# Information for File # 2015-01029-TJH

**Applicant:** South Washington Watershed District

**Corps Contact:** Tom Hingsberger

**Address:** 180 E. 5th Street, Suite 700, St. Paul, Minnesota 55101-1638

**E-Mail:** thomas.j.hingsberger@usace.army.mil

**Phone:** (651) 290-5367

**Primary County:** Washington County

**Section:** 26, 27, 34, 35

**Township:** 27N

**Range:** 21W

**Information Complete On:** March 17, 2015

**Posting Expires On:** July 13, 2015

**Authorization Type:** LOP-05-MN

This application is being reviewed in accordance with the practices for documenting Corps jurisdiction under Sections 9 & 10 of the Rivers and Harbor Act of 1899 and Section 404 of the Clean Water Act identified in Regulatory Guidance Letter 07-01. We have made a preliminary determination that the aquatic resources proposed to be impacted by the proposed project are regulated by the Corps of Engineers under Section 10 of the Rivers and Harbors Act. Our jurisdictional review could result in modifications to the scope of the project's regulated waterbody/wetland impacts and compensatory mitigation requirements identified above. An approved jurisdictional determination will be made prior to reaching a permit decision, and will be posted on the St. Paul District web page at http://www.mvp.usace.army.mil/.

**Project Includes:** Upland bank shaping, culvert replacements, riffle complex construction, and channel restoration in the Lower East Ravine.

PROJECT DESCRIPTION AND PURPOSE: The South Washington Watershed District is working in conjunction with 3M to install ravine stabilization measures along the Lower East Ravine in Cottage Grove, MN. This project is a component of the Central Draw Storage Facility and is needed to provide a controlled emergency overflow outlet for runoff to the Mississippi River during 1% chance or less frequent precipitation events. The stabilization measures include installation of rock and woody debris riffles as well as

cedar and boulder revetments placed at strategic locations along the ravine corridor. It includes vegetation management activities, including the removal of invasive herbaceous plants, buckthorn, honeysuckle and other invasive shrubs, and tree species along with seeding activities that will occur adjacent to the stream channel. Two culverts will be removed and replaced along the ravine reach. The culverts are currently placed under private access roads and will be replaced with culverts installed at the current stream bed elevation so as to not impede or impound stream flows. The purpose of the project is to dissipate energy and reduce erosion from high flows, and protect the habitat, water quality and publicly-owned recreation resources within the Lower East Ravine between Highway 61 and the Mississippi River.

NAME, AREA AND TYPES OF WATERS (INCLUDING WETLANDS) SUBJECT TO LOSS: Stream enhancements are proposed for approximately 9,700 linear feet of the Lower East Ravine. The amounts and areas of fill material that would be discharged into Deep marsh and Hardwood swamp wetlands located within the Lower East Ravine are shown on the attached plan and profile drawings. Fill material would be discharged into approximately 540 square feet of the ravine for the installation of two culverts.

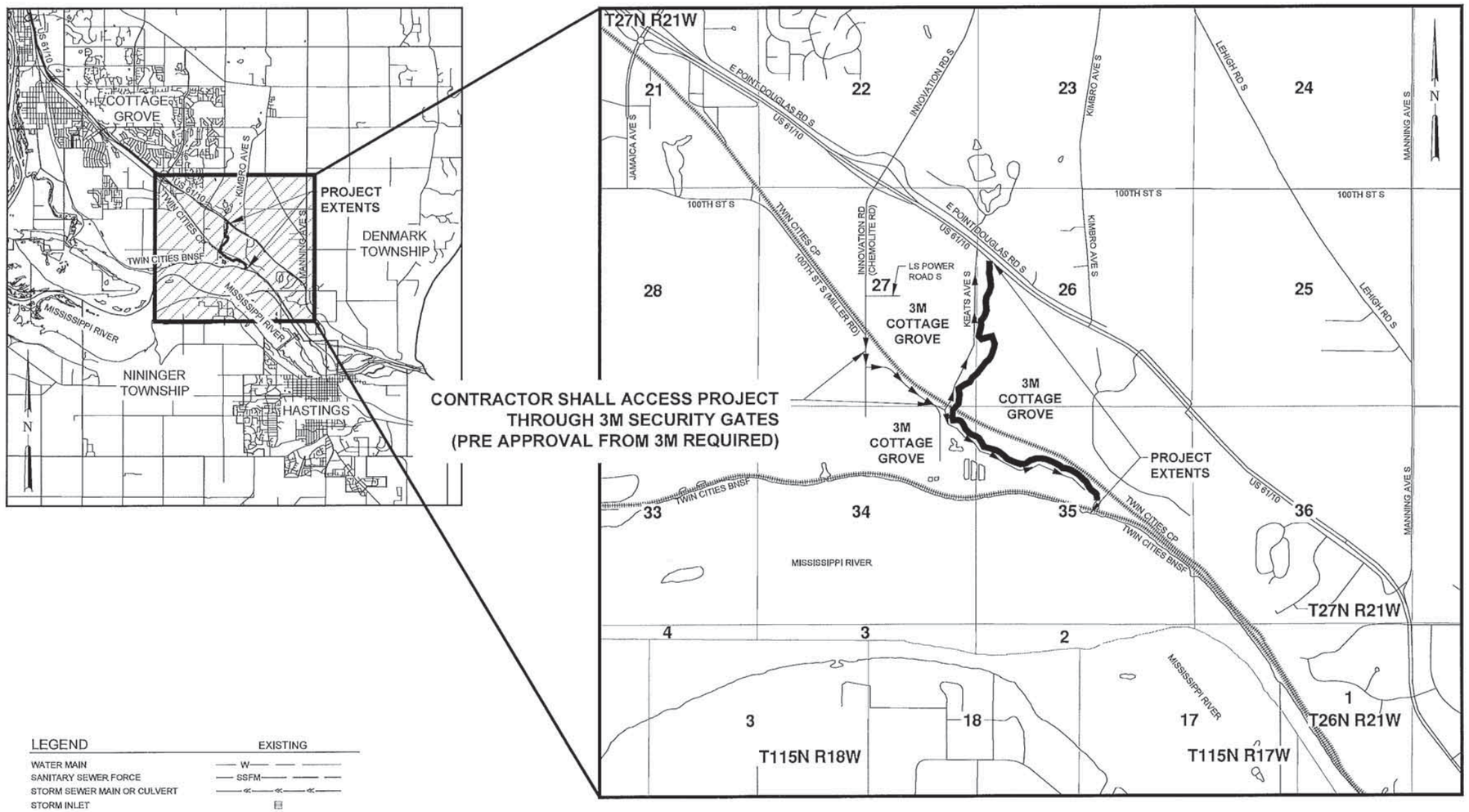
ALTERNATIVES CONSIDERED: The preferred alternative was developed following review by the South Washington Watershed District.

COMPENSATORY MITIGATION: No compensatory mitigation is proposed for this stream restoration project.

**Drawings** See attached.

# CONSTRUCTION PLANS
# FOR
# LOWER EAST RAVINE STABILIZATION

## SOUTH WASHINGTON WATERSHED DISTRICT
## COTTAGE GROVE, MINNESOTA
## MARCH 2015

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| 2 | AERIAL AND PHOTOGRAPHS - STA 0+00 TO 18+00 |
| 3 | AERIAL AND PHOTOGRAPHS - STA 18+00 TO 33+00 |
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NOTES:

1. GEODETIC CONTROL

   VERTICAL: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

   HORIZONTAL: COUNTY COORDINATES (MNDOT), WASHINGTON COUNTY, US FOOT

2. UTILITY

   PRIOR TO ANY EXCAVATION WORK, THE CONTRACTOR IS RESPONSIBLE UNDER MINNESOTA STATE STATUTE 216D AND MINNESOTA RULES CHAPTER 7560 TO CONTACT GOPHER STATE ONE CALL FOR THE LOCATION OF UNDERGROUND UTILITY FACILITIES IN PROXIMITY TO THE EXCAVATION SITE.

   THE SUBSURFACE UTILITY INFORMATION IN THIS PLAN IS UTILITY QUALITY LEVEL D. THIS UTILITY QUALITY LEVEL WAS DETERMINED ACCORDING TO THE GUIDELINES OF CI/ASCE 38-02, ENTITLED "STANDARD GUIDELINE FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA".

LEGEND

| | EXISTING |
|---|---|
| WATER MAIN | W |
| SANITARY SEWER FORCE | SSFM |
| STORM SEWER MAIN OR CULVERT | |
| STORM INLET | |
| MANHOLE | |
| OVERHEAD ELECTRIC | OHE |
| FENCE | X X |
| TREES | |
| RAILROAD TRACKS | |
| CONTOUR | 935 |
| CONTOUR, PROPOSED | 935 |
| BUILDING | |
| RIPRAP | |

2015-01029-TJH
SWWD Lower East Ravine Stabilization
1 of 16

PRELIMINARY

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

Signature: _____ Date: 3-10-2015
Printed Name: Gregory S. Bowles License #: 41929

South Washington WATERSHED District

PREPARED BY:

Houston Engineering Inc.

MAPLE GROVE, MINNESOTA

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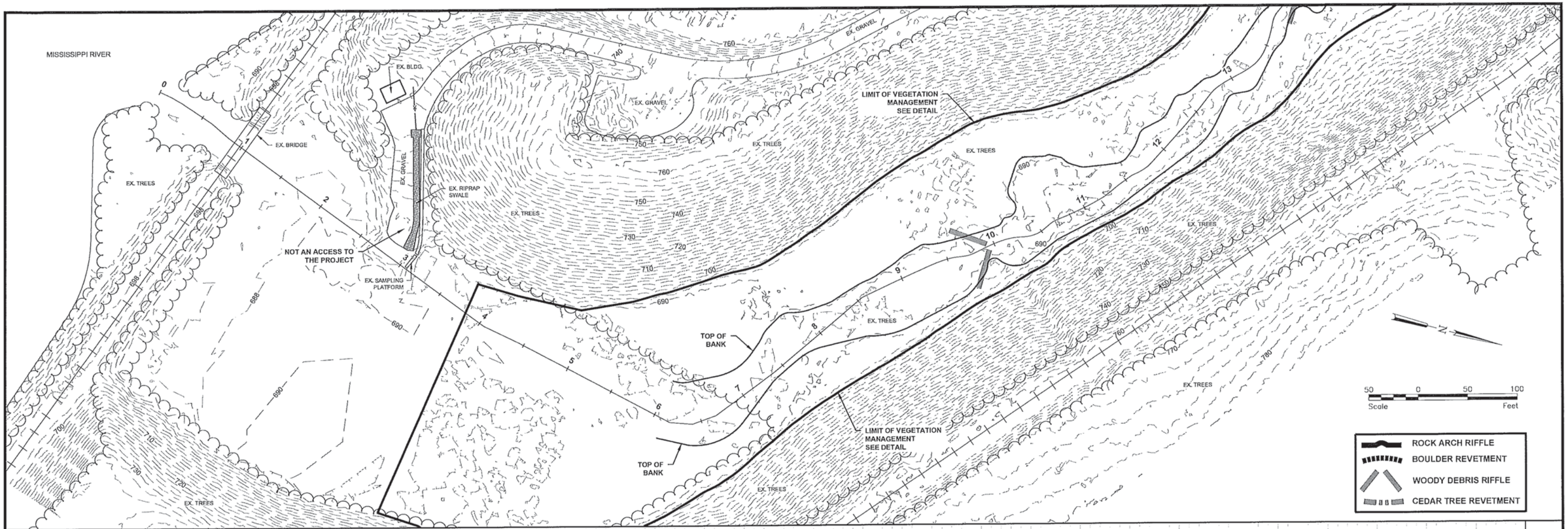
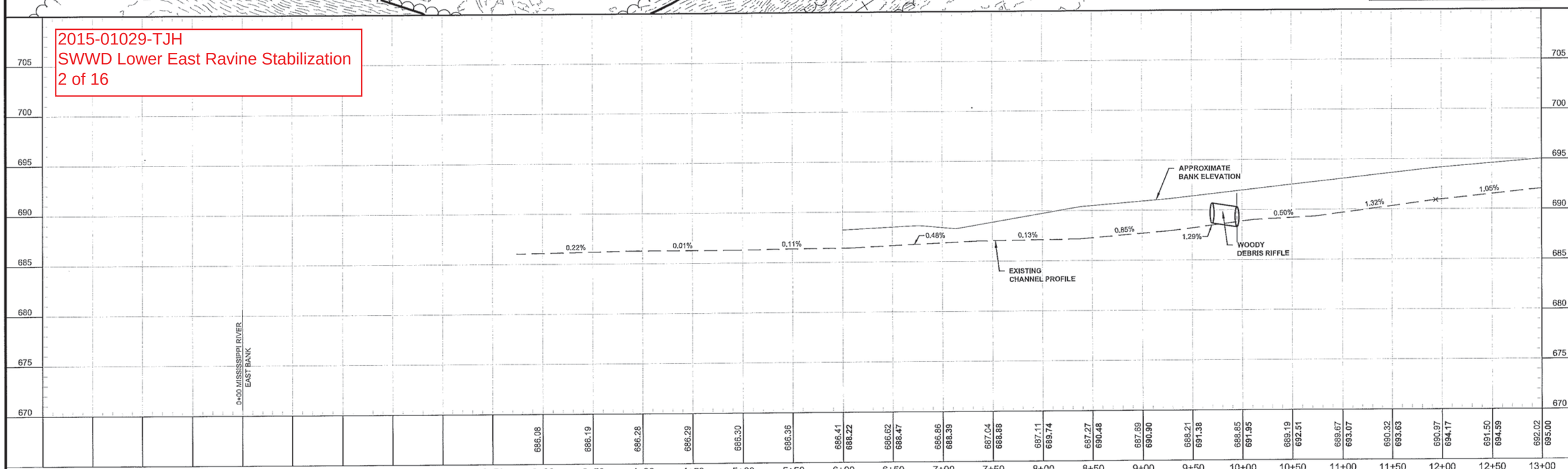



2015-01029-TJH
SWWD Lower East Ravine Stabilization
2 of 16




| No. | Revision | Date | By |
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| | | | |

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Signature: Date: 3-10-2015
Printed Name: Gregory S. Bowles License #: 41929

Houston Engineering Inc.

Maple Grove
P: 763.493.4522
F: 763.493.5572

| Drawn by | Date |
|---|---|
| DJL | 3-10-15 |
| **Checked by** | **Scale** |
| LDO | AS SHOWN |

**LOWER EAST RAVINE STABILIZATION**

COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

PLAN AND PROFILE
STA 0+00 TO 13+00
PROJECT NO. 4876-027

SHEET
15 of 31

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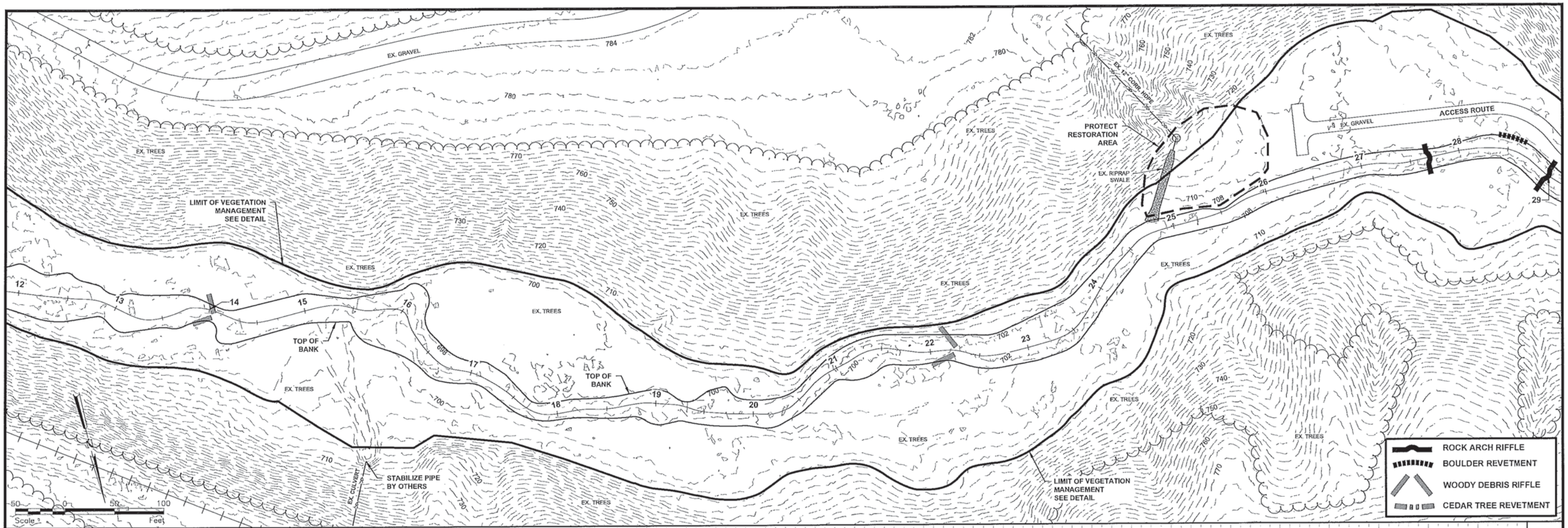
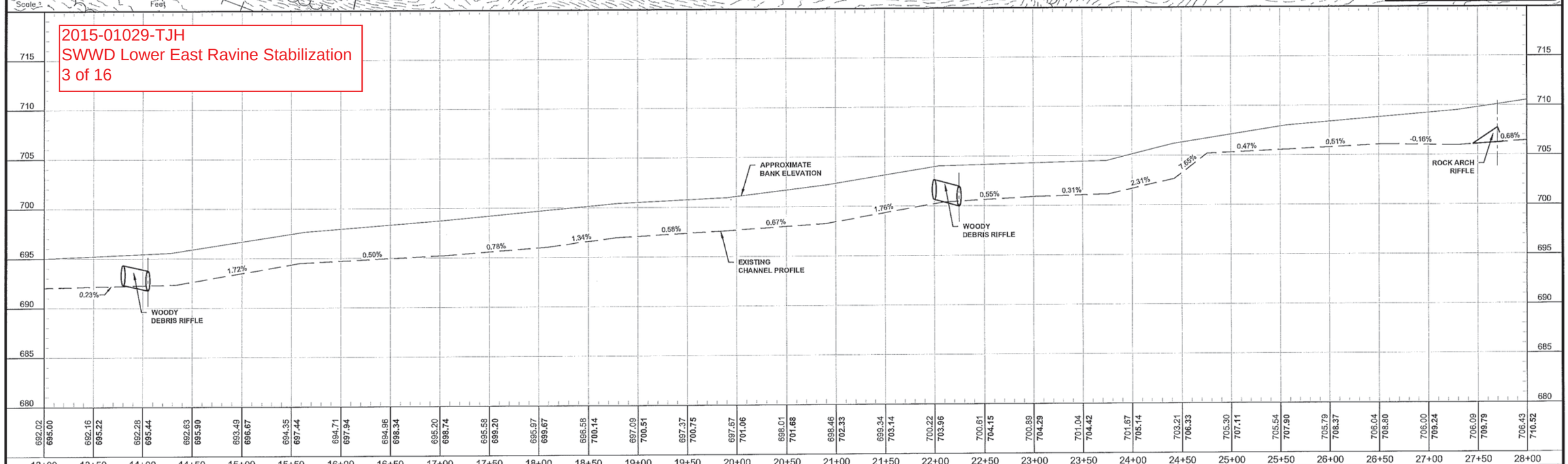



2015-01029-TJH
SWWD Lower East Ravine Stabilization
3 of 16

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**LOWER EAST RAVINE STABILIZATION**

COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

PLAN AND PROFILE
STA 13+00 TO 28+00
PROJECT NO. 4876-027

SHEET
16 of 31

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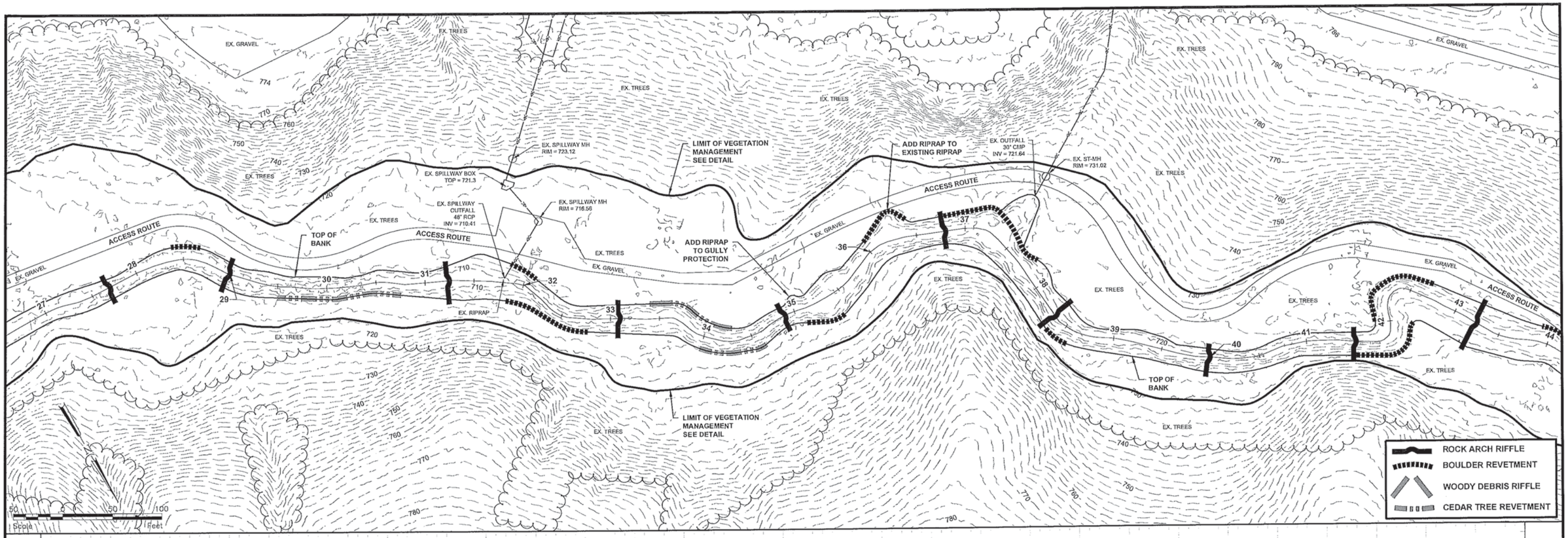
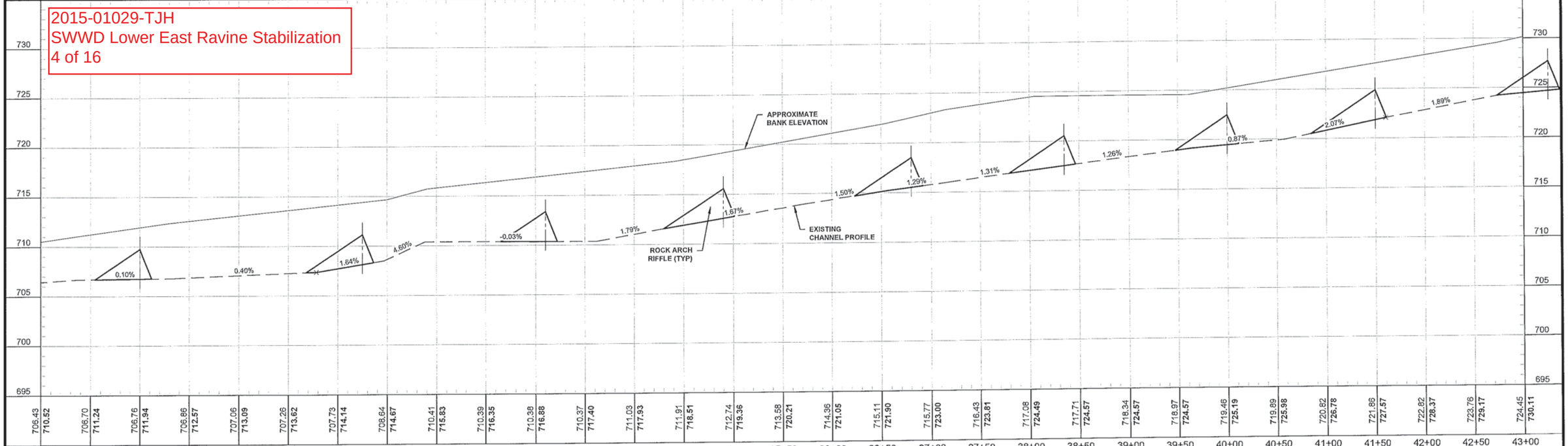



2015-01029-TJH
SWWD Lower East Ravine Stabilization
4 of 16

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**LOWER EAST RAVINE STABILIZATION**
COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

PLAN AND PROFILE
STA 28+00 TO 43+00
PROJECT NO. 4876-027

SHEET 17 of 31

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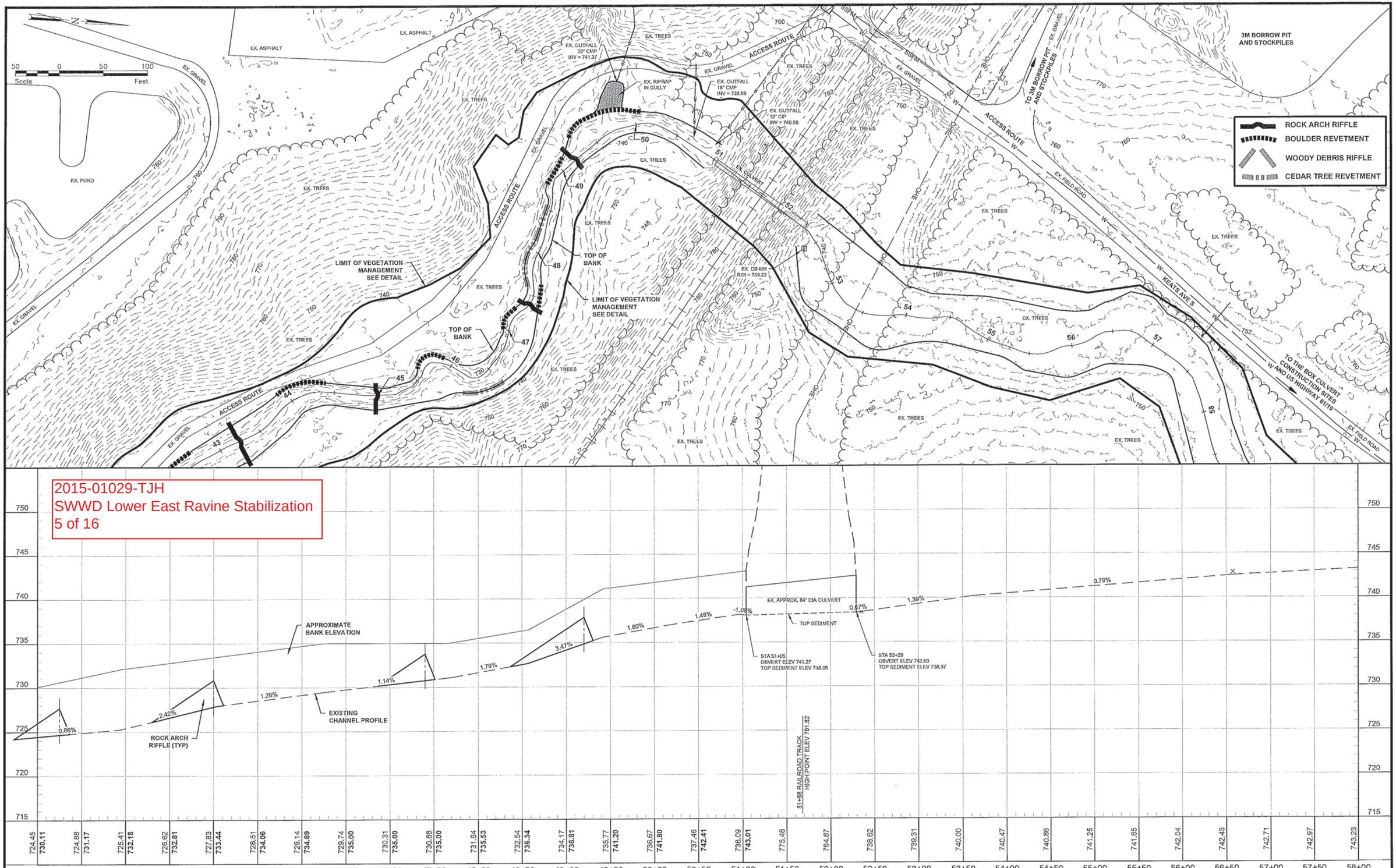


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**LOWER EAST RAVINE STABILIZATION**

COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

PLAN AND PROFILE
STA 43+00 TO 58+00
PROJECT NO. 4876-027

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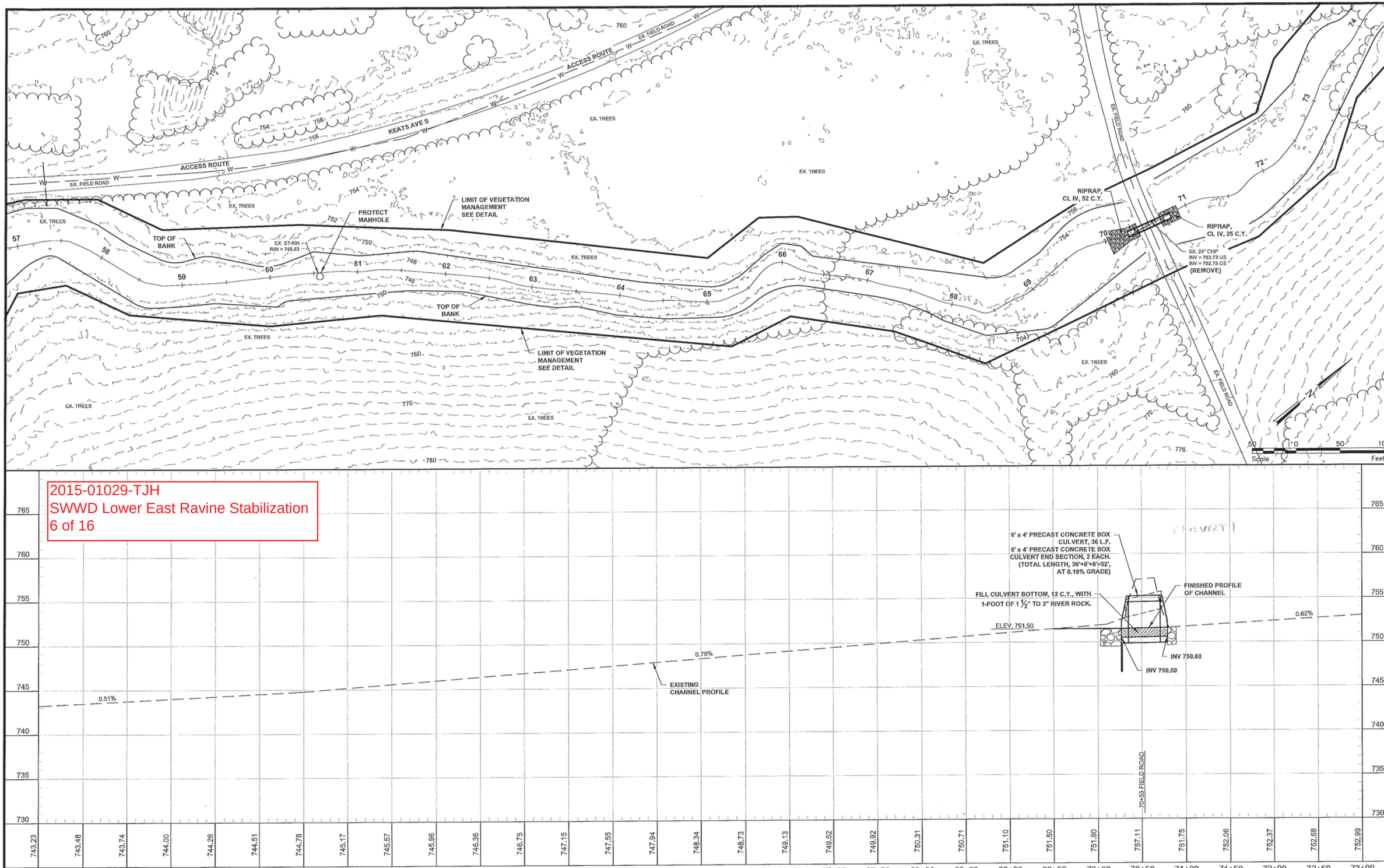


2015-01029-TJH
SWWD Lower East Ravine Stabilization
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**LOWER EAST RAVINE STABILIZATION**

COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

PLAN AND PROFILE
STA 58+00 TO 73+00
PROJECT NO. 4876-027

SHEET
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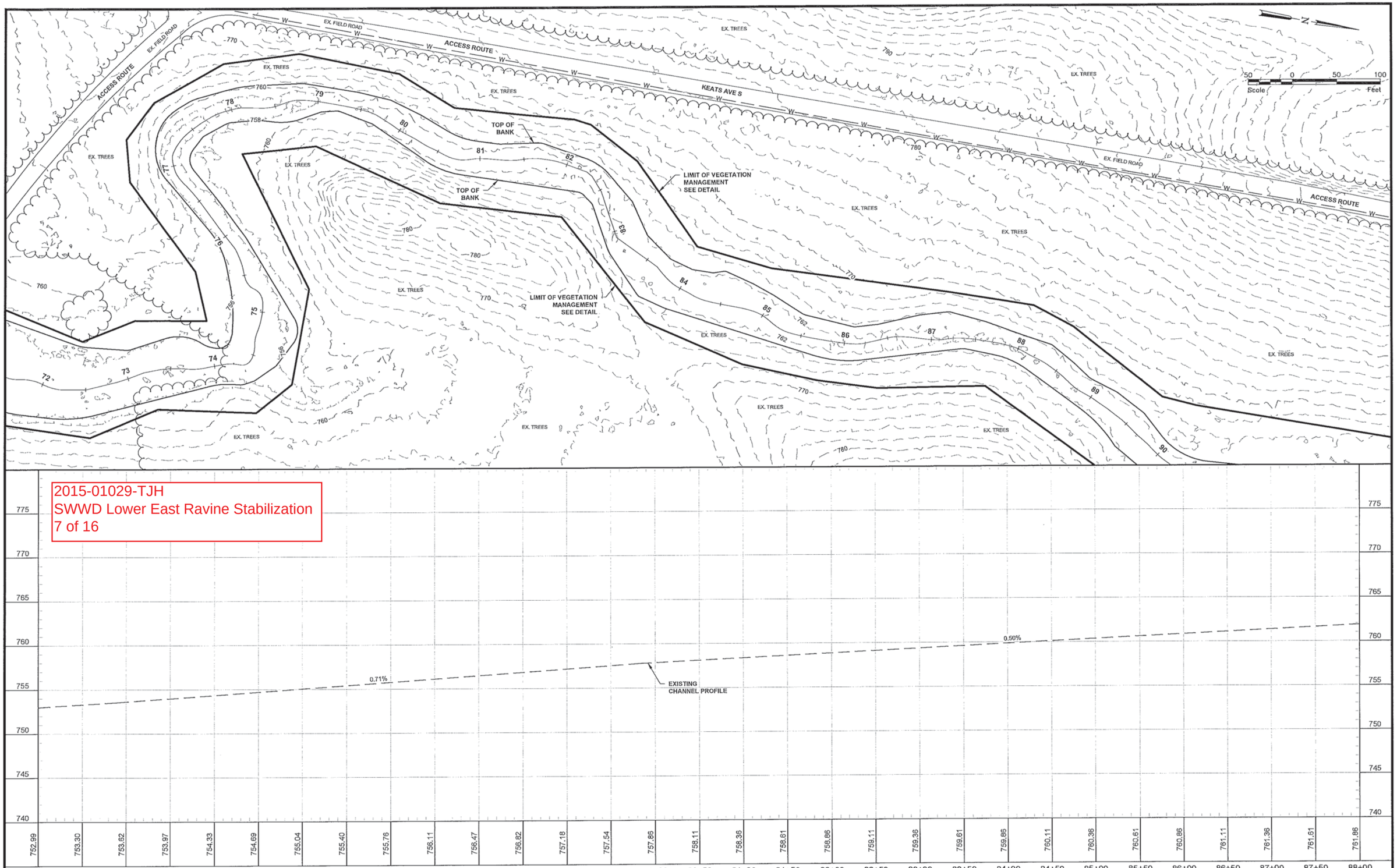


2015-01029-TJH
SWWD Lower East Ravine Stabilization
7 of 16

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Checked by LDO
Date 3-10-15
Scale AS SHOWN

**LOWER EAST RAVINE STABILIZATION**
COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

PLAN AND PROFILE
STA 73+00 TO 88+00
PROJECT NO. 4876-027

SHEET
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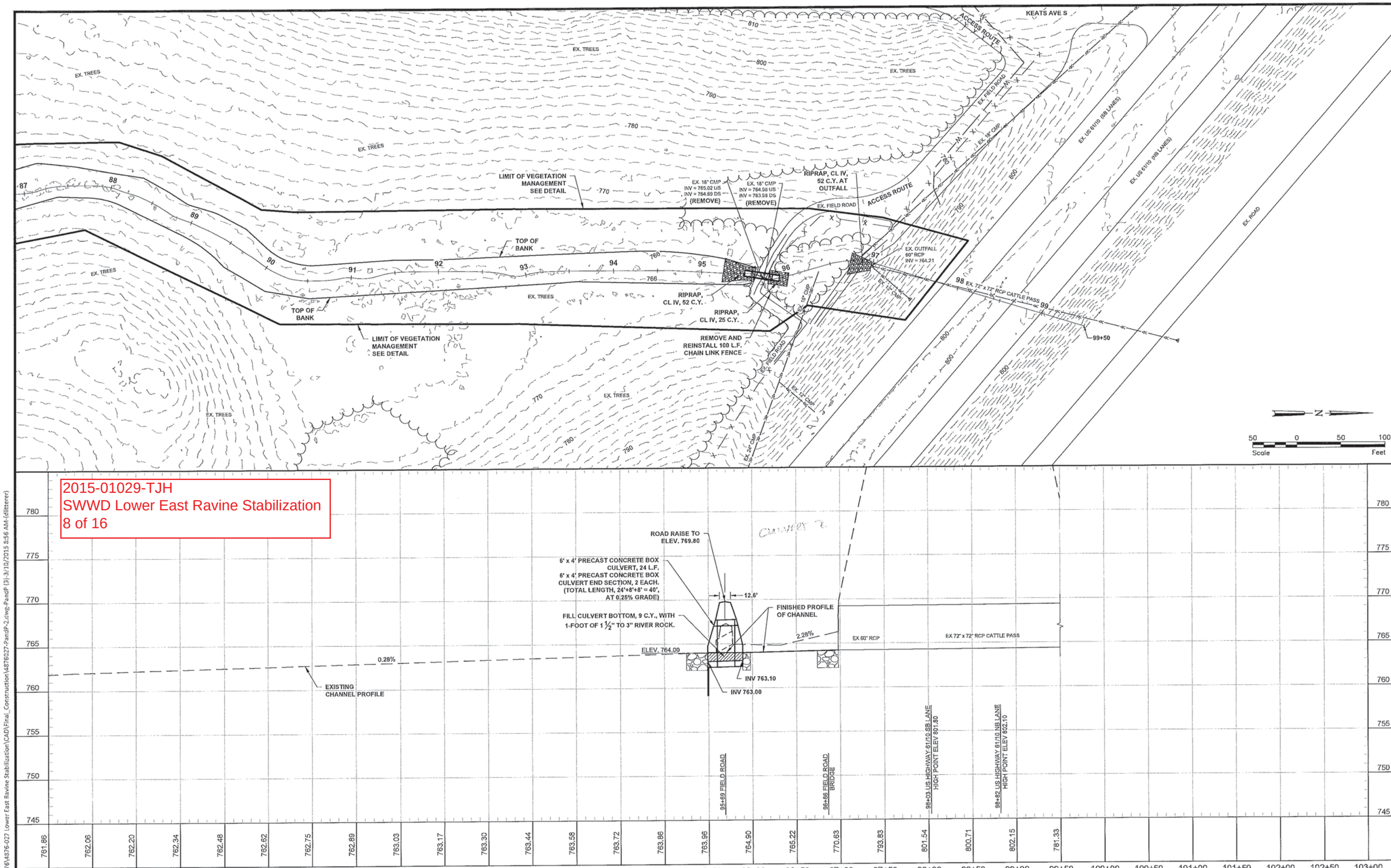


2015-01029-TJH
SWWD Lower East Ravine Stabilization
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Drawn by DJL | Date 3-10-15
Checked by LDO | Scale AS SHOWN

**LOWER EAST RAVINE STABILIZATION**
COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

PLAN AND PROFILE
STA 88+00 TO 97+00
PROJECT NO. 4876-027

SHEET 21 of 31

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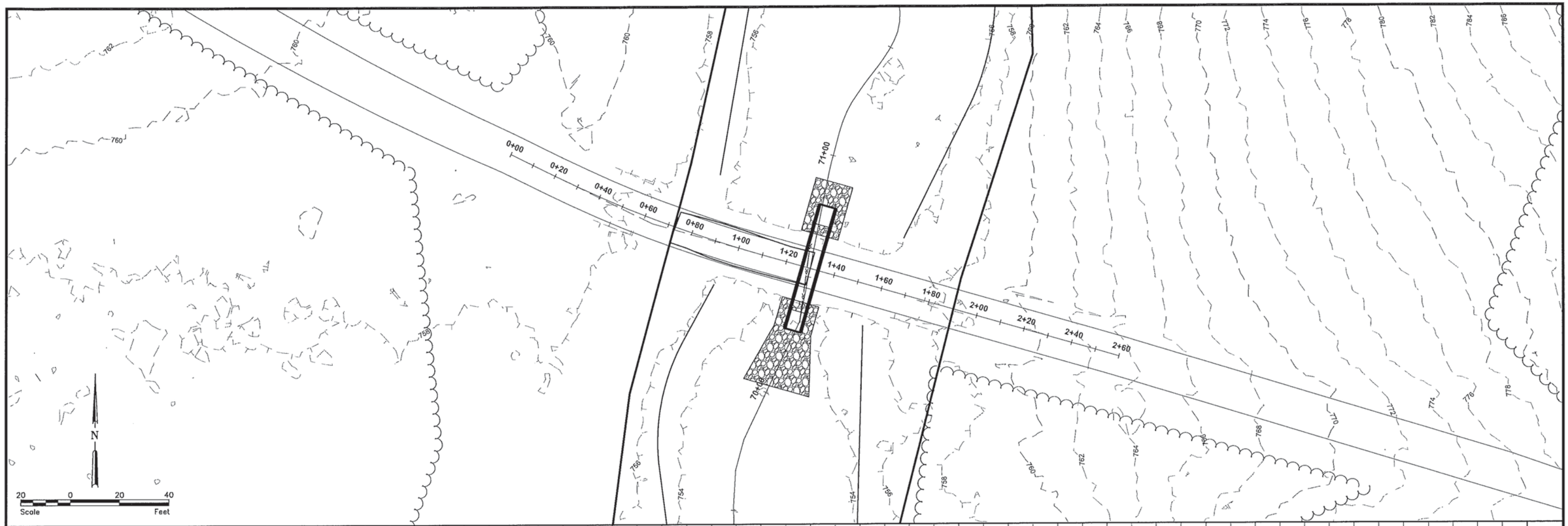
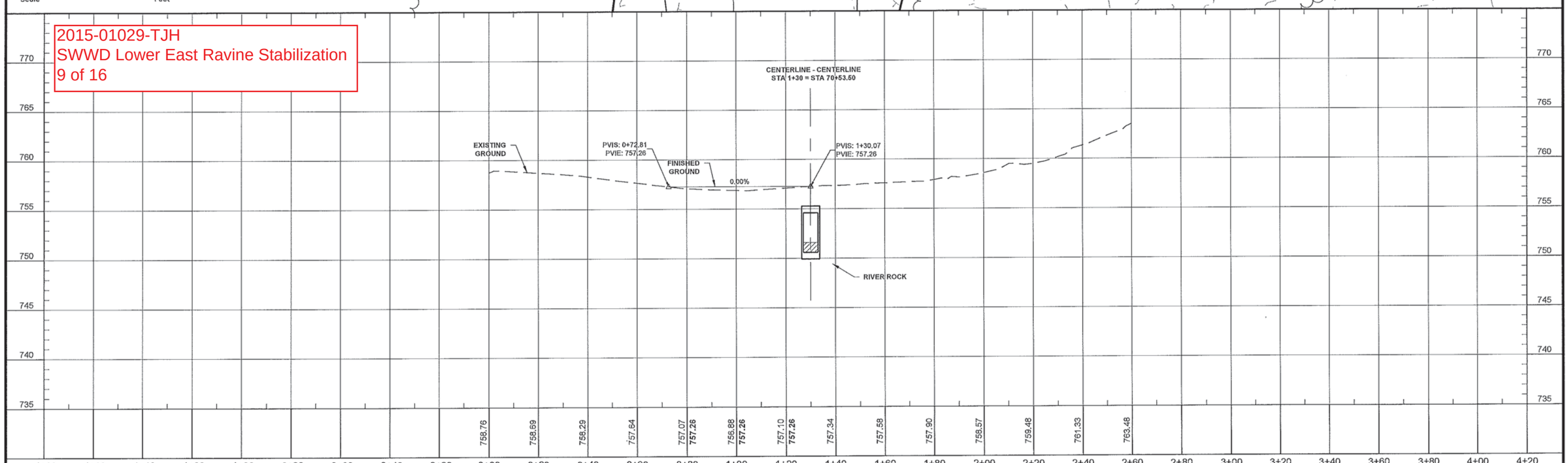
SWWD Lower East Ravine Stabilization
9 of 16

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| DJL | 3-10-15 |
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**LOWER EAST RAVINE STABILIZATION**

COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

PLAN AND PROFILE
FIELD ROAD AT STA 70+53
PROJECT NO. 4876-027

SHEET
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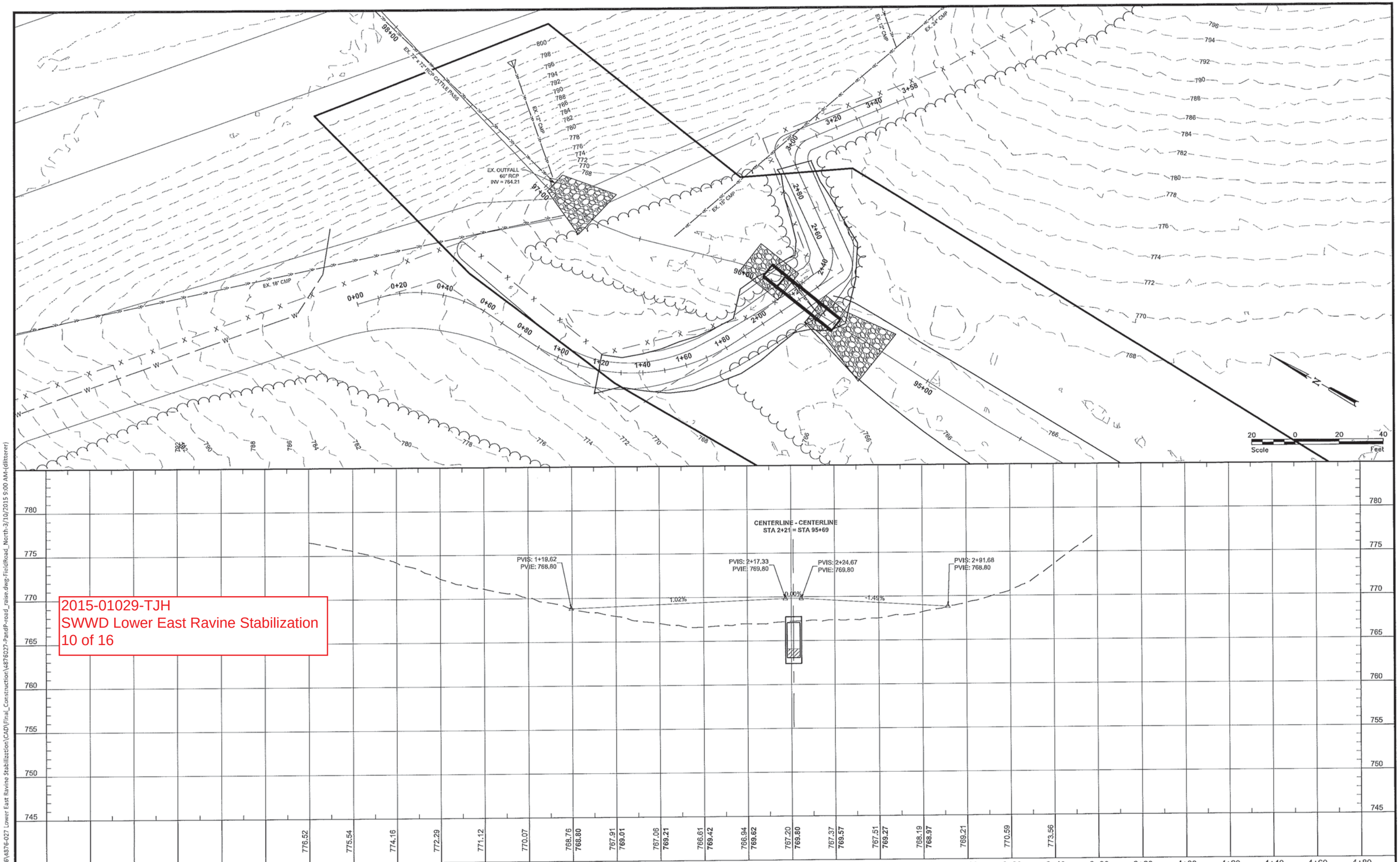


2015-01029-TJH
SWWD Lower East Ravine Stabilization
10 of 16

| No. | Revision | Date | By |
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Signature: Date: 3-10-2015
Printed Name: Gregory S. Bowles License #: 41929

Houston Engineering Inc.

Maple Grove
P: 763.493.4522
F: 763.493.5572

Drawn by DJL
Checked by LDO
Date 3-10-15
Scale AS SHOWN

**LOWER EAST RAVINE STABILIZATION**

COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

PLAN AND PROFILE
FIELD ROAD AT STA 95+69
PROJECT NO. 4876-027

SHEET
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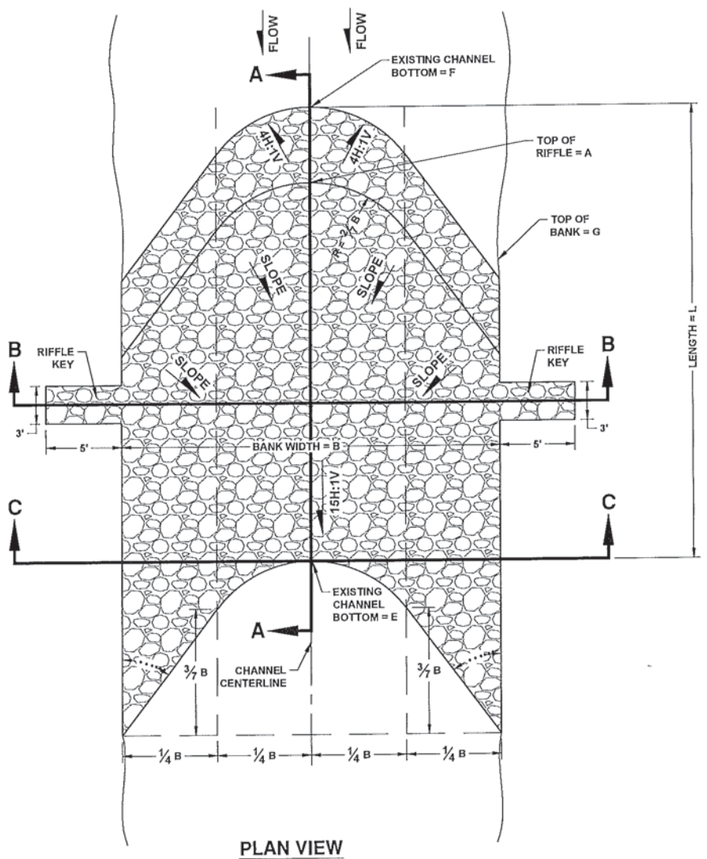
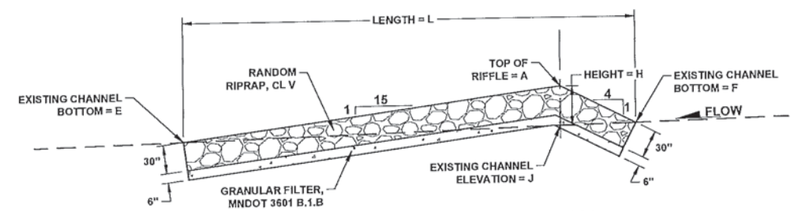
## ROCK RIFFLE TABULATION

| TOP OF RIFFLE STATION ON CHANNEL CENTERLINE [A] | STATION TO STATION ON CHANNEL CENTERLINE DOWNSTREAM [E] | | UPSTREAM [F] | TOP OF BANK ELEVATION [G] | EXISTING CHANNEL ELEVATION AT TOP OF RIFFLE AT CHANNEL CENTERLINE [J] | TOP OF RIFFLE ELEVATION AT CHANNEL CENTERLINE [A] | LENGTH (FT) [L] | BANK WIDTH (FT) [B] | HEIGHT (FT) [H] | RIPRAP IN RIFFLE (CU YD) | RIPRAP IN RIFFLE KEYS (CU YD) | TOTAL ROCK RIFFLE RIPRAP, CL V (CU YD) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27+70 | 27+45 | TO | 27+76 | 710.10 | 706.20 | 707.70 | 31 | 21 | 1.5 | 60.3 | 4.4 | 64.7 |
| 29+00 | 28+54 | TO | 29+12 | 712.00 | 706.80 | 709.80 | 58 | 26 | 3 | 139.6 | 4.4 | 144.1 |
| 31+25 | 30+68 | TO | 31+36 | 714.40 | 708.14 | 711.14 | 68 | 33 | 3 | 207.8 | 4.4 | 212.2 |
| 33+10 | 32+65 | TO | 33+22 | 717.00 | 710.40 | 713.40 | 57 | 29 | 3 | 153.1 | 4.4 | 157.5 |
| 34+90 | 34+30 | TO | 35+01 | 719.20 | 712.60 | 715.60 | 71 | 21 | 3 | 138.1 | 4.4 | 142.5 |
| 36+80 | 36+23 | TO | 36+91 | 722.60 | 715.50 | 718.50 | 68 | 28 | 3 | 176.3 | 4.4 | 180.7 |
| 38+35 | 37+79 | TO | 38+46 | 724.60 | 717.50 | 720.50 | 67 | 33 | 3 | 204.7 | 4.4 | 209.2 |
| 40+00 | 39+47 | TO | 40+12 | 725.20 | 719.50 | 722.50 | 65 | 24 | 3 | 144.4 | 4.4 | 148.9 |
| 41+50 | 40+85 | TO | 41+61 | 727.60 | 721.80 | 724.80 | 76 | 24 | 3 | 168.9 | 4.4 | 173.3 |
| 43+25 | 42+73 | TO | 43+37 | 730.60 | 724.70 | 727.70 | 64 | 46 | 3 | 272.6 | 4.4 | 277.0 |
| 45+00 | 44+29 | TO | 45+11 | 733.40 | 727.80 | 730.80 | 82 | 26 | 3 | 197.4 | 4.4 | 201.9 |
| 47+40 | 46+86 | TO | 47+51 | 735.00 | 730.80 | 733.80 | 65 | 21 | 3 | 126.4 | 4.4 | 130.8 |
| 49+20 | 48+37 | TO | 49+31 | 739.90 | 734.90 | 737.90 | 94 | 24 | 3 | 208.9 | 4.4 | 213.3 |

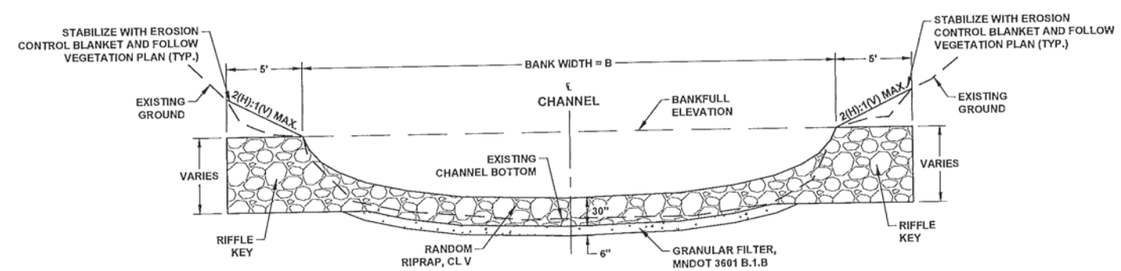
TOTAL 2257.0 CUBIC YARDS



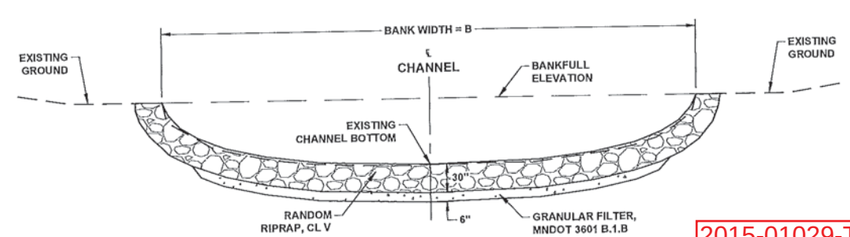

PLAN VIEW




PROFILE ALONG CENTERLINE, SECTION A-A
NOT TO SCALE




SECTION B-B
NOT TO SCALE




SECTION C-C
NOT TO SCALE

2015-01029-TJH
SWWD Lower East Ravine Stabilization
11 of 16

## ROCK ARCH RIFFLE DETAIL
NOT TO SCALE

| No. | Revision | Date | By |
|---|---|---|---|
| | | | |

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

Signature: _____ Date: 3-10-2015
Printed Name: Gregory S. Bowles License #: 41929

Houston Engineering Inc.
Maple Grove
P: 763.493.4522
F: 763.493.5572

| Drawn by | Date |
|---|---|
| DJL | 3-10-15 |
| Checked by | Scale |
| LDO | AS SHOWN |

LOWER EAST RAVINE STABILIZATION
COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

CONSTRUCTION DETAILS
ROCK ARCH RIFFLE
PROJECT NO. 4876-027

SHEET 8 of 31

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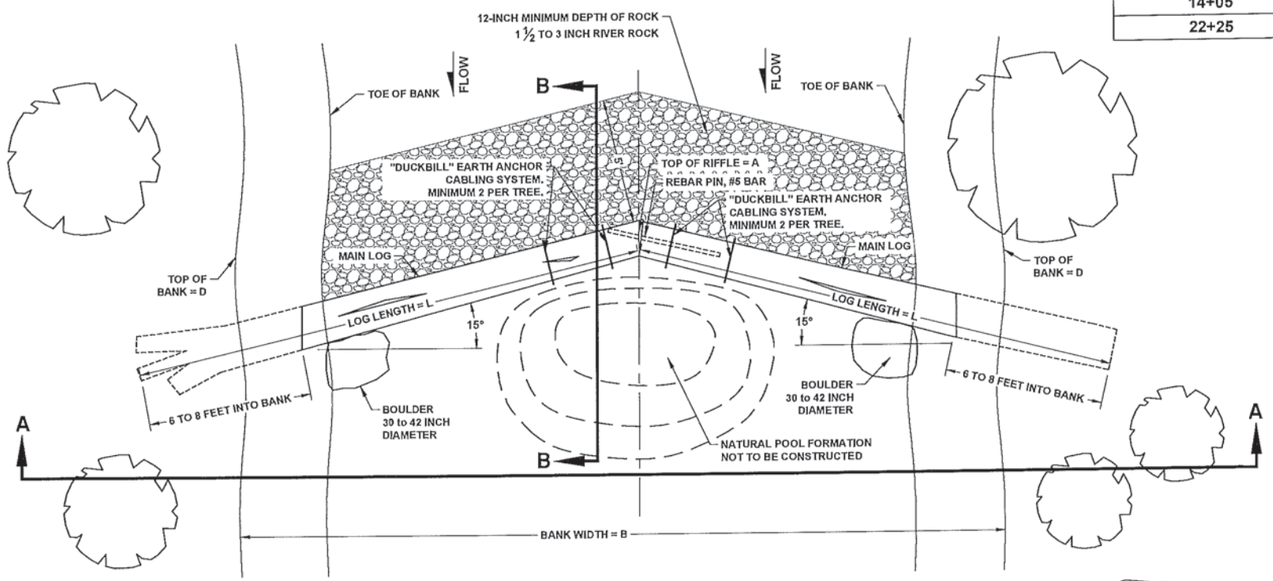
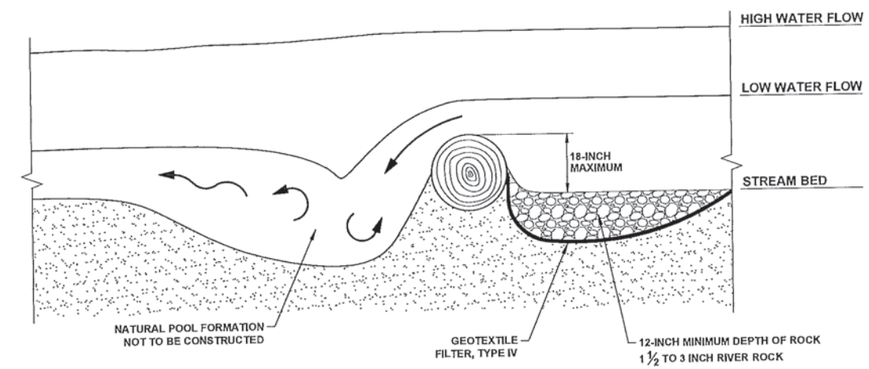
| WOOD DEBRIS RIFFLE TABULATION | | | | |
|---|---|---|---|---|
| TOP OF RIFFLE STATION ON CHANNEL CENTERLINE [A] | TOP OF BANK ELEVATION [D] | EXISTING CHANNEL BOTTOM ELEVATION AT CHANNEL CENTERLINE [E] | BANK WIDTH (FT) [B] | LOG LENGTH (FT) [2 x L] |
| 9+95 | 691.70 | 688.80 | 48 | 64 |
| 14+05 | 695.40 | 692.30 | 24 | 40 |
| 22+25 | 704.10 | 700.50 | 28 | 44 |
| | | | TOTAL | 148 FEET |



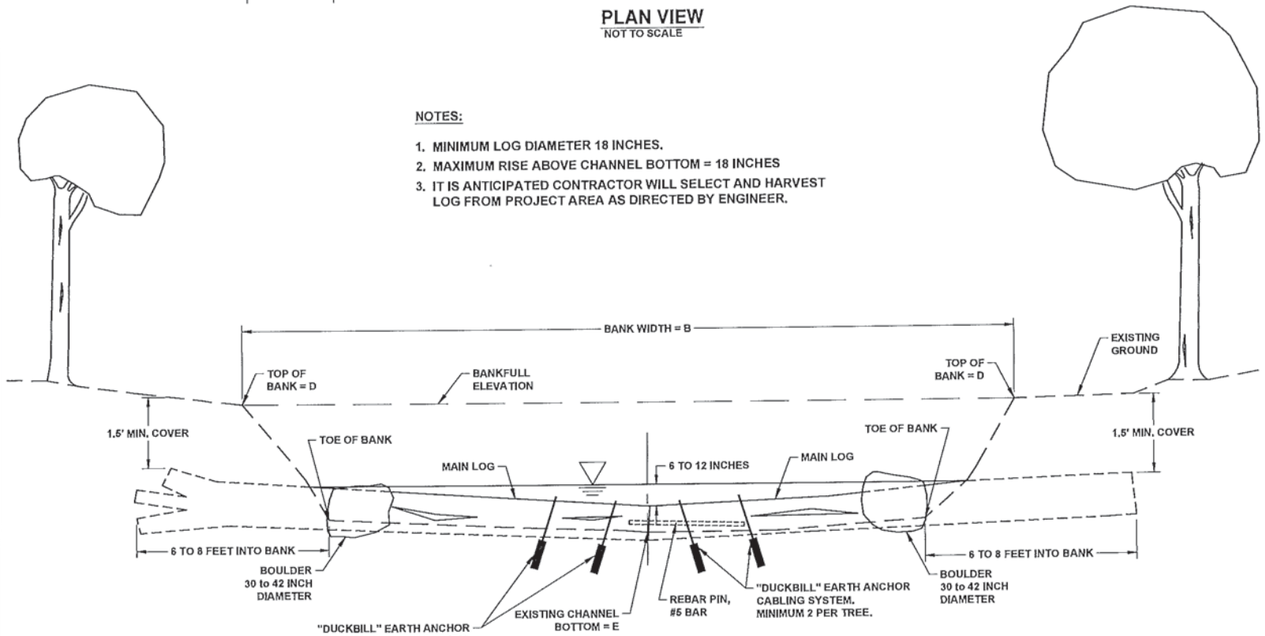

PLAN VIEW
NOT TO SCALE




SECTION B-B
NOT TO SCALE

NOTES:

1. MINIMUM LOG DIAMETER 18 INCHES.
2. MAXIMUM RISE ABOVE CHANNEL BOTTOM = 18 INCHES
3. IT IS ANTICIPATED CONTRACTOR WILL SELECT AND HARVEST LOG FROM PROJECT AREA AS DIRECTED BY ENGINEER.




SECTION A-A
NOT TO SCALE

2015-01029-TJH
SWWD Lower East Ravine Stabilization
12 of 16

# WOODY DEBRIS RIFFLE DETAIL

NOT TO SCALE

| No. | Revision | Date | By |
|---|---|---|---|

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

Signature: Date: 3-10-2015
Printed Name: Gregory S. Bowles License #: 41929

Houston Engineering Inc.

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Drawn by DJL | Date 3-10-15
Checked by LDO | Scale AS SHOWN

LOWER EAST RAVINE STABILIZATION
COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

CONSTRUCTION DETAILS
WOODY DEBRIS RIFFLE
PROJECT NO. 4876-027

SHEET 9 of 31

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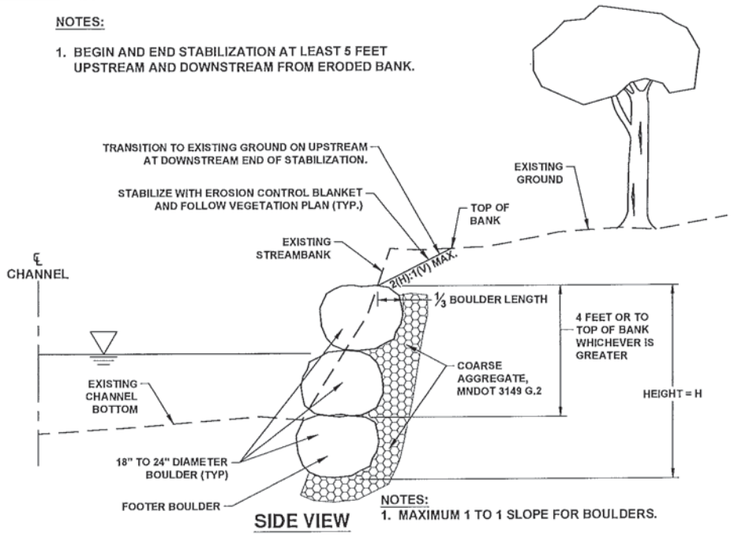
NOTES:

1. BEGIN AND END STABILIZATION AT LEAST 5 FEET UPSTREAM AND DOWNSTREAM FROM ERODED BANK.




SIDE VIEW

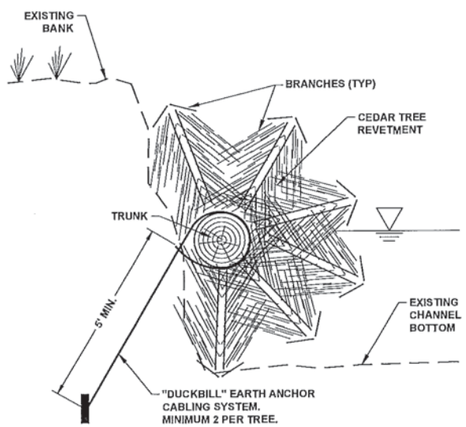
NOTES:
1. MAXIMUM 1 TO 1 SLOPE FOR BOULDERS.

## BOULDER REVETMENT DETAIL

NOT TO SCALE

| BOULDER REVETMENT TABULATION | | | | | | |
|---|---|---|---|---|---|---|
| STATION TO STATION (DOWNSTREAM) | | (UPSTREAM) | BANK | HEIGHT (FT) [H] | LENGTH (FT) [1] [L] | NOTES |
| 28+40 | TO | 28+70 | LT | 6.0 | 40 | STABILIZE FROM START OF GULLY |
| 31+85 | TO | 32+75 | RT | 6.0 | 100 | TIE IN TO DOWNSTREAM EXISTING RIPRAP |
| 31+85 | TO | 32+15 | LT | 6.0 | 40 | TIE IN TO DOWNSTREAM EXISTING RIPRAP |
| 35+10 | TO | 35+40 | RT | 6.0 | 50 | TIE EMBANKMENT PROTECTION INTO ROCK RIFFLE |
| 36+00 | TO | 36+40 | LT | 6.0 | 70 | |
| 36+80 | TO | 37+80 | LT | 6.0 | 135 | |
| 38+40 | TO | 38+60 | RT | 6.0 | 35 | TIE EMBANKMENT PROTECTION INTO ROCK RIFFLE |
| 41+50 | TO | 42+20 | RT | 6.0 | 90 | TIE EMBANKMENT PROTECTION INTO ROCK RIFFLE |
| 42+00 | TO | 42+70 | LT | 6.0 | 110 | |
| 43+90 | TO | 44+40 | LT | 6.0 | 70 | TIE INTO EXISTING RIPRAP |
| 45+60 | TO | 45+90 | LT | 6.0 | 50 | TIE INTO EXISTING RIPRAP |
| 47+05 | TO | 47+25 | LT | 6.0 | 40 | TIE EMBANKMENT PROTECTION INTO ROCK RIFFLE |
| 47+30 | TO | 47+60 | RT | 6.0 | 40 | TIE EMBANKMENT PROTECTION INTO ROCK RIFFLE |
| 48+80 | TO | 49+10 | LT | 6.0 | 45 | |
| 49+30 | TO | 50+05 | LT | 6.0 | 105 | TIE IN TO GULLY RIPRAP |
| | | | | TOTAL | 1020 FEET | |

[1] LENGTH INCLUDES ADDITIONAL 10 FEET FOR UPSTREAM AND DOWNSTREAM OVERLAP

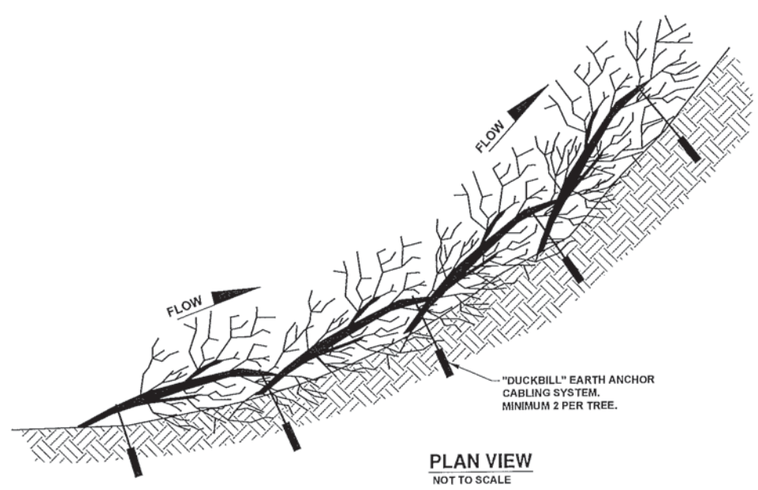



TYPICAL SECTION

NOT TO SCALE

| TREE REVETMENT TABULATION | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| STATION TO STATION (DOWNSTREAM) | | (UPSTREAM) | BANK | EXISTING CHANNEL ELEVATION AT CHANNEL CENTERLINE (DOWNSTREAM) | (UPSTREAM) | TOP OF BANK ELEVATION (DOWNSTREAM) | (UPSTREAM) | LENGTH [2] (FT) | NOTES |
| 29+50 | TO | 30+75 | RT | 706.86 | 707.36 | 712.57 | 713.88 | 155 | EXCAVATE BANK TO FIT AND STABILIZE DISTURBED AREAS WITH EROSION CONTROL BLANKET AND VEGETATION |
| 33+40 | TO | 34+30 | LT | 710.37 | 711.56 | 717.30 | 718.24 | 120 | |
| 34+00 | TO | 34+60 | RT | 711.03 | 712.07 | 717.93 | 718.70 | 100 | |
| 46+20 | TO | 46+50 | RT | 729.39 | 729.74 | 734.93 | 735.00 | 80 | |
| 47+60 | TO | 48+60 | LT | 730.99 | 732.79 | 735.00 | 736.60 | 130 | EXCAVATE BANK TO FIT AND STABILIZE DISTURBED AREAS WITH EROSION CONTROL BLANKET AND VEGETATION |
| | | | | | | TOTAL | | 585 FEET | |

[2] LENGTH INCLUDES ADDITIONAL 30 FEET PER STATION




PLAN VIEW

NOT TO SCALE

NOTES:

1. USE FRESH, BRUSHY, CEDAR TREES CONTAINING MANY BRANCHES OR ENGINEER APPROVED EQUAL. LENGTH OF TREE SHALL BE 10 TO 15 FEET.
2. REMOVE BRANCHES FROM ONE SIDE OF TREE TO ALLOW TRUNK TO SIT TIGHT AGAINST BANK.
3. BEGIN INSTALL ON THE DOWNSTREAM END AND MOVE UPSTREAM WITH THE TOP OF THE TREES POINTING DOWNSTREAM.
4. THE FIRST TREE IS ANCHORED BY INSTALLING "DUCKBILL" EARTH ANCHORS TWO FEET FROM TOP OF TREE.
5. THE ANCHOR IS DRIVEN INTO THE BANK AT A 45 DEGREE ANGLE FAR ENOUGH SO THAT THE CABLE IS TIGHT AND THE TREE WILL NOT MOVE. BEND CABLE OVER TRUNK. EACH ANCHOR BAR SHOULD PROVIDE A MINIMUM PULL OUT RESISTANCE OF 150 LBS OR INSTALL ANCHORS AT PROPORTIONATELY CLOSER SPACING.
6. PLACE SECOND TREE UPSTREAM SO THAT THE TOP OF THE UPSTREAM TREE OVERLAPS THE BASE OF THE DOWNSTREAM TREE BY 3 FEET.
7. A SECOND EARTH ANCHOR IS CABLED AROUND THE TWO TREES AND DRIVEN INTO THE GROUND. CONTINUE WORKING UPSTREAM.
8. BEGIN AND END REVETMENTS AT LEAST ONE TREE LENGTH BEYOND ERODING PORTIONS OF THE BANK.
9. WEAVE THE REMOVED BRANCHES INTO THE BRANCHES ON THE BACKSIDE OF THE REVETMENT TO CREATE A DENSE MATRIX OF BRUSH.
10. IN AREAS OF HIGHER BANK CUTS, REVETMENTS SHALL BE STACKED UP MULTIPLE LAYERS HIGH TO TOP OF BANK.

## CEDAR TREE REVETMENT DETAIL

NOT TO SCALE

2015-01029-TJH
SWWD Lower East Ravine Stabilization
13 of 16

| No. | Revision | Date | By |
|---|---|---|---|
| | | | |

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

Signature: Date: 3-10-2015
Printed Name: Gregory S. Bowles License #: 41929

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P: 763.493.4522
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| Drawn by | Date |
|---|---|
| DJL | 3-10-15 |
| Checked by | Scale |
| LDO | AS SHOWN |

LOWER EAST RAVINE STABILIZATION
COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

CONSTRUCTION DETAILS
BOULDER & TREE REVETMENTS
PROJECT NO. 4876-027

SHEET 10 of 31

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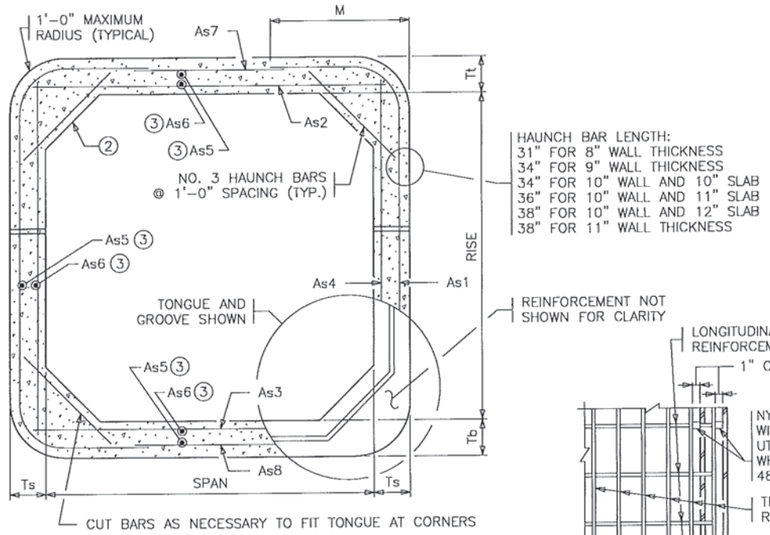
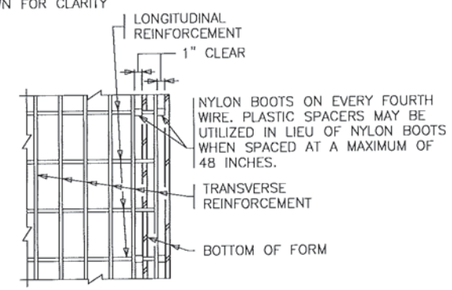
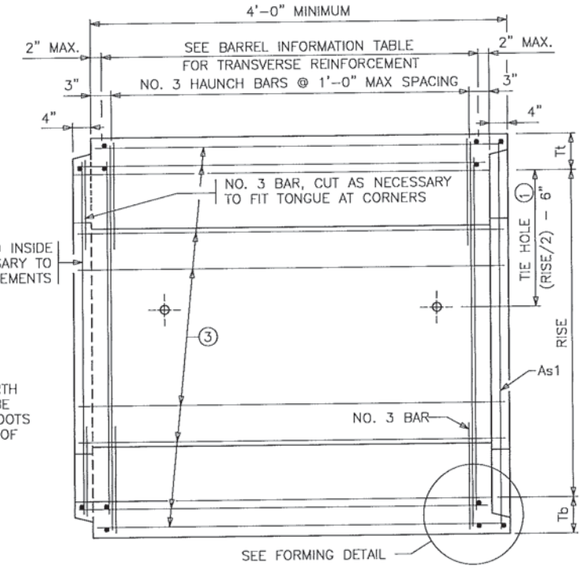



TRANSVERSE BARREL SECTION

BAR REINFORCEMENT OPTION SHOWN

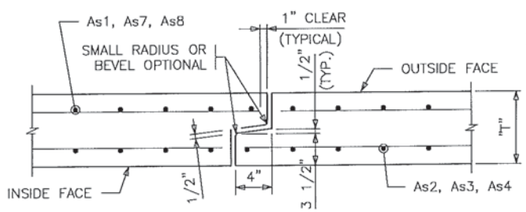



PLAN

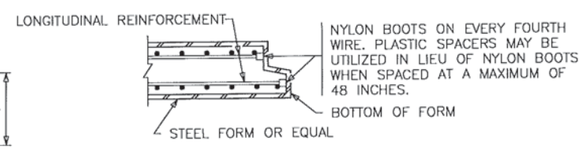



LONGITUDINAL BARREL SECTION

BAR REINFORCEMENT OPTION SHOWN

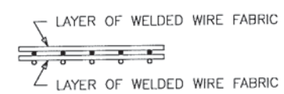



TONGUE AND GROOVE JOINT DETAIL




SECTION

FORMING DETAIL




FABRIC LAYER DETAIL

WHEN MORE THAN ONE LAYER OF WELDED WIRE FABRIC IS USED TO OBTAIN THE REQUIRED REINFORCEMENT AREAS, THE WIRES OF THE WELDED WIRE FABRIC SHALL BE PLACED AS SHOWN

## CONSTRUCTION NOTES

CULVERTS TO BE CONSTRUCTED AS PER MNDOT SPEC. 2412 EXCEPT AS NOTED.

THE WELDED WIRE FABRIC, SHEAR REINFORCEMENT AND REINFORCEMENT BARS SHALL CONFORM TO APPLICABLE REQUIREMENTS OF AASHTO M259.

1 1/2" MIN. AND 2" MAX. CONCRETE COVER ON ALL REINFORCEMENT, INCLUDING SHEAR REINFORCEMENT, EXCEPT FOR TONGUE AND GROOVE DETAIL.

ANY OF THE FOLLOWING COMBINATIONS OF STEEL REINFORCEMENT MAY BE USED:
(a) 1 OR 2 LAYERS OF WELDED WIRE FABRIC OR
(b) 1 LAYER OF WELDED WIRE FABRIC AND 1 LAYER OF REINFORCEMENT BARS OR
(c) 1 LAYER OF REINFORCEMENT BARS.

THE REINFORCEMENT SHALL BE DEVELOPED IN ACCORDANCE WITH AASHTO "LRFD BRIDGE DESIGN SPECIFICATIONS". IF BAR REINFORCEMENT IS SUBSTITUTED FOR WELDED WIRE FABRIC, THE AREA OF REINFORCEMENT SHALL BE INCREASED BY 8%.

THE MAXIMUM SIZE OF REINFORCEMENT BARS SHALL BE NO. 6. THE MAXIMUM WELDED WIRE FABRIC SIZE SHALL BE A W23 PER LAYER (MAXIMUM OF 2 LAYERS).

THE SPACING CENTER TO CENTER OF THE TRANSVERSE WIRES SHALL NOT BE LESS THAN 2" NOR MORE THAN 4". THE SPACING CENTER TO CENTER OF THE LONGITUDINAL WIRES SHALL NOT BE MORE THAN 8".

WELDING WILL NOT BE ALLOWED ON REINFORCEMENT BARS OR WELDED WIRE FABRIC, EXCEPT THAT THE ORIGINAL WELDING REQUIRED TO MANUFACTURE WIRE FABRIC IS ACCEPTABLE.

WHEN REINFORCEMENT IS CUT, ADDITIONAL REINFORCEMENT SHALL BE ADDED ON BOTH SIDES OF THE CUT MEMBER TO REPLACE OR EXCEED THE CUT STEEL.

CONCRETE SHALL BE MIX NO. 3W36 WITH NO CALCIUM CHLORIDE ALLOWED.

SHOP DRAWING APPROVAL PER MNDOT SPEC. 3238.2.A IS NOT REQUIRED UNLESS OPENINGS OR ATTACHMENTS ARE PLACED ON A BARREL SEGMENT.

COMPACT THE FIRST 1.5' (LOOSE) OF FILL ABOVE THE BOX WITH LIGHT COMPACTION EQUIPMENT SUCH AS PLATE COMPACTORS OR WALK BEHIND ROLLERS.

TRANSVERSE REINFORCEMENT IS PARALLEL TO THE CULVERT SPAN. LONGITUDINAL REINFORCEMENT IS PERPENDICULAR TO THE CULVERT SPAN.

① CULVERT TIES ARE TO BE 1" DIAMETER RODS. SEE DETAILS IN THE PLANS FOR CONNECTION DETAILS.

② HAUNCH SIZE AS FOLLOWS:
6'-0" AND 8'-0" WIDTHS – 6" TO 12"
10'-0" WIDTHS – 10" TO 12"
12'-0" AND 14'-0" WIDTHS – 12"

③ LONGITUDINAL REINFORCEMENT DENOTED AS As5 AND As6 MUST BE PLACED IN ALL SLABS AND WALLS AND MUST BE 0.06 SQ. IN./FT. MIN.

BARREL INFORMATION TABLE ***

| LOCATION | SIZE | CLASS | f'c (P.S.I.) | FILL HEIGHT RANGE (FT.) | DISTRIBUTION SLAB REQUIRED * | RECESSED TIE RODS REQUIRED ** | DIMENSIONS | | | | | WEIGHT (LBS./FT.) | WELDED WIRE FABRIC REINFORCEMENT | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | As1 | | | As2 | | As3 | | As4 | | As7 | | As8 | |
| | | | | | | | SPAN (FT.) | RISE (FT.) | Tt (IN.) | Tb (IN.) | Ts (IN.) | | AREA (IN.²/FT.) | LENGTH (FT.) | M (FT.) | AREA (IN.²/FT.) | LENGTH (FT.) | AREA (IN.²/FT.) | LENGTH (FT.) | AREA (IN.²/FT.) | LENGTH (FT.) | AREA (IN.²/FT.) | LENGTH (FT.) | AREA (IN.²/FT.) | LENGTH (FT.) |
| CHANNEL STATION 70+53 | 6'x4' | 1 | 5000 | 2–3 | NO | NO | 6 | 4 | 8 | 8 | 8 | 2575 | 0.29 | 10'–2" | 2'–8" | 0.36 | 6'–6" | 0.30 | 6'–6" | 0.20 | 4'–6" | 0.20 | 4'–6" | 0.20 | 4'–6" |
| CHANNEL STATION 95+70 | 6'x4' | 1 | 5000 | 2–3 | NO | NO | 6 | 4 | 8 | 8 | 8 | 2575 | 0.29 | 10'–2" | 2'–8" | 0.36 | 6'–6" | 0.30 | 6'–6" | 0.20 | 4'–6" | 0.20 | 4'–6" | 0.20 | 4'–6" |

* ALL CLASS 1 CULVERTS WITH FILL HEIGHTS OF LESS THAN 2'–0" REQUIRE A DISTRIBUTION SLAB. IF A DISTRIBUTION SLAB IS NOT REQUIRED, INDICATE "NO" IN THIS BOX.

** FOR PEDESTRIAN CULVERT APPLICATIONS HIDE–AWAY OR RECESSED TIE CONNECTIONS ARE REQUIRED, SEE STANDARD PLATE 3145. IF REQUIRED, INDICATE "YES" IN THIS BOX.

*** BOX CULVERTS WITH SPANS FROM 6 TO 14 FT. ARE DESIGNED FOR HL–93 LIVE LOADS (AASHTO LRFD 3.6.2.1) NOT INCLUDING THE DESIGN LANE LOAD. BOXES WITH SPANS OF 16 FT. ARE DESIGNED FOR HL–93 LIVE LOADS INCLUDING THE DESIGN LANE LOAD.

# PRECAST CONCRETE BARREL DETAILS

NOT TO SCALE

2015-01029-TJH
SWWD Lower East Ravine Stabilization
14 of 16

| No. | Revision | Date | By |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

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Signature: Date: 3-10-2015
Printed Name: Gregory S. Bowles License #: 41929

Houston Engineering Inc.

Maple Grove
P: 763.493.4522
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Drawn by DJL | Date 3-10-15
Checked by LDO | Scale AS SHOWN

LOWER EAST RAVINE STABILIZATION
COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

CONSTRUCTION DETAILS
PRECAST CONCRETE BARREL
PROJECT NO. 4876-027

SHEET 12 of 31

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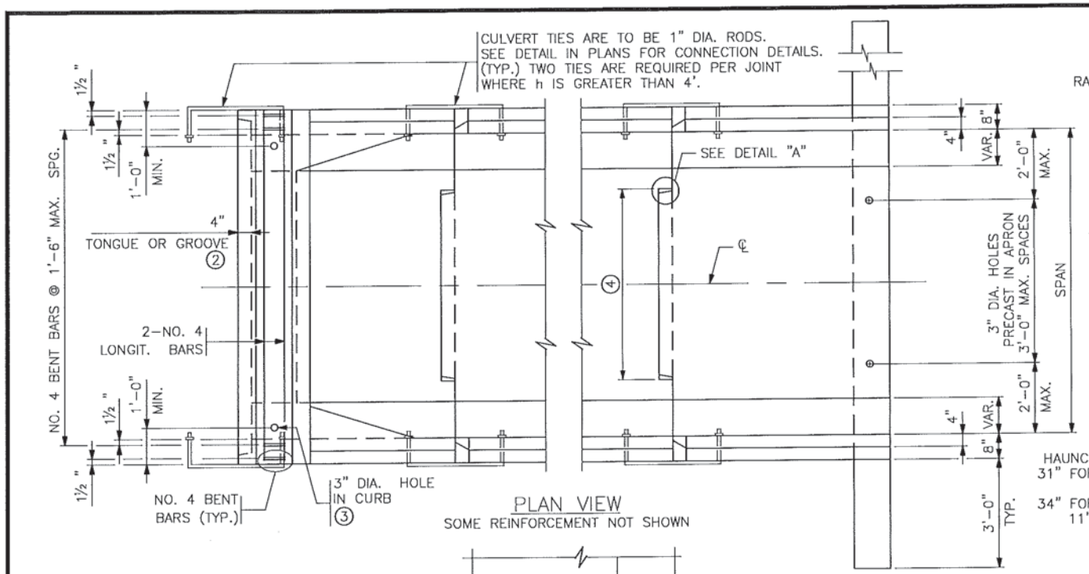
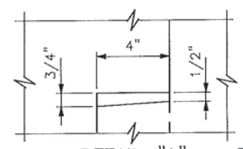
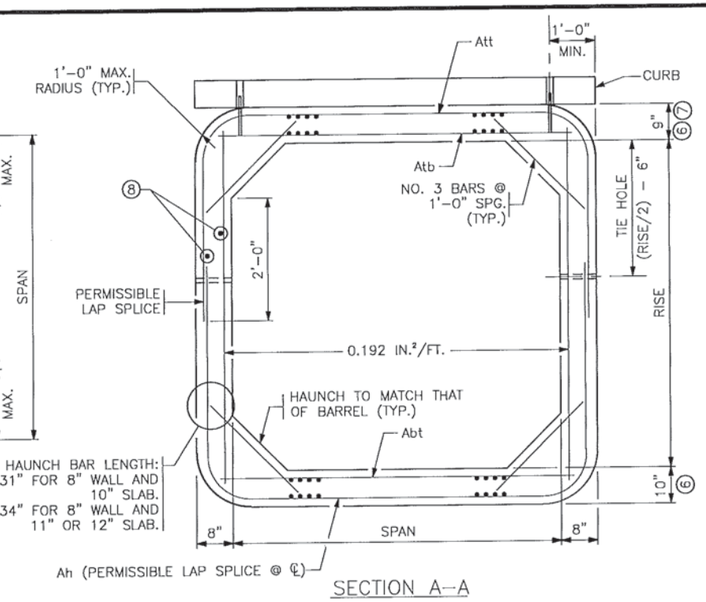


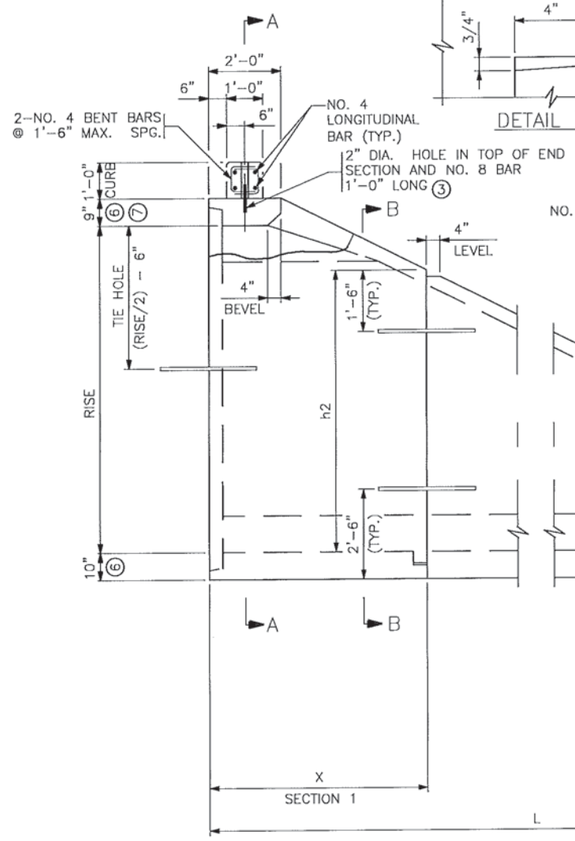

PLAN VIEW
SOME REINFORCEMENT NOT SHOWN



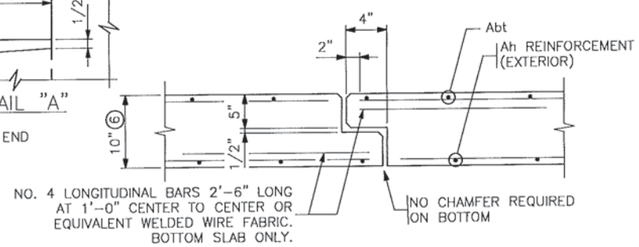
DETAIL "A"



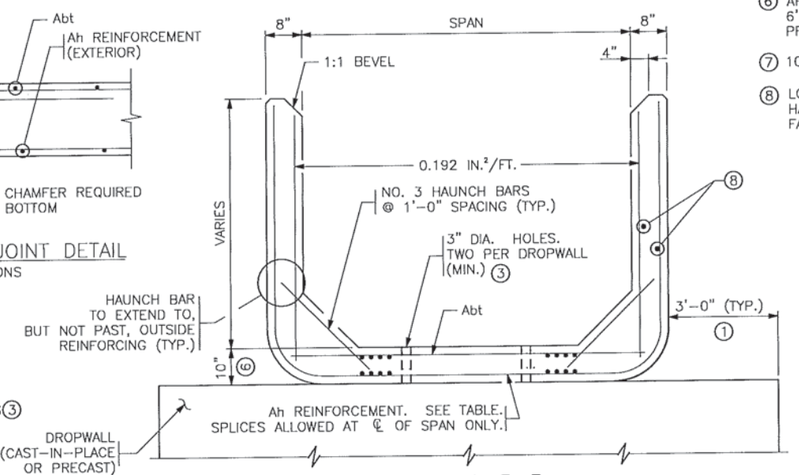

SECTION A-A



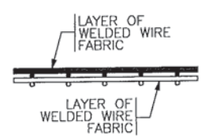

SIDE ELEVATION




TONGUE AND GROOVE JOINT DETAIL
BETWEEN END SECTIONS




SECTION B-B




FABRIC LAYER DETAIL
WHEN MORE THAN ONE LAYER OF WELDED WIRE FABRIC IS USED TO OBTAIN THE REQUIRED REINFORCEMENT AREAS, THE WIRES OF THE WELDED WIRE FABRIC SHALL BE PLACED AS SHOWN.

## CONSTRUCTION NOTES

SEE "PRECAST CONCRETE BARREL DETAILS" FOR ADDITIONAL DIMENSIONS AND CONSTRUCTION NOTES.

ALL END SECTIONS REQUIRE CURB ON LINTEL BEAM.

ON ALL END SECTIONS FOR WATERWAYS, USE DROPWALLS ON INLET AND OUTLET ENDS.

SEE "EMBANKMENT PROTECTION FOR BOX CULVERTS" DETAIL.

FINISH ALL EXPOSED EDGES OF CONCRETE WITH 1/2" OR 3/4" CHAMFER OR RADIUS UNLESS OTHERWISE NOTED.

① WITH DOUBLE BOXES LOCATE DROPWALL JOINTS BETWEEN END SECTIONS. LIMITS OF EXCAVATION FOR DROPWALL TO BE APPROXIMATELY THE SAME AS DROPWALL DIMENSIONS. DROPWALL TO BE CONCRETE MIX NO. 1A43 OR MIX NO. 3Y43. FURNISHING AND INSTALLATION OF DROPWALL TO BE INCLUDED IN PRICE BID FOR END SECTIONS. DROPWALL NOT REQUIRED FOR NON-WATERWAY USE.

② CHECK LOCATION TO DETERMINE WHETHER A TONGUE OR A GROOVE IS USED.

③ FILL HOLE WITH GROUT. GROUT SHALL CONSIST OF 1 PART CEMENT AND 2 PARTS SAND. USE TYPE 1A AIR ENTRAINED PORTLAND CEMENT. GROUT MIX SHALL HAVE A MAXIMUM SLUMP OF 4".

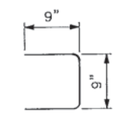
④ 3'-6" MIN. TONGUE AND 3'-7" MIN. GROOVE FOR CULVERTS WITH 6'-0" SPANS. 5'-0" MIN. TONGUE AND 5'-1" MIN. GROOVE FOR CULVERTS WITH SPANS GREATER THAN 6'-0". CENTER TONGUE AND GROOVE ON ℄ OF EACH APRON JOINT. TONGUE AND GROOVE JOINT ON ALL THREE SIDES OF APRON IS PERMISSIBLE.

⑤ AS AN ALTERNATE TO THE ONE LAYER WELDED WIRE FABRIC, PROVIDE TWO LAYERS OF REBAR OR WELDED WIRE FABRIC WITH THE STEEL AREA EQUAL TO HALF OF THE TEMPERATURE STEEL PER CODE REQUIREMENTS IN EACH FACE OF THE DROPWALL.

⑥ APRON TOP AND BOTTOM SLAB THICKNESS MAY BE 8" FOR CULVERTS WITH 6' SPANS ONLY. BOTTOM SLAB THICKNESS MAY BE INCREASED UP TO 2" MAX. PROVIDED CONCRETE COVER IS 1½" MIN., 2" MAX.

⑦ 10" MINIMUM TOP SLAB FOR 14' AND 16' SPANS.

⑧ LONGITUDINAL REINFORCEMENT PERPENDICULAR TO THE CULVERT SPAN SHALL HAVE A MINIMUM OF 0.06 SQUARE INCHES PER PERIPHERAL FOOT ON ALL FACES OF THE BARREL.




NO. 4 BENT BAR

**Att, Atb REINFORCEMENT**

| SPAN (FT.) | Att (IN²/FT.) | Atb (IN²/FT.) |
|---|---|---|
| 6 | 0.27 | 0.44 |
| 8 | 0.47 | 0.60 |
| 10 | 0.62 | 0.74 |
| 12 | 0.88 | 1.06 |
| 14 | 1.20 | 1.58 |
| 16 | 1.52 | 2.09 |

**Abt REINFORCEMENT**

| SPAN (FT.) | Abt (IN²/FT.) |
|---|---|
| 6-10 | 0.20 |
| 12 | 0.30 |
| 14 | 0.39 |
| 16 | 0.39 |

**APRON DIMENSIONS & Ah REINFORCEMENT**

| RISE FT. | L FT. | SECTION 1 X | SECTION 1 Ah | h2 | SECTION 2 Y | SECTION 2 Ah | h3 | SECTION 3 Z | SECTION 3 Ah | h4 | SECTION 4 ZZ | SECTION 4 Ah | h5 | SECTION 5 ZZZ | SECTION 5 Ah | h6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 8 | 8'(4') | 0.192 | 1'-9"(3'-9") | (4') | (0.192) | (1'-9") | | | | | | | | | |
| 5 | 10 | 6' | 0.192 | 3'-9" | 4' | 0.192 | 1'-9" | | | | | | | | | |
| 6 | 12 | 6' | 0.192 | 4'-9" | 6' | 0.192 | 1'-9" | | | | | | | | | |
| 7 | 14 | 6' | 0.192 | 5'-9" | 8'(4') | 0.192 | 1'-9"(3'-9") | (4') | (0.192) | (1'-9") | | | | | | |
| 8 | 16 | 6' | 0.20 | 6'-9" | 6' | 0.192 | 3'-9" | 4' | 0.192 | 1'-9" | | | | | | |
| 9 | 18 | 6' | 0.29 | 7'-9" | 6' | 0.20 | 4'-9" | 6' | 0.192 | 1'-9" | | | | | | |
| 10 | 20 | 6' | 0.42 | 8'-9" | 6' | 0.29 | 5'-9" | 8'(4') | 0.192 | 1'-9"(3'-9") | (4') | (0.192) | (1'-9") | | | |
| 11 | 22 | 6' | 0.60 | 9'-9" | 6' | 0.42 | 6'-9" | 6' | 0.192 | 3'-9" | 4' | 0.192 | 1'-9" | | | |
| 12 | 24 | 6' | 0.78 | 10'-9" | 6' | 0.60 | 7'-9" | 6' | 0.20 | 4'-9" | 6' | 0.192 | 1'-9" | | | |
| 13 | 26 | 6' | 1.03 | 11'-9" | 6' | 0.78 | 8'-9" | 6' | 0.28 | 5'-9" | 8'(4') | 0.192 | 1'-9"(3'-9") | (4') | (0.192) | (1'-9") |
| 14 | 28 | 6' | 1.38 | 12'-9" | 6' | 1.03 | 9'-9" | 6' | 0.40 | 6'-9" | 6' | 0.192 | 3'-9" | 4' | 0.192 | 1'-9" |

NOTE: Ah IS AREA OF REINFORCEMENT PER FOOT OF LENGTH (IN²/FT.)
VALUES IN ( ) MAY BE USED FOR END SECTIONS WITH SPANS OF 14' AND 16' ONLY.

# PRECAST CONCRETE END SECTION
# TYPE I - SINGLE OR DOUBLE BARREL

NOT TO SCALE — FOR SKEWS UP TO 7½°

2015-01029-TJH, SWWD Lower East Ravine Stabilization
15 of 16

| No. | Revision | Date | By |
|---|---|---|---|
| | | | |

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

Signature: Date: 3-10-2015
Printed Name: Gregory S. Bowles License #: 41929

Houston Engineering Inc.

Maple Grove
P: 763.493.4522
F: 763.493.5572

Drawn by DJL | Date 3-10-15
Checked by LDO | Scale AS SHOWN

LOWER EAST RAVINE STABILIZATION
COTTAGE GROVE, MINNESOTA
SOUTH WASHINGTON WATERSHED DISTRICT

CONSTRUCTION DETAILS
PRECAST CONCRETE END SECTION
PROJECT NO. 4876-027

SHEET 13 of 31

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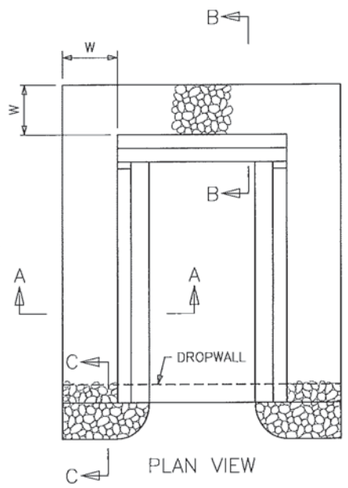
## CONSTRUCTION NOTES

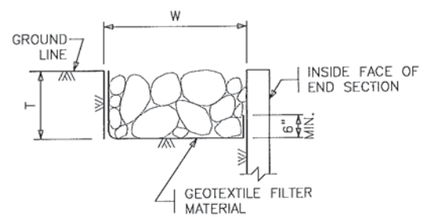
THIS DETAIL IS FOR CULVERT EMBANKMENT PROTECTION ONLY. REFER TO THE GRADING PLANS FOR ADDITIONAL RIPRAP OR OTHER SCOUR PROTECTION MEASURES.

RIPRAP SHALL COMPLY WITH MNDOT SPECS. 2511 AND 3601.

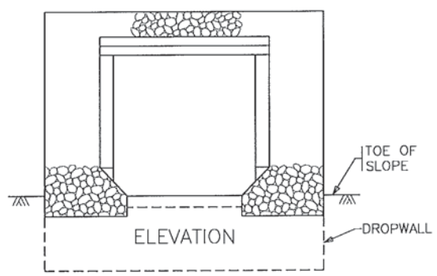
(1) FOR TYPE OF GEOTEXTILE FILTER MATERIAL REQUIRED, SEE SPEC. 3733. GEOTEXTILE STRIPS SHOULD BE CONTINUOUS WITHOUT OVERLAPS, EXCEPT FOR THE TOP STRIP, WHICH SHOULD SHINGLE VERTICAL STRIPS. THE TOP EDGE SHOULD BE BURIED TO PREVENT UNDERMINING.




PLAN VIEW



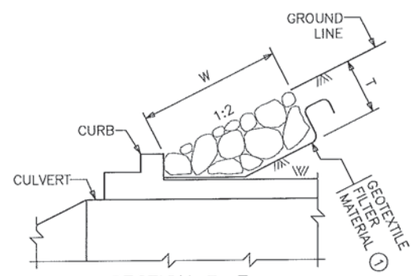

SECTION A–A




ELEVATION

SINGLE BARREL

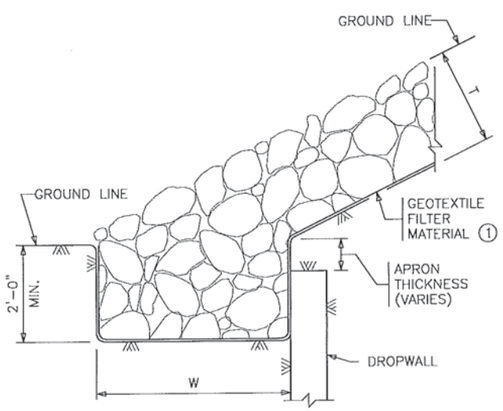
CLASS III OR IV SHOWN FOR SKEWS UP TO 7 1/2°




SECTION B–B

RIPRAP CLASS

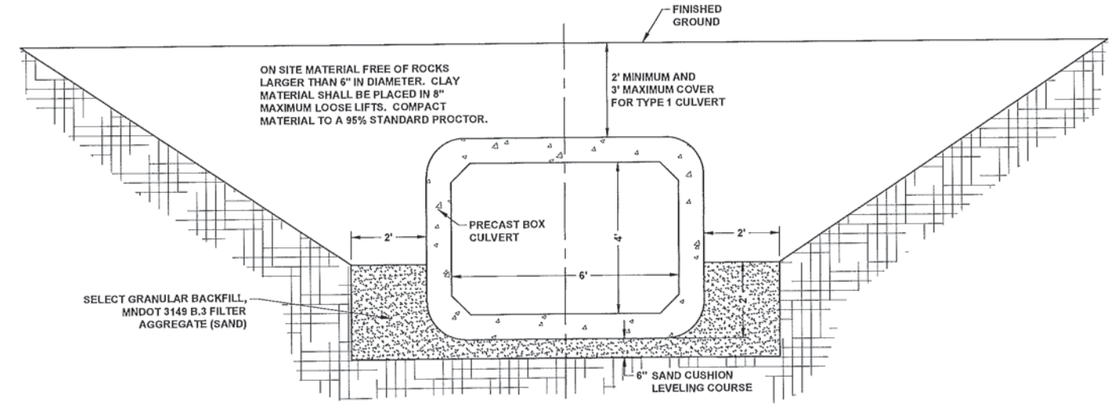
| RIPRAP CLASS | T | W |
|---|---|---|
| ~~III~~ | ~~1'–6"~~ | ~~3'–0"~~ |
| IV | 2'–0" | 4'–0" |




SECTION C–C

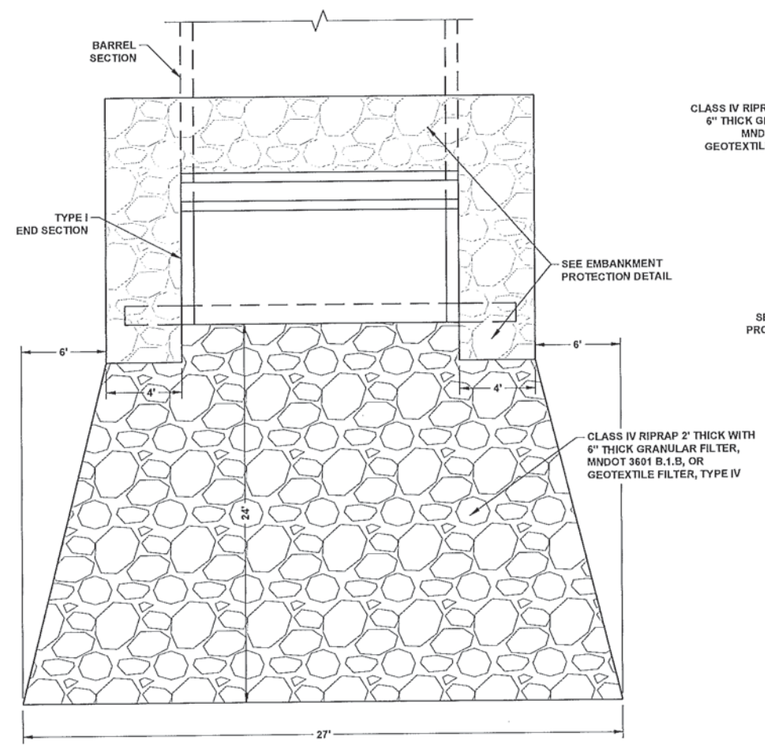
## EMBANKMENT PROTECTION FOR BOX CULVERTS DETAIL

NOT TO SCALE

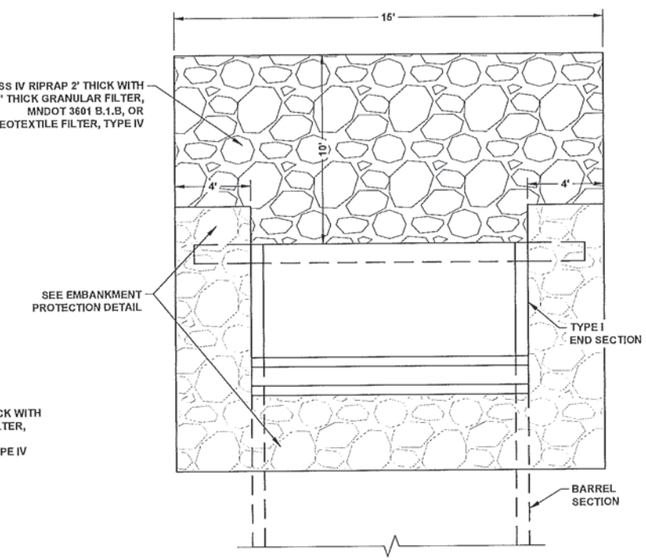



## BOX CULVERT TRENCH AND BEDDING DETAIL

NOT TO SCALE




OUTLET




INLET

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SWWD Lower East Ravine Stabilization
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## RIPRAP AT PRECAST CONCRETE END SECTIONS DETAIL

NOT TO SCALE

| No. | Revision | Date | By |
|---|---|---|---|
| | | | |

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

Signature: Date: 3-10-2015
Printed Name: Gregory S. Bowles License #: 41929

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LOWER EAST RAVINE STABILIZATION
COTTAGE GROVE, MINNESOTA
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CONSTRUCTION DETAILS
RIPRAP AT END SECTION
PROJECT NO. 4876-027

SHEET 14 of 31

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