	.00	.00	.00	0.	
1	0820	33	.00	.00	.00	1481.	*	1	1650	84	.00	.00	.00	.00	0.	

1	0830	34	.00	.00	.00	1241.	*	1	1700	85	.00	.00	.00	0.
1	0840	35	.00	.00	.00	1031.	*	1	1710	86	.00	.00	.00	0.
1	0850	36	.00	.00	.00	856.	*	1	1720	87	.00	.00	.00	0.
1	0900	37	.00	.00	.00	711.	*	1	1730	88	.00	.00	.00	0.
1	0910	38	.00	.00	.00	590.	*	1	1740	89	.00	.00	.00	0.
1	0920	39	.00	.00	.00	490.	*	1	1750	90	.00	.00	.00	0.
1	0930	40	.00	.00	.00	407.	*	1	1800	91	.00	.00	.00	0.
1	0940	41	.00	.00	.00	338.	*	1	1810	92	.00	.00	.00	0.
1	0950	42	.00	.00	.00	278.	*	1	1820	93	.00	.00	.00	0.
1	1000	43	.00	.00	.00	228.	*	1	1830	94	.00	.00	.00	0.
1	1010	44	.00	.00	.00	185.	*	1	1840	95	.00	.00	.00	0.
1	1020	45	.00	.00	.00	135.	*	1	1850	96	.00	.00	.00	0.
1	1030	46	.00	.00	.00	104.	*	1	1900	97	.00	.00	.00	0.
1	1040	47	.00	.00	.00	82.	*	1	1910	98	.00	.00	.00	0.
1	1050	48	.00	.00	.00	65.	*	1	1920	99	.00	.00	.00	0.
1	1100	49	.00	.00	.00	51.	*	1	1930	100	.00	.00	.00	0.
1	1110	50	.00	.00	.00	40.	*	1	1940	101	.00	.00	.00	0.
1	1120	51	.00	.00	.00	31.	*							

TOTAL RAINFALL = 4.25, TOTAL LOSS = .50, TOTAL EXCESS = 3.75

PEAK FLOW + (CFS)	TIME (HR)	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	16.67-HR
		(CFS)			
+ 5550.	3.00	2312.	838.	838.	838.
		(INCHES)	3.707	3.733	3.733
		(AC-FT)	1147.	1155.	1155.

CUMULATIVE AREA = 5.80 SQ MI

*** **

* *
13 KK * *
* *

HYDROGRAPH ROUTING DATA

14 RS	STORAGE ROUTING									
	NSTPS	1	NUMBER OF SUBREACHES							
	ITYP	STOR	TYPE OF INITIAL CONDITION							
	RSVRIC	.00	INITIAL CONDITION							
	X	.00	WORKING R AND D COEFFICIENT							
15 SV	STORAGE	1.0	3.0	9.0	20.0	32.0	47.0	65.0	81.0	100.0
16 SE	ELEVATION	1082.00	1083.00	1084.00	1085.00	1086.00	1087.00	1088.00	1089.00	1090.00
17 SL	LOW-LEVEL OUTLET									
	ELEVL	1080.50	ELEVATION AT CENTER OF OUTLET							
	CAREA	37.70	CROSS-SECTIONAL AREA							
	COQL	.71	COEFFICIENT							
	EXPL	.50	EXPONENT OF HEAD							

18 SS	SPILLWAY		
	CREL	1089.00	SPILLWAY CREST ELEVATION
	SPWID	80.00	SPILLWAY WIDTH

COUW 2.86 WEIR COEFFICIENT
EXPW 1.50 EXPONENT OF HEAD

19 ST

TOP OF DAM

TOPEL 1091.00 ELEVATION AT TOP OF DAM
DAMWID 374.00 DAM WIDTH
COQD .00 WEIR COEFFICIENT
EXPD 1.50 EXPONENT OF HEAD

COMPUTED OUTFLOW-ELEVATION DATA

(EXCLUDING FLOW OVER DAM)

OUTFLOW	.00	281.03	301.82	325.92	354.21	387.88	428.63	478.94	542.64	625.87
ELEVATION	1082.00	1082.21	1082.48	1082.81	1083.22	1083.76	1084.49	1085.48	1086.89	1089.00
OUTFLOW	629.02	634.21	643.11	656.66	675.88	701.71	735.12	777.07	828.54	890.46
ELEVATION	1089.04	1089.08	1089.14	1089.22	1089.31	1089.41	1089.54	1089.67	1089.83	1090.00

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

(INCLUDING FLOW OVER DAM)

STORAGE	1.00	1.43	1.95	2.61	3.00	4.34	7.59	9.00	14.35	20.00
OUTFLOW	262.92	281.03	301.82	325.92	339.43	354.21	387.88	401.61	428.63	455.39
ELEVATION	1082.00	1082.21	1082.48	1082.81	1083.00	1083.22	1083.76	1084.00	1084.49	1085.00
STORAGE	25.73	32.00	45.34	47.00	65.00	81.00	81.73	82.55	83.67	85.10
OUTFLOW	478.94	503.45	542.64	547.31	587.90	625.87	629.02	634.21	643.11	656.66
ELEVATION	1085.48	1086.00	1086.89	1087.00	1088.00	1089.00	1089.04	1089.08	1089.14	1089.22
STORAGE	86.82	88.85	91.19	93.82	96.76	100.00				
OUTFLOW	675.88	701.71	735.12	777.07	828.54	890.46				
ELEVATION	1089.31	1089.41	1089.54	1089.67	1089.83	1090.00				

1

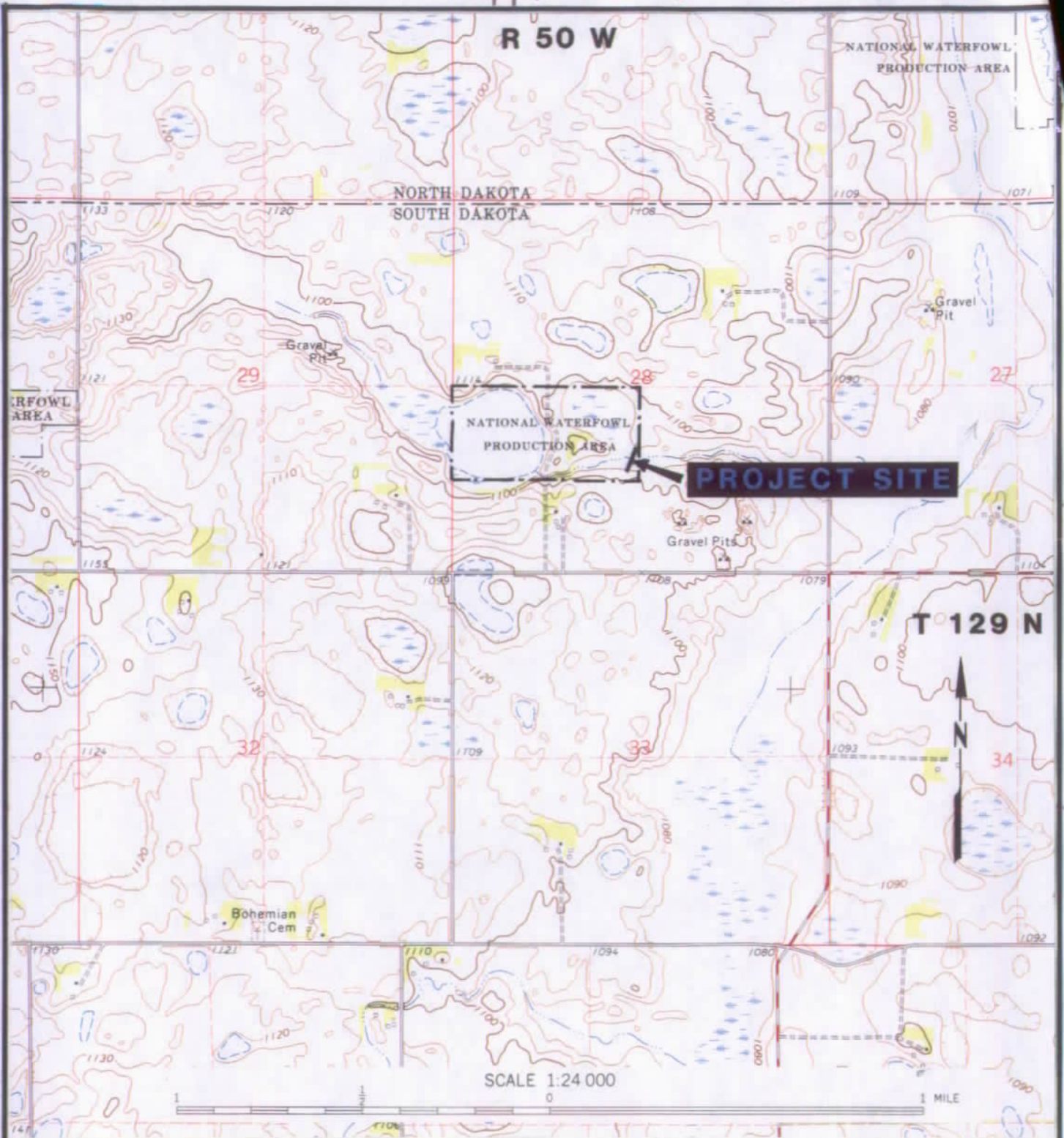
PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES TIME TO PEAK IN HOURS

RATIOS APPLIED TO PRECIPITATION

OPERATION	STATION	AREA	PLAN
HYDROGRAPH AT			
+	BASIN	5.80	1 FLOW TIME
ROUTED TO			
+		5.80	1 FLOW TIME

*** NORMAL END OF HEC-1 ***

C:\HECEXE>



I, William A. Godby, Regional Engineer, do hereby certify that this map was prepared under my direction and correctly represents the works for the accompanying application.

William A. Godby
William A. Godby



UNITED STATES DEPARTMENT OF THE INTERIOR				
FISH AND WILDLIFE SERVICE				
ENGINEERING				
NAVRATIL WPA				
ROBERTS COUNTY,			SOUTH DAKOTA	
WATER RIGHTS FILING MAP				
DESIGNED GC	DRAWN MG	CHECKED CW	DATE 8/90	DENVER, COLO.
DRAWING NO. 8R-SD-617-WR-P-18.0				SHEET 1 OF 1

RECEIPT

Division of Water Rights

South Dakota Department of Water and Natural Resources

Pierre, August 27, 19 90

412353

RECEIVED OF US Dept of Interior, US Fish & Wildlife Service, Box 25486 DFC Denver CO
80225

the following amount in fees for services rendered as provided for by law:

Fee for Application for Permit No. <u>5470-3</u> to Appropriate Water, to construct works and to put water to beneficial use _____	150	00
Fee for Application for Permit No. _____ to Appropriate Water for Future Use _____		
Fee to retain Future Use Permit No. _____ after period of seven years.		
Fee for Inspecting Constructed Works, confirming beneficial use and issuing Water License No. _____		
Fee for Filing Transfer Form _____		
Fee for Filing Extension Request _____		
Fee for Certified Copy of _____		
Fee for Print Copy of Map _____		
Fee for Certifying _____		
Fee for _____		
(Any Other Work Provided by Law)	Total	150 00

By

John Hatch (ms)
Chief Engineer

$\text{Average slope } 85\% = \frac{\text{Elev. } 5.4 \text{ mi.} - \text{Elev. } 0.6 \text{ mi.}}{5.4 \text{ mi.} - 0.6 \text{ mi.}} = \frac{1185 - 1085}{4.8} = 20.8 \text{ ft/mi.}$
 However, Drainage is very ponded!!
 4.8 miles

$\Delta \text{Basin} = 5.7 \text{ mi.}^2$

$10 \times 6.4 = 64 \text{ miles}$
 $1.89 \times 6.4 = 12.1 \text{ miles}$

$1.89 \times 6.4 = 12.1 \text{ miles}$





United States Department of the Interior
FISH AND WILDLIFE SERVICE



IN REPLY REFER TO:

BA/EN
WR SD
Mail Stop 60190

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

AUG 20 1990



South Dakota Department of
Water and Natural Resources
523 East Capitol, Foss Building
Pierre, South Dakota 57501-3181

Gentlemen:

The Fish and Wildlife Service and Ducks Unlimited will construct a small dam to enhance an existing wetland for waterfowl production purposes at the Navratil Waterfowl Production Area (WPA), in Roberts County.

Enclosed are the following documents:

1. Form 2, Application for Permit to Appropriate Water (duplicate);
2. Form 2A, Supplemental Information (duplicate);
3. Filing Map;
4. Engineering Drawings, DU-1-SD-105-01, four sheets; and
5. Money Order in the amount of \$150.

Please advise this office of the name and address of the newspaper selected to publish the Notice of Hearing so that we can forward the required Authorization of Advertisement prior to publication.

If you have any questions or require further information, please contact Cheryl Williss in our Engineering office at (303) 236-5321.

Sincerely,

Regional Director

Enclosures

cc: Ducks Unlimited

 **Department of
Water & Natural Resources**

Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

August 27, 1990

John L. Spinks, Deputy Regional Director
U.S. Fish and Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, CO 80225

Dear Mr. Spinks:

This letter is in response to the water permit application received by this office on August 27, 1990 for impoundment of 33 acre-feet of water at the Navratil Waterfowl Production Area in Roberts County. A preliminary risk assessment is necessary in order to proceed with processing this permit application pursuant to ARSD 74:02:08:05.01.

The preliminary risk assessment shall consist of an on-site inspection of the downstream area with a description of any structures and a elevation in reference to the stream channel bottom. This assessment must be prepared by a SD Registered Professional Engineer or a person who is employed by a federal or state agency and who designs or inspects dams as part of the person's employment acting under the supervision of a professional engineer.

If you have any questions, please feel free to contact this office.

Sincerely,

Eric Gronlund
Water Rights Division
605 773-3352

enc.

cc: Cheryl Williss



United States Department of the Interior
FISH AND WILDLIFE SERVICE



IN REPLY REFER TO:

BA/EN
WR SD
Mail Stop 60190

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

AUG 30 1990



Mr. Eric Gronlund
South Dakota Department of
Water and Natural Resources
523 East Capitol, Foss Building
Pierre, South Dakota 57501-3181

Dear Mr. Gronlund:

As discussed in your telephone conversation with Cheryl Williss on August 29, 1990, enclosed is the Ducks Unlimited design report which will serve as the risk assessment for the proposed structure on the Navratil WPA in Roberts County.

Sincerely,

William A. Godby
Regional Engineer

Enclosure

DESIGN REPORT

NAVRATIL WPA



LOCATION OF PROPOSED PROJECT

The proposed dam will be located in NE $\frac{1}{4}$ of SW $\frac{1}{4}$ of Section 28, Township 129 North, Range 50 West, in Roberts County, South Dakota. The dam will be constructed on an unnamed tributary to the Big Slough watercourse which eventually discharges into the Bois Des Sioux River. The watershed contributing to the project consists of approximately 5.8 square miles. A substantial amount of ponding exists throughout the watershed.

CLASSIFICATION OF PROPOSED DAM

Based on the classification criteria outlined in Chapter 74:02:08 "Safety of Dams", it is recommended that the proposed dam be classified as a small, Category 3 dam. No loss of life and minimal economic loss potential is expected should failure occur. The product of the intermediate storage capacity times the effective height is 527 which is less than 3000.

PRELIMINARY RISK ASSESSMENT

The proposed dam will be located in a rural area. No residences or other buildings are located immediately downstream adjacent to the channel. A gravelled section line road exists approximately $\frac{1}{2}$ mile downstream, however, based on information obtained in the field, data present on the U.S.G.S. quadrangular maps, and the relative small size and capacity of the created marsh, the crossing should be in little danger in the unlikely event of a failure. Immediately downstream from the crossing, the channel exits into the much larger Big Slough watercourse. Therefore, the risk to the general public would appear minimal.

DESIGN

In accordance with South Dakota requirement 74:02:08:07.01, the minimum spillway design flood for the proposed dam is a 25 year frequency event. The proposed dam is designed to exceed the South Dakota requirements. The primary spillway will pass flows produced by a 10 year 24 hour rainfall without utilizing the emergency spillway. The primary and emergency spillway combined will pass flows produced by the 100 year 24 hour rainfall with a maximum velocity of 2.4 feet per second in the control section and 5.7 feet per second on the outlet slope. The level crest is of sufficient length to prevent failure in the event of any headcutting during infrequent events. A minimum of 1.46' freeboard exists between the maximum water surface elevation and the top of the finished embankment during the 25 year event. Also, sufficient freeboard exists to prevent overtopping during the 100 year event.

DISCHARGE CAPACITY

The SCS TR-20 Hydrology program was used to determine the discharge at various reservoir stages with respect to time. The program uses accepted procedures to develop inflow and outflow hydrographs. The data inputted into the TR-20 program was calculated from accepted formulas and procedures. The primary spillway capacity was calculated by comparing discharges developed by the weir flow formula, orifice flow formula, and formulas for calculating head loss through corrugated metal pipe. The emergency spillway capacity was calculated using Technical Release No. 39 Hydraulics of Broad-Crested Spillways developed by the Soil Conservation Service. A total discharge curve for the proposed dam is attached.

The following is a relationship between peak inflows, corresponding outflows and reservoir elevations.

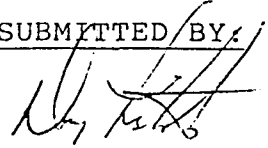
EVENT	PEAK INFLOW (CFS)	MAXIMUM WATER SURFACE ELEVATION (MSL)	FREEBOARD AVAILABLE (FT)	TOTAL DISCHARGE (CFS)
5 YR	62	1,087.17	4.33	58
10 YR	192	1,089.04	2.46	131
25 YR	297	1,090.04	1.46	278

PLANS, SPECIFICATIONS, AND SOILS REPORT

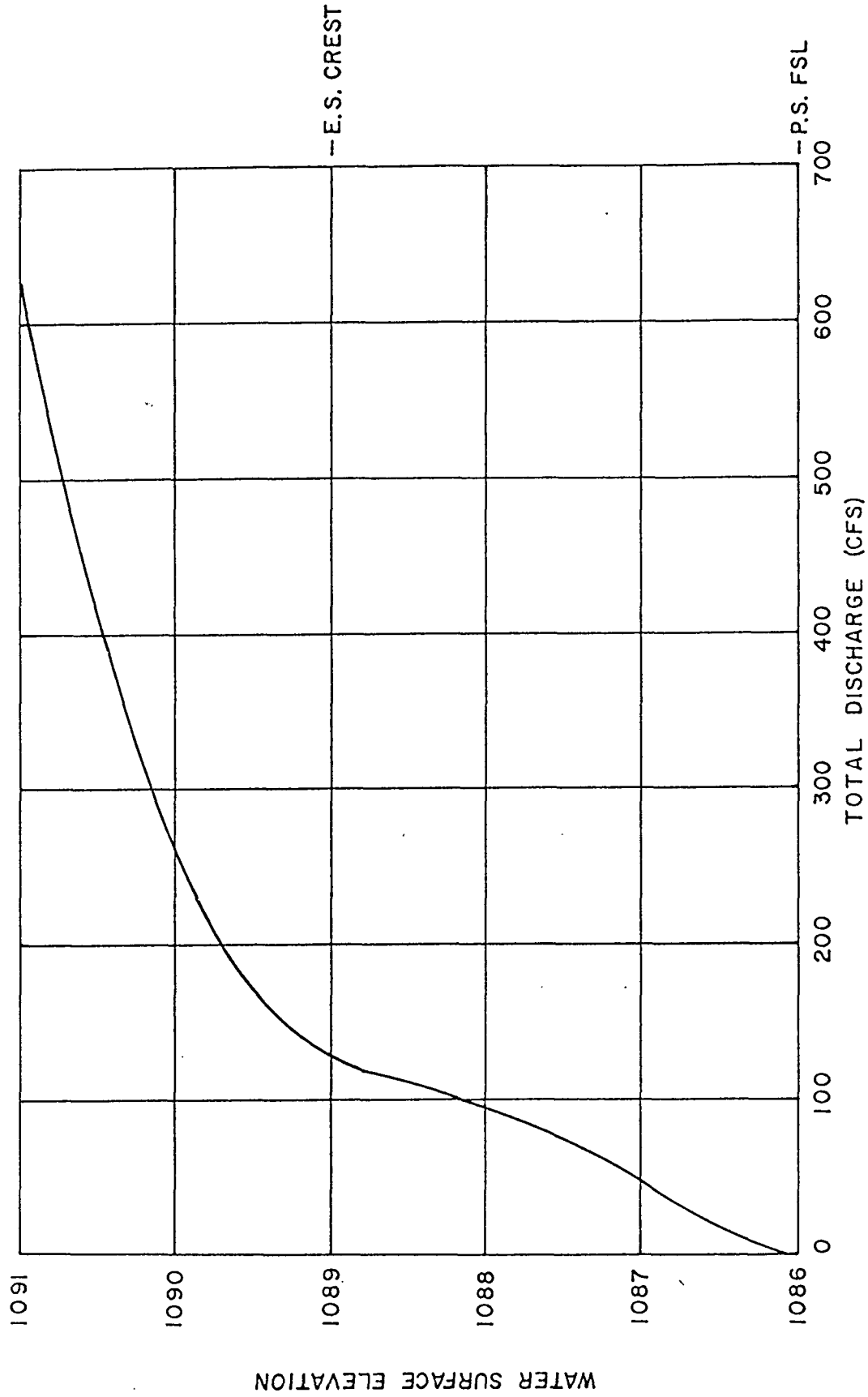
A preliminary set of plans is submitted with the Design Report. A set of standard construction specifications has previously been submitted to the Division of Water Rights for the purpose of permit review. This information will satisfy section 74:02:08:09 of the "SD Dam Safety Requirements."

DATED: May 7, 1990

SUBMITTED BY:


Doug Lipetzky, P.E.
PE-4499

DISCHARGE CURVE



NAVRATIL WPA
SD-105-01

60" Ø RISER W/ 48" Ø BARREL
80' WIDE EMERGENCY SPILLWAY

Conversation or File Documentation

NAME OF PERSON OR FILE: Todd Luke - Naubay National Wildlife Refuge

ADDRESS: _____ COUNTY _____

DATE: 9/13/90 TELEPHONE 947-4521RE: Navratil WPA Water Permit Application

COMMENTS:

I returned Mr. Luke's call. He was wondering the status of the application so I explained the permitting process. I told him the soonest the permit could be considered by the WMB is at the December 5 meeting in Rapid City. I said we would cc: copies of notice, report & recommendations to him.

While I had him on the phone I asked ~~if~~ him if the dam would cause water to be impounded back into the larger pool in the NW $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 28. Mr. Luke stated that it wouldn't. The impoundment would be no greater than the 13.5 acres shown on Form 2A and would be totally in the NE $\frac{1}{4}$ SW $\frac{1}{4}$ of Section 28.

File in Permit or other file as necessary. Use to document conversations and what the other party was told; why action or decision was made.

NAME: Eric Hunkeler 9/13/90



United States Department of the Interior
FISH AND WILDLIFE SERVICE



IN REPLY REFER TO:

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

RW/RE
LA--SD W.A.
Roberts
Danek, Joseph (359F)
MAIL STOP 60135



SEP 19 1990

CERTIFIED MAIL #P448-976644
RETURN RECEIPT REQUESTED

Mr. Joseph Danek
Hankinson
North Dakota 58041

Dear Mr. Danek:

On July 20, 1990, you and your wife executed a flowage easement to the United States of America for the preservation of waterfowl production habitat on your land in Roberts County, South Dakota, for a consideration of \$600.00. The easement includes a provision that it might be accepted by the United States within 9 months.

We are pleased to inform you that the easement was accepted by the United States of America on the above date. It is now a binding contract and we have forwarded the easement for recording. Copies of the easement document and map showing the area covered by the flowage easement are attached for your personal records. Please examine them and notify our office immediately if you find that they do not reflect the understanding reached between you and our negotiator.

You are responsible, now and in the future, for informing your tenants, land managers, and farm operators of the terms of the easement. If you plan to sell this land, you should inform prospective purchasers of the terms of the easement.

A United States Treasury check for payment of this easement consideration will be requested after the abstracter returns the recorded easement.

As stated in the enclosed Involuntary Conversion Information Sheet, you may wish to contact your tax advisor or the Internal Revenue Service to determine if you will benefit as a result of this sale of land or interest in land to the United States.

Attached are instructions for filing a claim for reimbursement as authorized by Public Law 91-646 when land or interest in land is sold to the United States. It is not necessary to return this form unless you wish to claim expenses incurred in the conveyance of land, such as those listed on the form. If you have any questions concerning items of eligibility under this Act, or any questions concerning this transaction, please feel free to contact our Wetlands Acquisition Office in Aberdeen (telephone: 605-226-7587).

Sincerely,

/s/ PAUL H. HARTMANN

CHIEF, DIVISION OF REALTY

Attachments

UNITED STATES DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
CONVEYANCE OF FLOWAGE EASEMENT

THIS INDENTURE, by and between Joseph Danek and Hazel C. Danek, husband and wife, of Hankinson, North Dakota, parties of the first part, and the UNITED STATES OF AMERICA, acting by and through the Secretary of the Interior of his authorized representative, party of the second part.

WITNESSETH:

WHEREAS, the Migratory Bird Hunting Stamp Act of March 16, 1934, as amended by the Act of August 1, 1958 (72 Stat. 486, 16 U.S.C., sec. 718d) authorizes the Secretary of the Interior to acquire certain lands or interests therein;

AND WHEREAS, acquisition of an interest in the lands described below has been determined necessary in furtherance of the purposes of that Act;

NOW THEREFORE, for and in consideration of the sum of Six hundred dollars (\$600.00), the parties of the first part do hereby convey to the party of the second part, commencing with the acceptance of this indenture by the Secretary of the Interior or his authorized representative which acceptance must be made within ---nine--- months of the execution of this indenture by the parties of the first part, or any subsequent date as may be mutually agreed upon during the term of this option, a perpetual right, power, privilege and easement to overflow, flood the following described property:

T. 129 N., R. 50 W., 5th P.M. Roberts County, South Dakota
sec. 28, that part of the SE $\frac{1}{4}$ NW $\frac{1}{4}$ lying below the 1090.04 MSL, containing 1.00 acre more or less.

Such right, power privilege and easement to include the right to raise the water level not to exceed a maximum of 1090.04 feet mean sea level by means of an impoundment located on lands owned by the party of the second part.

The parties of the first part, for themselves and for their heirs, successors, and assigns, expressly waive and release the party of the second part from any and all claims they may have for damages which may have occurred or which in the future may occur by reason of construction, building or maintenance of dams or spillways on land owned or controlled by the party of the second part or by reason of flooding, overflow, or the depositing of material resulting from said flooding or overflow.

Subject, however, to all existing rights-of-way for highways, roads, railroads, pipelines, canals, laterals, electrical transmission lines, telegraph and telephone lines, cable lines and all outstanding mineral rights.

SPECIAL PROVISIONS

1. This indenture shall not be binding upon the party of the second part until accepted by the Secretary of the Interior or his authorized representative, although this indenture is acknowledged by the parties of the first part to be presently binding upon them and to remain so until the expiration of said period for acceptance, as hereinabove described, by virtue of the payment to parties of the first part, by the party of the second party, of the sum of \$1.00, the receipt of which is hereby expressly acknowledged by parties of the first part.

2. Notice of acceptance of this agreement shall be given to parties of the first part by certified mail addressed to: Mr. Joseph Danek, Hankinson, North Dakota 58041 and such notice shall be binding upon all parties of the first part without sending a separate notice to each.

It is further mutually agreed that no Member of or Delegate to Congress, or Resident Commissioner shall be admitted to any share or part of this contract, or to any benefit to arise thereupon. Nothing, however, herein contained shall be construed to extend to any incorporated company, where such contract is made for the general benefit of such corporation or company.

4. Payment of the consideration will be made after acceptance of this indenture by the Secretary of the Interior or his authorized representative and after the Field Solicitor of the Department of the Interior shall have approved the easement interest thus vested in the United States.

IN WITNESS WHEREOF the parties of the first part have hereunto set their hands and seals this 20th day of July, 1990.

Joseph Danek (L.S.)
Joseph Danek

Hazel C Danek (L.S.)
Hazel C. Danek

ACKNOWLEDGMENT

STATE SOUTH DAKOTA)
) SS
COUNTY OF ROBERTS)

On this 20th day of July, 1990, before me personally appeared Joseph Danek and Hazel C. Danek, husband and wife, known to me to be the persons described in and who executed the foregoing instrument and acknowledged to me that they executed the same as their free act and deed.

(SEAL)

Roger J. Tringali (L.S.)

Notary Public

My Commission Expires: 2/18/1995

ACCEPTANCE

The Secretary of the Interior, acting by and through his authorized representative, has executed this agreement on behalf of the United States this _____ day of _____, 19____.

THE UNITED STATES OF AMERICA

By _____

(Title)





United States Department of the Interior

FISH AND WILDLIFE SERVICE
WAUBAY NATIONAL WILDLIFE REFUGE
RR 1, BOX 79
WAUBAY, SD 57273-9736
605/947-4521



Eric Gronlund
Water Rights Division
South Dakota Department of Water and Natural Resources
Joe Foss Building
523 East Capitol
Pierre, SD 57501-3181

Dear Eric:

I have enclosed confirmation of acceptance of a flowage easement needed for the Navratil Waterfowl Production Area-Ducks Unlimited project in Roberts County for your information. It may be helpful in the processing of our water permit application. If you have any questions, feel free to contact me at the above address.

Sincerely,

Todd Luke
Biological Technician

Report on Water Permit Application
No. 5470-3, U.S. Fish and Wildlife Service
P.O. Box 25486, Denver Federal Center
Denver, Colorado 80225

Introduction

Water Permit Application No. 5470-3 proposes to appropriate 65 acre feet annually by constructing a dam in the Navratil Waterfowl Production Area. The dam site is to be located in the NE1/4 SW1/4 of Section 28, T129N R50W. The appropriated water is to be used to enhance an existing wetland for waterfowl production purposes.

It should be noted that this application proposes to appropriate 65 acre feet of runoff annually while the proposed dam is only capable of storing 33 acre feet. The purpose of the additional 32 acre feet annually is to offset any evaporation losses experienced by the proposed dam during the summer months (Cheryl Williss, 1990).

Review of Existing Water Rights

The Division files do not indicate any water rights downstream of the proposed dam (Division, 1990). The North Dakota border is located 1 1/2 miles downstream of the proposed dam.

Safety of Dams Review

The proposed dam has a normal and maximum height of 4.5 and 8.5 feet respectively. Normal and maximum storage are 33 and 122 acre feet respectively. Safety of Dams Rules Chapter 74:02:08 require that the proposed dam have a spillway capacity capable of passing/storing a 25 year 24 hour storm. The Ducks Unlimited design report, submitted with the application, indicates that the proposed dam exceeds minimum design requirements and passes/stores a 100 year 24 hour storm.

The Division also checked the spillway capacity of the proposed dam. Two runoff modelling methods were used to determine the runoff expected from the Navratil WPA drainage basin. The two methods used were: the United States Geological Survey's ESTIMATING FLOOD PEAKS VOLUMES, AND HYDROGRAPHS ON SMALL STREAMS, SEPTEMBER 1980, WATER RESOURCES INVESTIGATIONS 80-80 and using Clarks method in conjunction with the United States Corps of Engineer computer program HEC1. The two methods yielded peak inflows/outflows of 379 and 838 cfs for the Navratil WPA.

The emergency spillway has a total discharge capacity of approximately 740 cfs based upon the broad crested weir equation and a "C" coefficient of 3.06. The proposed dam also has a 48 inch corrugated metal pipe with a maximum head of 5.0 feet which is capable of passing a 10 year 24 hour storm (Ducks Unlimited, 1990).

In summary, all Safety of Dams Rules, Chapter 74:02:08 have been met by the applicant.

Conclusions

1. There is a reasonable probability that there is unappropriated water available for the applicant's proposed use.
2. The proposed diversion can be developed without unlawful impairment of existing rights.
3. The proposed use is a beneficial use.
4. All Safety of Dams Rules (74:02:08) requirements have been met.



David S. Brown
Natural Resources Engineer II
DWNR, Water Rights Division

Bibliography

Cheryl Willis, Personal communication, October 1, 1990, United States Department of the Interior, Fish and Wildlife Service, Post Office Box 25486, Denver Federal Center, Denver Colorado 80228

Division, 1990, Files and Records, Department of Water and Natural Resources, Joe Foss Building, Pierre, South Dakota 57501

Ducks Unlimited, 1990, DESIGN REPORT, NAVRATIL WPA, submitted by Doug Lipewtzky, P. E., PE-4499 with water permit application 5470-3.

RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 5470-3, U.S. Fish & Wildlife Service

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Division, Department of Water and Natural Resources concerning Water Permit Application No. 5470-3, U.S. Fish & Wildlife Service, P.O. Box 25486, Denver Federal Center, Denver CO.

The Chief Engineer is recommending APPROVAL of Application No. 5470-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use and 4) in the public interest.

See report on application for additional information.

A handwritten signature in cursive script, appearing to read "John Hatch", is written over the typed name.

JOHN HATCH, Chief Engineer
October 25, 1990



Department of Water & Natural Resources

Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

October 29, 1990

NOTE: TO BE SURE OF PUBLICATION ON
THE CORRECT DATES, CONTACT
THE NEWSPAPER RIGHT AWAY.

John L. Spinks Jr., Regional Director
U.S. Fish & Wildlife Service
Box 25486, DFC
Denver CO 80225

Dear Mr. Spinks:

Water Permit Application No. 5470-3 for waterfowl production has been examined and found to comply with the South Dakota Water Laws and applicable rules. A notice of hearing has been sent to the Publisher of the Rosholt Review printed at Rosholt SD. For your information, a copy of the notice is enclosed. Copies of the report and the Chief Engineer's recommendation are also enclosed. Please review the notice prior to publication and notify this office, if you have any corrections or questions.

Be sure to contact the above newspaper to authorize publication of your Notice of Intent to Appropriate Water and to arrange for payment. Early contact with the paper can eliminate delays. The publisher has been instructed to publish your notice once each week for two consecutive weeks with the last publication to occur twenty days before the board meeting. We must receive Proof of Publication before the application can be considered by the Water Management Board.

Sincerely,

Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures



Department of Water & Natural Resources

Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

October 29, 1990

Rosholt Review
Box 136
Rosholt SD 57260-0136

ATTN: Legal Publications:

Enclosed is a Notice of Hearing on Application No. 5470-3 to be published twice. Please publish the first notice on or before November 8, 1990 with the second publication 7 days later.

The APPLICANT MUST VERIFY TO YOU THAT THE NOTICE IS TO BE PUBLISHED, before you make the first publication. Please BILL the APPLICANT for the cost of publication. The APPLICANT is U.S. Fish & Wildlife Service, Box 25486, DFC, Denver CO 80225.

A copy of BOTH publications must be SENT to the WATER RIGHTS DIVISION. IMMEDIATELY return the FIRST publication with the FIRST Transmittal form on the bottom of this page. The first copy is needed to check the publication for errors so any corrections can be made in the second publication. Publication errors can invalidate the public notice and cause the applicant costly delays.

Please be sure the SECOND publication is returned IMMEDIATELY with the enclosed Proof of Publication form. DO NOT WAIT until the end of the month or the billing cycle. The permit application cannot be considered by the Water Management Board until proof of publication has been received.

Sincerely,

Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

CUT HERE

FIRST TRANSMITTAL NOTICE

TO: Eric Gronlund
Water Rights Division
Joe Foss Building
Pierre SD 57501-3181

No. _____

Date _____

We are in receipt of your letter of _____ enclosing Notice of Hearing to
Appropriate Water by Application No. _____ which was first published in our issue
of _____. ENCLOSED IS A COPY OF THIS FIRST PUBLICATION.

Name _____

Newspaper _____

Instruction to Newspaper - Publish first Notice on or before November 8, 1990 with the second publication 7 days later. The applicant is responsible for payment.

NOTICE OF HEARING on Application No. 5470-3 to Appropriate Water

Notice is given that the U.S. Fish & Wildlife Service, P.O. Box 25486, DFC, Denver CO 80225 has filed an application for a water permit to appropriate and impound up to 65 acre-feet of water annually by constructing a dam (33 acre feet of storage) in the Navratil Waterfowl Production Area. The dam site is to be located in the NE1/4 SW1/4 Section 28-T129N-R50W. Water is to be used to provide for waterfowl production.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 5470-3 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest.

Any person interested in opposing or supporting this application must file a written petition with BOTH the applicant and Chief Engineer. The applicant must also file a petition if opposing the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Division, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by November 26, 1990. The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained.

The Chief Engineer will act on this application in accordance with the above recommendation and no hearing will be held if the applicant does not contest the Chief Engineer's recommendation and no petition is filed opposing the application. If the applicant contests the recommendation or an interested person opposes the application, then the application will be considered by the Water Management Board. Petitions filed in support of the application will not require the Board to hear the application. The Board may conduct a hearing no sooner than 10:00 am, on December 5, 1990 at the Hilton Inn, Deerfield Room, 445 Mt. Rushmore Road, Rapid City SD and the hearing may be rescheduled for a later date. If the hearing is rescheduled, notice will be given of the time and place. The above hearing date will be automatically delayed for at least 20 days upon written request to the Chief Engineer from the applicant or any interested person opposing the application. The request for an automatic delay must be filed by November 26, 1990.

The Chief Engineer's recommendation is not final or binding upon the Board. The Board is authorized to 1) approve, 2) approve with qualifications, 3) defer, or 4) deny this application based on the facts presented at the public hearing. This hearing is an adversary proceeding. Any person filing a petition opposing the application and/or the applicant have the right to be represented by a lawyer and may present evidence or cross-examine witnesses according to SDCL 1-26. These and other due process rights will be forfeited if not exercised. Decisions of the Board may be appealed to the Circuit Court and State Supreme Court as provided by law. Contact the Water Rights Division to request copies of information pertaining to this application or to assure access to the hearing by the handicapped.

This application is made pursuant to SDCL 46-1-1 thru 46-1-9, 46-1-12 thru 46-1-16; 46-2-3.1, 46-2-9, 46-2-11, 46-2-13, 46-2-17; 46-2A-1 thru 46-2A-10, 46-2A-12, 46-2A-14, 46-2A-15; 46-5-1 thru 46-5-11, 46-5-13 thru 46-5-15, 46-5-24, 46-5-25, 46-5-30.2, 46-5-30.4, 46-5-31; and Board Rules ARSD 74:02:01:01 thru 74:02:01:15.

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA)
County Roberts) ss.

I, Kathleen Cook, Editor

certify that the attached printed Notice was taken
from the Rosholt Review

A newspaper which during the whole time of publication of
said notice herein after stated, has been and is printed and
published in the _____

_____ Town _____ of Rosholt

County of Roberts and State of South Dakota;
that the said notice was published in said newspaper on the
following two dates:

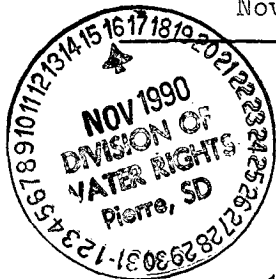
Nov. 7, 1990

Nov. 14, 1990

Kathleen Cook
(Signature)

Editor
(Title)

Nov. 14, 1990
(Date Signed)



Cost of Printing: 124 lines 10 pt. @ 26.4¢ per

line 2 wk. legal rate (\$45.14)

PUBLIC NOTICE

NOTICE OF HEARING on Application No. 5470-3 to Appropriate Water

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mendation or an interested person opposes the application, then the application will be considered by the Water Management Board. Petitions filed in support of the application will not require the Board to hear the application. The Board may conduct a hearing no sooner than 10:00 a.m., on December 5, 1990 at the Hilton Inn, Deerfield Room, 445 Mt. Rushmore Road, Rapid City SD and the hearing may be rescheduled for a later date. If the hearing is rescheduled, notice will be given of the time and place. The above hearing date will be automatically delayed for at least 20 days upon written request to the Chief Engineer from the applicant or any interested person opposing the application. The request for an automatic delay must be filed by November 26, 1990.

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This application is made pursuant to SDCL 46-1-1 thru 46-1-9, 46-1-12 thru 46-1-16; 46-3-3.1, 46-2-9, 46-2-11, 46-2-13, 46-2-17; 46-2A-1 thru 46-2A-10, 46-2A-12, 46-2A-14, 46-2A-15; 46-5-1 thru 46-5-11, 46-5-13 thru 46-5-15, 46-5-24, 46-5-25, 46-5-30.2, 46-5-30.4, 46-5-31; and Board Rules ARSD 74:02:01:01 thru 74:02:01:15.

(Nov. 7 & 14, 1990)



DEPARTMENT OF WATER & NATURAL RESOURCES

Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

MAR 25 1991

John L. Spinks, Jr.
U.S. Fish and Wildlife Service
PO Box 25486
Denver, CO 80225

Dear Mr. Spinks:

Enclosed is Water Permit No. 5470-3 as approved by the Water Management Board authorizing you to construct your water diversion system and put the water to beneficial use, not exceeding the limits as specified in the Water Permit.

Also enclosed is Form 10, Notice of Completion of Works and Application of Water to Beneficial Use, which you are to complete and submit to the Chief Engineer when you have completed the system and/or have put the water to beneficial use. An inspection can then be scheduled so that the Water License may be issued, thus completing your acquisition of a Water Right.

Very truly yours,

JOHN HATCH, Chief Engineer
Water Rights Division
605 773-3352

enclosures

PLEASE NOTE: Certain changes can be made in your permit within the five year construction period, usually without affecting the priority date provided an application to amend your permit is made within the five year period - i.e. changes in location or number of diversion points (wells) or location of land to be irrigated. Well locations for wells into the same aquifer can be moved up to 660 feet without application.

Applications to amend a permit after the five year construction period will be assigned a new priority date. Applications to change water sources, to add lands or increase original diversion rates, if approved will usually receive the date of the new application as a priority date regardless of the five year construction period.

Permit No. 5470-3
Minnesota-Whetstone - Water District

Report Of Examination Of Works And/Or Application of Water To Beneficial Use

TO: Chief Engineer, Division of Water Rights, DENR, Foss Bldg., Pierre, SD 57501

I have this day made a thorough examination of the water use system constructed by US Fish and Wildlife Service of PO Box 25486 holder of Permit No. 5470-3, bearing the priority of August 27, 1990 authorizing the storage of 33 acre-feet with the authorized impoundment of up to 65 ac-ft annually of the waters of surface water for wildlife propagation purposes, in Roberts County.

I have to report on the conditions of the same as follows:

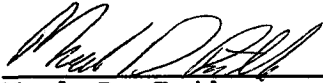
A. Works used to divert the water:

A 13 foot high 380 foot long dam capable of storing 33 ac-ft

The system is in the following condition good. The point of diversion is located in the NE1/4 SW1/4 of Section 28 T129N-R50W. The works are capable of storing 33 acre-feet of water which is to be used for wildlife propagation. The license should be issued for 33 acre-feet of storage with the authorized impoundment of up to 65 ac-ft annually.

Applicable permit qualifications have been complied with: Yes ☒ No

Exceptions to compliance are: none Date: 10/6/1992



Mark D. Rath
Natural Resources Engineer
DENR, Water Rights Division

REPORT ON INSPECTION OF PERMIT NO. 5470-3

DATE: 10/6/1992

DIVERSION POINT LEGAL LOCATION: NE1/4 SW1/4 Section 28 T129N-R50W

DAM INFORMATION:

- 1) Height to crest 13 feet
- 2) Height to primary spillway 8 feet
- 3) Height to secondary spillway 9 ft
- 4) Crest width 15 feet
- 5) Crest length 380 feet
- 6) Spillway length 150 feet
- 7) Spillway width 65 feet
- 8) Approx. storage 33 ac-ft
- 9) Approx. storage to crest ac-ft
- 10) Date constructed: 1991
- 11) Outlet tubes:
 - a) diameter 24 inches
 - b) type CMP
 - c) valved Y
 - d) valve type Stop Log
 - e) location on structure
Center
- 12) Category of Dam III
- 13) Inspection Sheet Completed N
- 14) Name of Contractor
Dakota Improvement

PERMIT QUALIFICATIONS AND REGULATIONS:

- 1) Soil and water permit lands agree with lands being irrigated and lands listed on permit NA
- 2) Special qualifications to permit being abided by Y
- 3) All structures, wells and lands on map Y
- 4) Irrigation Questionnaires checked to determine if permit owner started irrigation by the end of construction period NA



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3181

January 15, 1993

5470-3

John L. Spinks, Jr.
U.S. Fish and Wildlife Service
P.O. Box 25486
Denver, CO 80225

Dear Mr. Spinks:

The inspection of your water use system and the inspection of the extent of application of water to beneficial use, as developed under Water Permit No. 5470-3, has been completed. Your final water right document, the Water License, can now be issued.

Statutes require that we charge a \$50.00 fee for the inspection and issuance of the Water License. Upon receipt of the \$50.00 fee from you, we will begin processing your Water License.

South Dakota Water Law 46-5-30.1 requires that a permit holder may not divert water until the \$50.00 license fee has been paid. Please contact us if you have any questions.

Sincerely,

Cheryl F. Frost
Secretary
Water Rights Division
(605) 773-3352

NOTE: On check or money order, please specify your permit number.
This will insure proper handling of the fee.



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Mountain-Prairie Region

TAKE
PRIDE IN
AMERICA

IN REPLY REFER TO:

BA EN
WR SD

Mail Stop 60190

MAILING ADDRESS:

Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:

134 Union Blvd.
Lakewood, Colorado 80228

JAN 28 1993



Ms. Cheryl F. Frost
Department of Environment and
Natural Resources
Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

Dear Ms. Frost:

In response to your letter of January 15, 1993, enclosed is a Money Order in the amount of \$50 to cover the inspection fee and issuance of the Water License for Water Permit No. 5470-3, Navratil Waterfowl Production Area, Roberts County.

If you have questions or require further information, please contact Linda Coe in our Water Rights Branch at (303) 236-5321.

Sincerely,

William A. Godby
Regional Engineer

Enclosure

RECEIPT

413612

Division of Water Rights

South Dakota Department of Environment and Natural Resources

Pierre, _____ February 1, 19 93

RECEIVED OF U.S. Fish & Wildlife Service, P.O.Box 25486, Denver Fed. Ctr., Denver, CO 80225

the following amount in fees for services rendered as provided for by law:

Fee for Application for Permit No. _____ to Appropriate Water, to construct and to put water to beneficial use _____		
Fee for Application for Permit No. _____ to Appropriate Water, for Future Use _____		
Fee to retain Future Use Permit No. _____ after period of seven years.		
Fee for Inspecting Constructed Works, confirming beneficial use and issuing Water License No. <u>5470-3</u>	50	00
Fee for Filing Transfer Form _____		
Fee for Filing Extension Request _____		
Fee for _____		

(Any Other Work Provided by Law)	Total	50 00

By Jahn Hatch
Chief Engineer

STATE OF SOUTH DAKOTA
WATER LICENSE NO. 5470-3

(1) U.S. Fish & Wildlife Service, of P.O. Box 25486, Denver Federal Center, Denver, CO 80225 made Application No. 5470-3, August 27, 1990 for a water permit to impound 65 acre feet of water annually by constructing a dam (33 acre feet storage capacity plus 32 acre feet seasonal use) in the Navratil Waterfowl Production Area, Roberts County, South Dakota for waterfowl production purposes. Permit No. 5470-3, with a priority date of August 27, 1990 was approved December 5, 1990 and issued to the applicant for diversion of water with construction of the described water supply system to be completed on or before December 5, 1995 and for the application to beneficial use of said water on or before December 5, 1999.

(2) It is certified that the applicant has complied with the provisions of South Dakota State Law relating to completion of the construction of the water supply system and is entitled to impound 65 acre feet of water (33 acre feet storage capacity plus 32 acre-feet seasonal use) for beneficial use. The location of the diversion point is in the NE 1/4 SW 1/4 of Section 28-T129N-R50W.

(3) The applicant has complied with the provisions of South Dakota State Law relating to the application of water to beneficial use.

(4) Pursuant to South Dakota Water Law 46-5-30.1 U.S. Fish & Wildlife Service of P.O. Box 25486, Denver Federal Center, Denver, CO 80225 the holder and/or owner of Water Permit No. 5470-3 is issued a license to appropriate water, the right to impound 65 acre feet of water annually (33 acre feet storage capacity plus 32 acre feet seasonal use) with a priority date of August 27, 1990 from the location specified in (2) of this license. The water is be used for the purpose of waterfowl production. This license is subject to any limitations or qualifications listed in Water Permit No. 5470-3 and subject to South Dakota State Law.



JOHN HATCH, Chief Engineer
Water Rights Division
Department of Environment and Natural Resources

NOV 14 1994

date



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3181

NOV 14 1994

5470-3

John L. Spinks, Jr., Regional Director
U.S. Fish & Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, CO 80225

Dear Mr. Spinks:

Enclosed is Water License No. 5470-3 and Receipt No. 413612 for \$50.00 which was assessed for an inspection and issuance of the license. Water License No. 5470-3 is the final document which completes the process of obtaining a water right.

As long as you use the water beneficially, as stated in the Water License, State Water Laws provide that you have a continuing right to use the water.

Very truly yours,

JOHN HATCH, Chief Engineer
Water Rights Division
(605) 773-3352

rd
enclosures

Gronlund, Eric

From: Gronlund, Eric
Sent: Tuesday, November 12, 2019 11:37 AM
To: Carrie Cordova
Subject: RE: [EXT] Water License No. 5470-3

Carrie

US Fish and Wildlife Service inquired regarding altering the dam authorized by South Dakota Water Right No. 5470-3. The USFWS is considering removal of the water control structure and replacing it with a fixed elevation set at the spillway.

Water Right No. 5470-3 authorizes a dam impounding 33 acre feet of water at the normal height of 4.5 feet. The maximum height of the dam, as approved, was 8.5 feet in height with an accompanying top of dam storage of 122 acre feet of water. The report from a 1992 on-site licensing investigation found the height to crest of the dam is 13 feet and the height to the primary spillway being 8 feet. The storage as the primary spillway remained 33 acre feet of water and the license was issued accordingly. The primary outlet is a 24 inch CMP controlled by stop logs.

Your inquiry is regarding whether additional permitting may be needed for the proposed alteration to a fixed elevation spillway.

- If the normal storage capacity is increased above 33 acre feet of water, a water right permit will need to be obtained for whatever the incremental increase in the normal storage will be. Example: if the normal storage will now be 45 acre feet of water, an application will need to be filed for the additional 12 acre feet of storage (45 minus 33 = 12).
- If the normal storage capacity is not to be increased above 33 acre feet of water, then no water right permitting is necessary. As a federal dam, USFWS will need to insure that federal dam safety requirements are met. The South Dakota DENR would request that the plans and specification for the dam alteration be provided in order to document our files.

Let me know if you have questions.

Eric Gronlund
Water Rights Program, DENR
605 773-3352
Eric.gronlund@state.sd.us

From: Carrie Cordova <carrie_cordova@fws.gov>
Sent: Wednesday, November 6, 2019 5:24 PM
To: Gronlund, Eric <Eric.Gronlund@state.sd.us>
Subject: [EXT] Water License No. 5470-3

Good Afternoon Eric,

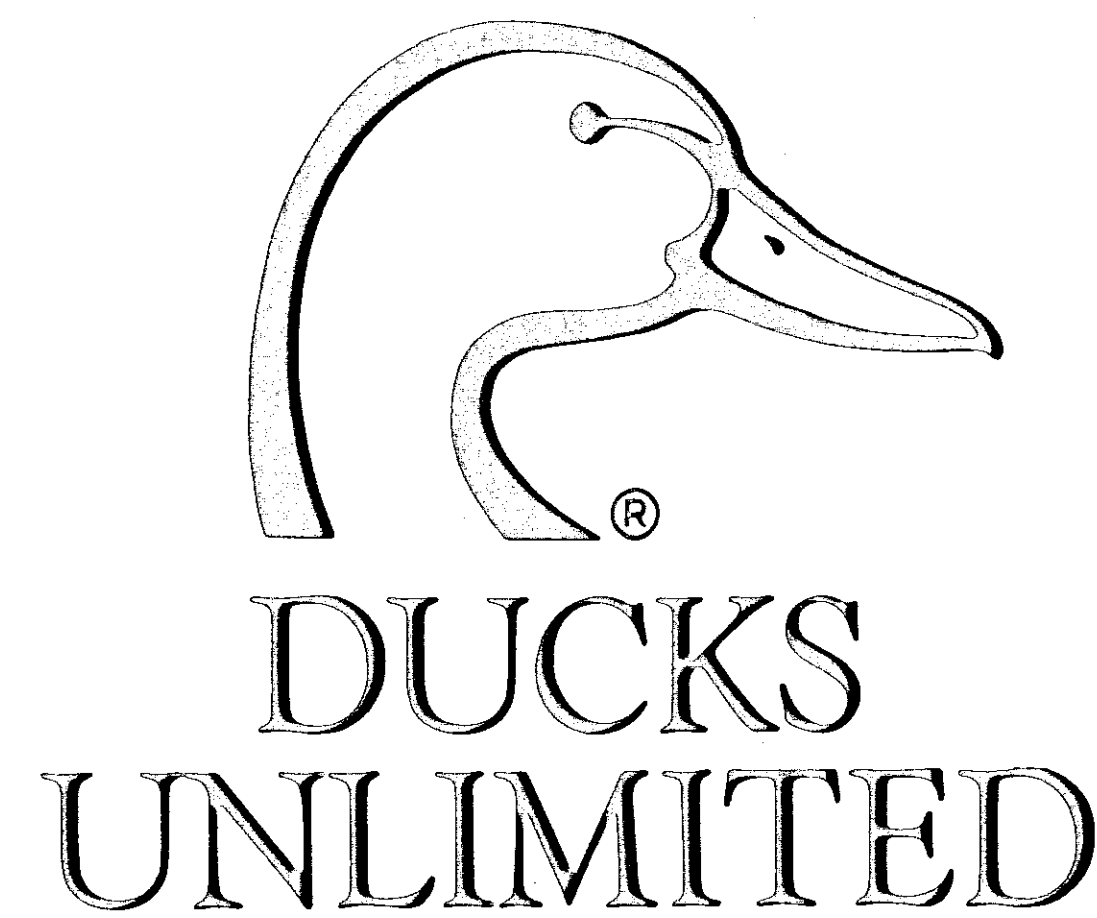
FWS may be proposing to remove the water control structure and replacing it with a fixed elevation set at the spillway? Would this proposal have any impact on our water license? Is there required paperwork that needs to be filed?

Thank you for your assistance.

Carrie Cordova, Water Rights Specialist

U.S. Fish & Wildlife Service
Water Resources Division (MS 69016)
P.O. Box 25486, Denver Federal Center
Denver CO 80225
303-236-5399

This e-mail message (including any attachments) is intended for the use of the individual or entity addressed. It may contain information that is privileged, confidential, or otherwise protected by law. If you are not the intended recipient, any dissemination, distribution, copying or use of this message or its contents is strictly prohibited. If you receive this message in error, please notify me immediately and destroy all copies of the message. Thank you.



DUCKS UNLIMITED

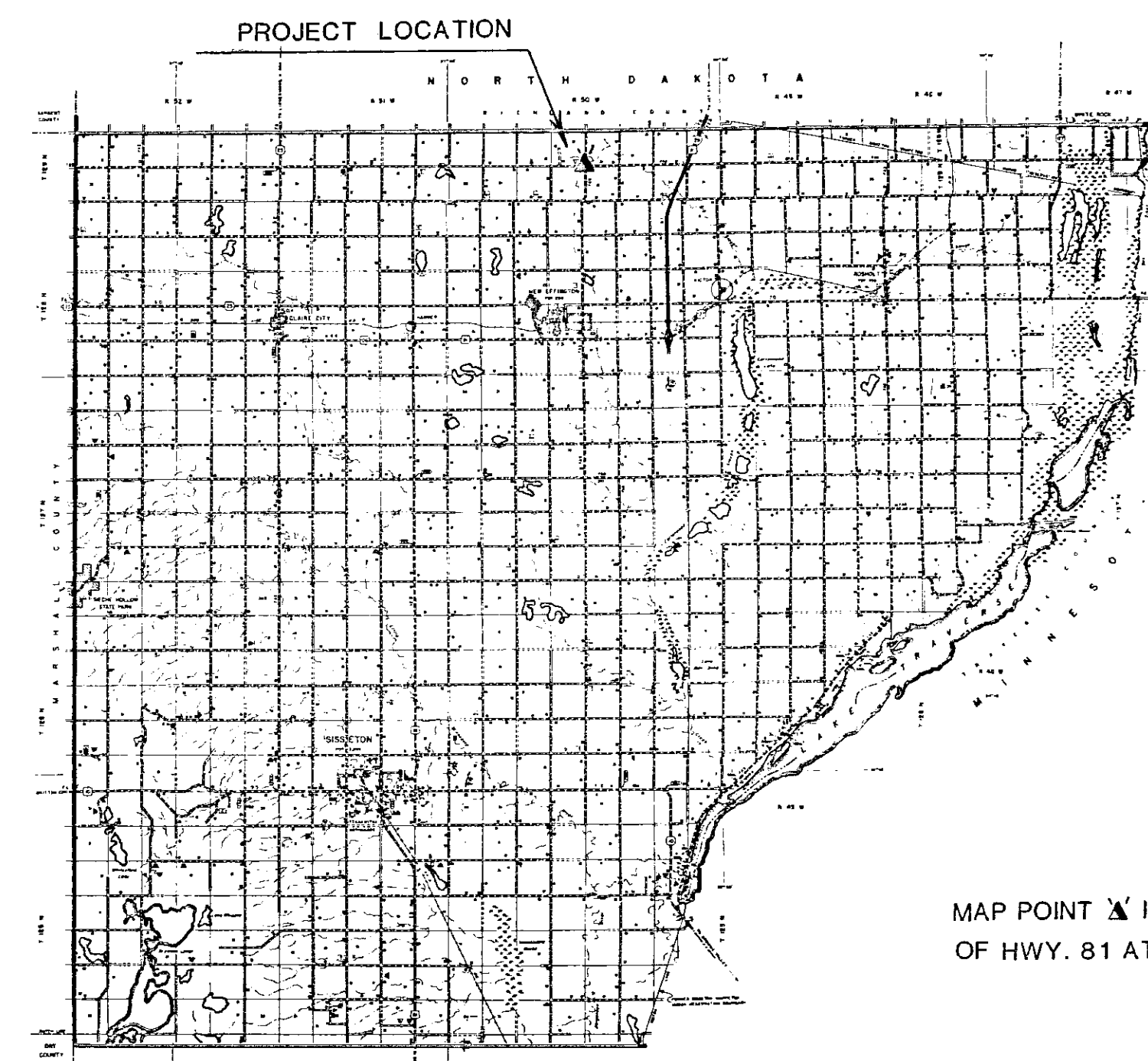
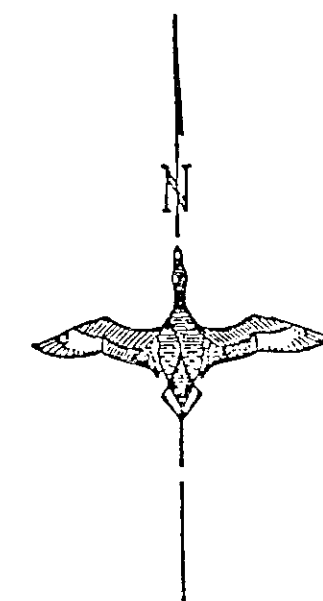
NAVRATIL WPA

SEC. 28, TWP. 129 N. RGE. 50 W.

ROBERTS COUNTY, SOUTH DAKOTA

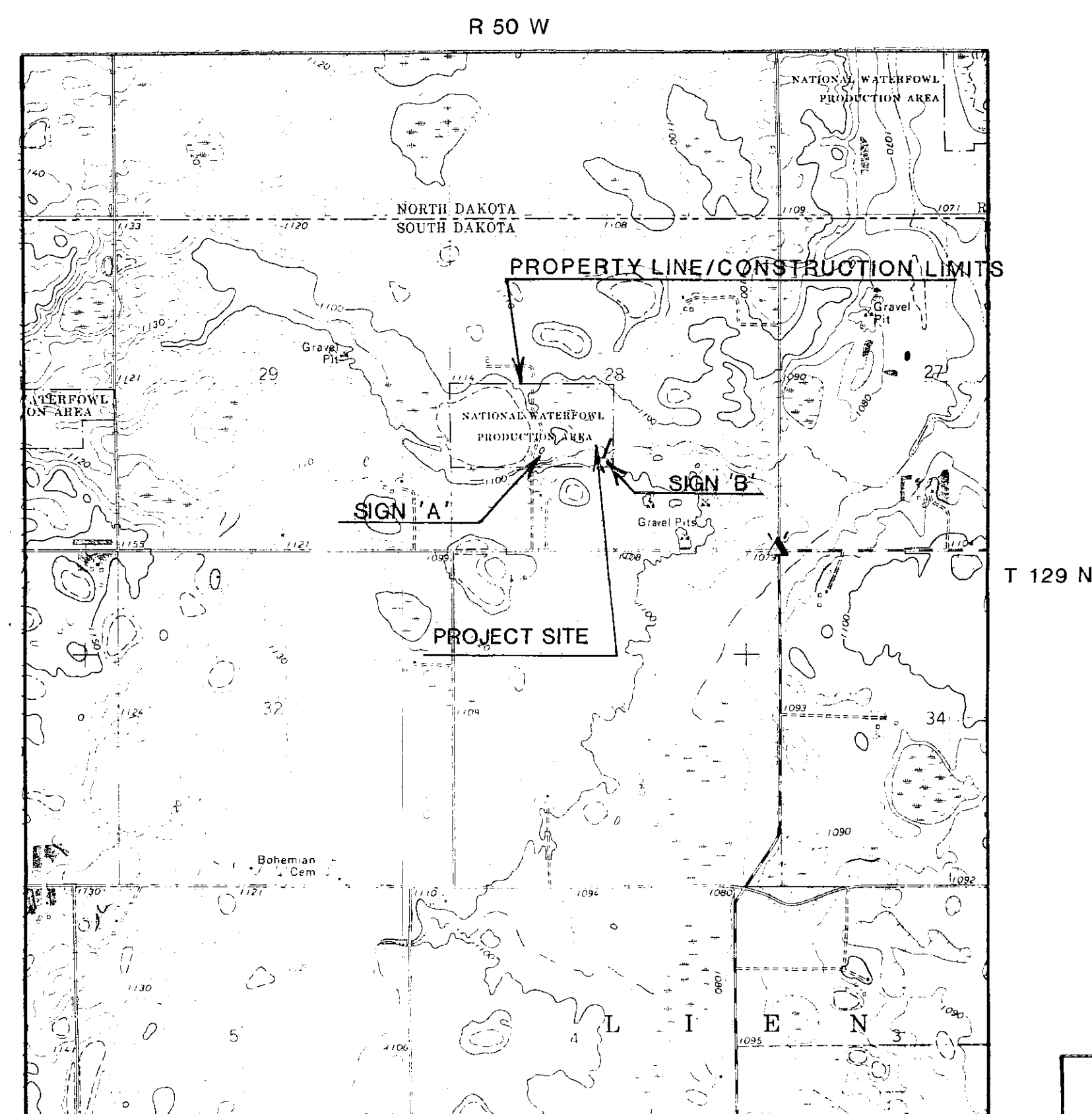
IN COOPERATION WITH

U.S. FISH & WILDLIFE SERVICE



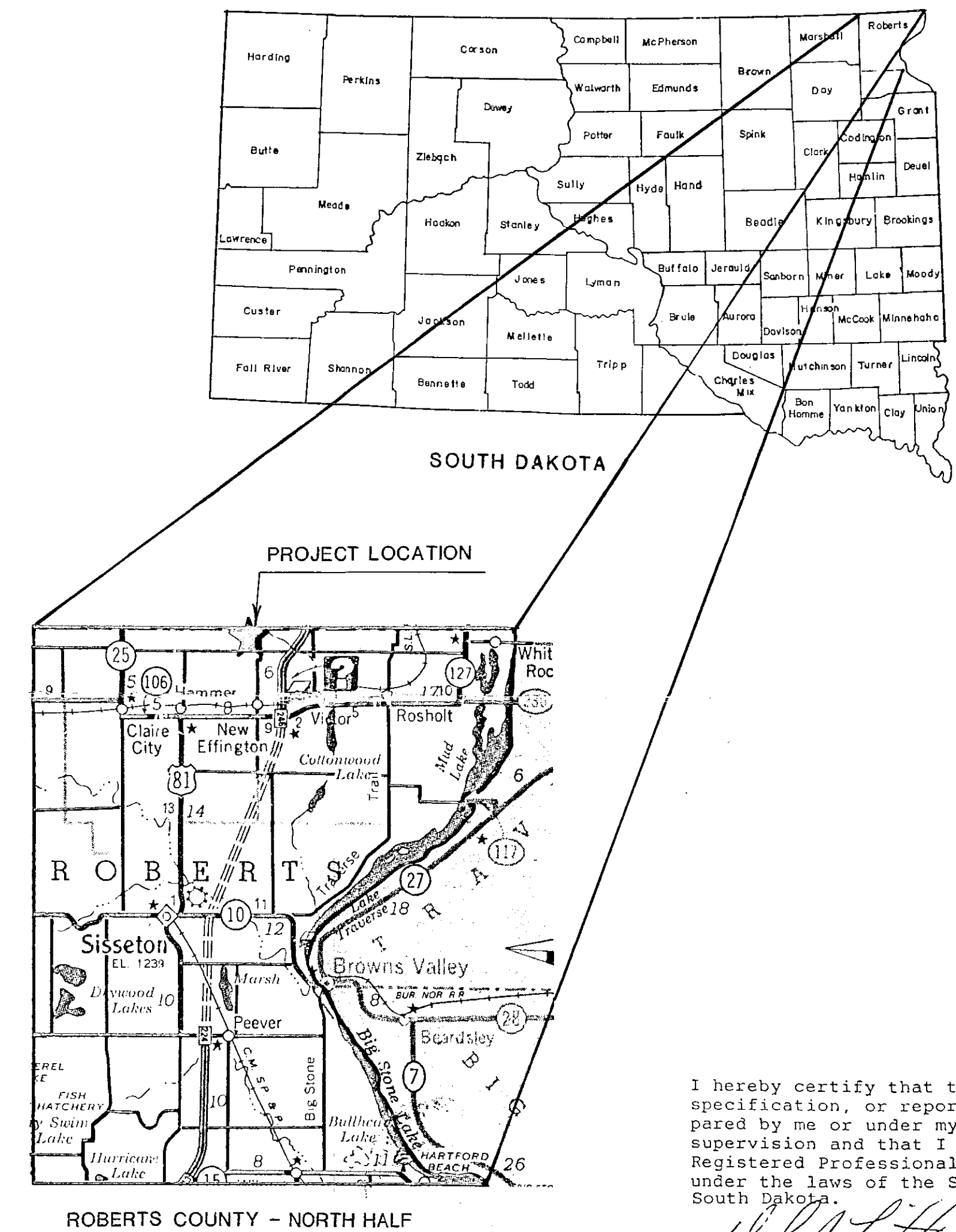
MAP POINT 'X' IS 5 MILES NORTH OF JUNCTION
OF HWY. 81 AT NEW EFFINGTON, S.D.

LOCATION MAP



VICINITY MAP

SCALE : 1" = 2,000'



INDEX

1. VICINITY MAP
2. TOPO MAP & E PROFILES
3. SITE PLAN & DETAILS
4. DETAILS & SOILS

SPECIFICATIONS

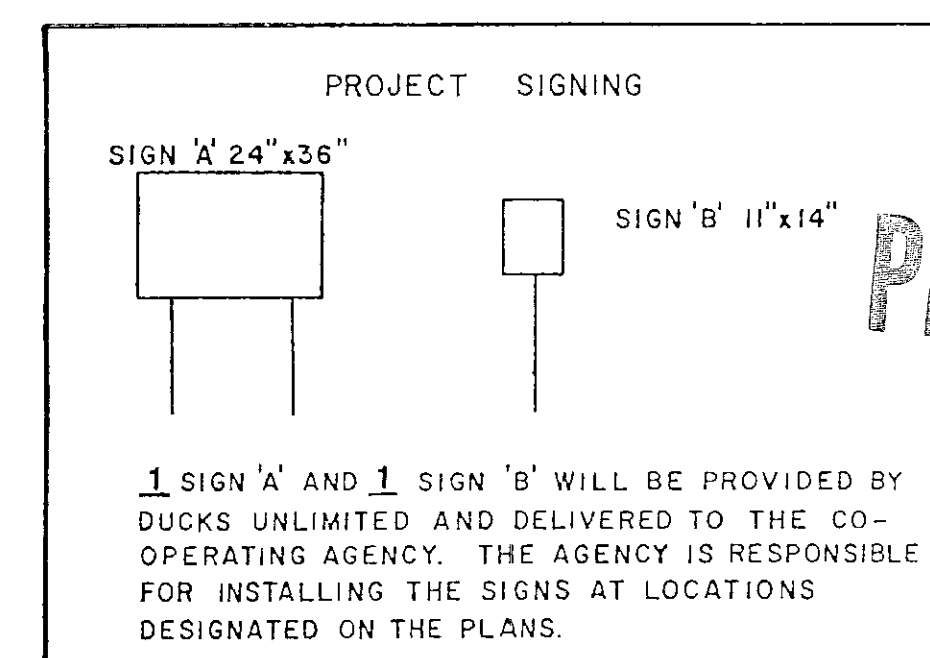
GENERAL CONDITIONS	101
MOBILIZATION	201
SITE PREPARATION	202
EXCAVATION	203
EMBANKMENT CONSTRUCTION	204
WATER	205
WATER CONTROL STRUCTURE INSTALLATION	206
WATER CONTROL STRUCTURE & CULVERT APPURTENANCES	206A
CULVERT INSTALLATION	207
CAST-IN-PLACE REINFORCED CONCRETE	208

ESTIMATED QUANTITIES

MOBILIZATION	1 L.S.
SITE PREPARATION	689 C.Y.-P
EXCAVATION*	98 C.Y.-P
EMBANKMENT**	3548 C.Y.
WATER	XXX M. GAL.
60" DIA. CMP RISER	1 L.S.
48" DIA. CMP OUTLET BARREL	60 L.F.
24" DIA. CMP INLET BARREL	12 L.F.

* INLET CHANNEL & PLUNGE POOL
** INCLUDES 15% SHRINKAGE

App'l 5470-3



1 SIGN 'A' and 1 SIGN 'B' WILL BE PROVIDED BY
DUCKS UNLIMITED AND DELIVERED TO THE CO-
OPERATING AGENCY. THE AGENCY IS RESPONSIBLE
FOR INSTALLING THE SIGNS AT LOCATIONS
DESIGNATED ON THE PLANS.



PRELIMINARY



PROJECT NO. DU-1-SD-105-01
GREAT PLAINS REGIONAL OFFICE

NAV RATIL WPA
VICINITY MAP

DESIGNED BY: DJL
DRAWN BY: TD
SURVEYED BY: GLJ
CHECKED BY:

DATE: 5-3-90

SHEET NO.: 1 OF 4

APPROVED BY:

APPROVED BY:



DUCKS UNLIMITED

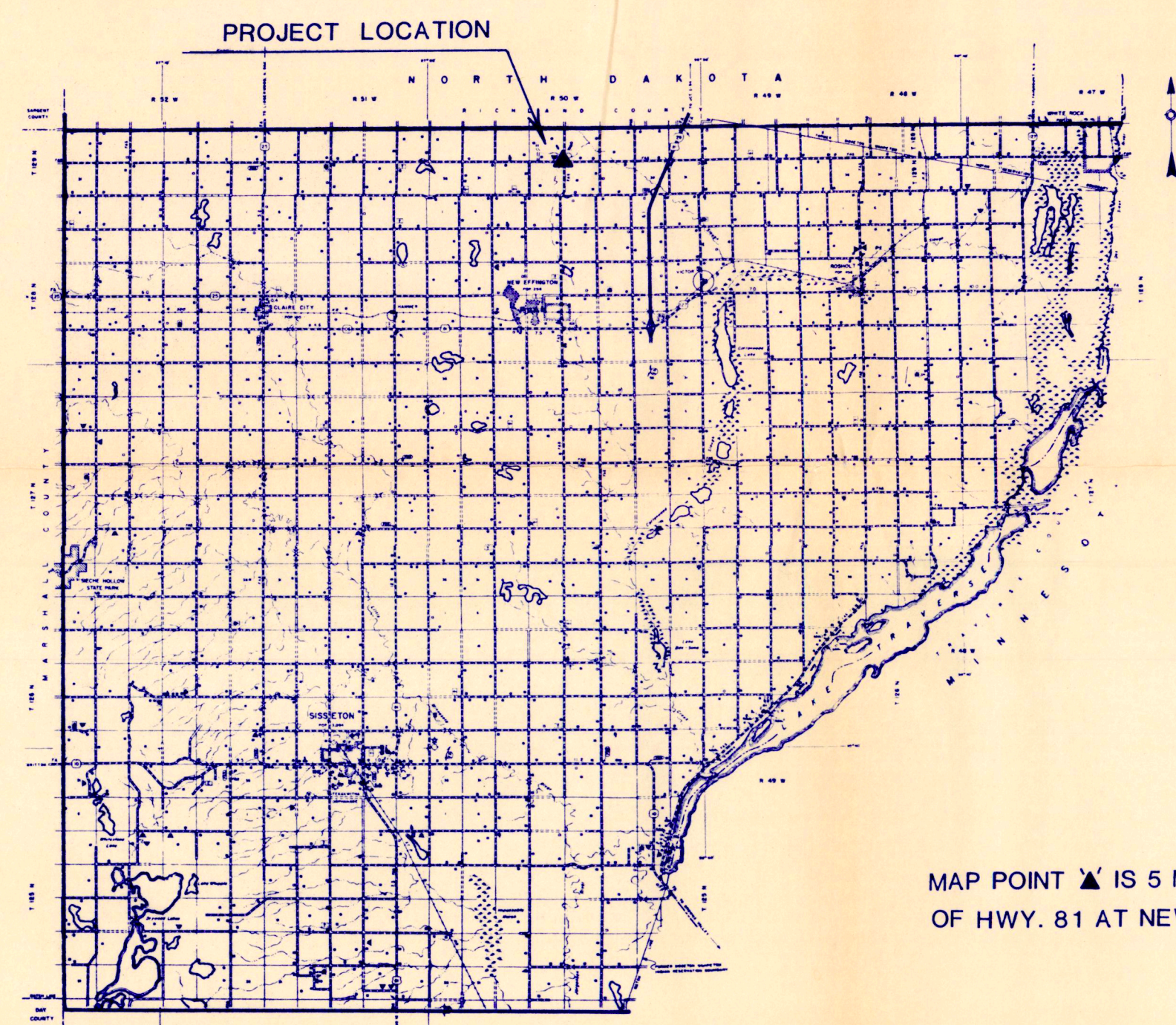
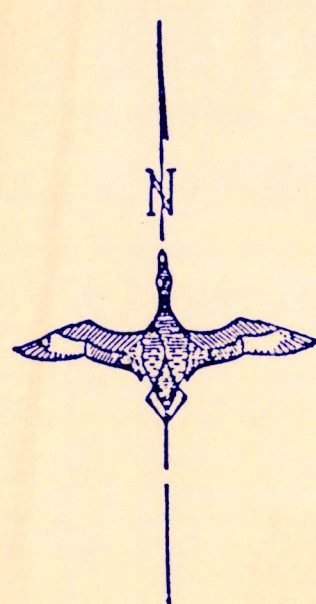
NAVRATIL WPA

SEC. 28, TWP. 129 N. RGE. 50 W.

ROBERTS COUNTY, SOUTH DAKOTA

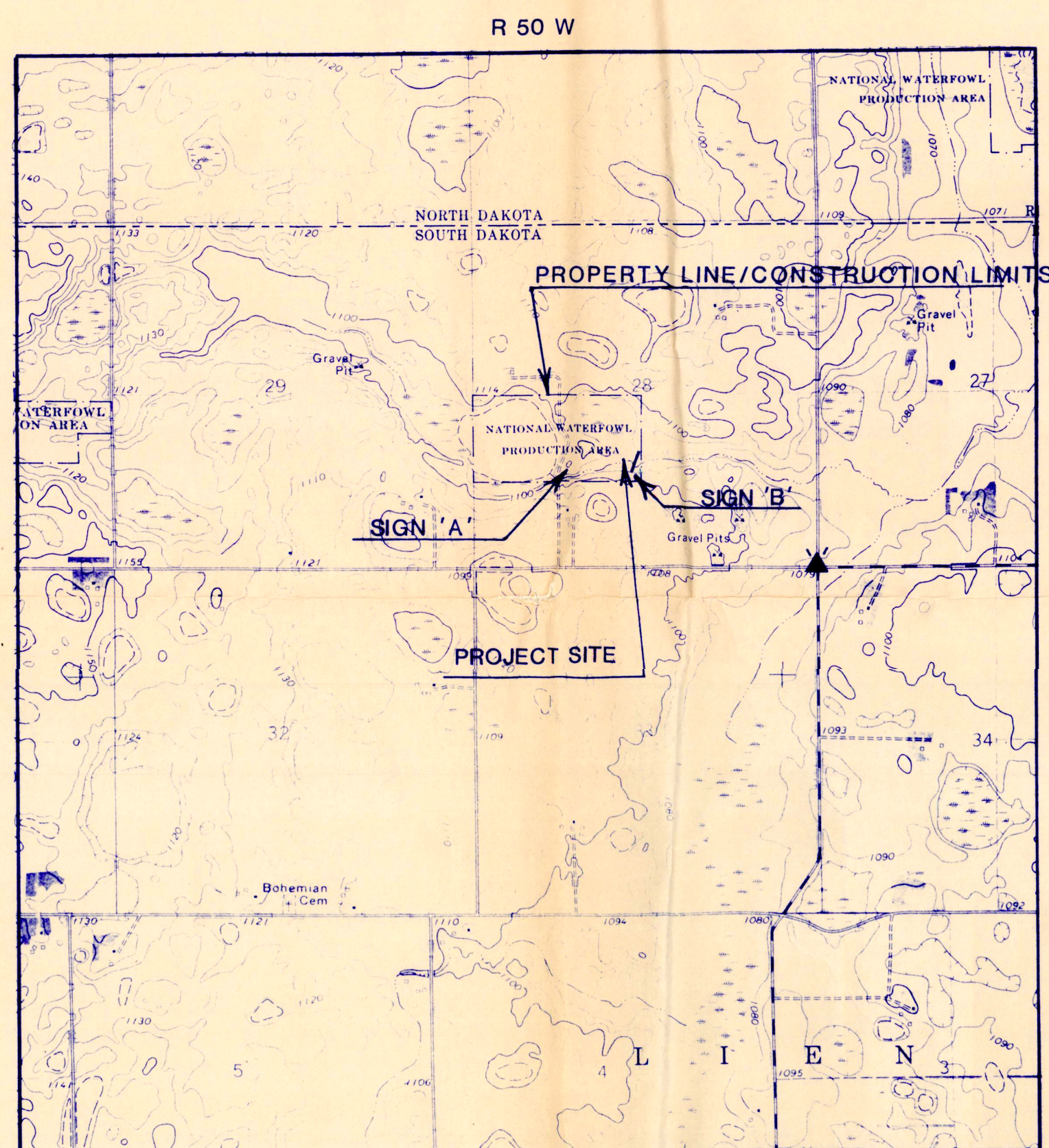
IN COOPERATION WITH

U.S. FISH & WILDLIFE SERVICE



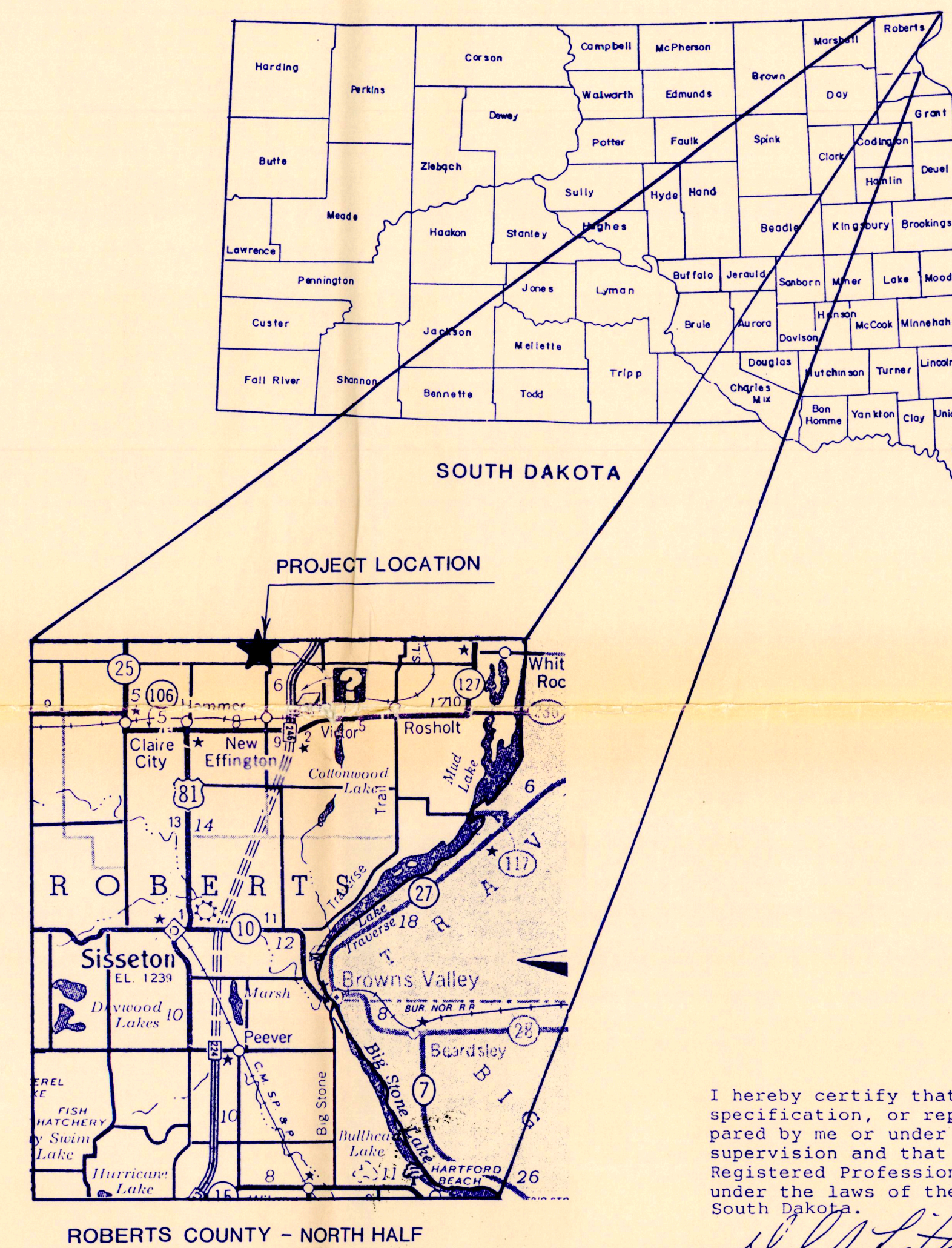
LOCATION MAP

MAP POINT ▲ IS 5 MILES NORTH OF JUNCTION
OF HWY. 81 AT NEW EFFINGTON, S.D.



VICINITY MAP

SCALE : 1" = 2,000'



I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of South Dakota.

Wayne J. Lutz

Date 5-17-90 Registration No. 4499

INDEX

1. VICINITY MAP
2. TOPO MAP & C PROFILES
3. SITE PLAN & DETAILS
4. DETAILS & SOILS

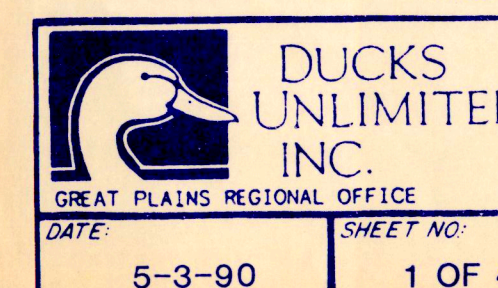
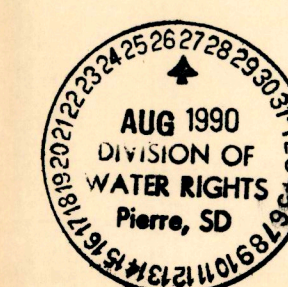
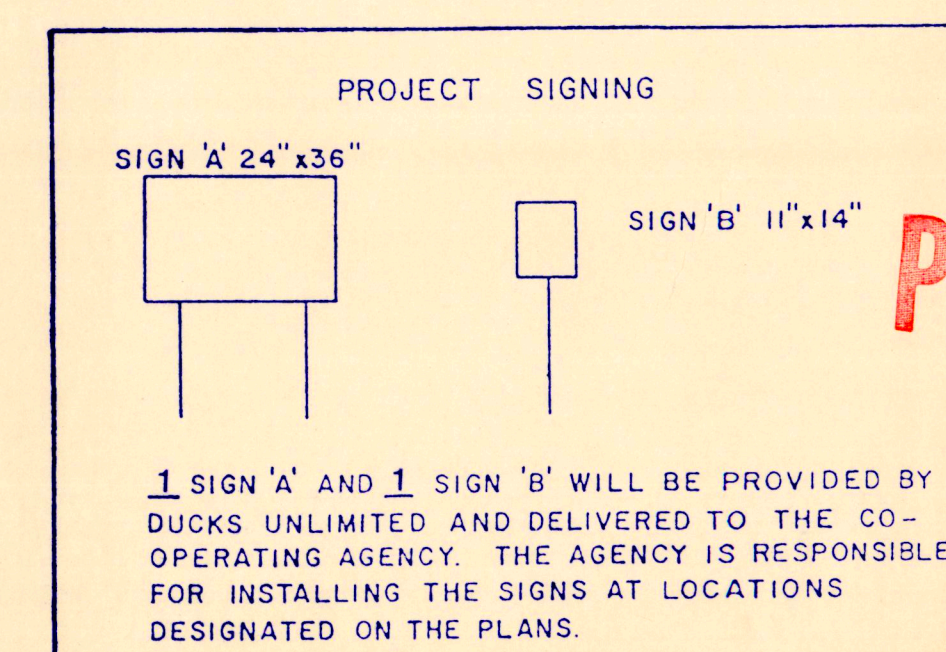
SPECIFICATIONS

GENERAL CONDITIONS	101
MOBILIZATION	201
SITE PREPARATION	202
EXCAVATION	203
EMBANKMENT CONSTRUCTION	204
WATER	205
WATER CONTROL STRUCTURE INSTALLATION	206
WATER CONTROL STRUCTURE & CULVERT APPURTENANCES	206A
CULVERT INSTALLATION	207
CAST-IN-PLACE REINFORCED CONCRETE	208

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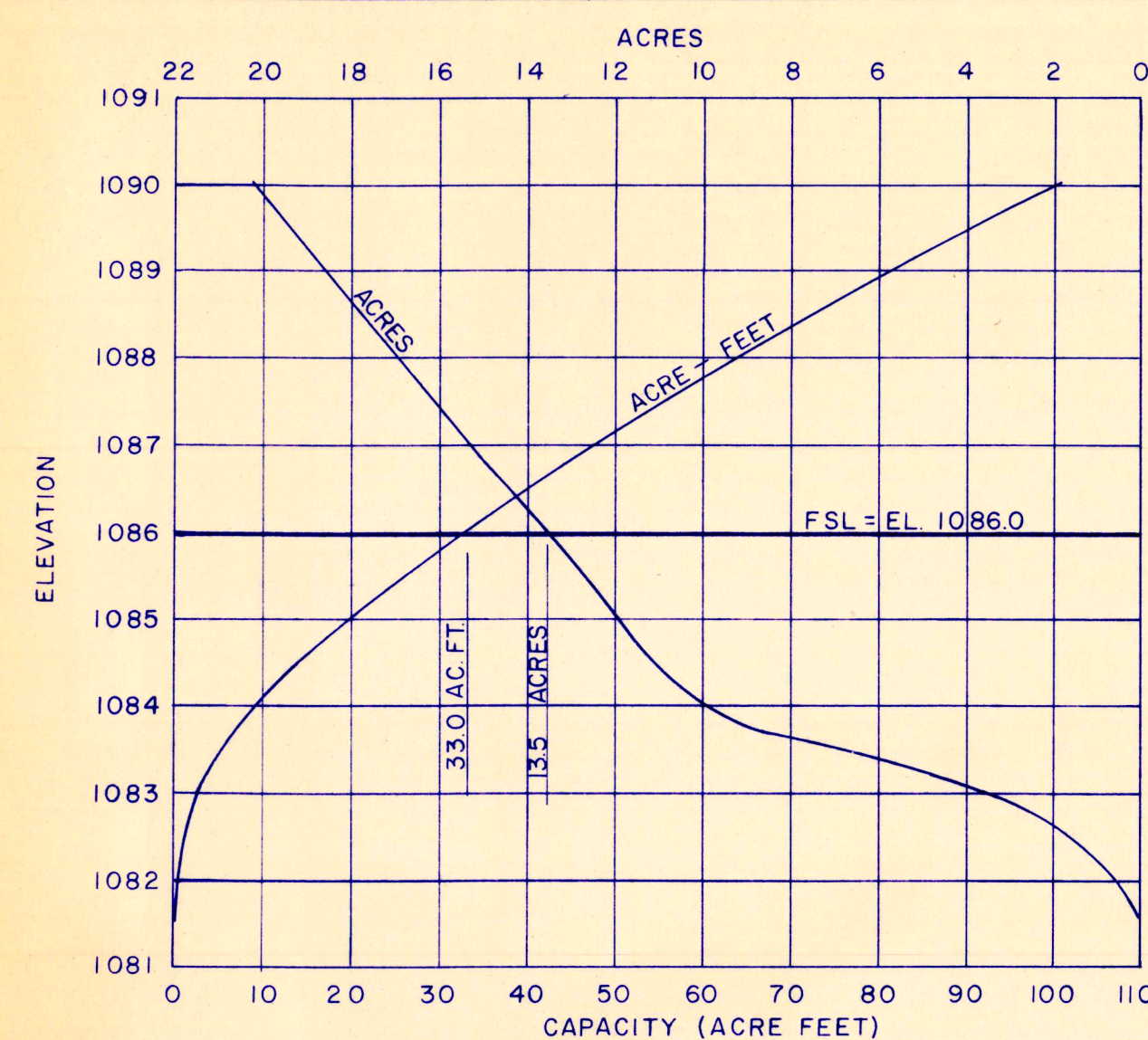
MOBILIZATION	1 L.S.
SITE PREPARATION	689 C.Y.-P
EXCAVATION*	98 C.Y.-P
EMBANKMENT**	3548 C.Y.
WATER	XXX M. GAL.
60" DIA. CMP RISER	1 L.S.
48" DIA. CMP OUTLET BARREL	60 L.F.
24" DIA. CMP INLET BARREL	12 L.F.

* INLET CHANNEL & PLUNGE POOL
** INCLUDES 15% SHRINKAGE

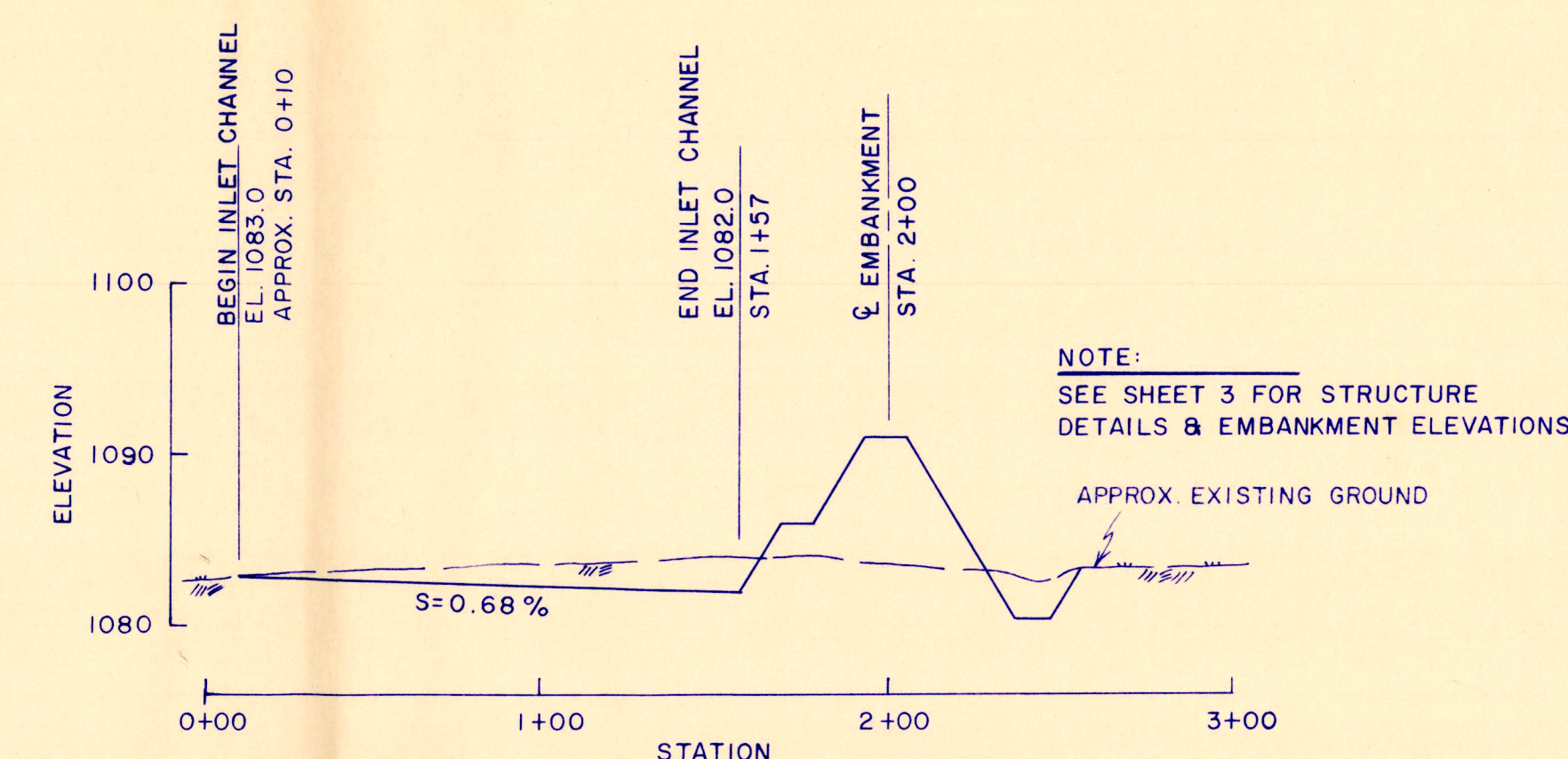
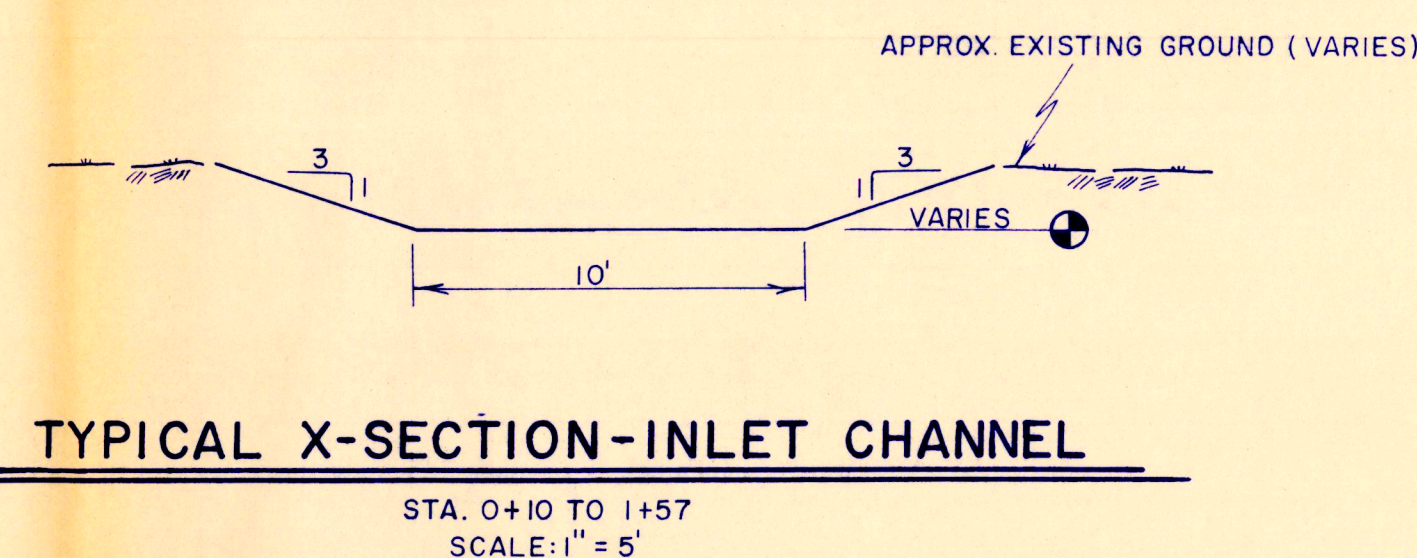


PROJECT NO. DU-1-SD-105-01	DESIGNED BY: DJL
NAV RATIL WPA VICINITY MAP	DRAWN BY: TD
	SURVEYED BY: GLJ
	CHECKED BY:
DATE: 5-3-90	SHEET NO.: 1 OF 4
APPROVED BY:	APPROVED BY:

MARSH DATA
FULL SERVICE LEVEL (FSL) = 1086.0
ACRES AT FSL = 13.5
ACRE- FEET AT FSL = 33.0
SHORELINE MILES AT FSL = .79

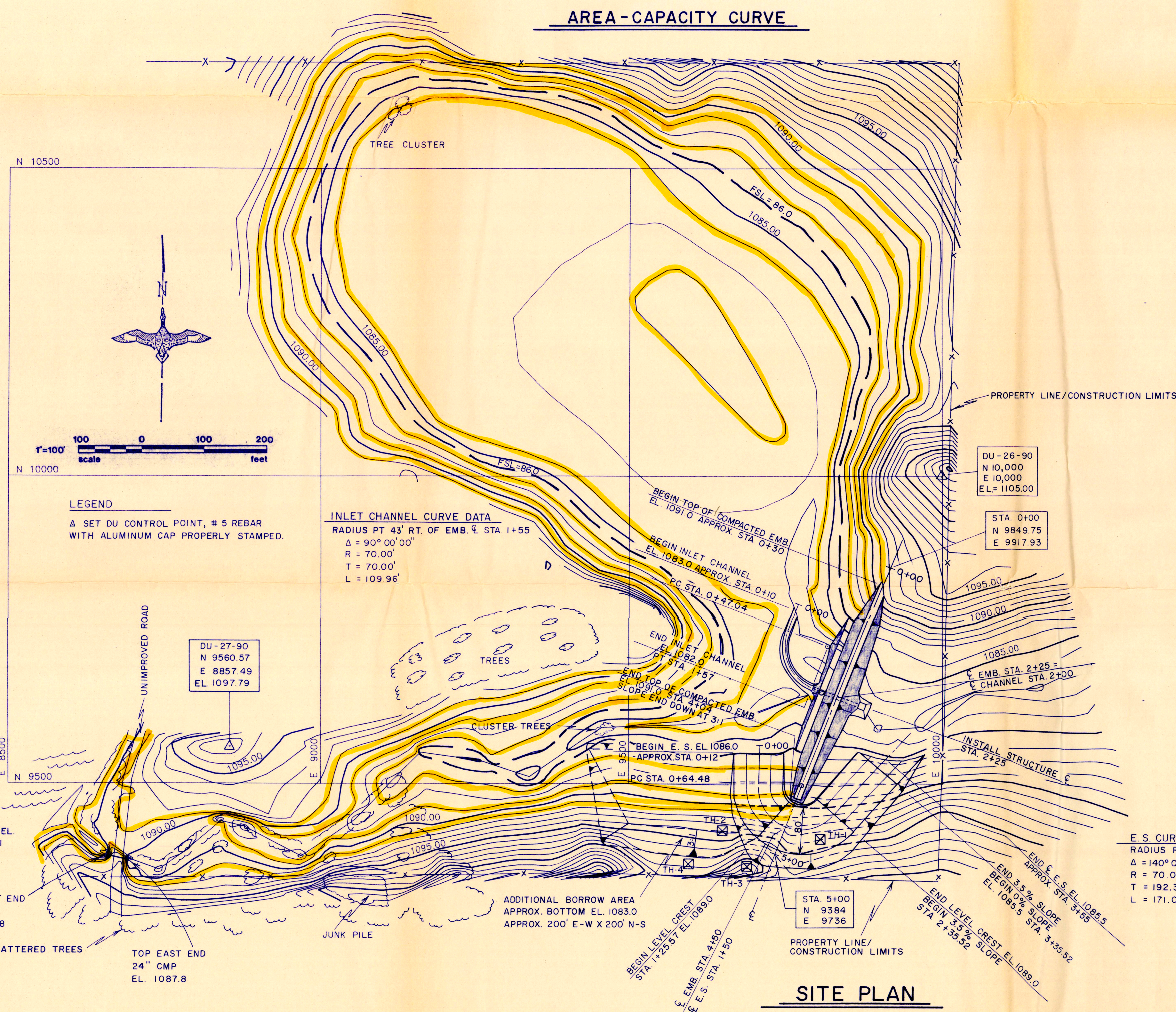


AREA-CAPACITY CURVE

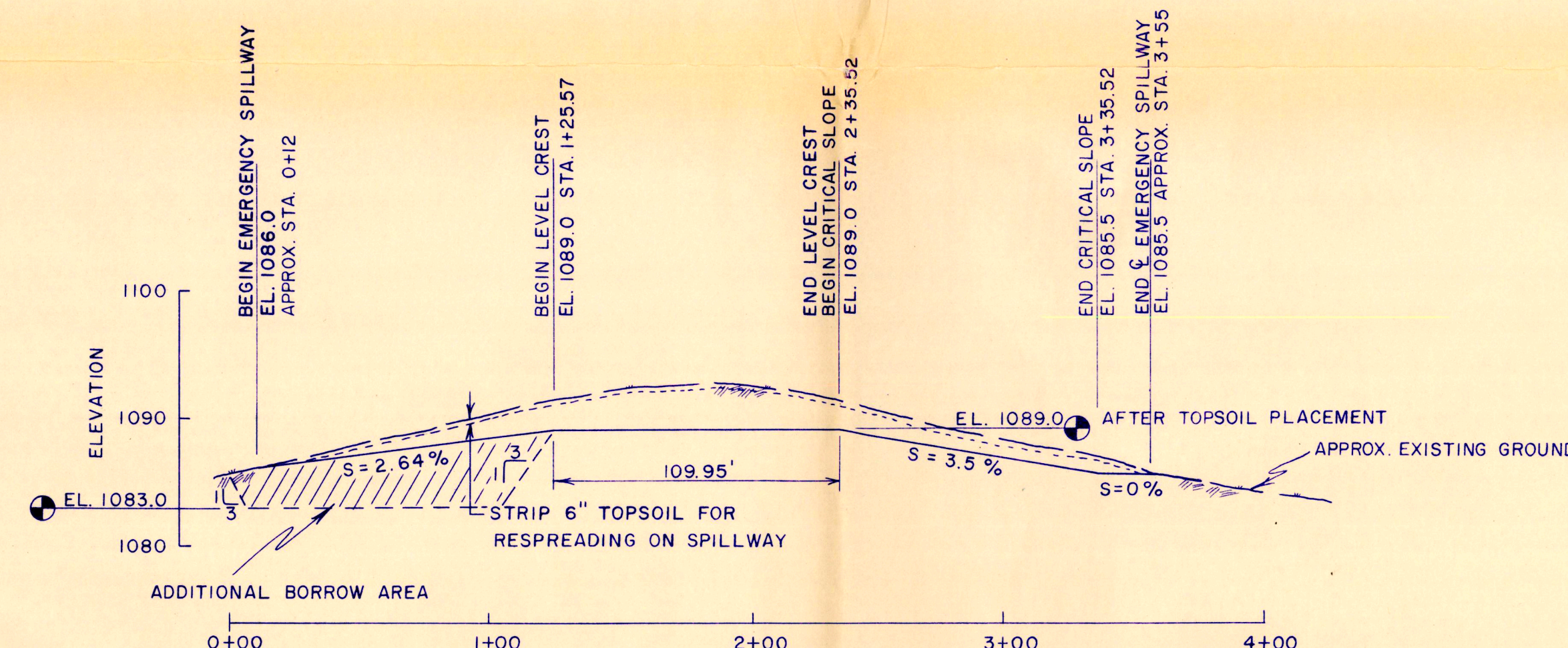


INLET CHANNEL C PROFILE

SCALE: 1" = 50' HORIZ
1" = 10' VERT

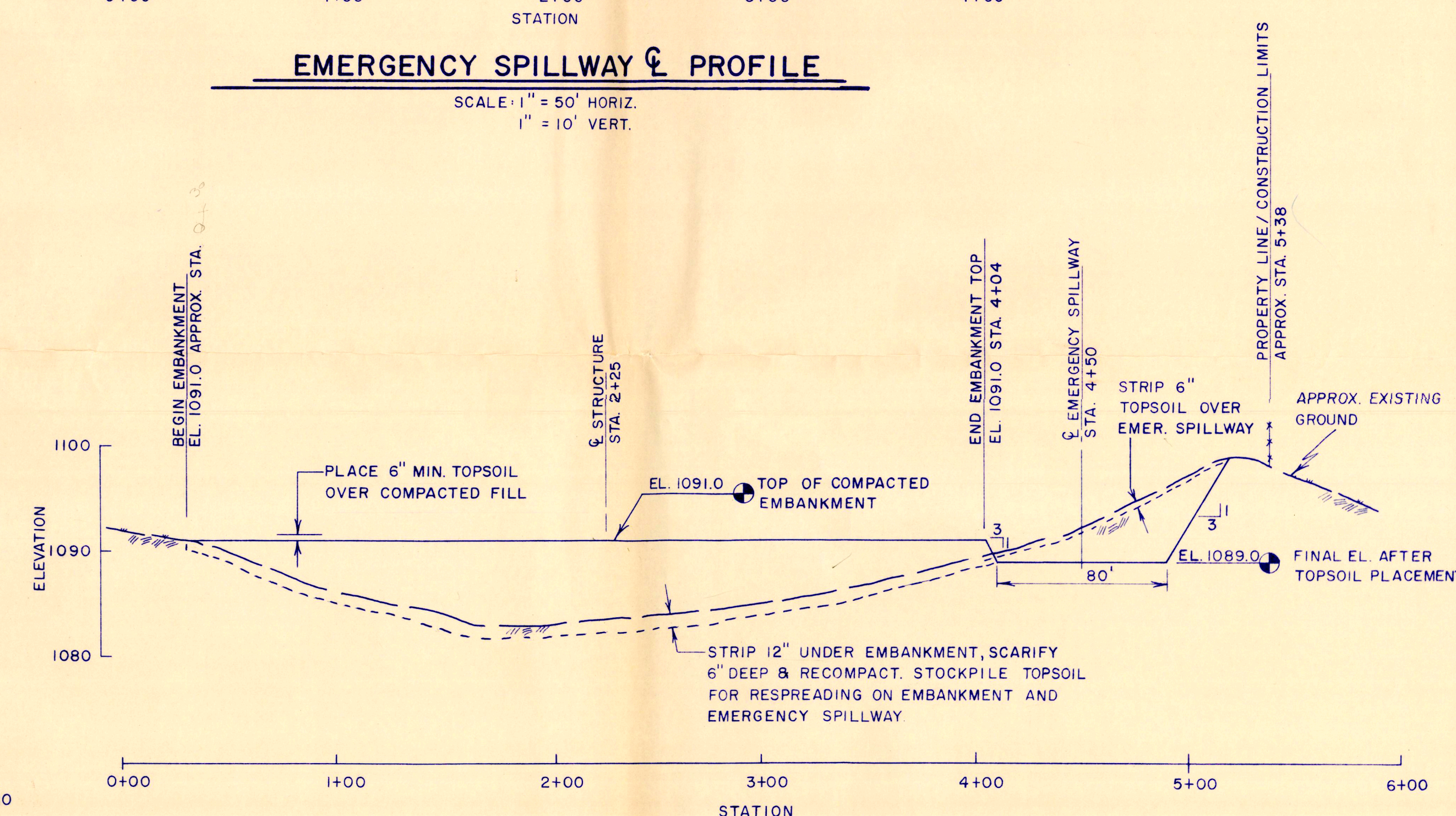


SITE PLAN



EMERGENCY SPILLWAY C PROFILE

SCALE: 1" = 50' HORIZ.
1" = 10' VERT.



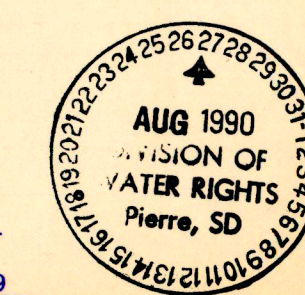
EMBANKMENT & PROFILE

SCALE: 1" = 50' HORIZ.
1" = 10' VERT.

PRELIMINARY

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of South Dakota.

Date 5-17-90 Registration No. 4499



**DUCKS
UNLIMITED
INC.**
GREAT PLAINS REGIONAL OFFICE

D	PROJECT NO: DU-I-SD-105-01
	NAVRATIL WPA TOPO MAP, & PROFILES

DESIGNED BY:	DJ
DRAWN BY:	TD
SURVEYED BY:	
CHECKED BY:	

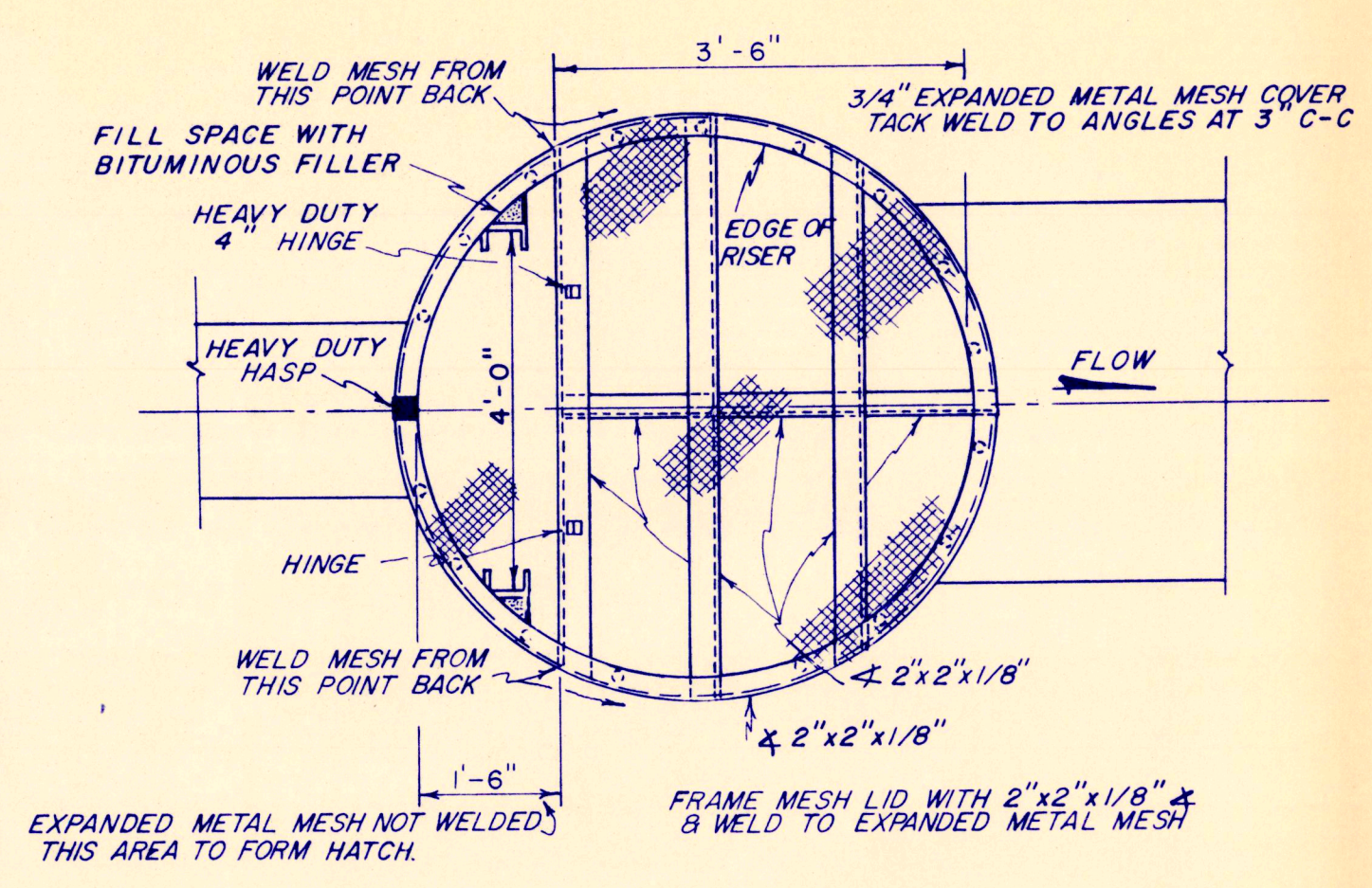
GREAT PLAINS
DATE: 5-2-90

SHEET NO:
2 OF 4

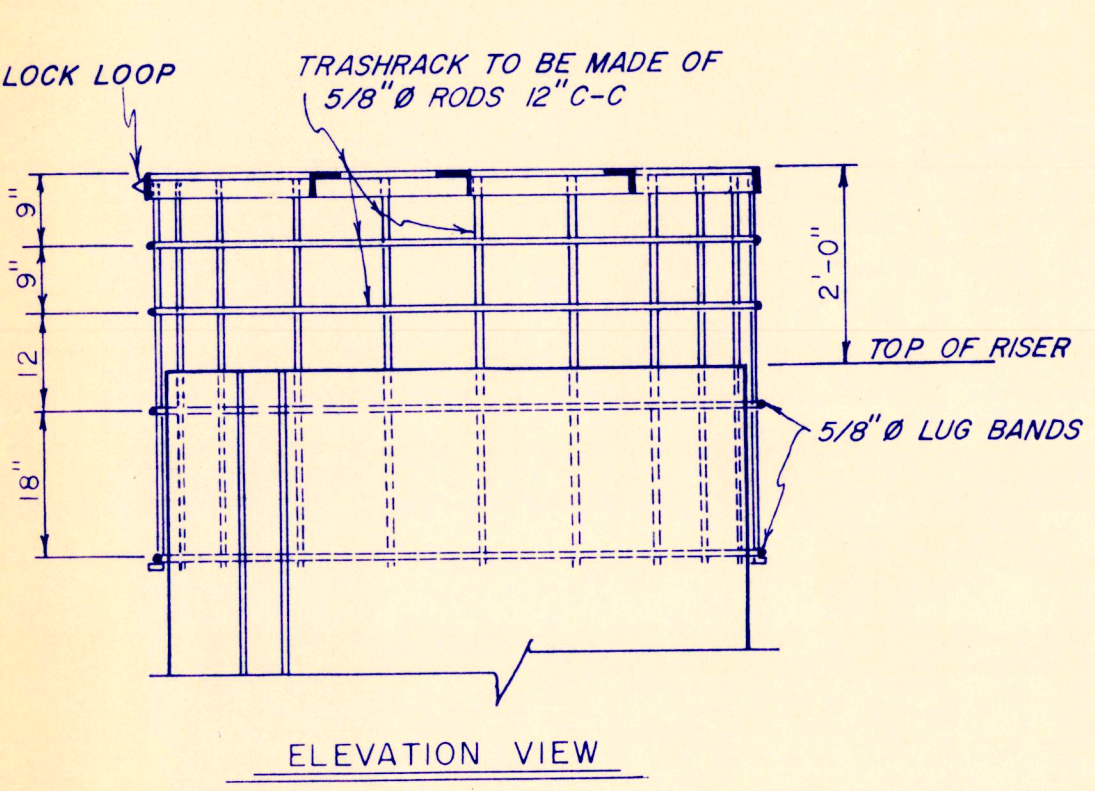
APPROVED BY _____

APPROVED BY

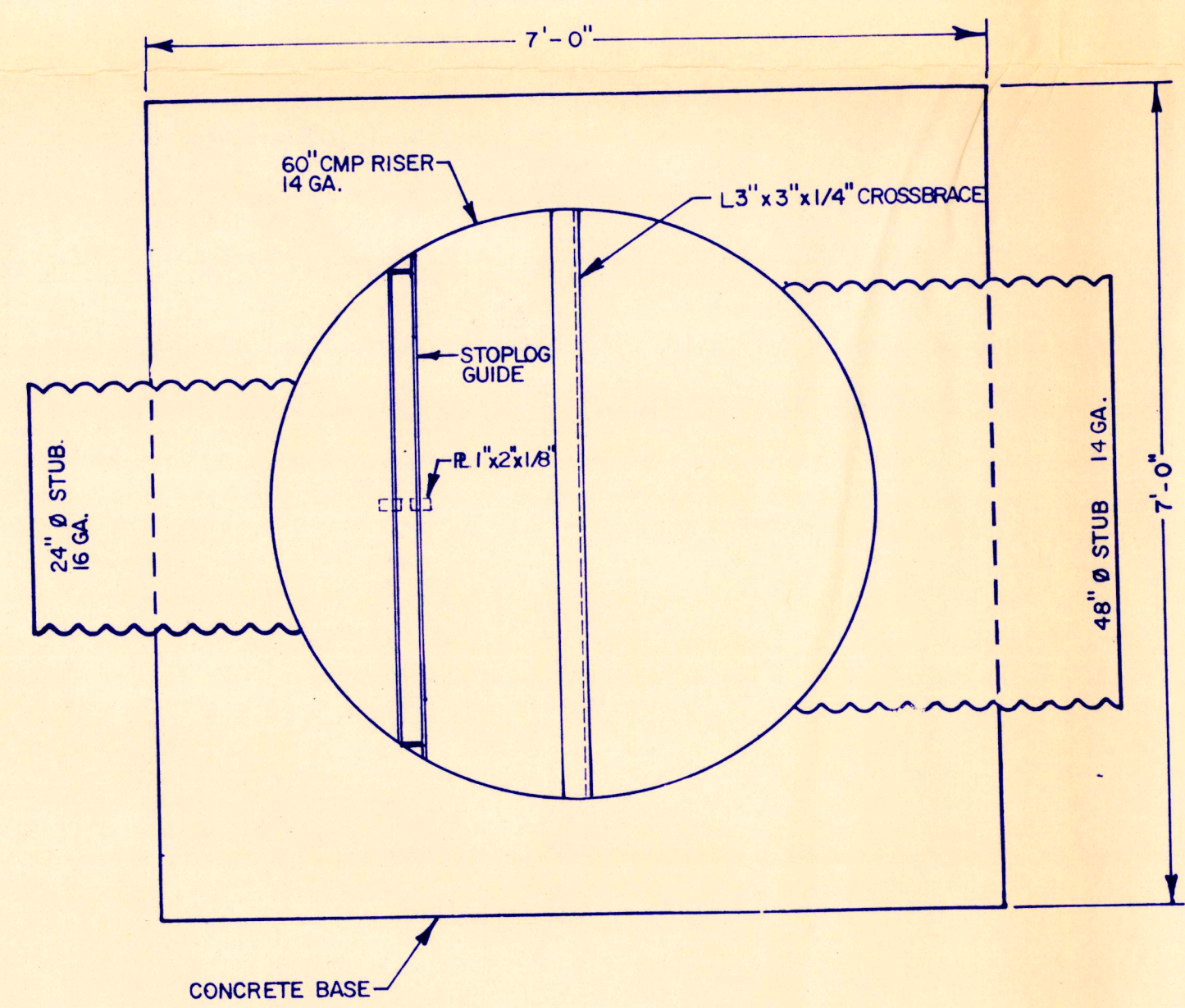
5470-3



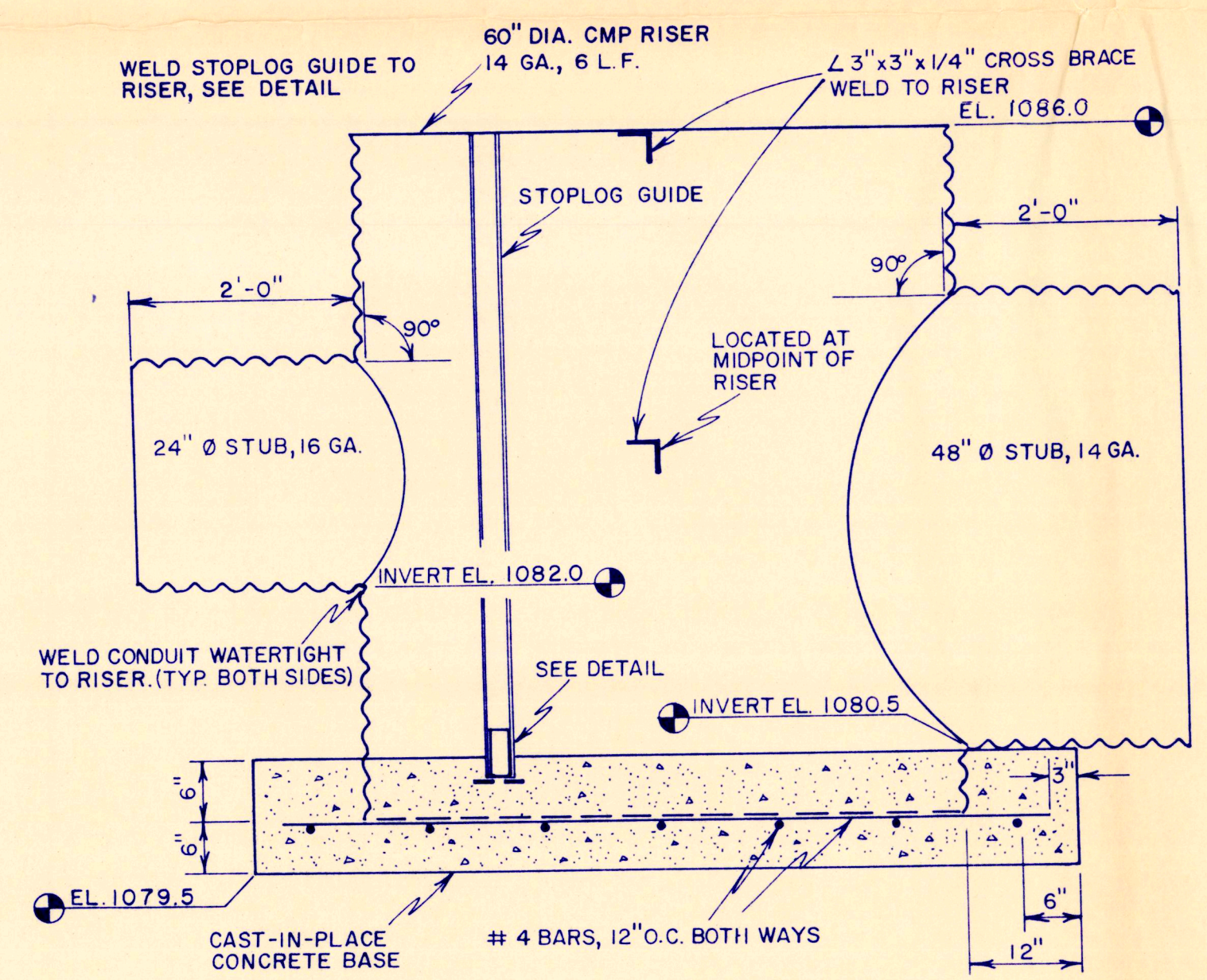
TRASHRACK DETAIL
NTS



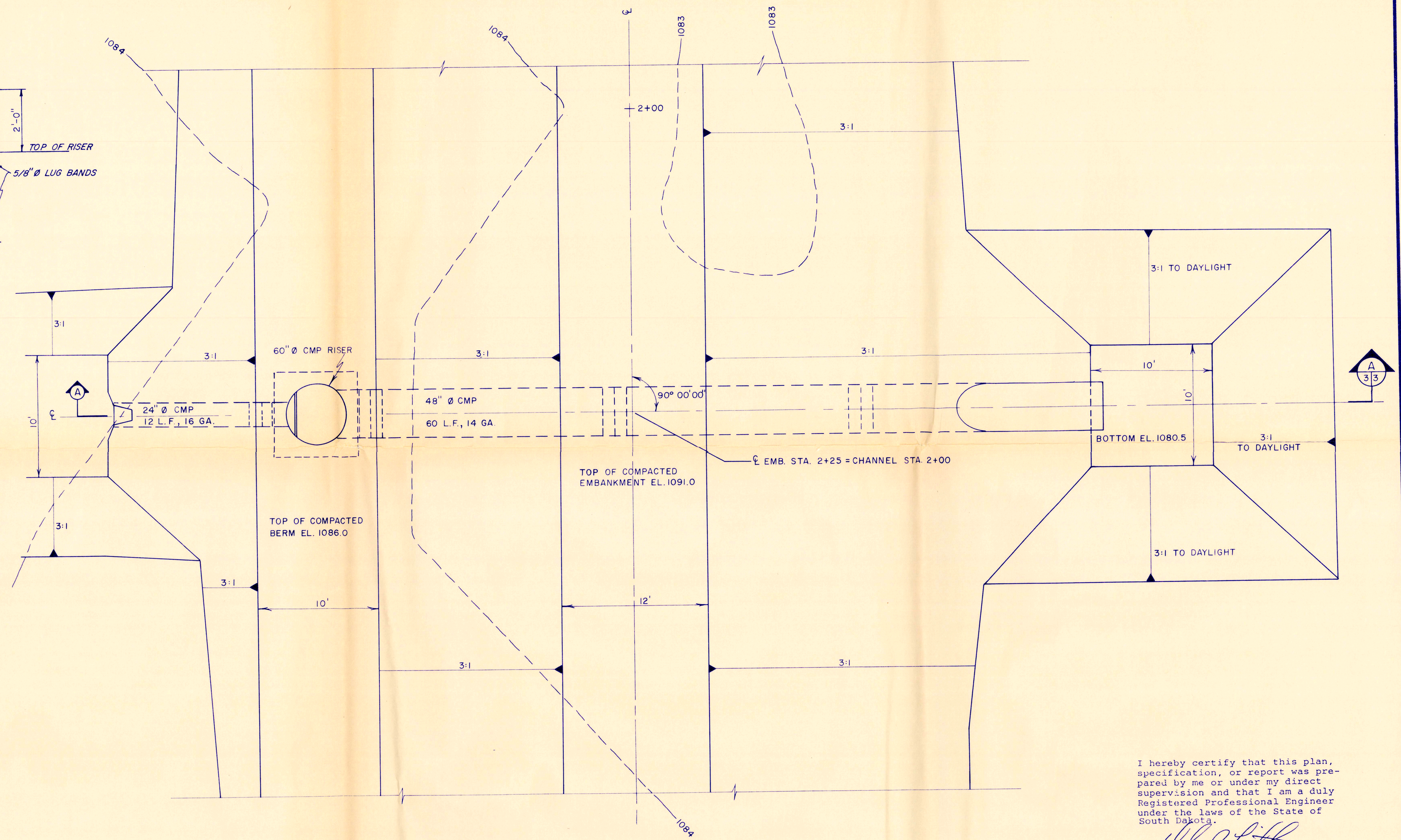
ELEVATION VIEW



PLAN VIEW
SCALE: 3/4" = 1'

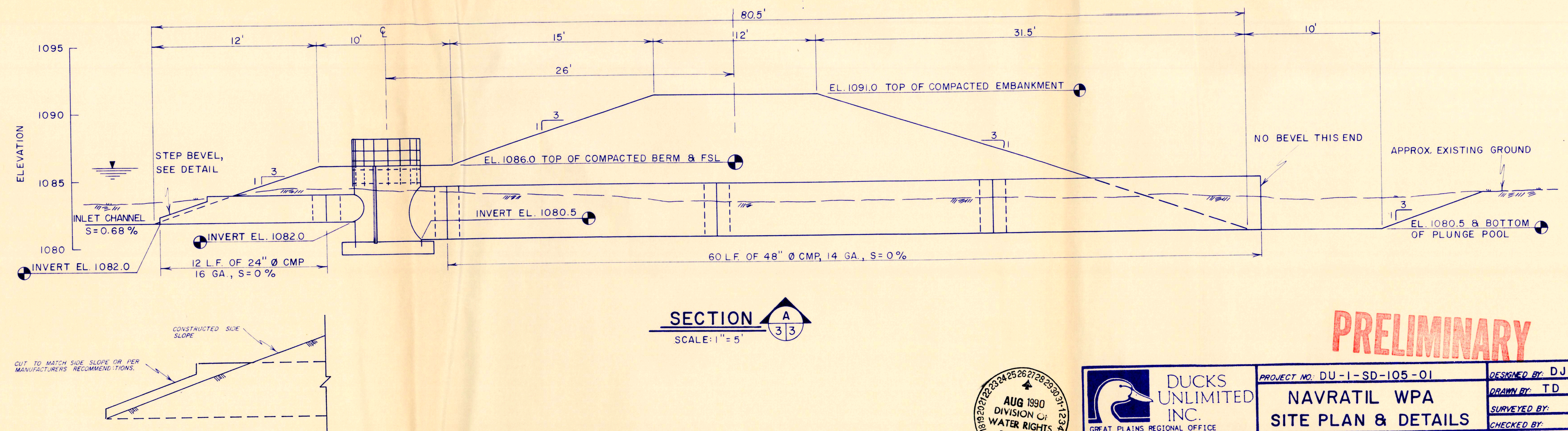


CONTROL STRUCTURE DETAIL
SCALE: 3/4" = 1'-0"

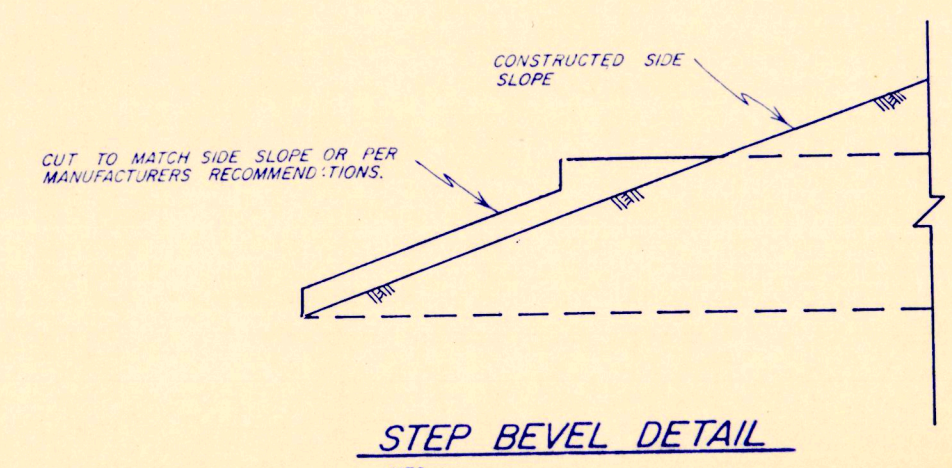


SITE PLAN
SCALE: 1" = 5'

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of South Dakota.
Signature
Date 5-17-90 Registration No. 4499

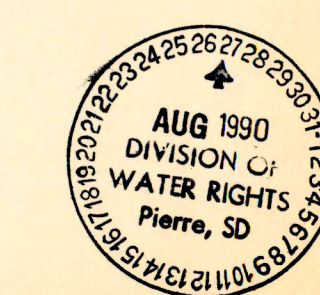


SECTION A-A
SCALE: 1" = 5'



STEP LEVEL DETAIL
NTS

PRELIMINARY



PROJECT NO. DU-1-SD-105-01	DESIGNED BY: DJL
NAVRATIL WPA	DRAWN BY: TD
SITE PLAN & DETAILS	SURVEYED BY:
DATE: 4-25-90	CHECKED BY:
SHEET NO. 3 OF 4	APPROVED BY:

MIDWEST TESTING LABORATORY

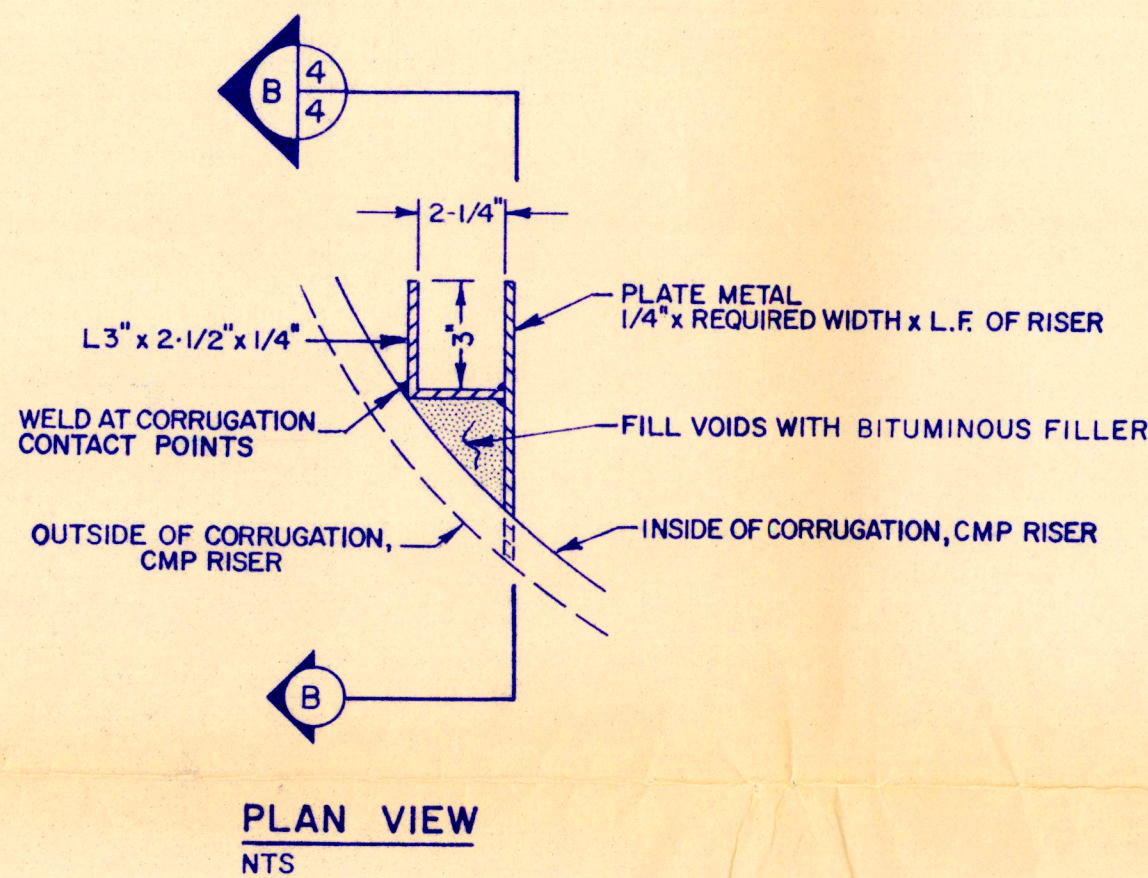
702 - 48th St. S. / P.O. Box 5355 / Grand Forks, ND 58206-5355 / (701) 772-2832

REPORT OF: PERMEABILITY TEST OF SOIL (Remolded)
 PROJECT: NAVRATIL--WPA
 DU # 1-SD-105-01
 ROBERTS COUNTY, SOUTH DAKOTA
 REPORTED TO: Ducks Unlimited, Inc.
 6115 E Main Ave
 Bismarck, ND 58501
 PROJECT NO: G127
 DATE: June 26, 1990
 COPIES: JUN 28 1990

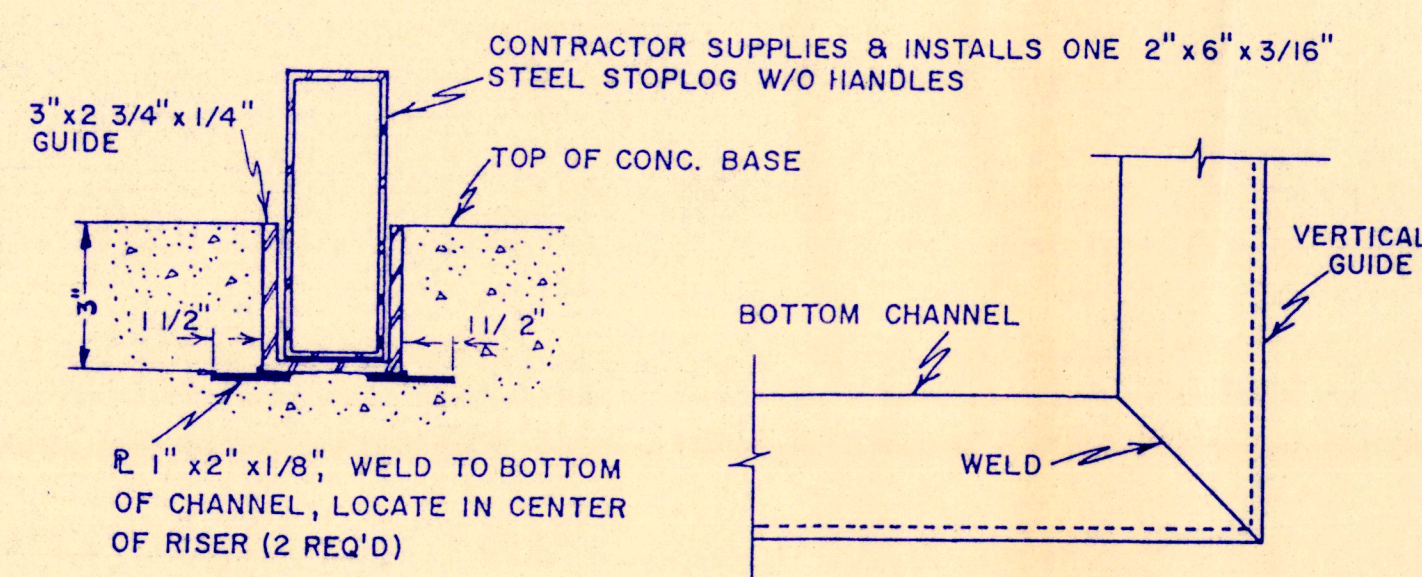
SAMPLE NUMBER: 1
 CLASSIFICATION: SANDY CLAY, brown, trace of gravel (CL)
 MOISTURE-DENSITY TEST: (See attached curves)
 Method: Standard Proctor, ASTM:D698-78, Method "C"
 Maximum Density (pcf): 107.4
 Optimum Moisture (%): 18.0

PERMEABILITY TEST OF SOIL:
 Sample: Loose Sample, Remolded
 Method: Permeability by Falling Head Method
 Molding Conditions:
 Moisture (%): 23.5
 Density (pcf): 107.4
 % of Proctor: 95%
 Coefficient of Permeability, "K" (cm/sec): 4.6×10^{-8}

REMARKS: The above samples were submitted to the laboratory by Ducks Unlimited, Inc and received for test on May 8, 1990. The samples were obtained from hand auger borings at locations shown on the attached drawing furnished by Ducks Unlimited.
 An additional sample (#3) was submitted but was not of sufficient size for tests requested. This sample appears to be similar to #2 and should have a similar permeability.



STOPLOG GUIDE DETAIL



HORIZONTAL STOPLOG GUIDE DETAIL

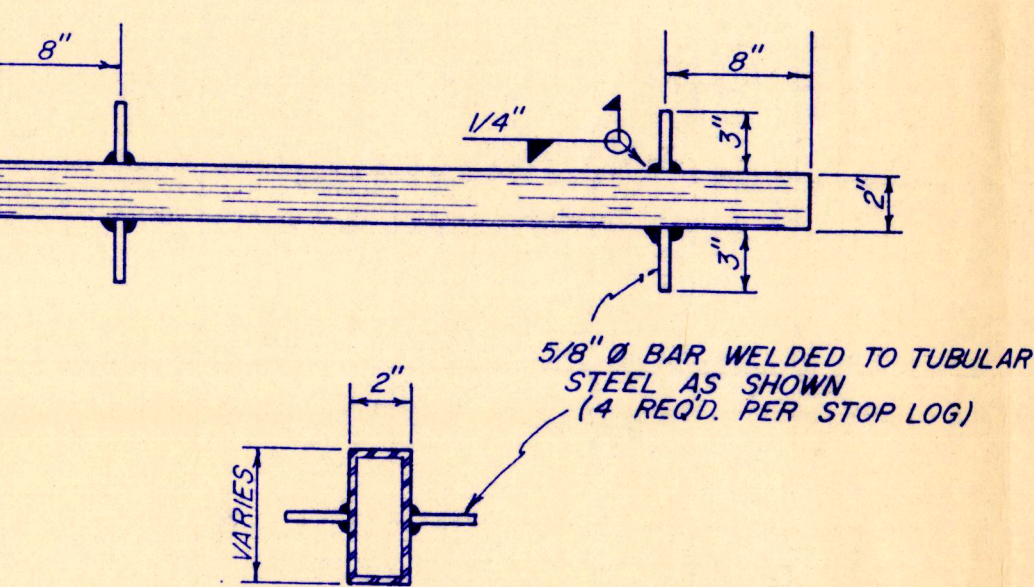
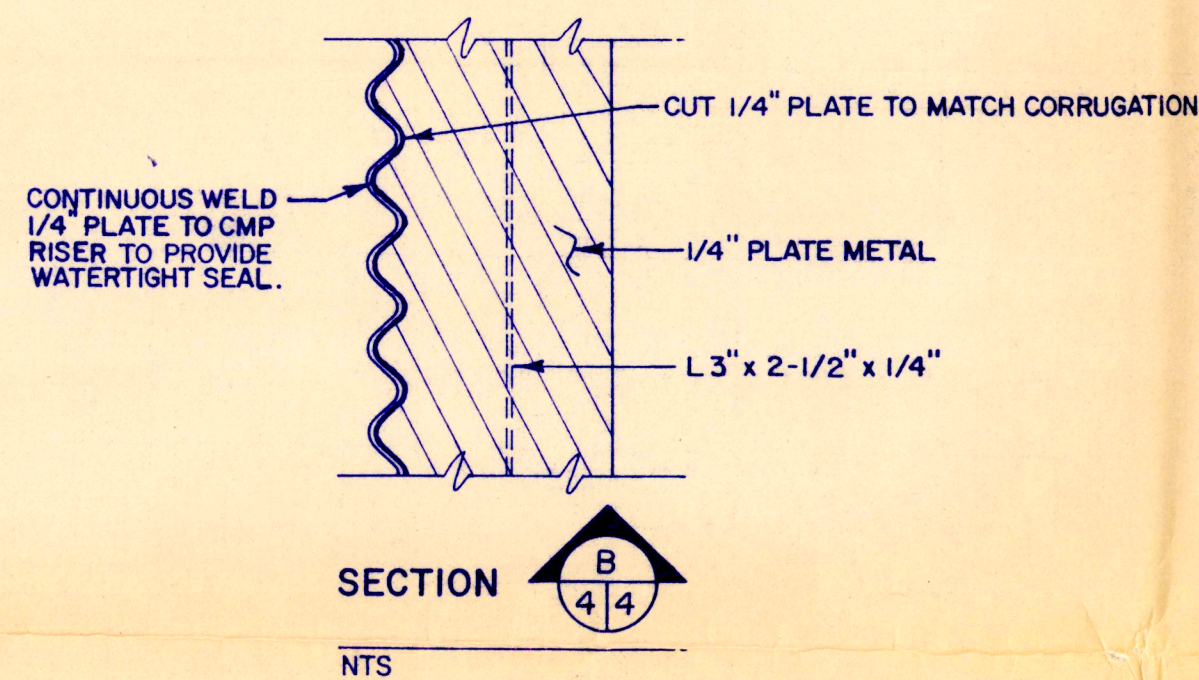
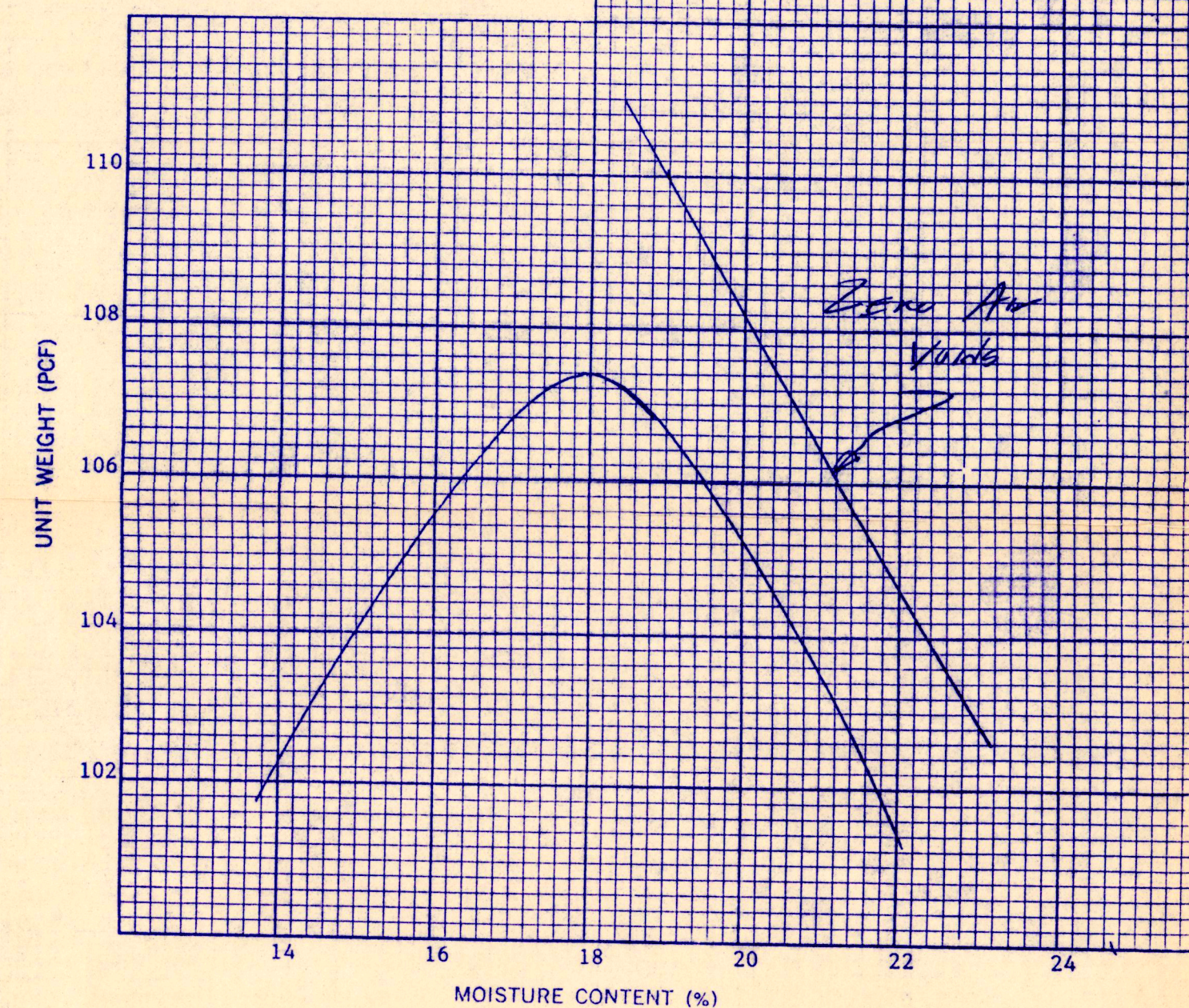
SCALE: 3" = 1'-0"

MIDWEST TESTING LABORATORY

702 - 48th St. S. / P.O. Box 5355 / Grand Forks, ND 58206-5355 / (701) 772-2832

REPORT OF: MOISTURE-DENSITY RELATIONS OF SOIL
 PROJECT: NAVRATIL--WPA
 DU # 1-SD-105-01
 ROBERTS COUNTY, SOUTH DAKOTA
 REPORTED TO: Ducks Unlimited, Inc.
 6115 E Main Ave
 Bismarck, ND 58501
 PROJECT NO: G127
 DATE: June 26, 1990
 COPIES:

SAMPLE NUMBER: 1
 METHOD: Standard Proctor, ASTM:D698-78, Method "C"
 SOIL TYPE: SANDY CLAY, brown, a trace of gravel (CL)
 MAXIMUM DENSITY: 107.4
 OPTIMUM MOISTURE: 18.0



STEEL STOPLOGS FURNISHED BY DUCKS UNLIMITED, CONTRACTOR SHALL FABRICATE & INSTALL.

STEEL STOPLOG DETAIL

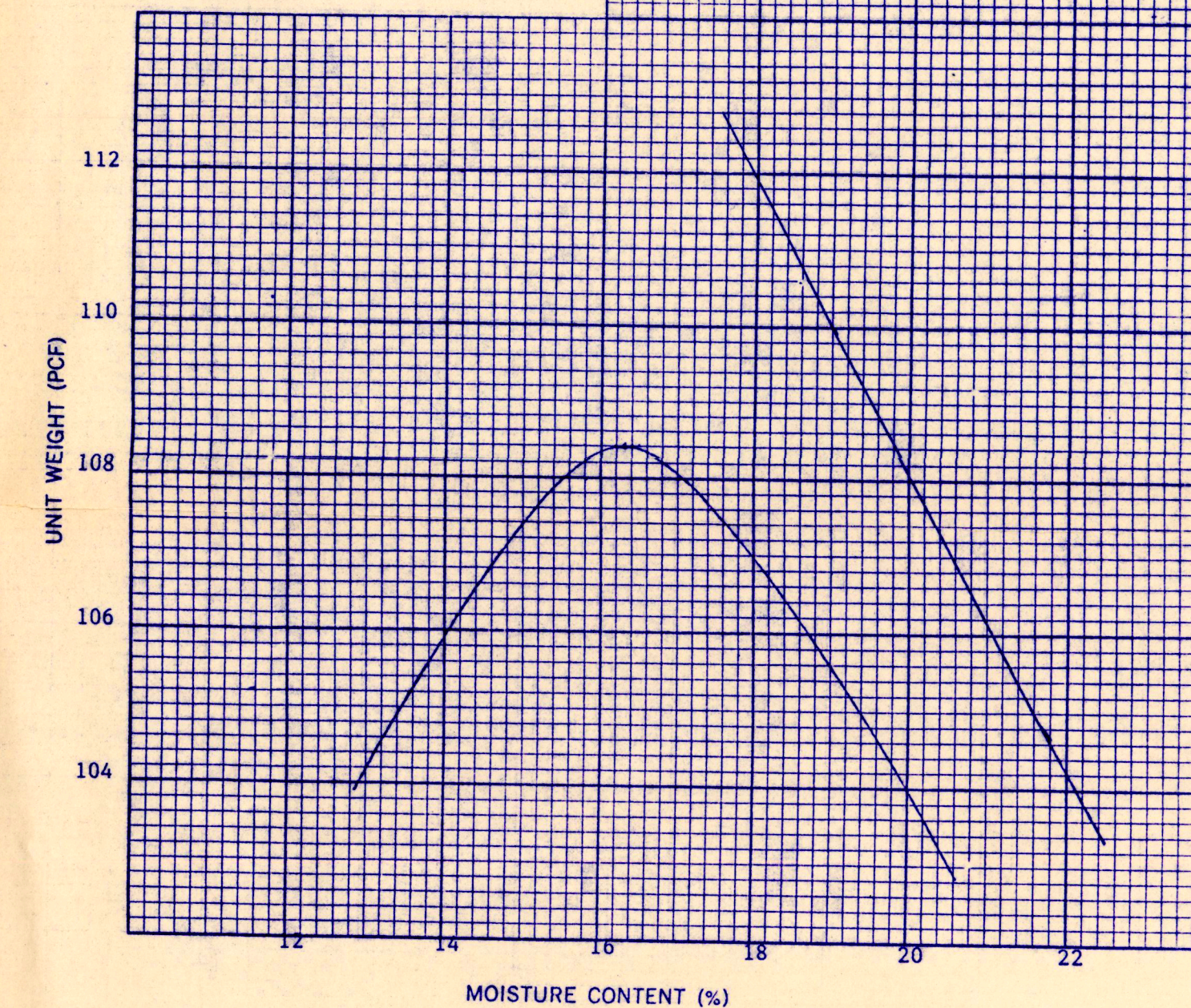
NTS

MIDWEST TESTING LABORATORY

702 - 48th St. S. / P.O. Box 5355 / Grand Forks, ND 58206-5355 / (701) 772-2832

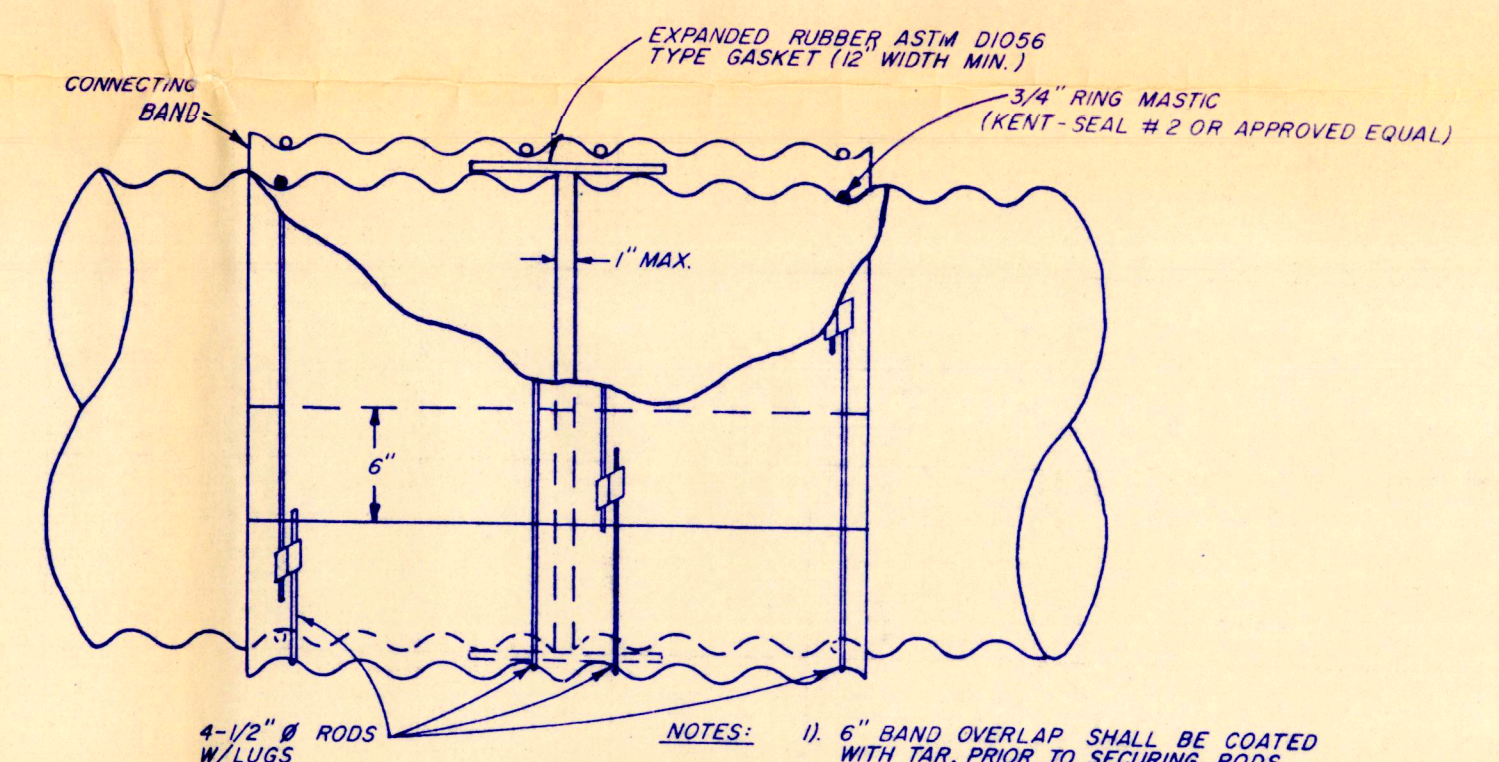
REPORT OF: MOISTURE-DENSITY RELATIONS OF SOIL
 PROJECT: NAVRATIL--WPA
 DU #1-SD-105-01
 ROBERTS COUNTY, SOUTH DAKOTA
 REPORTED TO: Ducks Unlimited, Inc.
 6115 East Main Ave
 Bismarck, ND 58501
 PROJECT NO: G127
 DATE: June 26, 1990
 COPIES:

SAMPLE NUMBER: 2
 METHOD: Standard Proctor, ASTM:D698-78, Method "C"
 SOIL TYPE: SANDY CLAY, dark brown, trace of gravel (CL)
 MAXIMUM DENSITY: 108.4
 OPTIMUM MOISTURE: 16.3



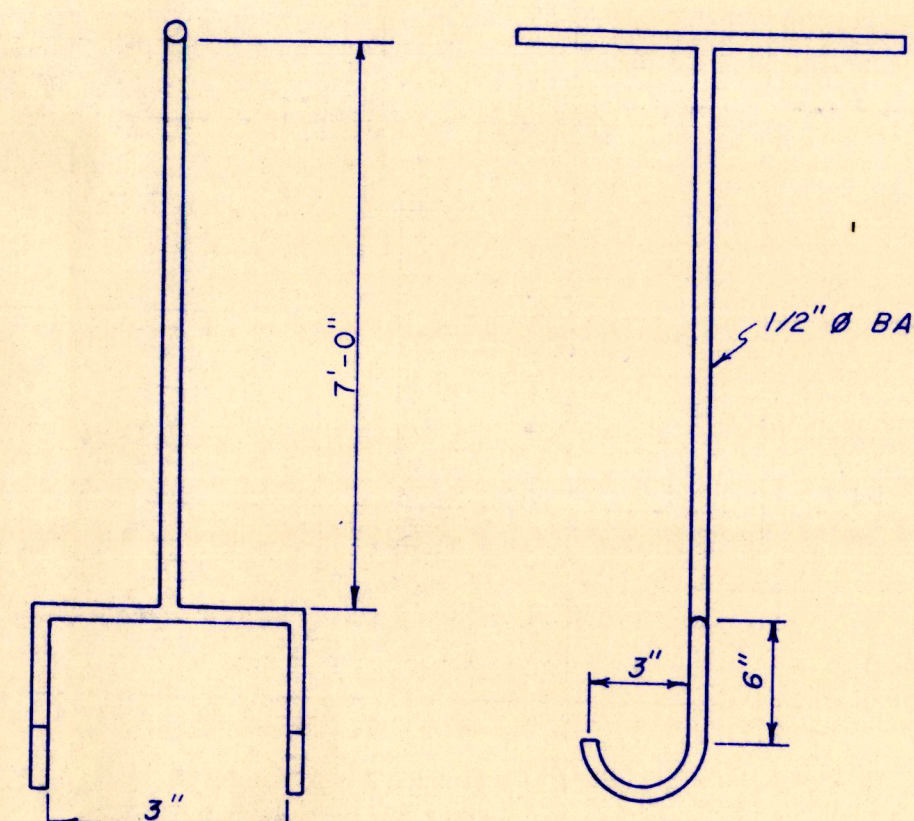
THE BORINGS DONE ON THIS PROJECT REPRESENT THE SOILS FOUND AT THE LOCATIONS OF THE BORINGS ONLY. SOILS MAY VARY BETWEEN LOCATIONS AND OTHER AREAS OF THE PROJECT SITE NOT DRILLED. A COMPLETE GEOTECHNICAL ENGINEERING REPORT IS AVAILABLE FOR REVIEW AT DUCKS UNLIMITED GREAT PLAINS REGIONAL OFFICE. THE CONTRACTOR WARRANTS THAT SITE CONDITIONS HAVE BEEN EXAMINED AS REQUIRED BY SECTION 101.203 EXAMINATION OF SITE CONDITIONS OF THE GENERAL CONDITIONS PRIOR TO BIDDING OR CONSTRUCTING THIS PROJECT. NO ADJUSTMENT TO THE CONTRACT WILL BE MADE DUE TO CHANGED SITE CONDITIONS.

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of South Dakota.
 Date 5-17-90 Registration No. 4499



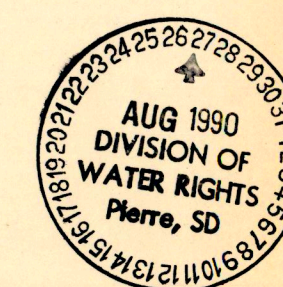
CONNECTING BAND DETAIL

NTS



LIFTING HOOK DETAIL

2 REQUIRED



DUCKS UNLIMITED INC. GREAT PLAINS REGIONAL OFFICE Pierre, SD	PROJECT NO: DU-1-SD-105-01	DESIGNED BY: DJL
	NAVATIL WPA	DRAWN BY: TD
	DETAILS & SOILS	SURVEYED BY:
	CHECKED BY:	
DATE: 5-2-90	SHEET NO: 4 OF 4	APPROVED BY:

PRELIMINARY