

COMPLETION REPORT
THURLOW TRANSFER DITCH
FISH PASSAGE IMPROVEMENT PROJECT
BEAVER CREEK,
METHOW SUBBASIN, WASHINGTON
MAY 2004



On the Cover

Cover Photo 1. Looking upstream at original Thurlow Transfer Ditch diversion dam. The ditch is on the left side of Beaver Creek, between the Upper Stokes and lower Stokes diversion. The arrow shows direction of flow of ditch water. (Photo A-1)

Cover Photo 2. Upstream view of completed weirs; Atype Weir No. 2 in foreground and V-type Weir No. 1 in background. Flows are normal for time of the season, about 15 cfs. (photo by Reclamation/Greg Knott; April 2004)

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All photographs by Bureau of Reclamation, Pacific Northwest Region (PN-3400/Design Group), Boise Idaho during November 2003 (except as noted)

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1. INTRODUCTION AND BACKGROUND

In the fall of 2003, the Thurlow Transfer Ditch Diversion Dam (cover photo 1), identified by the Washington Department of Fish and Wildlife (WDFW) as a barrier to fish movement, was replaced by two rock weirs (cover photo 2). The new weirs allow fish passage for all species and life stages, meet diversion flow requirements for the irrigators, and are less noticeable. The project, the last of three in the area,¹ is located on Beaver Creek, a tributary of the Methow River in Okanogan County, Washington. 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 that was done. Appendix B contains a location map and “as-built” drawings of the project.

1.1 ENDANGERED SPECIES ACT (ESA)

The ESA requires all Federal agencies, including the Bureau of Reclamation (Reclamation), to take actions that will assist in the protection of “listed” species. Under the ESA, NOAA Fisheries (formerly the National Marine Fisheries Service or NMFS) oversees the protection and recovery of certain “endangered” or “threatened” species, including salmon and steelhead. NOAA Fisheries’ judgment of how to protect these species is presented in a “biological opinion” (BiOp) issued to Federal agencies. A BiOp is a detailed description of the present situation and includes actions which Federal agencies are required to take.

The Federal Columbia River Power System (FCRPS) consists of 14 dams and related facilities operated by the U.S. Army Corps of Engineers (ACOE) and Reclamation; the Bonneville Power Administration (BPA) markets the power from these facilities. In December 2000, NMFS issued its “2000 FCRPS BiOp” containing 199 actions that BPA, ACOE, and Reclamation must implement. These actions are intended to avoid jeopardy to the continued survival of eight stocks of salmon and steelhead in the Columbia River Basin.

The responsibilities for habitat improvement are shared among the FCRPS agencies. Reclamation is currently working on fish passage improvements in nine tributary subbasins in Idaho, Oregon, and Washington, including the Methow River subbasin. There are no authorized Bureau of Reclamation projects in these subbasins. Actions identified in these subbasins are “off-site” from Reclamation’s projects and are designed to improve the survival of fish during spawning and rearing life stages. Reclamation’s charge for its nine subbasins is to work with willing partners on non-Federal lands to correct fish screen deficiencies, provide for fish passage at instream diversion barriers, and secure adequate instream flow for the listed fish.

¹ Descriptions of the other two 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).

1.2 PROBLEMS AND SOLUTIONS

The 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. Reclamation developed additional concepts. The irrigators selected their preference in coordination with the landowner. Reclamation then completed final designs. The projects continued to evolve over time in response to irrigator, landowner, and permitting agency comments.

The Twin Creeks CRM meetings were an important tool, particularly during the early phases of the design process. (The meetings are held as necessary, usually about every six weeks.) 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).

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 landowner and the construction company. OCD received and held the SRFB grant funds. When provided with paid invoices and upon approval of the irrigator, the district paid the contractor and various suppliers of construction materials (such as pipe and the concrete diversion structure). Okanogan Conservation District 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 its restoration efforts

1.3 PARTICIPATION AND COOPERATION

The Thurlow Transfer Ditch fish passage improvement project was successful because of the teamwork of the willing participants. The Thurlow Transfer Ditch Diversion supplies water to five separate water users. The primary irrigators on the system are Bernard and Diane Thurlow. The irrigators provided a great deal of site and water flow information during the design phase of the project and were available to answer questions as they arose. The Thurlow Transfer Ditch diversion is located on land owned by the Campbell family, which provided access and staging areas.

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 led to expedited permit issuance and no unpleasant surprises during construction.

WDFW and the Okanogan National Forest 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, welding equipment, and hand tools.

1.4 PERMITTING

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. Reclamation provided technical assistance to OCD during consultation. NOAA Fisheries issued a single BiOp for all six projects on August 6, 2003, along with a letter of concurrence from FWS.

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 Thurlow Transfer Ditch project was issued in early November, 2003.

1.5 CONTRACTS SPECIFICATIONS AND BIDDING

Technical specifications and contract language for the project were completed by Reclamation using standard NRCS format and language. There are five irrigators on the ditch, and Bernard and Diane Thurlow are at the far end. They agreed to be the parties responsible for contract administration; they reviewed and accepted the specifications and contract package. OCD, acting for the Thurlows, sent the specifications for the Thurlow Transfer Ditch to nine contractors in August 2003. Proposals from the contractors were due in September 2003; only one proposal was received.

For the Thurlow Transfer Ditch project, the contract for construction was between private irrigators (the Thurlows) and the construction company. OCD received and held the SRFB grant funds. When provided with invoices, the district reimbursed the contractor and suppliers (for items such as pipe and the concrete structures) for the Thurlows. During construction, Reclamation had no contractual relationship or other obligations with the contractor or OCD.

2. PROJECT DESCRIPTION

The purpose of the Thurlow Transfer Ditch project was to improve fish passage both upstream and down and to screen the flow into the ditch. The ditch is about 7 miles long, serving five irrigators, and the Thurlow property is at the downstream end. The diversions from the ditch were screened at the various points-of-use. However, it was difficult for fish to return to Beaver Creek because of barriers such as measurement weirs and fallen timber. Another constraint is that the ditch intercepts and crosses through Frazer Creek, which is sometimes dry above and below the crossing point. At the end of the irrigation season, large numbers of fish would often need to be rescued from the ditch; this was accomplished by volunteer efforts of various local landowners and irrigators. The new screen at the head of the ditch should eliminate the entrapment of fish.

Passage improvements were accomplished by the removal of the old diversion dam and the construction of a new diversion (Weir No. 1) upstream. To stabilize the channel, Weir No. 2 was constructed at the site of old diversion. The “invert elevation” (the lowest point) of the new headgate and ditch was lowered about 8 inches to reduce the water height required in the creek to make the diversion; this saved resources compared to building several rock structures to raise the water surface to the original level. The ditch needed to be cleaned-out for about 400 feet because it had started fairly flat. The metal measuring weir was replaced and set slightly lower than the original.

The existing 3½-foot-high diversion dam, made of stacked logs and lined with plastic (photos A-1, A-2, A-3, A-5, and A-6), was removed entirely; two weirs replaced it. Weir No. 1, a so-called Rosgen “V-type” vortex rock structure (photos A-27 and A-28), was installed about 70 feet upstream of the existing log structure. This new weir was designed to have a drop in the creek of no more than 0.8 foot, which meets WDFW standards for fish passage. Because the large rocks established a hardened point, Weir No. 1 provides “grade control;” this means the stream is unable to downcut its bed over time. It also forms a small pool at the new point of diversion sufficient to allow diversion of the water right. Weir No. 2, a Rosgen “A”-type (or double-drop) vortex rock structure, was constructed at the location of the previous dam to stabilize the channel, 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.

A new diversion box and headgate was installed at Weir No. 1 (photos A-16, A-17, and A-18). About 90 feet of 36-inch-diameter conveyance pipe was installed from the diversion box to just upstream of the concrete wasteway/control structure. The new fish screen sits about 20 feet downstream of the wasteway/control structure (photos A-19 and A-20). It is a single, 3-foot-diameter drum screen with a paddlewheel drive. The old headgate (photo A-4) was removed.

2.1 PROJECT MATERIALS, QUANTITIES, AND SUPPLIERS

The materials used for the project were ordered separately from the construction contract. Invoices for materials were sent to the landowner who approved payment to the suppliers by the district. The contractor was responsible only for the installation of materials.

Diversion structure — The concrete diversion box — including the headgate, trashrack, grating, and pipe stub — was pre-cast locally and delivered to the site by Arm and Hammer Construction Company of Twisp. The diversion box was built to the dimensions shown on the drawings with minor changes (the method of attaching the trashrack to the concrete box). The trashrack was fabricated as a single piece and also galvanized. The diversion box grating (on top) is standard 1 inch grate and was galvanized as a unit (photo A-18). A 36-inch diameter, Waterman C-10 slide gate was used as a headgate. Due to difficulties at the factory, the gate was unavailable during the fall construction period and wasn't installed by district employees until March 2004.

Due to the weight of the structure, the box was cast in two sections so there was a front half and a back half (photos A-17 and A-17) . The pipe stub was 36-inch-diameter, double-walled HDPE (high density polyethylene) pipe. The two halves of the structure were fastened together using six metal plates, 3/8th-inch thick (two on each side and two on the bottom). These were attached onto the two concrete sections with 3/8th-inch impact-type anchor bolts. The gap between the sections was filled with a mastic (tar-like) pipe-joint material (such as used to seal CMP, corrugated metal pipe); then, non-shrink grout was applied all around the joint to seal it against the elements. To prevent uneven settling brought on by the weight of the structure, a 6-inch-thick layer of compacted gravel was laid over a section of geotextile as a foundation

Water conveyance pipe — The 36-inch conveyance pipe was double-walled HDPE manufactured by the ADS Company, designed for open channel flow only; about 90-feet was installed from the diversion box to the ditch which included two 45-degree fittings. The soils in which the pipe was placed were a sandy-silt with a significant amount of cobble-sized material. The average depth of fill over the pipe is about 3 feet. All pipe for this project including the fish bypass pipe (8-inch PVC) and the sluice pipe (12-inch PVC) was supplied by Cascade Pipe and Feed Supply of Twisp.

Dewatering — The worksite was dewatered using 30-inch-diameter, double-walled, HDPE pipe, which was routed around the construction area (photos A-6 and A-10); the pipe and its watertight gaskets were also manufactured by the ADS Company. A total of 200 feet of dewatering pipe and two 45-degree fittings were purchased by OCD for use on several projects. About 150 feet of dewatering pipe and one 45-degree fittings was used for the Thurlow Transfer Ditch project. Surface excavation ranging in depth from 1 to 5 feet was needed to ensure proper grade. The dewatering pipeline was not backfilled unless necessary for weight on the pipe or where the equipment needed to cross. The dewatering pipe was used for other Beaver Creek projects.

Wasteway — The concrete wasteway/control structure was installed between the delivery pipe from the headworks and the fish screen. Its purpose is to provide additional control over water flow down

the ditch; it will also provide a backup control gate should the headworks be flooded or otherwise unreachable during very large flow events in the creek. This concrete structure will support a 36-inch-diameter, Waterman C-10 slide gate, which is expected to arrive by April 2004 and be installed by district personnel after high flows have receded.

Located just upstream of the wasteway/control structure is a 12-inch-diameter, Waterman C-10 slidegate attached directly to about 40 feet of 12-inch-diameter, Schedule 40 PVC pipe. This gate and pipe are used as a sluiceway for sediment that deposits upstream of the wasteway/control structure. There is also a constructed earth spillway located just upstream of the wasteway/control structure that would act as an overflow to prevent too much water from going down the ditch and creating flooding downstream.

Fish screen — The drum-type fish screen is powered by a paddlewheel and its single drum is sized for 3.5 cfs. The bypass is an 8-inch-diameter, Schedule 40 PVC pipe. The fishscreen was supplied by the WDFW Yakima Screen Shop; it was delivered to the site by two WDFW employees who helped with its installation. (See photos A-19 and A-20.)

Structural rocks — The large-diameter rocks used in this project came from two separate sources (photos A-10 thru A-13). The majority of the rocks were provided by the Stokes Ranch (which also uses water from the ditch) location several miles downstream of the Thurlow Transfer Ditch diversion. The remainder of the rocks were purchased from a family-owned quarry located about 30 miles east of the project site, near the town of Malott. After inspection and selection, about seventy-five rocks of various sizes were brought from the Stokes Ranch to the site in July 2003. The Malott pit rocks were delivered to the site in October 2003. The Malott rocks were angular and granitic ranging from just less than 2 feet in average diameter to over 4 feet; the Stokes Ranch Rocks were of similar size but more rounded. The estimated weights of the rocks ranged from 600 to 4,000 pounds.

The material excavated from the two rock-weir sites were similar in composition and consisted of a silt-sand-gravel-cobble mixture with an occasional large boulder. Typically, the material was “well graded” (evenly mixed) although along the banks of the creek, there was some layering from flood deposits and heavier percentages of fine materials.

Seepage reduction — After the rocks for each weir were in place, an impervious “geocomposite” fabric was spread on the upstream side of each one. The purpose of the fabric was to reduce or prevent water from traveling underneath the large rocks and to encourage deposition of fine materials if small leaks through the backfill did occur. The fabric was placed in various configurations and was held in place by the weight of the large rocks and by fill material.

The fabric consists of two layers of “16-ounce” geotextile (weight per square yard) bonded to each side of a 50-mil-thick (about 1/20th of an inch), impermeable polyvinylacetate membrane. The fabric was manufactured by Huesker Inc. (product number HGC-165016) and purchased directly from the company. About 500 square feet of material was installed at the Thurlow Transfer Ditch

site. At Weir No. 1, where the diversion box is located and minimal seepage is preferred, the pool was fully lined; the downstream Weir No. 2, primarily used for stabilization and low-flow fish passage, was only lined in the middle third.

2.2 CONSTRUCTION TIMELINE

Construction on the project began on the morning of November 3, 2003 with the excavation for the dewatering pipe trench. The last of the cleanup was completed on November 18, 2003. The weather was adequate with seasonal temperatures and some snow and rain. Low temperatures were around 10 degrees some days and icing of pipes and the creek posed minor problems. Creek flows stayed consistent and were estimated to range between 4 and 8 cfs with the higher flows in the afternoons after the temperatures warmed up. Revegetation will be completed in the spring of 2004 and will be monitored by the district; informal site monitoring by the irrigator, landowner, district, and Reclamation will continue through the years.

The project was built in the following steps:

1. Installation of 125 feet of dewatering pipe around site of both proposed weirs and the existing dam; Photos A-7, A-10, A-13, and A-25.
2. Temporary installation of 12-inch PVC pipe from upstream of cofferdam to the existing ditch to provide irrigation water during construction; Photo A-10.
3. Installation of ecology block cofferdam with plastic; electroshocking and removal of resident fish from site (1 day); Photos A-8 and A-9.
4. Deconstruction of log-and-plastic diversion dam.
5. Construction of most of Weir No. 2, including geocomposite liner and backfill (2 days); Photos A-10 A-11, A-13, and A-14. A small section is left uncompleted to allow equipment access.
6. Deepen ditch and install new measuring weir. (1 day); Photo A-23.
7. Construction of most of Weir No. 1 and backfill (1 day); Photos A-15 and A-17. A small section is left uncompleted to allow equipment access downstream.
8. Installation of diversion box and backfill (1day); Photos A-16, A-17, and A-18.
9. Removal of temporary 12-inch pipe and installation of 36-inch-diameter conveyance pipe (1 day).
10. Installation of fish screen and fish-screen bypass pipe (1 day); Photos A-19 and A-20.
11. Installation of wasteway/control structure. (1/2 day); Photo A-20.
12. Installation of sluice gate and sluice pipe (1/2 day); Photo A-21.

13. Completion of cleanup, regrading, removal of materials and dewatering pipe, etc.; initial revegetation (1 day); Photo A-24 and A-26.

A walkthrough was conducted November 17, 2003 by the landowner, irrigator, OCD, the contractor, and Reclamation. The participants discussed final grading, cleanup and revegetation, including the type and number of plants, and the schedule for work. A few “punchlist” (minor post-project completion work) items were identified, including removal of the rebar lifting eyes from the new diversion box, changing the attachment bolts for the trashrack to make it easier to remove, and placement of excess large rocks for instream habitat. The majority of punchlist items were completed by November 18, 2003; the remainder will be completed in the spring of 2004. The installation of the 36-inch control gates was discussed and scheduled for the spring of 2004 before high flows. Temporary plywood gates were made to prevent flows from entering the ditch over the winter.

A final walkthrough of the project by the landowner, some of the irrigators, OCD, and Reclamation is scheduled to occur sometime in July 2004. By that time, the new structures should have been tested by snowmelt and the highwater season. Any additional punchlist items or required repairs can be discussed at that time, including items related to revegetation.

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 irrigator. 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 proposed an extensive long-term monitoring plan for the entire Beaver Creek watershed. The plan is being drafted by Reclamation personnel and contractors, who are working with the landowners and various agencies to make sure the monitoring meets the needs of all concerned.

3. CONCLUSIONS

So far, the Thurlow Transfer Ditch Fish Passage Improvement project has been successful. It has yet to be tested by significant high flows. Weir No. 1 and the diversion box are delivering the required water flows to the ditch at relatively low creek flows. The fish passage portion of the project meets all appropriate standards. Maintenance of the new rock structures and headworks by the irrigation should be minimal. The revegetation program will be completed in the spring and plant growth will be monitored. A turnover document will be signed by the irrigator, OCD, and Reclamation after the first high-water season has passed and any necessary repairs or changes are made.

Thurlow Diversion Fish Passage Improvement Project

Appendix A. Construction Photographs (color)

All photographs by U.S. Bureau of Reclamation, Pacific Northwest Region, Boise, Idaho, PN 3400/Design Group, Boise, Idaho, November 2003 (except as noted)



Photo A-1. Looking upstream at original Thurlow Transfer Ditch diversion dam. The ditch is on left side of Beaver Creek, between the Upper Stokes and Lower Stokes diversions. Arrow shows direction of flow of ditch water.



Photo A-2. Looking downstream at original diversion dam; the arrow indicates the head of the irrigation ditch. (*September 2003*)



Photo A-3. Looking down at original diversion dam; the original ditch is in lower left of photo. The contractor-installed dewatering pipe is indicated by arrow.



Photo A-4. Looking downstream at the original ditch headgate; the arrow indicates the direction of flow of the wasteway ditch. The former headgate was located about 50 feet downstream from the diversion dam. (September 2003)



Photo A-5. Looking downstream at the original diversion dam; the arrow shows the direction of flow of the ditch.



Photo A-6. The dewatering pipe just prior to installation; the pipe was to be installed on the right side of the creek, where the excavator is sitting.



Photo A-7. Dewatering pipe in place (upper left); crew placing temporary irrigation pipe (lower right). Note fish-blocking net across stream (arrow). The cofferdam was built where the worker in the creek is standing.



Photo A-8. Ecology-block-and-plastic cofferdam in place. Temporary irrigation pipe has been backfilled. Staff from WDFW are electroshocking fish.



Photo A-9. USFS and Okanogan Conservation District staff electroshocking fish in construction area for release downstream.



Photo A-10. Contractor constructing Weir No. 2, a double-drop A-type. Irrigation water is being supplied by temporary diversion pipeline (arrow).



Photo A-11. Looking upstream at right arm of A-type Weir No. 2. The direction of flow of the temporary irrigation pipeline is indicated by the arrow. The cofferdam is out of view around the corner (upper left).



Photo A-12. Looking upstream at left arm of V-type Weir No. 1 under construction.



Photo A-13. Looking upstream at completed A-type Weir No. 2. Track hoe is working on upstream No. 1 “V” weir.



Photo A-14. Looking down at nearly completed Weir No. 2. The left arm of the weir will extend to the orange paint-mark on the pipe.



Photo A-15. Looking at site of V-type Weir No. 1 just downstream from cofferdam; contractor working on left side.



Photo A-16. Viewing back section of new diversion control box; the new turnout structure is at the left side of photo.



Photo A-17. Setting concrete control structure on right side of V-type Weir No. 1. Pump with blue pipeline is removing seepage water.



Photo A-18. On left side upstream from A-type Weir No. 2, concrete diversion structure with trashrack in place. The permanent diversion pipe is in place and backfilled. Note the metal strap holding the two sidepieces of the trashrack. In all, six straps were used.



Photo A-19. Track hoe moving new fishscreen structure for placement in diversion ditch.



Photo A-20. View looking up diversion ditch; the new fishscreen is in place. Behind the turnout structure (arrow) is the end of the 30-inch-diameter permanent diversion pipe.



Photo A-21. Contractor installing sluice gate in diversion ditch just upstream of turnout structure.



Photo A-22. View from fishscreen looking down diversion ditch.



Photo A-23. Installed by Okanogan Conservation District, this new, sharp-crested rectangular measuring weir is located on the irrigation ditch about 400 feet downstream of the diversion point.



Photo A-24. Looking downstream from left side, the majority of construction is complete, and the temporary dewatering pipe is still in place. Site rehabilitation is underway; the diversion pipe ends just beyond the new fence posts.



Photo A-25. Looking downward at completed A-type Weir No. 2. The cofferdam has been removed and normal seasonal flows are in the stream channel.



Photo A-26. Looking downward at Weir No. 2; the dewatering pipe has been removed and has been temporarily set along the stream. The excavator is finishing the rock weir.



Photo A-27. Looking upstream at completed weirs. The A-type Weir No. 2 and the V-type Weir No. 1 is indicated by arrow. The dewatering pipe is soon to be moved offsite.



Photo A-28. Closer upstream view of project. Weir No. 2 is in the foreground and Weir No. 1 in the background. Flows are normal for the time of the season, about 6 cfs.



Photo A-29. Looking downstream at the new diversion box; Weir No. 1 is creating the vortex in the middle-left of the photo. *(April 2004)*

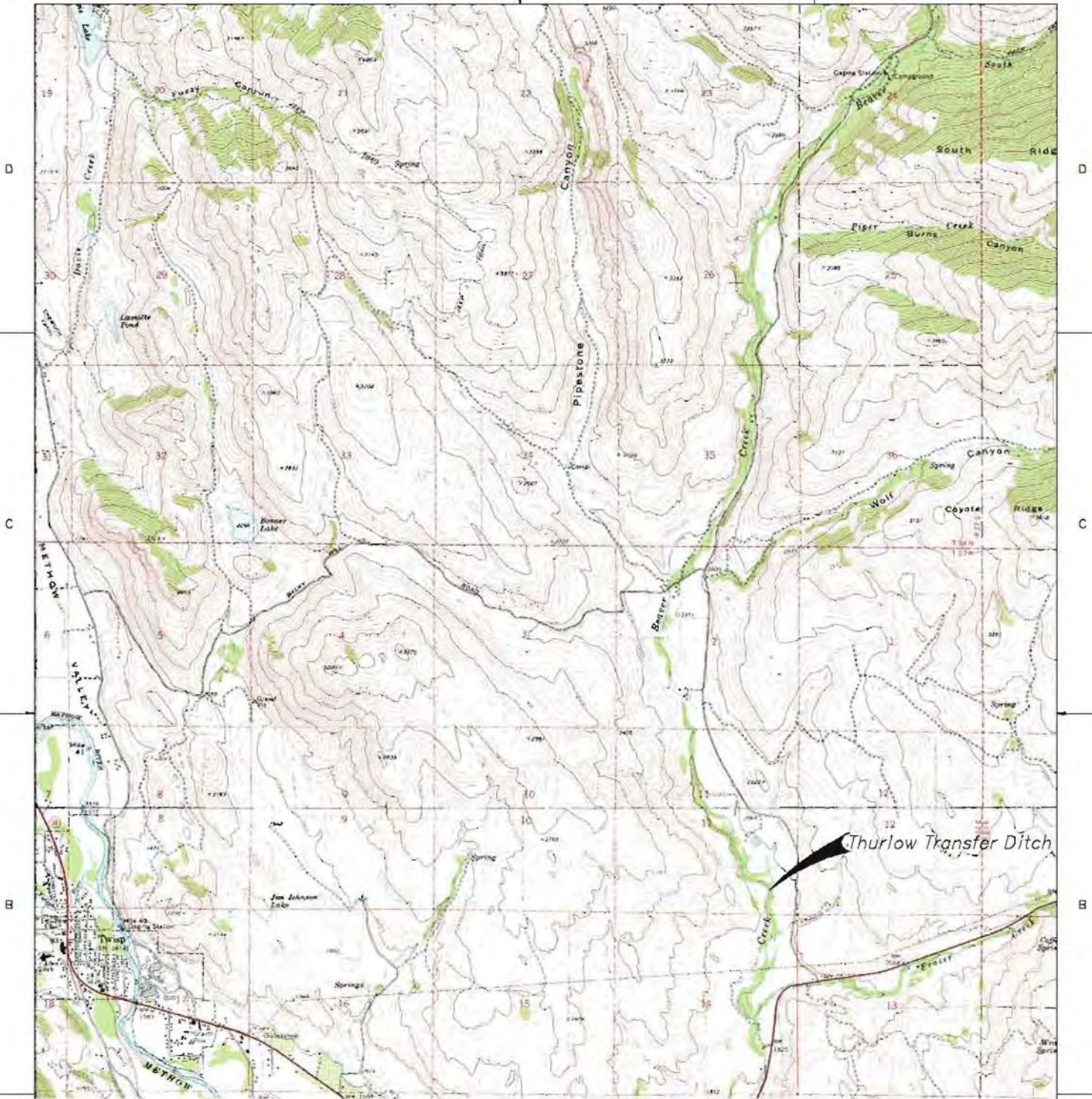


Photo A-30. Looking up the Thurlow Transfer Ditch. The headgate to the new 12-inch sluiceway is in front and the fish screen in the background. *(April 2004)*

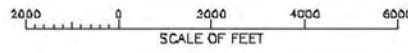
Thurlow Diversion Fish Passage Improvement Project

Appendix B. As-Built Drawings

- Figure B-1. Location Map: Thurlow Diversion (1678-100-300)
- Figure B-2. Thurlow Transfer Ditch, Site Plan and Sections (1678-100-301)
- Figure B-3. Thurlow Transfer Ditch, Profiles (1678-100-302)
- Figure B-4. Thurlow Transfer Ditch, Cross Vane Weirs, Sections (1678-100-337)
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Thurlow Transfer Ditch



 ALWAYS THINK SAFETY	
<small>UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION</small>	
<small>FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN</small>	
THURLOW TRANSFER DITCH LOCATION MAP	
<small>DESIGNED <u>Jeff S. McLaughlin</u> CHECKED <u>Daniel J. Wilson</u></small>	
<small>DRAWN <u>S. Weddle/J. Ward</u> TECH APPROVAL <u>Jeff S. McLaughlin</u></small>	
<small>APPROVAL <u>Daniel J. Wilson</u></small>	
<small>PEER REVIEWER, PROGRAM NUMBER (ACTING)</small>	
<small>CADD FILENAME 1678-100-300.DWG</small>	<small>CADD SYSTEM AutoCAD Rev 18.0</small>
<small>BOISE, IDAHO</small>	<small>DECEMBER 2002</small>

DATE AND TIME PLOTTED
 MAY 6, 2004 10:33
 PLOTTED BY
 JMWAO



Fill to narrow streambank

Proposed V-weir #1 with non-permeable geo membrane, hand placed upstream side of weir boulders

Diversion headgate structure, invert of discharge pipe @ 99.00

36" ϕ double walled HDPE pipe Approx. 90' long

45° Elbow

Existing ditch to be back filled with compacted material

Existing Log diversion dam to be removed

(-337)

Proposed double drop V-weir #2 with non-permeable geo membrane, hand placed upstream side of weir boulders

45° Elbow, skewed to fit

NAIL IN BIG PINE ELEV=106.62

Sediment pond

New wasteway structure w/ control gate

PIN 1 ELEV=100.0

12" ϕ schedule 40 PVC pipe with waterman slide gate

Invert of ditch to be lowered 9" at start of ditch tapering to zero at about 400' downstream.

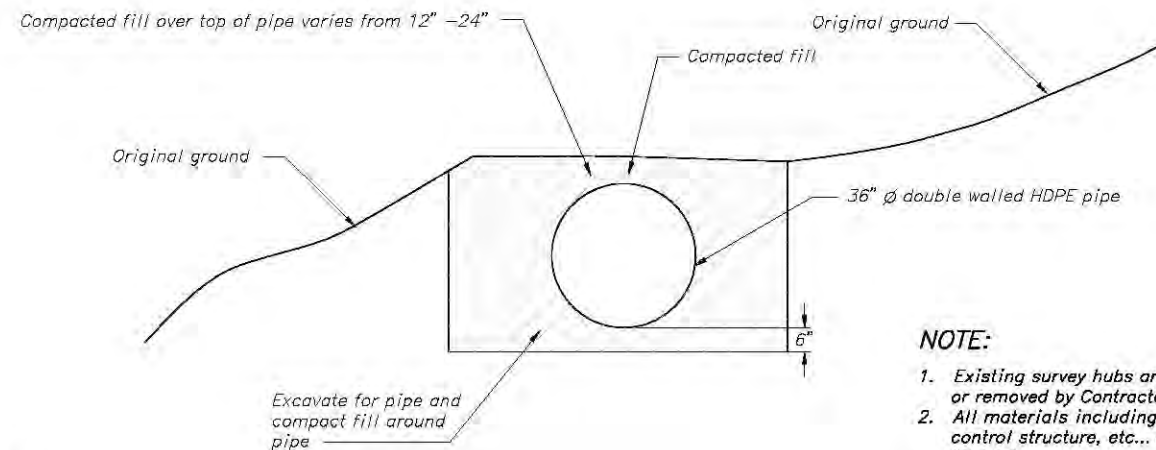
2+00

Proposed Steel frame fishscreen

Existing headgate to be removed

Existing ditch

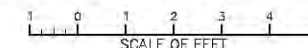
8" ϕ schedule 40 PVC bypass pipe bypass pipe route located in field



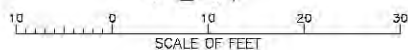
NOTE:

- Existing survey hubs are not to be damaged or removed by Contractor.
- All materials including rocks, all pipe, the control structure, etc... are furnished by the District.
- All layout and elevations will be provided by the Engineer.

**SECTION D-D
36" DIVERSION PIPE**



PLAN

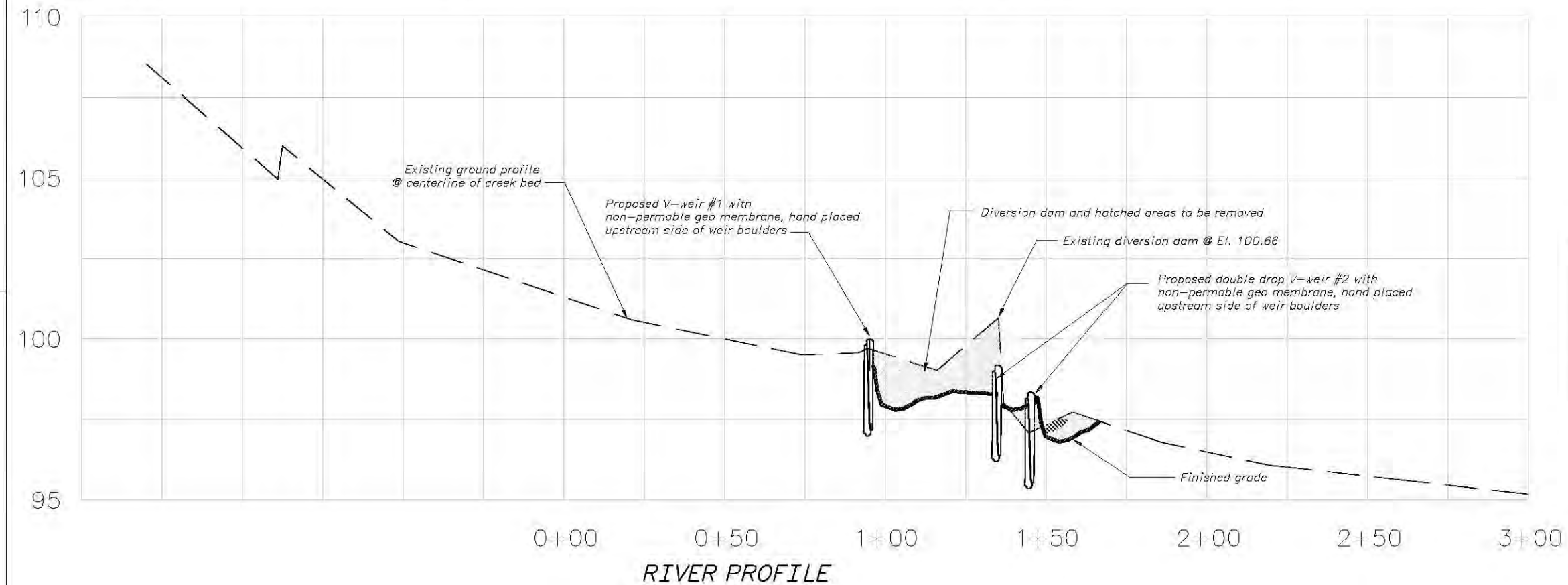


PROPOSED V-WEIR LOCATIONS

STATION	ELEVATION	DESCRIPTION
0+95	100.26	Proposed V- weir #1
1+35	99.20	Proposed double drop V- weir #2
1+45	98.40	

Elevations and Stations are @ low point on weirs

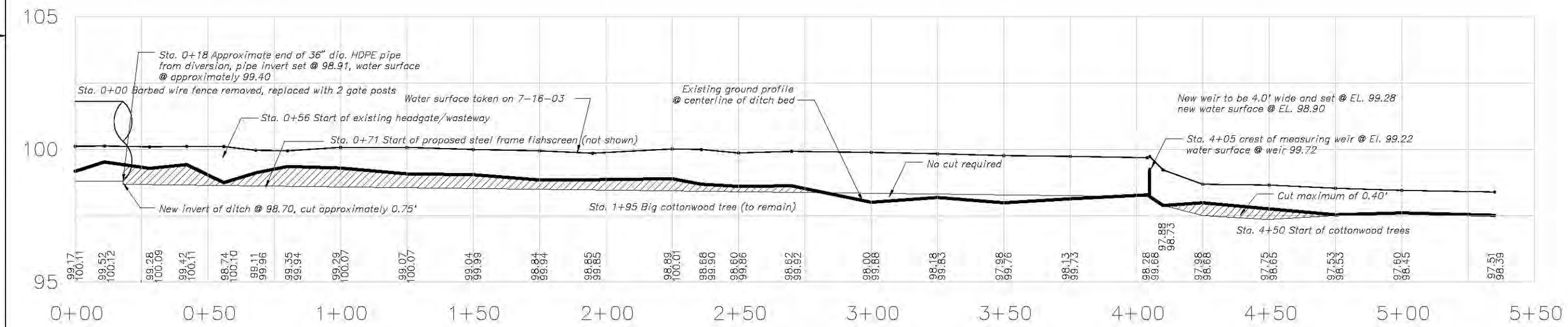
REV NO. 2004-04-30 7	AS BUILT BY 100, JBW, 2004-04-30 100-J.S.M.
ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN THURLOW TRANSFER DITCH SITE PLAN AND SECTIONS	
DESIGNED: Jeff S. McLaughlin	CHECKED: Daniel J. Wilson
DRAWN: S. Weddle/J.Ward	TECH. APPROVAL: Jeff S. McLaughlin
APPROVAL: Daniel J. Wilson PEER REVIEWER/PROGRAM MANAGER (ACTING)	
CADD SYSTEM AutoCAD Rev. 16.0 BOISE, IDAHO	CADD FILENAME 1678-100-301.DWG OCTOBER 2002
1678-100-301	



PROPOSED V-WEIR LOCATIONS

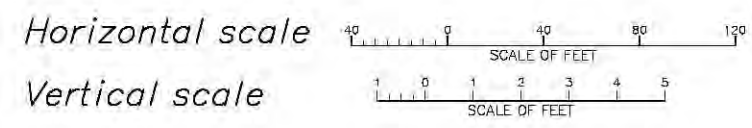
STATION	ELEVATION	DESCRIPTION
0+95	100.26	Proposed V- weir #2
1+35	99.20	Proposed double drop V- weir #1
1+45	98.40	

Elevations and Stations are @ low point on weirs

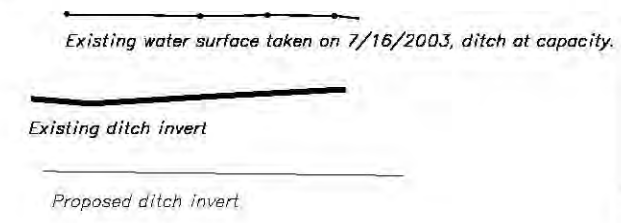


NOTE:
1. Measuring weir installation to be done by others.

DITCH PROFILE



KEY



REV NO. 2004-04-30 AS BUILT BY 100, JBW, 2004-04-30
1 100-J.S.M.

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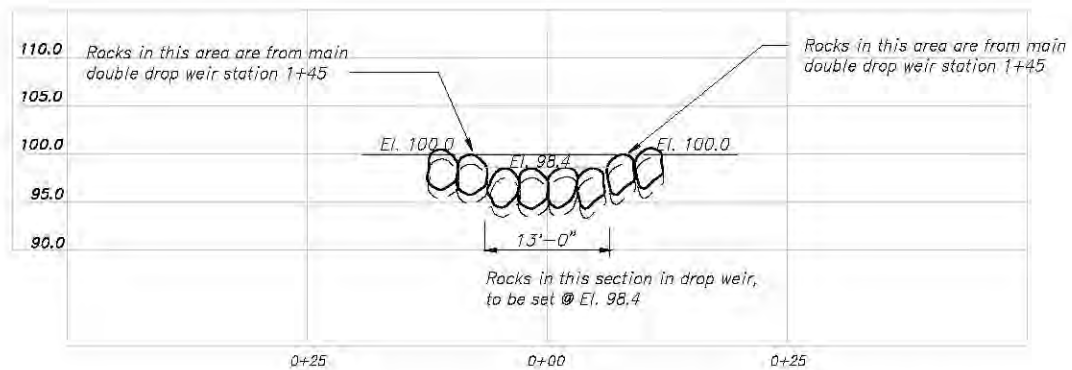
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
FCRPS HABITAT IMPROVEMENT PROGRAM
METHOW RIVER SUBBASIN
**THURLOW TRANSFER DITCH
PROFILES**

DESIGNED: Jeff S. McLaughlin CHECKED: Daniel J. Wilson
DRAWN: S. Weddle/J. Ward TECH. APPROVAL: Jeff S. McLaughlin
APPROVAL: Daniel J. Wilson
PEER REVIEWER/PROGRAM MANAGER (ACTING)

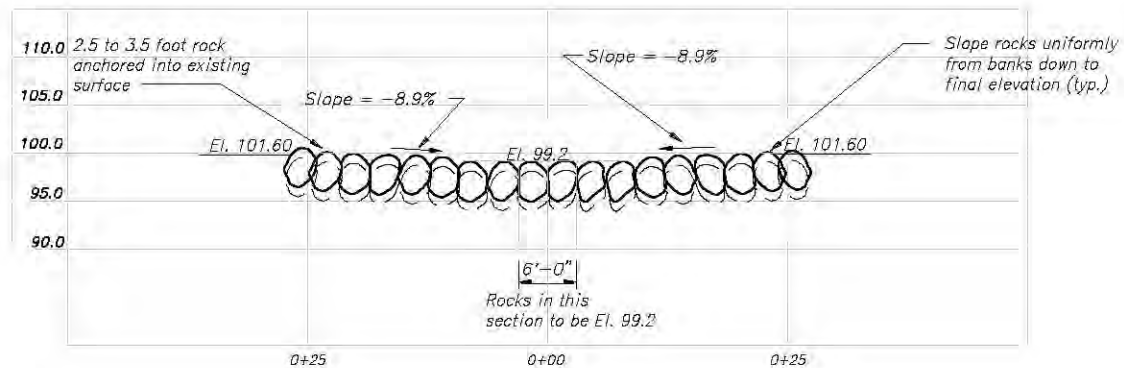
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BOISE, IDAHO: OCTOBER 2002 1678-100-302

SPECIFICATION #

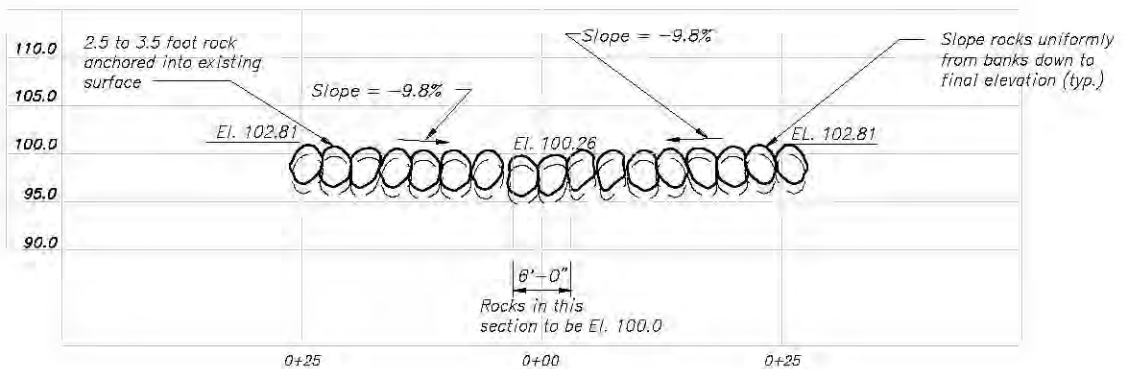
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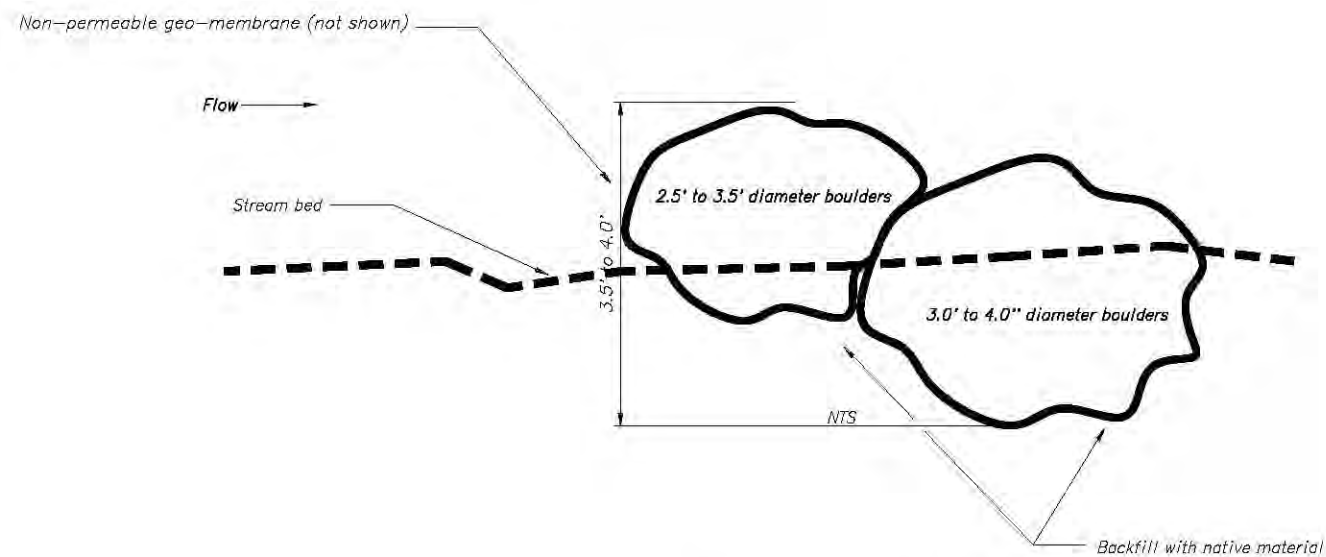
DOUBLE DROP V - WEIR #2 SECTION C-C
STATION 1+45
SCALE OF FEET



DOUBLE DROP V - WEIR #2 SECTION B-B
STATION 1+35
SCALE OF FEET



V - WEIR #1 SECTION A-A
STATION 0+95
SCALE OF FEET

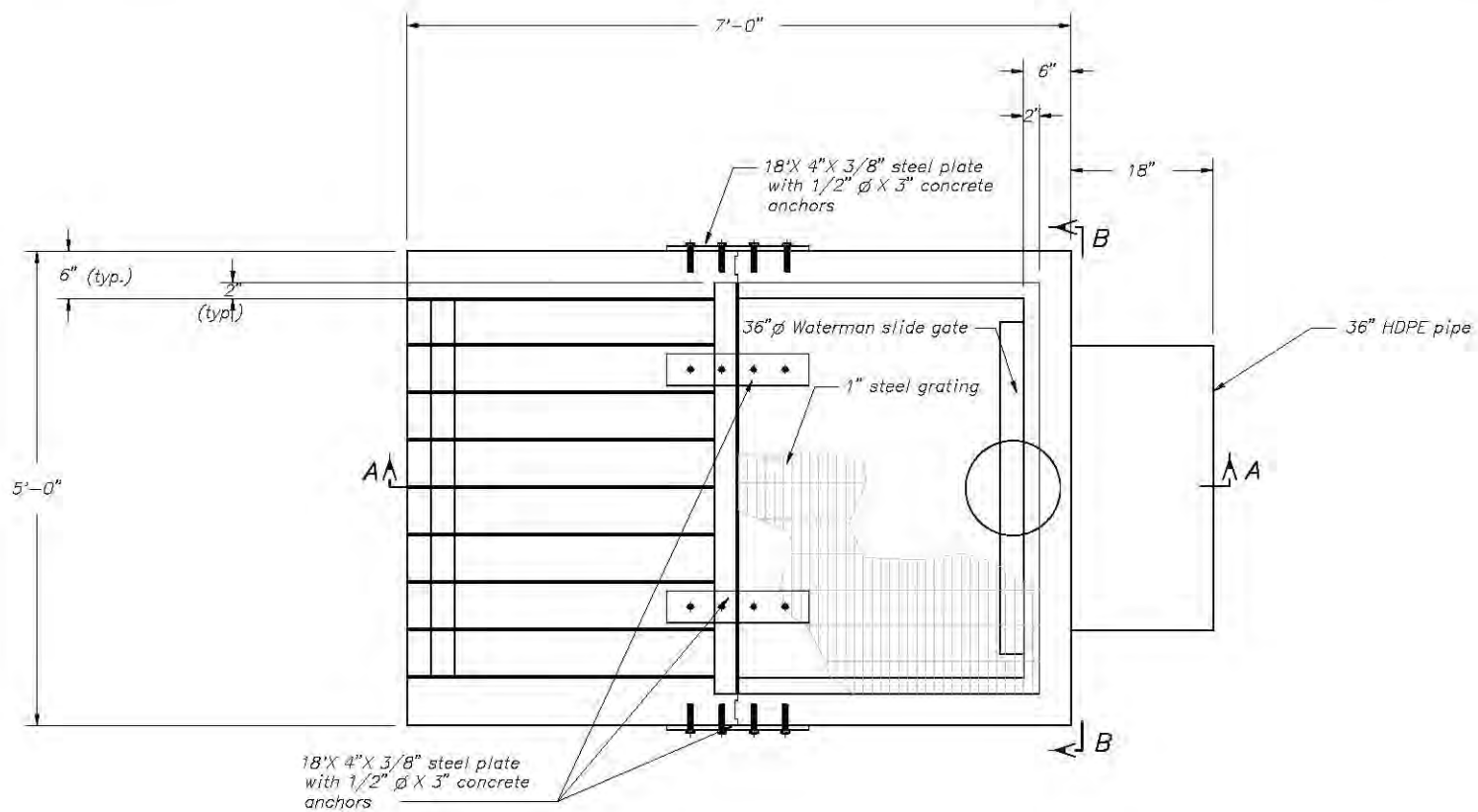


SECTION OF TYPICAL ROCK WEIR

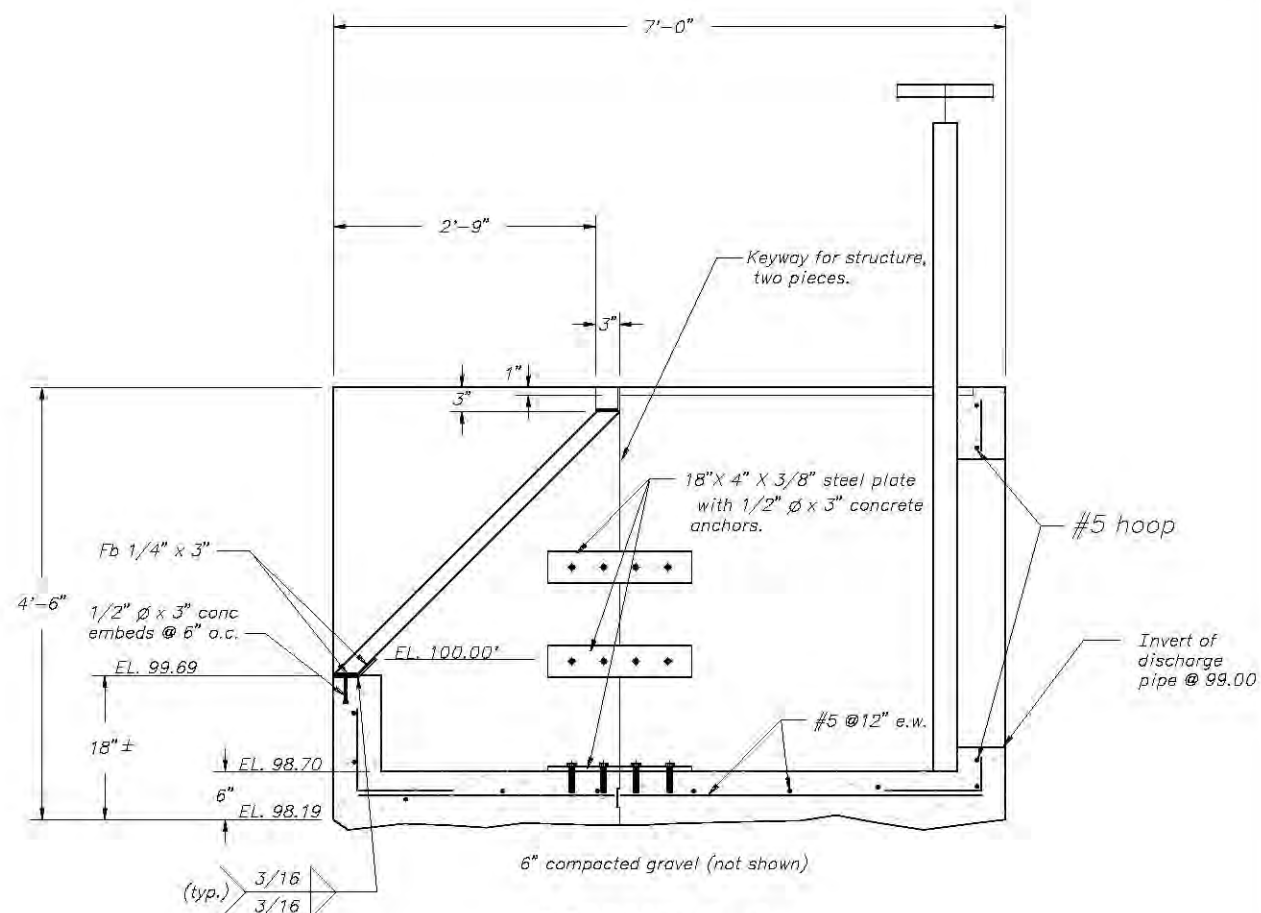
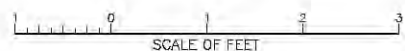
NOTES:

1. Local elevations used and are not based on sea level datum.
2. Rocks furnished by the District, approx. distance to point of use is 150 ft.

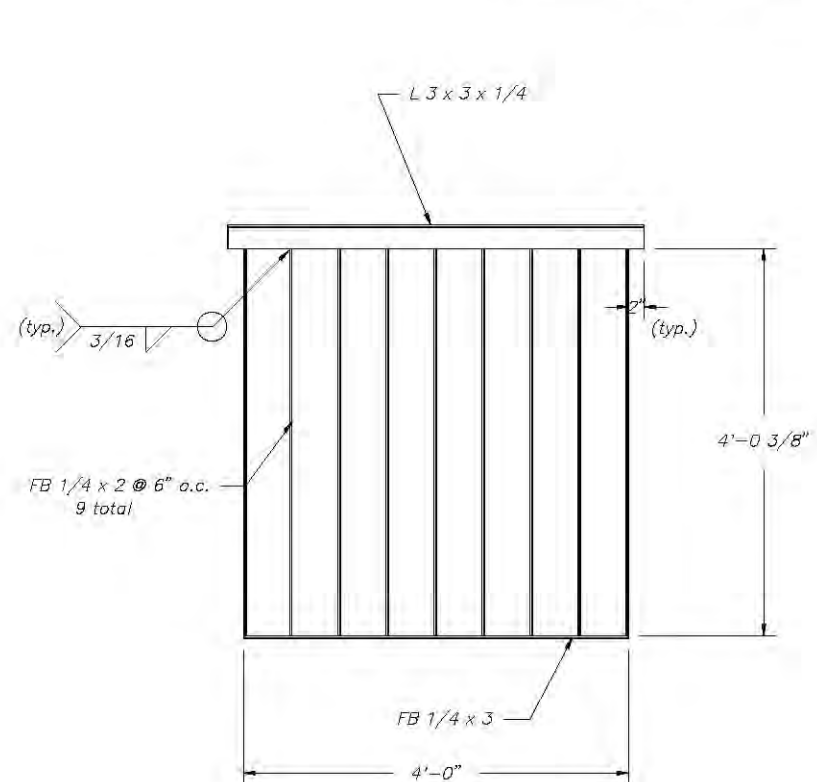
REV. NO. 2004-04-30 7	AS BUILT BY 100, JBW, 2004-04-30 100-J.S.M.
ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN THURLOW TRANSFER DITCH CROSS VANE WEIRS SECTIONS	
DESIGNED: Jeff S. McLaughlin	CHECKED: Daniel J. Wilson
DRAWN: S. Weddie/J. Ward	TECH. APPROVAL: Jeff S. McLaughlin
APPROVAL: Daniel J. Wilson PEER REVIEWER/PROGRAM MANAGER (ACTING)	
CADD SYSTEM AutoCAD Rev. 15.0 BOISE, IDAHO	CADD FILENAME 1678-100-337.DWG JANUARY 2003 1678-100-337



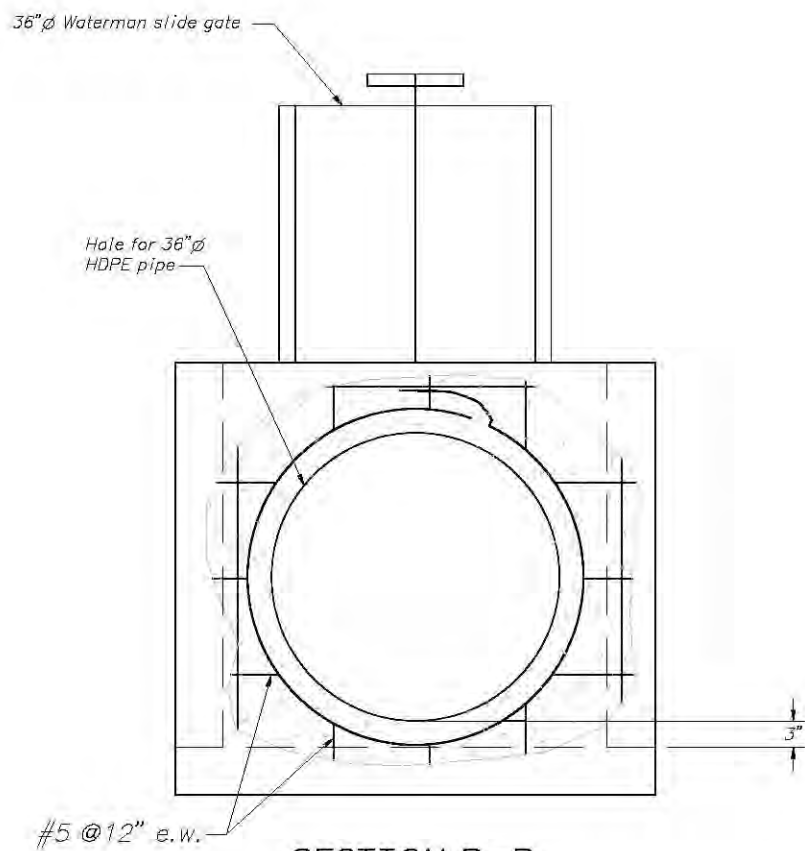
PLAN



SECTION A-A



TRASHRACK DETAIL

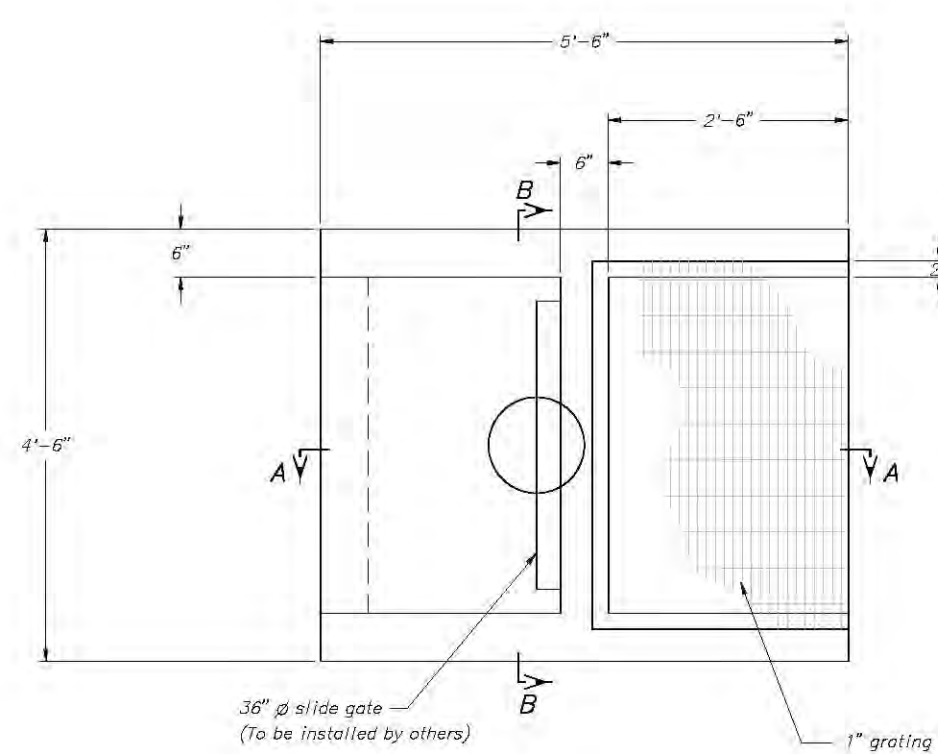


SECTION B-B

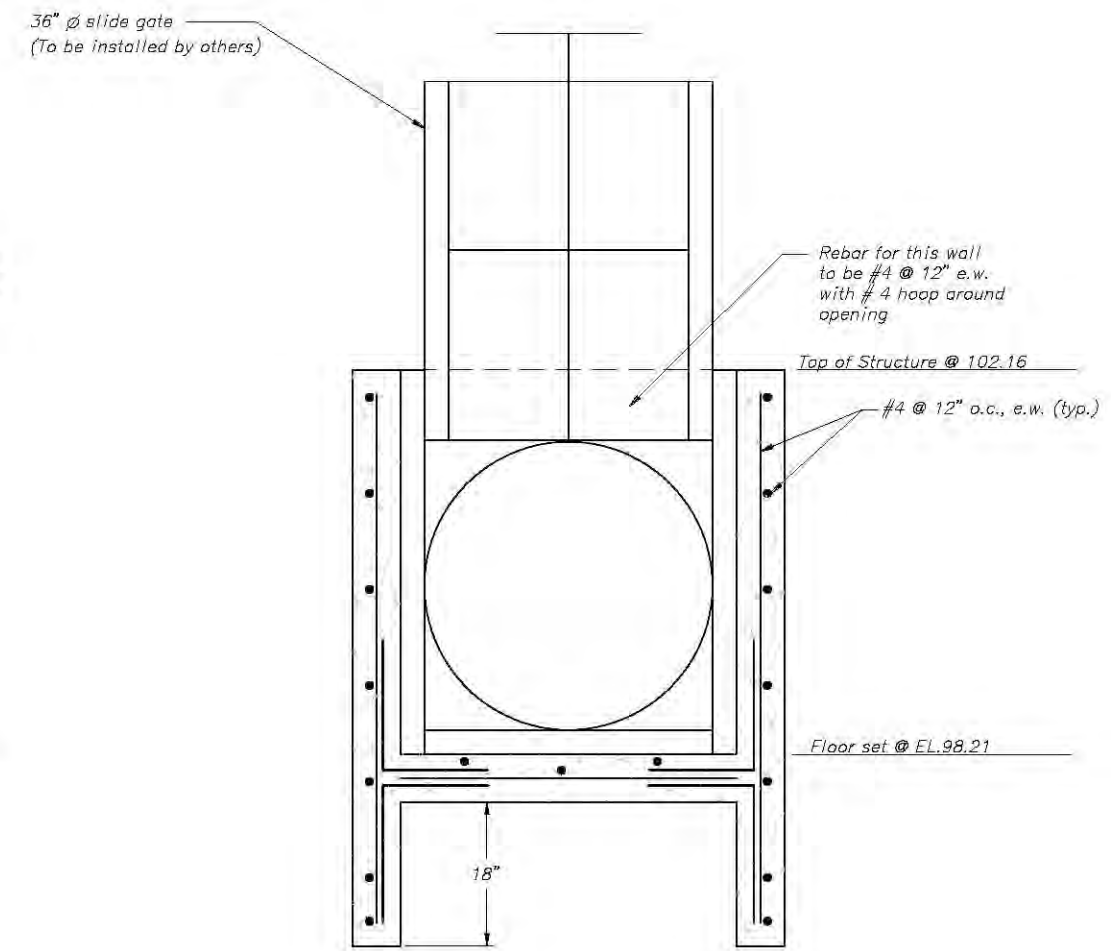
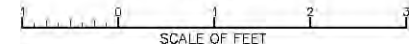
NOTES:

1. Final elevation of headgate structure determined in the field.
2. Gate to have a tolerance of $\pm .25"$ to allow the gate to fit within design dimensions.
3. Headworks furnished by others, to be installed by contractor.
4. 36" ϕ HDPE grouted to control structure in the field.

REV NO. 2004-04-30 1	AS BUILT BY 100, J.W.W. 2004-04-30 100-J.S.W.
ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN THURLOW TRANSFER DITCH CONTROL STRUCTURE PLAN, SECTION AND DETAIL	
DESIGNED: Jeff S. McLaughlin	CHECKED: Daniel J. Wilson
DRAWN: S. Weddle/J. Ward	TECH. APPROVAL: Jeff S. McLaughlin
APPROVAL: Daniel J. Wilson PEER REVIEWER/PROGRAM MANAGER (ACTING)	
CADD SYSTEM AutoCAD Rev. 16.0 BOISE, IDAHO	CADD FILENAME 1678-100-303.DWG OCTOBER 2002
1678-100-303	

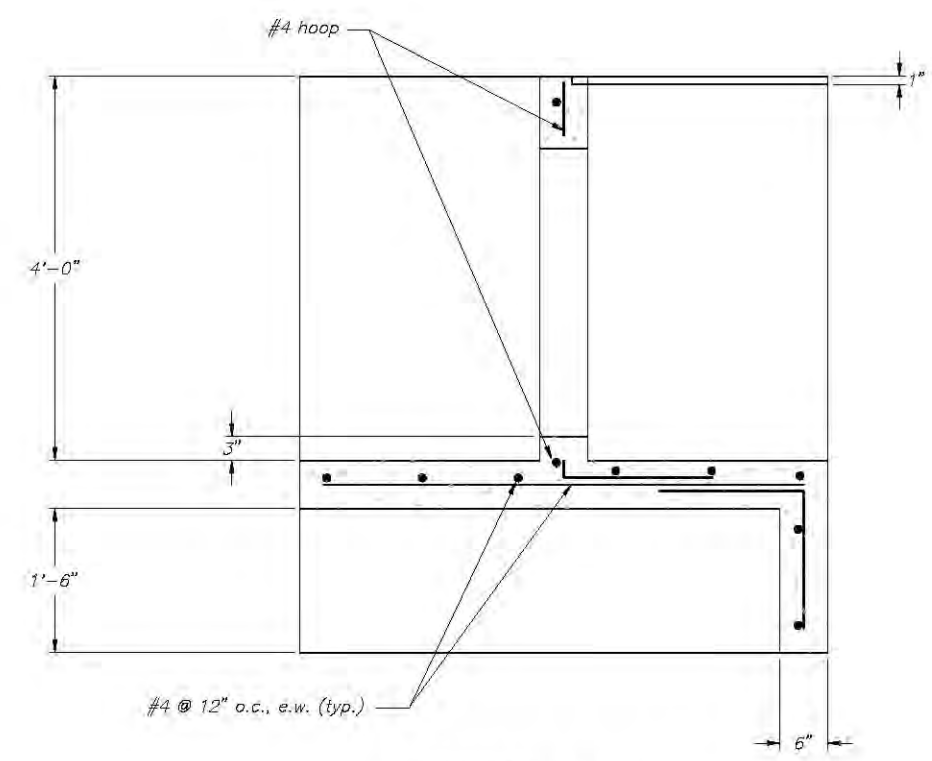


PLAN



SECTION B-B

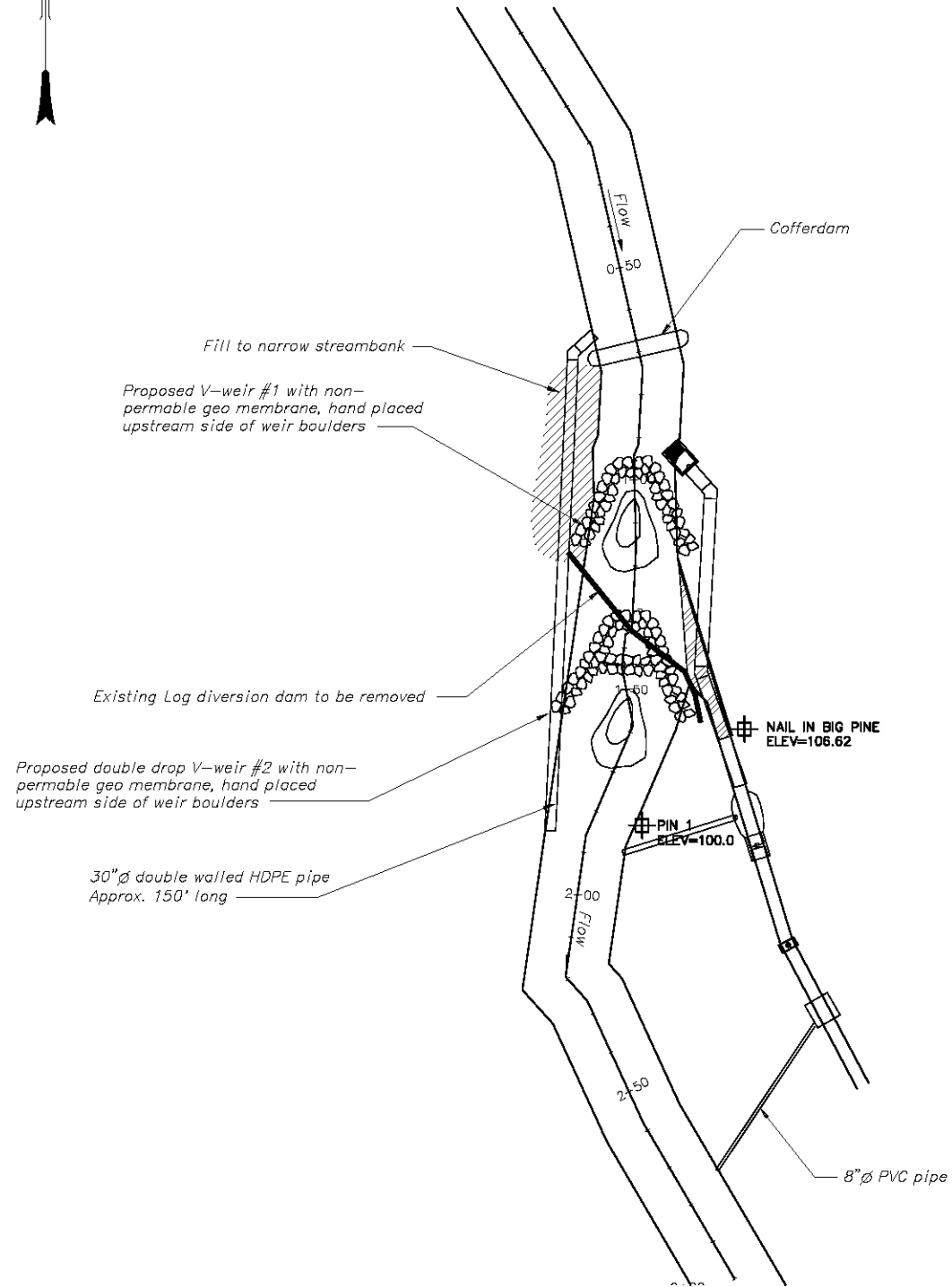
NOTE:
Wasteway structure elevation to be provided by the Engineer.



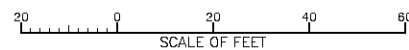
SECTION A-A

REV NO. 2004-04-30 7	AS BUILT BY 100, JBW. 2004-04-30 100 - J.S.M.
ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN THURLOW TRANSFER DITCH WASTEWAY STRUCTURE PLAN AND SECTIONS	
DESIGNED: Jeff S. McLaughlin	CHECKED: Daniel J. Wilson
DRAWN: S. Weddle/J. Ward	TECH. APPROVAL: Jeff S. McLaughlin
APPROVAL: Daniel J. Wilson PEER REVIEWER/PROGRAM MANAGER (ACTING)	
CADD SYSTEM AutoCAD Rev. 16.0 BOISE, IDAHO	CADD FILENAME 1678-100-304.DWG OCTOBER 2002
1678-100-304	

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PLAN



NOTES:

1. Dewatering pipe slope approximately 2%, actual slope staked in the field.
2. Dewatering pipe to be removed and the trench filled in and compacted by equipment travel.

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 ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FCRPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN THURLOW TRANSFER DITCH DEWATERING PLAN	
DESIGNED <u>Jeff S. McLaughlin</u> CHECKED <u>Daniel J. Wilson</u> DRAWN <u>S. Weddle/J. Ward</u> TECH. APPROVAL <u>Jeff S. McLaughlin</u> APPROVAL <u>Daniel J. Wilson</u> <small>PEER REVIEWER/PROGRAM MANAGER (ACTING)</small>	
CADD SYSTEM AutoCAD Rev. 16.0 BOISE, IDAHO	CADD FILENAME 1678-100-313.DWG OCTOBER 2002 1678-100-313

SPECIFICATION #

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