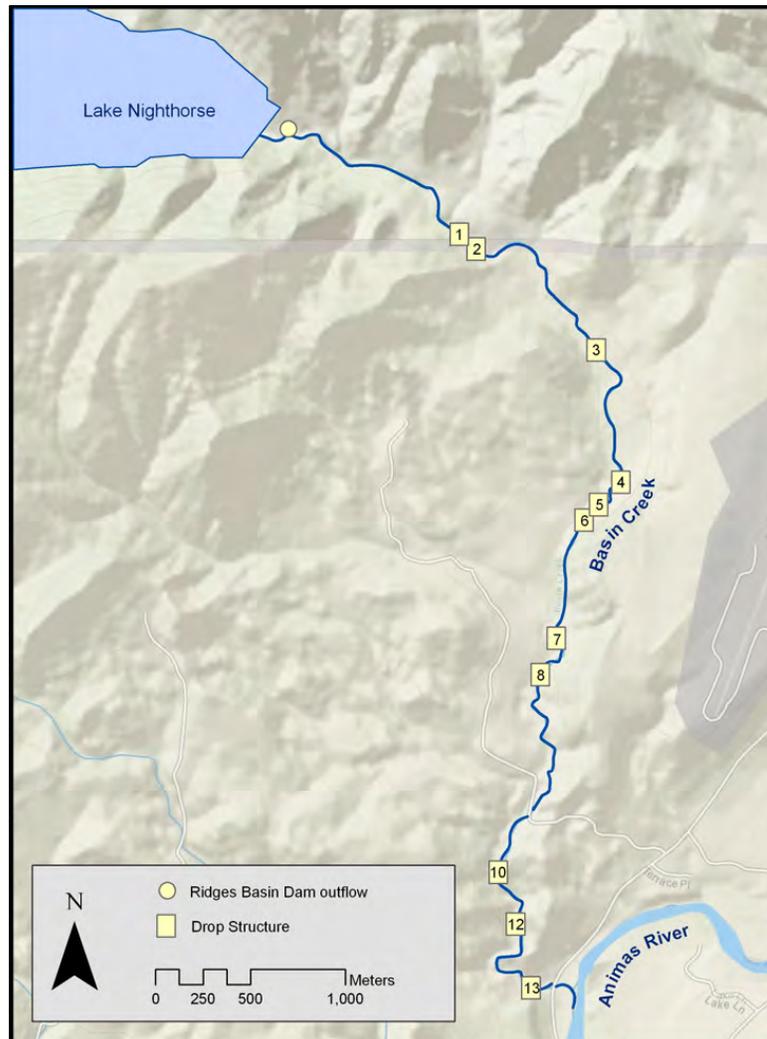


TRIP REPORT OF SITE VISITS TO BASIN CREEK, DURANGO, COLORADO  
12 MAY 2014 AND 9-10 JULY 2014



SUBMITTED BY  
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**Introduction:** A monitoring protocol needed to be developed for the outflow of Ridges Basin Dam to determine if the escapement of fish, fish larvae, and fish eggs from Lake Nighthorse into the Animas River via Basin Creek is occurring. Two visits to Basin Creek and Ridges Basin Dam were conducted by American Southwest Ichthyological Researchers, LLC (ASIR) to assess the feasibility of designing a monitoring protocol. The initial site visit was made on 12 May 2014. This site visit was made during a period when there was no release from Lake Nighthorse. The second site visit was conducted on 9-10 July 2014 during a test release from Lake Nighthorse into Basin Creek so assessment of aquatic habitats could be made during and immediately after the release of water.

**12 May 2014 Site Visit:** The initial visit to Basin Creek and Lake Nighthorse/Ridges Basin Dam was conducted during a period when there was no release from Lake Nighthorse. Beginning at the downstream most point of the study area, confluence of Basin Creek and the Animas River, each drop structure was visited and visually surveyed up to the outlet works of Ridges Basin Dam. All 11 drop structures in the study area were visited (Figure 1). Each of the drop structures downstream of Drop Structure 6 contained pools of water that apparently originated from a seep at Drop Structure 6 (Figure 2-5). The drop structure pools were connected by a small shallow stream of water. Upstream of Drop Structure 6, Basin Creek was dry until immediately below the outlet works of Ridges Basin Dam. At that site, seepage from dam drains and water leaking from the emergency valve contributed to the wetted area immediately downstream of the concrete dissipation structure (Figure 6 and 7).

From the 12 May 2014 site visit it was determined that, due to the connectivity of the lower portion of Basin Creek and the Animas River, any potential monitoring site(s) would have to be located upstream of Drop Structure 6. While the flow connecting the drop structure pools was minimal and the grouted drop structures appeared to act as a fish barrier, the pools formed at the base of each drop structure were large enough to maintain a wetted area and act as suitable fish habitat for a long duration. Fishes from the Animas River maybe able to access these pools during periods of operational releases from Ridges Basin Dam and persist in them long after releases from the dam ceased.

**9-10 July 2014 Site Visit:** During the second visit to Basin Creek and Ridges Basin Dam water was released from the dam for a duration of approximately 26 hours. A release of 70 cubic feet per second (cfs) was initiated on 9 July 2014 at 08:07 hours and lasted for about 5.5 hours (Figure 8). The purpose of the higher initial flow was to flush the channel within Basin Creek and saturate the subsurface soil. The period of release at 70 cfs was extended for a longer duration than initially expected (approximately 1.5 hours) due to the amount of time it took for the water to pass through all the drop structures and saturate the subsurface soils. By 1400 hours on 9 July 2014 discharge from the dam was reduced to 30 cfs which was a typical release from the dam for water delivery purposes. The discharge of 30 cfs was maintained until 10:06 hours on 10 July 2014 (20 hours).

Drop Structures 13, and 1-8 were visually observed at 70 cfs discharge on 9 July 2014. During these flushing releases the water was turbid and carried a significant amount of suspended woody and particulate debris. At 70 cfs water backed-up into several off channel washes creating low velocity habitats. These off channel backwaters were observed immediately below the concrete dissipation structure at the dam outlet, upstream of Drop Structure 1 (about 0.32 miles downstream of the concrete water-energy dissipation structure), downstream of Drop Structures 2 and 3, upstream of Drop Structure 4 and between Drop Structures 6 and 7. When flows were reduced to 30 cfs the only notable off channel habitat that remained were the backwater formed immediately below the concrete water-energy dissipation structure at the dam outlet and in a drain on river left immediately upstream of Drop Structure 4 (Figures 9-13). Also observed during the release at 70 cfs was a waterfall that formed downstream of Drop Structure 8 (directly across from the USBR access gate). The spill over the falls was at least 2 m high and the base of the falls was deeply undercut. The waterfall appeared to pose a barrier to upstream fish movement (Figure 14).

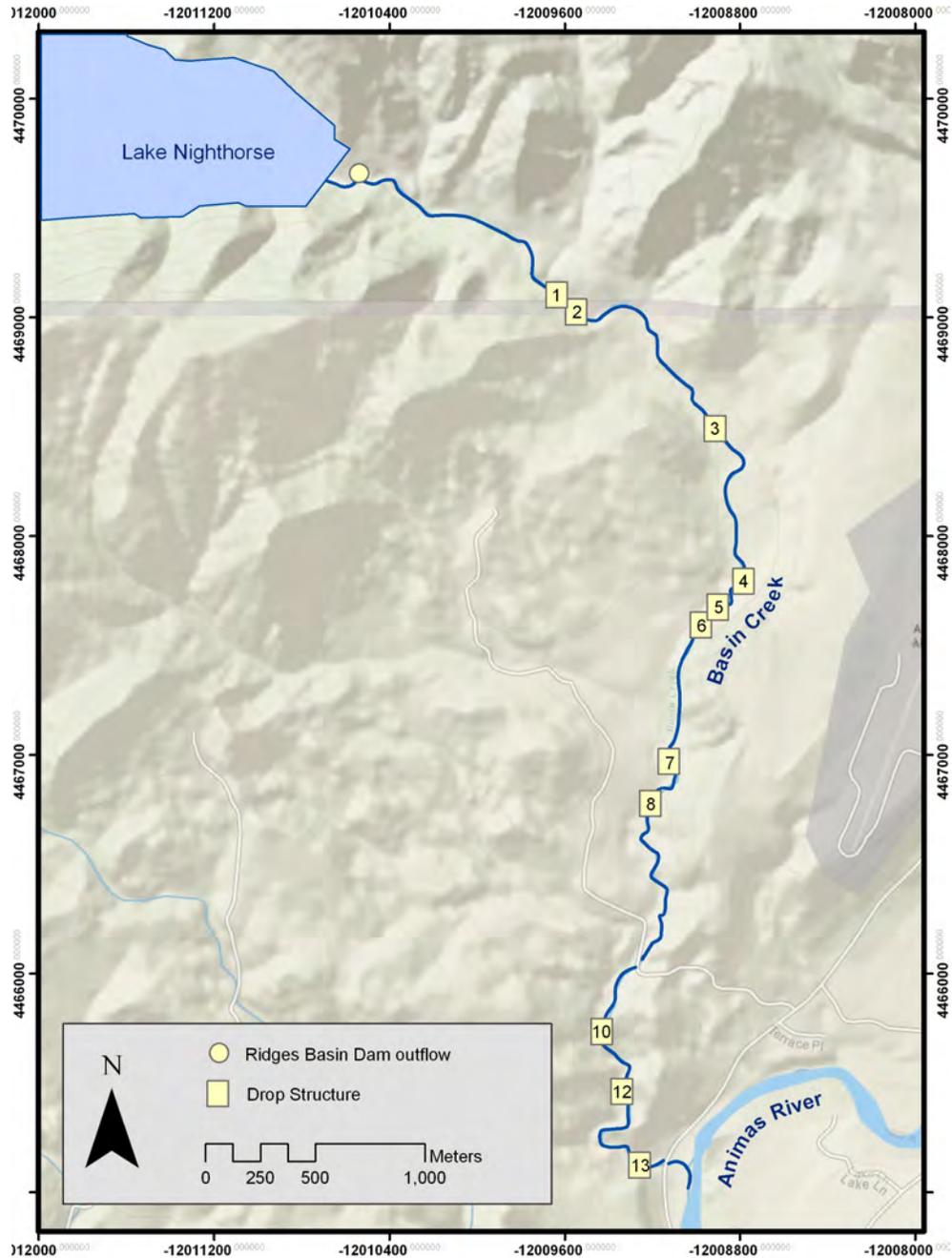


Figure 1. Lake Nighthorse and Basin Creek study area with the locations and numbers of the Drop Structures indicated. (Drop Structures 9 and 11 were not constructed).

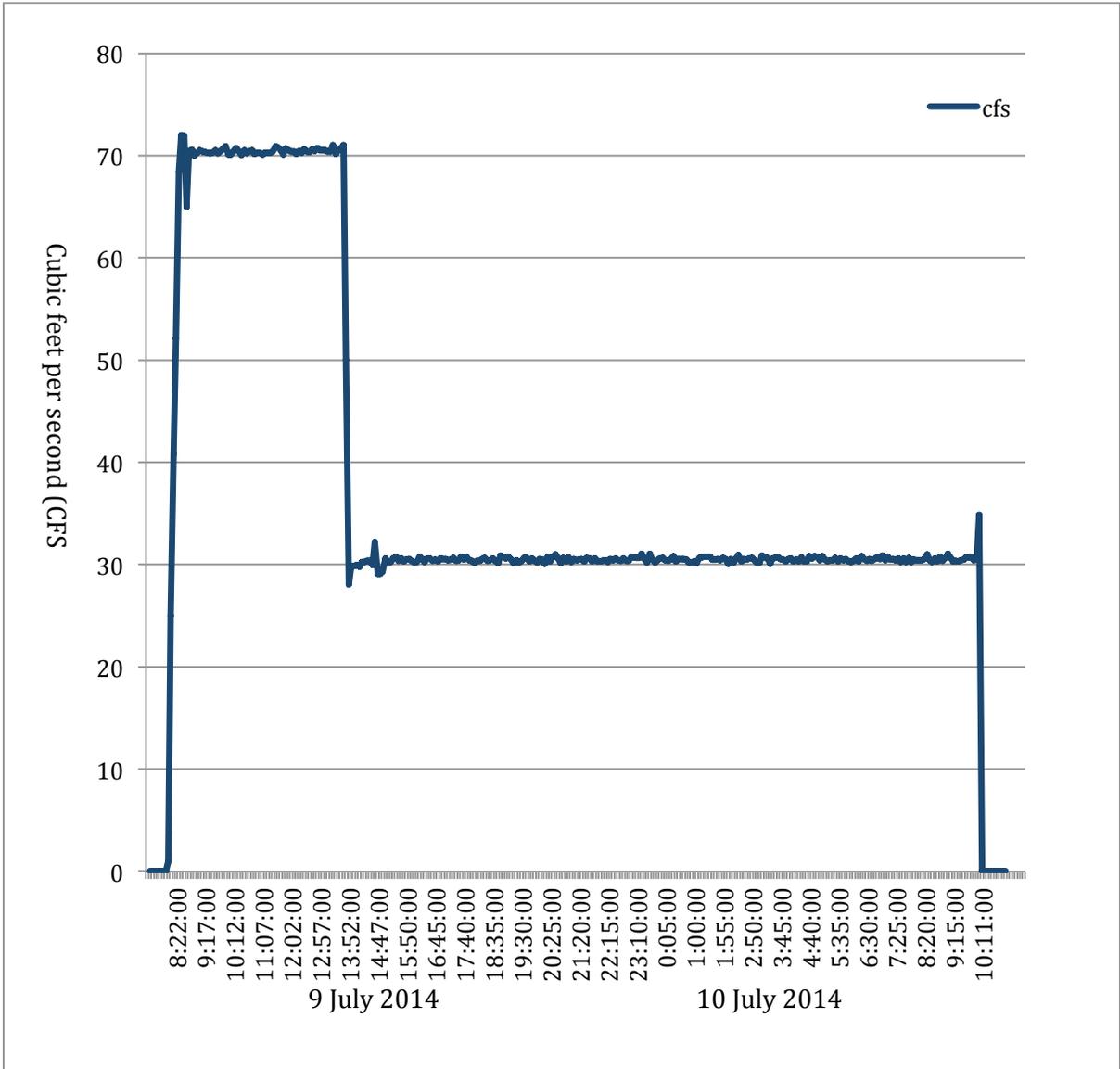


Figure 8. Hydrograph of the 9-10 July 2014 test release at Ridges Basin Dam (provided by Robert Waldman, USBR, Durango).



Figure 9. Backwater formed to the right of the concrete dissipation structure.



Figure 10. Backwater habitat formed immediately downstream dissipation structure.



Figure 11. Backwater formed above Drop Structure 4 at 70 cfs



Figure 12. Mouth of backwater formed above Drop Structure 4 at 30 cfs.



Figure 13. Terminal portion of backwater at 30 cfs.



Figure 14. Waterfall formed downstream of Drop Structure 8.

As discharge stabilized at 30 cfs water clarity increased significantly. The outlet of Ridges Basin Dam and Drop Structures 1-4 were assessed at 30 cfs and again 3 hours after flows from Lake Nighthorse were terminated. During the 30 cfs release, large pools were formed in the drop structures downstream of the grouted drop structures forming low velocity habitats.

During the visual survey three hours after the release had been terminated, above Drop Structure 6, numerous pools had formed at the base of the drop structures as well as in the bend pools in Basin Creek (Figure 15). While these pools had lower velocities than during the release at 30 cfs, water continued to drain reducing the size of the pools while still allowing for downstream movement of aquatic organisms if present. Water continued to drain from Basin Creek after 1700 hours 10 July 2014.

The outlet of Ridges Basin Dam retained water after the release had terminated in the concrete dissipation structure downstream of the outlet and in a small portion of Basin Creek including the backwater that is formed in the drainage channel from the dam itself. The outlet of Ridges Basin Dam has been modified with a temporary wooden wall suitable for setting up five plankton nets. This design was previously used to assess passage of fish from the reservoir to Basin Creek. It is capable of sampling the entire outflow of each release thereby providing a precise determination of escapement from the reservoir (Figure 16).

Drop structures, versus the main channel or off channel pools, appeared to hold the greatest volume of low velocity pool habitat after the release was terminated. Of the available pool habitat upstream of Drop Structure 6, Drop Structures 1-4 had the largest surface area of pool habitat type. The drop structures varied in wetted area, draining rates, and water retention times. Drop Structures 1 and 2 had the smallest pools and tended to drain fastest with the least amount of low velocity habitat (Figure 17 and 18). Drop Structure 3 held the second greatest volume of water after the release was terminated and low velocity habitats were formed on either side of a berm bisecting the 20 meter wide pool (Figure 19). Drop Structure 4 held the largest volume of water of all the drop structures upstream of Drop Structure 6 (Figure 20) as a large pool formed in its settling basin. The pool at Drop Structure 4 was still draining water seven hours after the termination of the release and 28 hours after the release (14:00 hours 11 July 2014) a large isolated pool remained (Robert Waldman, USBR, Durango, personal communication; Figure 21). Drop Structure 5 had negligible retention of water and low velocity habitat was minimal.

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**Conclusions:**

The following observations were apparent after the two site visits to Ridges Basin and Basin Creek:

- ◆ The aquatic habitat located directly below the concrete water energy dissipation structure at the outfall of the dam appears permanent.
- ◆ When there is no release from Lake Nighthorse, Basin Creek is dry from about 0.25 mile downstream of concrete water-energy dissipation structure (Figure 7) to a point upstream of Drop Structure 6.
- ◆ Even when there is no release from Lake Nighthorse, Basin Creek holds water from Drop Structure 6 downstream to Drop Structure 13.
- ◆ Upon cessation of discharge from the reservoir, of the drop structure pools upstream of Drop Structure 6, Drop Structure 4 provides the largest area of low velocity habitat and retains water in its settling pool long after the release has ceased.



(a)



(b)

Figure 15. Remnant bend pools formed about four hours after termination of the 30 cfs release. Bend pools were draining downstream and were not isolated. Bend pools (a) and (b) located upstream of Drop Structure 1.



(a)



(b)

Figure 16. Outlet of Ridges Basin Dam: (a) release from Lake Nighthorse at 30 cfs (9 July 2014) and (b) termination of the release (10 July 2014). Note the temporary structure in place downstream of the release gate where plankton nets were previously set to sample escapement of fish from Lake Nighthorse.



(a)



(b)



(c)



(d)

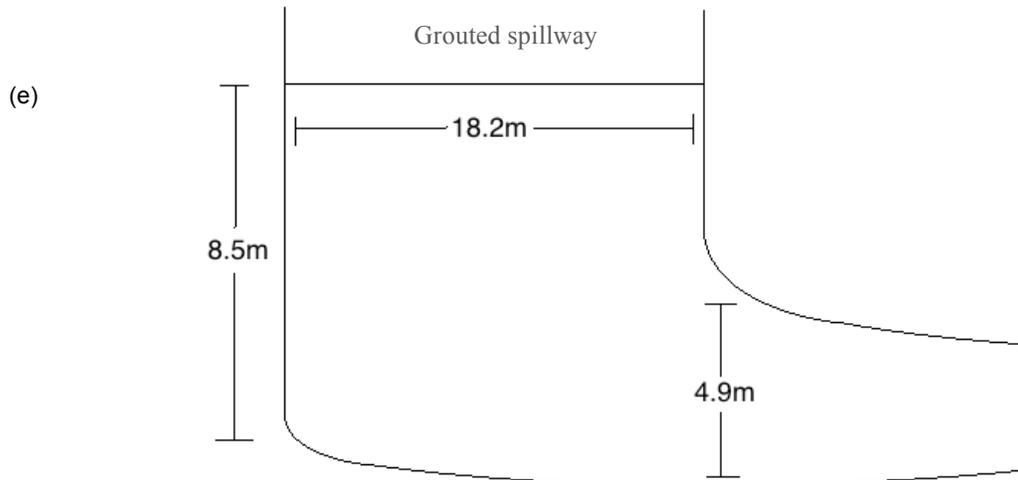


Figure 17. Drop Structure 1: Photographs (a) and (b) at the 30 cfs release, photographs (c) and (d) three hours after termination of release. Diagram (e) wetted area of Drop Structure 1 at 30 cfs release.



(a)



(b)



(c)



(d)

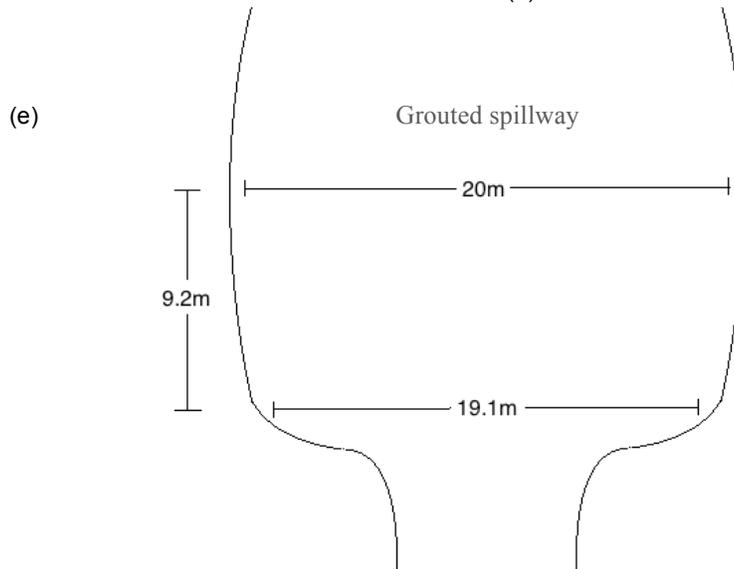


Figure 18. Drop Structure 2: Photographs (a) and (b) at the 30 cfs release, photographs (c) and (d) three hours after termination of release. Diagram (e) wetted area of Drop Structure 2 at 30 cfs release.



(a)



(b)



(c)



(d)

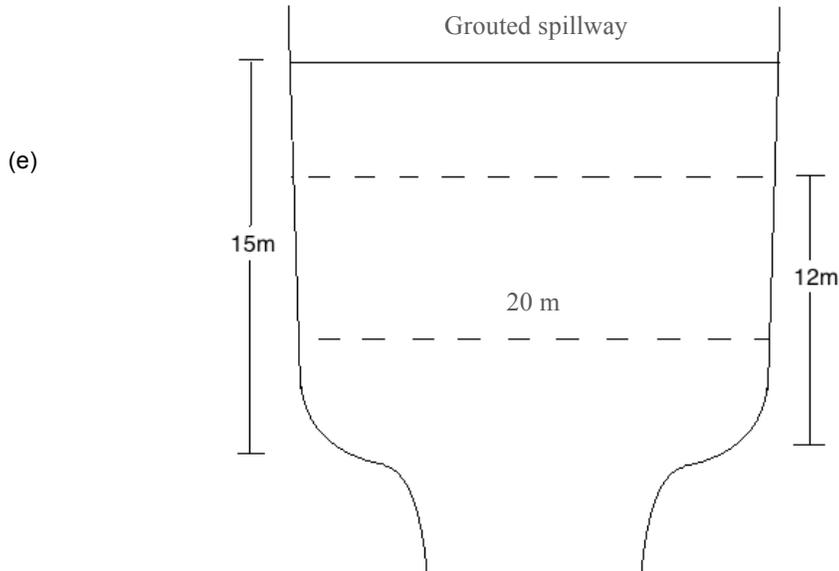


Figure 19. Drop Structure 3: Photographs (a) and (b) at 30 cfs release, photographs (c) and (d) three hours after termination of release. Diagram (e) wetted area of Drop Structure 3 at 30 cfs release.



(a)



(b)



(c)



(d)

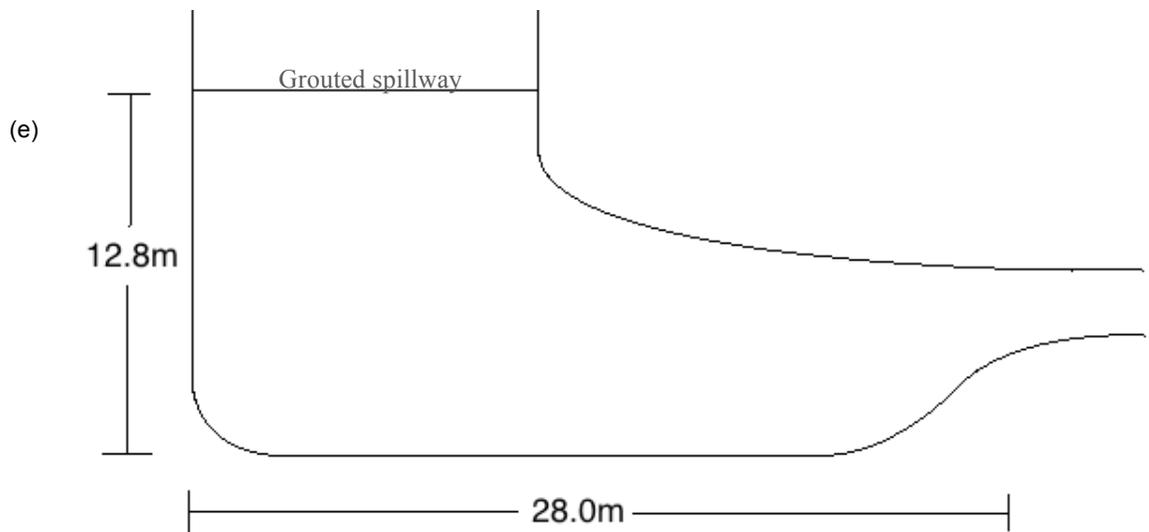


Figure 20. Drop Structure 4: Photographs (a), (b), (c), and (d) at the 30 cfs release. Diagram (e) wetted area of Drop Structure 4 at 30 cfs release.



(a)



(a)



(b)



(b)



(c)



(c)

Figure 21. Drop Structure 4 after termination of release. Photographs (a) four hours after termination of release, (b) seven hours after termination of release, and (c) 28 hours after termination of release. Photographs (b) and (c) provided by Robert Waldman (USBR, Durango).

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### **Acknowledgements:**

The Southern Ute Indian Tribe (Tribal Council Headquarters in Ignacio, Colorado, Current Chairman Clement Frost) graciously allowed access to their sovereign property for site visits to Basin Creek and Lake Nighthorse. In addition, we allowed to obtain photographic records of Basin Creek Drop Structures located on permitted Southern Ute Indian Reservation. Steve Whiteman, Wildlife Division Head at the Southern Ute Indian Tribe was the tribal liaison for permits and our colleague Ben Zimmerman (Fisheries Biologist, Southern Ute Indian Tribe) assisted with the initial visit.

Robert Waldman (USBR, Durango Office) provided a detailed tour, history, and operations of Ridges Basin Dam and Lake Nighthorse and providing access and photographs of Basin Creek during both site visits. Brent Uilenberg (USBR) coordinated site visits, conference calls and the reservoir release for these two trips. Ed Warner (USBR), Tyler Artichoker (USBR), and Ryan Christianson (USBR) coordinated dam operations for the 9-10 July 2014 release and were available to answer questions pertaining to the dam and its operations. Jim White (Colorado Division of Parks and Wildlife) participated in both trips and provided information pertaining to their ongoing fish sampling efforts in Lake Nighthorse. Sharron Whitmore (U.S. Fish and Wildlife Service, San Juan River Basin Recovery Implementation Program) accompanied us on the 9-10 July 2014 trip and provided background information.

Dale Ryden (U.S. Fish and Wildlife Service, Region 6, Grand Junction, Colorado) and David Campbell (U.S. Fish and Wildlife Service, Region 2, San Juan River Basin Recovery Implementation Program) provided information on the Biological Opinion pertaining to non-native fish escapement from Lake Nighthorse that the U.S. Fish and Wildlife Service (Region 2) had officially reviewed and commented upon.