

Considered: _____

WATER PERMIT NO. 5135-3

MAP No. same

Name of Applicant U.S. Fish and Wildlife Service

Post Office Address P.O. Box 25486, DFC, Denver CO 80225

Amount of Water Claimed 80 acre-feet Total Acres NA

Source of Water Supply tributary of Shortfoot Creek

Water to be used for Fish & Wildlife County Marshall

About 1 1/2 miles S of Hillhead.

PROOF OF PUBLICATION: Received _____ Not Received _____

APPLICATION: Approved 7/8/87 Subject to _____

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

PRIORITY _____ Date Received Feb. 12, 1987 Fee 150⁰⁰ Remarks _____

2/12/87

Corrected Application Received April 10, 1987 Period of Annual Use Jan 1 - Dec 31

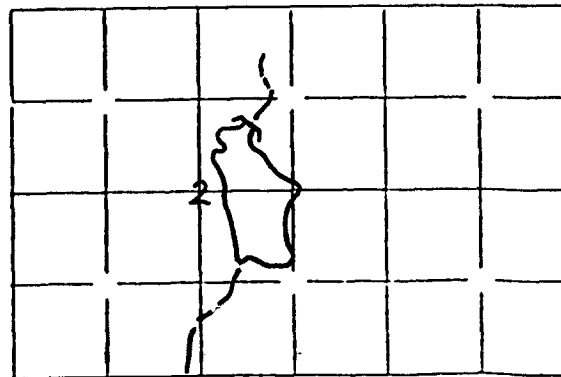
WATER QUALITY APPROVAL RECEIVED NA APPROVED/CONDITIONAL (Circle one)

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

Diversion Point dam: SW 1/4 NE 1/4 section 2 -

T127N-R54W

Land to be Irrigated NA



Well Log: Driller NA Licensed YES _____ NO _____

Depth of Well _____ REMARKS _____

Type of Map Topo PREPARED BY Fish & Wildlife Reviewed and the Number

assigned on April 29, 1987 By Ron Duvall

No. 5135-3 Hydrologic Unit 09020105
 Map No. same Basin Red Rainy
 Newspaper Britton Journal, Box 69 (Wed)

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 ☒ Fish and Wildlife

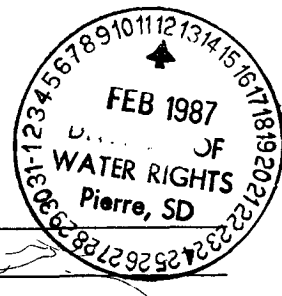
Type of Application: Check one or more of the following

New ☒ Vested Right ☐ Future Use ☐ Change Use ☐☐ Amend Permit No. _____ with old priority date retainedChange 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. _____1. Name of Applicant United States of America
Fish and Wildlife Service Phone No. (303) 236-5322Post Office Address P.O. Box 25486, Denver Federal Center, Denver State Colorado 80225
(Street, RR or Box) Zip Code2. Amount of water claimed (c.f.s.) 80 AF storage at elevation 1878 msl3. Source of water supply Unnamed tributary of Shortfoot Creek4. Location of point of diversion NE1/4 SW1/4 NE1/4 Section 2, T127N R54WCounty Marshall5. Counties where water will be used Marshall6. 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)

Engineering report and specifications 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~~ COLORADO
County of Jefferson)^{ss}I, Galen Buterbaugh, Reg. Dir., U.S. Fish & Wildlife Service 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 Galen Buterbaugh
Regional DirectorSubscribed and sworn to before me this ninth day of February 1987Susan E. Craddock
Notary Public (or other qualified officer)My Commission Expires 08/05/89

WATER PERMIT

The Water Management Board hereby approves Water Permit Application No. _____

(Applicant)

(Post Office Address)

(State)

(Zip Code)

With the following qualifications.

Date of first receipt of application _____, 19____.

Date of return to applicant for correction, amendments or changes required _____, 19____.

Date of receipt of corrected application _____, 19____. Approved _____, 19____.

The Water Management Board hereby approves this Water Permit No. _____ authorizing the construction of the water use system and the placing of water to beneficial use as stated in the Application and as qualified in the Water Permit approval, subject, however, to the following limitations and conditions:

1. The date from which applicant may claim right is _____, 19____.
2. The equivalent of at least one-fifth of the specified work is to be completed on or before _____, 19____.
3. The whole of said work is to be completed on or before _____, 19____.
4. The limit of time from proof of beneficial use of water appropriated in accordance herewith is _____, 19____.
5. The water appropriated shall be used for the purpose of _____

6. The prior right of all persons who, by compliance with the laws of the State of South Dakota, have acquired a right to the use of water must not be unlawfully impaired by this appropriation.
7. The amount of the appropriation herein granted shall not exceed _____ cubic feet per second; neither shall it exceed the capacity of the above described water supply system nor shall it exceed the amount of water needed for beneficial uses served and to which water is actually and beneficially applied for _____ on or before _____, 19____; said water to be used during the following described annual period: _____

WATER MANAGEMENT BOARD

By: _____

Chief Engineer

Division of Water Rights

Dept. of Water and Natural Resources

_____, 19____

WATER PERMIT

The Water Management Board hereby approves Water Permit Application No. 5135-3
U.S. Fish & Wildlife Service P.O. Box 25486, Denver Federal Center
(Applicant) (Street, RR or Box)
Denver Colorado 80225 With the following qualifications.
(City) (State) (Zip Code)

Low flows as needed for downstream domestic use including livestock watering and prior water rights must be by-passed.

Date of first receipt of application February 12, 1987.
 Date of return to applicant for correction, amendments or changes required February 27, 1987.
 Date of receipt of corrected application April 10, 1987. Approved July 8, 1987.

The Water Management Board approved this Water Permit No. 5135-3 authorizing the construction of the water use system and the placing of water to beneficial use as stated in the Application and as qualified in the Water Permit approval, subject, however, to the following limitations and conditions:

1. The date from which applicant may claim right is February 12, 1987.
2. The equivalent of at least one-fifth of the specified work is to be completed on or before December 8, 1989.
3. The whole of said work is to be completed on or before July 8, 1992.
4. The limit of time for proof of beneficial use of water appropriated in accordance herewith is July 8, 1996.
5. The water appropriated shall be used for the purpose of providing habitat for fish, waterfowl and wildlife production.
6. The prior right of all persons who, by compliance with the laws of the State of South Dakota, have acquired a right to the use of water must not be unlawfully impaired by this appropriation.
7. The amount of the appropriation granted shall not exceed 80 acre feet annually ~~per second~~, neither shall it exceed the amount of water needed for the beneficial uses served and to which water is actually and beneficially applied for FWP on or before July 8, 1996. The water is to be used during the following described annual period: January 1 - December 31

WATER MANAGEMENT BOARD

By: John Hatch
Chief Engineer **JOHN HATCH**
 Division of Water Rights
 Dept. of Water and Natural Resources

AUG 19 1987

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

Ulteig Engineers, Inc.

Box 1569

Fargo, ND 58107

*

b) Freeboard 3.5 feet

c) Crest Width 10.0 feet

Crest Length 170.0 feet

d) Height 12.5 feet

e) Outlet Dimensions:
Pipe diameter 48 inches

Spillway width 50 feet

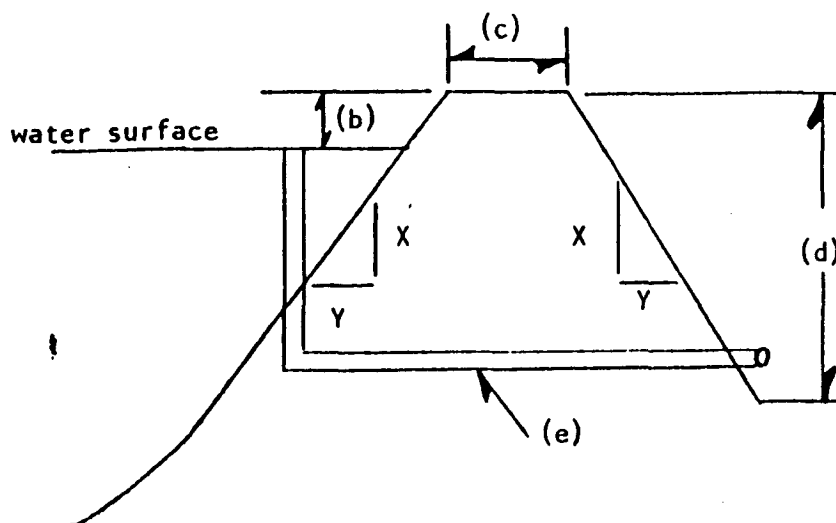
f) X & Y Slope
Upstream 4:1

Downstream 3:1

Surface Area of Impoundment 24 acres

Storage 80 acre feet

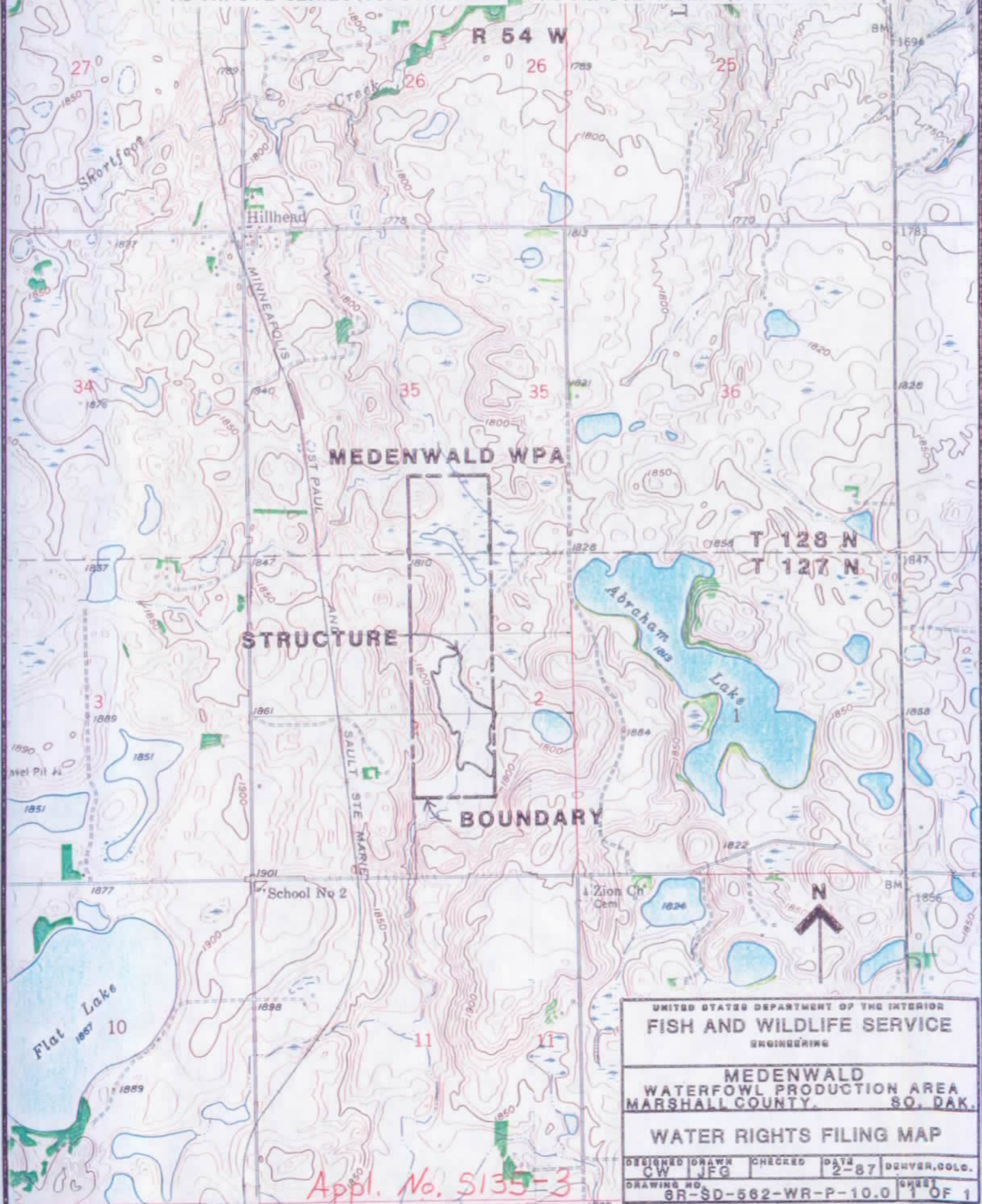
Drainage area above dam 1800 acres



Galvin B. Buttrick
Signature of Applicant Regional Director

HILLHEAD QUADRANGLE
SOUTH DAKOTA—MARSHALL CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

VEBLEN QUADRANGLE
SOUTH DAKOTA—MARSHALL CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



UNITED STATES DEPARTMENT OF THE INTERIOR			
FISH AND WILDLIFE SERVICE			
ENGINEERING			
MEDENWALD			
WATERFOWL PRODUCTION AREA			
MARSHALL COUNTY, SO. DAK.			
WATER RIGHTS FILING MAP			
DESIGNED	DRAWN	CHECKED	DATE
CW	JFG		2-87
DRAWING NO.			DENVER, COLO.
6R-SD-562-WR-P-10.0			SHEET 1 OF 1

RECEIPT

Division of Water Rights

South Dakota Department of Water and Natural Resources

410813

Pierre, April 10, 1987

RECEIVED OF U.S. Fish & Wildlife, PO 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>5145-8</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
Chief Engineer

JOHN HATCH





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

BA/WTR
WR SD
MAIL STOP 60190

FEB 9 1987



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

Gentlemen:

The U.S. Fish and Wildlife Service and Ducks Unlimited, Inc. propose to construct an impoundment on the Medenwald Waterfowl Production Area in Marshall County. Enclosed are the following materials pertaining to the project:

1. Form 2, Application for Permit to Appropriate Water (in duplicate)
2. Form 2A, Supplemental Information (in duplicate)
3. Filing Map No. 6R-SD-562-WR-P-10.0
4. Engineering report prepared by Ulteig Engineers, Inc.
5. Specifications
6. Engineering drawings, 5 sheets
7. Government Purchase Order in the amount of \$150.

Please sign the purchase order where indicated and return to this office, or send an invoice so that payment can be issued.

The adjacent landowner whose lands will be affected by this project has agreed to grant an easement to the United States. A copy will be forwarded to your office when it is obtained.

Ducks Unlimited, Inc. has contracted for a soils study of the construction site. This soils report will be available in the spring.

We would appreciate your advising us of the name and address of the newspaper selected to publish the Notice of Application, so that we can forward the required Authorization of Advertisement prior to publication.

Please direct any technical questions to Roger Smith of Ducks Unlimited, Inc., 6115 East Main Avenue, Bismarck, ND 58501 (telephone (701) 258-5599). Any other questions should be addressed to Cheryl Williss of our Water Resources Division at (303) 236-5322.

Sincerely,



GALEN L. BUTERBAUGH
Regional Director

Enclosures (7)

cc: Ducks Unlimited, Inc.

MEDENWALD
CONSTRUCTION SPECIFICATIONS



	<u>Spec. #</u>
Key Trench Construction	5
Special Provision for Key Trench Construction	5.1
Topsoil Excavation & Placement	2.A
Excavation	4
Embankment Construction	9
Special Provision for Embankment Construction	9.1
Culvert Installation	12
Special Provision for Culvert Installation	12.2
Stoplog Control Structure	14
Riprap Placement	6

SPECIFICATIONS FOR KEY TRENCH CONSTRUCTION

1. GENERAL CONDITIONS

The General Conditions and Special Provisions attached hereto shall apply to and be part of this specification.

2. DESCRIPTION

The work shall include the supply of all labor, material and equipment required to excavate a key trench and place material to the original ground level in accordance with the plans or to limits staked in the field or as directed by the Engineer. The work shall include:

- excavation of organic soils, debris or other pervious materials from the key trench area.
- disposal of excavated materials into windrows or into disposal areas designated by the Engineer.
- placement and compaction of acceptable mineral soils into the key trench excavation to the original ground level elevation.

3. CONSTRUCTION METHODS

3.1 KEY TRENCH CONSTRUCTION

The Contractor shall not commence embankment construction until such work specified under "CLEARING AND GRUBBING" and where applicable "TOP-SOIL EXCAVATION" has been completed to the satisfaction of the Engineer.

The key trench excavation shall be made to the lines and grades shown on the drawings but may be altered during construction upon the direction of the Engineer to adjust for variation in soil conditions. Excavated material if acceptable in quality to the Engineer may be stockpiled for use in "TOPSOIL EXCAVATION AND PLACEMENT" in accordance with the specification and the items included herein. Unacceptable materials shall be disposed of by placing into designated borrow areas.

Key trench backfilling operations shall proceed after excavation has been completed to the satisfaction of the Engineer.

The key trench material shall be constructed and the material shall be of the same quality as the material specified under "EMBANKMENT CONSTRUCTION".

3.2 BORROWS

Borrow areas shall be maintained during construction of the key trench such that contamination of materials nor moisture content changes do not occur. During construction, the control of drainage in the key trench excavation, dewatering placement area and borrows must be maintained and is the responsibility of the Contractor. Should material quality lessen through inadequate drainage the contractor may be directed by the Engineer to construct drainage facilities.

3.3 TRIMMING

The key trench completed to the original ground surface elevation shall be rough levelled prior to commencing "EMBANKMENT CONSTRUCTION".

4. METHOD OF MEASURE

Key trench construction shall be measured on a volume basis. The volume to be paid for shall be the total number of cubic yards excavated and replaced with acceptable materials. Measurements shall be made following excavation of the excavated key trench and the measured cross-section shall be superimposed on the original or stripped ground line whichever is applicable. Volumes of excavation and key trench construction will be computed using the end area method of volume calculation.

5. BASIS OF PAYMENT

Key trench construction shall be paid for at the contract unit price per cubic yard for "KEY TRENCH CONSTRUCTION".

Each cubic yard to be measured as specified herein shall be payment in full for supplying all materials, compaction and for performing all operations herein described and all other items incidental to the work included in this specification.

SPECIAL PROVISION FOR KEY TRENCH CONSTRUCTION2. DESCRIPTION

This provision limits the quantity of excavation eligible for payment under the "Key Trench Construction" specification.

4. METHOD OF MEASURE

The maximum quantity of excavation eligible for payment is that quantity listed on the unit price table of the Standard Bid Form and will be the final payment quantity. Measurement of the "Key Trench" excavation will not be required unless otherwise determined by the Field Engineer.

SPECIFICATIONS FOR TOPSOIL EXCAVATION AND PLACEMENT1. GENERAL CONDITIONS

The General Conditions and Special Provisions attached hereto shall apply to and be part of this specification.

2. DESCRIPTION

This specification shall cover the excavation, removal, stockpiling and placement of topsoil in designated areas of borrows, dikes, and channels. The work to be done by the Contractor under this specification shall include all labor, materials, and equipment necessary for the satisfactory completion of the work as specified herein.

3. MATERIAL

Topsoil shall consist of organic surface soils, peats, and black mineral soils. The material shall be free from tree roots, large stones and boulders, unsuitable debris and be acceptable in quality to the Engineer.

4. CONSTRUCTION METHODS4.1 CLEARING AND GRUBBING

No stripping of topsoil shall commence until any clearing and/or grubbing operations called for have been completed in accordance with the "SPECIFICATION FOR CLEARING AND GRUBBING".

4.2 EXCAVATION

Topsoil excavation shall be the excavation of organic surface soils, peat or black mineral soils in the area of dikes, channels or borrows as staked or in accordance with plans and specifications to depths designated and approved by the Engineer. The work shall include the excavation, stockpiling as necessary and the placement of the topsoil over the surface of constructed embankments, berms, borrows or in those areas designated by the Engineer. Topsoil materials shall be removed to the lateral limits of the dikes,

borrows, or berms specified and shall be placed in windrows outside the indicated toe of the embankment or borrow. Upon completion of embankment construction the topsoil shall be blended against the embankment, berm or borrow and trimmed to blend with the area or slopes. The topsoil shall be placed over designated areas evenly in a layer four to six inches in thickness over the entire crest, side slopes, berms of an embankment and/or the surface of borrows. The placed material shall be trimmed to specified tolerances above the lines and grades shown on the plans and as staked in the field.

5. METHOD OF MEASURES

Topsoil excavation and placement shall be measured on a volume basis. The volume to be paid for shall be the number of cubic yards of topsoil excavated, stockpiled and placed in accordance with this specification. The quantity will be determined by measuring the areas where topsoil will be stripped and multiplying them by the average topsoil depth in the various areas. This depth shall be either called for in the plans or measured during the soils exploration and shown on the plans. The areas to be stripped of topsoil shall be those directly below any embankments, above any excavations or any other areas shown on the plans. Any ditches, spillways or other excavations shown on the plans and designated as borrow areas shall be included in the area measured. The area measured shall not include borrow areas, outside of the excavations shown on the plans, that are developed for the sole purpose of providing material for embankments.

The volume of topsoil excavation and placement eligible for payment shall be measured from the plans as described above. This volume shall be listed on the unit price table of the Standard Bid Form and shall be the final quantity. Any additional topsoil stripping done by the Contractor shall not be paid for under this specification unless approved by the Engineer in the field.

Measurement of "TOPSOIL EXCAVATION AND PLACEMENT" in the field will not be required unless otherwise determined by the Engineer in the field.

6. BASIS OF PAYMENT

The cost of all labor, equipment, materials and incidental items necessary to perform the work as specified shall be included in the price bid for "TOPSOIL EXCAVATION AND PLACEMENT".

Topsoil excavation and placement done on borrow areas, outside of the excavations shown on the plans, developed for the sole purpose of providing material for embankments shall be paid for as specified in the specification for "BORROW AREA DEVELOPMENT".

SPECIFICATION FOR EXCAVATION

1. GENERAL CONDITIONS

The General Conditions and Special Provisions attached hereto shall apply to and be part of this specification.

2. CLASSIFICATION

Excavation will be designated as unclassified excavation, common excavation or rock excavation in accordance with the following definitions:

a. **Common excavation** shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the combined or separate use of heavy ripping equipment and wheel tractor-scrapers and pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of not more than one cubic yard and equipped with attachments (such as shovel, bucket, backhoe, dragline or clam shell) appropriate to the character of the materials and the site conditions.

For the purpose of defining the above equipment, the following definitions shall apply:

Heavy ripping equipment shall be defined as a tractor-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of at least 200 net horse power (at the flywheel).

Wheel tractor scraper shall be defined as a self-loading (not elevating) and unloading scraper having a struck bowl capacity of at least 12 yards.

Pusher tractor shall be defined as track-type tractor having a power rating of at least 200 net horse power (at the flywheel) equipped with appropriate attachments.

b. **Rock excavation** shall be defined as the excavation of all hard compacted or cemented materials the accomplishment of which requires

blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation.

c. **Unclassified excavation** shall include all materials encountered regardless of their nature or the manner in which they are removed.

3. CONSTRUCTION METHODS

3.1 CLEARING AND GRUBBING

Material from clearing and grubbing operations shall be considered as unsuitable site material to be disposed of as in "SPECIFICATION FOR CLEARING AND GRUBBING".

3.2 TOPSOIL REMOVAL

Topsoil where indicated shall be stripped, stockpiled and placed under the item "SPECIFICATION FOR TOPSOIL REMOVAL". Where not specified under that item, topsoil shall be considered ditch excavation and will be measured and paid for under that item.

3.3 EXCAVATION

Excavation shall mean the removal of all materials encountered within the limits of excavation as shown on the drawings or as staked by the Engineer. Excavation shall be performed in as nearly a continuous operation as possible, trimmed and levelled to conform to the required lines, grades and tolerances. Areas overexcavated shall be replaced with suitable materials compacted to a density at least equal to that of the existing material or to the satisfaction of the Engineer. Excavated material shall be deposited on one or both sides of the ditch within limits shown on the plans or as directed by the Engineer.

3.4 USE OF EXCAVATED MATERIALS

To the extent that they are needed, all suitable materials removed from the specified excavations shall be used in the construction of the specified earth or rock-filled portions of the permanent

works. The suitability of materials for specific purposes will be determined by the Engineer. The Contractor shall not waste, or otherwise dispose of, suitable materials.

The Contractor shall control the rock excavation operations to produce the size gradations specified for other parts of the work, if the rock is designated by the Engineer as suitable for use.

Excavated materials not suitable for use in construction such as soil containing sod or humus, stripped materials, and marsh excavated materials shall, when directed by the Engineer, be wasted. All wasted excavated materials shall be deposited as uniformly and continuously as possible in successive layers. No specific compaction will be required but where the material is placed with equipment other than tractor scrapers, blading and levelling is required to minimize voids within the embankment. The fill shall be levelled upon completion to conform to lines and grades and enable the area to be seeded.

3.5 DISPOSAL OF WASTE MATERIALS

All surplus or unsuitable excavated materials designated as waste by the Engineer shall be disposed of at the locations shown on the plans or as directed by the Engineer.

3.6 CONTROL OF SURFACE WATER

The Contractor is responsible for control of surface water and drainage during the construction period. All temporary fills, crossings, culverts necessary to promote drainage will be installed and removed at the Contractor's expense prior to acceptance of the work. Any flooding caused or claims arising due to the flooding of adjacent lands as a result of the construction of these temporary works will be the Contractor's responsibility.

4. METHOD OF MEASURE

All excavation shall be measured on a volume basis. The number of cubic yards of excavation paid for shall be made by superimposing the final cross-section on the applicable stripped or original ground profile and using average end area methods of volume calculation. Measurement will

be made for material placed on either embankments or in fills.

5. BASIS OF PAYMENT

Excavation shall be paid for at the contract unit price per cubic yard for "EXCAVATION". Each cubic yard to be measured as specified herein which shall be payment in full for supplying all materials, equipment and labor for performing all operations herein described and all other items incidental to the work. No payment will be made for material placed on embankments or in fills.

SPECIFICATIONS FOR EMBANKMENT CONSTRUCTION

1. DESCRIPTION

This work shall include the supply of all labor, materials and equipment required to complete the construction of dams, dikes, and roadway embankments to the lines and grades as shown on the plans or as staked by the Engineer. The work shall include:

- Embankment construction with material from designated borrow areas and/or from ditch or dugout excavation.
- Leveling and trimming of embankment and borrow areas.
- Disposal of unsuitable material.

2. MATERIAL

Embankment (including filling of the key trench) shall be constructed of materials from designated ditches, dugouts and borrow areas. These materials must be of mineral soils (free from frozen lumps, boulders, organics, roots or debris) approved by the Engineer.

3. CONSTRUCTION

The Contractor shall not commence embankment construction until such work specified under "CLEARING AND GRUBBING" and "TOPSOIL EXCAVATION" and "KEY TRENCH CONSTRUCTION" has been completed to the satisfaction of the Engineer.

Where embankment material is excavated with bucket equipment from ditches or borrow, it shall be deposited into the embankment within reach of the equipment. To prevent berm failure, stock piling on berms will not be permitted. Materials shall be placed and spread in layers with each layer after spreading not to exceed eight inches in thickness.

Where embankment material is excavated with tractor-scraper units or dozed from ditches or borrow, it shall be placed in successive layers

across the entire width of the embankment. Each layer must be spread as deposited longitudinally or laterally along the embankment with each layer not exceeding 8 inches in thickness. The embankment at all times must be maintained in a reasonably level condition and equipment shall be directed over the full width of each layer to facilitate uniform compaction. Where berms are required, these shall be maintained in their natural state with minimum disturbances.

All embankment material shall be compacted by suitable compaction equipment to a minimum of 95% of maximum density as determined by the Standard Proctor Method ASTM D698. Moisture content shall be in the range of -1% to +3% of optimum moisture content. Additional water required to bring embankment material within the percent moisture specified shall be determined by the field engineer.

All embankments will be construction staked to final grade elevations shown on the drawings. Embankments shall be brought to these elevations using embankment material graded to a tolerance of ± 0.1 ft. Topsoil or riprap materials are to be placed on top of embankment construction. Topsoil depths shall be four to six inches while riprap depths shall be as specified on the drawings.

In wet areas, the initial layer thickness may be increased to provide a working pad capable of supporting the spreading and levelling equipment. In these cases, spreading should commence from the embankment centerline and place material toward the edges.

All embankment construction must be as continuous as possible and the fill maintained such that drainage is assured at all time.

Following substantial completion of the embankment or a portion thereof, final grade stakes will be given.

Should fill settlement occur during the construction of the embankment and within seven days of substantial completion, and prior to acceptance of the work, additional material shall be placed and trimmed to achieve final grade by the Contractor at his own expense. After embankments have been constructed to grade, they

lines, grades and cross-sections shown on the plans and/or as staked. Acceptance of finished embankment may be made progressively during the course of construction upon the request of the Contractor. A completed embankment once accepted by the Engineer shall not be used by the Contractor for haulage, access or other purposes without the consent of the Engineer.

Where borrow areas such as ditches and dugouts form part of the work, they shall be built according to plan or as staked and shall be considered incidental to the work.

Following completion of the work, borrows are to be left in a graded condition acceptable to the Engineer and all haul roads, access roads, and temporary crossings are to be removed. Unsuitable material will be spoiled at the Contractor's expense in areas shown on the plans or as designated by the Engineer.

4. MEASUREMENT

Embankment shall be measured on a volume basis. The volume to be paid for shall be the total number of cubic yards measured at the borrow site. Measurements shall be made by super-imposing final cross sections on the original ground profile along the center line of the borrow pit using average end method at a maximum of 50 ft. intervals for calculating volume.

5. PAYMENT

Embankment construction shall be paid at the contract unit price cubic yard for "EMBANKMENT CONSTRUCTION". Each cubic yard to be measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items incidental to the work included in this specification.

Additional costs incurred for the supply and application of water will be at a unit price agreed to by the field engineer and Contractor prior to application and is not to be included as part of the unit price for "embankment construction".

SPECIAL PROVISION TO EMBANKMENT SPECIFICATIONDESCRIPTION

This special provision addresses the measurement and payment of material placed in the embankment.

MEASUREMENT

All material placed in the embankment will be included in the measurement of excavation as described in the "Specification for Excavation". No separate measurement will be made of the material placed in the embankment. An estimate of the embankment quantity will be shown on the plans.

PAYMENT

No separate payment will be made for embankment construction other than the payment made for "Excavation" whether placed into the embankment or not.

SPECIFICATIONS FOR CULVERT INSTALLATION

1. GENERAL CONDITIONS

The General Conditions and Special Provisions hereto attached shall apply to and be part of this specification.

2. DESCRIPTION

The work of this section shall include the supply of all labor, materials and equipment required to complete the construction of all crossings called for on the drawings and/or specified herein.

This work shall consist of assembling corrugated metal pipe sections with material supplied; excavating; cofferdam and dewatering as necessary; preparing the bed for the pipe; supply placing and compacting backfill to the lines and grades shown on the drawings, as specified.

3. MATERIALS

All materials will be supplied by the Contractor. All materials shall be handled and stored in a careful and workmanlike manner, to the satisfaction of the Engineer. Contractor shall be responsible for handing material from point of stockpile to construction area.

4. CONSTRUCTION METHODS

4.1 EXCAVATION

The Contractor will be required to excavate the base to the lines of excavation and to a depth of the invert elevations as shown on the plans. Base excavation shall extend three feet beyond the ends and sides of the pipe, or pipes, and the excavation shall be transitioned to meet the existing channel slopes. If necessary, the excavation shall be dewatered in order to prevent disturbing the natural soil conditions at the base of the excavation and to allow the placing and compacting of the backfill material in the dry.

Cofferdams will be required for all excavations in active water course channels and in areas of ground water seepage. Cofferdams must be built to withstand all the forces to which they may be subjected and shall be located such as to give sufficient clearance for the construction of cutoff trenches and/or sump pits for dewatering unless otherwise provided. Cofferdam placement, maintenance and removal shall be the responsibility of the Contractor and shall be considered as incidental to the placement of the culvert.

Dewatering shall be accomplished by constructing cut-off trenches and sump pits around the outside perimeter of the pipe beds. These shall be excavated to a depth of no less than 2 feet below the elevation of the base of the excavation. Trenches and sump pits shall be shored and braced with cribs as necessary. The Contractor will be required to provide sufficient pumping capacity to lower and maintain the ground water approximately 1 foot below the base of excavation.

The excavated base shall be inspected by the Engineer prior to commencement of backfilling. If the Engineer deems further excavation to be required below the bottom of the excavation line shown on the plans and specified herein, the Contractor shall excavate such additional materials as directed by the Engineer. The work involved in doing this additional excavation will be classified as extra work and will be paid for as such.

The Contractor shall not overexcavate by digging below specified lines and grades. If, in the opinion of the Engineer, the Contractor overexcavates material in an area, he shall replace at his expense the overexcavated material with suitable site material and compact that material to a density equal to the surrounding insitu-material, or to the satisfaction of the Engineer.

Excavated material not required as backfill shall be classified as "surplus material" and will be dealt with as outlined in the Special Provisions.

4.2 INSTALLATION AND ASSEMBLY OF PIPE

The Contractor, after preparation of the bed, shall assemble the pipe sections, progressively in accordance with the manufacturer's instructions.

All pipe supplied to site shall be inspected prior to assembly, for chipping or damage in handling and shall be repaired as directed by the Engineer.

All materials damaged, lost, broken or deemed unsuitable due to the Contractor's method of installation, handling or from neglect shall be replaced by the Contractor at his expense.

4.3 BACKFILL

All materials to be used for bed preparation and backfill will be suitable site material as approved by the Engineer. In the event that no suitable site material is available for the pipe installation, the Contractor shall supply suitable material from an approved borrow area the payment for placing this fill will be classified as extra work and will be paid for as such.

The Contractor shall compact the insitu-material below the invert elevations prior to assembly and erection of the pipe. This bed shall be fully levelled and compacted throughout the full width and length of the trench and to the exact grade as specified, so that the barrel of the pipe shall be uniformly and evenly supported throughout its entire length.

Initial backfill shall be deposited in horizontal, uniform layers not exceeding 6 inches in thickness before compaction, and each layer shall be thoroughly compacted throughout to ensure thorough tamping of backfill under the haunches and around the pipe. This is to be achieved by hand and mechanical compaction. Compacted backfill shall be placed in this manner and shall extend to a depth of 1 inch above the top of the pipe for the entire width of the trench. Each layer will be inspected and approved by the Engineer prior to proceeding with the next layer of fill.

After the above initial backfilling has been completed and approved, the remaining backfill, consisting of suitable site material, shall be placed in layers not exceeding 10 inches before compaction. Each layer shall be compacted by mechanical means to a density equivalent to that of the surrounding unexcavated material. Each layer will be inspected and approved by the Engineer prior to proceeding with the next layer of backfill.

No boulders, rock, ice, snow, organic material or debris shall be permitted in the trench. This material will be classified as unsuitable material and treated as such.

Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacements or which may damage the installation, shall not be used.

Backfill shall be executed to the lines and grades shown on the plans and as specified herein.

4.4 PLACE RIPRAP

Placement of riprap shall be in accordance with "SPECIFICATION FOR RIPRAP PLACEMENT".

4.5 WATER CONTROL GATE INSTALLATION

Gates shall be inspected prior to installation for chipping or damage in handling. Damage shall be repaired as specified by the Engineer.

The gates shall be attached to the pipe in same manner as described in Section 4.2 of this specification.

Any materials damaged, lost, broken or deemed unsuitable due to the Contractor's method of installation, handling, or from neglect, shall be replaced by the Contractor at his expense.

4.6 ROAD SURFACE OF CULVERT CROSSING

Any road material removed as necessary for the installation of the culvert shall be replaced to the width, depth, consistency and compaction of existing road on each side.

5. QUALITY CONTROL

5.1 WORKMANSHIP AND MATERIALS

All workmanship and materials furnished and supplied under this specification are subject to close and systematic inspection and testing by the Engineer including all operations, from the selection and production of materials, to final acceptance of the specified work.

The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or works which are not in accordance with the requirements of this specification.

5.2 ACCESS

The Engineer shall be afforded full access for the inspection and control testing of materials, both at the site of work and at any plant or borrow pit used for the supply of the materials, to determine whether the materials are being supplied in accordance with this specification.

6. METHOD OF MEASURE

The Engineer shall determine by field measurement the actual number of lineal feet of each culvert size-group placed. The length of couplers shall not be included in the measurement of the lineal feet of culvert. Where sloped ends are used, the length measured shall be the bottom length of the pipe.

6.1 EXCAVATION AND REPLACEMENT

Excavation and replacement of unsuitable material required to be removed below the established grade of the culvert invert shall be measured in cubic yards by the Engineer.

6.2 GENERAL REQUIREMENTS

All excavation, cofferdams (installation and removal), dewatering, backfill, compaction, assembly and installation of pipe shall be

considered as incidental to construction of the culvert crossing and no separate payment will be made for this work unless otherwise specified herein.

7. BASIS OF PAYMENT

This work will be paid for at the contract unit price for culvert installation.

All items to be measured as specified herein, which price shall be payment in full for supplying all material and performing all operations herein described and all other work incidental to the work included in this specification.

SPECIAL PROVISION FOR CULVERT PLACEMENT2. DESCRIPTION

This special provision lists the types of pipe material that will be acceptable. All other items not changed by this special provision shall remain as specified in the specification for culvert installation.

3. MATERIALS

The pipe shall be of the length and gauge as shown on the plans. All pipe shall be made of galvanized steel or aluminum. Pipe made of galvanized steel shall be coated. This coating shall be a double dipped bituminous coating or a 10 mill polymeric film laminate. The coatings shall be applied to both the inside and the outside of the pipe.

Pipe shall be close rivited or of a "lock seam" construction. Pipe having the polymeric film laminate shall be of the "lock seam" construction only. A one foot width of the helical corrugations shall be reformed into annular corrugations to allow the use of watertight connecting bands. These connecting bands shall be two feet wide bands with annular corrugations. They shall have the same coating as the pipe.

Where the coating is damaged due to handling or fabrication, damaged areas shall be coated with a bituminous or polymeric patching material.

SPECIFICATION FOR STOPLOG CONTROL STRUCTURE
INSTALLATION

1. GENERAL CONDITIONS

The General Conditions and Special Provisions hereto attached shall apply to and be part of this specification.

2. DESCRIPTION

The work of this section shall include the supply of all labor, materials, and equipment required to complete the installation of the culvert control structures as called for on the drawings and/or specified herein.

This work shall consist of coupling the structure to the pipe; excavating; preparing base; install concrete base pad; supply, placing and compacting backfill to the lines and grades shown on the drawing or as specified.

3. MATERIALS

3.1 SUPPLY OF MATERIALS

The Contractor shall supply all couplers, nuts, bolts, corrugated metal riser controls, stoplogs, stoplog channels, sealants, and all accessories recommended by the material manufacturer or necessary for a complete installation. Also, any anti-seep diaphragms and associated fittings shown in the plans.

The Contractor shall supply to the site ready mix concrete, or site mix concrete in accordance with the "SPECIFICATION FOR CAST-IN-PLACE REINFORCED CONCRETE". Forms, reinforcing steel or wire mesh, for the concrete pad for the control structure will be the responsibility of the Contractor.

All materials supplied by the Contractor shall be subject to inspection by the Engineer.

3.2 HANDLING AND STORAGE OF MATERIALS

All materials shall be handled and stored in careful and workmanlike manner to the satisfaction of the Engineer.

4. CONSTRUCTION METHODS

Excavation, cofferdam and dewatering, backfill, compaction, pipe assembly and installation shall be carried out in accordance with the "SPECIFICATION FOR CULVERT INSTALLATION".

Riprap shall be carried out in accordance with the "SPECIFICATION FOR RIPRAP REPLACEMENT".

Cast-in-place concrete, reinforcing, mixing, delivery and placement shall be carried out in accordance with the "SPECIFICATION FOR CAST-IN-PLACE REINFORCED CONCRETE".

4.1 BACKFILL

If, in the opinion of the Engineer, the site excavated material is unsuitable for backfill, the Contractor shall supply, from an assigned borrow area, suitable impervious backfill material. No granular backfill will be allowed for pipe placement unless approved by the Engineer. The payment for supplying this impervious fill will be classified as extra work and will be paid for as such.

4.2 FORMWORK FOR BASE

Forms for concrete must be of substantial construction that will withstand, without any distortion, the internal force of the concrete, and any temporary force exerted by any construction procedure.

Forms shall be constructed true to the lines and grades as called for on the plans and shall be tightly built so that no leakage of concrete will occur. The inside face of the form shall be smooth and even surfaced. All forms shall be treated with form oil. Whenever necessary, forms shall be constructed with openings for removal of dirt, sawdust, wood chips, rubbish or any other foreign material.

4.3 FALSEWORK

Falsework for support of formwork and/or control structure shall be approved by the Engineer prior to placement of same.

Falsework shall remain in place, in whole, for a minimum of five (5) days unless otherwise approved by the Engineer.

4.4 CONTROL STRUCTURE INSTALLATION

Control structure, as delivered to site, shall be cast-in-place into the concrete foundation. The structure shall be supported with adequate falsework so as to maintain the lines and grades shown on the plans, and to maintain those lines and grades without movement, until the concrete has reached a strength as specified herein.

Care shall be taken in the placement of the concrete so as not to splash concrete on the control structure. All concrete splashed on the structure shall be cleaned off immediately, to the satisfaction of the Engineer.

All stoplogs, tiedown lock, grating, railing, and assembly tools shall be removed from the control structure prior to installation of the control structure in the concrete base. All of these items shall be re-installed after completion of structure installation.

Falsework, chairs, or supportive devices used in supporting the control structure in the formwork, and to be permanently incorporated in the concrete shall be of the same material as and shall be considered as reinforcing. All such falsework, chairs and supportive devices shall be approved by the Engineer prior to installation. No supportive devices shall protrude from the finished surface of the concrete, unless approved by the Engineer.

4.5 ANTI-SEEP DIAPHRAGM INSTALLATION

Anti-seep diaphragms and associated fittings shall be constructed and attached to the C.M.P. at the stations shown on the plans. Diaphragms should be located midway between two adjacent riveted circumferential seams or at least 4' from a field joint. Backfill operation's shall be carried out as not to damage diaphragms.

5. QUALITY CONTROL

5.1 WORKMANSHIP AND MATERIALS

All workmanship and materials furnished and supplied under this specification are subject to close and systematic inspection and testing by the Engineer including all operations from the selection and production of materials through to final acceptance of the specified work. The Contractor shall be wholly responsible for the control of all operations incidental thereto notwithstanding any inspection or approval that may have been previously given. The Engineer reserves the right to reject any materials or works which are not in accordance with the requirements of this specification.

5.2 ACCESS

The Engineer shall be afforded full access for the inspection and control testing of materials, both at the site of work and at any plant or borrow pit used for the supply of the materials, to determine whether the materials are being supplied in accordance with this specification.

6. METHODS OF MEASURE

The installation of culvert control structures will be measured on a per unit basis. The quantity to be paid for shall be the actual number of control structures installed, measured by the Engineer in the field.

All excavation, dewatering, backfill, compaction, installation of control structure, concrete base, and anti-seep diaphragms shall be considered as incidental to construction for the control structure and no separate payment will be made for this work unless otherwise specified herein.

7. BASIS OF PAYMENT

The construction of the culvert control structures will be paid for at the contract price per unit for "CONTROL STRUCTURE" to be measured as specified herein, which price shall be payment in full for supplying all material and for performing all operations herein described and all other work incidental to the work included in this specification.

SPECIFICATION FOR RIPRAP PLACEMENT

1. GENERAL CONDITIONS

The General Conditions and Special Provisions hereto attached shall apply to and be part of this specification.

2. DESCRIPTION

This work shall consist of supply and placement of transitions and rock riprap as protective covering along side slopes and bases of channels, slopes around culvert inlets and outlets and on embankments or such other places as may be indicated on the plans, as specified herein, or as directed by the Engineer.

3. SUPPLY OF MATERIALS

The Contractor shall supply rock for riprap purposes which shall consist of field stone or rough, unhewn quarry rock. Unless otherwise specified, the stone shall be well graded and range in size from a 6" to 18" in diameter with not more than 25% greater than 12". Rock shall be approved by the Engineer prior to installation.

4. CONSTRUCTION METHODS

4.1 FILTER MATERIAL

A filter of at least 6", unless otherwise specified on plans, consisting of material from a source approved by the Engineer, shall be laid prior to the placing of any rock riprap.

4.2 PLACING OF RIPRAP

A. Random Placing of Riprap

Random riprap shall be dumped or rolled into place in such a manner that the smaller stones will be uniformly distributed throughout the mass. Sufficient hand work shall be done to provide a neat and uniform surface, with the depth being specified herein and as shown on the plans.

B. Thickness of RipRap

The surface may not vary from the theoretical surface by more than 4" at any point, unless otherwise specified.

5. METHOD OF MEASURE

Riprap shall be measured in cubic yards of acceptably placed rock. The volume of material to be paid shall be the volume of material placed to the depth shown on the plans. And the area on which acceptable placement has been made. The total quantity will be computed to the nearest cubic yard.

6. BASIS OF PAYMENT

Riprap placement shall be paid for at the contract unit price per cubic yard for "RIPRAP PLACEMENT".

Each cubic yard to be measured as specified herein, which price shall be payment in full for supplying all materials and for performing all operations herein described and all other items including supplying and placing filter material which are incidental to the work included in these specifications.



MEDENWALD WPA
HILLHEAD, SOUTH DAKOTA

DESIGN REPORT



I hereby certify that the attached 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.

Wesley W. Schon
Date 11-25-86 Reg. No. 4183

ULTEIG ENGINEERS, INC.

FARGO BISMARCK MINNEAPOLIS

NOVEMBER 1986

MEDENWALD WPA

Purpose: To enhance production of waterfowl by maintaining a pool of water for habitat and weed control.

Classification: This dam is a Class A hazard.

$$10.5 \times 169 = 1774 < 3000$$

Design Parameters: Primary structure - pass 10 year, 24 hour event; emergency spillway - pass 100 year, 24 hour event.

Watershed Area: 1800 acres. See Figure 1.

Soil Types:

Forman-Buse loams

Forman-Austad loams

Renshaw-Fordville loams

All are classified SCS Type B soils.

Crop Cover: See Figure 2.

Hydrologic Curve Number: 70. See Figure 2.

Time of Concentration: 6 Hours. See Figure 3.

Rainfall:

$$Q_{10}^{24} = 3.7" \text{ Adjusted for HCN} = 70 \qquad Q_{10}^{24}_{70} = 1.13"$$

$$Q_{100}^{24} = 5.3" \text{ Adjusted for HCN} = 70 \qquad Q_{100}^{24}_{70} = 2.26"$$

Runoff:

$$Q_{10} \frac{1.13"}{12"/1} \times 1800A = 169 \text{ A-Ft.}$$

$$Q_{100} \frac{2.26"}{12"/1} \times 1800A = 339 \text{ A-Ft.}$$

Structure Hydraulics:

Primary Structure

72" Diameter Full Round Riser

48" Diameter Outfall Line

$$S = 1.75\%$$

$$L = 80 \text{ Ft.}$$

Three considerations were analyzed:

Weir Discharge

Orifice Pipe

Pipe Flow $n = .024$

See Figure 11 for primary structure details.

With a water surface elevation of 1880.5 or 2.5 feet above the weir crest

$$Q_{\text{weir}} = 166 \text{ CFS}$$

$$Q_{\text{orifice}} = 185 \text{ CFS}$$

$$Q_{\text{pipe}} = 152 \text{ CFS Maximum Discharge}$$

Secondary Structure (Emergency Spillway)

Based on Technical Release #2, Supplement A, U.S. Department of Agriculture, an inlet channel #3 will pass the following flows for a 50 foot width.

Elevation 1880.5	H = 0.5' = 50 CFS
Elevation 1881.0	H = 1.0' = 103 CFS
Elevation 1881.5	H = 1.5' = 223 CFS

Space/Storage Curves: See Figure 5.

Storage Requirements

A. Normal Full Service Level

Elevation 1878
Storage 80 A-Ft.
Discharge 0

B. Q_{10}^{24}

Elevation 1879.5
Storage 117 A-Ft.
Maximum Discharge 138 CFS

C. Q_{100}^{24}

Elevation 80.7
Storage 176.3 A-Ft.
Maximum Discharge 225 CFS

See Figure 4 for inflow hydrographs

See Figure 8 for outflow hydrographs

Figures 6 and 7 represent the statistical data and calculations to develop the outflow quantity and storage requirements.

Earthwork Quantities

Cut:

Spillway Excavation	3600 C.Y.
4" Subcut (for Topsoil)	150
Dam Topsoil Stripping	
1' x 10,200 ^{FT} 2 / 27 =	380
Keyway - $\frac{21+12}{2} \times 3 \times (65+65+10) \div 27 =$	<u>260</u>
	4390 C.Y.

Fill:

Embankment	1950 C.Y.
Keyway	260
Topsoil Dam	190
Topsoil Spillway	<u>340</u>
	2740
Shrinkage @ 1.45%	<u>1233</u>
	3973 C.Y.

Earthwork Cross Section Quantities - Figures 9 and 10

BID QUANTITIES

		<u>Unit</u>	<u>Qty.</u>	<u>Unit Price</u>	<u>Extended Price</u>
1	Excavation/ Embankment	C.Y.	4,500	\$ _____	\$ _____
2	Primary Spillway Structure	L.S.	--	---	_____
3	Topsoiling	C.Y.	550	_____	_____
	Total				\$ _____

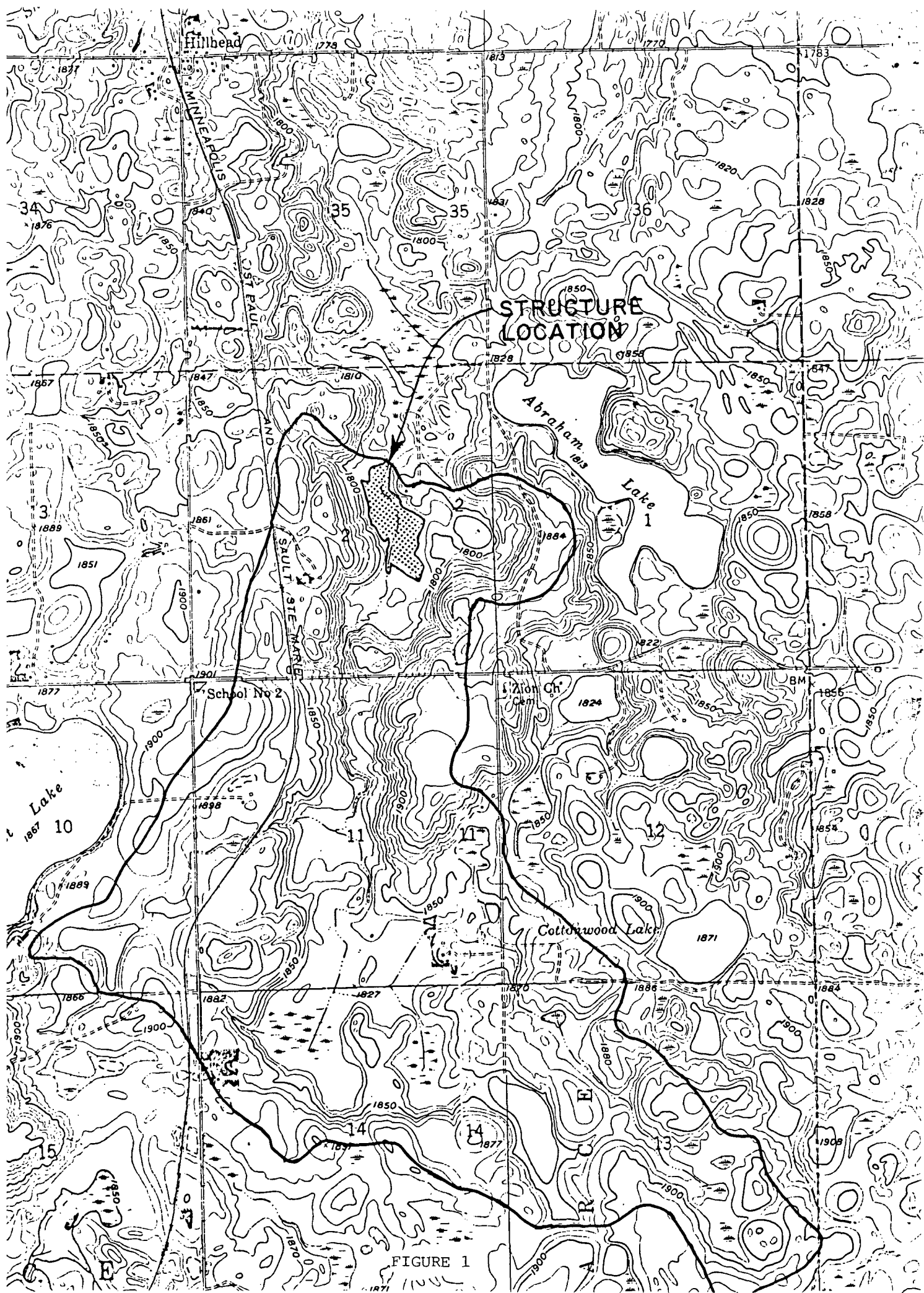


FIGURE 1

TABLE 3-1

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

HYDROLOGIC CURVE NUMBER COMPUTATION SHEET

Present LAND USE FOR RURAL AREAS
Present or FutureWatershed Medenwald Site _____ D.A. _____ Acres 1800Computed by Wesley Schon Date 10-30-86 Checked by _____ Date _____

Cover	Practice	Condition or Rotation	Acres per Practice	Curve Numbers Moisture Condition II				Product
				A Soils	B Soils	C Soils	D Soils	
Fallow	Straight Row		60	77	86	91	94	5160
Row Crops	Straight Row	Poor		72	81	88	91	
	Straight Row	Good	121	67	78	85	89	9438
	Straight Row	Mulch till		61	76	84	87	
	Contoured 2/	Poor		70	79	84	88	
	Contoured 2/	Good		65	75	82	86	
	Contoured 2/	Mulch till		62	73	80	85	
	C and T 1/	Poor		66	74	80	82	
	C and T 1/	Good		62	71	78	81	
	C and T 1/	Mulch till		61	70	77	80	
Sm. Grain	Straight Row	Poor		65	76	84	88	
	Straight Row	Good	425	63	75	83	87	31875
	Straight Row	Mulch till		58	74	82	86	
	Contoured 2/	Poor		63	74	82	85	
	Contoured 2/	Good		61	73	81	84	
	Contoured 2/	Mulch till		59	72	80	83	
	C and T 1/	Poor		61	72	79	82	
	C and T 1/	Good		59	70	78	81	
	C and T 1/	Mulch till		58	69	77	80	
Legumes or Rotation Meadow	Straight Row	Poor		66	77	85	89	
	Straight Row	Good		58	72	81	85	
	Contoured 2/	Poor		64	75	83	85	
	Contoured 2/	Good		55	69	78	83	
	C and T 1/	Poor		63	73	80	83	
	C and T 1/	Good		51	67	76	80	
Pasture or Rangeland		Poor		68	79	86	89	
		Fair		49	69	79	84	
		Good	917	39	61	74	80	55937
Meadow (Permanent)		Good		30	58	71	78	
Wood or Forest Land		Poor		45	66	77	83	
		Fair		36	60	73	79	
		Good		25	55	70	77	
Farmsteads		--	20	59	74	82	86	1480
Roads	Dirt Surface	--	42	72	82	87	89	3444
(Inc. R.O.W.)	Hard Surface	--	12.4	74	84	90	92	1042
Impervious Surfaces		--		100	100	100	100	
Water Surfaces (lakes, ponds)		--	66	100	100	100	100	6600
Swamp (open water) 3/		--		85	85	85	85	
Swamp (vegetated 4/		--	137.3	78	78	78	78	10686
Low Density Residential		--		47	65	76	82	
Medium Density Residential		--		54	70	79	84	
High Density Residential		--		70	81	87	90	
Commercial and Industrial		--		86	91	93	94	

Total Acres 1800 Product Total = 125662Weighted Runoff Curve No. $\frac{\text{Product Total}}{\text{Total Acres}} = \frac{125662}{1800} = 69.81 \approx 70$

- 1/ Contoured and graded terraces or land with less than 2% slope.
 2/ Includes level terraced areas. (runoff corrected by volume)

- 3/ 1/3 of swamp surface is open water.
 4/ Swamp has no open water and the design is a 25-year frequency or less.

TIME OF CONCENTRATION CALCULATIONS
MEDENWALD WPA
HILLHEAD, SOUTH DAKOTA

UEI # 1892.11

LIN NO.	BEGNING STATION	ENDING STATION	BEGNING ELEV.	ENDING ELEV.	FLOW COND.	REACH L. FEET	DROP FEET	SLOPE %	VELOCITY FT/SEC.	TIME SECS.
1	19,300	18,200	1880	1870	MARSH	1,100	10	0.91%	0.8	1,375
2	18,200	17,300	1870	1860	SWALE/GRASS	900	10	1.11%	2.0	450
3	17,300	14,500	1860	1850	SWALE/GRASS	2,800	10	0.36%	1.1	2,545
4	14,500	14,100	1850	1840	SWALE/GRASS	400	10	2.50%	3.0	133
5	14,100	13,500	1840	1830	SWALE/GRASS	600	10	1.67%	2.4	250
6	13,500	10,500	1830	1825	SWALE/PASTURE	3,000	5	0.17%	0.9	3,529
7	10,500	8,500	1825	1820	MARSH	2,000	5	0.25%	0.5	4,444
8	8,500	6,300	1820	1810	MARSH	2,200	10	0.45%	0.4	5,000
9	6,300	4,700	1810	1800	SWALE/GRASS	1,600	10	0.63%	1.5	1,067
10	4,700	3,300	1800	1790	SWALE/GRASS	1,400	10	0.71%	1.6	875
11	3,300	2,000	1790	1780	MARSH	1,300	10	0.77%	0.8	1,733
12	2,000	0	1780	1770	MARSH	2,000	10	0.50%	0.6	3,333
TOTALS						19,300	110	0.57%		24,736
										HOURS
										6.87

FIGURE 3

MEDENWALD WPA

HYDROGRAPH FAMILY 2, $T_c = 6$ hr.

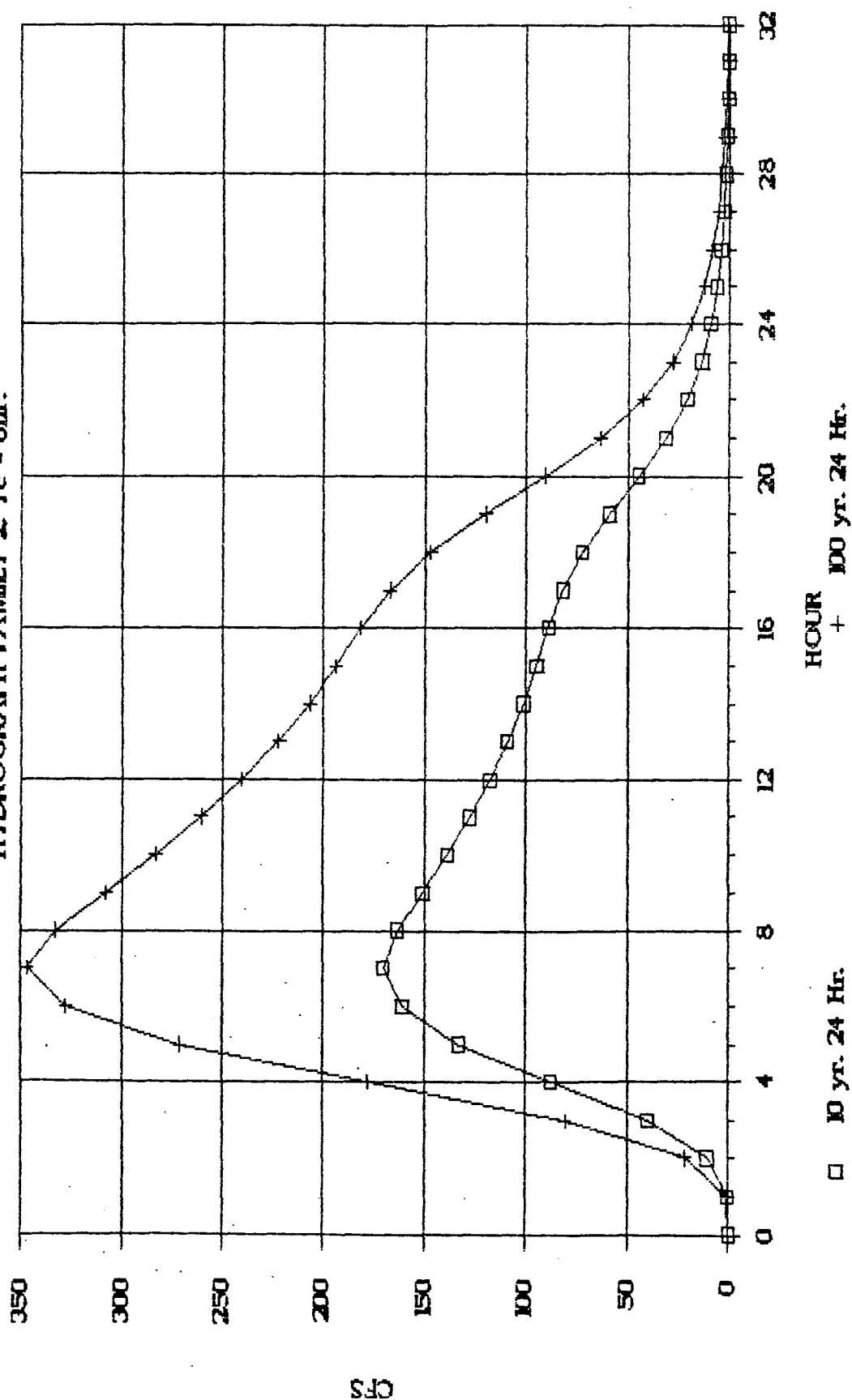


FIGURE 4

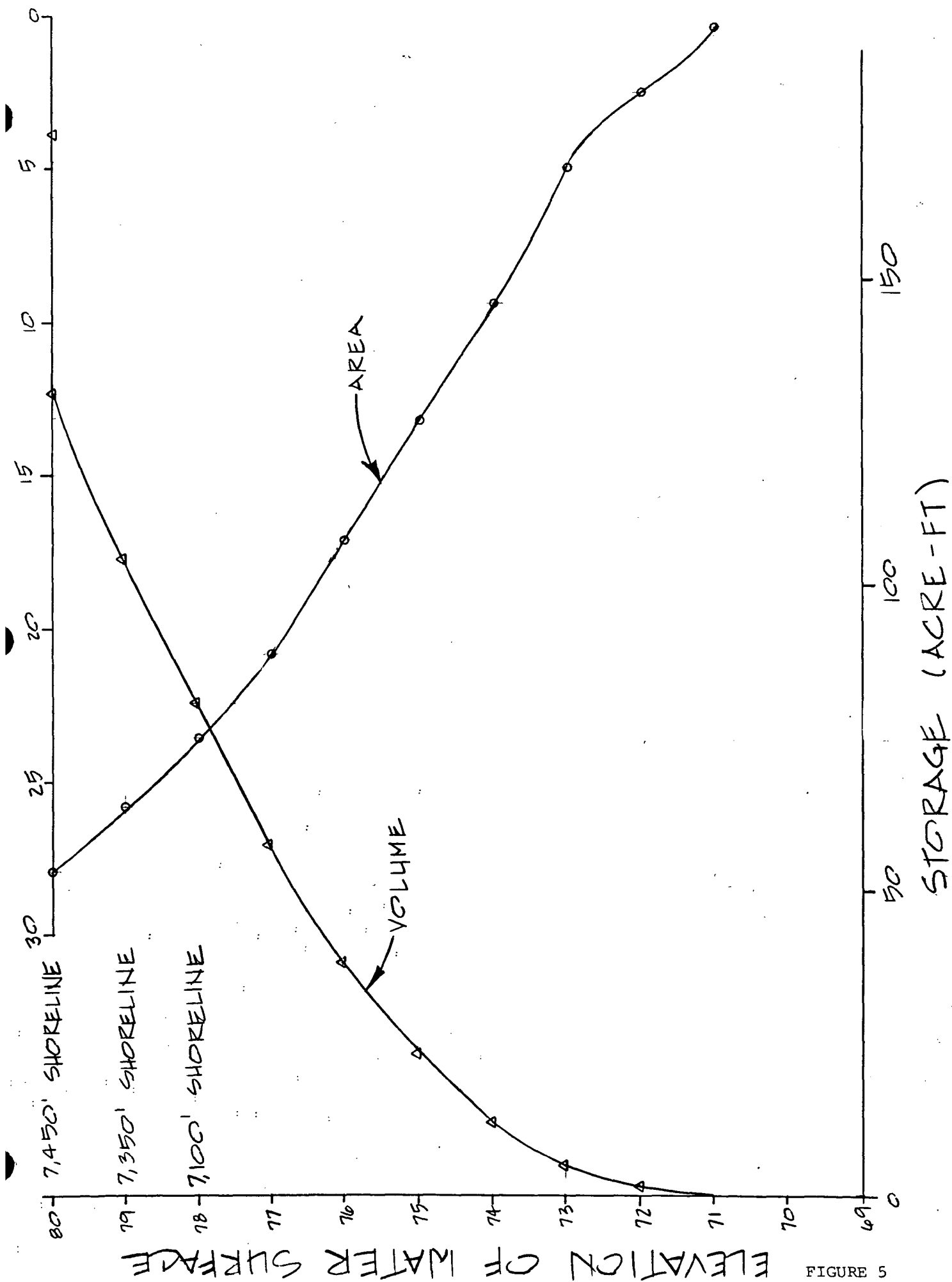


FIGURE 5

MEDENWALD WPA

STORAGE INDICATION DATA
72" X 48" PRIMARY STRUCTURE
50' WIDE EMERGENCY SPILLWAY

ELEVATION:	STORAGE A-ft.		STORAGE/dt:	OUTFALL		S/dt + 0/
	GROSS	NET		CFS	OUTFALL/2	
1878 :	80	0 :	0 :	0	0 :	0
1878.5 :	93	13 :	315 :	25	12.5 :	327
1879 :	105	25 :	605 :	69	34.5 :	640
1879.5 :	117	37 :	895 :	136	68 :	963
1880 :	130	50 :	1,210 :	152	76 :	1,286
1880.5 :	163	83 :	2,009 :	202	101 :	2,110
1881 :	196	116 :	2,807 :	255	127.5 :	2,935
1881.5 :	231	151 :	3,654 :	375	187.5 :	3,842

CONVERSION FOR dt= .5hr. - 24.2

FIGURE 6

FLOOD ROUTING
BY
STORAGE INDICATION METHOD

MEDENWALD WPA
HILLHEAD, SOUTH DAKOTA
1892.11
PRINCIPAL SPILLWAY, 100 YR., 24HR STORM
72" RISER, 48" OUTFALL

TIME HRS.	INFLOW	INFLOW AVG.	S1/dt - 01/2	S2/dt -02/2	OUTFLOW CFS	
0	1				0	
		6.5	0			
0.5	12			6.5	0.5	
		16.5	6			
1	21			22.5	2	
		38	20.5			
1.5	55			58.5	5	
		68	53.5			
2	81			121.5	12	
		105.5	109.5			
2.5	130			215	18	MAXIMUM S1/dt-02/2 2442
		154	197			
3	178			351	24	MAXIMUM DISCHARGE 225 CFS
		198	327			
3.5	218			525	52	
		244.5	473			STORAGE REQUIRED 176.2603 ACRE-FT.
4	271			717.5	87	
		283.5	630.5			
4.5	296			914	126	
		312	788			
5	328			1100	143	
		331.5	957			
5.5	335			1288.5	152	
		341	1136.5			
6	347			1477.5	168	
		344	1309.5			
6.5	341			1653.5	177	
		337	1476.5			
7	333			1813.5	185	
		326.5	1628.5			
7.5	320			1955	195	
		314	1760			
8	308			2074	201	
		302	1873			
8.5	296			2175	207	
		289.5	1968			
9	283			2257.5	213	
		277.5	2044.5			
9.5	272			2322	216	
		266	2106			
10	260			2372	219	
		254.5	2153			

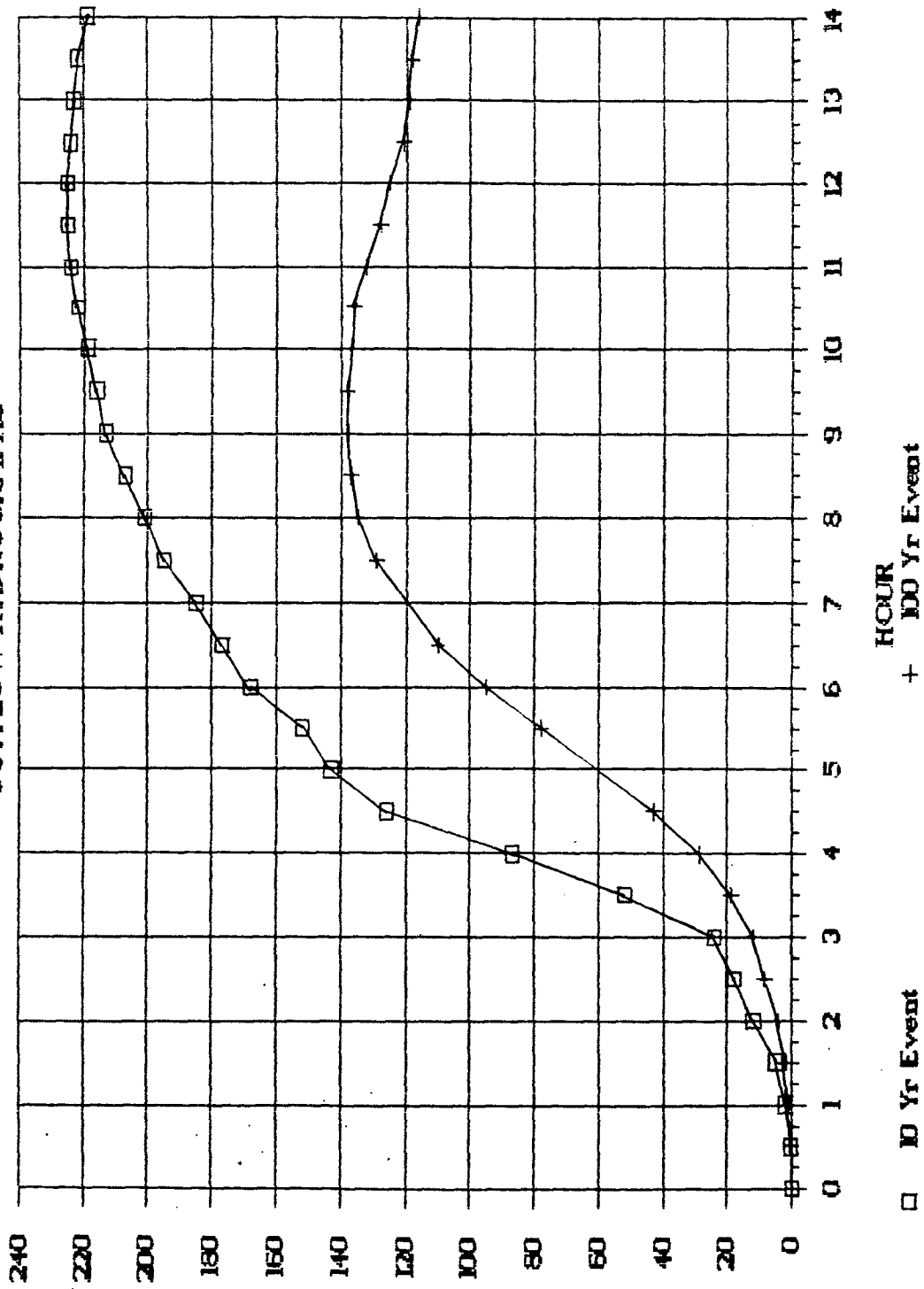
FIGURE 7

10.5	249			2407.5	222
		244.5	2185.5		
11	240			2430	224
		235	2206		
11.5	230			2441	225
		226	2216		
12	222			2442	225
		218	2217		
12.5	214			2435	224
		210.5	2211		
13	207			2421.5	223
		203.5	2198.5		
13.5	200			2402	222
		197	2180		
14	194			2377	219

FIGURE 7 (CONTINUED)

MEDENWALD WPA

OUTFLOW HYDROGRAPHS



CFS

FIGURE 8

Earthwork Summary For MEDENFILL

Average End Area Method

Station (ft)	Area Of Cut (Sq.Ft)	Area Of Fill (Sq. Ft)	Incremental Cut (Cu.Yd)	Volume Of Fill (Cu. Yd)	Total Volume Of Cut (Cu.Yd)	Volume Of Fill (Cu. Yd)
0.0	0.0	0.0			0.0	0.0
25.0	0.0	153.2	0.0	70.9	0.0	70.9
50.0	0.0	508.0	0.0	306.1	0.0	377.1
75.0	0.0	793.3	0.0	602.4	0.0	979.5
100.0	0.0	489.0	0.0	593.6	0.0	1573.1
125.0	0.0	135.0	0.0	288.9	0.0	1862.0
160.0	0.0	0.0	0.0	87.5	0.0	1949.5

FIGURE 9

Earthwork Summary For MEDENWALD WEST SPILLWAY

Average End Area Method

Station (Ft)	Area Of Cut (Sq.Ft)	Area Of Fill (Sq. Ft)	Incremental Cut (Cu.Yd)	Volume Of Fill (Cu. Yd)	Total Volume Of Cut (Cu.Yd)	Total Volume Of Fill (Cu. Yd)
0.0	0.0	0.0			0.0	0.0
20.0	62.6	0.0	23.2	0.0	23.2	0.0
60.0	269.3	0.0	245.8	0.0	268.9	0.0
80.0	176.8	0.0	165.2	0.0	434.1	0.0
100.0	275.2	0.0	167.4	0.0	601.5	0.0
120.0	389.6	1.1	246.2	0.4	847.8	0.4
160.0	541.7	0.0	689.9	0.8	1537.6	1.2
200.0	534.6	0.0	797.3	0.0	2335.0	1.2
240.0	427.8	0.0	712.9	0.0	3047.9	1.2
280.0	212.5	0.0	474.3	0.0	3522.1	1.2
300.0	0.0	0.0	78.7	0.0	3600.8	1.2

FIGURE 10



United States Department of the Interior
FISH AND WILDLIFE SERVICE

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

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

IN REPLY REFER TO:

BA/EN
WR SD
MAIL STOP 60190

MAR 26 1987

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

Gentlemen:

On February 9, 1987, the Fish and Wildlife Service submitted an Application for Permit to Appropriate Water pertaining to an impoundment to be constructed on the Medenwald Waterfowl Production Area in Marshall County.

Enclosed is a report of soil investigation conducted for the project. We would appreciate your returning this report after you have completed your review.

Sincerely,

William A. Godby
Regional Engineer

Enclosure



MIDWEST TESTING LABORATORY

REPORT OF SOIL INVESTIGATION

Proposed Control Structure
Medenwald W.P.A.
Near Hillhead, South Dakota
Project Number 3829



CONSTRUCTION MATERIAL TESTS

WASTE WATER TESTS

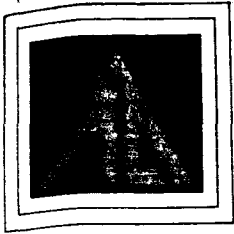
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SOIL & INVESTIGATIONS

REPORT OF SOIL INVESTIGATION

Proposed Control Structure
Medenwald W.P.A.
Near Hillhead, South Dakota
Project Number 3829





MIDWEST TESTING LABORATORY

4102 7TH AVENUE NORTH • P.O. BOX 3042 • FARGO, N. DAK. 58108-3042 • 701-282-9633

January 21, 1987

Ulteig Engineers, Inc.
P.O. Box 1569
Fargo, ND 58107-1569

Attn: Wes Schon

Re: Soil Investigation
Proposed Control Structure
Medenwald W.P.A.
Near Hillhead, South Dakota

Gentlemen:

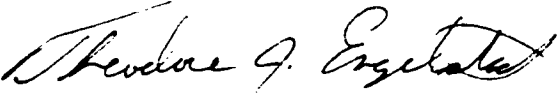
The attached report covers the soil investigation we conducted for the above project. Three copies of our report are being furnished for your use. The work was conducted in accordance with your instructions and authorization.

Approximately 50 percent of the soil samples obtained will be held at our office for two months and will then be discarded unless we are notified to hold them for a longer period of time.

The evaluations contained in this report have considered the normal contingencies, however, should any questions arise pertaining to the soil conditions during preparation of the working drawings or unexpected conditions develop during construction, please do not hesitate to contact us.

Very truly yours,

MIDWEST TESTING LABORATORY, INC.


Theodore J. Engelstad, P.E.

TJE:pjf

Proj. No. 3829

REPORT OF SOIL INVESTIGATION

Proposed Control Structure
Medenwald, W.P.A.
Near Hillhead, South Dakota
Project Number 3829

INTRODUCTION

The proposed construction will be an earthen embankment for water level control of the Medenwald Waterfowl Production Area. To conduct our investigation, three soil test borings were performed on January 5, 1987. The purpose of these borings was to determine the soil conditions at the site and obtain samples for laboratory analysis. The following report will describe the soil conditions encountered and with the aid of laboratory analysis evaluate these conditions in relation to the proposed construction.

SITE AND SOIL CONDITIONS

The proposed structure will be located at the north end of the Medenwald Waterfowl Production Area, which is located in the eastern half of Section 2, Township 127 North, Range 54 West, in Marshall County, South Dakota. This is roughly one mile east and one mile south of Hillhead. The proposed control structure location is a relatively narrow channel that drains towards the north. Two borings were performed for the structure, one near the bottom of the channel and the other approximately eight feet up from the bottom and on the east side.

- - - - - MIDWEST TESTING LABORATORY - - - - -

Our third boring was performed on a knoll situated in the area of the proposed emergency spillway, which is also to be used as a borrow area for the embankment construction. The surface elevation of this boring is approximately 16 feet above the existing channel bottom. A contour map furnished us of the site indicates existing horizontal to vertical channel side slopes of 4 or 5:1 on the west side and approximately 6:1 on the east side.

The general soil profile among our borings consists of a shallow surface soil layer underlain by lean clay with sand and sandy lean clays. The lean and sandy lean clays are predominantly found in a rather stiff or stiff condition. This material is of low plasticity and of various colorations ranging from browns to grays. Also, lenses or seams of sand were encountered within the sandy lean clay deposits in the upper regions of borings one and two.

For a graphical and more complete description of the soils encountered within our borings, please refer to the attached boring logs.

GROUND WATER

Ground water was encountered at boring number two at the times and levels recorded on the boring log. Water was noted as entering this hole from lenses and seams of sand found at approximately 2½ to 3 foot depth. This level roughly corresponds to the elevation of the bottom of the channel, which was nearly dry at the time of our boring. In general, ground water movement is quite restricted through cohesive soils such as the sandy lean clays that we encountered, and therefore, a very long period of observation would be necessary for the true ground water conditions to establish where continuous

waterbearing sand seams are not present. At this site, we can assume that the ground water condition in the immediate vicinity responds quite closely with fluctuations in the surface water level of the wetlands.

LABORATORY INVESTIGATION

One soil sample was selected from the proposed borrow area for laboratory analysis. The testing program was designed to determine its index properties and the laboratory moisture density relation, according to the procedure ASTM D698-78. The index properties show a low plasticity clay with a well graded grain size distribution, indicating a material that would have a low permeability coefficient when properly compacted.

All of the laboratory test results are included following the boring logs.

ANALYSIS AND RECOMMENDATIONS

Structural Details

We understand that the proposed earth dike will be approximately 150 feet long and have a top elevation of 1782. Also, a drop structure will maintain a normal water level at approximately 1780. We further understand that an earthen emergency spillway is proposed to skirt the west side of the dike.

Discussion

Our borings indicate that below topsoil layers firm soil conditions are present that would be well adequate to support the proposed embankment. The predominant foundation soil condition consists of cohesive soils that are quite restrictive

to ground water movement. In the upper few feet, however, lenses and seams of sand are present, and we recommend that potential seepage through these inclusions be cut off by excavation and backfill with a cohesive borrow material.

The material found in the borrow area is suitable for the proposed embankment construction. Judging by the three borings performed the sandy lean clay predominantly found at boring number three is typical of the area. We recommend that this material be placed in uniform lifts, each thoroughly compacted to a minimum of 95 percent of the maximum density as determined by the Standard Proctor ASTM D698-78. We also recommend that this embankment fill be placed at a moisture content ranging from optimum to four percent above the optimum as determined by the above proctor method. The dike constructed in this manner will offer good seepage resistance with long term storage; however, the phreatic surface will eventually extend across the cross section of a homogeneous embankment and intercept the down stream slope. This has a destabilizing effect on the down stream portion of an embankment. Measures that may be taken to prevent this occurrence would include providing an internal drainage facility or constructing a pervious down stream outer shell. With proper drainage provisions embankment slopes of 3:1 will have adequate stability.

FIELD INVESTIGATION PRODECURES

Three soil test borings were performed on January 5, 1987. The borings were performed at the locations discussed with you and shown on the attached sketch. The surface elevations were referenced to your benchmark number three, which is a capped rebar located approximately as shown on the attached sketch. This was furnished as elevation 1784.81.

- - - - - MIDWEST TESTING LABORATORY - - - - -

Soil Sampling

The borings were advanced with 3-3/8 inch hollow stem auger, with split barrel samples obtained in accordance with ASTM D1586-67. Using this procedure a two inch O.D. split barrel sampler is driven by a 140 pound weight falling 30 inches. The number of blows required to drive the sampler 12 inches after a six inch initial set is the Standard Penetration Resistance and will be referred to as N value, an index related to the consistency of cohesive soils and the relative density of cohesionless soils.

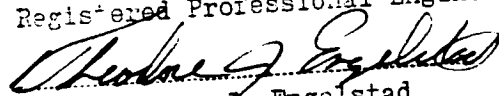
Soil Classifications

As the borings were advanced in the field and samples obtained they were visually and manually classified in accordance with ASTM D2488-69. Representative portions of all samples were returned to the laboratory for verification of the field classifications. Selected samples were submitted to a program of laboratory tests to aid in determining the characteristics of the soil. Logs of the borings, laboratory test results and charts illustrating the soil classification procedures and descriptive terminology are attached.

LIMITATIONS OF INVESTIGATION

The area of the borings in relation to the entire site is relatively small and therefore, should not be assumed to be necessarily typical of the entire area of the site. Also, this investigation cannot represent soil conditions below the depths of our borings. Because of these and other reasons, we recommend close observation during construction for soil conditions not typical of the strata logged.

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer:


Theodore J. Engelstad

Date Jan. 21, 1987 Reg. No. ND 2312



MIDWEST TESTING LABORATORY



JOB NO. 3829 LOG OR TEST BORING NO. 1 VERTICAL SCALE 1"=4'
PROJECT Proposed Control Structure, Medenwald W.P.A., Near Hillhead, South Dakota

DEPTH IN FEET	SOIL DESCRIPTION SURFACE ELEV. <u>1777.8</u>	SAMPLE		N VALUE	LABORATORY TESTS			
		NO.	TYPE		MOISTURE	DENSITY	LL/PL	Qu
1	LEAN CLAY WITH SAND-black to very dark brown, frozen (CL/OL)	1	FA					
4	LEAN CLAY WITH SAND-dark grayish brown, rather stiff, frozen to 1½ feet (CL)	2	SS	14				
6	SANDY LEAN CLAY-grayish brown mottled, medium, with lenses of sand	3	SS	7				
	SANDY LEAN CLAY-gray, mottled brown, and brownish gray, stiff to very stiff to stiff (CL)	4	SS	20				
		5	SS	20				
		6	SS	28				
		7	SS	23				
		8	SS	36				
		9	SS	19				
26	END OF BORING							

WATER LEVEL DATA			
DATE	TIME	CAVE IN DEPTH	WATER LEVEL
1-5-87	1515	HSA 24½'	NONE
1-5-87	1522	23'	NONE
1-5-87	1535	23'	NONE

BORING DATA
STARTED 1-5-87 COMPLETED 1-5-87 @ 1515
METHOD USED:
3-3/8" HSA 0-24½'

[illegible]

WATER LEVEL DATA			
DATE	TIME	CAVE IN DEPTH	WATER LEVEL
1-5-87	1400	HSA 24 1/2'	NONE
1-5-87	1418	23'	22.5'
1-5-87	1532	23'	16.6'

BORING DATA

STARTED 1-5-87 COMPLETED 1-5-87 @ 1400

METHOD USED:

3-3/8" HSA 0-24 1/2'

MIDWEST TESTING LABORATORY



JOB NO. 3829 PROJECT Proposed Control Structure, Medenwald, W.P.A., Near Hillhead, SD

BORING NO.: 3				WATER LEVEL DATA			
LAYER	SOIL DESCRIPTION	SURFACE ELEV.	1785.9	DATE	TIME	W.L.	CAVE-IN
0-1'	LEAN CLAY WITH SAND-very dark brown (CL/OL)						
1-10'	SANDY LEAN CLAY-brown, mottled light gray (CL)						
				BORING DATA			
				STARTED	1-5-87		
				COMPLETED	1-5-87		
				CREW CHIEF	M. Larson		

BORING NO.:				WATER LEVEL DATA			
LAYER	SOIL DESCRIPTION	SURFACE ELEV.		DATE	TIME	W.L.	CAVE-IN
				BORING DATA			
				STARTED			
				COMPLETED			
				CREW CHIEF			

BORING NO.:				WATER LEVEL DATA			
LAYER	SOIL DESCRIPTION	SURFACE ELEV.		DATE	TIME	W.L.	CAVE-IN
				BORING DATA			
				STARTED			
				COMPLETED			
				CREW CHIEF			



MIDWEST TESTING LABORATORY



4102 - 7th Ave. N. / P. O. Box 3042 / Fargo, North Dakota 58108 / Dial (701) 282-9633

REPORT OF: TESTS OF SOILS

PROJECT: Proposed Control Structure,
Medenwald W.P.A.
Near Hillhead, South Dakota

DATE: January 21, 1987

REPORTED TO: Ulteig Engineers, Inc.
P.O. Box 1569
Fargo, ND 58107-1569

COPIES:

PROJECT NO: 3829

SAMPLE NUMBER: 1
LOCATION: Boring 3 @ 1'-5'
CLASSIFICATION: SANDY LEAN CLAY (CL)
COLOR: brown, mottled light gray

PARTICLE DISTRIBUTION (See attached curve)

Gravel (%)	
Coarse (plus 30 mm)	0
Fine (30-5 mm)	2
Sand (%)	
Coarse (5-2 mm)	3
Medium (2-.44 mm)	8
Fine (.44 - .074 mm)	20
Fines (%)	
Silt (.074 - .005 mm)	28
Clay (.005-.001 mm)	16
Colloids (less than .001 mm)	23

ATTERBERG LIMITS:

Liquid Limit	37
Plastic Limit	17

LABORATORY MOISTURE-DENSITY RELATION (See attached curve)

Method	Standard Proctor ASTM D698-78, Method "A"
Optimum Moisture (%)	18.4
Maximum Density (#/cu.ft.)	106.9



MIDWEST TESTING LABORATORY



Project No. 3829

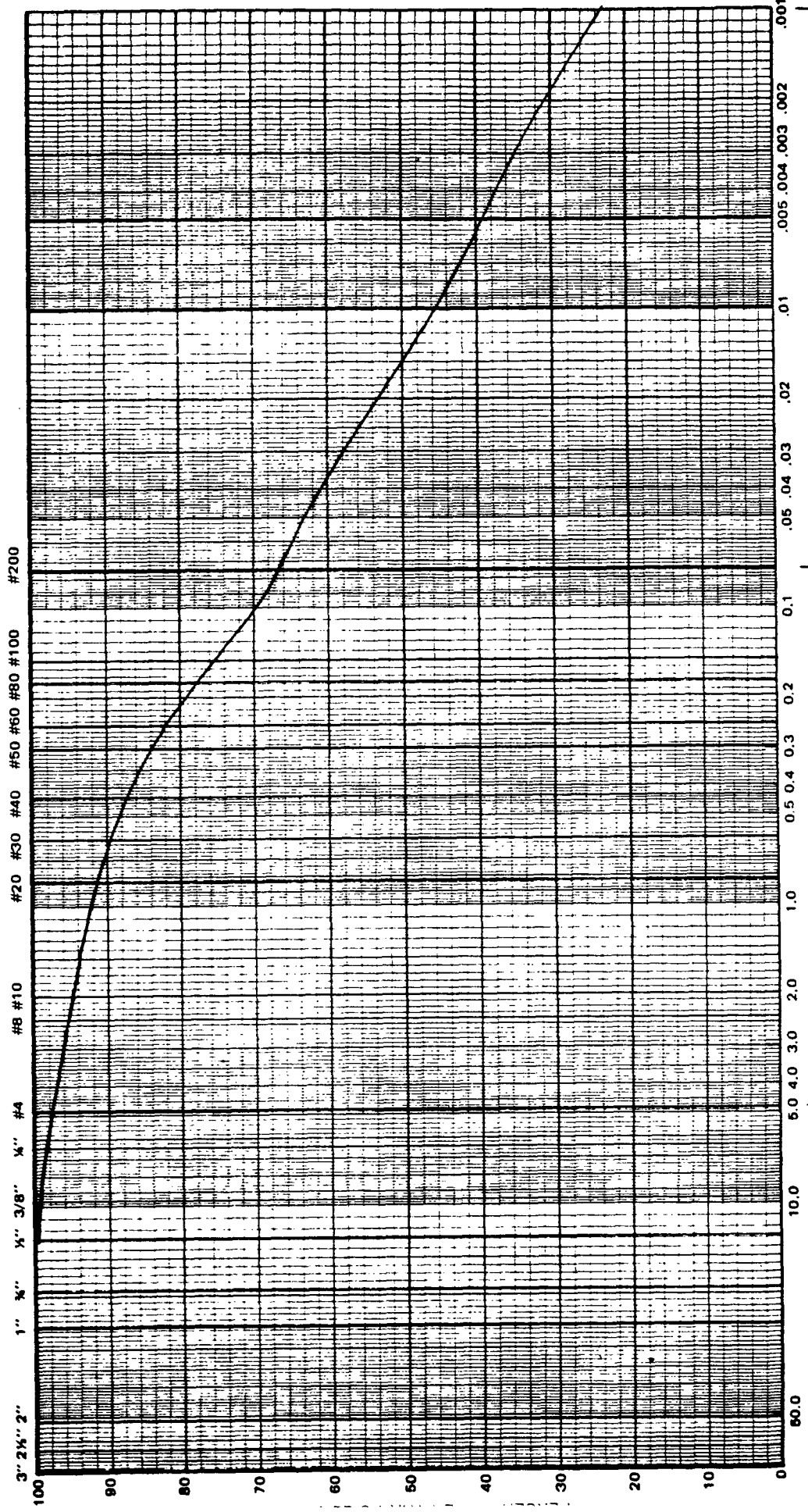
Project: Proposed Control Structure
Medenwald, W.P.A.

Sample Source Boring 3 @ 1'-5'

Classification SANDY LEAN CLAY-brown, mottled light gray (CL) Reported To: Ulteig Engineers, Inc.

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES





MIDWEST TESTING LABORATORY



4102 - 7th Ave. N. / P. O. Box 3042 / Fargo, North Dakota 58108 / Dial (701) 282-9633

REPORT OF: MOISTURE-DENSITY RELATIONS OF SOIL

PROJECT: Proposed Control Structure
Medenwald W.P.A.
Near Hillhead, South Dakota

DATE: January 21, 1987

REPORTED TO: Ulteig Engineers, Inc.
P.O. Box 1569
Fargo, ND 58107-1569

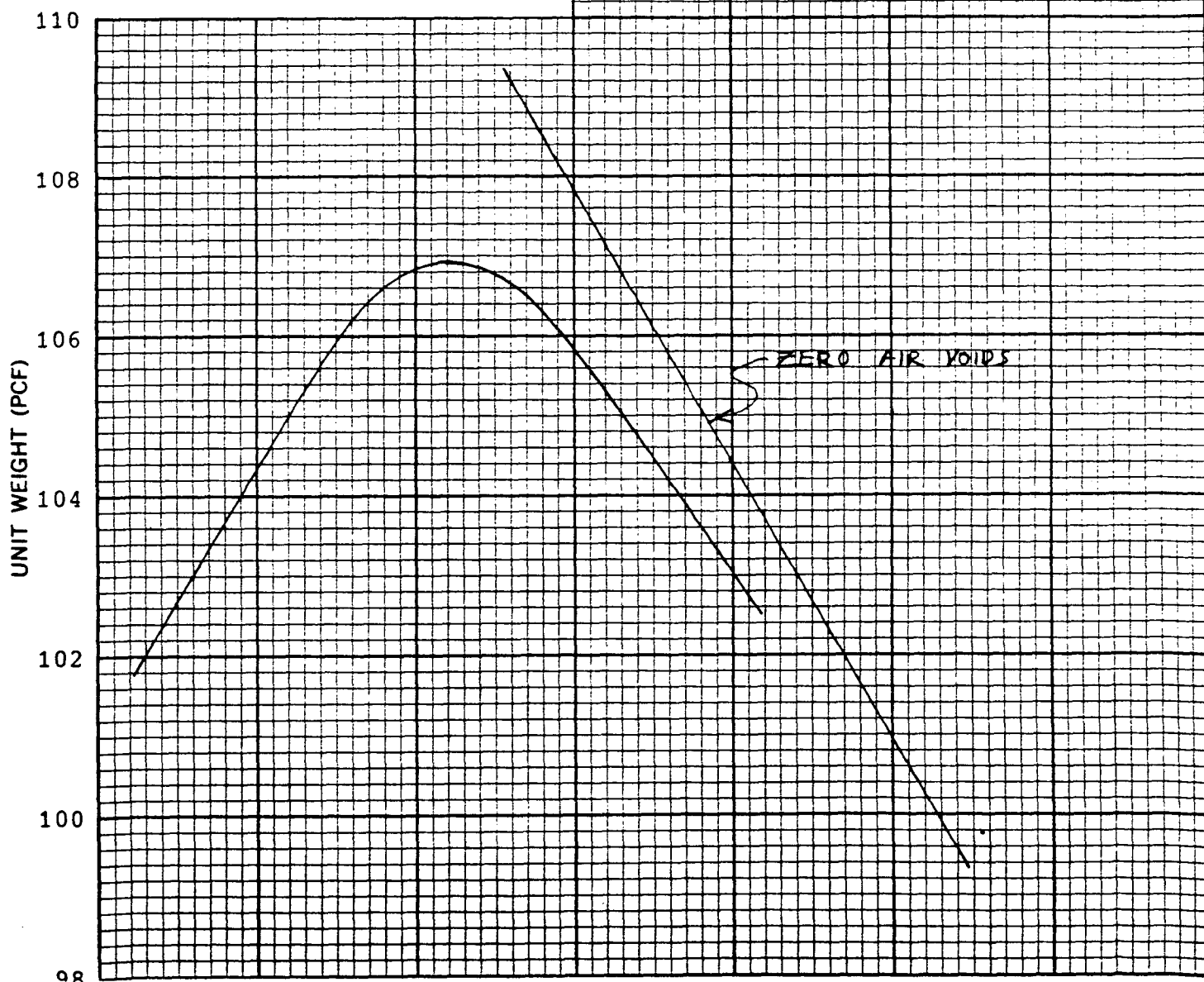
COPIES:

PROJECT NO: 3829

SAMPLE NUMBER: 1 (Boring 3 MAXIMUM DENSITY: 106.9 pcf OPTIMUM MOISTURE: 18.4%
@ 1'-5')

METHOD: Standard Proctor ASTM D698-78,
Method "A"

SOIL TYPE: SANDY LEAN CLAY-brown,
mottled light gray (CL)



DESCRIPTIVE TERMINOLOGY

RELATIVE DENSITY OF COHESIONLESS SOILS

Term	"N" Value
Very Loose	0-4
Loose	5-8
Medium Dense	9-15
Dense	16-30
Very Dense	Over 30

THICKNESS OF SOIL INTRUSIONS

Term	Range
Lense/Lamination	0-1/8"
Seam	1/8"-1"
Layer	1"-12"

CONSISTENCY OF COHESIVE SOILS

Term	"N" Value
Soft	0-4
Medium	5-8
Rather Stiff	9-15
Stiff	16-30
Very Stiff	Over 30

PARTICLE SIZES

Term	Range
Boulders	Over 8"
Cobbles	3"-8"
Gravel	
Coarse	3/4"-3"
Fine	#4-3/4"
Sand	
Coarse	#4-#10
Medium	#10-#40
Fine	#40-#200
Silt and Clay	Determined by Plasticity Characteristics

NOTE: Sieve sizes shown are U.S. Standard

RELATIVE PROPORTIONS

Term	Range
Trace	0-5%
A Little	5-15%
Some	15-30%
With	30-50%

DRILLING & SAMPLING SYMBOLS

Symbol	Definition
FA	Flight Auger
SS	Split Spoon
TW	Thin-Walled Tube
HSA	Hollow Stem Auger
N	Penetration Resistance: blows required to drive a two-inch OD split spoon sampler one foot by means of a 140-pound hammer falling 30 inches.

LABORATORY TEST SYMBOLS

Symbol	Definition
LL	Liquid Limit, %
PL	Plastic Limit, %
Q _u	Unconfined Compressive Strength, psf
Additional insertions in Q _u column	
G	Specific Gravity
SL	Shrinkage Limit, %
pH	Hydrogen Ion Content - Meter Method
O	Organic Content, % - Com- bustion Method
M.A.	Grain Size Analysis - Mechan- ical Method
Hyd.	Grain Size Analysis - Hydro- meter Method
C	One-Dimensional Consolidation
Q _c	Triaxial Compression

WATER LEVEL INFORMATION

Water levels shown on the boring logs are levels measured in the borings at the time and under the conditions noted. In sand, the indicated levels can be considered reliable. In clay soil, it is not possible to determine the ground water level within the normal scope of a test boring investigation, except where lenses or layers of more previous

water-bearing soil are present. Even then, a long period of time may be necessary to reach equilibrium. Therefore, the position of the water level noted on the boring logs for cohesive or mixed-texture soils may not indicate the true level of the ground water table.



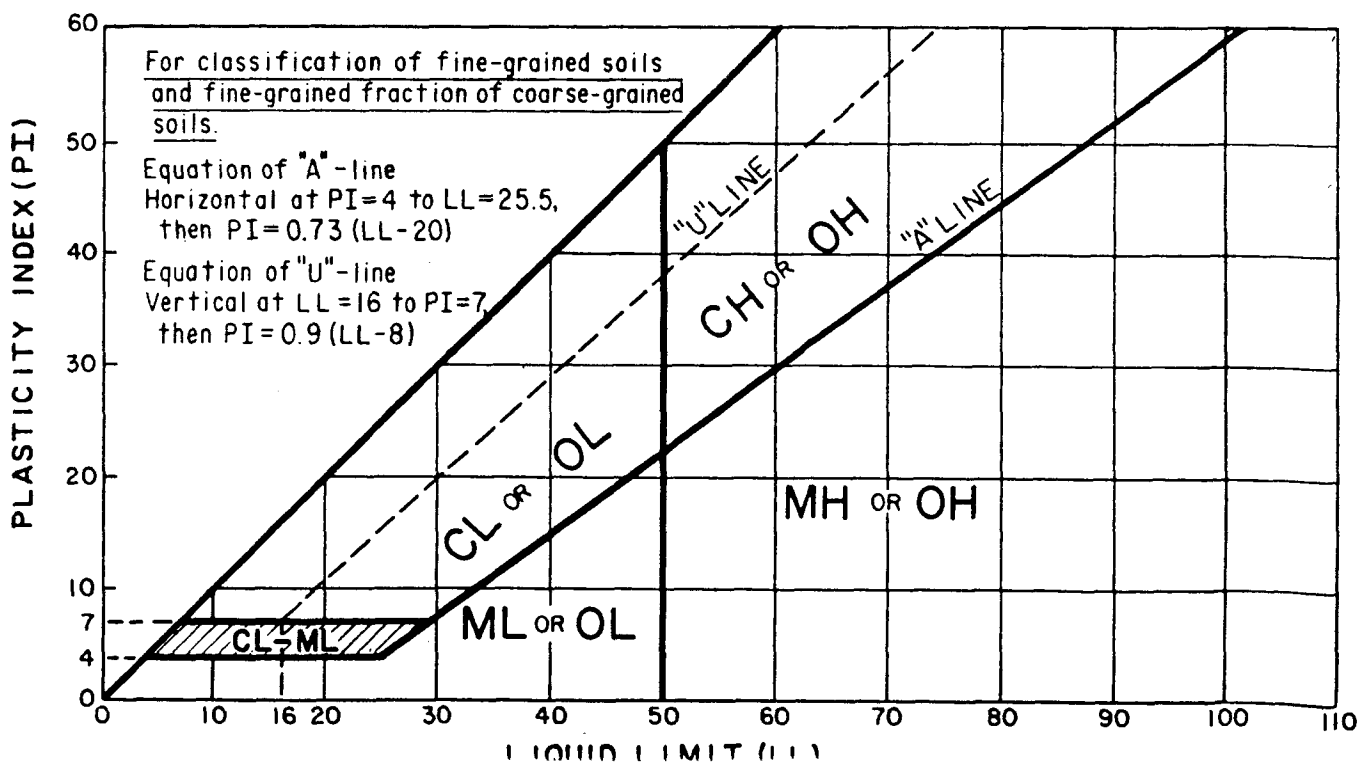
MIDWEST TESTING LABORATORY

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests^a

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^d				Soil Classification	
				Group Symbol	Group Name ^b
Coarse-Grained Soils More than 50 % retained on No. 200 sieve	Gravels More than 50 % of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5 % fines ^c	$Cu \geq 4$ and $1 \leq Cc \leq 3^e$	GW	Well-graded gravel ^f
			$Cu < 4$ and/or $1 > Cc > 3^e$	GP	Poorly graded gravel ^f
		Gravels with Fines More than 12 % fines ^c	Fines classify as ML or MH	GM	Silty gravel ^{f, g, h}
			Fines classify as CL or CH	GC	Clayey gravel ^{f, g, h}
	Sands 50 % or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5 % fines ^d	$Cu \geq 6$ and $1 \leq Cc \leq 3^e$	SW	Well-graded sand ⁱ
			$Cu < 6$ and/or $1 > Cc > 3^e$	SP	Poorly graded sand ⁱ
		Sands with Fines More than 12 % fines ^d	Fines classify as ML or MH	SM	Silty sand ^{g, h, j}
			Fines classify as CL or CH	SC	Clayey sand ^{g, h, j}
Fine-Grained Soils 50 % or more passes the No. 200 sieve	Silt and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line ^j	CL	Lean clay ^{k, l, m}
			$PI < 4$ or plots below "A" line ^j	ML	Silt ^{k, l, m}
		organic	$\frac{\text{Liquid limit} - \text{oven dried}}{\text{Liquid limit} - \text{not dried}} < 0.75$	OL	Organic clay ^{k, l, m, n} Organic silt ^{k, l, m, o}
	Silt and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay ^{k, l, m}
			PI plots below "A" line	MH	Elastic silt ^{k, l, m}
		organic	$\frac{\text{Liquid limit} - \text{oven dried}}{\text{Liquid limit} - \text{not dried}} < 0.75$	OH	Organic clay ^{k, l, m, p} Organic silt ^{k, l, m, q}
Highly organic soils	Primarily organic matter, dark in color, and organic odor			PT	Peat

^a Based on the material passing the 3-in. (75-mm) sieve.^b If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.^c Gravels with 5 to 12 % fines require dual symbols:GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay^d Sands with 5 to 12 % fines require dual symbols:SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

$$^e Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

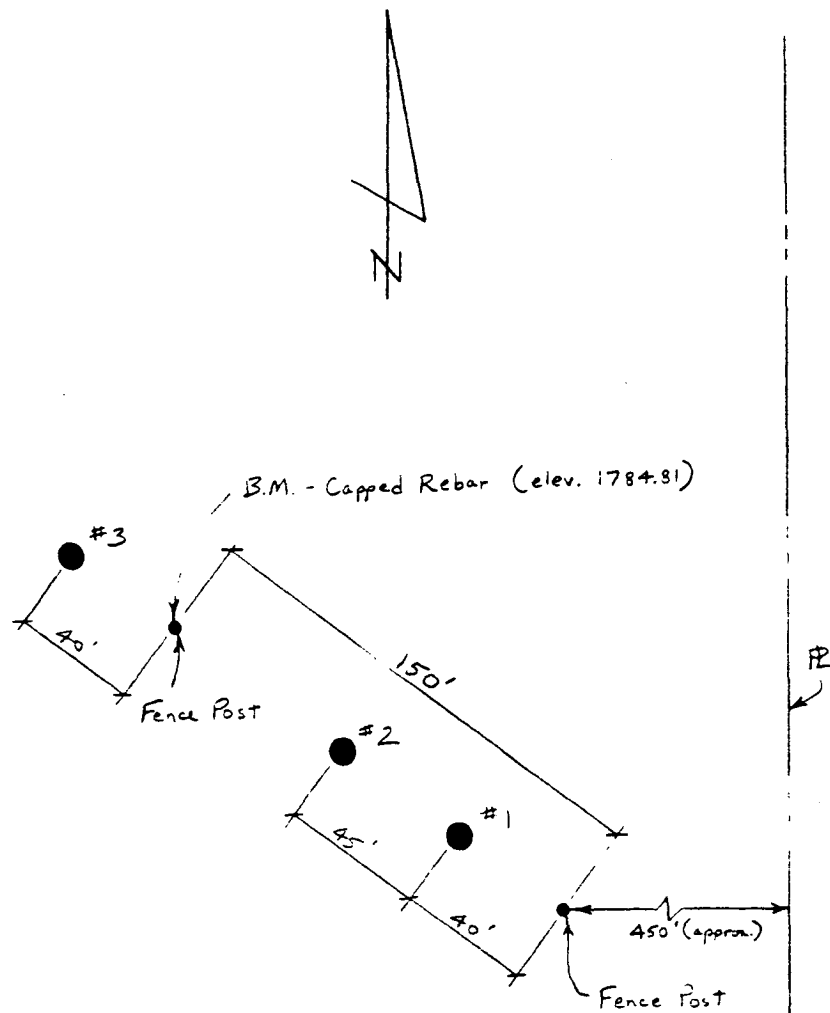
^f If soil contains ≥ 15 % sand, add "with sand" to group name.^g If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.^h If fines are organic, add "with organic fines" to group name.ⁱ If soil contains ≥ 15 % gravel, add "with gravel" to group name.^j If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.^k If soil contains 15 to 29 % plus No. 200, add "with sand" or "with gravel," whichever is predominant.^l If soil contains ≥ 30 % plus No. 200, predominantly sand, add "sandy" to group name.^m If soil contains ≥ 30 % plus No. 200, predominantly gravel, add "gravelly" to group name.ⁿ $PI \geq 4$ and plots on or above "A" line.^o $PI < 4$ or plots below "A" line.^p PI plots on or above "A" line.^q PI plots below "A" line.



MIDWEST TESTING LABORATORY



TEST BORING LAYOUT



PROJECT PROPOSED CONTROL STRUCTURE, MEDENWALD, W.P.A. JOB NO. 3829

REPORT ON APPLICATION NO. 5135-3
U.S. Fish & Wildlife Service
May 18, 1987

Water Permit Application No. 5135-3 is to construct a dam (80 acre feet storage capacity) in the Medenwald Waterfowl Production Area. The dam is to be located in the SW1/4 of the NE1/4 of Section 2 - T127N - R54W, Marshall County. Water is to be used to provide habitat for fish, waterfowl, and wildlife production.

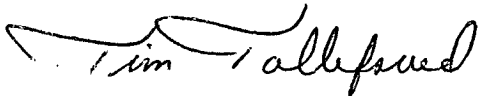
DISCUSSION

The dam is classified as a small size category three dam. The spillway capacity is designed to pass the 100 year flood which meets the minimum spillway design flood criteria established by Water Management Board Rules Chapter 74:02:08 Safety of Dams for this category and size of dam. It will be equipped with a stoplog water control structure which will allow the reservoir to be maintained at various levels or completely drained.

This dam will be located on an unnamed tributary of Shortfoot Creek. There are currently no existing water rights downstream from this dam.

CONCLUSIONS

1. Plans and specifications for this dam meet the Water Management Board Safety of Dams Rules.
2. There are currently no existing water rights downstream from this dam which will be adversely affected by approval of this application.
3. It is recommended Application No. 5135-3 be approved with the qualification that low flows as needed for downstream domestic use including livestock water must be by-passed.



Tim Tollefsrud
Natural Resources Engineer

RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 5135-3

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. 5135-3, U.S. Fish and Wildlife Service, PO Box 25486, DFC, Denver CO.

The Chief Engineer is recommending APPROVAL of Application No. 5135-3 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 with the following qualifications:

Low flows as needed for downstream domestic use including livestock watering and prior water rights must be by-passed.

See the attached report for additional information.


JOHN HATCH, Chief Engineer
May 26, 1987



Department of Water & Natural Resources

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

WATER RIGHTS DIVISION
(605) 773-3352

May 27, 1987

Galen Buterbaugh, Regional Director
U.S. Fish & Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, Colorado 80225

Dear Mr. Buterbaugh:

We have reviewed the plans and specifications for the Medenwald Waterfowl Production Area Dam, Water Right Application No. 5135-3, in Marshall County. The plans and specifications as submitted are approved.

Our review was to determine compliance with the minimum spillway design flood requirements as specified by Water Management Board Rules Chapter 74:02:08 Safety of Dams. Approval applies only to the portion of the plans and specifications that could result in uncontrolled release of water from the dam. Approval of these plans and specifications does not release the U.S. Fish & Wildlife Service as owner from the responsibility for operating and maintaining the dam in good repair to assure the safety of the dam.

Very truly yours,

John Hatch, Chief Engineer
Water Rights Division

JH:RD:ms

Instruction to Newspaper - Publish first publication of the following Notice on or before June 3, 1987 with 2nd publication 1 week later. The applicant is responsible for payment.

NOTICE OF HEARING on Application No. 5135-3 to Appropriate Water
~~and/or to Amend Water Permit or Water Right No. _____~~

Notice is hereby given that the U.S. Fish and Wildlife Service whose mailing address is P.O. Box 25486, DFC, Denver, Colorado, ~~South Dakota~~ has made an application for a permit

to construct a dam (80 acre-feet storage capacity) in the Medenwald Waterfowl Production Area. The dam is to be located in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ Section 2-T127N-R54W and will have an outlet elevation of 1878.0 feet mean sea level. The dam is to be equipped with a stoplog water control structure (72 inch riser with 48 inch tube) to allow the dam pool to be maintained at various levels or drained. An emergency spillway is also to be constructed for the dam. Water is to be used to provide habitat for fish, waterfowl and wildlife production.

Pursuant to SDCL 46-2A-2 the Chief Engineer of the Water Rights Division recommends

APPROVAL of Application No. 5135-3 because 1) unappropriated water is available, 2) will be no unlawful impairment of existing rights, 3) is beneficial use of water and 4) is in the public interest.

This application will be considered by the Water Management Board at room 216, Joe Foss Building, 523 E. Capitol, Pierre, South Dakota, July 8 1987 at 10:00 am.

The recommendation of the Chief Engineer is not final or binding upon the Board and the Board is authorized to 1) approve, 2) approve with qualifications, 3) defer, or 4) deny this application after it reaches a conclusion based upon facts presented at the public hearing. Any interested person who may be affected by a Board decision and who intends to participate in the hearing before the Board and present evidence or cross-examine witnesses according to SDCL 1-26, must file a written petition with BOTH the applicant and the Chief Engineer by June 26, 1987. The petition may be informal, but it must include a statement describing the petitioners interest in the application, the reasons for the petitioner's opposition to or support of the application, and the signature and mailing address of the petitioner or his legal counsel if legal counsel is obtained. The applicant need not file a petition.

This application is made pursuant to the provisions of SDCL 46-1-1 thru 46-1-9, 46-1-12 thru 46-1-15; 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; ~~(ground) 46-6-3, 46-6-3.1, 46-6-6.1, 46-6-10, 46-6-13, 46-6-14; (future use) 46-5-38 thru 46-5-40, (transfer lands) 46-5-30.4, 46-5-33 thru 46-5-35, (10,000 AFA) 46-5-20.1, 46-5-0.1, and Board Rules ARSD 74:02:01:01 thru 74:02:01:15, (future use) 74:02:01:24 thru 74:02:01:25, (10,000 AFA) 74:02:01:15:02 thru 74:02:01:15:05.~~

This hearing is an adversary proceeding. The applicant or any person, after filing a petition, has the right to be present or to be represented by a lawyer. These and other due process rights will be forfeited if they are not exercised. Decisions of the Board may be appealed to the Circuit Court and the State Supreme Court as provided by law.

Any person wishing a copy of the Chief Engineer's recommendation, further information on this application or to assure access to the hearing by the handicapped can contact the Water Rights Division, DWNr, Joe Foss Bldg, Pierre SD (605 773-3352) for assistance prior to the hearing date. The time of the hearing will be automatically extended for at least twenty days upon written request of the applicant or any person who has filed a petition to oppose or support the application. The request for extension must be filed with the Chief Engineer by June 26, 1987.

No. 5135-3

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA)
) ss.
County Marshall)

I, Charles L. Card hereby

certify that the annexed printed copy of Notice of Intent to Appropriate

Water was taken from the Britton Journal

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

City _____ of Britton

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

June 3, 1987

June 10, 1987

Charles L. Card
(Signature)

publisher
(Title)

6/10/87
(Date Signed)

Cost of Printing: 140.33

27 (June 3-10)

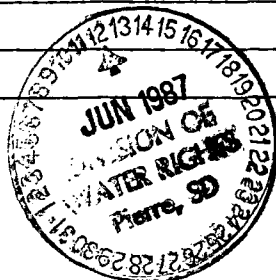
NOTICE OF HEARING
on Application No. 5135-3
To Appropriate Water

Notice is hereby given that the U. S. Fish and Wildlife Service whose mailing address is P. O. Box 25486, DFC, Denver, Colorado, has made an application for a permit to construct a dam (80 acre-foot storage capacity) in the Medenwald Waterfowl Production Area. The dam is to be located in the SW $\frac{1}{4}$ NE $\frac{1}{4}$ Section 2-T127N-R54W and will have an outlet elevation of 1878.0 feet mean sea level. The dam is to be equipped with a stoplog water control structure (72 inch riser with 48 inch tube) to allow the dam pool to be maintained at various levels or drained. An emergency roadway is also to be constructed for the dam. Water is to be used to provide habitat for fish, waterfowl and wildlife production.

Pursuant to SDCL 46-2A-2 the Chief Engineer of the Water Rights Division recommends APPROVAL of Application No. 5135-3 because 1) unappropriated water is available, 2) will be no unlawful impairment of existing rights, 3) is beneficial use of water and 4) is in the public interest.

This application will be considered by the Water Management Board at room 216, Joe Foss Building, 523 E. Capitol, Pierre, South Dakota, July 8, 1987, at 10:00 a.m.

The recommendation of the Chief Engineer is not final or binding upon the Board and the Board is authorized to 1) approve, 2) approve with qualifications, 3) defer, or 4) deny this application after it reaches a conclusion based upon facts presented at the public hearing. Any interested person who may be affected by a Board decision and who intends to participate in the hearing before the Board and present evidence or cross-examine witnesses according to SDCL 1-26, must file a written petition with BOTH the applicant and the Chief Engineer by June 26, 1987. The petition may be informal, but it must include a statement describing the petitioners interest in the application, the reasons for the petitioner's opposition to or support of the application, and the signature and mailing address of the petitioner or his legal counsel if legal counsel is obtained. The applicant need not file a petition.



This application is made pursuant to the provisions of SDCL 46-1-1 thru 46-1-9, 46-1-12 thru 46-1-15; 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.

This hearing is an adversary proceeding. The applicant or any person, after filing a petition, has the right to be present or to be represented by a lawyer. These and other due process rights will be forfeited if they are not exercised. Decisions of the Board may be appealed to the Circuit Court and the State Supreme Court as provided by law.

Any person wishing a copy of the Chief Engineer's recommendation, further information on this application or to assure access to the hearing by the handicapped can contact the Water Rights Division, DWNr, Joe Foss Bldg., Pierre, SD (605-773-3352) for assistance prior to the hearing date. The time of the hearing will be automatically extended for at least twenty days upon written request of the applicant or any person who has filed a petition to oppose or support the application. The request for extension must be filed with the Chief Engineer by June 26, 1987.



Department of Water & Natural Resources

Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501

Water Rights Division
605 773-3352

AUG 19 1987

U.S. Fish & Wildlife Service
PO Box 25486, Denver Federal Center
Denver, Colorado 80225

Dear Sir:

Enclosed herewith is your Water Permit No. 5135-3 as approved by the Water Management Board authorizing you to construct your water diversion system and the water to beneficial use, not exceeding the limits as specified in said Water Permit No. 5135-3.

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 your Water License may be issued to you, thus completing your acquisition of a Water Right.

Very truly yours,

A handwritten signature in black ink, appearing to read "John Hatch". The signature is written in a cursive, flowing style.

JOHN HATCH, Chief Engineer
Water Rights Division

JH: ms

enclosure

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.

WNR-809-5/83

**NOTICE OF COMPLETION OF WORKS AND
APPLICATION OF WATER TO BENEFICIAL USE**

Date July 25, 1988

TO: Water Rights Division, DWNR
Joe Foss Building
Pierre SD 57501-3181

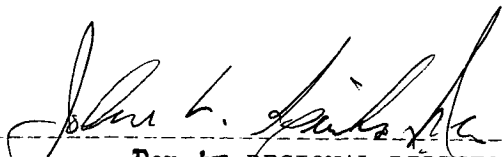
FROM: United States of America
Fish and Wildlife Service, P.O. Box 25486, DFC Denver, CO 80225
name address city

I have completed the construction of the water diversion system and I have put the water to beneficial use to the maximum extent it is going to be used. I have not exceeded the amounts specified in Water Permit No. 5135-3.

Water Permit No. 5135-3 states that the diversion system is to be constructed by July 8, 1992, and that the water it put to beneficial use by July 8, 1996.

The diversion system was completed on August 1987.
Applying the water to beneficial use was completed on April 1988.

You may schedule an inspection so that the Water License may be issued.


signature **Deputy REGIONAL DIRECTOR**
JOHN L. SPINKS, JR.





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

JUL 27 1988



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

Dear Sirs:

The Fish and Wildlife Service holds Conditional Water Permit No. 5135-3 for construction of an impoundment on the Medenwald Waterfowl Production Area in Marshall County.

Enclosed is the completed form stating that construction was completed and this water was put to beneficial use in April 1988. Please place us on your schedule for an inspection so that a perfected Water Permit can be issued.

If you have any further questions, please contact Cheryl Williss at 303/236-5321.

Sincerely,

JOHN L. SPINKS, JR.
Deputy Regional Director

Enclosure

Permit No. 5135-3

Red Rainy 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 Services of Denver, CO holder of Permit No. 5135-3, bearing the priority of 2/12/1987 authorizing the diversion of 0 cu. ft. per second and/or the storage of 80 acre-feet of the waters of surface water for providing habitat for fish, waterfowl and wildlife habitat purposes, in Marshall County.

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

A. Works used to divert the water:

One dam located in the SW1/4 NE1/4 which is capable of impounding 80 ac-ft.

B. Works used to transport water to place of use:

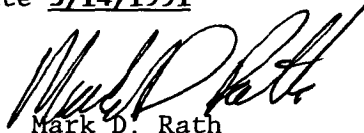
C. Works used to apply water to beneficial use:

The system is in the following condition good. The point of diversion is located SW1/4 Section 2, T127N, R54W 6m NE1/4. The works are capable of diverting and conveying to the place of use 0 cu. ft. per second of water and/or storing 80 acre-feet of water which is to be used for providing fish, waterfowl, and wildlife habitat. Water has been put to beneficial use to the maximum extent as follows:

comprising a total of 0 acres of land and the license should be issued for 0 cfs and/or 80 acre-feet of storage.

Application permit qualifications have been complied with ☒ Yes ☐ No

Exceptions to compliance are: none Date 5/14/1991



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

LICENSE FOR PERMIT NUMBER 5135-3

1. Legal location of wells:

Dams and Structures SW1/4 NE1/4 Section 2-T127N-R54W

2. Well Information: Well Drilling Firm

Completion Report? Yes No No. of Wells Depth(s) feet

Casing a) diameter inches Screen a) type
b) length feet b) length feet
c) type Static Water Level feet

Pump a) make Motor a) make
b) model b) model no.
c) size c) horsepower rating
d) capacity GPM d) serial no.
e) turbine pump - no. of stages
f) operating PSI

3. Distribution lines or canals

a) size inches
b) type
c) length feet

4. Dam Information:

a) height to crest 12.5 feet m) Outlet tubes:
b) height to primary spillway 5 feet 1) diameter 36 inches
c) height to secondary spillway 6 feet 2) type CMP
d) crest width 10 feet 3) valved (Y/N) y
e) crest length 170 feet 4) valve type stop log

4. Dam Information Continued:

- f) spillway length 100 feet 5) location on structure:
g) spillway width 50 feet NW side
h) approx. storage 80 AC-FT n) Category of Dam 3
i) approx. storage to crest AC-FT
j) date constructed 1989
k) inspection sheet completed? (Y/N) n
l) name of contractor Ducks Unlimited

5. System Type a) sideroll:

- 1) length feet
2) diameter of pipe inches
3) make, model & number of
sprinklers
4) spacing of sprinklers feet
5) nozzle size

b) towline:

- 1) length feet
2) make, model & number of
sprinklers
3) spacing of sprinklers
4) nozzle size

c)gun:

- 1) make
2) nozzle size
3) capacity (GPM)
4) hose size inches
5) hose length feet

d) center pivot:

- 1) make
2) number of towers
3) distance between towers
4) overall length feet
5) end gun (Y/N)
6) high or low pressure

e) gated pipe:

- 1) length feet
2) diameter inches
3) spacing of gates inches

- 7) make and size of nozzles:
8) capacity (GPM)

5. System Type Continued:

- | f) portable boom: | g) siphons: |
|-------------------|---------------------|
| 1) make | 1) size inches |
| 2) nozzle size | 2) number |
| 3) capacity (GPM) | |

NOTE: For Permits with additional wells or changes in well locations, record the following for each well: pumping capacity, date constructed, well driller and if a well log is available.

Indicate any other permit(s) which are associated with project

Yes	No	Check Items
<u>NA</u>		1. Soil and water permit lands agree with lands being irrigated and lands listed on permit?
<u>Y</u>		2. Special qualifications to permit being abided by?
<u>Y</u>		3. All structures, wells and lands on map?
<u>NA</u>		4. Irrigation Questionnaires checked to determine if permit owner started irrigation by end of construction period?
<u>NA</u>		5. Is chemigation used?
<u>NA</u>		6. If yes, does equipment comply with chemigation rules?

REMARKS:



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

July 18, 1991

Cheryl Williss
US Fish & Wildlife Service
Denver Federal Center
PO Box 25486
Denver, CO 80225

RE: Licensing of Water Permit Nos. 4865-3, 5091-3, 5135-3,
5177-3, 5188-3, 5221-3 and 5472-3

Dear Ms. Williss:

The inspection of the water use systems and the inspection of the extent of application of water to beneficial use, as developed under Water Permit Nos. 4865-3, 5091-3, 5135-3, 5177-3, 5188-3, 5221-3 and 5472-3, have been completed. The water licenses for these permits can now be issued.

Statutes require that we charge a \$50.00 fee for the inspection and issuance of each of the Water Licenses. Upon receipt of \$350.00 from you, we will begin processing your Water Licenses.

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,

Genny McMath
Natural Resources Analyst
(605) 773-3352

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



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



JUL 26 1991

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

Dear Ms. McMath:

In response to your letter of July 18, 1991, please find enclosed a Money Order in the amount of \$350 to cover the inspection and issuance of the following Water Licenses:

4865-3	Janssen WPA (Grant County)
5091-3	Ringer WPA (Marshall County)
5135-3	Medenwald WPA, Marshall County)
5177-3	Roe WPA (Codington County)
5188-3	Hofland WPA (Marshall County)
5221-3	Reyelts WPA (Grant County)
5472-3	Spink County WPA (Spink County)

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

Sincerely,

William A. Godby
Regional Engineer

Enclosure

RECEIPT

Division of Water Rights

South Dakota Department of Water and Natural Resources

412768

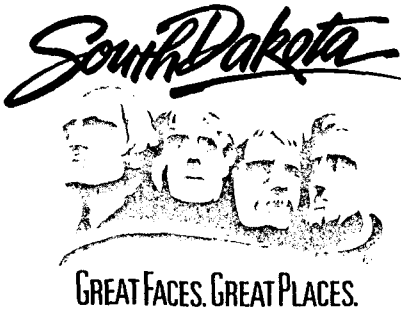
Pierre, _____ August 1, 1991

RECEIVED OF U.S. Dept of Interior, Fish & Wildlife Serv, PO Box 25486, 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 works 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>5135-3</u>	50	00
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	50 00

By John Hatch (CF)
Chief Engineer



SEP 27 1991

**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

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

U.S. Fish & Wildlife Service
Denver Federal Center
P.O. Box 25486
Denver, CO 80225

Dear Sirs:

Enclosed are Water License Nos. 4579-3, 4865-3, 5091-3, 5135-3, 5177-3, 5221-3, and 5472-3. They are the final water right documents completing your process of obtaining water rights. Enclosed are the receipts which you paid for the inspection and issuance of these water licenses.

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

Very truly yours,

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

enclosures

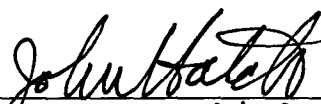
STATE OF SOUTH DAKOTA
WATER LICENSE NO. 5135-3

(1) The U.S. Fish & Wildlife Service of Denver Federal Center, P.O. Box 25486, Denver, CO 80225 made Application No. 5135-3, February 12, 1987 for a water permit to store 80 acre feet of water annually from an unnamed tributary of Shortfoot Creek in a dam located in the Medenwald Waterfowl Production area, Marshall County, South Dakota for providing habitat for fish, waterfowl and wildlife production. Permit No. 5135-3 with a priority date of February 12, 1987 was approved July 8, 1987 and issued to applicant(s) for storage of water with construction of the described water supply system to be completed on or before July 8, 1992 and for the application to beneficial use of said water on or before July 8, 1996.

(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 store 80 acre feet of water annually for beneficial use. The location of the dam is: in the SW 1/4 NE 1/4 of Section 2, T127N, R54W.

(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 Section 46-5-30.1 the U.S. Fish & Wildlife Service of Denver Federal Center, P.O. Box 25486, Denver, CO 80225 the holder(s) and/or owner(s) of Water Permit No. 5135-3 is issued a license for storage of water, the right to store 80 acre feet of water annually from a tributary of Shortfoot Creek in a dam located in the Medenwald Waterfowl Production area with a priority date of February 12, 1987 from the location specified in (2) of this license. The water is stored for the purpose of providing habitat for fish, waterfowl and wildlife production. This license is subject to any limitations or qualifications listed in Water Permit No. 5135-3 and subject to South Dakota State Law.

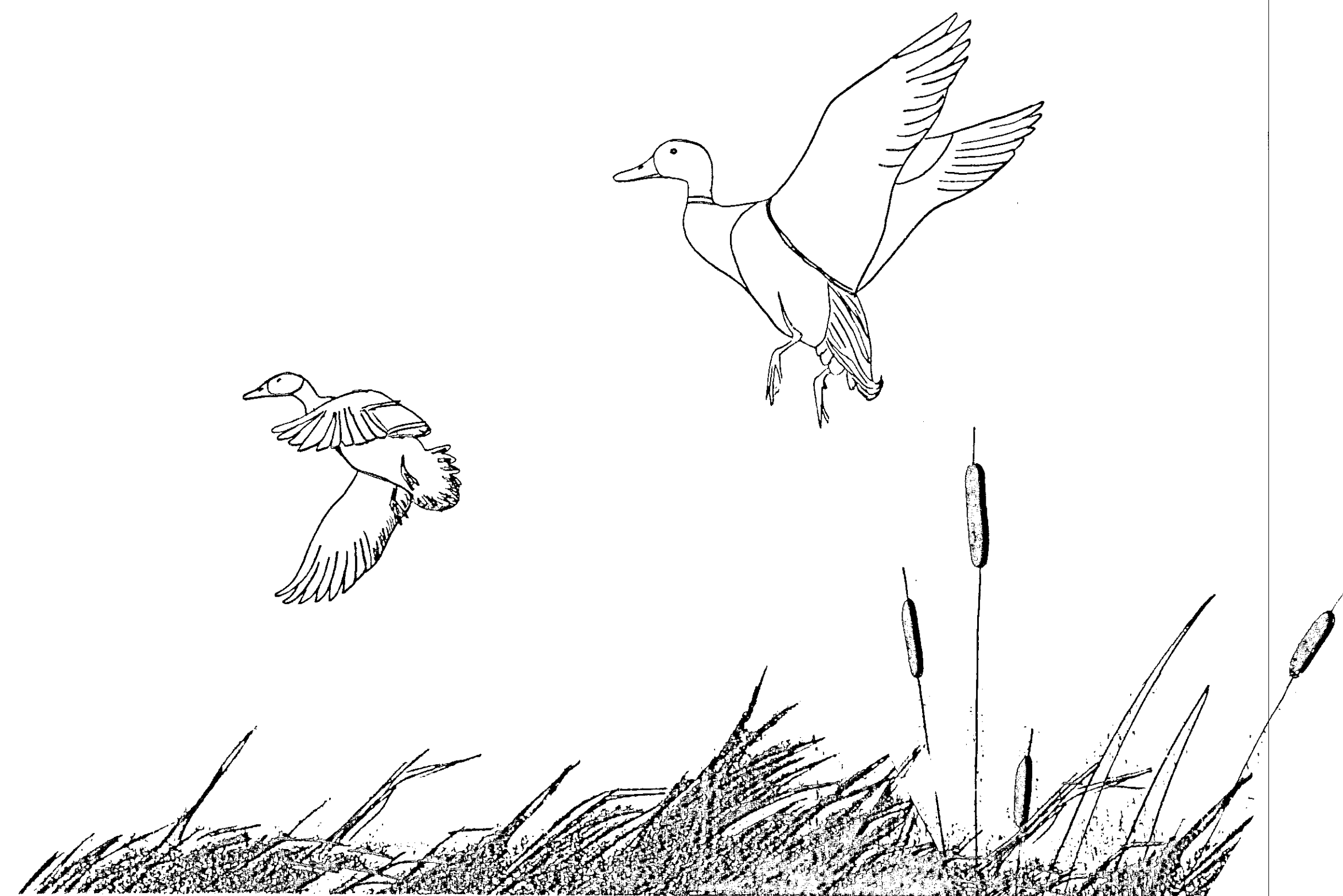

SEP 27 1991
JOHN HATCH, Chief Engineer
Water Rights Division
Department of Environment and
Natural Resources

PROJECT

MEDENWALD W.P.A.
TOPOGRAPHICAL MAP &
STRUCTURE FOR WATER CONTROL

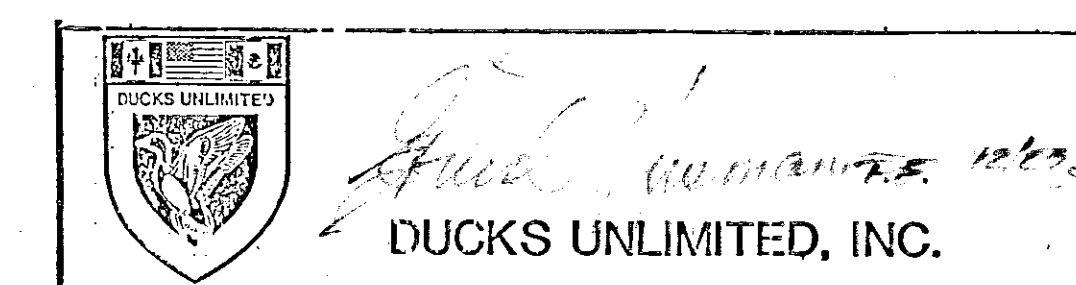
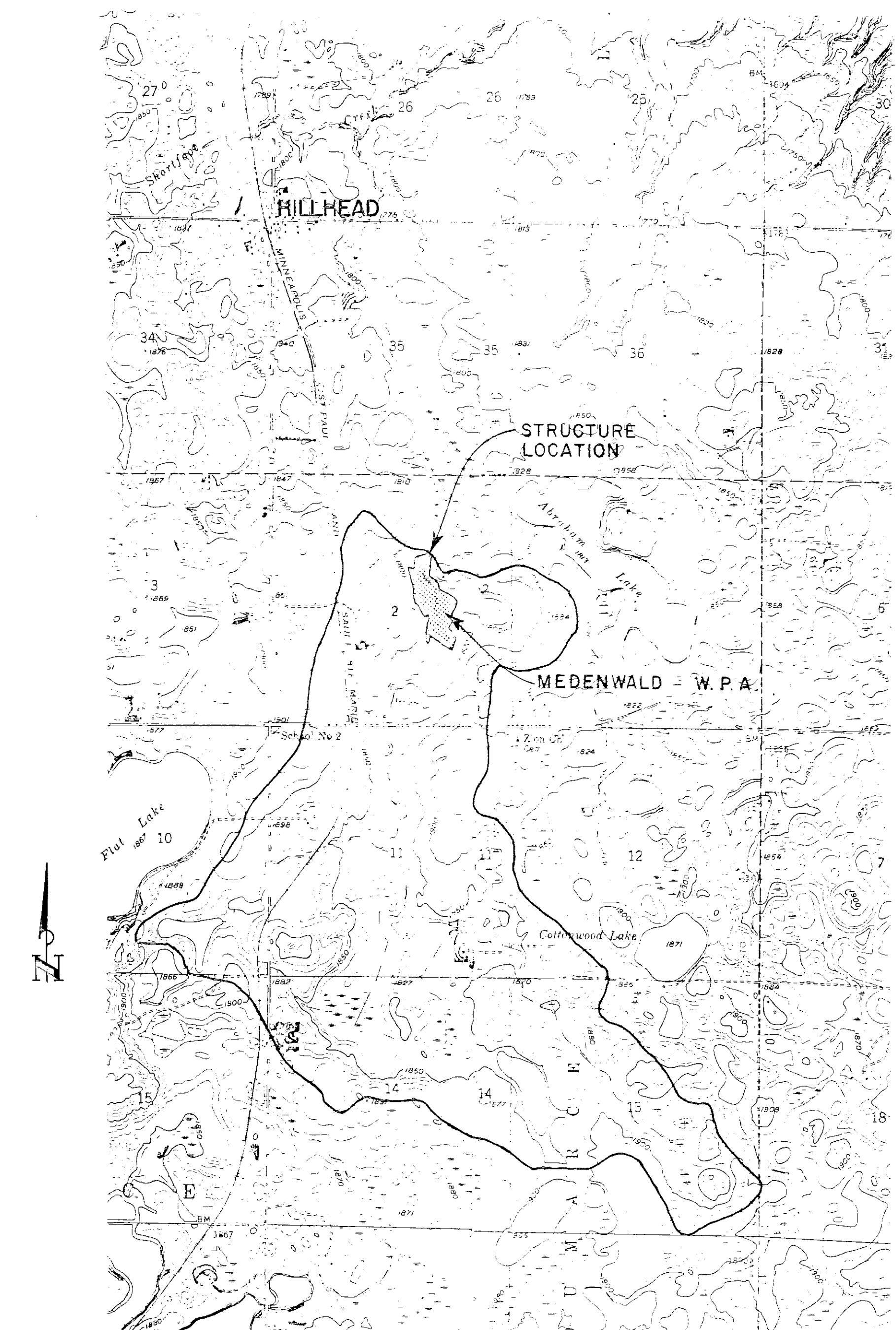
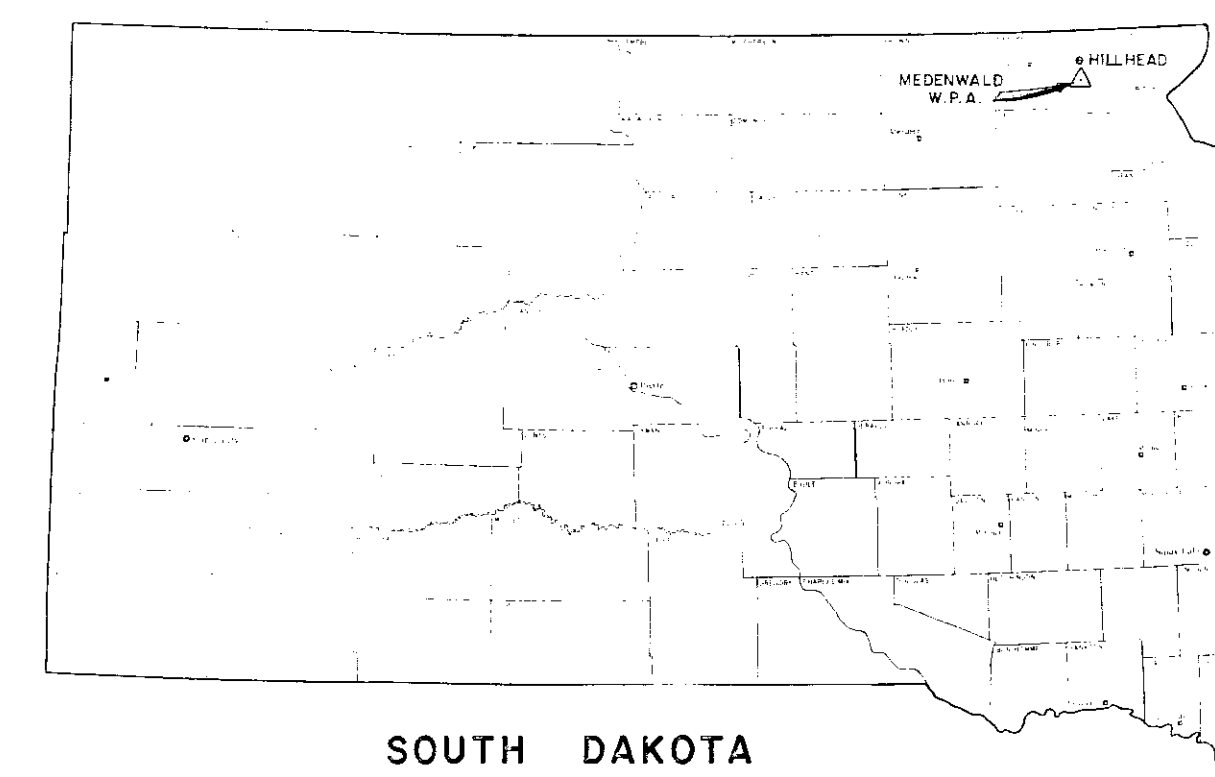
PREPARED FOR

DUCKS UNLIMITED, INC.



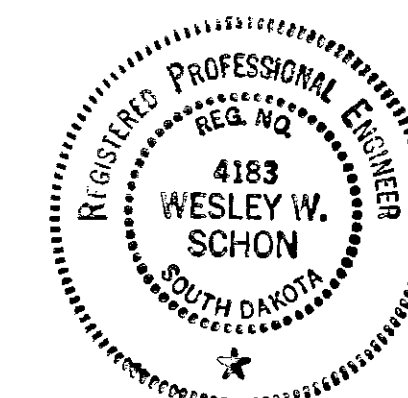
PREPARED BY

ULTEIG ENGINEERS, INC.
FARGO - MINNEAPOLIS - BISMARCK



I HEREBY CERTIFY THAT THE ATTACHED 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.

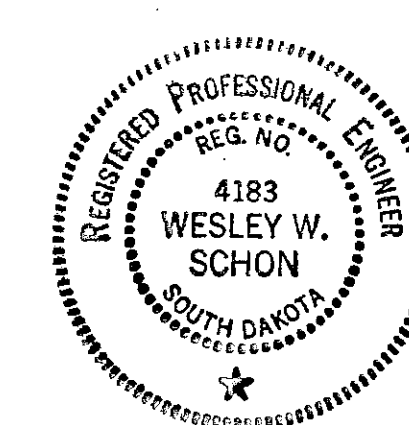
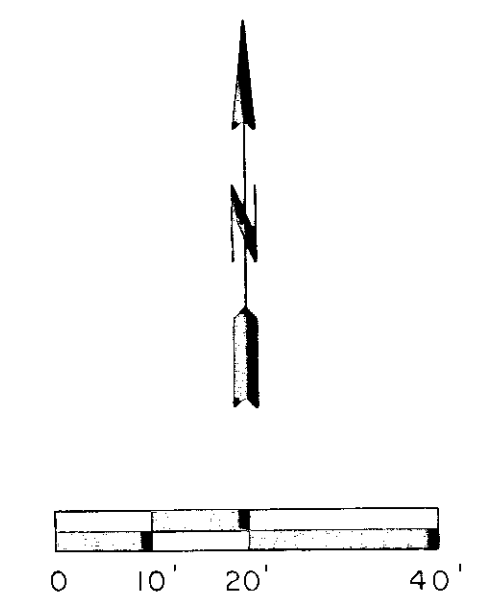
Wesley W. Schon
DATE 11-25-86 REG. NO. 4183



Appl. No. 5135-3

QUANTITIES

EXCAVATION	4,500 CY
TOPSOIL	550 CY
48" PIPE	80 LF
72" RISER	6 LF
24" PIPE	10 LF
ROCK RIP RAP	± 30 CY



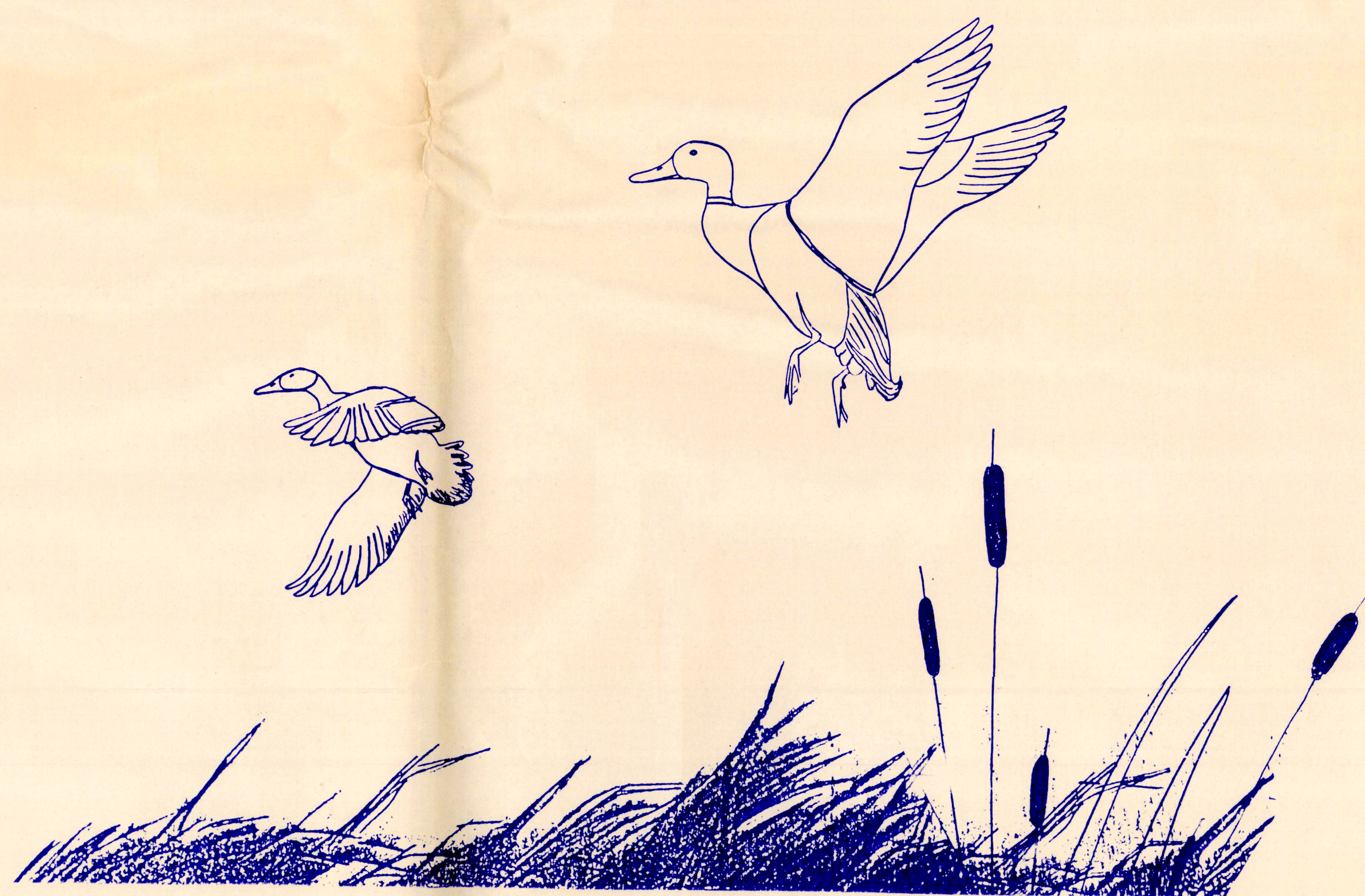
REV	DATE	DESCRIPTION	BY
DUCKS UNLIMITED, INC. MEDENWALD, W.P.A.			
ULTEIG ENGINEERS, INC. CONSULTING ENGINEERS • ARCHITECTS FARGO • BISMARCK • MINNEAPOLIS			
DRAWN BY	SCALE	PROJECT NO.	
CHECKED BY	AS SHOWN	1892.11	
APPROVED BY	DATE	SHEET	2 of 5
	11/25/86		

PROJECT

**MEDENWALD W.P.A.
TOPOGRAPHICAL MAP &
STRUCTURE FOR WATER CONTROL**

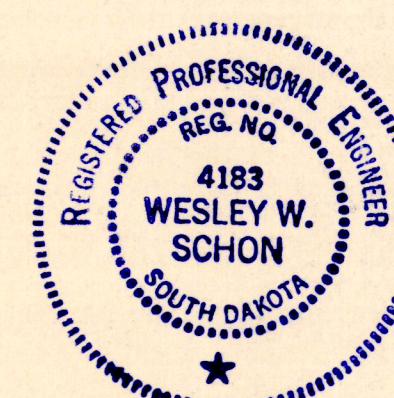
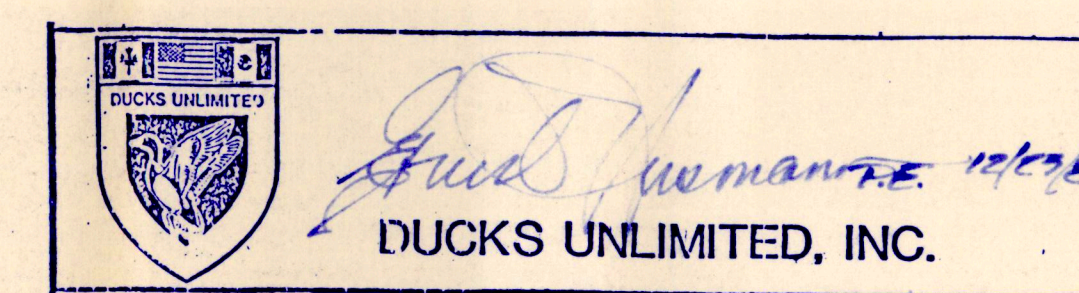
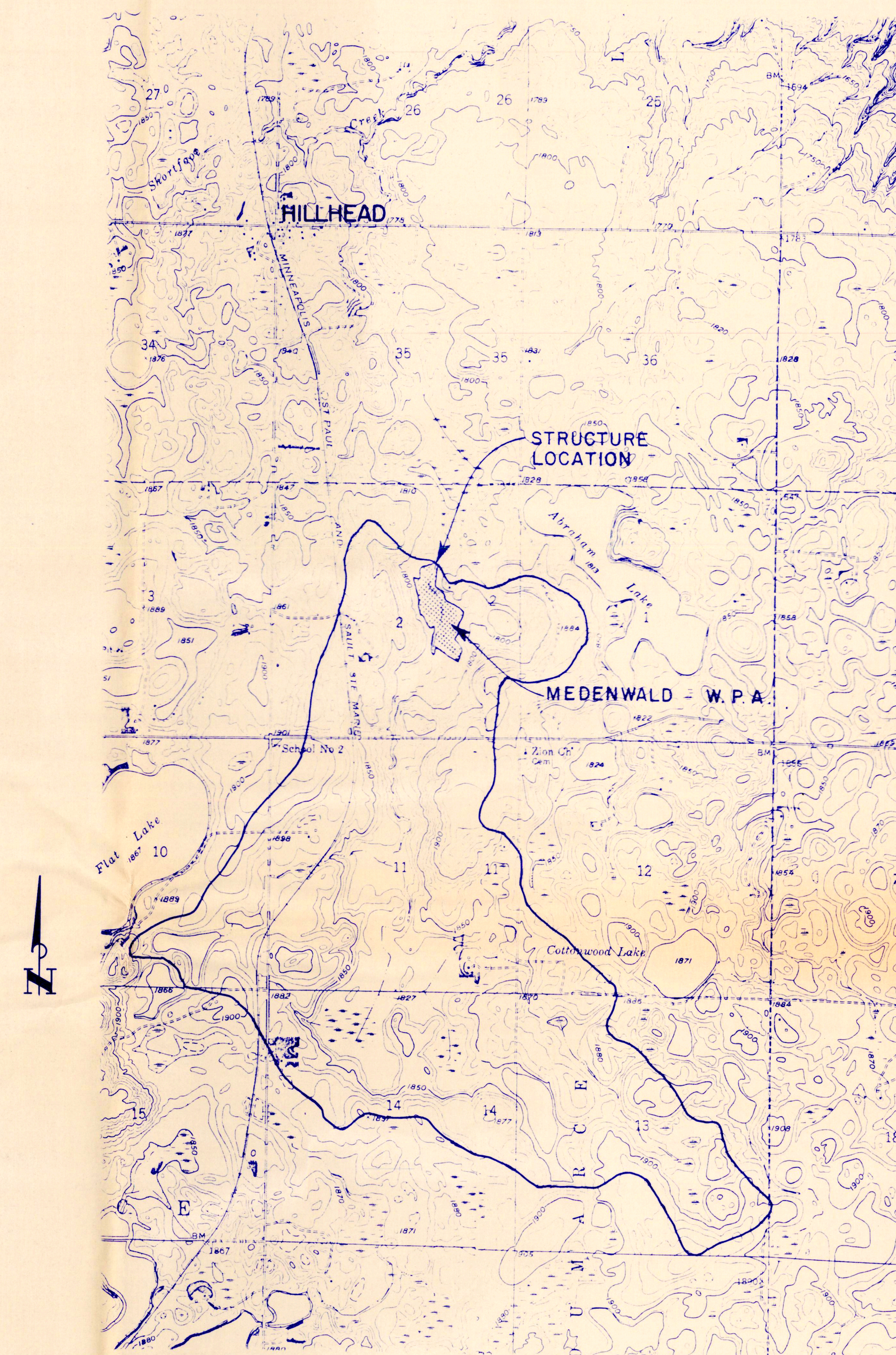
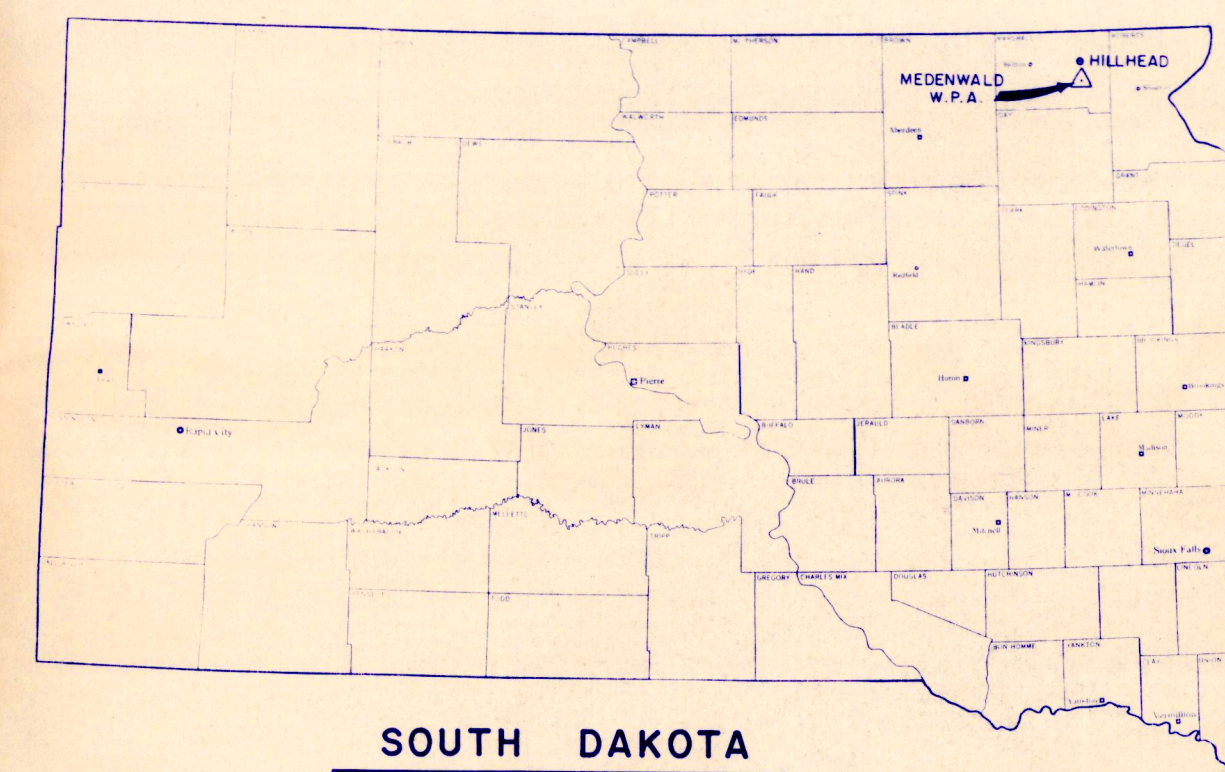
PREPARED FOR

DUCKS UNLIMITED, INC.



PREPARED BY

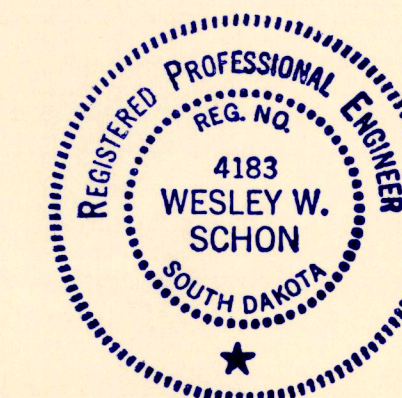
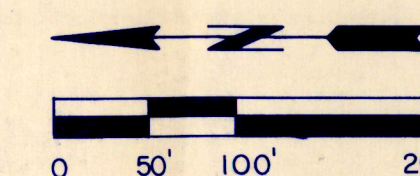
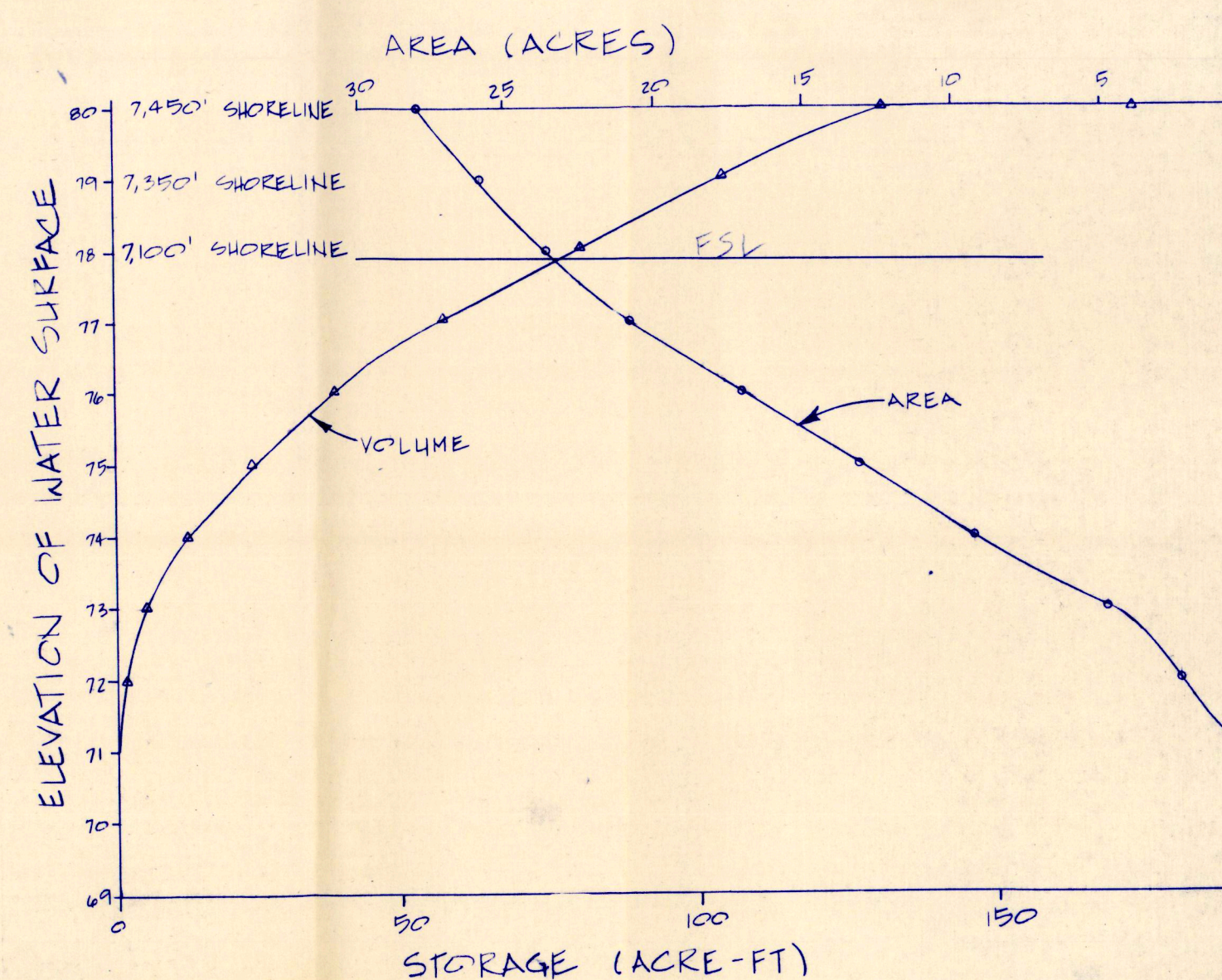
ULTEIG ENGINEERS, INC.
FARGO - MINNEAPOLIS - BISMARCK

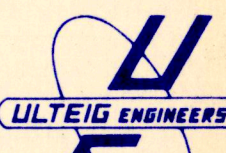


I HEREBY CERTIFY THAT THE ATTACHED PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF SOUTH DAKOTA.

Wesley W. Schon
DATE 11-25-86 REG. NO. 4183

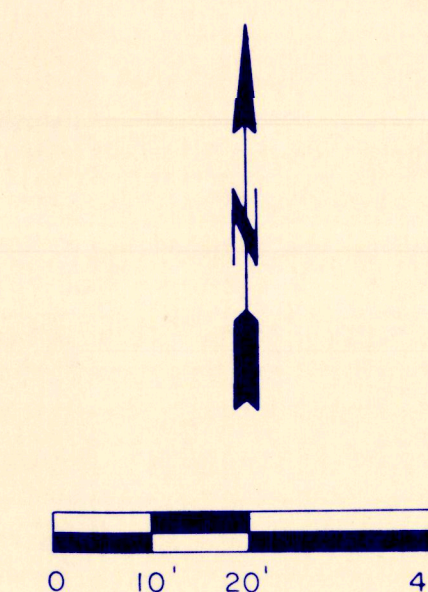
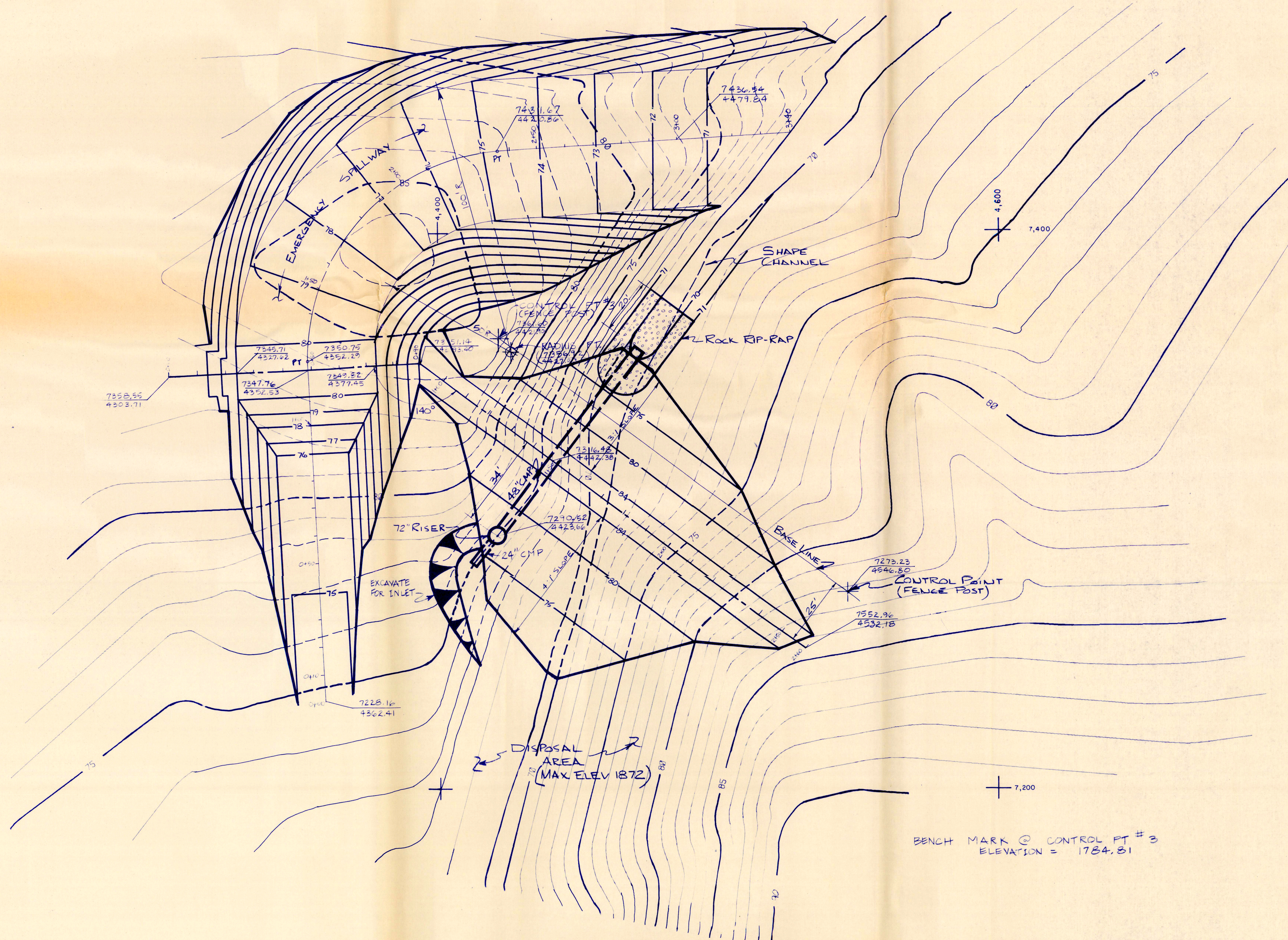
Appl No. 5135-3



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△			
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△			
REV.	DATE	DESCRIPTION	BY
DUCKS UNLIMITED, INC. MEDENWALD, W.P.A.			
TOPOGRAPHICAL MAP			
ULTEIG ENGINEERS, INC. CONSULTING ENGINEERS • ARCHITECT FARGO • BISMARCK • MINNEAPOLIS			
DRAWN BY: G.F. CHECKED BY: <i>WWS</i> APPROVED BY: <i>WWS</i>	SCALE: AS SHOWN DATE: 11/25/86	PROJECT NO. 1892.11 SHEET 1 of 5	

QUANTITIES

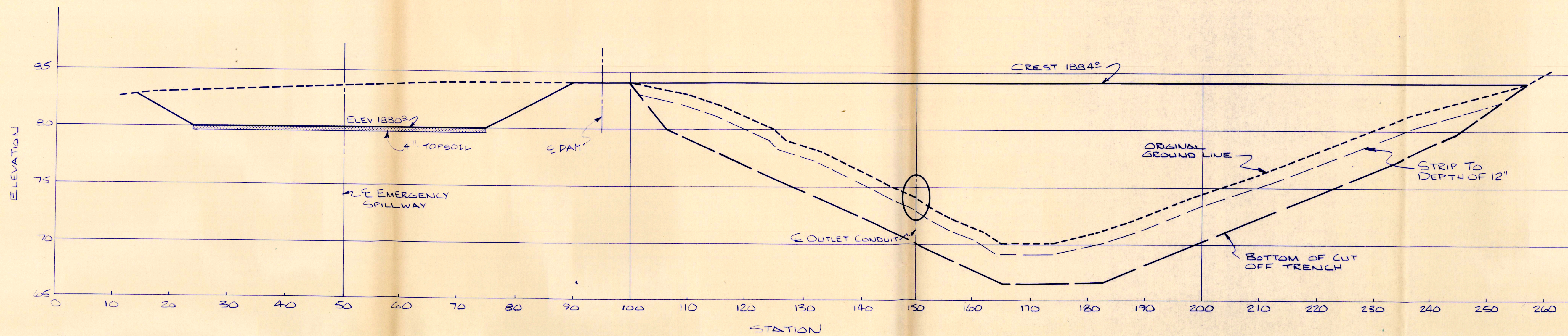
Excavation	4,500 CY
Topsoil	550 CY
48" PIPE	80 LF
72" RISER	6 LF
24" PIPE	10 LF
Rock Rip Rap	± 30 CY



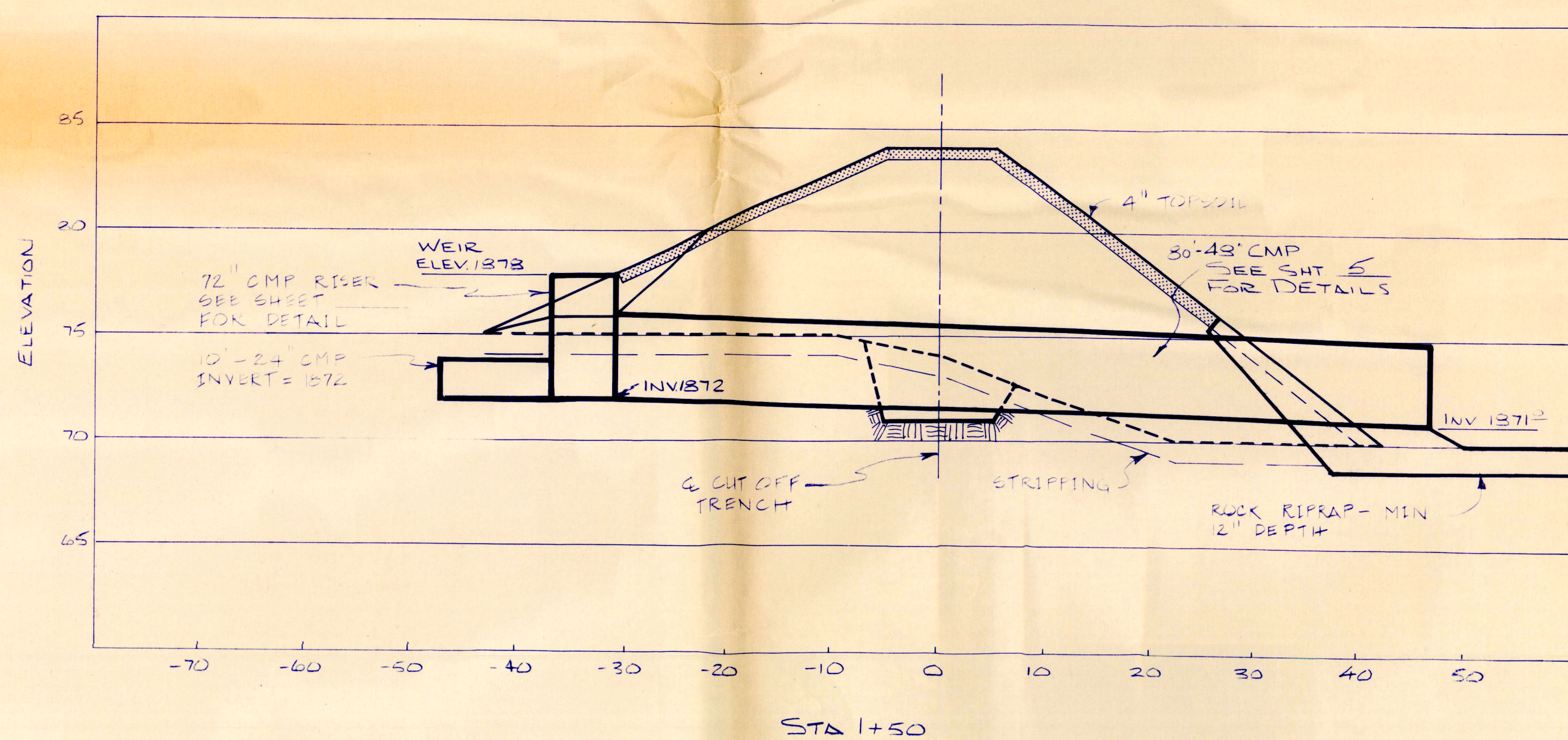
BENCH MARK @ CONTROL PT #3
ELEVATION = 1784.81



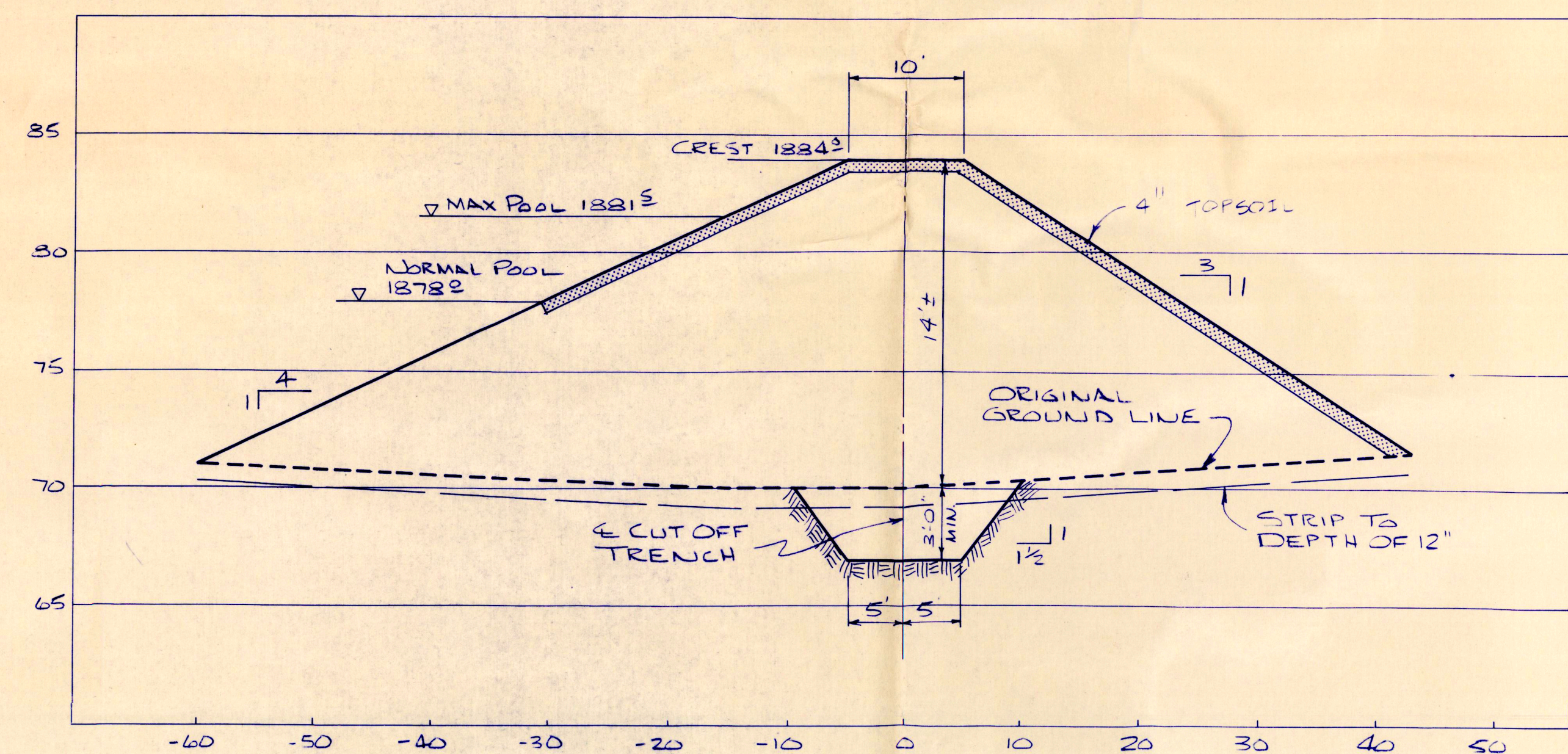
REV	DATE	DESCRIPTION	BY
DUCKS UNLIMITED, INC. MEDENWALD, W.P.A.			
ULTEIG ENGINEERS, INC. CONSULTING ENGINEERS • ARCHITECTS FARGO • BISMARCK • MINNEAPOLIS			
DRAWN BY	SCALE	PROJECT NO.	
CHECKED BY	DATE	1892.11	
APPROVED BY	11/23/96	SHEET	2 of 5



PROFILE ON E CREST OF DAM



STA 1+50

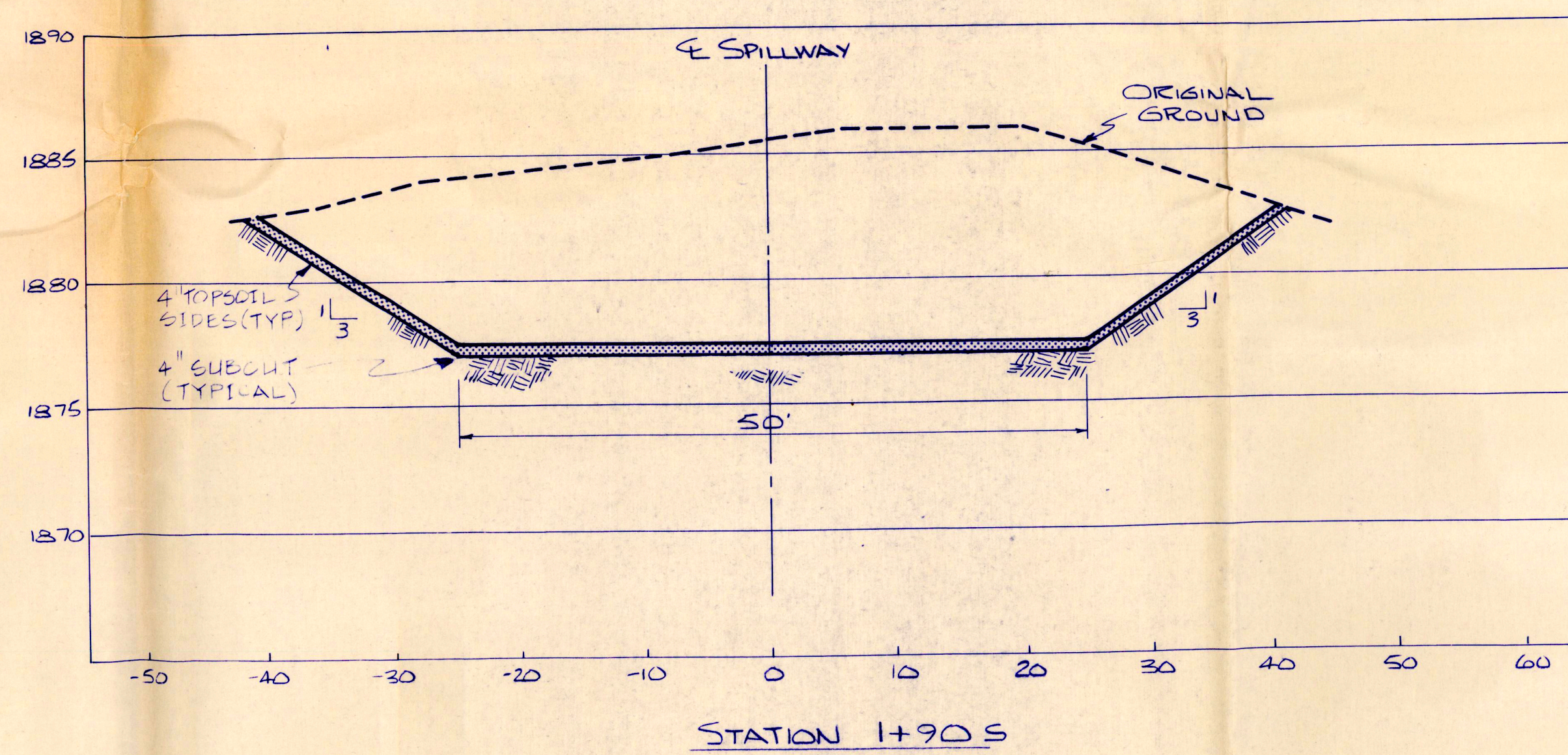
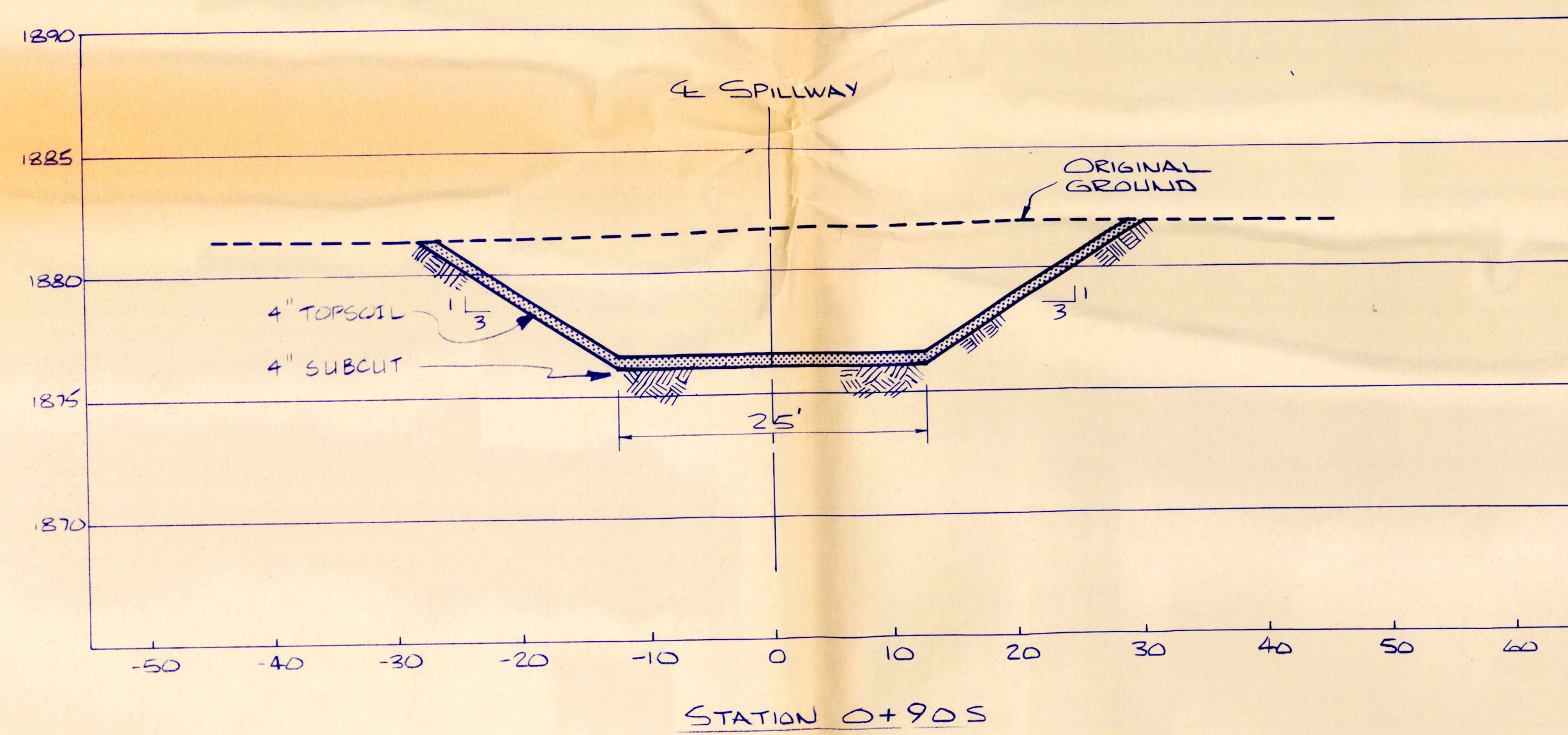
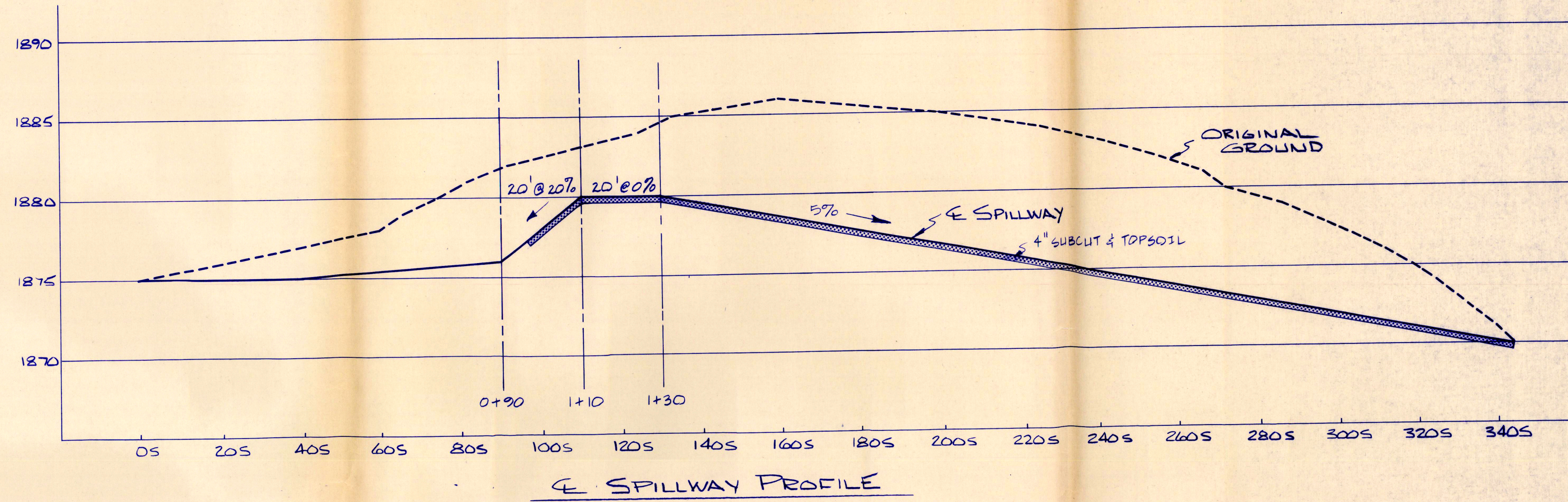


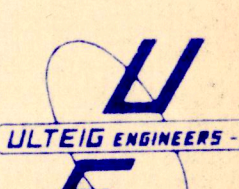
MAXIMUM SECTION
STA 1+75

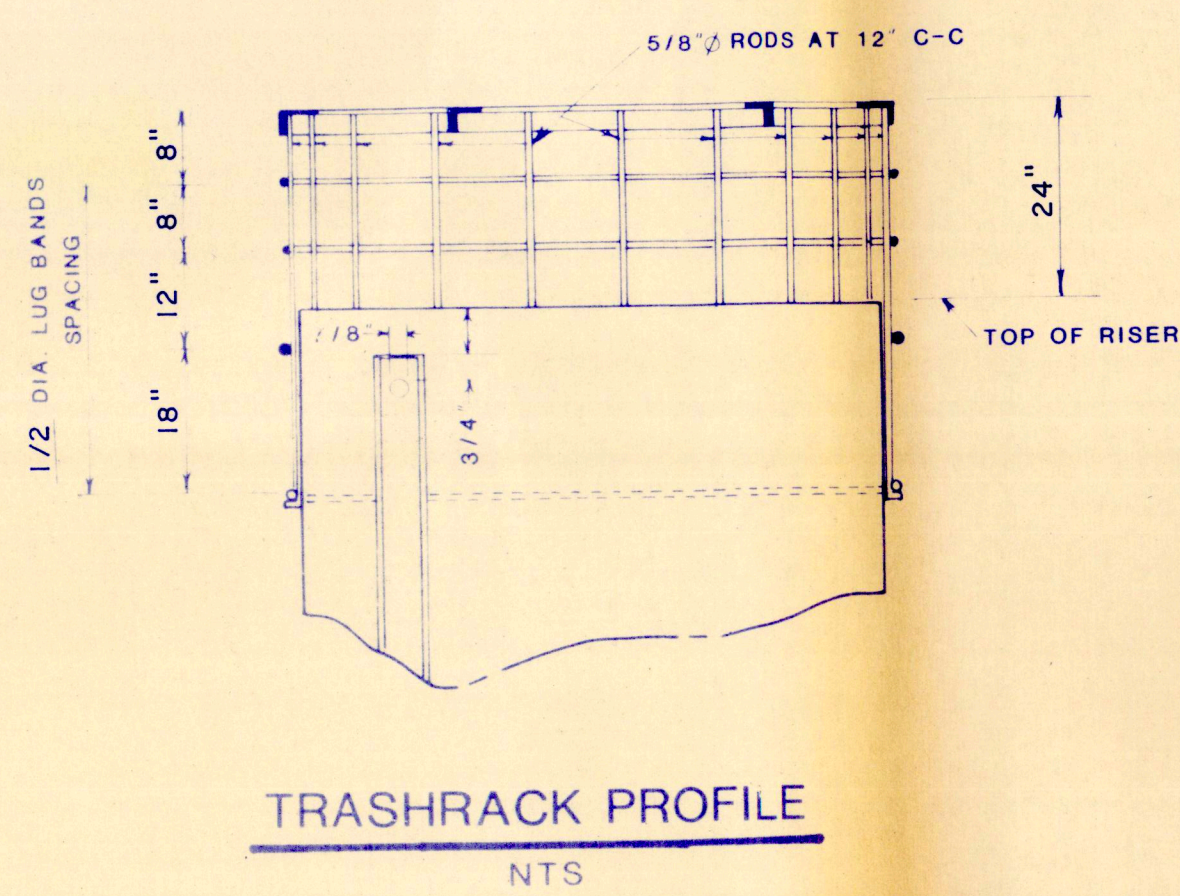
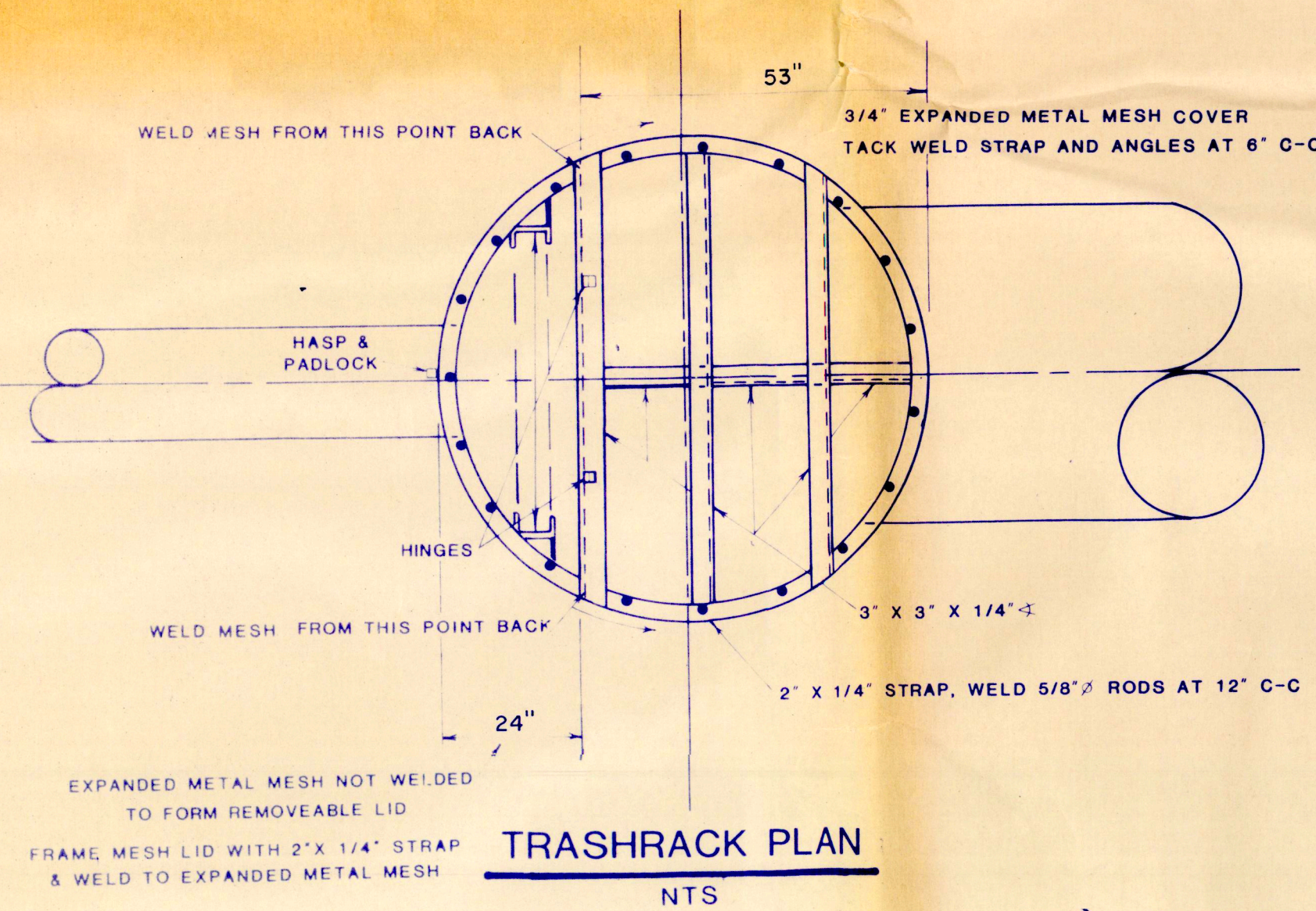
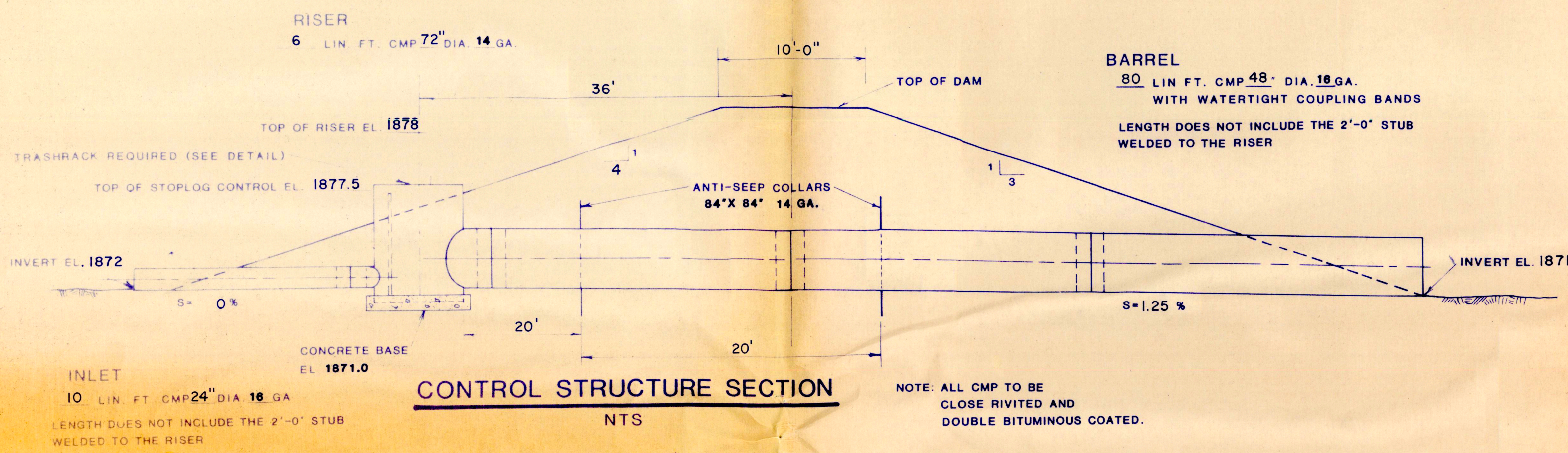
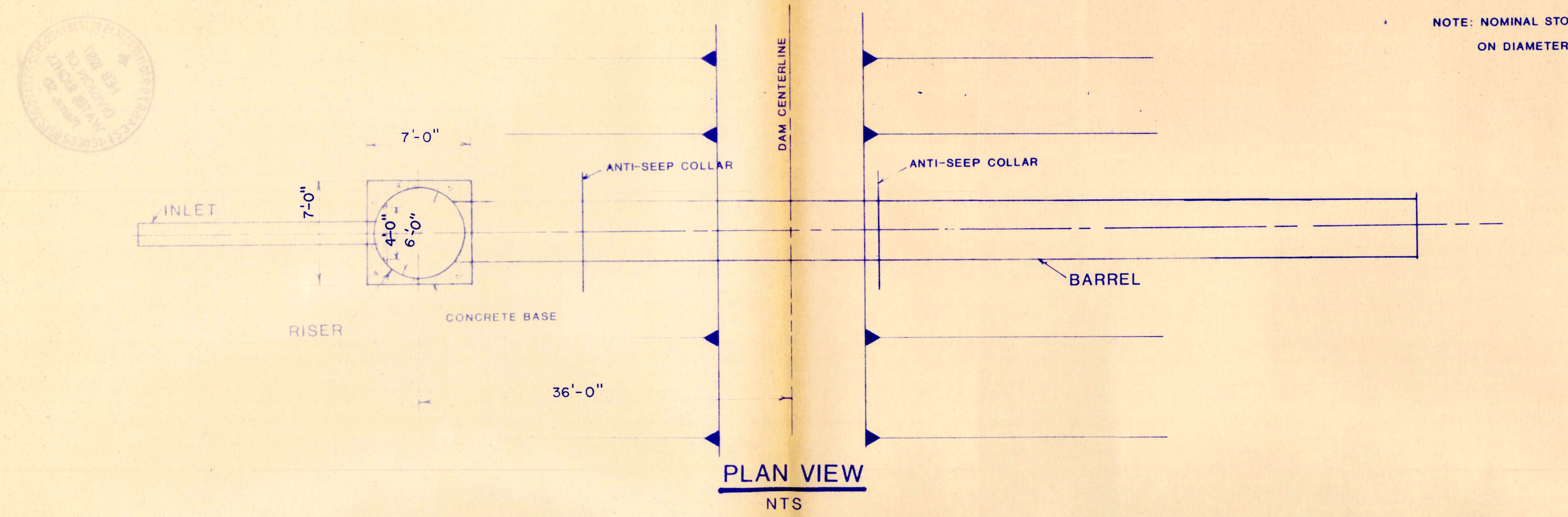


REV	DATE	DESCRIPTION	BY

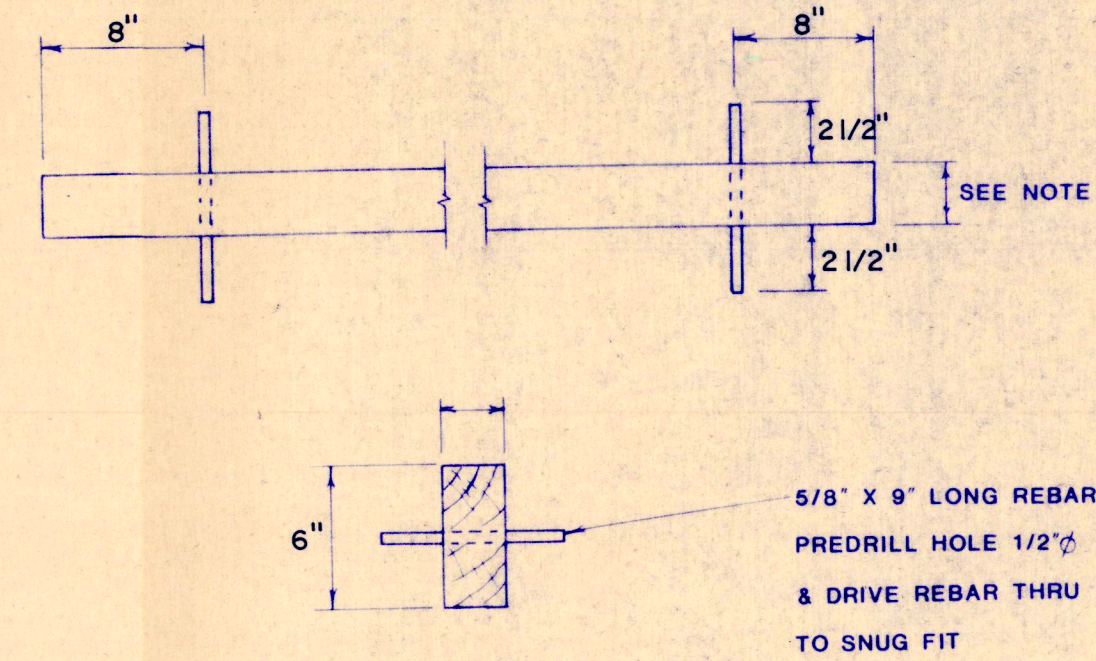
DUCKS UNLIMITED, INC. MEDENWALD, W.P.A.		
DAM SECTIONS		
DRAWN BY: MBB CHECKED BY: H.W.S. APPROVED BY: H.W.S.	SCALE: AS SHOWN DATE: 11/25/86	PROJECT NO: 1892.11 SHEET 3 of 5



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△					
REV	DATE	DESCRIPTION			BY
DUCKS UNLIMITED, INC. MEDENWALD, W.P.A.					
SPILLWAY SECTION					
ULTEG ENGINEERS, INC. CONSULTING ENGINEERS • ARCHITECT FARGO • BISMARCK • MINNEAPOLIS					
DRAWN BY: <i>W.D.S.</i>		SCALE: AS SHOWN		PROJECT NO. 1892.11	
CHECKED BY: <i>W.D.S.</i>		DATE: 11/25/86		SHEET 4 of 5	
APPROVED BY: <i>W.D.S.</i>					



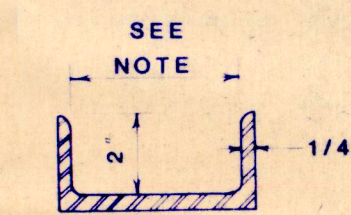
NOTE: NOMINAL STOPLOG THICKNESS BASED ON DIAMETER & HEIGHT OF RISER



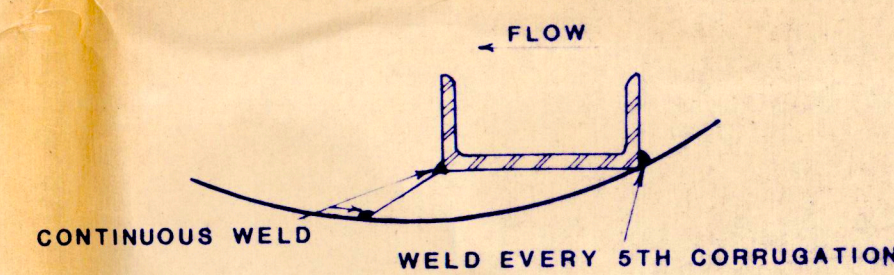
DIA. OF INLET	NOMINAL STOPLOG THICKNESS IN INCHES*							
	HEIGHT OF INLET							
	4	5	6	7	8	9	10	
48	2	2	3	3	3	3	3	
54	2	3	3	3	3	3	4	
60	3	3	3	3	4	4	4	
66	3	3	3	4	4	4	4	
72	3	3	4	4	4	4	5	
78	3	4	4	4	4	5	5	
84	4	4	4	5	5	5	5	

BASED ON FIBER STRESS 1,000 PSI AND SHEAR STRESS = 80 PSI

STOPLOG RECOMMENDATIONS



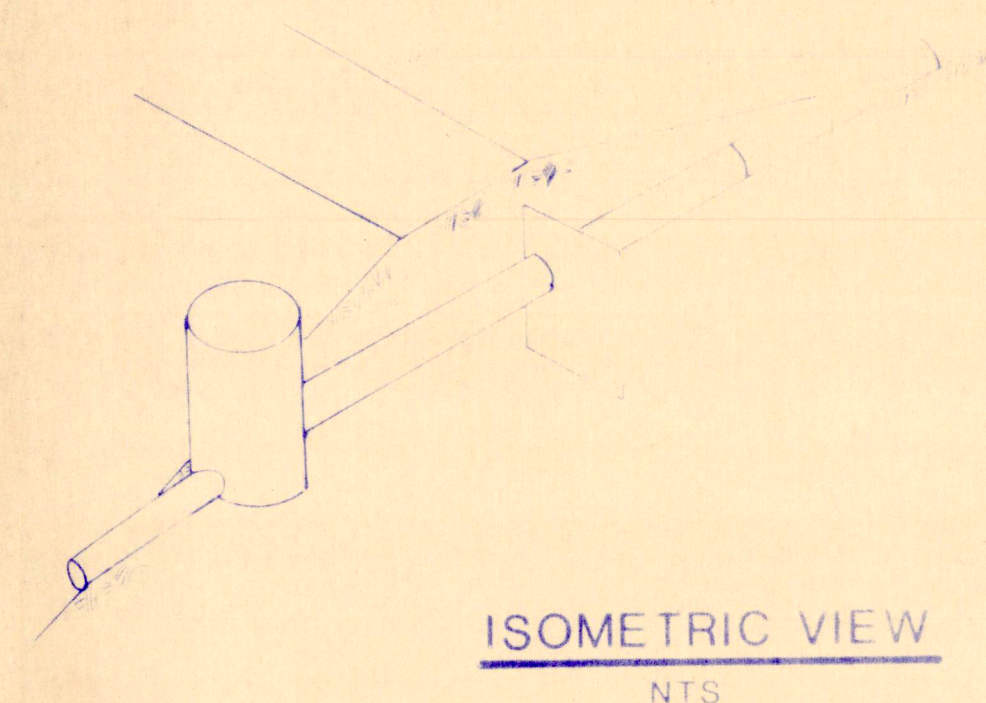
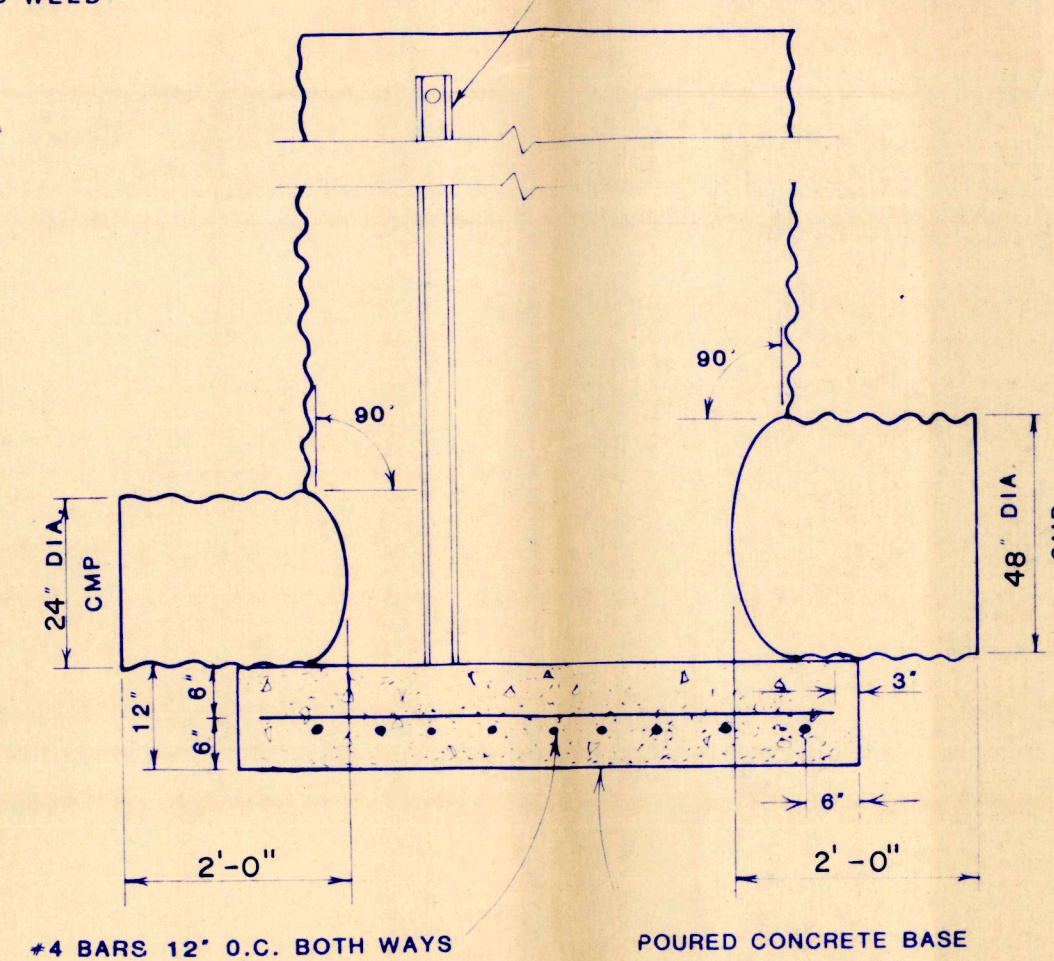
CORRUGATED METAL FILLET BETWEEN RISER & CHANNEL



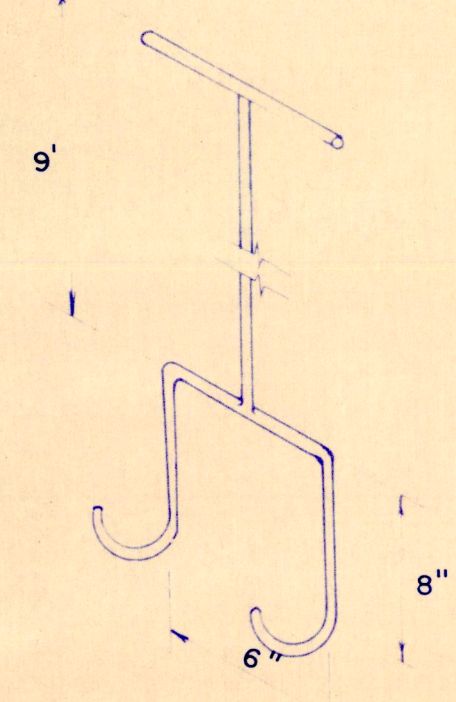
STOPLOG CHANNEL DETAILS
NTS

WELD CONDUIT CMP TO RISER CMP WITH CONTINUOUS WELD

CHANNEL 5' X 2' X 1/4", 5.5' HIGH TWO REQUIRED, WELD TO RISER. SEAL SPACE BETWEEN CHANNEL AND RISER WITH ASPHALT.



DEPTH AS REQUIRED TO PROVIDE REACH TO BOTTOM OF STRUCTURE PLUS 1 FT. ABOVE RISER



STOPLOG LIFTING HOOK
2 REQUIRED

CONDUIT - RISER DIA. RELATIONSHIP		
INLET CONDUIT DIA.	RISER DIA.	OUTLET CONDUIT DIA.
24"	72"	48"

NO.	DESCRIPTION OF REVISION	DATE	BY
DUCKS UNLIMITED, INC.			
FULL-ROUND STOPLOG CONTROL STRUCTURE W/ TRASHRACK			
DESIGNED	DRAWN	SURVEYED	CHECKED
APPROVED			
APPROVED			
DESCRIPTION	SEC	TWP	RGE
DATE	DRAWING NO.		
11/25/86	DU-STD-11-2		