As-Built Report

Turnbow Diversion near Hanna, Utah

Prepared for:

Utah Reclamation Mitigation

and Conservation Commission

Prepared by:

Allred Restoration, Inc

August 2010

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Project Description and Objectives

This stream diversion project documentation was prepared at the request of the Utah Reclamation Mitigation and Conservation Commission under Contract 08-CS-40-8245, Delivery Order A6.

As part of its mitigation program, the URMCC is authorized to rehabilitate diversion dams and restore fish habitat on the Duchesne River. The Turnbow Diversion Project was developed under the cooperative agreement between the Mitigation Commission and Duchesne County Water Conservancy District to meet the objectives of Section 203(a)(5) of the Central Utah Project Completion Act (Titles II through VI of P.L. 102-575, as amended.

The objective of this project was replacement of a problem irrigation diversion on the Duchesne River with a low-maintenance diversion structure that would provide for fish passage and not require annual in-stream maintenance work. The majority of the construction was completed in the fall of 2009, with a small amount of follow up work in the spring of 2010.

The stream channel work was completed by Duchesne County Water Conservancy District personnel (primarily Randy Crozier). Allred Restoration, Inc. provided design work for stream channel modification and on-site observation and oversight.

This report summarizes condition of the river and diversion structure prior to the project, and then documents the completed work on both the river and the concrete structure.

General Location

The Turnbow Diversion site is located upstream of the town of Hanna, Utah, on the main stem of the Duchesne River (Figures 1 and 2). The diversion is located on the outside of a sharp bend in the river. This location allows it to provide water for lands on the south side of the river.

Prior Condition

The Turnbow Diversion area is on river right, and is located roughly 1000 feet downstream of a county road bridge. The diversion previously consisted of a long angled sill and a concrete headwall (Figure 3). Although the width of the Duchesne River is only approximately 40 feet in this area, the sill length was almost 200 feet. The sill was composed of large rock, cobble, gabions, beams, plastic, chain link fencing, and other items (Figures 4, 5, and 6), and it required frequent maintenance because it was unstable

during periods of high streamflow. The headwall was protected by gabions (Figure 7) and was fairly new and in relatively good condition, however, its location and configuration, with respect to the channel, promoted sediment deposition in the entry and did not provide adequate flow to the ditch system (Figure 8), which has a very low gradient.

Completed Actions

The existing headwall, sill, and associated debris were completely removed from the channel. Concrete and other mixed materials and debris were hauled away for proper disposal; suitable rock materials were salvaged and reused on-site.

The major elements of the diversion project are shown in Figure 9. The old sill was replaced with a new rock riffle at the location shown. The riffle was constructed to mimic a "natural" form (Figure 10), which allows fish passage while providing upstream water surface elevations that allow sufficient water to be diverted into the ditch. Instead of an abrupt drop, the new riffle loses elevation over a much longer distance. The gradual elevation loss required more rock to construct, but has the advantage of being very stable over time because it eliminates undercutting that is common at more abrupt sills. The scour hole below the old sill was filled with a matrix of large rock: voids were filled with river cobble during riffle construction. A smaller riffle located immediately downstream was enhanced and stabilized somewhat to create a small pool below the main riffle.

A new bank (Figure 11) was constructed using large rock with a minimum 1.5 foot median diameter, at the location shown in Figure 9. The bank was built with a riprap layer that is a minimum of 3 feet thick, with a side slope of 2 to 1. The rock layer in the new bank ties in directly to the large rock filling the scour hole to deter any future erosion or channel incision at the site. The new rock bank was positioned to allow room for a short ditch section to be constructed behind it (Figure 12). This new ditch section required some excavation of the finer-grained slope material, which was compacted and used to maintain separation between the river channel and the ditch, and to control leakage. The ditch did not require a fabric liner because leakage did not appear to be a problem. The new ditch joins the existing ditch system at grade.

The channel area located immediately upstream of the diversion was recontoured and shaped to provide a smooth bed transition into the reconstructed area (Figure 13). Some additional rock was placed along the river left bank, upstream of the structure to limit future stream movement at the site.

A new headwall and gate system was constructed by Extreme Excavating of Park City, Utah, via a contract with the Duchesne County Water Conservancy District (Figures 14 and 15). It was positioned at the location and orientation shown in Figure 9. The invert of the gate opening of the new headwall structure was located slightly above the new bed of the stream to avoid excessive sediment deposition in the new structure and ditch. Flow

is directed across the entrance to the structure to sweep away debris. The new gate had to be custom ordered, which caused a delay in completion of the structure. However, the gate was eventually delivered and installed.

Detailed design of the concrete structure was completed by the US Bureau of Reclamation (see Attachment 1). Construction oversight and quality assurance of the concrete structure were completed by others, and are beyond the scope of the river design construction contract and of this document.

Rock Materials Specs and Test Results

The rock used for the project came from a nearby slope, and was trucked to the site. The rock met the size requirements shown in Table 1.

Table 1. Rock Sizing Parameters

Parameter	Value
Computed D30, ft	1.45
Specific Weight, pcf	165
Layer Thickness, ft	3
Selected Minimum D30, ft	1.46
Selected Minimum D90, ft	2.12

The rock used on the project was tested on August 1, 2008, by RB&G Engineering, Inc. (Provo, Utah), to ensure it met the minimum requirements. Acceptable limits and rock test results are shown in Table 2.

Table 2. Rock Material Specifications and Test Results

Test Type	Acceptable Limit	Test Results
Bulk Specific Gravity	2.3 Minimum	2.373
Absorption	5% Maximum	1.90%
Sodium Sulfate Soundness	12% Maximum	2.7%
Los Angeles Abrasion	45% Maximum	37.8%

Summary

The new diversion was completed in a timely manner, and all activities related to construction went essentially as planned. The structure has been functioning as designed, since the beginning of this irrigation season. On June 8th, the Duchesne River USGS gage near Tabiona, UT (*09277500 DUCHESNE RIVER NEAR TABIONA, UT*) recorded a

provisional daily mean streamflow of 1,070 cfs. No damage to the structure or surrounding area was noted as a result of this snowmelt peak discharge. In summary, the structure appears to be working well and delivering irrigation water as intended.

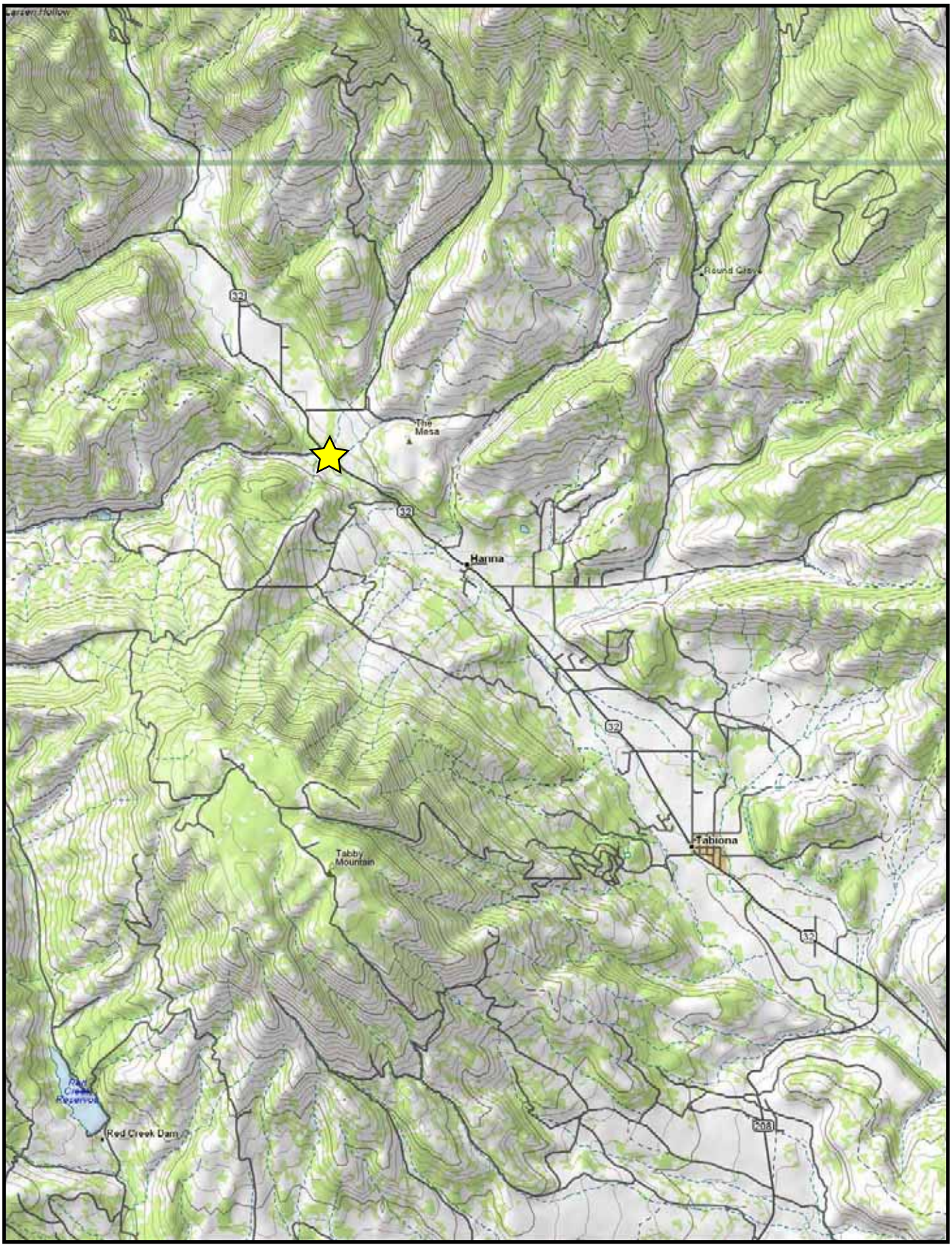


Figure 1. Map of the area near Hanna and Tabiona, Utah, showing the approximate location of the completed work at the Turnbow Diversion (Star). Map scale: 1 inch = approx. 1.68 miles.

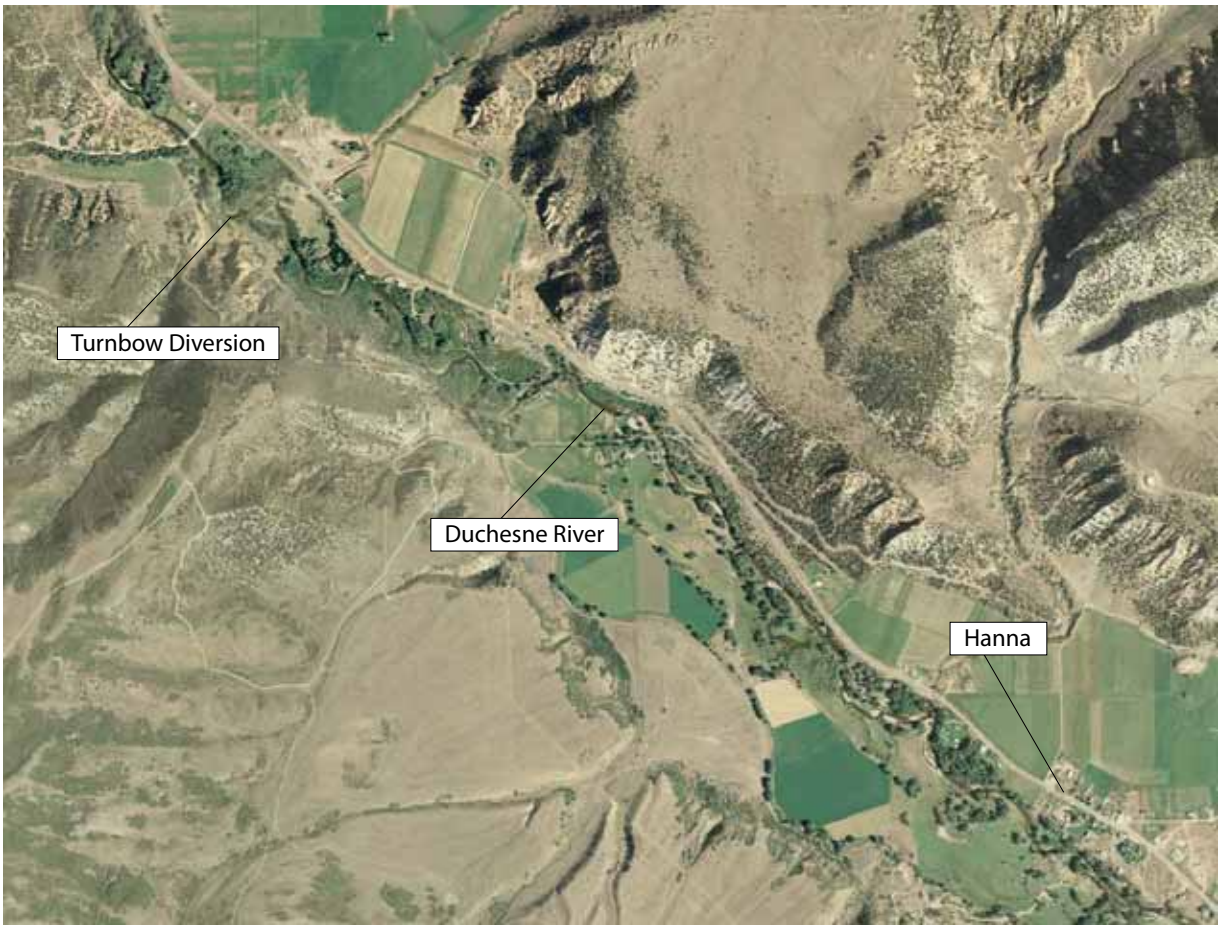


Figure 2. Aerial image of the Duchesne River upstream of the town of Hanna, Utah, showing the location of the Turnbow irrigation diversion.

Figure 3. Aerial image of the pre-project condition of the Duchesne River at the Turnbow Diversion, showing the long angled sill and the location of the headwall.

Figure 4. Photograph of the pre-project sill and headwall at the Turnbow Diversion, taken from cliffs on river right, looking downstream.

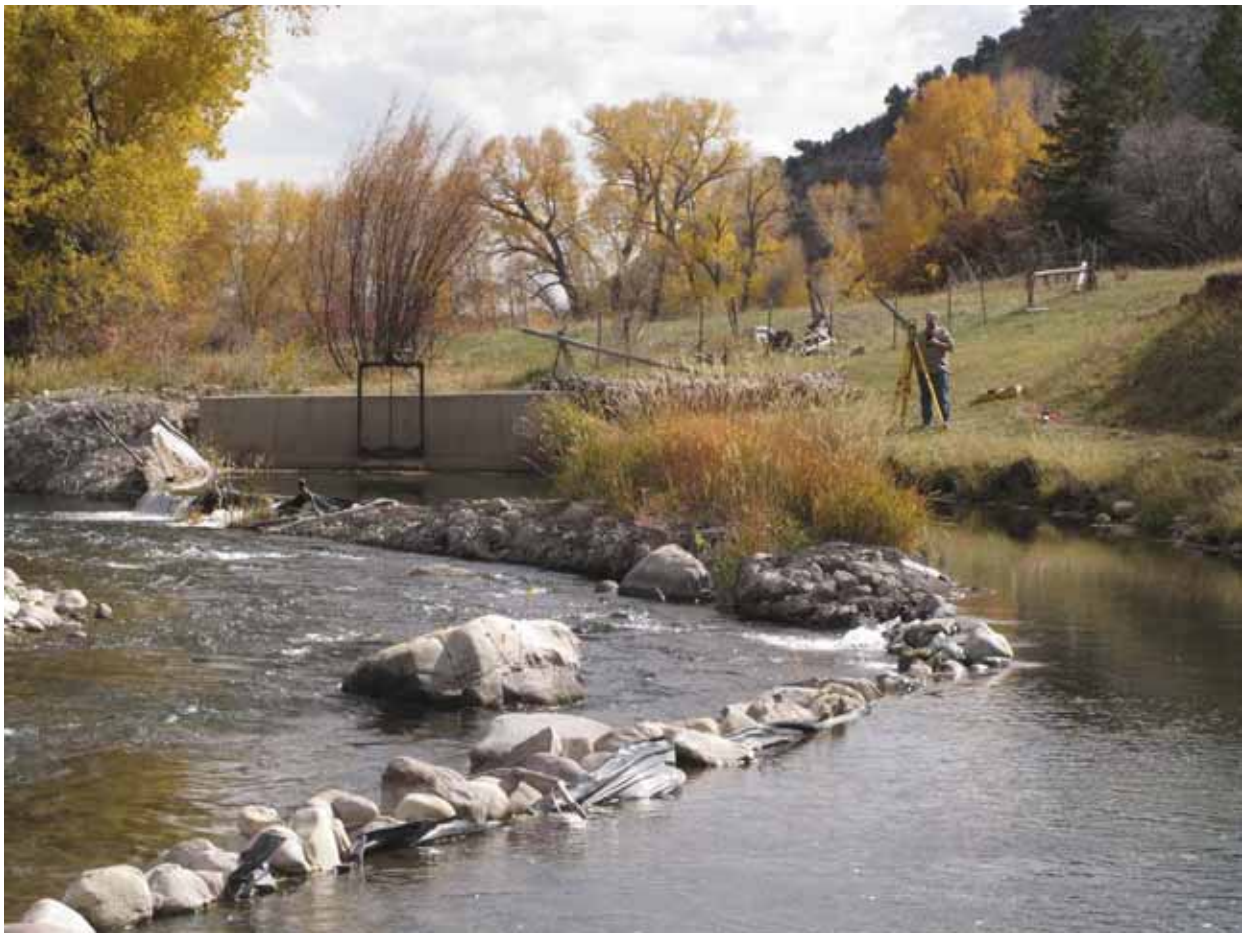


Figure 5. Photograph of the pre-project sill and headwall at the Turnbow Diversion, showing plastic and other debris in the sill.

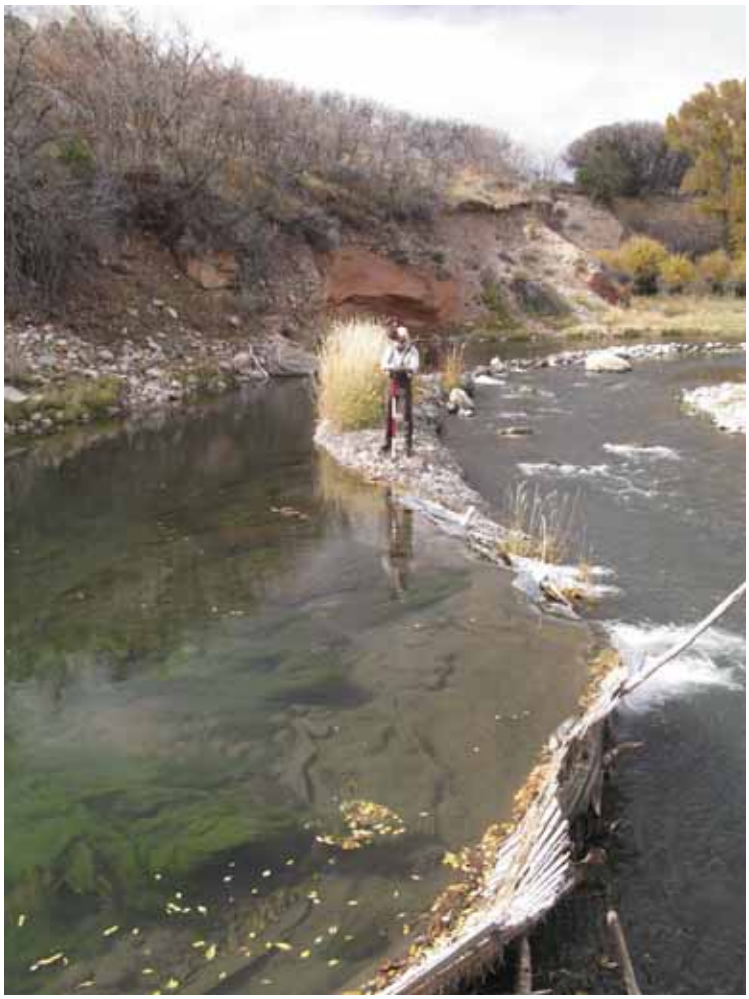


Figure 6. Photograph of the pre-project sill at the Turnbow Diversion, showing miscellaneous debris used in the sill.

Figure 7. Photograph of the pre-project headwall and gabions at the Turnbow Diversion.

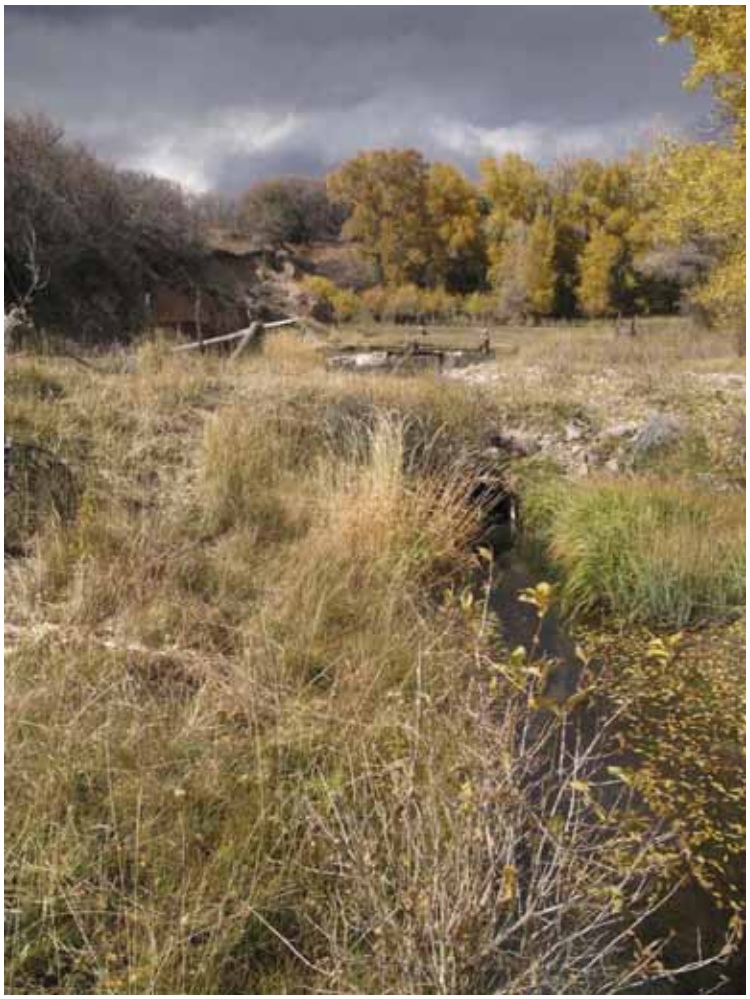


Figure 8. Photograph of the pre-project exit culvert and ditch at the Turnbow Diversion, looking upstream.

Figure 9. Completed action elements to rebuild the Turnbow Diversion.

Figure 10. Photograph of newly-constructed riffle below the Turnbow Diversion. The riffle was constructed to have a natural form that does not promote erosion near the structure, and allows fish movement. This image was taken looking upstream. The new structure is visible near the center of the photo.

Figure 11. Photograph of the newly-constructed bank and rock protection downstream of the new structure. This photo also shows the constructed riffle at a somewhat higher discharge than is shown in Figure 10.

Figure 12. Photograph of the diversion area following construction: showing the concrete structure, the bank that divides the river channel from the new section of ditch, and the new riffle.

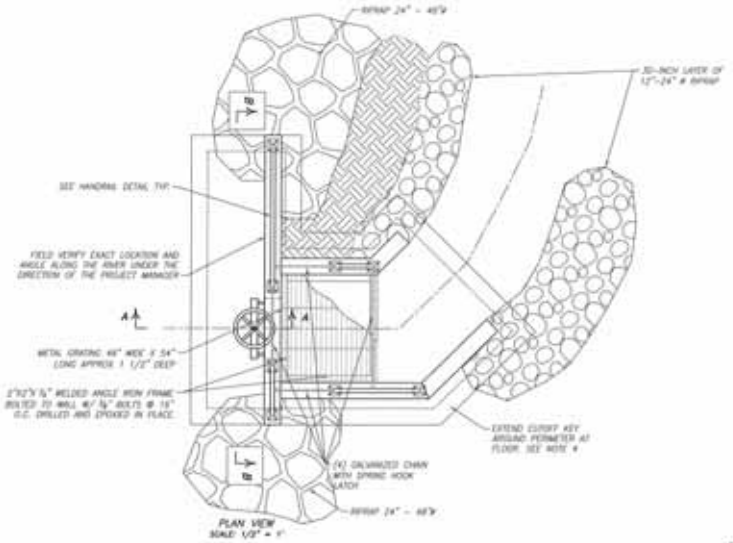
Figure 13. Photograph of the area immediately upstream of the new diversion. The new channel blends smoothly into the existing channel. Track marks from equipment were subsequently removed and the area was scarified and reseeded. The image was taken from river right, looking downstream.

Figure 14. Photograph of the new diversion, during bank construction, showing large rocks that were placed to transition between the structure and new banks. The soil behind the large rock was compacted to limit seepage, using a trackhoe and a rolling compactor.

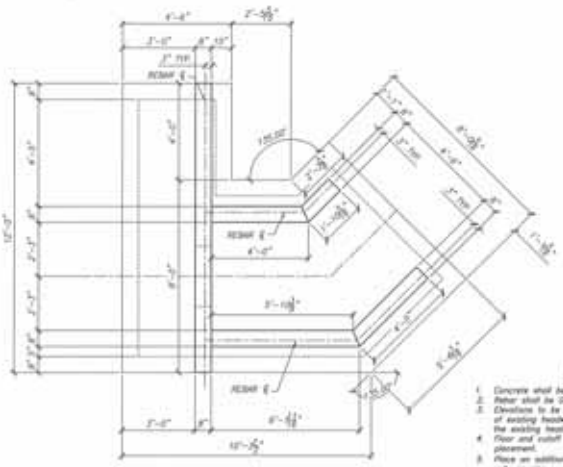
Figure 15. Photograph of the completed concrete diversion; with railings, gate, and grating installed.

ATTACHMENT 1

RECLAMATION
Managing Water in the West



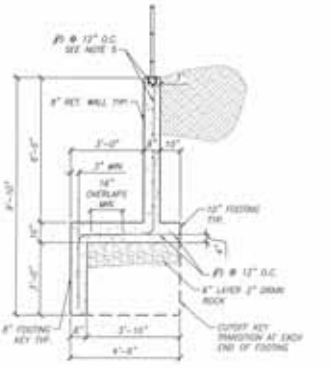
PLAN VIEW
SCALE: 1/2" = 1'



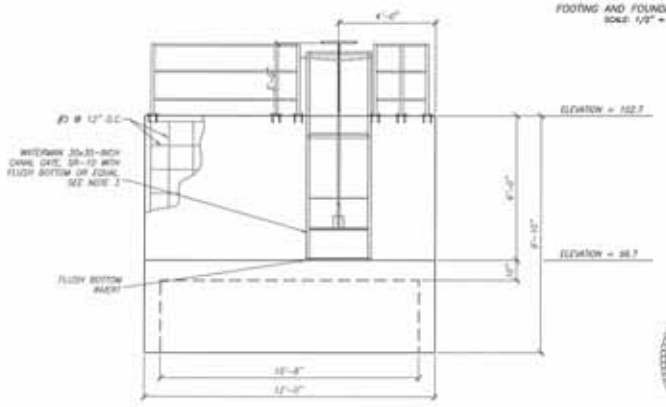
FOOTING AND FOUNDATION PLAN
SCALE: 1/2" = 1'

NOTES

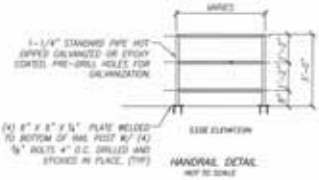
1. Concrete shall be 4,000 psi min. 28-day strength
2. Rebar shall be Grade 60.
3. Elevations to be referenced from top right corner of existing headwall, elevation 102.53, when facing the existing headwall from the river.
4. Floor and cutoff concrete shall be a monolithic placement.
5. Place an additional #5 bar around perimeter of gate opening.



TYPICAL CONCRETE W/ REBAR SECTION
NOT TO SCALE



SECTION B-B INLET STRUCTURE
NOT TO SCALE



HANDRAIL DETAIL
NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER
No. 343863-2202
SCOTT M. WINTERTON
STATE OF UTAH
9/23/09

ALWAYS THINK SAFETY

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
UPPER COLORADO REGION
PROVO, UTAH

DUCHESNE RIVER

RAINBOW DIVERSION STRUCTURE

PLAN AND SECTIONS

DESIGNED ..... CHECKED .....
DRAWN ..... TRACE WIDTH ..... SCALE AS NOTED
APPROVED .....
DATE .....

DRAWING NO. ..... SHEET 1 OF 1

ATTACHMENT 1