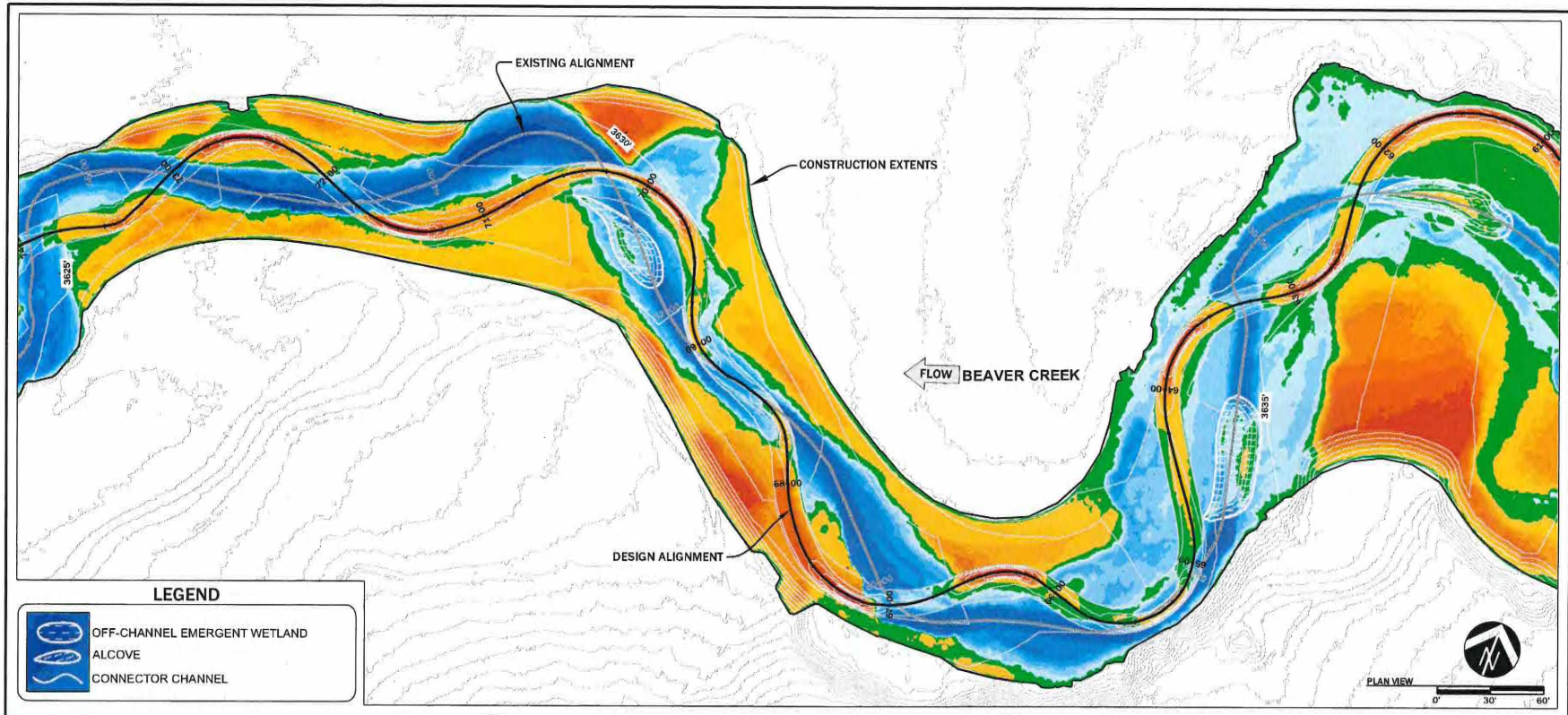
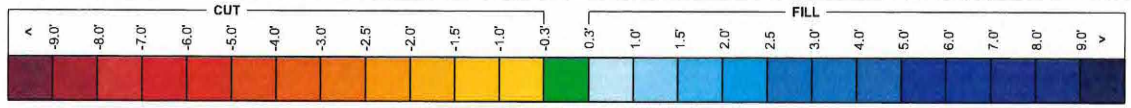
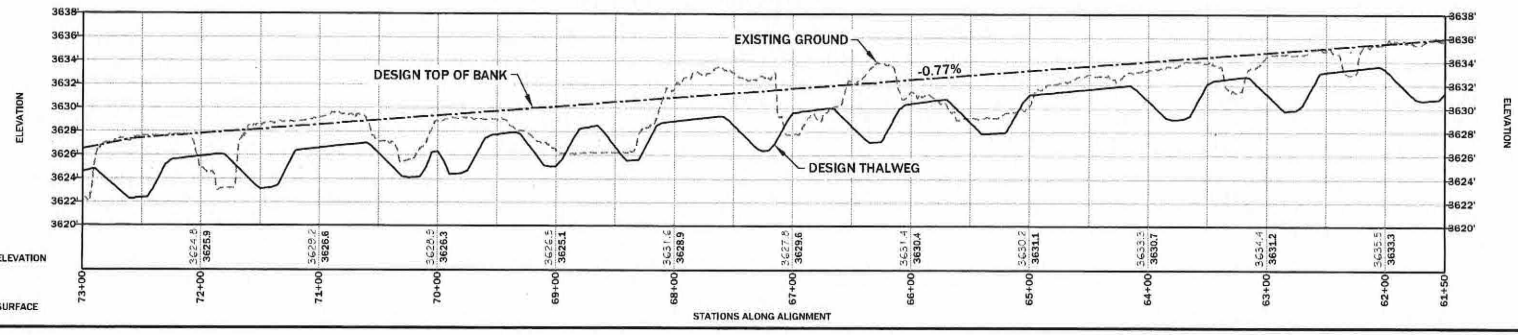
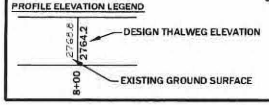






PROFILE ELEVATION LEGEND



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GRADING PLAN AND PROFILE

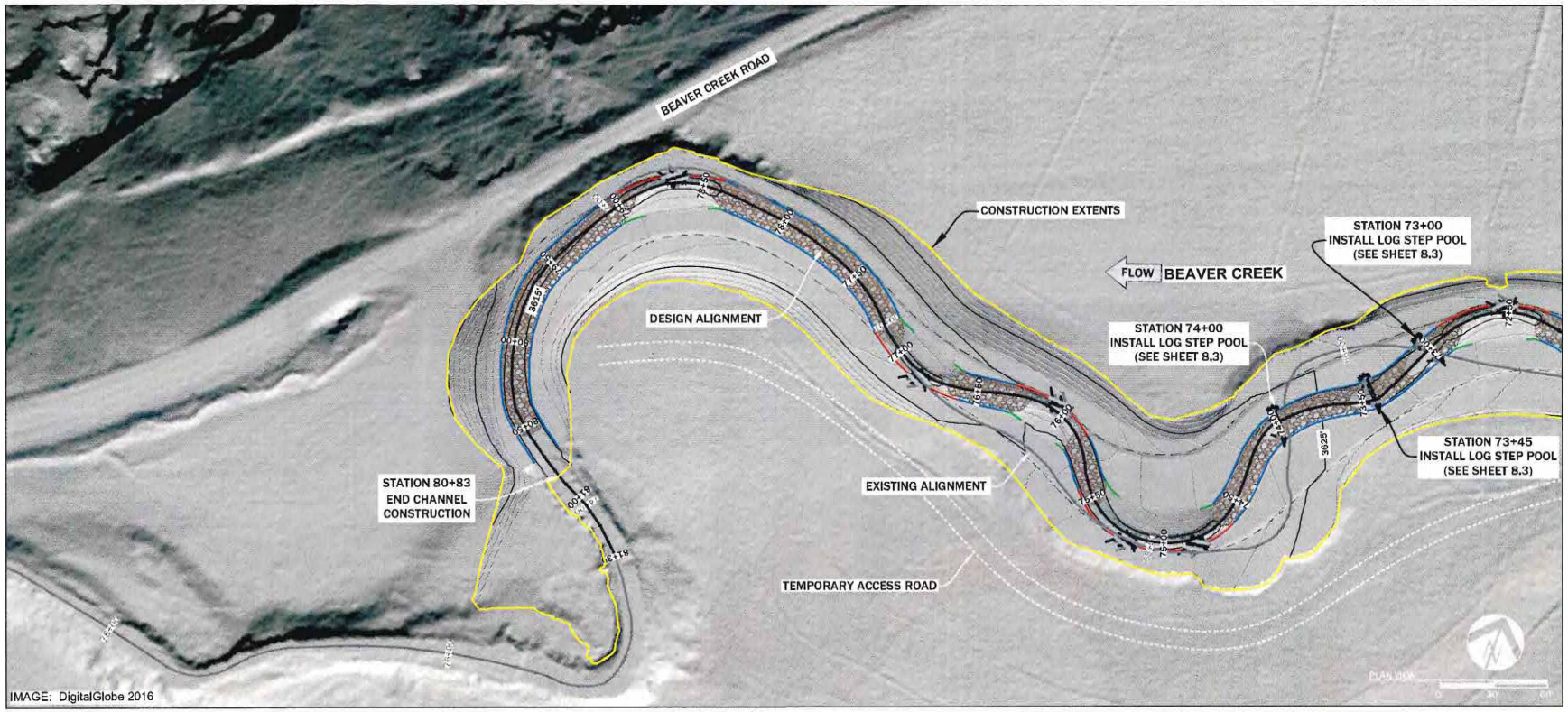
BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	11-6-18	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

SHEET NUMBER
5.9



LEGEND

BANK STRUCTURES	DETAIL SHEET #
LARGE WOOD STRUCTURE (LWS)	8.0
VEGETATED WOOD MATRIX TYPE 1 (VWM 1)	8.1
VEGETATED WOOD MATRIX TYPE 2 (VWM 2)	8.1
VEGETATED WOOD MATRIX TYPE 3 (VWM 3)	8.1
CHANNEL STRUCTURES	
CONSTRUCTED RIFFLE (CR)	8.2
LOG STEP POOL	8.3

CHANNEL TOP OF BANK ELEVATIONS

STATION	ELEVATION (FT)
74+00	3624.47
75+00	3622.43
76+00	3620.38
77+00	3618.34
78+00	3617.53
79+00	3616.96
80+00	3616.40

STRUCTURE SCHEDULE

STATION START	STATION END	BANK	STRUCTURE
72+90	74+60	L	VWM 2
72+90	74+60	R	VWM 2
73+00	73+10	C	LSP
73+10	73+45	C	CR
73+45	73+55	C	LSP
73+50	73+99	C	CR
73+55	74+00	C	CR
74+00	74+10	C	LSP
74+10	74+69	C	CR
74+12	74+69	C	CR
74+60	74+69	R	VWM 1
74+60	74+78	L	VWM 3
74+78	74+88	L	LWS
74+88	75+16	L	VWM 3
75+16	75+26	L	LWS
75+26	75+57	L	VWM 3
75+42	75+91	C	CR
75+42	75+57	R	VWM 1
75+57	75+82	L	VWM 2
75+57	75+82	R	VWM 2
75+82	75+91	L	VWM 1
75+82	76+00	R	VWM 3
76+00	76+10	R	LWS
76+10	76+31	R	VWM 3
76+21	76+69	C	CR
76+21	76+31	L	VWM 1
76+31	76+60	L	VWM 2
76+31	76+60	R	VWM 2
76+60	76+60	R	VWM 1
76+60	76+77	L	VWM 3
76+77	76+87	L	LWS
76+87	77+17	L	VWM 3
77+02	78+46	C	CR
77+02	77+17	R	VWM 1
77+17	78+38	L	VWM 2
77+17	78+38	R	VWM 2
78+38	78+46	L	VWM 1
78+38	78+59	R	VWM 3
78+59	78+69	R	LWS
78+69	79+04	R	VWM 3
78+89	79+04	C	CR
78+89	79+04	L	VWM 1
79+04	80+70	L	VWM 2
79+04	80+70	R	VWM 2

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PLAN VIEW AND STRUCTURE LAYOUT

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

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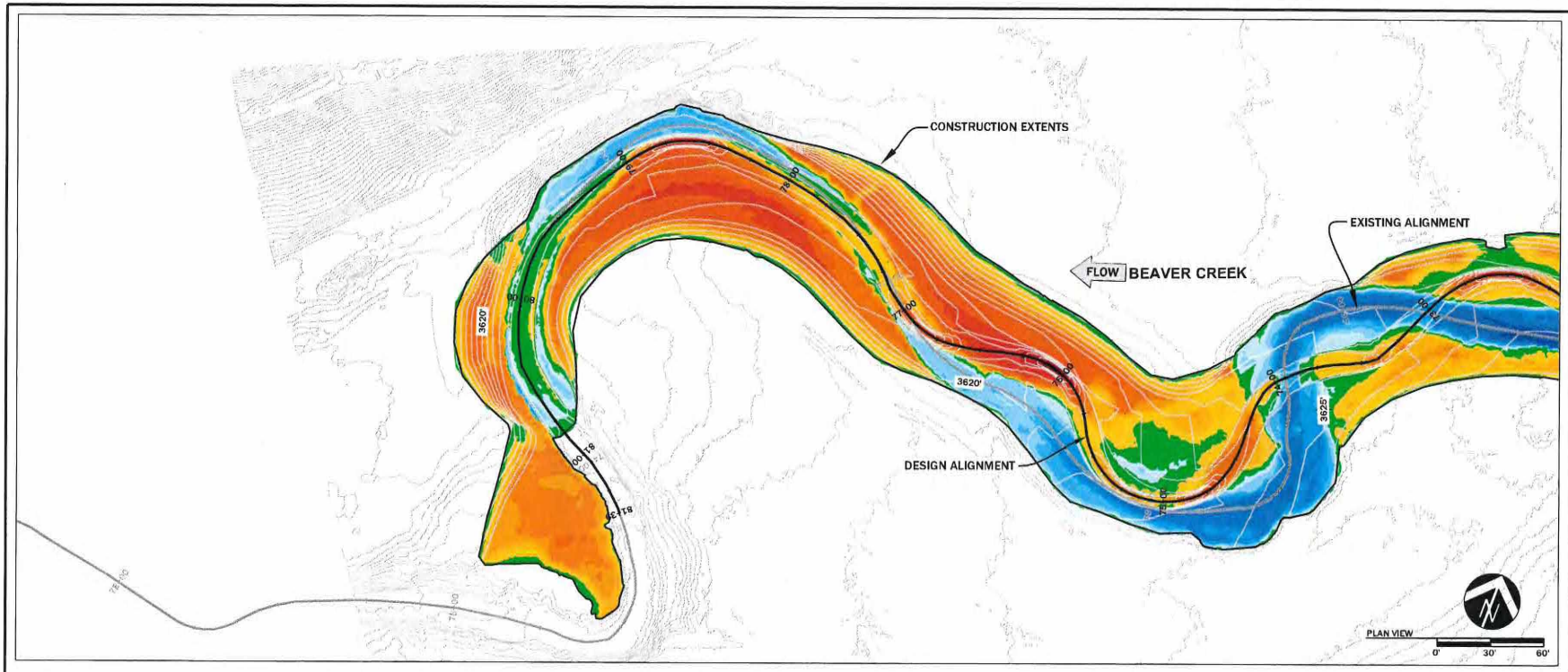
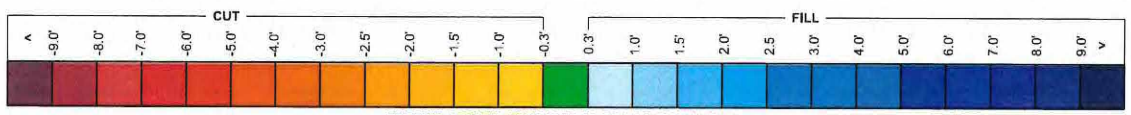
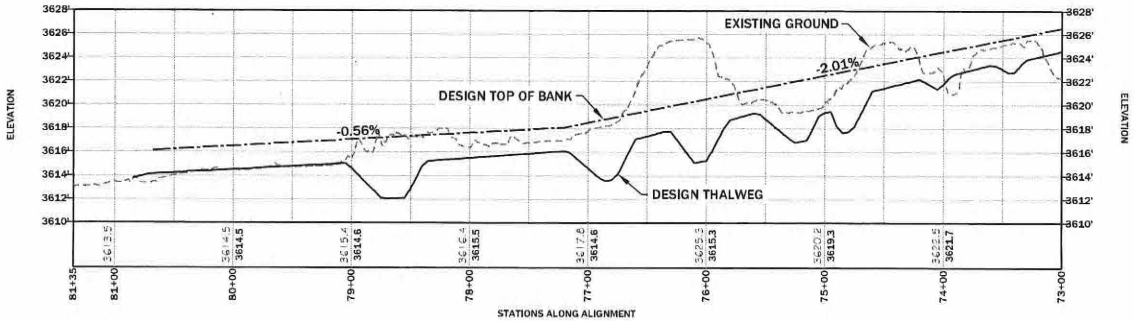
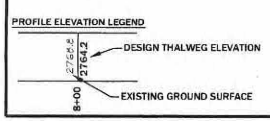
PROJECT NUMBER
RDG-17-006

SHEET NUMBER
5.10









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GRADING PLAN AND PROFILE

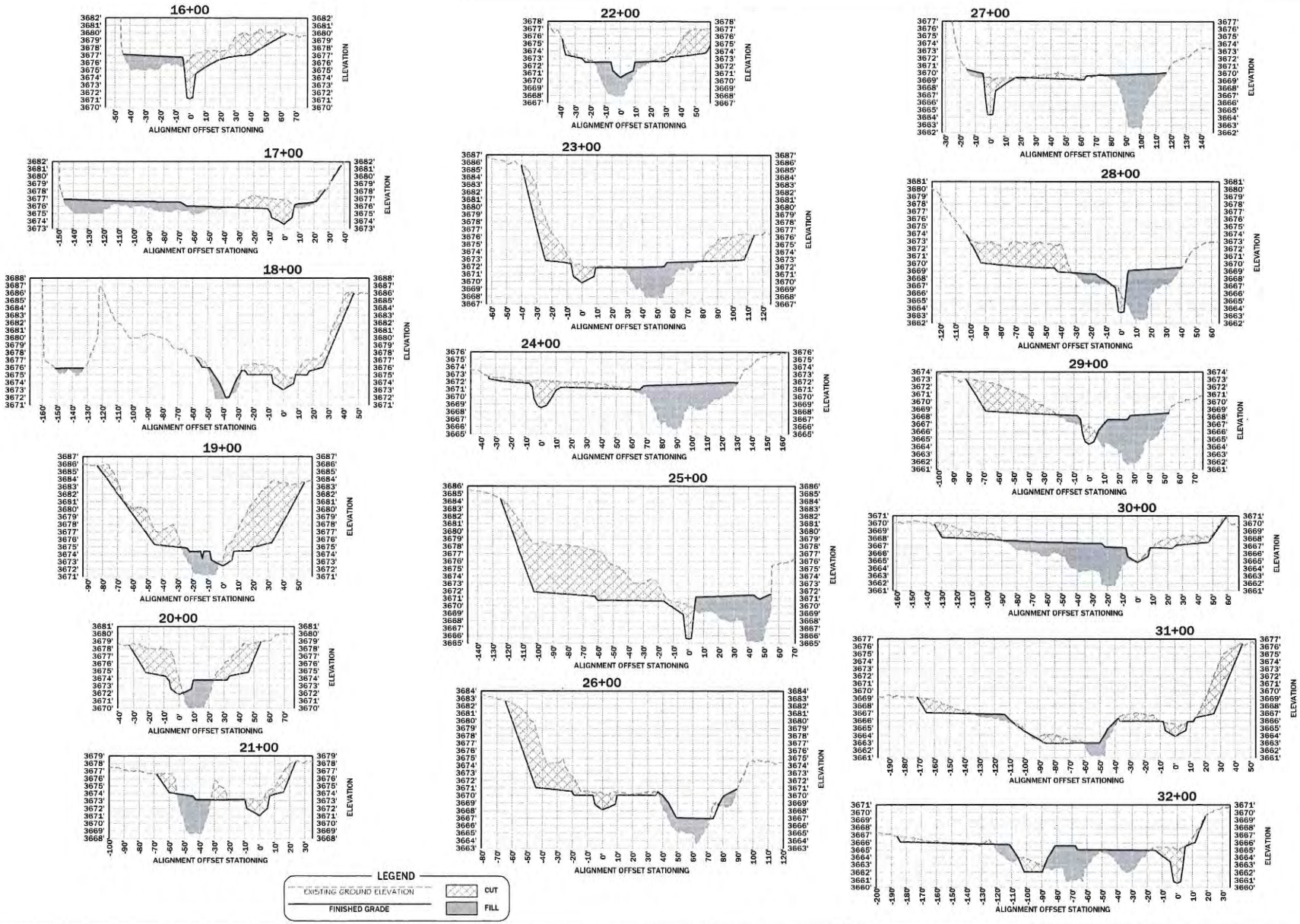
BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	11-6-18	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

SHEET NUMBER
5.11



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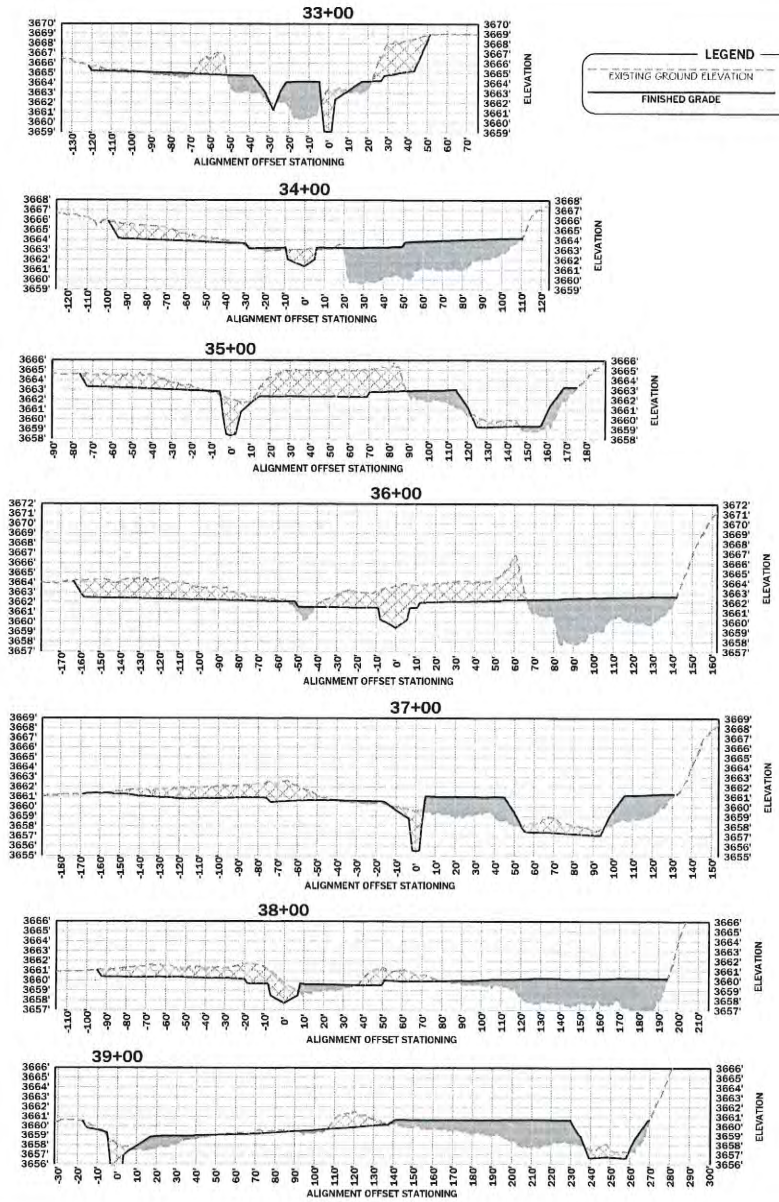
CROSS SECTIONS

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	11-6-18	KW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

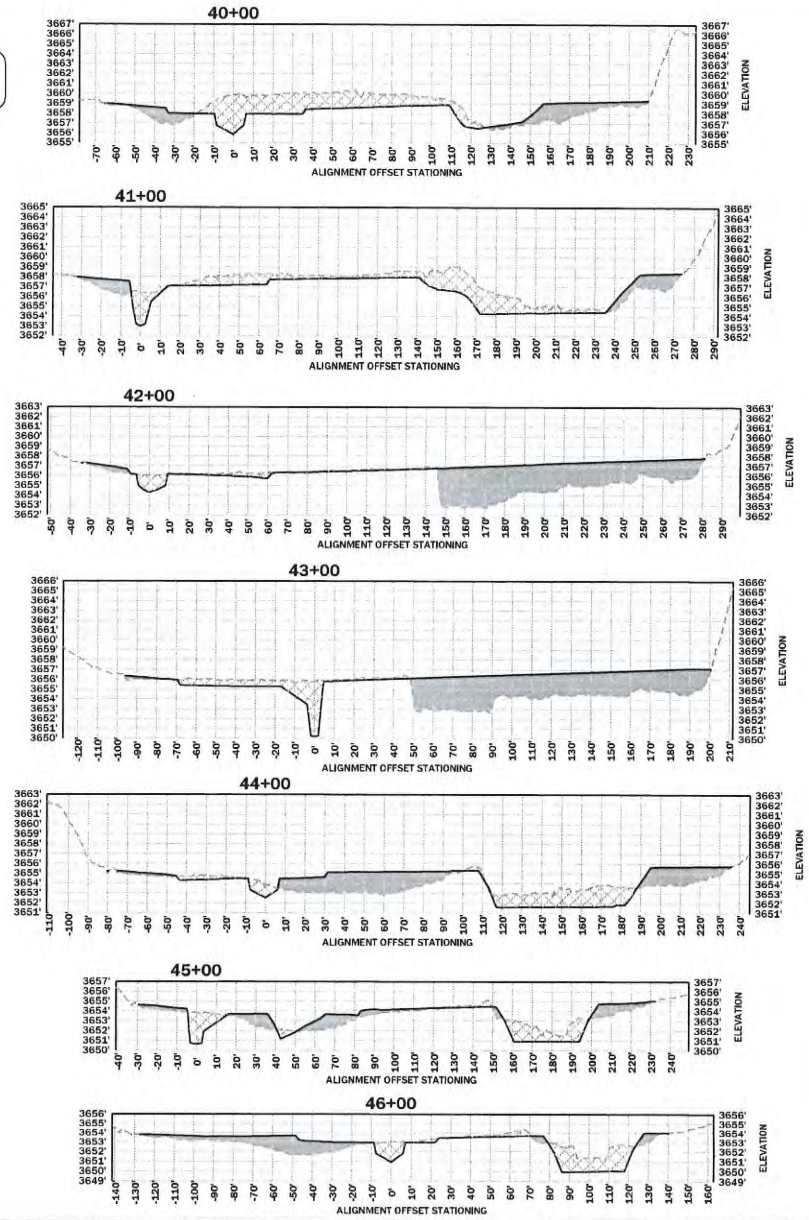
SHEET NUMBER
6.0



LEGEND

EXISTING GROUND ELEVATION — CUT

FINISHED GRADE — FILL



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CROSS SECTIONS

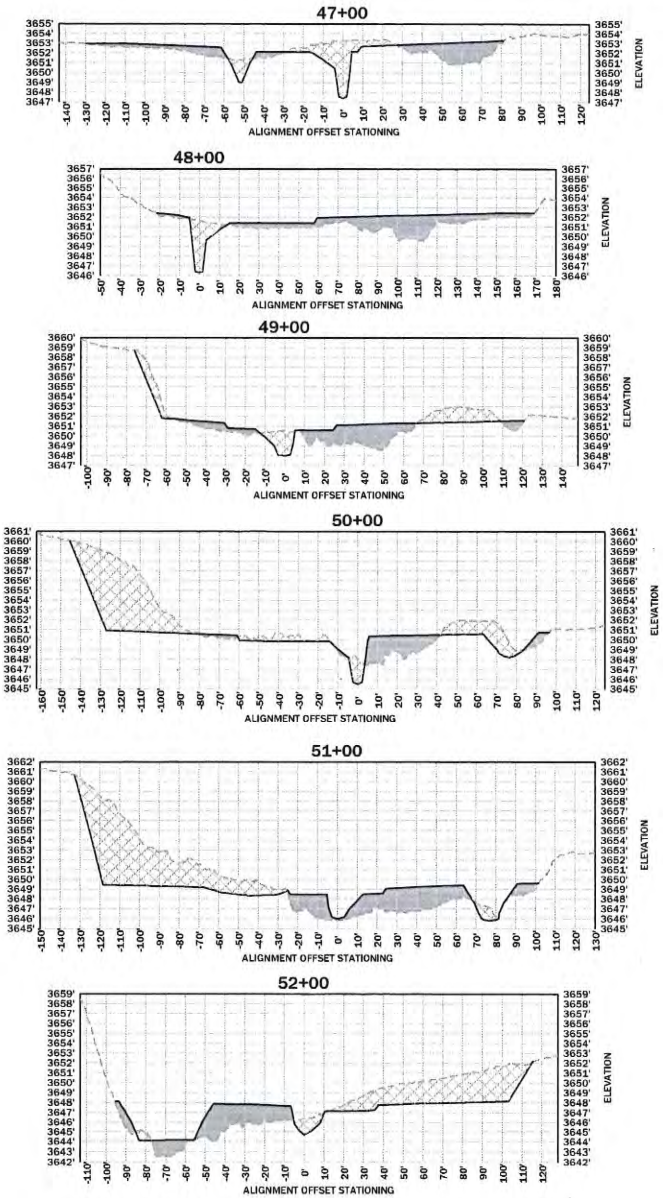
BEAVER CREEK RESTORATION PROJECT

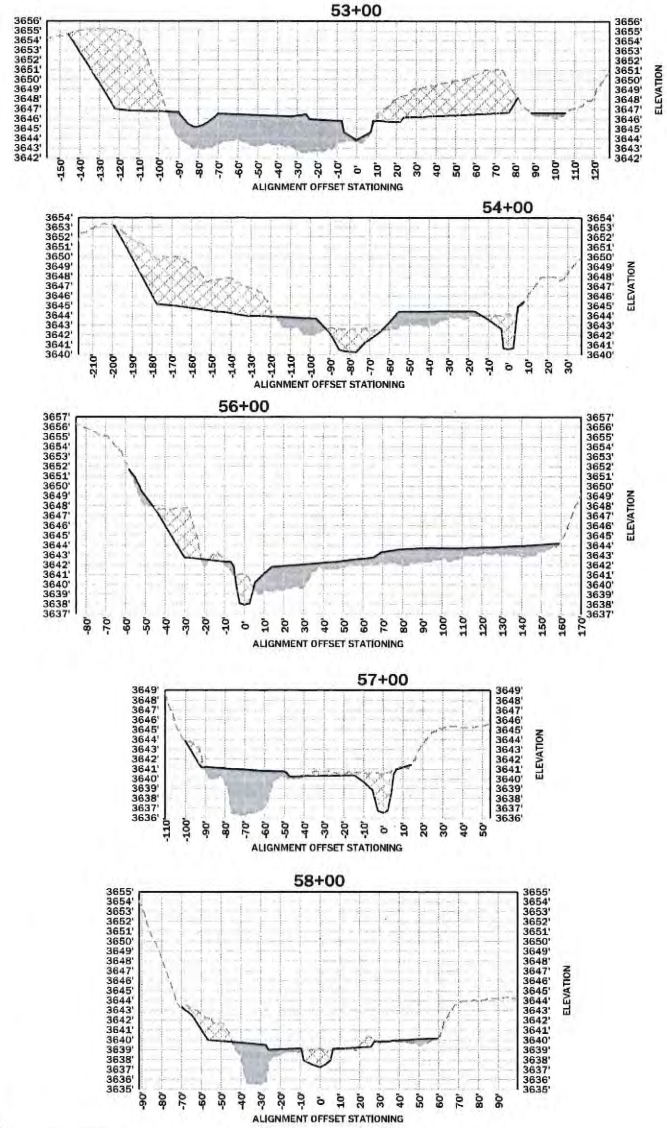
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	11-6-18	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

SHEET NUMBER
6.1





LEGEND

EXISTING GROUND ELEVATION	CUT
FINISHED GRADE	FILL

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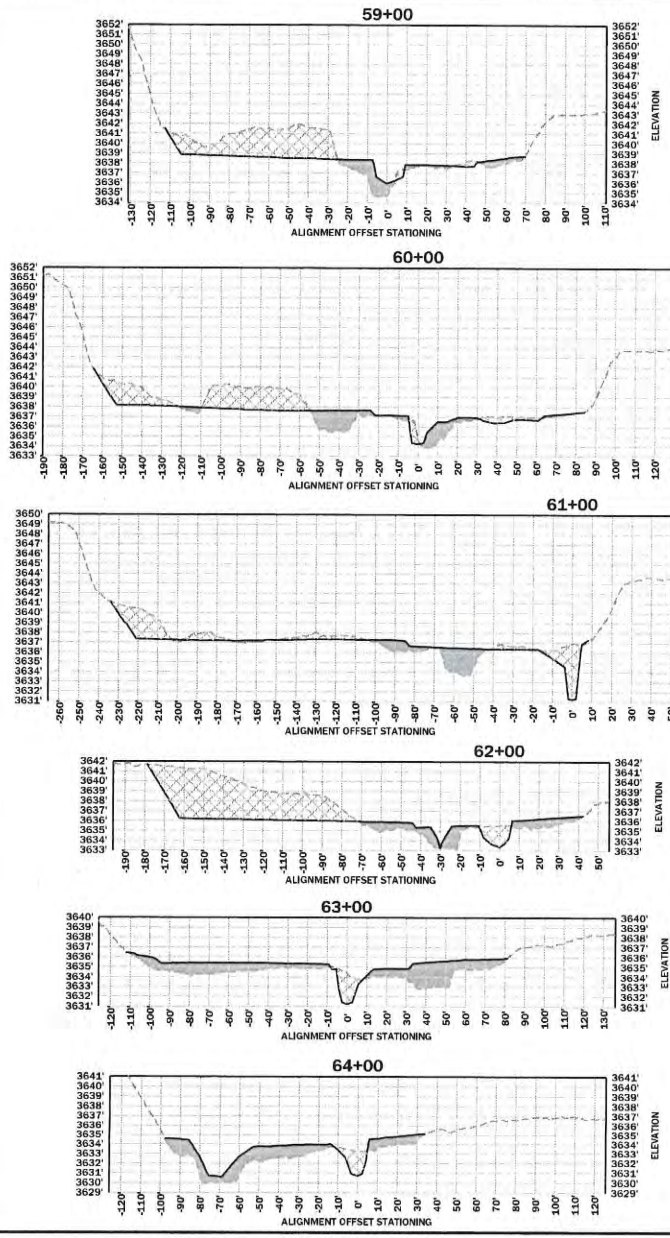
CROSS SECTIONS

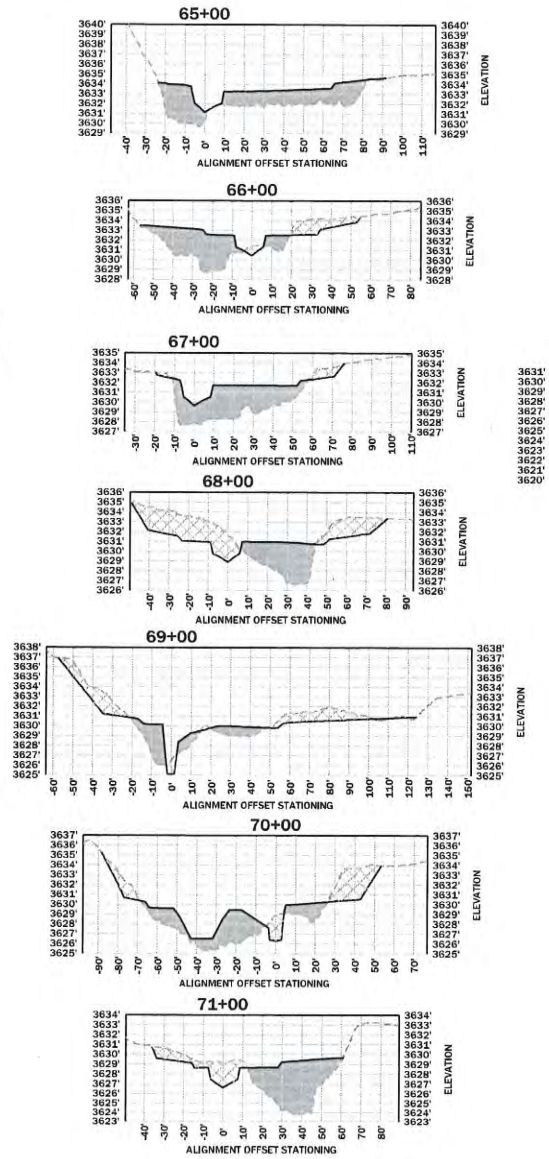
BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

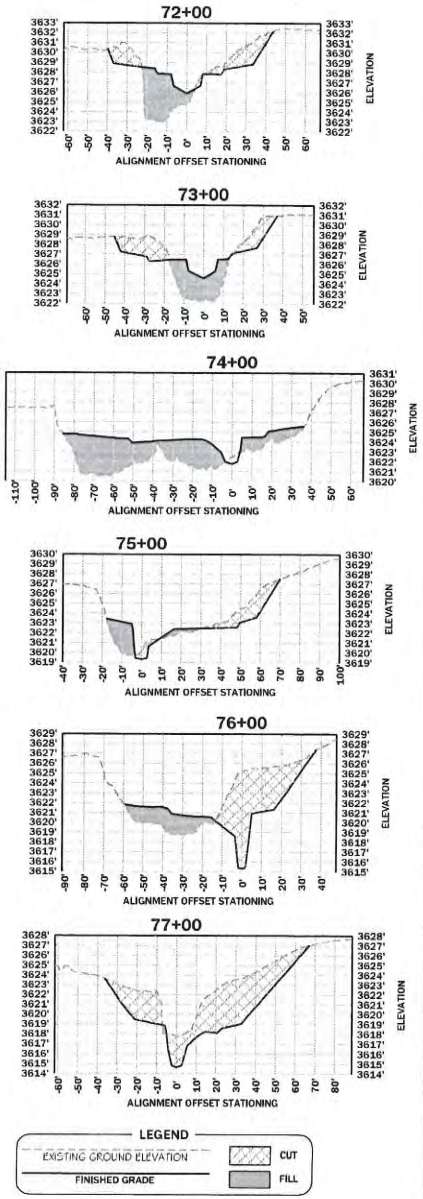
NO.	DATE	BY	DESCRIPTION	CHK
1	11-6-18	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

SHEET NUMBER
6.2







LEGEND

EXISTING GROUND ELEVATION	CUT
FINISHED GRADE	FILL

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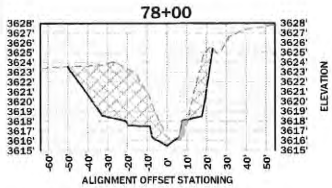
CROSS SECTIONS

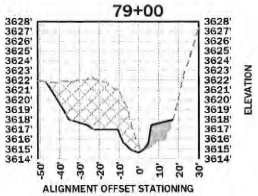
BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

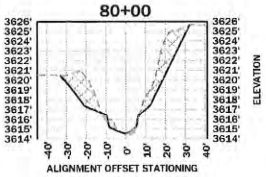
NO.	DATE	BY	DESCRIPTION	CHK.
1	11-4-18	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

SHEET NUMBER
6.3







LEGEND

EXISTING GROUND ELEVATION	CUT
FINISHED GRADE	FILL

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CROSS SECTIONS

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

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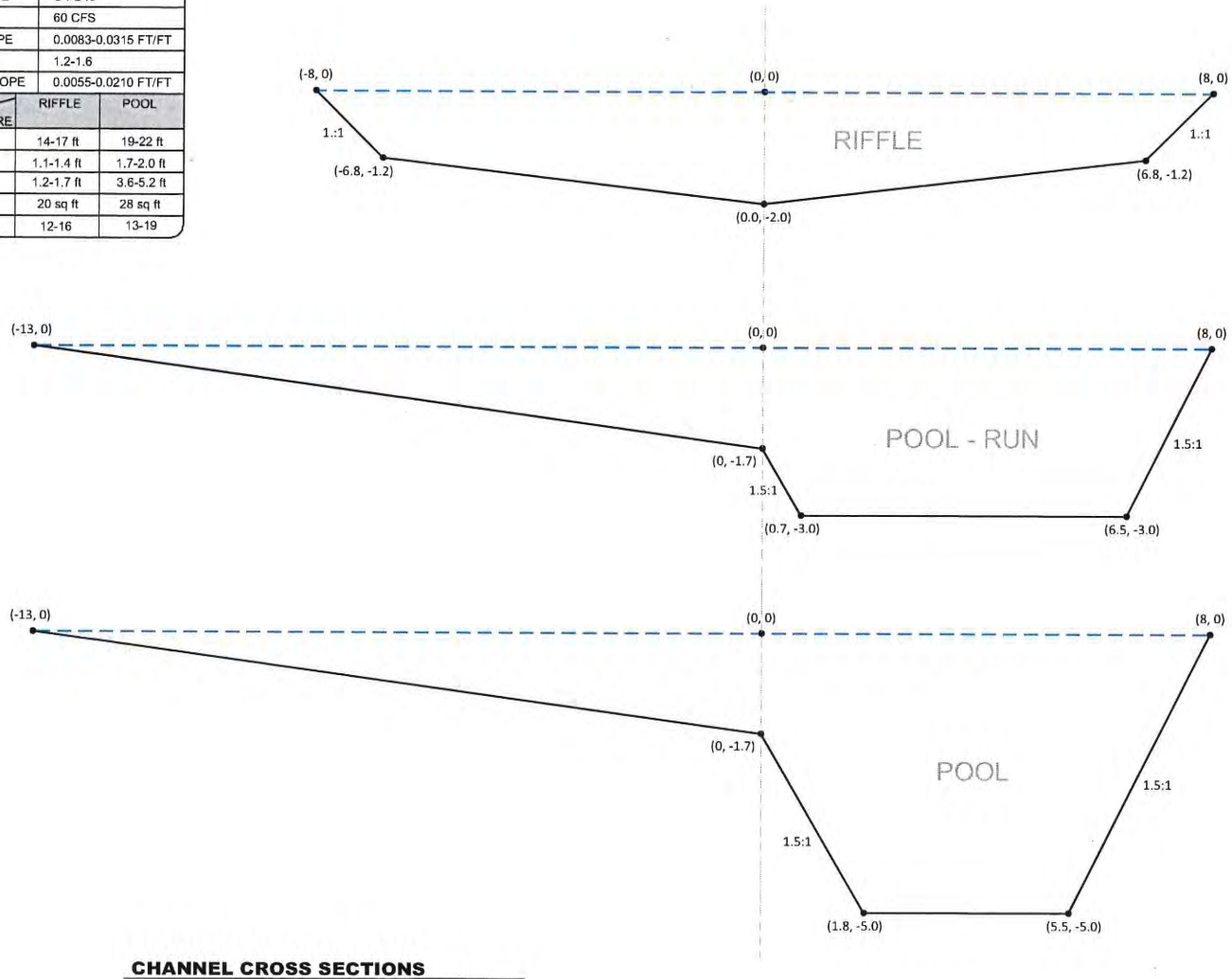
RDG-17-006

SHEET NUMBER
6.4

BEAVER CREEK PHASE 1

BANKFULL CHANNEL DESIGN CRITERIA		
STREAM TYPE	C4-B4c	
DISCHARGE	60 CFS	
VALLEY SLOPE	0.0083-0.0315 FT/FT	
SINUOSITY	1.2-1.6	
CHANNEL SLOPE	0.0055-0.0210 FT/FT	
PARAMETER / FEATURE	RIFFLE	POOL
WIDTH	14-17 ft	19-22 ft
MEAN DEPTH	1.1-1.4 ft	1.7-2.0 ft
MAX. DEPTH	1.2-1.7 ft	3.6-5.2 ft
XS AREA	20 sq ft	28 sq ft
WIDTH:DEPTH	12-16	13-19



CHANNEL CROSS SECTIONS
TYPICAL

0' 1' 2'

NOTE: COORDINATES ARE REFERENCED FROM TOP OF BANK THALWEG

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CHANNEL CROSS SECTION DIMENSIONS

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

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RDG-17-006

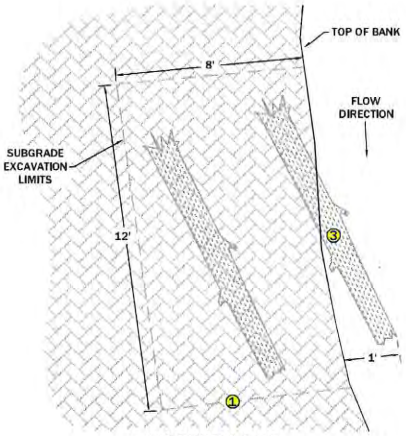
SHEET NUMBER
7.0

GENERAL NOTES

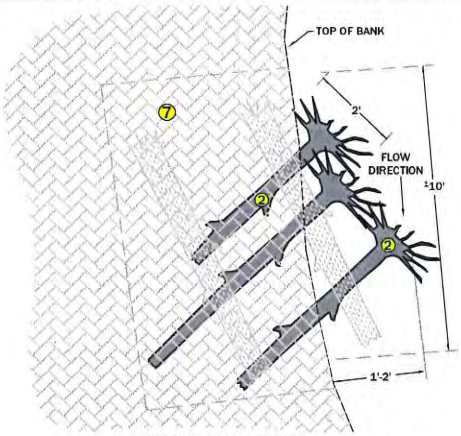
1. CONSTRUCTION OF THE LARGE WOOD STRUCTURE WILL OCCUR AFTER THE STREAMBANK SUBGRADE AND CHANNEL STREAMBED SUBGRADE IS ESTABLISHED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE ENGINEER.
3. FIELD ENGINEER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR EACH LARGE WOOD STRUCTURE PRIOR TO CONSTRUCTION

CONSTRUCTION NOTES

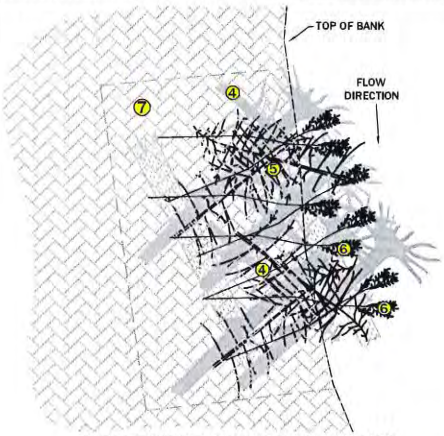
1. EXCAVATE TO THE EXCAVATION LIMITS. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. INSTALL TWO FOOTER LOGS (MEDIUM WOOD) AT THE BASE OF THE EXCAVATED TRENCH AT THE ORIENTATIONS NOTED IN PLAN VIEW. FOOTER LOGS SHALL PROJECT NO GREATER THAN 2 FT. BEYOND 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 TWO ROOTWAD LOGS (LARGE 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 2 FT. BEYOND THE FINISHED BANK LINE.
4. BACKFILL TRENCH WITH STOCKPILED MATERIAL UP TO THE TOP OF THE FOOTER LOGS (MEDIUM WOOD). BACKFILL SHALL BE BUCKET COMPACTED.
5. INSTALL A SECOND TIER OF TWO FOOTER LOGS (MEDIUM WOOD) FOOTER LOGS SHALL PROJECT NO GREATER THAN 2 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 LIMBS (SMALL WOOD) AND BRUSH AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. BRUSH AND LIMBS SHALL PROJECT NO GREATER THAN 2 FT. BEYOND THE FINISHED BANK LINE.
7. INSTALL TWO TO THREE ROOTWAD LOGS (LARGE WOOD) INTERSECTING THE LOWER TIER OF ROOTWADS 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 2 FT. BEYOND THE FINISHED BANK LINE.
8. INSTALL LIMBS (SMALL WOOD), BRUSH AND WILLOW CUTTINGS INTERWOMEN INTO WOOD MATRIX. 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 THE TOP OF THE ROOTWAD LOGS. BACKFILL SHALL BE BUCKET COMPACTED.
10. INSTALL DEFLECTOR LOGS (MEDIUM WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. DEFLECTOR LOGS SHALL PROJECT NO GREATER THAN 2 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.
11. PLACE AND BUCKET COMPACT STOCKPILED NATIVE MATERIAL TO THE FINISHED BANK LINE. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.



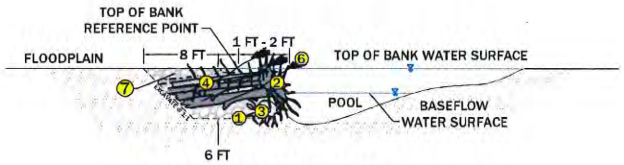
FOOTER LOGS
PLAN VIEW
0' 2.5' 5'



ROOTWAD LOGS
PLAN VIEW
0' 2.5' 5'



DEFLECTOR AND BRUSH WOOD
PLAN VIEW
0' 2.5' 5'



LARGE WOOD STRUCTURE
SECTION VIEW
0' 5' 10'

STREAMBED FILL GRADATION - 1

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
6	95	D100
5	90-95	D95
4	85-90	D84
3	65 - 85	D65
2	50 - 65	D50
1	30 - 50	D35
0.5	10 - 30	D15
FINES	0-10	

MATERIAL SCHEDULE (PER STRUCTURE)

	ITEM	QUANTITY	DIA. (IN)	LENGTH (FT)	ROOTWAD (Y/N)
1	CY OF SUBGRADE EXCAVATION	10			
2	LARGE WOOD	4	10-12	15-20	YES - 2 FT DIA. MIN.
3	MEDIUM WOOD	5	8-10	10-15	NO
4	SMALL WOOD	5	3-6	8-10	OPTIONAL 1-2 FT
5	BRUSH	4	<3	8-10	OPTIONAL 1-2 FT
6	WILLOW CUTTINGS	50		0.75-1.5	6 - 8
7	CY OF STREAMBED FILL GRADATION - 2	5			

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LARGE WOOD STRUCTURE DETAIL

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

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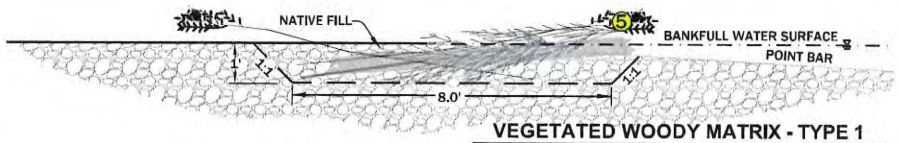
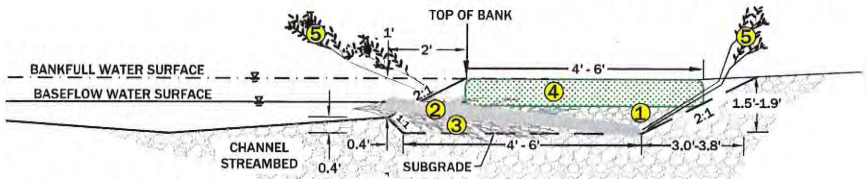
RDG-17-006

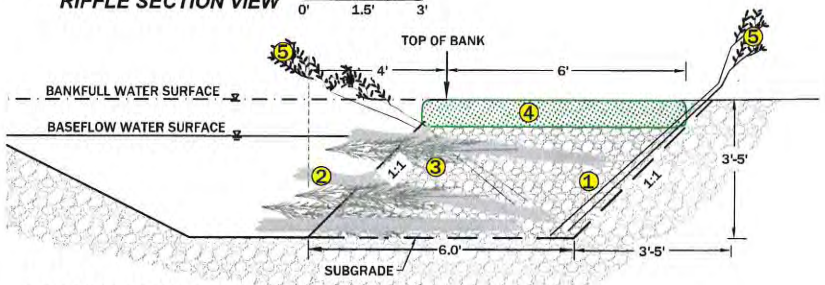
SHEET NUMBER
8.0



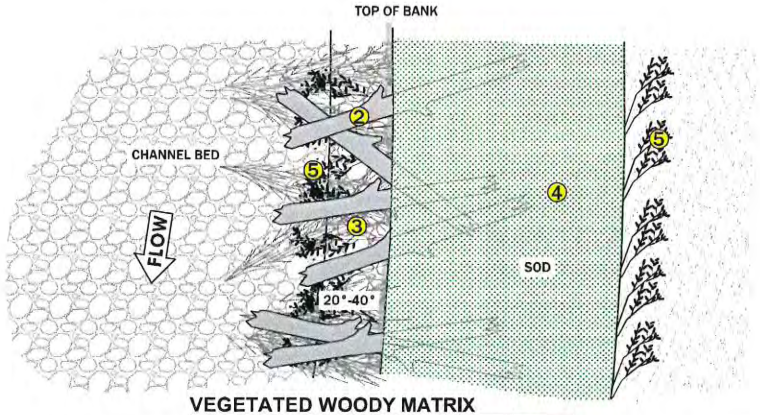
VEGETATED WOODY MATRIX - TYPE 1
POINT BAR SECTION VIEW 0' 1.5' 3'



VEGETATED WOODY MATRIX - TYPE 2
RIFFLE SECTION VIEW 0' 1.5' 3'



VEGETATED WOODY MATRIX - TYPE 3
POOL SECTION VIEW 0' 1.5' 3'



VEGETATED WOODY MATRIX
PLAN VIEW 0' 1.5' 3'

GENERAL NOTES

1. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE ENGINEER.
2. FIELD ENGINEER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR EACH VEGETATED WOODY MATRIX STRUCTURE PRIOR TO CONSTRUCTION.

CONSTRUCTION NOTES

1. EXCAVATE STREAMBANK TO SUBGRADE ELEVATIONS.
2. PLACE SMALL WOOD IN THE STREAMBANK AT SKEWED ANGLE TO THE STREAMBANK. WOOD SHALL BE PLACED BELOW THE TOP OF BANK ELEVATION. SMALL WOOD MAY OVERLAP.
3. PLACE BRUSH WITHIN THE MATRIX OF SMALL WOOD. BRUSH SHALL PLACED BELOW TOP OF BANK LINE.
4. PLACE CUTTINGS INTO THE SMALL WOOD/BRUSH MATRIX WITH THE STEMS IN CONTACT WITH THE BASEFLOW WATER TABLE AND THE LEAVES AT OR ABOVE THE BANKFULL WATER SURFACE ELEVATION.
5. BACKFILL STREAMBANK WITH STREAMED FILL PER THE GRADATION SHOWN ON THE DRAWINGS.
6. WASH FINES AND WATER FROM ONSITE INTO THE STREAMED FILL TO SEAL THE VOIDS IN THE BACKFILL.
7. PLACE A 6-10 INCH SOD MAT BEGINNING AT BANKLINE AND EXTENDING BACK 6 FEET IN TO FLOODPLAIN TO MATCH FINISHED GROUND ELEVATIONS. REFER TO VEGETATION SALVAGE PLAN FOR SOD SOURCES.

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	*RIFFLE QUANTITY*	*POOL QUANTITY*	*POINT BAR QUANTITY*	*DIA. (IN)*	*LENGTH (FT)*
1	CY OF STREAMBED FILL	0.3	0.9	0.3		
2	SMALL WOOD	0.4	0.85	0.2	3-6	8
3	BRUSH	0.4	0.85	0.3	1-3	8
4	SOD MAT	12 SF	12 SF	-	8-10 (THICK)	3 - 6
5	WILLOW CUTTINGS	5	5	5	0.75-1.5	6 - 8

STREAMBED FILL GRADATION - 1
(STATIONS 15+30 TO 72+54, 77+17 TO 80+71)

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
6	95	D100
5	90-95	D95
4	85-90	D84
3	65 - 85	D65
2	50 - 65	D50
1	30 - 50	D35
0.5	10 - 30	D15
FINES	0-10	

STREAMBED FILL GRADATION - 2
(STATION 72+54 TO 77+17)

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
10	95	D100
8	90-95	D95
6	85-90	D84
4	65 - 85	D65
2	50 - 65	D50
1	30 - 50	D35
0.5	10 - 30	D15
FINES	0-10	

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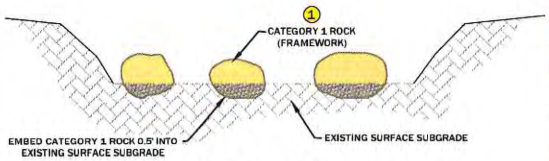
VEGETATED WOODY MATRIX DETAIL
BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK.
1	11-6-18	NW	FINAL DESIGN	JM

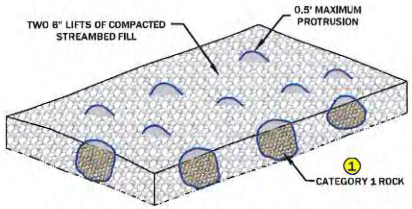
PROJECT NUMBER
RDG-17-006

SHEET NUMBER
8.1



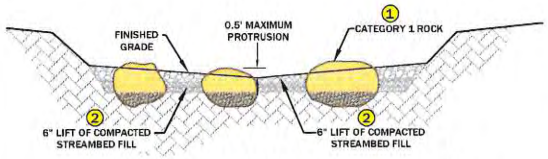
CATEGORY 1 ROCK INSTALLATION
SECTION VIEW
NTS

CHANNEL SUBGRADE



CHANNEL ALLUVIUM LIFT INSTALLATION
3-D VIEW
NTS

CHANNEL ALLUVIUM MATRIX



CHANNEL ALLUVIUM LIFT INSTALLATION
SECTION VIEW
NTS

CHANNEL ALLUVIUM MATRIX WITH FRAMEWORK

TYPICAL CONSTRUCTED CHANNEL STREAMBED

TYPICAL CONSTRUCTED CHANNEL STREAMBED

GENERAL NOTES

1. PLACEMENT OF THE CONSTRUCTED CHANNEL STREAMBED WILL OCCUR AFTER THE CHANNEL AND STREAMBANK SUBGRADE IS ESTABLISHED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED THE ENGINEER.
3. CONTRACTOR SHALL MARK THE UPSTREAM AND DOWNSTREAM EXTENTS OF THE LOCATIONS OF THE CONSTRUCTED CHANNEL STREAMBED STRUCTURES.

CONSTRUCTION NOTES

1. EXCAVATE STREAMBED TO SUBGRADE ELEVATIONS. THE ENGINEER WILL CONFIRM WHETHER SUBGRADE EXCAVATION AND RIFFLE CONSTRUCTION ARE NECESSARY BASED ON OBSERVED SUBSTRATE CONDITIONS OR WHETHER ONE LIFT WILL BE SUFFICIENT.
2. PREPARE THE BOULDER FRAMEWORK. CONTRACTOR SHALL PLACE 18-INCH TO 24-INCH BOULDERS (CATEGORY 1 ROCK) ON OR EMBEDDED IN THE SURFACE OF THE CHANNEL SUBGRADE AS INDICATED ON THE DRAWING. DUE TO THE INHERENT VARIABILITY IN MATERIALS, BOULDER ELEVATIONS SHALL BE EMBEDDED INTO THE EXISTING SUBGRADE TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE WILL BE NO GREATER THAN 0.5-FT.
3. PLACE STREAMBED FILL IN TWO 6 INCH LIFTS OR DIRECTED BY ENGINEER.
4. PLACE THE FIRST LIFT OF STREAMBED FILL AROUND FRAMEWORK ROCK AND COMPACT USING WEIGHT OF EQUIPMENT.
5. WASH FINES AND WATER FROM ONSITE INTO THE RIVERBED FILL OF THE FIRST LIFT TO SEAL THE VOIDS.
6. PLACE THE SECOND LIFT USING MINIMAL COMPACTION.
7. WASH FINES AND WATER FROM ONSITE INTO THE RIVERBED FILL OF THE FIRST LIFT TO SEAL THE VOIDS.
8. GRADE THE RIVERBED TO MATCH FINISHED GROUND ELEVATIONS.

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	QUANTITY
1	CATEGORY 1 ROCK	0.6 EA
2	STREAMBED FILL	0.35 CY

STREAMBED FILL GRADATION - 1 (STATIONS 15+30 TO 72+54, 77+17 TO 80+71)

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
6	95	D100
5	90-95	D95
4	85-90	D84
3	65 - 85	D65
2	50 - 65	D50
1	30 - 50	D35
0.5	10 - 30	D15
FINES	0-10	

STREAMBED FILL GRADATION - 2 (STATION 72+54 TO 77+17)

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
10	95	D100
8	90-95	D95
6	85-90	D84
4	65 - 85	D65
2	50 - 65	D50
1	30 - 50	D35
0.5	10 - 30	D15
FINES	0-10	

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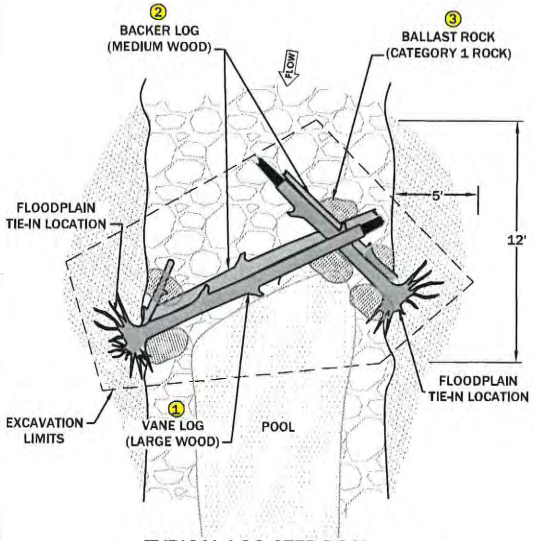
CONSTRUCTED CHANNEL STREAMBED DETAIL

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

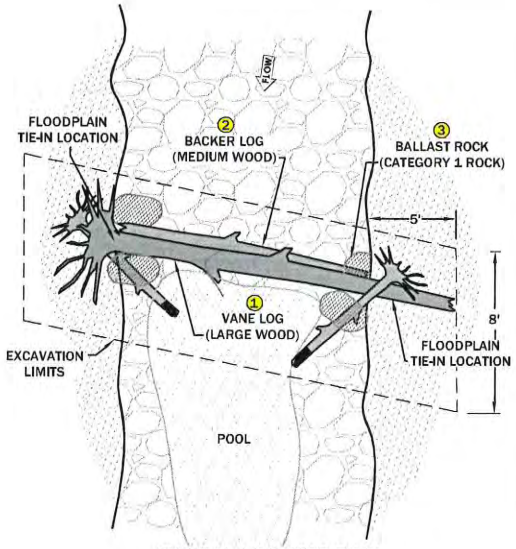
NO.	DATE	BY	DESCRIPTION	CHK.
1	11-6-18	NW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

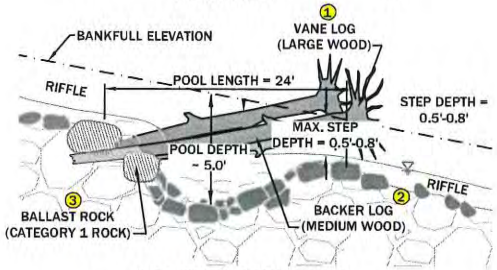
SHEET NUMBER
8.2



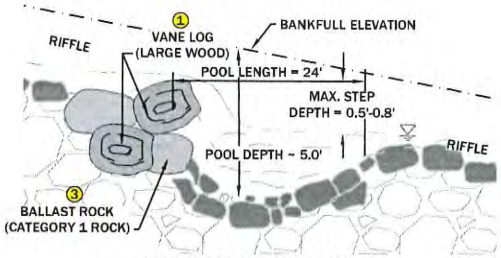
TYPICAL LOG STEP POOL
PLAN VIEW
NTS



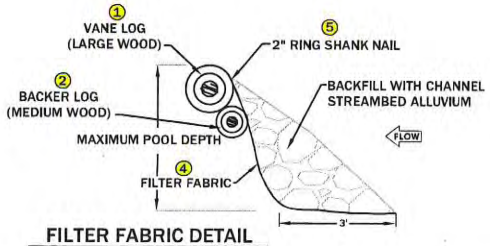
TYPICAL LOG STEP POOL
PLAN VIEW
NTS



LOG STEP POOL DETAIL
PROFILE VIEW
NTS



LOG STEP POOL DETAIL
PROFILE VIEW
NTS



FILTER FABRIC DETAIL
NTS

MATERIAL SCHEDULE (PER STRUCTURE)

	ITEM	QUANTITY
1	LARGE WOOD	4
2	MEDIUM WOOD	3
3	CATEGORY 1 ROCK	4
4	LF OF FILTER FABRIC	17
5	2" RING SHANK NAILS	20

GENERAL NOTES

1. CONSTRUCTION OF THE LOG STEP POOL WILL OCCUR PRIOR TO THE CONSTRUCTED CHANNEL STREAMBED.
2. IT IS CONTRACTOR'S RESPONSIBILITY TO CUT WOOD INTO APPROPRIATE SIZE LENGTHS TO FIT STRUCTURE DIMENSIONS.
3. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY ENGINEER.
4. CONTRACTOR SHALL MARK AND ENGINEER SHALL APPROVE THE FLOODPLAIN AND CHANNEL STREAMBED TIE-IN LOCATIONS.

CONSTRUCTION NOTES

1. EXCAVATE TO THE EXCAVATION LIMITS. EXCAVATED MATERIAL SHALL BE STOCKPILED ON THE FLOODPLAIN OUTSIDE OF THE IMMEDIATE WORK AREA.
2. INSTALL VANE LOGS (LARGE WOOD) AT THE FLOODPLAIN TIE-IN LOCATIONS AND TO THE ORIENTATIONS NOTED ON THE DRAWING. VANE LOGS SHALL BE PLACED ON CHANNEL ALLUVIUM AND THE ROOTWADS SHALL BE EMBEDDED INTO THE STREAMBANK A MINIMUM OF 5-FT. RELATIVE TO FINISHED BANK LINE.
3. ORIENT VANE LOGS IN CONTACT WITH THE CHANNEL STREAMBED AS SHOWN ON THE DRAWING. EMBED VANE LOG TIPS INTO THE CHANNEL STREAMBED A MINIMUM OF 3-FT. SLOPING AT AN ANGLE NO GREATER THAN 6% RELATIVE TO FLOODPLAIN ELEVATION. VANE LOG TIPS SHALL BE A MINIMUM OF 3-FT. BELOW THE CHANNEL STREAMBED FINISHED GRADE.
4. INSTALL BACKER LOGS (MEDIUM WOOD) ON THE UPSTREAM SIDE OF THE VANE LOGS AS SHOWN ON THE DRAWINGS. BACKER LOGS SHALL BE FLUSH WITH THE VANE LOGS AND EXTEND FROM THE FLOODPLAIN TIE-IN LOCATIONS TO THE TIPS OF THE VANE LOGS.
5. INSTALL CATEGORY 1 ROCK UPSTREAM AND DOWNSTREAM OF THE STREAMBANK TIE-IN LOCATIONS AND VANE LOG TIPS. ROCK SHALL BE IN CONTACT WITH VANE LOGS AND BACKER LOGS TO PROVIDE BALLAST AND TO PREVENT THE STRUCTURE FROM SHIFTING WHILE THE STRUCTURE IS BACKFILLED.
6. ATTACH NON-WOVEN GEOTEXTILE FABRIC TO VANE LOGS AND EXTEND VERTICALLY TO THE MAXIMUM DEPTH OF THE POOL CHANNEL CROSS-SECTION ON THE UPSTREAM SIDE OF THE STRUCTURE, AS SHOWN ON DRAWING. BACKFILL VANE LOGS WITH EXCAVATED CHANNEL STREAMBED ALLUVIUM TO CHANNEL STREAMBED FINISHED GRADE.
7. REGRADE UPSTREAM AND DOWNSTREAM CHANNEL STREAMBED FINISHED GRADE ELEVATIONS. IF EXCESS MATERIAL IS SIDECAST IN POOL DURING CONSTRUCTION, CONTRACTOR SHALL RE-EXCAVATE POOL TO THE DESIGN DEPTH AS APPROVED BY ENGINEER.

EXAMPLE OF A CONSTRUCTED LOG STEP POOL

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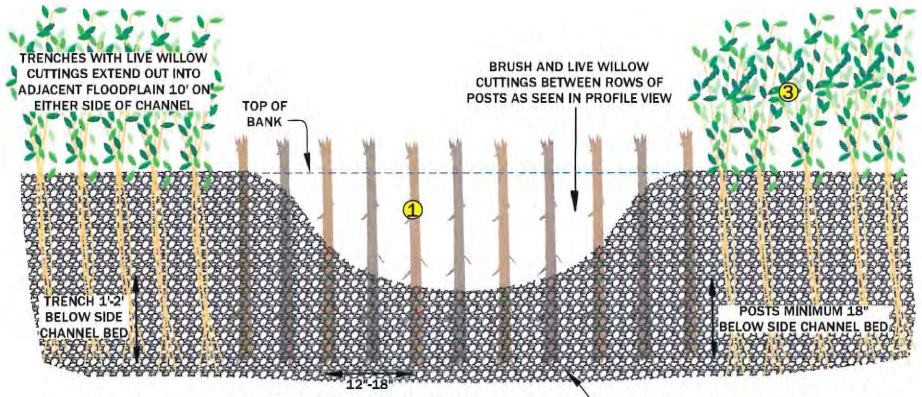
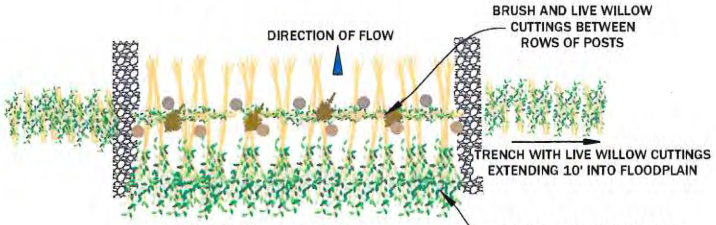
LOG STEP POOL DETAIL
BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK.
1	11-8-18	NW	FINAL DESIGN	JM

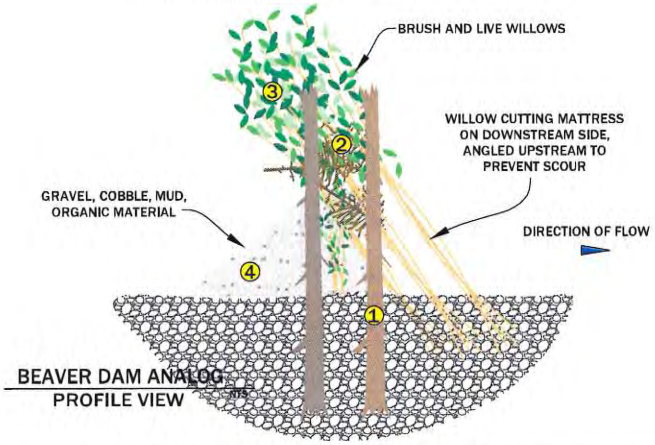
PROJECT NUMBER
RDG-17-006
SHEET NUMBER
8.3



BEAVER DAM ANALOG
SECTION VIEW
NTS



BEAVER DAM ANALOG
PLAN VIEW
NTS



BEAVER DAM ANALOG
PROFILE VIEW
NTS

GENERAL NOTES

1. CONSTRUCTION OF BEAVER DAM ANALOGS WILL OCCUR AFTER THE SIDE CHANNEL AND FLOODPLAIN SUBGRADE BACKFILL IS PLACED AND THE CHANNEL STREAMBED IS CONSTRUCTED.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY THE ENGINEER.
3. FIELD ENGINEER SHALL MARK THE GENERAL CONSTRUCTION LOCATION FOR EACH BEAVER DAM ANALOG PRIOR TO CONSTRUCTION.

CONSTRUCTION NOTES

1. CONSTRUCT BEAVER DAM ANALOGS AT LOCATIONS STAKED BY ENGINEER AFTER COMPLETION OF SIDE CHANNEL CONSTRUCTION.
2. EXCAVATE A TRENCH EXTENDING APPROXIMATELY 10 FT INTO THE FLOODPLAIN ON EITHER SIDE OF THE STAKED BEAVER DAM ANALOG LOCATION. THE TRENCH SHOULD EXTEND APPROXIMATELY 1-2 FT BELOW THE BED OF THE SIDE CHANNEL. PLACE WILLOW CUTTINGS AT A SPACING OF 5/LINEAR FOOT INTO THE TRENCH AND BACKFILL WITH EXCAVATED NATIVE FLOODPLAIN FILL.
3. INSTALL TWO ROWS OF POSTS SPANNING THE WIDTH OF THE SIDE CHANNEL BETWEEN THE TWO FLOODPLAIN TRENCHES. SPACE ROWS 12 IN APART. SPACE POSTS IN EACH ROW APPROXIMATELY 12-18 IN APART AND ENSURE THAT AT LEAST ONE ROW OF STAKES HAS ONE STAKE INSTALLED IN THE BANK OF THE SIDE CHANNEL. STAKES SHOULD BE DRIVEN A MINIMUM OF 18 IN BELOW THE BED OF THE SIDE CHANNEL.
4. INSTALL BRUSH (GREEN CONIFER BRANCHES PREFERRED) AND LIVE WILLOW CUTTINGS IN THE 12 IN SPACE BETWEEN THE TWO ROWS OF POSTS. INSTALL BRUSH AND CUTTINGS IN 0.5 FT LAYERS AND COMPACT EACH LAYER AFTER INSTALLATION.
5. PRIOR TO INSTALLING THE FINAL LAYER (0.5 FT) OF BRUSH, INSTALL A MATTRESS OF WILLOW CUTTINGS ON THE DOWNSTREAM SIDE OF THE BEAVER DAM ANALOG. ORIENT CUTTINGS IN AN UPSTREAM DIRECTION WITH THE CUT ENDS BURIED INTO THE SIDE CHANNEL BED AND THE BRANCH TIPS EXTENDING UPSTREAM AND ON TOP OF THE LAST PLACED LAYER OF BRUSH BETWEEN THE POSTS. INSTALL THE FINAL LAYER OF BRUSH BETWEEN THE POSTS ON TOP OF THE WILLOW MATTRESS CUTTINGS TO SECURE THEM.
6. INSTALL A WEDGE OF COBBLE, GRAVEL, MUD AND ORGANIC MATTER ALONG THE UPSTREAM ROW OF POSTS. COMPACT MATERIAL TO ENSURE GOOD CONTACT WITH THE POSTS, BRUSH, CHANNEL BED AND CHANNEL BANKS.

MATERIAL SCHEDULE (PER LINEAR FOOT)

	ITEM	QUANTITY	DIMENSIONS
1	UNTREATED OR SALVAGED WOODEN POSTS	1	3" D, 4' L
2	BRUSH	3	1"-3" D, 4'-8' L, GREEN WOOD PREFERRED
3	LIVE WILLOWS	5	0.5"-1" D, 4'-6' L
4	GRAVEL/COBBLE/MUD	0.4 CY	VARIES

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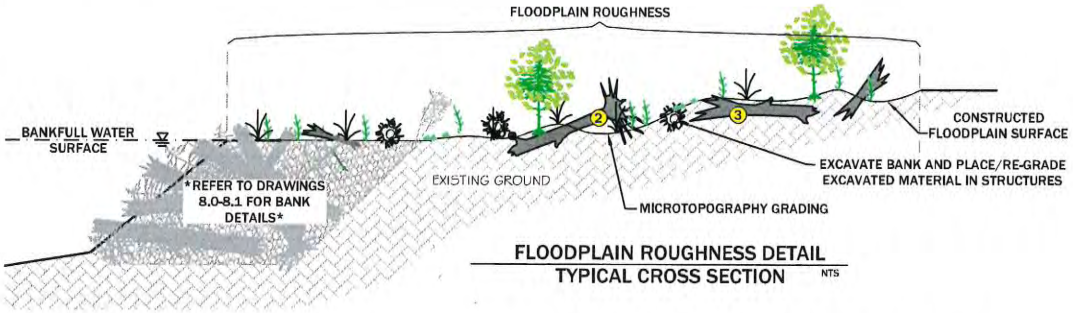
BEAVER DAM ANALOG DETAIL
BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

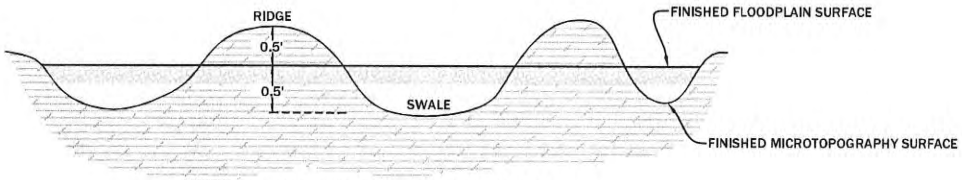
NO.	DATE	BY	DESCRIPTION	CHK
1	11-6-18	KVW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

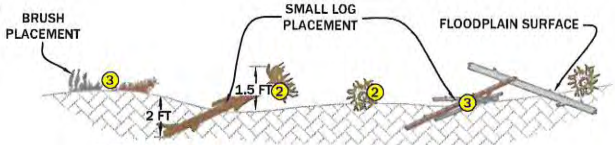
SHEET NUMBER
8.4



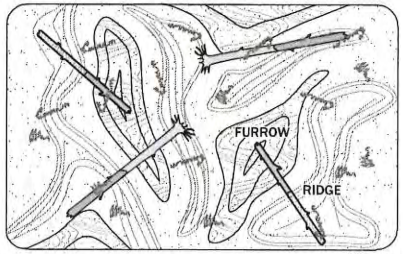
FLOODPLAIN ROUGHNESS DETAIL
TYPICAL CROSS SECTION NTS



DETAIL 1 - MICROTOPOGRAPHY GRADING
SECTION VIEW NTS



DETAIL 2 - FLOODPLAIN ROUGHNESS WOOD
SECTION VIEW NTS



DETAIL 3 - MICROTOPOGRAPHY AND FLOODPLAIN WOOD PLACEMENT
PLAN VIEW NTS

GENERAL NOTES

1. CONSTRUCTION OF FLOODPLAIN ROUGHNESS WILL OCCUR AFTER CONSTRUCTION OF THE CHANNEL STREAMBED, PLACEMENT OF GROWTH MEDIA, INSTALLATION OF LARGE WOOD STRUCTURE BANK TREATMENT, INSTALLATION OF VEGETATED WOOD MATRIX BANK TREATMENT.
2. ANY CHANGES TO THE CONSTRUCTION SEQUENCE MUST BE APPROVED BY THE ENGINEER.

CONSTRUCTION NOTES

1. CONTRACTOR SHALL DEVELOP MICROTOPOGRAPHY AND PLACE WOODY MATERIAL IN THE CONSTRUCTED FLOODPLAIN.
2. TRANSPORT SMALL WOOD AND BRUSH FROM DESIGNATED BORROW SOURCES OR STOCKPILE AREAS AND PLACE IT WITHIN THE MICROTOPOGRAPHY TREATMENT AREA AS SHOWN ON DRAWINGS.
3. PLACE SMALL WOOD AT A RATE OF 50 PIECES PER ACRE, BRUSH AT A RATE OF 150 PIECES PER ACRE AND SPACED AT A TYPICAL DISTANCE OF 20 FEET FROM OTHER COARSE WOOD.
4. BURY WOOD WITHIN THE FLOODPLAIN SURFACE, WITH ONE HALF OF THE LENGTH BURIED TO A DEPTH OF 2-FT. AND NO GREATER THAN 1.5-FT EXPOSED AS SHOWN ON DRAWING.
5. CONSTRUCT LOW AND HIGH FEATURES (RIDGES AND FURROWS) AS SHOWN ON DRAWINGS. MAXIMUM HEIGHT OF RIDGES AND DEPTH OF FURROWS SHALL BE NO GREATER THAN 0.5-FT. RELATIVE TO FINISHED FLOODPLAIN SURFACE.

MATERIAL SCHEDULE (PER ACRE)

	ITEM	QUANTITY
2	SMALL WOOD	50
3	BRUSH	150

EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS

EXAMPLE OF CONSTRUCTED FLOODPLAIN ROUGHNESS

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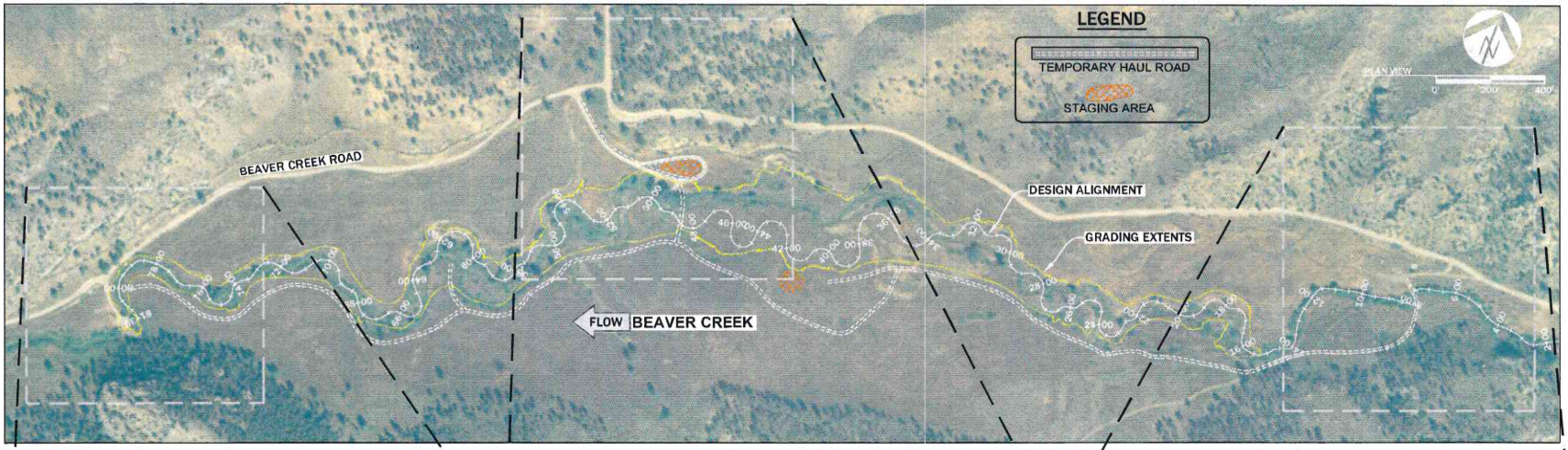
FLOODPLAIN ROUGHNESS DETAIL
BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

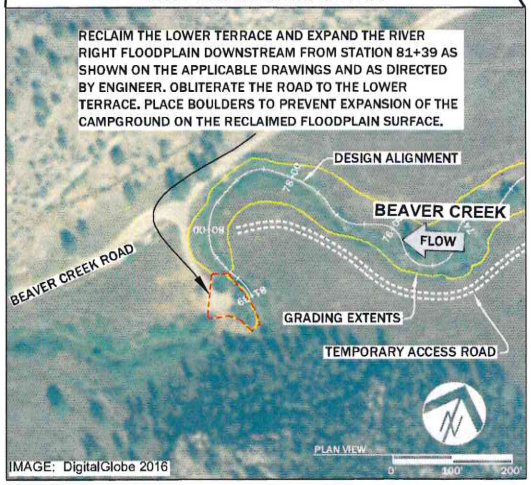
NO.	DATE	BY	DESCRIPTION	CHK
1	11-6-18	MW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

SHEET NUMBER
8.5



DISPERSED CAMPSITE #3



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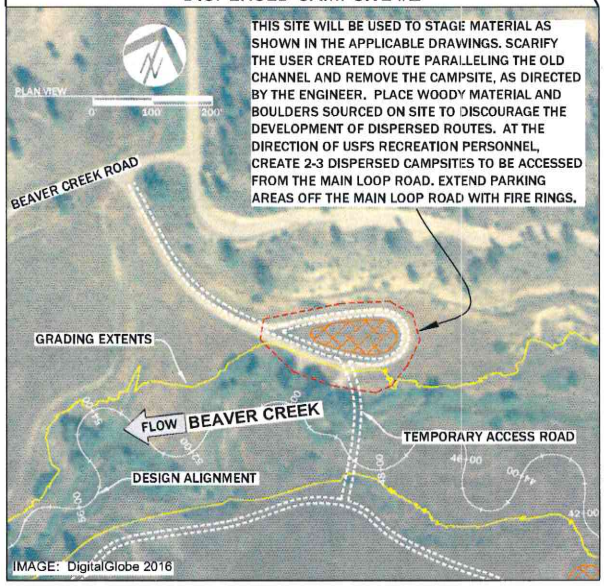

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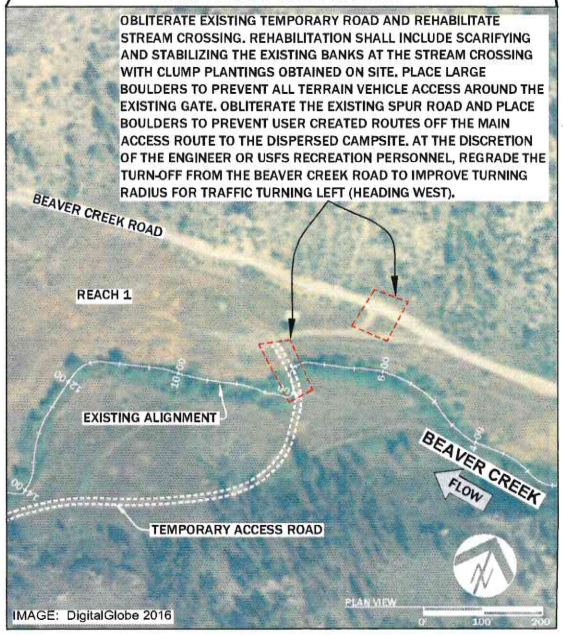

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DISPERSED CAMPGROUND DETAIL

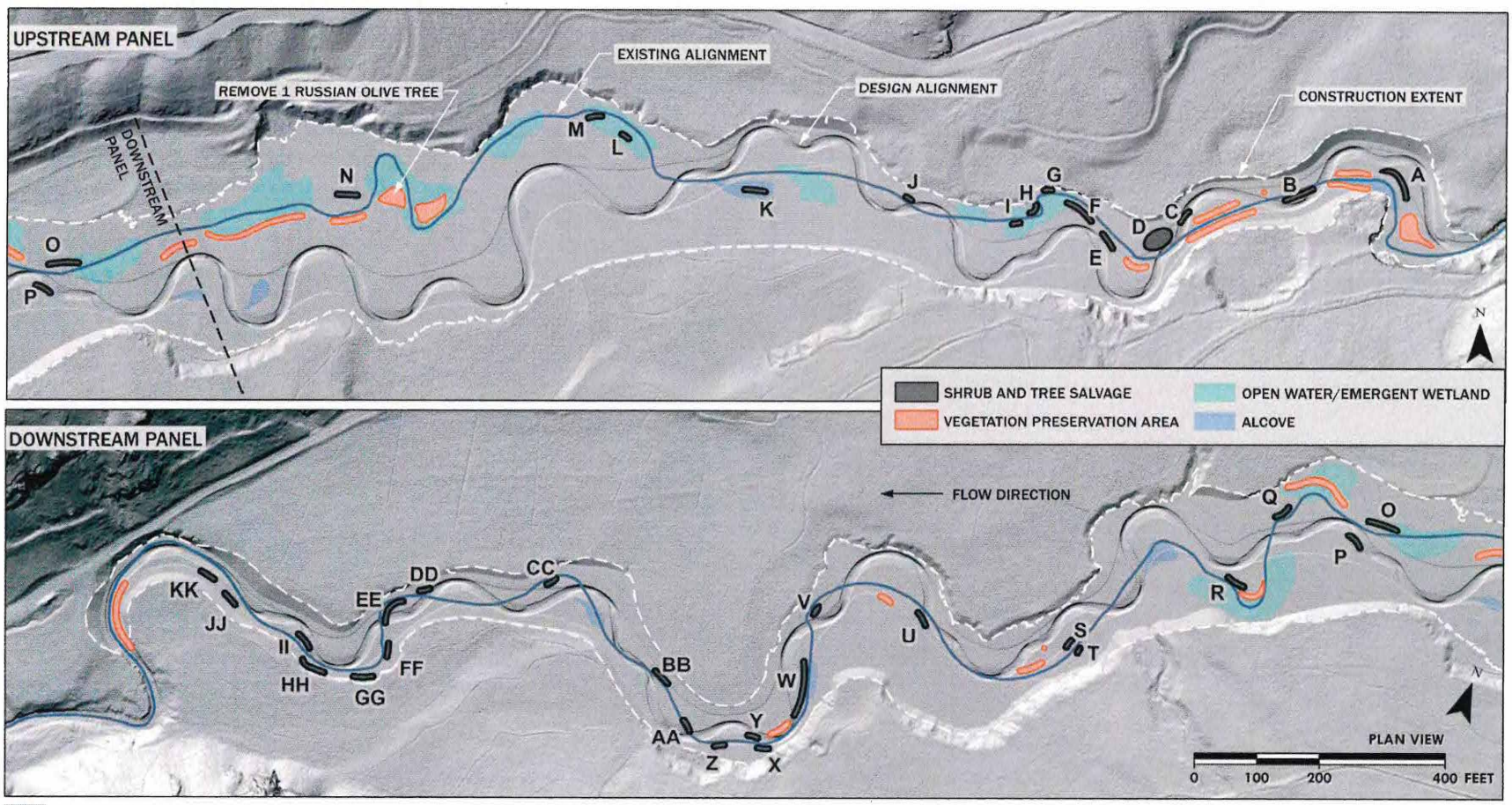
BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	11-6-18	KVV	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

SHEET NUMBER
8.6



SALVAGE SHRUBS AND TREES, TRANSPLANT TO CONSTRUCTED FLOODPLAIN

ID	SPECIES	NUMBER
A	SANDBAR WILLOW, COTTONWOOD	20
B	DOGWOD, ALDER, COTTONWOOD	5
C	SANDBAR WILLOW	5
D	COTTONWOOD SAPLINGS	50
E	SANDBAR WILLOW, DOGWOOD	3
F	SANDBAR WILLOW, COTTONWOOD, BIRCH	6
G	SANDBAR WILLOW, ALDER	2
H	COTTONWOOD	5
I	COTTONWOOD, ALDER	2
J	ALDER	1
K	COTTONWOOD SAPLINGS	20
L	YELLOW WILLOW	1

ID	SPECIES	NUMBER
M	ALDER	1
N	SANDBAR WILLOW, COTTONWOOD SAPLINGS	10
O	SANDBAR WILLOW, COTTONWOOD SAPLINGS	12
P	COTTONWOOD	5
Q	YELLOW WILLOW	4
R	SANDBAR WILLOW	5
S	COTTONWOOD	2
T	DOGWOOD	1
U	COTTONWOOD	5
V	COTTONWOOD	10
W	SANDBAR WILLOW, COTTONWOOD	15
X	COTTONWOOD	2

ID	SPECIES	NUMBER
Y	COTTONWOOD	1
Z	DOGWOOD	1
AA	COTTONWOOD	10
BB	SANDBAR WILLOW	4
CC	YELLOW WILLOW	2
DD	COTTONWOOD, ALDER	3
EE	COTTONWOOD, YELLOW WILLOW	9
FF	YELLOW WILLOW, ALDER	3
GG	YELLOW WILLOW, COTTONWOOD, ALDER	3
HH	YELLOW WILLOW, COTTONWOOD	10
II	COTTONWOOD	10
JJ	ALDER	2
KK	COTTONWOOD	2

APPROXIMATE NUMBER OF SHRUBS AND TREES TO SALVAGE AND TRANSPLANT

SPECIES	NUMBER
SANDBAR WILLOW	49
YELLOW WILLOW	19
COTTONWOOD	166
ALDER	11
DOGWOOD	7
TOTAL	252

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VEGETATION SALVAGE PLAN

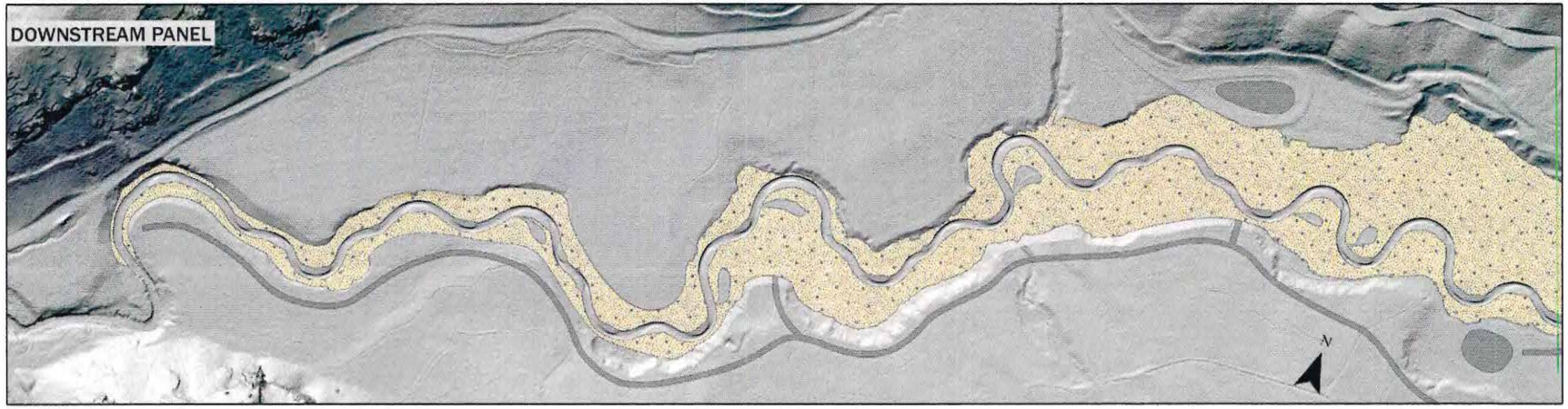
BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

NO.	DATE	BY	DESCRIPTION	CHK
1	11-6-18	KVW	FINAL DESIGN	JM

PROJECT NUMBER
RDG-17-006

SHEET NUMBER
9.0



LOCATION	SPECIES		PLS/ACRE	TOTAL PLS LBS
FLOODPLAIN 13.38 ACRES	IDAHO FESCUE	*FESTUCA IDAHOENSIS*	3.05	40.78
	BLUEBUNCH WHEATGRASS	*PSEUDOROEGNERIA SPICATA*	6.86	91.75
	THICKSPIKE WHEATGRASS	*ELYMUS MACROURUS*	6.86	91.75
	SLENDER WHEATGRASS	*ELYMUS TRACHYCAULUS*	4.76	63.71
			TOTAL	287.99

UPLAND 1.65 ACRES	IDAHO FESCUE	*FESTUCA IDAHOENSIS*	2.46	4.06
	BLUEBUNCH WHEATGRASS	*PSEUDOROEGNERIA SPICATA*	5.54	9.14
	STREAMBANK WHEATGRASS	*ELYMUS LANCEOLATUS*	5.54	9.14
	MOUNTAIN BROME	*BROMUS MARGINATUS*	15.38	25.38
			TOTAL	47.72

PLAN VIEW

0 100 200 400 FEET

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SEEDING PLAN AND SCHEDULE

BEAVER CREEK RESTORATION PROJECT
NEAR YORK, MONTANA

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WOODY VEGETATION SALVAGE

YOUNG WILLOW, COTTONWOOD, ALDER, AND DOGWOOD SHRUBS/TREES SHALL BE SALVAGED AS SPECIFIED ON SHEET 9.0 (VEGETATION SALVAGE PLAN) TO THE GREATEST EXTENT POSSIBLE AND PLANTED IN LOCATIONS ON THE CONSTRUCTED FLOODPLAIN, SPECIFIED ON-SITE BY THE CONSTRUCTION MANAGER. HARVEST SHALL OCCUR SUCH THAT AN INTACT ROOT BALL REMAINS. SHRUBS AND TREE SHALL BE YOUNG AND BETWEEN 3 AND 10 FEET TALL, AND THE ROOTBALL (ROOTS AND SOIL MASS) SHALL BE THE DEPTH OF THE EXCAVATOR BUCKET. THE ROOTBALL SHALL BE WRAPPED IN BIODEGRADABLE BURLAP AND TWINE TO HOLD IT IN PLACE DURING TRANSPORT, AND SHALL BE LEFT UNDER THE TRANSPLANT DURING PLANTING, TAKING CARE TO NOT EXPOSE BURLAP ABOVE THE SOIL LINE. A SUITABLE STOCKPILE LOCATION SHALL BE IDENTIFIED BY THE CONSTRUCTION MANAGER FOR STAGING THE TREES/SHRUBS BEFORE THEY CAN BE PLANTED IN APPROPRIATE LOCATIONS. PLANTING HOLES SHALL BE PRE-DUG IN LOCATIONS SPECIFIED BY THE CONSTRUCTION MANAGER. THE HOLES SHALL BE BACKFILLED WITH SOIL AND WATER AFTER PLANTING. FILL SHALL BE ADEQUATELY COMPACTED TO MINIMIZE AIR POCKETS, BY LIGHLY TAMPING THE SOIL WITH THE EXCAVATOR BUCKET. TRANSPLANTS SHALL BE THOROUGHLY WATERED IMMEDIATELY FOLLOWING INSTALLATION. TRANSPLANTS SHALL BE PRUNED BACK FOLLOWING PLANTING, CUTTING OFF ONE-THIRD TO ONE-HALF OF THE ABOVE-GROUND BIOMASS.

BROADCAST SEEDING

BROADCAST SEEDING SHALL OCCUR IN ALL DISTURBED AREAS OUTSIDE OF THE CHANNEL AND POINT BAR AREAS. COMMERCIAL SEED MIXES AND BROADCAST RATES ARE PROVIDED ON SHEET 9.3 (SEEDING SCHEDULE). IN ADDITION TO BROADCAST SEEDING OF FLOODPLAINS, SLOPE AREAS, AND DITCH RECLAMATION AREAS, SEEDING SHALL OCCUR ON ALL DISTURBED UPLAND SITES (MATERIALS STAGING AREAS, ACCESS ROUTES) AND SHALL CONSIST OF THE UPLAND SPECIES MIX AND SEEDING RATE (LBS/ACRE). SEED BROADCAST AREAS ARE DEFINED ON SHEET 9.1 (SEEDING PLAN). THE BROADCAST METHOD SHALL BE USED, WHEREBY SEED IS SCATTERED ON THE SURFACE OF THE GROUND INSTEAD OF PLANTED IN THE GROUND. FLOODPLAIN AREAS WITH MICROTOPOGRAPHY TREATMENT SHALL BE BROADCAST SEEDED AND DRAGGED. SEEDBEDS IN ALL OTHER AREAS SHALL BE PREPARED BY ROUGHENING THE SOIL SURFACE PRIOR TO SEED BROADCAST, THEN SEEEDED AND HARROWED. FLOODPLAIN AND UPLAND BROADCAST SEEDING SHALL OCCUR IN LATE FALL OR EARLY SPRING DEPENDING ON THE CONSTRUCTION TIMELINE.

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REVEGETATION SPECIFICATIONS

BEAVER CREEK RESTORATION PROJECT

NEAR YORK, MONTANA

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9.2

Material Quantities

Category	Item	Quantity	Units	Diameter	Length
Wood	Large Wood	304	ea	10 in - 12 in	15 ft - 20 ft
	Medium Wood	374	ea	8 in - 10 in	10 ft - 15 ft
	Small Wood	5,190	ea	3 in - 6 in	8 ft - 10 ft
	Brush	5,234	ea	3 in minus	8 ft - 10 ft
	Willow Cuttings	47,375	ea	0.25 in	6 ft - 8 ft

Category	Item	Quantity	Units	Diameter	Quantity	Units
Rock	Category 1 Rock (18"-24") (ea)	2,488	ea	30 in - 36 in	2289	yd^3
	Streambed Fill Gradation 1 (CY)	5,190	yd^3			
	Streambed Fill Gradation 2 (CY)	804	yd^3			
	8oz Amoco ProPex4553 Nonwoven Needlepunched (felt Geotextile) (sf)	51	lf			
	2" 6d Ringshank Nails w/washers (#)	60	ea			

Structure Quantities

Structure	Quantity	Units
Large Wood Structure	73	ea
Constructed Channel Streambed	4,127	lf
Vegetated Wood Matrix Type 1	1,161	lf
Vegetated Wood Matrix Type 2	5,663	lf
Vegetated Wood Matrix Type 3	2,817	lf
Log Step Pool	3	ea
Beaver Dam Analog	10	ea
Microtopography	13	ac

Earthwork Quantities

Earthwork	Quantity	Units
Cut	26,560	cy
Fill	18,720	cy
Net	7,840	cy

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MATERIALS LIST
BEAVER CREEK RESTORATION PROJECT
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10.0