

COMPLETION REPORT
FORT-THURLOW DIVERSION DAM
FISH PASSAGE IMPROVEMENT PROJECT,
BEAVER CREEK, METHOW SUBBASIN, WA



PREPARED FOR
OKANOGAN CONSERVATION
DISTRICT
OMAK, WASHINGTON

BY U.S. BUREAU OF RECLAMATION
PACIFIC NORTHWEST REGION
UPPER COLUMBIA AREA OFFICE
METHOW FIELD STATION

OCTOBER 2005

ON THE COVER

Cover Photo 1. Fort-Thurlow Diversion Dam prior to rehabilitation to meet fish passage standards.

Photo by Reclamation (September 2004)

Cover Photo 2. Lower end of Fort-Thurlow Diversion Dam after rehabilitation to meet fish passage standards.

Photo by Reclamation (November 2004)

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

In the fall of 2004, the Fort-Thurlow Diversion Dam (cover photo 1), identified by the Washington Department of Fish and Wildlife (WDFW) as a total barrier to fish movement, was modified by reducing the height of the existing concrete dam and adding four rock weirs downstream (cover photo 2). The new weirs and dam modifications allow fish passage for all species and life stages at all but the lowest flows, meet diversion flow requirements for the irrigators, and are less noticeable in the river.

The project is the last of four on lower Beaver Creek, a tributary of the Methow River in Okanogan County, Washington.^{1/} Together, they open upwards of 23 miles of Beaver Creek to the passage and rearing of anadromous fish. In particular, the species of interest is steelhead with some use by juvenile spring Chinook salmon in the lower reaches; bull trout are also present. 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 appendices; Appendix A shows a series of photographs documenting the work; Appendix B contains a location map and “as-built” drawings of the project.

1.1 PROBLEMS AND SOLUTIONS

The Fort-Thurlow Diversion Dam fish passage improvement project is one of a series of voluntary efforts by various Beaver Creek landowners implemented by and through the Twin Creeks Coordinated Resources Management (CRM) process. The original surveys and the initial design work were provided by the USDA Natural Resources Conservation Service (NRCS). At the request of Beaver Creek landowners, Reclamation reviewed the existing NRCS work and developed additional concepts. The irrigators selected their preference in coordination with the landowner. Reclamation then completed final designs. The projects continued to evolve in response to comments by irrigators, the landowner, and permitting agencies.

The Twin Creeks CRM meetings were an important tool, particularly during the early phases of the design process. Landowners in the Beaver Creek watershed, other interested parties, and all local, State, and Federal agencies with resource management responsibilities were invited to the Twin Creeks CRM meetings. The venue was used to explain and discuss the issues and processes involved in such projects. It was also a good forum to keep people informed of issues in the watershed and ongoing progress with the project and grant applications. The meetings are an ongoing program and are coordinated by the Okanogan Conservation District (OCD or District).

Based on the early designs, OCD 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. OCD received and held the SRFB grant funds. When

¹ Descriptions of two of the other three projects can be seen on the Bureau of Reclamation’s Pacific Northwest Regional Office website at <http://www.usbr.gov>. They are *Completion Report, Upper Stokes Fish Passage Improvement Project, Beaver Creek, Methow Subbasin, Washington* (March 2004) and *Completion Report, Lower Stokes Fish Passage Improvement Project, Beaver Creek, Methow Subbasin, Washington* (March 2004).

provided with paid invoices related to the project and upon approval of the irrigators, the District paid the contractor and various suppliers of construction materials. OCD 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.

1.2 PARTICIPATION AND COOPERATION

The Fort-Thurlow Diversion fish passage improvement project was successful because of the teamwork of the willing participants. The Fort-Thurlow Diversion supplies water to two separate water users, Mike Fort and the Thurlows (Bernard and Diane). The irrigators provided a great deal of site information and water flow data during the design phase of the project and were available to answer questions as they arose. The Fort-Thurlow Diversion is located on land owned by Lou Tice, who provided access and staging areas. The ditch crosses Lower Beaver Creek Road, maintained by Okanogan County which provided design advice and copies of typical drawings.

Another important aspect of this project was the cooperation and coordination between the various permitting agencies; this was fostered in large part by their participation in the Twin Creeks CRM process. As a result, the permitting agencies were involved with the design concepts from the beginning. This in turn led to expedited permit issuance and no unpleasant surprises during construction. WDFW provided valuable on-site assistance and advice during fish-salvage operations at no cost to the landowner.

Boulder Creek Contracting, locally owned by Pete and Patti DeLange, performed the construction work. The firm provided all heavy equipment and various other items, including a dewatering pump, motorized hand compactor, and hand tools.

1.3 PERMITTING

WDFW administers a coordinated interagency permitting process (Joint Aquatic Resource Permit Application, or “JARPA”). 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. A separate HPA is required for each project; the HPA for the Fort-Thurlow Diversion Dam project was issued in October of 2003.^{2/}

Because the State of Washington SRFB funding originated from Federal sources, consultation was required with NOAA Fisheries and with the U.S. Fish and Wildlife Service (FWS) under Section 7 of the ESA. To save time and money, OCD prepared a single plan that combined six proposed projects on Beaver Creek and submitted one “biological assessment” (BA) to NOAA Fisheries and to FWS in March 2003.^{3/} Reclamation provided technical assistance to OCD during consultation.

² The HPA was issued on October 22, 2003 by the Washington Department of Fish and Wildlife Region 2 Wenatchee Field Office, Ephrata, Washington. Log Number ST-F 2668-01.

³ *Biological Assessment for Beaver Creek*, prepared by Bob Anderson for Okanogan Conservation District, Okanogan, WA, in cooperation with the Bureau of Reclamation’s Methow Field Office.

NOAA Fisheries issued a single BiOp for all six projects on August 6, 2003.^{4/} FWS provided a “letter of concurrence.”^{5/}

1.4 CONTRACTS SPECIFICATIONS AND BIDDING

Technical specifications and contract language for the project were completed by Reclamation using standard NRCS format and language. The irrigators, Mike Fort and the Thurlows, were responsible for contract administration; they reviewed and concurred with the specifications and contract package. OCD, acting for the irrigators, sent the specifications to Boulder Creek Contracting in September 2004. The proposal from the contractor was received in late September 2004; after review by OCD and the landowners, it was accepted, materials were ordered, and work began soon after.

For the Fort-Thurlow Diversion project, the contract for construction was between the irrigators and the construction company. OCD received and held the SRFB grant funds. When provided with paid invoices, the District reimbursed the irrigators for project-related items; these included contractor payments and materials such as pipe and the concrete diversion structure. During construction, Reclamation had no contractual relationship or other obligations with the contractor or the District.

⁴ NMFS Biological Opinion of August 6, 2003; tracking number 2003/00809. *Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Beaver Creek.*

⁵ The 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.

2. PROJECT DESCRIPTION

The purpose of the Fort-Thurlow Diversion 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 their water right. This was done by using a series of fish-friendly weirs for passage which also allowed lowering the water surface while providing a sufficient water supply to the irrigation ditch. The top of the dam was also lowered.

The “invert elevation” (the lowest point) of the new headgate of the delivery ditch was lowered about 20 inches compared to the existing headgate. This reduced the water height required in the creek to make the diversion. The dam was lowered 20 inches by the removal of concrete.

2.1 CONSTRUCTION PROCESS

Construction took place over a three-week period, but was not continuous. The project began the week of November 1, 2004 with the collection and transportation of the large rocks from the Stokes Property about 3 miles from the project site. The last of the cleanup was completed about November 23, 2004. Revegetation was started immediately after the Thanksgiving holiday and was completed in the spring of 2005.

The weather was adequate with seasonal temperatures and some snow and rain. Low temperatures were around 15 °F some days but there were no difficulties with the dewatering pipe or coffer dams. Creek flows stayed consistent and were estimated to range between 4 and 8 cfs with the higher flows following light rains in the basin.

2.2 PRE-CONSTRUCTION

2.2.1 MOBILIZATION AND STAGING

Initial mobilization of equipment took place and materials were delivered to the site. This included the large rocks for the weirs provided from the Stokes property. The project was laid out using stakes and flagging prior to the start of project. Photos A-6, A-7, and A-8.

2.2.2 REMOVAL OF EXISTING FISH SCREEN

The existing fish screen was removed prior to the start of project and set aside for reinstallation. It met existing WDFW guidelines and did not have to be upgraded.

2.3 CONSTRUCTION STEPS

The separate steps in the construction process are described chronologically in this section, with the approximate length of time for each step and photo numbers. “Day [x]” refers to “work day” as opposed to continuous days from project start.

2.3.1 DAY 1 – DEWATERING AND BYPASSING CREEK AROUND SITE

A temporary cofferdam was installed just upstream from the diversion. It was comprised of ecology blocks for mass and 6-mil-thick plastic sheeting to hold back the water and divert it. (Ecology blocks are cast at a concrete batch plant from left-over ready-mix; for the Fort-Thurlow project, the

blocks were about 6 feet long by 2 feet high by 2 feet wide; this is a typical size.) It was decided to use the existing diversion ditch and the former fish access road to bypass the creek water around the new-weir construction area. The tracked excavator dug a trench from the fish screen back up to the concrete diversion structure. Photos A-8 and A-9.

Sediment protection was provided by placing hay bales downstream from the project area and upstream of the dewatering pipe. As the water was cut from the stream channel to the temporary diversion bypass, two WDFW biologists used electro-shock techniques to remove salmonids and other fish from the reach that was dewatered. The fish were released downstream from the project area.

2.3.2 DAY 2 – PIT-RUN MATERIAL

About 100 cubic yards of pit-run material was hauled in, placed, and compacted downstream of the existing concrete dam at the planned location for Rock Weir No. 1 (the uppermost).

2.3.3 DAYS 2-5 – CONSTRUCTION OF FISH PASSAGE WEIRS

A series of four weirs meeting WDFW standards, were constructed, including installation of geocomposite liner and backfill. The upper three structures are “A” type vortex rock weirs; the last is a “V” type; the two types are explained below.

Weir No. 1 (numbered from upstream to downstream) is a Rosgen-style “double drop” or “A-type” (so-called because of its shape) vortex rock structure. It was installed immediately downstream of the existing concrete structure. Weir No. 1 was designed to have a drop in the creek of no more than 0.8 foot across each of its two drops, which meets WDFW standards for fish passage. This rock weir is set slightly higher than the lip of the remaining concrete dam so it becomes the control over the water surface and provides the required water surface to make the irrigation diversion. See Photo A-10.

Weirs No. 2 and No. 3 are also double-drop, rock vortex structures. They were constructed at 30-foot intervals downstream from Weir No. 1. They raised the existing streambed, prevent downcutting, and provide a controlled drop to the existing streambed below the dam. (Headcutting is a large, downward movement of a streambed created when a stream is steepened.) Each drop met WDFW standards. Photo A-11.

Weir No. 4 was built at the level of the existing streambed. The weir is a single-drop, Rosgen-style “V-type” rock vortex structure (so-called because of its shape); its drop is 0.8 foot. This weir created a transition between the built-up section upstream and the natural streambed downstream and was designed to provide grade control should the existing stream downcut over time.

2.3.4 DAYS 6-7 – PARTIAL REMOVAL OF DIVERSION DAM

The existing 5½-foot-high concrete diversion dam was reduced in height by about 20-inches by cutting the top wall off the dam. The remainder of the dam was inundated by the pool formed by Weir No. 1. A small portion of the top wall was left on each abutment to create an opening in the wall that matched the existing streambed width. This prevented the creek from spreading out, which would otherwise allow sediment and bedload to drop out. The concrete waste was buried on site. The upstream coffer dam was removed to allow stream flow over the weirs and allow work to begin on the canal section.

2.3.5 DAY 8 – REMOVAL OF HEADGATE AND HEADWALL MODIFICATION

A small cofferdam was installed in front of the existing headgate using materials from the on-stream structure, including ecology blocks, rocks, and earthfill. Photo A-9.

The existing headgate was removed, the headwall was excavated to the depth of new diversion gate, and a new hole was cut in the headwall.

2.3.6 DAY 9 – INSTALLATION OF NEW HEADGATE AND PIPE FROM HEADGATE

Since lowering the ditch required that it be fairly deep from the headgate to the point where it left the road, most of the open irrigation ditch in the project area was replaced with pipe. Immediately after the headgate, about 35 feet of 36-inch-diameter, double-walled HDPE (high density polyethylene) pipe was installed. Photos A-12 and A-13.

2.3.7 DAYS 10 AND 11 – INSTALLATION OF PIPE UNDER ROADWAY

Immediately after the fish screen, the ditch enters another 10-foot section of 36-inch-diameter HDPE pipe; it then transitions into a length of 36-inch-diameter CMP (corrugated metal pipe) which travels under the county road. The 36-inch CMP is 14-gage with standard corrugations and a flared inlet at the upper end. The total length of the pipe is 80 feet plus the inlet. Photo A-17.

The 10-foot section of HDPE pipe was originally intended as a temporary crossing for installation of the waste and fish bypass pipes. However, after discussions with the irrigators, the pipe was left in place and will work well. There is a small opening between the two pipes that is fairly deep and has side slopes of about 1:1. At the request of the irrigators, the Okanogan Conservation District agreed to place a metal screen over the opening; the work was accomplished in the fall of 2004 after consultation between the irrigators, OCD, and Reclamation.

2.3.8 DAY 12 – REINSTALLATION OF FISH SCREEN

The existing fish screen was reset about 20 feet downstream of the pipe opening very near its former location but lower in elevation. A stoplog controlled metal waste-overflow structure was installed immediately upstream of the fish screen. The waste structure is 4 feet wide and sluices the overflow water back to the creek through about 80 feet of 15-inch-diameter, 63 psi plastic irrigation pipe (PIP). This structure will be used to sluice sediment from the front of the fish screen as well as providing for overflow when the irrigation pumps are shut off.

The fish bypass pipe is immediately downstream and runs side by side with the waste pipe. It is 8-inch-diameter, Schedule 40 PVC pipe. The two pipes daylight just downstream of a large boulder placed to create a deeper hole for the pipe outlets and to prevent sediment at the outlet of the pipe. Photo A-15 and A-16.

2.3.9 DAYS 12 AND 13 – WASTE STRUCTURE

The installation of a waste structure, 15-inch-diameter wastepipe, and an 8-inch-diameter fish bypass pipe included the addition of a 10-foot length of 36-inch-diameter HDPE pipe in the ditch downstream of the fish screen for access. Photo A-13.

2.3.10 DAY 14 – DOWNSTREAM DITCH; CONTROL BOX, TRASHRACK, AND PIPE

A new concrete pipe intake with a metal trashrack was installed about 30 feet downstream from the measuring weir. About 200 feet of 21-inch-diameter, 63 psi PIP was installed from the pipe stub of the intake box. A single 45-degree fitting was used to turn the corner away from the road about 100 feet downstream of the pipe intake. Photo A-22.

The remainder of the downstream piping is scheduled to be installed in the fall of 2005 as a separate project.

2.3.11 DAY 15 – INSTALLATION OF MEASURING WEIR AND RECORDER

The metal measuring weir was replaced and set lower than the original. The new weir is a 3-foot-wide Cipoletti-style with an adjustable crest. The non-moving portion of the weir blade is 3/8-inch-thick steel plate with ecology blocks on each side. The existing water measurement instrument and stilling well were reinstalled at the new weir. The new measuring weir is located very near to the former site and has the same shape and dimensions as the old weir. Information is gathered by a data recorder set and maintained by the irrigators. Photo A-22.

2.3.12 DAY 15 – FINAL CLEANUP AND SITE RESTORATION

Final cleanup included waste removal, grading, and beginning of revegetation efforts. Seeding of grasses at the site occurred in late November. Planting of trees and shrubs was completed in the spring. All revegetation work was done by OCD. Species of shrubs and trees included cottonwood cuttings, wild roses, alders, and others.

3. CONCLUSIONS

So far, the Fort-Thurlow Ditch fish passage improvement project has been successful. A few “punchlist” (minor post-project completion work) items remain to be completed. In the spring of 2005, there were some reasonably high flows in the creek estimated to be between 80 and 100 cfs (see photo A-20). The weirs and headgate performed well. The fish passage portion of the project meets all appropriate standards. Monitoring efforts indicated that upwards of 25 to 50 adult steelhead passed through the area.

The diversion was able to take about 5 cfs with very little flow in the creek. There was additional capacity in the fish screen and the measurement weir appeared to be within criteria. Adjustment of the intake trashrack should allow proper measurement of flow up to the maximum diversion of 6 cfs given a reasonable amount of water in the creek. Maintenance of the new rock structures and headworks by the irrigators should be minimal.

The revegetation appears to have been successful with good growth of grasses and high success on cuttings and plantings of cottonwood, wild rose, and other native shrubs. All revegetation will be monitored by the District with informal site monitoring by the irrigators, landowner, OCD, and Reclamation to continue through the years.

The punchlist items included adjustment of the measuring weir, removal of metal from the lower portion of the intake box, addition of reinforcement bars to the upper headgate frame and the addition of safety grating to the intake area of the 36-inch-diameter CMP. The majority of punchlist items were completed by the end of June 2005 and the remainder will be accomplished by the end of the 2005 irrigation season.

Once it has been determined that the project has performed well and is delivering the required amount of water to the ditch, then the parties will sign a “turnover” agreement. This would establish that the maintenance of the project and any necessary repairs to the facilities would become the responsibility of the irrigators. If specific repairs or punchlist items are identified by that time, they would be fixed prior to signing. It is anticipated that the irrigators, OCD, and Reclamation would each sign the agreement.

Basic monitoring will occur over the next couple of years to make sure the project is functioning satisfactorily. In addition to that type of sporadic monitoring, Reclamation has initiated an extensive long-term monitoring plan for the entire Beaver Creek watershed. The plan will monitor fish passage over all the lower Beaver Creek structures by trapping and tagging fish at the lower and upper end of the project area. In addition, a long term study of transects, bedload movement, and velocity profiles over the structures will be completed.

**FORT-THURLOW DIVERSION DAM
FISH PASSAGE IMPROVEMENT PROJECT,
BEAVER CREEK, METHOW SUBBASIN, WA**

**ATTACHMENT A
CONSTRUCTION PHOTOGRAPHS**

**All Photographs by
U.S. Bureau of Reclamation
Pacific Northwest Region Design Group, Boise ID
Pre-construction photos August 2004;
Construction photos November 2004.**

Photo A-1. Lower Beaver Creek Road and existing ditch (on left side) before construction; looking downstream.



Photo A-2. Existing irrigation ditch before construction; looking downstream.



Photo A-3. Existing Fort-Thurlow Diversion dam before construction (looking downstream).



Photo A-4. Existing diversion channel before construction (looking upstream).



Photo A-5. Beaver Creek before construction (looking downstream).



**Photo A-6. Existing diversion structure before construction (looking upstream).
The ribbon and lath are layout for double-drop Weir No. 1. (upstream end).**



Photo A-7. Beaver Creek before construction (looking downstream). Ribbon and lath are layout for single-drop Weir No. 4 (downstream end).



Photo A-8. Beaver Creek before construction (looking downstream). Ribbon marks tree to be removed. Arrow indicates hay bales set to reduce sediment.



Photo A-9. Existing Beaver Creek diversion during construction (looking downstream). The cofferdam above the diversion is made of concrete “ecology blocks.” Weir No. 1 is in foreground.



Photo A-10. Construction of Weir No. 1 in Beaver Creek (looking downstream).



Photo A-11. Placement of double-drop Weir No. 2 in Beaver Creek.



Photo A-12. New inlet for Fort-Thurlow diversion ditch.



Photo A-13. New 36-inch-diameter, double-walled HDPE pipe for Fort-Thurlow diversion ditch (looking upstream).



Photo A-14. The existing fish screen was reinstalled in the newly excavated and realigned reach of Fort-Thurlow ditch; WDFW provided assistance.



Photo A-15. Fish screen in place in reach of Fort-Thurlow ditch (looking downstream).



Photo A-16. Fish screen and overflow structure in place in irrigation ditch.



Photo A-17. Fort-Thurlow ditch at road cut. New alignment ends at this point and joins existing ditch.



Photo A-18. Beaver Creek, looking upstream at Weirs 4 (foreground), 3, and 2.



Photo A-19. Looking upstream at Weirs 3 (foreground), 2, and 1. Arrows indicate remains of the former diversion structure with center section removed.



Photo A-20. Looking upstream at Weirs 3, 2, and 1 during high water flows in May 2005. The photo point is almost the same as in Photo A-19, taken November 2004 at the completion of construction.



**Photo A-21. Close-up view of Weir No. 1 (looking upstream).
Arrow indicates left abutment of former diversion structure.**



Photo A-22. This reach of the Fort-Thurlow irrigation ditch (looking downstream) was re-excavated but not realigned. The outlet for the new HDPE pipe crossing under Lower Beaver Creek Road is in the ditch at the bottom of the photo. The weir downstream measures only irrigation flows because the fish return is further upstream. The trashrack is for safety and to prevent debris from entering in the lower ditch.

**FORT-THURLOW DIVERSION DAM
FISH PASSAGE IMPROVEMENT PROJECT,
BEAVER CREEK, METHOW SUBBASIN, WA**

ATTACHMENT B

LOCATION MAP; AS-BUILT DRAWINGS

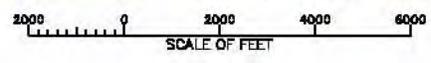
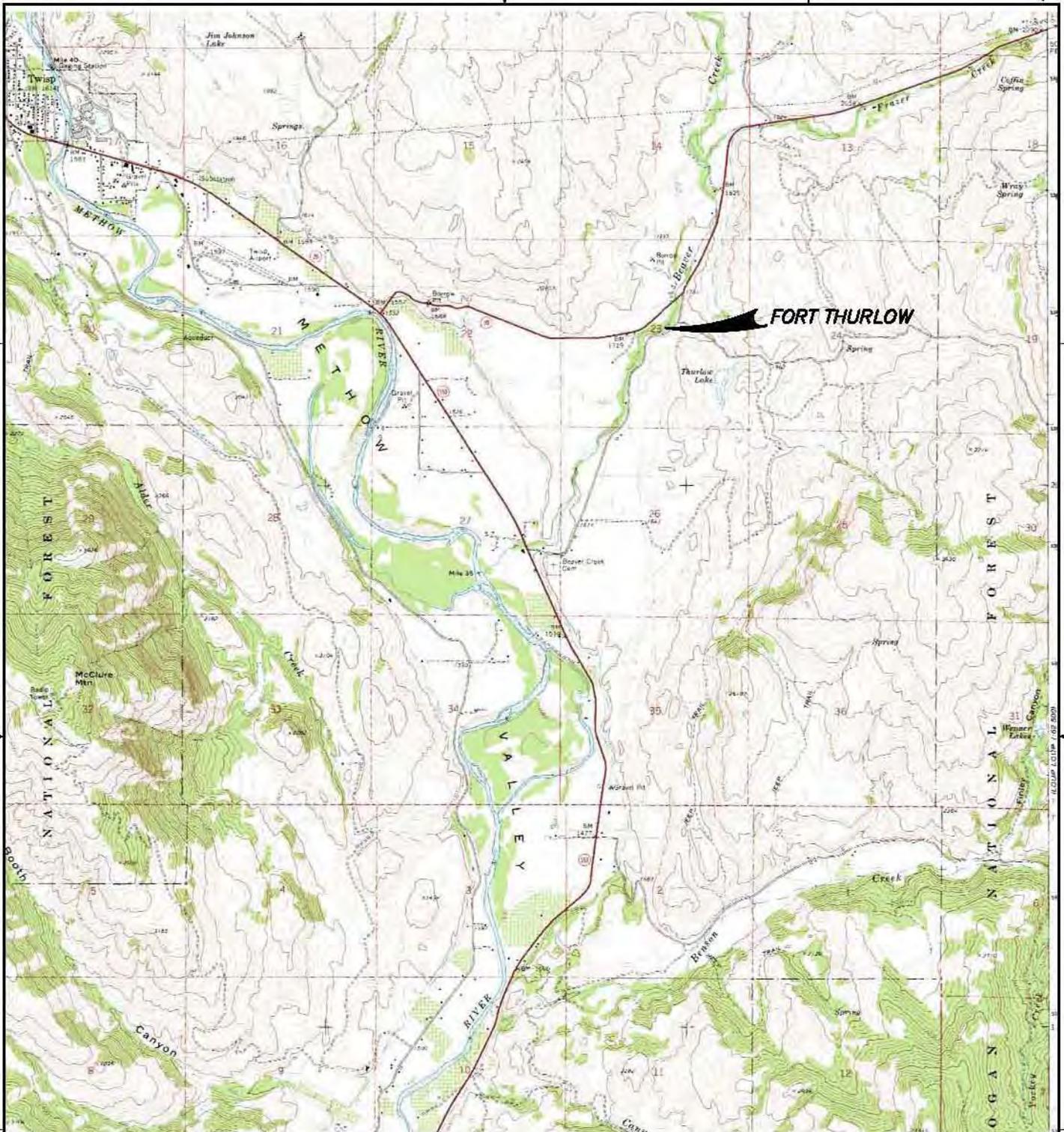
- B-1. Location Map, Beaver Creek Fort Thurlow; No. 1678-100-451
- B-2. Site Plan; No. 1678-100-441
- B-3. Creek Plan and Profile; No. 1678-100-442
- B-4. Canal Plan and Profile; No. 1678-100-443
- B-5. Weir [1] Profile and Section; No. 1678-100-444
- B-6. Weir [2] Profile and Section; No. 1678-100-445
- B-7. Weir [3] Profile and Section; No. 1678-100-446
- B-8. Weir [4] Profile and Section; Section of Typical Rock Weir; No. 1678-100-447
- B-9. Transition Structure, Plan and Sections; No. 1678-100-448
- B-10. Sluiceway Structure; Plans and Sections; No. 1678-100-452
- B-11. Sections A-A [under road] and B-B [Cippoletti weir]; No. 1678-100-453
- B-12. Dewatering Plan; No. 1678-100-449
- B-13. Headgate Intake Structure; No. 1678-100-480

D

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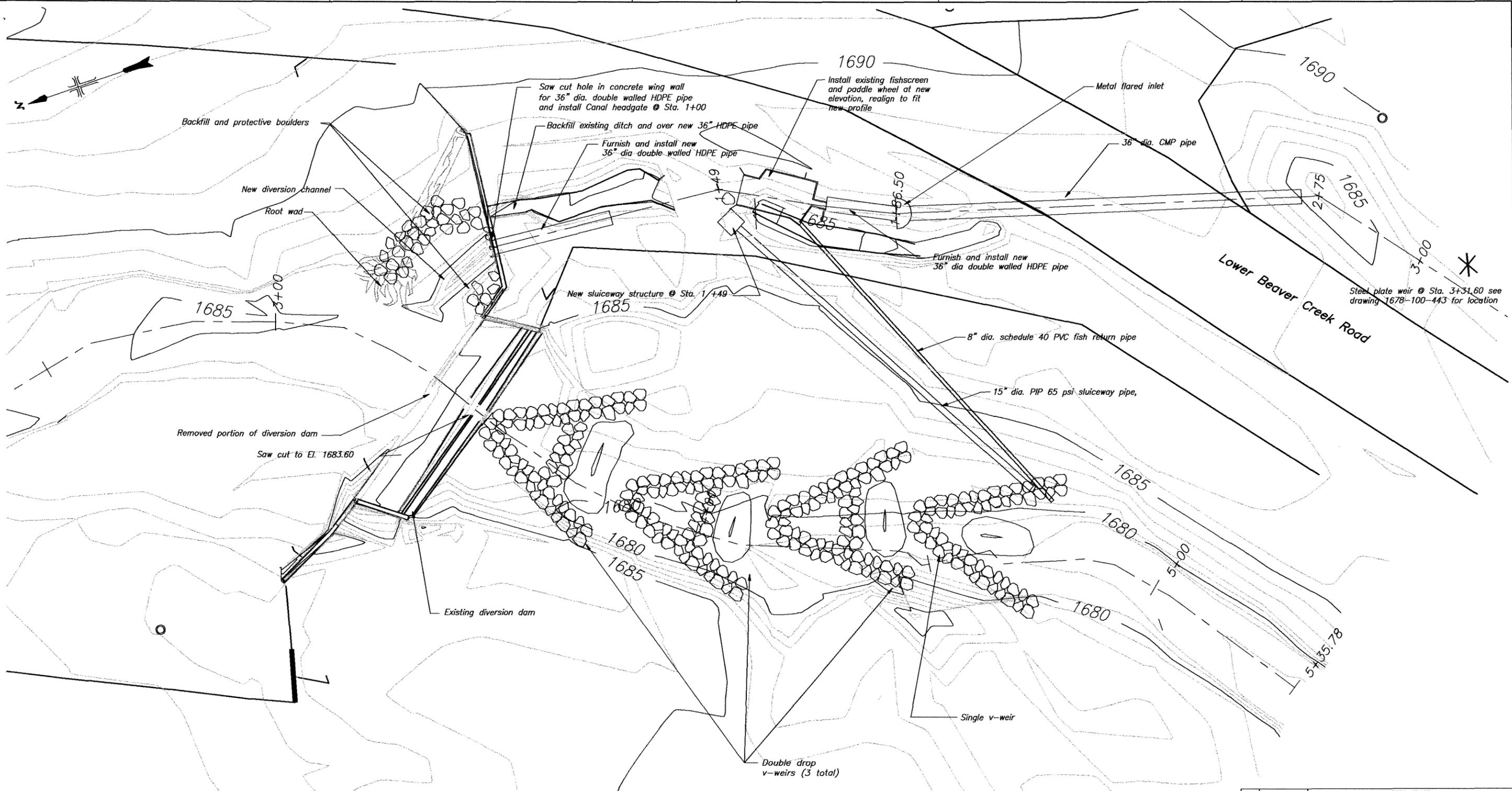
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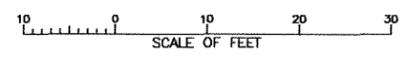


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ALWAYS THINK SAFETY		
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN BEAVER CREEK FORT THURLOW LOCATION MAP		
DESIGNED <u>Jeff McLaughlin</u>		CHECKED <u>Meagan Montague</u>
DRAWN <u>Scott Weddie</u>		TECH. APPROVAL <u>Jeff McLaughlin</u>
APPROVAL <u>Don Wilson</u>		
LADD FILENAME 1078-100-451 AS BUILT.DWG		CADD SYSTEM AutoCAD R14.0
BRUCE, 10/10		September, 2004

DATE AND TIME PLOTTED
 DRAWN BY SCOTT WEDDIE
 PLOTTED BY
 JAWAD



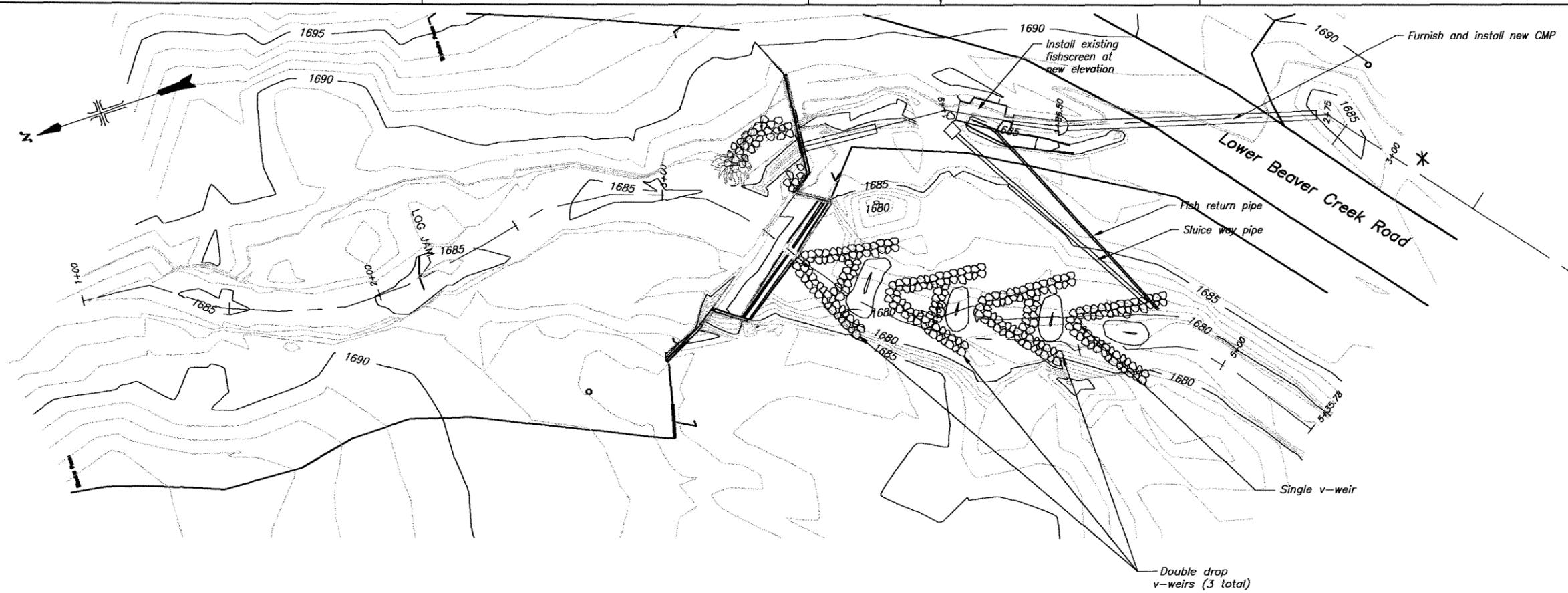
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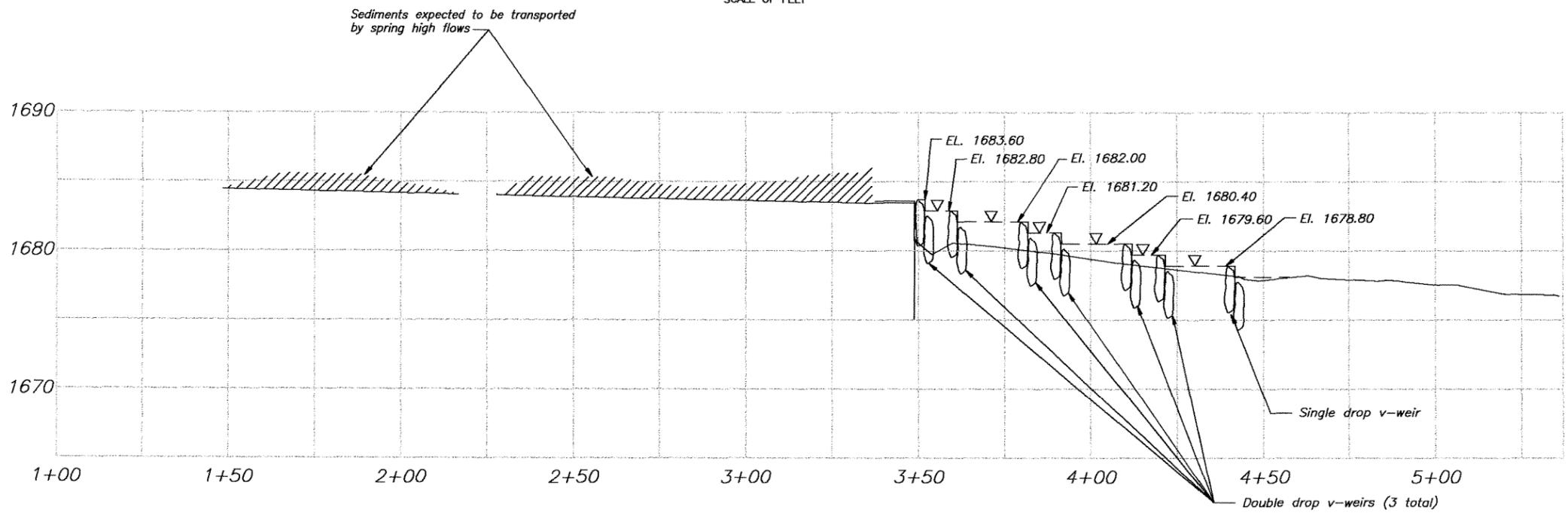
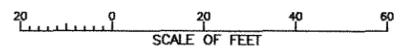
- NOTES:**
1. Geotextile fabric installed on middle section each weir for low flow fish passage.
 2. Ditch weir blade and transition structure show on drawing 1678-100-443

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 ALWAYS THINK SAFETY	
<small>UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN BEAVER CREEK FORT THURLOW BEAVER CREEK SITE PLAN</small>	
DESIGNED <u>Jeff McLaughlin</u>	CHECKED <u>Megan Montague</u>
DRAWN <u>Scott Weddle</u>	TECH. APPROVAL <u>Jeff McLaughlin</u>
APPROVAL <u>Don Wilson</u> <small>PEER REVIEWER/PROGRAM MANAGER</small>	
BOISE, IDAHO	MAY 2004
SHEET 2 OF 13	1678-100-441

AUGUST 1981, 16.0
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 JMWAD



PLAN



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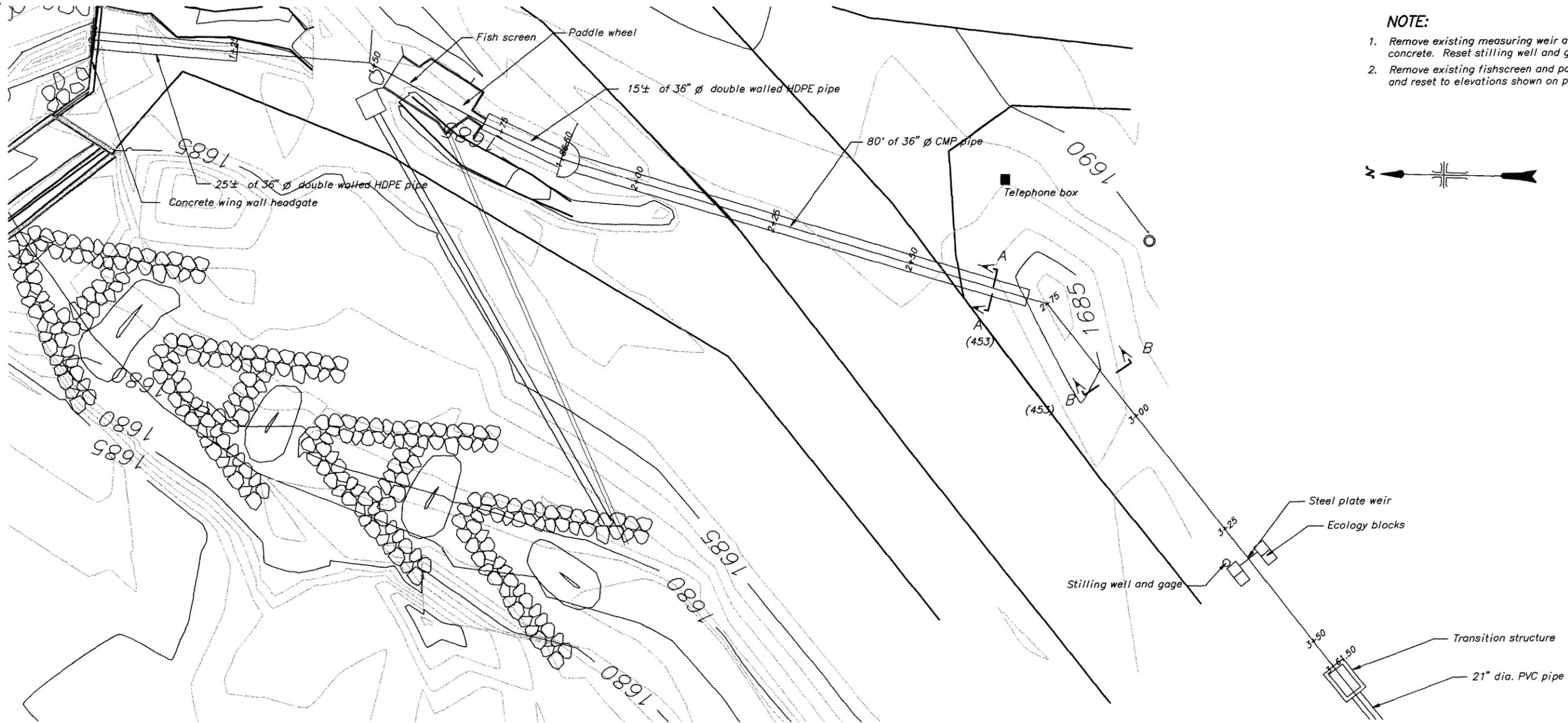
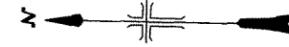
- NOTE:**
1. Crest of diversion dam apron is El. 1683.60.
 2. If possible, weir #4 will be built as a single weir and not a double drop.

REV. NO. 2004-04-30 7	AS BUILT BY 100, J.B.W. 2005-01-20 B- J.S.M.
ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION CORPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN BEAVER CREEK FORT THURLOW BEAVER CREEK CREEK PLAN AND PROFILE	
DESIGNED - Jeff McLaughlin	CHECKED - Megan Montague
DRAWN - Scott Weddle	TECH. APPROVAL - Jeff McLaughlin
APPROVAL - Dan Wilson PEER REVIEWER/PROGRAM MANAGER	
BOISE, IDAHO	MAY 2004
SHEET 3 OF 13	1678-100-442

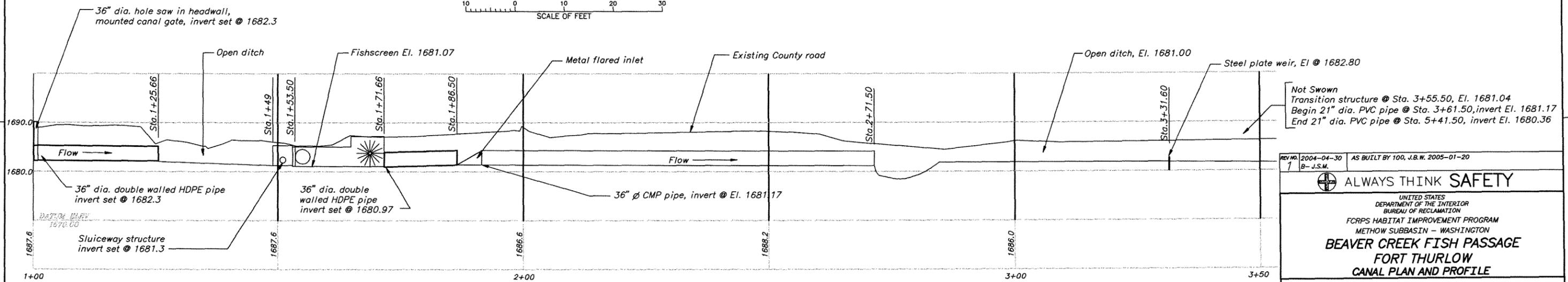
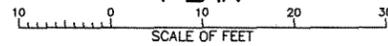
AutoCAD Rev. 16.0
 1678-100-442 AS BUILT
 DATE AND TIME PLOTTED
 JANUARY 24, 2005 16:27
 PLOTTED BY
 JMW

NOTE:

1. Remove existing measuring weir and dispose of concrete. Reset stilling well and gage.
2. Remove existing fishscreen and paddle wheel and reset to elevations shown on profile.



PLAN



PROFILE

REV. NO. 2004-04-30 AS BUILT BY 100, J.B.W. 2005-01-20
 B-J.S.M.

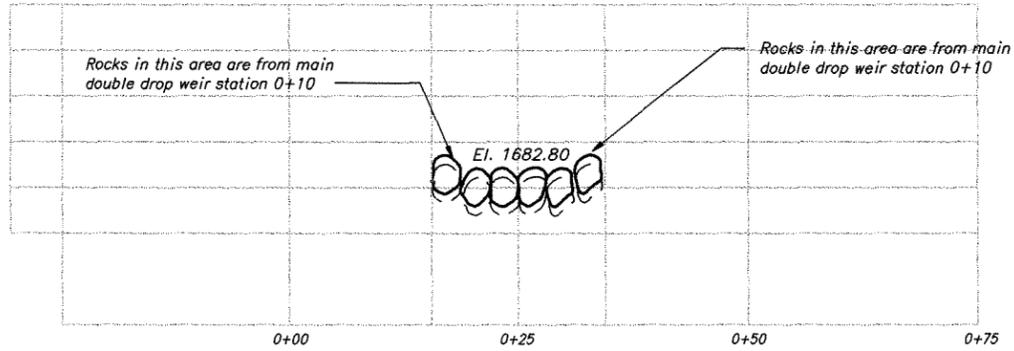
ALWAYS THINK SAFETY

UNITED STATES
 DEPARTMENT OF THE INTERIOR
 BUREAU OF RECLAMATION
 FCRRS HABITAT IMPROVEMENT PROGRAM
 METHOW SUBBASIN - WASHINGTON
**BEAVER CREEK FISH PASSAGE
 FORT THURLOW
 CANAL PLAN AND PROFILE**

DESIGNED: Jeff McLaughlin CHECKED: Meagan Montague
 DRAWN: Scott Weddle TECH. APPROVAL: Jeff McLaughlin
 APPROVAL: Dan Wilson
 PEER REVIEWER/PROGRAM MANAGER

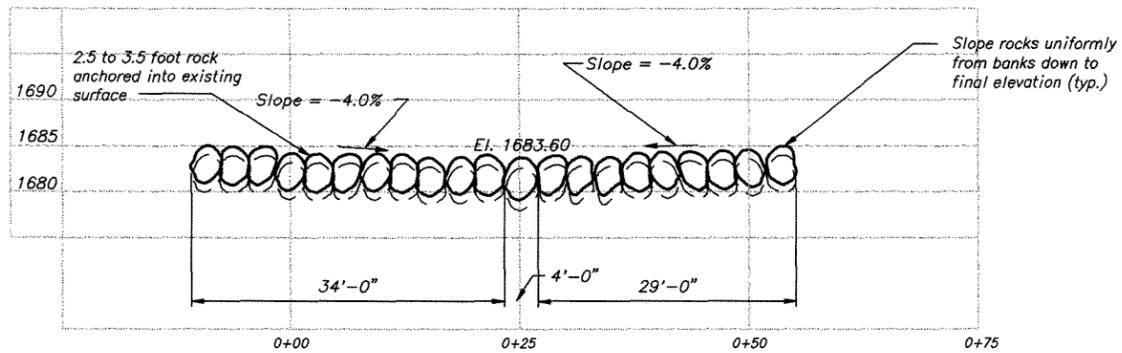
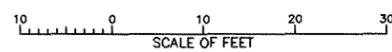
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 BOISE, IDAHO OCTOBER 2002 1678-100-443

SPECIFICATION #



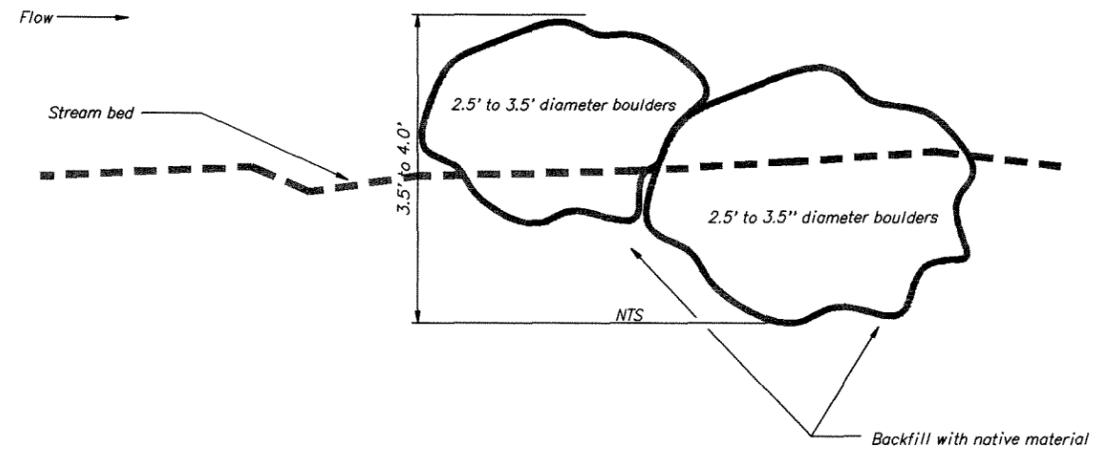
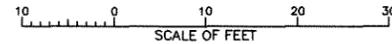
DOUBLE DROP V - WEIR 1 PROFILE

STATION 3+61



DOUBLE DROP V - WEIR 1 PROFILE

STATION 3+49



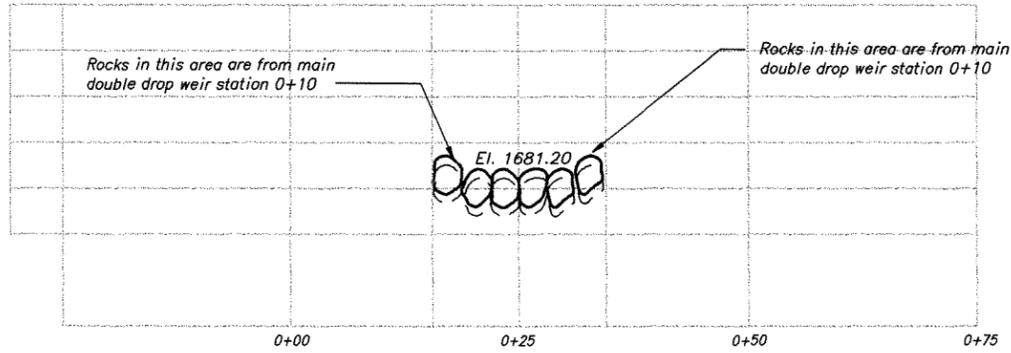
SECTION OF TYPICAL ROCK WEIR

NOTE:

Width across mouth of structure is 35 feet.
Distance from first drop to double drop is 12 feet.

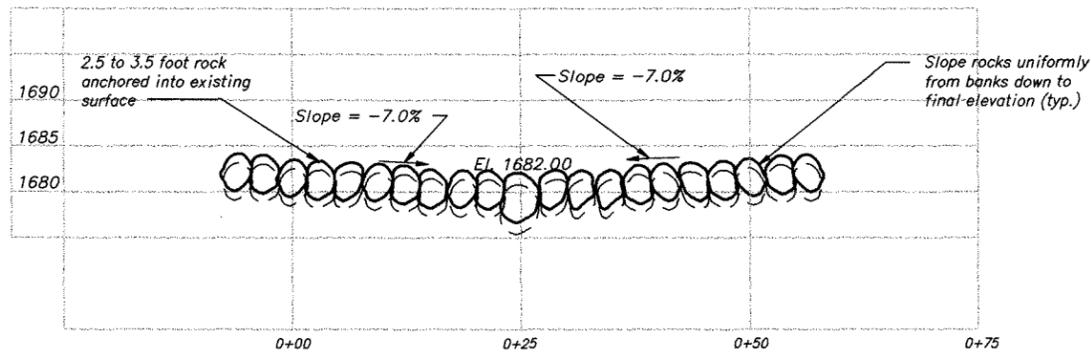
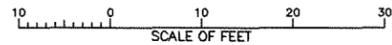
REV NO. 1	2004-04-30	AS BUILT BY 100, J.B.W. 2005-01-21
B-J.S.M.		
ALWAYS THINK SAFETY		
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION CORPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN BEAVER CREEK FORT THURLOW BEAVER CREEK WEIR PROFILE AND SECTION		
DESIGNED <u>Jeff McLaughlin</u>	CHECKED <u>Meagan Montague</u>	
DRAWN <u>Scott Weddle</u>	TECH. APPROVAL <u>Jeff McLaughlin</u>	
APPROVAL <u>Dan Wilson</u> PEER REVIEWER/PROGRAM MANAGER		
BOTSE, IDAHO	MAY 2004	1678-100-444
SHEET 5 OF 13		

AutoCAD Plot, 16.0
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 DATE AND TIME PLOTTED
 JANUARY 21, 2005 15:42
 PLOTTED BY
 JMW



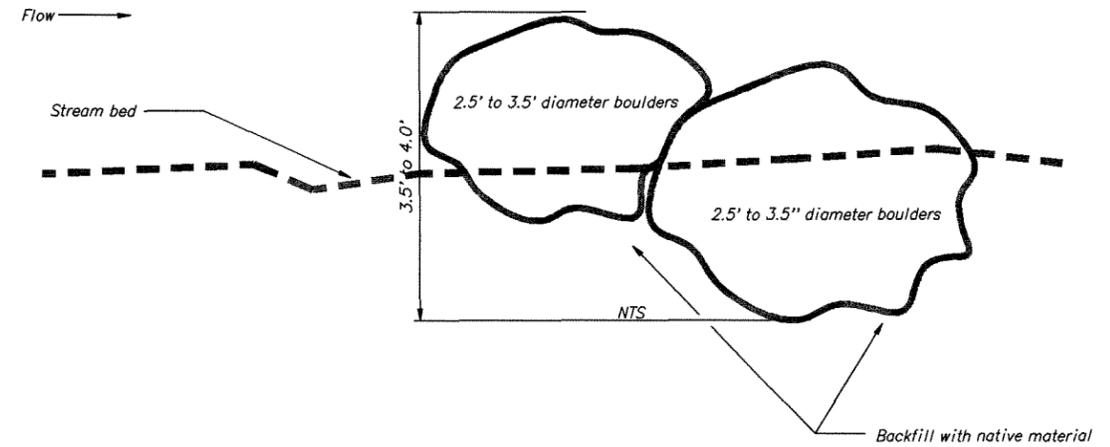
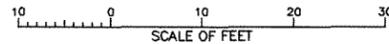
DOUBLE DROP V - WEIR 2 PROFILE

STATION 3+91



DOUBLE DROP V - WEIR 2 PROFILE

STATION 3+79



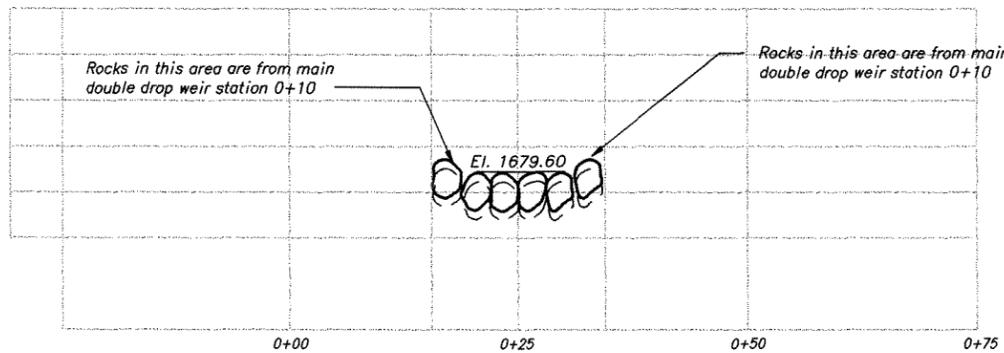
SECTION OF TYPICAL ROCK WEIR

NOTE:

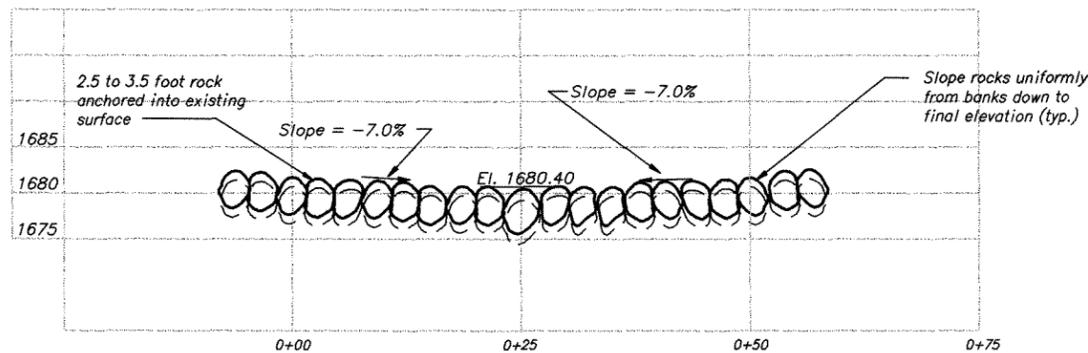
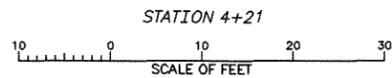
Width across mouth of structure is 33 feet.
Distance from first drop to double drop is 12 feet.

REV. NO. 7	2004-04-30	AS BUILT BY 100, J.B.W. 2005-01-21
ALWAYS THINK SAFETY		
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION CORPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN BEAVER CREEK FORT THURLOW BEAVER CREEK WEIR PROFILE AND SECTION		
DESIGNED	Jeff McLaughlin	CHECKED
DRAWN	Scott Weddle	TECH. APPROVAL
APPROVAL		PEER REVIEWER/PROGRAM MANAGER
BOISE, IDAHO		MAY 2004
SHEET 6 OF 13		1678-100-445

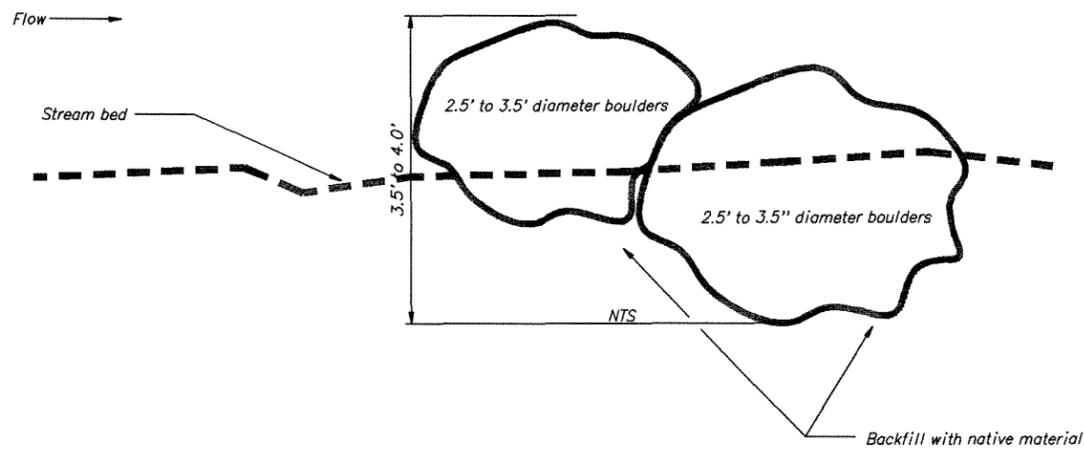
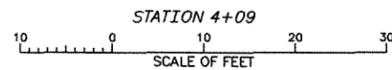
AutoCAD Rev. 16.0
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 DATE PLOTTED: 01/21/05 15:43
 PLOTTED BY: JMW



DOUBLE DROP V - WEIR 3 PROFILE



DOUBLE DROP V - WEIR 3 PROFILE



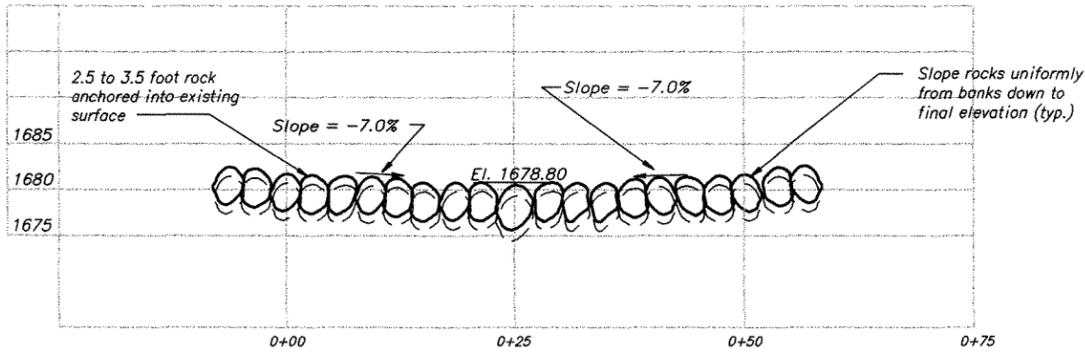
SECTION OF TYPICAL ROCK WEIR

NOTE:

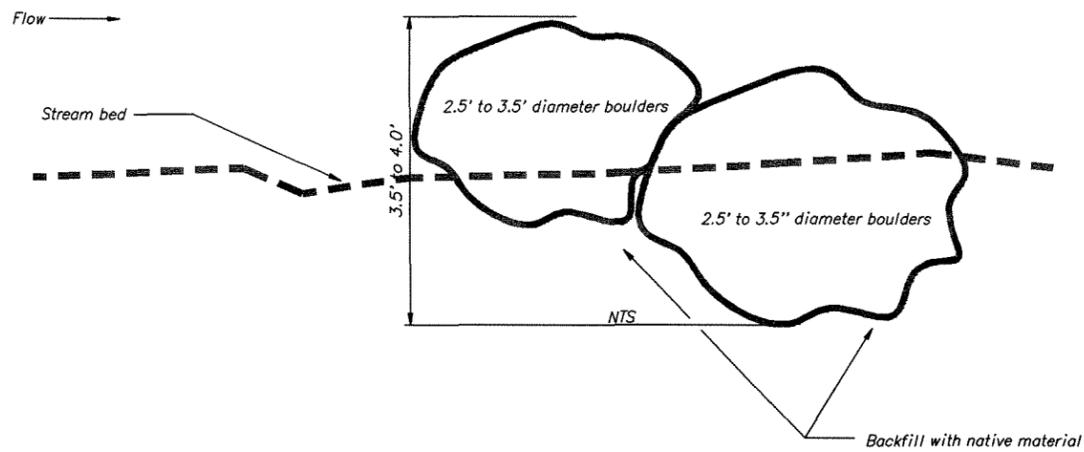
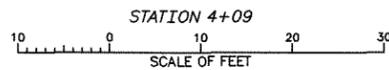
Width across mouth of structure is 32 feet.
Distance from first drop to double drop is 12 feet.

REV. NO. 7	2004-04-30 B-J.S.M.	AS BUILT BY 100, J.B.W. 2005-01-20
ALWAYS THINK SAFETY		
<small>UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN</small> BEAVER CREEK FORT THURLOW BEAVER CREEK WEIR PROFILE AND SECTION		
DESIGNED <u>Jeff McLaughlin</u>	CHECKED <u>Meggon Montague</u>	
DRAWN <u>Scott Weddle</u>	TECH. APPROVAL <u>Jeff McLaughlin</u>	
APPROVAL <u>Dan Wilson</u> <small>PEER REVIEWER/PROGRAM MANAGER</small>		
BOTSE, IDAHO	MAY 2004	1678-100-446
<small>SHEET 7 OF 12</small>		

LUNAR SYSTEM
 AutoCAD 2004, 16.0
 CAD FILENAME
 1678-100-446 AS BUILT.DWG
 DATE AND TIME PLOTTED
 JANUARY 21, 2005 15:46
 PLOTTED BY
 JWB



V - WEIR 4 PROFILE



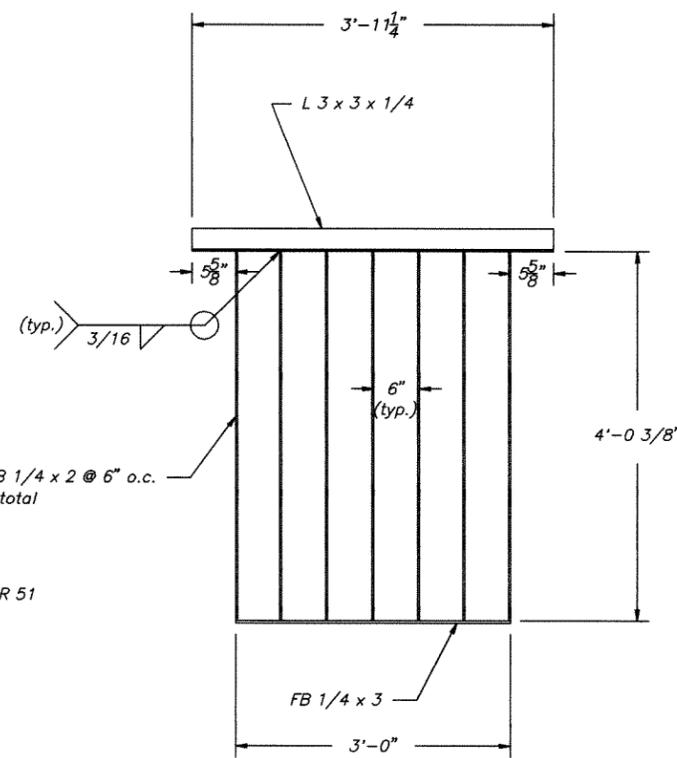
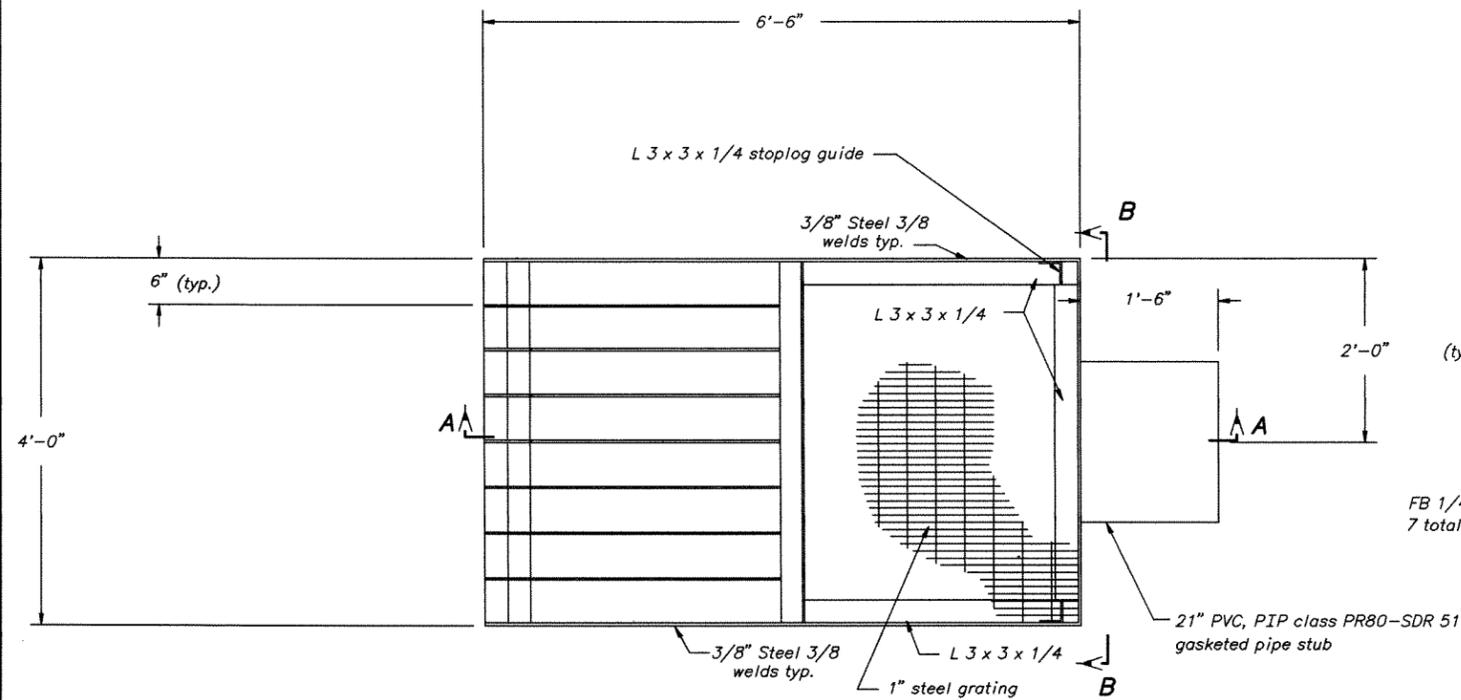
SECTION OF TYPICAL ROCK WEIR

NOTE:

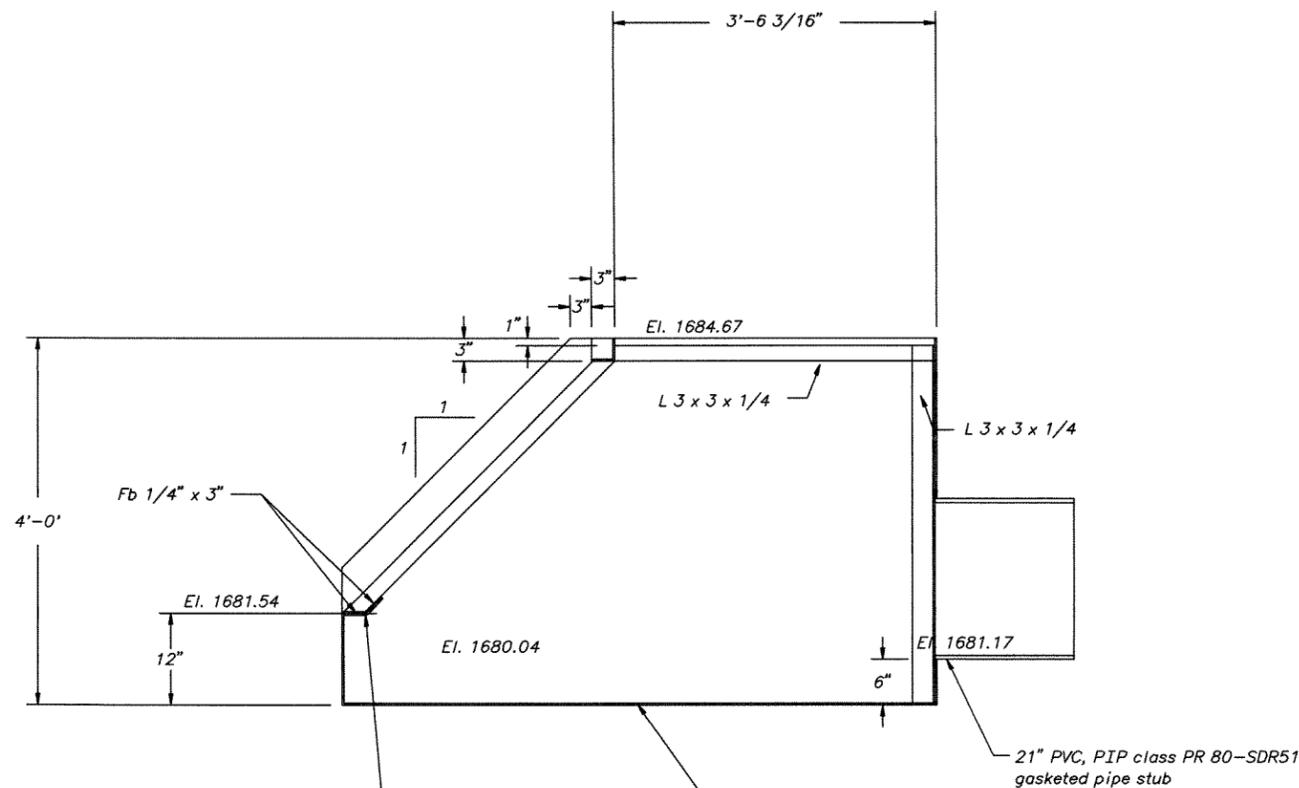
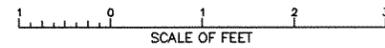
Width across mouth of structure is 32 feet.
Distance from first drop to double drop is 12 feet.

REV NO. 1	2004-04-30	AS BUILT BY 100, J.B.W. 2005-01-21
B- J.S.M.		
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION CORPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN BEAVER CREEK FORT THURLOW BEAVER CREEK WEIR PROFILE AND SECTION		
DESIGNED	Jeff McLaughlin	CHECKED
		Meagan Montague
DRAWN	Scott Weddle	TECH. APPROVAL
		Jeff McLaughlin
APPROVAL		Don Wilson
		PEER REVIEWER/PROGRAM MANAGER
BOISE, IDAHO	SHEET 8 OF 13	MAY 2004
1678-100-447		

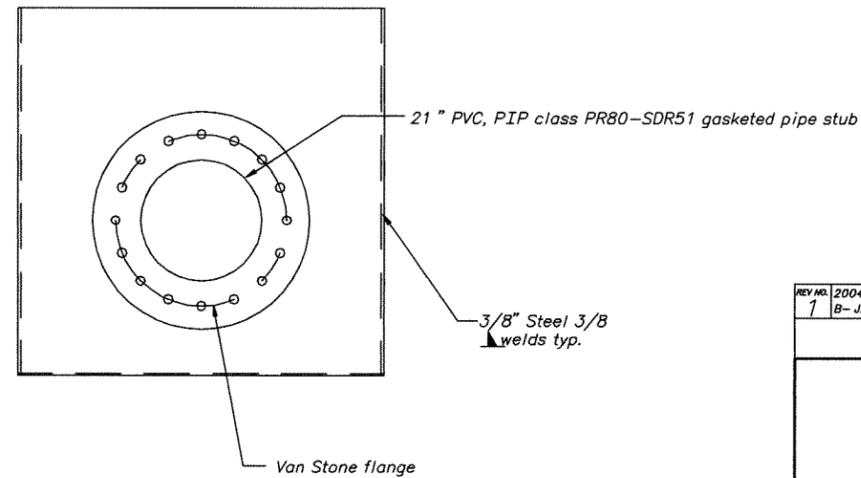
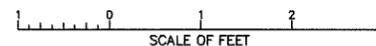
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 DATE AND TIME PLOTTED
 JANUARY 21, 2005 15:47
 PLOTTED BY
 JMW



PLAN



SECTION A-A



SECTION B-B

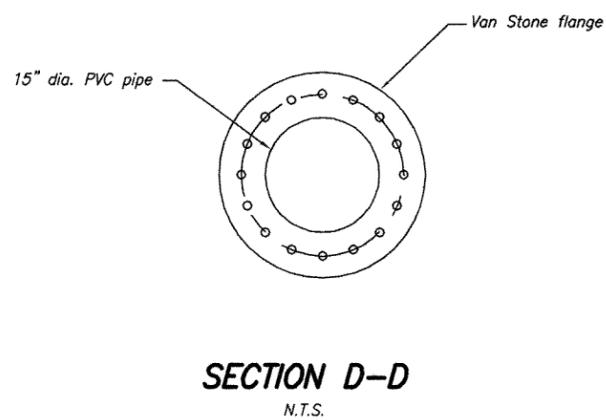
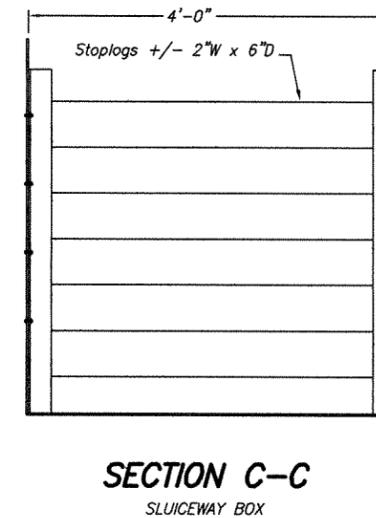
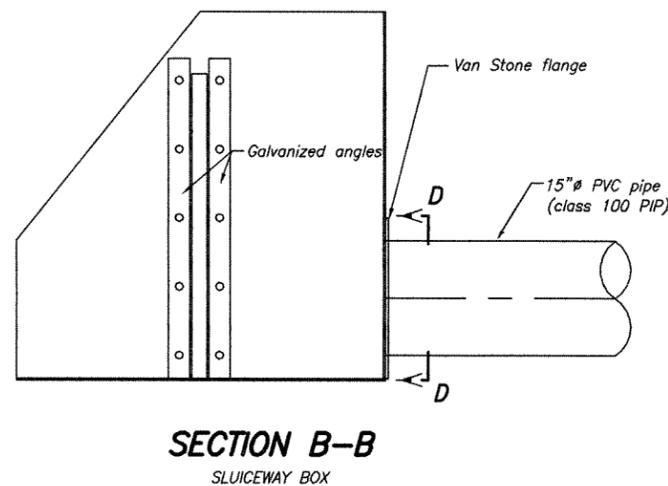
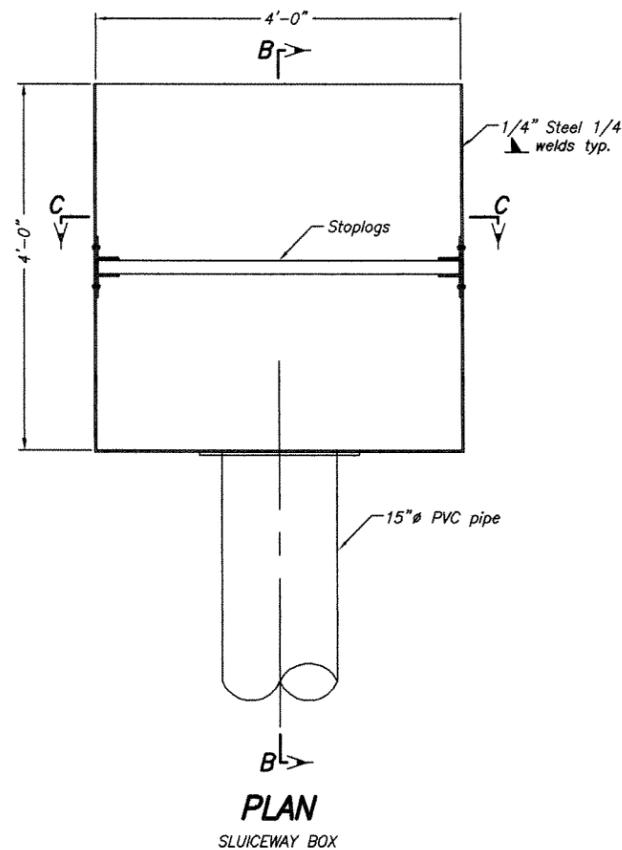
NOTE:

1. Final elevation of intake structure determined in the field.
2. Grate to have a tolerance of -.25" to allow grate to fit within design dimensions.

REV. NO. 1	2004-04-30	AS BUILT BY 100, J.B.W. 2005-01-21
1 B- J.S.M.		
ALWAYS THINK SAFETY		
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN		
FORT THURLOW DIVERSION TRANSITION STRUCTURE PLAN AND SECTIONS		
DESIGNED	Jeff McLaughlin	CHECKED Megan Montague
DRAWN	Scott Weddle	TECH. APPROVAL Jeff McLaughlin
		APPROVED Dan Wilson
		PEER REVIEWER/PROGRAM MANAGER
CADD SYSTEM	AutoCAD R16.0	CADD FILE NAME
BOISE, IDAHO	1678-100-448 AS BUILT DWG	JANUARY 2002

SPECIFICATION #

PLANNED BY CHARGED



DATE AND TIME PLOTTED
JANUARY 21, 2005 15:16
PLOTTED BY
JMW

CAD SYSTEM
AutoCAD R16.0
CAD FILENAME
1678-100-452 AS BLDG.DWG

REV NO. 2004-04-30 1	AS BUILT BY 100, J.B.W. 2005-01-21 B-J.S.M.
ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN	
FORT THURLOW DIVERSION SLUICeway STRUCTURE PLANS AND SECTIONS	
DESIGNED Jeff McLaughlin	CHECKED Meagan Montague
DRAWN Scott Weddle	TECH. APPR. Jeff McLaughlin
APPROVED Dan Wilson PROGRAM MANAGER	
BOISE, IDAHO	2004-09-27
SHEET 10 OF 13	
1678-100-452	

D

C

B

A

D

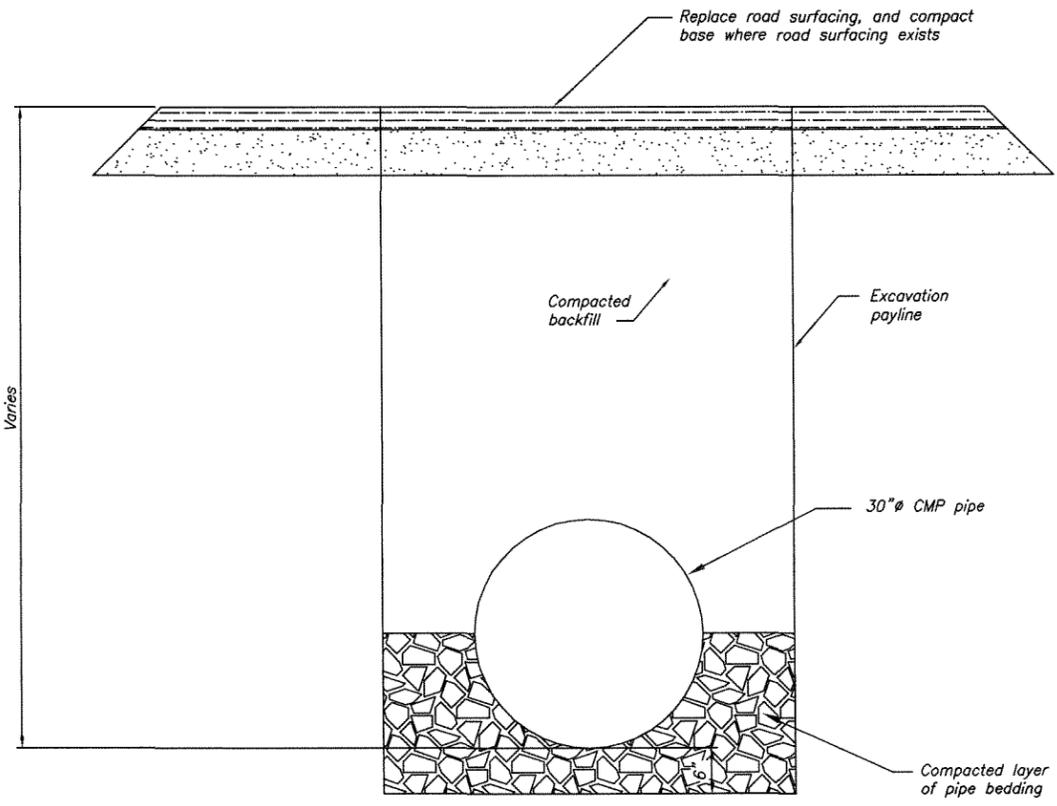
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B

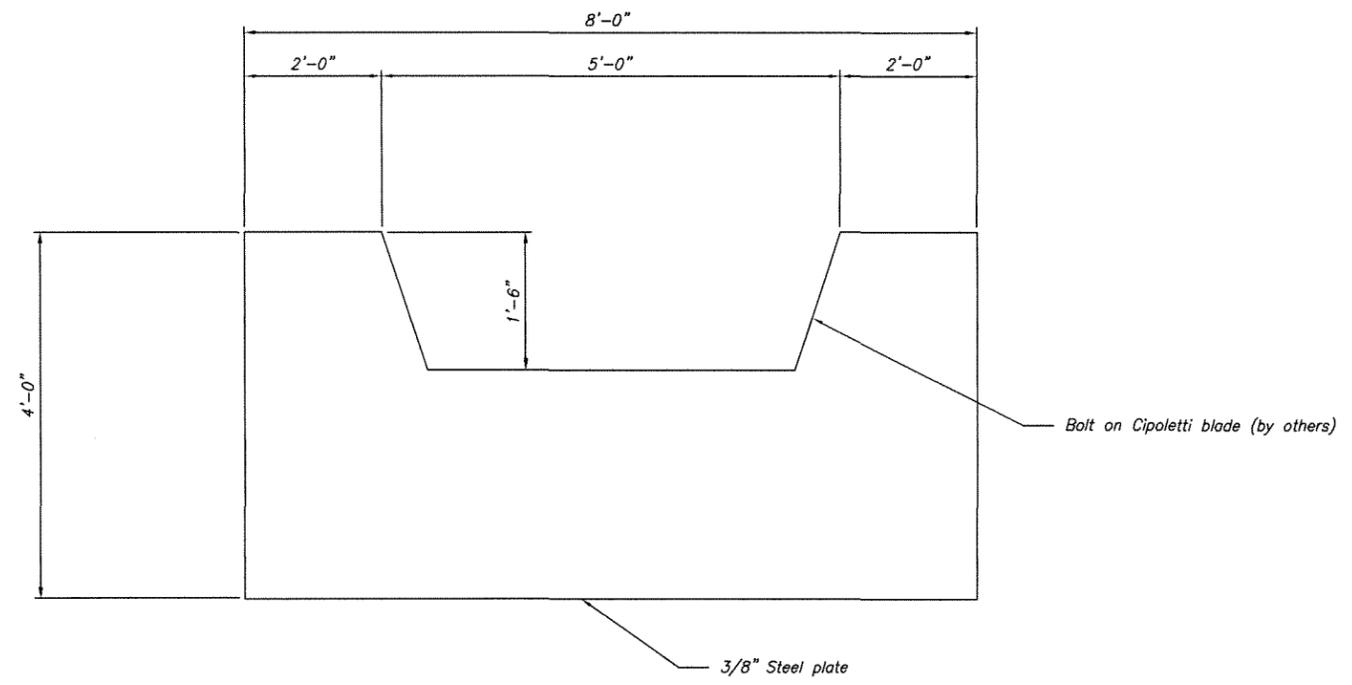
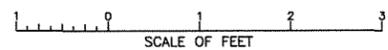
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DATE AND TIME PLOTTED
JANUARY 24, 2005 16:22
PLOTTED BY
JHWB

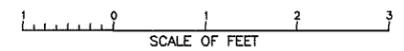
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CIV. FILENAME
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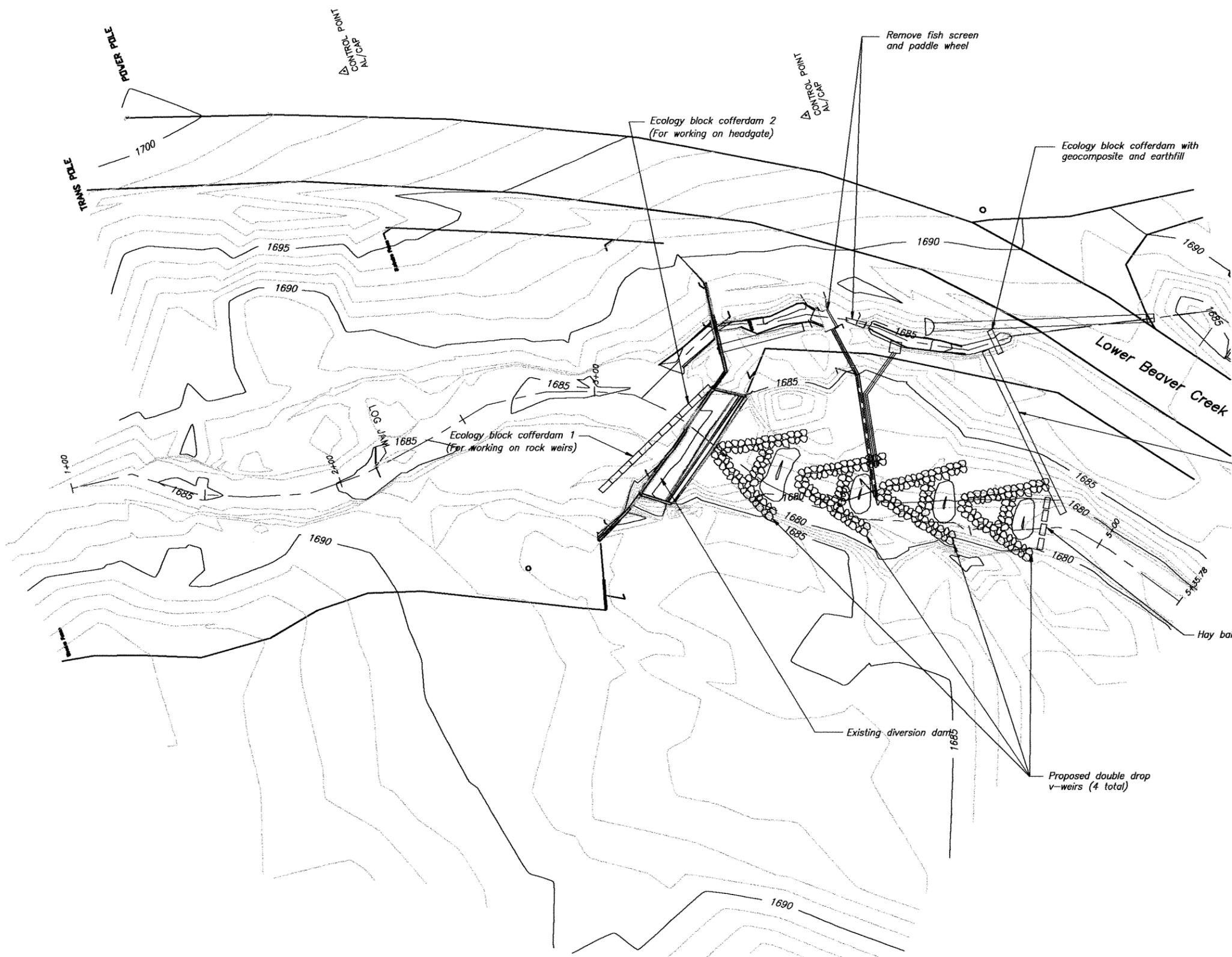
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(1678-100-443)



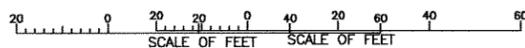
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(1678-100-443)



REV NO. 1	2004-04-30	AS BUILT BY 100, J.B.W. 2005-01-21
B- J.S.M.		
ALWAYS THINK SAFETY		
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRRS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN FORT THURLOW DIVERSION SECTIONS		
DESIGNED	Jeff McLaughlin	CHECKED
		Meagan Montague
DRAWN	Scott Weddle	TECH. APPR.
		Jeff McLaughlin
APPROVED <u>Dan Wilson</u> PROGRAM MANAGER		
BOISE, IDAHO	2004-09-28	1678-100-453
SHEET 11 OF 13		



PLAN



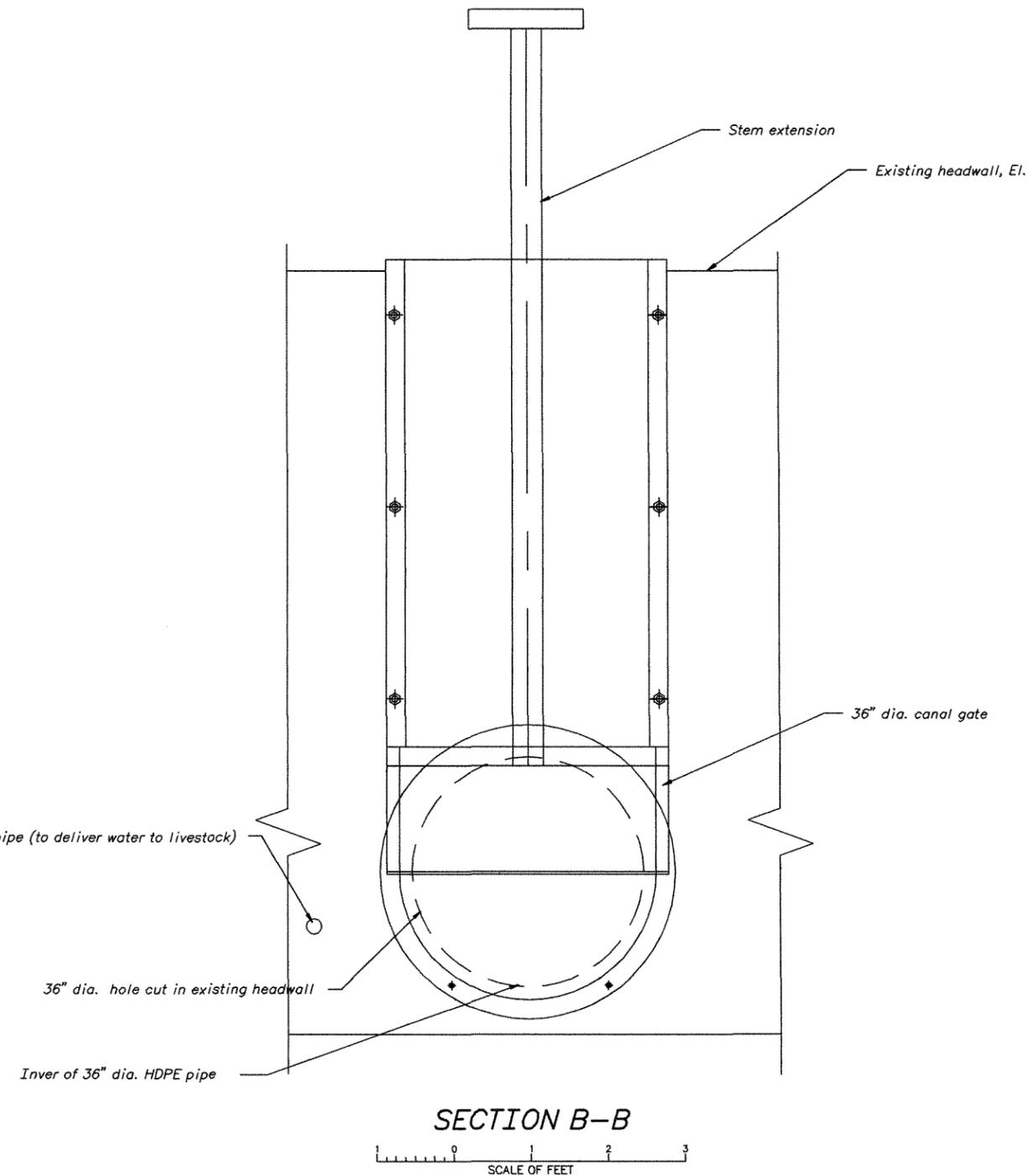
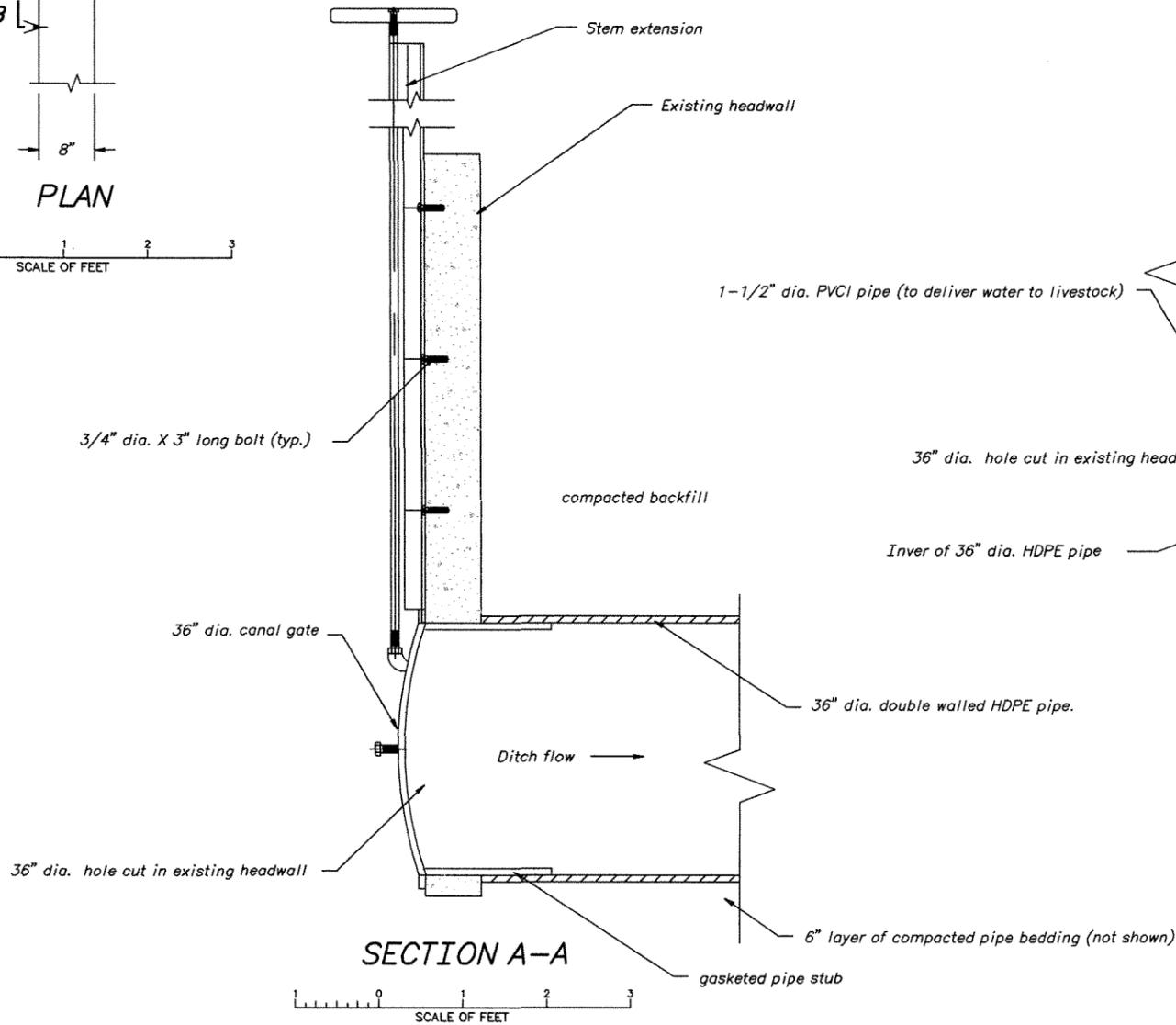
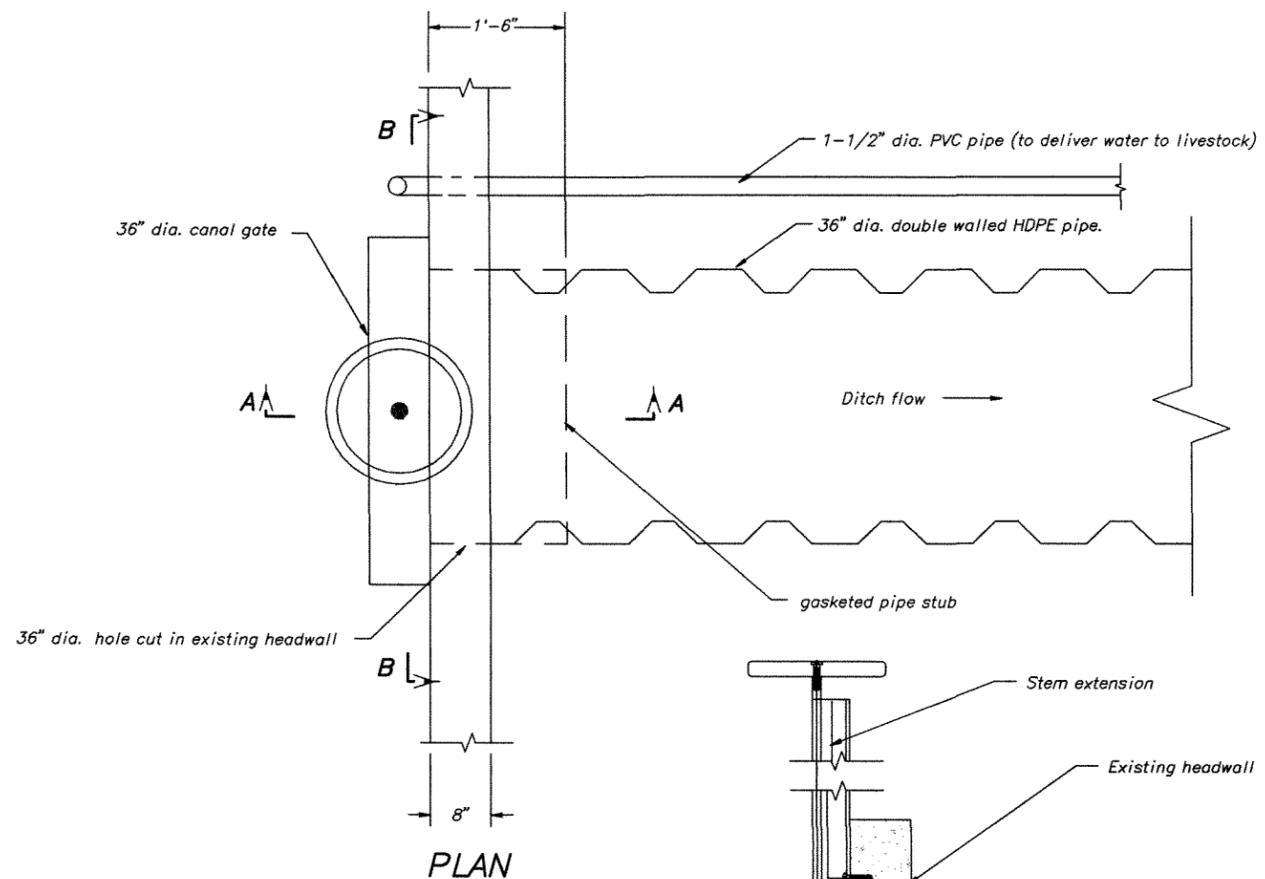
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
FCRPS HABITAT IMPROVEMENT PROGRAM
METHOW RIVER SUBBASIN
**BEAVER CREEK
FORT THURLOW
BEAVER CREEK
DEWATERING PLAN**

DESIGNED Jeff McLaughlin CHECKED Meagan Montague
DRAWN Scott Weddle TECH. APPROVAL Jeff McLaughlin
APPROVAL Don Wilson
PIER REVIEWER/PROGRAM MANAGER

BOISE, IDAHO SHEET 1 OF 1 MAY 2004 **1678-100-449**

CAD SYSTEM
AutoCAD 2004
CAD FILENAME
1678-100-449.DWG
DATE AND TIME PLOTTED
DATE AND TIME PLOTTED
PLOTTED BY
JMW/AD



REV NO. 1	2004-04-30	AS BUILT BY 100, J.B.W. 2004-12-03
B- J.S.M.		
ALWAYS THINK SAFETY		
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN		
FORT THURLOW DIVERSION HEADGATE INTAKE STRUCTURE PLAN AND SECTIONS		
DESIGNED: Jeff McLaughlin	CHECKED: _____	
DRAWN: Scott Weddle	TECH. APPROVAL: _____	
APPROVED: _____ PEER REVIEWER/PROGRAM MANAGER		
CADD SYSTEM: AutoCAD Rev. 16.0	CADD FILENAME: 1678-100-480 AS BUILT.DWG	
BOISE, IDAHO	JANUARY 2005	1678-100-480

PUNCHED BY: JAWB