

WATER PERMIT NO. 8178-3

Name of Applicant: **Irene J Tvinnereim Irrevocable Trust**

Address: **1716 S Roosevelt St, Aberdeen SD 57401** Phone: **605 225-7682**

Amount of Water Claimed: **149.3 AF** Total Acres: **NA**

Source of Water Supply: **runoff**

Water to be used for: **recreation, fish& wildlife, wetland restoration** County: **Day**

Type of Waste Disposal System:

Location: **8 miles northwest of Webster**

PRIORITY Date Received: **7-24-15** Application/License Fee: **\$ 950**

Corrected Application Received: **7-31-15** Period of Annual Use: **Jan 1 – Dec 31**

Remarks:

Diversion Point: **approximate center of the E 1/2**
Sec 29-T123N-R56W

Land to be Irrigated: **NA**

Depth of Well: **NA**

Well Driller:

Remarks:

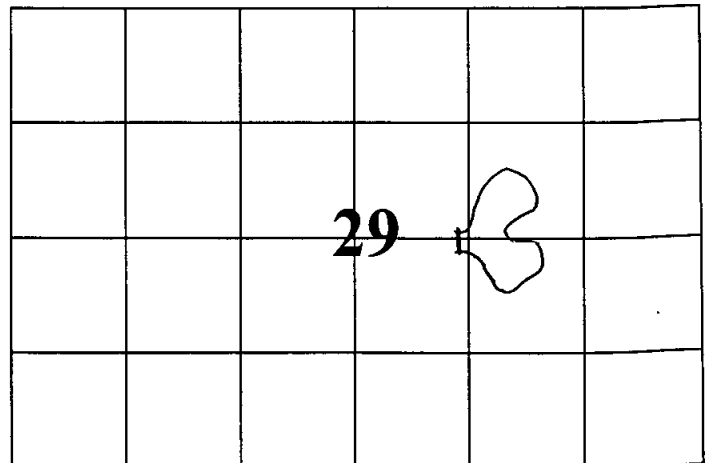
Type of Map: **aerial**

Prepared by:

Reviewed and the Number Assigned on: **8-4-15**

By: **Karen Schlaak**

Notice of Hearing - date to intervene: _____



FORM 2: Application for uses other than irrigation
(type or print)

Mail to: PMB 2020 DENR - Water Rights 523 E Capitol Ave Pierre, SD 57501-3182 ph. (605) 773-3352	No. <u>8178-3</u> (office use only) Hydrologic Unit <u>10160010</u>
	Basin <u>James River</u> <u>605-345</u>
	Newspaper <u>Reporter & Farmer - Webster</u> <u>3356</u>
	<u>Public Opinion - Waterton</u> <u>605-886-</u> <u>6901</u>

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WATER RIGHTS
PROGRAM

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

Check use(s) of water:

- | | | | |
|---|---|--|--|
| ☐ Municipal | ☐ Suburban Housing | ☒ Recreational | ☐ Institutional |
| ☐ Rural Water System | ☐ Commercial | ☒ Fish & Wildlife | ☐ Geothermal Heat |
| ☐ Domestic (over 18 gpm) | ☐ Industrial | ☒ Other <u>Wetland Restoration</u> | |

Type of Application: ☒ New ☐ Vested Right (Use predates Mar 2, 1955) ☐ Future Use Reservation
(check one) ☐ Place to Beneficial Use Water Reserved by Future Use Permit No. _____
☐ Amendment/Correction to Permit No. _____

Description of amendment/correction: (i.e. change diversion point(s), add diversion point(s), change use, etc.)

1. Name to Appear on Water Permit Irene J Tvinnereim Irrevocable Trust
(check one) ☐ Owner ☐ Tenant/lessee ☒ Owner's Legal Agent % Virginia Tobin, Trustee
(name and complete address if different than above name)

Mailing Address 1716 S. Roosevelt St. Aberdeen SD 57401
(Address) (City) (State) (Zip Code)

Home Phone 605 225-7682 Cell _____ Email _____

2. Amount of water claimed _____ *CFS or _____ **GPM 149.3 ***AF
(*Cubic Feet per Second) (**Gallons per Minute) (***)Acre Feet - storage capacity of dam/dugout or annual use if applicable)

3. Source of water supply one dam (wetland restoration) filled by surface runoff

4. Location of point of diversion Dam in E2, 29-123-56 (approximate center E 1/2) County Day
(example - 3 wells in SW1/4 NE1/4 section 12-T104N-R53W)

If not a public water supply (e.g. municipal), will water be used outside of the area described above? ☐ Yes ☒ No

If "Yes," where will water be used? Wetland ponded S 1/2 NE 1/4, N 1/2 SE 1/4 Sec 29-7/23N-R 56W
(example - NW1/4 section 12-T104N-R53W)

5. County or counties where water will be used Day

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

7. Give a description of the 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)

The proposed dam (wetland restoration) is planned to be built in the Fall of 2015. The height of the dam is 8.1' in the ditch. The depth of water is 3.4' in the ditch and 7' in the wetland. The dam has a 14' top and 3:1 sideslopes. The principal spillway is a riser hood combination. A 30" diameter concrete riser 2' long feeds water into a 12" PVC hooded barrel that is approximately 50' long. The auxiliary spillway is 22' wide with 3:1 sideslopes. In addition, this dam falls under the South Dakota Safety of Dams Rules.

I, Virginia Tobin, Trustee, the applicant, certify that I have read this application, have examined the attached map, and that the matters stated are true.

SOUTH DAKOTA
WATER PERMIT NO. 8178-3

Date of first receipt of application July 24, 2015.

Date of return to applicant for corrections, amendments or changes July 27, 2015.

Date of receipt of corrected application July 31, 2015.

The Chief Engineer, on behalf of the Water Management Board, issues Water Permit No. 8178-3 to Irene J Tvinnereim Irrevocable Trust, c/o Virginia Tobin, Trustee, 1716 S Roosevelt St, Aberdeen SD 57401 authorizing the construction of the dam and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 8178-3 authorizes impoundment of 149.3 acre-feet of water from runoff by constructing a dam for a wetland restoration project located in the approximate center of the E 1/2 Section 29 with water impounded in the S 1/2 NE 1/4 and the N 1/2 SE 1/4 Section 29; all in T123N-R56W. This permit authorizes impoundment of sufficient water to maintain water to the outlet elevation of 1740.0 feet mean sea level (msl).
2. The water appropriated shall be used for the purpose of recreation, fish and wildlife propagation, livestock water and wetland restoration and may not exceed the amount of water needed for beneficial use.
3. The water is to be used during the following described annual period: January 1 – December 31.
4. The date of approval of Permit No. 8178-3 is October 1, 2015.
5. The date from which applicant may claim right is July 24, 2015.
6. One-fifth of the construction is to be completed on or before April 1, 2018.
7. All construction is to be completed on or before October 1, 2020.
8. Water is to be put to beneficial use on or before October 1, 2024.
9. Water rights obtained in compliance with the laws of the State of South Dakota may not be unlawfully impaired by this appropriation.

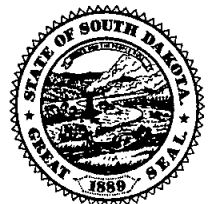
QUALIFICATIONS

1. Water Permit No. 8178-3 authorizes an impoundment with a storage capacity of 149.3 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation.
2. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.

WATER MANAGEMENT BOARD

By: 
Jeanne Goodman, Chief Engineer
Water Rights Program
Department of Environment and Natural Resources

OCT 29 2015
date



Supplemental Information

(type or print)

1. Well Information

(check one or both as applicable) ☐ Drilling new well(s) ☐ Using existing well(s)

a) If new wells, how many ____ Have test holes been drilled ☐ Yes ☐ No Drilled by ____
(if yes, please provide copies of logs)

b) If existing wells, how many ____ Provide copy of log(s), if available. Drilled by ____

c) Well Depth ____ Depth to Top of Water Bearing Material ____ Depth to Water from Surface ____

d) Distance to nearest existing domestic well:

On applicant's property ____ On property owned by others ____

2. Wastewater Disposal System Information

a) Type of System (i.e. septic tank, drain field) ____

b) System Capacity (gallons) ____ Year Constructed ____

c) Connected to the City of ____ Sanitary System

3. Dugout Information

a) Surface Dimensions ____ Depth ____

b) Depth to water (ground surface to water level) ____

4. Water Storage Dams

If the proposed water use system contains one or more storage dams, please furnish the information requested below for each dam. The locations of the dams need to 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:

Laura Stern, PE
Agricultural Engineer
USDA/NRCS
520 Third Avenue
Brookings, SD 57006

b) Freeboard 3.5'

c) Crest Width 14'

Crest Length 211'

d) Height 8.1'

e) Primary Outlet Capacity 8.6 cfs (top dam)

If pipe, diameter 12"

f) Secondary Spillway Capacity 55.4 cfs (top)

Spillway Width 22'

g) X & Y Slope (e.g. 3 to 1 is a typical slope)

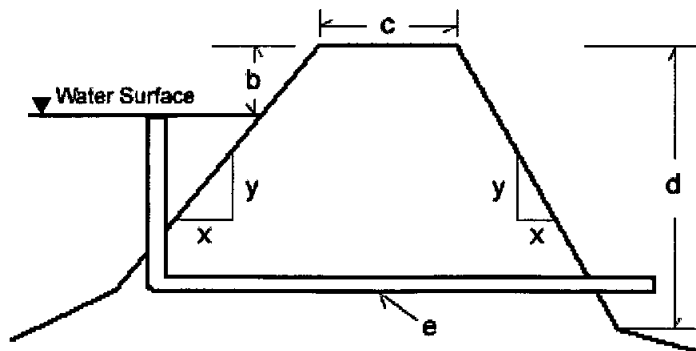
Upstream 3:1

Downstream 3:1

h) Surface Area of Impoundment 35.3 acres

i) Storage 149.3 Acre Feet

j) Drainage Area Above Dam 380.0 Acres

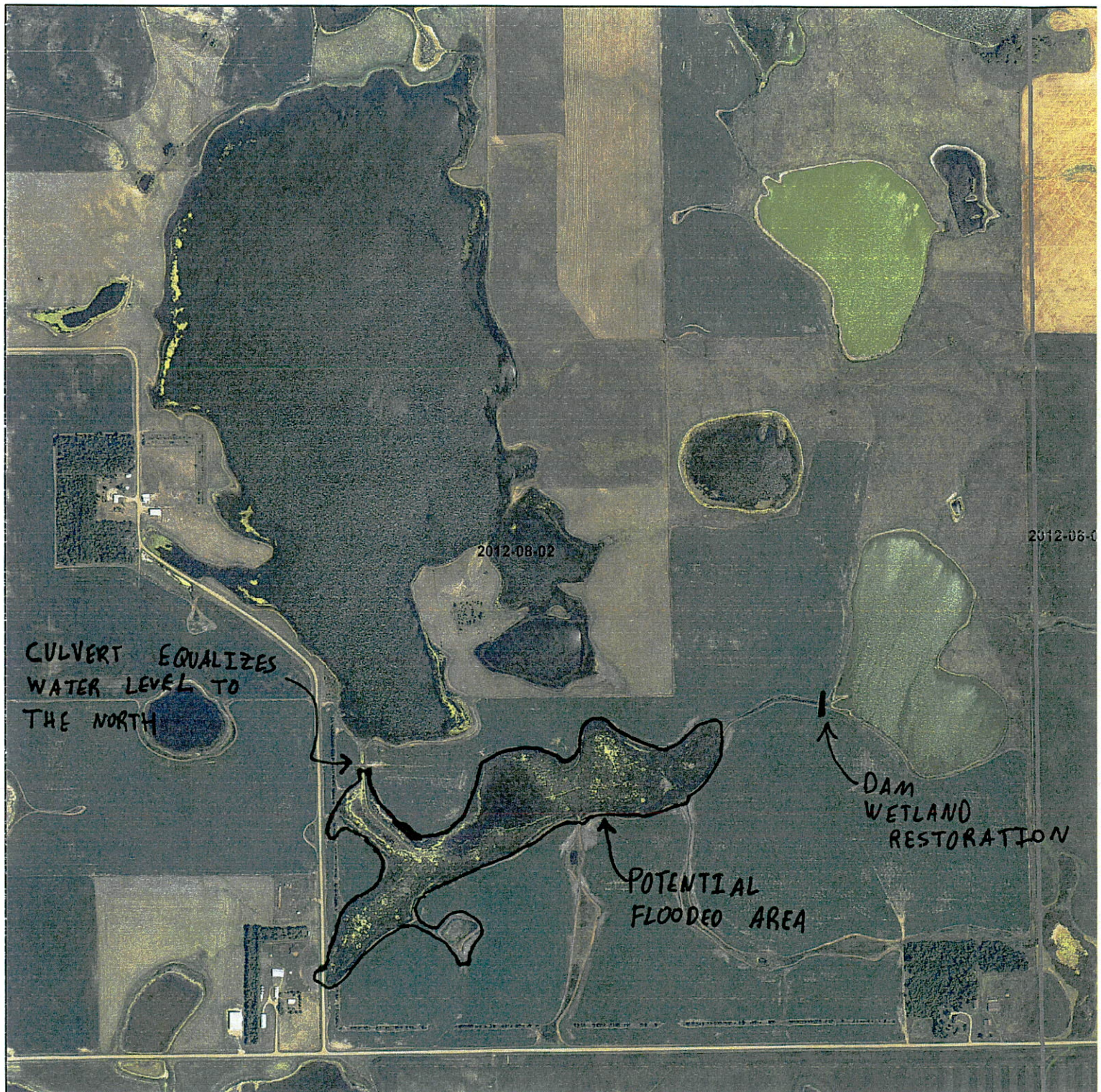


Potential Flooded Area if the Dam Breached

Field Office: Webster FO

Agency: USDA-NRCS

Legal Desc: E1/2 Sec 29, T123N, R56W



0 320 640 1,280 1,920 2,560 3,200 3,840
Feet



Tvinnereim Trust Wetland Restoration
Day County, South Dakota
E2, Section 29, Township 123 North, Range 56 East



0 285 570 1,140 1,710 2,280 2,850 3,420
Feet



Map Prepared By:
Laura Stern
Agricultural Engineer
USDA-NRCS
May 8, 2015

Laura Stern

RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date 7/31, 20 15

RECEIVED OF Irene Tvinnereim Irrevocable Trust 1716 S Roosevelt St Aberdeen SD 57401

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

Fee for Application for Permit No. _____ to Appropriate Water, to construct and to put water to beneficial use	200	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 _____		
Fee for Issuing New Well Driller's License No. _____ for C.Y. _____		
Fee for Renewal of Well Driller's License No. _____ for C.Y. _____		
Fee for Issuing Well Pump Installer's License No. _____ for C.Y. _____	200	00
Fee for Renewal of Well Pump Installer's License No. _____ for C.Y. _____		
(Any Other Work Provided by Law)	TOTAL	200 00

No. **07462**

By *Jeanne Goodman*
Chief Engineer

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WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date 7/27, 20 15

RECEIVED OF Irene Twinnerein Irrevocable Trust 1716 S Roosevelt St Aberdeen 57401

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

Fee for Application for Permit No. _____ to Appropriate Water, to construct and to put water to beneficial use	750	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 _____		
Fee for Issuing New Well Driller's License No. _____ for C.Y. _____		
Fee for Renewal of Well Driller's License No. _____ for C.Y. _____		
Fee for Issuing Well Pump Installer's License No. _____ for C.Y. _____		
Fee for Renewal of Well Pump Installer's License No. _____ for C.Y. _____		
(Any Other Work Provided by Law)	TOTAL	750 00

No. 07459

By Jeanne Goodman
Chief Engineer



United States Department of Agriculture

May 8, 2015

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PMB 2020 Department of Environment and Natural Resources
Water Rights Program
523 E Capitol Avenue
Pierre, SD 57501-3182

Dear Mr. Tim Schaal:

Please find enclosed plans, design documentation, construction and material specifications, and a hazard classification for the Tvinnereim Trust Dam located in the E2, 29-123-56 in Day County. This is a wetland restoration project. The wetland had been partially restored with a culvert through a crossing on a ditch and a small earthen ditchplug between the culvert crossing and wetland. The riser elevation of this dam is 3.4' above the existing culvert and 1' above the small earthen ditchplug.

The dam needs a Safety of Dams Review as it has a height of 8.1 feet and storage of 280.2 acre-feet at the top of the dam. This dam also needs to go through the Water Rights Permit Process as it stores 149.3 acre-feet of water at the principal spillway. The Water Rights Permit Application will be submitted by the Tvinnereim Trust.

I will be on maternity leave until August 3. If you have any questions regarding the Tvinnereim Trust Dam information, please contact Michelle Burke or Joy Cordier Jensen at 605-692-2344.

Sincerely,

Laura Stern, PE
Agricultural Engineer

Attachment: Tvinnereim Trust WRP Dam Plans, Design Documentation, Construction Specifications, and Hazard Classification

cc: Lindsey Goldade, District Conservationist, NRCS, 600 East HWY 12, Suite 1, Webster, SD 57274-1135

United States Department of Agriculture



Natural Resources Conservation Service
Field Support Office
520 Third Avenue
Brookings, SD 57006

Telephone: (605) 692-2344
Fax: (605) 697-5374

May 8, 2015

Leon and Virginia Tobin
Tvinnereim Trust
1716 S. Roosevelt St.
Aberdeen, SD 57401

Rod Tobin
Tvinnereim Trust
415 South Main Street
Aberdeen, SD 57402

Dear Tvinnereim Trust:

The USDA Natural Resources Conservation Service (NRCS) has designed a wetland restoration for you in the E ½ of Section 29, Township 123 North, and Range 56 West, in Day County. Due to the overall height from the top of the dam to the downstream toe (8.1') and the storage capacity below the top of the dam that would flow downstream (200 acre-feet), the wetland restoration falls within the size category in which potential downstream damage should be considered in the unlikely event the dam should fail. Under the Dam Safety Act, we are required to analyze damage potential on all such dams. This does not reflect on the adequacy of the design or construction.

A general evaluation was made of the area below the dam that could be flooded should a sudden failure occur. The evaluation indicated that the flooded area would only affect land enrolled in the Wetland Reserve Program, a township road, fences, and a cattle feedlot. Therefore, it was assigned a class (A) or low hazard rating. The design of the dam was based on this classification.

If future development should occur downstream of the dam or should another dam be built upstream, the hazard classification could change abruptly. You need to be aware of this in order to alert future developers of the hazard that could occur. This is your responsibility.

If you would like a more detailed analysis or in the event of future development in the area downstream of the dam, NRCS is ready to assist you in evaluating the potential impact area on the downstream development should there be a sudden failure of the dam.

I am sending a copy of this letter and attached map to the South Dakota Department of Environment and Natural Resources (DENR), which is the state agency responsible for dam safety. Due to the storage of this wetland restoration, the DENR will be performing a Safety of Dams Review of the dam design.

If you have any questions on this matter, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Laura Stern", with a stylized flourish at the end.

Laura Stern, PE
Agricultural Engineer

United States Department of Agriculture



Natural Resources Conservation Service
Field Support Office
520 Third Avenue
Brookings, SD 57006

Telephone: (605) 692-2344
Fax: (605) 697-5374

Attachments: Potential Flooded Area Map

cc: Water Rights Program, Department of Environment and Natural Resources, Joe Foss Building, 523 E Capitol, Pierre, SD 57501

Design Report 378 Pond Tvinnereim Trust-Day County
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Summary

This wetland restoration is located in the E ½ of Section 29, T123N, and R56W. The location of the wetland restoration is at the current crossing, which has a culvert in it. The existing culvert will be removed and replaced with a riser drop structure. The riser elevation is 3.4' above the existing culvert and 1' above an earthen plug upstream of the existing culvert. The principal spillway of this site is a 12" diameter SDR-26 PVC pipe, with a 30" dia. concrete drop structure.

Job Description

This site is a Hazard Class "A" and Job Class IV structure with a drainage area of 380 acres. In the event of a breach, the water would run into downstream wetlands, one of which is also enrolled in the Wetland Reserve Program. If the culvert between downstream wetlands does not equalize the water fast enough, a township road would be covered with less than a foot of water. A feedlot would also be impacted.

Basis for Design

Overall design of this structure was governed by the 378 Pond Standard. The design is routing the 2-yr 24-hr storm through the principal spillway and a 50-yr 24-hr storm through the auxiliary spillway. SITES program was used to flood route the design.

General Basic Data

Hydraulic Data Summary		
Drainage Area	380 Acres	
Time of Concentration	1.7 hours	
Runoff Curve Number	73	
Principal Spillway, 2 YR 24-hr. Rainfall	2.4 inches	
Auxiliary Spillway, 50 YR 24-hr. Rainfall	4.9 inches	
Principal Spillway Discharge	7.3 CFS	
Auxiliary Spillway Discharge	1.1 CFS	
Estimated 25 year sediment storage	6.1 ACFT	
Crest of Normal Pool	35.3 Acres	149.3 ACFT storage
Crest of Auxiliary Spillway	37.0 Acres	203.5 ACFT storage
Top of Dam	39.8 Acres	280.2 ACFT storage

Soils

The soils were investigated by drilling 5 test holes along the centerline of the dam and auxiliary spillway. The two holes near the ditch had a water table at 2.5' below the surface. The soils in the area were primarily CL and CH material.

Environmental Considerations

The disturbed area is 0.5 acres. Since this is less than 1 acre, a storm water discharge permit application has not been completed. However, all disturbed areas are to be seeded and/or mulched (depending on the date of seeding). The seeding is to be completed immediately following construction. The use of silt fences will be used as necessary.

Construction Schedule

Construction of this dam is proposed to begin in the fall of 2015 after the project receives approval from the South Dakota Department of Environment and Natural Resources for the water right permit application.

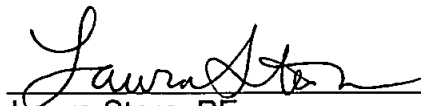
Authority

This project was designed by Laura Stern, PE, Agricultural Engineer for the United States Department of Agriculture- Natural Resources Conservation Service. This dam is classified as a Class IV structure due to the product of the storage times height. Plans were reviewed by Joy Cordier Jensen, PE, Civil Engineer, and Job Approval Authority was exercised by Laura Stern.

Landowner Information

Leon and Virginia Tobin
1716 S Roosevelt St.
Aberdeen, SD 57401
605-225-7682

Rod Tobin
415 South Main Street
Aberdeen, SD 57402



Laura Stern, PE
Agricultural Engineer
USDA-NRCS
520 Third Avenue
Brookings, SD 57006
605-692-2344, ext. 118
laura.stern@sd.usda.gov

5-8-2015
Date

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TVINNEREIM TRUST DAM
E2, 29-123-56
DAY COUNTY

HAZARD CLASSIFICATION

DOCUMENTATION FOR HAZARD CLASSIFICATION

Producer: **Tvinnereim Trust** Name of Site: **East--Heart Shaped**
 County: **Day**
 Field #: Watershed:
 Location
 1/4 Section: Section: **29** Township: **123** Range: **56**
 Latitude: Longitude:

Dam in Series: **No**
 Explain:

Dam and Reservoir Data

Assumed Job Class	IV
Assumed Hazard Class	A
Centerline Elevation Channel Bottom*	1736
Centerline Elevation Flood Plain*	1740
Centerline Elevation Top of Dam*	1743.5
Centerline Elevation Auxiliary Spillway Crest*	1741.5
*Elevation is based on Mean Sea Level Datum	

Max. Depth of Water within Reservoir **7** Ft.

Storage

Storage Below Principal Spillway	149.3 Ac.-Ft.
Storage between Principal Spillway and Auxiliary Spillway	54.2 Ac.-Ft.
Storage between Auxiliary Spillway and Top of Dam	76.7 Ac.-Ft.
Other	0 Ac.-Ft.
Total Storage to Top of Dam	280.2 Ac.-Ft.

Downstream Conditions

1. Valley Conditions Downstream of Structure	Parallel
Approximate Slope of Channel	1 %
2. Stream Channel Size	
Depth	5 Ft.
Bottom Width	12 Ft.
Top Width	40 Ft.
3. Valley Characteristics	
Width	110 Ft.
Roughness Coefficient	0.1
Slope	2 %

Downstream valley may be described in breach routing rather than on this form.

Describe Type of Infrastructure, Distance Downstream and Distance Above Floodplain Elevation	Distance Downstream From Dam	Approx. Distance Above Floodplain Elevation	Location in Potential Impact Area?	
			YES	NO
Roads				
Paved Township or Paved County Road, D>2'			☐	☒
Other, Describe:			☐	☒
timber bridge with low girders			☐	☒
Bridges: Describe type and opening size			☐	☒
Railroads:				
Major Railroad, Describe:			☐	☒
Buildings and Utilities:				
Farm Building(s)			☐	☒
Public, Industrial or Commercial Buildings			☐	☒
Rel. Import. Utility serving mult. rural users			☐	☒
			☐	☒
Describe:				

Location:

Is Dam located within five miles of urban development?

No

Describe Potential Development:

None-the land is in a WRP easement under perpetual easement to remain in grass

Rational For Determining Hazard Class:

See attached Twinnereim Trust Dam Hazard Classification Narrative and the map of the Potential Flooded Area if the Dam Breached

Method Used for Evaluation of Impact Area

Visual Assessment

Further Evaluation Needed

No

Attached: Breach Routings ☐

Maps ☒

Other supporting documents:

Actual Hazard Class*

A

Final Job Class

IV

Hazard Analysis by:

Laura Stern

Date:

1/13/2015

Approved by

Laura Stern

Date:

5-8-2015

*Definition of Hazard Classification in National Engineering Manual 520.21 and SD Amendment 19

Tvinnereim Trust Dam Hazard Classification Narrative

If the site breached with the pool area at the top of the dam, about 200 ac-ft would be released from El. 1743.5 to El. 1738. The entire storage volume was not used as this is a pothole and the reasoning is the breach would not cut down to the bottom of the wetland. The cut would stop around the inlet of today's current ditch elevation, which is El. 1738. If the structure should breach, the water flows downstream to another wetland. The overflow from the receiving wetland then goes into another large wetland which is over two times the size of the first and second wetland. See attached map. A minimum of a two-foot diameter culvert passes the water from the second wetland to the third wetland. The control point of the ditch between the second and third wetland was at 1730.5 at the time of the survey. Therefore, water would not flow from the second into the third wetland until the water level reached El. 1730.5. If the culvert did not equalize the flow fast enough between the second and third wetland, the water would flow across the gravel road to the west of the middle wetland. The gravel road sits at El. 1734.4. The water would be less than one foot in depth over the gravel road as the storage in the middle basin between El. 1730.5 and El. 1735.4 is 229ac-ft, which is more than the 200 ac-ft coming from the breached site.

Winpond screenshot below is storage in the middle wetland, the one which would receive the water from the breached site.

The screenshot shows the WinPond software interface. The title bar reads 'WinPond'. The menu bar includes 'File', 'View', 'Tools', and 'Help'. The main window has a header with the NRCS logo and 'United States Department of Agriculture Natural Resources Conservation Service'. Below this is a navigation bar with buttons: 'Previous', 'Next', 'Ground Profile/Cross Section', 'Elevation-Storage Data', 'Ground Profile/Cross Section', 'Plots', 'Project', 'Elevation-Storage', 'Hydrology', 'Routing', 'Bank/Channel', 'Ground', 'Elevation-Storage', 'Plots', 'Project'. The 'Elevation-Storage' button is selected. The main area displays 'Select the desired elevation storage input method: ☒ Acres ☐ Square Inches'. Below this is a table titled 'Elevation-Storage Data (in Acres)'. The table has four columns: 'Elevation (feet)', 'Pool Area (acres)', 'Int. Storage (ac.ft.)', and 'Accum. Storage (ac.ft.)'. The data rows are as follows:

	Elevation (feet)	Pool Area (acres)	Int. Storage (ac.ft.)	Accum. Storage (ac.ft.)
Delete	30.50	25.20	0.00	0.00
Delete	31.00	32.60	14.45	14.45
Delete	32.00	39.90	36.25	50.70
Delete	33.00	47.30	43.60	94.30
Delete	35.40	65.30	135.12	229.42
Delete				
Delete				
Delete				

At the bottom left are buttons 'Clear All' and 'View'. At the bottom right is a checkbox labeled 'I am making a template project'.

TVINNEREIM TRUST DAM
E2, 29-123-56
DAY COUNTY

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DESIGN DOCUMENTATION

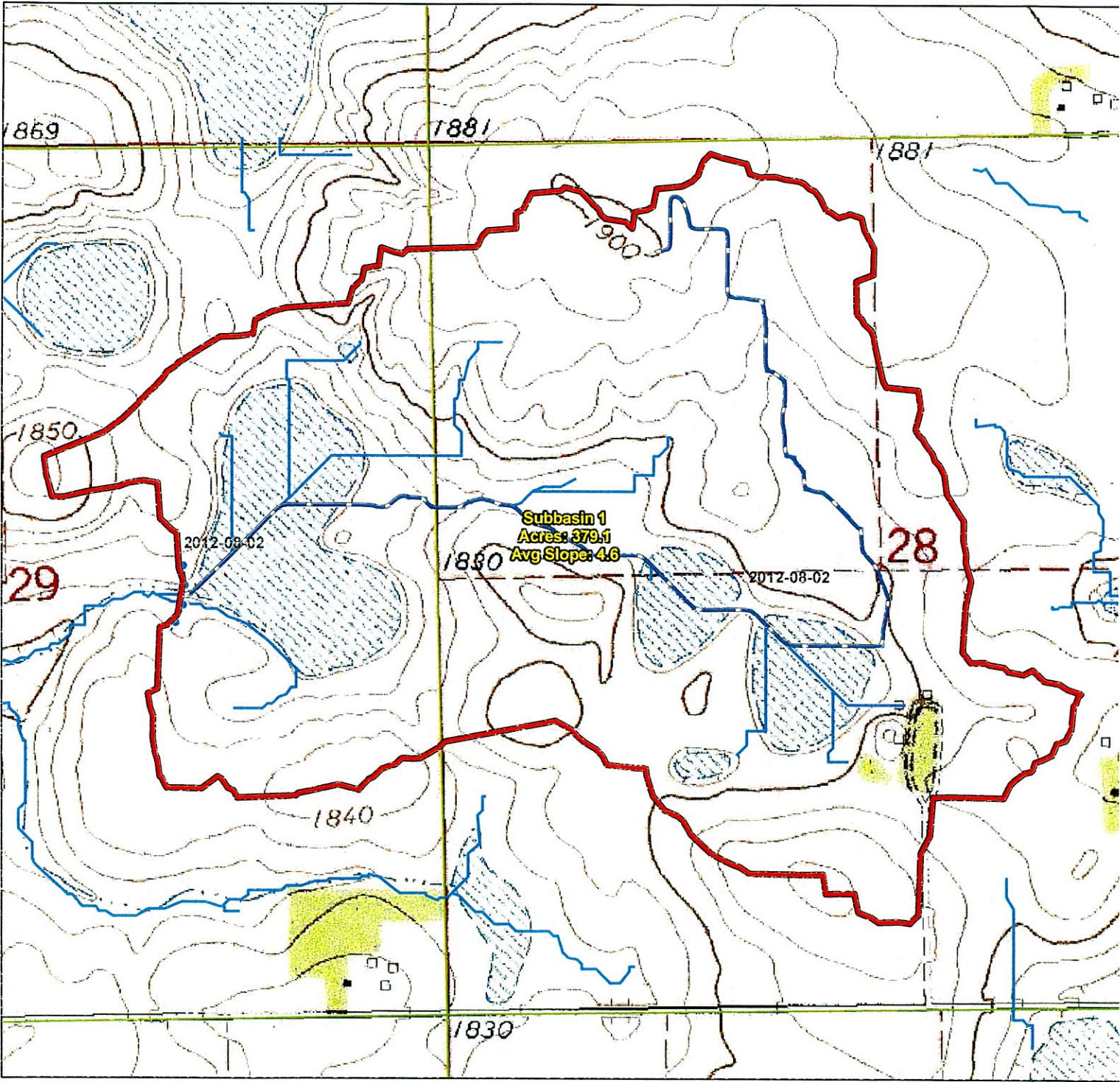
Drainage Area

1/17

Field Office: Webster FO

Agency: USDA-NRCS

Legal Desc: E1/2 Sec 29, T123N, R56W



0 265 530 1,060 1,590 2,120 2,650 3,180 Feet



2/7

TwinnereimEast_EngTools.txt

#####

Executing "2.Calculate Runoff Curve Number" Tool

User Name: Laura.Stern

Date Executed: Tue May 06 15:12:23 2014

ArcGIS Version:

ArcGIS Version : 10.0

User Parameters:

inWatershed: TwinnereimEast

Checking Values in landuse layer...

Checking Values in soils layer...

Successfully intersected Hydrologic Groups, Landuse, and Subbasin Boundaries

Checking Landuse and Condition Values in intersected data

There were 16 Cropland related polygons with a 'Fair' condition listed. This Landuse assumes a condition of 'Good' or 'Poor'..

A condition of Good will be assumed and assigned to these polygons.

Successfully Joined to TR_55_RCN Lookup table to assign Land Use Codes

Successfully Joined to HYD_GRP_Lookup table to assign Hydro Codes

Successfully Joined to TR_55_RCN Lookup table to assign Curve Numbers for Unique Combinations

Successfully Calculated Weighted Runoff Curve Number for each SubBasin

Subbasin ID: 1

Weighted Average RCN Value: 73.0

Adding unique identifier to each subbasin's soil and landuse combinations

Successfully created RCN Layer: TwinnereimEast_RCN

Successfully Compacted FGDB: TwinnereimEast_EngTools.gdb

Adding Layers to ArcMap

3/17

TwinnereimEast_EngTools.txt

#####

Executing "4.Update Watershed Attributes" Tool

User Name: Laura.Stern

Date Executed: Tue May 06 11:52:23 2014

ArcGIS Version:

ArcGIS Version : 10.0

User Parameters:

Input Watershed: TwinnereimEast

Successfully updated drainage area(s)

Successfully updated flow path length(s)..

Successfully re-calculated average slope

=====

User Watershed: TwinnereimEast

Subbasin: 1

Acres: 379.14

Area: 1,534,344.64 Sq. Meters

Avg. Slope: 4.62.

=====

Successfully Compacted FGDB: TwinnereimEast_EngTools.gdb

Flowpath = 8626 ft

Oh Soils = Oldham silty clay loam - ponded for brief periods
0.5' to 1.5'

Southern Inclusion - ponded frequently for very long periods
ponded 5' above to 1' below

PEMAD - NWI label

Trimble
5475 Kellenburger Road
Dayton, Ohio 45424-1099, USA
1-937-233-8921
Thursday, May 08, 2014 3:52:55 PM

4/17

PROJECT: H:\terramodelDATA\Tvitteireim WRP Stage Heart.pro

Perimeter / Area Measurements of Selected Lines

Object Name	Layer	Perimeter Length (ft)	Enclosed Area (Sq. Ft.)
1738	POINTS_CON	5366.51	1416298.36 - 32.5 ac
1741	POINTS_CON	5637.46	1586406.46 - 36.4
1746	POINTS_CON	7116.66	1967993.81 - 45.2
1740	POINTS_ICON	5575.53	1536855.91 - 35.3
1739	POINTS_CON	5546.42	1485929.39 - 34.1
1742	POINTS_CON	5776.46	1639283.99 - 37.6
1743	POINTS_CON	5970.27	1699119.15 - 39.0
1744	POINTS_CON	6295.41	1769644.20 - 40.6
1745	POINTS_ICON	6705.04	1864366.26 - 42.8

Total perimeter length = 53989.76 ft

Total enclosed area = 14965897.54 Sq. Ft.

DEPTH OF WETLAND

S/17

Steve Winter called me back on May 14, 2013. He had a good grasp of what the wetland depth would be. The site probably is a Southam which was originally a ponded Oldham or Oldham Parnell. A Southam is deeper than an Oldham by today's soils classifications (soil names changed about 20 years ago. Oldham and Parnell were combined). The Southam soil has a depth of 3-5' minimum with the Southam sites that were originally labeled Oldham 6-8' deep. We talked about the Tvinnereim site which had no emergent vegetation with steep sides. With these characteristics, it was thought that the Tvinnereim site fit into the deeper classification of 6-8' deep. For purposes of coming up with a storage number for the dams, the bottom of the wetland will be assumed to be 7' below the saddle elevation of 1740.

From: Stern, Laura - NRCS, Brookings, SD
Sent: Friday, May 09, 2014 12:42 PM
To: Howe, Lance - NRCS, Redfield, SD; Winter, Steven - NRCS, Redfield, SD
Subject: Tvinnereim Depth Opinion

Lance and Steve,
I am looking for your opinion on how deep a Oldham silty clay loam pothole might be in Day County. I am designing a mini-dam on a WRP in Day County located in the 29-123-56 and need to make some kind of estimate on how much water the dam will hold. I have attached the survey and a plan map for the site. The wetland I have a question on is the heart-shaped one. I surveyed until I hit open water. The site is mapped Oldham silty clay loam. On my survey, the saddle for the site was around 1740. I surveyed down to 1737 and then the rest was open water. Would you have any ideas on how deep a pothole like this would generally be? I appreciate any advice you might have.

Thank you,
Laura Stern, PE
Agricultural Engineer
USDA-NRCS
520 Third Avenue
Brookings, SD 57006-0626
laura.stern@sd.usda.gov
Phone: 605-692-2344 ext. 3

HYDRAULICS OF CLOSED CONDUIT SPILLWAYS

PART XIII

THE HOOD DROP INLET ARS-NC-23 AUGUST 1975

Summary of Recommendations

For convenience of reference, the results of the tests on the hood drop inlet are summarized under the headings: drop inlet size, priming head, entrance loss coefficient, pressure coefficient inside the barrel entrance, and type of hood drop inlet. The correct ranges of application of the equations specified in this summary must be used because the equations representing the entrance loss and pressure coefficients apply to all three hood drop inlet entrances—the square reentrant, circular reentrant, and square flush—but over different ranges of inlet proportions. Also the equations for circular drop inlets and flush hood barrel entrances must be corrected as explained under the recommendation summary heading, Type of hood drop inlet.

$$\frac{H}{D} = 1.2 - 0.8 \frac{Z_1}{D}$$

For intermediate height drop inlets, $1.0 < Z_1/D < 1.25$

No data are available to define the priming head. The authors suggest that the higher of the priming heads given by equations XIII-6 and XIII-9 be used to estimate the priming head for intermediate height drop inlets.

For high drop inlets, $Z_1/D \geq 1.25$

$$\frac{H}{D} = C_1 \left(\frac{B}{D} \right)^{-0.25} \quad (\text{XIII-9})$$

where, for the

square drop inlet, reentrant hood $C_1 = 0.54$
 circular drop inlet, reentrant hood $C_1 = 0.63$
 square drop inlet, flush entrance hood $C_1 = 0.54$

Drop inlet size

Performance criteria based on the head required to cause the barrel to prime are the basis for determining the minimum size B/D of the hood drop inlet. The minimum size varies with the type of hood drop inlet and the drop inlet height Z_1 . The minimum recommended values of B/D are listed in table XIII-4.

Priming head

The head H over the crest of the drop inlet at which the barrel will prime or begin to flow full depends on whether the control is the hood inlet or the drop inlet crest. It varies with the drop inlet height for low drop inlets of adequate size. For high drop inlets of adequate size, the priming head is determined by the drop inlet size—actually the length of the drop inlet crest. The priming heads are:

For the low drop inlets, $Z_1/D \leq 1.0$

$$\begin{aligned} B &= 2.5' \\ D &= 1' \\ Z &= Z_1 \end{aligned}$$

TABLE XIII-4.—Minimum size of the hood drop inlet

Drop inlet height	Drop inlet—		
	Square	Circular	Square
	Head—		
	Reentrant	Reentrant	Flush
	Minimum B/D		
$Z_1/D \leq 1.00$	4.0	3.77	1.5
$1.00 < Z_1/D < 1.25$	4.0	3.77	1.5
$Z_1/D \geq 1.25$	1.5	2.0	1.25

THIS PUBLICATION JUSTIFIES USING A 2.5' DIA RIVER WITH A 1' DIA BARREL.
 PER EQUATION XIII-9 THE BARREL WILL PRIME AT 0.5' PER ATTACHED
 FOWA DOCUMENTATION, WORK FROM 35' LENGTH TO A HEAD OF
 0.4'

WEIR FLOW CONTROLS UNTIL 1740.4 WHERE
IT SWITCHES TO FULL PIPE FLOW. SEE
NEXT PAGE

7/17

Project Name: Twinnereim WRP East

Computed by: Laura Stern

Date: 5/15/2014

Checked by: _____

Date: _____

laDropInlet.xls Ver 1.02

Computed by: Laura Stern			Outflow, CFS				Structure Outflow, CFS	Controlling Factor		
Date: 5/15/2014	Checked by:	Date:	Elev	HW Ft	Weir	Inlet Orifice			Barrel Orifice	Full Pipe
Input Data			1740.0	0.0	0.00	0.00	4.63	5.45	0.00	Weir Flow
Riser Type & Diameter (in)	Circular	30	1740.1	0.1	0.72	7.47	4.78	5.56	0.72	Weir Flow
Length of Weir Obstruction(ft)		0.5	1740.2	0.2	2.04	10.57	4.93	5.67	2.04	Weir Flow
		6	1740.3	0.3	3.75	12.95	5.07	5.78	3.75	Weir Flow
Principal Spillway Crest Elev (ft)		1740.4	1740.4	0.4	5.77	14.95	5.21	5.89	5.21	Barrel Orifice
Invert of Barrel Elevation (ft)		1738	1740.5	0.5	8.06	16.71	5.35	5.99	5.35	Barrel Orifice
Barrel Orifice Coefficient (C)		0.6	1740.6	0.6	10.60	18.31	5.48	6.09	5.48	Barrel Orifice
Pipe Diameter (in)		12	1740.7	0.7	13.35	19.77	5.61	6.19	5.61	Barrel Orifice
Pipe Length (ft)		54	1740.8	0.8	16.31	21.14	5.74	6.29	5.74	Barrel Orifice
Entrance Coefficient 'Ke'		1	1740.9	0.9	19.46	22.42	5.86	6.39	5.86	Barrel Orifice
Mannings 'n-value'		0.011	1741.0	1.0	22.80	23.64	5.98	6.49	5.98	Barrel Orifice
Elbow Elev (if None, Leave 'BLANK')			1741.1	1.1	26.30	24.79	6.10	6.58	6.10	Barrel Orifice
Length of Outlet ('BLANK' if none)			1741.2	1.2	29.97	25.89	6.21	6.67	6.21	Barrel Orifice
Outlet Type	Cantilever		1741.3	1.3	33.79	26.95	6.33	6.77	6.33	Barrel Orifice
Outlet Elevation (ft)		1737	1741.4	1.4	37.76	27.97	6.44	6.86	6.44	Barrel Orifice
Tailwater Elev (if unknown, leave 'Blank')			1741.5	1.5	41.88	28.95	6.55	6.95	6.55	Barrel Orifice
Auxiliary Spillway Elev (ft)		1741.5	1741.6	1.6	46.14	29.90	6.66	7.04	6.66	Barrel Orifice
Maximum Headwater Elev (ft)		1745	1741.7	1.7	50.53	30.82	6.76	7.12	6.76	Barrel Orifice
Elev Increment After Full Pipe Flow		0.1	1741.8	1.8	55.05	31.71	6.87	7.21	6.87	Barrel Orifice
Basic Output			1741.9	1.9	59.71	32.58	6.97	7.29	6.97	Barrel Orifice
Full Pipe Flow - Max. Outflow (cfs):	9.57		1742.0	2.0	64.48	33.43	7.07	7.38	7.07	Barrel Orifice
Full Pipe Flow - Max. Velocity (fps):	12.18		1742.1	2.1	69.38	34.25	7.18	7.46	7.18	Barrel Orifice
Useable Weir Length (Ft):	7.35		1742.2	2.2	74.39	35.06	7.27	7.55	7.27	Barrel Orifice
Riser Area (Sq Ft):	4.81		1742.3	2.3	79.52	35.84	7.37	7.63	7.37	Barrel Orifice
Barrel Area (Sq Ft):	0.79		1742.4	2.4	84.76	36.62	7.47	7.71	7.47	Barrel Orifice
Kp:	0.022405		1742.5	2.5	90.11	37.37	7.56	7.79	7.56	Barrel Orifice
Friction Slope (HW at the A.S. Crest):	0.02722		1742.6	2.6	95.57	38.11	7.66	7.87	7.66	Barrel Orifice
Pipe Slope:	0.01852		1742.7	2.7	101.14	38.84	7.75	7.94	7.75	Barrel Orifice
Outlet Elbow Angle (deg):	0.0		1742.8	2.8	106.81	39.55	7.84	8.02	7.84	Barrel Orifice
Maximum Barrel Invert Elevation for avoiding Barrel Orifice Control:	1737.48		1742.9	2.9	112.59	40.25	7.93	8.10	7.93	Barrel Orifice
Km:	0.00000		1743.0	3.0	118.46	40.94	8.02	8.17	8.02	Barrel Orifice
Tailwater Elev Used For Full Pipe Flow:	1737.6		1743.1	3.1	124.43	41.61	8.11	8.25	8.11	Barrel Orifice
Notes & Warnings			1743.2	3.2	130.50	42.28	8.20	8.33	8.20	Barrel Orifice
NOTE: Barrel Orifice control can be eliminated by increasing the riser depth.			1743.3	3.3	136.66	42.94	8.29	8.40	8.29	Barrel Orifice
			1743.4	3.4	142.92	43.58	8.37	8.47	8.37	Barrel Orifice
			1743.5	3.5	149.27	44.22	8.46	8.55	8.46	Barrel Orifice
			1743.6	3.6	155.72	44.85	8.54	8.62	8.54	Barrel Orifice
			1743.7	3.7	162.25	45.46	8.62	8.69	8.62	Barrel Orifice
			1743.8	3.8	168.87	46.07	8.71	8.76	8.71	Barrel Orifice
			1743.9	3.9	175.58	46.68	8.79	8.83	8.79	Barrel Orifice
			1744.0	4.0	182.38	47.27	8.87	8.90	8.87	Barrel Orifice
			1744.1	4.1	189.26	47.86	8.95	8.97	8.95	Barrel Orifice
			1744.2	4.2	196.23	48.44	9.03	9.04	9.03	Barrel Orifice
			1744.3	4.3	203.28	49.01	9.11	9.11	9.11	Full Pipe Flow
			1744.4	4.4	210.41	49.58	9.19	9.17	9.17	Full Pipe Flow
			1744.5	4.5	217.62	50.14	9.26	9.24	9.24	Full Pipe Flow
			1744.6	4.6	224.92	50.69	9.34	9.31	9.31	Full Pipe Flow
			1744.7	4.7	232.29	51.24	9.42	9.37	9.37	Full Pipe Flow
			1744.8	4.8	239.74	51.78	9.49	9.44	9.44	Full Pipe Flow
			1744.9	4.9	247.27	52.32	9.57	9.50	9.50	Full Pipe Flow
			1745.0	5.0	254.88	52.85	9.64	9.57	9.57	Full Pipe Flow

Project Name: Tvinnereim WRP East

laHoodInlet.xls Ver 1.10

Computed by: Laura Stern

Date: 5/15/2014

Checked by: _____

Date: _____

			Outflow, CFS			Structure Outflow, CFS	Controlling Factor
	Elev	HW Ft	Weir	Slug Flow	Full Pipe		
Input Data	1738.0	0.0	0.00	0.00	2.22	0.00	Weir Flow
	1738.1	0.1	0.08	0.00	2.49	0.08	Weir Flow
	1738.2	0.2	0.16	0.00	2.72	0.16	Weir Flow
	1738.3	0.3	0.31	0.00	2.94	0.31	Weir Flow
	1738.4	0.4	0.46	0.00	3.15	0.46	Weir Flow
Principal Spillway Crest Elev (ft)	1738	0.5	0.65	0.00	3.34	0.65	Weir Flow
Inside Wall - Type	Smooth	0.6	0.88	0.00	3.52	0.88	Weir Flow
Pipe Diameter (in)	12	0.7	1.22	0.00	3.69	1.22	Weir Flow
Pipe Length (ft)	54	0.8	1.56	0.00	3.85	1.56	Weir Flow
Entrance Coefficient 'Ke'	1	0.9	1.88	0.00	4.01	1.88	Weir Flow
Mannings 'n-value'	0.011	1.0	2.20	0.00	4.16	2.20	Weir Flow
Elbow Elev (if None, Leave 'BLANK')		1.1	2.50	2.00	4.31	2.50	Weir Flow
Length of Outlet ('BLANK' if none)		1.2	2.80	6.00	4.45	4.45	Full Pipe Flow
Outlet Type	Cantilever	1.3	3.05	10.00	4.59	4.59	Full Pipe Flow
Outlet Elevation (ft)	1737	1.4	3.30	14.00	4.72	4.72	Full Pipe Flow
Tailwater Elev (if unknown, leave 'Blank')		1.5	3.55	18.00	4.85	4.85	Full Pipe Flow
Auxiliary Spillway Elev (ft)	1741.5	1.6	3.80	22.00	4.98	4.98	Full Pipe Flow
Maximum Headwater Elev (ft)	1744	1.7	4.05	26.00	5.10	5.10	Full Pipe Flow
Elev Increment After Full Pipe Flow	0.1	1.8	4.30	30.00	5.22	5.22	Full Pipe Flow
Basic Output		1.9			5.34	5.34	Full Pipe Flow
		2.0			5.45	5.45	Full Pipe Flow
Full Pipe Flow - Max. Outflow (cfs):	8.90	2.1			5.56	5.56	Full Pipe Flow
Full Pipe Flow - Max. Velocity (fps):	11.33	2.2			5.67	5.67	Full Pipe Flow
		2.3			5.78	5.78	Full Pipe Flow
		2.4			5.89	5.89	Full Pipe Flow
Barrel Area (Sq Ft):	0.79	2.5			5.99	5.99	Full Pipe Flow
Kp:	0.0224057	2.6			6.09	6.09	Full Pipe Flow
Friction Slope (HW at the A.S. Crest):	0.02722	2.7			6.19	6.19	Full Pipe Flow
Pipe Slope:	0.01852	2.8			6.29	6.29	Full Pipe Flow
Outlet Elbow Angle (deg):	0.0	2.9			6.39	6.39	Full Pipe Flow
		3.0			6.49	6.49	Full Pipe Flow
		3.1			6.58	6.58	Full Pipe Flow
Km:	0.00000	3.2			6.67	6.67	Full Pipe Flow
Tailwater Elev Used For Full Pipe Flow:	1737.6	3.3			6.77	6.77	Full Pipe Flow
		3.4			6.86	6.86	Full Pipe Flow
		3.5			6.95	6.95	Full Pipe Flow
		3.6			7.04	7.04	Full Pipe Flow
		3.7			7.12	7.12	Full Pipe Flow
		3.8			7.21	7.21	Full Pipe Flow
		3.9			7.29	7.29	Full Pipe Flow
		4.0			7.38	7.38	Full Pipe Flow
		4.1			7.46	7.46	Full Pipe Flow
		4.2			7.55	7.55	Full Pipe Flow
		4.3			7.63	7.63	Full Pipe Flow
		4.4			7.71	7.71	Full Pipe Flow
		4.5			7.79	7.79	Full Pipe Flow
		4.6			7.87	7.87	Full Pipe Flow
		4.7			7.94	7.94	Full Pipe Flow
		4.8			8.02	8.02	Full Pipe Flow
		4.9			8.10	8.10	Full Pipe Flow
		5.0			8.17	8.17	Full Pipe Flow
		5.1			8.25	8.25	Full Pipe Flow
		5.2			8.33	8.33	Full Pipe Flow
		5.3			8.40	8.40	Full Pipe Flow
		5.4			8.47	8.47	Full Pipe Flow
		5.5			8.55	8.55	Full Pipe Flow
		5.6			8.62	8.62	Full Pipe Flow
		5.7			8.69	8.69	Full Pipe Flow
		5.8			8.76	8.76	Full Pipe Flow
		5.9			8.83	8.83	Full Pipe Flow
		6.0			8.90	8.90	Full Pipe Flow

Notes & Warnings

FULL PIPE FLOW AT
EL. 1740.5

9/17

SITES XEQ 05/06/2015 WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
VER 2005.1.6 (USER MANUAL - DATED DECEMBER 2005)
TIME 23:24:43

***** 80-80 LIST OF INPUT Data *****

SITES 01/01/2005 0.59375 H5
SAVMOV 0 101
SAVMOV 101 1 1
STRUCTURE
1733 0
1738 32.5
1739 34.1
1740 35.3
1741 36.4
1742 37.6
1743 39
1744 40.6
1745 42.8
1746 45.2
THIS RUN SETS THE A.S. AT EL. 1741.6
THE PIPE FLOW FROM THIS RUN WAS
USED IN THE NEXT RUN OF SITE SHEET 10
WHICH SETS THE A.S. AT
EL. 1741.5 TO BE MORE COORDINATE
ENDTABLE
WSDATA 5A1 AC 73 380 8626 4.62
BASEFLOW 0
PDIRECT 2.4 5.10
POOLDATA ELEV 1740 1740 0 1735.4 1735.4 SC
PSINLET 1 7.85
PSDATA 1 54 12 .011 1737.5
ASDATA 41 1212 10 3 2
ASINSURF 41 7.6 B
ASINLET 41 0.0 0.0 200 0.0 3
210 1
ENDTABLE
ASEXSURF 41 7.6
0.8 0
2
1.5 0
.01
ENDTABLE
ASEXIT 41 N 60
BTMWIDTH FEET 20
GRAPHICS I
GO,DESIGN HL TYPE2 24 TYPE2378 24
SAVMOV 2 101 1
ENDJOB

***** MESSAGE - ALTERNATE STRUCTURE ID (S 1) BEING USED
SINCE USER DID NOT INPUT AN ID.

***** MESSAGE - ALTERNATE SUBWATERSHED ID (A) BEING USED SINCE
USER DID NOT INPUT AN ID.

***** MESSAGE - DRAINAGE AREA FROM WSDATA CONTROL BEING CONVERTED FROM
ACRES TO SQUARE MILES FOR COMPUTATION PURPOSES.

***** MESSAGE - NO EXIT SLOPE GIVEN, A DEFAULT SLOPE OF 0.04 FT/FT IS USED.

1SITES -----

XEQ 05/06/2015

VER 2005.1.6

TIME 23:24:43

SITE = S 1

PASS= 1

WSID=

SUBW= A

PART= 1

***** BASIC Data *****
CLIMATE AREA - NOT DEFINED DESIGN CLASS A1 = LT 3000.

STORM DISTRIBUTION-PSH 24 HOUR TYPE II RAINFALL DISTRIBUTION

STORM DISTRIBUTION AUX. -24 HOUR TYPE II RAINFALL DISTRIBUTION

PRECIP. - P-PS,1-DAY	P-PS,10-DAY	P-SD	P-FB	
2.40	0.00	0.00	5.10	
WSDATA - CN	DA-SM	TC/L	-/H	QRF
73.00	0.59	8626.00	4.62	0.00
SITEDATA- PERM POOL	CREST PS	FP SED	VALLEY FL	378?
1740.00	1740.00	0.00	1735.40	YES
BASEFLOW	INITIAL EL	EXTRA VOL	SITE TYPE	
0.00	0.00	0.00	DESIGN	
PSDATA - NO. COND	COND L	DIA/W	-/H	
1.00	54.00	12.00	0.00	
PS N	KE	WEIR L	TW EL	
0.011	1.00	7.85	1737.50	
2ND STG	ORF H	ORF L	START AUX.	
0.00	0.00	0.00	0.00	
ASCRESTS - AUX.1	AUX.2	AUX.3	AUX.4	AUX.5
0.00	0.00	0.00	0.00	0.00
AUX.Data - REF.NO.	RETARD. Ci	TIE STATION	INLET LENGTH	
41	0.00	1212.00	10	
AUX.Data - INLET Ci	SIDE SLOPE	EXIT Ci	EXIT SLOPE	ACTUAL AUX?
7.600	3.00	7.600	0.040	NO
BTM WIDTH - BW1	BW2	BW3	BW4	BW5
ft 20.00	0.00	0.00	0.00	0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1SITES -----

XEQ 05/06/2015

VER 2005.1.6

TIME 23:24:43

SITE = S 1

PASS= 1

WSID=

SUBW= A

PART= 2

MESSAGE ----- Climatic Index changed from 0.0 to 1.0 for this run.

PERM POOL	1740.00 FT	149.2 ACFT	35.30 AC	3.9 CFS
CREST PS	1740.00 FT	149.2 ACFT	35.30 AC	3.9 CFS
SED ACCUM	1740.00 FT	149.2 ACFT	35.30 AC	3.9 CFS
START ELEV	1740.00 FT	149.2 ACFT	35.30 AC	0.0 CFS

>>>> MINIMUM DEPTH (1.00 FT) USED FOR NHCP378 RUN - CREST PS TO CREST AUX.

NRCS-PSH	D= 24.00 HR	P= 2.40 IN	Q= 0.51 IN	DA= 0.59 SM
	TC= 1.70 HR	CN= 73.00	VOL= 16.3 ACFT	

PEAK = 58.9 CFS, AT 13.1 HRS.

ROUTED RESULT - HYD TYPE	EMAX	VOL-MAX	AMAX	QMAX
NRCS-PSH	1741.00 FT	185.1 ACFT	36.40 AC	6.6 CFS

PS STORAGE 35.9 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST	1740.00 FT	149.2 ACFT	0.00 CFS
CONTROL IS 0.000 DETENTION STORAGE			

TIME LIMIT REACHED = 10.00 DAYS. FLOW WAS 0.43 CFS, ELEV = 1740.06

RATING TABLE DEVELOPED, SITE = S 1:
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	1740.00	0.00	0.00	0.00	149.25	35.30
2	1740.10	0.75	0.75	0.00	152.72	35.41
3	1740.20	2.11	2.11	0.00	156.19	35.52
4	1740.29	3.88	3.88	0.00	159.68	35.62
FULL CONDUIT FLOW, ELEV = 1740.39 FT						
5	1740.39	5.97	5.97	0.00	163.18	35.73
6	1741.09	6.67	6.67	0.00	188.49	36.51
7	1741.79	7.29	7.29	0.00	214.38	37.35
8	1742.50	7.86	7.86	0.00	240.89	38.29
9	1743.20	8.39	8.39	0.00	268.08	39.31
10	1743.90	8.89	8.89	0.00	296.04	40.44
11	1744.60	9.37	9.37	0.00	324.88	41.92
12	1745.30	9.82	9.82	0.00	354.82	43.52
13	1746.00	10.25	10.25	0.00	385.92	45.20

1SITES -----
XEQ 05/06/2015

WSID=

VER 2005.1.6
TIME 23:24:43

SITE = S 1

PASS= 1

SUBW= A
PART= 3

AUX. CREST 1741.00 FT 185.1 ACFT 36.40 AC 6.6 CFS

PS STORAGE 35.9 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 1740.06 FT 151.2 ACFT 35.36 AC 0.4 CFS

EFFECTIVE HEIGHT(H)= 5.6 FEET, PRODUCT= 1037. (H * STORAGE AT CREST AUX.).

INPUT DESIGN CLASS = A1 = LT 3000. PRODUCT.

NRCS-FBH D= 24.00 HR P= 5.10 IN Q= 2.36 IN DA= 0.59 SM
TC= 1.70 HR CN= 73.00 VOL= 74.7 ACFT

PEAK = 329.2 CFS, AT 13.0 HRS.

***** WARNING - UPSTREAM END OF CREST 1012. IS UPSTREAM OF THE
FIRST GROUND POINT 1202. STATION.

RATING TABLE DEVELOPED, SITE = S 1:
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	1740.00	0.00	0.00	0.00	149.25	35.30
2	1740.10	0.75	0.75	0.00	152.72	35.41
3	1740.20	2.11	2.11	0.00	156.19	35.52
4	1740.29	3.88	3.88	0.00	159.68	35.62
					FULL CONDUIT FLOW, ELEV = 1740.39 FT	
5	1740.39	5.97	5.97	0.00	163.18	35.73
6	1740.47	6.06	6.06	0.00	165.89	35.81
7	1740.54	6.14	6.14	0.00	168.62	35.90
8	1740.62	6.21	6.21	0.00	171.35	35.98
9	1740.70	6.29	6.29	0.00	174.09	36.07
10	1740.77	6.36	6.36	0.00	176.84	36.15
11	1740.85	6.43	6.43	0.00	179.59	36.23
12	1740.92	6.51	6.51	0.00	182.35	36.32
13	1741.00	6.58	6.58	0.00	185.11	36.40
14	1741.25	7.80	6.81	0.99	194.24	36.70
15	1741.50	9.02	7.03	1.99	203.45	37.00
16	1741.95	11.18	7.42	3.77	220.22	37.54
17	1742.50	15.94	7.86	8.08	241.08	38.30
18	1743.50	117.56	8.61	108.94	280.10	39.80
19	1744.75	346.39	9.47	336.92	331.27	42.25
20	1746.00	672.27	10.25	662.02	385.90	45.20

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX	VEGETAL COVER FACTOR	MAINT. CODE	ROOTING DEPTH (ft)	REACH LOCATION *
1	1012.	1212.	0.0	7.6	**	**	**	CREST
2	1212.	1272.	4.0	7.6	0.80	2	1.5	EXIT !

* Upper case indicates a reach of constructed spillway channel.

** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.

! Reach 2 used in computing exit channel velocities.

DRAWDOWN USING FREEBOARD STORM FOLLOWS, STARTING AT ELEVATION 1741.00 FT.

DRAWDOWN (DDT) TEST 1740.00 FT 149.2 ACFT 0.00 CFS
CONTROL IS 0.000 DETENTION STORAGE

TIME LIMIT REACHED = 10.00 DAYS. FLOW WAS 0.17 CFS, ELEV = 1740.02

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP FT	VOL-AUX. ACFT
NRCS-FBH	20.0	1741.82	215.5	37.4	0.82	30.4

^^^^ NOTE -- ACTUAL Hp OF 0.82 RAISED TO MEET MIN. 378 CRITERIA.

PEAK - CFS DISCHARGE =	Q-PS 7.3	Q-AUX. 3.3	Q-TOT. 10.6
---------------------------	-------------	---------------	----------------

	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
AUXILIARY SPILLWAY ---	0.09	1.72	3.254	4.410

EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
(Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)

Aux. Spillway Discharge = 3. cfs; Bottom Width = 20. ft

REACH NO.	FROM STA	TO STA	SLOPE %	MANNING`S n	VELOCITY ft/s	TOTAL STRESS lb/ft^2	EFFECTIVE STRESS lb/ft^2
2	1212.	1272.	4.00	0.317	0.45	0.87	0.002

AUXILIARY SPILLWAY DURATION FLOW = 55.9 HOURS
ATTACK, OE/B = 0.4 ACFT/FT

***** MESSAGE - NHCP378 CRITERIA USED BUT AUXILIARY SPILLWAY RATING NOT
BASED ON ASFILE RATINGS.

EXIT CHANNEL FLOW SUBCRITICAL: MAX VELOCITY= 0.4 FT/SEC
EXIT SLOPE = 0.040 FT/FT
FLOW DEPTH = 0.3 FT

>>>> NHCP378 RUN - MINIMUM DEPTH, CREST AUX. TO TOP OF DAM IS 2.00 FT.
 NEW TOP OF DAM ELEVATION = 1743.00.

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.HP FT	VOL-AUX. ACFT
MINIMUM AUX.	20.0	1743.00	260.6	39.0	2.00	75.5

PEAK - CFS DISCHARGES =	Q-PS	Q-AUX.	Q-TOT.
	8.2	58.5	66.8

AUXILIARY SPILLWAY ---	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-Sc FT/FT	25% OF Q Sc FT/FT
	0.62	4.30	0.127	0.949

 Inflow Hyd 1 PSH-Peak = 4.90 CFS at 12.95 hrs., Location Point

Inflow Hyd 1 FBH-Peak = 10.57 CFS at 16.16 hrs., Location Point
 HYDOUT 1

1SITES....JOB NO. 1 COMPLETE.

0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

2 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

SITES.....COMPUTATIONS COMPLETE

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	S 1	A	0.59	73.	1.70	0.59	378NR	A1	

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	12.0	1741.0	20.0	2.0	1743.0	0.	0.	0.4	MIN. AUX.

* INTEGRITY DIST. AND EXIT VEL. ARE BASED ON THE ROUTED HYDROGRAPH

AND WILL NOT RELATE TO THE MAX. ELEV. (TOP OF DAM),
WHICH IS SET BY MINIMUM DESIGN CRITERIA.

SITES.....SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.6 ,01/01/2005
FILES

INPUT = C:\Sites\TinnereimEast\TinnereimEastSites.D2C
OUTPUT = C:\Sites\TinnereimEast\TinnereimEastSites.OUT
DATED 05/06/2015 23:24:43

GRAPHICS FILES GENERATED

OPTION "L" = C:\Sites\TinnereimEast\TinnereimEastSites.DRG DATED 05/06/2015 23:24:43
OPTION "P" = C:\Sites\TinnereimEast\TinnereimEastSites.DHY DATED 05/06/2015 23:24:43
OPTION "E" = C:\Sites\TinnereimEast\TinnereimEastSites.DEM DATED 05/06/2015 23:24:43

THIS RUN SETS THE A.S. 10/17
AT EL. 1741.5

SITES XEQ 05/06/2015 WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
VER 2005.1.6 (USER MANUAL - DATED DECEMBER 2005)
TIME 23:45:52

***** 80-80 LIST OF INPUT Data *****

SITES 01/01/2005 0.59375 H4
SAVMOV 0 101
SAVMOV 101 1 1
STRUCTURE
1733 0
1738 32.5
1739 34.1
1740 35.3 0
1741 36.4 6.58
1742 37.6 7.46
1743 39 8.24
1744 40.6 8.95
1745 42.8 9.63
1746 45.2 10.25
ENDTABLE
WSDATA 5A1 AC 73 380 8626 4.62
BASEFLOW 0
PDIRECT 5.10
POOLDATA ELEV 1740 1733 0 1735.4 1735.4
ASDATA 41 1212 10 3 .1 2
ASCREST ELEV 1741.5
ASINSURF 41 7.6 B
ASINLET 41 0.0 0.0 200 0.0 3
210 1
ENDTABLE
ASEXSURF 41 7.6
0.8 0
2
1.5 0
.01
ENDTABLE
ASEXIT 41 N 60
BTMWIDTH FEET 20
GRAPHICS I
GO,DESIGN HL TYPE2 24 TYPE2378 24 1740
SAVMOV 2 101 1
ENDJOB

***** MESSAGE - ALTERNATE STRUCTURE ID (S 1) BEING USED
SINCE USER DID NOT INPUT AN ID.

***** MESSAGE - ALTERNATE SUBWATERSHED ID (A) BEING USED SINCE
USER DID NOT INPUT AN ID.

***** MESSAGE - DRAINAGE AREA FROM WSDATA CONTROL BEING CONVERTED FROM
ACRES TO SQUARE MILES FOR COMPUTATION PURPOSES.

```

1SITES -----
XEQ 05/06/2015                               WSID=
VER 2005.1.6                                SUBW=  A
TIME 23:45:52                                SITE = S    1    PASS=    1    PART=    1

```

```

***** BASIC Data *****
CLIMATE AREA - NOT DEFINED                DESIGN CLASS  A1 = LT 3000.

```

STORM DISTRIBUTION-PSH 24 HOUR TYPE II RAINFALL DISTRIBUTION

STORM DISTRIBUTION AUX. -24 HOUR TYPE II RAINFALL DISTRIBUTION

PRECIP. - Q-PS,1-DAY	Q-PS,10-DAY	P-SD	P-FB	
0.00	0.00	0.00	5.10	
WSDATA - CN	DA-SM	TC/L	-/H	QRF
73.00	0.59	8626.00	4.62	0.00
SITEDATA- PERM POOL	CREST PS	FP SED	VALLEY FL	378?
1740.00	1733.00	0.00	1735.40	YES
BASEFLOW	INITIAL EL	EXTRA VOL	SITE TYPE	
0.00	0.00	0.00	DESIGN	
PSDATA - NO. COND	COND L	DIA/W	-/H	
0.00	0.00	0.00	0.00	
PS N	KE	WEIR L	TW EL	
0.000	0.00	0.00	0.00	
2ND STG	ORF H	ORF L	START AUX.	
0.00	0.00	0.00	1740.00	
ASCRESTS - AUX.1	AUX.2	AUX.3	AUX.4	AUX.5
1741.50	0.00	0.00	0.00	0.00
AUX.Data - REF.NO.	RETARD. Ci	TIE STATION	INLET LENGTH	
41	0.00	1212.00	10	
AUX.Data - INLET Ci	SIDE SLOPE	EXIT Ci	EXIT SLOPE	ACTUAL AUX?
7.600	3.00	7.600	0.100	NO
BTM WIDTH - BW1	BW2	BW3	BW4	BW5
ft 20.00	0.00	0.00	0.00	0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

```

1SITES -----
XEQ 05/06/2015                               WSID=
VER 2005.1.6                                SUBW=  A
TIME 23:45:52                                SITE = S    1    PASS=    1    PART=    2

```

MESSAGE ---- Climatic Index changed from 0.0 to 1.0 for this run.

PERM POOL	1740.00 FT	149.2 ACFT	35.30 AC	0.0 CFS
-----------	------------	------------	----------	---------

CREST PS	1733.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
SED ACCUM	1733.00 FT	0.0 ACFT	0.00 AC	0.0 CFS
START ELEV	1740.00 FT	149.2 ACFT	35.30 AC	0.0 CFS

 RATING TABLE DEVELOPED, SITE = S 1:
 WITH PS GIVEN AND AUX. COMPUTED BY PROGRAM
 AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1						
	ELEV.	Q-TOTAL	Q-PS	Q-AUX.	VOLUME	AREA
	FEET	CFS	CFS	CFS	AC-FT	ACRE
1	1733.00	0.00	0.00	0.00	0.00	0.00
2	1738.00	0.00	0.00	0.00	81.25	32.50
3	1739.00	0.00	0.00	0.00	114.55	34.10
4	1740.00	0.00	0.00	0.00	149.25	35.30
5	1741.00	6.58	6.58	0.00	185.10	36.40
6	1742.00	7.46	7.46	0.00	222.10	37.60
7	1743.00	8.24	8.24	0.00	260.40	39.00
8	1744.00	8.95	8.95	0.00	300.20	40.60
9	1745.00	9.63	9.63	0.00	341.90	42.80
10	1746.00	10.25	10.25	0.00	385.90	45.20

1SITES -----
 XEQ 05/06/2015 WSID=
 VER 2005.1.6 SUBW= A
 TIME 23:45:52 SITE = S 1 PASS= 1 PART= 3

AUX. CREST	1741.50 FT	203.5 ACFT	37.00 AC	7.0 CFS
------------	------------	------------	----------	---------

PS STORAGE 203.5 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV	1740.00 FT	149.2 ACFT	35.30 AC	0.0 CFS
------------	------------	------------	----------	---------

EFFECTIVE HEIGHT(H)= 6.1 FEET, PRODUCT= 6.1241 (H * STORAGE AT CREST AUX.).

INPUT DESIGN CLASS = A1 = LT 3000. PRODUCT.

NRCS-FBH	D= 24.00 HR	P= 5.10 IN	Q= 2.36 IN	DA= 0.59 SM
	TC= 1.70 HR	CN= 73.00	VOL= 74.7 ACFT	

PEAK = 329.2 CFS, AT 13.0 HRS.

***** WARNING - UPSTREAM END OF CREST 1012. IS UPSTREAM OF THE
 FIRST GROUND POINT 1202. STATION.

 RATING TABLE DEVELOPED, SITE = S 1:
 WITH PS GIVEN AND AUX. COMPUTED BY PROGRAM

AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	1733.00	0.00	0.00	0.00	0.00	0.00
2	1733.71	0.00	0.00	0.00	1.63	4.60
3	1734.42	0.00	0.00	0.00	6.52	9.21
4	1735.13	0.00	0.00	0.00	14.68	13.81
5	1735.83	0.00	0.00	0.00	26.09	18.42
6	1736.54	0.00	0.00	0.00	40.77	23.02
7	1737.25	0.00	0.00	0.00	58.71	27.63
8	1737.96	0.00	0.00	0.00	79.91	32.23
9	1738.67	0.00	0.00	0.00	103.28	33.57
10	1739.38	0.00	0.00	0.00	127.43	34.55
11	1740.08	0.55	0.55	0.00	152.21	35.39
12	1740.79	5.21	5.21	0.00	177.56	36.17
13	1741.50	7.02	7.02	0.00	203.47	37.00
14	1741.73	8.13	7.22	0.91	211.82	37.27
15	1741.95	9.21	7.42	1.79	220.24	37.54
16	1742.36	11.14	7.74	3.40	235.55	38.10
17	1742.85	14.68	8.12	6.55	254.58	38.79
18	1743.75	82.99	8.77	74.22	290.11	40.20
19	1744.88	265.77	9.55	256.23	336.57	42.53
20	1746.00	528.71	10.25	518.46	385.90	45.20

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA (ft)	TO STA (ft)	SLOPE (%)	RETARDANCE CURVE INDEX	VEGETAL COVER FACTOR	MAINT. CODE	ROOTING DEPTH (ft)	REACH LOCATION *
1	1012.	1212.	0.0	7.6	**	**	**	CREST
2	1212.	1272.	10.0	7.6	0.80	2	1.5	EXIT !

* Upper case indicates a reach of constructed spillway channel.

** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.

! Reach 2 used in computing exit channel velocities.

DRAWDOWN USING FREEBOARD STORM FOLLOWS, STARTING AT ELEVATION 1741.50 FT.

DRAWDOWN (DDT) TEST 1733.00 FT 0.0 ACFT 0.00 CFS
CONTROL IS 0.000 DETENTION STORAGE

TIME LIMIT REACHED = 10.00 DAYS. FLOW WAS 0.55 CFS, ELEV = 1740.08

***** NOTE - EXTENSIVE TIME REQUIRED TO DRAWDOWN SITE; COMPUTATIONS
STOPPED AT 30 DAYS (0.35 CFS).

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX. -HP FT	VOL-AUX. ACFT
NRCS-FBH	20.0	1741.89	218.0	37.5	0.39	14.5

^^^^^ NOTE -- ACTUAL Hp OF 0.39 RAISED TO MEET MIN. 378 CRITERIA.

PEAK - CFS Q-PS Q-AUX. Q-TOT.
DISCHARGE = 7.4 1.6 8.9

	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-Sc	25% OF Q Sc
AUXILIARY	FT	FT/SEC	FT/FT	FT/FT
SPILLWAY ---	0.06	1.35	3.825	5.193

EROSIONALLY EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
(Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)

Aux. Spillway Discharge = 2. cfs; Bottom Width = 20. ft

REACH NO.	FROM STA	TO STA	SLOPE %	MANNING'S n	VELOCITY ft/s	TOTAL STRESS lb/ft^2	EFFECTIVE STRESS lb/ft^2
2	1212.	1272.	10.00	0.317	0.45	1.06	0.003

AUXILIARY SPILLWAY DURATION FLOW = 32.4 HOURS
ATTACK, OE/B = 0.1 ACFT/FT

***** MESSAGE - NHCP378 CRITERIA USED BUT AUXILIARY SPILLWAY RATING NOT
BASED ON ASFILE RATINGS.

EXIT CHANNEL FLOW SUBCRITICAL: MAX VELOCITY= 0.4 FT/SEC
EXIT SLOPE = 0.100 FT/FT
FLOW DEPTH = 0.2 FT

>>>> NHCP378 RUN - MINIMUM DEPTH, CREST AUX. TO TOP OF DAM IS 2.00 FT.
NEW TOP OF DAM ELEVATION = 1743.50.

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.HP FT	VOL-AUX. ACFT
MINIMUM AUX.	20.0	1743.50	680.2	39.8	2.00	76.8

PEAK - CFS Q-PS Q-AUX. Q-TOT.
DISCHARGES = 8.6 55.4 64.0

	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-Sc	25% OF Q Sc
AUXILIARY	FT	FT/SEC	FT/FT	FT/FT
SPILLWAY ---	0.60	4.23	0.135	1.042

Inflow Hyd 1 FBH-Peak = 8.92 CFS at 16.26 hrs., Location Point
HYDOUT 1

1SITES....JOB NO. 1 COMPLETE.

0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

1 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

SITES.....COMPUTATIONS COMPLETE

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	-----	-----	-----	-----	-----	-----	-----	-----	
	S 1	A	0.59	73.	1.70	0.59	378NR	A1	
PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
----	-----	-----	-----	-----	-----	-----	-----	-----	-----
1	0.0	1741.5	20.0	2.0	1743.5	0.	0.	0.4	MIN. AUX.

* INTEGRITY DIST. AND EXIT VEL. ARE BASED ON THE ROUTED HYDROGRAPH
AND WILL NOT RELATE TO THE MAX. ELEV. (TOP OF DAM),
WHICH IS SET BY MINIMUM DESIGN CRITERIA.

SITES.....SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.6 ,01/01/2005
FILES

INPUT = C:\Sites\TvinneireimEast\TvinneireimEastSitesSetAS.D2C
OUTPUT = C:\Sites\TvinneireimEast\TvinneireimEastSitesSetAS.OUT
DATED 05/06/2015 23:45:52

GRAPHICS FILES GENERATED

OPTION "L" = C:\Sites\TvinneireimEast\TvinneireimEastSitesSetAS.DRG DATED 05/06/2015 23:
OPTION "P" = C:\Sites\TvinneireimEast\TvinneireimEastSitesSetAS.DHY DATED 05/06/2015 23:
OPTION "E" = C:\Sites\TvinneireimEast\TvinneireimEastSitesSetAS.DEM DATED 05/06/2015 23:

Annual Yield and Sediment Storage

Project: Tvinnereim East

Calculations By: Laura Stern

Checked By: JCS

*****Annual Surface Yield *****

Input Data

Isogram # = 2 1/2
Curve Number = 73
Contributing Acres = 380
% chance = 50

runoff = 0.37 inches

$$\frac{\text{Contributing Acres} * \text{Inches of Runoff}}{12} = 11.7 \text{ ACFT}$$

$$\text{Storage at Principal Spillway} = 149.3 \text{ ACFT}$$

*****Sediment Yield*****

Input Data

Erodibility Area = F
Gross Rate = 0.0029 50-75% cultivated
Drainage Area = 380
Delivery Rate = 22 Median-Minimum- grass buffer all the way around wetland
Design Life = 25

$$\text{Gross Rate} * \text{Drainage Area} * \text{Delivery Rate} * \text{Years} = 6.1 \text{ ACFT}$$

$$\text{Available Sediment Storage} = 615.8 \text{ years}$$

REF:
EFM 2-83 Method A

Trimble
 5475 Kellenburger Road
 Dayton, Ohio 45424-1099, USA
 1-937-233-8921
 Wednesday, January 07, 2015 3:41:42 PM

12/17

PROJECT: H:\terramodelDATA\Tvitthereim WRP.pro

 Perimeter / Area Measurements of Selected Lines

Object Name	Layer	Perimeter Length (ft)	Enclosed Area (Sq. Ft.)
DAMEAST	DAMEAST	466.6	6625.60
AUXILIARYEAST	AUXILIARYEAST	582.1	9235.64

0.15 ac
 0.21 ac

Total perimeter length = 1048.7 ft
 Total enclosed area = 15861.24 Sq. Ft.

$$\text{STRIPPING DAM} = \frac{6625 (.5)}{27} = 122.7 \text{ CY} \approx 123 \text{ CY} \checkmark$$

$$\text{STRIPPING AS} = \frac{9235 (.5)}{27} = 171 \text{ CY} \checkmark$$

$$\text{TOTAL STRIPPING} = 123 + 171 = 294 \text{ CY}$$

$$\text{SEEDING} = 0.15 \text{ ac} + 0.21 \text{ ac} = 0.36 \approx 0.5 \text{ ac}$$

13/17

SURFACE TO SURFACE VOLUME REPORT

Trimble
5475 Kellenburger Road
Dayton, Ohio 45424-1099, USA
1-937-233-8921

Project: H:\terramodelDATA\Tvitteireim WRP.pro
Report Generated: Wednesday, January 07, 2015 3:25:38 PM

Where the second surface is above the first the volume is reported as fill.
Where the second surface is below the first the volume is reported as excavation.

Shrinkage/swell factors:	Excavation	1.0000	Fill	1.0000
First Surface	Number	Second Surface		Number
Layer Name	of Points	Layer Name		of Points
POINTS	2,536	AUXILIARYEAST		83
Excavation Volume (Cu. Yd.)		Fill Volume (Cu. Yd.)		
604.2		0.0		

Net Difference: 604.1 Cu. Yd. Waste

AS STRIPPING = 171 CY

AS EXCAVATION = 604 - 171 = 433 CY

Any Level Yardage Calculation

(see Technical Note Design SD-1 for AnyLevel Method guidance)

Name:			Twinrereim Trust WRP								Section:		29		Township:		123		Range:		56	
Computations By:			Stern								Date:		1/7/2015				County:		Day			
Type of Earthwork:			Core Trench and Crossing Removal														Is this a earth fill quantity?		No			
STATION			1	2	3	4	5	6	7	8	9	10	11	12	13	END AREA	AVE AREA	DISTANCE	CY			
0+09	ELEVATION															0.0						
	DISTANCE																19.5	4.	2.9			
0+13	ELEVATION	742.8	742.8	739.8	739.8	742.8										39.0						
	DISTANCE	-8.0	8.0	5.0	-5.0	-8.0										39.0	39.0	87.	125.7			
1+00	ELEVATION	739.1	739.1	736.1	736.1	739.1										39.0						
	DISTANCE	-8.0	8.0	5.0	-5.0	-8.0										52.1	52.1	1.	1.9			
1+01	ELEVATION	739.1	739.1	734.6	734.6	739.1										65.3						
	DISTANCE	-9.5	9.5	5.0	-5.0	-9.5										64.3	64.3	15.	35.7			
1+16	ELEVATION	738.5	738.7	738.5	734.2	734.2	738.5									63.3						
	DISTANCE	-9.3	0.0	9.3	5.0	-5.0	-9.3									63.3	63.3	10.	23.5			
1+26	ELEVATION	738.2	738.4	738.2	733.9	733.9	738.2									63.3						
	DISTANCE	-9.3	0.0	9.3	5.0	-5.0	-9.3									63.3	63.3	10.	23.5			
1+36	ELEVATION	738.7	738.9	738.7	734.4	734.4	738.7									63.4						
	DISTANCE	-9.3	0.0	9.3	5.0	-5.0	-9.3									64.3	64.3	8.	19.1			
1+44	ELEVATION	739.0	739.0	734.5	734.5	739.0										65.3						
	DISTANCE	-9.5	9.5	5.0	-5.0	-9.5										52.1	52.1	2.	3.9			
1+46	ELEVATION	739.1	739.1	736.1	736.1	739.1										39.0						
	DISTANCE	-8.0	8.0	5.0	-5.0	-8.0										39.0	39.0	16.	23.1			
1+62	ELEVATION	739.3	739.3	736.3	736.3	739.3										39.0						
	DISTANCE	-8.0	8.0	5.0	-5.0	-8.0										39.0	39.0	54.	78.0			
2+16	ELEVATION	742.9	742.9	739.9	739.9	742.9										39.0						
	DISTANCE	-8.0	8.0	5.0	-5.0	-8.0										19.5	19.5	4.	2.9			
2+20	ELEVATION															0.0						
	DISTANCE																					
	ELEVATION																					
	DISTANCE																					
	ELEVATION																					
	DISTANCE																					

The top 6" is accounted for in the stripping quantity

VOLUME

340.0 CU. YD ✓

TOTAL VOLUME

340.0 CU. YD

4/1/14

SURFACE TO SURFACE VOLUME REPORT

15/17

Trimble
5475 Kellenburger Road
Dayton, Ohio 45424-1099, USA
1-937-233-8921

Project: H:\terramodel\DATA\Tvitteireim WRP.pro
Report Generated: Wednesday, January 07, 2015 3:24:05 PM

Where the second surface is above the first the volume is reported as fill.
Where the second surface is below the first the volume is reported as excavation.

Shrinkage/swell factors:		Excavation	1.0000	Fill	1.0000
First Surface Layer Name	Number of Points	Second Surface Layer Name	Number of Points		
POINTS	2,536	DAMEAST	81		
Excavation Volume (Cu. Yd.)		Fill Volume (Cu. Yd.)			
0.0		542.1			

Net Difference: 542.1 Cu. Yd. Borrow

EARTH FILL = DAM FILL + DAM STRIPPING + CORE
= 542 + 123 + 340

EARTH FILL = 1005 CY

EARTH FILL w/ ^{5%} SETTLEMENT = 1055

NRCS-ENG-523A Rev. 10-97

STATE SD		PROJECT TWINNEREIM WRP	
BY SICRN	DATE 1-20-95	CHECKED BY G.C.D.	DATE 5.5.95
SUBJECT BOUYANCY CUMPS		JOB NO.	
		SHEET 16 OF 17	

BASED ON EFM 3-11 THROUGH 3-14

ESTIMATED PRECAST RISER WEIGHT = 1,840 lbs

WEIGHT OF EARTH ON RISER

BOUYANT SOIL = 50 lb/ft³ RISER HT = 2'

$$\text{FOOTING AREA} = \pi \left(\frac{25.5 \text{ in}}{12 \text{ in/ft}} \right)^2 - \pi \left(\frac{18 \text{ in}}{12 \text{ in/ft}} \right)^2 = 6.7 \text{ ft}^2$$

$$\text{EARTH WEIGHT} = \text{FOOTING AREA} (\text{HT}) \text{ SOIL} = 6.7 (2') 50 \text{ lb/ft}^3 = 670 \text{ lb}$$

BAFFLE WEIGHT

10 GAUGE STEEL WEIGHS 5.625 lb/ft²

$$\text{BAFFLE} = 4.5' \times 1.33' = 6 \text{ ft}^2$$

$$\text{BAFFLE WT} = 6 \text{ ft}^2 (5.625 \text{ lb/ft}^2) = 33.8 \text{ lb}, \approx 34 \text{ lb}$$

$$\text{TOTAL SUBMERGED WT} = \text{RISER} + \text{EARTH} + \text{BAFFLE} = 1840 + 670 + 34 = \underline{\underline{2544 \text{ lbs}}}$$

BOUYANT FORCE = VOLUME DISPLACED BY RISER $\times$ WATER UNIT WT.

RISER OUTSIDE DIAMETER = 37" RADIUS = 18.5"

$$\text{RISER VOLUME} = \pi \left(\frac{18.5}{12} \right)^2 2.5' = 18.7 \text{ ft}^3$$

$$\text{FOOTING VOLUME} = 6.7 \text{ ft}^2 (0.5') = 3.4 \text{ ft}^3$$

$$\text{BOUYANT FORCE} = (18.7 + 3.4) 62.4 \text{ lb/ft}^3$$

$$\text{BOUYANT FORCE} = \underline{\underline{1379 \text{ lb}}}$$

$$\text{Safety Factor} = \frac{\text{TOTAL WT}}{\text{BOUYANT FORCE}} = \frac{2544 \text{ lb}}{1379 \text{ lb}} = 1.84 \text{ SF} > 1.5 \text{ SF} \checkmark$$

RISER WILL NOT FLOAT

STRUCTURE DATA

DRAINAGE AREA ACRES	ANNUAL YIELD @ 50% AC.FT.	PEAK RUNOFF 50 YR. CFS. (25or50yr)	EMERG. SPWY. 50 YR. CFS.	WATER DEPTH @ P.S. FT.	SURFACE AREA @ P.S. ACRES	SEDIMENT STORAGE AC.FT.	STORAGE		
							@ P.S. AC.FT.	@ E.S. AC.FT.	@ TOP OF DAM AC.FT.
380	11.7	329.2	1.6	7.0' 3.4'	35.3	6.1	149.3	203.5	280.2

7.0' in Wetland; 3.4' in Ditch

CONSTRUCTION & DESIGN NOTES

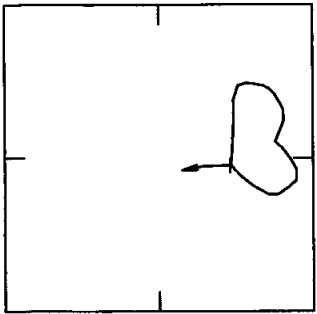
1. S.D. LAW STATES: "NO EXCAVATOR MAY BEGIN ANY EXCAVATION WITHOUT FIRST NOTIFYING THE ONE-CALL NOTIFICATION CENTER AT THE NUMBER 1-800-781-7474."

2. LANDOWNER IS RESPONSIBLE FOR COMPLYING WITH ALL FEDERAL, STATE, AND LOCAL LAWS AND MAINTAINING THIS DAM IN ACCORDANCE WITH S.D. OPERATION & MAINTENANCE GUIDELINES.

3. THIS PROJECT IS X IS NOT CLASSIFIED AS A "DAM" BY S.D. LAW. ACCORDING TO S.D. LAW, A STRUCTURE IS CLASSIFIED AS A DAM IF IT IS > THAN 25 FT HIGH (TOP TO D.S. TOE) AND IMPOUNDS > THAN 15 AC FT OR IF IT IS > THAN 6 FT HIGH AND IMPOUNDS > THAN 50 AC FT.
4. IF CULTURAL RESOURCES ARE DISCOVERED, DISCONTINUE CONSTRUCTION AND NOTIFY THE LOCAL NRCS OFFICE.

5. SEED ABOVE HWL, THE TOP AND BACKSLOPE OF DAM, THE E.S., ALL DIKES, AND ALL DISTURBED AREAS DESIGNATED BY THE ENGINEER.

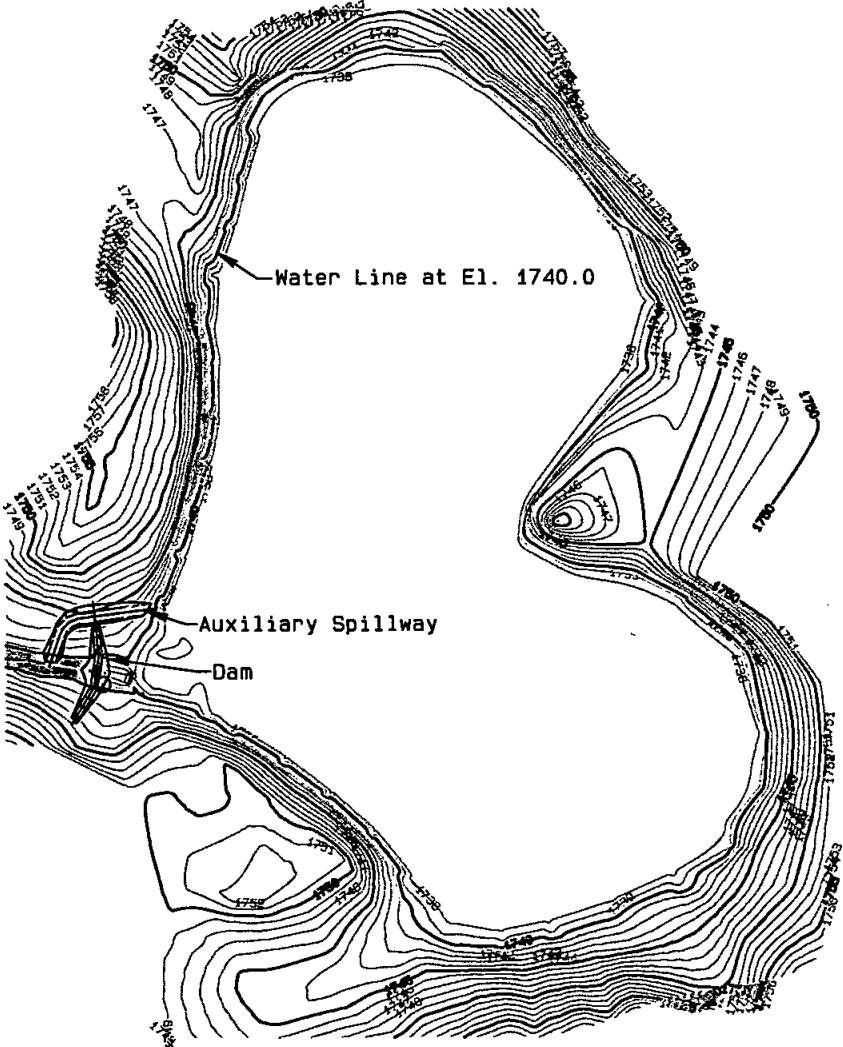
6. SCARIFYING & STRIPPING OF THE CORE TRENCH SHALL BE INSPECTED AND APPROVED BY AUTHORIZED PERSONNEL PRIOR TO BACKFILL. EXCAVATE CORE TRENCH 1 FT INTO IMPERMEABLE MATERIAL. MINIMUM CORE TRENCH IN UN-DISTURBED GROUND IS 2 FT. CONSTRUCT THE FULL DEPTH OF THE CORE TRENCH TO HWL. ELEV. (see Profile of Embankment).



E2 SEC. 29 T123R56
LOCATION MAP

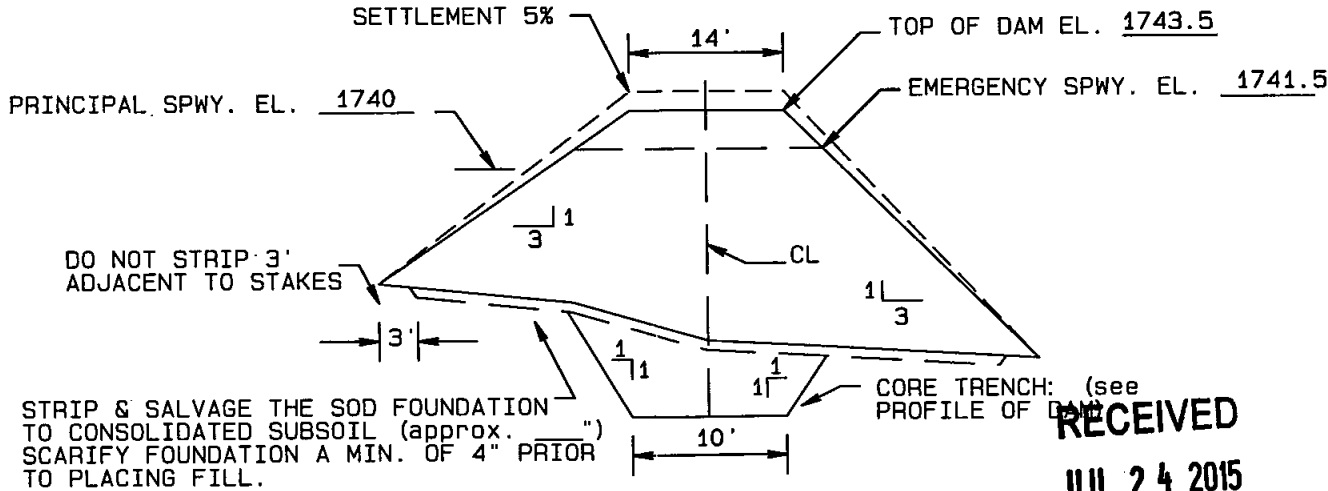
TABLE OF QUANTITIES

ITEM	UNIT	QUANT.	AS BUILT
EXCAVATION			
STRIPPING DAM & AS	CY	294	
CORE TRENCH	CY	340	
AUXILIARY SPILLWAY	CY	433	
EARTH FILL--EMBANKMENT AND CORE	CY	1055	
PRINCIPAL SPILLWAY			
2' CONCRETE RISER	EACH	1	
PVC PIPE ASTM D3034 SDR 26	LF	50	
INLET BAFFLE	EACH	1	
DRAIN FILTER MATERIAL	CY	3.7	
GEOTEXTILE	SY	19	
ROCK RIPRAP	CY	6.6	
SEEDING			
SILT FENCE	LF	30	



PLAN VIEW OF DAM & POOL AREA

approximate scale 1" = 400 ft.



TYPICAL CROSS SECTION OF DAM

S. D. CONSTR. & MATERIAL SPECS.

- SD - 3

SD - 4

SD - 5

SD - 7S

SD - 8

SD - 10

SD - 17

SD - 20

SD - 28

SD - 55

SD - 95

SD - 96

SD - 592
- STRUCTURE REMOVAL

STRIPPING

EXCAVATION

EARTH FILL CLASS "S"

ROCK RIPRAP AND BEDDING

SALVAGING & SPREADING TOPSOIL

METAL FAB. & INSTALLATION

PLASTIC PIPELINE IRRIGATION

SEEDING

PLASTIC PIPE

GEOTEXTILE

SILT FENCE

GEOTEXTILE

The above specifications are incorporated by reference. For full text versions, see:
http://www.sd.nrcs.usda.gov/technical/SD_Engineering.html

EARTH DAM

Tvinnereim Trust WRP

E2, S 29, T 123, R 56

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

Designed Stern Date 1-15

Drawn Stern Date 1-15

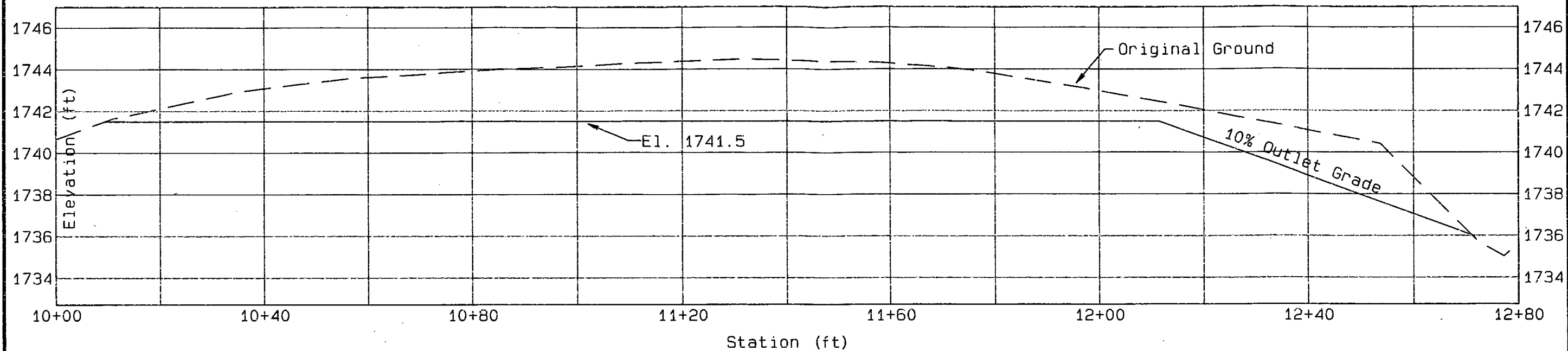
Checked [Signature] Date 5-15

Approved by: [Signature]

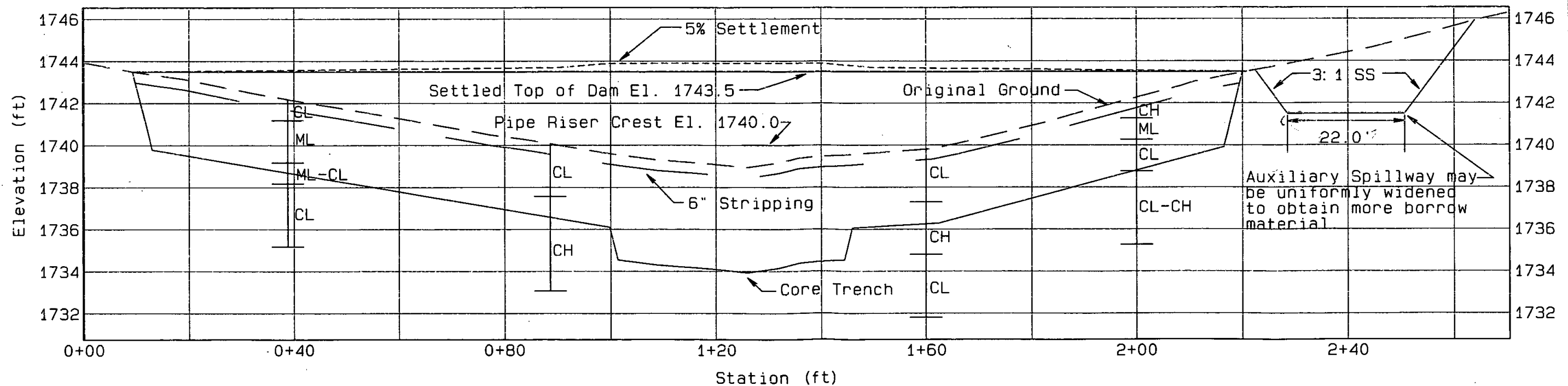
Title: Agricultural Engineer

Sheet 1 of 6 File Name: Tvinnereim WRP

PROFILE ALONG CENTERLINE OF AUXILIARY SPILLWAY



TYPICAL AUXILIARY SPILLWAY CROSS SECTION



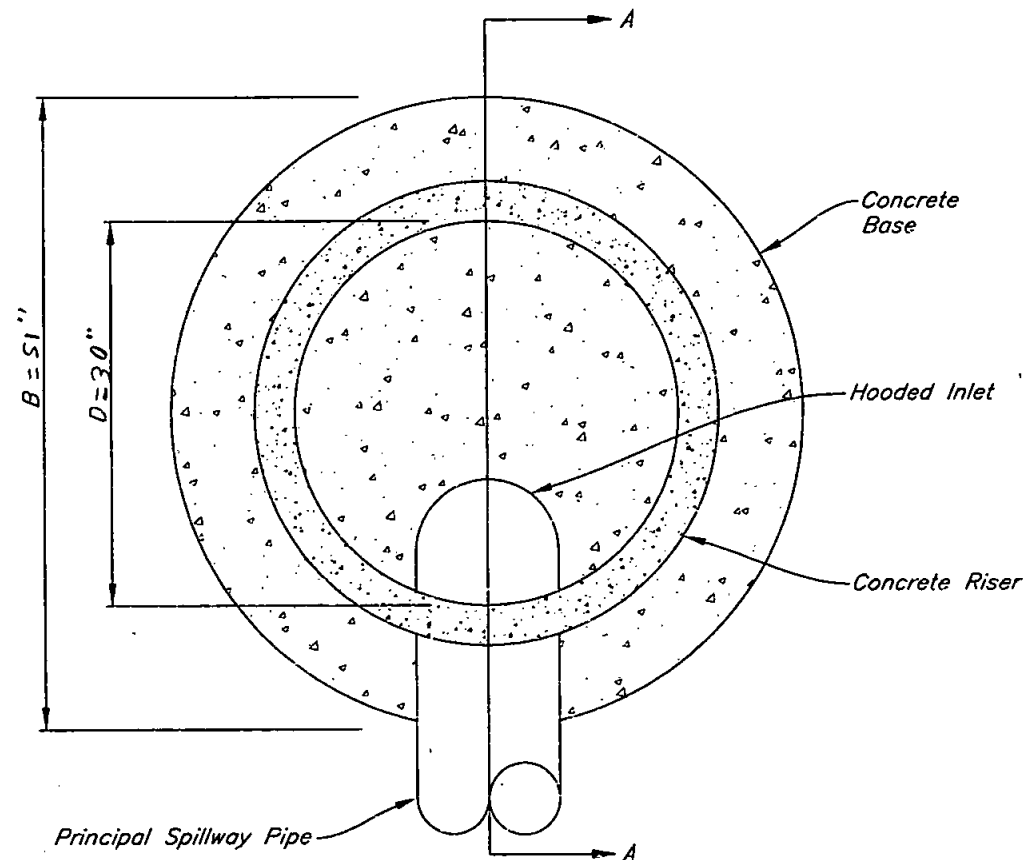
Date	1-15
Designed	Laura Stern
Drawn	Laura Stern
Checked	1-15
Approved	

PRODUCER	Twinerim Trust WRP
E2	SECTION 29 T.123 R. 56
Day	COUNTY
Day	CONSERVATION DISTRICT

USDA - NRCS
Brookings Field Support Office
520 Third Street
Brookings, South Dakota 57006

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

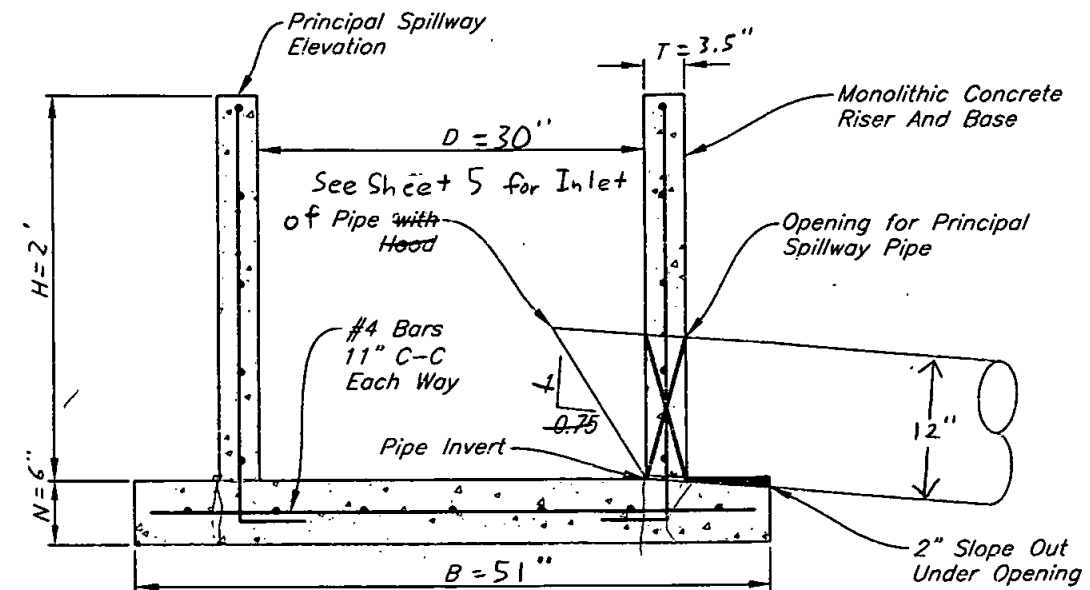
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Drawing No.	
1/16/2016 4:20PM	
Sheet 3 of 5	



PLAN VIEW PRECAST RISER AND BASE

CONSTRUCTION NOTES

1. The riser and base is precast reinforced concrete and is manufactured according to ASTM C478 Standard Specification For Precast Reinforced Concrete Manhole Sections.
2. Provide a watertight joint between the precast concrete riser and the principal spillway pipe barrel.
3. Contact NRCS prior to installation for other options for the construction of the riser if a precast monolithic riser and base is not used.



SECTION VIEW A-A

GUIDE TABLE FOR PRECAST RISER AND BASE DIMENSIONS						
(D) RISER DIAMETER	(H) RISER HEIGHT	(T) WALL THICKNESS	(B) BASE DIAMETER	(N) BASE THICKNESS	ESTIMATED WEIGHT	DIA. PIPE BARREL
30"	4.2'	3.5"	51"	6"	2,600 LBS 1,840	10" to 18"
30"	4.5'	3.5"	51"	6"	2,790 LBS	10" to 18"
30"	5'	3.5"	51"	6"	2,980 LBS	10" to 18"
36"	4'	4"	64"	6"	3,770 LBS	10" to 24"
36"	4.5'	4"	64"	6"	4,030 LBS	10" to 24"
36"	5'	4"	64"	6"	4,290 LBS	10" to 24"
36"	5.5'	4"	64"	6"	4,550 LBS	10" to 24"
36"	6'	4"	64"	6"	4,815 LBS	10" to 24"
48"	4'	5"	79"	8"	6,870 LBS	10" to 30"
48"	4.5'	5"	79"	8"	7,300 LBS	10" to 36"
48"	5'	5"	79"	8"	7,740 LBS	10" to 36"
48"	5.5'	5"	79"	8"	8,170 LBS	10" to 36"
48"	6'	5"	79"	8"	8,600 LBS	10" to 36"

PRECAST CONCRETE RISER AND BASE
WITH HOODED INLET
REV. 1/2012

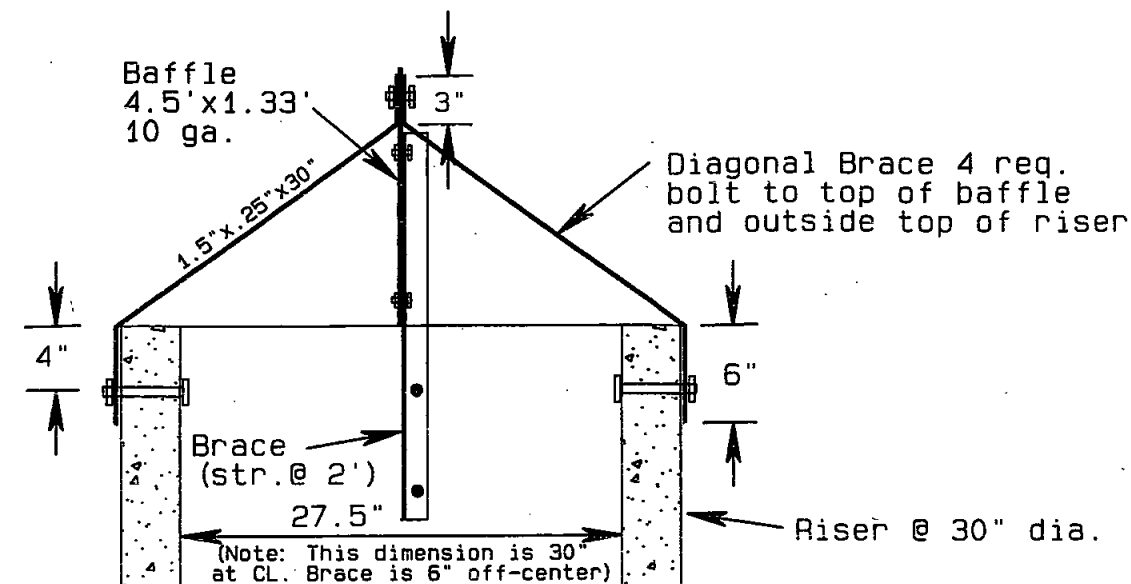
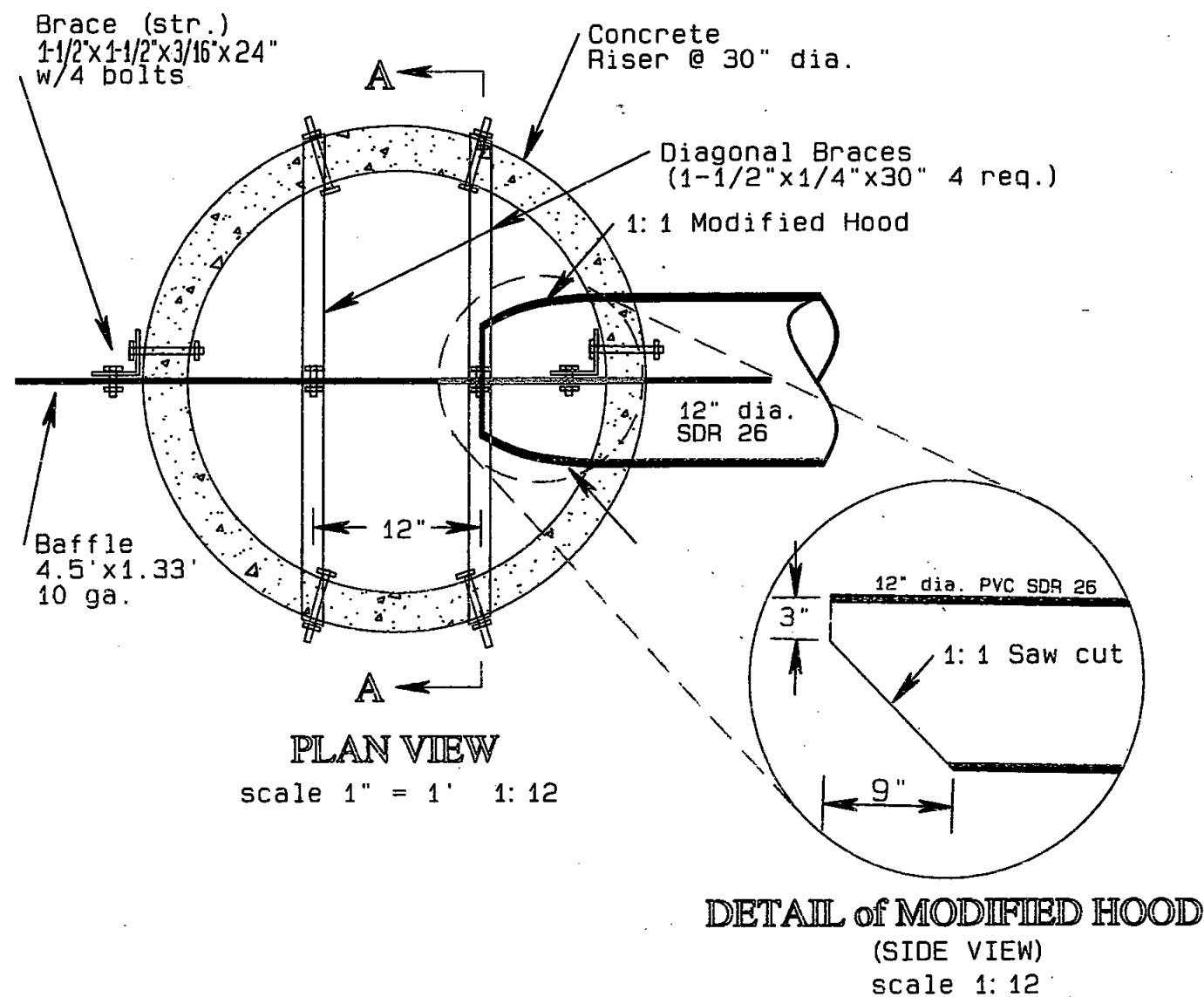
Date 1-15
Designed STERN
Drawn _____
Checked _____
Approved _____

NAME: Twinning Trust WRP
378 POND
PRECAST CONCRETE RISER AND BASE WITH HOODED INLET
E2, Sec 29, T 123, R 56 DAY _____ County, South Dakota

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

File No.
JP 1-0_P.dwg
Drawing No.

4/13/12 3:00 PM
Sheet 4 of 6

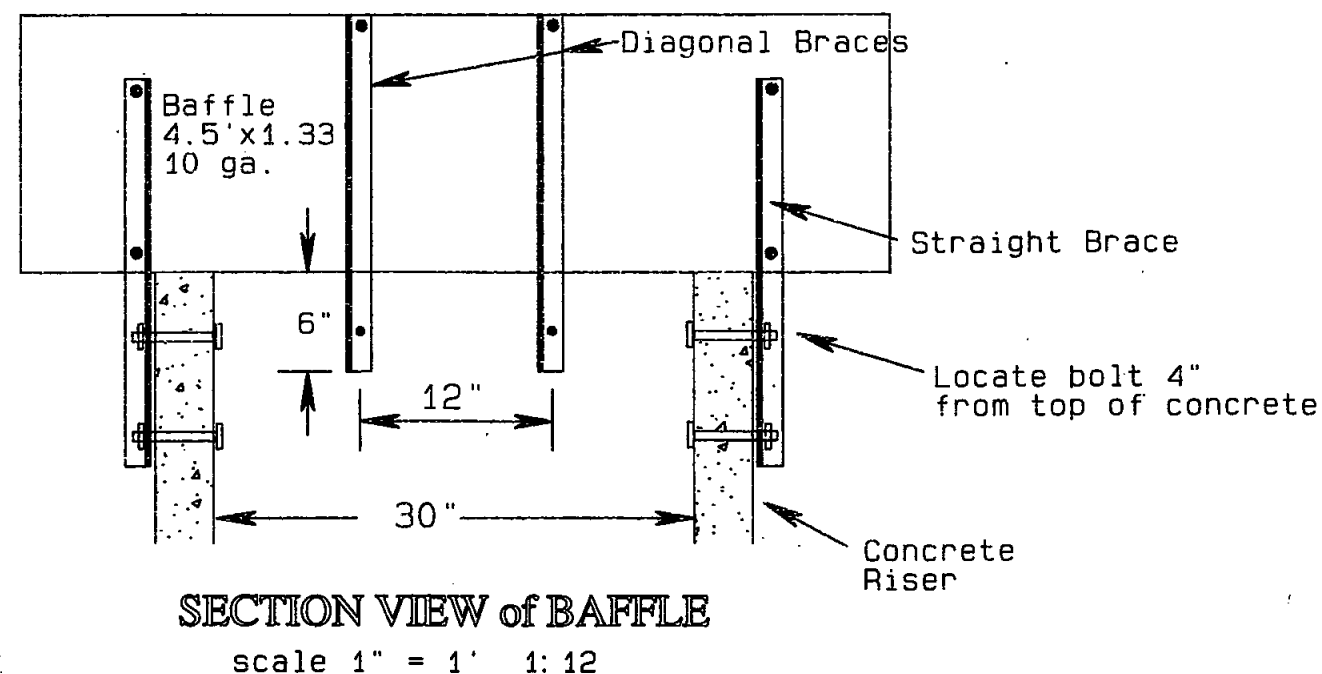


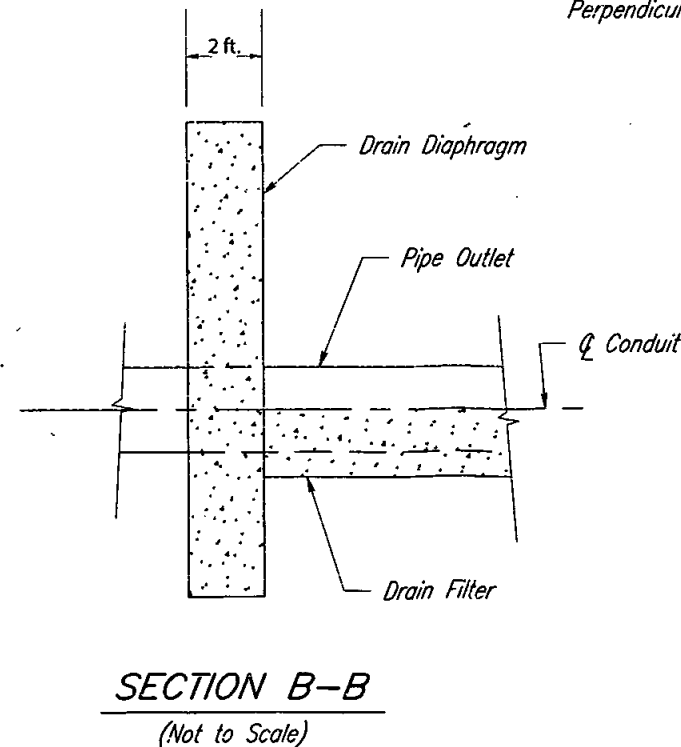
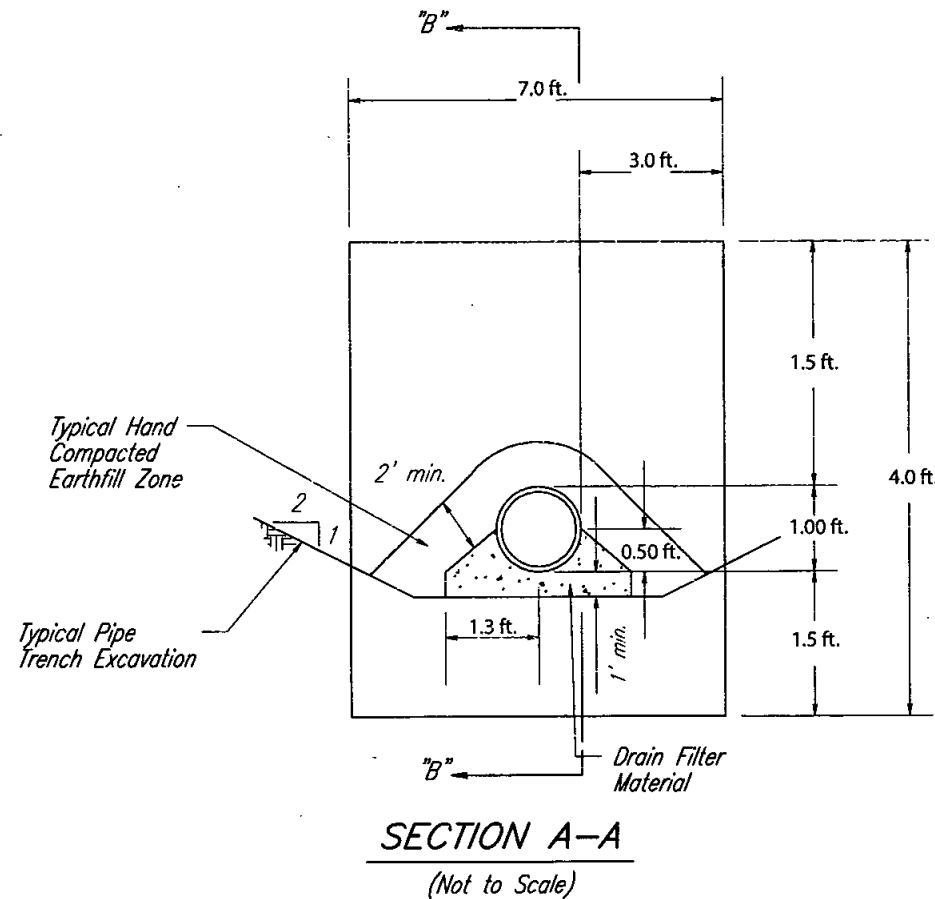
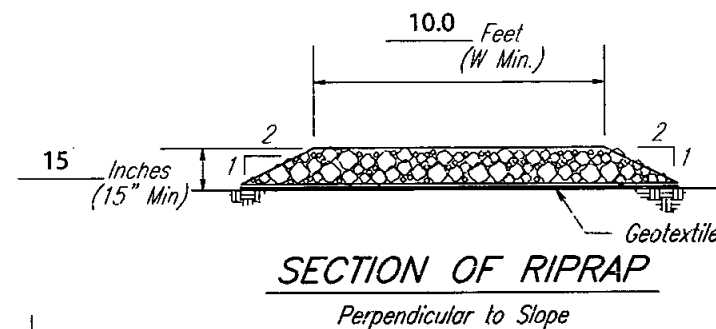
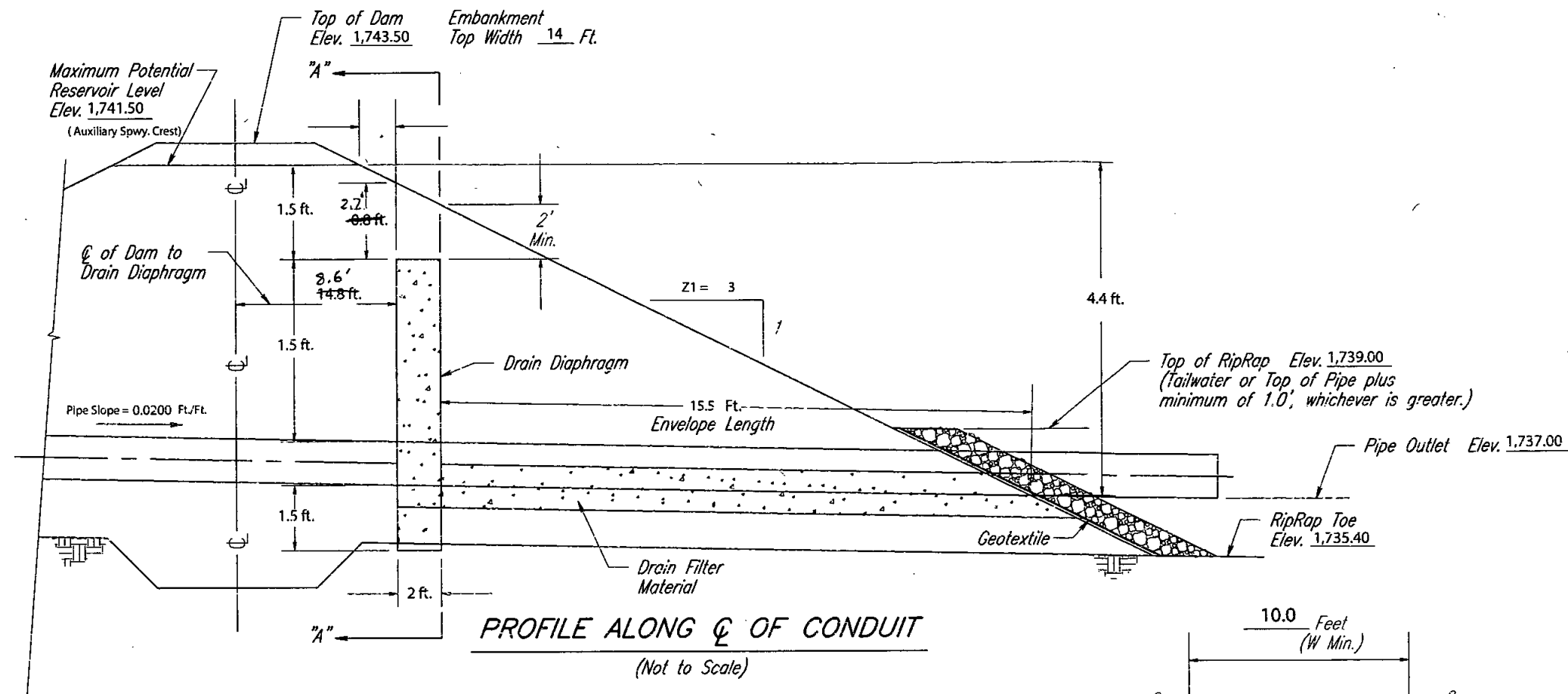
NOTE:

- 1.) All cuts shall be shear or saw cuts.
- 2.) All bolts are 1/2" dia. and shall have a nut and split washer (8 @ 5" long & 6 @ 1.25" long).
- 3.) All bolts, nuts, and washers, shall be galvanized, cadmium plated, or stainless steel.
- 4.) Steel baffle, angles, and flat bar, shall be clean and dry prior to painting. Paint with 2 coats of zinc-rich cold galvanized compound using brush, or aerosol application, or zinc dust - zinc oxide primer ASTM D79, D520, or D4146. All welds shall be painted with a base coat prior to the 2 main coats.
- 5.) The one-piece 4.5'x1.33' baffle shall be perpendicular to dam CL.

TABLE OF QUANTITIES

ITEM DESCRIPTION	UNIT	QUANTITY	AS BUILT
4'-6" x 1'-4" x 10 ga. steel	EACH	1	
Steel equal angles (1-1/2" x 1-1/2" x 3/16" x 24" 2 req.)	LIN. FT.	4	
Bolts, Nuts, & Washers	JOB	1	
Steel Flat bar (1-1/2" x 1/4" x 30" 4 req.)	Lin. Ft.	10	





SUMMARY OF DESIGN AND DIMENSIONS

DESIGN DATA	
H = 1.5 Feet	Hd = 4.40 Feet
X = 3.0 Feet	D = 12 Inches
R = 1.5 Feet	Y = 1.5 Feet
C = Feet	Aggregate Gradation #1
Embankment Backslope (Z1) = 3.0 Pipe Slope (S) 0.0200 Ft./Ft.	
DIMENSIONS	
W = 7.0 Feet	(Total Width of Drain Diaphragm)
T = 4.0 Feet	(Total Height of Drain Diaphragm)
t = 2 Feet	(Thickness of Single Filter)

ESTIMATED QUANTITIES

Drain Filter Material	3.7 Cubic Yards
Geotextile	19.0 Square Yards
Rock Riprap	6.6 Cubic Yards

DRAIN FILTER MATERIAL GRADATION

SIEVE SIZE	PERCENT PASSING
3/8 in.	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	2-30
#100	0-10

ASTM C-#33
FINE CONCRETE
AGGREGATE GRADATION

ROCK RIPRAP GRADATION

PERCENT SMALLER	WEIGHT RANGE (LBS.)	AVERAGE CUBIC DIMENSION
100	50 lb.	10"
50-80	30 lb.	7"
15-50	10 lb.	5"
0-15	3 lb.	3"

CONSTRUCTION NOTES

- The Drainage Diaphragm and envelope will be installed by placing Drain Filter Material in maximum 15 inch thick uncompacted lifts. Each lift will be saturated uniformly with approximately 1.2 gallons of water per cubic foot of loose Drain Filter Material prior to compaction. Each lift will then be compacted by a minimum of two passes of a hand-directed vibratory compactor over the entire lift surface. No compaction of the drain envelope above the pipe invert will be required.
- The maximum height of drop of the Riprap onto the Geotextile in the pipe outlet area shall be 3 feet.

MATERIAL NOTES

- The Geotextile shall conform to the Class 1 requirements specified in Table 2 for Nonwoven Geotextiles in Material Specification SD-592.

DRAINAGE DIAPHRAGM DETAILS

REVISIONS		
DATE	APPROVED	TITLE
07/31/2009	July 31, 2009	State Conservation Engineer

JOB PLAN 3.8 (07/2009)

Designed	Stern	Date	1-12-15
Drawn			
Checked			
Approved			

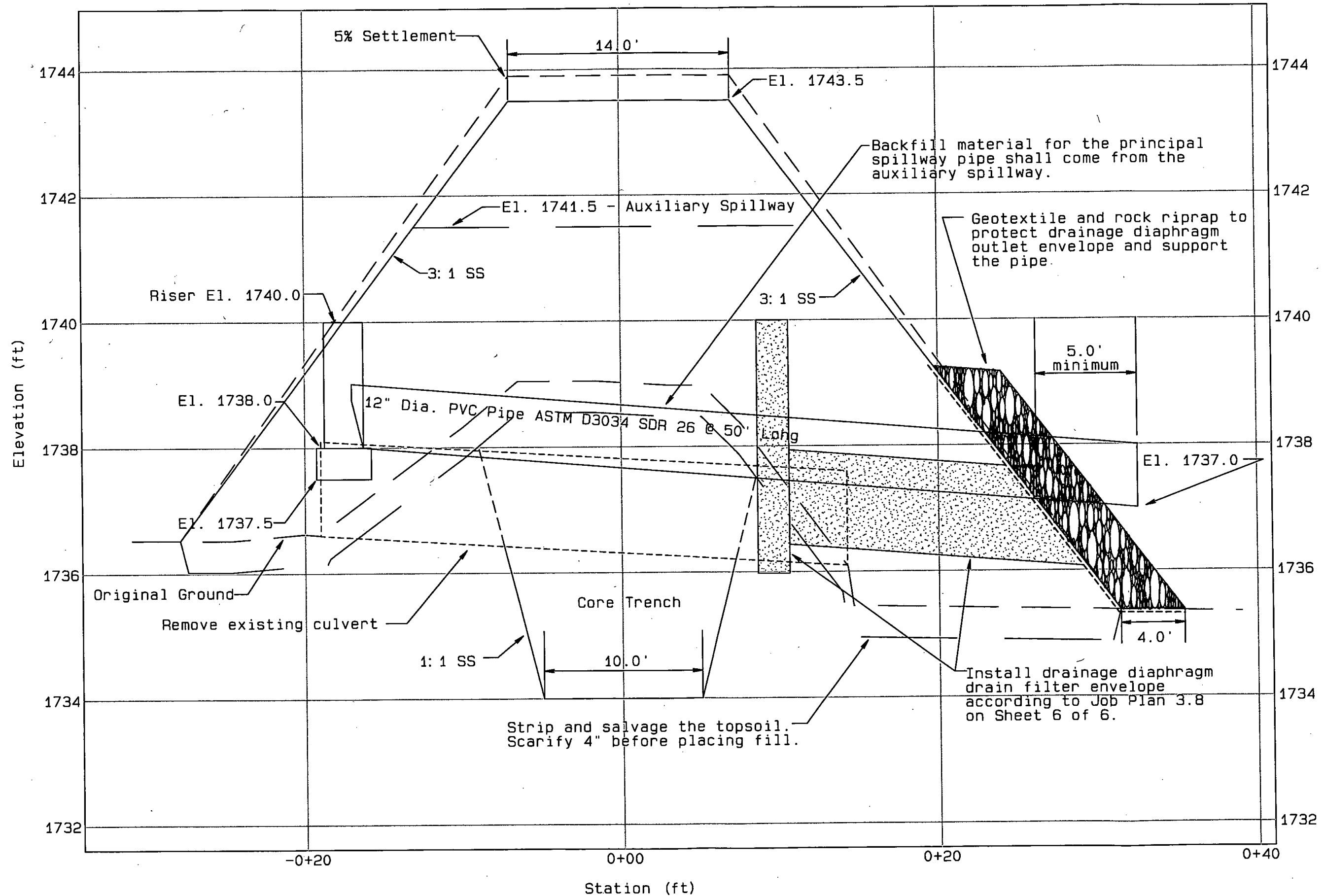
PRODUCER	Twinreim WRP
SECTION	29
T	123
R	56
Day	COUNTY
Day	CONSERVATION DISTRICT

USDA - NRCS
State Office Engineering Staff
200 Fourth Street SW
Huron, South Dakota 57350

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

File Name:	SDJobPlan_Drainage Diaphragm 3.8 07 2009.dwg
Drawing No.	
7/21/2009 2:23PM	
Sheet	6 of 6

PROFILE OF PRINCIPAL SPILLWAY



Date	1-15
Designed	Laura Stern
Drawn	Laura Stern
Checked	
Approved	

PRODUCER	Tinnereim Trust WRP
E2	SECTION 29 T.123 R.56
Day	COUNTY
Day	CONSERVATION DISTRICT

USDA - NRCS
 Brookings Field Support Office
 520 Third Street
 Brookings, South Dakota 57006

NRCS
 Natural Resources Conservation Service
 United States Department of Agriculture

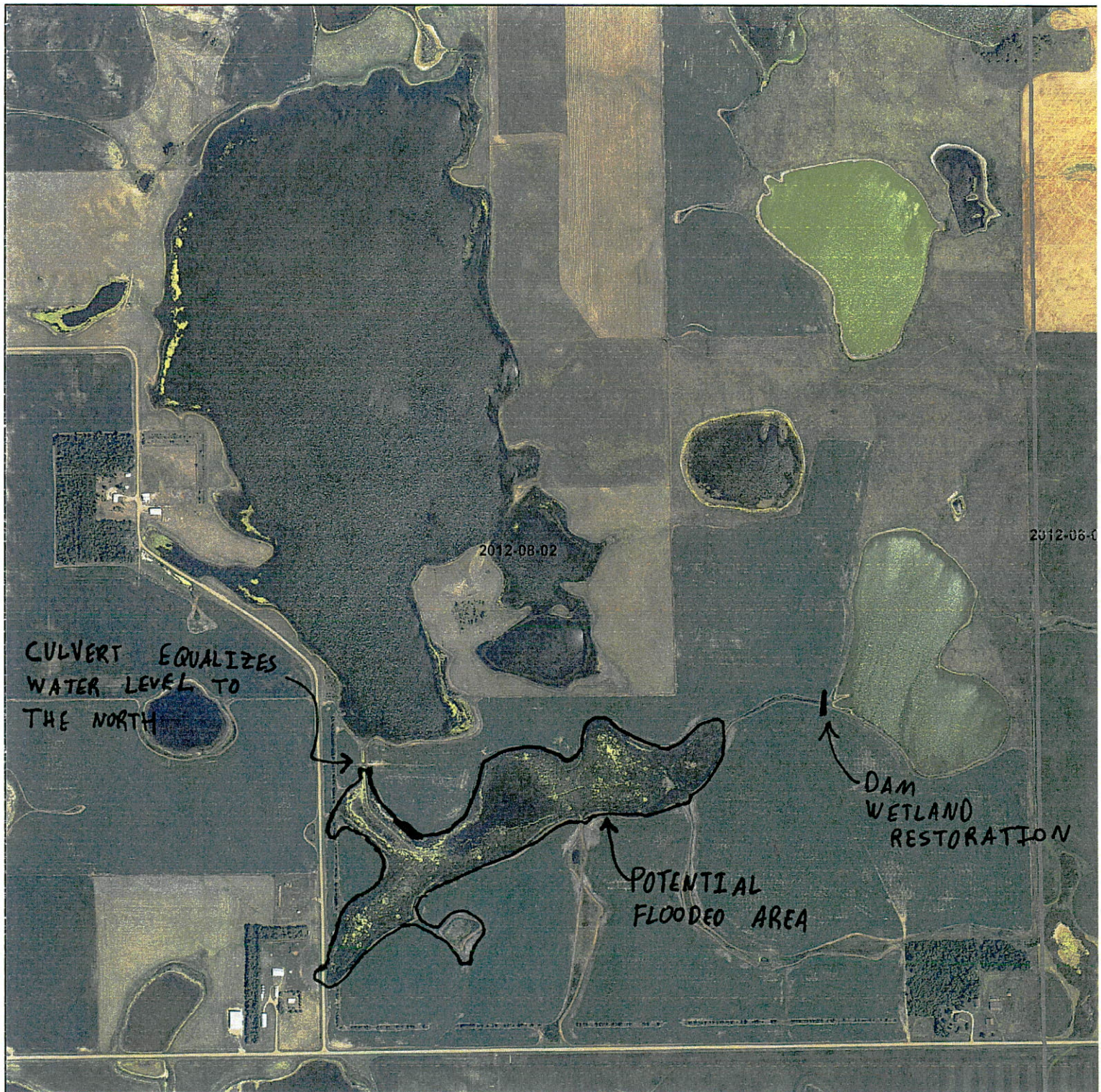
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5/7/2016 3:06PM	
Sheet	2 of 6

Potential Flooded Area if the Dam Breached

Field Office: Webster FO

Agency: USDA-NRCS

Legal Desc: E1/2 Sec 29, T123N, R56W



0 320 640 1,280 1,920 2,560 3,200 3,840
Feet



United States Department of Agriculture



Natural Resources Conservation Service
Field Support Office
520 Third Avenue
Brookings, SD 57006

Telephone: (605) 692-2344
Fax: (605) 697-5374

May 8, 2015

Leon and Virginia Tobin
Tvinnereim Trust
1716 S. Roosevelt St.
Aberdeen, SD 57401

Rod Tobin
Tvinnereim Trust
415 South Main Street
Aberdeen, SD 57402

Dear Tvinnereim Trust:

The USDA Natural Resources Conservation Service (NRCS) has designed a wetland restoration for you in the E ½ of Section 29, Township 123 North, and Range 56 West, in Day County. Due to the overall height from the top of the dam to the downstream toe (8.1') and the storage capacity below the top of the dam that would flow downstream (200 acre-feet), the wetland restoration falls within the size category in which potential downstream damage should be considered in the unlikely event the dam should fail. Under the Dam Safety Act, we are required to analyze damage potential on all such dams. This does not reflect on the adequacy of the design or construction.

A general evaluation was made of the area below the dam that could be flooded should a sudden failure occur. The evaluation indicated that the flooded area would only affect land enrolled in the Wetland Reserve Program, a township road, fences, and a cattle feedlot. Therefore, it was assigned a class (A) or low hazard rating. The design of the dam was based on this classification.

If future development should occur downstream of the dam or should another dam be built upstream, the hazard classification could change abruptly. You need to be aware of this in order to alert future developers of the hazard that could occur. This is your responsibility.

If you would like a more detailed analysis or in the event of future development in the area downstream of the dam, NRCS is ready to assist you in evaluating the potential impact area on the downstream development should there be a sudden failure of the dam.

I am sending a copy of this letter and attached map to the South Dakota Department of Environment and Natural Resources (DENR), which is the state agency responsible for dam safety. Due to the storage of this wetland restoration, the DENR will be performing a Safety of Dams Review of the dam design.

If you have any questions on this matter, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Laura Stern".

Laura Stern, PE
Agricultural Engineer

United States Department of Agriculture



Natural Resources Conservation Service
Field Support Office
520 Third Avenue
Brookings, SD 57006

Telephone: (605) 692-2344
Fax: (605) 697-5374

Attachments: Potential Flooded Area Map

cc: Water Rights Program, Department of Environment and Natural Resources, Joe Foss
Building, 523 E Capitol, Pierre, SD 57501

United States
Department of
Agriculture



NRCS
Natural
Resources
Conservation
Service

Soil Mechanics Level I

Module 1 - Unified Soil Classification System

Study Guide

PART A - TERMS AND DEFINITIONS

ACTIVITY 11 - PLASTIC LIMIT AND PLASTICITY INDEX

DEFINITIONS AND DISCUSSION

PLASTIC LIMIT - is the water content at which a soil changes from the plastic to the semi-solid state of consistency. This change is not an abrupt change. The plastic limit consequently is somewhat arbitrary by definition.

The plastic limit is the water content at which a soil being dried begins to crumble when rolled into a thread approximately 1/8-inch in diameter. To determine a soils' plastic limit, the portion of the sample finer than the No. 40 sieve is used. A sample is wetted to a water content within the plastic state of consistency - that is to a water content at which a 1/8-inch thread can be rolled without the sample cracking or crumbling. Then, the sample is gradually dried by adding small amounts of dry soil and thoroughly mixing, or by continuous kneading of the soil. Periodically, a 1/8-inch thread is rolled out as the sample is dried. After a certain amount of drying, you will no longer be able to roll out the 1/8-inch diameter thread without it crumbling, and you will not be able to reform a ball of soil. At that point, the plastic limit of the soil has been reached, and a water content test is performed on the sample. This water content is the plastic limit of the soil.

If a 1/8-inch thread cannot be rolled out at any water content tried, then the soil is described as non-plastic.

The ASTM procedure for performing the plastic limit test is ASTM D4318.

PLASTICITY INDEX - is the numerical difference between the liquid limit and plastic limit water contents of a soil:

$$PI = LL - PL$$

This value identifies the range of water content over which a soil has plastic behavior characteristics. Soils with PI values less than 8 are low in plasticity. Soils with PI values greater than 30-40 are high in plasticity.

Complete the problems on the following page before continuing.

Cooperator TVI NARRAGANSETT County DAY Date 7-1-14
Practice WETLAND RESTORATION Cons. District DAY Hole No. 1
Farm _____ Tract _____ Field E2 Sec 29 T 123 R 56 Soil Name _____
Investigator S. Winter/L. Stern Hole El. 1742.4 Sampled _____ Drilling Location _____

[illegible]

Notes:

Unified Symbols and Group Names	Agricultural Waste Management Field Handbook, Chapter 10								
	Table 10D-3 (1161 test results)			Table 10D-2					
	Soil Group	Median K, cm/s	Median K, ft/d	Unified Class	Perm Group				In Perm Group
					I	II	III	IV	
GW = Well graded gravel, gravel-sand mix, few fines	I	7.2x10-4	2.0	CH	N	N	S	U	A=Always
GP = Poorly graded gravel, gravel-sand mix, few fines		3.5x10-4	1.0	MH	N	S	U	S	
GC = Clayey gravel, gravel-sand-clay mix	II	4.8x10-6	0.014	CL	N	S	U	S	
GM = Silty gravel, gravel-sand-silt mix		1.5x10-6	0.004	ML	N	U	S	N	
SW = Well graded sand, gravelly sand with few fines	II	4.8x10-6	0.014	CL-ML	N	A	N	N	S=Sometimes
SP = Poorly graded sand, gravelly sand with few fines		1.5x10-6	0.004	GC	N	S	U	S	
SC = Clayey sand, sand-clay mix	III	8.8x10-7	0.0025	GM	S	U	S	S	
SM = Silty sand, sand-silt mix		2.1x10-7	0.0006	GW	A	N	N	N	
CL = Lean inorganic clay, low to medium plastic LL < 50	III	8.8x10-7	0.0025	SM	S	S	S	S	
CH = Fat inorganic clay, gravelly/sandy/silty clay LL > 50		2.1x10-7	0.0006	SC	N	N	U	S	
CL-ML = Silty Clay	IV	4.9x10-7	0.0014	SW	A	N	N	N	
OL = Organic silts and organic silty clays, low plasticity		3.5x10-8	0.0001	SP	A	N	N	N	
OH = Organic silt/clay, medium to high plasticity	IV	3.5x10-8	0.0001	GP	A	N	N	N	
ML = Inorganic silt, very fine sand, low plastic LL < 50									
MH = Inorganic silt, fine sand or silty soils LL > 50									

Location In Section (x)



N

1197a

DRILLING LOG DOCUMENTATION

Cooperator TWINNER ELM County DAY Date 7-1-14
Practice WETLAND RESTORATION Cons. District 1-1 Hole No. 2
Farm _____ Tract _____ Field E2 Sec 29 T 123 R 56 Soil Name OLD FARM-LIKE
Investigator WINTER Hole El. 1739.8 Sampled _____ Drilling Location _____

Depth, feet	Unified Symbol	Group Name Soil Material	Description of Material							
0			Depth feet	Munsell Color	USDA Texture	Unified Classification	Geological Material (Oxidized ?)	WT:	Permeability Group c/ass	Other: (Concretions, Stratification, Moisture Content, etc.)
5			0-2.5	10YR2/1	SicL	CL	Clayey Alluvium	2.5' - when logged		
			2.5-5	2.5Y3/1	Sic	CH	Clayey Alluvium			
10			5-8	2.5Y6/2	CL	CL	Glacial Till			
15										
20										
25										

Notes: CORE TO 3.5'

4-5 FT DEPT OTHERWILL

WILL BE VISUAL SUGGEST WHEN CAN'T RECOVER CORE

Unified Symbols and Group Names			Agricultural Waste Management Field Handbook, Chapter 10			
GW = Well graded gravel, gravel-sand mix, few fines			Table 10D-3 (1161 test results)		Table 10D-2	
GP = Poorly graded gravel, gravel-sand mix, few fines			Soil Group	Median K cm/s	Median K ft/d	Unified Soil Group
GC = Clayey gravel, gravel-sand-clay mix						Perm Group
						In Perm

Notes: CORE TO 3.5'

4-5' OF DRILL OTHERWELL

WELL LOG WITH SUGGESTED CORRECTIONS

Location In Section (x)

	X



N

Unified Symbols and Group Names		Agricultural Waste Management Field Handbook, Chapter 10								
GW = Well graded gravel, gravel-sand mix, few fines GP = Poorly graded gravel, gravel-sand mix, few fines GC = Clayey gravel, gravel-sand-clay mix GM = Silty gravel, gravel-sand-silt mix SW = Well graded sand, gravelly sand with few fines SP = Poorly graded sand, gravelly sand with few fines SC = Clayey sand, sand-clay mix SM = Silty sand, sand-silt mix CL = Lean inorganic clay, low to medium plastic LL < 50 CH = Fat inorganic clay, gravelly/sandy/silty clay LL > 50 CL-ML = Silty Clay OL = Organic silts and organic silty clays, low plasticity OH = Organic silt/clay, medium to high plasticity ML = Inorganic silt, very fine sand, low plastic LL < 50 MH = Inorganic silt, fine sand or silty soils LL > 50		Table 10D-3 (1161 test results)			Table 10D-2					
		Soil Group	Median K, cm/s	Median K, ft/d	Unified Class	Perm Group I II III IV				In Perm Group
		I	7.2x10-4	2.0	CH	N	N	S	U	A=Always
		I	3.5x10-4	1.0	MH	N	S	U	S	
					CL	N	S	U	S	N=Never
					ML	N	U	S	N	
		II	4.8x10-6	0.014	CL-ML	N	A	N	N	S=Sometimes
		II	1.5x10-6	0.004	GC	N	S	U	S	
					GM	S	U	S	S	U=Usually
		III	8.8x10-7	0.0025	GW	A	N	N	N	
		III	2.1x10-7	0.0006	SM	S	S	S	S	
					SC	N	N	U	S	
		IV	4.9x10-7	0.0014	SW	A	N	N	N	
		IV	3.5x10-8	0.0001	SP	A	N	N	N	
					GP	A	N	N	N	

DRILLING LOG DOCUMENTATION

Cooperator TVN/WRP County DAY Date 7-1-14
Practice WETLAND RESTORATION Cons. District DAY Hole No. 3
Farm _____ Tract _____ Field E2 Sec 29 T 123 R 56 Soil Name PARNELL LAKE
Investigator S. Winter/L. Stern Hole El. 1740.1 Sampled _____ Drilling Location _____

Depth, feet	Unified Symbol	Group Name Soil Material	Description of Material						
			Depth feet	Munsell Color	USDA Texture	Unified Classification	Geological Material (Oxidized ?)	WT:	Permeability Group class
0									
5			0-1	2.5Y3/1	CL	CL			
			1-2.5	10YR2/1	S:CL	CL	CLAYEY SAND	2.5	
			2.5-7	2.5Y3/1	S:CL	CH	CLAYEY SAND		
10									
15									
20									
25									

Notes: 3.5' LOPE

Location In Section (x)

	X



N

Unified Symbols and Group Names		Agricultural Waste Management Field Handbook, Chapter 10					
		Table 10D-3 (1161 test results)			Table 10D-2		
Soil Group	Median K, cm/s	Median K, ft/d	Unified Class	Perm Group I II III IV	In Perm Group		
I	7.2x10-4	2.0	CH	N N S U	A=Always		
I	3.5x10-4	1.0	MH	N S U S			
			CL	N S U S			
II	4.8x10-6	0.014	ML	N U S N	N=Never		
II	1.5x10-6	0.004	CL-ML	N A N N			
			GC	N S U S			
III	8.8x10-7	0.0025	GM	S U S S	S=Sometimes		
III	2.1x10-7	0.0006	GW	A N N N			
			SM	S S S S			
IV	4.9x10-7	0.0014	SC	N N U S			
IV	3.5x10-8	0.0001	SW	A N N N			
			SP	A N N N	U=Usually		
			GP	A N N N			

GW = Well graded gravel, gravel-sand mix, few fines
GP = Poorly graded gravel, gravel-sand mix, few fines
GC = Clayey gravel, gravel-sand-clay mix
GM = Silty gravel, gravel-sand-silt mix
SW = Well graded sand, gravelly sand with few fines
SP = Poorly graded sand, gravelly sand with few fines
SC = Clayey sand, sand-clay mix
SM = Silty sand, sand-silt mix
CL = Lean inorganic clay, low to medium plastic LL < 50
CH = Fat inorganic clay, gravelly/sandy/silty clay LL > 50
CL-ML = Silty Clay
OL = Organic silts and organic silty clays, low plasticity
OH = Organic silt/clay, medium to high plasticity
ML = Inorganic silt, very fine sand, low plastic LL < 50
MH = Inorganic silt, fine sand or silty soils LL > 50

DRILLING LOG DOCUMENTATION

Cooperator WINN County JAY Date 7-1-14
Practice WATER RESOURCES Cons. District DA Hole No. 4
Farm Tract Field E2 Sec 24 T 123 R Soil Name
Investigator S. Winter / L. Stone Hole El. 1742.3 Sampled Drilling Location

Depth, feet	Unified Symbol	Group Name Soil Material	Description of Material							
			Depth feet	Munsell Color	USDA Texture	Unified Classification	Geological Material (Oxidized ?)	WT:	Permeability Group* class	Other: (Concretions, Stratification, Moisture Content, etc.)
0										
5			1-1	2.5Y3/1	CL	CL				
			1-3	10YR 2/1	L	ML	GLASS			
			2-4	2.5Y5/2	L	ML-CL				WETNESS
10			4-7	2.5Y5/3	CL	CL	T			
15										

Notes:

Location In Section (x)

	X



N

Unified Symbols and Group Names		Agricultural Waste Management Field Handbook, Chapter 10								
		Table 10D-3 (1161 test results)			Table 10D-2					
		Soil Group	Median K, cm/s	Median K, ft/d	Unified Class	Perm Group I II III IV				In Perm Group
GW = Well graded gravel, gravel-sand mix, few fines		I	7.2x10-4	2.0	CH	N	N	S	U	A=Always
GP = Poorly graded gravel, gravel-sand mix, few fines		I	3.5x10-4	1.0	MH	N	S	U	S	
GC = Clayey gravel, gravel-sand-clay mix					CL	N	S	U	S	
GM = Silty gravel, gravel-sand-silt mix					ML	N	U	S	N	N=Never
SW = Well graded sand, gravelly sand with few fines		II	4.8x10-6	0.014	CL-ML	N	A	N	N	
SP = Poorly graded sand, gravelly sand with few fines		II	1.5x10-6	0.004	GC	N	S	U	S	S=Sometimes
SC = Clayey sand, sand-clay mix					GM	S	U	S	S	
SM = Silty sand, sand-silt mix		III	8.8x10-7	0.0025	GW	A	N	N	N	U=Usually
CL = Lean inorganic clay, low to medium plastic LL < 50		III	2.1x10-7	0.0006	SM	S	S	S	S	
CH = Fat inorganic clay, gravelly/sandy/silty clay LL > 50					SC	N	N	U	S	
CL-ML = Silty Clay		IV	4.9x10-7	0.0014	SW	A	N	N	N	
OL = Organic silts and organic silty clays, low plasticity		IV	3.5x10-8	0.0001	SP	A	N	N	N	
OH = Organic silt/clay, medium to high plasticity					GP	A	N	N	N	
ML = Inorganic silt, very fine sand, low plastic LL < 50										
MH = Inorganic silt, fine sand or silty soils LL > 50										

DRILLING LOG DOCUMENTATION

Cooperator TVI/NERCOM County CAY Date 7-1-14
Practice WETLAND RESTORATION Cons. District DAY Hole No. Auxiliary Spillway
Farm _____ Tract _____ Field E2 Sec 29 T 123 R 56 Soil Name CLC
Investigator S. Winter/K. Stern Hole El. 1744.6 Sampled _____ Drilling Location _____

Depth, feet	Unified Symbol	Group Name Soil Material	Description of Material					
0			Depth feet	Munsell Color	USDA Texture	Unified Classification	Geological Material (Oxidized ?)	WT:
5			0-3.5	10YR 5/1	CL	CL		
			3.5-4	2.5Y 4/4	CL	CL		
10			4-1	2.5Y 5/3	CL	CLCH		
15								
20								
25								

Notes:

Location In Section (x)

	X



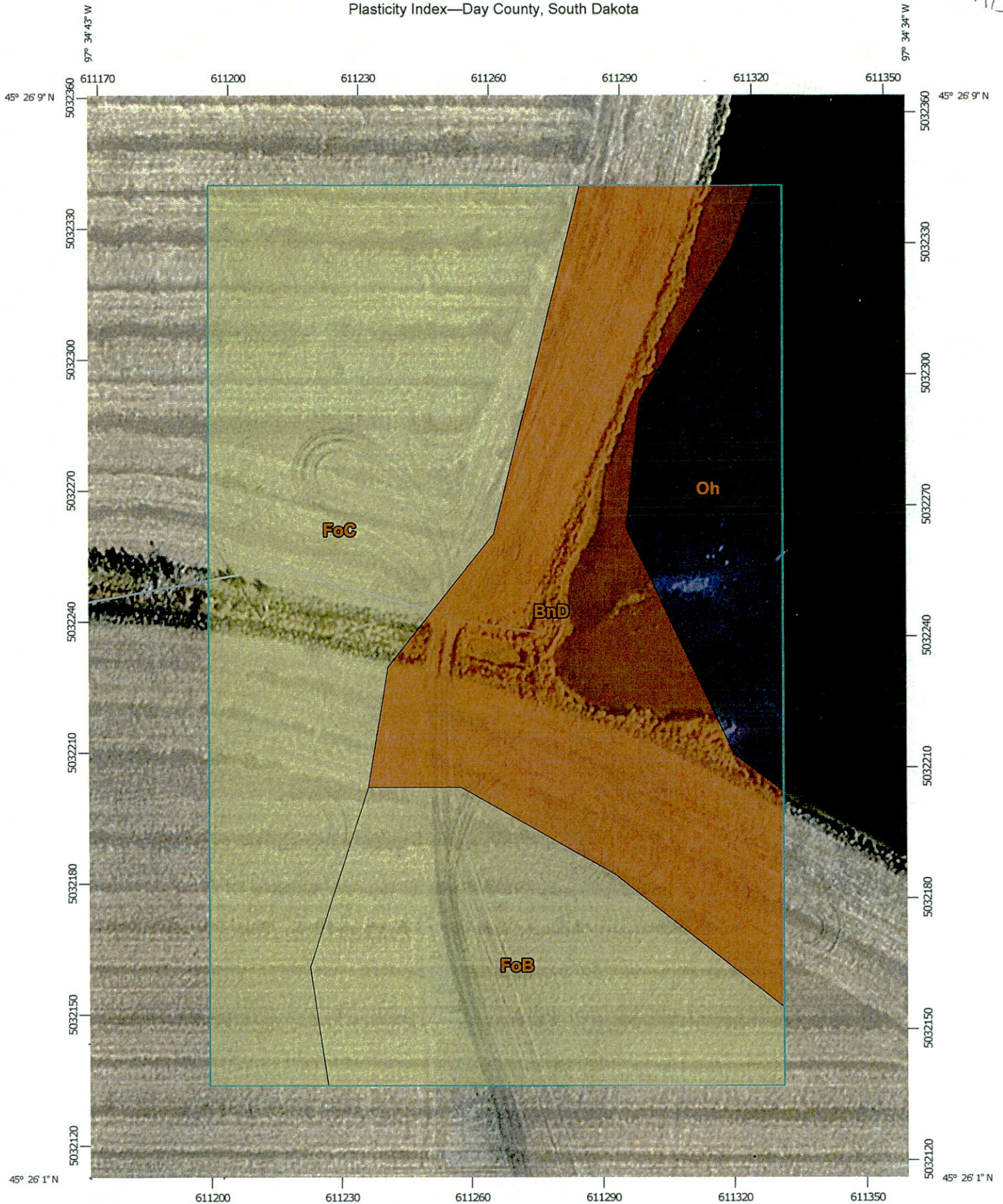
N

Unified Symbols and Group Names		Agricultural Waste Management Field Handbook, Chapter 10					
		Table 10D-3 (1161 test results)			Table 10D-2		
Soil Group	Median K, cm/s	Median K, ft/d	Unified Class	Perm Group I II III IV	In Perm Group		
I	7.2x10-4	2.0	CH	N N S U	A=Always		
I	3.5x10-4	1.0	MH	N S U S			
			CL	N S U S			
II	4.8x10-6	0.014	ML	N U S N	N=Never		
II	1.5x10-6	0.004	CL-ML	N A N N			
			GC	N S U S			
III	8.8x10-7	0.0025	GM	S U S S	S=Sometimes		
III	2.1x10-7	0.0006	GW	A N N N			
			SM	S S S S			
			SC	N N U S			
IV	4.9x10-7	0.0014	SW	A N N N			
IV	3.5x10-8	0.0001	SP	A N N N			
			GP	A N N N	U=Usually		

GW = Well graded gravel, gravel-sand mix, few fines
GP = Poorly graded gravel, gravel-sand mix, few fines
GC = Clayey gravel, gravel-sand-clay mix
GM = Silty gravel, gravel-sand-silt mix
SW = Well graded sand, gravelly sand with few fines
SP = Poorly graded sand, gravelly sand with few fines
SC = Clayey sand, sand-clay mix
SM = Silty sand, sand-silt mix
CL = Lean inorganic clay, low to medium plastic LL < 50
CH = Fat inorganic clay, gravelly/sandy/silty clay LL > 50
CL-ML = Silty Clay
OL = Organic silts and organic silty clays, low plasticity
OH = Organic silt/clay, medium to high plasticity
ML = Inorganic silt, very fine sand, low plastic LL < 50
MH = Inorganic silt, fine sand or silty soils LL > 50

Plasticity Index—Day County, South Dakota

17b/17b



Map Scale: 1:1,210 if printed on A portrait (8.5" x 11") sheet.

0 15 30 60 90 Meters

0 50 100 200 300 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge ticks: UTM Zone 14N WGS84



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

5/7/2015
Page 1 of 4

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Background

 Aerial Photography

Soils

Soil Rating Polygons

-  ≤ 12.1
-  > 12.1 and ≤ 12.2
-  > 12.2 and ≤ 18.4
-  Not rated or not available

Soil Rating Lines

-  ≤ 12.1
-  > 12.1 and ≤ 12.2
-  > 12.2 and ≤ 18.4
-  Not rated or not available

Soil Rating Points

-  ≤ 12.1
-  > 12.1 and ≤ 12.2
-  > 12.2 and ≤ 18.4
-  Not rated or not available

Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Day County, South Dakota
Survey Area Data: Version 20, Sep 17, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 15, 2010—Oct 21, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Plasticity Index

Plasticity Index— Summary by Map Unit — Day County, South Dakota (SD037)				
Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
BnD	Buse-Barnes loams, 9 to 20 percent slopes	12.1	2.0	29.4%
FoB	Forman-Buse-Aastad loams, 1 to 6 percent slopes	12.2	1.3	19.8%
FoC	Forman-Buse-Aastad loams, 2 to 9 percent slopes	12.2	2.6	39.3%
Oh	Oldham silty clay loam	18.4	0.8	11.5%
Totals for Area of Interest			6.7	100.0%

Description

Plasticity index (PI) is one of the standard Atterberg limits used to indicate the plasticity characteristics of a soil. It is defined as the numerical difference between the liquid limit and plastic limit of the soil. It is the range of water content in which a soil exhibits the characteristics of a plastic solid.

The plastic limit is the water content that corresponds to an arbitrary limit between the plastic and semisolid states of a soil. The liquid limit is the water content, on a percent by weight basis, of the soil (passing #40 sieve) at which the soil changes from a plastic to a liquid state.

Soils that have a high plasticity index have a wide range of moisture content in which the soil performs as a plastic material. Highly and moderately plastic clays have large PI values. Plasticity index is used in classifying soils in the Unified and AASHTO classification systems.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Rating Options

Units of Measure: percent

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Average)

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk "*" denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007 (<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>).

Engineering Properties—Day County, South Dakota														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>Pct</i>	<i>Pct</i>					<i>Pct</i>	
BnD—Buse-Barnes loams, 9 to 20 percent slopes														
Buse	50	C	0-7	Loam	CL, CL-ML, ML	A-6, A-4	0-0-0	0-0-0	90-95-100	85-90-95	70-83-95	55-73-90	20-28-35	3-9-15
			7-22	Clay loam, loam	ML, CL, CL-ML	A-6, A-4, A-7	0-0-0	0-0-0	90-95-100	85-93-100	70-80-90	55-70-85	25-35-45	5-13-20
			22-60	Clay loam, loam	ML, CL, CL-ML	A-4, A-7, A-6	0-0-0	0-0-0	90-95-100	85-93-100	70-80-90	55-70-85	25-35-45	5-13-20
Barnes	40	C	0-6	Loam	CL, CL-ML	A-6, A-4	0-0-0	0-3-5	90-95-100	85-93-100	80-90-100	60-70-80	20-30-40	5-13-20
			6-13	Clay loam, loam	CL, CL-ML	A-6, A-4	0-0-0	0-3-5	90-95-100	85-93-100	75-85-95	55-68-80	25-33-40	5-13-20
			13-32	Clay loam, loam	CL, CL-ML	A-4, A-6	0-0-0	0-3-5	90-95-100	85-93-100	75-85-95	55-68-80	25-33-40	5-13-20
			32-60	Clay loam, loam	CL, CL-ML	A-6, A-4	0-0-0	0-3-5	90-95-100	85-93-100	75-85-95	55-68-80	25-33-40	5-13-20

Engineering Properties--Day County, South Dakota														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>Pct</i>	<i>Pct</i>					<i>Pct</i>	
FoB--Forman-Buse-Aastad loams, 1 to 6 percent slopes														
Forman	40	C	0-8	Loam	CL, CL-ML	A-4, A-6	0-0-0	0-3-5	95-98-100	90-95-100	85-93-100	60-75-90	20-30-40	5-10-15
			8-15	Clay loam	CL, CL-ML	A-4, A-7, A-6, A-7-6	0-0-0	0-3-5	95-98-100	90-95-100	80-88-95	60-70-80	25-35-45	5-13-20
			15-60	Loam, clay loam	CL, CL-ML	A-6, A-4, A-7	0-0-0	0-3-5	95-98-100	90-95-100	80-88-95	60-70-80	25-35-45	5-13-20
Buse	30	C	0-7	Loam	CL, CL-ML, ML	A-6, A-4	0-0-0	0-0-0	90-95-100	85-90-95	70-83-95	55-73-90	20-28-35	3-9-15
			7-22	Loam, clay loam	ML, CL, CL-ML	A-6, A-4, A-7	0-0-0	0-0-0	90-95-100	85-93-100	70-80-90	55-70-85	25-35-45	5-13-20
			22-60	Loam, clay loam	ML, CL, CL-ML	A-4, A-7, A-6	0-0-0	0-0-0	90-95-100	85-93-100	70-80-90	55-70-85	25-35-45	5-13-20
Aastad	20	C	0-14	Loam	ML, CL	A-6, A-7-5, A-7	0-0-0	0-3-5	95-98-100	95-98-100	80-88-95	50-63-75	35-40-45	10-15-20
			14-29	Clay loam	CL	A-7-6, A-7	0-0-0	0-3-5	95-98-100	90-95-100	75-85-95	50-63-75	40-45-50	15-20-25
			29-60	Clay loam, loam	CL	A-7, A-6, A-7-6	0-0-0	0-3-5	95-98-100	85-93-100	75-85-95	55-65-75	35-43-50	12-19-25

Engineering Properties—Day County, South Dakota														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>Pct</i>	<i>Pct</i>					<i>Pct</i>	
FoC—Forman-Buse-Aastad loams, 2 to 9 percent slopes														
Forman	40	C	0-8	Loam	CL, CL-ML	A-4, A-6	0-0-0	0-3-5	95-98-100	90-95-100	85-93-100	60-75-90	20-30-40	5-10-15
			8-15	Clay loam	CL, CL-ML	A-4, A-7, A-6, A-7-6	0-0-0	0-3-5	95-98-100	90-95-100	80-88-95	60-70-80	25-35-45	5-13-20
			15-60	Loam, clay loam	CL, CL-ML	A-6, A-4, A-7	0-0-0	0-3-5	95-98-100	90-95-100	80-88-95	60-70-80	25-35-45	5-13-20
Buse	30	C	0-7	Loam	CL, CL-ML, ML	A-6, A-4	0-0-0	0-0-0	90-95-100	85-90-95	70-83-95	55-73-90	20-28-35	3-9-15
			7-22	Loam, clay loam	ML, CL, CL-ML	A-6, A-4, A-7	0-0-0	0-0-0	90-95-100	85-93-100	70-80-90	55-70-85	25-35-45	5-13-20
			22-60	Loam, clay loam	ML, CL, CL-ML	A-4, A-7, A-6	0-0-0	0-0-0	90-95-100	85-93-100	70-80-90	55-70-85	25-35-45	5-13-20
Aastad	20	C	0-14	Loam	ML, CL	A-7, A-6, A-7-5	0-0-0	0-3-5	95-98-100	95-98-100	80-88-95	50-63-75	35-40-45	10-15-20
			14-29	Clay loam	CL	A-7, A-7-6	0-0-0	0-3-5	95-98-100	90-95-100	75-85-95	50-63-75	40-45-50	15-20-25
			29-60	Clay loam, loam	CL	A-7-6, A-7, A-6	0-0-0	0-3-5	95-98-100	85-93-100	75-85-95	55-65-75	35-43-50	12-19-25
Oh—Oldham silty clay loam														
Oldham	90	C/D	0-8	Silty clay loam	CH, CL, ML, MH	A-7	0-0-0	0-0-0	100-100-100	95-98-100	90-95-100	85-93-100	40-50-60	15-20-25
			8-47	Clay loam, silty clay loam, silty clay	CL, MH, CH, ML	A-7	0-0-0	0-0-0	100-100-100	95-98-100	85-93-100	85-93-100	40-50-60	15-20-25
			47-60	Silty clay loam, clay loam, silt loam	CL-ML, CL	A-6, A-4, A-7	0-0-0	0-0-0	100-100-100	95-98-100	85-93-100	70-85-100	25-35-45	5-13-20

Data Source Information

Soil Survey Area: Day County, South Dakota
Survey Area Data: Version 20, Sep 17, 2014

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JUL 24 2015

WATER RIGHTS
PROGRAM



JEFFREY T. SVEEN
JOSEPH P. BARNETT
REED RASMUSSEN
GREGG C. MAGERA
JULIE DVORAK*
RODRICK L. TOBIN*
CHRISTOPHER JUNG*
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SIEGEL BARNETT & SCHUTZ LLP
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415 S. MAIN STREET - 400 CAPITOL BUILDING
P.O. BOX 490
ABERDEEN, SOUTH DAKOTA 57402-0490

STAN SIEGEL (1928-1996)
JOSEPH H. BARNETT (1931-1985)
RAYMOND M. SCHUTZ (1929-2012)
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TELEPHONE (605) 225-5420
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*Also licensed in North Dakota
•Also licensed in Montana
■Also licensed in Minnesota

July 23, 2015

Mr. Tim Schaal
PMB 2020 Dept of Environment and Natural Resources
Water Rights Program
523 East Capitol Avenue
Pierre SD 57501-3182

Re: Virginia J. Tvinnereim Irrevocable Trust

Dear Mr. Schaal:

Enclosed please find the Water Rights Program packet completed by the above entity with assistance from the NRCS office in Webster, South Dakota. Also enclosed is its check in the amount of \$750.

Best regards,

/s/ Rodrick L. Tobin

Rodrick L. Tobin
of SIEGEL, BARNETT & SCHUTZ, L.L.P.
rtobin@sbslaw.net

RLT.ny

Enclosures



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

July 27, 2015

Rodrick L Tobin
Siegel Barnett & Schultz
PO Box 490
Aberdeen SD 57402

RE: Irene J Tvinnereim Irrevocable Trust

Dear Mr. Tobin:

Thank you for submitting the *Application for a Permit to Appropriate Water* for wetland restoration on behalf of the Irene J Tvinnereim Irrevocable Trust located in Day County. In order to complete the application, the following is required.

- We received the check for \$750.00. The application license fee of \$200.00 is also required at this time. Please submit this amount.

If you have any questions, please contact me.

Sincerely,

Karen Schlaak
Water Rights Program
605 773-3352
karen.schlaak@state.sd.us

JEFFREY T. SVEEN
JOSEPH P. BARNETT
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ABERDEEN, SOUTH DAKOTA 57402-0490

July 29, 2015

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JUL 31 2015

**WATER RIGHTS
PROGRAM**

STAN SIEGEL (1928-1996)
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Ms. Karen Schlaak
PMB 2020 Dept of Environment and Natural Resources
Water Rights Program
523 East Capitol Avenue
Pierre SD 57501-3182

Re: Virginia J. Tvinnereim Irrevocable Trust – Water Rights Program

Dear Ms. Schlaak:

Thank you for notifying me of the \$200 application license fee required for the Application for a Permit to Appropriate Water. Enclosed is a check in the amount of \$200 from the Virginia J. Tvinnereim Irrevocable Trust.

Best regards,

/s/ Rodrick L. Tobin

Rodrick L. Tobin
of SIEGEL, BARNETT & SCHUTZ, L.L.P.
rtobin@sbslaw.net

RLT:ny

Enclosures



United States Department of Agriculture

May 8, 2015

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JUL 24 2015

WATER RIGHTS
PROGRAM

PMB 2020 Department of Environment and Natural Resources
Water Rights Program
523 E Capitol Avenue
Pierre, SD 57501-3182

Dear Mr. Tim Schaal:

Please find enclosed plans, design documentation, construction and material specifications, and a hazard classification for the Tvinnereim Trust Dam located in the E2, 29-123-56 in Day County. This is a wetland restoration project. The wetland had been partially restored with a culvert through a crossing on a ditch and a small earthen ditchplug between the culvert crossing and wetland. The riser elevation of this dam is 3.4' above the existing culvert and 1' above the small earthen ditchplug.

The dam needs a Safety of Dams Review as it has a height of 8.1 feet and storage of 280.2 acre-feet at the top of the dam. This dam also needs to go through the Water Rights Permit Process as it stores 149.3 acre-feet of water at the principal spillway. The Water Rights Permit Application will be submitted by the Tvinnereim Trust.

I will be on maternity leave until August 3. If you have any questions regarding the Tvinnereim Trust Dam information, please contact Michelle Burke or Joy Cordier Jensen at 605-692-2344.

Sincerely,

Laura Stern, PE
Agricultural Engineer

Attachment: Tvinnereim Trust WRP Dam Plans, Design Documentation, Construction Specifications, and Hazard Classification

~~cc: Lindsey Goldade~~, District Conservationist, NRCS, 600 East HWY 12, Suite 1, Webster, SD 57274-1135

RECEIVED

MAY 13 2015

**WATER RIGHTS
PROGRAM**

TVINNEREIM TRUST DAM

**E2, 29-123-56
DAY COUNTY**

**CONSTRUCTION AND MATERIAL
SPECIFICATIONS**

CONSTRUCTION SPECIFICATION

SD-3 STRUCTURE REMOVAL

1. Scope

The work shall consist of the removal, salvage, and disposal of structures (including fences) from the designated areas.

2. Marking

Each structure or structure part to be removed will be as described on the drawings or marked by the Natural Resources Conservation Service (NRCS) inspector.

3. Removal

The extent and depth of required structural removal shall be as described on the drawings or shall be as designated by the NRCS inspector.

4. Salvage

Structures or structure parts designated to be salvaged shall be carefully removed and neatly placed in the specified or approved storage location. Salvaged structures that are capable of being disassembled shall be dismantled into individual members or sections. Such structures shall be neatly and systematically match marked with paint before disassembly. All connectors and other parts shall be marked to indicate their proper location within the structure and shall be fastened to the appropriate structural member or packed in suitable containers.

Material from fences designated to be salvaged shall be placed outside the work area on the fence owner's property. Fence wire shall be rolled into uniform rolls of suitable size and piled with other salvaged materials. Posts and rails shall be neatly stacked.

All salvaged materials shall remain the property of the owner unless otherwise specified.

5. Disposal of Refuse Materials

Refuse materials shall be disposed of by burning and/or burying at locations shown on the drawings or shall be disposed of by methods and at sites selected by the contractor and approved by the NRCS inspector. Materials to be buried shall be placed at least two feet below the surrounding ground line and shall be covered by at least two feet of soil with the soil surface graded to drain.

The contractor is responsible for complying with all applicable laws and regulations and the payment of any and all fees that may result from disposal.

CONSTRUCTION SPECIFICATION

SD-4 STRIPPING

1. Scope

The work shall consist of removing topsoil and other undesirable materials from borrow areas and foundations of structures and earth fill areas.

2. General

Required stripping excavation depth will be the depth needed to expose subsoil reasonably free of roots and other perishable organic materials. Excavated earth material suitable for fill shall be placed in earth fill areas as appropriate. Stripped material suitable for topsoil shall be stockpiled and placed over disturbed areas as shown on the drawings or as approved by the Natural Resources Conservation Service (NRCS) inspector. All waste material shall be disposed of as shown on the drawings or as approved by the NRCS inspector.

3. Foundation Stripping

Remove loose soil and extend stripping to a reasonably smooth surface in consolidated subsoil. Except as shown on the drawings, foundation slopes shall be excavated to one horizontal to one vertical, or flatter.

4. Borrow Area Stripping

Borrow areas shall be stripped to expose material suitable for earth fill.

CONSTRUCTION SPECIFICATION

SD-5 EXCAVATION

1. Scope

The work shall consist of excavation required by the drawings and specifications and disposal of the excavated material.

2. Classification

Common Excavation is defined as the excavation of all materials that can be excavated, transported, and unloaded using heavy ripping equipment and heavy rubber tired loaders or scrapers with pusher tractors. This classification includes rocks smaller than one cubic yard.

Rock Excavation is defined as the excavation of all hard, compacted, or cemented materials that require blasting or the use of unusually large ripping and excavating equipment. This classification includes the removal of isolated rocks larger than one cubic yard.

Unclassified Excavation is defined as the excavation of all materials (including rock) encountered, regardless of the nature of the material or the excavation method needed.

3. Use of Excavated Materials

To the extent needed, all suitable materials from excavations shall be used in the construction of specified earth or rock fills. Suitability of materials for specific purposes will be determined by the Natural Resources Conservation Service (NRCS) inspector. The contractor shall not waste or otherwise dispose of suitable excavated materials.

4. Disposal of Waste Materials

All surplus and unsuitable excavated materials will be disposed of at the locations shown on the drawings or designated by the landowner or NRCS inspector. The disposal site shall be left in a neat condition suitable to be seeded without additional shaping and sloped to provide drainage.

5. Excavation Limits

Excavated surfaces too steep to be safe without support, shall be supported as necessary to safeguard the work and workers. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations. The contractor shall furnish, place, and subsequently remove such supporting installations. Excavations outside the lines and limits shown on the drawings required to meet safety requirements shall be the responsibility of the contractor in constructing and maintaining a safe and stable excavation. Excavation side slopes may be flattened for safety reasons where approved by the NRCS inspector. Excavations shall be completed to specified lines and grades prior to placement of earth fill or construction of structures.

7. Borrow Excavation

When suitable materials from specified excavations are insufficient to construct specified fills, additional material shall be obtained from designated borrow areas. The extent and depth of borrow pits shall be as approved by the NRCS inspector. Borrow pits must be shaped to eliminate unsightly conditions and steep or unstable slopes. Borrow areas shall be excavated and finally dressed to blend with the existing topography and sloped to prevent ponding and to provide drainage. All borrow sites shall be left in a neat condition suitable to be seeded without additional shaping.

CONSTRUCTION SPECIFICATION

SD-7S EARTHFILL-CLASS S

1. Scope

The work shall consist of the construction of compacted earth fills where the amount of compaction is to be controlled by specifying a construction method.

2. Materials

All fill materials shall be obtained from required excavations and designated borrow areas. Selection, blending, placement, and compaction of fill will be subject to approval of the Natural Resources Conservation Service inspector.

Fill materials shall contain no frozen material, sod, roots or other perishable material, or rocks larger than eight inches in diameter. Fill shall not be placed on a frozen surface.

3. Foundation Preparation

All foundation (including abutment) surfaces shall be shaped one horizontal to one vertical or flatter except as otherwise specified.

After stripping (see stripping specification), the foundation shall be loosened thoroughly by scarifying or plowing to a minimum depth of four inches. The foundation shall then be compacted by the process specified for the fill.

4. Placement

All foundation excavation and preparation shall be completed and the foundation shall be free of standing water before placing fill. Except as required by the drawings, fill material shall be mixed and uniformly placed throughout the entire fill without lenses, streaks, pockets, or layers of material that differ significantly from surrounding material.

Placement and compaction methods must prevent damage to structures and allow the structure to assume backfill loads gradually and uniformly. Within 2 feet of any structure, fill layer thickness must not exceed 4 inches and equipment loads must not exceed 400 pounds.

Fill shall be placed in approximately horizontal layers. Except as described above, fill layer thickness shall not exceed nine inches for compaction by large machines or four inches for small hand directed power tampers.

If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill, to a depth of not less than two inches, before the next layer is placed.

Except as otherwise specified, openings temporarily left in dam fills (for pipe installation, stream flow, etc.) shall have side slopes three horizontal to one vertical or flatter. When filling the opening, the bonding surface of the fill in place shall be stripped of all material not meeting the requirements of this specification and shall be scarified, moistened, and recompacted as new earthfill is placed.

5. Control of Moisture Content

At the time of compaction, earth fill materials shall have a moisture content that when kneaded in the hand will form a firm ball that does not easily crumble when pressed between the hands. If the soil is too wet, it will yield free water when kneaded in the hand.

Fill materials must be wetted or dried and mixed as needed to achieve proper moisture prior to compaction.

6. Compaction (Class S)

Fill layers shall be compacted by one of the following methods.

- a. By routing the hauling and spreading equipment such that all points of the fill are traversed by at least one tread track of the loaded equipment traveling parallel to the centerline of the fill.
- b. By at least 2 passes of a tamping (sheepsfoot) roller weighing at least 100 pounds per square inch of bearing area.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping or manually directed power tampers or plate vibrators. Within 2 feet of any structure, equipment loads must not exceed 400 pounds.

Compaction of fill adjacent to concrete structures shall not be started for at least the following number of days after placement of the concrete.

Concrete Structure	Days After Concrete Placement
Vertical or near-vertical walls with earth load on one side only	14
Walls backfilled on both sides simultaneously	7
Conduits and spillway risers, cast-in-place (with inside forms in place)	7
Conduits and spillway risers, cast-in-place (forms removed)	14
Conduits, pre-cast, cradled	2
Conduits, pre-cast, bedded	1
Anti-seep collars and cantilever pipe supports (backfill both sides simultaneously)	3

CONSTRUCTION SPECIFICATION

SD-8 ROCK RIPRAP AND BEDDING

1. Scope

The work shall consist of furnishing and installing loose rock riprap and blankets, including filter layers, bedding, or geotextiles as shown on the drawings.

2. Materials

Rock Riprap - Individual rock fragments shall be dense, hard, durable, and free from cracks, seams, and other defects conducive to accelerated weathering. Except as otherwise specified, rock fragments shall be angular or sub-rounded. The least dimension of an individual rock fragment shall be not less than one-third the greatest dimension of the fragment. ASTM D4992 provides guidance on selecting rock from a source.

Rock that fails to meet the above requirements will be accepted only if similar rock from the same source has been demonstrated to be sound after three years of exposure to conditions similar to conditions where the riprap is to be placed.

The rock shall conform to the grading limits shown on the drawings. Sand, rock fines, and dirt shall be less than five percent of the total weight of the riprap.

Sand, Gravel Filter - Filter aggregates shall be sand, gravel, crushed stone, or mixtures thereof. Aggregates shall be composed of clean, hard, durable mineral particles free of organic matter, clay balls, soft particles, or other substances that would interfere with free-draining properties of the aggregates.

Not more than 5 percent of the material of the material may be limestone and not more than 15 percent may be flat, elongated particles.

Except as otherwise shown on the drawings, the aggregate shall meet the following gradation requirements after placement.

Filter Aggregate Size	Percent Finer by Weight
3"	100
1"	90 to 100
#4	50 to 85
#50	10 to 40
#200	0 to 5

Geotextile - Geotextiles shall conform to the National Engineering Handbook Material Specification 592-Geotextile. The geotextile fabric shall be protected from moisture, dust, dirt, debris, and ultraviolet light prior to installation.

3. Subgrade Preparation

Subgrade surfaces on which riprap, bedding, or geotextile will be placed shall be cut or filled to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved materials and shall conform to the requirements of the specified class of fill.

Riprap, bedding, or geotextile shall not be placed until the foundation preparation is completed and the surfaces have been inspected and approved by the Natural Resources Conservation Service inspector.

4. Equipment-placed Rock Riprap

Rock riprap shall be placed by equipment on the surface and to the depth specified. It shall be installed to the full course thickness in one operation and in a manner as to avoid serious displacement of the underlying material. The rock shall be delivered and placed in a manner that ensures the riprap in place is reasonably homogenous with the larger rocks uniformly distributed and firmly in contact one to another and with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface.

Rock riprap shall be placed in a manner to prevent damage to structures. Hand placing is required as necessary to prevent damage to new and existing structures.

5. Hand-placed Rock Riprap

The rock riprap shall be placed on the surface and to the depth specified. It shall be securely bedded with the larger rocks firmly in contact one to another without bridging. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a substitute for larger rocks. Flat slab rock shall be laid on its vertical edge except where it is laid like paving stone and the thickness of the rock equals the specified depth of the riprap course.

6. Filters, Bedding, or Geotextiles

When the drawings specify filters, bedding, or geotextile beneath the rock riprap, the designated material shall be placed on the prepared subgrade surface as specified. Compaction of filter or bedding aggregate is not required, but the surface of such material shall be furnished reasonably smooth and free of mounds, dips, or windrows.

Where drawings require geotextiles beneath riprap, the geotextile shall be laid on the prepared subgrade surfaces with no folds or ripples. The geotextile fabric should be in direct contact with the subgrade surface and secured to prevent displacement. Except as otherwise specified, the fabric should be placed parallel to stream alignments and perpendicular to lake shorelines. Except as otherwise specified, the geotextile splices shall overlap at least 18 inches, or shall be sewn following the geotextile manufacturer's recommendations. Anchoring pins shall be placed as recommended by the geotextile manufacturer except as otherwise specified.

CONSTRUCTION SPECIFICATION

SD-10 SALVAGING AND SPREADING TOPSOIL

1. Scope

The work shall consist of salvaging topsoil from borrow pits or other excavations and spreading it in the designated areas to the specified depths.

2. Quality of Topsoil

Topsoil shall consist of friable soil reasonably free of grass, roots, weeds, sticks, stones, or other foreign materials.

3. Excavation

Topsoil shall be removed after clearing, grubbing and removing vegetation and shall be incorporated in required earthfill areas as specified, or stockpiled. Objectionable materials shall be removed and buried, or disposed of, at locations approved by the Natural Resources Conservation Service inspector.

4. Spreading

Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Surfaces to be covered shall be lightly scarified just prior to the spreading operation.

All earth fills not to be submerged shall be covered with topsoil to a depth of 6 to 18 inches measured perpendicular to the surface of the fill and placed to the neat lines shown on the drawings.

After placement is completed, the topsoil surface shall be left in a condition that will permit seeding equipment to be operated without excessive smoothing.

CONSTRUCTION SPECIFICATION

SD-17 METAL FABRICATION AND INSTALLATION

1. Scope

This specification is applicable to metalwork items not covered by other specifications. It is applicable to such items as trash guards, anti-vortex devices, and similar structures or parts. It is not applicable to concrete reinforcing steel, water control gates, fences, wells, piles, or pipe conduits.

2. Materials

Steel - Except as otherwise specified, steel shall be malleable, weldable, carbon steel.

Bolts, nuts, washers, rods, rivets, etc., shall be a material equal to the steel being fastened.

Aluminum - Except as otherwise specified, aluminum shall be ASTM alloy 6061-T6.

3. Fabrication

Metal items shall be fabricated to close fit, following requirements shown on the drawings. Welds shall be made all around in a manner developing as much strength as possible.

4. Protective Coatings

Galvanizing - Except as otherwise specified, items shown on the drawings to be galvanized, shall be galvanized according to ASTM A123, except bolts, screws, and other fasteners 0.5 inch or less in diameter may be coated with electro-deposited zinc or cadmium coating following ASTM B766 or B633.

Zinc Painting - For items specified to be painted with zinc paint, the surfaces shall be cleaned and painted as follows:

Cleaning - Surfaces to be painted must be clean and dry. Remove oil and grease using a solvent. Clean surfaces to be painted using sand blasting, power disk sanding, or wire brushing.

Paint - Apply 2 coats of zinc-rich cold galvanized compound using brush, or aerosol application (example: Rust-Oleum Professional Galvanizing Compound) or zinc dust - zinc oxide primer ASTM D79, D520, or D4146.

4. Erection

All parts of the metal structure shall be properly aligned and erected true and plumb, closely conforming to the drawings.

CONSTRUCTION SPECIFICATION

SD-20 PLASTIC PIPELINE

(IRRIGATION)

1. Scope

The work consists of furnishing and installing Poly-vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe complete with fittings and appurtenances, as shown on the drawings.

2. Materials

Plastic pipe and fittings shall conform to Material Specification SD-55.

3. Handling and Storage

Pipe shall be delivered to the site and handled by means that provide adequate support to the pipe. Plastic pipe shall be protected from bending, impact, abrasion, and cutting damage. Manufacturer's recommendations must be followed. Special care shall be taken to avoid impact damage below 40°F temperature. Pipe that is not ultraviolet resistant must not be exposed to sunlight for more than 15 days.

4. Joints and Connections

All joints and connections shall be made to carry design flows without significant pressure loss and to withstand the maximum design working pressure without leakage. Manufacturer's recommendations must be followed.

Dissimilar metals must not be in contact with each other. Steel or other metals subject to corrosion must be protected from corrosion using high quality materials.

5. ~~Trench Construction~~

Except as shown on the drawings, pipe trenches shall be not wider than 30 inches.

Where rocks or other material that may damage the pipe is encountered, the trench bottom shall be excavated at least four inches below pipe grade and backfilled with bedding material consisting of sand or fine-grained soil.

6. ~~Road Crossings~~

All pipelines installed that cross roads (township or county) shall be sleeved. The preferred sleeve installation method is by directional drilling, boring or jacking. Conventional open-trench crossings shall not be allowed. If sleeves are installed by narrow trenching, the trench shall be cut at an angle of at least 15 degrees from perpendicular to the road centerline. The narrow trench within the roadway embankment shall be filled with clean ½" maximum size aggregate to within 6" of the top of the trench then finished with 6" of materials matching the existing road surface.

Minimum sleeve material shall be ¼" thick wall steel, DR-7 HDPE or Schedule 40 (equivalent wall thickness). The roadway owner may require a "right to occupy" permit that specifies other casing materials and/or construction methods, but they shall meet the minimum requirements as stated above.

7. Placement

Small holes shall be excavated in bedding material under pipe bells, fittings, and appurtenances as needed to assure the pipeline is uniformly supported on bedding at line and grade throughout its entire length. Blocking or mounding beneath the pipeline to bring it to design grade is not permitted. Care shall be taken to prevent distortion or damage and to exclude foreign material from entering the pipeline.

8. ~~Thrust Blocks~~

Thrust blocks must be formed against solid, compact earth. Thrust blocks shall consist of filling the space between the pipe and trench wall with concrete to the top of the pipe and to the dimensions shown on the drawings.

9. Backfill

All backfill recommendations of the pipe manufacturer shall be met. Vehicles or construction equipment shall not cross the pipe until earth cover over the pipe exceeds two feet.

Initial backfill to six inches above top of pipe is required. Initial backfill shall be placed in two stages. In the first stage (haunching), backfill is placed to the pipe spring line (center of pipe). In the second stage, it is placed to 6 inches above the top of the pipe. Except as otherwise specified, earth haunching and initial backfill shall consist of soil that is free of rocks, hard clods, or other objects more than one inch in diameter. Except where the pipe trench is precision excavated with pipe fitting bottom and with trench width not more than 110 percent of the pipe diameter, earth fill shall be worked and compacted under the haunches of the pipe to provide continuous support in layers not more than 6 inches thick. Care shall be taken to insure the pipe is not deformed, damaged, or displaced.

Final backfill shall consist of remaining backfill from top of initial backfill to ground surface, including mounding for settlement. Final backfill within two feet of the pipe shall be free of debris, rocks, or other objects three inches nominal diameter or larger. Final backfill shall be placed in approximately uniform, void free, compacted layers.

10. ~~Testing~~

The pipeline shall be completely tested for two hours at design pressure for pressure, leakage, and proper functioning; unless otherwise noted on the construction drawings. Lines must be slowly filled to avoid damage.

Conditions requiring repair and retest include excessive water hammer, continuing unsteady delivery of water, damage to the pipe, detrimental discharge from control valves, visible leaks, and/or loss of more than one-half gallon of water per hour per inch diameter per mile of pipe.

11. Certification and Guarantee

The installing contractor shall certify that his or her installation complies with this specification. The contractor shall furnish the installation owner a one-year written guarantee protecting the installation from defective materials and construction. Material manufacturers and pipe markings must also be supplied to the owner in writing.

**CONSTRUCTION SPECIFICATION
SD-28 SEEDING**

will be filled
out by local field
office.

1. Scope

The work shall consist of furnishing all labor, equipment, and materials needed for seeding the areas shown on the drawings.

2. General

Permanent Seeding and related operations shall be performed in the following time periods:

Early Spring prior to 5/15 – Cool-season species only.

Late Spring 5/15 to 6/15 – Warm-season species only with a companion crop.

Late Summer 8/1 to 9/1 – Cool-season species with a cover crop.

Dormant 11/1 to Spring Thaw - Cool season species with mulch.

Permanent seeding must be completed as soon as possible during the first allowable seeding time period after construction. If construction ends between 5/15 and 9/15, a cover crop shall be planted immediately after construction. The cover crop shall be clipped or chemically killed and perennial species shall be planted during the next available establishment period. Consider the previous two years of herbicide application. Any potential carryover problems should be addressed by delaying construction and seeding, establishing a cover crop, and/or changing the species to be planted.

3. Fertilizer

Fertilizer is ☐ Required ☐ Not Required

If fertilizer is used it shall be supplied and applied as follows: Apply fertilizer based on the recommendations from a soil test or apply 30 to 40 pounds of actual N and 40 to 60 pounds of P₂O₅ per acre. Ten to 15 tons of manure per acre may be used in lieu of the commercial fertilizer and will also increase organic matter. Do not use manure on areas that will drain directly into a water body or stream. 5 to 10 pounds of zinc per acre may be added to speed up growth on medium-textured soils. Thoroughly mix all fertilizer and/or manure into the upper three to five inches of the soil during final seedbed preparation.

4. Seedbed Preparation

The area to be seeded shall be made reasonably smooth and firm. Ditches shall be filled to conform to design lines and grades before seedbed preparation is begun. The seedbed will be worked to a depth of three to five inches. Drag or pack to break up large clods and firm the seedbed. Prior to seeding, required fertilizer shall be applied and mixed with the soil surface to a depth of 3 inches. The seedbed should be firm enough so that the boot heel of an average adult penetrates the soil to a depth of approximately 1/2 inch. The contractor shall suspend operations when the soil is too wet.

5. Sowing Seed

Except as otherwise specified, seeding shall be performed immediately after seedbed preparation. Seeding shall be drilled or broadcast and incorporated in a manner that will achieve uniform distribution of seed placed at appropriate soil depth. Optimum seeding depths are 1/4 to 3/4 inch.

When seeding waterways or similar water flow areas, machinery operations must be performed in a direction that is not parallel to water flow (use figure-eight or serpentine pattern, etc.).

6. Permanent Seeding

Seed requirements and seeding rates are listed below. Documentation must be provided showing the seed meets current South Dakota laws and regulations. The seed must be planted within nine months of its latest germination test.

	Grass	Seeding Rate (PLS lbs./Acre)	
		Drilled	Broadcast
☐	Smooth Brome grass ¹	12	16
☐	Western Wheatgrass	8	10
☐	Intermediate Wheatgrass	8	10
☐	Slender Wheatgrass	5	6
☐	Western Wheatgrass	15	20
☐	Reed Canarygrass	5	7
☐	Other, See Attached Seeding Sheet		

¹ Smooth brome grass is not recommended where the adjacent vegetation is predominantly native, as smooth brome grass is highly invasive.

7. Cover Crops

If permanent seeding is not completed during the early or late spring period, a cover crop meeting the following rates and dates will be planted immediately after construction. Cover crops are required for all practices constructed after the early or late spring seeding period and before September 15 (those designed to be seeded between August 1 to September 1). Cover crops are not recommended to be seeded between September 15 and November 1 since it is likely that most of the seeds will remain in the soil and compete with the planned seeded species.

Cover Crop	Seeding rate (lbs./acre)	Spring Dates	Fall Dates
None			

The cover crop will be clipped to 8-10 inches in height or chemically killed during the boot stage to prevent seed formation. Remove or spread excess residues that would interfere with drilling the perennial species.

8. Companion Crops

Companion Crops are ☐ Required ☐ Not Required to be seeded during the permanent seeding period. Companion crops are only to be used for warm-season species seeded in the late spring period (5/15 to 6/15). The companion crops shall be seeded as follows:

Companion Crop	Seeding rate (lbs./acre)
None	

Companion crops shall be seeded at the same time as the permanent seeding. The companion crop should be clipped and removed or mowed before it becomes competitive with the perennial species or sets seed.

9. **Mulching**
Mulching is ☐ Required ☐ Not Required

Mulching is encouraged but not required for all construction and seeding dates. Mulching is required for all waterways constructed between September 15 and the spring thaw and when seeding into a bare seedbed during the early spring period where the design velocity is greater than 2.5 fps. Except as otherwise specified, required mulching must be performed as soon as possible after seeding. Mulch shall be applied uniformly as follows. Straw will be applied uniformly at a rate of 3,000 pounds minimum to 4,000 pounds maximum per acre. The straw will be anchored using an anchoring tool (or a farm disk set straight with adequate weight) that has serrated straight disk blades spaced 6-10" apart that punches mulch into the ground with a depth of approximately 2 inches. All anchoring should be at right angles to the slope.

If late summer or dormant seeding dates are used, seed just prior to mulching.

PLASTIC PIPE (SD-55)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of Poly Vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe, fittings, and joint materials.

2. Material

The pipe and fittings shall be free of visible cracks, holes, foreign inclusions, or other defects, and shall have dimensions measured as prescribed in ASTM D2122. Joints and fittings shall be as described in the pipe AWWA or ASTM specification and shall be compatible with and have pressure ratings at least equal to the specified pipe. Rubber gaskets for pipe joints shall conform to ASTM F477 Elastomeric Seals (Gaskets for Joining Plastic Pipe). Except as otherwise specified, pipe must conform to the following specifications.

Poly vinyl chloride (PVC) Pipe

Plastic pipe - Schedule 40, 80, or 120	ASTM D1785 or D2466
Pressure rated pipe - SDR Series	AWWA C900 or ASTM D2241
Plastic drain, waste, and vent pipe and fittings	ASTM D2665
Composite sewer pipe	ASTM D2680
Type PSM PVC sewer pipe and fittings	ASTM F3034
Large-diameter gravity sewer pipe and fittings	ASTM F679
Smooth-wall Underdrain Systems for Highway, Airport, and Similar Drainage	ASTM F758
Type PS-46 gravity flow sewer pipe and fittings	ASTM F789
Profile gravity sewer pipe and fittings based on controlled inside diameter	ASTM F794
Corrugated sewer pipe with a smooth interior and fittings	ASTM F949
Pressure pipe, 4-inch through 12-inch for water distribution	AWWA C900
Water transmission pipe, nominal diameters 14-inch through 36-inch	AWWA C905

Polyethylene (PE) pipe

Schedule 40	ASTM D2104
SIDR-PR based on controlled inside diameter	ASTM D2239
Schedules 40 and 80 based on outside diameter	ASTM D2447
SDR-PR based on controlled outside diameter	ASTM D3035

High density polyethylene (HDPE) pipe

Plastic pipe and fittings	ASTM D3350
SDR-PR based on controlled outside diameter	ASTM F714
Plastic moldings and extrusion compounds	ASTM D1248
Heat joining polyolefin pipe and fittings	ASTM D2657

Acrylonitrile-butadiene-styrene (ABS) pipe

Plastic pipe, schedules 40 and 80	ASTM D1527
Plastic pipe, SDR-PR	ASTM D2282
Schedule 40 plastic drain, waste, and vent pipe	ASTM D2661
Composite sewer pipe	ASTM D2680
Sewer pipe and fittings	ASTM 2751

3. Perforations

Except as otherwise specified, perforations of perforated pipe shall meet the following requirements:

- a. Perforations may be circular or slots, but must be free of materials that reduce effective openings.
- b. Circular perforations shall be 3/16 to 5/16 inch diameter holes arranged in rows parallel to the axis of the pipe. Center-to-center perforation spacing along rows shall not exceed 2.5 inches. Perforations may appear at the ends of short and random lengths. Rows shall be arranged in equal groups at equal distance from pipe bottom vertical centerline. Lowermost rows shall be separated by 60 to 125 degrees. Uppermost rows shall be separated by an arc of 166 degrees or less. Other rows shall be uniformly spaced.

- c. Slot perforations shall be located within two rows, with one row in each of the lower quadrants of the pipe. Slots shall be no wider than 1/8 inch and spaced no more than 1.5 inches apart.
- d. Row numbers and minimum openings must be as follows.

Nominal pipe size, inch	Perforations		Minimum opening/foot, square inches
	Minimum number of rows circular	slot	
3 to 4	2	2	0.22
6 to 10	4	2	0.44
12 or larger	6	2	0.66

4. Potable use pipeline

Pipelines specified for use to carry potable water shall meet requirements of the National Sanitation Foundation (NSF).

CONSTRUCTION SPECIFICATION

SD-95 GEOTEXTILE

1. Scope

The work shall consist of furnishing all material, equipment, and labor necessary for the installation of geotextiles.

2. Quality

Geotextiles shall conform to the requirements of Material Specification SD-592 and this specification.

3. Storage

Before installation, geotextile shall be protected from damage by weather, sunlight, and other causes.

4. Surface Preparation

The surface on which geotextile is to be placed shall be graded to the lines and grades shown on the drawings. Except as shown on the drawings, the surface shall be reasonably free of loose rock and clods, holes, depressions, projections, water, and muddy conditions.

5. Placement

Before geotextile is placed, the soil surface will be inspected for quality assurance. Geotextile shall be unrolled along the placement area and loosely laid without stretching so that it will conform to surface irregularities without tearing when upper materials are placed. The geotextile may be folded and/or overlapped as needed for proper placement. Geotextile sections shall be joined by sewing or overlapping.

Geotextile sections joined by sewing shall have seams producing minimum seam strength equal to 90 percent of minimum fabric strength. The sewn overlap shall be at least six inches, and the sewing shall consist of at least two parallel stitched rows at least one-half inch apart with rows at least two inches from fabric edges. The stitching must be a lock-type stitch. Installed geotextile must be secured to prevent movement during construction.

Geotextile sections joined by overlapping shall be overlapped a minimum of 18 inches and secured to the underlying soil surface using securing pins as provided and recommended by the geotextile manufacturer. Upstream or upslope geotextile sections shall overlap abutting downslope geotextile.

Geotextile tears shall be repaired by overlap (described above) of additional geotextile placed in contact with the torn geotextile.

CONSTRUCTION SPECIFICATION

SD-96 SILT FENCE

1. Scope

The work shall consist of furnishing all material, equipment, and labor necessary for the installation of silt fences.

2. Quality

Silt fence fabric shall conform to the requirements of Material Specification SD-592, Table 1, Class II and III and this specification. Posts may be wood, steel, or steel T fence posts. Wood posts shall have minimum dimensions of 1.5"x1.5" by the length shown on the plans. Steel shall consist of either size #6 reinforcing steel or larger, or shall consist of ASTM A 120 steel pipe with a minimum diameter of 3/4 of an inch.

3. Storage

Before installation, silt fence shall be protected from damage by weather, sunlight, and other causes.

4. Installation

Where silt fence is placed to contain sediment from runoff from slopes, hills, berms, or spoil piles, place the silt fence along the contour of the slope, the base of the slope, or as shown on the plans. The maximum spacing of the posts shall be eight feet.

Where silt fence is placed to contain sediment from concentrated flow (pipe discharge, culverts, waterways) place the silt fence perpendicular to the flow with the ends turned upstream or as shown on the plans. The maximum spacing of the posts shall be four feet.

The fabric shall be anchored to the post by a minimum of three staples or ties.

Bottom of the silt fence shall be keyed in a minimum of six inches.

Trenches shall not be excavated wider and deeper than necessary for proper installation.

The final eight feet of the silt fence shall be turned up the slope.

5. Maintenance

Typical silt fence life is five to eight months. If permanent vegetation is not established during this period of time, the fence shall be inspected to determine if the fabric needs to be replaced.

Clean sediment from silt fence when accumulations reach one-third the height of the exposed fence.

Silt fence shall be inspected after every runoff event and promptly repaired if necessary.

GEOTEXTILE (SD-592)

MATERIAL SPECIFICATION

1. Scope

This specification covers the quality of geotextile.

2. General Requirements

Geotextiles shall be a minimum of 85 percent by weight polypropylenes, polyesters, polyamides, polyethylene, polyolefins, or polyvinylidenechlorides. They shall be formed into a stable network of filaments or yarns retaining dimensional stability relative to each other. The geotextile shall be defect free and conform to Table 1 or 2 requirements as applicable to the material specified. The geotextile shall be free of chemical treatments or coatings that reduce its porosity. Geotextiles shall have enhanced resistance to ultraviolet light.

Thread used for sewing shall be high strength polypropylene, polyester, or polyamide, and shall be at least as resistant to ultraviolet light as the geotextile.

3. Classification

Woven - Fabrics formed by interweaving monofilament yarn, creating distinct and measurable openings. The edges of woven fabric shall be selvaged or otherwise finished to prevent the outer yarn from unraveling.

Nonwoven - Fabrics formed by random placement of threads in a mat and bonded by needle punching.

4. Shipping and Storage

Geotextile shall be shipped in rolls wrapped with a cover. Each roll shall be labeled to clearly identify the brand, class, and production run following ASTM D4873.

Table 1. Requirements for Woven Geotextile

Property	Test Method	Class I	Class II&III	Class IV
Tensile strength, lb. ^{1/}	ASTM D4632	200 min.	120 min.	180 min.
Elongation at failure, % ^{1/}	ASTM D4632	<50	<50	<50
Puncture, lb. ^{1/}	ASTM D4833	90 min.	60 min.	60 min.
Ultraviolet light, % residual tensile strength	ASTM D4355	70 min.	70 min.	70 min.
Apparent opening size (AOS)	150-hr. exposure ASTM D4751	As specified, but >.212mm (#70) ^{2/}	As specified, but >.212 mm (#70)	As specified, but >.212mm (#70)
Percent open area (%)	CWO-02215-86 ^{3/}	4.0 min.	4.0 min	1.0 min.
Permeability, permittivity Sec. ⁻¹	ASTM D4491	0.10 min.	0.10 min.	0.10 min.

Table 2. Requirements for Needle-Punched Nonwoven Geotextile

Property	Test Method	Class I	Class II	Class III	Class IV
Tensile Strength, lb. ^{1/}	ASTM D4632	180 min.	120 min.	90 min.	115 min.
Elongation at failure, % ^{1/}	ASTM D4632	≥ 50	≥ 50	≥ 50	≥ 50
Puncture, lb.	ASTM D4833	80 min.	60 min.	40 min.	40 min.
Ultraviolet light, % residual tensile strength	ASTM D4355	70 min.	70 min.	70 min.	70 min.
Apparent Opening Size (AOS)	150-hr. exposure ASTM D4751	As specified max. #40 ^{2/}	As specified max. #40 ^{2/}	As specified max. #40 ^{2/}	As specified max. #40 ^{2/}
Permeability permittivity sec ⁻¹	ASTM D4491	0.70 min.	0.70 min.	0.70 min.	0.70 min.

^{1/} Minimum average roll value (weakest principal direction).

^{2/} US standard sieve size.

^{3/} CWO is a US Army Corps of Engineers reference.



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

September 14, 2015

8178-3

Irene J. Tvinnereim Irrevocable Trust
1716 S Roosevelt St.
Aberdeen, SD 57401

Dear Interested Party:

We have reviewed the plans and specifications for your dam project located in the E ½ of Section 29 T123N-R56W in Day County. The plans and specifications for the construction of the dam are approved. Approval of the plans and specifications does not authorize construction of the dam. The construction of the dam may not begin until Water Permit No. 8178-3 is approved.

Our review was to determine compliance with the requirements of the Water Management Board Safety of Dams Rules, Chapter 74:02:08. Approval of these plans and specifications does not release you, as owner of the dam, from the responsibility for operating and maintaining the dam in good repair to ensure the safety of the dam.

The Tvinnereim Trust Dam will be classified as a small size Category 3, Low Hazard dam with a dam height of 8.1 feet and a normal storage capacity of 149.3 acre-feet and a maximum storage capacity of 280.2 acre-feet.

If you have any questions, please feel free to contact the South Dakota Water Rights Program at (605) 773-3352.

Sincerely,

Timothy G. Schaal, P.E.
South Dakota DENR- Water Rights Program
Engineer IV

cc: Laura Stern, NRCS Brookings, 520 3rd Ave, Brookings, SD 57006

No. 8178-3

Water Rights Program - DENR
Conversation File Documentation

NAME OF PERSON OR FILE: Water Permit No. 8178-3 Tvinnereim

ADDRESS: COUNTY: Day County

DATE: September 14, 2015 TELEPHONE:

RE: called to applicant's attorney, Roderick Tobin

I contacted Mr. Tobin to inquire whether domestic use for livestock watering should be added as a proposed use on the application. Mr. Tobin indicated that they entered into a NRCS easement but that does allow from them to get authorization to graze the property. He doesn't know if that will ever happen but he thought it was a good idea to add livestock watering to the application. He requested that DENR amend the application accordingly.

NAME: Eric Hurland



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

September 17, 2015

Rodrick L Tobin
Siegel Barnett & Schultz
PO Box 490
Aberdeen SD 57402

RE: Irene J Twinnereim Irrevocable Trust

Dear Mr. Tobin:

Enclosed is the Recommendation of the Chief Engineer and the Report on Water Permit Application No. 8178-3. The notice for the application is scheduled to be published in the Reporter and Farmer, Webster and the Watertown Public Opinion on September 21st.

Sincerely,

Karen Schlaak
Water Rights Program
605 773-3352
karen.schlaak@state.sd.us

enclosures



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 8178-3, Irene J Tvinnereim Irrevocable Trust**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Environment and Natural Resources concerning Water Permit Application No. 8178-3, Irene J Tvinnereim Irrevocable Trust, c/o Virginia Tobin, Trustee, 1716 S Roosevelt Street, Aberdeen SD 57401.

The Chief Engineer is recommending APPROVAL of Application No. 8178-3 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) it is in the public interest with the following qualifications:

1. Water Permit No. 8178-3 authorizes an impoundment with a storage capacity of 149.3 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation.
2. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.

See report on application for additional information.

Jeanne Goodman, Chief Engineer
September 14, 2015

REPORT TO THE CHIEF ENGINEER ON
WATER PERMIT APPLICATION NO. 8178-3
Irene J. Tvinnereim Irrevocable Trust
September 9, 2015

Water Permit No. 8178-3 was filed by Irene J. Tvinnereim Irrevocable Trust and proposes to impound 149.3 acre feet (ac-ft) of runoff behind a dam located in the approximate center of the E ½ of Sec 29, T123N-R56W. This impounded water will be used for wetland restoration, recreation, livestock watering, and the propagation of fish and wildlife.

DISCUSSION

This application proposes to construct a small size, Category 3, Low Hazard dam. The dam has been designed by the Natural Resources Conservation Service (NRCS). The plans and specifications have been reviewed and construction of the dam can begin if and when Water Permit Application No. 8178-3 is approved. Failure of this dam or excess flow through the auxiliary spillway has the potential to flood an area of downstream wetlands.

The dam will be 8.1 feet high with an effective height (difference between toe and secondary spillway) of 6.1 feet. Normal storage capacity of the dam will be approximately 149 acre-feet with a reservoir level at the primary spillway elevation, and a maximum storage capacity of 280.2 acre-feet with a reservoir level at the top of dam elevation. A dam of this size and hazard classification is required to have a minimum spillway design capable of passing a 25 year frequency event.

The dam has a drainage area of 380 acres or 0.59 square miles. The dam has a 12 inch diameter primary spillway with a two foot concrete riser and a maximum capacity of 5.99 cfs. A 25-year frequency event produces a peak runoff of approximately 167 cfs and a 100-year frequency event produces a peak runoff of approximately 276 cfs. The primary spillway will have a capacity of approximately 5.99 cfs with a capacity on the auxiliary spillway reaching up to 162 cfs. The combined maximum outflow of the two spillways is greater than the expected resultant runoff from a 25-year storm.

The annual yield for this drainage area with an 80 percent chance of occurrence, or 8 out of 10 years, is expected to be 4.12 acre-feet. The annual yield with a 50 percent chance of occurrence, or 1 out of 2 years, is expected to be 11.72 acre-feet, and the annual yield with a 10 percent chance of occurrence, or 1 out of 10 years, is expected to be 60.17 acre-feet.

The Tvinnereim Trust Dam will be located in the approximate center of the E ½ of Section 29-T123N-R56W on an unnamed tributary to an unnamed lake in Day County. There are no existing Water Rights/Permits filed on the unnamed tributary or the unnamed lake.

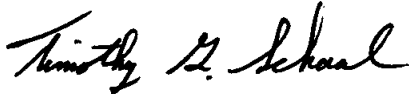
CONCLUSIONS

- 1) There is unappropriated water available for the proposed impoundment.
- 2) The proposed dam is a small size, Category 3, Low Hazard dam.

- 3) Approval of Water Permit No. 8178-3 is not expected to adversely impair any existing water permits or rights.

A handwritten signature in black ink, appearing to read 'Bracken Capen', with a stylized, flowing script.

Bracken Capen
South Dakota DENR- Water Rights Program
Engineer I

A handwritten signature in black ink, appearing to read 'Timothy G. Schaal', with a stylized, flowing script.

Timothy G. Schaal, P.E.
South Dakota DENR- Water Rights Program
Engineer IV

Supplementary Calculations for Water Permit No.
8178-2
02-Sep-15
Prepared by: Bracken Capen

	Elev (ft)	Vol (ac-ft)
Top of Dam	1743.5	280.2
Primary Spillway	1740	149.25
Aux Spillway	1741.5	203.45
D/S Toe	1735.4	
Total Height (ft)	8.1	
Effective Height (ft)	6.1	
Intermediate Storage Capacity (ac-ft)	203.45	
Effective Height x Intermediate Storage Capacity	1241.04	
25 year storm spillway design		
Region A		
Drainage Area (acres)	380	
Drainage Area (mi^2)	0.59	
Peak Flow (cfs) 25 year	166.85	
$Q_{25}=218CA^{0.513}$		
Peak Flow (cfs) 100 year	275.90	
$Q_{100}=362CA^{0.521}$		
Aux Spillway Capacity (cfs)	161.79	
$Q=CLH^{1.5}$		
C (unitless)	2.6	
L (ft)	22	
H (ft)	2	
NRCS Annual Yield		
ISO	2.5	
DA (acres)	380	
CN	73	
80% likelihood runoff (inches/acre)	0.13	
Resultant runoff (ac-ft)	4.12	
50% likelihood runoff (inches/acre)	0.37	
Resultant runoff (ac-ft)	11.72	
10% likelihood runoff (inches/acre)	1.90	
Resultant runoff (ac-ft)	60.17	

AFFIDAVIT OF PUBLICATION

County of Day
State of South Dakota,

} ss.

RECEIVED

OCT 15 2015

WATER RIGHTS
PROGRAM

John Suhr, of said county and state being duly sworn on oath, says: That the Reporter & Farmer is a legal weekly newspaper of general circulation, and an official newspaper as required by Session Laws of 1893, printed and published in Webster, in said county and state, by the Day County Printing Company and has been such newspaper during the time hereinafter mentioned, that I, John Suhr, the undersigned, am publisher of said newspaper, and have personal knowledge of all facts stated in this affidavit and that the advertisement headed, Water Application, Tvinnereim Trust; DENR, a printed copy of which is hereunto attached, was printed and published in the said newspaper one successive and complete issues as follows:

First Publication	Sept. 21, 2015;
Second Publication	,
Third Publication	,
Fourth Publication	,
Fifth Publication	,

That the full amount of fees for publication of the annexed notice is \$29.03 and inures solely to the Reporter & Farmer, published by The Day County Printing Company, that no arrangement or understanding for a division thereof has been made with any other person, and that no part thereof has been agreed to be paid any person whomsoever.

Subscribed and sworn to before me this 21st day of September, 2015.

LeAnn M. Suhr
Day County South Dakota
My Commission Expires November 2, 2017


Notary Public, Day County, South Dakota

Water ap

NOTICE OF APPLICATION
No. 8178-3

to Appropriate Water

Notice is given that Irene J. Tvinnereim Irrevocable Trust, c/o Virginia Tobin, Trustee, 1716 S. Roosevelt St., Aberdeen, SD 57401 has filed an application for a water permit to impound 149.3 acre-feet of water from runoff by constructing a dam for a wetland restoration project located in the approximate center of the E1/2 Section 29 with water impounded in the S1/2NE1/4 and the N1/2SE1/4 Section 29; all in T123N-R56W. This application requests impoundment of sufficient water to maintain water to the outlet elevation of 1,740.0 feet mean sea level (msl). The water will be used for recreation, fish and wildlife propagation, livestock water and wetland restoration purposes.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 8178-3 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on this application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hear-

Application

ing will be scheduled and the Water Management Board will consider this application. Notice of the hearing will be given to the applicant and any person filing a petition.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E. Capitol, Pierre, SD 57501 (605-773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by October 1, 2015.

The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application.

Steven M. Pirner, Secretary,
Department of Environment
and Natural Resources.

Published once at the total
approximate cost of \$29.03.

RECEIVED

SEP 25 2015

WATER RIGHTS
PROGRAM

Form 8

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA)
) SS
County of Codington)

I, Monica K. Saathoff

certify that the attached printed Notice was taken
from the Watertown Public Opinion

printed and published in Watertown

County of Codington and
state of South Dakota. The notice was published

in the newspaper on the following date:

September 21st, 2015

Cost of Printing \$63.10

Monica K Saathoff
(Signature)

Bookkeeper

(Title)

September 21st, 2015

(Date Signed)

DEPARTMENT
OF
ENVIRONMENT
AND NATURAL
RESOURCES

NOTICE OF APPLICATION
NO. 8178-3 to Appropriate
Water

Notice is given that Irene J. Tvinnereim Irrevocable Trust, c/o Virginia Tobin, Trustee, 1716 S Roosevelt St. Aberdeen, SD 57401 has filed an application for a water permit to impound 149.3 acre-feet of water from runoff by constructing a dam for a wetland restoration project located in the approximate center of the E 1/2 Section 29 with water impounded in the S 1/2 NE 1/4 and the N 1/2 SE 1/4 Section 29; all in T123N-R56W. This application requests impoundment of sufficient water to maintain water to the outlet elevation of 1740.0 feet mean sea level (msl). The water will be used for recreation, fish and wildlife propagation, livestock water and wetland restoration purposes. Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 8178-3 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on this application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider this application. Notice of the hearing will be given to the applicant and any person filing a petition. Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's

recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by October 1, 2015. The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application. Steven M. Pirner, Secretary, Department of Environment and Natural Resources. Published once at an approximate cost of \$58.10. (September 21, 2015)

63.10
All legal notices in the Public Opinion and other South Dakota newspapers can be found at
www.sdpublicnotices.com

Schlaak, Karen

From: Schlaak, Karen
Sent: Tuesday, September 15, 2015 8:06 AM
To: news@reporterandfarmer.com
Subject: 8178-3, Irene J Tvinnereim Irrevocable Trust
Attachments: 8178-3public.short.docx; FORM8 FRM.doc

Attached is a notice to be published on September 21, 2015.

Irene J Tvinnereim Irrevocable Trust, c/o Virginia Tobin, Trustee, 1716 S Roosevelt St, Aberdeen SD 57401 (605 225-7682) has been notified to contact you to authorize publication and arrange for payment.

Please send the affidavit or return the attached Proof of Publication form ASAP.

Let me know if you have questions. Please acknowledge receipt of this email.

Karen Schlaak

Water Rights Program
523 E Capitol Ave
Pierre SD 57501
Phone: 605 773-3352

Schlaak, Karen

From: Schlaak, Karen
Sent: Tuesday, September 15, 2015 8:05 AM
To: legals@thepublicopinion.com
Subject: 8178-3, Irene J Tvinnereim Irrevocable Trust
Attachments: 8178-3public.short.docx; FORM8 FRM.doc

Attached is a notice to be published on September 21, 2015.

Irene J Tvinnereim Irrevocable Trust, c/o Virginia Tobin, Trustee, 1716 S Roosevelt St, Aberdeen SD 57401 (605 225-7682) has been notified to contact you to authorize publication and arrange for payment.

Please send the affidavit or return the attached Proof of Publication form ASAP.

Let me know if you have questions. Please acknowledge receipt of this email.

Karen Schlaak
Water Rights Program
523 E Capitol Ave
Pierre SD 57501
Phone: 605 773-3352



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

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

September 14, 2015

Irene J Tvinnereim Irrevocable Trust
Virginia Tobin - Trustee
1716 S Roosevelt St
Aberdeen SD 57401

Dear Ms. Tobin:

Water Permit Application No. 8178-3 for fish & wildlife propagation and livestock water use has been examined and found to comply with the South Dakota Water Laws and applicable rules. A notice has been sent to the Reporter & Farmer printed at Webster SD (Ph # 605-345-3356) and the Public Opinion printed at Watertown SD (Ph # 605-886-6901). You will need to contact the newspaper(s) and authorize publication of this notice. For your information, a copy of the notice, the recommendation of the Chief Engineer and report on the application are enclosed. Please review the notice prior to publication and notify this office, if you have any corrections or questions.

Be sure to contact the above newspaper(s) to authorize publication of your Notice and to arrange for payment. Early contact with the paper(s) can eliminate delays. Upon receiving authorization from you, the publisher has been instructed to publish your notice. The newspaper has also been instructed to send us the Proof of Publication. We must receive Proof of Publication before action can be taken on the application.

Sincerely,


Eric Gronlund
Natural Resources Engineer
(605) 773-3352

enclosures

NOTE: If you plan to contest any part of the Chief Engineer's recommendation, you must file a petition pursuant to the procedures outlined in the attached notice of hearing. The Water Management Board will then consider your concerns during a hearing on the application.

Instruction to Newspaper - Publish the Notice on September 21, 2015. The applicant is responsible for payment.

NOTICE OF APPLICATION NO. 8178-3 to Appropriate Water

Notice is given that Irene J Tvinnereim Irrevocable Trust, c/o Virginia Tobin, Trustee, 1716 S Roosevelt St. Aberdeen SD 57401 has filed an application for a water permit to impound 149.3 acre-feet of water from runoff by constructing a dam for a wetland restoration project located in the approximate center of the E 1/2 Section 29 with water impounded in the S 1/2 NE 1/4 and the N 1/2 SE 1/4 Section 29; all in T123N-R56W. This application requests impoundment of sufficient water to maintain water to the outlet elevation of 1740.0 feet mean sea level (msl). The water will be used for recreation, fish and wildlife propagation, livestock water and wetland restoration purposes.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 8178-3 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on this application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider this application. Notice of the hearing will be given to the applicant and any person filing a petition.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by October 1, 2015.

The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application. Steven M. Pirner, Secretary, Department of Environment and Natural Resources.

Published once at the total approximate cost of _____.



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182

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OCT 29 2015

Irene J Tvinnereim Irrevocable Trust
Virginia Tobin
1716 S Roosevelt St
Aberdeen SD 57401

Dear Ms. Tobin:

Enclosed is Water Permit No. 8178-3 authorizing construction of the water diversion system and beneficial use of the water, not exceeding the limits as specified in the Water Permit.

Form 10, *Notice of Completion of Works and Application of Water to Beneficial Use*, is enclosed. Please return this completed form after you have finished the system and have put the water to beneficial use. An investigation can then be scheduled so the water license may be issued, thus completing the acquisition of a water right.

An informational sheet *Common Water Right Questions?* is also enclosed. This sheet is intended to answer some of the questions associated with obtaining and keeping a water right.

Sincerely,

Jeanne Goodman, Chief Engineer
Water Rights Program
(605) 773-3352

enclosures

Report of Examination of Works and/or Application of Water to Beneficial Use For Permit No. **8178-3**

I have this day, **October 14, 2024**, made a thorough examination of the water use system constructed by **Irene J Tvinnereim Irrevocable Trust, 1716 S Roosevelt St, aberseen, SD, 57401** of Permit No. **8178-3**, bearing the priority of **July 24, 2015** authorizing the storage of **149.3** acre-feet of the waters from **runoff** for **wetland restoration** purposes, in **Day** County.

D. Compliance with Permit Requirements:

- 1) Permit qualifications being abided by **Y**
- 2) Exceptions to compliance are: **None**

E. Condition and Location:

1. The system is in **good** condition with the point(s) of diversion located as follows: **PRINCIPAL SPILLWAY LOCATION From the SW corner, Sec 29 T123N R56W, 2540 ft N & 3800 ft E Lat 45.43478 Long -97.57761 (NW ¼ SE ¼)**
2. The works are capable of storing **149.3** acre-feet of water which is to be used for **wetland restoration**. the license should be issued for **149.3** acre-feet of storage.
3. All structures, wells and lands on map **Y**

F. Comments or other permit(s) associated with the project:

FSA maps and the ArcGIS program were used to construct the attached map and the estimated water surface acreage of 35 acres.

Dam details appear to be consistent with the proposed details in the Permit Application. It seems reasonable to assume that an average water depth of about 4.3 feet for the stored water would result in a total water storage of 150 ac-ft behind an 8-foot dam.



Darrell DeBoer
Water Rights Inspector
DENR, Water Rights Program

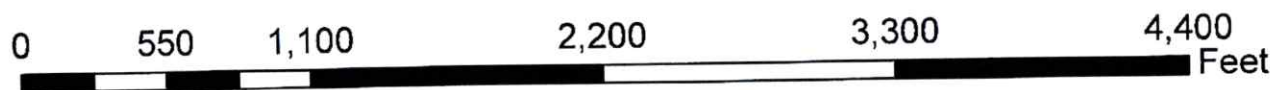
Date report completed: **October 15, 2024**



Looking southeast across the impoundment. The dam is to the right in the photo.



Looking south along the crest of the dam. Excellent vegetation makes it difficult to see the dam, but it is the light-colored mound in the center of the upper one-half of the photo. The emergency spillway is shown in the lower one half of the photo.





**DEPARTMENT of AGRICULTURE
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 E CAPITOL AVE
PIERRE SD 57501-3182
danr.sd.gov

Irene J Tvinnereim Irrevocable Trust
c/o Virginia Tobin
1716 S Roosevelt St
Aberdeen, SD 57401

No. 8178-3

Dear Ms. Tobin:

Enclosed is Water License No. 8178-3. This is the final water right document completing your process of obtaining a Water Right. Included with your license is a map prepared by the staff engineer who conducted the field investigation.

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

Sincerely,

Mark Mayer, PE
Director of Office of Water
(605) 773-3352

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**STATE OF SOUTH DAKOTA
WATER LICENSE NO. 8178-3**

(1) Irene J Tvinnereim Irrevocable Trust, c/o Virginia Tobin, made Application No. 8178-3, July 24, 2015, for a water permit to impound 149.3 acre feet of water from runoff by constructing a dam for recreation, fish and wildlife propagation, livestock water and wetland restoration purposes, in Day County, South Dakota. Permit No. 8178-3, with a priority date of July 24, 2015, was approved October 1, 2015, and issued to the applicant for diversion of water with construction of the described water supply system to be completed on or before October 1, 2020, and for the application to beneficial use of water on or before October 1, 2024.

(2) It is certified that the permit holder has complied with the provisions of South Dakota State Law relating to completion of the construction of the water supply system and is entitled to impound 149.3 cubic feet of water per second for beneficial use. The location of the spillway is:

- 2,540 feet N and 3,800 feet E from the SW corner Section 29, T123N, R56W (NW ¼ SE ¼)
(Latitude 45.43478 and Longitude -97.57761)

(3) The water is to be used during the following described annual period: January 1 – December 31.

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

(5) Pursuant to South Dakota Water Law 46-5-30.1 Irene J Tvinnereim Irrevocable Trust, the holder and/or owner of Water Right No. 8178-3 is issued a license to appropriate water, the right to impound 149.3 acre feet of water from runoff, with a priority date of July 24, 2015, from the location specified in (2) of this license for recreation, fish and wildlife propagation, livestock water and wetland restoration purposes.

This license is subject to South Dakota Water Law, any limitations or conditions listed in Water Right No. 8178-3 and subject to the following qualifications:

1. Water Permit No. 8178-3 authorizes an impoundment with a storage capacity of 149.3 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation.
2. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.



Mark Mayer, PE
Director of Office of Water



date

