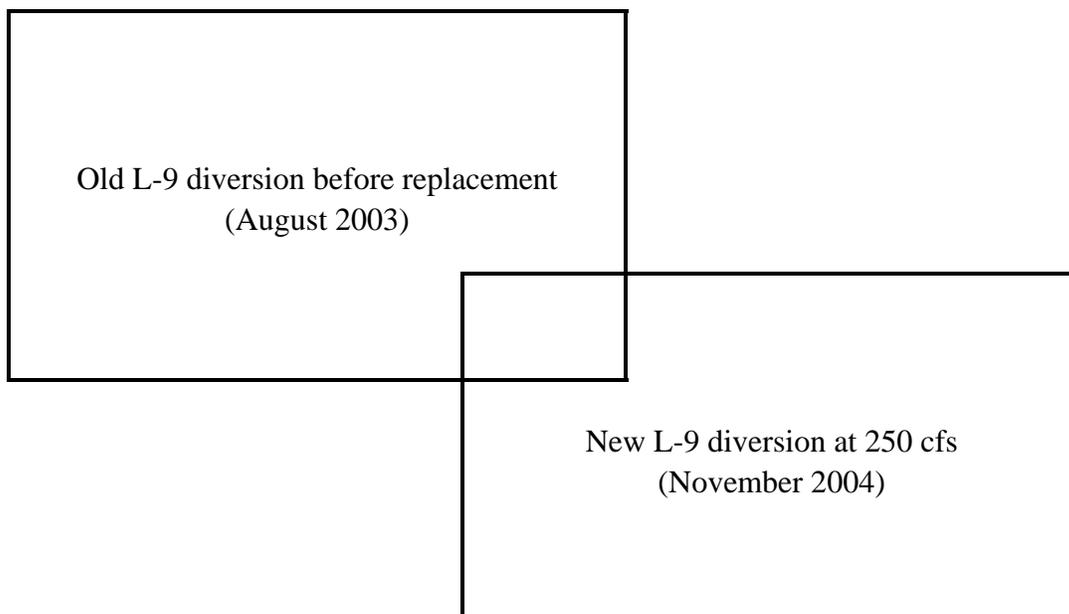


# Completion Report Lemhi River L-9 Diversion Replacement Lemhi River Subbasin Salmon, Idaho



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

**December 2007**



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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## Attachments

- Attachment A: Photographs of L-9 Project
- Attachment B: Design Drawings of L-9 Project



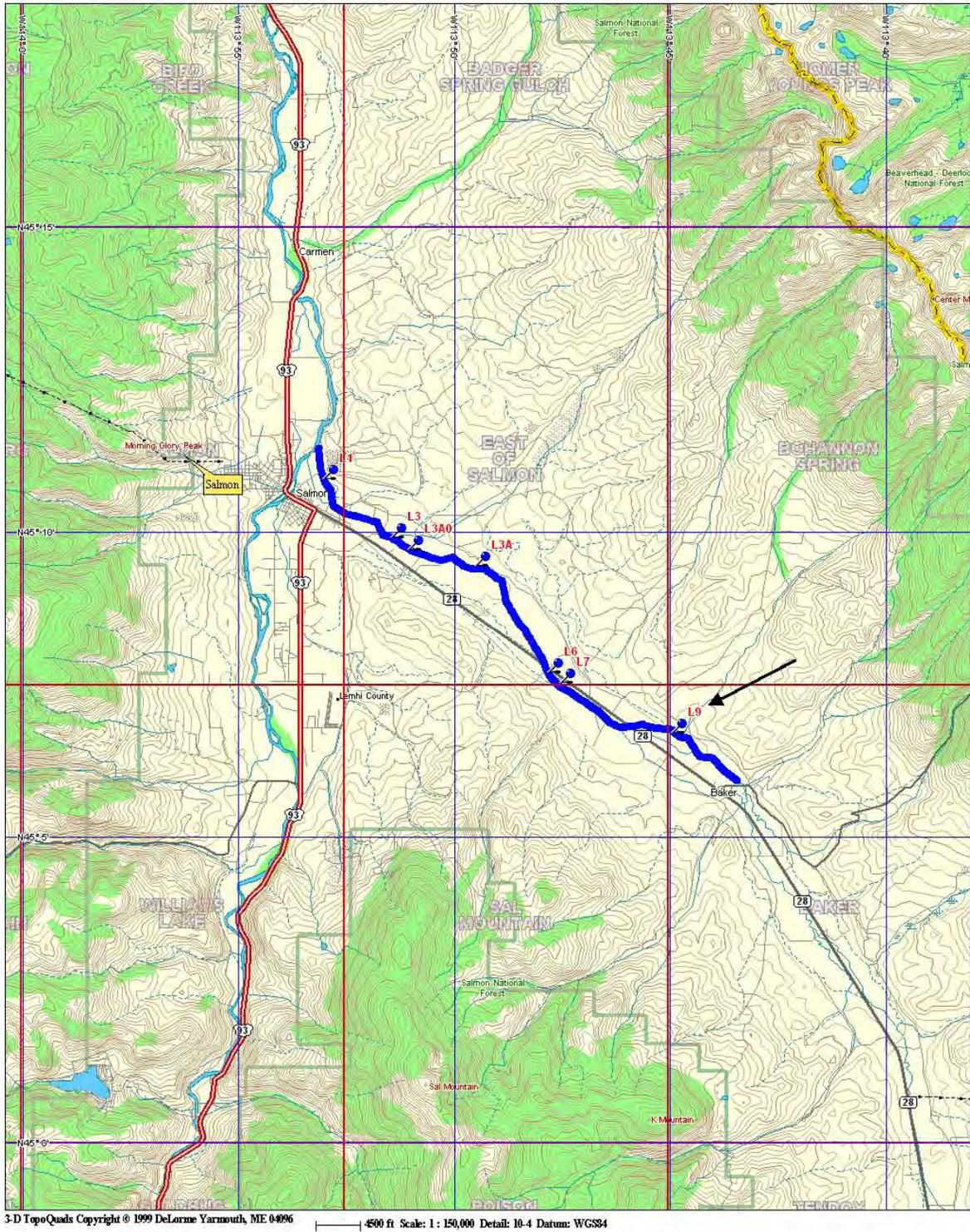


Figure 1. L-9 project location



# 1. Introduction

Throughout the Lemhi River subbasin, irrigation diversions, combined with other domestic uses of water, have negatively affected salmonids by reducing water flow, entrapping juvenile fish in the unscreened diversions as they migrate downstream, and impeding upstream migration of adult fish. The primary objective of the L-9 irrigation diversion replacement project was to implement actions to improve the passage of adult and juvenile salmon and steelhead in the Lemhi River.

The Lemhi River provides habitat for several species of fish listed as either threatened or endangered under the Endangered Species Act (ESA), as well as resident fish. Section 7(a)(2) of the ESA requires that all Federal agencies consult with the National Marine Fisheries Service (NMFS), or the U.S. Fish and Wildlife Service (USFWS), to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in adversely modifying their critical habitat. The NMFS oversees the implementation of the ESA for certain listed species including anadromous salmon and steelhead.

Currently, there are 12 listed anadromous evolutionarily significant units (ESU) and one ESU proposed for listing within the Columbia River. Consultation with NMFS was completed on these ESUs and a Biological Opinion (BiOp) was issued in 2002 and a subsequent BiOp issued on November 30, 2004.<sup>1</sup> This consultation contained an Updated Proposed Action by the action agencies including a Tributary Habitat Program.<sup>2</sup>

## 1.1 Background

Irrigation diversions have long been identified as having potential for causing harm to resident and migratory fish. Irrigators in the Lemhi subbasin typically use push-up diversion dams to raise water levels and/or direct water into irrigation conveyance canals or “ditches.” Push-up diversion dams are usually constructed out of large rock that is placed, or streambed gravel material that is pushed up in a linear fashion across the stream channel. Water diverted from the river or creek channel is then conveyed via the ditch and distributed to agricultural fields. If diverted water is unscreened, fish can be carried into fields or entrapped in ditches.

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<sup>1</sup> Biological Opinion on the Operation of the Federal Columbia River Power System including the 19 Bureau of Reclamation Projects in the Columbia Basin, November 30, 2004 (revised and reissued pursuant to court order, *NWF v. NMFS*, Civ. No. CV 01-640-RE (D. Oregon).

<sup>2</sup> Final Updated Proposed Action for the FCRPS Biological Opinion Remand, U.S. Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration, November 24, 2004.

An existing rock weir (push-up) diversion in the Lemhi River was identified by Idaho Department of Fish and Game (IDFG) and NMFS as having potential for impeding migration and causing harm to resident and migratory fish. Reclamation approached the irrigators and landowner and obtained permission to pursue a project to replace the existing diversion with one that would better provide for fish passage and reduce the need for periodic instream maintenance. The diversion (L-9) was located in close proximity to another diversion (L-8A). The two diversions were considered by Reclamation to be good candidates for consolidation into one point of diversion. However, reluctance of the L-8A and L-9 irrigators to share diversion and headworks structures required abandonment of Reclamation's efforts to pursue consolidation. Project development was then focused on replacing solely the L-9 irrigation diversion. Reclamation developed a project proposal that was subsequently reviewed and ranked by the Upper Salmon Basin Watershed Project (USBWP) Technical Team, and submitted to Bonneville Power Administration (BPA) for funding consideration by the Lemhi Soil and Water Conservation District (LSWCD) and USBWP.

## **1.2 Problems and Solutions**

The L-9 diversion was constructed of rock, located on private land, and spanned the entire width of the river. As constructed, it contributed to problems such as channel dewatering, fish passage, and entrainment of fish in the irrigation ditch. Typical of this type diversion, entering the river channel with heavy equipment was necessary to conduct periodic maintenance. The wooden headgate structure at the point of diversion was in disrepair and in need of replacement along with the diversion. The existing fish screen in the ditch was compliant with NMFS screening criteria and therefore was not replaced.

## **1.3 Participation and Cooperation**

Reclamation implemented the Tributary Habitat Program for the Lemhi River subbasin, as set forth in the Updated Proposed Action, as a conservation measure to provide for early actions to assist with recovery of the ESUs within the Columbia River. The upper Salmon and Lemhi subbasin ESUs include the Snake River steelhead and the Snake River spring/summer Chinook. Within these conservation measures, Reclamation addresses limiting factors such as instream flow, barriers, channel morphology, and entrainment. For this program, Reclamation works with willing partners to provide technical assistance and logistical help with implementation of habitat projects leading to correction of tributary and spawning and rearing deficiencies associated with these limiting factors.

Reclamation's participation in the L-9 project was funded under the direction of the Tributary Habitat Program. Technical assistance provided by Reclamation included project coordination, environmental compliance, development of contract design documents, and construction inspection.

Funding for construction of the L-9 diversion project was provided by BPA. The LSWCD was the project sponsor and handled distribution and administration of BPA funding. The USBWP provided assistance on behalf of the LSWCD with environmental compliance. Landowners and irrigators granted permission to complete the project, provided access to the property, and participated in design review.

## **1.4 Environmental Compliance**

Staff in the Reclamation Field Office in Salmon and in the USBWP office assisted BPA with completion of National Environmental Policy Act (NEPA) documents and BPA/NMFS Habitat Improvement Project BiOp and Section 7 ESA compliance requirements. Reclamation contracted with a local consulting firm on behalf of BPA to prepare a Biological Assessment (BA) for submission to USFWS for ESA consultation. In addition, Reclamation hired a local contractor to complete a cultural resource survey and obtain archeological clearance from the State Historic Preservation Office (SHPO). Work in the river to replace the diversion was authorized pursuant to the Clean Water Act (CWA) and Idaho Department of Water Resources (IDWR) stream alteration permit exemptions. This exemption, referred to locally as the “irrigator's exemption,” authorizes irrigators or their assigns to perform maintenance on diversions and appurtenances.

## **1.5 Contract Specifications and Bidding**

Reclamation's Pacific Northwest (PN) Region design office developed and provided to the LSWCD preliminary design drawings for replacement of the existing river diversion with a series of double drop “A” weirs. The design was rejected by NMFS because the footprint of the “A” weirs in the river channel would have been excessively large. Preliminary cost estimates also indicated construction costs would have exceeded the available amount budgeted by BPA for the project. Further collaboration between all parties involved led to agreement on a design for an improved cross channel diversion weir located in the same existing alignment.

Reclamation provided the LSWCD separate draft and final project drawings. Preliminary and draft designs were widely circulated by Reclamation for review and comment prior to finalization and project implementation.

Contract design specifications developed for construction at L-9 called for construction of the following features: a cross channel weir "wing dam" diversion to be constructed of concrete block or large rock, a rock-lined channel or "ramp" for fish passage, a stoplog wasteway, metal headworks, and a water measurement structure in the ditch. The project was advertised and the construction contract administered by the LSWCD. Probst Construction of Tendoy, Idaho was the successful low bidder for the project and completed the construction.

## **2. Project Description**

The project is located at River Mile 9.5 on the Lemhi River in central Idaho, approximately 9 miles southeast of the town of Salmon, in Lemhi County (Figure 1). As is common with all diversions on the mainstem Lemhi, L-9 is on a reach of the river that flows through privately-owned ranch land. Existing features consisted of a rock diversion weir, wooden headgate at the point of diversion, secondary ditch headgate and wasteway, and a hydraulic powered, rotary drum fish screen in the ditch. Project features designed for L-9 included construction of a new rock or concrete block diversion weir with a geo-textile liner placed on the upstream face, rock-lined fish passageway (ramp), metal headgate with trashrack and stoplog wasteway, and a water measurement device (ramp flume) in the ditch. The contractor selected the option of using large rock boulders as the primary material for construction of the diversion weir.

The primary purpose of the L-9 irrigation diversion replacement was to improve fish passage of adult and juvenile salmon and steelhead and still meet irrigation delivery requirements.

### **2.1 L-9 Construction**

During construction of the L-9 diversion, Reclamation provided an inspector from the Yakima Construction Office. A field engineer from the Salmon office was onsite during construction and the design engineer from the PN Region office was also available for consultation.

Construction of L-9 began in August 2004 during the irrigation season and was completed in September 2004. Fish passage and irrigation water delivery were maintained during construction by placement of a temporary cofferdam in the river and excavation of a temporary bypass ditch.

Major project features for the L-9 construction included:

- Placement of a temporary cofferdam in the river channel to divert water around the construction area for fish passage and irrigation delivery.

- Demolition and removal of the existing L-9 rock weir diversion and headgate structures.
- Construction of a cross channel weir diversion with a geo-textile liner placed on the upstream face. The new diversion weir was constructed of large rock boulders and included a 6-foot-wide stoplog sluiceway. A geo-textile liner was placed on the upstream face to reduce seepage.
- Construction of a fish passage opening in the weir and a 150-foot-long rock-lined channel to provide fish migration passage over the weir.
- Construction of a new metal headworks with trashrack at the ditch inlet.
- Installation of a metal ramp flume water measurement structure in the ditch.
- Removal of the temporary cofferdam and bypass channel.
- Seeding and mulching.

Mitigation measures to reduce construction impacts included provision of fish passage during construction, removal of the cofferdam, sediment monitoring, reseeding of adjacent river banks, and salvage of fish from the diversion ditch prior to construction.

The banks along this reach of the river are well armored with riprap and a rock dike on one side; therefore, minimal damage occurred to streambanks and riparian vegetation during construction. Site rehabilitation and seeding were effective in mitigating for the ground disturbing effects of construction.

As required by NMFS, efforts to remove fish from the site were made by IDFG biologists. Electrofishing was conducted to remove fish from the ditch prior to dewatering and no mortalities were observed.

As expected, temporary pulses of sediment were released into the water column while work was occurring. However, the amount of sediment released into the water column was minimal and of short duration.

### **3. Summary**

Since completion of construction of a new weir and headworks at L-9, annual repair to the rock weir diversion after high flow events has been unnecessary. As expected, occasional accumulation of woody debris in front of the headgate occurs and requires removal by the irrigators. However, diversion, control, and measurement of irrigation water have been significantly improved and maintenance costs reduced.

Monitoring of the project since it was completed in 2004 indicates it has functioned well to ensure fish passage in this reach of the river. The need for annual in-channel

maintenance to the weir with an excavator has so far been eliminated, thus reducing the risk of injury to fish and periodic discharge of sediment into the river. The rock ramp fish passageway has proven to be effective in providing for migration of all life stages of fish over the structure.

Reclamation is very grateful to BPA for providing the funding necessary for the construction of the L-9 diversion project. BPA staff in Portland provided valuable assistance throughout development of this project.

Reclamation wishes to thank the LSWCD and USBWP for the assistance provided in completion of the HIP BiOp requirements and administration of BPA funding for construction of the L-9 diversion.

Thanks go to employees of the NMFS and USFWS for providing assistance with review of design and completion of Section 7 ESA consultation. The fish removal assistance provided by IDFG is greatly appreciated.

Finally, special thanks go to the landowners and irrigators for their willingness to allow Reclamation to develop this project. The patience and participation of LaMar Cockrel, the irrigator's representative, throughout the process of planning and implementation was invaluable.

**Completion Report  
Lemhi River L-9 Diversion Replacement  
Lemhi River Subbasin  
Salmon, Idaho**

**Attachment A  
Photographs**

**Photographs by the Bureau of Reclamation  
Pacific Northwest Region Design Group  
Boise, Idaho  
and  
Salmon Field Office  
Salmon, Idaho**





**Photograph 1. Old L-9 diversion**



**Photograph 2. Old L-9 diversion and headgate**



**Photograph 3. Old L-9 headgate**



**Photograph 4. Prior to removal of old diversion, a temporary cofferdam was constructed in the river to divert flow and provide fish bypass.**



**Photograph 5. Placing rock for the new diversion dam.**



**Photograph 6. Inspector checking the size of the rocks. Typical rock size was 4'x4'x3'.**



**Photograph 7. Rock weir under construction with header and footer rocks in place.**



**Photograph 8. Smaller rocks were added to fill the voids between the large header rocks.**



**Photograph 9.** River gravels and cobbles were added to further fill in any cracks or voids between the larger rocks.



**Photograph 10.** Backside of the headgate structure.



**Photograph 11. Frontside of the headgate structure. The headgates and trashrack were added later.**



**Photograph 12. Sluiceway plate installed in rock weir.**



**Photograph 13.** Installation of a geocomposite liner to minimize water leakage through the new rock dam.



**Photograph 14.** River gravels and cobbles were used to cover the liner on the upstream face of the dam.



**Photograph 15. Construction of a 150-foot-long, rock-lined fish passageway channel (ramp).**



**Photograph 16. Completed rock-lined fish passage channel (ramp).**



**Photograph 17. Water measurement device (ramp flume) installed in irrigation ditch.**



**Photograph 18. View of completed headgate and sluiceway.**



**Photograph 19. Completed diversion looking upstream from the headgate. Fish passage channel (ramp) at the upstream end of diversion dam.**



**Photograph 20. View of completed diversion and headgate from upstream.**



**Photograph 21. Completed ramp flume in ditch.**



**Photograph 22. Completed L-9 diversion at 250 cfs.**



**Attachment B**  
**Design Drawings**

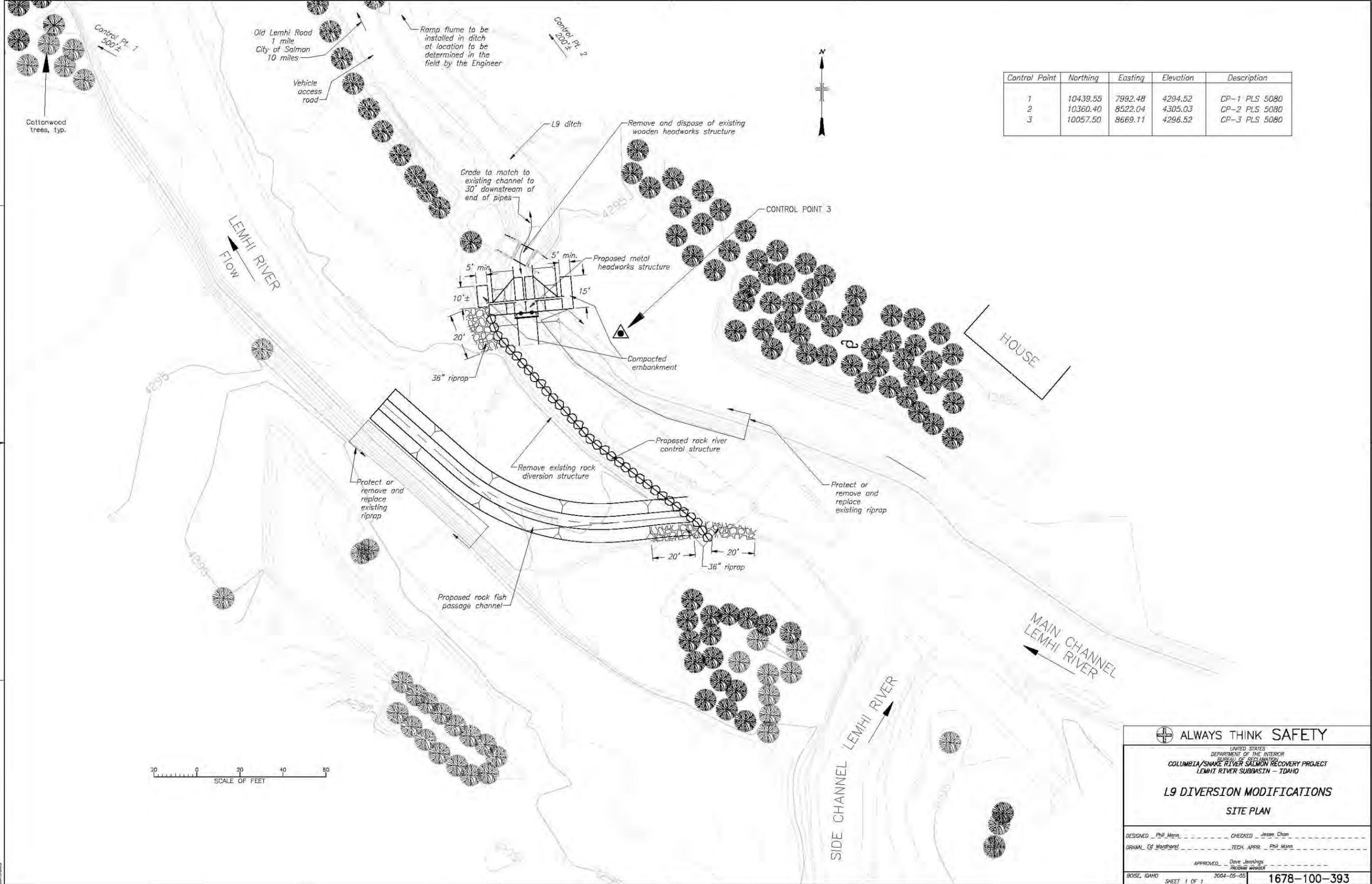


Design Drawings L-9 Diversion Modifications

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1678-100-393	L-9 Diversion Modifications, Site Plan
1678-100-394	L-9 Diversion Modifications, Headworks, Plan, Sections and Details
1678-100-395	L-9 Diversion Modifications, Rock River Control Structure; Plan, Elevation, and Sections
1678-100-396	L-9 Diversion Modifications; Rock Fish Passage Channel; Plan, Profile, and Section
1678-100-403	L-9 Diversion, Ramp Flume, Plan and Sections





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2	10360.40	8522.04	4305.03	CP-2 PLS 5080
3	10057.50	8669.11	4296.52	CP-3 PLS 5080

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UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 BUREAU OF RECLAMATION  
 COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT  
 LEMHI RIVER SUBBASIN - IDAHO  
**L9 DIVERSION MODIFICATIONS**  
**SITE PLAN**

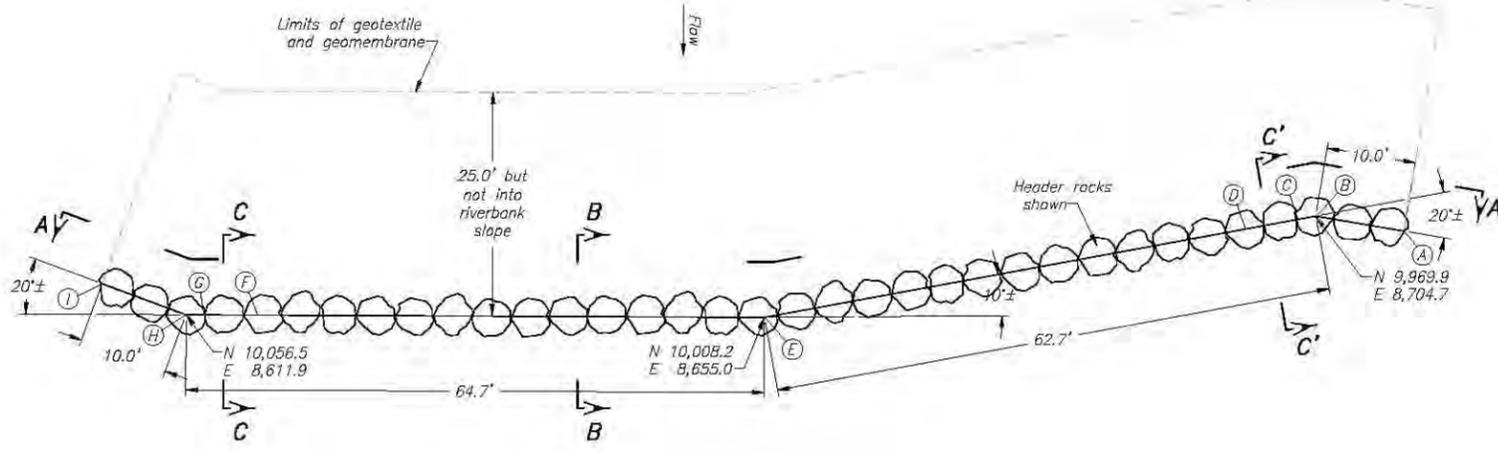
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 DRAWN Ed Marshorst      TECH. APPR. Phil Mann  
 APPROVED Dave Jennings  
PROBATION ENGINEER

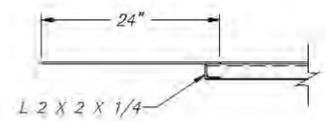
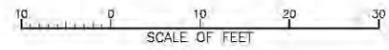
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PLAN - ROCK RIVER CONTROL STRUCTURE



SECTION D-D

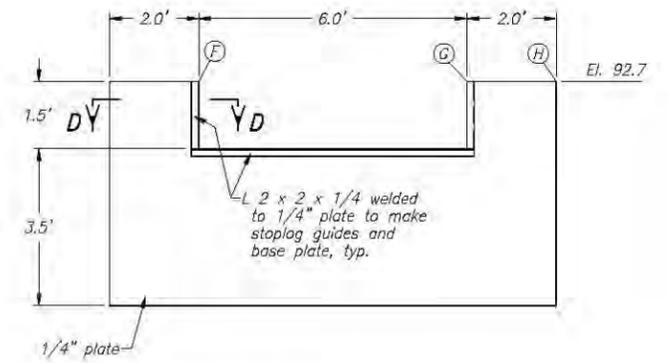
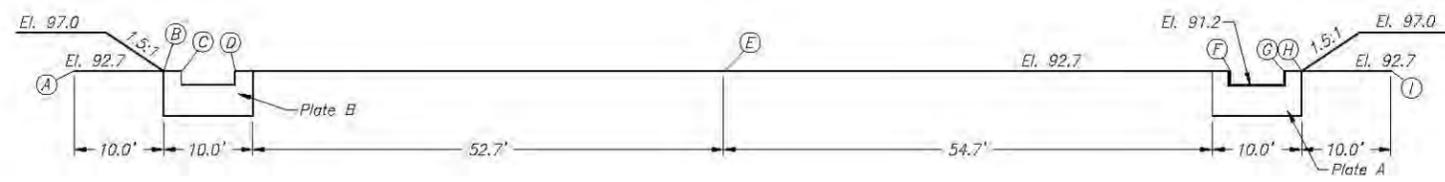


PLATE A - ELEVATION (looking downstream)



SECTION A-A

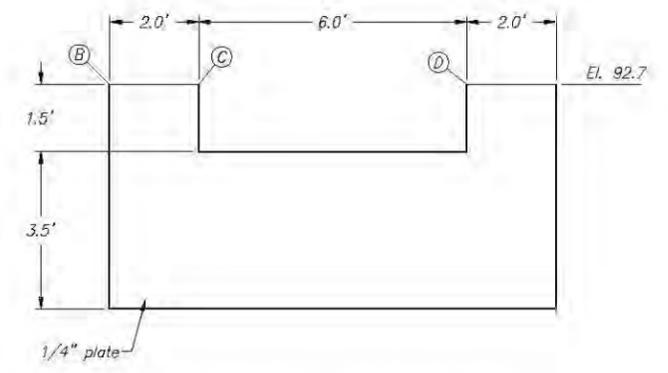
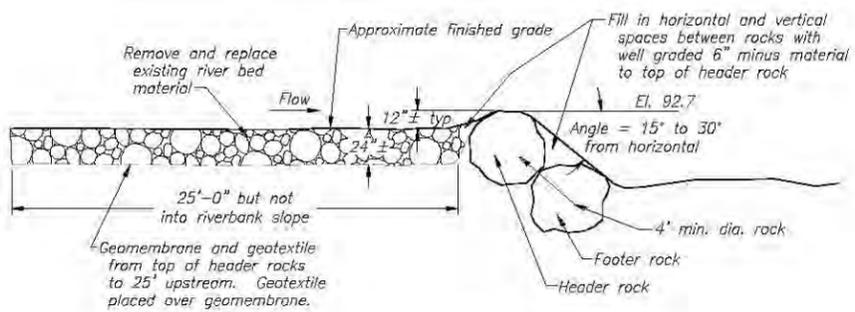
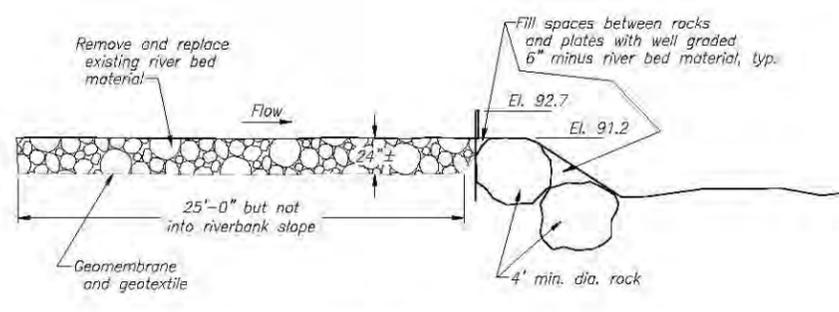


PLATE B - ELEVATION (looking downstream)

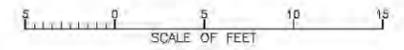
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SECTION B-B ROCK WEIR - TYPICAL SECTION

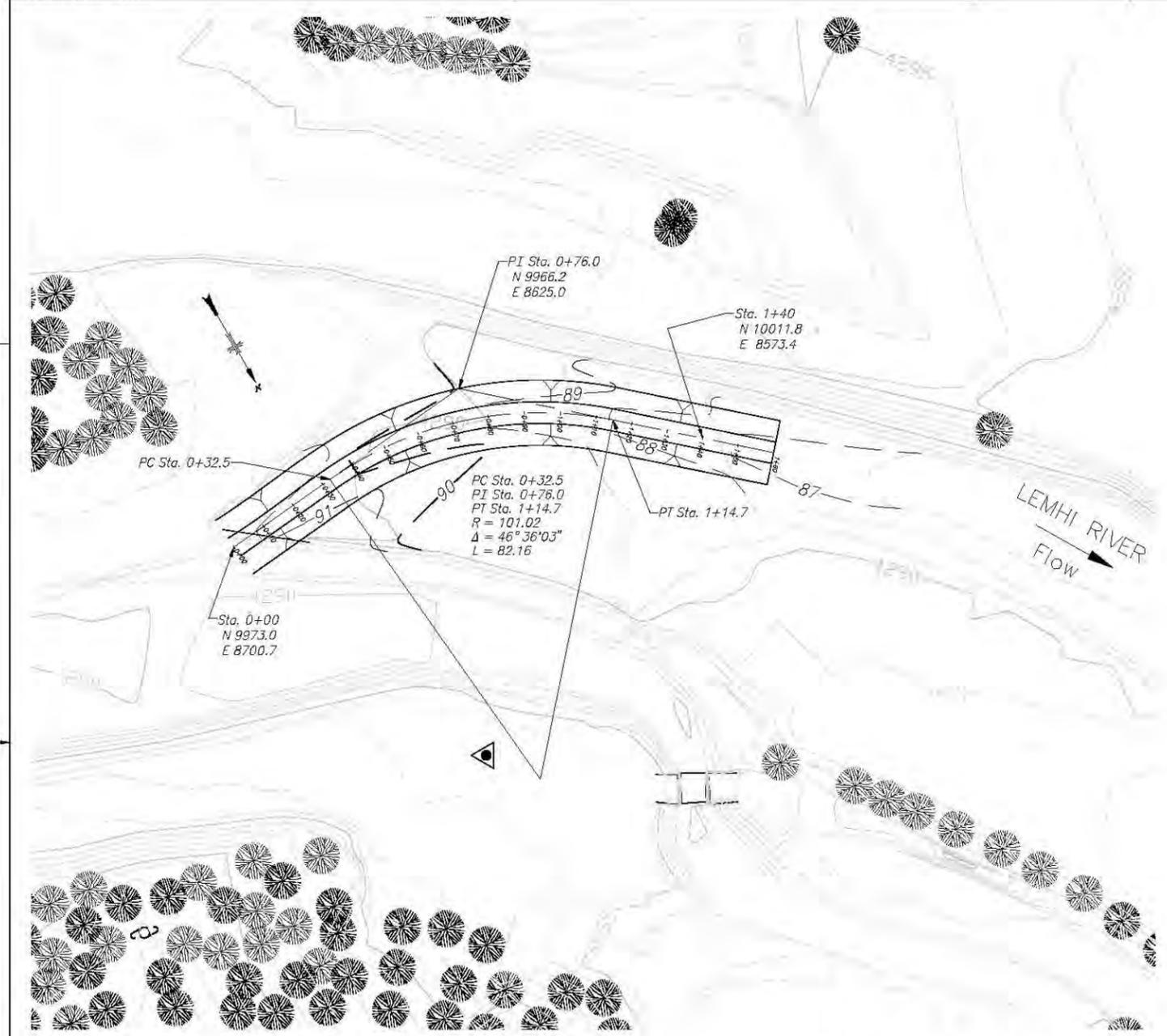


SECTION C-C SECTION C'-C' Similar

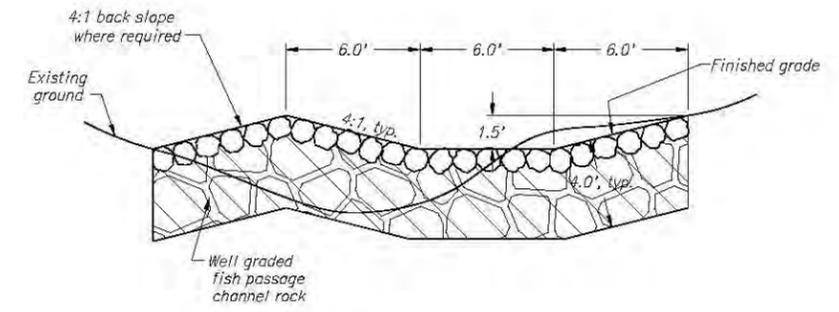
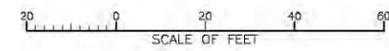


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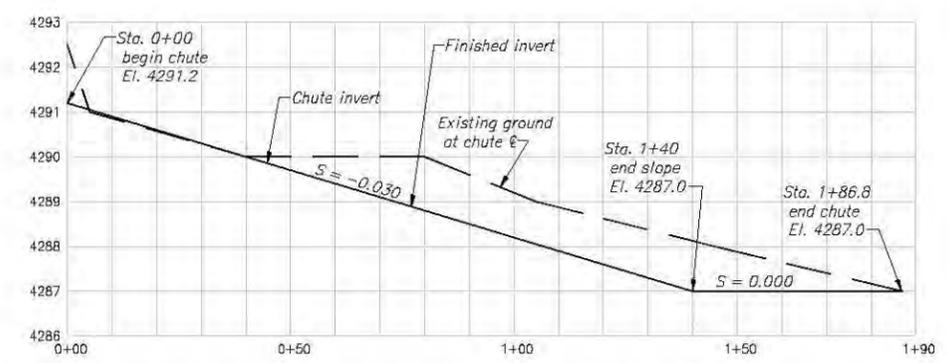
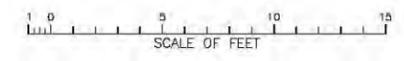
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<b>L9 DIVERSION MODIFICATIONS</b>	
<b>ROCK RIVER CONTROL STRUCTURE</b>	
<b>PLAN, ELEVATION, AND SECTIONS</b>	
DESIGNED <i>Phil Mann</i>	CHECKED <i>Jesse Chan</i>
DRAWN <i>Ed Morshorst</i>	TECH. APPR. <i>Phil Mann</i>
APPROVED: <i>Dave Jennings</i> PROGRAM MANAGER	
BOISE, IDAHO	SHEET 1 OF 1 2004-05-06 1678-100-395



PLAN



TYPICAL SECTION  
ROCK FISH PASSAGE CHANNEL



PROFILE

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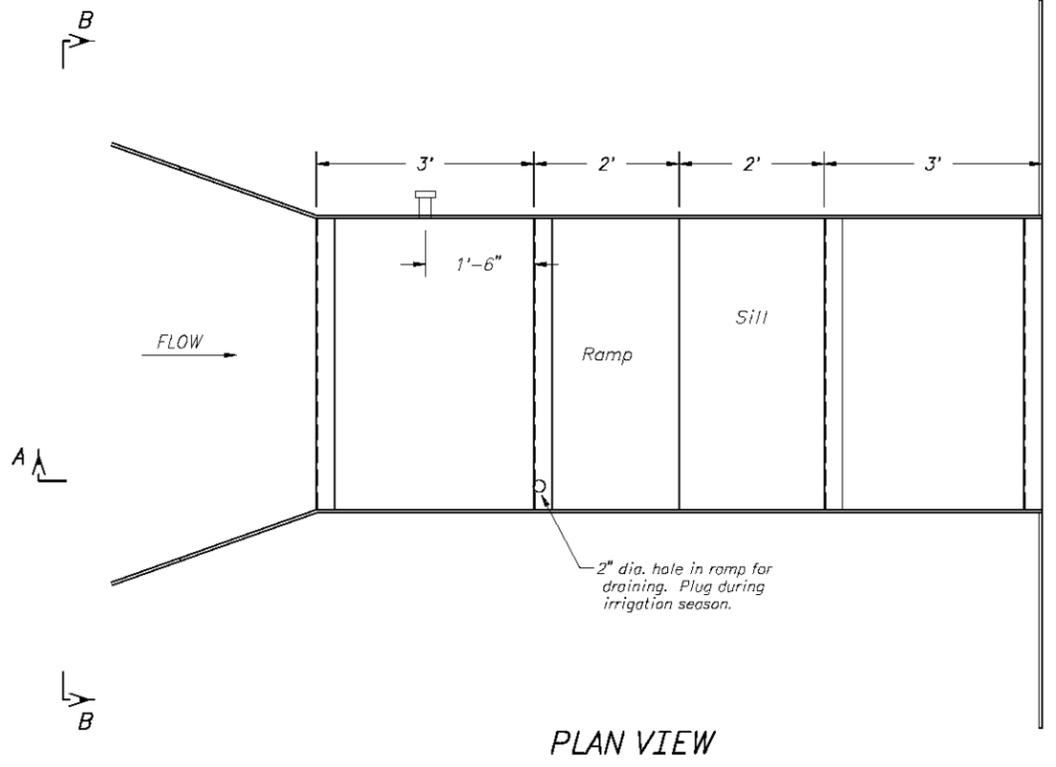
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 DEPARTMENT OF THE INTERIOR  
 BUREAU OF RECLAMATION  
 COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT  
 LEMHI RIVER SUBBASIN - IDAHO

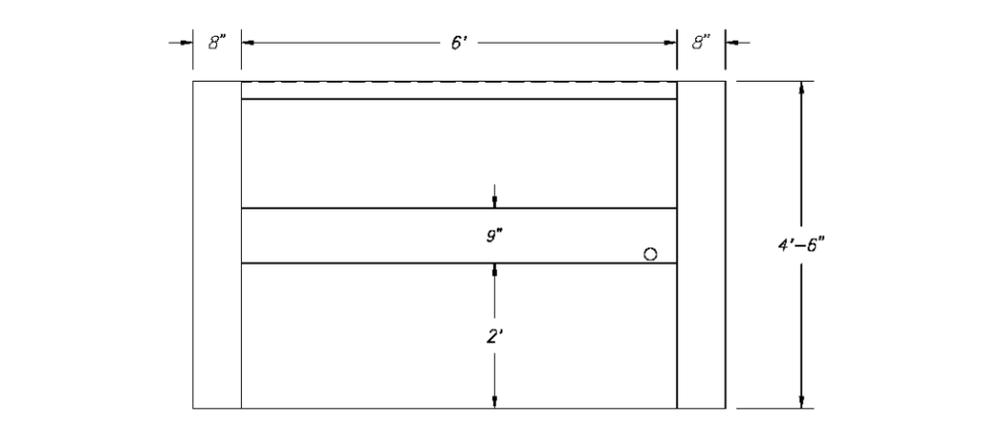
**L9 DIVERSION MODIFICATIONS**  
**ROCK FISH PASSAGE CHANNEL**  
**PLAN, PROFILE, AND SECTION**

DESIGNED Phil Mann CHECKED Jesse Chan  
 DRAWN Ed Mardherst TECH. APPR. Phil Mann  
 APPROVED Dave Jennings  
 PROGRAM MANAGER

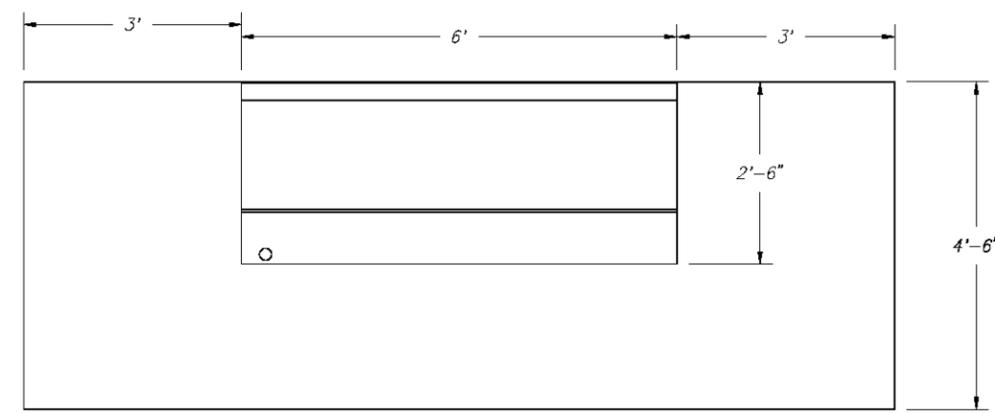
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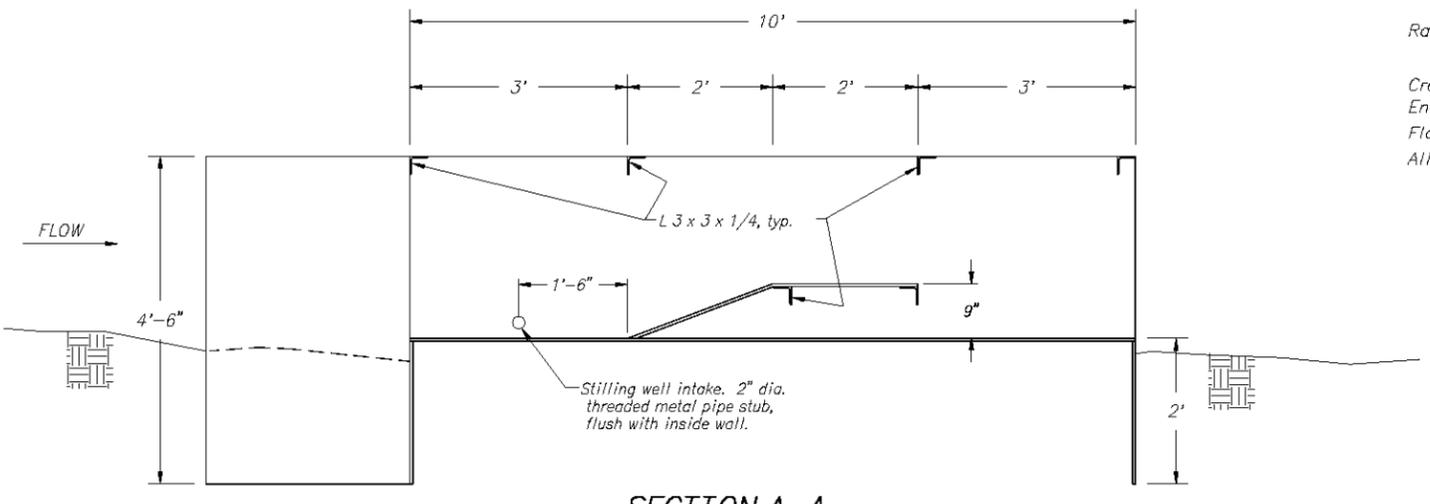
PLAN VIEW



SECTION B-B



SECTION C-C



SECTION A-A

NOTES:

- Ramp flume to be constructed out of steel.
- 1/8" minimum thickness.
- Crest must be level when flume is installed in the canal, to within 0.02'.
- Engineer to specify location for flume installation in ditch.
- Floor of Flume set at Elevation 4289.7, within 0.02'.
- All joints to be welded full length or all around.

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<small>UNITED STATES          DEPARTMENT OF THE INTERIOR          BUREAU OF RECLAMATION          COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT          LEMHI SUBBASIN - IDAHO</small>	
<b>L9 DIVERSION</b> <b>RAMP FLUME</b> <b>PLAN AND SECTIONS</b>	
DESIGNED <u>Phil Mann</u>	CHECKED <u>Jesse Chan</u>
DRAWN <u>Phil Mann</u>	EDM. TECH. APPR. <u>Phil Mann</u>
APPROVED <u>Dave Jennings</u> PROJECT MANAGER	
BOISE, IDAHO	1678-100-403
<small>SHEET 1 OF 1      2004-06-23</small>	

