RECLAMATION

Managing Water in the West

TR-2011-05

Travel to Visit Central Arizona Project, Parker Dam, and Hoover Dam

Dates of Travel: August 2-4, 2011

U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Hydraulic Investigations and Laboratory Services Group
Denver, Colorado

August 2011

BUREAU OF RECLAMATION
Technical Service Center
Denver, Colorado

TRAVEL REPORT

Code: 86-68460 Date: August 16, 2011

To: Manager, Hydraulic Investigations and Laboratory Services Group

From: Joshua D. Mortensen & Bryan J. Heiner

Subject: Travel to visit Central Arizona Project, Parker Dam, and Hoover Dam

Travel period: 2 Aug. 2011 – 4 Aug. 2011

2. Places or offices visited: Central Arizona Project, Parker Dam, Headgate Rock Dam, and Hoover Dam

3. Purpose of trip: Improve understanding of invasive mussel control applications and challenges of various facilities along the Lower Colorado River and Central Arizona Project. Knowledge gained at field facilities is important to enhance the effectiveness of invasive mussel research activities currently being conducted in Reclamation's Hydraulics Laboratory in Denver, Colorado.

4. Synopsis of trip:

CAP: Josh Mortensen and Bryan Heiner traveled by air to Phoenix, AZ on the morning of August 2, 2011. They then rented a car and met Dan Young at headquarters of the Central Arizona Project (CAP). They followed Dan by car to the Hassayampa pumping plant where he showed them several features of the facility including the trash racks and rake system, the cooling water system, and several components of the pumping system. One of the main challenges faced by downstream pumping facilities on the CAP is debris (mainly tumble weeds) blown into the canal which causes a head differential across the trash racks. Very few mussels are found in CAP facilities downstream of the Mark Wilmer intake pumping plant. Dan pointed out that several ultrasonic depth sensors are being tested to be integrated into an automated alarm system when the differential across the trash racks is too high. This work stemmed from a failure of two trash racks at the Hassayampa plant. Josh and Bryan then followed Dan by car to the Little Harquahala pumping plant upstream, which is of the same design as the Hassayampa facility. There they witnessed a demonstration run of the trash rake system which lowers the rake all the way down the trash racks which are about 20 feet deep and then brings the trash above the water surface where it is unloaded (Figure 1). Video recordings and photographs of each facility were obtained for future reference and documentation.

Figure 1 – Trash rake being raised by cable at the Little Harquahala pumping plant on the CAP. Trash racks and raking systems are of similar design for all of CAP pumping facilities.

The Mark Wilmer intake pumping plant was the last stop on the CAP. While an abundance of Quagga mussels are found at this facility, aquatic debris loading continues to be the biggest challenge (Figure 2). To date, mussels have not created noticeable head loss through the trash rack until aquatic debris is present. Aquatic weeds from Lake Havasu come into the forebay in large quantities and adhere to the mussel covered trash rack which causes head differential across the trash racks. It is believed that without the presence of mussels many of the weeds would pass through the trash rack and head loss would not accumulate as quickly. A boat style weed harvester is manned twenty-four hours a day to gather the weeds upstream of the forebay. For the cooling system, strainers are used to capture mussel debris. So far colonization within the cooling lines and other small piping systems has not caused problems. Following the visit to Mark Wilmer, Josh and Bryan stayed the night in Lake Havasu City.

Figure 2 - A small pile of aquatic debris removed from the trash rack structure at the inlet to Mark Wilmer Pumping Plant.

Parker Dam: The morning of August 3rd Josh and Bryan met Leonard Willett in Lake Havasu City and traveled together to Parker Dam. First, they looked at the trash racks upstream of the forebay which are about 60 feet deep (Figure 3). A raking system is being investigated for future installation on this trash rack since heavy aquatic debris loads are a concern. The design and installation of a trash raking system may be challenging for this site due to the large depths and high velocities seen through the trash racks.

Once inside the facility, John Steffen met the group and showed them various systems within the facility. Mussel colonization within the cooling and fire suppression systems has been a challenge. Fine mesh filters, air cooling systems, and frequent flushing of the fire suppression system have helped keep all the systems working. John mentioned that ideas such as reducing the number of sharp turned fittings in the cooling lines, designing and installing more air cooling systems, and using treated domestic water for fire suppression systems would likely help minimize problems caused by mussels.

Figure 3 – Section of trash rack on the forebay of Parker Dam. A trash raking system is currently being planned for this trash rack in the near future.

Headgate Rock Dam: Josh, Bryan, and Leonard then traveled downstream to look at the trash rake used at Headgate Rock Dam. Again, Quagga mussels were present on the trash racks but aquatic weed debris has been the main challenge. Due to high velocities through the trash rack, weights were mounted on the backside of the rake to keep it balanced in the flow (Figure 4). Operators commented that once balanced the rake seemed to work well.

Figure 4 – Trash rake at Headgate Rock Dam. Weights were added to the back side of the rake to keep it balanced against high velocities through the trash racks.

Hoover Dam: After staying the night in Henderson, Nevada, Josh and Bryan met Leonard at Hoover Dam at about 9:00 the morning of Thursday, August 4th. Leonard showed them various components of the facility including the 30 ft diameter penstocks, the cooling system (Figure 4) of the turbines, generators, and transformers, and sections of the fire suppression system. Hoover's complex cooling system draws water from upstream off the penstocks as well as the tailbay downstream. Mussel debris that breaks off of the upstream trash racks and penstocks clog many portions of the cooling system, especially as pipe size is reduced. One unit's cooling system was set up to temporarily pump all the water from the tailbay through a strainer which is showing promising results for reducing debris clogging, allowing operating temperatures to remain within the acceptable range. Fire system pipes are at risk as they are easily clogged with mussel debris and colonization. While reducing colonization of mussels within the piping systems would help, it appeared that Hoover's greatest challenge is dealing with debris from dead mussel shells.

Leonard also showed Josh and Bryan the jet valves used when dewatering the penstocks as well as the wicket gates on the Arizona turbines. After meeting with Leonard time allowed Josh and Bryan to take a public historical tour of Hoover Dam. At about 4:00 pm they departed to the airport to return to Denver.

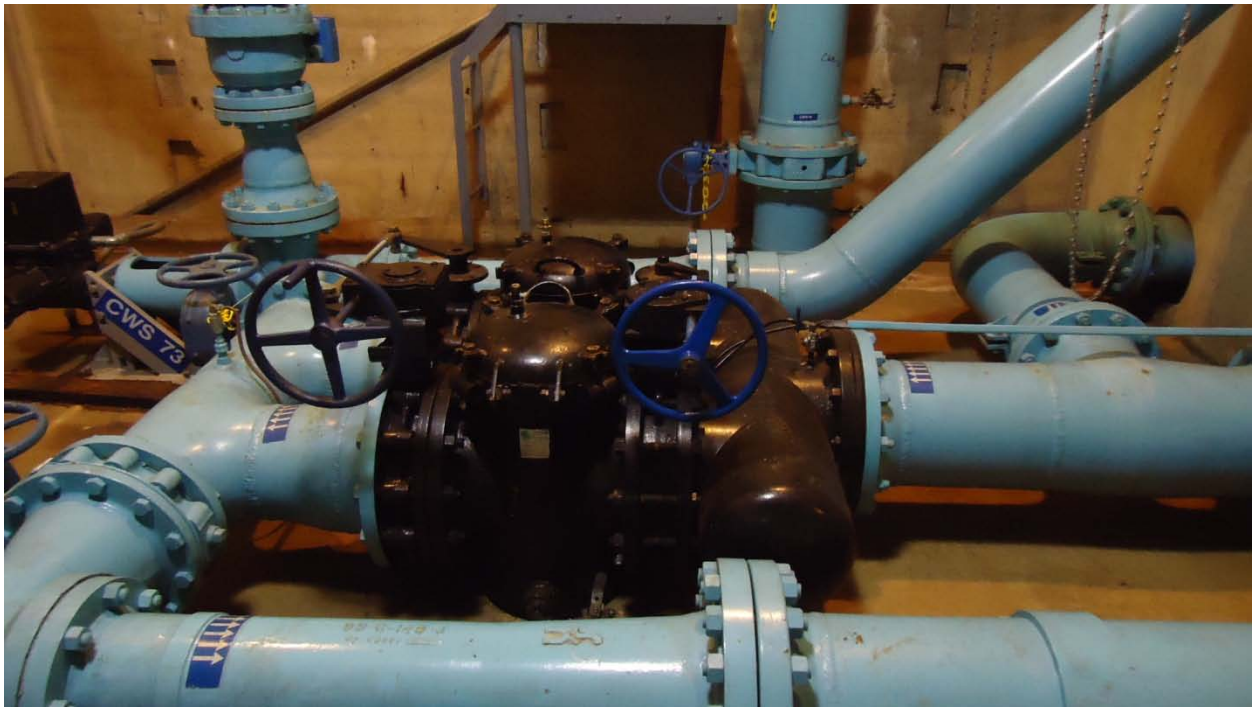

Figure 5 – Part of the cooling water system coming off the penstocks at Hoover Dam. A portion of the cooling water is also drawn from the tailbay.

5. Conclusions: Even though each facility faces similar problems related to invasive mussels, each one has unique challenges and it is unlikely that a standardized solution will apply to all facilities with invasive mussel challenges. Additional insight was gained from each site visit and facility which will make research efforts more effective. Open communication among personnel from separate facilities as well as with researchers will be important for effective control and management of invasive mussels in the future.

6. Action correspondence initiated or required: None

7. Client feedback received: None

cc:
Leonard Willett (LCD-8200)
Dan Young (Central Arizona Project)
John Steffen (LCD-P10)
Joseph Kubitschek (86-68460)

SIGNATURES AND SURNAMES FOR:

Travel to: Central Arizona Project, Parker Dam, and Hoover Dam

Date or Dates of Travel: 2 Aug. 2011 – 4 Aug. 2011

Names and Codes of Travelers: Joshua D. Mortensen & Bryan J. Heiner – 86-68460

Travelers

Joshua D Mortensen
Signature

10 August 2011
Date

B Heiner
Signature

10 August 2011
Date

Noted and Dated by:

Robert F. Enholly
Signature

Manager, 86-68460
Title

8/15/11
Date