

# NEVADA CREEK PHASE 2 RESTORATION PROJECT CONCEPTUAL DESIGN

## PROJECT PARTNERS



BIG BLACKFOOT CHAPTER OF TROUT UNLIMITED  
P.O. BOX 1  
OVANDO, MONTANA 59854



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



US FISH AND WILDLIFE SERVICE  
P.O. BOX 66  
196 LOWER LAKE SIDE LANE  
OVANDO, MONTANA 59854

## PROJECT DESCRIPTION

BIG BLACKFOOT CHAPTER OF TROUT UNLIMITED (BBCTU), IN COOPERATION WITH MONTANA FISH, WILDLIFE & PARKS (MFWP) AND THE U.S. FISH AND WILDLIFE SERVICE (USFWS), RETAINED RIVER DESIGN GROUP, INC. TO DEVELOP CHANNEL, AQUATIC HABITAT, AND FLOODPLAIN RESTORATION PLANS FOR A 3,700 REACH OF NEVADA CREEK, LOCATED APPROXIMATELY 55 MILES EAST OF MISSOULA, MONTANA. NEVADA CREEK IS A THIRD ORDER TRIBUTARY TO THE MIDDLE BLACKFOOT RIVER AND SUPPORTS POPULATIONS OF WESTSLOPE CUTTHROAT TROUT, RAINBOW TROUT, BROWN TROUT AND OTHER FISH SPECIES. NEVADA CREEK HAS BEEN IDENTIFIED AS AN IMPAIRED WATERBODY BY THE MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY. THE STREAM IS CONSIDERED NONSUPPORTING OF AQUATIC LIFE, COLD WATER FISHERY, AND CONTACT RECREATION DUE TO SEDIMENT AND HABITAT RELATED CAUSES (MDEQ 2008). PROBABLE CAUSES OF WATER QUALITY IMPAIRMENT INCLUDE LOW FLOW ALTERATION, TOTAL PHOSPHORUS, PHYSICAL SUBSTRATE, HABITAT ALTERATIONS, SEDIMENTATION/SILTATION, AND TOTAL NITROGEN. PROBABLE SOURCES OF IMPAIRMENT INCLUDE AGRICULTURE AND STREAMBANK MODIFICATION/DESTABILIZATION.

IN 2012, A 4,400 FOOT REACH OF NEVADA CREEK DOWNSTREAM OF NEVADA CREEK RESERVOIR (PHASE 1) WAS RESTORED TO ADDRESS PRIMARY CAUSES OF WATER QUALITY IMPAIRMENT INCLUDING STREAMBANK MODIFICATIONS AND PHYSICAL HABITAT ALTERATIONS. THE PROJECT INVOLVED RESTORING STREAMBANK AND FLOODPLAIN CONDITIONS TO REDUCE STREAMBANK EROSION AND SEDIMENT LOADING TO NEVADA CREEK, AND ENHANCING CHANNEL MORPHOLOGY WITH RIFFLE AND POOL HABITAT FEATURES. BASED ON PHYSICAL EFFECTIVENESS MONITORING, PHASE 1 HAS BEEN SUCCESSFUL IN MEETING THE INTENDED PROJECT GOALS AND SEDIMENT REDUCTION TARGETS. THIS PROJECT IS A CONTINUATION OF PHASE 1, AND WILL CONSIST OF APPROXIMATELY 3,700 FEET OF CHANNEL. SIMILAR TO PHASE 1, THIS PROJECT WILL SUBSTANTIALLY REDUCE STREAMBANK RELATED SOURCES OF SEDIMENT TO NEVADA CREEK AND RECONNECT AND RE-ESTABLISH FUNCTIONING FLOODPLAIN SURFACES, WHILE SETTING THE STAGE FOR RECOVERY OF THE RIPARIAN ZONE AND AQUATIC HABITAT CONDITIONS.

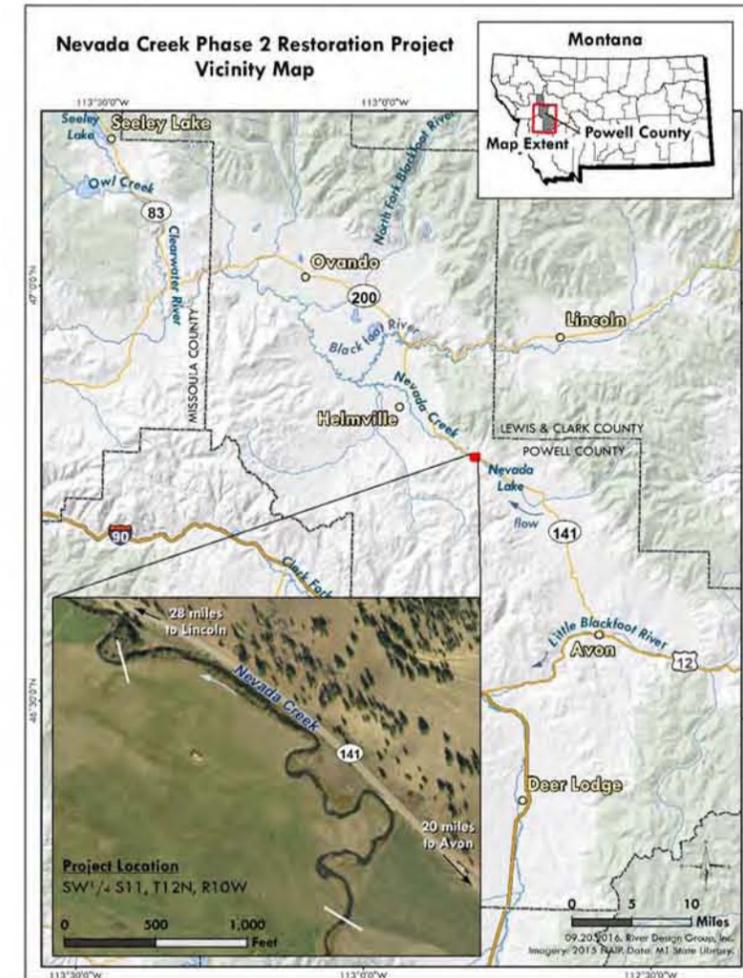
## GENERAL NOTES

1. CONTOUR INTERVAL IS NOTED ON DRAWINGS.
2. SLOPES DESIGNATED AS 2:1, 1.5:1, ET CETERA, ARE THE RATIOS OF HORIZONTAL DISTANCE TO VERTICAL DISTANCE.
3. DIMENSIONS ARE NOTED IN FEET AND TENTHS OF A FOOT.
4. TOPOGRAPHY AND CROSS SECTION GROUND LINES ARE BASED ON SURVEY WORK PERFORMED FROM JULY TO AUGUST 2016. LIDAR DATA WAS COLLECTED BY TROUT UNLIMITED. ALL LIDAR DATA WAS COORDINATED BY RDG.
5. ALL EXISTING CONDITIONS ARE TO BE VERIFIED IN THE FIELD PRIOR TO CONSTRUCTION AND ANY ADJUSTMENTS TO THE DRAWINGS SHALL BE MADE AS DIRECTED BY THE ENGINEER.
6. EXISTING PRIVATE IMPROVEMENTS, WHICH LIE WITHIN THE CONSTRUCTION LIMITS, UNLESS OTHERWISE NOTED WILL BE REMOVED BY THE OWNER PRIOR TO CONSTRUCTION, OR ABANDONED IN PLACE.
7. PROTECT ALL TREES AND LAND AREAS NOT LOCATED WITHIN THE PROJECT CONSTRUCTION STAGING OR EARTHWORK LIMITS. EXERCISE CARE IN AREAS NOT SO MARKED TO AVOID UNNECESSARY DAMAGE TO NATURAL VEGETATION.
8. THE PROJECT SPONSOR IS RESPONSIBLE FOR COMPLYING WITH ALL PERMITS AND EASEMENTS INCLUDING ALL FEDERAL, STATE, COUNTY, AND LOCAL PERMIT CONDITIONS.
9. EXCAVATION, TRENCHING, SHORING, AND SHIELDING SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR PERFORMING THE WORK, THESE DRAWINGS ARE NOT INTENDED TO PROVIDE MEANS OR METHODS OF CONSTRUCTION.
10. EXCAVATION SHALL MEET THE REQUIREMENTS OF OSHA 29 CFR PART 1926, SUBPART P, EXCAVATIONS. ACTUAL SLOPES SHALL NOT EXCEED THE SLOPES AS INDICATED ON DRAWINGS.
11. ALL EXCAVATORS AND BULLDOZERS SHALL BE EQUIPPED WITH MACHINE GRADE GPS ((L1/L2/GLONASS)), CONSTRUCTION AREAS WILL BE STAKED OUT PRIOR TO CONSTRUCTION USING SURVEY GRADE GPS (L1/L2/GLONASS).
12. ENGINEER WILL PROVIDE SURVEY CONTROL AND GRADING SURFACES FOR EQUIPMENT WITH GPS MACHINE CONTROL CAPABILITY. CONTRACTOR SHALL PROVIDE SURVEY STAKING AND LAYOUT FOR CONSTRUCTION.
13. VERTICAL TOLERANCE FOR CONSTRUCTION COMPLIANCE WILL BE 0.3 FEET. HORIZONTAL TOLERANCE WILL BE 1.0 FEET.
14. CONTRACTOR SHALL CONFIRM QUANTITIES. REPORTED VOLUMES ARE NEATLINE AND DO NOT INCLUDE ADJUSTMENTS FOR COMPACTION OR OTHER FACTORS.

## DRAWING INDEX

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## NEVADA CREEK PHASE 2 VICINITY MAP

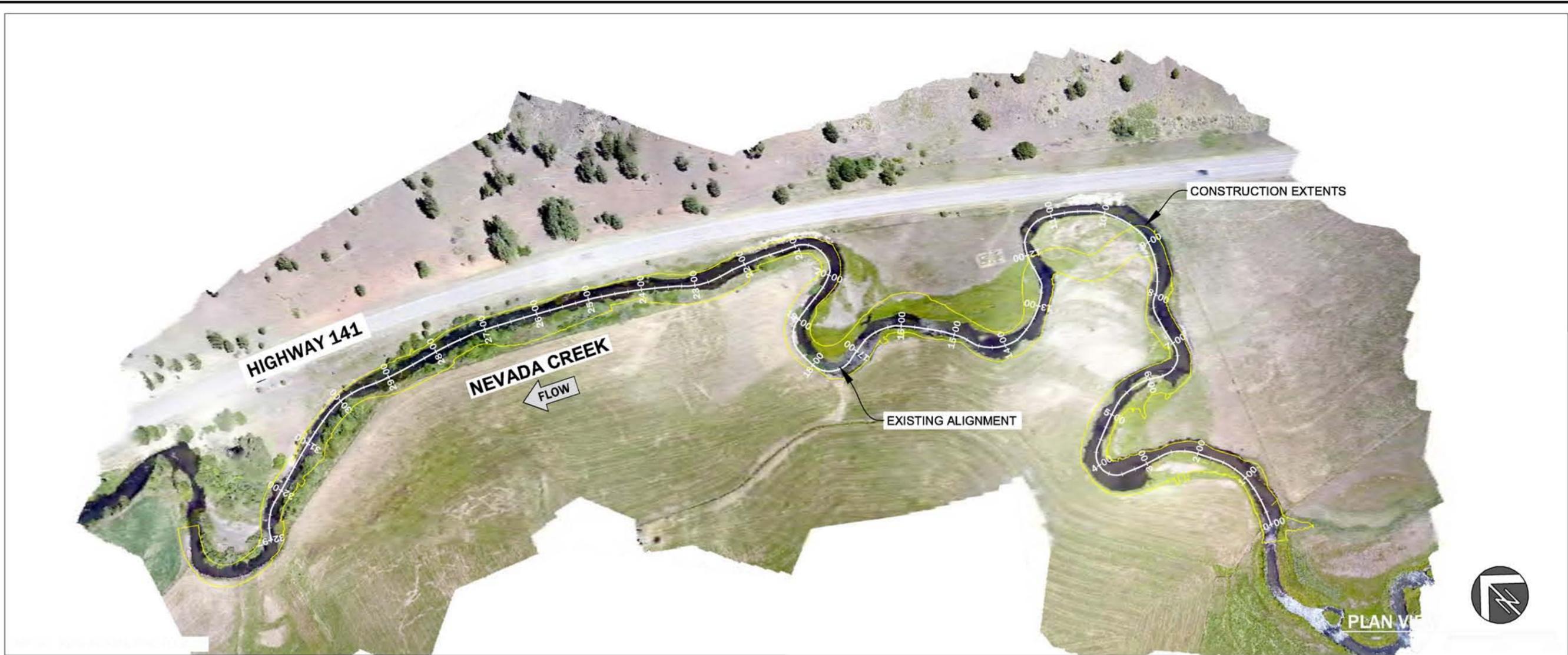


## STANDARD OF PRACTICE

RIVER DESIGN GROUP, INC. WORKS EXCLUSIVELY IN THE RIVER ENVIRONMENT AND UTILIZES THE MOST CURRENT AND ACCEPTED PRACTICES AVAILABLE FOR PLANNING AND DESIGN OF RIVER, FLOODPLAIN, AND AQUATIC HABITAT RESTORATION PROJECTS. CURRENT STANDARDS FOR THE DESIGN OF RESTORATION PROJECTS VARY DEPENDING ON PROJECT GOALS. STABILITY CRITERIA INCLUDE DESIGNING STREAMBED AND STREAMBANK STRUCTURES FOR THE 10-YEAR RECURRENCE INTERVAL FLOOD. HEC-RAS, A ONE-DIMENSIONAL RIVER ANALYSIS MODEL WAS USED TO COMPLETE HYDRAULIC MODELING AND EVALUATE WATER SURFACE ELEVATIONS, CHANNEL AND OVERBANK SHEAR STRESSES, AND VELOCITIES FOR A RANGE OF FLOWS, INCLUDING BANKFULL DISCHARGE, THE 10-YEAR DESIGN STABILITY FLOW, AND HIGHER RETURN INTERVAL DISCHARGES INCLUDING THE 100-YEAR FLOW.

COVER PAGE

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	PRELIMINARY DESIGN	JM
			preliminary	
			-not for construction-	
PROJECT NUMBER				
RDG-16-041				
SHEET NUMBER				
1.0				



**EXISTING CONDITIONS**

**EXISTING CONDITIONS**

THE PHASE 2 PROJECT AREA IS LOCATED IN THE LOWER NEVADA CREEK WATERSHED, WHICH EXTENDS FROM NEVADA CREEK RESERVOIR TO THE CONFLUENCE WITH THE MAINSTEM BLACKFOOT RIVER. THE PROJECT AREA IS CONTAINED WITHIN A SEGMENT OF NEVADA CREEK THAT IS CONSIDERED NONSUPPORTING OF AQUATIC LIFE, COLD WATER FISHERY, AND CONTACT RECREATION DUE TO SEDIMENT AND HABITAT RELATED IMPAIRMENT CAUSES. THE SEDIMENT/HABITAT RELATED 303(D) LISTINGS FOR LOWER NEVADA CREEK ARE FLOW ALTERATIONS, PHYSICAL SUBSTRATE HABITAT ALTERATIONS, AND SEDIMENTATION/SILTATION (MDEQ 2008). SOURCE OF IMPAIRMENT INCLUDE AGRICULTURE AND BANK MODIFICATION/DESTABILIZATION. AN ESTIMATED 215.6 TONS PER YEAR OF SEDIMENT ARE GENERATED IN THE PROJECT AREA FROM STREAMBANK RELATED SOURCES OF SEDIMENT. APPROXIMATELY 59% OF STREAMBANKS IN THE PROJECT AREA (4,074 FEET) DISPLAY MEDIUM TO VERY HIGH BANK ERODIBILITY HAZARD RATINGS. 545 LINEAR FEET OF STREAMBANK HAVE BEEN STABILIZED WITH ROCK RIP-RAP.

MFWP (PIERCE, ET AL, 2002B) HAS IDENTIFIED THE FOLLOWING FISHERIES-RELATED IMPAIRMENTS ON LOWER NEVADA CREEK: 1) IRRIGATION IMPACTS (ENTRAINMENT AND DEWATERING); 2) CHANNEL ALTERATIONS; 3) LACK OF INSTREAM COMPLEXITY; 4) DEGRADED RIPARIAN VEGETATION DUE TO EXCESSIVE LIVESTOCK ACCESS; AND 5) LOW WATER QUALITY. LOWER NEVADA CREEK HAS BEEN DESCRIBED AS HAVING HISTORICALLY LIKELY BEEN A BEAVER/WILLOW COMPLEX THAT HAS BEEN CONVERTED TO HAY/GRAZING MEADOWS THROUGH CONTROL OF BEAVER (PIERCE, ET AL, 2001). TO DATE, RESTORATION PROJECTS ON LOWER NEVADA CREEK HAVE INCLUDED GRAZING MANAGEMENT, INSTALLATION OF FISH LADDERS AND SCREENS ON IRRIGATION DIVERSIONS, AND IMPLEMENTATION OF THE PHASE 1 RESTORATION PROJECT IMMEDIATELY DOWNSTREAM OF NEVADA CREEK RESERVOIR IN 2012.

THE NEVADA CREEK PHASE 2 RESTORATION PROJECT ENCOMPASSES 3,500 OF CHANNEL. THE PROJECT INCLUDES TWO SUB-REACHES. THE UPPER REACH IS CHARACTERIZED BY MODERATE CHANNEL ENTRENCHMENT WITH FLOODPLAIN AND LOW TERRACE SURFACES ADJACENT TO THE CHANNEL SUPPORTING HERBACEOUS WETLANDS. DUE TO CHANNEL WIDENING AND ENLARGEMENT, HISTORICAL FLOODPLAIN SURFACES ARE MOSTLY DISCONNECTED FROM THE CHANNEL. SEVERE STREAMBANK EROSION OCCURS OVER MOST OF THE UPPER REACH DUE TO CHANNEL ENTRENCHMENT AND LAND USE PRACTICES THAT HAVE DISPLACED WOODY RIPARIAN VEGETATION RESULTING IN DECREASED STREAMBANK ROOTING DENSITY AND DEPTH. THE STREAM CLASSIFIES AS A HIGH WIDTH-TO-DEPTH RATIO C4 STREAM TYPE WITH GRADIENTS RANGING FROM 0.2 TO 0.5 PERCENT. BED MATERIALS ARE PREDOMINANTLY GRAVEL AND COBBLE WITH A HIGH PERCENTAGE OF SANDS AND SILTS.

THE LOWER REACH IS HIGHLY ENTRENCHED DUE TO CHANNEL STRAIGHTENING AND HIGHWAY ENCROACHMENT. BANK EROSION, LACK OF FLOODPLAIN CONNECTIVITY, STORMWATER RUNOFF FROM THE HIGHWAY, AND LACK OF WETLAND/RIPARIAN VEGETATION CHARACTERIZE THE REACH. THE STREAM CLASSIFIES AS BOTH B4 AND F4 STREAM TYPES DEPENDING ON THE DEGREE OF ENTRENCHMENT. A SHORT INCLUSION OF C4 STREAM TYPE OCCURS AT THE DOWNSTREAM END OF THE REACH. STREAM GRADIENT AVERAGES 0.4 PERCENT.

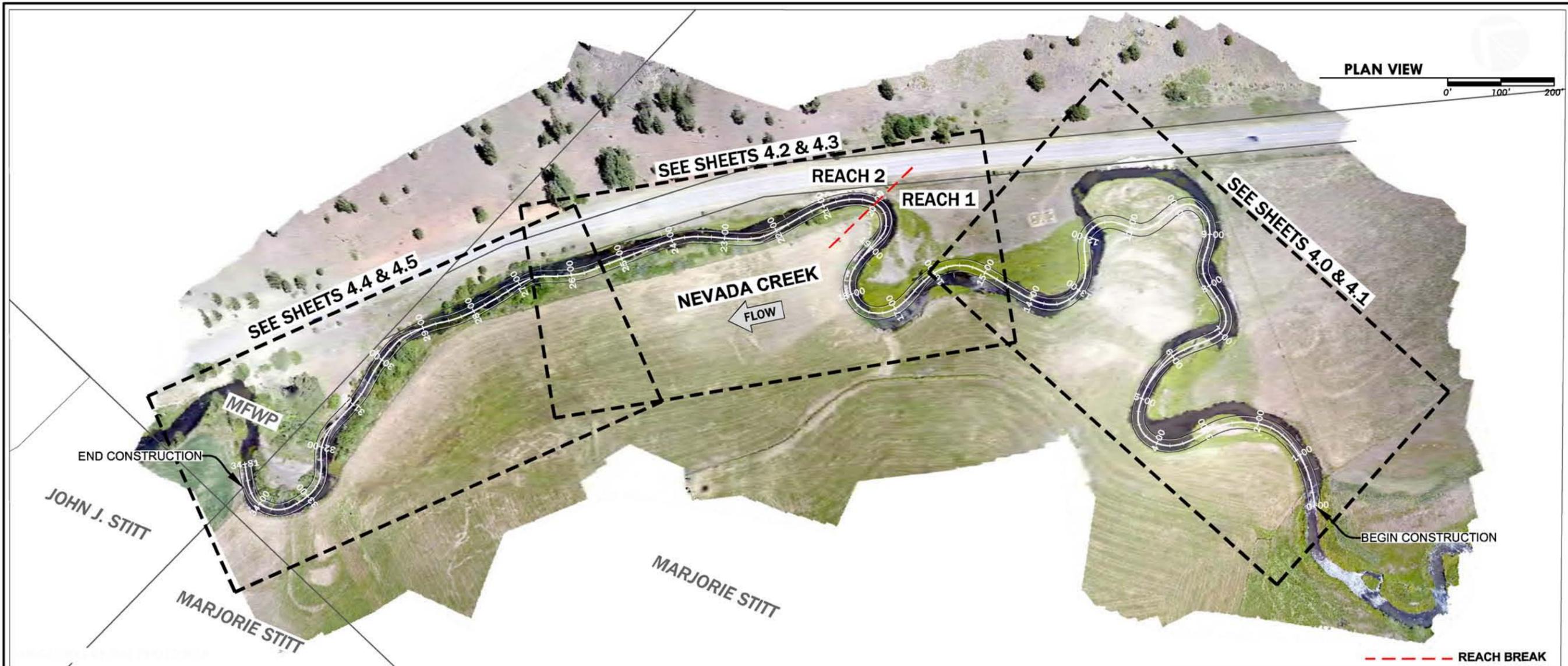
THE CONSTRAINTS AND LIMITING FACTORS IDENTIFIED DURING THE GEOMORPHIC INVESTIGATION INCLUDE:

- HIGH CHANNEL ENTRENCHMENT RATIOS AND DISCONNECTED FLOODPLAIN SURFACES, PARTICULARLY IN THE LOWER REACH.
- VERY HIGH CHANNEL WIDTH-TO-DEPTH RATIOS THROUGH MOST OF THE UPPER REACH.
- MEDIUM TO VERY HIGH BANK ERODIBILITY CONDITIONS THROUGH MOST OF THE UPPER REACH.
- LACK OF WOODY RIPARIAN SHRUBS THROUGH MOST OF THE UPPER REACH.
- PAST BANK STABILIZATION PRACTICES, PRIMARILY RIP RAP, LIMIT VEGETATION ESTABLISHMENT AND CHANNEL MARGIN COMPLEXITY.
- SIMPLIFIED AQUATIC HABITAT CONDITIONS, INCLUDING LOW POOL FREQUENCY AND LONG, EXTENDED RIFFLES WITH A HIGH PERCENTAGE OF FINE SEDIMENT.

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	DESIGN	JM
<i>preliminary</i>				
<i>-not for construction-</i>				

PROJECT NUMBER  
RDG-16-041

SHEET NUMBER  
**2.0**



**SITE PLAN AND INDEX**

**RESTORATION ALTERNATIVES**

RESTORATION ALTERNATIVES FOR THE NEVADA CREEK PHASE 2 RESTORATION PROJECT WERE DEVELOPED BY RIVER DESIGN GROUP IN CONSULTATION WITH BBCTU, MFWP, AND USFWS. ALTERNATIVES CONSIDERED BUT NOT SELECTED RANGED FROM NO ACTION (ALTERNATIVE 1) TO EXPANDING THE FLOODPLAIN AND CONVERTING THE EXISTING CHANNEL TO A C4 STREAM TYPE (ALTERNATIVE 2). DUE TO LANDOWNER CONCERNS, A PREFERRED ALTERNATIVE (ALTERNATIVE 3) WAS DEVELOPED THAT BALANCES NATURAL RESOURCE OBJECTIVES AND FUTURE LAND USE NEEDS (RANCHING AND AGRICULTURE). THE PREFERRED ALTERNATIVE WILL RESTORE THE CHANNEL AND FLOODPLAIN WITHIN THE EXISTING MEANDER BELT WIDTH ALONG A MAJORITY OF THE PROJECT LENGTH. EXISTING TERRACES IN THE UPPER REACH THAT CURRENTLY SUPPORT UPLAND VEGETATION WILL BE LOWERED TO BANKFULL ELEVATION TO ENCOURAGE DEVELOPMENT OF HERBACEOUS AND SCRUB-SHRUB WETLAND COMMUNITIES ON NEWLY CREATED FLOODPLAIN SURFACES. EXPANDING THE MEANDER BELT WIDTH IN THE LOWER REACH IS PROPOSED TO MITIGATE IMPACTS RESULTING FROM HIGHWAY ENCROACHMENT. THE PREFERRED ALTERNATIVE INCORPORATES A GRAZING MANAGEMENT STRATEGY THAT RESTRICTS GRAZING WITHIN THE FLOODPLAIN CORRIDOR. EXCLOSURE FENCING AND OFF-CHANNEL WATERING SOURCES WILL BE INSTALLED AS COMPONENTS TO THE PLAN.

**RESTORATION OBJECTIVES**

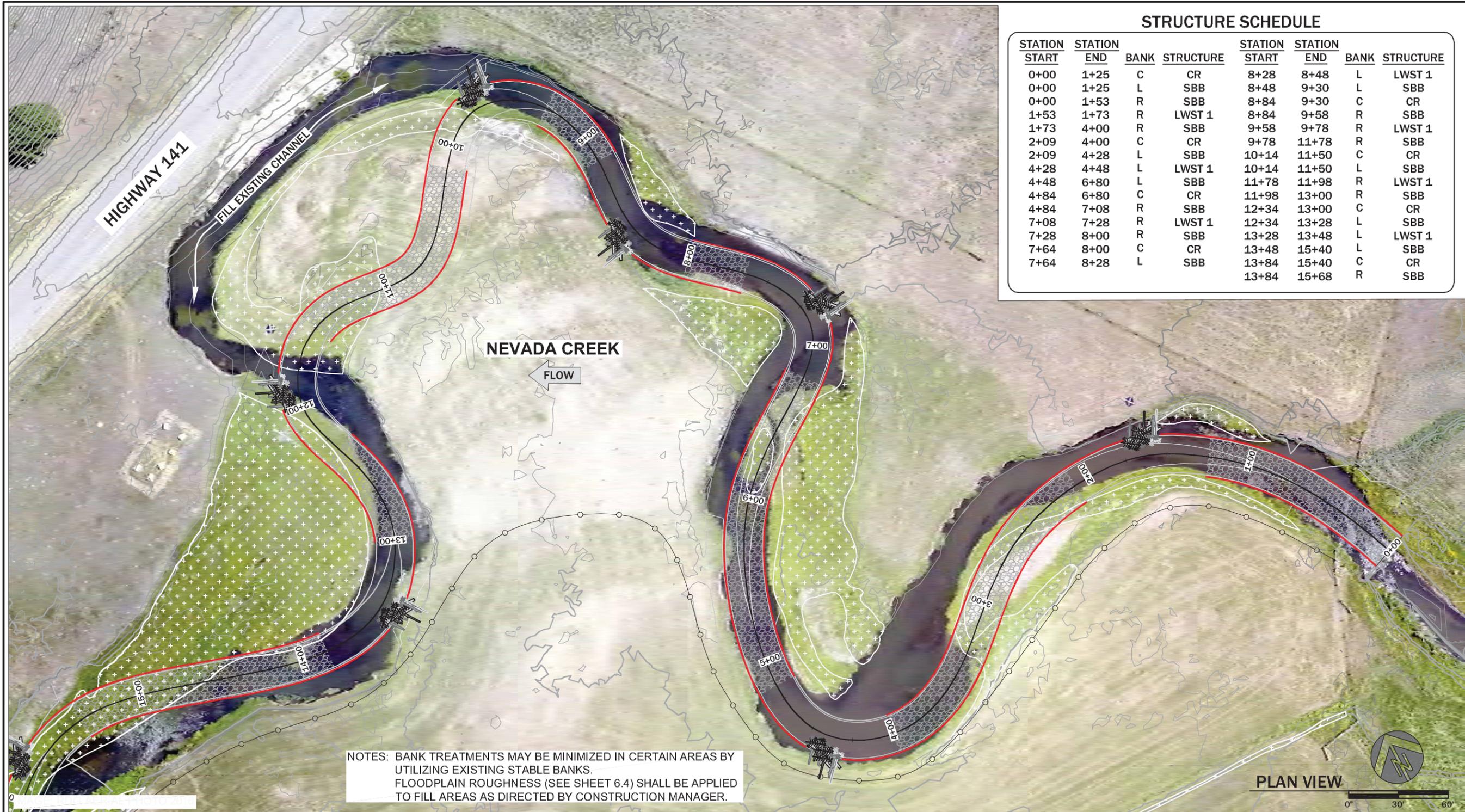
- THE FOLLOWING OBJECTIVES WERE DEVELOPED BY BBCTU IN CONJUNCTION WITH USFWS AND MFWP:
- IMPROVE INSTREAM AQUATIC HABITAT CONDITIONS FOR SALMONIDS BY LOWERING CHANNEL WIDTH-TO-DEPTH RATIOS, INCREASING POOL FREQUENCY, OVERHEAD COVER, CHANNEL MARGIN COMPLEXITY, AND THE DISTRIBUTION OF RIFFLE, RUN, POOL AND GLIDE CHANNEL HABITAT UNITS.
  - DECREASE SURFACE WATER TEMPERATURE BY REDUCING CHANNEL WIDTH-TO-DEPTH RATIOS, INCREASING VEGETATION COVER AND SHADE, AND ENHANCING HYPORHEIC FLOW EXCHANGE BETWEEN THE FLOODPLAIN, WETLANDS, AND CHANNEL.
  - REDUCE SEDIMENT SUPPLY BY RESTORING STREAMBANKS WITH VEGETATION AND WOOD.
  - IMPLEMENT FLOODPLAIN RESTORATION TREATMENTS THAT SET THE STAGE FOR NATURAL RECRUITMENT OF RIPARIAN VEGETATION.
  - IMPLEMENT A GRAZING MANAGEMENT PLAN TO PROTECT SENSITIVE FLOODPLAIN AND RIPARIAN AREAS.
  - UTILIZE NATURAL CHANNEL DESIGN TECHNIQUES AND AVOID THE USE OF HARDENED, NON-DEFORMABLE STRUCTURES SUCH AS ROCK AND LOG VANES, WEIRS, AND OTHER CHANNEL SPANNING STRUCTURES.

**RESTORATION TREATMENTS**

THE RESTORATION PLAN FOCUSES ON RESTORING ERODING STREAMBANKS, RE-ESTABLISHING PROPER CHANNEL CROSS-SECTION, PLAN FORM AND LONGITUDINAL PROFILE DIMENSIONS, AND IDENTIFYING OPPORTUNITIES TO INCREASE FLOODPLAIN CONNECTIVITY. SPECIFICALLY, THE FOLLOWING GUIDELINES WERE USED IN DEVELOPING THE DESIGN:

- MINIMIZE STREAMBED TREATMENTS AND TO UTILIZE ON-SITE NATIVE MATERIAL FOR CHANNEL SHAPING AND RECONSTRUCTION, TO THE GREATEST EXTENT PRACTICAL.
- INCORPORATE VEGETATED WOOD AND BRUSH FASCINE MATRIX STRUCTURES AND LIMIT THE USE OF ROCK AND VEGETATED SOIL LIFTS. LARGE WOOD WILL BE USED ONLY WHERE NECESSARY FOR BANK STABILIZATION AND POOL HABITAT DEVELOPMENT/ENHANCEMENT.
- SHAPE THE CHANNEL TO FORM THE APPROPRIATE CHANNEL DIMENSIONS WITHIN THE OVER-WIDENED STREAM CORRIDOR, INCLUDING RIFFLE, RUN, POOL AND GLIDE CHANNEL HABITAT FEATURES;
- INCREASE SINUOSITY WHILE MAINTAINING OPEN WATER HABITAT THROUGH THE USE OF FINGER BARS (VEGETATED FLOODPLAIN SURFACES), ALCOVES, AND BACKWATER BAYS.
- EXPAND THE FLOODPLAIN IN THE ENTRENCHED, LOWER REACH BY REDUCING BANK HEIGHTS AND CREATING A NARROW FLOODPLAIN CORRIDOR THAT WILL SUPPORT EMERGENT AND SCRUB-SHRUB WETLANDS. CONVERT THE "F" STREAM TYPE SECTIONS TO "B" STREAM TYPES WHERE FEASIBLE.
- INCREASE AQUATIC HABITAT COMPLEXITY IN AREAS WHERE COST LIMITS MORE ACTIVE RESTORATION OPPORTUNITIES.
- MITIGATE WATER QUALITY AND HABITAT IMPACTS WHERE THE STREAM INTERACTS WITH THE HIGHWAY EMBANKMENT.
- MAINTAIN ADEQUATE PUBLIC ACCESS TO THE STREAM AND FLOODPLAIN CORRIDOR.

NO.	DATE	BY	DESCRIPTION	CHK
1	01-22-16	NW	FINAL DESIGN	JW/GD
preliminary -not for construction-				
PROJECT NUMBER				
RDG-15-025				
SHEET NUMBER				
<b>3.0</b>				



NOTES: BANK TREATMENTS MAY BE MINIMIZED IN CERTAIN AREAS BY UTILIZING EXISTING STABLE BANKS.  
 FLOODPLAIN ROUGHNESS (SEE SHEET 6.4) SHALL BE APPLIED TO FILL AREAS AS DIRECTED BY CONSTRUCTION MANAGER.

**STRUCTURE SCHEDULE**

STATION START	STATION END	BANK	STRUCTURE	STATION START	STATION END	BANK	STRUCTURE
0+00	1+25	C	CR	8+28	8+48	L	LWST 1
0+00	1+25	L	SBB	8+48	9+30	L	SBB
0+00	1+53	R	SBB	8+84	9+30	C	CR
1+53	1+73	R	LWST 1	8+84	9+58	R	SBB
1+73	4+00	R	SBB	9+58	9+78	R	LWST 1
2+09	4+00	C	CR	9+78	11+78	R	SBB
2+09	4+28	L	SBB	10+14	11+50	C	CR
4+28	4+48	L	LWST 1	10+14	11+50	L	SBB
4+48	6+80	L	SBB	11+78	11+98	R	LWST 1
4+84	6+80	C	CR	11+98	13+00	R	SBB
4+84	7+08	R	SBB	12+34	13+00	C	CR
7+08	7+28	R	LWST 1	12+34	13+28	L	SBB
7+28	8+00	R	SBB	13+28	13+48	L	LWST 1
7+64	8+00	C	CR	13+48	15+40	L	SBB
7+64	8+28	L	SBB	13+84	15+40	C	CR
				13+84	15+68	R	SBB

**CHANNEL TOP OF BANK ELEVATIONS**

STATION	ELEVATION (FT)	STATION	ELEVATION (FT)
0+00	4528.14	8+00	4526.42
1+00	4527.93	9+00	4526.15
2+00	4527.71	10+00	4525.61
3+00	4527.50	11+00	4525.07
4+00	4527.28	12+00	4524.52
5+00	4527.07	13+00	4523.98
6+00	4526.85	13+47	4523.73
7+00	4526.64	14+00	4523.56
		15+00	4523.23

**LEGEND**

STRUCTURES	DETAIL SHEET #
LARGE WOOD STRUCTURE TYPE (LWST 1)	6.1
SOD AND BRUSH BANK (SBB)	6.2
CONSTRUCTED RIFFLE (CR)	6.3
EXISTING WETLANDS	
PROPOSED ENCLOSURE FENCING	

**EARTHWORK VOLUMES**

STATION	CUT (CY)	FILL (CY)
0+00 TO 15+00	867	TBD

NOTE: REPORTED VOLUMES ARE NEATLINE.

\*IMPORTED FILL WILL BE MINIMIZED BY INCORPORATING ALCOVES, FINGER BARS AND OPEN WATER WETLANDS DURING FINAL DESIGN\*

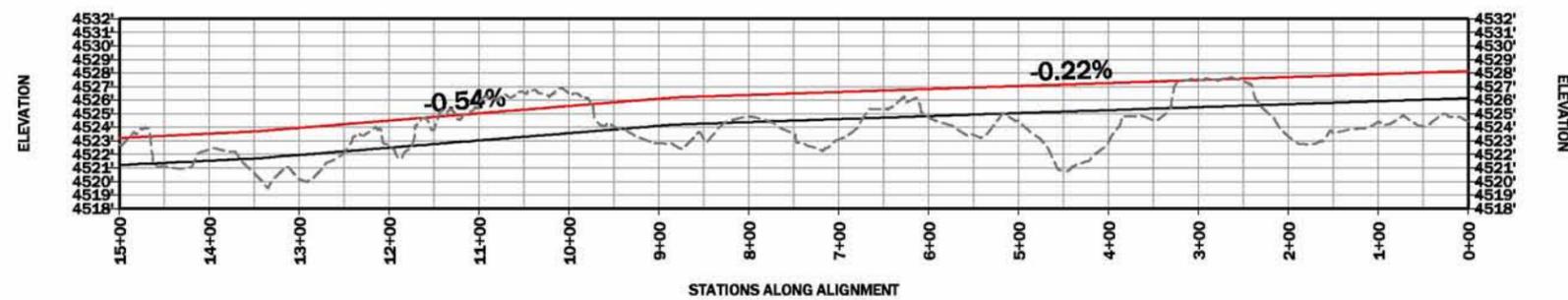
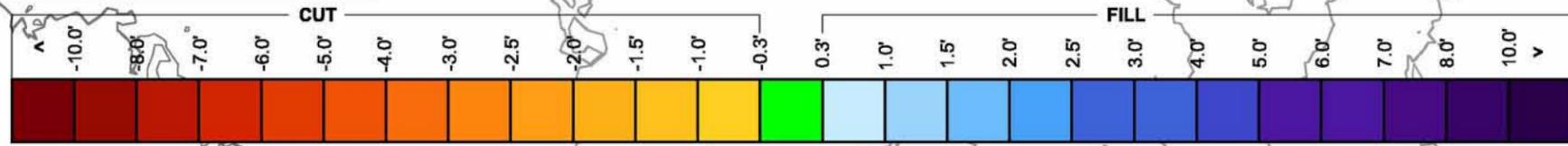
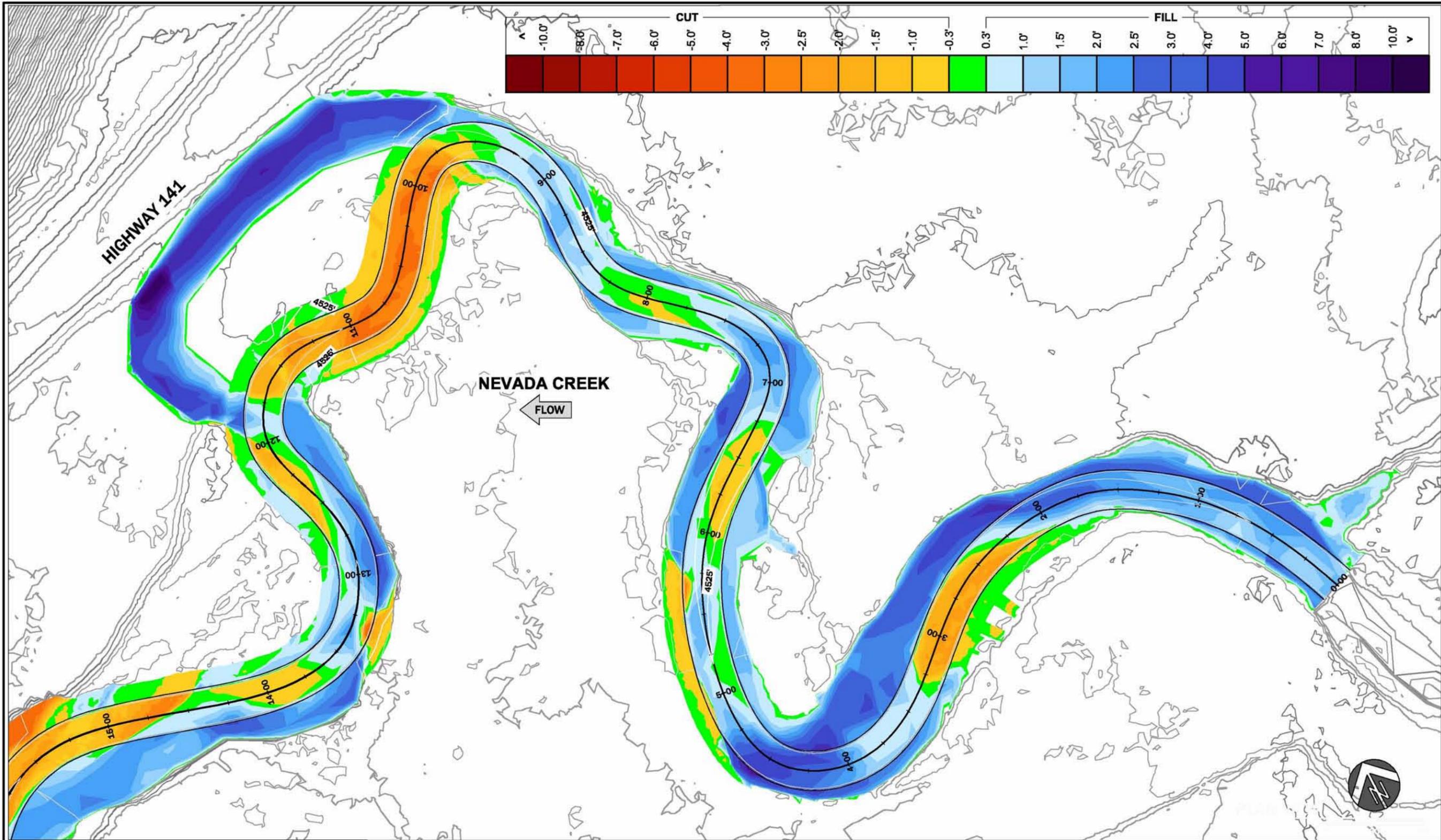
**PLAN VIEW AND STRUCTURE LAYOUT  
 REACH 1**

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	DESIGN	JM

PROJECT NUMBER  
RDG-16-041

SHEET NUMBER

**4.0**



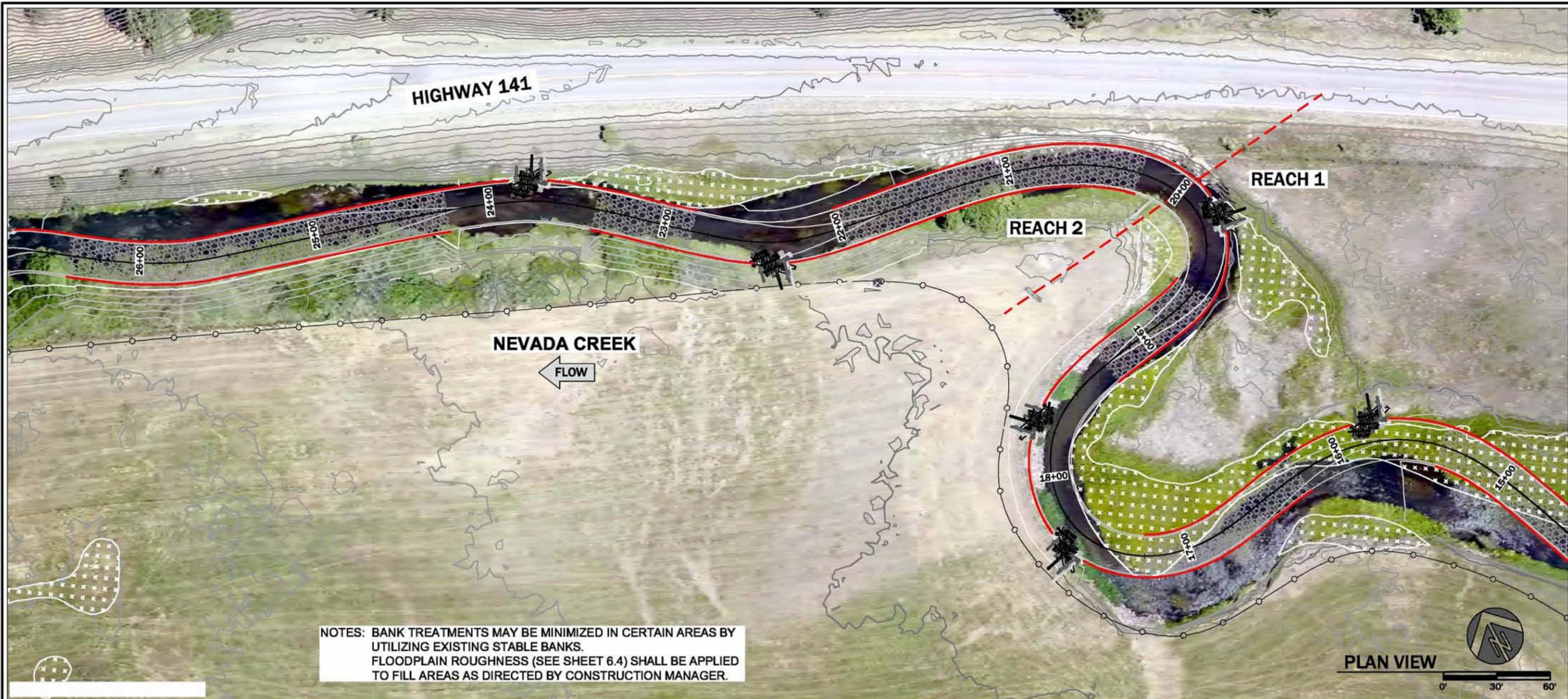
# GRADING PLAN AND PROFILE REACH 1

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	DESIGN	JM
			<i>preliminary</i>	
			<i>-not for construction-</i>	

PROJECT NUMBER  
RDG-16-041

SHEET NUMBER

# 4.1



NOTES: BANK TREATMENTS MAY BE MINIMIZED IN CERTAIN AREAS BY UTILIZING EXISTING STABLE BANKS. FLOODPLAIN ROUGHNESS (SEE SHEET 6.4) SHALL BE APPLIED TO FILL AREAS AS DIRECTED BY CONSTRUCTION MANAGER.

**PLAN VIEW AND STRUCTURE LAYOUT  
REACH 1 & 2**

**CHANNEL TOP OF BANK ELEVATIONS**

STATION	ELEVATION (FT)
16+00	4522.90
17+00	4522.58
18+00	4522.25
19+00	4521.93
20+00	4521.60
21+00	4521.28
22+00	4520.91
23+00	4520.49
24+00	4520.08
25+00	4519.66
26+00	4519.24

**LEGEND**

STRUCTURES	DETAIL SHEET #
LARGE WOOD STRUCTURE TYPE (LWST 1)	6.1
SOD AND BRUSH BANK (SBB)	6.2
CONSTRUCTED RIFFLE (CR)	6.3
EXISTING WETLANDS	
PROPOSED ENCLOSURE FENCING	

**STRUCTURE SCHEDULE**

STATION START	STATION END	BANK	STRUCTURE
15+68	15+88	R	LWST 1
15+88	17+25	R	SBB
16+24	17+25	C	CR
16+24	17+53	L	SBB
17+53	17+73	L	LWST 1
17+73	18+17	L	SBB
18+17	18+37	L	LWST 1
18+37	19+40	L	SBB
18+73	19+40	C	CR
18+73	19+68	R	SBB
19+68	19+88	R	LWST 1
19+88	22+00	R	SBB
20+24	22+00	C	CR
20+24	22+28	L	SBB
22+28	22+48	L	LWST 1
22+48	23+40	L	SBB
22+84	23+40	C	CR
22+84	23+68	R	SBB
23+68	23+88	R	LWST 1
23+88	26+68	R	SBB
24+24	26+40	C	CR
24+24	26+40	L	SBB

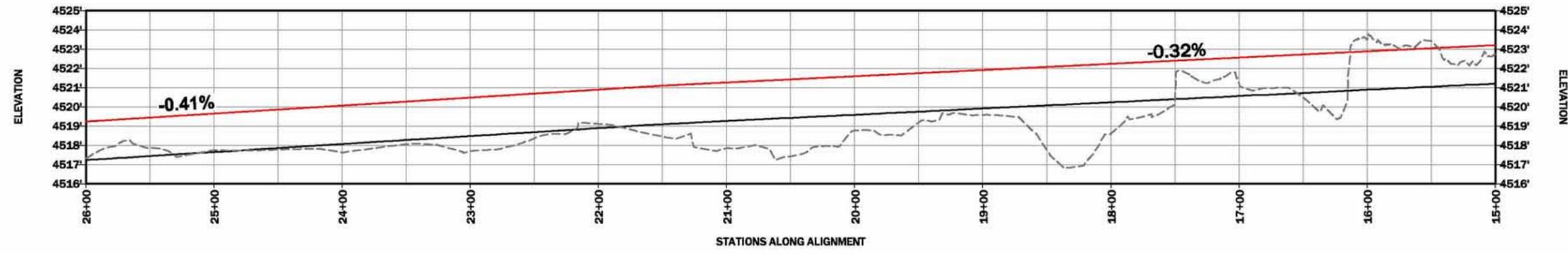
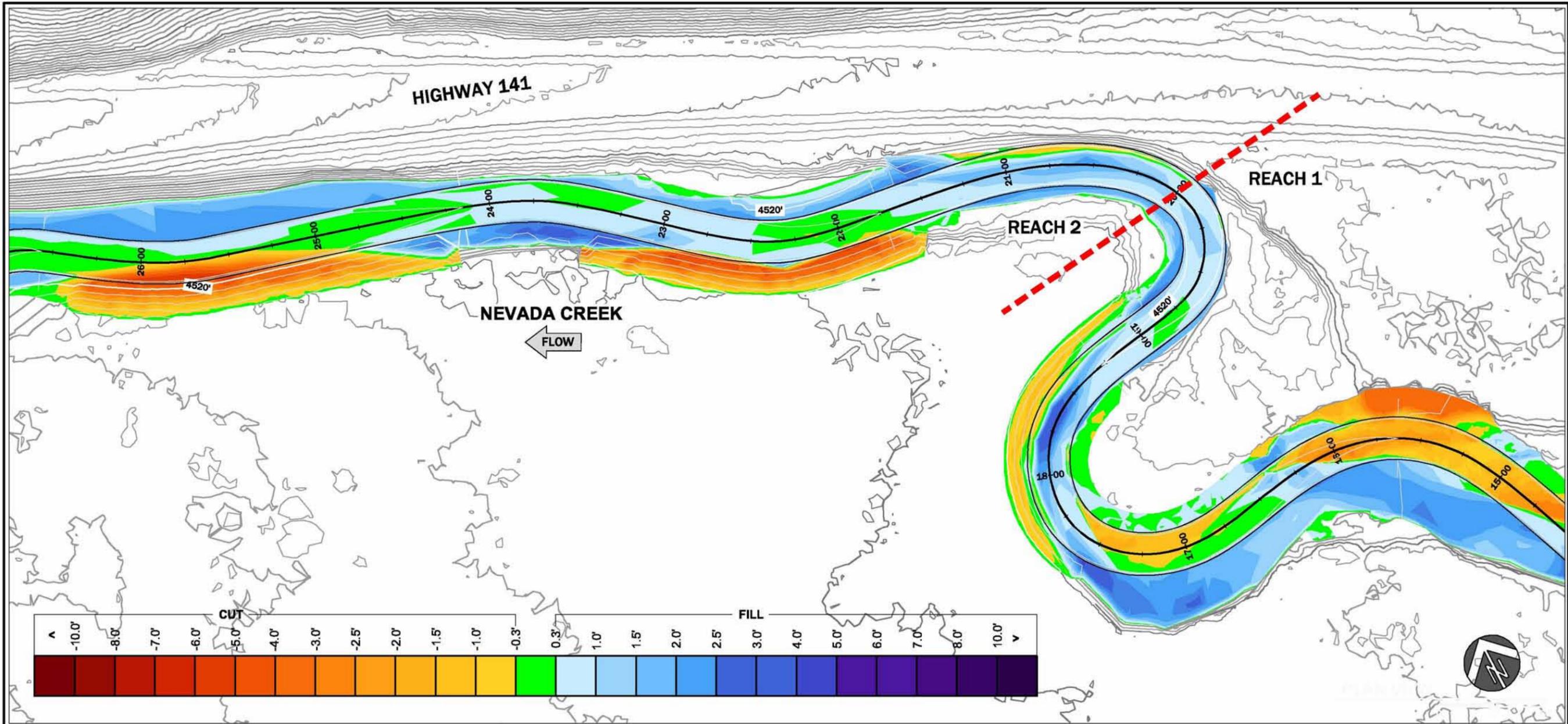
**EARTHWORK VOLUMES**

STATION	CUT (CY)	FILL (CY)
15+00 TO 26+00	1,037	1,037

NOTE: REPORTED VOLUMES ARE NEATLINE.  
\*IMPORTED FILL WILL BE MINIMIZED BY INCORPORATING ALCOVES, FINGER BARS AND OPEN WATER WETLANDS DURING FINAL DESIGN\*

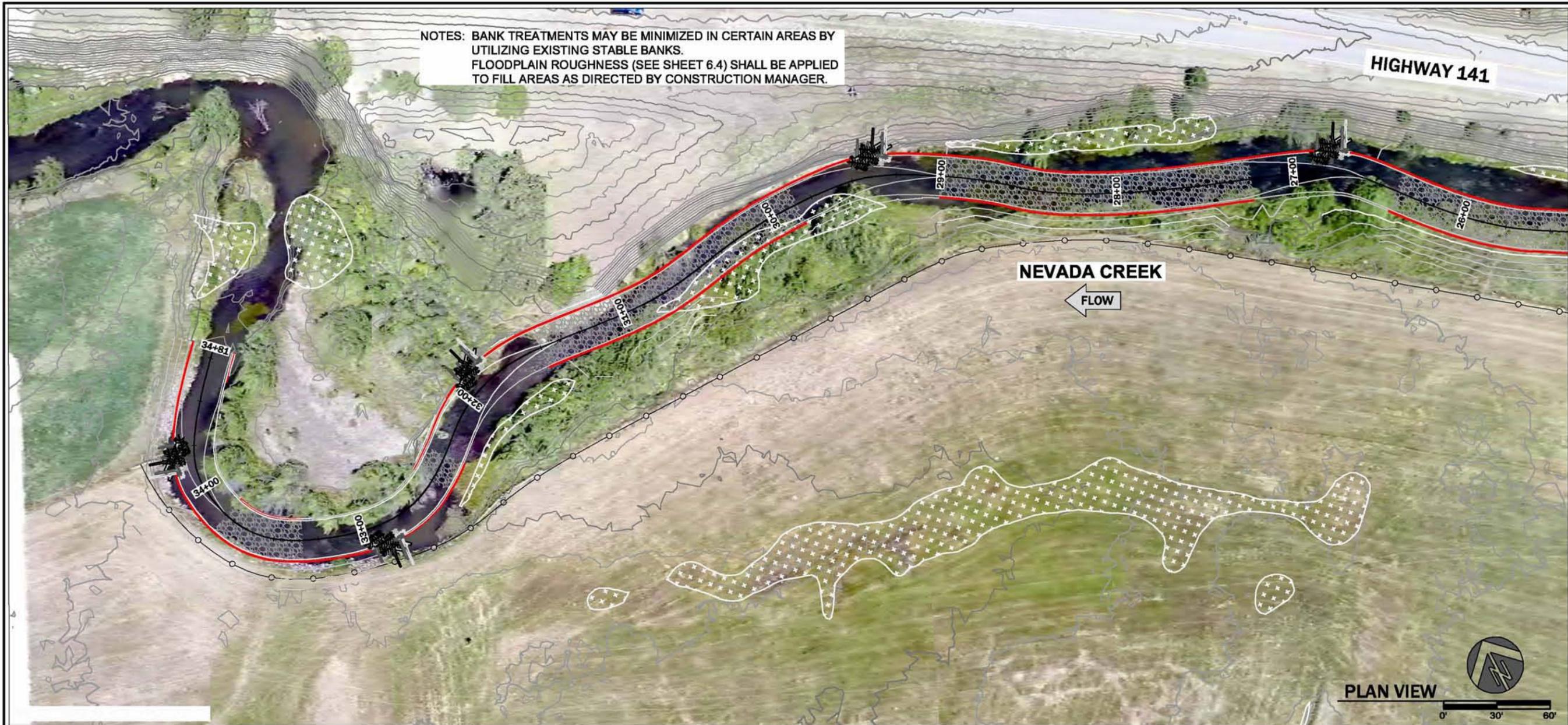
NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	DESIGN	JM

*preliminary - not for construction*



**GRADING PLAN AND PROFILE  
REACH 1 & 2**

NO.	DATE	BY	DESCRIPTION	CHK
1	10-22-16	NW	DESIGN	JM
<i>preliminary</i>				
<i>-not for construction-</i>				
PROJECT NUMBER				
RDG-16-041				
SHEET NUMBER				
<b>4.3</b>				



**PLAN VIEW AND STRUCTURE LAYOUT  
REACH 2**

**CHANNEL TOP OF BANK ELEVATIONS**

STATION	ELEVATION (FT)
27+00	4518.83
28+00	4518.41
29+00	4518.00
30+00	4517.58
31+00	4517.16
32+00	4516.75
33+00	4516.33
34+00	4515.92
34+81	4515.58

LEGEND		
STRUCTURES		DETAIL SHEET #
	LARGE WOOD STRUCTURE TYPE (LWST 1)	6.1
	SOD AND BRUSH BANK (SBB)	6.2
	CONSTRUCTED RIFFLE (CR)	6.3

**STRUCTURE SCHEDULE**

STATION START	STATION END	BANK	STRUCTURE
26+68	26+88	R	LWST 1
26+88	29+28	R	SBB
27+24	29+00	C	CR
27+24	29+00	L	SBB
29+28	29+48	R	LWST 1
29+48	31+78	R	SBB
29+84	31+50	C	CR
29+84	31+50	L	SBB
31+78	31+98	R	LWST 1
31+98	32+50	R	SBB
32+34	32+50	C	CR
32+34	32+78	L	SBB
32+78	32+98	L	LWST 1
32+98	34+08	L	SBB
33+34	33+80	C	CR
33+34	33+80	R	SBB
34+08	34+28	L	LWST 1
34+28	34+64	L	SBB

**EARTHWORK VOLUMES**

STATION	CUT (CY)	FILL (CY)
26+00 TO 34+81	468	468

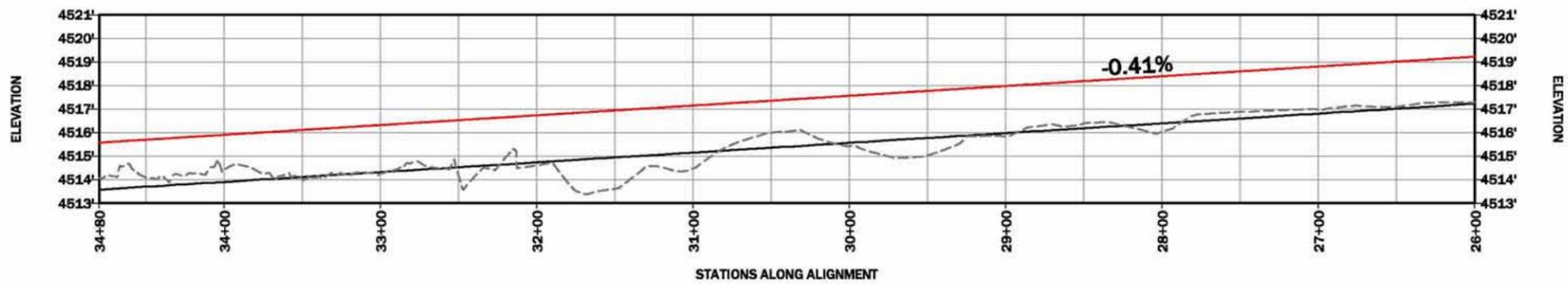
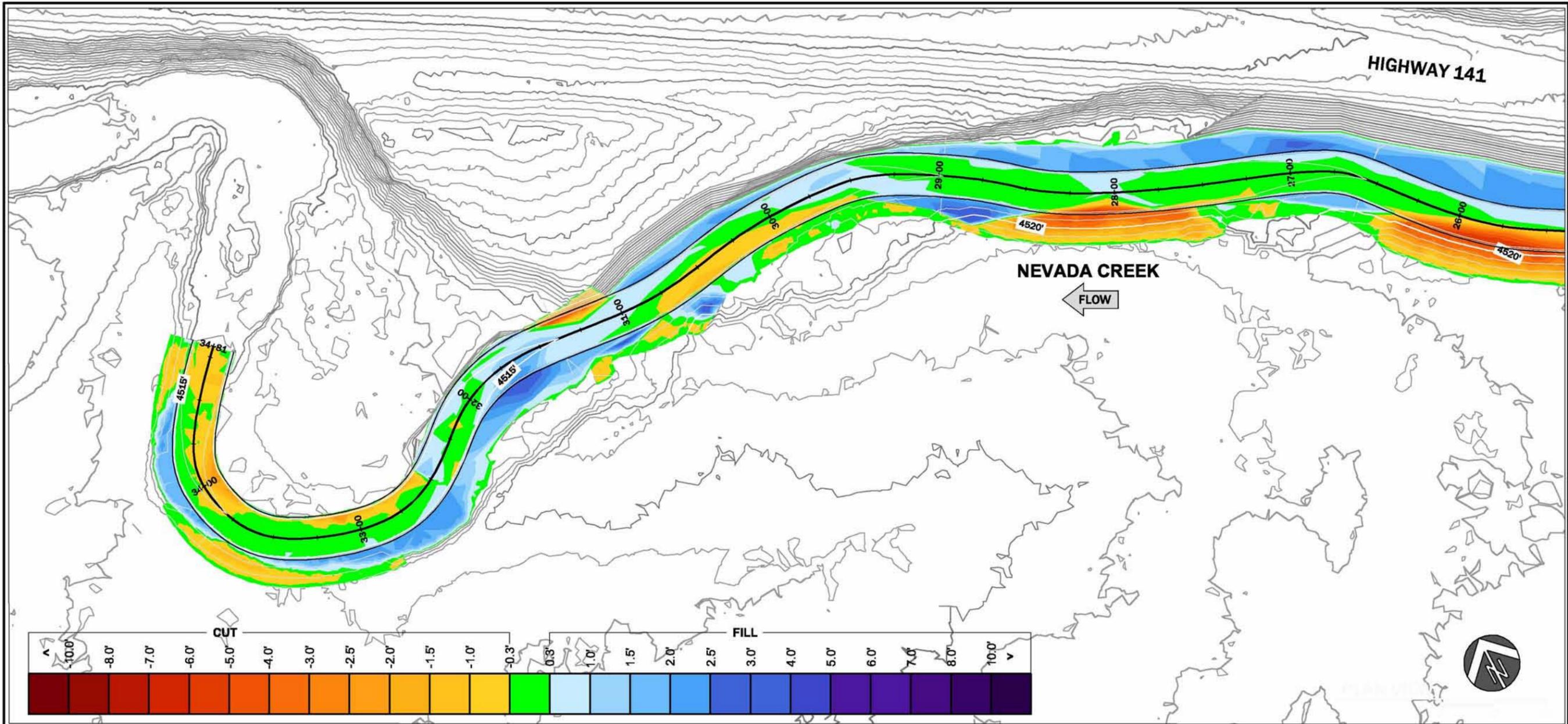
NOTE: REPORTED VOLUMES ARE NEATLINE.  
\*IMPORTED FILL WILL BE MINIMIZED BY INCORPORATING ALCOVES, FINGER BARS AND OPEN WATER WETLANDS DURING FINAL DESIGN\*

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	DESIGN	JM

preliminary  
-not for construction-

PROJECT NUMBER  
RDG-16-041

SHEET NUMBER  
**4.4**



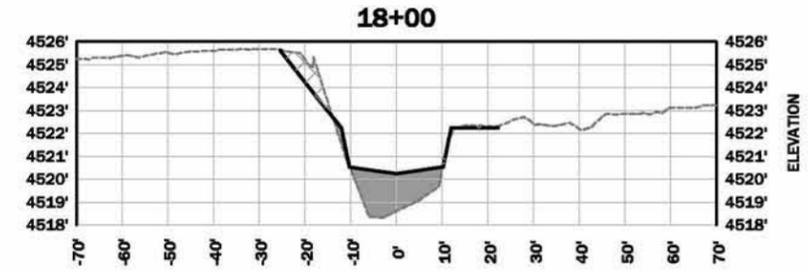
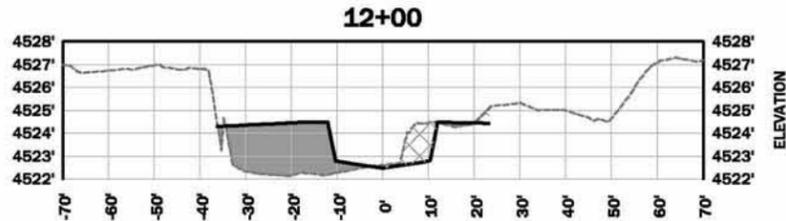
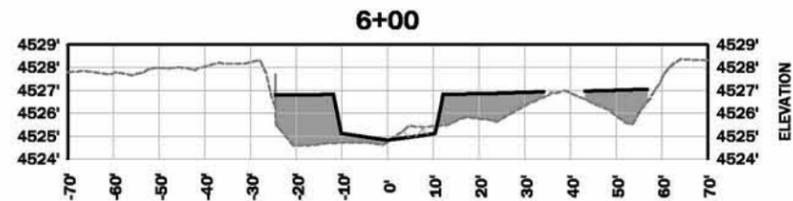
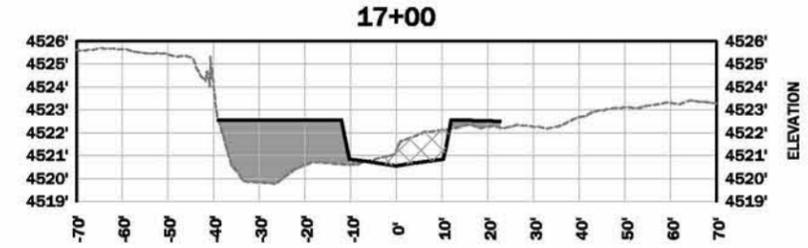
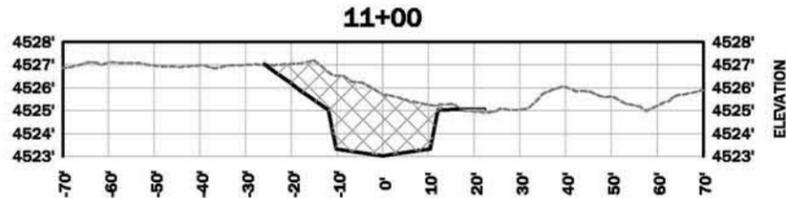
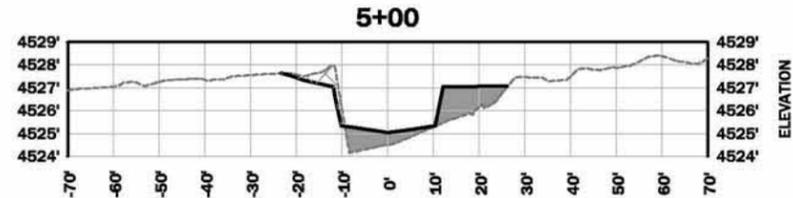
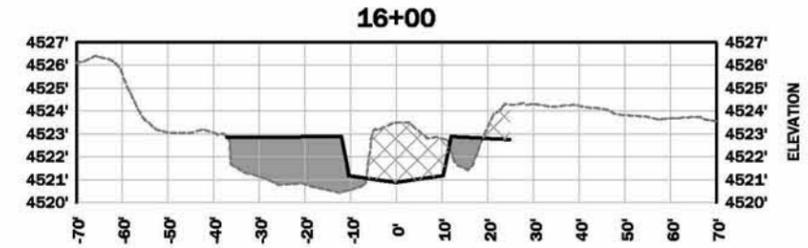
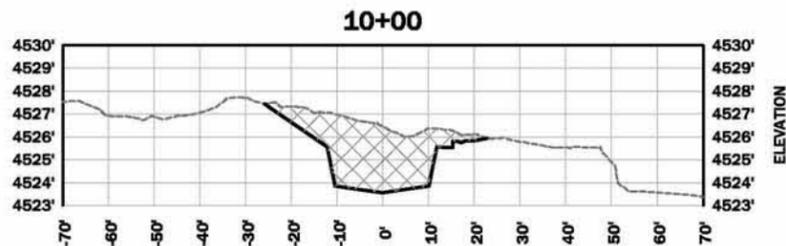
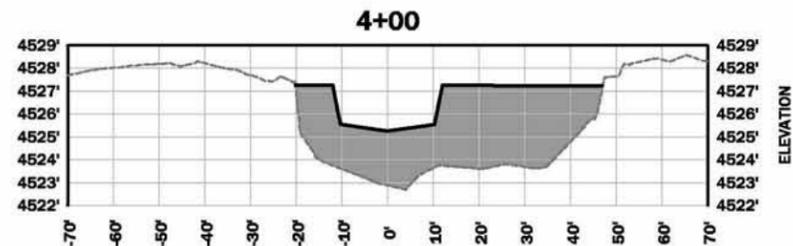
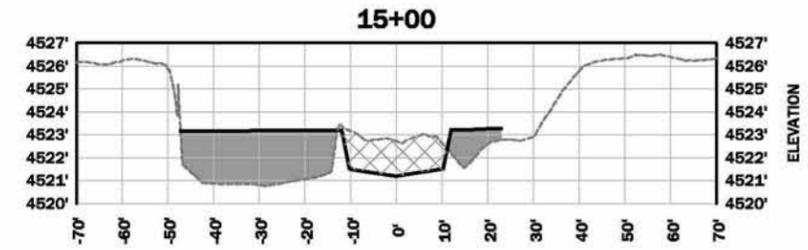
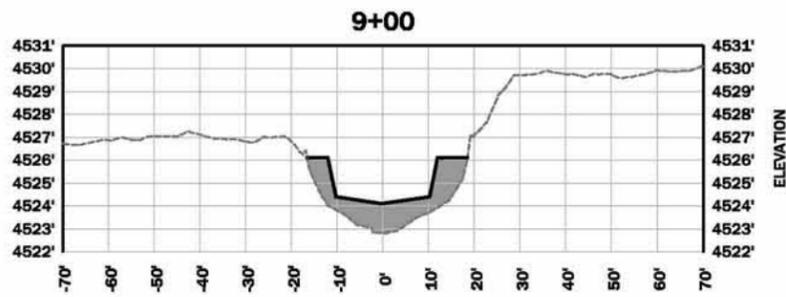
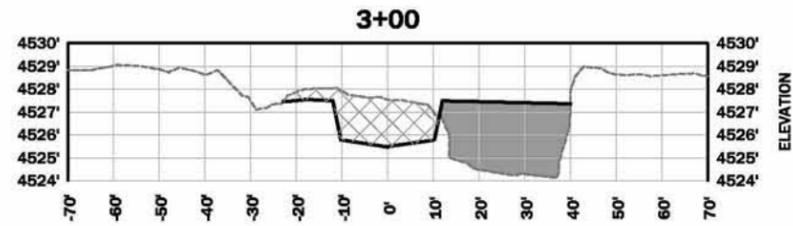
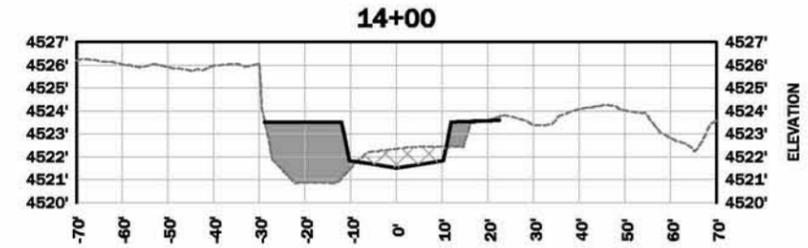
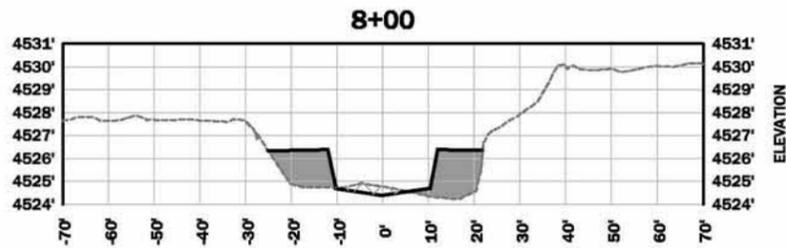
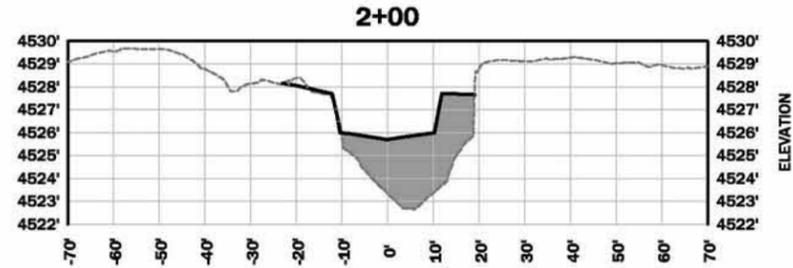
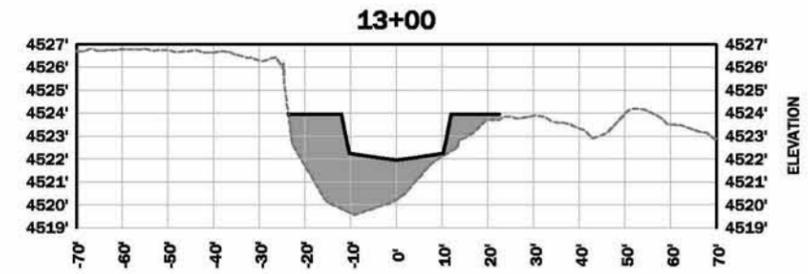
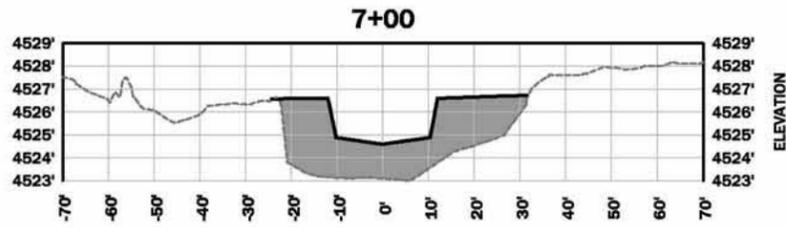
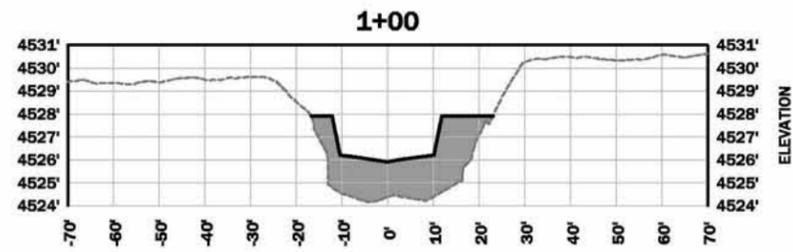
**GRADING PLAN AND PROFILE  
REACH 2**

NO.	DATE	BY	DESCRIPTION	CHK
1	10-22-16	NW	DESIGN	JM
<i>preliminary</i>				
<i>-not for construction-</i>				

PROJECT NUMBER  
RDG-16-041

SHEET NUMBER  
**4.5**

**CROSS SECTIONS**



**LEGEND**

--- EXISTING GROUND      [diagonal lines] CUT

— DESIGN SURFACE        [gray fill] FILL

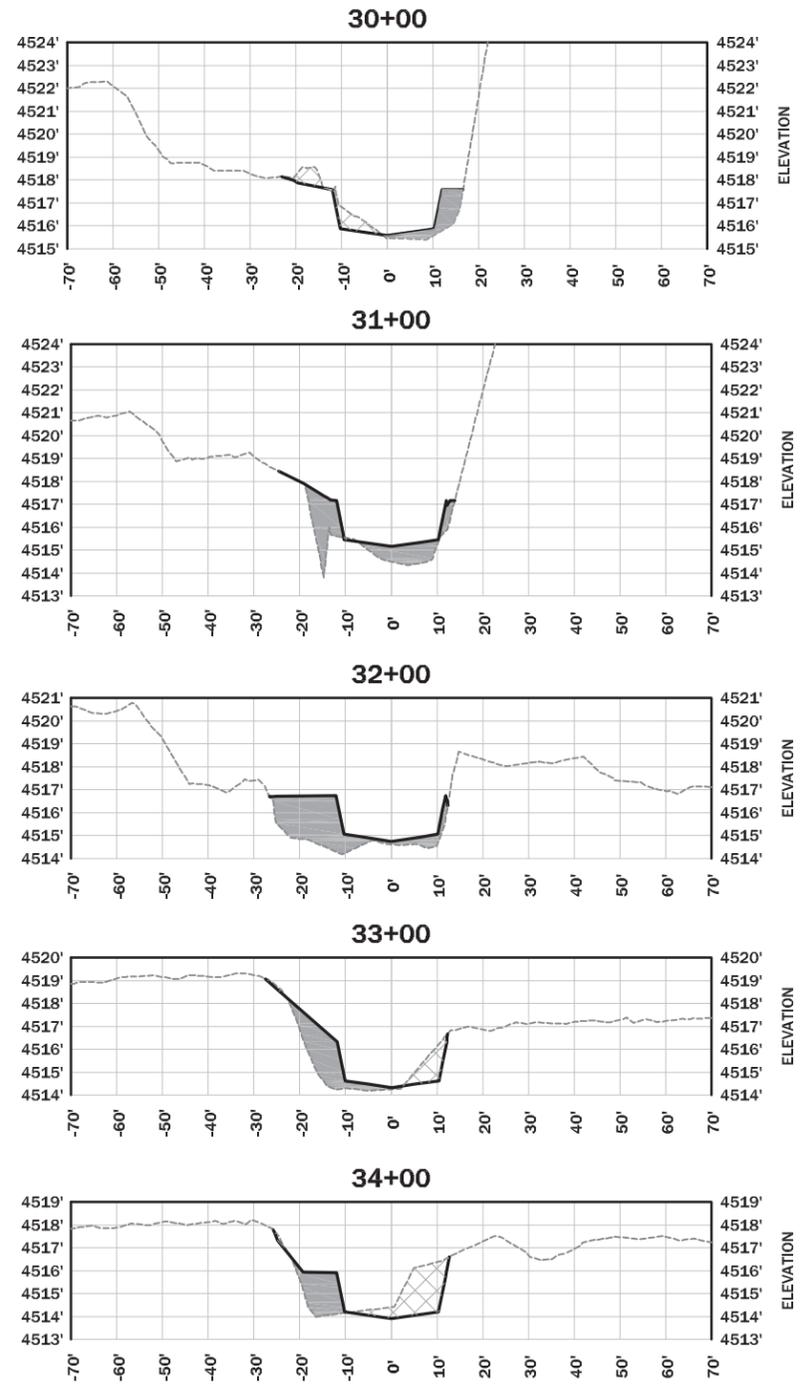
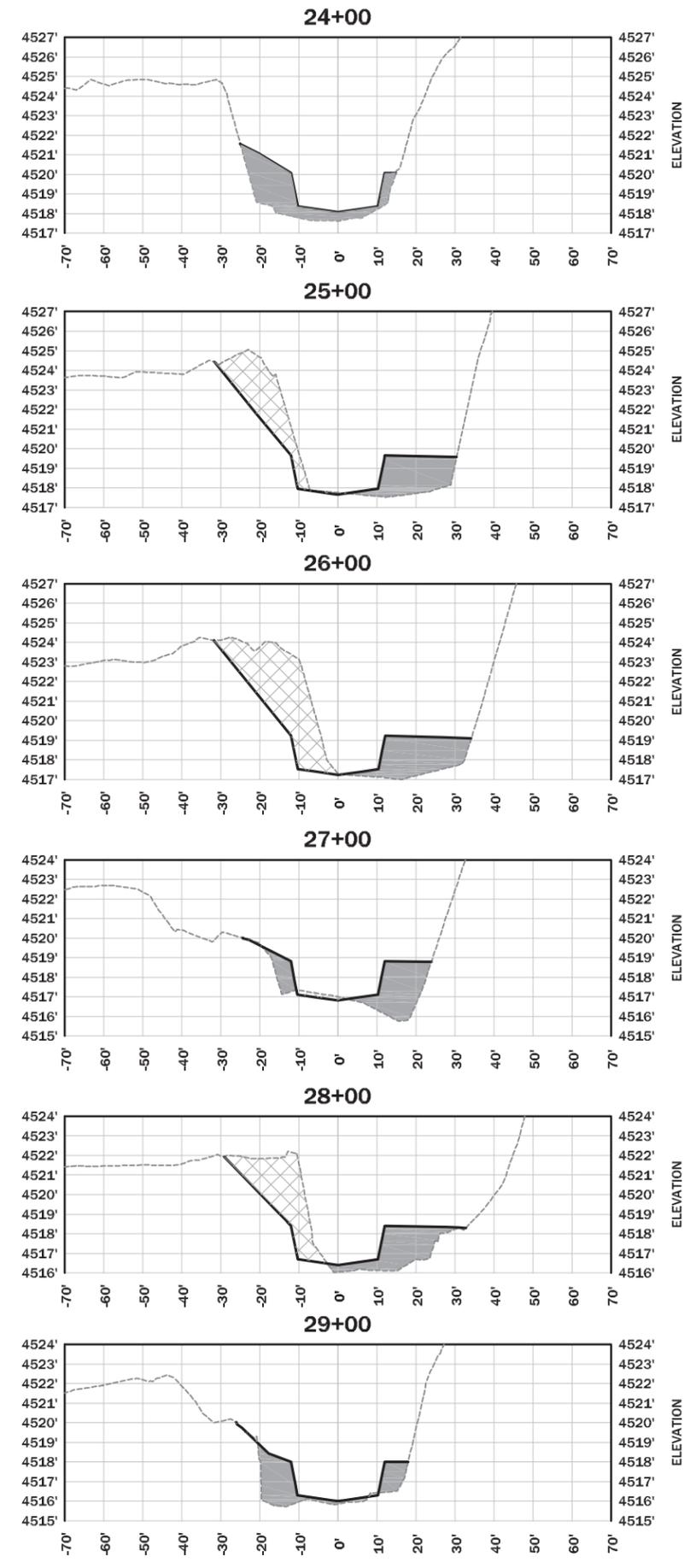
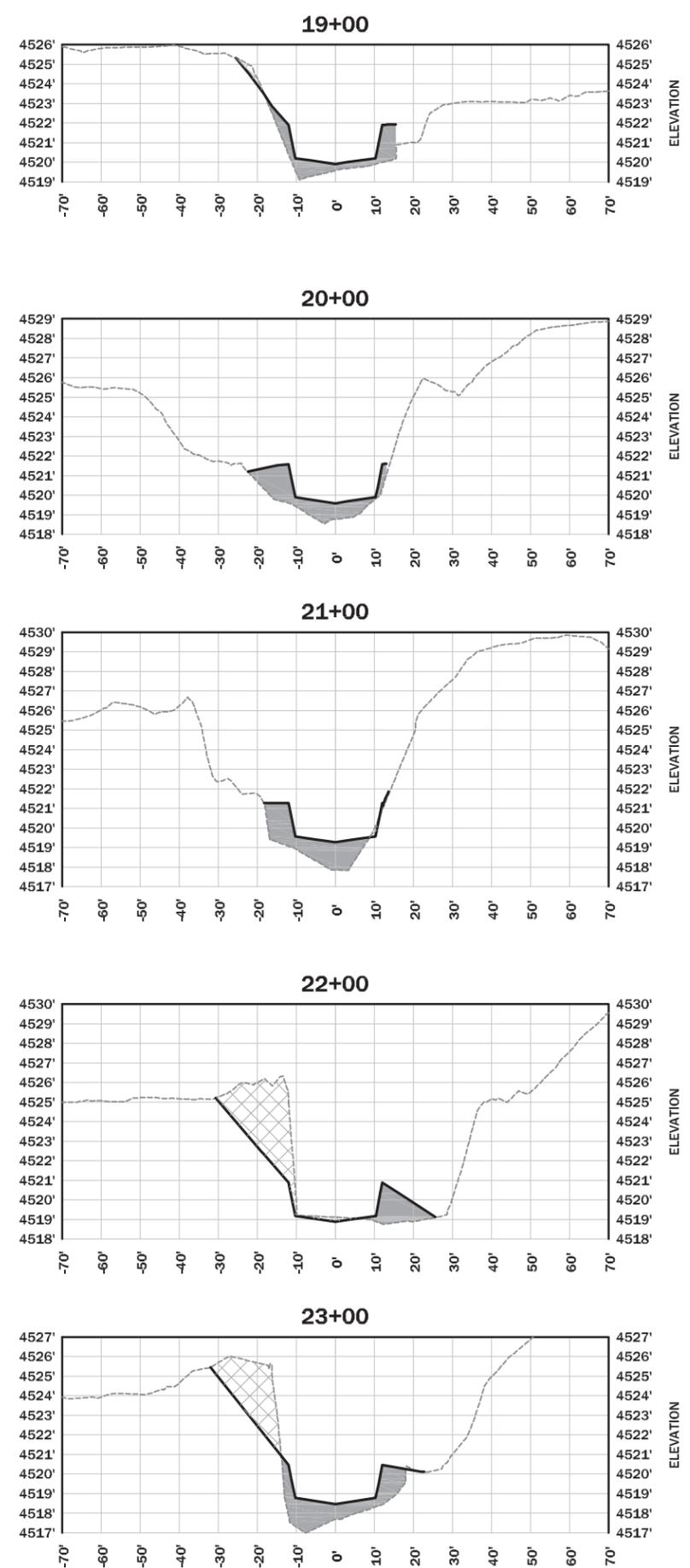
NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	PRELIMINARY DESIGN	JM
			<i>preliminary</i>	
			<i>-not for construction-</i>	

PROJECT NUMBER  
RDG-16-041

SHEET NUMBER

**5.0**

# CROSS SECTIONS



**LEGEND**

- - - - - EXISTING GROUND  
 \_\_\_\_\_ DESIGN SURFACE  
 CUT  
 FILL

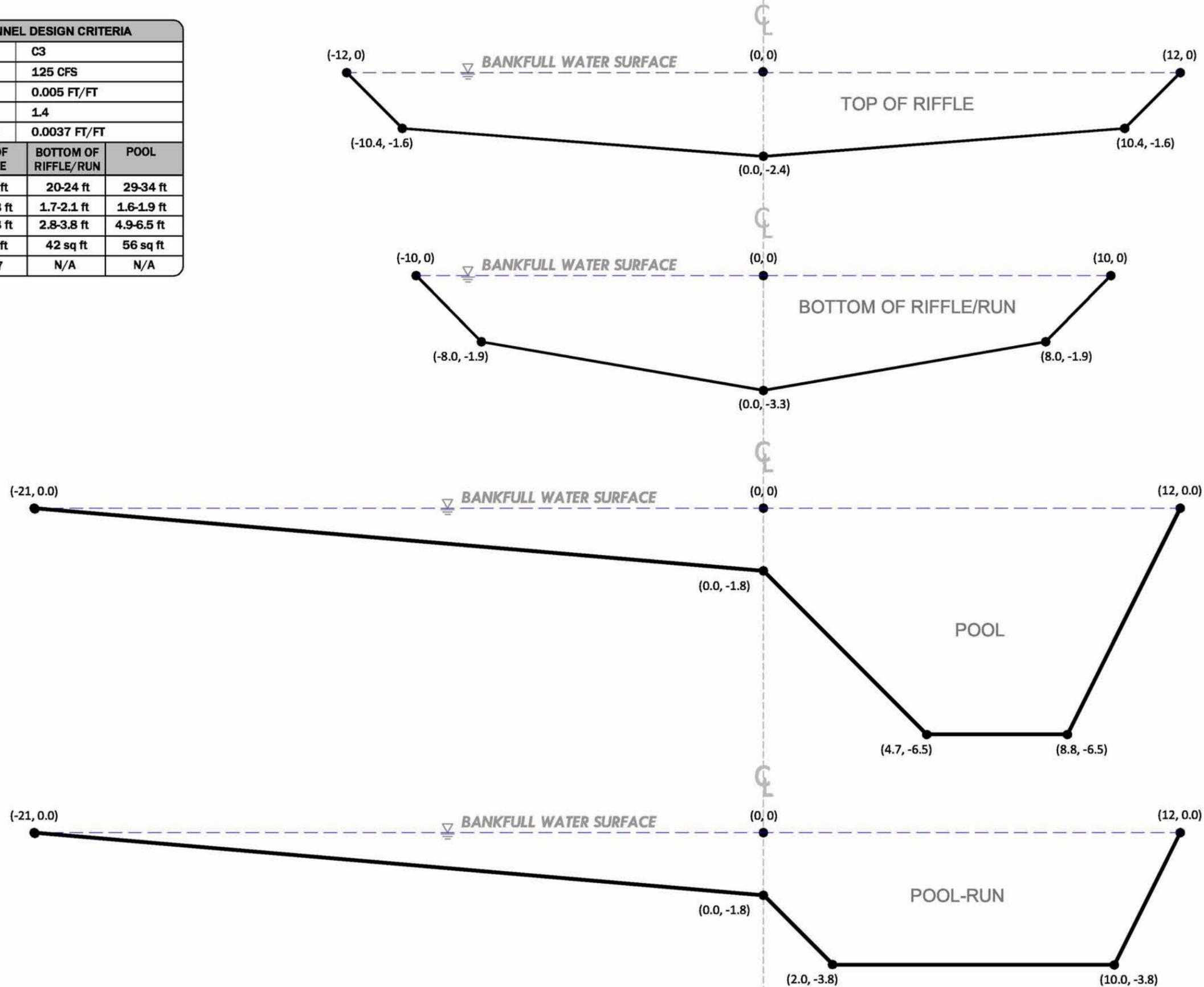
NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	PRELIMINARY DESIGN	JM
			preliminary	
			-not for construction-	

PROJECT NUMBER  
RDG-16-041

SHEET NUMBER

# 5.1

BANKFULL CHANNEL DESIGN CRITERIA			
STREAM TYPE	C3		
DISCHARGE	125 CFS		
VALLEY SLOPE	0.005 FT/FT		
SINUOSITY	1.4		
CHANNEL SLOPE	0.0037 FT/FT		
PARAMETER	TOP OF RIFFLE	BOTTOM OF RIFFLE/RUN	POOL
WIDTH	23-26 ft	20-24 ft	29-34 ft
MEAN DEPTH	1.5-1.8 ft	1.7-2.1 ft	1.6-1.9 ft
MAX. DEPTH	2.1-2.8 ft	2.8-3.8 ft	4.9-6.5 ft
XS AREA	40 sq ft	42 sq ft	56 sq ft
WIDTH:DEPTH	13-17	N/A	N/A



**CHANNEL CROSS SECTIONS**  
TYPICAL

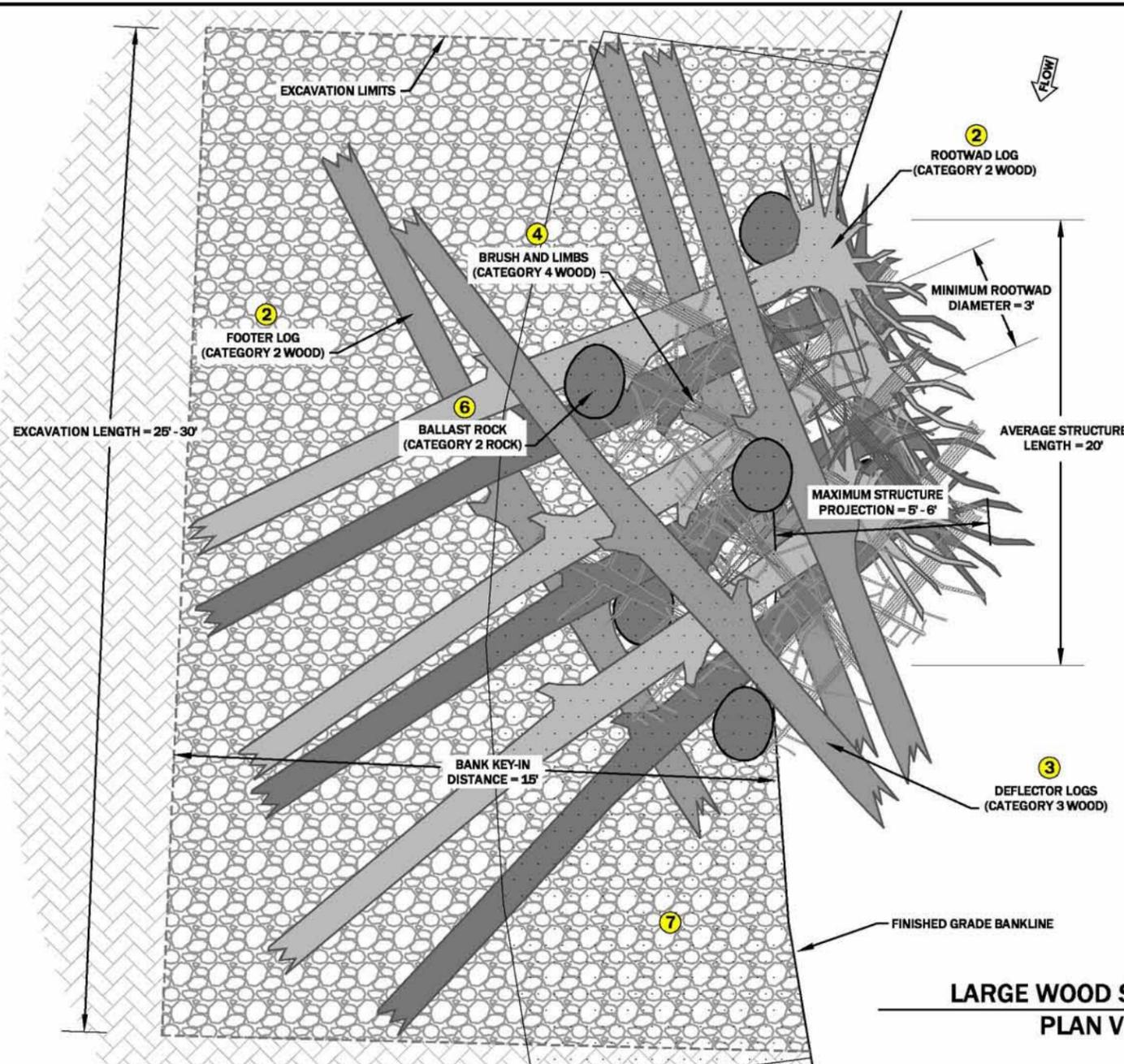
NOTE: COORDINATES ARE REFERENCED FROM TOP OF BANK CENTERLINE

**CHANNEL CROSS SECTION DIMENSIONS**

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	DESIGN	JM

PROJECT NUMBER  
RDG-16-041

SHEET NUMBER  
**6.0**



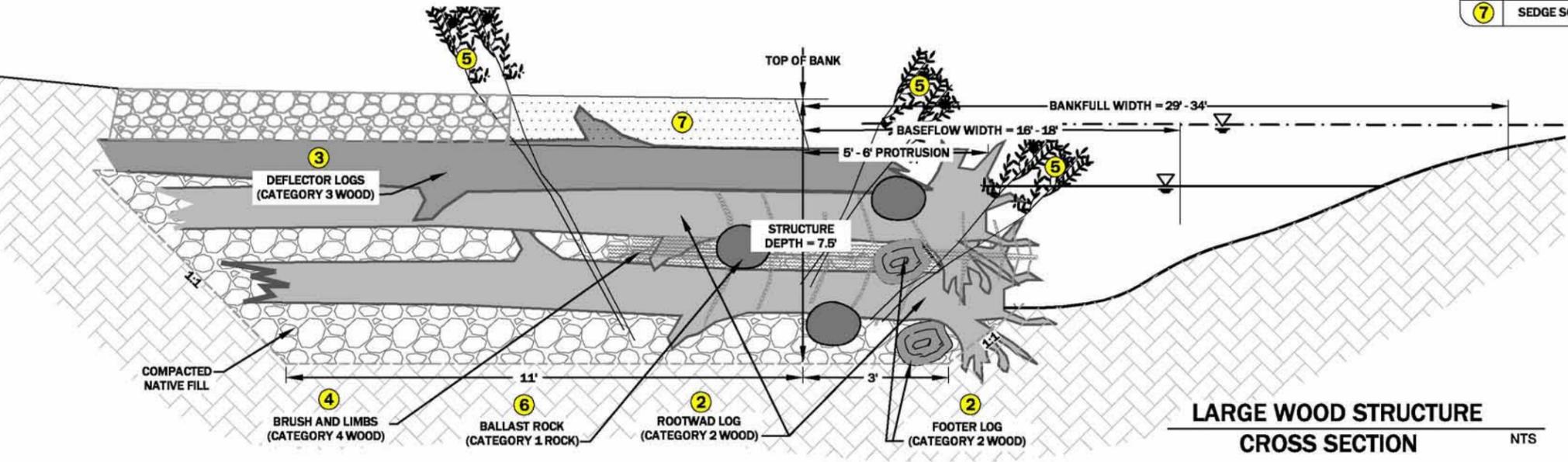
**LARGE WOOD STRUCTURE PLAN VIEW** NTS

- GENERAL NOTES**
1. CONSTRUCTION OF THE LARGE WOOD STRUCTURE WILL OCCUR AFTER THE CHANNEL AND FLOODPLAIN SUBGRADE BACKFILL IS PLACED AND THE CHANNEL STREAMBED IS CONSTRUCTED. PLACEMENT OF FLOODPLAIN VEGETATIVE GROWTH MEDIA AND INSTALLATION OF FLOODPLAIN ROUGHNESS SHALL BE COMPLETED AFTER THE LARGE WOOD STRUCTURES ARE INSTALLED.
  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

- 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 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 THREE TO FIVE ROOTWAD LOGS (CATEGORY 2 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 5-6 FT. BEYOND THE FINISHED BANK LINE.
  4. BACKFILL TRENCH WITH STOCKPILED MATERIAL UP TO THE TOP OF THE FOOTER LOGS. BACKFILL SHALL BE BUCKET COMPACTED. PLACE CATEGORY 1 ROCK WHERE ROOTWAD LOGS INTERSECT FOOTER LOGS.
  5. INSTALL A SECOND TIER OF TWO FOOTER LOGS (CATEGORY 2 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 BRUSH AND LIMBS (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 THREE ROOTWAD LOGS (CATEGORY 2 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 5-6 FT. BEYOND THE FINISHED BANK LINE.
  8. INSTALL BRUSH AND LIMBS (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.
  9. BACKFILL TRENCH WITH STOCKPILED MATERIAL UP TO THE TOP OF THE ROOTWAD LOGS. BACKFILL SHALL BE BUCKET COMPACTED. PLACE CATEGORY 2 ROCK WHERE ROOTWAD LOGS INTERSECT LOWER ROOTWAD LOGS.
  10. INSTALL DEFLECTOR LOGS (CATEGORY 2 WOOD) AT APPROXIMATE 45° ANGLE TO ROOTWAD STEMS. DEFLECTOR LOGS SHALL PROJECT NO GREATER THAN 3 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 MATERIAL TO THE FINISHED BANK LINE. NO AREAS BEHIND THE FINISHED BANKLINE ARE TO BE LEFT BELOW FINISHED GRADE.

**MATERIAL SCHEDULE (PER STRUCTURE)**

ITEM	QUANTITY
<b>2</b> CATEGORY 2 WOOD	7
<b>3</b> CATEGORY 3 WOOD	3
<b>4</b> CATEGORY 4 WOOD	3
<b>6</b> CATEGORY 1 ROCK	3
<b>5</b> WILLOW CUTTINGS	30
<b>7</b> SEDGE SOD MAT	20 LF



**LARGE WOOD STRUCTURE CROSS SECTION** NTS



EXAMPLE OF A LARGE WOOD STRUCTURE

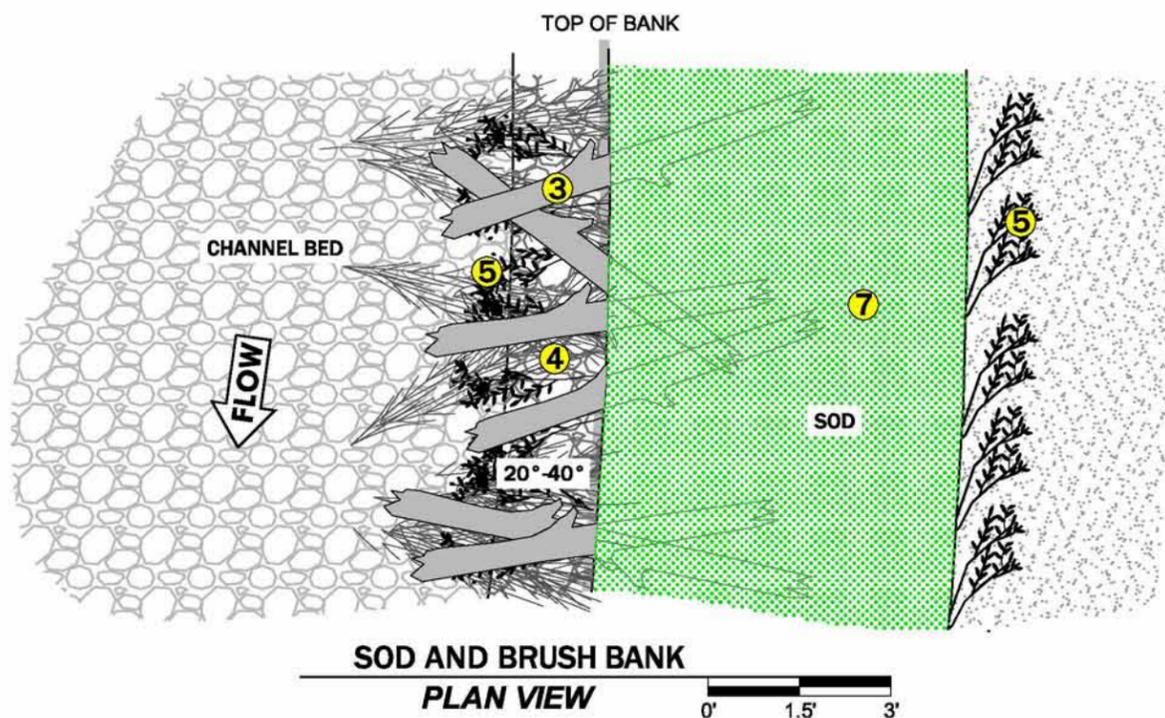
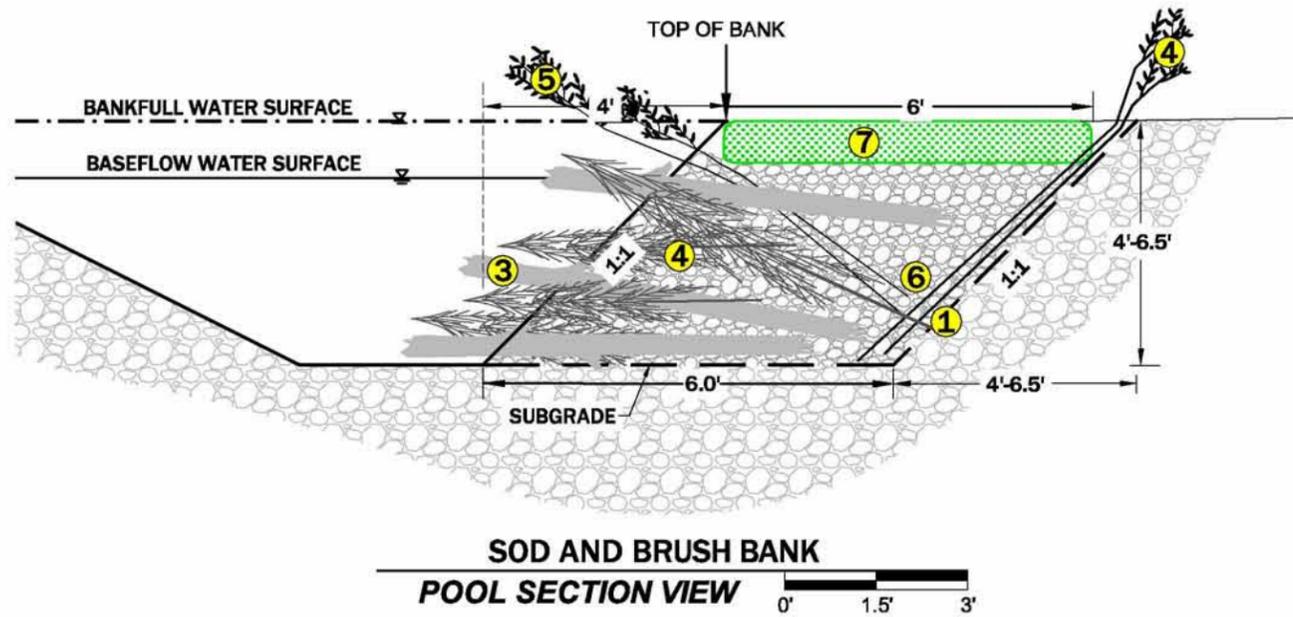
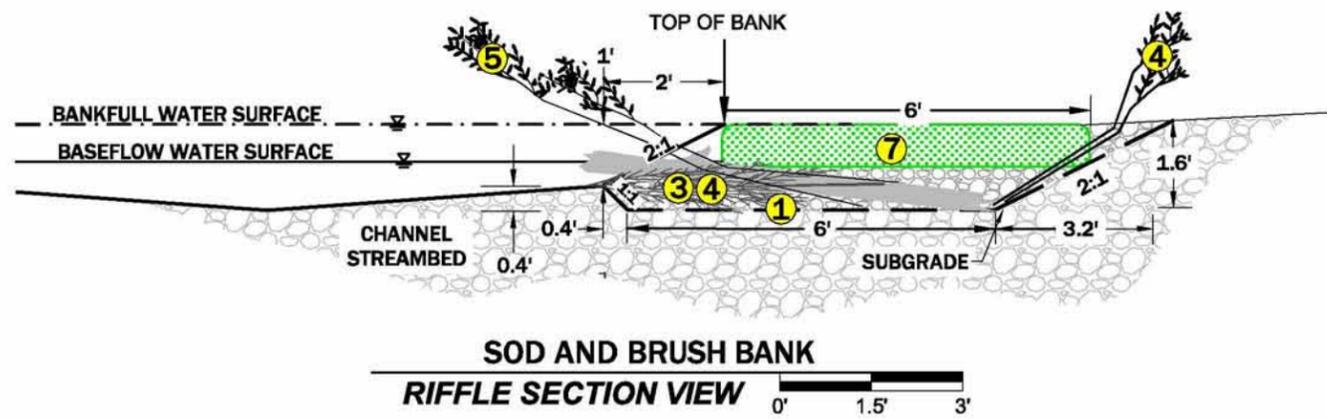
**LARGE WOOD STRUCTURE DETAIL**

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	FINAL DESIGN	JM/GD

*preliminary*  
*-not for construction-*

PROJECT NUMBER  
RDG-15-025

SHEET NUMBER  
**6.1**



## 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 SOD AND BRUSH 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. APPLICATION OF ADEQUATE BACKFILL AND SOD MAT BALLAST IS CRITICAL TO COUNTERACT BUOYANCY AND SLIDING/ROTATION OF WOOD. PLACEMENT OF WOOD UP TO 8 INCHES BELOW BANKFULL ELEVATION CAPPED WITH A SOD MAT AND PLACEMENT OF HEALTHY WOODY VEGETATION IN CONTACT WITH THE WATER TABLE THROUGHOUT THE GROWING SEASON IS CRITICAL FOR RAPID VEGETATION ESTABLISHMENT.

## CONSTRUCTION NOTES

- 1 EXCAVATE STREAMBANK TO SUBGRADE ELEVATIONS.
- 2 PLACE SMALL LOGS IN THE STREAMBANK AT SKEWED ANGLE TO THE STREAMBANK. LOGS SHALL BE PLACED BELOW THE TOP OF BANK ELEVATION. LOGS MAY OVERLAP.
- 3 PLACE BRUSH WITHIN THE MATRIX OF SMALL LOGS. BRUSH SHALL BE PLACED BELOW TOP OF BANK LINE.
- 4 PLACE CUTTINGS INTO THE LOG/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 STREAMBANK FILL PER THE GRADATION SHOWN ON THE DRAWINGS.
- 6 WASH FINES AND WATER FROM ONSITE INTO THE STREAMBANK FILL TO SEAL THE VOIDS IN THE BACKFILL.
- 7 PLACE A 8-12 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.

## STREAMBANK FILL GRADATION

SIZE (INCHES)	PERCENT PASSING	REPRESENTATIVE SIZE CLASS
4-5	100	D95
2-4	90 - 100	D84
1.5-2.0	50 - 80	D65
1.0-1.5	30 - 50	D35
0.5-1.0	10 - 30	D15
FINES	0	

## MATERIAL SCHEDULE (PER LINEAR FOOT)

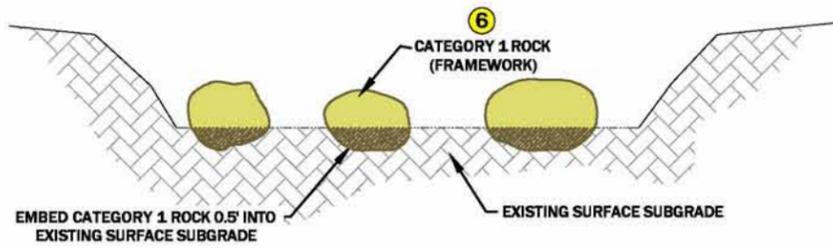
ITEM	RIFFLE QUANTITY	POOL QUANTITY	DIA. (IN)	LENGTH (FT)
1 CY OF SUBGRADE EXCAVATION	0.34	1		
6 CY OF STREAMBANK FILL	0.1	0.3		
3 CATEGORY 3 WOOD	0.2	1	3-6	8-10
4 CATEGORY 4 WOOD	0.3	1	1-3	8-10
7 SEDGE SOD MAT	12 SF	12 SF	8-12 (THICK)	
5 WILLOW CUTTINGS	10	10	0.75-1.5	6-8

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	DESIGN	MD

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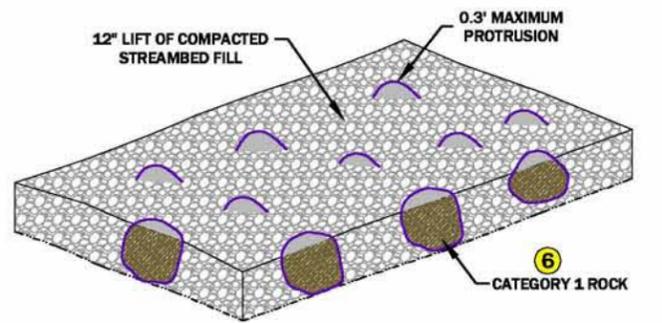
**6.2**



**CATEGORY 1 ROCK INSTALLATION**  
SECTION VIEW NTS



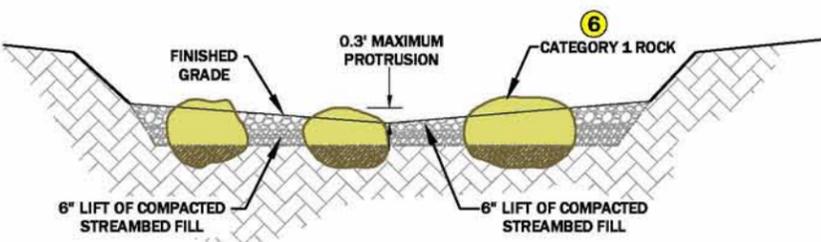
CHANNEL SUBGRADE



**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. CONSTRUCTION OF THE ENGINEERED RIFFLE WILL OCCUR AFTER THE CHANNEL AND FLOODPLAIN SUBGRADE BACKFILL IS PLACED.
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.

**NOTES ON CONSTRUCTED CHANNEL STREAMBED INSTALLATION**

1. PRIOR TO CONSTRUCTION OF THE ENGINEERED RIFFLE, ENGINEER SHALL VERIFY CHANNEL SUBGRADE ELEVATIONS. CHANNEL SUBGRADE SERVES AS THE FOUNDATION FOR THE CONSTRUCTED CHANNEL STREAMBED.
2. CONTRACTOR SHALL STOCKPILE CHANNEL ALLUVIUM PER SPECIFICATIONS NOTED ON THE DRAWING.
3. PREPARE THE COBBLE FRAMEWORK. CONTRACTOR SHALL PLACE 8-INCH D100 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, D100 BOULDER ELEVATIONS SHALL BE PLACED ONTO THE EXISTING SUBGRADE TO ASSURE BOULDER PROTRUSION ABOVE FINISH GRADE WILL BE NO GREATER THAN 0.3-FT.
4. PREPARE THE CHANNEL ALLUVIUM MATRIX. AFTER THE BOLDER FRAMEWORK IS COMPLETE AND INSPECTED BY ENGINEER, PLACE A 0.5' LIFT OF STREAMBED FILL AND WASH FINES INTO THE STREAMBED. PLACE AN ADDITIONAL 0.5' LIFT OF STREAMBED FILL TO FINISHED GRADE AND WASH FINES INTO STREAMBED. INDIVIDUAL COURSES SHALL BE BUCKET COMPACTED.

**STREAMBED FILL GRADATION**

SIZE CLASS	PERCENT PASSING
4-INCH	100
3-INCH	90 - 100
2-INCH	50 - 80
1-INCH	30 - 50
0.5-INCH	10 - 30
SAND	0

**MATERIAL SCHEDULE (PER LINEAR FOOT)**

ITEM	QUANTITY
6 CATEGORY 2 ROCK	2 EA
7 STREAMBED FILL	1.0 CY

**CONSTRUCTED CHANNEL  
STREAMBED DETAIL**

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	FINAL DESIGN	JM/GD

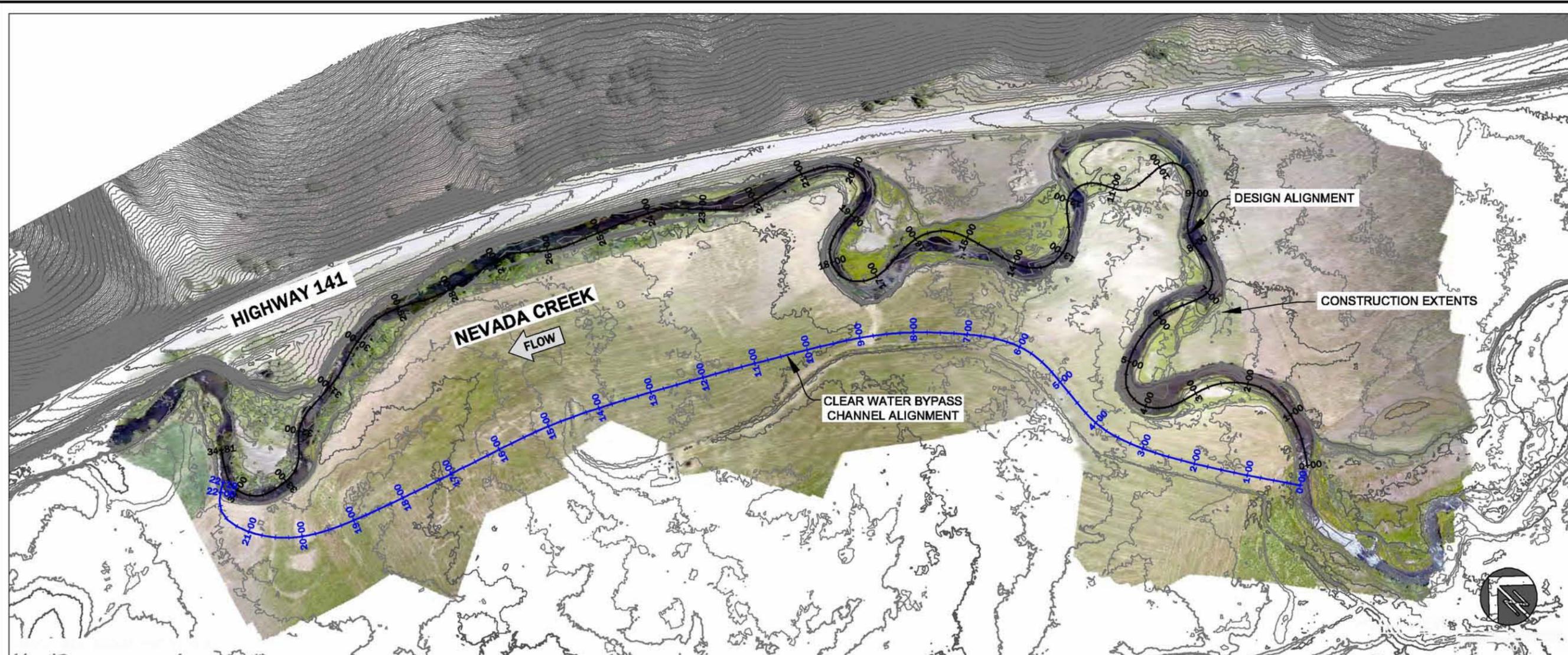
preliminary  
-not for construction-

PROJECT NUMBER  
RDG-18-041

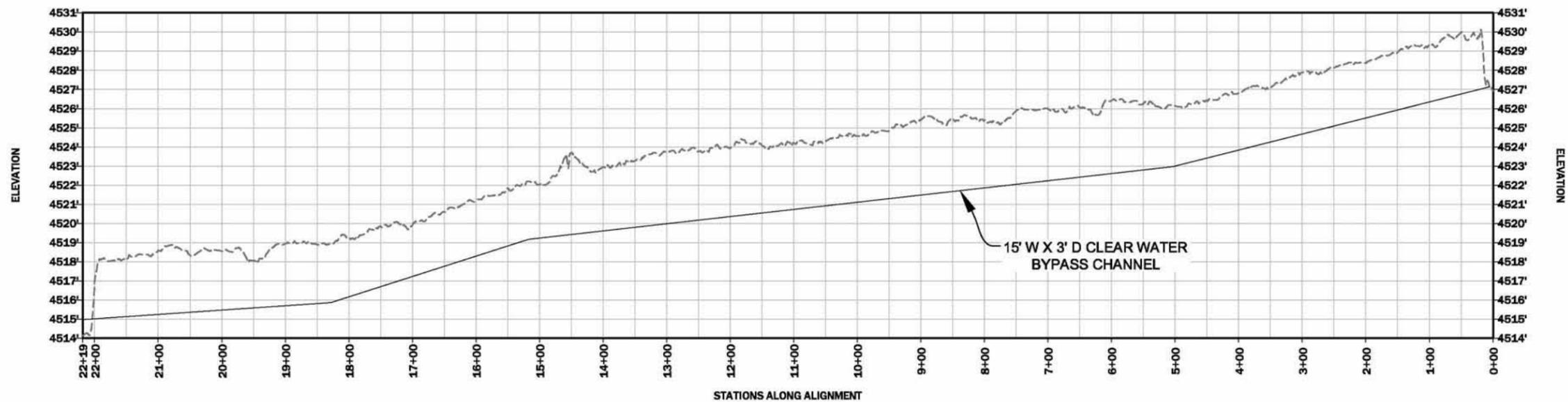
SHEET NUMBER

**6.3**





**BYPASS CHANNEL PROFILE**



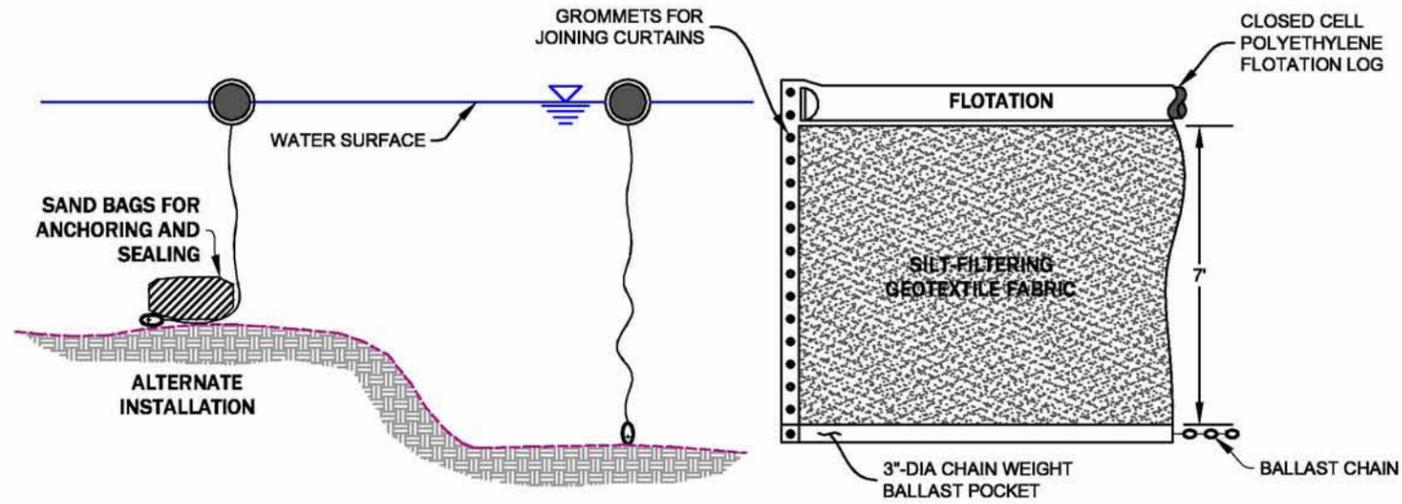
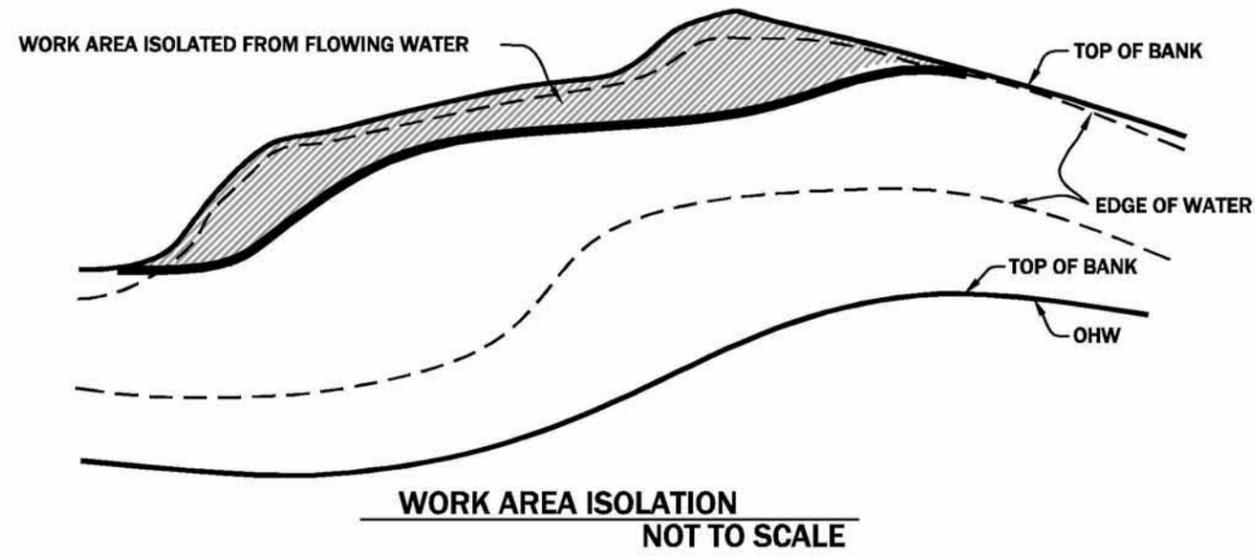
**DEWATERING PLAN**

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	DESIGN	JM

**PROJECT NUMBER**  
RDG-16-041

**SHEET NUMBER**

**7.0**



FLOATING SILT CURTAIN SHALL BE A "LAYFIELD FSC 13" OR APPROVED EQUAL. THE BODY OF THE FLOATING SILT CURTAIN IS MADE FROM A STRONG, HIGH-FILTRATION FABRIC THAT RETAINS FINE SILTS AND SEDIMENTS ON-SITE. THE FLOAT AND BOTTOM SLEEVE ARE CONSTRUCTED FROM A UV-STABLE, HIGH-STRENGTH POLYETHYLENE (I.E. RIPSTOP-TYPE MATERIAL). THE FLOATING SILT CURTAIN IS INCREASED IN LENGTH BY JOINING ADDITIONAL SECTIONS OF CURTAIN, WHICH TYPICALLY COMES IN 50' LENGTHS.

**FLOATING SILT CURTAIN**  
NOT TO SCALE



EXAMPLE OF FLOATING SILT CURTAIN PLACEMENT

**BMP DETAILS**

NO.	DATE	BY	DESCRIPTION	CHK
1	11-22-16	NW	FINAL DESIGN	JM/GD
			<i>preliminary</i>	
			<i>-not for construction-</i>	

PROJECT NUMBER  
RDG-18-041

SHEET NUMBER

**7.1**

# MATERIALS LIST

Category	Item	Quantity	Units	Diameter	Length	Rootwad
<b>Wood</b>	Category 2 Wood	126	ea	6 in - 10 in	10 ft - 12 ft	Yes
	Category 3 Wood	2,597	ea	3 in - 6 in	10 ft	No
	Category 4 Wood	3,614	ea	< 3 in	10 ft	No
	Riparian Cuttings	TBD	ea	0.25 in	6 ft - 8 ft	No
<hr/>						
Category	Item	Quantity	Units	Diameter		
<b>Rock</b>	Streambed Fill	1,495	cy			
	Category 1 Rock	54	ea	18 in - 24 in		
	Category 2 Rock	44	cy	8 in		
<hr/>						
Category	Item	Quantity	Units	Diameter	Length	
<b>Floodplain Micro</b>	Small Wood	TBD	ea	3 in - 6 in	10 ft	
	Brush	TBD	ea	< 3 in	10 ft	
<hr/>						
Category	Item	Quantity	Units	Quantity	Units	
<b>Misc.</b>	Sod	5,446	lf	0.38	ac	
	Exclosure Fencing	2,628	lf			

NO.	DATE	BY	DESCRIPTION	CHK
1	11-23-16	NW	DESIGN	MD
			preliminary	
			-not for construction-	
PROJECT NUMBER RDG-16-041				
SHEET NUMBER <b>8.0</b>				