FUTURE FISHERIES IMPROVEMENT PROGRAM
GRANT APPLICATION

(Please fill in the highlighted areas)
all sections (IA, IB, IC, etc.) must be addressed or the application will be considered invalid

I. APPLICANT INFORMATION

A. Applicant Name: Big Blackfoot Chapter of Trout Unlimited

B. Mailing Address: PO Box 1

C. City: Ovando State: MT Zip: 59854

Telephone: 406.240.4824 E-mail: ryen@montanatu.org

D. Contact Person: Ryen Neudecker

Address if different from Applicant: See above

City: State: Zip:

Telephone: E-mail:

E. Landowner and/or Lessee Name (if other than Applicant): Stew Schwartz

Mailing Address: 445 US HWY 89

City: Vaughn State: MT Zip: 59487-9532

Telephone: 406-965-3360 E-mail: NA

II. PROJECT INFORMATION*

A. Project Name: Blackfoot River Fish Screen Project

River, stream, or lake: Blackfoot River

Location: Township: 14N Range: 9W Section: 26
Latitude: 46.561755 Longitude: -112.422282 *within project (decimal degrees)*

County: Lewis and Clark

B. Purpose of Project:

The overall goal of the Blackfoot River Fish Screening Project is to eliminate fish entrainment, improve migration corridors for native migratory trout and improve irrigation practices.

C. Brief Project Description:

The Blackfoot River Watershed in western Montana supports populations of two imperiled native species, bull trout and westslope cutthroat trout. The mainstem Blackfoot River and primary tributaries have been designated critical habitat for bull trout and a bull trout core area watershed. Westslope cutthroat trout currently occupy approximately 90% of their historical range in the Blackfoot and the watershed also supports one of the larger fluvial metapopulations of genetically unaltered westslope cutthroat trout in Montana. This project, located in the upper Blackfoot River watershed of Montana involves eliminating entrainment of all fish including native westslope cutthroat trout and bull trout down an irrigation diversion. Specifically, an unscreened irrigation diversion located within a critical migratory corridor for native trout populations will be upgraded by installing a low-maintenance, cost-effective, self-cleaning fish screen with a headgate to allow for hydraulic control. A limited amount of instream wood and willow plantings will be installed and willow plantings will occur along the river bank margin in the diversion area to protect the new infrastructure.

The diversion described in this application, located near river-mile 104, falls within the migration corridor for the only population of fluvial bull trout in the upper Basin. In addition, the diversion lies between wintering/summering areas in the Blackfoot River and spawning sites for westslope cutthroat trout in upper river tributaries. FWP observations identified native trout and other species (brown trout, whitefish, sculpin) are being entrained within the ditch. These tributaries maintain the fluvial population in the upper reaches of the Blackfoot River. In addition, genetic testing has shown that these critical spawning sites contribute to the fluvial bull trout population in the lower river reaches as much as 90 stream miles downriver.

It should also be noted that this project is tied to the larger Habitat Conservation Program which entails a conservation easement with direct ties to restoration of native trout streams. The landowner has also participated in numerous restoration projects on the ranch benefiting native trout including stream restoration, grazing management, fish passage, fish screening and an instream water lease.

Project Goals & Objectives:

The overall goal of the Blackfoot River Fish Screening Project is to eliminate fish entrainment, improve migration corridors for native migratory trout, and allow for efficient irrigation practices.

Specific objectives include:

1. Install a low-maintenance, cost-effective, self-cleaning fish screen capable of operating between 2 and 12 cfs.
2. Install a cost-effective, low maintenance headgate capable of providing hydraulic control through a range of flows from 0 to 12 cfs.
3. Effectively screen all age classes of salmonids
4. Minimize sediment delivery to the ditch using a sediment sluice gate.
5. Provide bank stability in the immediate project area.

D. Length of stream or size of lake that will be treated: The project area will include 700 feet of Blackfoot River. Bank work is limited to 200 feet and is designed to protect infrastructure and encourage revegetation of an eroding bank line.

E. Project Budget:

Grant Request (Dollars): $ 49,949.00

Contribution by Applicant (Dollars): $ _____ In-kind $ 5,505

(salaries of government employees are not considered as matching contributions)

Contribution from other Sources (Dollars): $ 99,000.20 In-kind $ 25,205

(attach verification - See page 2 budget template)

Total Project Cost: $ 174,154.20

F. Attach itemized (line item) budget – see template

G. Attach specific project plans, detailed sketches, plan views, photographs, maps, evidence of landowner consent, evidence of public support and fish biologist support, and/or other information necessary to evaluate the merits of the project. If project involves water leasing or water salvage complete supplemental questionnaire (fwp.mt.gov/habitat/futurefisheries/supplement2.doc).

H. Attach land management and maintenance plans that will ensure protection of the reclaimed area.

III. PROJECT BENEFITS*

A. What species of fish will benefit from this project?:

Bull trout, westslope cutthroat trout, brown trout, mountain whitefish and sculpin

B. How will the project protect or enhance wild fish habitat?:

Yes: Screening this irrigation diversion will eliminate entrainment of native trout within a critical migration corridor, as well as other fish that inhabit the upper Blackfoot River

C. Will the project improve fish populations and/or fishing? To what extent?:

Yes: This project is expected to improve recruitment to the main Blackfoot River by eliminating the loss of fish to a large irrigation ditch.

D. Will the project increase public fishing opportunity for wild fish and, if so, how?:

Yes: Public access is located above and below this reach of river at two county bridge sites. The landowner also participates in the FWP Block Management Program. Overall, this project should improve recruitment of trout to a large section of the river by improving habitat connectivity and preventing fish losses at this diversion.

E. The project agreement includes a 20-year maintenance commitment. Please discuss your ability to meet this commitment.

The landowner has signed a 20-year landowner agreement

F. What was the cause of habitat degradation in the area of this project and how will the project correct the cause?:

This diversion is located within a critical migratory corridor for native trout and by screening the intake, we will eliminate entrainment at this diversion point.

G. What public benefits will be realized from this project?:

This project involves the continuation of the partnership-driven Blackfoot Restoration program and will benefit both a Federally threatened species and a MT Species of Special Concern by improving fish survival and habitat connectivity in a blue-ribbon trout fishery.

H. Will the project interfere with water or property rights of adjacent landowners? (explain):

No. The screen is sized for the irrigators water right.

I. Will the project result in the development of commercial recreational use on the site?: (explain):

No

J. Is this project associated with the reclamation of past mining activity?:

No

Each approved project sponsor must enter into a written agreement with the Department specifying terms and duration of the project.

IV. AUTHORIZING STATEMENT

I (we) hereby declare that the information and all statements to this application are true, complete, and accurate to the best of my (our) knowledge and that the project or activity complies with rules of the Future Fisheries Improvement Program.

Applicant Signature:  Date: May 17, 2017

Sponsor (if applicable):

***Highlighted boxes will automatically expand.**

Mail To: **Montana Fish, Wildlife & Parks**
Habitat Protection Bureau
PO Box 200701
Helena, MT 59620-0701

E-mail To: **Michelle McGree**
mmcgree@mt.gov
(electronic submissions MUST be signed)

Incomplete or late applications will be rejected and returned to applicant.
Applications may be rejected if this form is modified.

*****Applications may be submitted at anytime, but must be signed and received by the Future Fisheries Program Officer in Helena before December 1 and June 1 of each year to be considered for the subsequent funding period.*****

Photo 1: Existing diversion located near river-mile 104. Typically tarps, fence posts and boards are installed across the river to divert instream flows. Ditch heads off to the left in this photo.

Blackfoot River fish screen

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

Both tables must be completed or the application will be returned

WORK ITEMS (ITEMIZE BY CATEGORY)	NUMBER OF UNITS	UNIT DESCRIPTION *	COST/UNIT	TOTAL COST	CONTRIBUTIONS			
					FUTURE FISHERIES REQUEST	IN-KIND SERVICES**	IN-KIND CASH	TOTAL
Personnel* **								
Survey	50	hours	$100.00	$ 5,000.00			5,000.00	$ 5,000.00
Design	200	hours	$110.00	$ 22,000.00			22,000.00	$ 22,000.00
Permitting	60	hours	$50.00	$ 3,000.00		3,000.00		$ 3,000.00
Oversight	90	hours	$100.00	$ 9,000.00			9,000.00	$ 9,000.00
				$ -				$ -
			Sub-Total	$ 39,000.00	$ -	$ 3,000.00	$ 36,000.00	$ 39,000.00
Travel								
Mileage	1500	miles	$0.57	$ 855.00		855.00		$ 855.00
Per diem				$ -				$ -
			Sub-Total	$ 855.00	$ -	$ 855.00	$ -	$ 855.00
Construction Materials** **								
FCA FIsh Screen	1	each	$56,000.00	$ 56,000.00	27,000.00		29,000.00	$ 56,000.00
Headgate/Sluice Gate	1	each	$5,450.00	$ 5,450.00	2,500.00		2,950.00	$ 5,450.00
Trash Rack	1	each	$2,500.00	$ 2,500.00	1,000.00		1,500.00	$ 2,500.00
36" HDPE Pipe	120	ft	$50.12	$ 6,014.40	2,000.00		4,014.40	$ 6,014.40
15" HDPE Pipe	180	ft	$10.31	$ 1,855.80	500.00		1,355.80	$ 1,855.80
12" HDPE Pipe	40	ft	$9.10	$ 364.00			364.00	$ 364.00
Bypass pipe flange	1	each	$175.00	$ 175.00			175.00	$ 175.00
Transistion Box	1	each	$415.00	$ 415.00			415.00	$ 415.00
Wood	1	lump sum	$4,000.00	$ 4,000.00		4,000.00		$ 4,000.00
WIlow Cuttings	2650	each	$1.00	$ 2,650.00	1,000.00	1,650.00		$ 2,650.00
Boulders	20	each	$50.00	$ 1,000.00		1,000.00		$ 1,000.00
16-20" Rock	60	CY	$45.00	$ 2,700.00		2,700.00		$ 2,700.00
12" Rock	300	CY	$40.00	$ 12,000.00		6,000.00	6,000.00	$ 12,000.00
8" Rock	300	CY	$38.00	$ 11,400.00	4,000.00	6,000.00	1,400.00	$ 11,400.00
3/4" minus	70	CY	$30.00	$ 2,100.00	500.00		1,600.00	$ 2,100.00
			Sub-Total	$ 108,624.20				$ 108,624.20
Equipment and Labor								
Hydraulic Excavator	125	hours	$145.00	$ 18,125.00	9,000.00		9,125.00	$ 18,125.00
Track Truck	30	hours	$125.00	$ 3,750.00	1,500.00		2,250.00	$ 3,750.00
Labor	40	hours	$45.00	$ 1,800.00	949.00		851.00	$ 1,800.00
			Sub-Total	$ 23,675.00	$ 11,449.00	$ -	$ 12,226.00	$ 23,675.00
Mobilization								
Mob/demob	1	lump sum	$2,000.00	$ 2,000.00				$ -

BUDGET TEMPLATE SHEET FOR FUTURE FISHERIES PROGRAM APPLICATIONS

			Sub-Total	$ 2,000.00	$ -	$ -	$ 2,000.00	$ 2,000.00
			TOTALS	$ 174,154.20	$ 49,949.00	$ 25,205.00	$ 99,000.20	$ 174,154.20

MATCHING CONTRIBUTIONS (do not include requested funds)

CONTRIBUTOR	IN-KIND SERVICE	IN-KIND CASH	TOTAL	Secured? (Y/N)
Landowner	$ 4,000.00		$ 4,000.00	Yes
Bring Back the Natives	$ -	$ 35,000.20	$ 35,000.20	Yes
WestSlope Chapter of Trout Unlimited	$ -	$ 10,000.00	$ 10,000.00	Yes
Montana Trout Unlimited	$ -	$ 5,000.00	$ 5,000.00	Yes
World Trout Foundation	$ -	$ 4,000.00	$ 4,000.00	Yes
US Forest Service	$ 15,700.00	$ -	$ 15,700.00	Yes
Big Blackfoot Chapter of Trout Unlimited	$ 5,505.00	$ -	$ 5,505.00	Yes
USFWS Partners for Fish & Wildlife Service	$ -	$ 45,000.00	$ 45,000.00	Yes
TOTALS	$ 25,205.00	$ 99,000.20	$ 124,205.20	

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Montana Partners for Fish & Wildlife
POB 66
Ovando, MT 59854

May 18, 2017

Montana Fish, Wildlife & Parks
Future Fisheries Habitat Improvement Panel
PO Box 200701
Helena, MT 59620-0701

RE: Blackfoot River Fish Screen Application

Dear Future Fisheries Panel Members:

This letter is written in support of the Blackfoot River Fish Screen application submitted by the Big Blackfoot Trout Unlimited (BBCTU). This important project aimed at eliminating entrainment of native trout is a collaborative effort between the private landowner, BBCTU, Montana Fish, Wildlife & Parks (MFWP), other local supporters and the USFWS Partners for Fish and Wildlife Program.

The proposed project will complement numerous efforts in the Blackfoot Watershed during the past 30 years which include instream habitat restoration, fish passage projects, road decommissioning, water conservation, intensive fisheries monitoring and fish screening projects. This broad-based community based conservation and restoration effort has resulted in population increases of almost 800% for westslope cutthroat and bull trout in comparison to baseline numbers.

The Partners for Fish and Wildlife has been privileged to work with the project private landowner, Mr. Stew Schwartz, on several projects during the last 10 years ranging from stream restoration, grazing management, fish passage, fish screening and riparian revegetation. The proposed project on the upper Blackfoot River is an important step in eliminating a major threat to native trout in a critical migration corridor and involves a private landowner who has shown himself committed to conservation. 8,000 acres of his ranch is protected in perpetuity under a conservation easement which has specific ties to restoring native trout populations.

I encourage your strong consideration of this proposal to enhance populations of bull and westslope cutthroat trout populations Blackfoot River watershed. Please don't hesitate to contact me if you have questions or need additional information.

Thanks for all your efforts on behalf of native trout.

Sincerely,

Randy Gazda

Randy Gazda, Assistant State Coordinator

FINAL DESIGN
FISH SCREEN AND IRRIGATION DIVERSION IMPROVEMENT PROJECT
BLACKFOOT RIVER
NEAR LINCOLN, MONTANA

PROJECT PARTNERS

BIG BLACKFOOT CHAPTER OF TROUT UNLIMITED
PO Box 1
Ovando, MT 59854

MONTANA FISH WILDLIFE & PARKS
3201 SPURGIN ROAD
MISSOULA, MONTANA 59804

PROJECT VICINITY MAP

PROJECT DESCRIPTION

THE SCHWARTZ DIVERSION IS LOCATED ON A SIDE CHANNEL OF THE BLACKFOOT RIVER APPROXIMATELY 1.6 MILES SOUTHWEST OF LINCOLN, MONTANA. THE BLACKFOOT RIVER NEAR THE PROJECT REACH SUPPORTS POPULATIONS OF WESTSLOPE CUTTHROAT TROUT, BULL TROUT, BROWN TROUT AND RAINBOW TROUT. IT HAS BEEN DESIGNATED CRITICAL BULL TROUT HABITAT AND IS AN IMPORTANT MIGRATORY CORRIDOR FOR NATIVE TROUT. THIS PROJECT INVOLVES WORK ON AN EXISTING IRRIGATION DIVERSION NEAR RIVER-MILE 103.7. THE EXISTING DIVERSION IS UNSCREENED AND LACKS A HEADGATE. THE BLACKFOOT RIVER RECENTLY CAPTURED THE SIDE CHANNEL WHERE THE DIVERSION EXISTS. THE SIDE CHANNEL IS STILL ENLARGING CAUSING ACTIVE BANK EROSION AND RISK TO AN ADJACENT HAY MEADOW. THE DIVERSION IS LOCATED ON PRIVATE LAND AND BBCTU WILL NEED TO COORDINATE WITH THE LANDOWNER FOR ACCESS THROUGHOUT THE DESIGN AND CONSTRUCTION PHASES.

THE PROJECT GOAL IS TO UPGRADE THE EXISTING IRRIGATION INFRASTRUCTURE TO ENSURE THAT IT PROVIDES FOR THE TRADITIONAL IRRIGATION WATER NEEDS OF THE IRRIGATOR WHILE ELIMINATING ENTRAINMENT OF ALL SPECIES AND SIZE CLASSES OF TROUT INHABITING THE RIVER.

SPECIFIC OBJECTIVES OF THIS PROJECT INCLUDE:

1. INSTALL A LOW MAINTENANCE, COST-EFFECTIVE, SELF-CLEANING FISH SCREEN CAPABLE OF OPERATING BETWEEN 2 AND 12 CFS WHILE SCREENING ALL AGE CLASSES OF TROUT;
2. THE SCREEN DESIGN MUST PROVIDE A BYPASS THAT OPERATES AT ALL FLOW CONDITIONS;
3. INSTALL A COST-EFFECTIVE, LOW MAINTENANCE HEADGATE CAPABLE OF PROVIDING HYDRAULIC CONTROL THROUGH A RANGE OF FLOWS FROM 0 TO 12 CFS;
4. EFFECTIVELY SCREEN ALL AGE CLASSES OF SALMONIDS (3/32" SCREEN SIZE OPENING);
5. MINIMIZE SEDIMENT DELIVERY TO THE DITCH;
6. PROVIDE BANK STABILITY IN THE IMMEDIATE PROJECT REACH.

BENCHMARK

SURVEY CONTROL WAS ESTABLISHED UNDER THE RESPONSIBLE CHARGE OF ANDREW BELSKI, PLS 14731.

THE PROJECT COORDINATES ARE BASED ON THE FOLLOWING:

HORIZONTAL PROJECTION:	MT83F
HORIZONTAL DATUM:	NAD83 CORS 2011
UNITS:	US SURVEY FEET
VERTICAL DATUM:	NAVD88 (GEOID 12B)

DRAWING INDEX

RDG RIVER DESIGN GROUP
256 Wisconsin Avenue Whitefish, MT 59937 ph:406-862-2538 fx:406-862-4963
311 SW Jefferson Avenue Corvallis, OR 97333 ph:541-738-8889 fx:541-738-8834

BLACKFOOT - SCHWARTZ DIVERSION

COVER PAGE AND NOTES

NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL	FINAL DESIGN	GD

PROJECT NUMBER
RDG-16-042

SHEET NUMBER
1.0

GENERAL SPECIFICATIONS

1. THE PROJECT SHALL BE CONSTRUCTED ACCORDING TO THE PLAN SET. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER OF ANY CHANGES PRIOR TO IMPLEMENTATION. THE CONSTRUCTION MANAGER FOR THIS PROJECT SHALL BE A DESIGNATED RIVER DESIGN GROUP REPRESENTATIVE.

2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO IDENTIFY ALL UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. CALL U-DIG PRIOR TO CONSTRUCTION.

3. COSTS INCURRED DUE TO PROJECT DELAYS RESULTING FROM FAILURE OF THE CONTRACTOR TO MEET THE REQUIREMENTS OF THE GENERAL SPECIFICATIONS, CONTRACTOR QUALIFICATIONS, CONSTRUCTION SPECIFICATIONS, MATERIALS SPECIFICATIONS AND REVEGETATION SPECIFICATIONS SHALL BE THE EXPENSE OF THE CONTRACTOR.

4. IN-WATER WORK PERIOD SHALL BE COORDINATED WITH MONTANA FISH, WILDLIFE AND PARKS. NO IN-STREAM WORK SHALL BE PERMITTED OUTSIDE OF THE APPROVED WINDOW.

CONTRACTOR QUALIFICATIONS

1. THE CONTRACTOR SHALL HAVE AT LEAST TWO (2) YEARS OF RIVER RESTORATION CONSTRUCTION EXPERIENCE AND SHALL HAVE COMPLETED AT LEAST FIVE (5) RIVER RESTORATION PROJECTS. OR, THE CONTRACTOR SHALL HAVE AT LEAST ONE (1) YEAR OF RIVER RESTORATION EXPERIENCE, SHALL HAVE COMPLETED AT LEAST THREE (3) RIVER RESTORATION PROJECTS, AND SHALL HAVE COMPLETED AN APPROVED RIVER RESTORATION TRAINING CLASS. APPROVED TRAINING CLASSES INCLUDE THOSE SPONSORED BY WILDLAND HYDROLOGY, INC., OR A SIMILARLY QUALIFIED PRACTITIONER OF NATURAL CHANNEL DESIGN STREAM RESTORATION PRINCIPLES.

2. IF THE CONTRACTOR CHOOSES TO DESIGNATE AN EMPLOYEE WITHOUT QUALIFIED STREAM RESTORATION EXPERIENCE, THE CONTRACTOR SHALL BE ON-SITE AT ALL TIMES WHEN THE EMPLOYEE IS PERFORMING RIVER RESTORATION WORK. FAILURE TO ABIDE BY THIS CONDITION WITHOUT PREVIOUS AGREEMENT WITH THE CONSTRUCTION MANAGER WOULD BE GROUNDS FOR TERMINATION.

3. THE CONTRACTOR SHALL MAINTAIN AT LEAST $2,000,000 IN LIABILITY INSURANCE AND HAVE PROOF OF LIABILITY INSURANCE ON-SITE DURING THE ENTIRETY OF PROJECT CONSTRUCTION.

4. THE CONTRACTOR SHALL HAVE PROOF OF WORKER'S COMPENSATION INSURANCE ON-SITE DURING THE ENTIRETY OF PROJECT CONSTRUCTION.

5. COPIES OF ALL PROJECT PERMITS SHALL BE POSTED ON-SITE IN A VISIBLE LOCATION. THE CONTRACTOR SHALL COMPLY WITH THE PROVISIONS OF THE PERMITS. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER OF ANY KNOWN CHANGES OR ACTIVITIES THAT COULD VIOLATE PERMIT REQUIREMENTS PRIOR TO IMPLEMENTATION. THE CONSTRUCTION MANAGER SHALL BE RESPONSIBLE FOR ALL CORRESPONDENCE WITH PERMIT AGENCIES.

TEMPORARY DIVERSION PROCEDURES

1. BBCTU SHALL BE NOTIFIED AT LEAST 72 HOURS PRIOR TO ACTIVATION OR DEACTIVATION OF ALL TEMPORARY BYPASS CHANNELS. THE PHONE NUMBER FOR THE BBCTU OFFICE IS 406-240-4824. BBCTU SHALL DETERMINE IF IT IS NECESSARY TO CONDUCT A FISH RESCUE.

TEMPORARY DIVERSION PROCEDURES

2. TEMPORARY DIVERSIONS SHALL BE ACTIVATED OR DEACTIVATED INCREMENTALLY IN THREE EQUAL STAGES TO ALLOW RESIDENT AQUATIC LIFE TO EXIT THE DEWATERED AREA.

3. A PERIOD OF APPROXIMATELY ONE HOUR SHALL BE ALLOWED BETWEEN THE FIRST TWO STAGES.

4. A PERIOD OF APPROXIMATELY 12 HOURS SHALL BE ALLOWED BEFORE THE FINAL STAGE. MFWP SHALL CONDUCT FISH RESCUES DURING THE 12 HOUR PERIOD.

5. UPON NOTIFICATION FROM TU, THE REMAINING FLOW SHALL BE DIVERTED.

6. EFFORTS SHALL BE MADE TO LIMIT TURBIDITY DURING DIVERSION ACTIVATION AND DEACTIVATION. MATERIAL USED TO DIVERT FLOW DURING STAGED DIVERSIONS SHALL BE CLEAN AND DEVOID OF FINES.

7. EFFORTS SHALL BE MADE TO LIMIT DISTURBANCE TO VEGETATION.

8. EFFORTS SHALL BE MADE TO AVOID FATALITIES OF AQUATIC LIFE.

MATERIALS SPECIFICATIONS

1. THE CONTRACTOR SHALL FURNISH ALL MATERIALS NECESSARY TO CONSTRUCT THE PROJECT. THE CONTRACTOR SHALL DELIVER ALL MATERIALS TO THE DESIGNATED STOCKPILE LOCATIONS LABELED ON THE PLAN SET OR TO A LOCATION SPECIFIED BY THE CONSTRUCTION MANAGER. IF A MATERIAL SOURCE HAS BEEN PRE-DETERMINED, THE CONSTRUCTION MANAGER SHALL PROVIDE DIRECTIONS TO THE CONTRACTOR.

2. MATERIAL QUANTITIES, DIMENSIONS AND SIZES SHALL CONFORM TO THE NOTES AND SPECIFICATIONS PROVIDED ON THE PLAN SET OR ON THE MATERIALS LIST.

3. THE CONSTRUCTION MANAGER SHALL INSPECT AND APPROVE ALL MATERIALS PRIOR TO CONSTRUCTION. IF MATERIALS DO NOT MEET THE MINIMUM REQUIREMENTS SPECIFIED IN THE PLAN SET OR MATERIAL LIST, THE CONSTRUCTION MANAGER SHALL REJECT THE MATERIALS.

EQUIPMENT SPECIFICATIONS

1. THE CONTRACTOR SHALL FURNISH ALL EQUIPMENT NECESSARY TO CONSTRUCT THE PROJECT. THE CONTRACTOR SHALL MOBILIZE ALL EQUIPMENT TO THE PROJECT AREA AS DIRECTED BY THE CONSTRUCTION MANAGER.

2. AT A MINIMUM, THE CONTRACTOR SHALL PROVIDE THE FOLLOWING EQUIPMENT FOR THIS PROJECT:

EXCAVATOR - ONE (1) EXCAVATOR SHALL BE REQUIRED. THE EQUIPMENT SHALL BE MINIMUM 200 CLASS. THE BUCKET VOLUME SHALL BE ONE (1) CUBIC YARD(S). THE BUCKET SHALL BE EQUIPPED WITH A HYDRAULIC THUMB FOR GRASPING LOGS, ROCKS, AND OTHER MATERIALS. THE EQUIPMENT MUST BE CAPABLE OF CROSSING WATER AND WORKING ON OR ADJACENT TO STEEP SLOPES. A CHAIN SHALL BE AVAILABLE FOR ATTACHING CULVERTS, PUMPS AND OTHER EQUIPMENT OR MATERIALS TO THE BUCKET FOR TRANSPORT ON-SITE.

DUMP TRUCK - ONE (1) TRACKED DUMP TRUCK SHALL BE REQUIRED FOR THIS PROJECT. TRUCK(S) SHALL HAVE A MINIMUM BED VOLUME OF EIGHT TO TEN (8-10) CUBIC YARDS. THE TRUCK(S) SHALL BE TRACKED AND CAPABLE OF DRIVING ON NON-ASPHALT SURFACES AND OFF-ROAD SURFACES.

ALL SURFACE VEHICLE - ONE (1) ALL-SURFACE VEHICLE (ASV) SHALL BE REQUIRED. THE EQUIPMENT SHALL BE EQUIPPED WITH SOD TRACKS TO MINIMIZE DISTURBANCE TO FRAGILE AREAS. ONE TREE SPADE SHALL BE PROVIDED AND BE OF SUFFICIENT SIZE TO TRANSPLANT LARGE, MATURE WILLOWS. A HARROW RAKE OR SIMILAR ATTACHMENT SHALL BE AVAILABLE TO RIP COMPACTED SURFACES AND TEMPORARY CONSTRUCTION ACCESS ROADS AT THE TERMINATION OF THE PROJECT.

CHAINSAW - ONE (1) CHAINSAW SHALL BE REQUIRED. THE CHAINSAW MUST BE CAPABLE OF COMPLETELY SAWING LOGS OF THE DIAMETER SPECIFIED IN THE MATERIAL SPECIFICATIONS. ALSO, THE CHAINSAW MUST BE CAPABLE OF SAWING PVC PIPES AS NOTED IN THE MATERIAL SPECIFICATIONS.

3. ALL EQUIPMENT SHALL BE WASHED PRIOR TO MOBILIZATION TO THE SITE TO MINIMIZE THE INTRODUCTION OF FOREIGN MATERIALS AND FLUIDS TO THE PROJECT SITE. ALL EQUIPMENT SHALL BE FREE OF OIL, HYDRAULIC FLUID, AND DIESEL FUEL LEAKS. TO PREVENT INVASION OF NOXIOUS WEEDS OR THE SPREAD OF WHIRLING DISEASE SPORES, ALL EQUIPMENT SHALL BE POWER WASHED OR CLEANED TO REMOVE MUD AND SOIL PRIOR TO MOBILIZATION INTO THE PROJECT AREA. IT WILL BE THE CONTRACTOR'S RESPONSIBILITY TO INSURE THAT ADEQUATE MEASURES HAVE BEEN TAKEN.

4. EQUIPMENT SHALL BE IN A WELL-MAINTAINED CONDITION TO MINIMIZE THE LIKELIHOOD OF A FLUID LEAK. IF A FLUID LEAK DOES OCCUR, THE CONSTRUCTION MANAGER SHALL BE NOTIFIED IMMEDIATELY, AND ALL WORK CEASED UNTIL THE LEAK HAS BEEN RECTIFIED. AT ALL TIMES DURING THE CONSTRUCTION PHASE, FLUID SPILL CONTAINMENT EQUIPMENT SHALL BE PRESENT ON-SITE AND READY FOR DEPLOYMENT SHOULD AN ACCIDENTAL SPILL OCCUR.

5. THE CONTRACTOR SHALL MAINTAIN A COMPLETE TOOL SET WITH COMMONLY REPLACED PARTS (E.G. O-RINGS) TO MINIMIZE DOWNTIME IN THE EVENT OF EQUIPMENT MALFUNCTION. THE CONTRACTOR SHALL HAVE AN EMERGENCY SPILL KIT ON SITE DURING THE PROJECT.

CONSTRUCTION SPECIFICATIONS

CHANNEL AND STABILIZATION STRUCTURES

1. CONSTRUCTION SHALL OCCUR IN ACCORDANCE WITH THE PLAN SET, CONSTRUCTION SPECIFICATIONS, EQUIPMENT SPECIFICATIONS, MATERIAL SPECIFICATIONS, REVEGETATION SPECIFICATIONS AND GENERAL SPECIFICATIONS.

2. CONSTRUCTION ACCESS SHALL BE DETERMINED BY THE CONSTRUCTION MANAGER. CONSTRUCTION EQUIPMENT SHALL NOT CROSS PRIVATE LAND UNLESS PERMISSION IS OBTAINED FROM THE LANDOWNER. THE CONTRACTOR SHALL LEAVE ALL GATES, WHETHER OPEN OR CLOSED, AS FOUND.

3. STRAW BALES AND SILT FENCING SHALL BE AVAILABLE AND INSTALLED BY THE CONTRACTOR IF DEEMED NECESSARY BY THE CONSTRUCTION MANAGER. CONSTRUCTION FENCING (LIMITS OF DISTURBANCE) SHALL BE INSTALLED BY THE CONTRACTOR IF DEEMED NECESSARY BY THE CONSTRUCTION MANAGER.

4. INITIALLY, THE CONTRACTOR SHALL EXCAVATE THE CHANNEL TO APPROXIMATE DESIGN DIMENSIONS USING THE EXCAVATOR. EXCAVATION SHALL COMPLY WITH CONSTRUCTION STAKES AND THE PLAN SET. EXCAVATION SHALL ESTABLISH CHANNEL ELEVATIONS WITHIN ONE-HALF FOOT OF FINAL ELEVATIONS. THE CONSTRUCTION MANAGER SHALL INSPECT THE CHANNEL EXCAVATION FOR COMPLIANCE WITH THE PLAN SET. ALL EXCAVATED MATERIALS SHALL BE STOCKPILED ON-SITE, ABOVE THE BANKFULL CHANNEL UNTIL HAULED OFF-SITE OR USED ON-SITE. DISTURBANCE TO RIPARIAN VEGETATION, CHANNEL BANKS AND SOD SHALL BE MINIMIZED. EXCAVATED SOD AND RIPARIAN SHRUB TRANSPLANTS SHALL BE CAREFULLY STOCKPILED AND REUSED FOR PLANTING FLOODPLAINS OR STREAM BANKS.

5. AFTER EXCAVATING THE CHANNEL, THE CONTRACTOR SHALL INSTALL BANK STABILIZATION AND HABITAT STRUCTURES USING THE EXCAVATOR. EACH STRUCTURE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LOCATIONS AND SPECIFICATIONS PROVIDED IN THE PLAN SET. THE CONSTRUCTION MANAGER SHALL INSPECT AND APPROVE ALL STRUCTURES PRIOR TO BACKFILLING.

6. AFTER ALL STRUCTURES ARE INSTALLED, THE CHANNEL WILL BE SHAPED TO WITHIN 0.2 FEET OF THE FINAL ELEVATIONS SPECIFIED ON THE PLAN SET USING AN EXCAVATOR. THE CONSTRUCTION MANAGER SHALL CHECK THE FINAL ELEVATIONS FOR COMPLIANCE WITH THE PLAN SET. ALL EXCAVATED MATERIALS SHALL BE STOCKPILED ON-SITE, ABOVE THE BANKFULL CHANNEL UNTIL HAULED OFF-SITE OR USED ON-SITE. DISTURBANCE TO RIPARIAN VEGETATION, CHANNEL BANKS AND SOD SHALL BE MINIMIZED.

7. THE CONTRACTOR SHALL REMOVE EXCESS MATERIALS, TEMPORARY CULVERTS AND EQUIPMENT FROM THE SITE. THE CONTRACTOR SHALL REGRADE DISTURBED AREAS AND CONSTRUCTION ACCESS ROADS TO THEIR ORIGINAL GRADES. THE CONTRACTOR SHALL TREAT COMPACTED SOIL AREAS INCLUDING ACCESS ROADS AND MATERIAL STOCKPILE AREAS. THE CONTRACTOR SHALL REMOVE SOIL FROM THE PROJECT SITE IF THE SOIL IS TAINTED WITH PETROLEUM-BASED FLUIDS.

DIVERSION STRUCTUES

1. DIVERSION STRUCTURES SHALL BE CONSTRUCTED ACCORDING TO THE PLANSET. THE SPECIFIC SEQUENCE WILL BE DEVELOPED BETWEEN THE CONTRACTOR, TU REPRESENTATIVE AND RDG CONSTRUCTION MANAGER. THE HEADGATE, SLUICEGATE, FISH RETURN PIPE, DITCH SHAPING, THE PRE-EXCAVATION FOR THE FISH SCREEN AND CONNECTING STRUCTURES WILL BE COMPLETED WITH THE OVERSIGHT OF RDG CONSTRUCTION MANAGER. THE ACTUAL SETTING OF THE FISH SCREEN WILL BE COMPLETED WITH THE OVERSIGHT OF THE FARMERS SCREEN REPRESENTATIVE. AFTER THE FISH SCREEN IS INSTALLED AND FUNCTIONAL, THE FINISH WORK WILL THEN BE COMPLETED WITH THE OVERSIGHT OF THE RDG CONSTRUCTION MANAGER.

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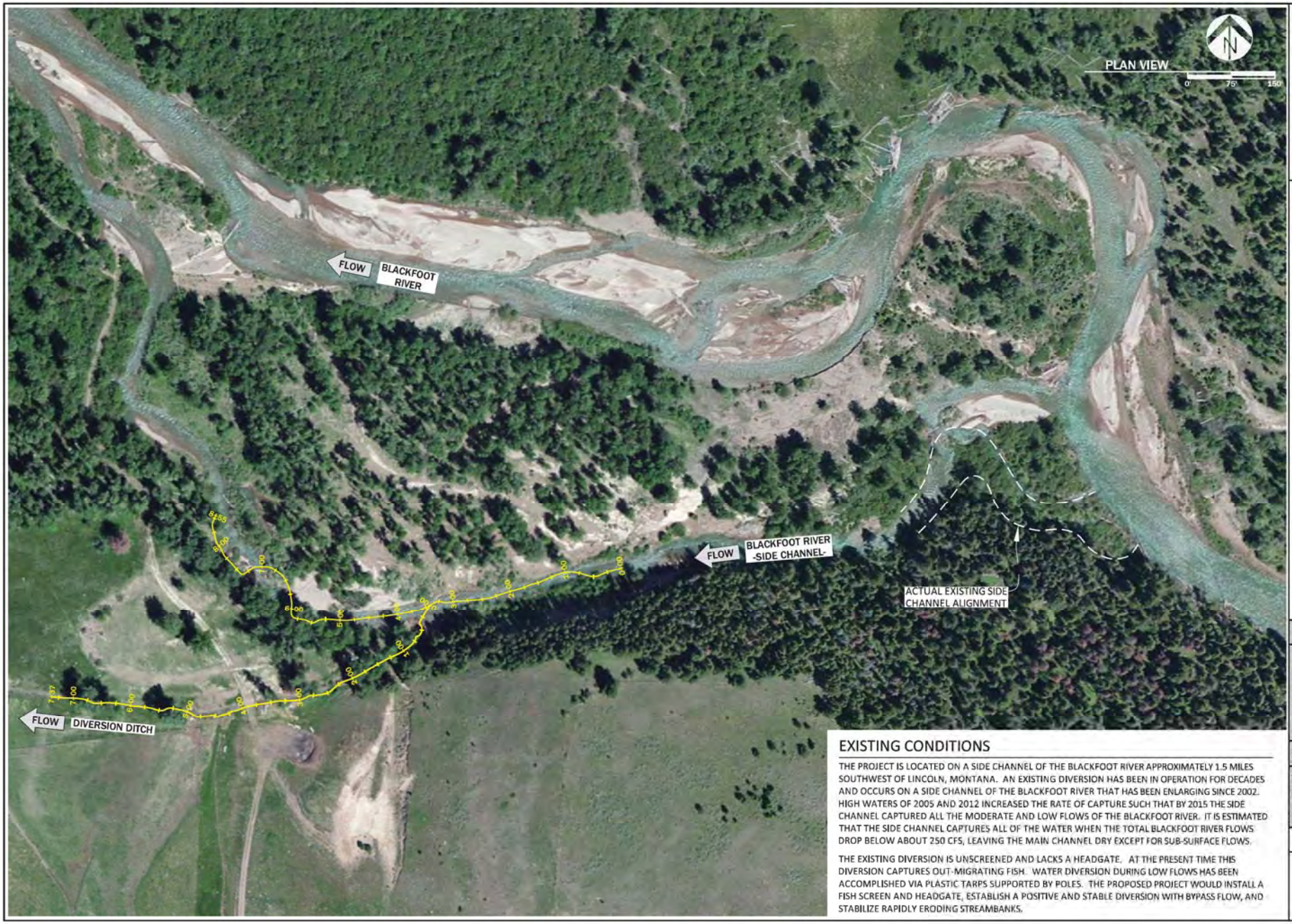
BLACKFOOT - SCHWARTZ DIVERSION

SPECIFICATIONS SHEET

NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL	FINAL DESIGN	GD

PROJECT NUMBER
RDG-16-042

SHEET NUMBER
2.0



EXISTING CONDITIONS

THE PROJECT IS LOCATED ON A SIDE CHANNEL OF THE BLACKFOOT RIVER APPROXIMATELY 1.5 MILES SOUTHWEST OF LINCOLN, MONTANA. AN EXISTING DIVERSION HAS BEEN IN OPERATION FOR DECADES AND OCCURS ON A SIDE CHANNEL OF THE BLACKFOOT RIVER THAT HAS BEEN ENLARGING SINCE 2002. HIGH WATERS OF 2005 AND 2012 INCREASED THE RATE OF CAPTURE SUCH THAT BY 2015 THE SIDE CHANNEL CAPTURED ALL THE MODERATE AND LOW FLOWS OF THE BLACKFOOT RIVER. IT IS ESTIMATED THAT THE SIDE CHANNEL CAPTURES ALL OF THE WATER WHEN THE TOTAL BLACKFOOT RIVER FLOWS DROP BELOW ABOUT 250 CFS, LEAVING THE MAIN CHANNEL DRY EXCEPT FOR SUB-SURFACE FLOWS.

THE EXISTING DIVERSION IS UNSCREENED AND LACKS A HEADGATE. AT THE PRESENT TIME THIS DIVERSION CAPTURES OUT-MIGRATING FISH. WATER DIVERSION DURING LOW FLOWS HAS BEEN ACCOMPLISHED VIA PLASTIC TARPS SUPPORTED BY POLES. THE PROPOSED PROJECT WOULD INSTALL A FISH SCREEN AND HEADGATE, ESTABLISH A POSITIVE AND STABLE DIVERSION WITH BYPASS FLOW, AND STABILIZE RAPIDLY ERODING STREAMBANKS.

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BLACKFOOT - SCHWARTZ DIVERSION

EXISTING CONDITIONS - OVERVIEW

NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL	FINAL DESIGN	GD

PROJECT NUMBER RDG-16-042

SHEET NUMBER 3.0

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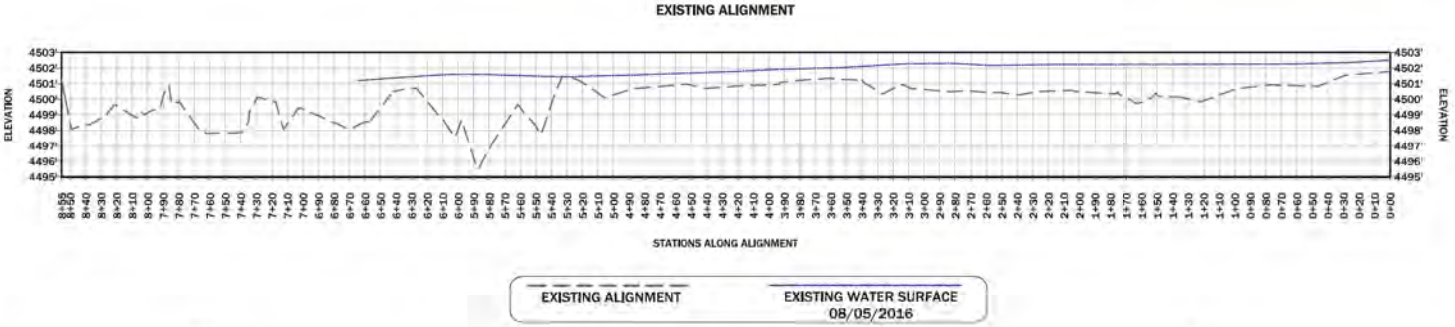
BLACKFOOT - SCHWARTZ DIVERSION

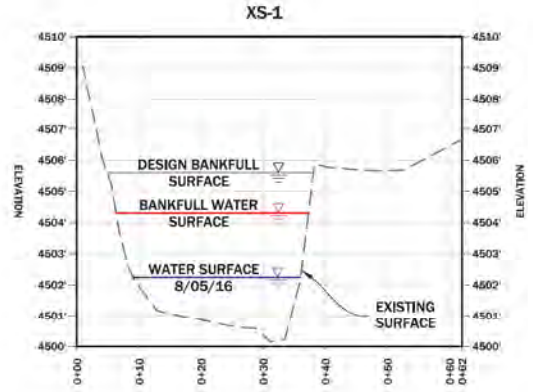
EXISTING CONDITIONS

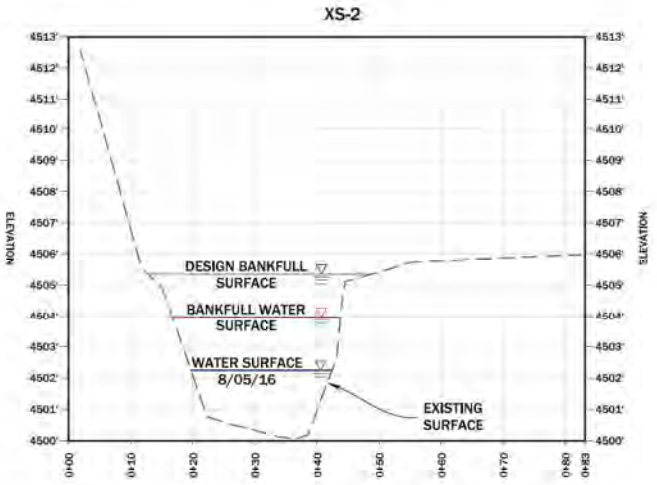
NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL	FINAL DESIGN	GD

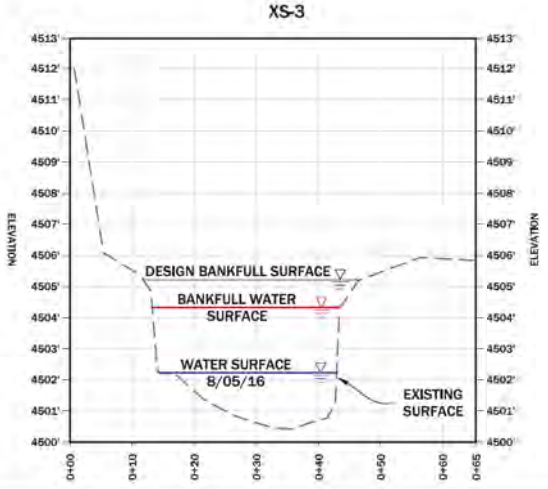
PROJECT NUMBER
RDG-16-042

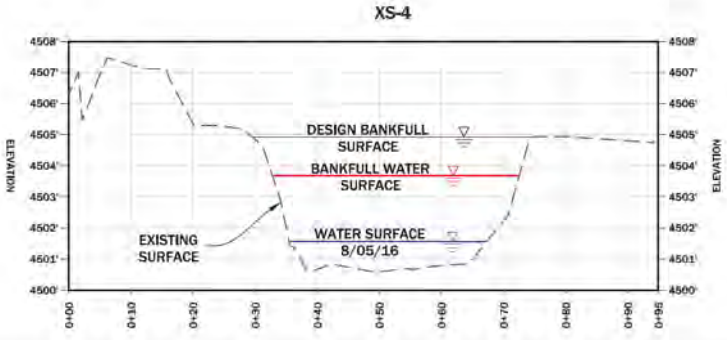
SHEET NUMBER
3.1











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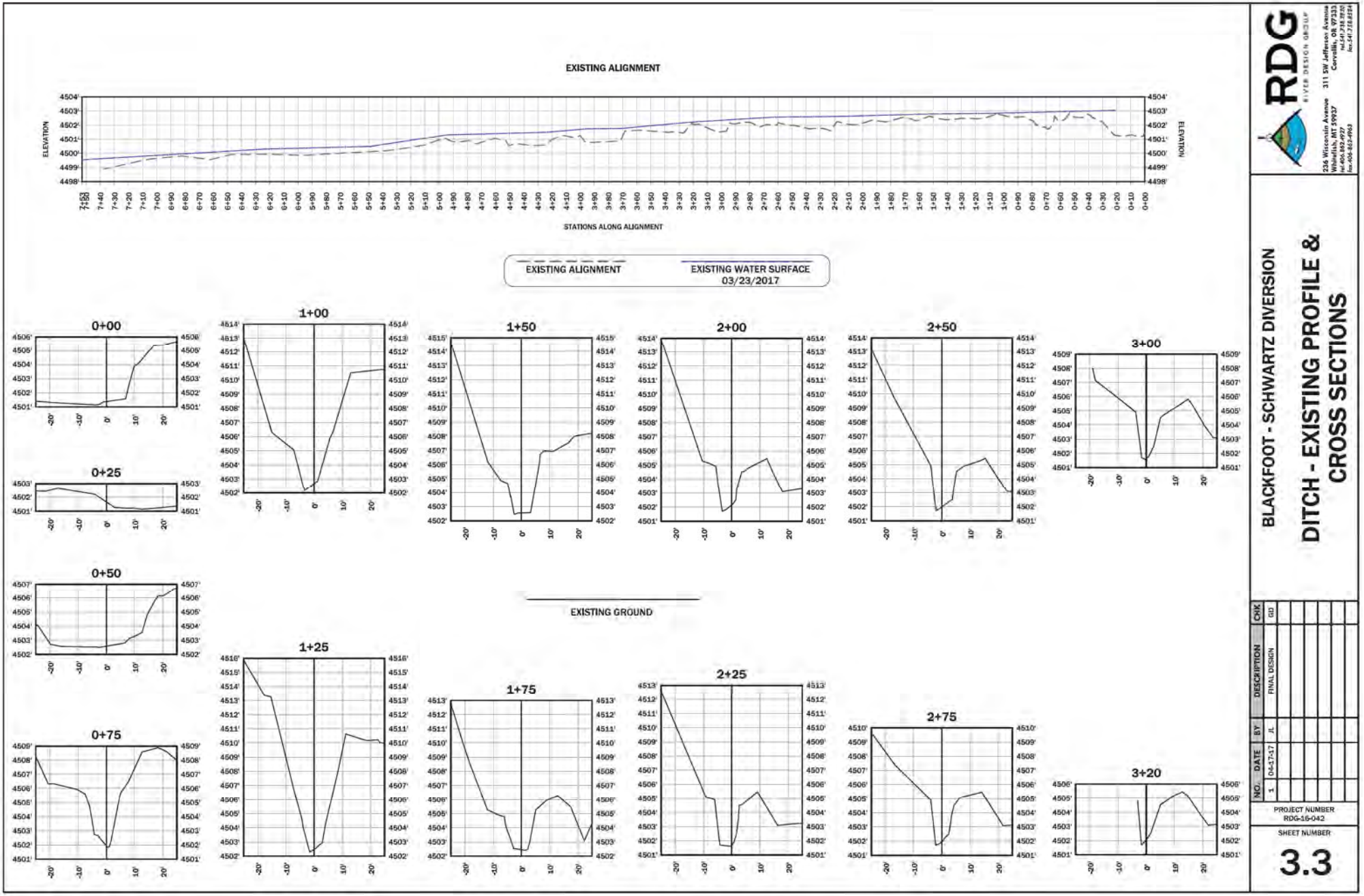
BLACKFOOT - SCHWARTZ DIVERSION

EXISTING PROFILE & CROSS SECTIONS

NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL	FINAL DESIGN	GD

PROJECT NUMBER
RDG-16-042

SHEET NUMBER
3.2



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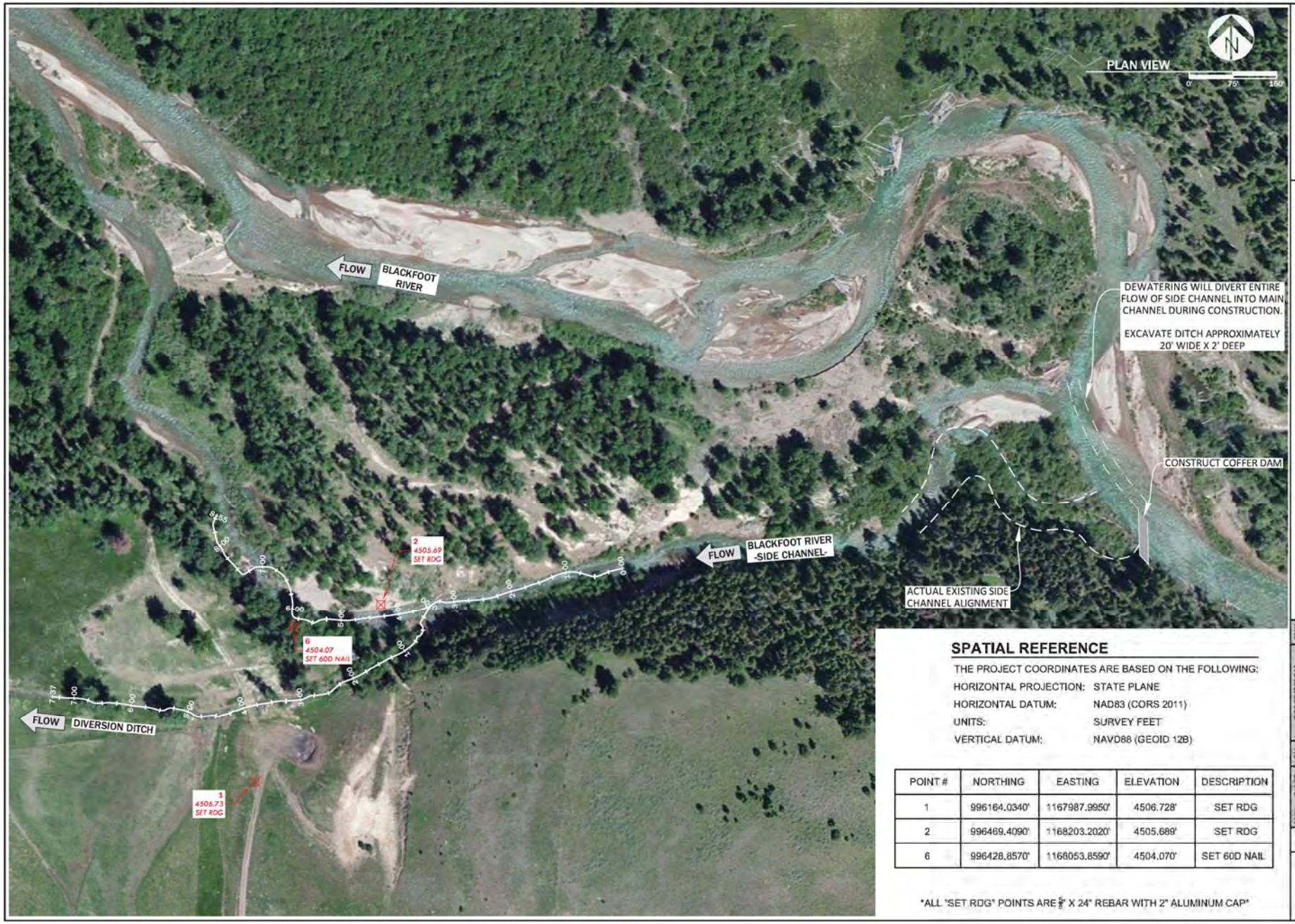
BLACKFOOT - SCHWARTZ DIVERSION

DITCH - EXISTING PROFILE & CROSS SECTIONS

NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL	FINAL DESIGN	GD

PROJECT NUMBER
RDG-16-042

SHEET NUMBER
3.3



SPATIAL REFERENCE

THE PROJECT COORDINATES ARE BASED ON THE FOLLOWING:

HORIZONTAL PROJECTION: STATE PLANE
HORIZONTAL DATUM: NAD83 (CORS 2011)
UNITS: SURVEY FEET
VERTICAL DATUM: NAVD88 (GEOID 12B)

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	996164.0340'	1167987.9950'	4506.728'	SET RDG
2	996469.4090'	1168203.2020'	4505.689'	SET RDG
6	996428.8570'	1168053.8590'	4504.070'	SET 60D NAIL

ALL "SET RDG" POINTS ARE $\frac{5}{8}$" X 24" REBAR WITH 2" ALUMINUM CAP

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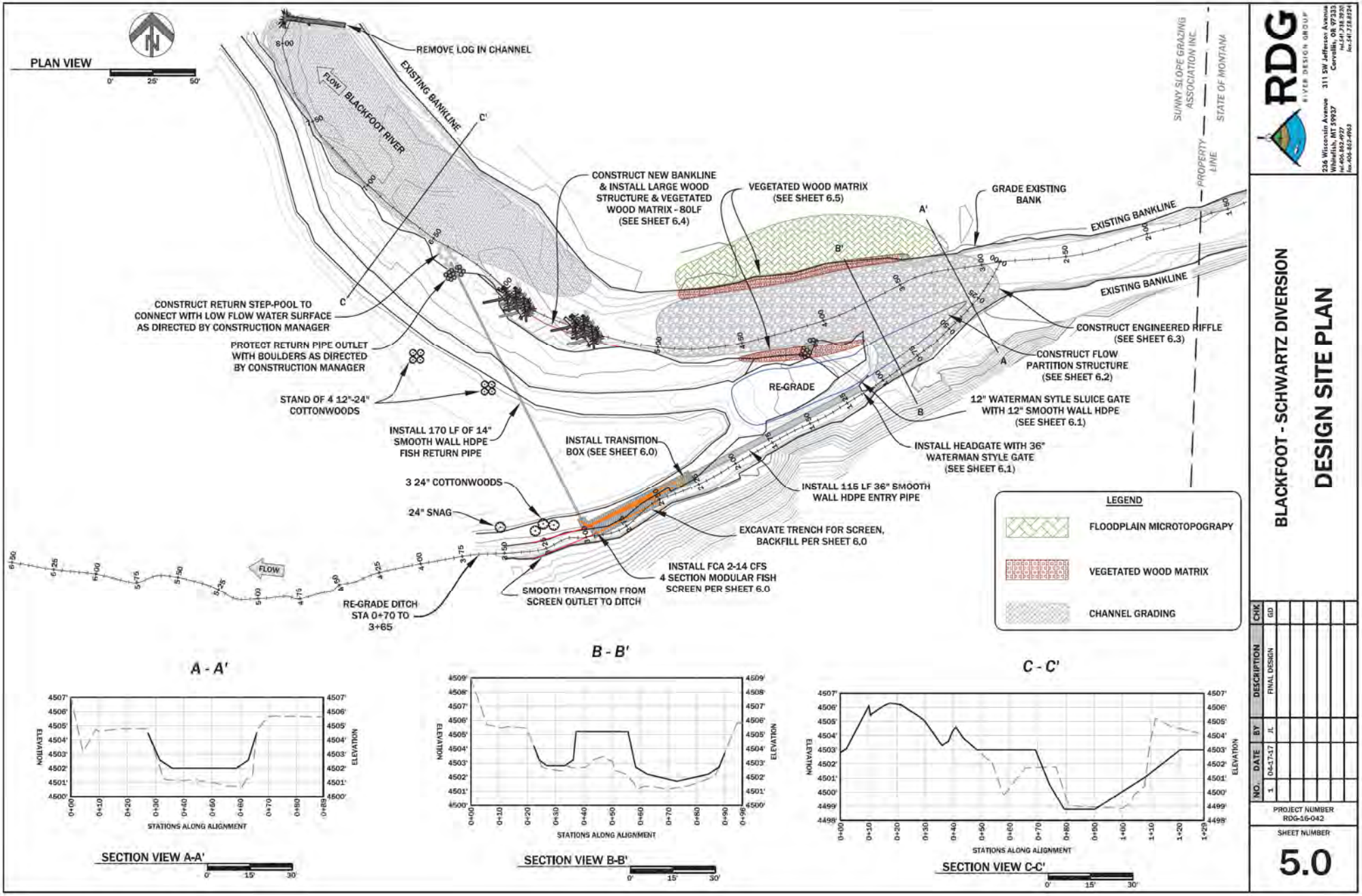
BLACKFOOT - SCHWARTZ DIVERSION

SURVEY CONTROL AND DEWATERING PLAN

NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL	FINAL DESIGN	GD

PROJECT NUMBER
RDG-16-042

SHEET NUMBER
4.0



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BLACKFOOT - SCHWARTZ DIVERSION

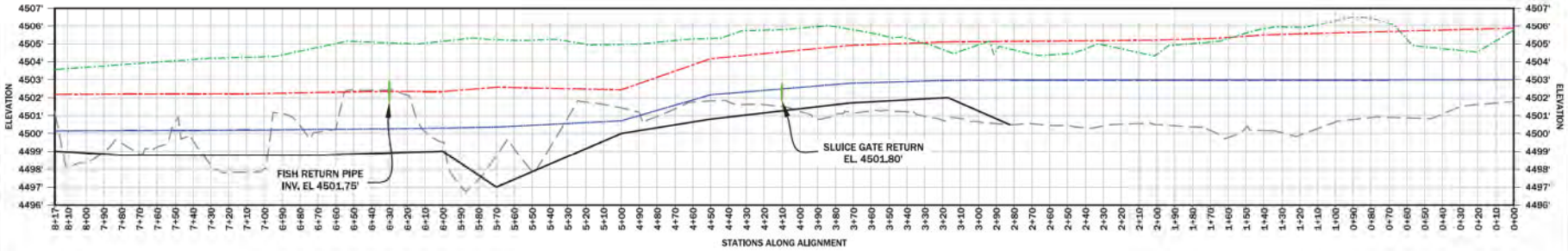
DESIGN SITE PLAN

NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL	FINAL DESIGN	GD

PROJECT NUMBER RDG-16-042

SHEET NUMBER 5.0

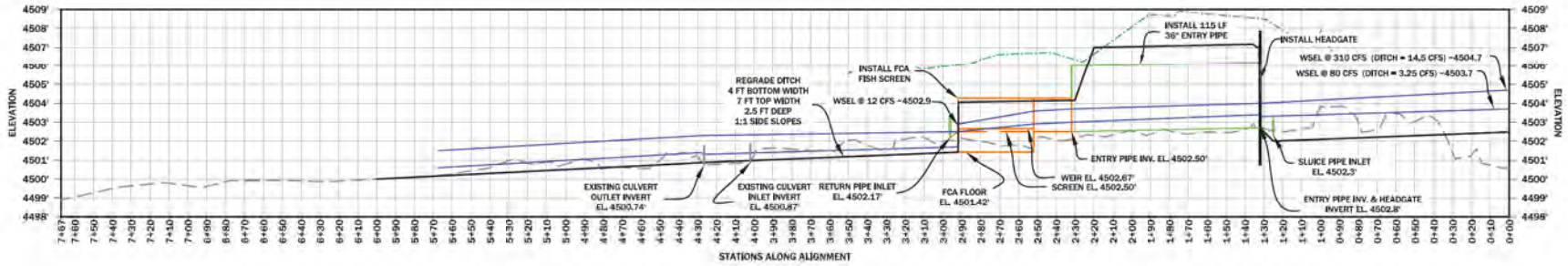
BLACKFOOT - LONGITUDINAL PROFILE



LEGEND

EXISTING GROUND | PROPOSED GROUND | TOP OF BANK (RIVER RIGHT) | DESIGN BANKFULL | DESIGN LOW FLOW (33 CFS)

DIVERSION DITCH - LONGITUDINAL PROFILE



LEGEND

EXISTING GROUND | TOP OF BANK (DITCH RIGHT) | PROPOSED GROUND | PROPOSED WATER SURFACE @ 12 CFS

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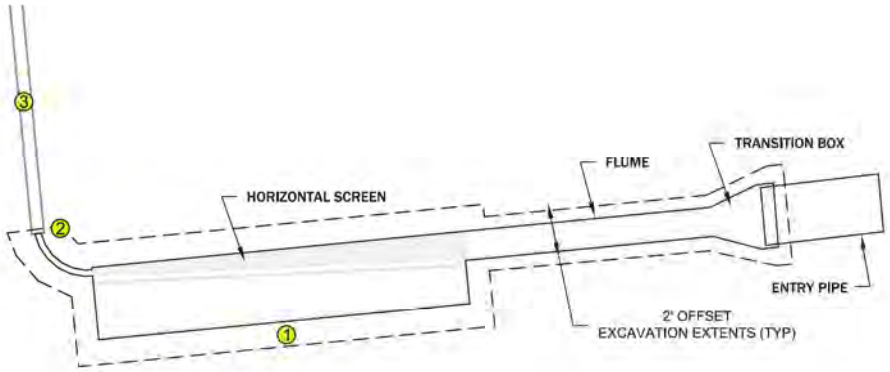
BLACKFOOT - SCHWARTZ DIVERSION

PROFILE VIEWS

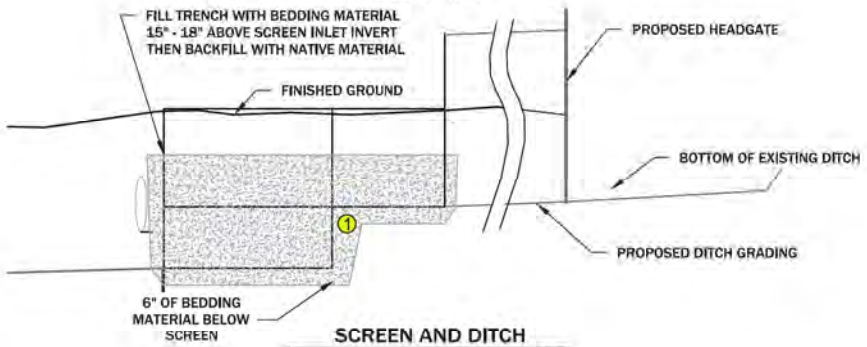
NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL/CN	FINAL DESIGN	GD

PROJECT NUMBER
RDG-16-042

SHEET NUMBER
5.1



EXCAVATION LIMITS
PLAN VIEW NTS



SCREEN AND DITCH
PROFILE VIEW NTS

DESIGN INTENT

PURPOSE: THE SCREEN EXCAVATION AND GRAVEL BASE PROVIDE A UNIFORM LEVEL SURFACE FOR FINAL PLACEMENT OF THE FARMERS SCREEN. THE FARMERS SCREEN SECTIONS WILL BE ASSEMBLED ON SITE AND CONNECTED TO THE BYPASS RETURN PIPE DURING ASSEMBLY. THE ENTRY PIPE WILL BE ATTACHED TO THE FLUME BY MEANS OF A CUSTOM TRANSITION BOX. THE ENTRY PIPE, TRANSITION BOX, BYPASS PIPE AND PIPE FLANGE WILL NEED TO BE PROCURED BY THE CONTRACTOR. THE FARMERS SCREEN EXIT FLUME WILL HAVE A STANDARD FLANGE CONNECTION PLATE AS SPECIFIED IN THE FLANGE CONNECTION PLATE DETAIL.

PLACEMENT CRITERIA: THE FARMERS SCREEN LOCATION HAS BEEN SELECTED BASED ON PROXIMITY TO THE HEADGATE AND HYDRAULIC FLOW CRITERIA. SITE EXCAVATION SHOULD EXTEND APPROXIMATELY 2 FEET BEYOND THE SCREEN DIMENSIONS AS SHOWN IN EXCAVATION LIMIT DRAWING.

SUPPLEMENTAL INFORMATION: A PLATE COMPACTOR AND A LASER LEVEL ARE REQUIRED FOR FARMERS SCREEN ASSEMBLY AND PLACEMENT. BOTTOM OF ENTRY PIPE WILL NEED TO BE CUT FLAT AS SHOWN IN TRANSITION BOX ISOMETRIC VIEW TO FIT INTO TRANSITION BOX.

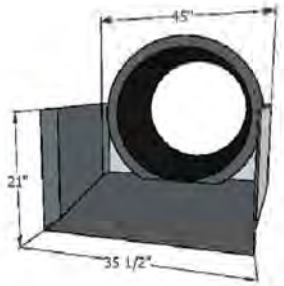
CONSTRUCTION NOTES

1. EXCAVATE DIVERSION DITCH TO THE PRESCRIBED ELEVATIONS.
2. FILL AND COMPACT 3/4" MINUS TO FINISH GRADE.
3. PLACE AND ASSEMBLE FARMERS SCREEN.
4. BACKFILL AROUND SCREEN
5. EXCAVATE ENTRY PIPE AND BYPASS PIPE TRENCHES.
6. PLACE TRANSITION BOX, ENTRY PIPE, BYPASS PIPE AND CONNECT TO FARMERS SCREEN.
7. GRADE DITCH DOWNSTREAM OF FARMERS SCREEN TO MATCH THE PROPOSED DITCH SLOPE.

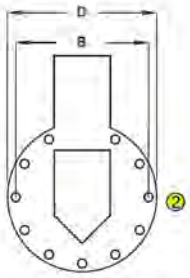
CONTRACTOR SUPPLIED CONSTRUCTION MATERIALS

	ITEM	MATERIAL	QUANTITY
1	SCREEN BEDDING GRAVEL	3/4" MINUS	70 CUBIC YARDS
2	BYPASS PIPE FLANGE	SEE SPEC. BELOW	1
3	BYPASS RETURN PIPE	14" DIAMETER	170 LINEAR FEET

NOTE: FURNISH SCREEN ZONE BACKFILL MATERIAL THAT IS REASONABLY FREE OF CLAY, SILT, AND OTHER DELETERIOUS MATERIAL IN ACCORDANCE AGGREGATE NO. 4 IN TABLE 701-4 OF THE MONTANA STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION 2014 EDITION.



TRANSITION BOX
ISOMETRIC VIEW NTS



FLANGE CONNECTION PLATE DETAIL
PLAN VIEW NTS

BYPASS PIPE FLANGE

CLASS 150 FLANGE SPECIFICATIONS					
NOMINAL PIPE SIZE	DIAMETER OF FLANGE, D	NUMBER OF BOLTS	DIAMETER OF BOLTS	DIAMETER OF BOLT HOLES	DIAMETER OF BOLT CIRCLE, B
14 INCHES	21 INCHES	12	1 INCH	1.12 INCHES	18-3/4

NOTE: THE BYPASS PIPE FLANGE WILL REQUIRE NUT, BOLT, AND WASHER COMBINATIONS TO SECURE THE PIPE TO THE FLANGE CONNECTION PLATE.

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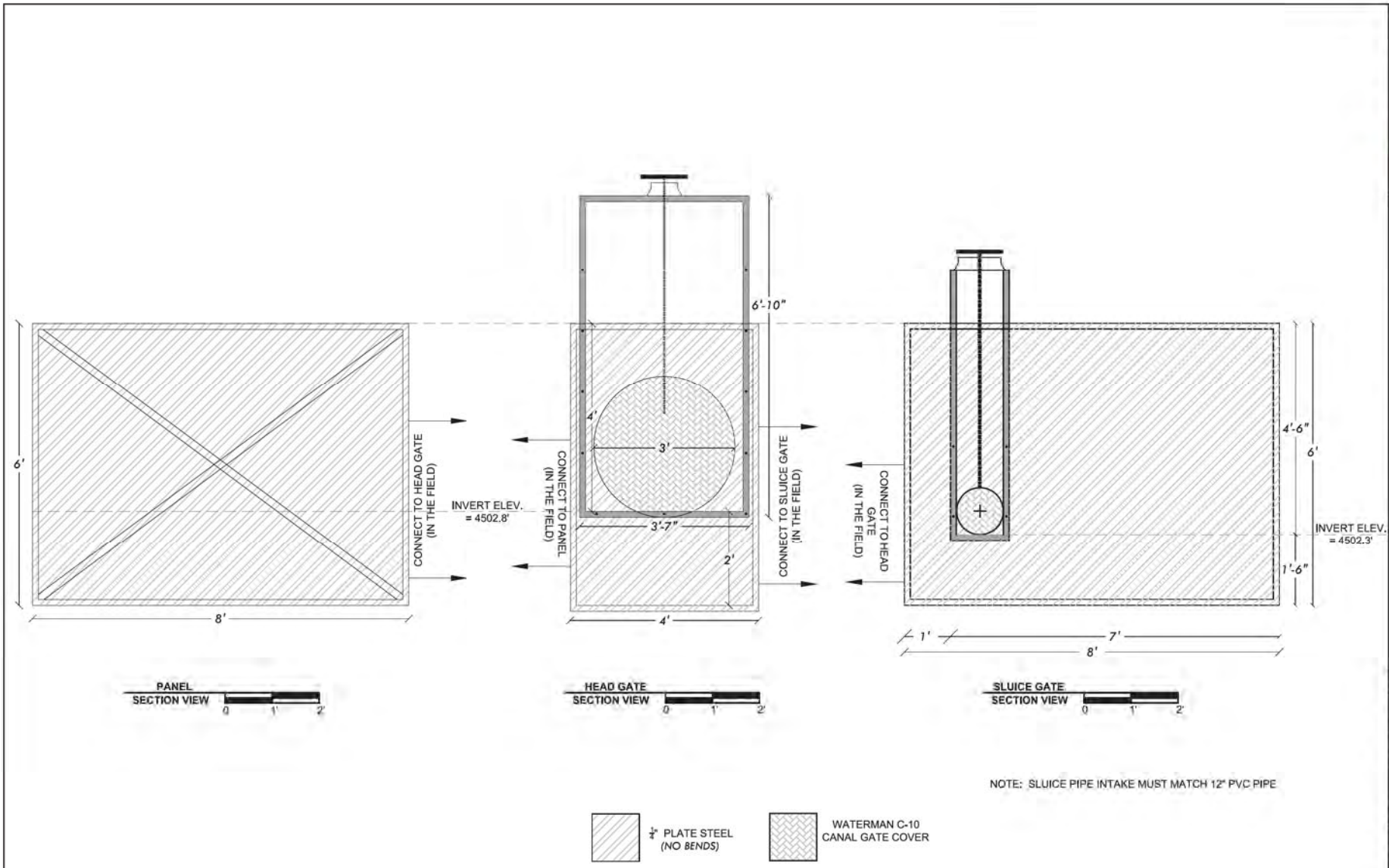
BLACKFOOT - SCHWARTZ DIVERSION

FISH SCREEN DETAILS

NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	CN	FINAL DESIGN	GD

PROJECT NUMBER
RDG-16-042

SHEET NUMBER
6.0



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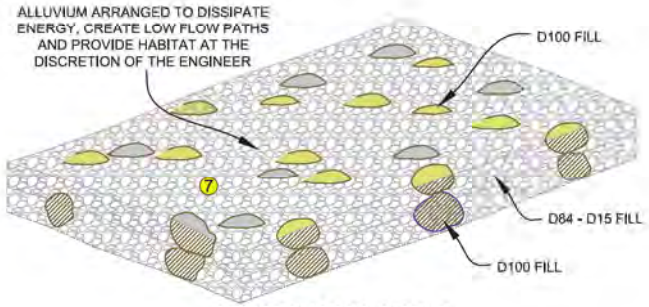
BLACKFOOT - SCHWARTZ DIVERSION

HEAD GATE AND SLUICE GATE DETAIL

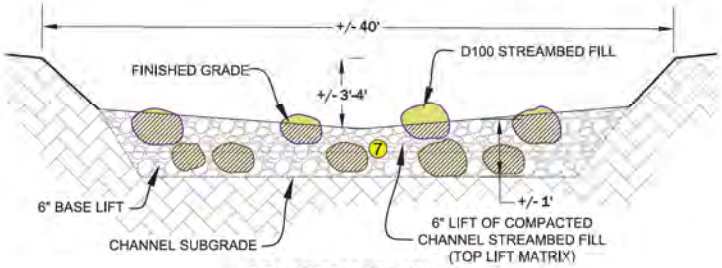
NO.	DATE	BY	DESCRIPTION	CHK.
1	04-17-17	JL	FINAL DESIGN	GD

PROJECT NUMBER
RDG-16-042

SHEET NUMBER
6.1



CONSTRUCTED RIFFLE
3-D VIEW NTS



CONSTRUCTED RIFFLE
SECTION VIEW NTS


CHANNEL SUBGRADE


TOP LIFT MATRIX


BASE LIFT MATRIX


TOP LIFT MATRIX WITH FRAMEWORK

DESIGN INTENT

THE INTENT OF THE ENGINEERED RIFFLE IS TO PROVIDE A STABLE CONSTRUCTED SURFACE COMPRISED OF NATIVE AND IMPORTED (WHEN NECESSARY) SUBSTRATE. THE ENGINEERED FILL IS USED TO INCREASE THE RIVER CHANNEL BED ELEVATION AND IS TYPICALLY CONSTRUCTED TO FORM RIFFLE, RUN, AND GLIDE HABITAT UNITS. THE FILL COMPOSITION INCLUDES FOUR PRIMARY SUBSTRATE CLASSIFICATIONS INCLUDING GRAVELS, COBBLES, BOULDERS, AND FINES. GRAVELS AND COBBLES FORM THE ENGINEERED FILL MATRIX. BOULDERS PROVIDE SCOUR RESISTANCE, INFLUENCE LOW FLOW STREAM FLOW PATTERNS AND HYDRAULICS, AND CREATE HABITAT. FINES ARE WASHED INTO THE MATRIX MATERIAL TO SEAL THE STREAMBED TO REDUCE PERCOLATION LOSSES AND BED MATERIAL MOVEMENT. BOULDERS PROTRUDE FROM THE ENGINEERED FILL SURFACE TO PROMOTE DIVERSE FLOW PATHS, PROVIDE ENERGY DISSIPATION AND CREATE AQUATIC HABITAT.

CONSTRUCTION NOTES

CONTRACTOR TO STOCKPILE STREAMBED FILL MATERIAL PER DESIGN SPECIFICATIONS. MATERIALS ARE TO BE STOCKPILED IN THE IMMEDIATE PROJECT AREA.

TREAT EXISTING CHANNEL BY REMOVING ORGANICS AND CREATING A PRISMATIC WORKING SURFACE. ALLUVIUM SHALL BE SALVAGED AND STOCKPILED.

CONTRACTOR SHALL PLACE STREAMBED FILL IN TWO SIX-INCH LIFTS. STREAMBED ALLUVIUM SHALL BE PLACED IN RIFFLE, RUN AND GLIDE CHANNEL UNITS AND SHALL BE BUCKET COMPACTED. STREAMBED ALLUVIUM SHALL BE PLACED TO FINISH GRADE ELEVATIONS AS SHOWN ON THE DRAWINGS. AT THE DISCRETION OF THE CONSTRUCTION MANAGER, ADDITIONAL FINES OR D100 SIZE MATERIAL SHALL BE INCORPORATED IN THE STREAMBED.

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIAMETER (IN)	QUANTITY
1	CATEGORY 2 ROCK	10 - 14	2 EA
2	STREAMBED FILL GRADATION	SEE GRADATION	1.5 CY

STREAMBED FILL GRADATION

REPRESENTATIVE SIZE CLASS	PERCENT PASSING	SIZE (INCHES)
D100	80 - 90	12
D84	60 - 70	10
D65	45 - 55	8
D50	30 - 40	5
D35	10 - 15	2
D15	5 - 15	0.08
<D15	0	0.001

NOTE: PRIOR TO INSTALLATION ALL ALLUVIUM SHALL BE SALVAGED FROM EXISTING CHANNEL.


TYPICAL CONSTRUCTED RIFFLE


TYPICAL CONSTRUCTED RIFFLE

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BLACKFOOT - SCHWARTZ DIVERSION

CONSTRUCTED RIFFLE STRUCTURE

NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL	FINAL DESIGN	GD

PROJECT NUMBER
RDG-16-042

SHEET NUMBER
6.2

DESIGN INTENT

PURPOSE: THE PURPOSE OF THE LARGE WOOD MATRIX STRUCTURE IS TO CREATE HYDRAULIC CONDITIONS THAT MAINTAIN A DEEP POOL AND STABILIZE ERODING BANKS.

PLACEMENT CRITERIA: THIS STRUCTURE IS DESIGNED TO FUNCTION ON A HIGH STRESS BANK WITH CONCAVE PLANFORM GEOMETRY. THE STRUCTURE IS TYPICALLY PLACED ON THE OUTER BANK OF A MEANDER BEND.

AQUATIC HABITAT OBJECTIVES ADDRESSED: THIS STRUCTURE CREATES COMPLEX HYDRAULICS SUCH AS EDDIES AND SECONDARY FLOW CIRCULATION. LARGE WOOD PROVIDES IN-STREAM COVER AND SHADE FOR TEMPERATURE REDUCTION. DEEP POOLS IMPROVE HYPORHEIC FLOW FOR TEMPERATURE MANAGEMENT. RESIDUAL POOLS PROVIDE LOW-VELOCITY HOLDING HABITAT AND OVER-WINTERING HABITAT.

VEGETATION OBJECTIVES ADDRESSED: CREATES STABLE CONDITIONS TO SUPPORT DEVELOPMENT OF DESIRED VEGETATION COMMUNITY TYPES.

GEOMORPHIC OBJECTIVES ADDRESSED: THIS STRUCTURE SUPPORTS POOL DEVELOPMENT PROCESSES. POOLS PROVIDE PLANFORM VARIABILITY AND FOSTER POINT BAR DEVELOPMENT. THE STRUCTURE IS COMPOSED OF NATIVE MATERIALS AND STABILIZES ERODING BANKS.

SUPPLEMENTAL INFORMATION: THE LARGE WOOD MATRIX STRUCTURE PROVIDES TEMPORARY BANK PROTECTION BY RE-DIRECTING FLOW AWAY FROM THE BANK AND DISSIPATING FLOW ENERGY INTO THE RIVERBED. THE STRUCTURE CREATES COMPLEX HYDRAULICS AND TURBULENCE, WHICH REQUIRE ATTENTION TO HOW THE STRUCTURE IS TIED IN TO EXISTING FEATURES OR OTHER BANK STRUCTURES. MAINTAINING ADEQUATE BACKFILL BALLAST IS CRITICAL TO COUNTERACT BUOYANCY AND SLIDING/ROTATION OF WOOD. STRUCTURE PERFORMANCE IS DEPENDENT ON STRUCTURE SIZE AND USE OF ADEQUATELY-SIZED WOOD WITH INTACT ROOTWADS. EXCAVATION OF THE POOL IN CONJUNCTION WITH THE STRUCTURE IS RECOMMENDED. THE STRUCTURE WILL TEND TO RECRUIT ADDITIONAL WOODY DEBRIS. INTEGRATING MATURE SHRUB TRANSPLANTS OR PLANTINGS ON THE FLOODPLAIN SURFACE BEHIND THIS STRUCTURE CREATES ROOTING STRUCTURE FOR LONG TERM BANK STABILITY. OVER TIME, THE STRUCTURE WILL DECOMPOSE OR BECOME ABANDONED/ BURIED IN THE FLOODPLAIN AS THE CHANNEL MIGRATES LATERALLY.

CONSTRUCTION NOTES

EXCAVATE STREAMBANK TO SUBGRADE ELEVATIONS.

PLACE CATEGORY 2 WOOD (FOOTER LOGS) IN THE STREAMBANK POINTING DOWNSTREAM PER THE ORIENTATION SHOWN ON THE DRAWINGS.

PLACE CATEGORY 1 WOOD (ROOTWAD LOGS) ON TOP OF FOOTER LOGS WITH ROOTWADS POINTING UPSTREAM. PLACEMENT SHALL BEGIN AT THE UPSTREAM END AND THE UPSTREAM ROOTWAD SHALL BE FLUSH WITH THE TOP OF BANK LINE. SUBSEQUENT ROOTWADS SHALL BE PLACED IN A DOWNSTREAM DIRECTION WITH GRADUALLY INCREASING PROJECTION INTO THE CHANNEL AS SHOWN ON THE DRAWINGS. ADJACENT ROOTWADS SHALL BE TOUCHING OR OVERLAPPING.

BACKFILL STREAMBANK TO THE TOP OF ROOTWAD LOGS WITH ON-SITE NATIVE ALLUVIUM.

WASH FINES AND WATER FROM ONSITE INTO THE STREAMBANK FILL TO SEAL THE VOIDS IN THE BACKFILL.

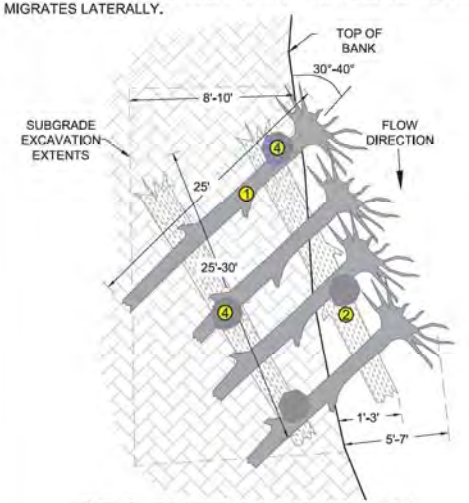
PLACE A SECOND LAYER OF CATEGORY 2 WOOD (FOOTER LOGS) ON TOP OF ROOTWADS AND POINTED IN A DOWNSTREAM DIRECTION AS SHOWN ON THE DRAWINGS.

PLACE A SECOND LAYER OF CATEGORY 1 WOOD (ROOTWAD LOGS) ON TOP OF FOOTER LOGS WITH ROOTWADS POINTING UPSTREAM. PLACEMENT SHALL BEGIN AT THE UPSTREAM END AND THE UPSTREAM ROOTWAD SHALL BE FLUSH WITH THE TOP OF BANK LINE. SUBSEQUENT ROOTWADS SHALL BE PLACED IN A DOWNSTREAM DIRECTION WITH GRADUALLY INCREASING PROJECTION INTO THE CHANNEL AS SHOWN ON THE DRAWINGS. ADJACENT ROOTWADS SHALL BE TOUCHING OR OVERLAPPING.

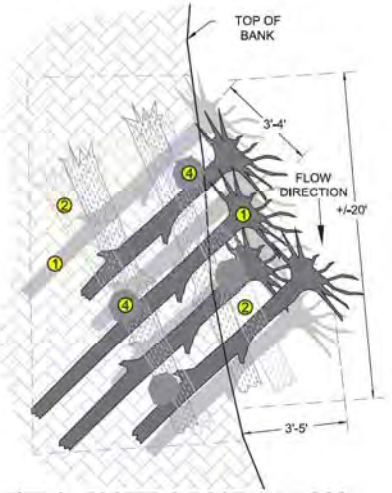
BACKFILL STREAMBANK TO THE TOP OF ROOTWAD LOGS WITH ON-SITE NATIVE ALLUVIUM.

WASH FINES AND WATER FROM ONSITE INTO THE STREAMBANK FILL TO SEAL THE VOIDS IN THE BACKFILL.

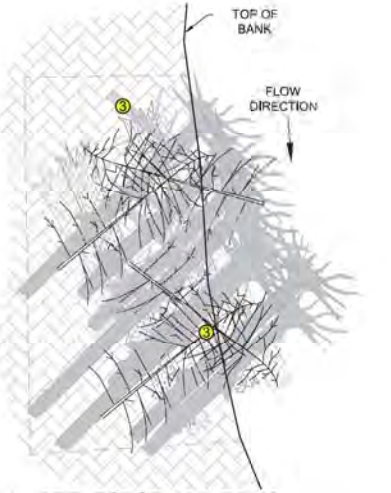
GRADE THE TOP OF BANK TO MATCH FINISHED GROUND ELEVATIONS.



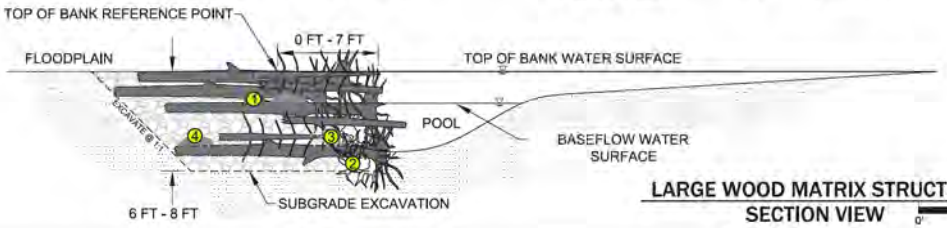
TIER 1 - FOOTER & ROOTWAD LOGS
PLAN VIEW



TIER 2 - FOOTER & ROOTWAD LOGS
PLAN VIEW



TIER 3 - DEFLECTOR AND BRUSH WOOD
PLAN VIEW



LARGE WOOD MATRIX STRUCTURE
SECTION VIEW

MATERIAL SCHEDULE (PER STRUCTURE)

	ITEM	QUANTITY	DIA. (IN)	LENGTH (FT)	ROOTWAD (Y/N)
1	CATEGORY 1 WOOD	10	10-20	25	YES 5 FT DIA.
2	CATEGORY 2 WOOD	6	12-15	25-30	OPTIONAL 5 FT
3	CATEGORY 3 WOOD	10	<6	15-20	OPTIONAL 5 FT
4	CATEGORY 1 ROCK	10	30 - 36		

RDG RIVER DESIGN GROUP
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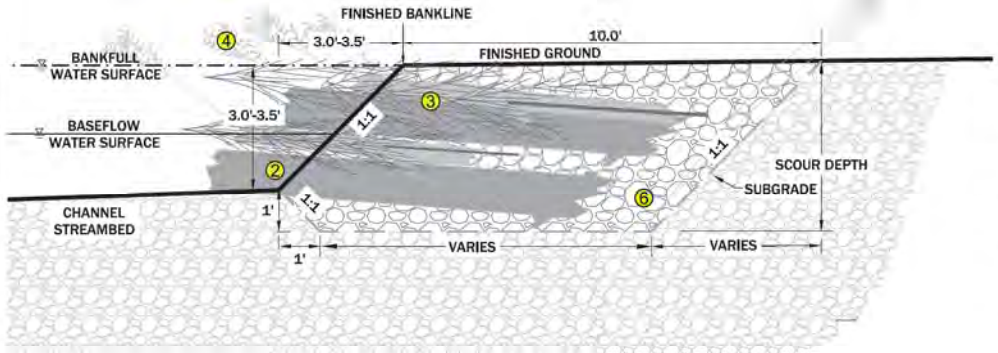
BLACKFOOT - SCHWARTZ DIVERSION

ENGINEERED DEBRIS JAM

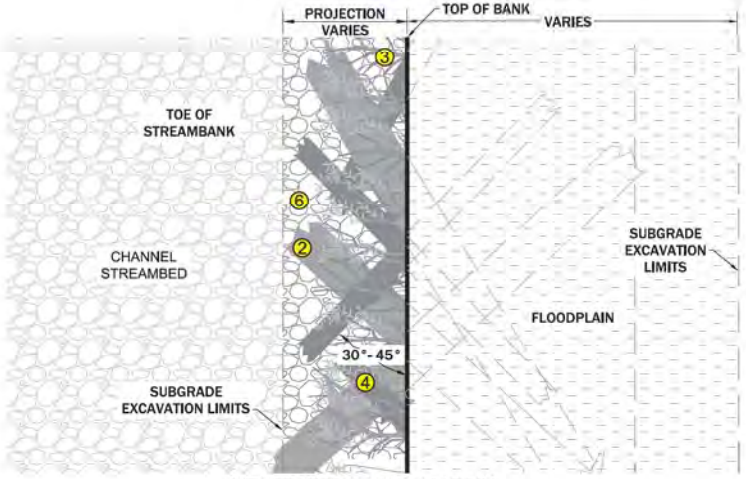
NO.	DATE	BY	DESCRIPTION	CHK.
1	04-17-17	JL	FINAL DESIGN	GD

PROJECT NUMBER
RDG-16-042

SHEET NUMBER
6.3



VEGETATED WOOD MATRIX
SECTION VIEW



VEGETATED WOOD MATRIX
PLAN VIEW

DESIGN INTENT

PURPOSE: THE PURPOSE OF THIS STRUCTURE IS TO CREATE A COMPLEX, VEGETATED BANK MARGIN THAT SUPPORTS AQUATIC HABITAT, VEGETATION AND GEOMORPHIC OBJECTIVES.

PLACEMENT CRITERIA: THIS STRUCTURE IS DESIGNED TO FUNCTION ON A MODERATE STRESS BANK WITH LOW TO MODERATE CURVATURE.

SUPPLEMENTAL INFORMATION: THE VEGETATED WOOD MATRIX STRUCTURE INCORPORATES NATIVE MATERIALS TO PROVIDE PREFERRED HABITAT CONDITIONS ALONG STREAMBANKS. THE STRUCTURE IS BUILT ON A ROCK AND WOOD TOE. STRUCTURE PERFORMANCE IS DEPENDENT ON TOE STABILITY AS WELL AS SMOOTH TRANSITIONS TO STABLE UPSTREAM AND DOWNSTREAM TIE-IN POINTS. MAINTAINING ADEQUATE BACKFILL BALLAST IS CRITICAL TO COUNTERACT BUOYANCY AND SLIDING/ROTATION OF WOOD. PLACEMENT OF WOOD AT OR BELOW BANKFULL AND PLACEMENT OF HEALTHY WOODY VEGETATION IN CONTACT WITH THE WATER TABLE THROUGHOUT THE GROWING SEASON IS CRITICAL FOR RAPID VEGETATION ESTABLISHMENT.

CONSTRUCTION NOTES

EXCAVATE STREAMBANK TO SUBGRADE ELEVATIONS.

PLACE CATEGORY 2 WOOD IN THE STREAMBANK AT SKEWED ANGLE TO THE STREAMBANK. WOOD SHALL BE PLACED BELOW THE TOP OF BANK ELEVATION. LOGS SHALL OVERLAP.

PLACE CATEGORY 3 WOOD WITHIN THE MATRIX OF SMALL WOOD. BRUSH MAY EXTEND ABOVE THE TOP OF BANK ELEVATION BY UP TO ONE FOOT.

PLACE CUTTINGS INTO THE WOOD/BRUSH MATRIX WITH THE STEMS IN CONTACT WITH THE BASEFLOW WATER TABLE AND THE LEAVES AT OR ABOVE THE BANKFULL WATER SURFACE ELEVATION.

BACKFILL STREAMBANK WITH STREAMBANK FILL PER THE GRADATION SHOWN.

WASH FINES AND WATER FROM ONSITE INTO THE STREAMBANK FILL TO SEAL THE VOIDS IN THE BACKFILL.

GRADE THE TOP OF BANK TO MATCH FINISHED GROUND ELEVATIONS.

CAP WITH TOPSOIL OR SOD MATS

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	DIAMETER (IN)	LENGTH (FT)	ROOTWAD	LIMBS	QUANTITY
②	CATEGORY 2 WOOD	8-12	10-15	OPTIONAL	YES	2
③	CATEGORY 3 WOOD	<6	10-15	OPTIONAL	YES	2
④	RIPARIAN CUTTINGS	0.25	6-8			10
⑥	CY OF STREAMBANK FILL	SEE GRADATION				1-1.5

STREAMBANK FILL GRADATION

REPRESENTATIVE SIZE CLASS	PERCENT PASSING	SIZE (INCHES)
D100	95 -100	8
D84	84 - 90	6
D65	65 - 80	4
D50	50 - 60	3
D35	35 - 45	1.5
D15	15 - 30	0.5
<D15	5 - 10	0.08

NOTE: ALL GRADATIONS TO BE APPROVED BY THE CONTRACTING OFFICER. ON-SITE MATERIALS MAY NEED TO BE SUPPLEMENTED WITH IMPORTED ROCK FROM AN APPROVED SOURCE.

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BLACKFOOT - SCHWARTZ DIVERSION

VEGETATED WOOD MATRIX

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RDG-16-042

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6.4

Category	Item	Quantity	Units	Diameter	Length	Rootwad
Wood	Category 1 Wood	20	ea	12in -2in	25 ft	Yes
	Category 2 Wood	542	ea	6 in - 12 in	12 ft - 20 ft	Optional
	Category 3 Wood	550	ea	6 in minus	10 ft	Optional
	Riparian Cuttings	2,650	ea	0.25 in -0.75 in	6 ft - 8 ft	No

Category	Item	Quantity	Units	Diameter	Quantity	Units
Rock	Category 1 Rock	20	ea	30 in-36 in	7-8	cubic yards
	Category 2 Rock	400	ea	16 in - 20 in	60	cubic yards
	Streambed Fill		ea	12 " minus	300	cubic yards
	Streambank Fill		ea	8 " minus	300	cubic yards
	Structure Bedding			3/4" minus	70	cubic yards

Category	Item	Quantity	Units	Rolls
Miscellaneous	Filter Fabric- Mirafi 180 N or equivalent	50	linear feet	
	36" HDPE smooth wall pipe	115	linear feet	
	12" HDPE smooth wall pipe	40	linear feet	
	14" HDPE smooth wall pipe	170	linear feet	
	36" x 82" Waterman C-10 gate or equivalent	1	ea	
	12" x 6' Waterman C-10 gate or equivalent	1	ea	
	6' x 20' x 1/4" Re-inforced steel headwall as per Sheet 6.1	1	ea	
	Bypass Pipe Flange as per Sheet 6.0	1	ea	
	FCA Screen as per Sheet 6.0	1	ea	
	Transition Screen as per Sheet 6.0	1	ea	
	Seed mix- upland	10	lbs	

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BLACKFOOT - SCHWARTZ DIVERSION

MATERIALS LIST

NO.	DATE	BY	DESCRIPTION	CHK
1	04-17-17	JL	FINAL DESIGN	GD

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RDG-16-042

SHEET NUMBER
7.0