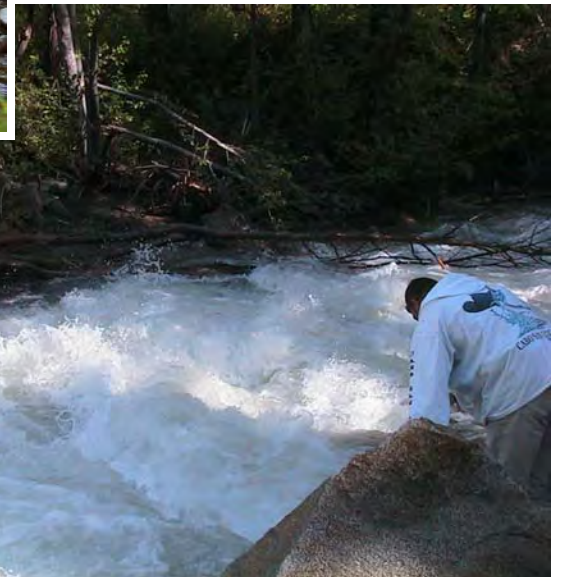


**COMPLETION REPORT**  
**WOLF CREEK DIVERSION DAM**  
**FCRPS HABITAT IMPROVEMENT PROGRAM**  
**WOLF CREEK, METHOW SUBBASIN, WA**



**PREPARED FOR**  
**WOLF CREEK**  
**RECLAMATION DISTRICT,**  
**OKANOGAN COUNTY, WA**



**U.S. DEPARTMENT OF THE INTERIOR**  
**BUREAU OF RECLAMATION**  
**PACIFIC NORTHWEST REGION**  
**COLUMBIA/SNAKE SALMON RECOVERY OFFICE**  
**BOISE, IDAHO**

**MARCH 2009**

**Cover Photo 1. Wolf Creek Diversion Dam prior to rehabilitation to meet fish passage standards. Note sandbags that help direct water into the headgate channel.**

*Photo by Reclamation (June 2001)*

**Cover Photo 2. High flows over Wolf Creek Diversion Dam after rehabilitation to meet fish passage standards.**

*Photo by Reclamation (June 2006)*

This project was initiated and completed through the combined efforts of many entities, public and private. The project's purpose of the project was to provide for continued use of water while enhancing conditions for anadromous fish listed under the Endangered Species Act.

**COMPLETION REPORT**  
**WOLF CREEK DIVERSION DAM**  
**FCRPS HABITAT IMPROVEMENT PROGRAM**  
**WOLF CREEK, METHOW SUBBASIN, WA**

**PREPARED FOR**  
**WOLF CREEK RECLAMATION DISTRICT,**  
**OKANOGAN COUNTY, WASHINGTON**

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**U.S. BUREAU OF RECLAMATION**  
**PACIFIC NORTHWEST REGION**  
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**BOISE, IDAHO**

**MARCH 2009**



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- B–3. Diversion Plan; No. 1678-100-558
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- B–7. Weirs Profile; No. 1678-100-372
- B–8. Weir Blades, Elevation, Section and Detail; No. 1678-100-560
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# 1. INTRODUCTION AND BACKGROUND

Throughout the Columbia River Basin, irrigation diversions and other uses of water have negatively affected salmonids and other fish species by reducing water flows, limiting upstream access to watersheds and spawning areas, and hindering downstream migration. This also describes the situation in the Methow River subbasin.

The Wolf Creek Diversion Dam (Cover Photo 1) was identified as a low-flow barrier to fish movement. This project was initiated with the goal of providing passage for fish at all species and life stages, meeting diversion flow requirements for the irrigators, and reducing the visual impact of the structure in river. The Bureau of Reclamation was requested to work with Wolf Creek Reclamation District (WCRD or the District) to design and install a new facility.

This report explains the design process and regulatory requirements leading to the new diversion and documents the construction that took place. To better illustrate what was accomplished, we have included two attachments: Attachment A shows a series of photographs documenting the work; Attachment B contains a location map and “as-built” drawings of the project.

## 1.1 BACKGROUND

The Methow River provides habitat for several species of fish “listed” as either “threatened” or “endangered” under the federal Endangered Species Act (ESA) of 1973, 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)<sup>1/</sup> or the U.S. Fish and Wildlife Service (FWS) to ensure that any action authorized, funded, or carried out by such agency is “not likely to jeopardize” the continued existence of a listed species or result in adversely modifying its critical habitat. NMFS oversees the implementation of the ESA for certain listed species, including anadromous salmon and steelhead (anadromous trout). FWS has ESA implementation responsibilities for many species, including the bull trout and the Northern spotted owl. In the Columbia River Basin, there are twelve listed anadromous “evolutionarily significant units” (ESU) and one ESU proposed for listing. An ESU is a distinctive group of Pacific salmon or steelhead. Consultation with NMFS was completed in these ESUs and a “biological opinion” (BiOp) was issued in November 2004 (NMFS 2004). This consultation contained an “updated proposed action” by the “Action Agencies” (which include the Bureau of Reclamation); a “tributary habitat program” was one aspect of the

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<sup>1/</sup> NMFS is also called NOAA Fisheries; it is an agency of the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.



action (ACOE et al. 2004). A revised BiOp superseded the above mentioned document in 2008; however, this project was constructed under the auspices of the 2004 document.

## 1.2 LOCATION

Wolf Creek originates in the Lake Chelan-Sawtooth Wilderness Area and flows east for 14.5 miles before entering the Methow River at river mile (RM) 52.8 (upriver about two-and-a-half miles from the city of Winthrop). The creek drains about 37 square miles; 95 percent of the drainage is located within either the wilderness area (above RM 4.6) or the Okanogan National Forest (RM 4.6 to RM 1). Wolf Creek is a “Tier 1 Key Watershed,” which means it is considered crucial for certain fish species and that it provides high-quality water.

The creek provides critical habitat for maintaining and recovering three endangered fish species — Upper Columbia River (UCR) steelhead, juvenile UCR spring Chinook salmon, and bull trout. “At-risk” Westslope cutthroat trout are also present. The watershed is within the range of the Northern spotted owl, an endangered species.

The ditch and piping for the WCRD delivery system is limited to about 13 cfs, maximum diversion, which is also the maximum capacity of the fish screen. The surface water that is diverted for irrigation purposes is located on Forest Service land and is monitored by that agency. Diversion by WCRD must ramp down as the creek drops to maintain a flow of 12 cfs at the mouth of the creek.

The point-of-diversion and structure is located about four-and-a-half miles upstream from the creek’s mouth and about 500 feet downstream from the Wilderness Area boundary. The log diversion structure spanned the entire channel width and was 5.5 feet in height (Photo A–1). It diverted water into an irrigation ditch on the right bank (looking downstream) of the creek (Photo A–2). Upslope from the stream, the irrigation ditch parallels Wolf Creek for about one mile, drops 100 feet in elevation, and then combines with flow taken from Little Wolf Creek. The ditch enters private land and eventually flows into Patterson Lake. The District has a water-transmission easement through Forest Service land that is about two miles long and 30 feet wide. It generally goes parallel to Wolf Creek and to Little Wolf Creek. The entire flow of Little Wolf Creek is diverted into the Wolf Creek ditch year round.

In 1999, a fish screen designed and maintained by WDFW was placed in the WCRD diversion canal about 150 feet from the diversion on Wolf Creek (Photo A–2). The purpose of the screen was to prevent fish from being carried down the ditch and into Patterson Lake. Prior to 1999, bull trout were effectively removed from the reproductive population of Wolf Creek when they were swept down the flume with no way to return to Wolf Creek.

Water from Patterson Lake is used for recreation, irrigation, and domestic use at the Sun Mountain Resort. Lake water is also used for irrigation purposes and is either pumped or flows to the floor of the Methow Valley via natural channel and pipeline.



### **1.3 PROBLEMS AND SOLUTIONS**

The diversion structure was failing and needed to be replaced. If the dam had failed before being upgraded, there would have been a limited opportunity to regain the diversion without instream work more destructive than the proposed project. There were on-going discussions between WCRD, the Forest Service, and other regulatory agencies to establish a mutually satisfactory solution to upgrade the facility by increasing diversion efficiency, reducing if not eliminating a barrier to fish passage, and lessening visual impacts.

The project is located on the upper portion of Wolf Creek, and its successful completion opened up about five additional miles of stream to the passage and rearing of anadromous fish. (There is a barrier waterfall near RM 10, which is inside the wilderness area).

### **1.4 PARTICIPATION AND COOPERATION**

The Wolf Creek Diversion Dam fish passage improvement project was a voluntary effort by the WCRD, which issued the contract for implementation and takes ownership of the facilities upon completion of the project.

### **1.5 ENVIRONMENTAL COMPLIANCE**

Because of the location of the diversion (on Federal land and near a wilderness area), a series of environmental reports and permits were required before construction could be undertaken. The presence of various fish species of differing life cycles and migration patterns limited the instream construction window to a single month (August) each year.

Federal legislation<sup>2/</sup> required an environmental assessment (EA); this was completed in September of 2003 and signed in February 2004 (WCRD 2004, p. 9). The legislation allowed the District to convert from a “special use permit” and to cross Forest Service land (WCRD 2004, p. 9). Requirements for an operation-and-maintenance (O&M) plan and a biological opinion (BiOp) are a part of the easement. Not covered by the EA are any future changes to the footprint of the Wolf Creek irrigation ditch. A “habitat conservation plan” (HCP) was not completed.

Based on the early designs, WCRD obtained construction funding for the project through a grant from the State of Washington Salmon Recovery Funding Board (SRFB, informally called the “Surf Board”). In addition, the District coordinated and administered the contracting process between the landowners and the construction company. WCRD received and held the SRFB grant funds. When provided with paid invoices related to the project and

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<sup>2/</sup> Commonly known as the “Colorado Ditch Bill,” this law authorize the Secretary of Agriculture to issue permanent easements without charge for certain water conveyance systems occupying Forest Service lands and used for agricultural irrigation or livestock watering purposes. The legislation (the Act of October 27, 1986; P.L. No. 99-545; 100 Stat. 3047) amended Title V of the Federal Land Policy and Management Act of 1976.

upon approval of the irrigators, the District paid the contractor and various suppliers of construction materials. WCRD also provided materials and manpower for construction activities and restoration of the construction site. As part of the SRFB agreement, the District will continue its participation by monitoring the restoration efforts, including site revegetation.

## **1.6 PERMITTING**

WDFW administers a coordinated interagency permitting process called JARPA (Joint Aquatic Resource Permit Application). As part of this process, a “hydraulic project approval” (HPA) is required from WDFW prior to construction. The HPA has specific requirements for the protection of aquatic habitat, streambank vegetation, prevention of oil and gas spills from equipment, and requirements for site restoration. The HPA for the Wolf Creek Diversion Enhancement project was issued in October 2003 (WDFW 2003).

Because the State of Washington SRFB funding originated from Federal sources, consultation was required with NMFS and FWS under Section 7 of the ESA. Since the project was located on Federal land, ESA consultation and NEPA compliance were completed by the Forest Services (WCRD 2004).

## 2. PROJECT DESCRIPTION

The purpose of the Wolf Creek Diversion Dam enhancement project was to improve fish passage both upstream and down for all age classes of fish while maintaining the ability of the irrigators to withdraw water. Also, to be compatible with the Scenic and Roadless designation plus candidate for Wild and Scenic designation, had to look natural and be built without long-term road construction. (Jen). This was done by constructing a series of four fish-friendly weirs for passage; these also allowed lowering the water surface while providing a sufficient water supply to the irrigation ditch. The diversion dam was removed.

Only high flows in the neighborhood of 250 cfs will flow over the entire cross-section of the weir plates.(Jen) Most of the stream power is concentrated in the middle of the weirs. The lower six feet of the weir plates are buried, ensuring stability and immobility.

Construction began with placement of ecology blocks for the cofferdam about 25 feet upstream of the existing structure (Photo A-3). These diverted the creek flow into a 30-inch diameter HDPE pipe, transporting the water to the headworks structure, down the wasteway channel, and into the creek about 200 feet downstream of the project site. The completed cofferdam included sandbags and plastic (Photo A-4).

An excavator broke up the previous concrete diversion channel washed out in the 1948 Flood (Photo A-5). It removed smaller pieces of the 1948 diversion dam as well as larger rocks for stockpiling in preparation for excavating the hole for the downstream weir (#4), which was assembled first (Photo A-6). Because it was critical that the middle three plates (of ten) be level and at the proper elevation, they were bolted together on the bank and set first; the other seven were then set and bolted (Photo A-7). Average completion time for each weir was one day. Approximately 250 cfs can flow between the plates before the creek rises high enough to reach the banks above the plates; the channel capacity will range from 700 to 900 cfs.

Each low-flow notch was staggered slightly to help break up the flow patterns. Each weir is about 16 inches higher than the previous weir. The spacing between each of the four weirs is about nine feet (Photo A-8).

Geotextile material was installed between each pair of weirs (Photo A-9). It is used to prevent seasonal low flows from running under or around the plates, thereby reducing fish-passage capability. Native material was used as fill up to about the midway point on the plates (Photo A-10). The fabric in place was not anchored to the weir plates but did run up the side about 18-inches; it was held in place with backfill. Rockfill from the talus slope was added to bring the backfill to grade (Photo A-11).

To aid in fish passage and create resting spots for juvenile fish, large-diameter rocks were placed randomly to help break up the flow, reduce velocities, and add pockets of slow-moving water (Photo A-12 and Photo A-13). A large rock was placed on the creek bank

upstream of the ditch entrance to block debris and logs from being forced into the ditch by the current (Photo A-13).

The line of rocks from the edge of the upper most weir should prevent erosion as water rises above the edge of the plates. Willows, logs, and native soil from the site were used as backfill for the remainder of the area which lead to a relatively quick revegetation (Photo A-15). Water will only use the area of the far bank in higher-than-average flow years. The highest of the line of rocks is slightly lower than the top of the headworks of the diversion.

The uppermost pool is expected to collect more bedload than it currently has because the new dam is higher than the old one and the flows are concentrated in the middle of creek (Photo A-16).

### **3. CONCLUSIONS**

The Wolf Creek fish passage has now been in place for three high-water seasons, two of which were well above long-term-average flows. The structure has performed well and, based on redd counts and observations from USFS personnel, appears to be passing adult bull trout. Some modifications to the left bank of the structure were made after the 2006 high-water season to allow better access to the flood plain. The work was accomplished using rock bars and other hand tools; it was observed to be successful during the 2007 high-water season. After the 2007 season, several large rocks that were blocking the upstream weir's low-flow notch were removed using equipment, and a small deflector barb was built on the right bank about 30 feet upstream of the diversion to adjust flows slightly. After the 2008 high-water season, the diversion ditch was cleaned out, a large log jam was removed from the diversion channel, and an overflow pipe was added just upstream of the fish screen in the canal. It is not anticipated that work will be required every year, however some maintenance will be required, especially after high-flow years.

Site visits over the last three years by personnel from many agencies and organizations have brought general agreement that the structure meets the intent of providing fish passage at the site.

## 4. REFERENCES

IN TEXT	FULL CITATION
ACOE et al. 2004	Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration. 2004. <i>Final Updated Proposed Action for the FCRPS Biological Opinion Remand, U.S. Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration</i> , 24 November 2004.
EPA 1999	U.S. Environmental Protection Agency. 1999. "Wolf Creek Ditch Special Use Permit, Okanogan National Forest, Okanogan County, WA." <i>Federal Register</i> , August 20, 1999; Vol. 64, No. 161, pp. 45502–45505. [from the Federal Register online <a href="http://www.wais.access.gpo.gov">www.wais.access.gpo.gov</a> , April 2007]
FWS 1998a	U.S. Fish and Wildlife Service. 1998a. <i>A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale</i> , February 1998.
FWS 1998b	U.S. Fish and Wildlife Service. 1998b. <i>Endangered and Threatened Wildlife species, Determination of Threatened Status for the Klamath River and Columbia River Delisting of several Evolutionarily Significant Units (ESUs) of West Coast steelhead. Final rule.</i> Federal Register, Vol. 63, No. 111, Wednesday, June 10, 1998. pp. 31647-31674.
FWS 2001	U.S. Fish and Wildlife Service determined on April 3, 2001 that the proposed action was not likely to adversely affect the Upper Columbia River (UCR) spring Chinook salmon or UCR steelhead Evolutionary Significant Units. Document number 01-SP-E 0152.
FWS 2005a	U.S. Fish and Wildlife Service. 2005a. <i>Biological Opinion for the Wolf Creek Diversion Enhancement, U.S. Department of Agriculture, Forest Service, Okanogan and Wenatchee National Forests, Methow Valley Ranger District.</i> FWS Reference Number 1-9-2004-F-W0518. FWS Central Washington Field Office, Wenatchee, WA. February 2, 2005.
FWS 2005b	U.S. Fish and Wildlife Service. 2005b. <i>Endangered and Threatened Wildlife and Plants; Designation of Critical habitat for the Bull Trout. Final Rule.</i> Federal Register, Vol. 70, No. 185, Monday, September 26, 2005. pp 56212–56311. <a href="http://www.fws.gov/policy/library/05-18880.html">http://www.fws.gov/policy/library/05-18880.html</a>
NMFS 2004	National Marine Fisheries Service. 2004. <i>Biological Opinion on the Operation of the Federal Columbia River Power System including the 19 Bureau of Reclamation Projects in the Columbia Basin, November 20, 2004; revised and re-issued pursuant to court order NWF v. NMFS, Civ. No. CV 01-640-RE (D. Oregon).</i>

IN TEXT	FULL CITATION
NPCC 2004	Northwest Power and Conservation Council. November 2004. <i>Final Methow Subbasin Plan</i> . [lead preparers] KWA Ecological Sciences, Inc.; Okanogan County; Washington Department of Fish and Wildlife; and Confederated Tribes of the Colville Reservation Tribes. <a href="http://www.nwcouncil.org/fw/subbasinplanning/methow/plan/">http://www.nwcouncil.org/fw/subbasinplanning/methow/plan/</a>
WCRD 2004	Wolf Creek Reclamation District. May 2004. <i>Biological Assessment for the Wolf Creek Diversion Enhancement, Okanogan County, Washington</i> . Prepared by fisheries biologist Darren M. Cross; reviewed by Jennifer A. Molesworth, USFS Methow Valley Ranger District Fisheries Biologist.
WDFW 2003	Washington Department of Fish and Wildlife. 2003. “Hydraulic Project Approval” (HPA). Log Number ST-F 2668-01. Issued on October 22, 2003 by the Region 2 Wenatchee Field Office, Ephrata, WA.

# **ATTACHMENT A – CONSTRUCTION PHOTOGRAPHS**

**ALL PHOTOGRAPHS BY  
U.S. BUREAU OF RECLAMATION  
PACIFIC NORTHWEST REGION DESIGN GROUP, BOISE ID**





**Photo A-1.**  
View of steel weir at the entrance to the ditch about 60 feet upstream of the intake structure. The weir is designed to provide grade control and prevent cutting of the canal section during high flows.



**Photo A-2.**  
Downstream view of the fish screen, staging area, and pipe bench prior to construction. The canal and fish screen are running near capacity which is about 13 cfs.





**Photo A-3.**  
Construction begins with placement of ecology blocks for the cofferdam about 25 feet upstream of the existing structure. The ecology blocks divert the creek flow in a 30-inch diameter HDPE pipe which transports the water to the headworks.



**Photo A-4.**  
Completed cofferdam including sandbags and plastic. The creek is diverted into a pipe just out of the bottom of the photo. Dewatered channel can be seen at the right of the photo.





**Photo A-5.**  
The excavator breaks up a section of the previous concrete diversion channel which had been washed out in the 1948 flood.



**Photo A-6.**  
Assembling the downstream weir (#4) first. It was critical that the middle three plates (of ten) be level and at the proper elevation, so they were bolted together on the bank and set first. Average completion time for each weir was one day.





**Photo A-7. A downstream view of Weir #4 prior to backfill. The bolted plate is almost completely buried in the existing streambed and should be nearly impossible to move. About 250 cfs can flow between the plates before the creek rises high enough to reach the banks above the plates. Channel capacity should be 700 to 900 cfs.**



**Photo A-8. The four weir plates prior to final backfill with angular material from the talus slope. The rise of the plates is clearly visible as is the offset of each one.**





**Photo A-9.** Installation of the geotextile material between two of the weir plates. The geotextile is designed to prevent low flows from running under or around the plates, thereby reducing the fish passage capability. The space between plates was half-filled with native material, the geotextile is installed, and then angular rock from the talus slope is added to bring the backfill to grade.



**Photo A-10.** Backfill material is added to the geotextile material to weight the fabric down prior to installation of the angular talus material.





**Photo A-11.**  
View of the backfilled weirs: final grading and final fill were completed with talus material. To aid in fish passage, several large-diameter rocks (at left) were randomly placed to help break up the flow, reduce water velocity, and add pockets of slow-moving water.



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Upstream view of all four weirs set in place and backfilled. Large rocks are being randomly placed to act as roughness to the flow and aid in fish passage at various flows. The staggering of the low-flow notches is noticeable.





**Photo A-13.** Upstream view of the low-flow notches after placement of some of the larger rocks designed to interrupt and roughen the flow creating lines and eddies to increase fish passage opportunities.



**Photo A-14.** A view looking downstream toward the entrance to the ditch. A large rock was placed on the creek bank upstream of the ditch entrance to block debris and logs from being forced into the ditch by the current.





**Photo A-15. Final grading of the far bank. The line of rocks from the edge of the upper-most weir (#1) should prevent erosion as water rises above the edge of the plates. Willows, logs, and native soil were used to backfill the remainder of the area. This lead to a relatively quick revegetation of the area. Water will only use the area of the far bank in higher that average flow years. The highest of the line of rocks is slightly lower than the top of the headworks of the diversion.**



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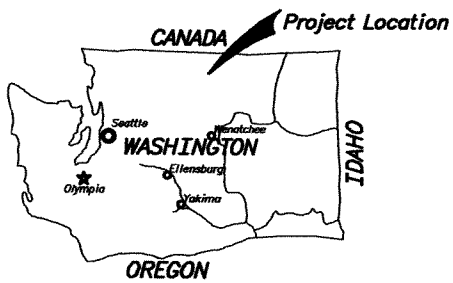
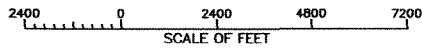
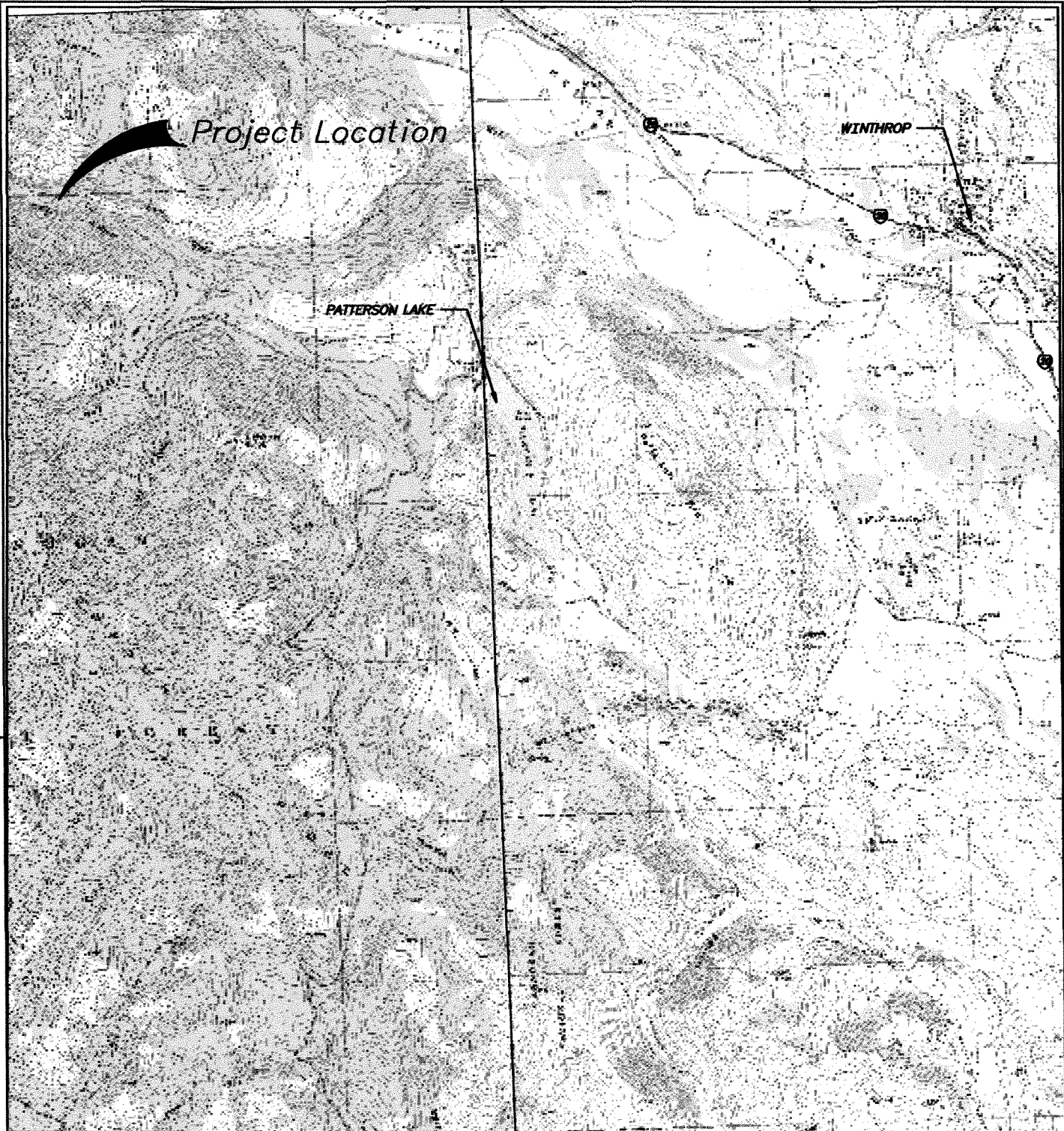
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**ALWAYS THINK SAFETY**

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION  
FCRPS HABITAT IMPROVEMENT PROGRAM  
METHOW RIVER SUBBASIN  
**WOLF CREEK DIVERSION**  
LOCATION MAP

DESIGNED Jeff McLaughlin CHECKED Jesse Chan

DRAWN J. Ward TECH. APPROVAL Jeff McLaughlin

APPROVAL Dave Jennings  
PROGRAM MANAGER

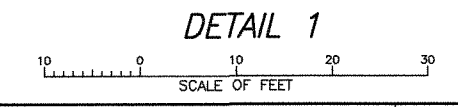
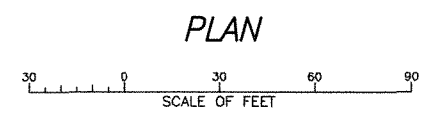
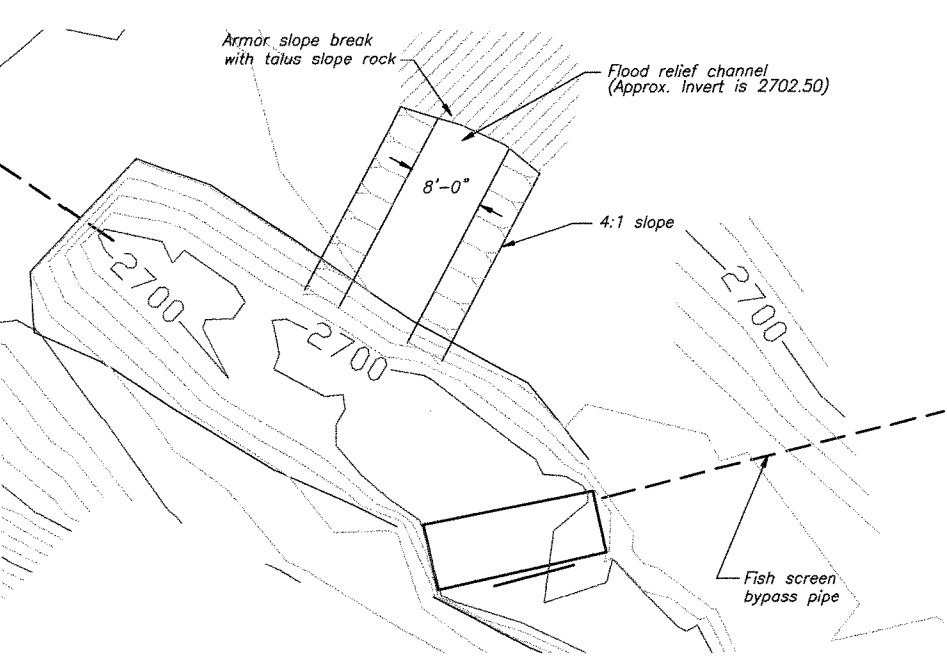
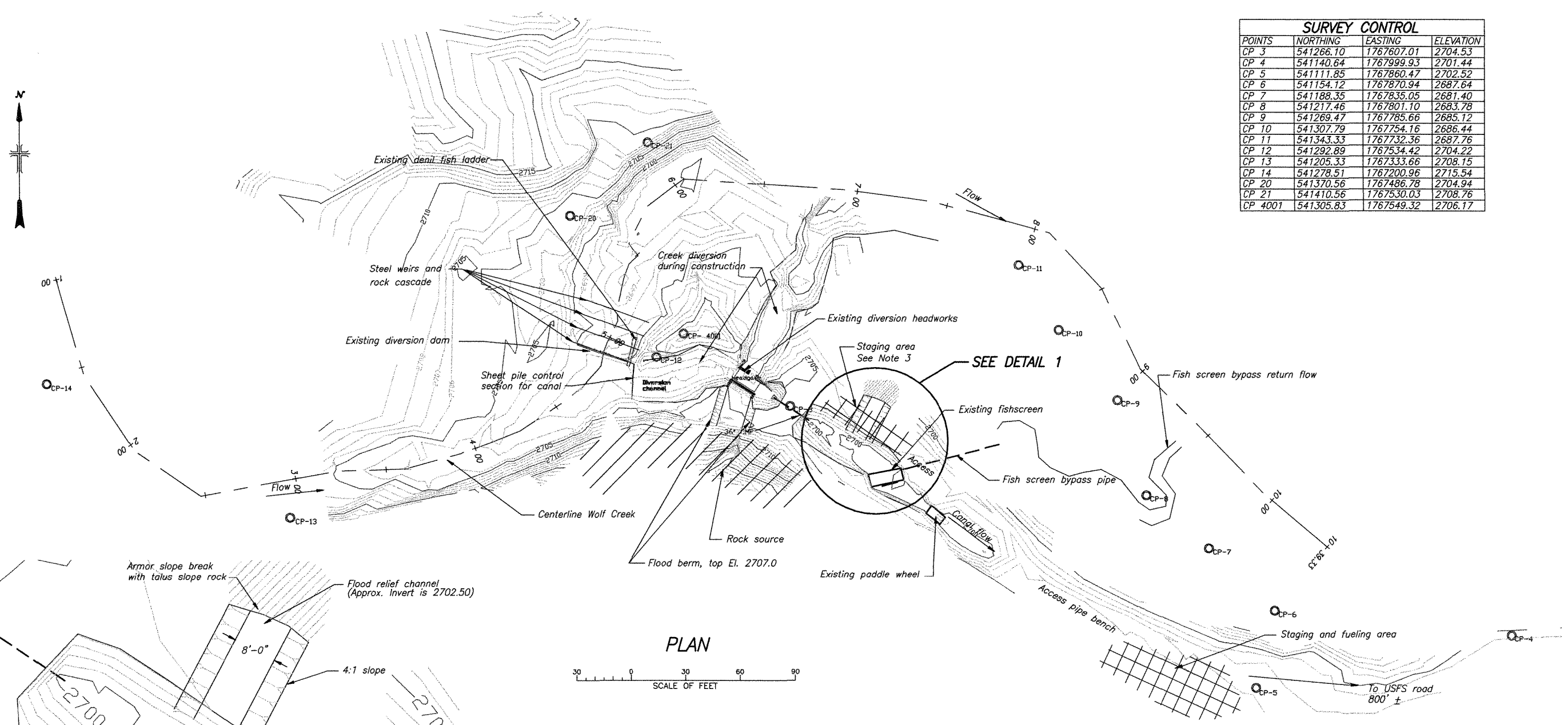
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1678-100-349.DWG  
BOISE, IDAHO

CADD SYSTEM  
AutoCAD Rev. 16.0  
JANUARY 2004

**1678-100-349**



SURVEY CONTROL			
POINTS	NORTHING	EASTING	ELEVATION
CP 3	541266.10	1767607.01	2704.53
CP 4	541140.64	1767999.93	2701.44
CP 5	541111.85	1767860.47	2702.52
CP 6	541154.12	1767870.94	2687.64
CP 7	541188.35	1767835.05	2681.40
CP 8	541217.46	1767801.10	2683.78
CP 9	541269.47	1767785.66	2685.12
CP 10	541307.79	1767754.16	2686.44
CP 11	541343.33	1767732.36	2687.76
CP 12	541292.89	1767534.42	2704.22
CP 13	541205.33	1767333.66	2708.15
CP 14	541278.51	1767200.96	2715.54
CP 20	541370.56	1767486.78	2704.94
CP 21	541410.56	1767530.03	2708.76
CP 4001	541305.83	1767549.32	2706.17



- NOTE:**
1. Cut flood relief channel to 0.5' elevation above top of screens.
  2. Denil fish ladder to be removed and provided to Wolf Creek Reclamation District intact and functional.
  3. Flood relief channel to be constructed after construction of weirs to allow area to be used as the staging area.

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UNITED STATES  
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FCRPS HABITAT IMPROVEMENT PROGRAM

METHOW RIVER SUBBASIN

**WOLF CREEK DIVERSION**

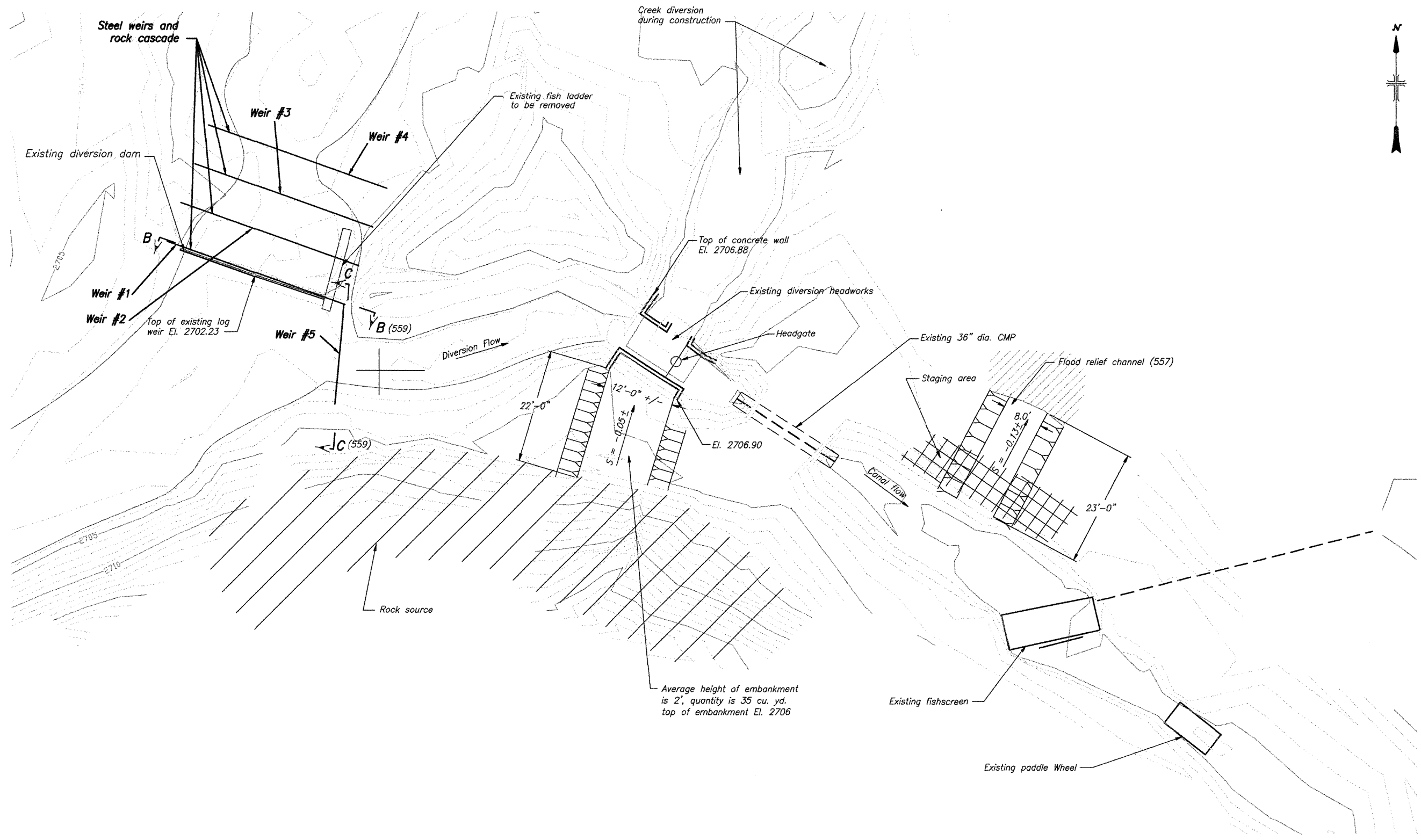
**SITE PLAN**

DESIGNED Jeff McLaughlin CHECKED Jesse Chan  
 DRAWN Scott Weddle TECH. APPROVAL Jeff McLaughlin  
 APPROVED Dave Jennings PROGRAM MANAGER

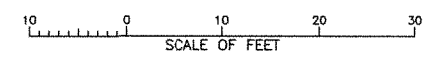
BOISE, IDAHO SHEET 1 OF 1 2004-07-08 **1678-100-414**

C.D. SWENY  
 AND ASSOCIATES  
 CIVIL ENGINEERS  
 1678-100-114.DWG  
 DATE AND TIME PLOTTED  
 JUNE 3, 2005 08:33  
 PLOTTED BY  
 WEDDLE



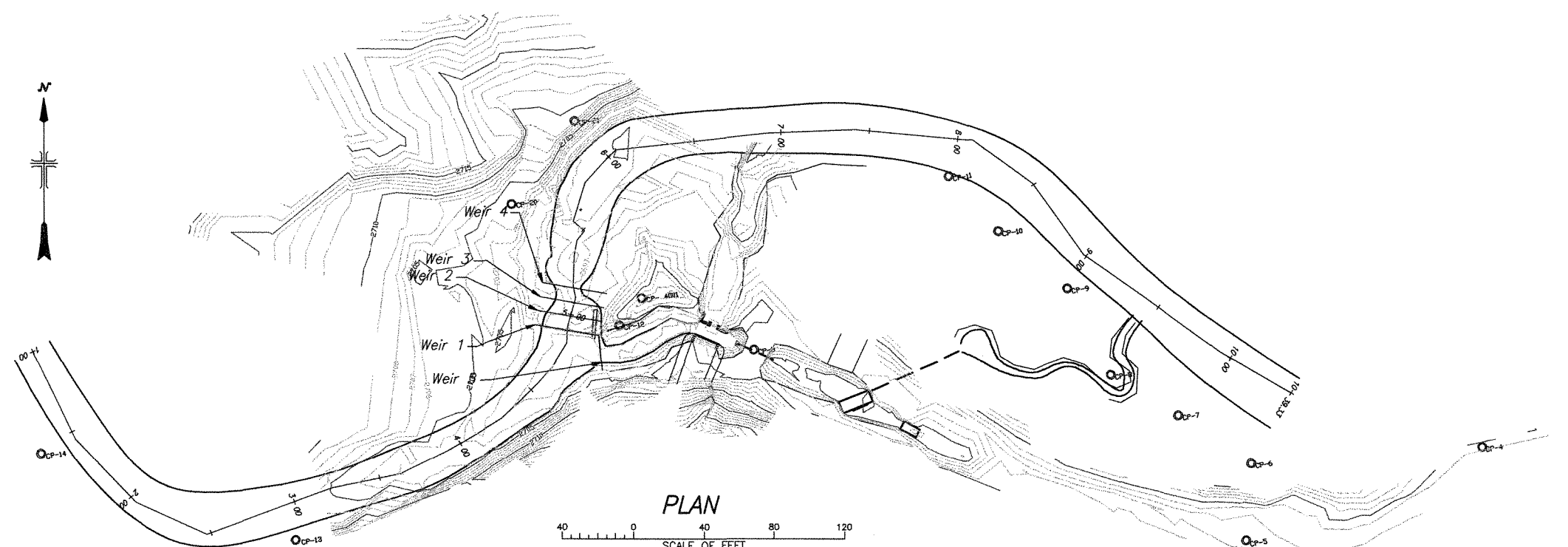


PLAN



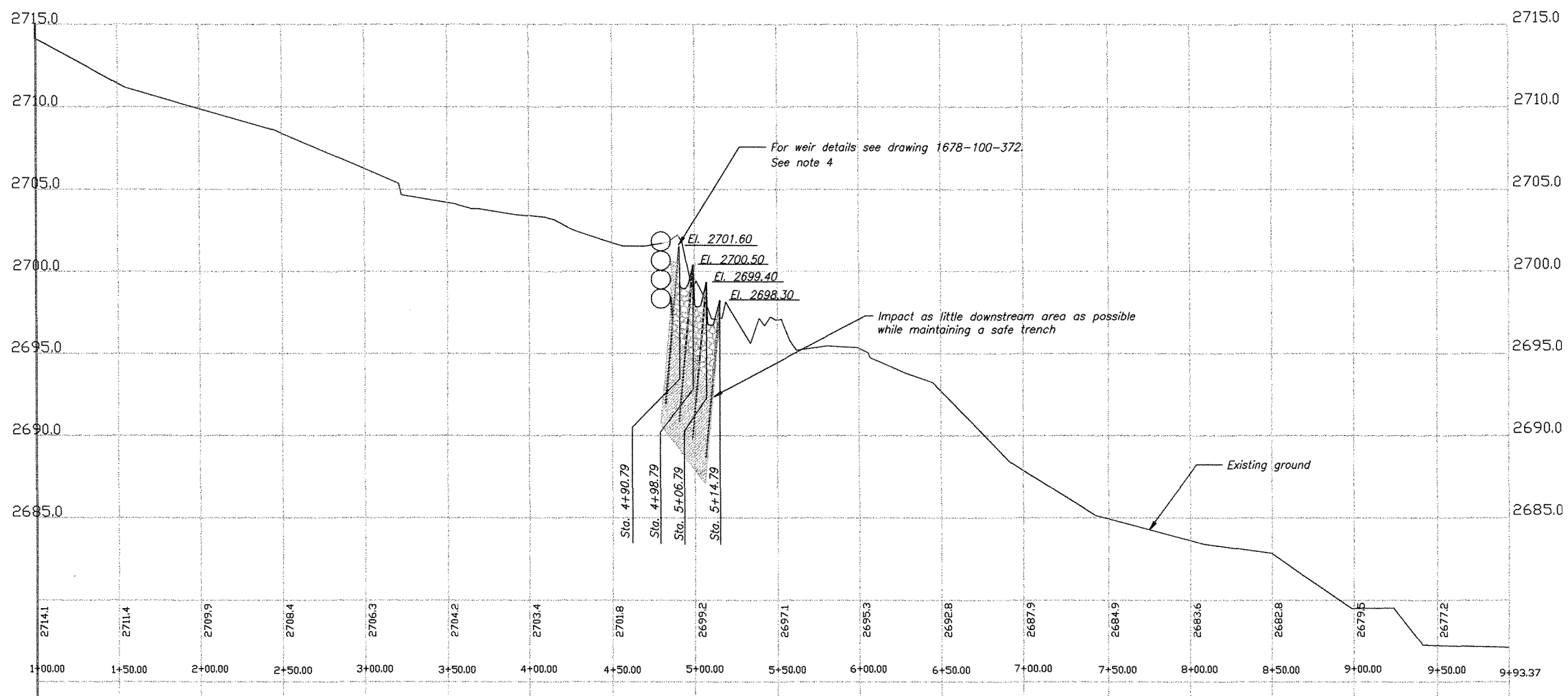
<b>ALWAYS THINK SAFETY</b>	
<small>UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM</small>	
<small>METHOW RIVER SUBBASIN</small>	
<b>WOLF CREEK DIVERSION</b>	
<b>DIVERSION PLAN</b>	
DESIGNED <u>Jeff McLaughlin</u>	CHECKED <u>Jesse Chan</u>
DRAWN <u>Scott Weddle</u>	TECH. APPROVAL <u>Jeff McLaughlin</u>
APPROVED <u>Dave Jennings</u> PROGRAM MANAGER	
BOISE, IDAHO	2004-07-08
SHEET 6 OF 6	<b>1678-100-558</b>

CAD SYSTEM: MicroCAD Rev. 16.0  
 CAD FILENAME: 1678-100-558.DWG  
 DATE AND TIME PLOTTED: JUNE 3, 2005 08:29  
 PLOTTED BY: BRISOLE



PLAN

SCALE OF FEET



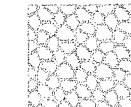
PROFILE

SCALE OF FEET

NOTES:

- Existing ground profile is drawn from centerline points on cross sections and occasional other shots. Actual ground elevations will vary given the unevenness of the terrain and variability between high and low points.
- Flows in bypass channel are expected to be under 20 cfs after July 15th and drop rapidly to approximately 10 cfs.
- Staging and borrow areas not shown.
- Top of weir elevations shown represent invert of low flow fish notch.

KEY



Rockfill borrow from talus slope, remainder is native material from creek bed minus large rock.

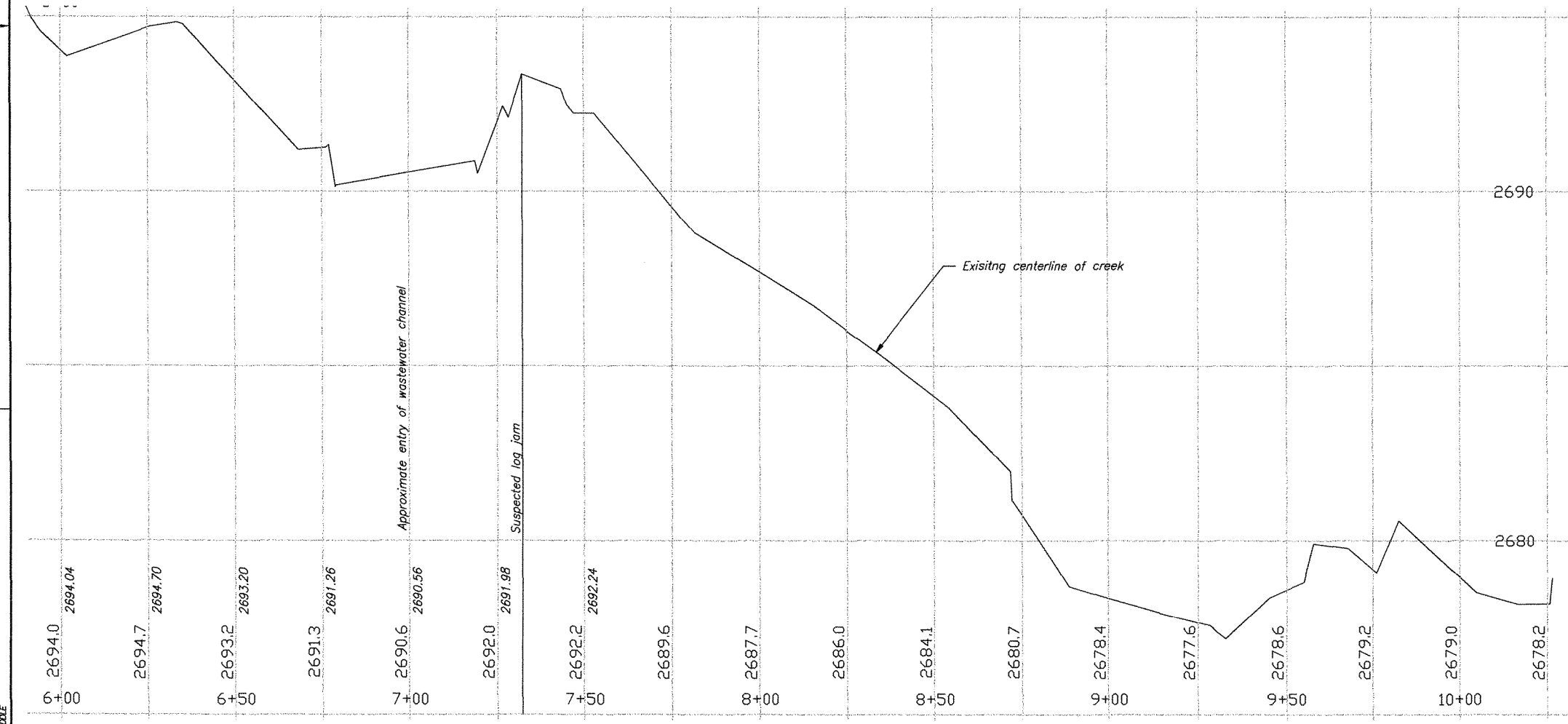
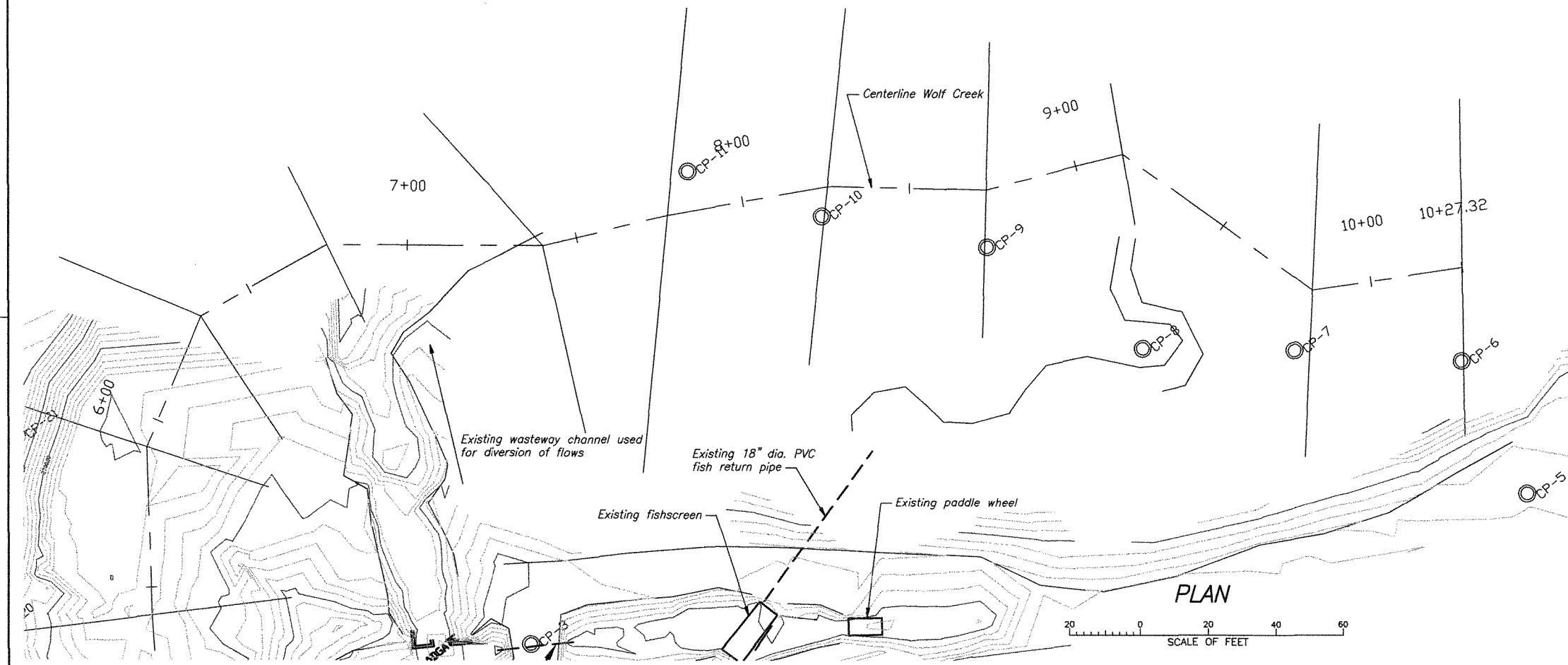
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FCRPS HABITAT IMPROVEMENT PROGRAM  
METHOW RIVER SUBBASIN  
**WOLF CREEK DIVERSION**  
WOLF CREEK  
**PLAN AND PROFILE STA. 1+00 TO 9+93.37**

DESIGNED Jeff McLaughlin CHECKED Jesse Chan  
DRAWN S. Weddle/JW TECH. APPROVAL Jeff McLaughlin  
APPROVED Dave Jennings  
PROGRAM MANAGER

BOISE, IDAHO SHEET 1 OF 1 2004-01-22 **1678-100-346**

CAD SYSTEM 16.0  
 AUTOCAD R14  
 CAD FILENAME  
 1678-100-346.DWG  
 DATE AND TIME PLOTTED  
 JUNE 3, 2005 08:41  
 PLOTTED BY  
 BRECKLE



**NOTE:**

Average slope of surveyed reach is 3.9% (36 feet of drop over 925 feet of channel length).

**PROFILE**

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METHOW RIVER SUBBASIN

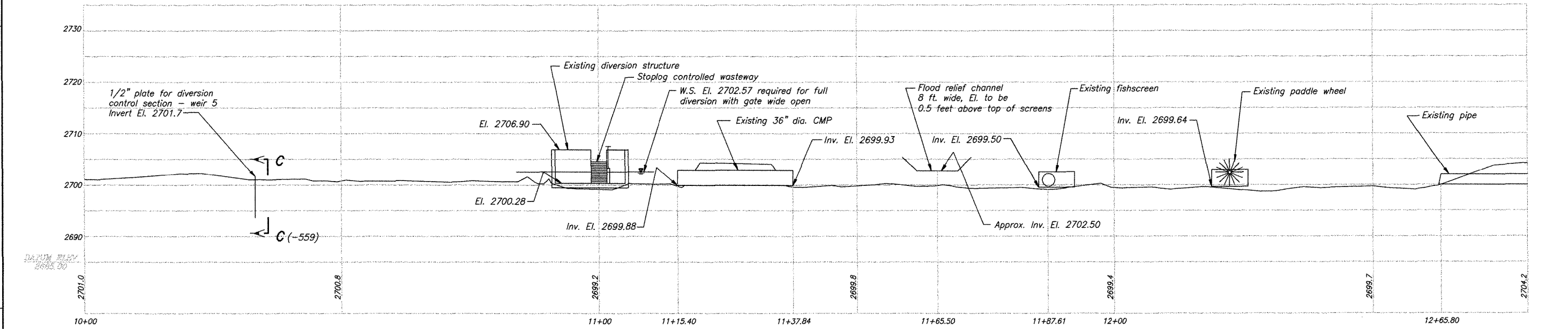
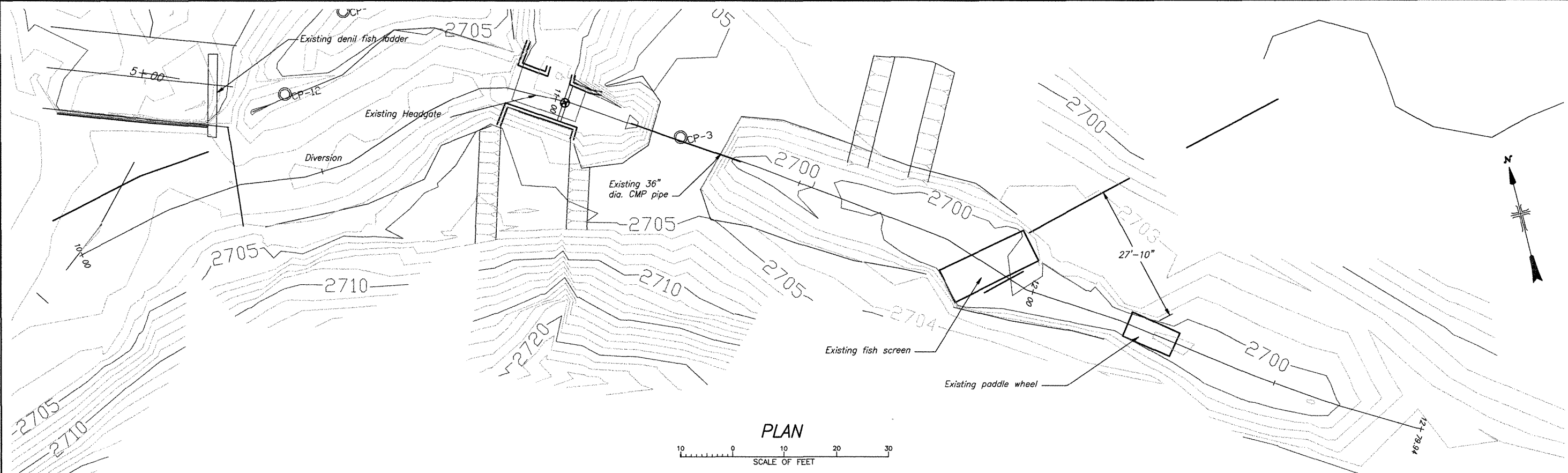
**WOLF CREEK DIVERSION**  
WOLF CREEK

**PLAN AND PROFILE STA. 6+00 TO 10+27**

DESIGNED: Jeff McLaughlin      CHECKED: Jesse Chan  
DRAWN: Scott Weddle      TECH. APPROVAL: Jeff McLaughlin  
APPROVED: Dove Jennings  
PEER REVIEWER/PROGRAM MANAGER

BOISE, IDAHO      SHEET 4 OF 1      2004-01-22      1678-100-347

CAD SYSTEM: AutoCAD R14.0  
 CAD FILENAME: 1678-100-347.DWG  
 DATE AND TIME PLOTTED: JUNE 3, 2005 08:39  
 PLOTTED BY: SWEET



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BUREAU OF RECLAMATION  
FCRPS HABITAT IMPROVEMENT PROGRAM  
METHOW RIVER SUBBASIN  
**WOLF CREEK DIVERSION**  
DIVERSION  
**PLAN AND PROFILE**

DESIGNED Jeff McLaughlin CHECKED Jesse Chan  
DRAWN Scott Weddle TECH. APPROVAL Jeff McLaughlin  
APPROVED Dave Jennings  
PROGRAM MANAGER

BOISE, IDAHO SHEET 1 OF 1 2004-07-08 **1678-100-557**

CUJ SYSTEM  
AUGUST 16, 2004  
CAD FILENAME  
1678-100-557.DWG  
DATE AND TIME PLOTTED  
JUNE 3, 2005 08:51  
PLOTTED BY  
SWEDE

Existing 14" dia. logs

Flow

Randomly placed boulders not shown.

NOTES:

- Existing diversion dam may be removed if it is found to be structurally unstable. The dam will be replaced with rockfill if it is to be removed.
- Add Eight to Ten randomly placed 3 ft. to 4 ft. diameter boulders as directed.
- Weir elevations shown are the inverts of the low flow fish notch.

KEY



- Well-graded rockfill borrow from talus slope. Minimal fine material.



- Native material from streambeds compacted by mechanical devices and equipment travel. Well-graded from fines to 18" dia., larger rocks set aside.

D  
C  
B  
A

D  
C  
B  
A

A

A

El. 2705

El. 2700

El. 2695

El. 2690

El. 2701.60

El. 2700.50

El. 2699.40

El. 2698.30

Excavation limit 1:1 slope

Existing ground

Fabric pinned to existing log dam

3" to 24" well graded rock from borrow area (typ.)

Geocomposite fabric, 122012 minimum. Lap fabric against steel weirs.

4'X 8'X 1/2" ASTM A36 or A50 steel plate. Supplied by Wolf Creek Reclamation District

2'-0"

12"

2701.8

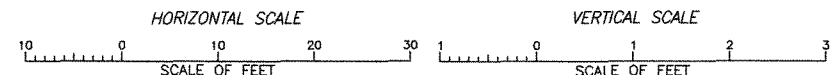
2699.2  
5+00

2697.1

2695.3  
6+00

2692.8

PROFILE



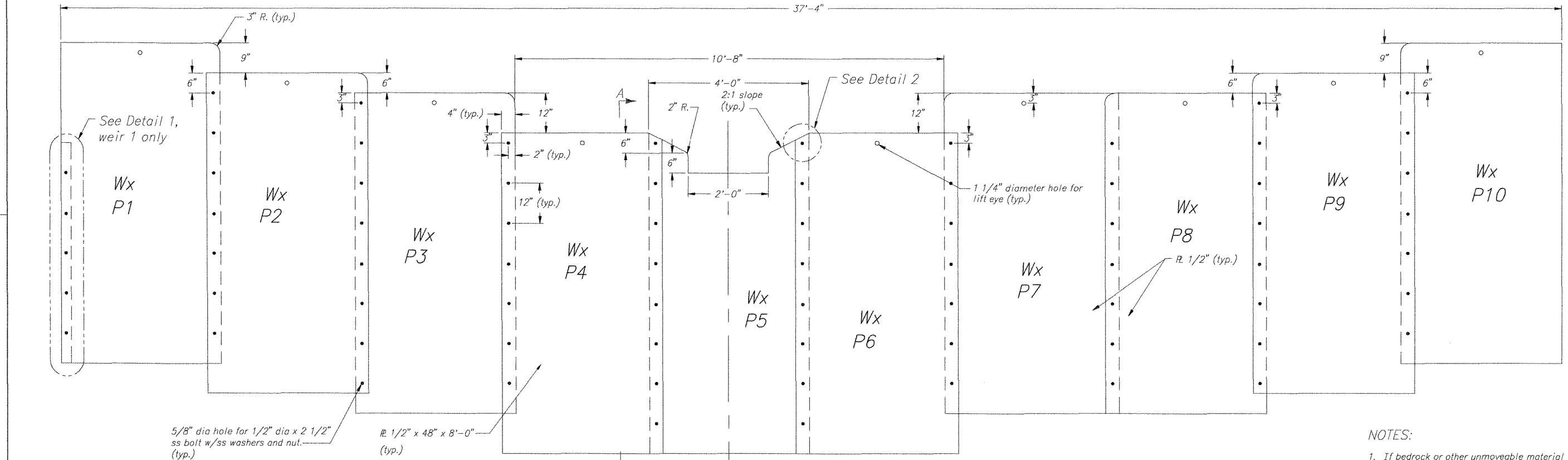
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DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION  
FCRPS HABITAT IMPROVEMENT PROGRAM  
METHOW RIVER SUBBASIN  
**WOLF CREEK DIVERSION**  
WEIRS  
**PROFILE**

DESIGNED Jeff McLaughlin CHECKED Jesse Chor  
DRAWN S. Weddle/JW TECH. APPROVAL Jeff McLaughlin  
APPROVED Dave Jennings  
PROGRAM MANAGER

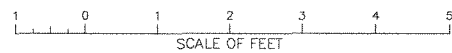
BOISE, IDAHO SHEET 1 OF 1 2004-01-22 1678-100-372

AutoCAD Rev. 16.0  
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DATE PLOTTED  
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PLOTTED BY  
SWEEDLE



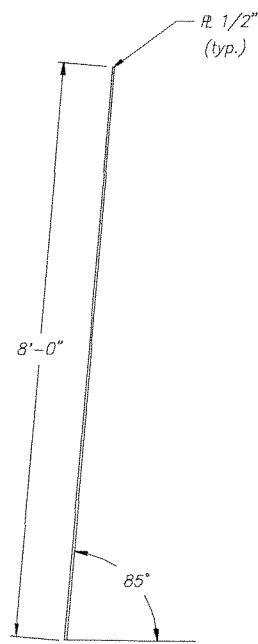
### WOLF CREEK STEEL WEIR ELEVATION (558, 559)

See drawing 1678-100-346 for weir identification

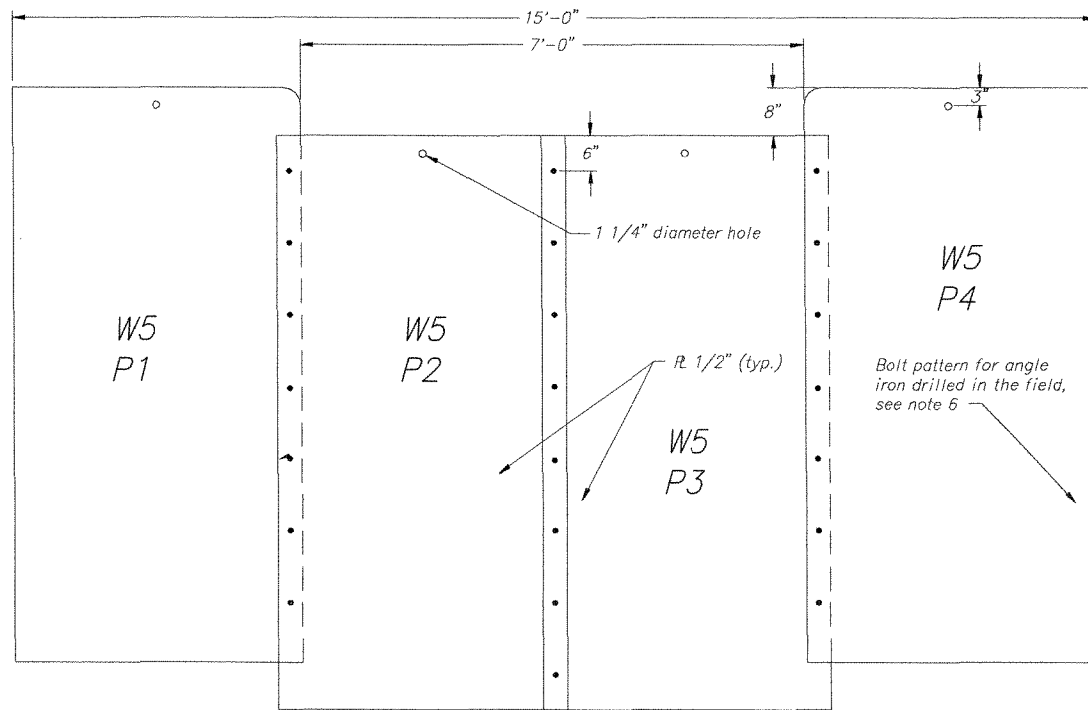


#### NOTES:

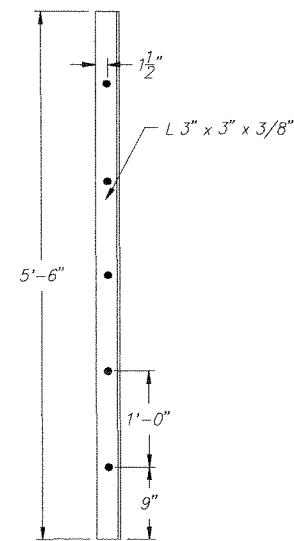
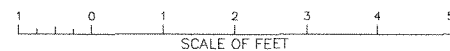
1. If bedrock or other unmoveable material is encountered, sheets will be torch cut to allow weir shape to be maintained.
2. All plate to be ASTM A36 or A50.
3. Steel plates to be marked for assembly denoting which plate and weir. For example W1 P1, W1 P2, W1 P3 etc... See drawing 1678-100-346 for weir identifiers.
4. Holes may be drilled or cut by plasma torch, location of holes +/- 1/16", size of holes +/- 1/16".
5. Assemble plates as directed by the field engineer.
6. Weir 1, plate 1 will connect to weir 5, plate 4. Field drill and bolt weir 5, plate 4 and angle shown in Detail 1.



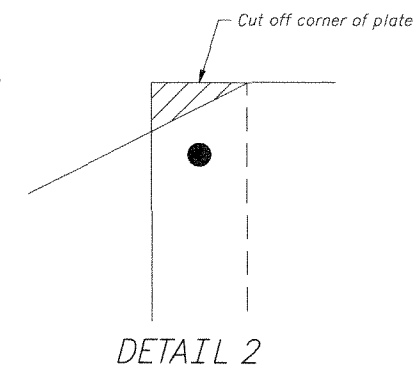
SECTION A-A



### DIVERSION CONTROL ELEVATION WEIR 5 (558, 559)



DETAIL 1  
WEIR 1 ONLY

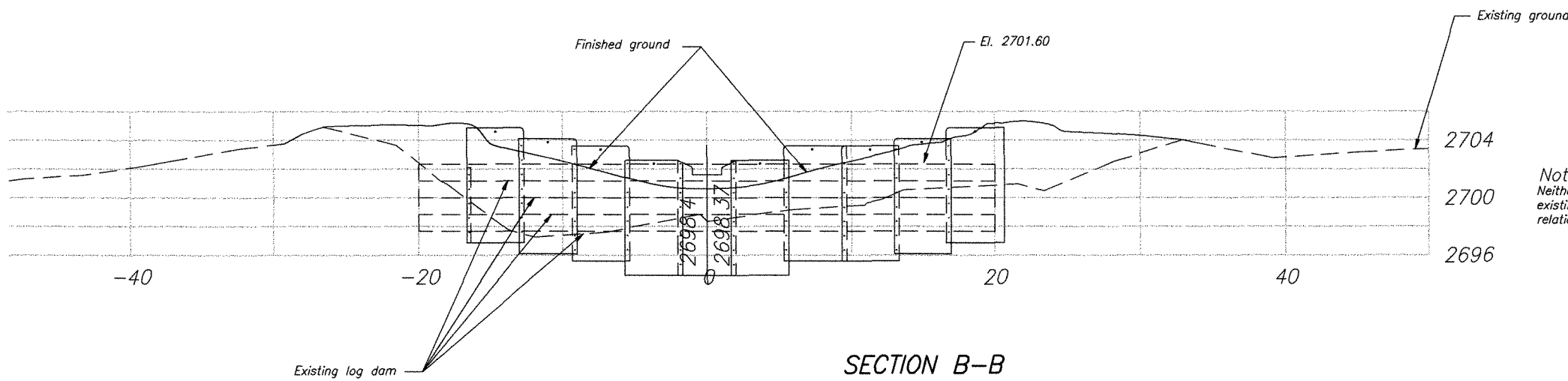


DETAIL 2

ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION CORPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN <b>WOLF CREEK DIVERSION</b> WEIR BLADES ELEVATION, SECTION AND DETAIL	
DESIGNED <u>Jeff McLaughlin</u>	CHECKED <u>Jesse Chan</u>
DRAWN <u>Scott Weddle</u>	TECH. APPROVAL <u>Jeff McLaughlin</u>
APPROVED <u>Dave Jennings</u>	
PEER REVIEWER/PROGRAM MANAGER	
CADD SYSTEM AutoCAD Rev 15.05	CADD FILENAME
BOISE, IDAHO	AUGUST, 2002
1678-100-560	

D

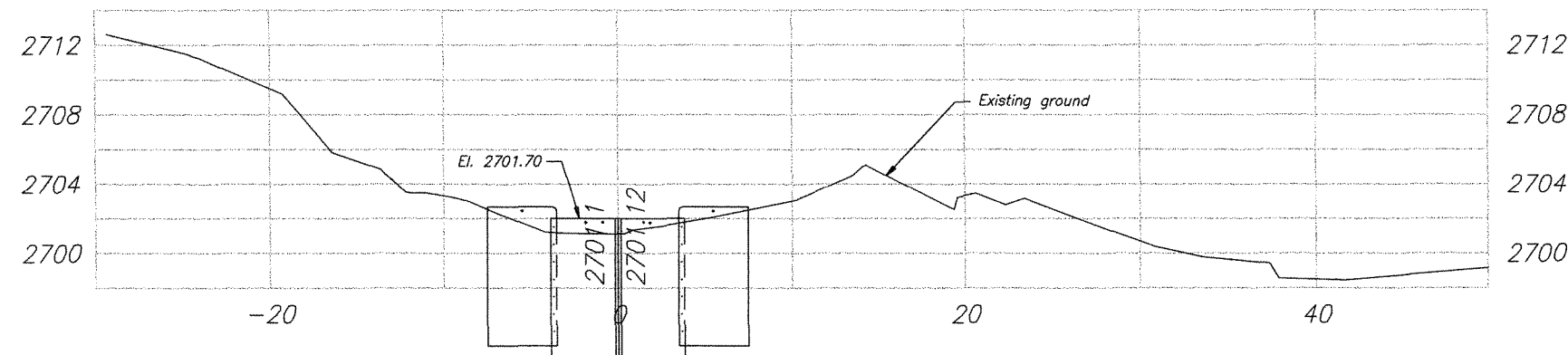
D



Note:  
Neither edge of this section accurately represents the actual elevation of the existing ground. The section is provided to give information regarding the relationship of the new weir to the old.

C

C




B

B

A

A

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<small>UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION</small> FCRRS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN	
<b>WOLF CREEK DIVERSION</b> <b>CREEK AND DIVERSION CROSS SECTIONS</b>	
DESIGNED <u>Jeff McLaughlin</u>	CHECKED <u>Jesse Chan</u>
DRAWN <u>Scott Weddle</u>	TECH. APPROVAL <u>Jeff McLaughlin</u>
APPROVED <u>Dave Jennings</u> <small>PROGRAM MANAGER</small>	
BOISE, IDAHO	2004-07-08
SHEET 1 OF 1	1678-100-559

AutoCAD Plot 16.0  
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 DATE AND TIME PLOTTED  
 JUNE 3, 2005 08:18  
 PLOTTED BY  
 SNEDELL



D

D

C

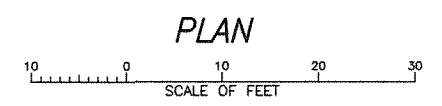
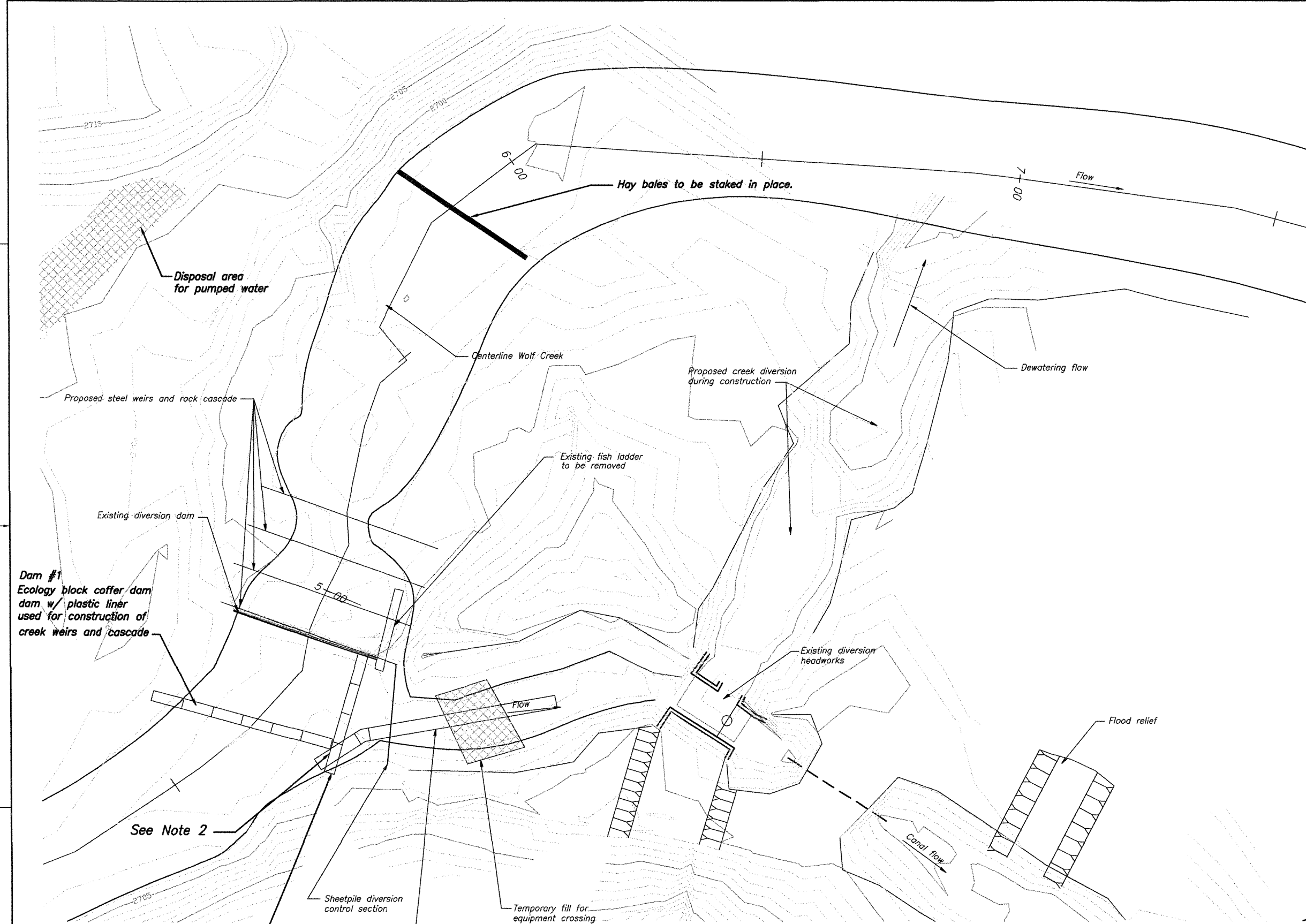
C

B

B

A

A



- NOTE:**
1. Contractor to supply ecology blocks, plastic, geofabric, hay bales, dewatering pipe, and pumps.
  2. Dewatering Dam #1 and 30" dewatering pipe to be constructed for steel weirs and rock cascade and then removed before dewatering Dam #2 is to be constructed for weir 5.

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<small>UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN</small>	
<b>WOLF CREEK DIVERSION</b>	
<b>DEWATERING PLAN</b>	
DESIGNED <u>Jeff McLaughlin</u>	CHECKED <u>Jerse Chan</u>
DRAWN <u>Scott Waddle</u>	TECH. APPROVAL <u>Jeff McLaughlin</u>
APPROVED <u>Dave Jennings</u> PROGRAM MANAGER	
BOISE, IDAHO	SHEET 6 OF 6    2004-07-08    1678-100-373

AUG2004 RW 16.0  
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 DATE AND TIME PLOTTED  
 JUNE 3, 2005 09:34  
 PLOTTED BY  
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