Cost-Share Proposal Form for NorthWestern Energy (NWE) Project 2188 TAC Funds

Project 2188 (Madison-Missouri River) License Protection, Mitigation and Enhancement (PM&E) projects are required to offset impacts to river resources from the continued operation of one or more of NWE's nine hydro developments (Hebgen, Madison, Hauser, Holter, Black Eagle, Rainbow, Cochrane, Ryan and Morony Dams). PM&E projects need to be prioritized toward in-river or on-the-ground measures that directly benefit fisheries and/or wildlife populations and their habitats:

Priority 1: 2188 License projects which meet License Article requirements and PM&E for fisheries or wildlife populations or their habitats within the main stem Madison River (Hebgen Reservoir to Three Forks) or Missouri River (Hauser Reservoir to Fort Peck Reservoir)

Priority 2: 2188 License projects which meet License Article requirements and PM&E for fisheries or wildlife populations or their habitats in primary tributaries or on adjacent lands and, in doing so, provide PM&E for Madison River (Hebgen Reservoir to Three Forks) or Missouri River (Hauser Reservoir to Fort Peck Reservoir) resources.

Priority 3: 2188 License PM&E projects which meet License Article requirements by providing scientific or other tangible PM&E benefits to Madison-Missouri River fisheries or wildlife populations or their habitats. These projects must be located in the greater Missouri River drainage upstream from Fort Peck Reservoir, but not necessarily located on the main stem Madison River or Missouri River or their adjacent lands or primary tributaries.

All TAC project proposals must include the following information:

Project Title: Pugsley Bridge Bank Stabilization

Date:10/29/2024

Explain how this Project addresses a specific Project 2188 License Article(s): Article 417 addresses this project by "provide(ing) funding to the Montana FWP for fisheries PM&E work in the middle Missouri River and the Great Falls area, including providing assistance to the FWS and Montana FWP for ongoing evaluation of pallid sturgeon in the Missouri River downstream of Morony dam;", because this bank stabilization project is intended to help address downstream erosion, landowner tolerance and protect important infrastructure during elevated spring releases from Tiber Dam aimed at promoting pallid sturgeon spawning in the Marias River and evaluating experimental releases.

Provide justification for Priority 1, 2 or 3 (above) that you selected: Priority 2

Project Sponsor (submitted by): Luke Holmquist – Montana Fish, Wildlife and Parks
Diane Roberts – Liberty County Conservation District

Location of Proposed Project:

Marias River, immediately downstream of Pugsley Bridge on the North Bank near Chester Montana.

Geocode (in decimal degrees ex 46.89743) (Bridge) Lat; _48.29134_____ Long: ___-111.04619_____
(Project) Lat; _48.29125_____ Long: __-111.04440_____

Total Project Cost: $170,357
$121,514 – construction
$48,843 – survey, development of alternatives, and preliminary design.

TAC Funds (Cost-Share) Requested for Project: $20,000

I. Introduction; brief statement of project to be completed with pertinent background information.

This project aims to stabilize the river left (north) bank immediately downstream of Pugsley Bridge. The project area is located on the Marias River downstream of Pugsley Bridge (Figure 1) on an outside bend of the river and has been subject to erosion and accelerated down-valley meander bend migration. Phase 1 of this project was completed circa 2014 and consisted of riprapping approximately 330 linear feet of streambank downstream of Pugsley Bridge. Since 2014, river bend erosion and migration has accelerated downstream of the Phase 1 project area. The landowner, Liberty County Conservation District, and Montana Fish, Wildlife & Parks have worked with River Design Group (RDG) to develop a preliminary restoration design to stabilize the eroding bank using strategies and techniques that will protect Pugsley Road and improve aquatic habitat conditions for trout and native species including pallid sturgeon. RDG presented 3 alternatives to a group of stakeholders and Alternative 2 was selected to move on the 50% design level equivalent.

II. Objectives; explicit statement(s) of what is intended to be accomplished.

The project will treat approximately 352 linear feet of eroding streambank downstream of the Phase 1 rip rap treatment.

III. Methods; description of how Project objectives will be accomplished.

This alternative effectively treats the eroding terrace by providing bank stabilization measures through the entire outside bank line. A vegetated wood matrix will span the entire project and two large wood structures would be installed at the apex of the meander and in the lower 25-feet of treated bankline. The proposed low terrace bench would encroach into the river by approximately 15-feet from the existing vertical bank line, smoothing out the current tortuous meander. The upper terrace scarp would be Daylighted at a 2(h):1(v) slope. Preliminary design plans with more details are shown at the end of this proposal.

IV. Schedule; when the Project work will begin and end.

Spring to Fall of 2025

V. Personnel; who will do the work? Identify Project leader or principal investigator.

Diane Roberts (Liberty County CD) – Project Lead – liaison between other stakeholders
Luke Holmquist (FWP Biologist) – Coordination, acquire funding in coordination with CD.
RDG – Construction oversight
Contractor - TBD

VI. Project budget must include amounts for the following:

Pugsley Bridge Bank Stabilization Cost Opinion - Alternative 2

				ALTERNATIVE 2 ENGINEER'S ESTIMATE	
WORK ITEM	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	TOTAL PRICE
1	MOBILIZATION, DEMOBILIZATION	1	LS	$22,000	$22,000
2	DEVELOP ACCESS ROADS, AND STAGING AREAS	1	LS	$2,000	$2,000.00
4	FURNISH WOOD	1	LS	$12,000	$12,000.00
5	FURNISH 8-INCH MINUS ALLUVIUM	528	CY	$35	$18,480.00
6	FURNISH BALLAST ROCK	20	CY	$60	$1,200.00
7	FURNISH WILLOWS	5,200	EA	$1.5	$7,800.00
8	EXCAVATE, HAUL, AND PLACE BACKFILL	600	CY	$12	$7,200.00
9	INSTALL LARGE WOOD STRUCTURES	2	EA	$5,000	$10,000.00
10	INSTALL VEGETATED WOOD MATRIX	352	LF	$50	$17,600.00
11	INSTALL WILLOW TRENCH	528	LF	$3	$1,584.00
12	INSTALL FLOODPLAIN TREATMENT	0.26	LS	$2,500	$650.00
13	CONSTRUCTION MANAGEMENT, AS-BUILT DRAWINGS & CERTIFICATION	1.0	LS	$21,000	$21,000.00
	TOTAL ALTERNATIVE 2 COST OPINION: ($)			$121,514.00	

AC = Acres EA = Each SY = Square Yards Kgal = 1,000 Gallons
CY = Cubic Yards LF = Linear Feet LS = Lump Sum LBS = Pounds

- All cost-share sources and amounts, including estimation of "in-kind" contributions
  - $50,000 – Tiber Fish Fund – proposal will be submitted in Winter of 2024/2025
  - $60,000 – Future Fisheries Funds - application submitted November 2024
  - $48,843 – State Wildlife Grant (FWP) – survey work and preliminary design of alternatives (completed)

***NorthWestern Energy TAC funds will not be used for agency overhead on projects that do not fund personnel. Applications for materials and equipment should not contain overhead.**

VII. Deliverables; describe work product (reports, habitat restoration, etc.) which will result from this Project. How will "success" for this project be monitored or demonstrated?

Deliverables will be a completed bank stabilization project immediately downstream of Pugsley Bridge on the river left bank of the Marias River. A report with photos will be submitted upon project completion.

VIII. Cultural Resources. Cultural Resource Management (CRM) requirements for any activity related to this Project must be completed and documented to NWE as a condition of any TAC grant. TAC funds may not be used for any land-disturbing activity, or the modification, renovation, or removal of any buildings or structures until the CRM consultation process has been completed. Agency applicants must submit a copy of the proposed project to a designated Cultural Resource Specialist for their agency. Private parties or non-governmental organizations are encouraged to submit a copy of their proposed project to a CRM consultant they may have employed. Private parties and non-governmental organizations may also contact the NWE representative for further information or assistance. Applications submitted without this section completed, will be held by the TAC, without any action, until the information has been submitted.

Summarize here how you will complete requirements for Cultural Resource Management:

Cultural Resource Management requirements will be completed by Northwestern Energy prior to the start of ground disturbance.

IX. Water Rights. For projects that involve development, restoration or enhancement of wetlands, please describe how the project will comply with the Montana DNRC's "Guidance for Landowners and Practitioners Engaged in Stream and Wetland Restoration Activities", issued by the Water Resources Division on 9 March 2016.

Summarize here how you will comply with Montana water rights laws, policies and guidelines:

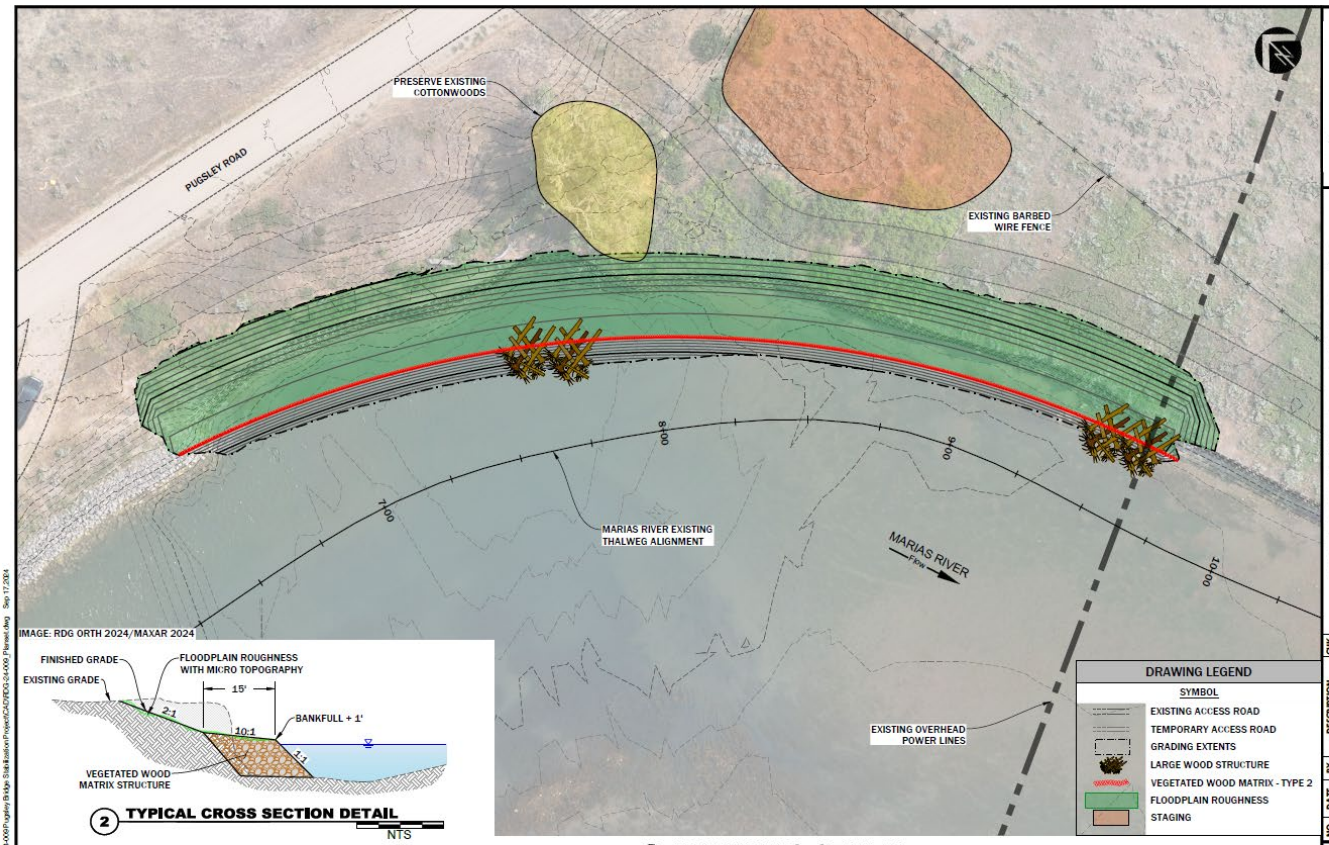
No water right changes will occur with this bank stabilization project. A SPA 124 and USACE 404 permit will be required for the project.

All TAC Project proposals should be 7 pages or less and emailed (as a WORD file) to each of:

- Andrew.Welch@NorthWestern.com
- Jon.Hanson@Northwestern.com
- Grant.Grisak@Northwestern.com

Further questions about TAC proposals or Project 2188 license requirements or related issues may be addressed to:

Andy Welch
Manager, Hydro License Compliance
Andrew.Welch@NorthWestern.com
O 406-444-8115
C 406-565-7549
208 N. Montana Ave
Suite 205
Helena, MT 59601



2 TYPICAL CROSS SECTION DETAIL
NTS

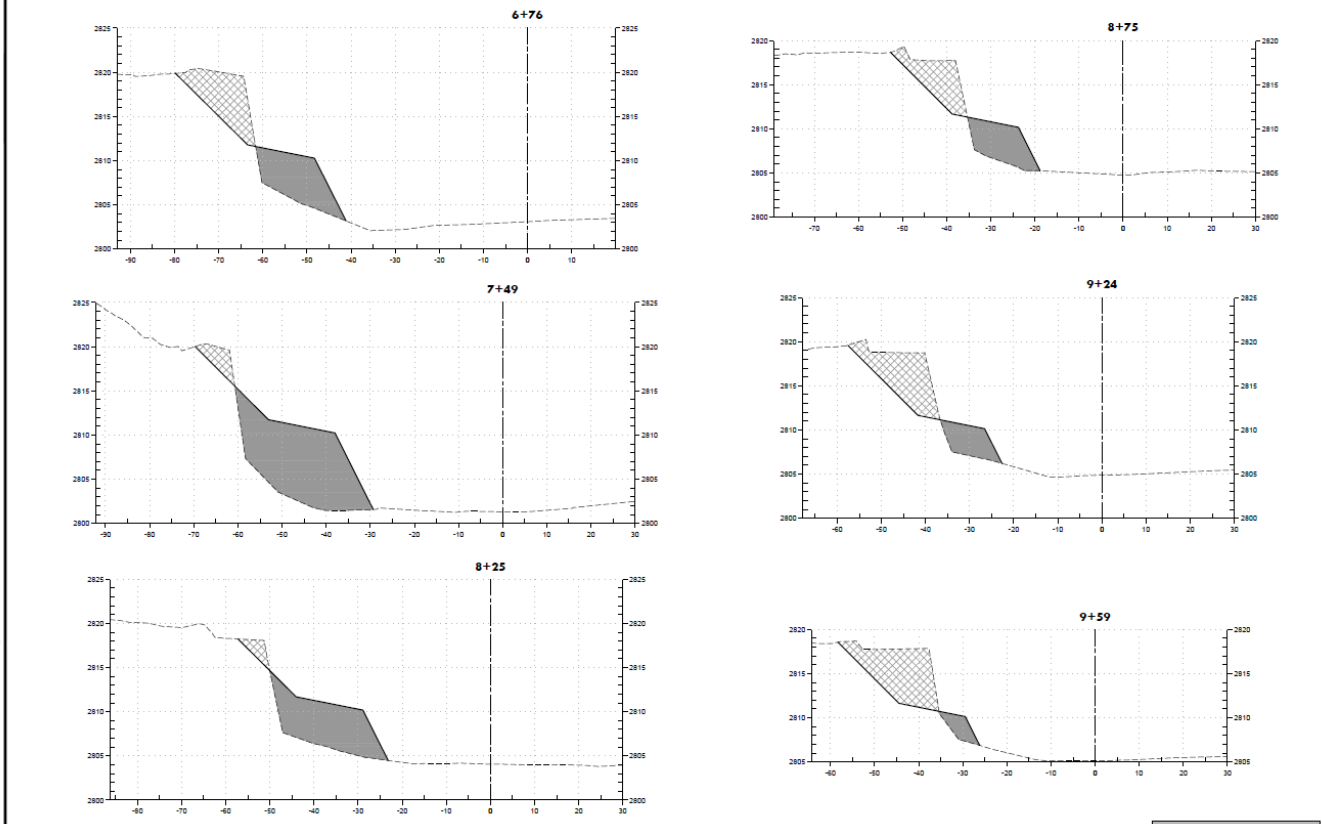
1 ALTERNATIVE 2 - SITE PLAN
PLAN VIEW
1" = 30'

RDG RIVER DESIGN GROUP
236 Wisconsin Avenue Whitefish, MT 59937 406.862.4927
311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920

ALTERNATIVE 2 - SITE PLAN
PUGSLEY BRIDGE STABILIZATION PROJECT
CHESTER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
X	9/12/24	LS	Preliminary Design	NW

PROJECT NUMBER RDG-24-009
DRAWING NUMBER 4.2
Drawing 8 of 14



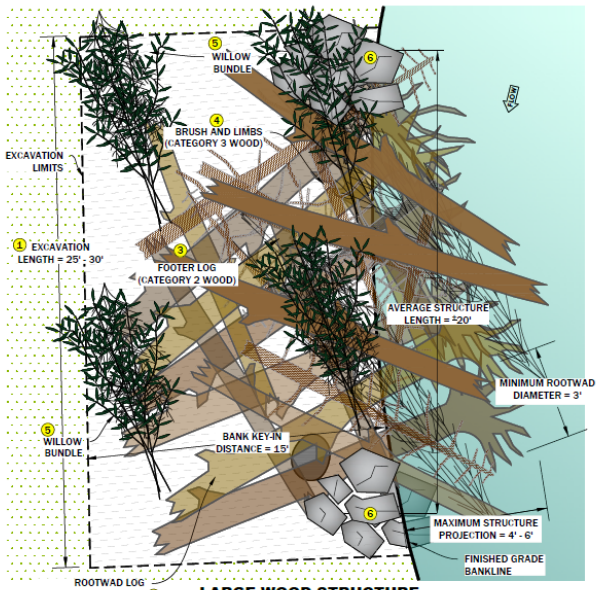
1 ALTERNATIVE 2 - CROSS SECTIONS
HOR: 1" = 20'
VER: 1: = 10'

RDG RIVER DESIGN GROUP
236 Wisconsin Avenue Whitefish, MT 59937 406.862.4927
311 SW Jefferson Avenue Corvallis, OR 97333 541.738.2920

ALTERNATIVE 2 - CROSS SECTIONS
PUGSLEY BRIDGE STABILIZATION PROJECT
CHESTER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
X	9/12/24	LS	Preliminary Design	NW

PROJECT NUMBER RDG-24-009
DRAWING NUMBER 4.3
Drawing 9 of 14



LARGE WOOD STRUCTURE
PLAN VIEW

GENERAL NOTES

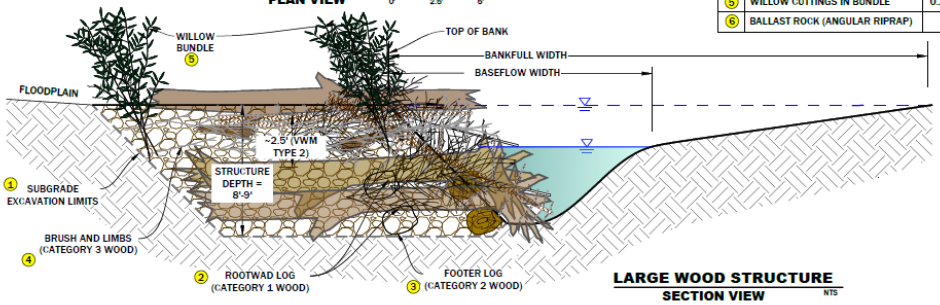
1. CONSTRUCTION OF THE LARGE WOOD STRUCTURE WILL OCCUR BEFORE THE INSTALLATION OF VEGETATED WOOD MATRIX BANK TREATMENTS. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE ENGINEER.
2. FIELD ENGINEER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR EACH LARGE WOOD STRUCTURE PRIOR TO CONSTRUCTION.

NOTES ON LARGE WOOD STRUCTURE INSTALLATION

1. EXCAVATE TO THE EXCAVATION LIMITS. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. INSTALL TWO FOOTER LOGS (CATEGORY 2 WOOD) AT THE BASE OF THE EXCAVATED TRENCH AT THE ORIENTATIONS NOTED IN PLAN VIEW. FOOTER LOGS SHALL PROJECT NO GREATER THAN 1 FT. BEYOND THE FINISH GRADE BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.
3. INSTALL 6 ROOTWAD LOGS (CATEGORY 1 WOOD) INTERSECTING BOTH FOOTER LOGS AT THE ORIENTATION NOTED IN PLAN VIEW. THE UPSTREAM ROOTWAD SHALL NOT PROJECT INTO THE CHANNEL AND SHALL BE FLUSH WITH THE FINISHED BANK LINE. THE DOWNSTREAM ROOTWAD SHALL PROJECT NO GREATER THAN 3 FT. BEYOND THE FINISHED BANK LINE
4. BACKFILL TRENCH WITH STOCKPILED MATERIAL UP TO THE TOP OF THE FOOTER LOGS (CATEGORY 2 WOOD). BACKFILL SHALL BE BUCKET COMPACTED.
5. INSTALL A SECOND TIER OF 4 FOOTER LOGS (CATEGORY 2 WOOD) FOOTER LOGS SHALL PROJECT NO GREATER THAN 1 FT. BEYOND THE FINISH GRADE BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.
6. INSTALL SMALL WOOD AND BRUSH (CATEGORY 3 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 3 FT. BEYOND THE FINISHED BANK LINE.
7. INSTALL 4 ROOTWAD LOGS (CATEGORY 1 WOOD) INTERSECTING THE LOWER TIER OF ROOTWADS AT THE ORIENTATION NOTED IN PLAN VIEW. THE ROOTWADS SHALL PROJECT NO GREATER THAN 2 FT. BEYOND THE FINISHED BANK LINE.
8. INSTALL SMALL WOOD AND BRUSH (CATEGORY 3 WOOD) AND WILLOW CUTTINGS INTERWOVEN INTO WOOD MATRIX UP TO FINISHED GRADE. BRUSH, LIMBS, AND WILLOW CUTTINGS SHALL PROJECT NO GREATER THAN 4 FT. BEYOND THE FINISHED BANK LINE.
9. BACKFILL WOOD MATRIX WITH STREAMBED FILL UP TO FINISHED GRADE WITH STOCKPILED NATIVE MATERIAL. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.
10. INSTALL DEFLECTOR LOGS (CATEGORY 2 WOOD)) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. DEFLECTOR LOGS SHALL BE HALF EMBEDDED IN THE FLOODPLAIN AND PROJECT NO GREATER THAN 4 FT. BEYOND THE FINISHED BANK LINE. EXPOSED ENDS OF FOOTER LOGS SHALL BE BROKEN/ROUGHENED SO AS TO APPEAR NATURAL. SAWED ENDS OF FOOTER LOGS SHALL NOT BE EXPOSED.

LARGE WOOD STRUCTURE MATERIAL SCHEDULE (PER STRUCTURE)

	ITEM	DIA. (IN)	LENGTH (FT)	ROOTWAD (Y/N)	QTY.
1	SUBGRADE EXCAVATION				50 CY
2	CATEGORY 1 WOOD	18" - 24"	20-25	YES - 36 IN DIA. MIN	10 EA
3	CATEGORY 2 WOOD	12" - 18"	20-25	OPTIONAL	12 EA
4	CATEGORY 3 WOOD	< 4"	15-25	OPTIONAL	25 EA
5	WILLOW CUTTINGS IN BUNDLE	0.25"-1.0"	8'		400 EA
6	BALLAST ROCK (ANGULAR RIPRAP)	24"			10 CY



LARGE WOOD STRUCTURE
SECTION VIEW NTS

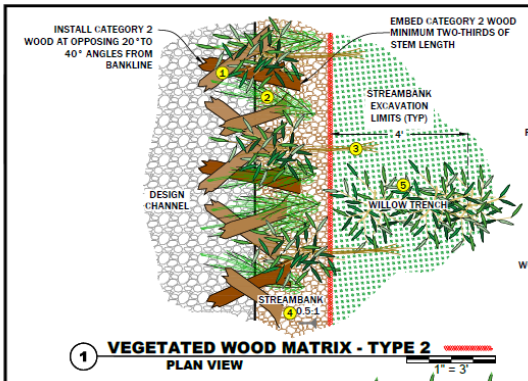
EXAMPLE OF A LARGE WOOD STRUCTURE

RDG RIVER DESIGN GROUP
226 Wisconsin Avenue, Whitefish, MT 59937, 406.862.4927
311 SW Jefferson Avenue, Corvallis, OR 97333, 541.758.3500

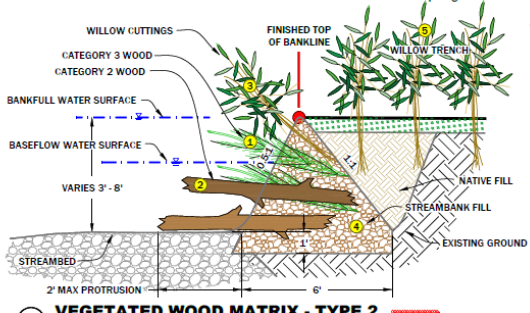
LARGE WOOD STRUCTURE DETAIL
PUGSLEY BRIDGE STABILIZATION PROJECT
CHESTER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
x	9/12/24	LS	Preliminary Design	NW

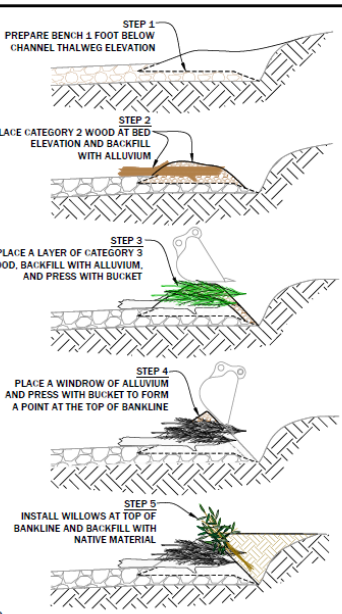
PROJECT NUMBER RDG-24-009
DRAWING NUMBER 5.0
Drawing 12 of 14



1 VEGETATED WOOD MATRIX - TYPE 2
PLAN VIEW 1" = 3'



2 VEGETATED WOOD MATRIX - TYPE 2
SECTION VIEW 1" = 3'



3 RECOMMENDED VEGETATED WOOD MATRIX INSTALLATION SEQUENCE
SECTION VIEW 1" = 5'

GENERAL NOTES

1. CONSTRUCTION OF THE VEGETATED WOOD MATRIX WILL OCCUR AFTER THE LARGE WOOD STRUCTURES ARE INSTALLED.
2. IF VEGETATED WOOD MATRIX STRUCTURES ARE INSTALLED PRIOR TO OCTOBER 1, LEAVE BACK TRENCH UNFILLED AND COMPLETE STRUCTURE WHEN DORMANT WILLOWS ARE AVAILABLE.
3. IT IS CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
4. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY CONSTRUCTION MANAGER.
5. CONTRACTOR SHALL MARK AND CONSTRUCTION ENGINEER SHALL APPROVE THE GENERAL LOCATION FOR EACH VEGETATED WOOD MATRIX STRUCTURE PRIOR TO CONSTRUCTION.

NOTES ON VEGETATED WOOD MATRIX INSTALLATION

1. EXCAVATE TO THE EXCAVATION LIMITS AS SHOWN. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. PREPARE THE BENCH OF THE STRUCTURE BY PLACING STREAMBED ALLUVIUM MINIMUM 1 FOOT BELOW CHANNEL THALWEG ELEVATION.
3. CATEGORY 2 AND CATEGORY 3 WOOD, AND STREAMBED ALLUVIUM SHALL BE PLACED IN ALTERNATING LIFTS AND BUCKET COMPACTED UP TO THE TOP OF BANK ELEVATION AS SHOWN IN THE INSTALLATION SEQUENCE. PLACE 6 FT TO 8 FT. DORMANT WILLOW CUTTINGS AT A DENSITY OF 5 PER LINEAR FT ALONG THE TOP OF BANK LINE ELEVATION. WILLOW CUTTINGS SHALL SLOPE AT AN APPROXIMATE 1:1 SLOPE AS SHOWN IN SECTION VIEW. STEMS MAY OVERLAP. THE CUT ENDS SHALL BE PLACED AT THE BASE OF THE SLOPES WITH THE UN-CUT ENDS EXTENDING BEYOND THE EDGE OF THE TRENCH SO NO GREATER THAN ONE-THIRD OF THE TOTAL CUTTING LENGTH IS EXPOSED BEYOND THE TOP OF BANKLINE. WILLOW CUTTINGS SHOULD INTERCEPT THE DESIGN TOP OF BANKLINE AS SHOWN IN STEP 5 OF THE INSTALLATION SEQUENCE.
4. THE UPSTREAM AND DOWNSTREAM ENDS OF THE STRUCTURE SHALL TRANSITION SMOOTHLY INTO ADJACENT STREAMBANK STRUCTURES TO MINIMIZE EROSION, FLANKING, AND BANK FAILURE.
5. AFTER INSTALLATION OF THE VEGETATED WOOD MATRIX, BACKFILL THE STRUCTURE WITH STOCKPILED MATERIAL TO FINISHED GRADE, AND BUCKET COMPACT. INSTALL WILLOW TRENCHES AT A RATE OF 5 PER LINEAR FOOT (OR 50 PER TRENCH) AS SHOWN. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.

TYPE 2 - VEGETATED WOOD MATRIX MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIA. (IN)	QTY.
1	CATEGORY 2 WOOD	12" - 18"	4
2	CATEGORY 3 WOOD	<4"	6
5	BANK WILLOW CUTTINGS	0.25"-1.0"	5
4	STREAMBANK ALLUVIUM	8" MINUS	1.5 CY

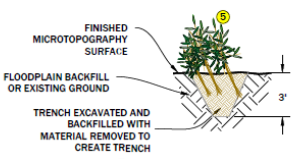
STREAMBANK FILL GRADATION

SIZE (IN)	PERCENT PASSING
8	100
4	90-100
3	50-80
1	30-50
0.05	10-30
FINES	10

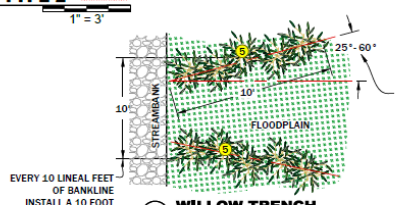
NOTE: MIX SALVAGED MATERIAL AND IMPORTED MATERIAL TO ACHIEVE SPECIFIED GRADATION

WILLOW TRENCH MATERIAL SCHEDULE (PER LINEAL FOOT)

	ITEM	DIA.	QUANTITY (EA)
5	WILLOW CUTTINGS	0.25" - 1"	5



4 WILLOW TRENCH
SECTION VIEW NTS



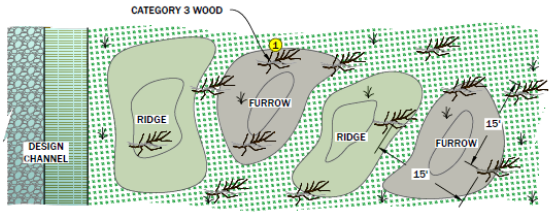
5 WILLOW TRENCH
PLAN VIEW NTS

RDG RIVER DESIGN GROUP
226 Wisconsin Avenue, Whitefish, MT 59937, 406.862.4927
311 SW Jefferson Avenue, Corvallis, OR 97333, 541.758.3500

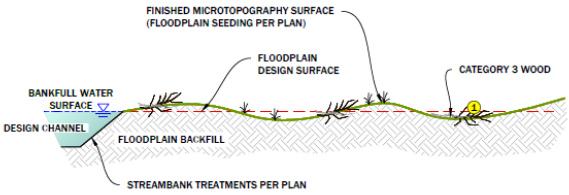
VEGETATED WOOD MATRIX TYPE 2 DETAIL
PUGSLEY BRIDGE STABILIZATION PROJECT
CHESTER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
x	9/12/24	LS	Preliminary Design	NW

PROJECT NUMBER RDG-24-009
DRAWING NUMBER 5.1
Drawing 13 of 14



1 MICROTOPOGRAPHY AND FLOODPLAIN WOOD PLACEMENT
PLAN VIEW NTS



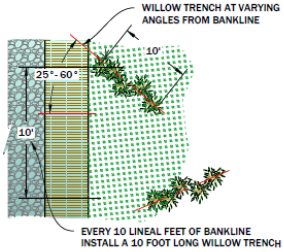
2 MICROTOPOGRAPHY AND FLOODPLAIN WOOD PLACEMENT
SECTION VIEW NTS

FLOODPLAIN TREATMENT MATERIAL SCHEDULE (PER ACRE)					
	ITEM	DIA. (IN)	LENGTH	QUANTITY (EA)	UNIT
1	CATEGORY 3 WOOD	<4"	15' - 25'	25	% COVER*

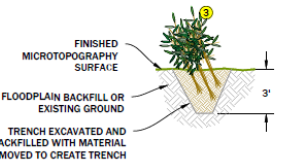
*APPROXIMATELY 250 PIECES/ACRE

EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS

EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS



3 FLOODPLAIN WILLOW TRENCH
PLAN VIEW NTS



4 FLOODPLAIN WILLOW TRENCH
SECTION VIEW NTS

WILLOW TRENCH MATERIAL SCHEDULE (PER LINEAL FOOT)			
	ITEM	DIA.	QUANTITY (EA)
3	WILLOW CUTTINGS	0.25" - 1"	5

NOTES ON WILLOW TRENCH INSTALLATION

1. WILLOW TRENCHES WILL BE CONSTRUCTED WITHIN THE FLOODPLAIN AT THE DIRECTION OF THE CONSTRUCTION MANAGER.
2. CONSTRUCTION OF WILLOW TRENCHES WILL OCCUR AFTER OCTOBER 1ST AND BEFORE THE END OF THE CONSTRUCTION SEASON.
3. CONTRACTOR SHALL MARK AND ENGINEER SHALL APPROVE THE GENERAL CONSTRUCTION LOCATION FOR EACH VEGETATED WILLOW TRENCH PRIOR TO CONSTRUCTION.
4. A TRENCH WILL BE CONSTRUCTED APPROXIMATELY 5' DEEP AND EXTEND THE LENGTH OF THE STAKED TREATMENT LOCATION. LIVE WILLOW CUTTINGS WILL BE PLACED IN THE TRENCH SUCH THAT THEY ARE INTERMIXED AND ORIENTED AT A NEAR VERTICAL ANGLE.
5. THE TRENCH WILL THEN BE BACKFILLED WITH THE SAME MATERIAL REMOVED TO CREATE THE TRENCH AND SHOULD MATCH THE ELEVATION OF THE SURROUNDING FLOODPLAIN GRADE.

NOTES ON FLOODPLAIN ROUGHNESS INSTALLATION

1. CONTRACTOR SHALL DEVELOP MICROTOPOGRAPHY AND PLACE WOODY MATERIAL IN THE CONSTRUCTED FLOODPLAIN.
2. TRANSPORT CATEGORY 2, AND CATEGORY 3 WOOD FROM FROM DESIGNATED STOCKPILE AREAS. PLACE CATEGORY 2 WOOD AT A RATE OF 35 PIECES PER ACRE AND SPACED AT AN AVERAGE DISTANCE OF 20 FEET FROM OTHER CATEGORY 2 WOOD. PLACE CATEGORY 3 WOOD SO IT COVERS 25 PERCENT OF THE FLOODPLAIN SURFACE (APPROXIMATELY 250 PIECES PER ACRE).
3. BURY CATEGORY 2 WOOD WITHIN THE FLOODPLAIN SURFACE, WITH ONE HALF OF THE LENGTH BURIED TO A DEPTH OF 2-FT., AND ONE HALF EXPOSED A MAXIMUM OF 2-FT ABOVE FINISHED GRADE AS SHOWN ON DRAWING. PLACE CATEGORY 3 WOOD ON THE SURFACE. CATEGORY 3 WOOD DOES NOT NEED TO BE BURIED.
4. CONSTRUCT LOW AND HIGH FEATURES (RIDGES AND FURROWS) AS SHOWN ON THE DRAWINGS. MAXIMUM HEIGHT OF RIDGES AND DEPTH OF FURROWS SHALL BE NO GREATER THAN 0.5-FT. RELATIVE TO FINISHED FLOODPLAIN SURFACE.

DESIGN INTENT

PURPOSE: THE PURPOSE OF THIS TREATMENT IS TO CREATE CHARACTERISTICS ON NEWLY CONSTRUCTED FLOODPLAIN SURFACES THAT ARE SIMILAR TO THE CONDITIONS ON NATURAL, VEGETATED FLOODPLAIN SURFACES.

PLACEMENT CRITERIA: TREATMENTS ARE APPLIED TO FLOODPLAIN SURFACES THAT LACK ROUGHNESS ELEMENTS AND VEGETATION.

SUPPLEMENTAL INFORMATION: FLOODPLAIN ROUGHNESS TREATMENTS REDUCE THE RISK OF SURFACE EROSION AND INCREASE THE RETENTION OF SEDIMENT AND NUTRIENTS FOR THE DEVELOPMENT OF RIPARIAN VEGETATION. FLOODPLAIN ROUGHNESS IS APPLIED USING TWO METHODS: (1) MICROTOPOGRAPHY GRADING AND (2) WOODY DEBRIS PLACEMENT. MICROTOPOGRAPHY GRADING WILL CREATE AN UNEVEN SURFACE OF FURROWS AND RIDGES ON THE FLOODPLAIN. WOODY DEBRIS WILL PROVIDE STABILITY AND CONTRIBUTE ORGANIC MATTER TO FLOODPLAIN SOILS. PROPER ANCHORING OF WOODY DEBRIS IS REQUIRED TO PREVENT MOVEMENT DURING OVERBANK FLOWS.

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FLOODPLAIN ROUGHNESS DETAIL

PUGSLEY BRIDGE STABILIZATION PROJECT
CHESTER, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
x	9/12/24	LS	Preliminary Design	NW

PROJECT NUMBER
RDG-24-005

DRAWING NUMBER
5.2
Drawing 14 of 14