Completion Report
Rapid River Diversion
Fish Passage Improvement Project

Rapid River, Little Salmon River Subbasin
Central Idaho

Final

Prepared for
Idaho County SWCD
Grangeville, Idaho

Prepared by
Bureau of Reclamation
Pacific Northwest Region
Snake River Area Office
Grangeville Field Station

June 2006

Looking at the point of diversion from the bridge upstream of the project site before construction. The original structure did not have an adjustable headgate. October 10, 2005.

Looking at the point of diversion from the bridge upstream of the project site after construction. The headgate and sluiceway built as part of the project are shown on the left of the photo. January 2006

This project was initiated and completed through the combined efforts of many entities, public and private. The purpose of the project was to provide for continued use of water while enhancing conditions for anadromous fish listed under the Endangered Species Act. The Bureau of Reclamation prepared this completion report in accordance with the 2004 National Marine Fisheries Service Federal Columbia River Power System Biological Opinion to describe the design and construction of this project.

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1. Introduction and Background

The Rapid River Diversion project removed a push-up dam on the lower Rapid River, a tributary of the Little Salmon River, which was a passage barrier to upstream migrating Chinook salmon, bull trout, and steelhead. The push-up dam also required annual instream maintenance with heavy machinery. The diversion did not have an adjustable headgate and the existing fishscreen was periodically overtopped with water. Construction began in fall 2005 on a new diversion structure consisting of a concrete headworks and sluiceway and two rock double-drop V-weirs. The diversion has improved stream connectivity, fish passage, and access to more than 8.0 miles of high quality spawning and early rearing habitat.

The project was sponsored by the Idaho County Soil and Water Conservation District (SWCD), Grangeville, Idaho. Funding was provided through the Idaho Office of Species Conservation from the Pacific Coast Salmon Recovery Funds matched with funds from the Idaho Water Quality Projects for Agriculture. The Bureau of Reclamation (Reclamation) assisted with the designs and permitting of the project (NOAA Fisheries 2004). The landowner and water user is Mr. Aaron Wilson, Cross O Ranch. The contractor was Cook and Sons, White Bird, Idaho.

The project was identified and planned as part of a conservation measure to implement the updated proposed action that is part of the 2004 FCRPS Biological Opinion. The tributary habitat program was designed as a voluntary program to work with private landowners and water users to address specific limiting factors in the basins in an attempt to offset mortality associated with the main stem Columbia River dams. Flow, diversions, and altered channel morphology were identified as limiting factors to spring/summer Chinook salmon and steelhead trout in the Little Salmon River subbasin (NOAA Fisheries 2004).

The Rapid River Diversion supplies water for irrigation of private property adjacent to the river. The diversion is on the Rapid River approximately 2.5 miles upstream from the confluence with the Little Salmon River (Drawing 1678-100T-469). The diversion is about 1-mile downstream from the Rapid River Fish Hatchery and about 1.25-miles upstream from the hatchery collection facility on Rapid River. Wild fish swim around the collection site in a concrete fish ladder and hatchery fish are trapped and hauled to the hatchery by truck.

1.1 Problems and Solutions

This project was part of a demonstration project that the Idaho County SWCD will use to show irrigation improvements to other private landowners in the local area to encourage continued participation in the program. The project was successful due to interagency efforts to work with willing landowners to address these resource-related issues.

1.2 Participation and Cooperation

The project was sponsored and coordinated by the Idaho County Soil and Water Conservation District. Funding was provided by the Idaho Office of Species Conservation (OSC) Pacific Coast Salmon Recovery Funds and the Idaho Water Quality Program for Agriculture. The landowner and water user, Mr. Aaron Wilson of Cross O Ranch, donated material for the project. The IDFG provided personnel and equipment during fisheries surveys and salvage operations. The Bureau of Reclamation provided technical assistance with the designs and permitting, material selection, and contract inspection. The contractor was Cook and Sons, White Bird, Idaho.

1.3 Fishery

Rapid River provides spawning and rearing habitat for threatened Snake River steelhead, endangered spring/summer Chinook salmon, and threatened bull trout. The river also provides habitat for numerous other native fisheries species, such as cutthroat trout and rainbow trout. Instream work occurred in the NE ¼, SW ¼, Section 6, T. 23 N., R. 1 E. (45°21'32"N 116°23'16"W). About 125 meters (410 feet) of the main channel of Rapid River was dewatered during the installation of the rock weirs. The mobilization of some fine sediment during the installation and removal of the coffer dams was unavoidable; however, best management practices were used to minimize the mobilization of this fine sediment in the river channel.

The completed project lies within designated critical habitat and essential fish habitat for spring/summer Chinook salmon. Chinook salmon use Rapid River for spawning, migration, and rearing. The population in Rapid River is heavily supplemented by hatchery fish released at the Rapid River Hatchery. Adult spring Chinook return to Rapid River from about May 24 through July 23. These fish are primarily hatchery returns. In 1999, 8 adult summer Chinook salmon returned to Rapid River from about July 16 through August 17. These fish were unmarked and presumed wild origin. Several hundred thousand Chinook salmon smolts are released into Rapid River from mid-March through the end of April. (IDFG 2001)

Steelhead trout use Rapid River for spawning, migration, and rearing. During 1999, 39 adult steelhead returned to Rapid River from March 20 to June 1. Ten of these steelhead were unmarked and allowed to pass the facilitiy. The remaining 29 hatchery steelhead were released in the Little Salmon River. Juvenile rainbow/steelhead trout outmigrate from the upper reaches of Rapid River during fall months. The timing of this outmigration is likely influenced by temperature and precipitation. (IDFG 2001)

Columbia Basin bull trout use Rapid River for spawning, migration, and rearing. Adult migrating bull trout enter Rapid River between May 8 and September 7 with most of the trout

passing the Rapid River hatchery trap by July 20. Fluvial bull trout from the Salmon and Rapid Rivers have been radiotagged during the last 10 years to acquire seasonal movement and survival data. Fluvial adult bull trout spawn in the upper reaches of the Rapid River subbasin (upstream from Paradise Creek) in early September and immediately begin the downstream migration to the Salmon River. The downstream migration is completed in September. Juvenial bull trout begin the downstream migration about August 14. The end of this migration has not been documented due to problems maintaining the downstream weir during the fall. The outmigration appears to be largely completed by November 1; however, this is likely precipitation and temperature dependent. (IDFG 1998)

1.4 Permits

Reclamation provided technical assistance with environmental permitting and compliance. Formal consultations under the Endangered Species Act were completed with NOAA Fisheries (2005) and USFWS (2005). A Finding of No Significant Impact and Programmatic Environmental Assessment were completed for the Tributary Habitat Program by Reclamation (2003). A cultural site evaluation was conducted as part of the NEPA process. The project was exempt from other permits.

Fish were salvaged from the work site and water quality monitored during construction as part of biological opinion terms and conditions (NOAA Fisheries 2004, USFWS 2000).

1.4.1 Fish Salvage

Fish were salvaged in a cooperative effort with personnel from Idaho Department of Fish and Game (IDFG), McCall Office and Bureau of Reclamation's (Reclamation) Snake River Area Office. Fish in the dewatered section of the stream were salvaged with the aid of an electroshocker and dip nets on October 11. The fish were transported to live wells and released upstream when the daily activites were completed. Prior to release a subsample of the fish were measured to the nearest millimeter (fork length and total length). On October 20 the river was moved to the south side of the channel and allowed to flow over the recently installed rock weirs. A second fish salvage was conducted in the newly dewatered channel. Water and fish were allowed to pass the work site continuously during construction. On the south side of the river, a headgate and sluice way were installed and the canal was reshaped to the existing fish screen (Table 1).

Table 1. Fish captured and transported from Rapid River Diversion construction site on October 11 and October 20, 2005.

Species	Total Number	Range of Fork Length (mm)	Range of Total Length (mm)
Fish collected from the south side of the channel, dewatered on October 11, 2005			
Chinook salmon	25	93-107	102-116
Rainbow/steelhead	112	51-302	52-315
Bull trout	5	198-228	206-236
Sculpin	269		
Fish collected from the north side of the channel, dewatered on October 20, 2005			
Rainbow/steelhead	49	52-176	
Sculpin	679		

1.4.2 Water Quality

Water samples were collected at three sites (upstream from the work site, 152-meters (500-feet) downstream from the work site, and 1,609-meters (1-mile) downstream from the work site at the Rapid River fish collection facility) during cofferdam construction and periodically during the instream work. The samples were stored on ice or in a refrigerator and were transported to Reclamation's Regional Water Quality Lab for measurement of total suspended solids (Table 2).

Table 2. Total suspended solids (mg/L) measured during instream construction.

Collection Date	Time	Upstream (background)	152-meters Downstream	1609-meters Downstream	Work Activity
October 2005					
11	14:45	1	11	13	construct cofferdam
13	10:30	<1	2		install V weirs in dry
18	12:00	1	2		install V weirs in dry
20	10:15	<1	8	11	move cofferdam
20	12:50	2	4	4	move cofferdam
20	14:30	2	3	3	move cofferdam
25	14:00	<1	<1		no activity
27	09:00	3	3		no activity
November 2005					
1		<1	9		start pumping at headgate
4		1	3		pumping at headgate
8		<1	<1		pumping at headgate
10		<1	9		pumping at headgate

1.4.3 Contracts Specifications and Bidding

Technical specifications and contract language for the project were completed by Reclamation using the standard NRCS format and language. The SWCD approved the specification and conducted the contract bidding and oversight (Table 3).

Table 3. Project timeline.

Activity	Completion Date	Lead Agency or Entity
Initial contact with landowner	June 2004	Reclamation
Predesign Memorandum	February 2005	Reclamation
Landowner agreement signed	March 7, 2005	Reclamation
Final design		Reclamation
NEPA documentation	September 1, 2005	Reclamation
Biological assessment sent to USFWS and NOAA Fisheries for review	April 19, 2005	Reclamation
USFWS Biological Opinion	September 8, 2005	USFWS
NOAA Fisheries Biological Opinion	October 7, 2005	NOAA Fisheries
Grant awards and processing	June 8, 2005	Idaho County SWCD
Contract bidding period open to public	August 9-22, 2005	Idaho County SWCD
Contractors' walk-through of site	August 16, 2005	Reclamation Idaho County SWCD
Construction contract awarded	September 19, 2005	Idaho County SWCD
Construction initiated	October 3, 2005	Cook and Sons, White Bird, Idaho
Construction completed	January 12, 2006	Cook and Sons, White Bird, Idaho

The Idaho County SWCD received and held the Idaho OSC funds and Idaho WQPA funds, and documented the cost shares. When provided with invoices, the district reimbursed the contractor and suppliers as needed (Table 4).

Table 4. Expenditures upon project completion, spring 2006.

Grant	Awarding Agency or Entity	Cost Share	Amount
Salmon Recovery Funds	Idaho Office of Species Conservation	25 %	$114,500
Water Quality Program for Agriculture	Idaho Soil Conservation Commission		$38,500
Non-Federal inkind contributions	Landowner, Idaho Department of Fish and Game		$9,500

2. Project Description

The project design modified the existing diversion dam and headworks to improve fish passage and irrigation water withdrawals. The project did not change water rights or irrigation water withdrawals at the site and was designed to reliably deliver 5.4 cfs, which is the maximum design rate for the existing fish screen (4.6 cfs) plus the screen bypass flow

(0.8 cfs) to return fish to the river. Design options are described in the *Rapid River Diversion Improvements Pre-Design Memorandum* (Reclamation 2005).

The project addressed three problems identified in the *Salmon Subbasin Management Plan*: stream flow diversion, anthropogenic migration barriers, and fish entering irrigation systems. The completed project has restored the river channel at the diversion site, and now meets NOAA Fisheries's fish passage guidelines. In addition, the need for instream maintenance has been reduced.

2.1 Construction Process

Construction activities occurred from October 2005 through January 2006, but construction activity was not continuous. A Reclamation geologist assisted in the selection of suitable weir rock from the landowner's feedlot. The work site was dewatered using a cofferdam constructed from large straw bales covered with an impermeable liner. Seepage into the worksite was removed using several 4-inch and 6-inch pumps. About 2,200 square meters (23,680 square feet) of stream bed was dewatered during construction. During installation of the weirs, the main channel of Rapid River was dewatered for 10 days. Thereafter, the cofferdam isolated the area surrounding the headgate and canal, and most of the river channel was watered during the remainder of construction.

The cofferdam was installed on October 11 and diverted the river to the north side of the channel. On October 20, the coffer dam was moved, diverting water to the south side of the channel. The streambed was excavated to install 3 to 4 foot diameter rocks for the V-weirs. Geomembrane liners were placed on the upstream face of each weir.

2.1.1 Description of Work

October 3-7

Contractor hauled large rock for weirs and stockpiled the rock adjacent to the work site. Rock donated by landowner from a feedlot located about 2 miles from the construction site.

October 10

Completed hauling rock from borrow pit to work site; began clearing at work site.

October 11

Continued clearing work site; began cofferdam construction. Reclamation and Idaho Department of Fish and Game (IDFG) personnel shocked and removed fish within the cofferdam area (Table 1). Dana Weigel took water quality samples (Table 2).

October 12

Diversion of river into canal continues. Verified survey control points and laid out the corner boulders of the weirs.

October 13

Diversion of river into canal continues. Water discharged into the adjacent pasture until it ran clear, then discharged back into the canal. Began work on the lower section of the lower weir; installed geomembrane liner against the face of the rock. Placed the bottom row of rock for the upper section of the lower weir.

October 14

Diversion of river into canal continues. Continued placing rock for lower weir. Native rock material was placed behind the weir rocks for support and to create the scour pool. Excavated upstream from the upper weir section and installed a geomembrane liner.

October 18

Diversion of river into canal continues. Set up pumps to dewater work site. Discharge was clean and directed to the canal. Completed placing rock for the upper and lower sections of the upper double-drop weir. Placed geomembrane liner on the face of weirs.

October 19

Diversion of river into canal continues. Built a cofferdam along the left side of the upper weir to dewater the canal and headworks structure work area. Removed the center portion of the straw-bale cofferdam, returning most of the river flow to its original channel and over the rock weirs.

October 20

Completed removing straw bales to divert water back into the river channel. Excavated a sump and installed pumps to dewater the headworks and canal work areas. Began excavation for the headworks structure down to the water level. Located and staked canal centerline, headworks structure. Reclamation and IDFG personnel shocked and removed fish from dewatered work areas (Table 1).

October 24

Installed additional pumps. Discharged water into the adjacent field until it ran clear, then directed water to the river. Cleared and grubbed the canal prism embankment area. Continued excavation for the headworks structure. Excavation for slope reinforcement rock completed. Contractor elected to build the alternate design for slope reinforcement using more smaller rocks.

October 25

Installed additional pump to dewater headwork and corral area. Continued to clear and grub canal banks and the emergency spillway. Completed excavation for the headworks and wing walls to approximately elevation 2147.5 feet.

October 26

Two trailers loaded with concrete forming material delivered to site.

November 2

Substituted two larger 6-inch pumps to dewater area. Installed perforated pipe collector. Subcontractor poured concrete for header structure on November 1st. Removed forms from the footer walls. Removed culvert downstream from the fish screen and installed the new section of 36-inch diameter corrugated metal pipe (CMP).

November 4

Dressing canal slopes to grade and compacted slopes between the headgate structure and the stop log structure. Formed up the wing wall footers and floor of the headgate structure.

November 7

Dewatered work area for headgate structure. Completed forming the headgate structure. Completed placing concrete for footers and floor of the headgate structure. Constructed a shelter over the concrete and applied curing compound.

November 10

Continued dewatering headgate structure. Tied rebar in the headgate structure walls; began setting the wall forms. Installed 3 feet of 36-inch CMP in the wall of the headgate structure.

November 11

Continued dewatering headgate structure. Placed all remaining concrete for headgate structure. Applied curing compound and covered the wall forms with concrete blankets. Pumps were run all night.

November 14

Continued running pumps to dewater the headgate structure. Removed the forms.

November 15

Continued running pumps to dewater the headgate structure. Patched tie holes and made small repairs to the concrete. Concrete allowed to set for +7 days; began to backfill on November 21st.

November 21

Dewatered area around the headgate structure while backfilling. Fill placed around the headgate structure and compacted up to elevation of the floor. Placed geomembrane on the upstream side of the structure. Slope-reinforcing rock placed on the downstream retaining wall. This completes the reinforcing wall on the downstream side of the structure. Placed 3-feet of rock on the downstream side of the structure in the river channel below the sluice gate to prevent erosion downstream of the structure when the sluice gate is opened. Placed fill upstream of the structure up to the invert of the structure floor.

November 22

Continued to dewater the headgate structure. Contractor placed weir rock adjacent to the headgate and began setting the two gates. Completed left side of weir to the headgate structure including geomembrane. While placing the weir rocks, adjustments were also made to several rocks in the middle of the weir that had been 6-inches too high during placement.

November 23

Continued to place backfill on the canal-side of the headgate structure. Compacted backfill material adjacent to the headgate with the whacker compacter. Set 19 feet of CMP culvert from the 3-foot-long stub in the headgate structure to the head of the canal. Compacted the backfill along the pipe. Set the headgate that controls water through the 36-inch CMP and mounted the 6-foot headgate on the downstream side of the headgate structure.

November 28

Contoured to dewater at reduced rate (last day). Placed more fill around the headgate structure. Placed extra rocks on the north side of the canal on the upstream side of the headgate structure to prevent erosion. Formed up the 6-foot gate to grout in place. Mounted stop log guides on the upstream and downstream sides of the headgate structure.

November 30

Placed stop log boards in the stop log structure between the fish screen and the headgate structure. Opened the head gate to the canal and filled the canal. Gate left open for stock-water run. Graded bank and slope along the river upstream of headgate. Removed small grout forms from around 6-foot sluice gate.

January 12

Completed seeding and strawing work area. Completed two wire gates in the new fence surrounding the canal. All specified work completed at the Rapid River site.

3. Conclusions

The Rapid River diversion project has resulted in a successfully operating irrigation diversion with improved fish passage. Seasonal high flows have not yet tested the rock weirs, and revegetation will take additional time to reestablish after reseeding. Water surface measurements were taken on November 9, 2006, just after the completion of the rock weirs, but before the completion of the headgate structure. At this time, a coffer dam was still in place and other construction material that caused some constriction on the upstream weir. The water surface elevations for the upstream weir were: 0.7 feet from upstream to the intermediate pool and 1.2 feet from the intermediate pool to the downstream pool. On the downstream weir, the water surface elevations were: 0.7 feet from upstream to the intermediate pool and 0.7 feet from the intermediate pool to the downstream pool.

Postconstruction adjustments to completed projects are oftentimes necessary once the project has been rewatered with higher flows. Two minor adjustments may be necessary for this project. First, the cross bar on the upstream A-weir appears to be higher in elevation than the design engineers intended. The intention was to have this drop closer to 0.7 feet, criteria for juvenile fish passage. The height of this drop will be reviewed during a field visit with NOAA Fisheries scheduled for August 7-9, 2006, and adjusted if needed. Second, about 0.3-0.5 feet of fill is needed at the overflow cutout in the canal embankment just upstream of the fish screen and downstream of the wasteway. The water surface elevations should be checked during canal operation to ensure that the screen submergence is in compliance for optimal operation (65-85 percent submergence of the drum screen).

4. References

Bureau of Reclamation (Reclamation). 2003. Finding of no significant impact and programmatic environmental assessment for implementing fish habitat improvement measures in four Mountain Snake Province subbasins under Action 149 of the December 2000 National Marine Fisheries Service Federal Columbia River Power System Biological Opinion. Snake River Area Office. Boise ID. April

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Rapid River Diversion
Fish Passage Improvement Project

Rapid River, Little Salmon River Subbasin
Central Idaho

Attachment A

Construction Photographs

Photographs by Bureau of Reclamation
Pacific Northwest Region Design Group
Boise, Idaho
and
Grangeville Field Station
Grangeville, Idaho

Photograph 1	Point of diversion looking upstream towards push-up dam and bridge before construction.
Photograph 2	View of the top of the upstream face of the push-up dam diversion from the right bank of the river looking downstream.
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Photograph 17	Rapid River has been diverted from the canal back into its original channel to isolate the canal and headworks work area.
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Photograph 22	View looking upstream from the canal showing large boulder for bank stabilization.
Photograph 23	Photograph showing the completed project immediately after construction, January 2006.

Photograph 1. Point of diversion looking upstream towards the push-up dam and bridge before construction. The headgate and sluiceway constructed during the project were placed near the bank on the right side of the photograph.

Photograph 2. View of the top of the upstream face of the push-up dam diversion from the right bank of the river looking downstream.

Photograph 3. View of the push-up dam on Rapid River looking upstream showing material that washes off the dam onto the riverbed downstream.

Photograph 4. Diversion channel wasteway structure and diversion culvert in foreground, diversion canal and fishscreen in background.

Photograph 5. Existing fishscreen installed and maintained by the Idaho Department of Fish and Game.

Photograph 6. Canal and culvert prior to construction.

Photograph 7. Boulders for weirs were stockpiled at worksite.

Photograph 8. Cofferdam construction, water is diverted into the existing canal.

Photograph 9 Dewatering worksite during weir installation by discharging water into adjacent pasture.

Photograph 10 Constructing lower weir.

Photograph 11. Rock weir during installation in the dewatered channel of Rapid River. Geomembrane has been placed on the upstream face of weir.

Photograph 12. Lower weir construction creating the scour pool.

Photograph 13. Dewatered section of Rapid River showing the completed lower weir after filling and grading the upstream face and geomembrane with native material.

Photograph 14. Constructing the upper rock weir and backfilling over the geomembrane with native material.

Photograph 15. Excavator building up the lower end of the cofferdam before moving the upper section to isolate the headworks and canal work.

Photograph 16. Center straw bales were removed from the cofferdam to begin returning water to the river channel.

Photograph 17. Rapid River has been diverted from the canal back into its original channel to isolate the canal and headworks work area.

Photograph 18. Rock placement to reinforce the left bank near the headgate.

Photograph 19. Wasteway structure and canal dewatered during construction, fall 2005.

Photograph 20. Canal prism realigned.

Photograph 21. Foundation and first section of retaining wall for the headgate and sluiceway.

Photograph 22. View looking upstream from the canal showing large boulder for bank stabilization. The coffer dam is shown on the left, and a portable pump used to dewater the work area is shown on the upper right of the photograph.

Photograph 23. Completed project immediately after construction, January 2006. The rock weirs with water running over them are in the middle of the photograph. The regraded canal and embankments are dewatered

Rapid River Diversion
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Rapid River, Little Salmon River Subbasin
Central Idaho

Attachment B

Survey Elevation Table and Final Design Drawings (includes location map)

Survey Elevation Table

Final Design Drawings

Drawing No. 1 1678-100-577 Location Map

Drawing No. 2 1678-100-645 Large Rock Sources Map

Drawing No. 3 1678-100-578 Site Plan

Drawing No. 4 1678-100-579 Survey Control and Existing Condition Plan

Drawing No. 5 1678-100-580 Headworks Plan, Sections and Detail

Drawing No. 6 1678-100-581 Headworks Sections, Details, Miscellaneous Metalwork

Drawing No. 7 1678-100-582 Grading Plan Rock Wiers and Headworks

Drawing No. 8 1678-100-583 Grading Plan–Fishscreen and Culvert

Drawing No. 9 1678-100-584 Rock Weirs Plan, Details, Section

Drawing No. 10 1678-100-587 Rock Weirs Sections and Details

Drawing No. 11 1678-100-585 36” Culvert Installation Plan, Elevation and Profile

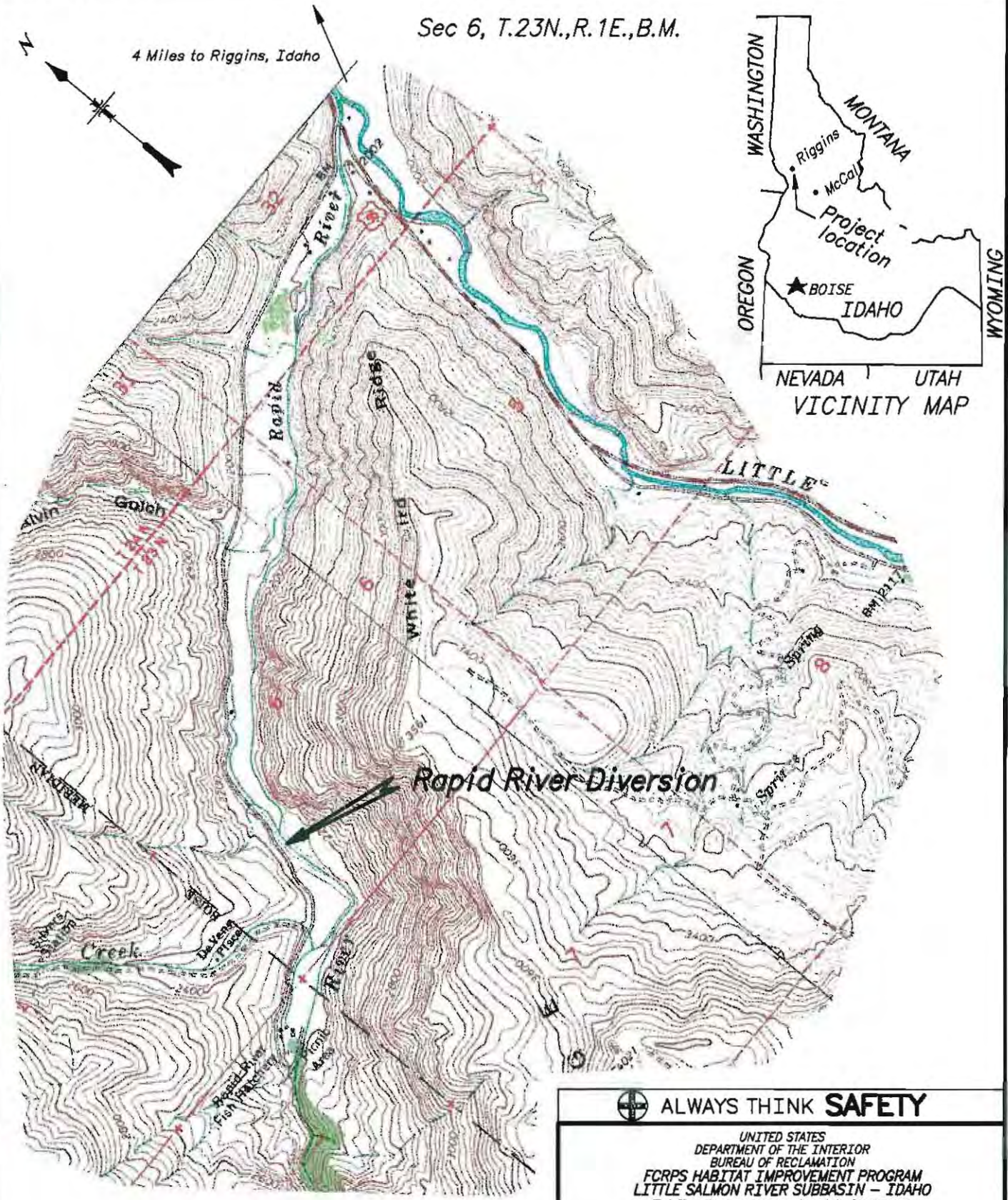
Drawing No. 12 40-D-6263 General Notes and Minimum requirements for Detailing Reinforcement

Drawing No. 13 40-D-6022 42” Two Rail Handrail Details

Survey of the rockweirs at Rapid River Diversion on 11/9/05.

Point	Description	Drawing Elevation	Field Elevation	Delta	Drop
Upstream rock weir					
ws1	upstream water surface		2154.7		
ws2	middle pool water surface		2154.0		0.7
ws3	downstream water surface		2152.8		1.2
U23	v-weir corner left	2153.8	2153.9	0.1	
U24	v-weir center left	2153.6	2153.6	0.0	
U14	v-weir center right	2153.6	2153.7	0.1	
U13	v-weir corner right	2153.8	buried	unknown	
U25	crossbar weir left	2153.5	2154.2	0.7	
U16	crossbar weir center	2152.7	2153.4	0.7	
U15	crossbar weir right	2153.5	2153.7	0.2	
Downstream rock weir					
ws4	upstream water surface		2152.8		
ws5	middle pool water surface		2152.1		0.7
ws6	downstream water surface		2151.4		0.7
D23	v-weir cornor left	2152.4	2152.3	-0.1	
D24	v-weir center left	2152.0	2152.0	-0.1	
D14	v-weir center right	2152.0	2151.9	-0.1	
D13	v-weir cornor right	2152.4	2152.4	0.0	
D25	crossbar weir left	2152.5	2152.2	-0.3	
D16	crossbar weir center	2150.8	2150.6	-0.2	
D15	crossbar weir right	2152.5	2152.4	-0.1	

1678-100-577



HEAVENS GATE, IDAHO
7.5" QUADRANGLE

0 2000 4000 6000
SCALE OF FEET

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
FCRPS HABITAT IMPROVEMENT PROGRAM
LITTLE SALMON RIVER SUBBASIN – IDAHO

RAPID RIVER DIVERSION
LOCATION MAP

DESIGNED Charlie Spindler _ TECH. APPROVAL Charlie Spindler	
CHECKED Steve E. Montague	
DRAWN G. Grooms / LB APPROVED Dave Jennings PROGRAM MANAGER	
CADD SYSTEM AutoCAD Rel. 16.0	CADD FILENAME 1678-100-577.DWG
BOISE, IDAHO Jan. 2004	1678-100-577

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LBOECKWEG

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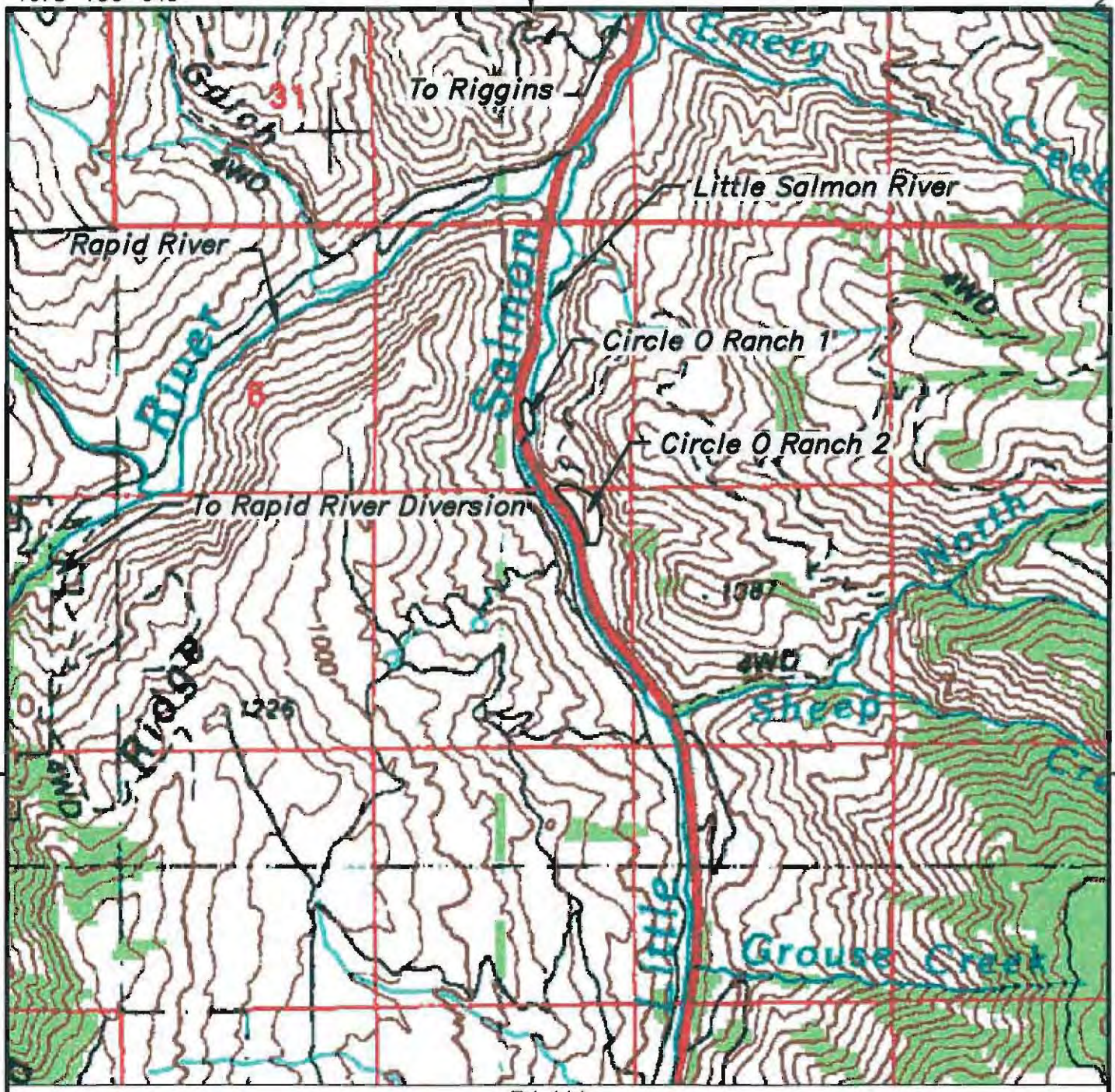

PLAN

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
FCRPS HABITAT IMPROVEMENT PROGRAM
LITTLE SALMON RIVER SUBBASIN - IDAHO

RAPID RIVER DIVERSION
LARGE ROCK SOURCES MAP

DESIGNED Charlie Spindler TECH. APPROVAL Charlie Spindler
CHECKED Steve Montague
DRAWN L. Boekweg APPROVED Dave Jennings
PROGRAM MANAGER

CADD SYSTEM	CADD FILENAME
AutoCAD Rel. 16.0	1678-100-645.DWG

1678-100-645

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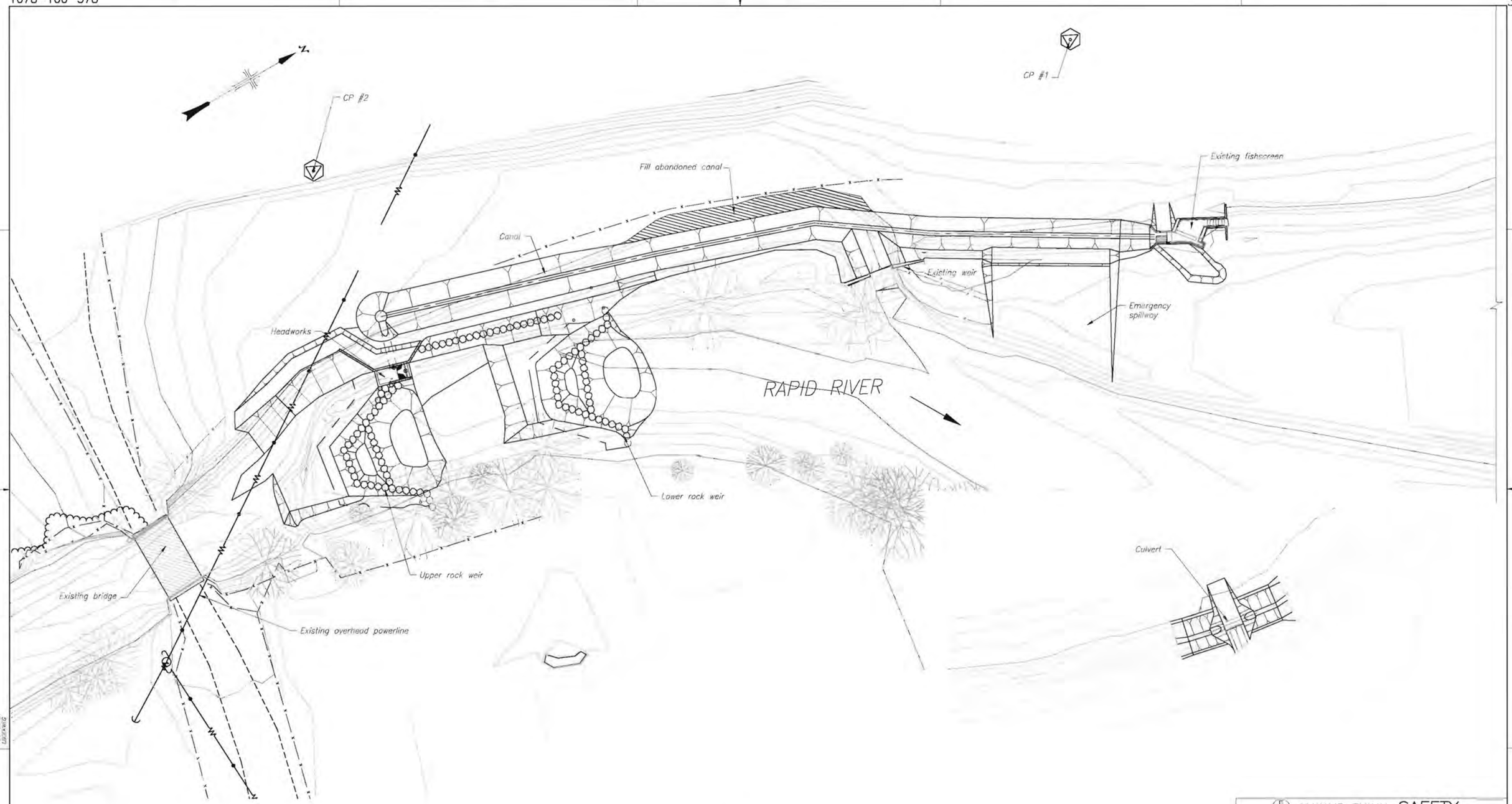
1678-100-578



SITE PLAN

SCALE: 0 20 40 60 OF FEET

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BUREAU OF RECLAMATION

COLUMBIA/SNAKE RIVER SALMON RECOVERY
FCRPS HABITAT IMPROVEMENT PROGRAM-LITTLE SALMON SUBBASIN

RAPID RIVER DIVERSION

SITE PLAN

DESIGNED Charlie Spindler CHECKED Steve Montague
DRAWN Boekweg TECH. APPR. Charlie Spindler
APPROVED Dave Jennings

BOISE, IDAHO SHEET 1 OF 1 2005-05-05

1678-100-578

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Boekweg

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Microstation V8
CAD FILENAME
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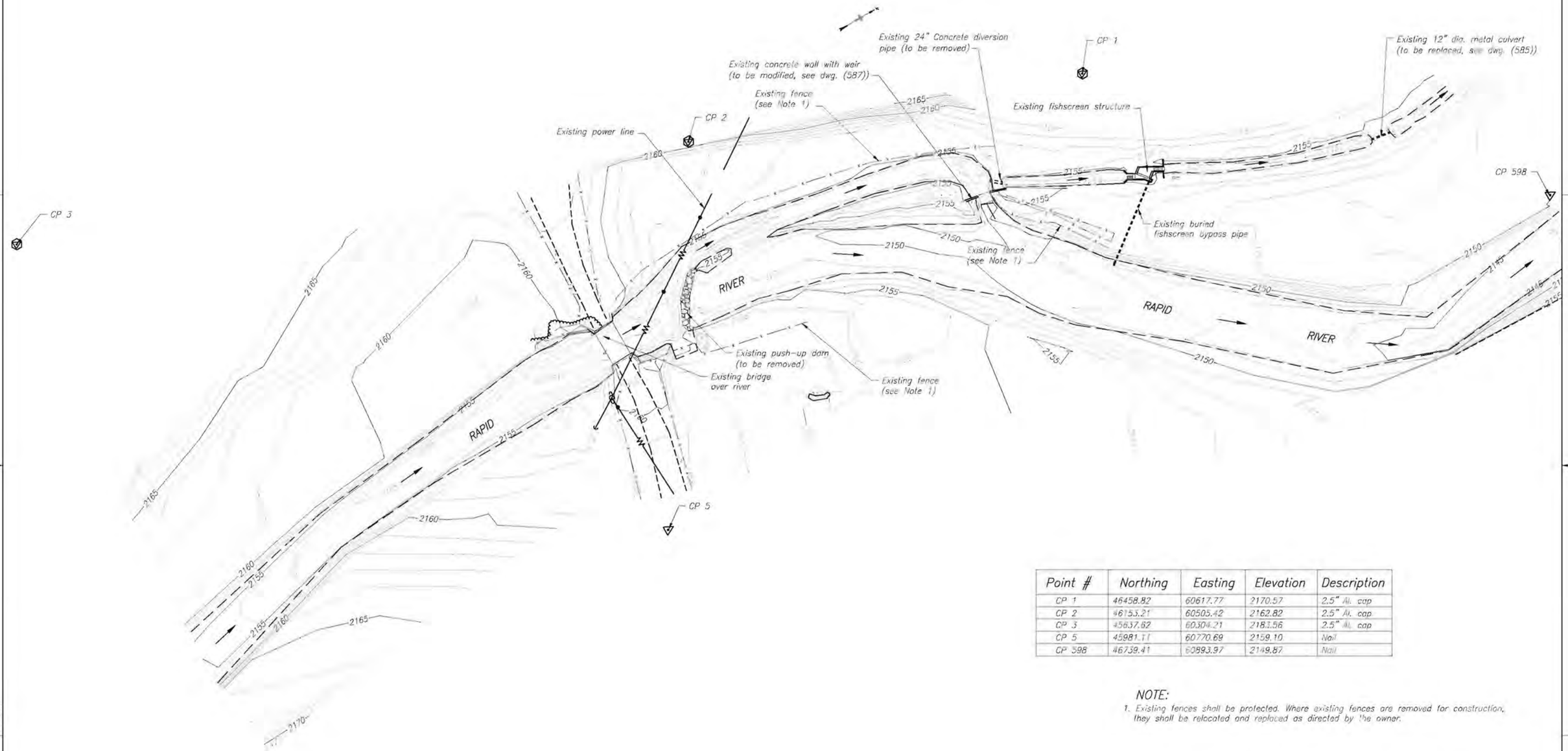

PLAN

40 0 40 80 120
SCALE OF FEET

Point #	Northing	Easting	Elevation	Description
CP 1	46458.82	60617.77	2170.57	2.5" Al. cap
CP 2	46153.21	60505.42	2162.82	2.5" Al. cap
CP 3	45837.82	60304.21	2181.56	2.5" Al. cap
CP 5	45981.11	60770.69	2159.10	Nail
CP 598	46739.41	60893.97	2149.87	Nail

NOTE:

1. Existing fences shall be protected. Where existing fences are removed for construction, they shall be relocated and replaced as directed by the owner.

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CAD SYSTEM
AutoCAD Civil 3D 2024
CAD FILENAME
1678-100-579.DWG

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FCRPS HABITAT IMPROVEMENT PROGRAM-LITTLE SALMON SUBBASIN

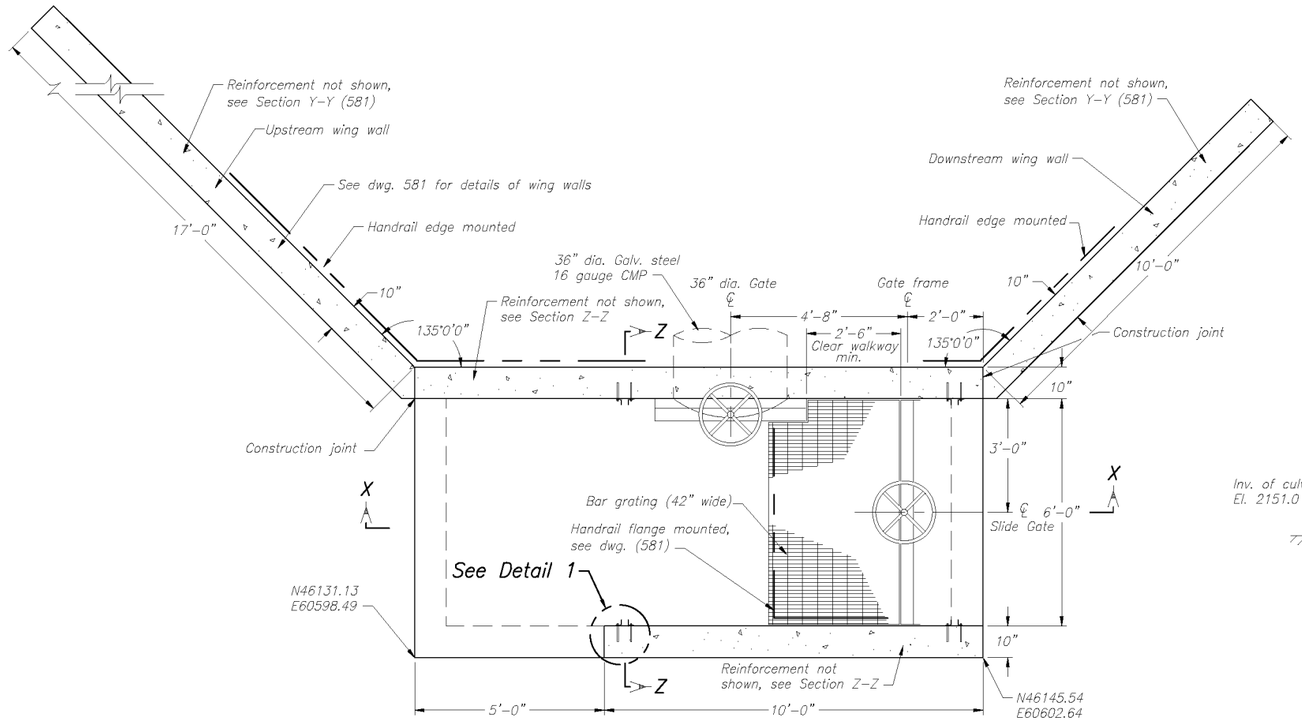
RAPID RIVER DIVERSION

SURVEY CONTROL AND EXISTING CONDITION

PLAN

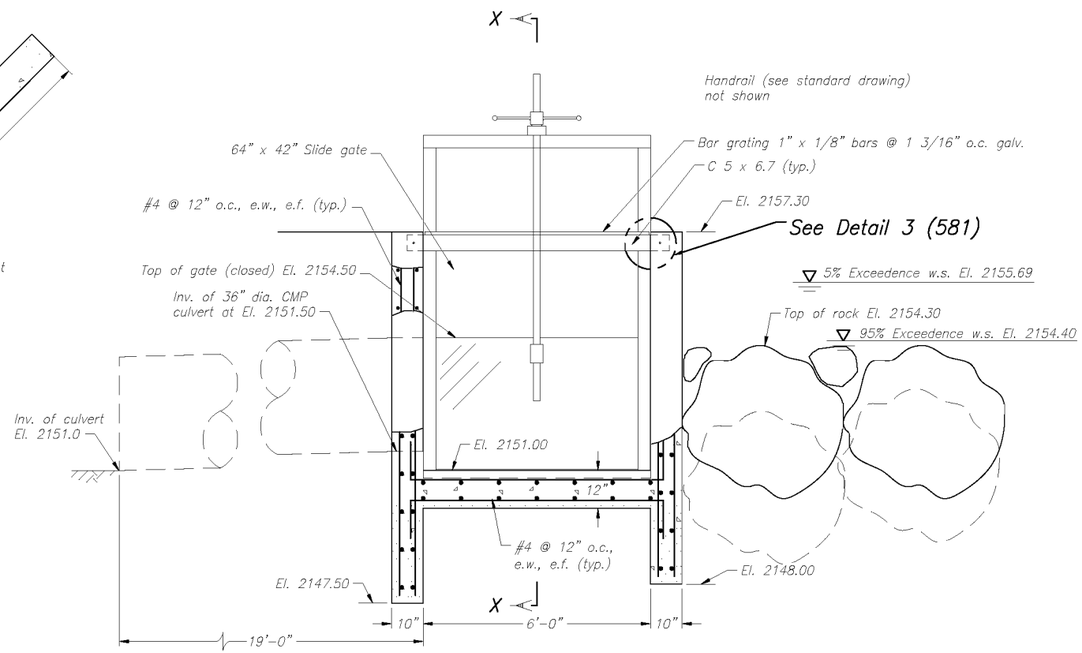
DESIGNED Charlie Spindler CHECKED Steve Montague
DRAWN L. Berweg TECH. APPR. Charlie Spindler
APPROVED Dave Lentsinga

BOISE, IDAHO SHEET 1 OF 1 2025-05-06 1678-100-579



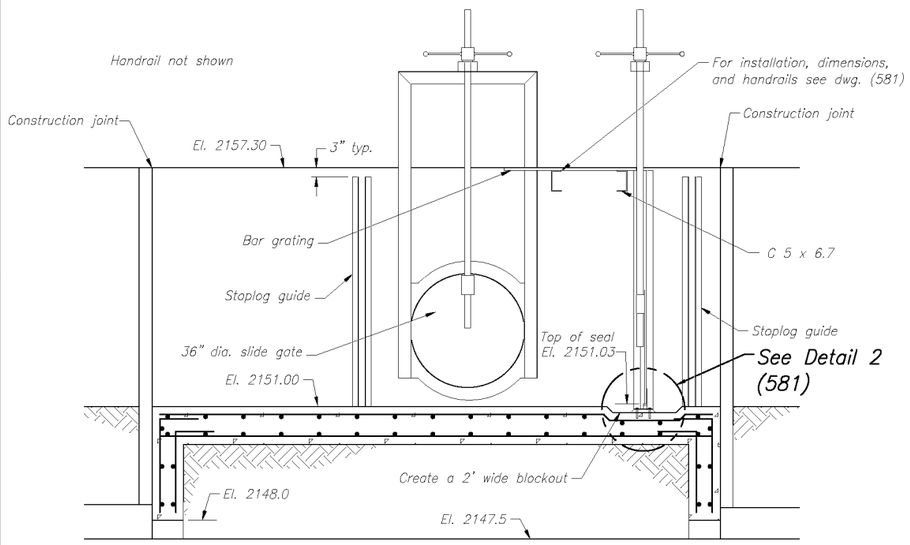
PLAN

SCALE OF FEET



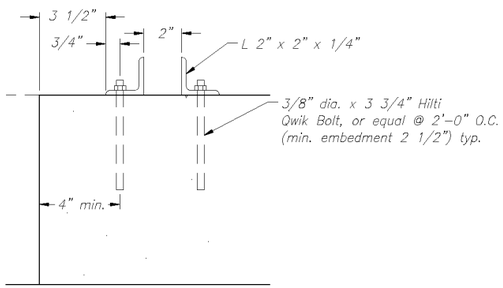
SECTION Z-Z

SCALE OF FEET



SECTION X-X

SCALE OF FEET



DETAIL 1

TYP. ALL LOCATIONS

SCALE OF INCHES

NOTES:

1. Handrails shall be installed shown and as necessary to limit maximum vertical fall exposure to 3' high. Details of handrails shall be per dwg. 40-D-6022 unless otherwise shown.
2. Specified compressive strength of concrete f_c', shall be 4000 psi., specified yield strength of reinforcement, f_y, shall be 60,000 psi.
3. Construction shall meet the requirements of USBR Standard Design General Notes and Minimum Requirements for Detailing Reinforcement, dwg 40-D-6263.

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RAPID RIVER DIVERSION

HEADWORKS

PLAN, SECTIONS AND DETAIL

DESIGNED Charlie Spindler CHECKED Steve Montague
DRAWN L. Boekweg TECH. APPR. Charlie Spindler
APPROVED Dave Jennings PROGRAM MANAGER

BOISE, IDAHO 2005-05-05 SHEET 1 OF 1

1678-100-580

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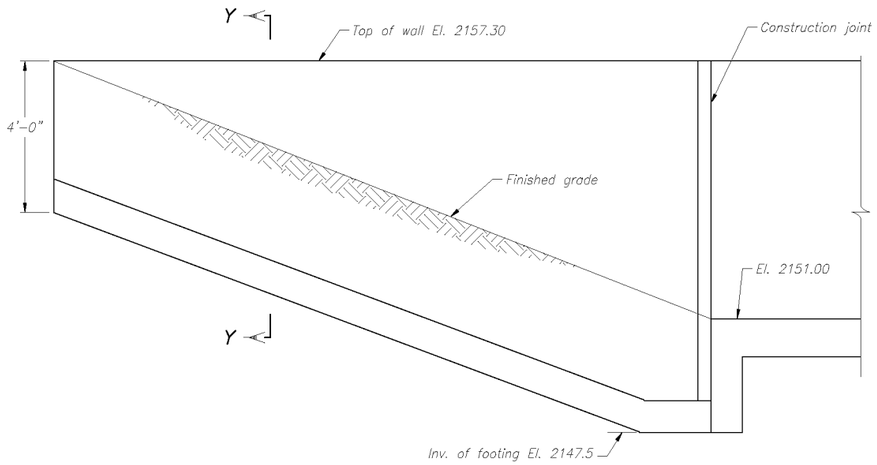
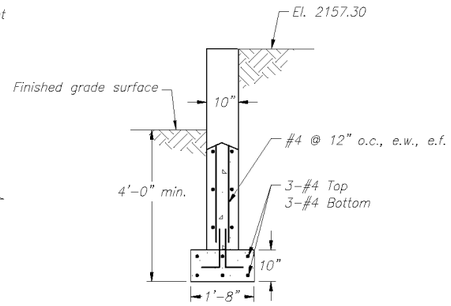


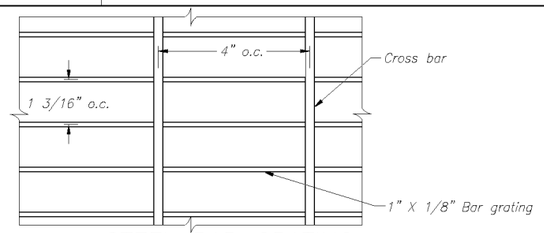
UPSTREAM WINGWALL
DOWNSTREAM WINGWALL IS SIMILAR

SCALE OF FEET

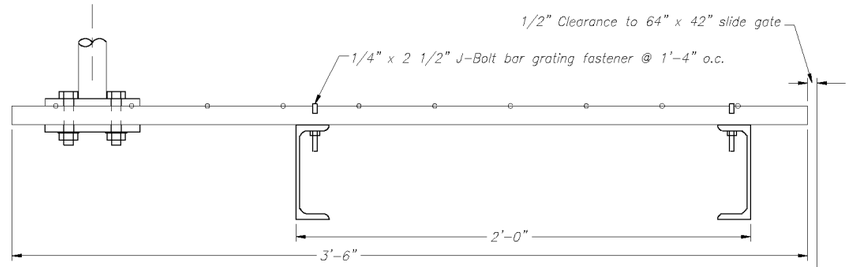


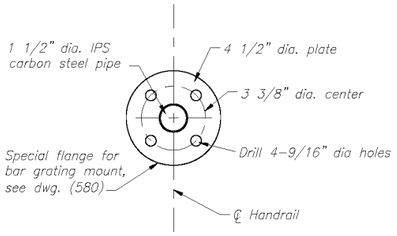
SECTION Y-Y

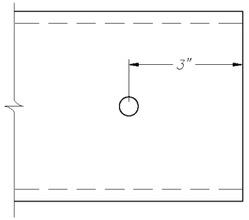
SCALE OF FEET



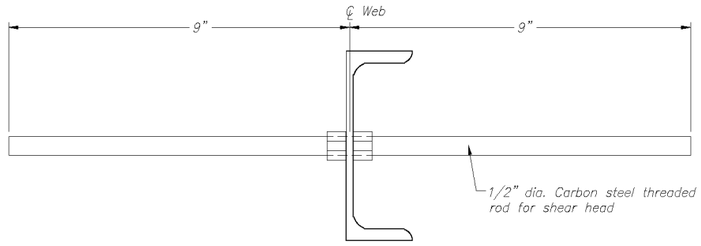
STEEL BAR GRATING
NTS

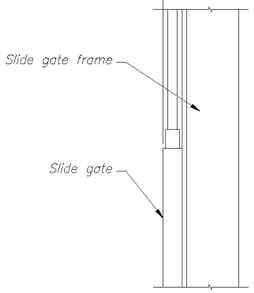






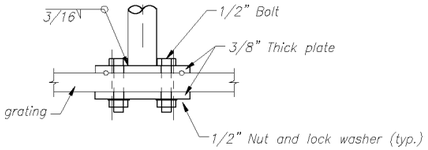
C 5 x 6.7
NTS





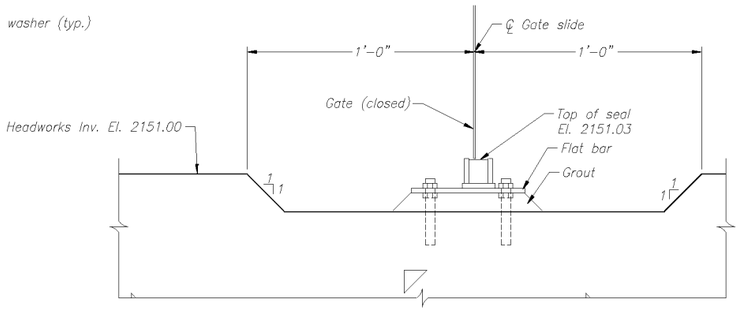
BAR GRATING

SCALE OF INCHES



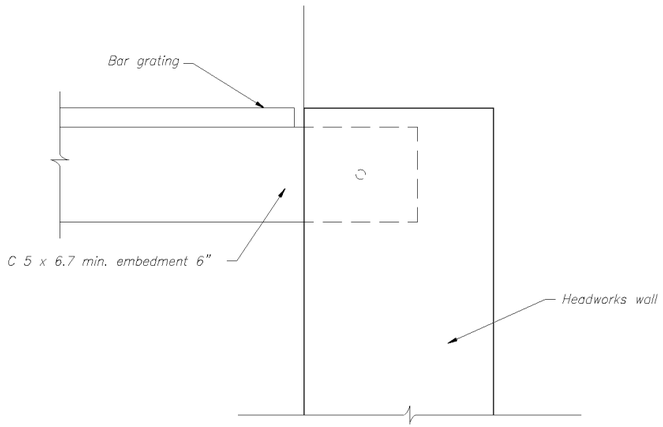
FLANGE MOUNTING

SCALE OF INCHES



Detail 2 (580)

SCALE OF INCHES



Detail 3 (580)

SCALE OF INCHES

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COLUMBIA/SNAKE RIVER SALMON RECOVERY
FCRPS HABITAT IMPROVEMENT PROGRAM-LITTLE SALMON SUBBASIN

RAPID RIVER DIVERSION

HEADWORKS

SECTIONS, DETAILS, MISCELLANEOUS METALWORK

DESIGNED Charlie Spindler CHECKED Steve Montague
DRAWN L. Boekweg TECH. APPR. Charlie Spindler
APPROVED Dave Jennings PROGRAM MANAGER

BOISE, IDAHO 2005-05-05 SHEET 1 OF 1

1678-100-581

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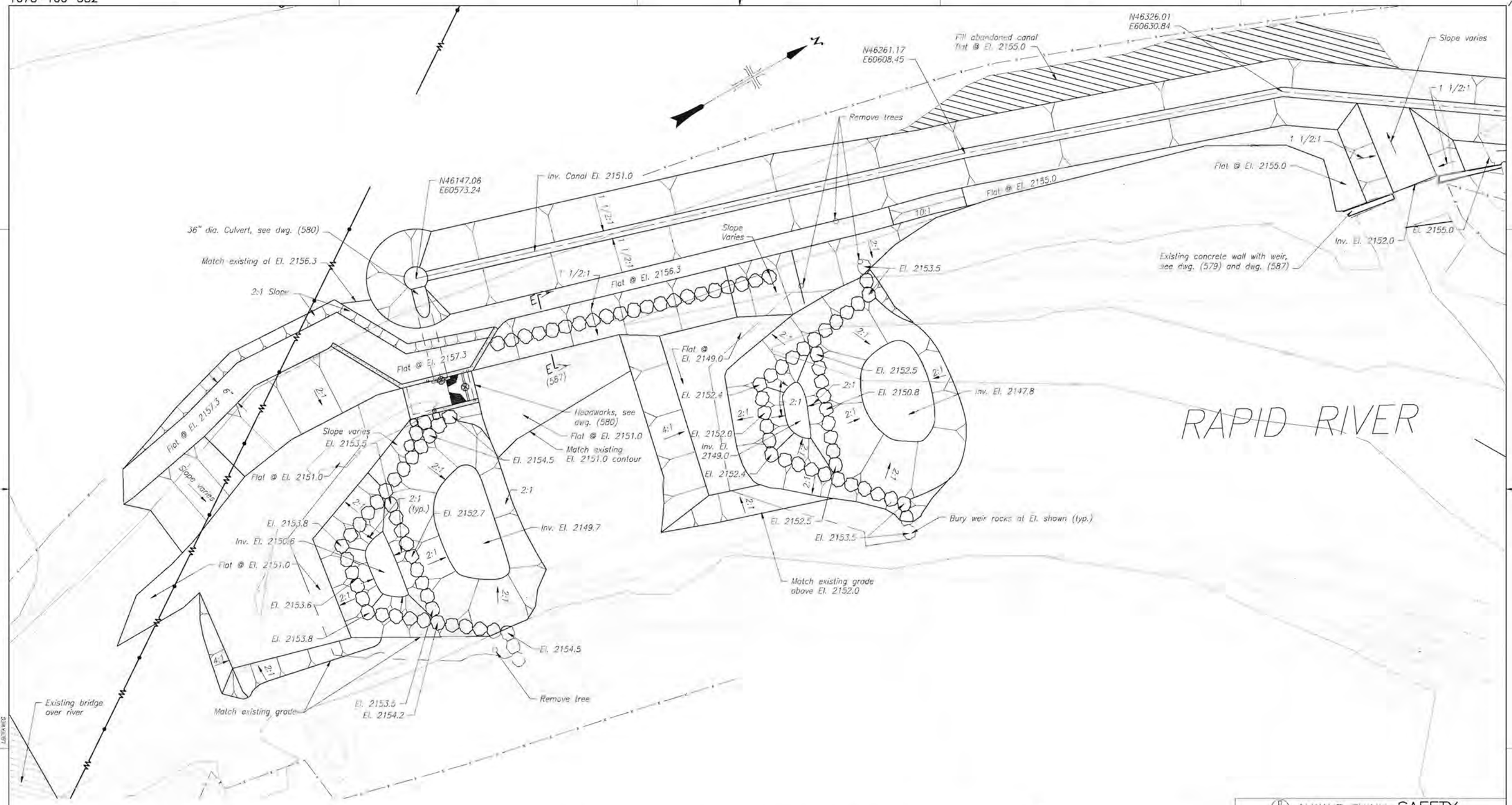

GRADING PLAN–ROCK WEIRS AND HEADWORKS

10 0 10 20 30
SCALE OF FEET

NOTE:

1. Elevations shown on this drawing for top of rocks are for reference only. Rocks shall be set to the line and elevations shown on drawing (584).

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RAPID RIVER DIVERSION

GRADING PLAN

ROCK WIERS AND HEADWORKS

DESIGNED Charlie Spindler CHECKED Steve Montague
DRAWN Backweg TECH. APPR. Charlie Spindler
APPROVED Dave Vanstrum
BOISE, IDAHO 2026-03-05 SHEET 1 OF 1 **1678-100-582**

DWG SYSTEM 16.0
AutoCAD 2022
DWG FILENAME
1678-100-582.DWG

PLOT SCALE 1:1
PLOT DATE 3/5/2026
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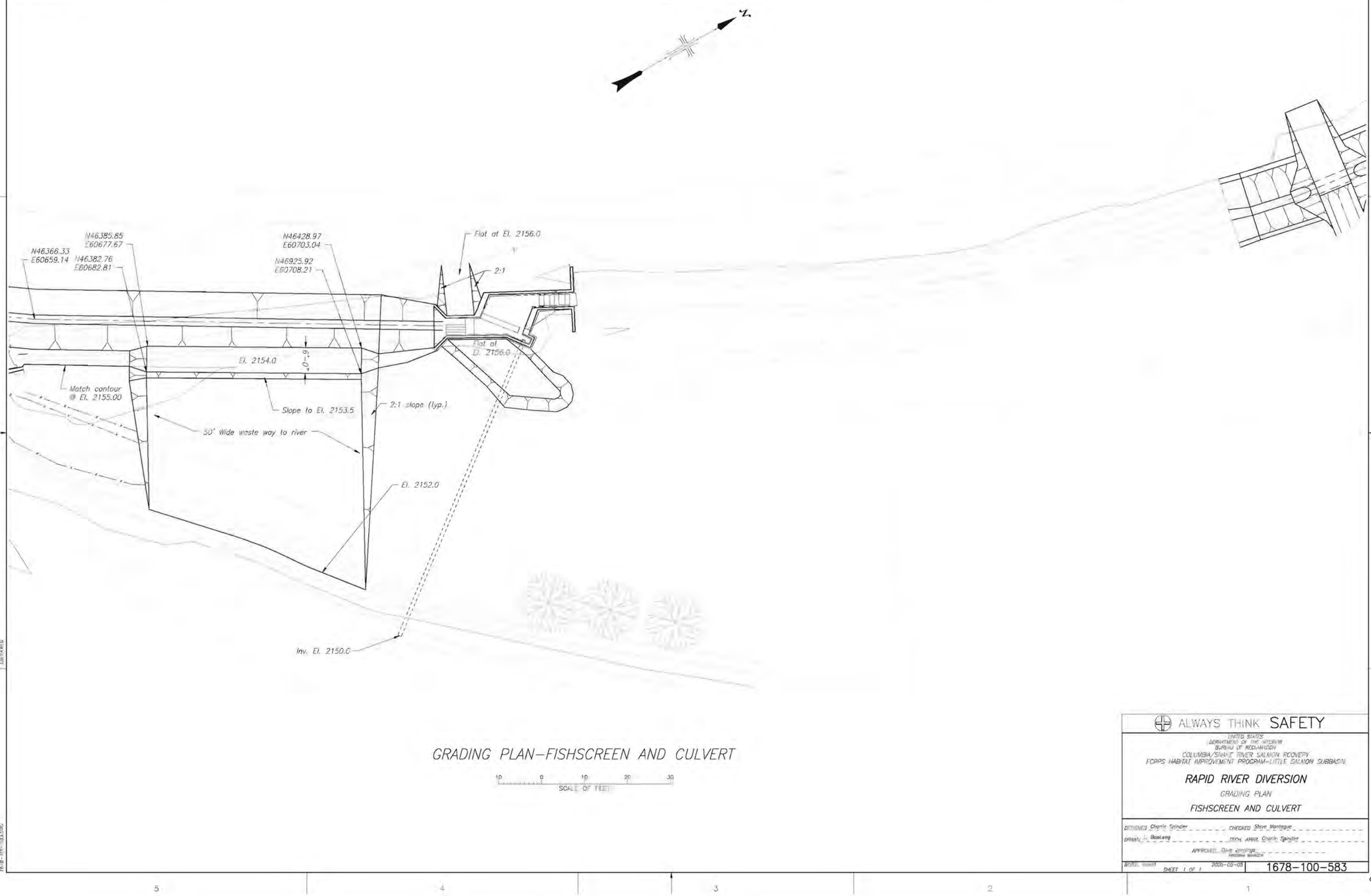
LBACKWEG



GRADING PLAN–FISHSCREEN AND CULVERT

10 0 10 20 30
SCALE OF FEET

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FCRPS HABITAT IMPROVEMENT PROGRAM–LITTLE SALMON SUBBASIN

RAPID RIVER DIVERSION

GRADING PLAN

FISHSCREEN AND CULVERT

DESIGNED Charlie Spindler CHECKED Steve Montague
DRAWN L. Beekwig TECH. APPR. Charlie Spindler
APPROVED Dave Jennings
HYDRAULIC MANAGER

BUREAU MARK SHEET 1 OF 1 2005-05-05 1678-100-583

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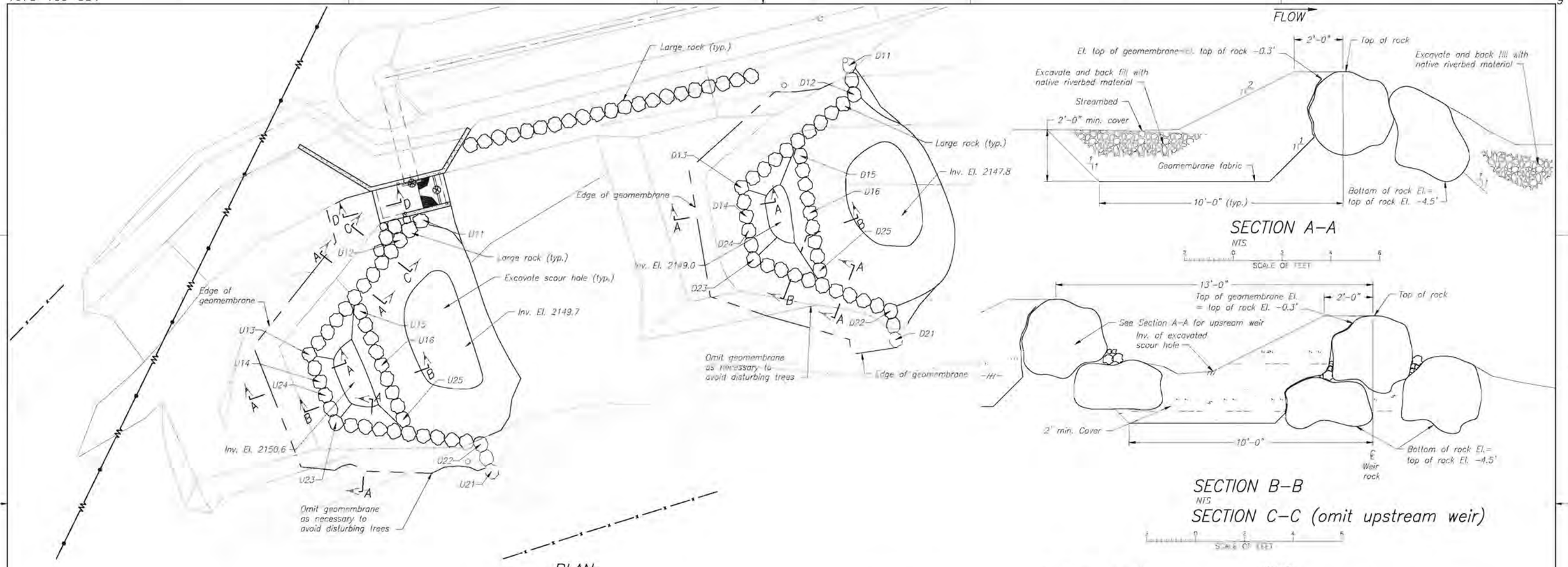


PLAN

SCALE OF FEET

SECTION A-A

NTS

SCALE OF FEET

SECTION B-B

NTS

SECTION C-C (omit upstream weir)

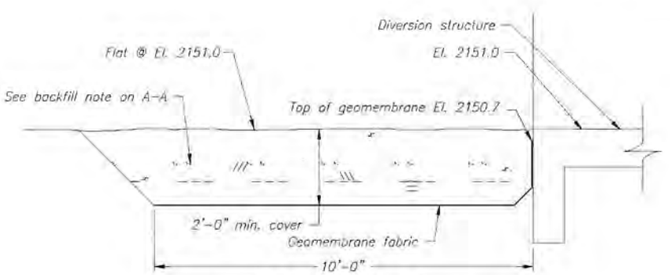
SCALE OF FEET

Upstream Wier

Left hand				Right Hand			
Point	Northing	Easting	Elevation	Point	Northing	Easting	Elevation
U11	46139.12	60602.32	2154.50	U21	46125.49	60653.98	2154.50
U12	46132.93	60603.52	2154.50	U22	46126.37	60646.02	2154.50
U13	46105.04	60614.56	2153.80	U23	46102.85	60629.48	2153.80
U14	46104.16	60620.50	2153.60	U24	46103.72	60623.46	2153.60
U15	46118.55	60612.01	2153.50	U25	46115.05	60635.74	2153.50
U16	46116.80	60623.87	2152.70				

Downstream Wier

Left hand				Right Hand			
Point	Northing	Easting	Elevation	Point	Northing	Easting	Elevation
D11	46230.60	60618.55	2153.50	D21	46210.73	60672.02	2153.50
D12	46228.50	60624.20	2153.50	D22	46212.83	60666.36	2153.50
D13	46198.92	60629.20	2152.40	D23	46193.69	60643.26	2152.40
D14	46196.83	60634.82	2152.00	D24	46195.78	60637.64	2152.00
D15	46212.66	60629.51	2152.50	D25	46204.30	60652.00	2152.50
D16	46208.48	60640.76	2150.80				

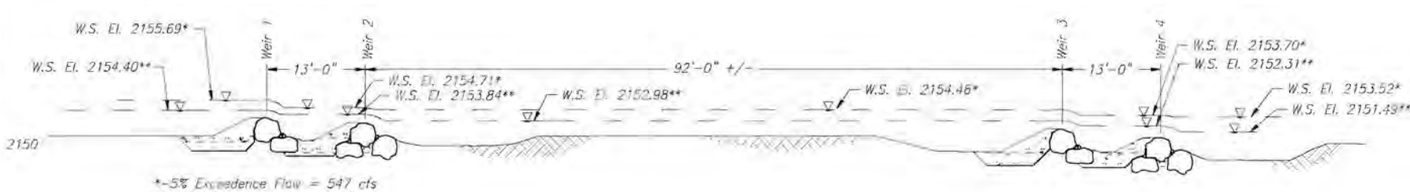


SECTION D-D

SCALE OF FEET

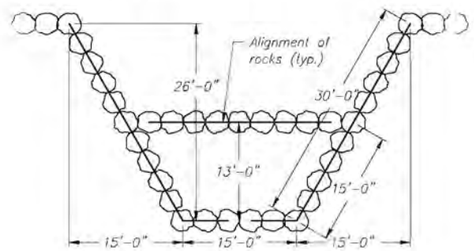
NOTES:

1. Min. dimension of large rocks shall be 2.3'.
2. Large rock shall also meet one of these criteria:
   a. Min volume shall be 14.1 cu. ft. or
   b. Length x Width x Height of enveloping rectangular prism shall be 27 cu. ft. or more, or
   c. Min. weight shall be 2200 lbs.
3. Geomembrane shall be a gas & water impermeable geotextile.
4. All backfill shall be compacted structural backfill.
5. Rocks shall be arranged by hand, with tools and with mechanized equipment so that the centers of the rock lay approximately on the alignment shown in plan.
6. The top of the rocks along the alignment shall lay on the line between endpoint coordinates shown within +/- 0.05 ft. in elevation.



PROFILE

SCALE OF FEET



TYPICAL WIER SECTION

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COLUMBIA/SNAKE RIVER SALMON RECOVERY
FCRPS HABITAT IMPROVEMENT PROGRAM-LITTLE SALMON SUBBASIN

RAPID RIVER DIVERSION

ROCK WEIRS

PLAN, DETAILS, SECTION

DESIGNED Charlie Spindler CHECKED Steve Mellinger

DRAWN Bockweg TECH. APPR. Charlie Spindler

APPROVED Dave Jennings

DATE SIGNED 2005-05-07

SHEET 1 OF 1

1678-100-584

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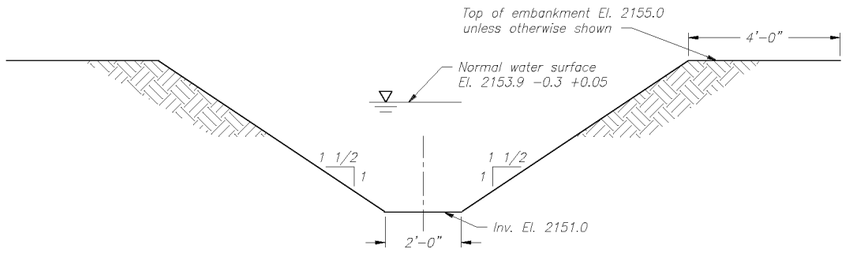
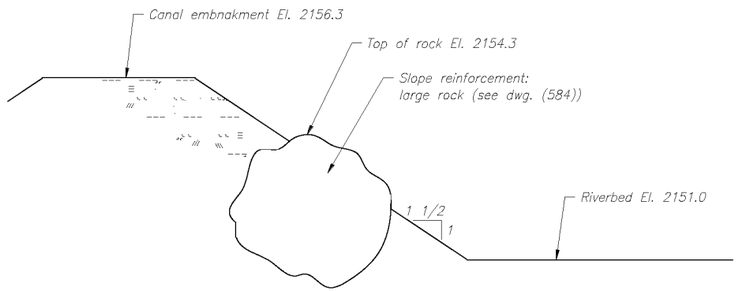


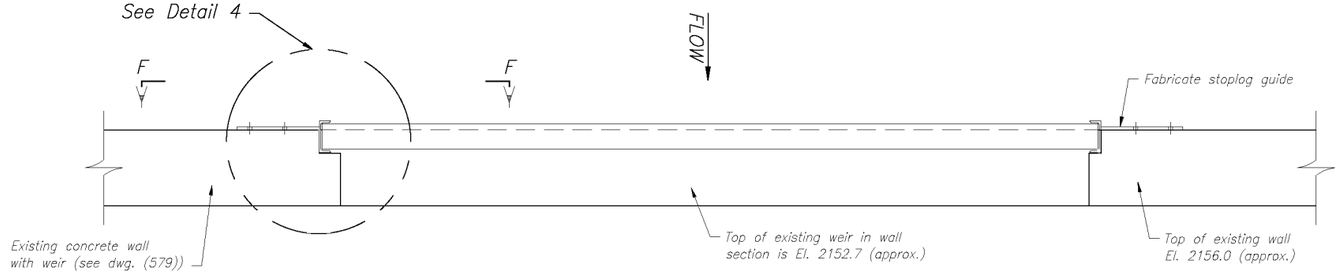
TYPICAL CANAL SECTION

2 0 2 4 6
SCALE OF FEET



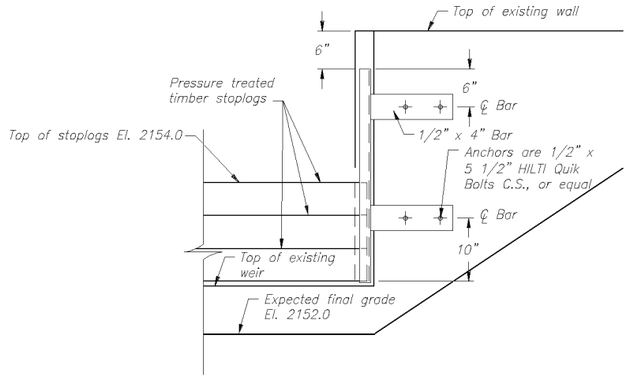
SECTION E-E (582)

2 0 2 4 6
SCALE OF FEET



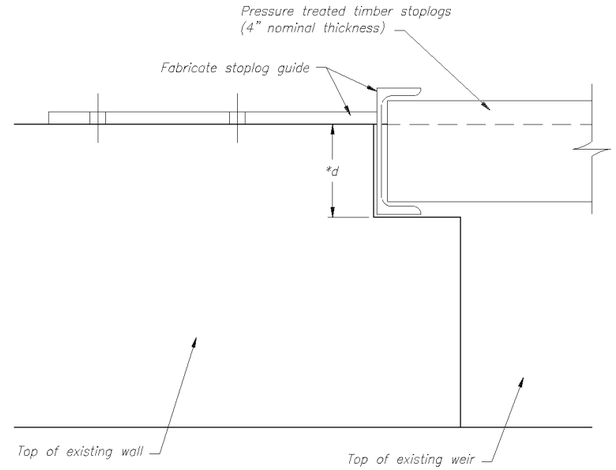
WALL PLAN

1 0 1 2 3
SCALE OF FEET



SECTION F-F

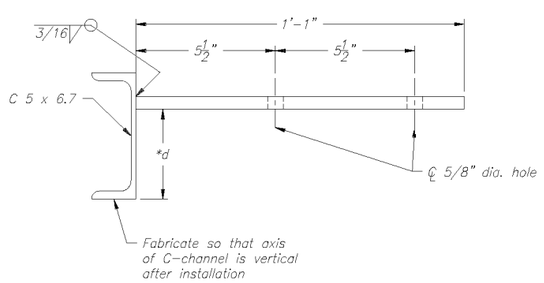
1 0 1 2 3
SCALE OF FEET



DETAIL 4

NTS

*d=Depth of the blackout in the existing concrete wall at the elevation of the new bar. This dimension shall be measured individually for each bar.



FABRICATED STOP LOG GUIDE

NTS

1 AS SHOWN
1 OPP. HAND

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COLUMBIA/SNAKE RIVER SALMON RECOVERY
FCRPS HABITAT IMPROVEMENT PROGRAM-LITTLE SALMON SUBBASIN

RAPID RIVER DIVERSION

ROCK WEIRS

SECTIONS AND DETAILS

DESIGNED Charlie Spindler CHECKED Steve Montague
DRAWN L. Boekweg TECH. APPR. Charlie Spindler
APPROVED Dave Jennings
PROGRAM MANAGER

BOISE, IDAHO 2005-05-09
SHEET 1 OF 1

1678-100-587

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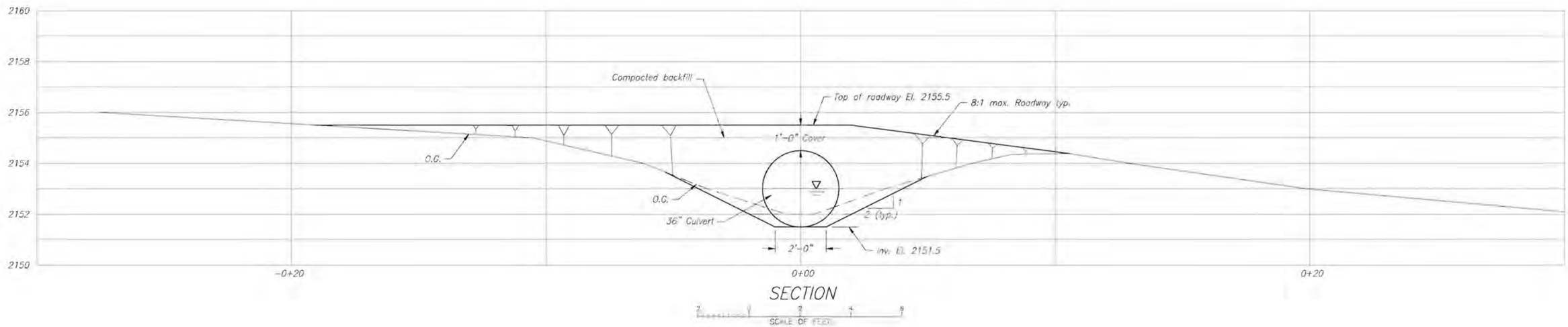
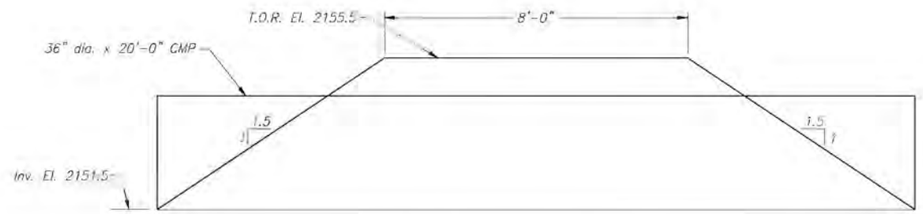


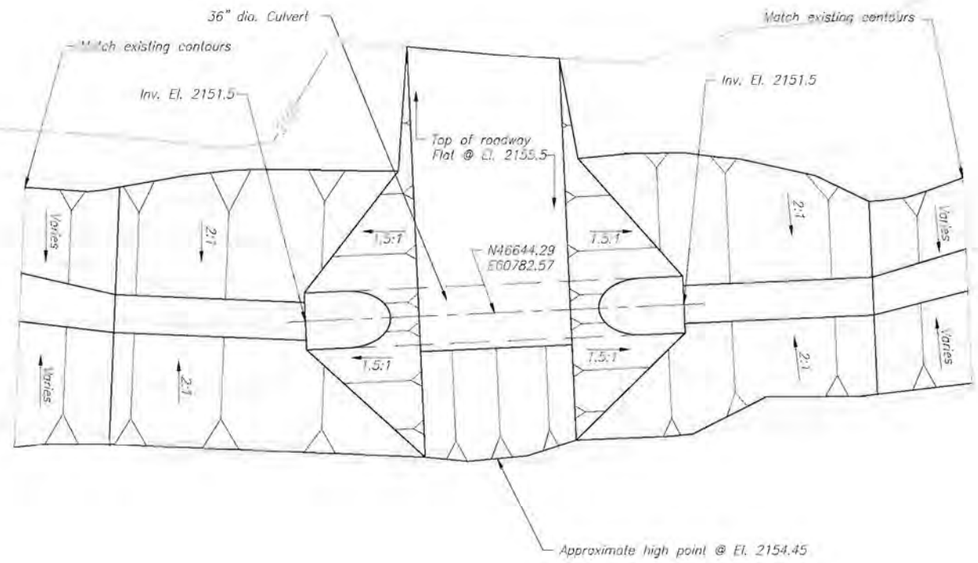
SECTION

SCALE OF FEET



CULVERT ELEVATION VIEW

SCALE OF FEET



PLAN

SCALE OF FEET

NOTE:

1. The existing 12"ø culvert at this location shall be removed and disposed (see dwg. (579)).

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FCRPS HABITAT IMPROVEMENT PROGRAM-LITTLE SALMON SUBBASIN

RAPID RIVER DIVERSION

36" CULVERT

INSTALLATION

PLAN, ELEVATION AND PROFILE

DESIGNED Charlie Spindler	CHECKED Steve Montague
DRAWN J. Boekweg	TECH. APPR. Charlie Spindler
APPROVED Dave Jennings, WATERSHED MANAGER	
DATE 2025-06-23	SHEET 1 OF 1

1678-100-585

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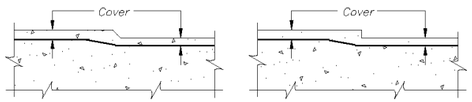
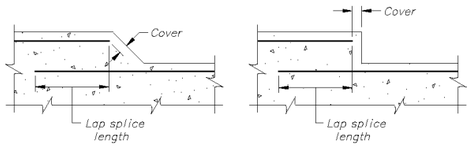
11

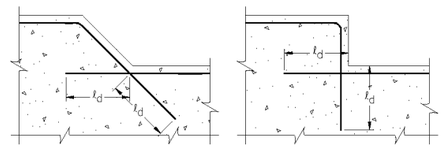


OFFSET LESS THAN 3"

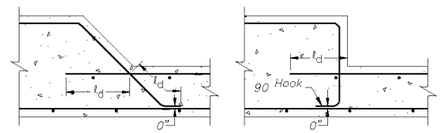


OFFSET 3" TO 8"

NOTE TO DESIGNERS AND DETAILERS: This detail may not be appropriate for tension areas of shallow structural members. If in doubt, use detail for offset greater than 8". See limits for noncontact lap splices in General Notes, Splices.

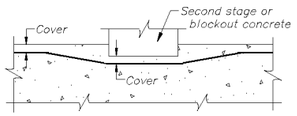


OFFSET GREATER THAN 8"

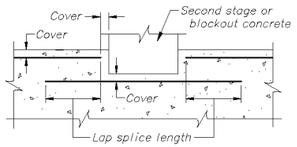


OFFSET GREATER THAN 8"
RESTRICTED MEMBER THICKNESS

TYPICAL OFFSET DETAILS

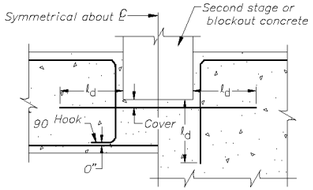


RECESS LESS THAN 3" DEEP



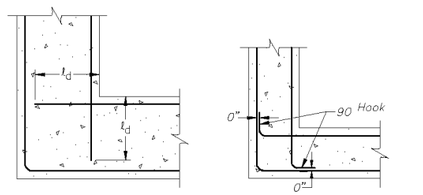
RECESS 3" TO 8" DEEP

NOTE TO DESIGNERS AND DETAILERS: This detail may not be appropriate for tension areas of shallow structural members. If in doubt, use detail for recess greater than 8". See limits for noncontact lap splices in General Notes, Splices.

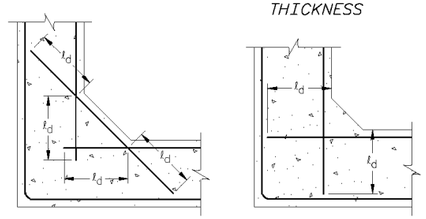


RECESS GREATER THAN 8"

TYPICAL BLOCKOUT RECESS DETAILS
(Second stage concrete shown)



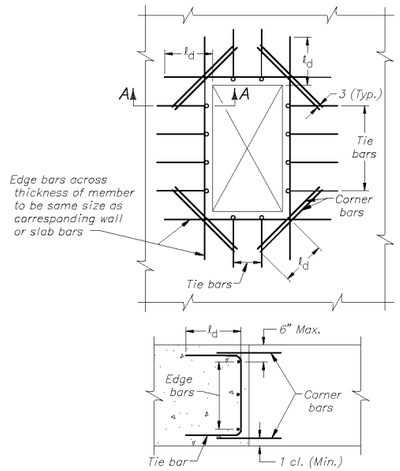
RESTRICTED MEMBER THICKNESS



FILLET 1'-0" OR GREATER

FILLET LESS THAN 1'-0"

TYPICAL CORNER DETAILS



SECTION A-A

OPENINGS:

TABLE FOR ADDITIONAL REINFORCEMENT

MEMBER THICKNESS	TIE BARS	EDGE BARS	CORNER BARS
Less than 10	None	1 - ctr.	2 - #4 ctr.
10 thru 1-6	None	2 - (1 ef)	4 - #4 (2 ef)
1-7 thru 3-0	#4 @ 1-0	3 - eq. spc.	4 - #4 (2 ef)
Over 3-0	#6 @ 1-0	Spc. @ 1-0	4 - #5 (2 ef)

Omit edge and tie bars along sides of openings where dimension is less than 1'-6".
Omit corner bars at sides of openings adjacent to floors, walls, or beams.
Omit corner bars if both dimensions of opening are less than 1'-6".

RECESSES:

Use corner bars in face of recesses deeper than 4" if either dimension of recess is equal to or greater than 1'-6".

ADDITIONAL REINFORCEMENT AROUND OPENINGS AND RECESSES

GENERAL NOTES 1/

UNLESS OTHERWISE SHOWN ON THE REINFORCEMENT DESIGN DRAWINGS, THE DETAILS AND NOTES SHOWN ARE MINIMUM REQUIREMENTS AND TYPICAL FOR ALL REINFORCEMENT DRAWINGS THAT REFER TO THIS DRAWING

ABBREVIATIONS:

bf = bottom face	br = bottom row	bl = bottom layer
tf = top face	tr = top row	tl = top layer
nf = near face	nr = near row	ml = middle layer
ff = far face	fr = far row	ns = near side
ef = each face	er = each row	fs = far side
if = inside face	ir = inside row	es = each side
of = outside face	or = outside row	ew = each way
	mr = middle row	ec = each corner

spc. = space or spaces
eq. spc. = equally spaced, equal spaces
d_b = nominal diameter or reinforcing bar
uv = uniformly varying lengths of bars between lengths shown
cl. = clear
ctr. = center or centers
add'l = additional
l_d = development length

SYMBOLS:

Bars shown thus ——#8@1-0 or ——#6@8 indicate a group of the same size bars equally spaced.
—o An open circle at the end of a bar indicates a bend with the bar turned away from the observer.
—• A closed circle at the end of a bar indicates a bend with the bar turned towards the observer.
Splices shown thus ═══ indicate a lap splice, not a bend in the bar.

DIMENSIONS:

Dimensions are to the centerline of the bars except for embedment of hooks, which are dimensioned to the outside of the bar.
Clear cover dimensions are marked "cl." and are dimensioned to the outside of the bar.

COVER:

Place the reinforcement so that the clear distance between face of concrete and nearest reinforcement is 1½" for #5 bars and smaller, 2" for #6 bars through #8 bars and 3" for #9 bars through #11 bars. Provide 3" clear distance from face of concrete for all bars when the concrete is placed against earth or rock. Clear distance is to the design dimension line.
Reinforcement parallel construction joints shall have a minimum of 2" clear cover.

PLACING:

Reinforcement at small openings (max. 1'-6") in walls and slabs may be spread apart not more than 1.50 times the bar spacing.
Reinforcement may be adjusted laterally to maintain a clear distance of at least 1" between the reinforcement and keys, water stops, anchor bolts, form ties, conduits, and other embedded materials. In heavily reinforced areas, relocation of the embedded material must be considered.
When bars are bent due to offsets less that 3" and recesses less that 3" deep, the slope of the inclined portion must not exceed 6 to 1.
Reinforcement parallel to anchor bolts or other embedded material shall be placed to maintain a clear distance of at least 1.33 times the maximum size aggregate.

SPACING:

The first and last bars in walls and slabs, stirrups in beams, and ties in columns are to start and end at a maximum of one half of the adjacent bar spacing. The minimum edge spacing shall be the smaller of either $2.5d_b$ or 0.5 of the adjacent bar spacing.

STANDARD HOOKS:

1. 180-degree bend plus $4d_b$ extension, but not less than 2½" at the free end of the bar.
2. 90-degree bend plus $12d_b$ extension at free end of the bar.

STIRRUP AND THE HOOKS:

1. #5 bar and smaller, 90-degree bend plus $6d_b$ extension at the free end of the bar.
2. #6, #7, and #8 bars, 90-degree bend plus $12d_b$ extension at the free end of the bar.
3. #8 bars and smaller, 135-degree bend plus $6d_b$ extension at the free end of the bar.

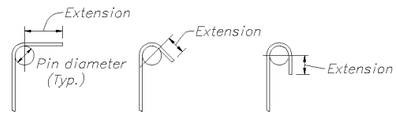


TABLE OF PIN DIAMETERS IN INCHES

BAR NO.	3	4	5	6	7	8	9	10	11
Standard bends	2 ¼	3	3 ¾	4 ½	5 ¼	6	9 ½	10 ¾	12
Stirrup and tie bends	1 ½	2	2 ½	4 ½	5 ¼	6			

REINFORCEMENT DOWELS:

Dowels indicated on the drawing, such as #8(d), shall be embedded a length equal to l_d and shall have a projection equal to that required for lap splicing to a bar of the same diameter.

PLAIN DOWELS:

Plain dowels across contraction joints shall be smooth bars uniformly coated with a film of oil before concrete placement. Viscosity of the oil shall have a SAE rating of not less than 250.

ACCESSORIES:

Bar supports, spacers, and other accessories are not shown on the design drawings. The recommendations of the ACI Detailing Manual-1988, or other approved supporting systems may be used.

DRAWING REFERENCES:

Numerals in parentheses ( ) following notes and section letters or numbers indicate the number of the drawing upon which the section or detail is shown; for example (524) denotes Drawing No. 557-D-524.

CODE AND DETAILING REFERENCES:

ACI Building Code Requirements for Structural Concrete (ACI 318-95).
ACI Detailing Manual - 1994.

NOTES TO DESIGNERS AND DETAILERS:

Splice lengths shown in the tables on this drawing are for Class B tension lap splices in accordance with ACI 318-95. Assumed conditions for these tables in addition to the requirements shown on this drawing are uncoated reinforcement, normal weight concrete, and the transverse reinforcement index (K_{tr}) equal to zero. Splices or development lengths other than those shown in the tables must be detailed on the reinforcement design drawings.

Some factors which require additional consideration are: Beams or columns with ties, lightweight aggregate concrete, epoxy-coated reinforcement, excess reinforcement, bars in compression, bundled bars, and seismic considerations.

SPLICES:

The minimum length of lap for splicing parallel bars shall be as given in the applicable table.
Staggered splices shall be separated to give 12 inches clear between ends of adjacent splices.
Bars spliced by noncontact lap splices shall not be spaced transversely farther apart than one-fifth the required lap splice length, nor 6" on centers.
When reinforcing bars of different size are to be spliced, the length of lap shall be governed by the smaller diameter bar.
Splices are to be made so that the required clear distances to face of concrete will be maintained.

f'c = 3000 psi TABLE 3 - 60 fy = 60,000 psi

BAR SIZE NO.	MINIMUM ℄ to ℄ BAR SPACING (INCHES)	LENGTH OF LAPPED SPLICE (INCHES)		DEVELOPMENT LENGTH l_d (INCHES)	
		TOP BARS *	OTHER BARS	TOP BARS *	OTHER BARS
3	3	17	16	13	12
4	3	23	18	18	14
5	4	28	22	22	17
6	5	34	26	26	20
7	6	49	38	38	29
8	6	56	43	43	33
9	7	63	49	49	38
10	8	71	55	55	42
11	9	79	61	61	47
9	6	63 **	49 **	49	38
10	6	75 **	58 **	58	45
11	6	93 **	71 **	71	55

f'c = 4000 psi TABLE 4 - 60 fy = 60,000 psi

BAR SIZE NO.	MINIMUM ℄ to ℄ BAR SPACING (INCHES)	LENGTH OF LAPPED SPLICE (INCHES)		DEVELOPMENT LENGTH l_d (INCHES)	
		TOP BARS *	OTHER BARS	TOP BARS *	OTHER BARS
3	3	16	16	12	12
4	3	20	16	15	12
5	4	25	39	19	15
6	5	29	23	23	18
7	6	43	33	33	25
8	6	49	37	37	29
9	7	55	42	42	33
10	8	62	47	47	37
11	9	68	53	53	41
9	6	55 **	42 **	42	33
10	6	65 **	50 **	50	39
11	6	80 **	62 **	62	48

* Top bars are all horizontal bars so placed that more than 12 inches of fresh concrete is cast below the development length or splice.
** Splices must be staggered.

1/ Unless otherwise shown on the reinforcement design drawings or this drawing, follow the recommendations established by the ACI Detailing manual - 1994.

6-1-97 D- G.P.G.	CONVERTED TO AUTOCAD DRAWING. REVISED TO CONFORM TO ACI 318-95. OTHER MINOR REVISIONS.
2-29-92 D- ROA	TOP BAR DEFINITION AND MINOR PUNCTUATION REVISION IN PLACING NOTE.
12-7-90 D- J.D.S.	REDRAWN TO NEW DRAFTING STANDARDS. REVISED CONCRETE COVER, NOTES TO DESIGNERS, TABLES, REINFORCEMENT AROUND OPENINGS, AND OTHER MINOR REVISIONS. REVISED TO CONFORM TO ACI 318-89.
9-27-84 D- NFP DG	REVISED PIN DIAMETER TABLE, REFERENCED THE ACI DETAILING MANUAL 1980. ADDED NOTES UNDER PLACING AND STANDARD HOOKS.
12-8-76 D- WRW	MINOR REVISIONS.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

STANDARD DESIGNS

GENERAL NOTES AND MINIMUM REQUIREMENTS FOR DETAILING REINFORCEMENT

DESIGNED M.F.WARD J.G.STARBUCK CHECKED GAYLE A.ERICKSON
DRAWN M.CAMPBELL TECH. APPROVAL H.G.ARTHUR
ACTING DIRECTOR, DESIGN AND CONSTRUCTION

CADD SYSTEM	CADD FILENAME	DATE AND TIME PLOTTED
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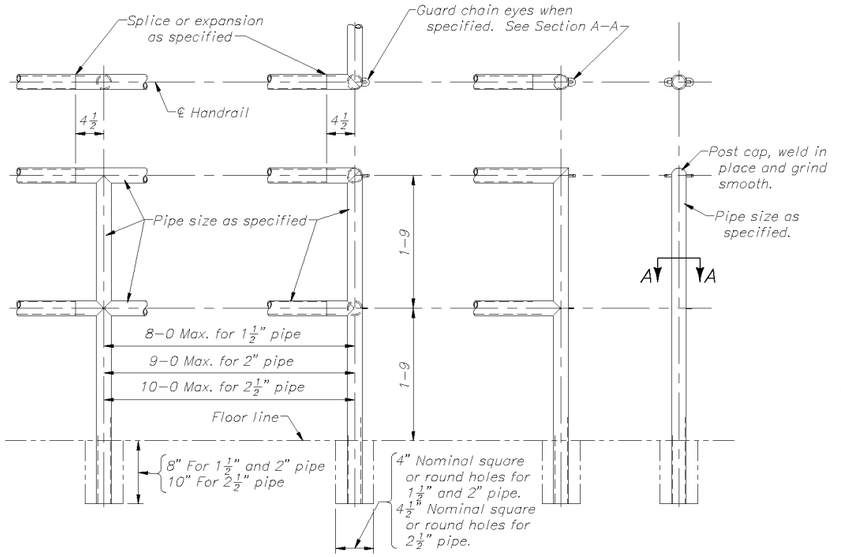
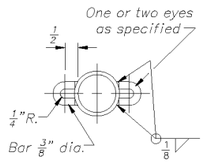
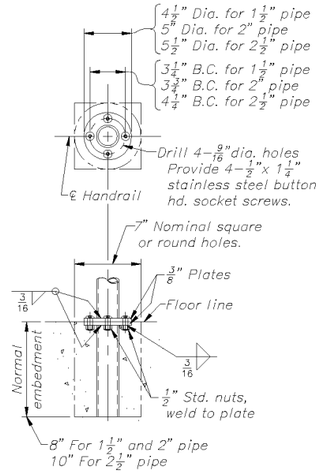


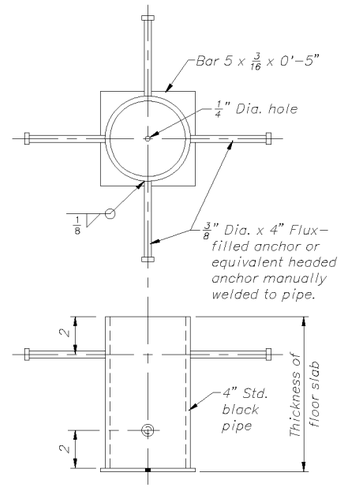
INTERMEDIATE POST | CORNER POST | END POST | GUARD CHAIN POST



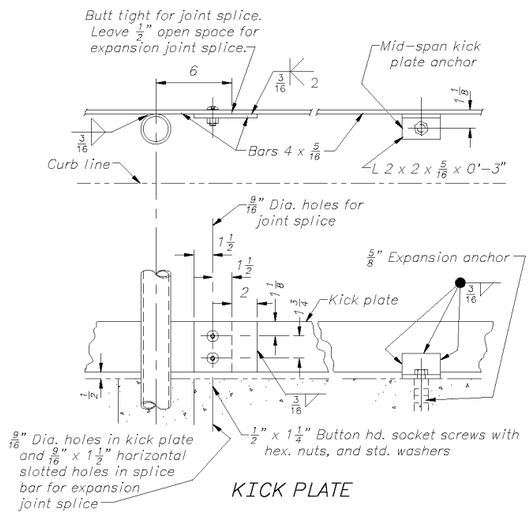
SECTION A–A
GUARD CHAIN EYES



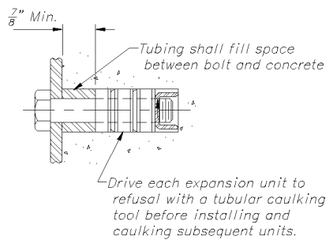
FLANGE MOUNTING
(FOR REMOVABLE HANDRAIL)



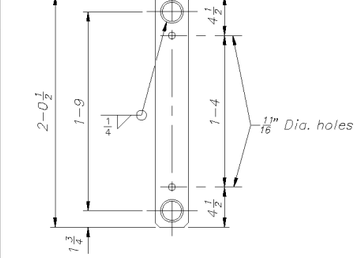
STEEL POST SOCKET



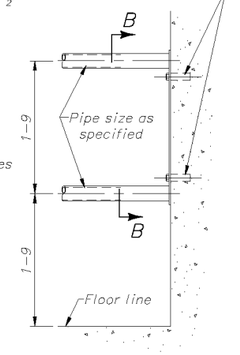
KICK PLATE



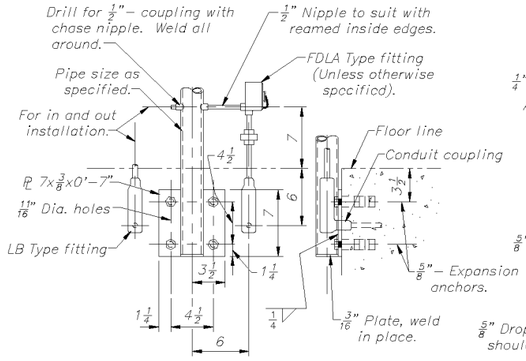
EXPANSION ANCHOR INSTALLATION
(GROUP I, TYPE 1, CLASS 2)



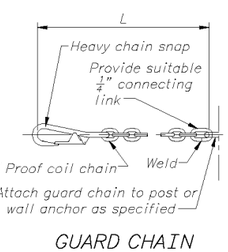
SECTION B–B



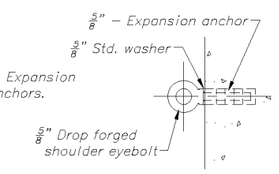
WALL MOUNTING



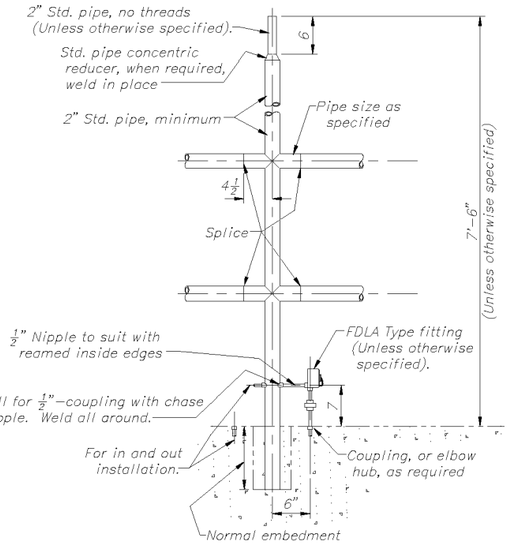
EDGE MOUNTING



GUARD CHAIN



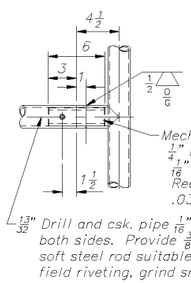
WALL ANCHOR



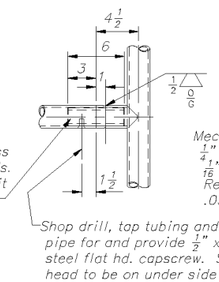
TYPICAL LIGHT POST

NOTES

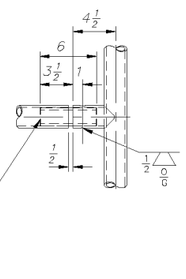
Welding symbols apply to the joints of all members of similar identification.
Weld all pipe joints with ⅛" reinforced welds and dress smooth.
All handrails shall be fabricated with new standard weight black pipe or tubing of sizes as specified on the installation drawing.
All handrails shall be fixed unless specified to be removable.
See installation drawing for variable dimensions, splices and requirements.
Corners and edges of all plates, bars and pipe ends shall be free of burrs.
All expansion anchors, screws, riveting material, and bolts shall be provided as required for complete installation.
Expansion anchors shall conform to Fed. Specs. FF–S–325, Group I, Type 1, Class 2; or Group II, Type 4, Class 1.
All holes for expansion anchors shall be core drilled.



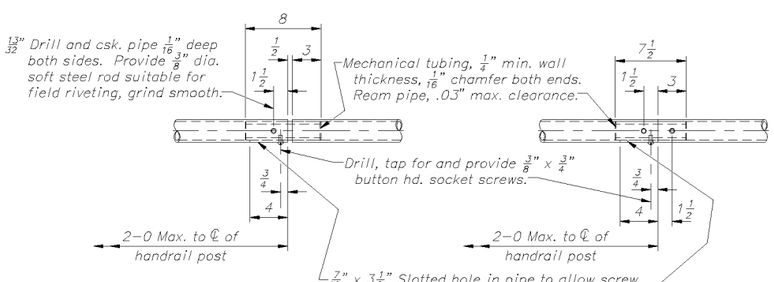
SPLICE NO. 1
(FOR FIXED HANDRAIL)



SPLICE NO. 2
(SPLICE NO. 2 REQUIRED WITH FLANGE MOUNTED REMOVABLE HANDRAIL)



SPLICE NO. 3
(FOR EXPANSION JOINT)



SPLICE NO. 4
(FOR FIXED JOINT IN CONTINUOUS RUN OF HANDRAIL)

SPLICE NO. 5
(FOR FIXED JOINT IN CONTINUOUS RUN OF HANDRAIL)

5 – 5 – 66 D – M.L.B.	EXPANSION ANCHORS REVISED.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
STANDARD DESIGNS

42" TWO RAIL HANDRAIL

DETAILS

DESIGNED H.F.Sheia/H.G.Arthur — CHECKED W.H.J./M.B.J.
DRAWN J.A.M./R.A.O. — TECH. APPROVAL B.R.Brynt
CHIEF ENGINEER

CADD SYSTEM	CADD FILENAME	DATE AND TIME PLOTTED
AutoCAD Rel. 16.0	40-D-6022.DWG	JUNE 28, 2005 13:50
DENVER, COLORADO	APRIL 15, 1965	40-D-6022