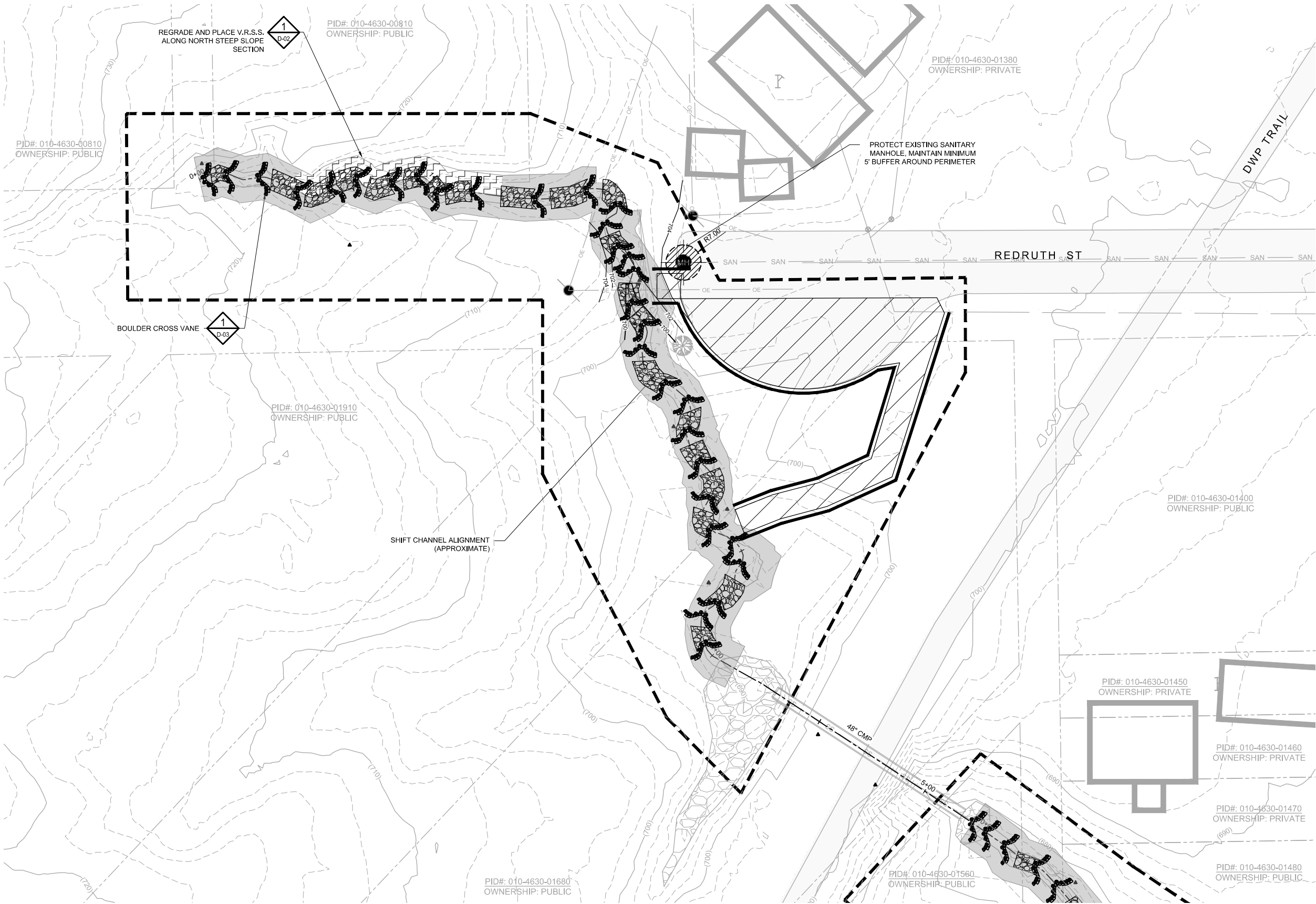


Kingsbury Bay Watershed Sediment Reduction Environmental Assessment Worksheet

Attachment 2:

Project Designs



LEGEND

(1040)

EXISTING INDEX CONTOUR

EXISTING INTERMEDIATE CONTOUR

EXISTING ROAD/TRAIL

EXISTING PROPERTY LINE

CONSTRUCTION LIMITS

EXISTING CHANNEL OR TRIBUTARY CENTERLINE

EXISTING BUILDING OR BUILT STRUCTURE

EXISTING CULVERT, SIZE & MTL. AS NOTED

EXISTING TREE, TO REMAIN (AS SURVEYED)

CONTROL POINT

VEGETATED REINFORCED SOIL SLOPE (V.R.S.S.)

GRADING

ACCESS/LAYDOWN AREA

RIPRAP

EXISTING RIPRAP

OE

OVERHEAD ELECTRIC

SAN

UNDERGROUND SANITARY MAIN

SS

UNDERGROUND STORM MAIN

>

EXISTING CULVERT

UE

UNDERGROUND ELECTRIC

GAS

UNDERGROUND GAS

UT

UNDERGROUND TELEPHONE

X

EXISTING FENCELINE

SEDIMENT CONTROL LOG

BOULDER CROSS VANE

J-HOOK BOULDER VANE

WETLAND DELINEATION

NOTES:

- CHANNEL SHALL BE GRADED AND RIPRAP PLACED BETWEEN BOULDER VANES TO CREATE RIFFLES AND POOLS, PER STRUCTURE TABLE (SHEET C-08)
- FINAL CHANNEL ALIGNMENT, GRADING, AND STRUCTURE LOCATION SHALL BE FIELD-MODIFIED AS DIRECTED BY ENGINEER.

PROJECT DATUM:

HORIZONTAL: MINNESOTA STATE PLANE NORTH, US FOOT, NAD83(2011)

VERTICAL: NAVD88

1 PLAN: TRIBUTARY 1A

0 20 40

SCALE IN FEET

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Name: JESSICA C. L. OLSON License #: 43102

Date: -

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Duluth, Minnesota
DNR Division of Ecological and Water Resources
St. Louis County (MN)
Section: 10, 11, 13, 14 Township: 49N Range: 15W

Revisions	
Date	By

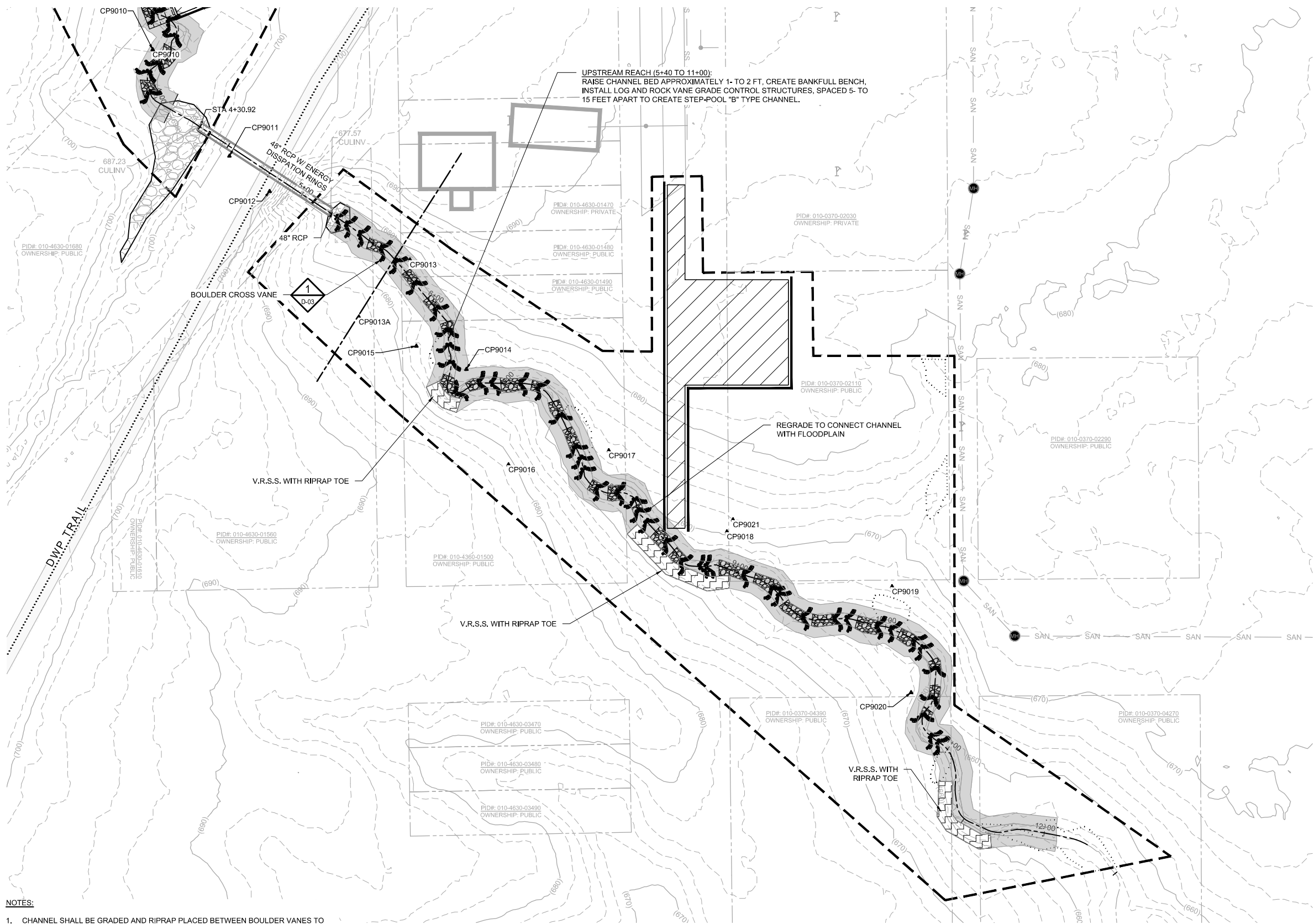
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Checked: JCO 12/20	Checked: JCO 02/21
Horz. datum: St. Louis Co. Coord.	Vert. datum: NAVD88

Sheet: C-06

CC2: -

File #: -



LEGEND

(1040)

EXISTING INDEX CONTOUR

EXISTING INTERMEDIATE CONTOUR

EXISTING ROAD/TRAIL

EXISTING PROPERTY LINE

CONSTRUCTION LIMITS

EXISTING CHANNEL OR TRIBUTARY CENTERLINE

EXISTING BUILDING OR BUILT STRUCTURE

EXISTING CULVERT, SIZE & MTL. AS NOTED

EXISTING TREE, TO REMAIN (AS SURVEYED)

CONTROL POINT

VEGETATED REINFORCED SOIL SLOPE (V.R.S.S.)

GRADING

ACCESS/LAYDOWN AREA

RIPRAP

EXISTING RIPRAP

OE

OVERHEAD ELECTRIC

SAN

UNDERGROUND SANITARY MAIN

SS

UNDERGROUND STORM MAIN

EXISTING CULVERT

UE

UNDERGROUND ELECTRIC

GAS

UNDERGROUND GAS

UT

UNDERGROUND TELEPHONE

X

EXISTING FENCELINE

SEDIMENT CONTROL LOG

BOULDER CROSS VANE

J-HOOK BOULDER VANE

WETLAND DELINEATION

CONTROL POINTS				
POINT #	DESCRIPTION	ELEVATION	NORTHING	EASTING
9012	CP9012	701.63	413111.37	2852507.76
9013	CP9013	676.87	413072.65	2852587.14
9014	CP9014	673.86	413010.78	2852619.07
9015	CP9015	676.32	413023.84	2852590.78
9016	CP9016	680.97	412956.78	2852642.89
9017	CP9017	673.25	412964.71	2852699.62
9018	CP9018	670.20	412918.87	2852766.42
9019	CP9019	666.37	412887.81	2852859.82
9020	CP9020	662.03	412827.93	2852870.61
9021	CP9021	671.68	412925.68	2852769.86
90133	CP9013A	682.49	413040.30	2852558.22

- NOTES:
- CHANNEL SHALL BE GRADED AND RIPRAP PLACED BETWEEN BOULDER VANES TO CREATE RIFFLES AND POOLS, PER STRUCTURE TABLE (SHEET C-13)
 - FINAL CHANNEL ALIGNMENT, GRADING, AND STRUCTURE LOCATION SHALL BE FIELD-MODIFIED AS DIRECTED BY ENGINEER

PROJECT DATUM:

HORIZONTAL: MINNESOTA STATE PLANE NORTH, US FOOT, NAD83(2011)

VERTICAL: NAVD88

1 PLAN: TRIBUTARY 1B

0 30 60

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Date: -

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Duluth, Minnesota
DNR Division of Ecological and Water Resources
St. Louis County (MN)
Section: 10, 11, 13, 14 Township: 49N Range: 15W

Revisions

Date	By

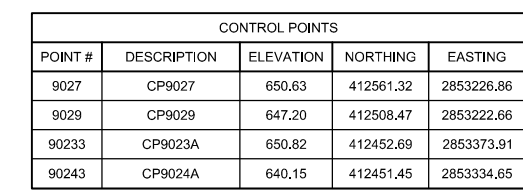
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Horz. datum: St. Louis Co. Coord.	Vert. datum: NAVD88

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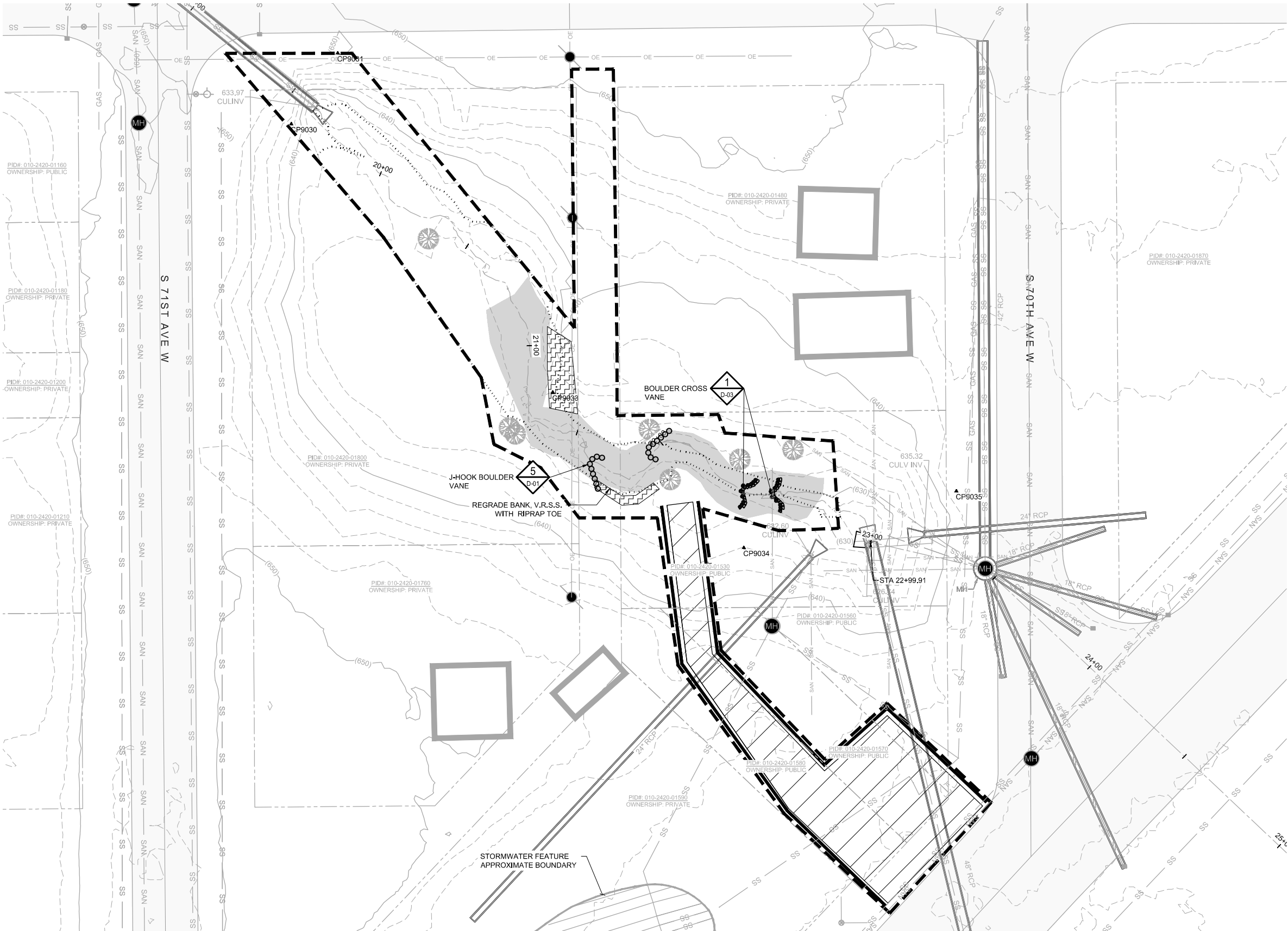
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- Sheet: C-16
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- File #: -

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LEGEND

(1040)

EXISTING INDEX CONTOUR

EXISTING INTERMEDIATE CONTOUR

EXISTING ROAD/TRAIL

EXISTING PROPERTY LINE

CONSTRUCTION LIMITS

EXISTING CHANNEL OR TRIBUTARY CENTERLINE

EXISTING BUILDING OR BUILT STRUCTURE

EXISTING CULVERT, SIZE & MTL. AS NOTED

EXISTING TREE, TO REMAIN (AS SURVEYED)

CONTROL POINT

VEGETATED REINFORCED SOIL SLOPE (V.R.S.S.)

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ACCESS/LAYDOWN AREA

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EXISTING RIPRAP

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OVERHEAD ELECTRIC

SAN

UNDERGROUND SANITARY MAIN

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UNDERGROUND STORM MAIN

EXISTING CULVERT

UE

UNDERGROUND ELECTRIC

GAS

UNDERGROUND GAS

UT

UNDERGROUND TELEPHONE

X

EXISTING FENCELINE

SEDIMENT CONTROL LOG

BOULDER CROSS VANE

J-HOOK BOULDER VANE

WETLAND DELINEATION

CONTROL POINTS				
POINT #	DESCRIPTION	ELEVATION	NORTHING	EASTING
9030	CP9030	642.97	412352.64	2853450.85
9031	CP9031	649.93	412379.79	2853468.69
9033	CP9033	633.52	412249.75	2853551.15
9034	CP9034	635.79	412190.18	2853624.44
9035	CP9035	643.35	412211.93	2853705.93

- NOTES:
1.

CHANNEL SHALL BE GRADED AND RIPRAP PLACED BETWEEN BOULDER VANES TO CREATE RIFFLES AND POOLS, PER STRUCTURE TABLE (SHEET C-23)
2.

FINAL CHANNEL ALIGNMENT, GRADING, AND STRUCTURE LOCATION SHALL BE FIELD-MODIFIED AS DIRECTED AS BY ENGINEER.

1 PLAN: TRIBUTARY 1D

0

20

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SCALE IN FEET

PROJECT DATUM:

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Name:

JESSICA C. L. OLSON

License #:43102

Date:

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Duluth, Minnesota

DNR Division of Ecological and Water Resources

St. Louis County (MN)

Section:10,11,13,14 Township: 49N Range: 15W

Revisions

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Title: TRIBUTARY 1D PLAN

Survey: RRE 12/20

Designed: BARR 01/21

Drawn: BARR 12/20

Drawn: BARR 02/21

Checked: JCO 12/20

Checked: JCO 02/21

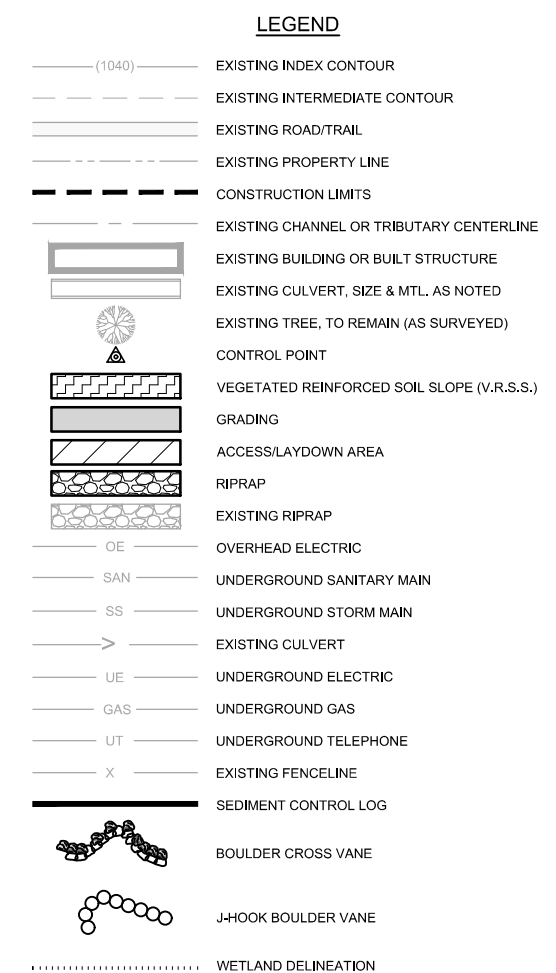
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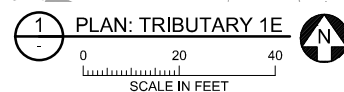
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CONTROL POINTS				
POINT #	DESCRIPTION	ELEVATION	NORTHING	EASTING
9037	CP9037	611.66	411561.87	2854179.87
9038	CP9038	612.76	411625.74	2854147.08
9039	CP9039	618.46	411674.06	2854055.98
9040	CP9040	618.77	411681.64	2854006.65
9041	CP9041	623.83	411719.71	2854021.09
9042	CP9042	615.31	411664.75	2854118.38

1. CHANNEL SHALL BE GRADED AND RIPRAP PLACED BETWEEN BOULDER VANES TO CREATE RIFFLES AND POOLS, PER STRUCTURE TABLE (SHEET C-28).
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VERTICAL: NAVD88



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Duluth, Minnesota
DNR Division of Ecological and Water Resources

St. Louis County (MN)

Section: 10, 11, 13, 14 Township: 49N Range: 15W

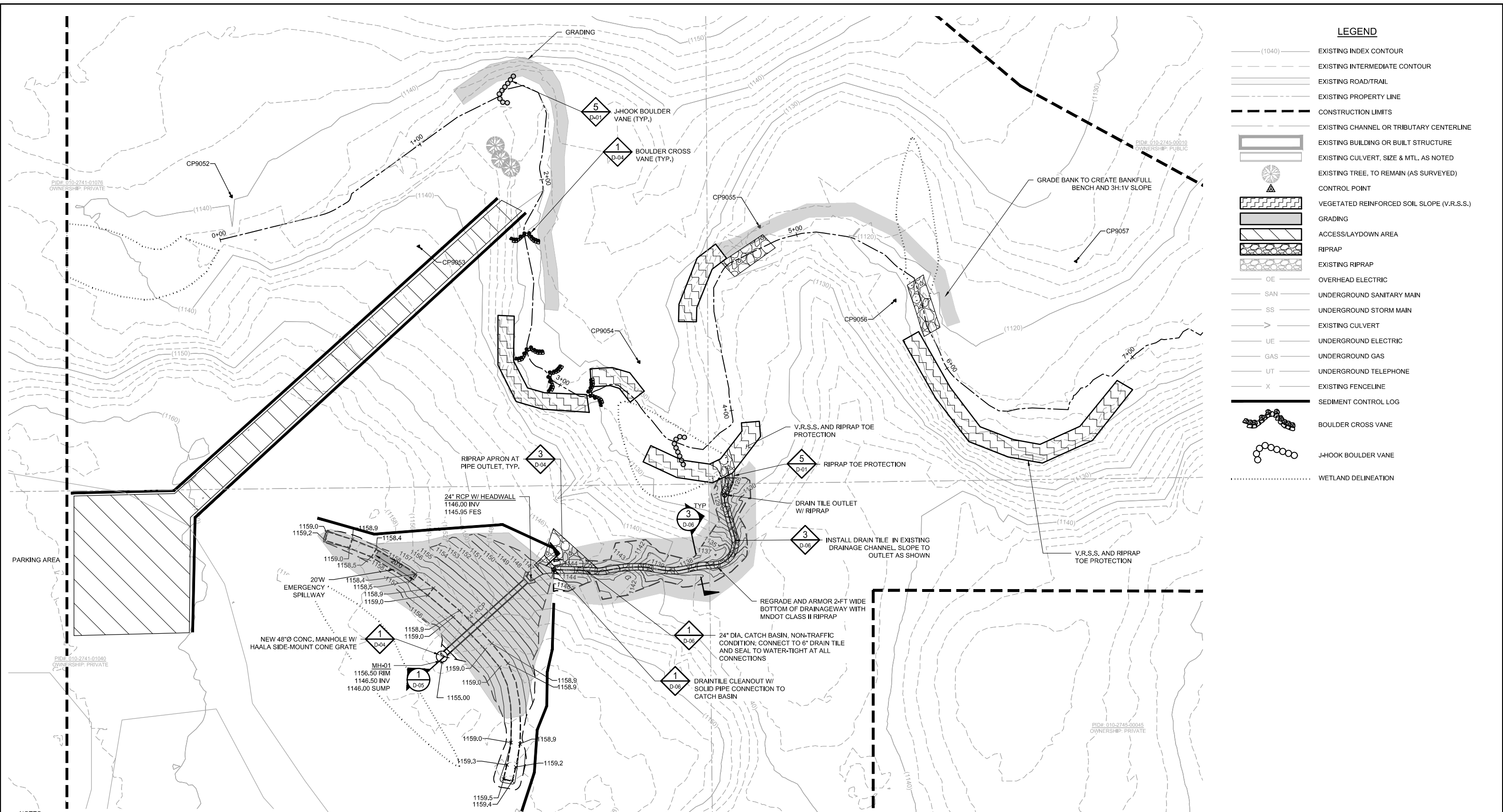
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Date	By
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Drawn: BARR 12/20	Drawn: BARR 02/21
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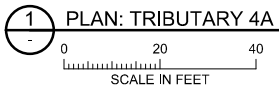
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NOTES:

- EXISTING CONTOUR DATA IS BASED ON SURVEYS PERFORMED BY BARR ENGINEERING NOVEMBER 2020 AND MAY 2021, AS SUPPLEMENTED WITH LIDAR DATA. BARR OBTAINED LIDAR DATA FROM MNDNR IN 2020.
- FINAL CHANNEL ALIGNMENT, GRADING, AND STRUCTURE LOCATION SHALL BE FIELD-MODIFIED AS DIRECTED BY ENGINEER.



LEGEND

- (1040) EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING ROAD/TRAIL
- EXISTING PROPERTY LINE
- CONSTRUCTION LIMITS
- EXISTING CHANNEL OR TRIBUTARY CENTERLINE
- EXISTING BUILDING OR BUILT STRUCTURE
- EXISTING CULVERT, SIZE & MTL. AS NOTED
- EXISTING TREE, TO REMAIN (AS SURVEYED)
- CONTROL POINT
- VEGETATED REINFORCED SOIL SLOPE (V.R.S.S.)
- GRADING
- ACCESS/LAYDOWN AREA
- RIPRAP
- EXISTING RIPRAP
- OE OVERHEAD ELECTRIC
- SAN UNDERGROUND SANITARY MAIN
- SS UNDERGROUND STORM MAIN
- EXISTING CULVERT
- UE UNDERGROUND ELECTRIC
- GAS UNDERGROUND GAS
- UT UNDERGROUND TELEPHONE
- X EXISTING FENCELINE
- SEDIMENT CONTROL LOG
- BOULDER CROSS VANE
- J-HOOK BOULDER VANE
- WETLAND DELINEATION



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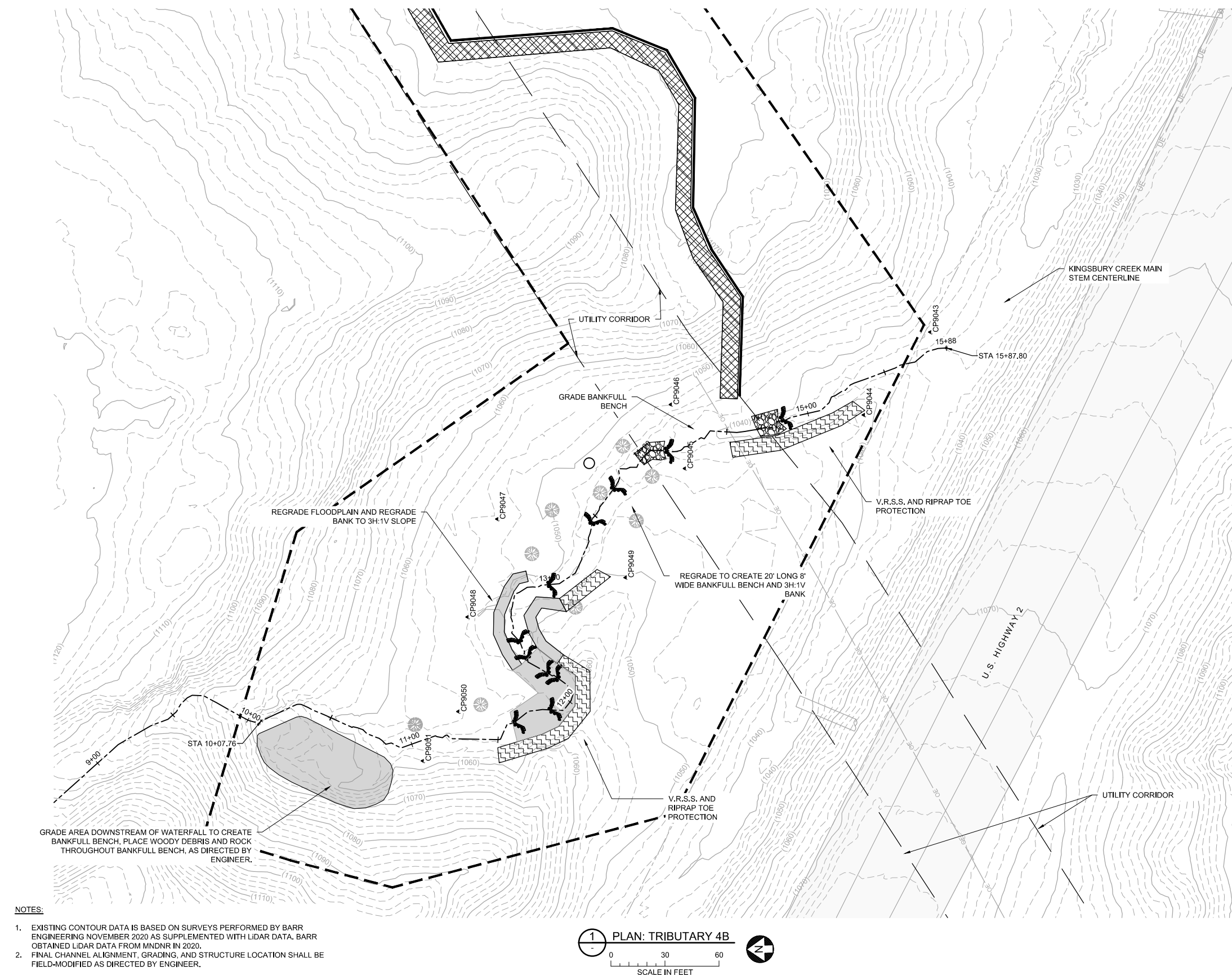
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St. Louis County (MN)
Section: 10, 11, 13, 14 Township: 49N Range: 15W

Revisions	
Date	By

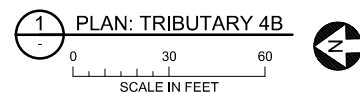
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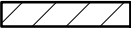












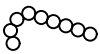

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- NOTES:**
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LEGEND	
	EXISTING INDEX CONTOUR
	EXISTING INTERMEDIATE CONTOUR
	EXISTING ROAD/TRAIL
	EXISTING PROPERTY LINE
	CONSTRUCTION LIMITS
	EXISTING CHANNEL OR TRIBUTARY CENTERLINE
	EXISTING BUILDING OR BUILT STRUCTURE
	EXISTING CULVERT, SIZE & MTL. AS NOTED
	EXISTING TREE, TO REMAIN (AS SURVEYED)
	CONTROL POINT
	VEGETATED REINFORCED SOIL SLOPE (V.R.S.S.)
	LIVE STAKE PLANTING AND GRADING
	ACCESS/LAYDOWN AREA
	RIPRAP
	EXISTING RIPRAP
	OVERHEAD ELECTRIC
	UNDERGROUND SANITARY MAIN
	UNDERGROUND STORM MAIN
	EXISTING CULVERT
	UNDERGROUND ELECTRIC
	UNDERGROUND GAS
	UNDERGROUND TELEPHONE
	EXISTING FENCELINE
	SEDIMENT CONTROL LOG
	BOULDER CROSS VANE
	J-HOOK BOULDER VANE
	WETLAND DELINEATION

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Section: 10, 11, 13, 14 Township: 49N Range: 15W

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Date	By
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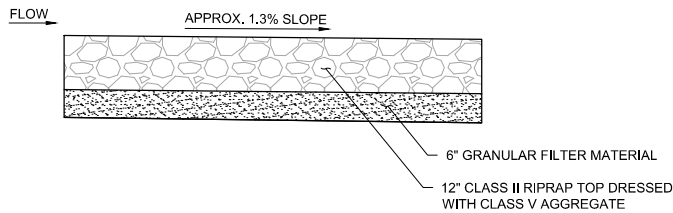
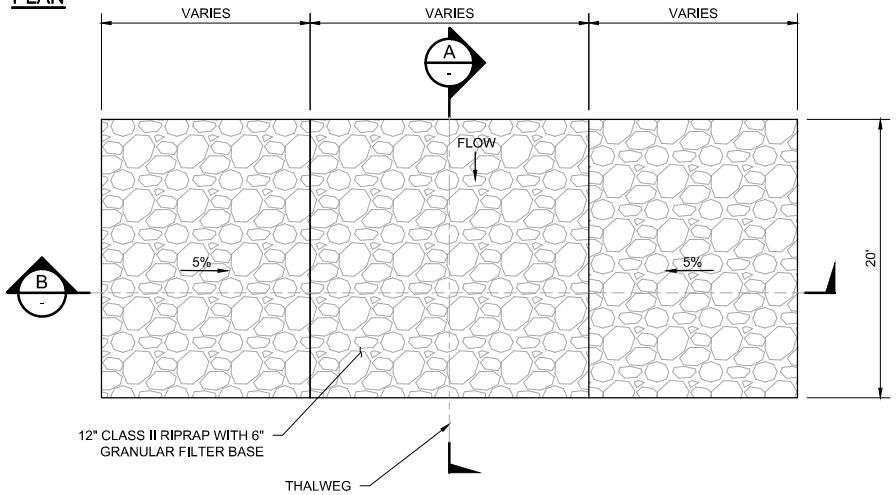
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Horz. datum: St. Louis Co. Coord.	Vert. datum: NAVD88

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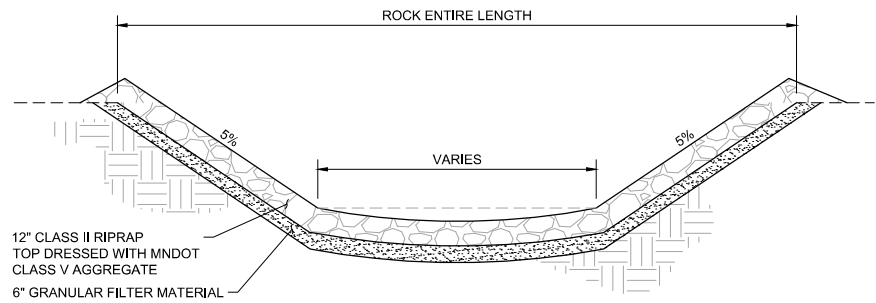
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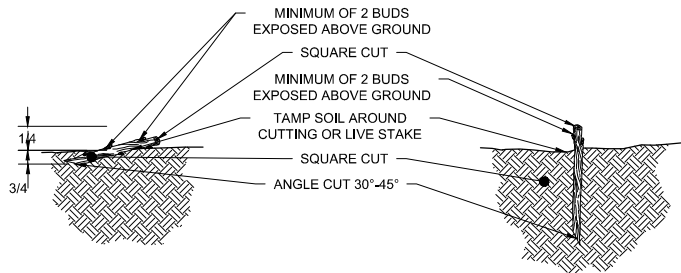
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B SECTION: TEMPORARY CREEK CROSSING
NOT TO SCALE

1 DETAIL: TEMPORARY CREEK CROSSING
NOT TO SCALE

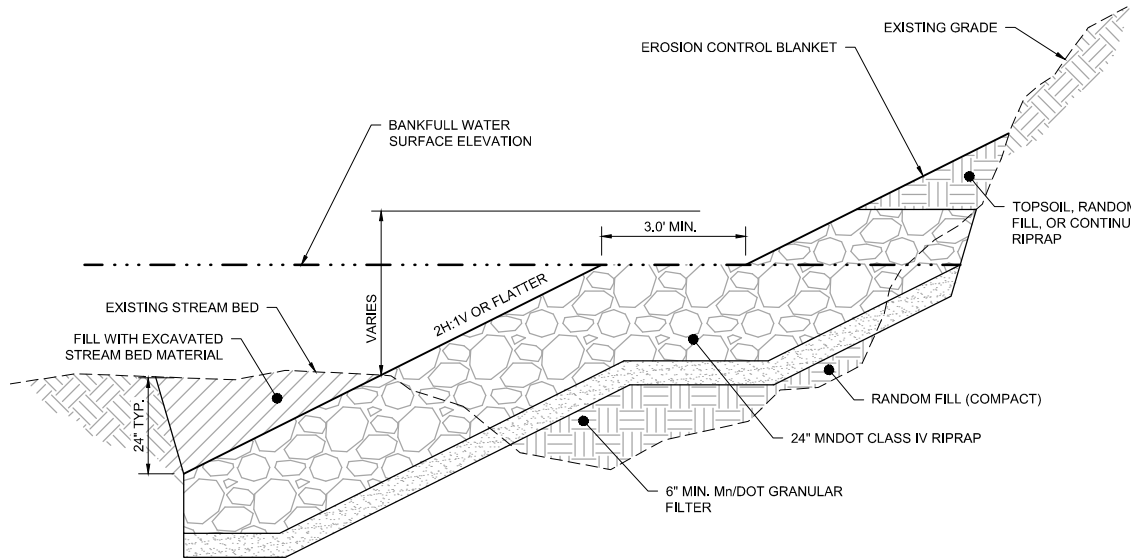
- NOTES:
1. LIVE STAKE OR CUTTING PLANTED PERPENDICULAR TO GROUND SURFACE.
 2. SEE PLANT MATERIAL LIST FOR SPECIES LENGTH AND SPACING.
 3. LIVE STAKES SHALL BE 3/4" DIAMETER MINIMUM. LIVE CUTTINGS SHALL BE 3/4" DIAMETER MIN..



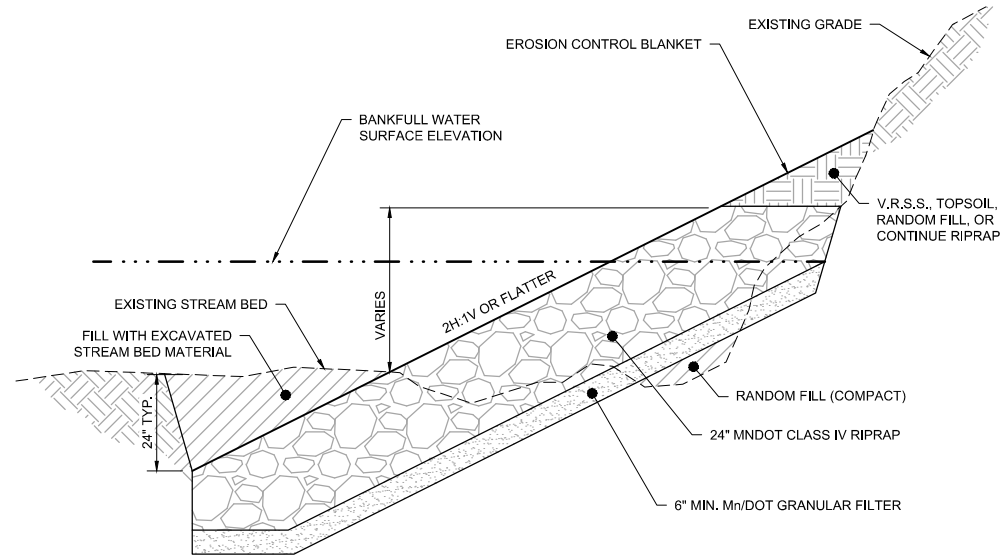
LIVE CUTTING

LIVE STAKE

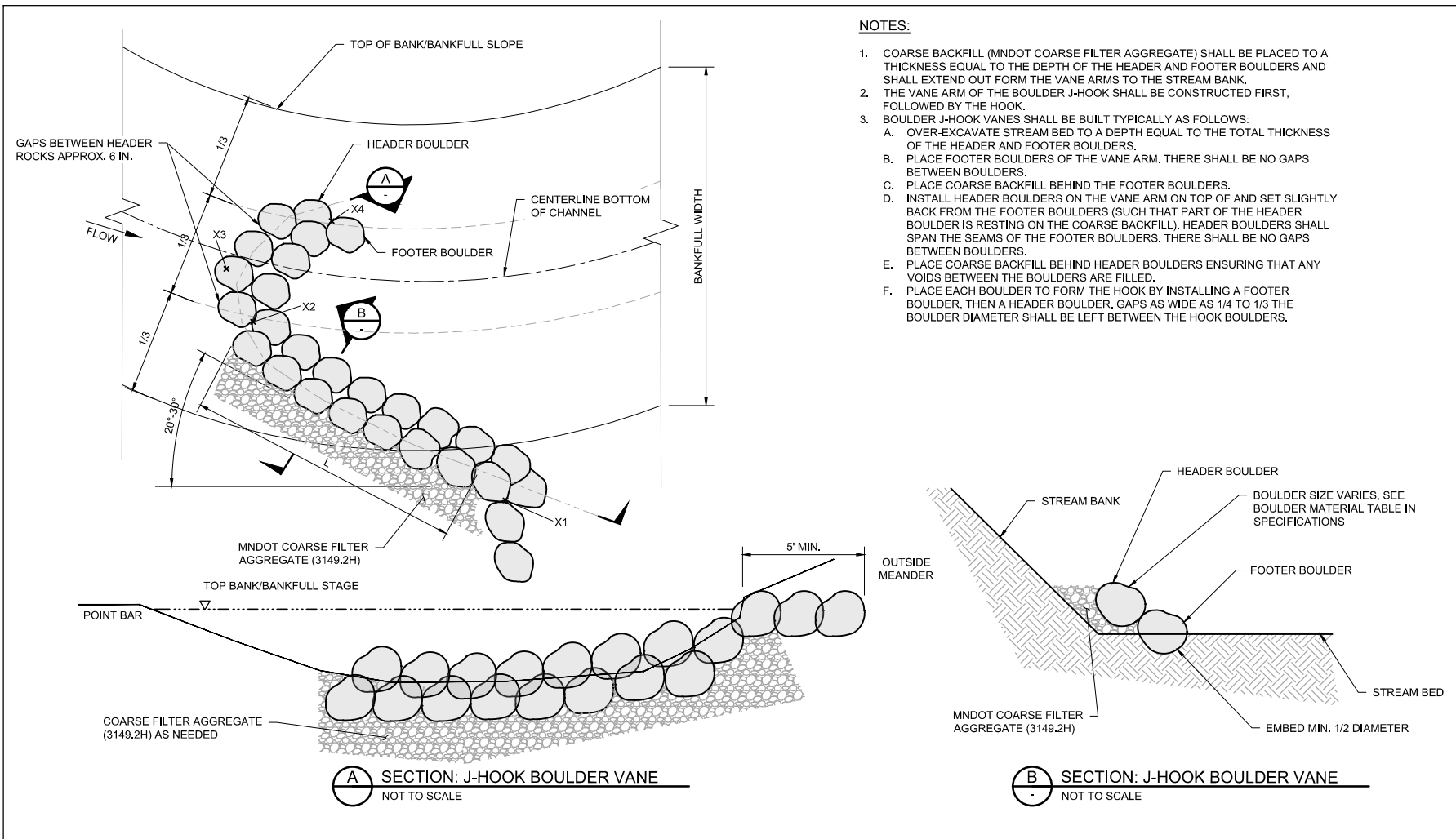
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NOT TO SCALE



2 DETAIL: RIPRAP TOE PROTECTION WITH BENCH
NOT TO SCALE



3 DETAIL: RIPRAP TOE PROTECTION
NOT TO SCALE



A SECTION: J-HOOK BOULDER VANE
NOT TO SCALE

B SECTION: J-HOOK BOULDER VANE
NOT TO SCALE

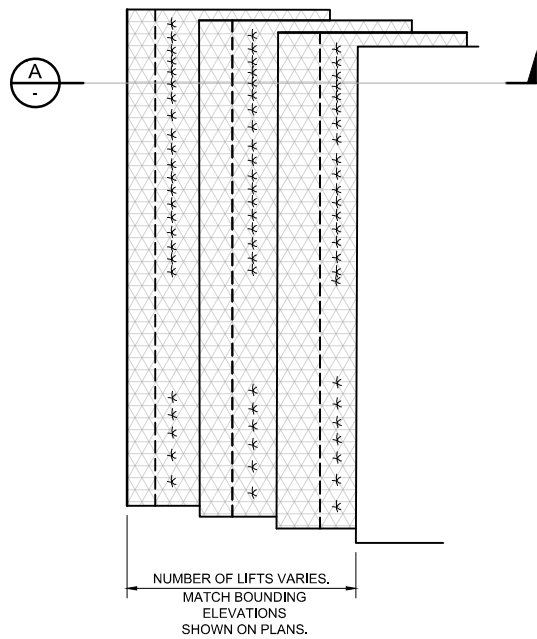
5 DETAIL: J-HOOK BOULDER VANE
NOT TO SCALE

NOTES:

1. COARSE BACKFILL (MNDOT COARSE FILTER AGGREGATE) SHALL BE PLACED TO A THICKNESS EQUAL TO THE DEPTH OF THE HEADER AND FOOTER BOULDERS AND SHALL EXTEND OUT FORM THE VANE ARMS TO THE STREAM BANK.
2. THE VANE ARM OF THE BOULDER J-HOOK SHALL BE CONSTRUCTED FIRST, FOLLOWED BY THE HOOK.
3. BOULDER J-HOOK VANES SHALL BE BUILT TYPICALLY AS FOLLOWS:
 - A. OVER-EXCAVATE STREAM BED TO A DEPTH EQUAL TO THE TOTAL THICKNESS OF THE HEADER AND FOOTER BOULDERS.
 - B. PLACE FOOTER BOULDERS OF THE VANE ARM. THERE SHALL BE NO GAPS BETWEEN BOULDERS.
 - C. PLACE COARSE BACKFILL BEHIND THE FOOTER BOULDERS.
 - D. INSTALL HEADER BOULDERS ON THE VANE ARM ON TOP OF AND SET SLIGHTLY BACK FROM THE FOOTER BOULDERS (SUCH THAT PART OF THE HEADER BOULDER IS RESTING ON THE COARSE BACKFILL). HEADER BOULDERS SHALL SPAN THE SEAMS OF THE FOOTER BOULDERS. THERE SHALL BE NO GAPS BETWEEN BOULDERS.
 - E. PLACE COARSE BACKFILL BEHIND HEADER BOULDERS ENSURING THAT ANY VOIDS BETWEEN THE BOULDERS ARE FILLED.
 - F. PLACE EACH BOULDER TO FORM THE HOOK BY INSTALLING A FOOTER BOULDER, THEN A HEADER BOULDER. GAPS AS WIDE AS 1/4 TO 1/3 THE BOULDER DIAMETER SHALL BE LEFT BETWEEN THE HOOK BOULDERS.

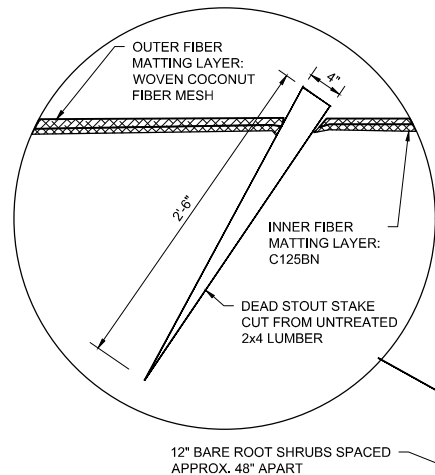
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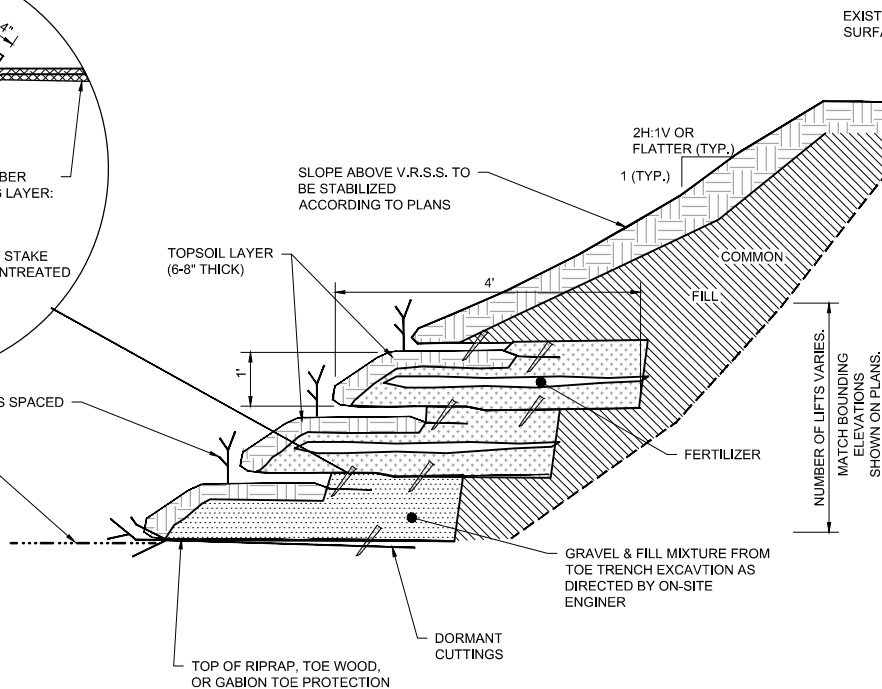
NOTES:

1. SOAK DORMANT CUTTINGS FOR A MINIMUM OF 24 HOURS IN FLOWING WATER BEFORE PLANTING. SOAKING FOR 5-7 DAYS IS CONSIDERED IDEAL. THE DORMANT CUTTINGS SHOULD ONLY BE INSTALLED DURING THE DORMANT SEASON. AFTER LEAF DROP IN THE FALL AND BEFORE BUD BREAK IN THE SPRING. DORMANT CUTTINGS STORED IN COLD STORAGE WITH NO VISIBLE SIGN OF BUD BREAK MAY BE USED INTO LATE SPRING.
2. EXCAVATE THE EXISTING STREAMBANK SLOPE SHOREWARD FROM AND LEVEL WITH THE TOP OF THE RIPRAP TO FORM A STABLE, UNDISTURBED SURFACE. A FLAT BENCH SHOULD BE CREATED FROM THE TOE OF THE STABLE CUT SLOPE TO THE TOE OF THE PROPOSED STREAM BANK TOE PROTECTION.
3. DORMANT CUTTINGS ARE TO BE PLACED ON TOP OF THE RIPRAP EXCAVATED BENCH AT 3 BRANCHES PER LINEAR FOOT; THE BASAL END OF THE CUTTINGS SHOULD EXTEND AT LEAST 2 FOOT PAST THE BACK OF THE RIPRAP. NO MORE THAN 6 INCHES OF THE BUDDING END OF THE LIVE BRANCH SHOULD EXTEND PAST THE FRONT OF THE RIPRAP. COVER THE DORMANT CUTTINGS WITH TOPSOIL TO CREATE AN EVEN SURFACE FOR THE CONSTRUCTION OF THE FIRST SOIL LIFT.
4. LAY NATURAL FIBER MATTING ON BOTTOM OF THE BENCH, OVERLAPPING ADJACENT MATTING BY 1 FOOT. THE OUTER EXPOSED FIBER MATTING LAYER OF EACH SOIL LIFT SHALL BE GEOCOIR/DEKOWE 900 WOVEN COCONUT FIBER MESH, BIOD-MATTM 90, OR AN ENGINEER APPROVED EQUIVALENT.
5. THE INNER LAYER OF EACH SOIL LIFT SHALL BE BIONET C125BN OR AN ENGINEER APPROVED EQUIVALENT. LAY THE INNER LAYER OF BIONET ON TOP OF NATURAL FIBER MATTING OF EACH SOIL LIFT. FABRIC SHOULD BE INSTALLED SMOOTH WITH NO UNNECESSARY FOLDS OR WRINKLES. STAKE THE SHOREWARD END OF THE FIBER MATTING IN PLACE WITH WOODEN STAKES SPACED EVERY THREE FEET AS SHOWN ON THE DRAWINGS.
6. THE FIRST 6 TO 8 INCHES OF THE BOTTOM SOIL LIFT SHALL BE FILLED WITH GRAVEL AND SAND MATERIAL EXCAVATED FROM THE STREAM BED. THE TOP 6 TO 8 INCHES ON THE FRONT OF SURFACE LAYER SHOULD BE COMPRISED OF TOPSOIL MIX AS SHOWN ON THE DRAWINGS.
7. THE TOPSOIL LAYER SHALL BE SEEDED WITH THE V.R.S.S. SEED MIX AT 0.7 POUNDS PER 1,000 SQUARE FEET OF LIFT SURFACE AREA AS SHOWN ON THE DRAWINGS.
8. FOLD THE FIBER MATTING OVER THE FILL MATERIAL AND STAKE IN PLACE SO THE FABRIC IS TAUT AND SMOOTH WITH NO UNNECESSARY FOLDS OR WRINKLES. BACKFILL BEHIND THE BOTTOM SOIL LIFT WITH GRANULAR FILTER MATERIAL TO MEET THE EXISTING SLOPE AS SHOWN ON THE DRAWINGS.



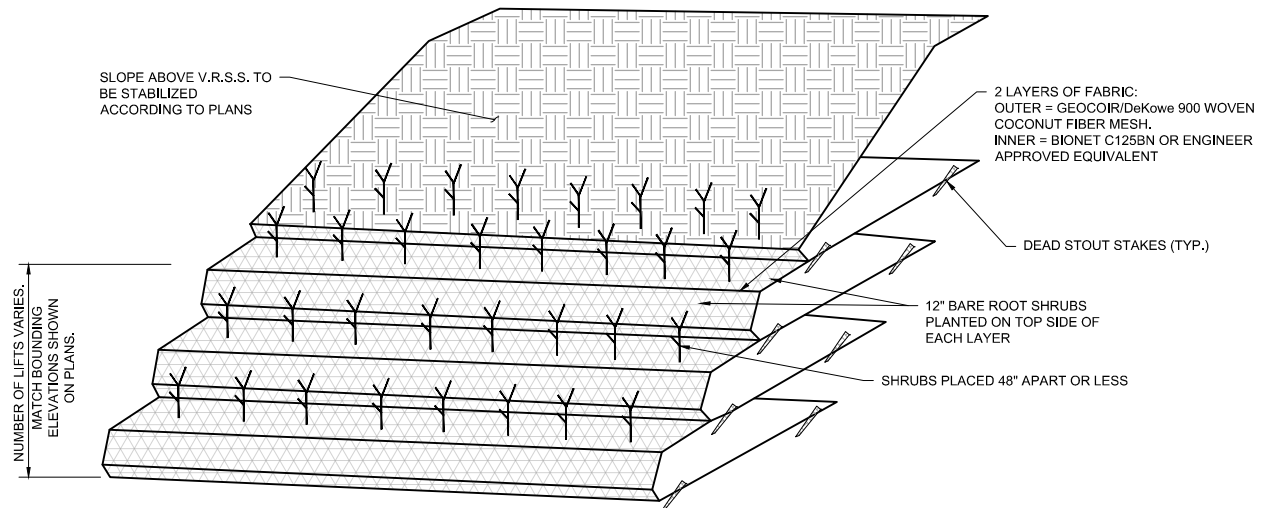
12" BARE ROOT SHRUBS SPACED APPROX. 48" APART

NORMAL WATER SURFACE LEVEL



A SECTION: CROSS-SECTION
NOT TO SCALE

ISOMETRIC



1 DETAIL: LIVE PLANT VEGETATED REINFORCED SOIL SLOPE (V.R.S.S.)
NOT TO SCALE

ISSUED FOR BID
NOT FOR CONSTRUCTION



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.
Name: JESSICA C. OLSON License #: 43102
Date: -

Operations Services
Safety
Facilities
Materials
Equipment
Field Operations
Information Management

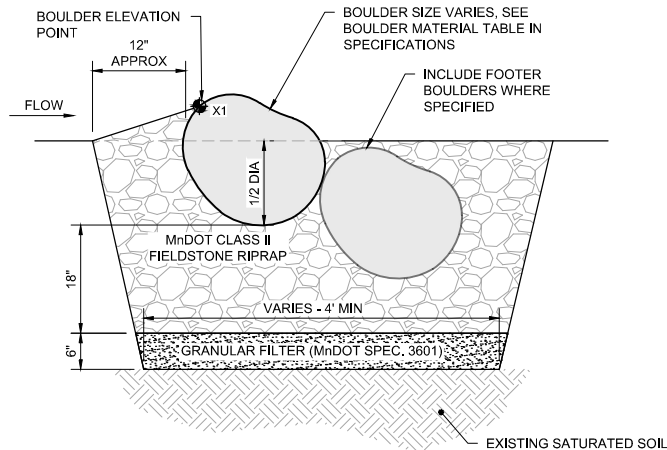
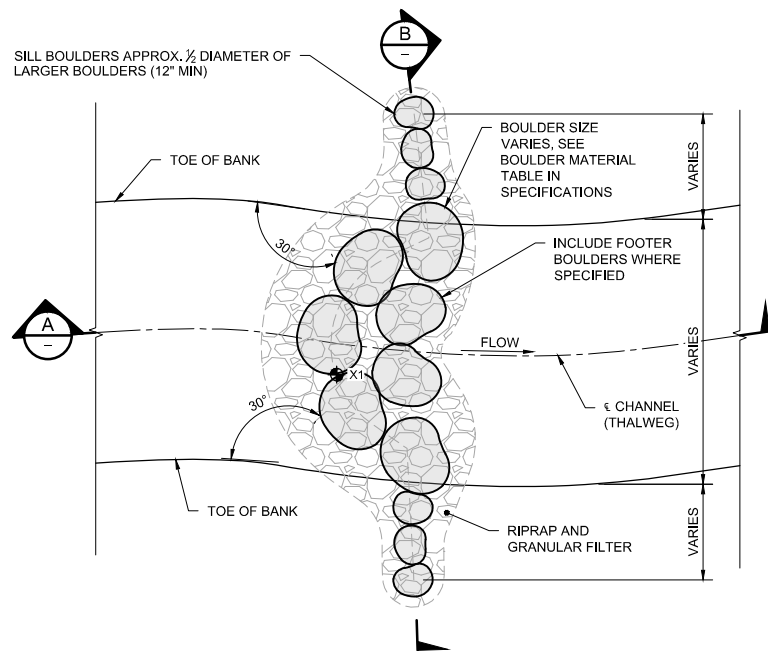
KINGSBURY CREEK RESTORATION
Duluth, Minnesota
DNR Division of Ecological and Water Resources
St. Louis County (MN)
Section: 10, 11, 13, 14 Township: 49N Range: 15W

Revisions	
Date	By

Title: STREAM RESTORATION DETAILS
Survey: RRE 12/20 Designed: BARR 01/21
Drawn: BARR 12/20 Drawn: BARR 02/21
Checked: JCO 12/20 Checked: JCO 02/21
Horz. datum: St. Louis Co. Coord. Vert. datum: NAVD88

Sheet: D-02
CC2: -
File #: -

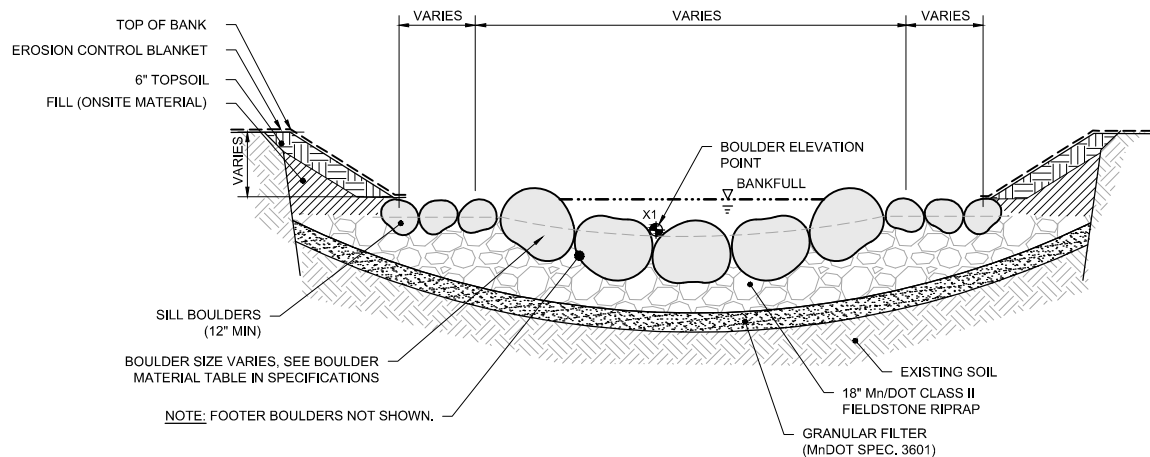
PLAN



A SECTION: BOULDER CROSS VANE WITH SUBGRADE STABILIZATION

NOTES:

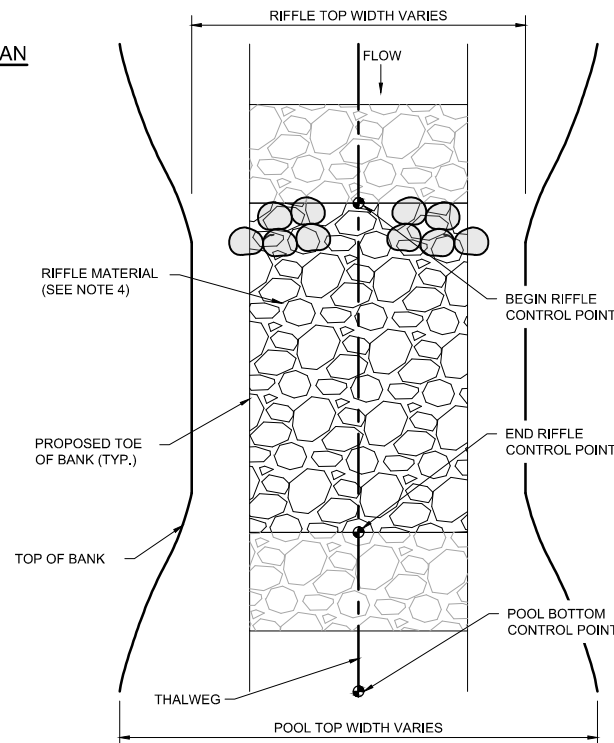
1. CROSS VANE LOCATIONS AND ELEVATIONS ARE APPROXIMATE AND MAY BE MODIFIED IN THE FIELD BY THE ENGINEER.
2. FINAL BOULDER PLACEMENT TO BE APPROVED BY THE ENGINEER IN THE FIELD. CONTRACTOR MAY BE REQUIRED TO ADJUST BOULDER ELEVATIONS AND ROTATION.
3. THERE SHALL BE NO SIGNIFICANT GAPS BETWEEN BOULDERS. RIPRAP BEDDING SHALL BE PLACED ON THE UPSTREAM SIDE OF THE BOULDERS TO PLUG SMALL GAPS (MAY REQUIRE HAND PLACEMENT).
4. BOULDERS OF AN UNSUITABLE SHAPE MAY BE RE-LOCATED OR REJECTED.
5. INSTALL EROSION CONTROL BLANKET ON DISTURBED BANKS.



B SECTION: BOULDER CROSS VANE WITH SUBGRADE STABILIZATION

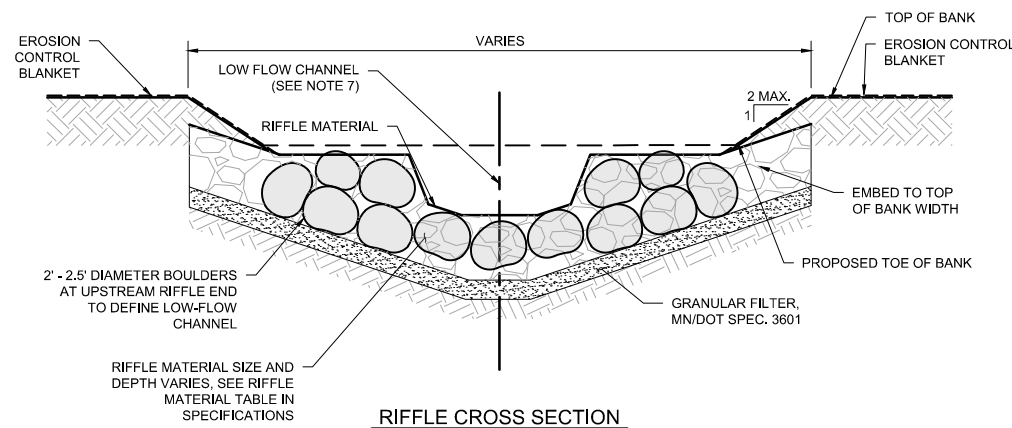
1 DETAIL: CROSS VANE - DOUBLE BOULDER WITH SUBGRADE STABILIZATION NOT TO SCALE

PLAN

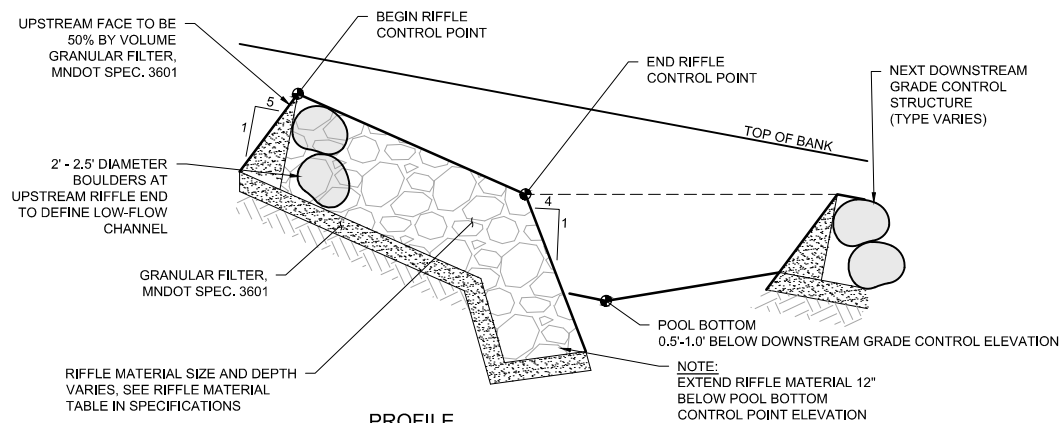


NOTES:

1. CONSTRUCTED RIFFLES SHALL BE INSTALLED IN NEWLY GRADED CHANNEL SECTION.
2. ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE BEGINNING AND END OF RIFFLE POINTS TO ESTABLISH PART OF THE PROFILE OF THE CHANNEL. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE RIFFLE INSTALLATION.
3. RIFFLE MATERIAL SHALL BE OF A TYPE, SIZE, AND GRADATION AS SPECIFIED. (SEE TABLE)
4. THE FACE OF THE RIFFLE UPSTREAM OF THE BEGIN RIFFLE CONTROL POINT SHALL BE 50% BY VOLUME GRANULAR FILTER AGGREGATE (MnDOT SPEC 3601) TO REDUCE VOID SPACES. FILTER AGGREGATE SHALL BE INCIDENTAL TO THE RIFFLE MATERIAL.
5. THE PLACEMENT OF BACKFILL AND/OR RIFFLE MATERIAL SHALL BE DONE IN A MANNER TO CREATE A SMOOTH PROFILE, WITH NO ABRUPT 'JUMP' (TRANSITION) BETWEEN THE UPSTREAM POOL-GLIDE AND THE RIFFLE, AND LIKEWISE NO ABRUPT 'DROP' (TRANSITION) BETWEEN THE RIFFLE AND THE DOWNSTREAM RUN-POOL. ALSO A THALWEG SHALL BE FASHIONED WITHIN THE RIFFLE WIDTH SO THAT THE FINISHED CROSS SECTION OF THE RIFFLE MATERIAL MATCHES THE SHAPE AND DIMENSIONS SHOWN ON THE RIFFLE TYPICAL SECTION.
6. SEE THE STREAM RESTORATION STRUCTURES TABLES FOR STATIONING AND ELEVATIONS.
7. SEE RIFFLE TYPICAL SECTION FOR BANKFULL AND LOW-FLOW CHANNEL DIMENSIONS.



RIFFLE CROSS SECTION



PROFILE

2 DETAIL: ROCK RIFFLE NOT TO SCALE

ISSUED FOR BID
95% DESIGN
NOT FOR CONSTRUCTION



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.

Name: JESSICA C. OLSON License #: 43102

Date: -

Operations Services
Safety
Facilities
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Equipment
Field Operations
Information Management

KINGSBURY CREEK RESTORATION
Duluth, Minnesota
DNR Division of Ecological and Water Resources
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