RECLAMATION

Managing Water in the West

TR-2012-02

Site Visit to Mirage Flats Irrigation District

Dates of Travel: February 23-25, 2012

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

BUREAU OF RECLAMATION
TECHNICAL SERVICE CENTER
DENVER, COLORADO

TRAVEL REPORT

RES-3.50

Codes: 86-68460 & 86-68210 **Date**: February 1, 2012

To: Robert Einhellig
Manager, Hydraulic Investigations and Laboratory Services Group

Delbert Smith
Manager, Water Resources Planning and Operations Support Group

From: Tom Gill, Hydraulic Engineer (86-68460)
Dale Lentz, Hydraulic Engineer (86-68460)
Roger Burnett, Civil engineer (86-68210)

Subject: Site Visit to Mirage Flats Irrigation District

1. Travel period: January 23-25, 2012

2. Places or offices visited: Mirage Flats Irrigation District

3. Purpose of trip: Examine operational concerns including: sediment management at Dunlap Diversion Dam; canal seepage and associated high groundwater issues along the upper reaches of the canal system; and upgrading and expansion of the District's electronic monitoring and control system.

4. Synopsis of trip: The TSC travelers arrived at the Mirage Flats Irrigation District (MFID) office near Hay Springs NE early afternoon on Monday January 23. We met with District Manager Mel Brozek who discussed the operational items that were the object of our visit. Following our discussions at the office, Mel took us on a field trip that included stops at Dunlap Diversion Dam, at the canal stretch where seepage and high groundwater are of concern, plus a stop to view the outlet works at Box Butte Reservoir.

The following morning Jack Wergin of NKAO accompanied us to the MFID office where we again met with Mel Brozek. Discussions on Tuesday morning were primarily focused on the sediment diversion and seepage issues. Roger and Jack discussed a seepage remediation project at MFID that had been undertaken in the mid1990's which they both had been involved with. (This project was completed prior to Mel becoming employed by MFID prior to the 2010 irrigation season.)

As part of this 1990's seepage investigation, multiple ground water monitoring wells were installed and a groundwater level study was conducted over the course of an irrigation season. Following the groundwater study, a membrane liner was installed on a section of the canal just downstream from the current canal reach of interest. Locations of the groundwater monitoring wells established as part of the 1990s study included well sites in the vicinity of the current seepage problems. Some of these wells are presumed to remain intact however the adjacent landowner has indicated to Mel that he may have removed one or two of the monitoring wells. Figures 1 and 2 are photographs of the seepage problem area.

Figure 1. Center-pivot field (in background) where high ground water below the MFID canal resulted in crop damage in 2011

Figure 2. This photo of the MFID canal taken on 01/23/2012 shows patterns in the ice (arrows) that indicate the canal is functioning as a ground water interceptor at the time of the visit.

Figures 1 and 2 were taken from approximately the same location, one looking away from the MFID canal to the southwest and the other looking across the canal roughly due north. Presence of water in the MFID canal at this location when no flow has been diverted from the Niobrara River since early August, along with the seepage inflow seen in Figure 2 are evidence of the high water table in this vicinity.

A soil sample taken from the canal bank in the vicinity of the seepage showed the material to be a non plastic very fine silty sand (see figure 3).

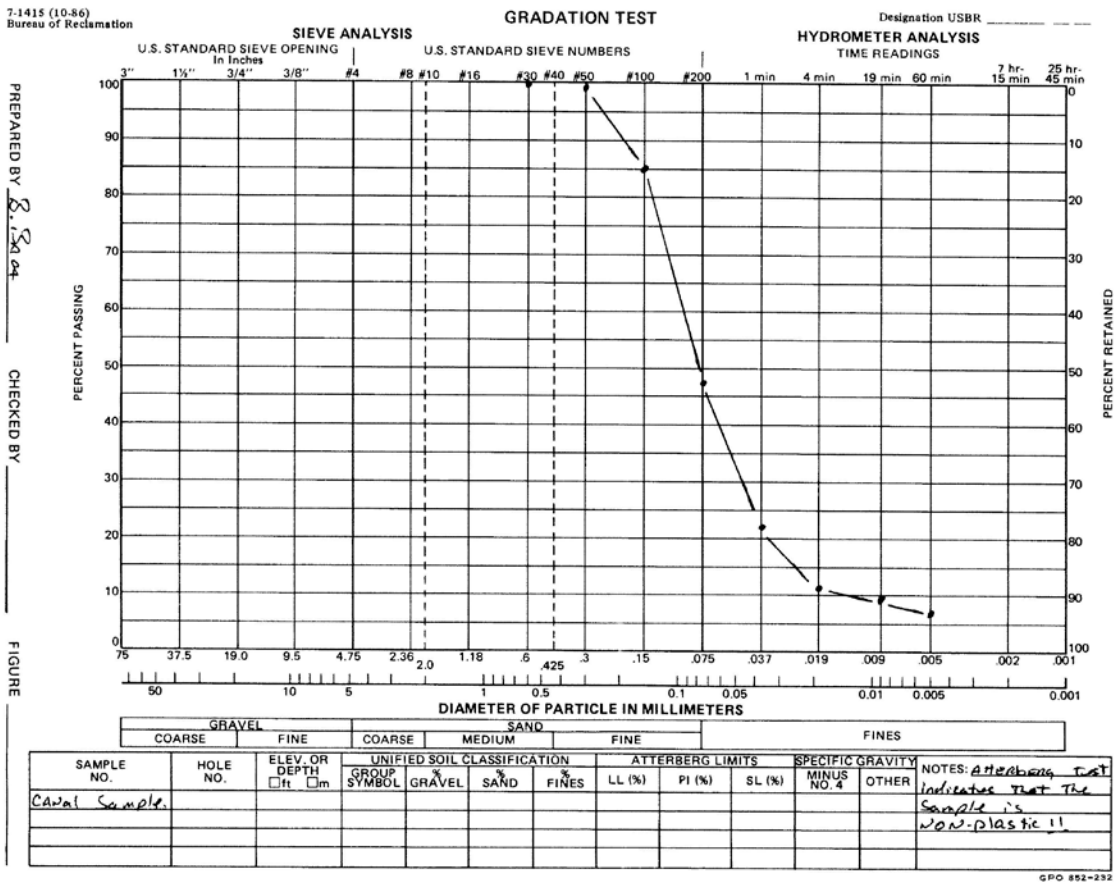

Figure 3. Gradation of a canal embankment soil sample near the worst seepage area in the upper reach of the system.

Sediments arriving at Dunlap Diversion Dam have apparently become an operational problem whether diverted into the canal or passed on downstream in the Niobrara. Diverted sediments must be dredged from the upper reaches of the canal. Mel informed the Reclamation visitors that within a few days of operation at the beginning of the 2011 delivery season, the upper canal reach that had been dredged prior to beginning deliveries in 2011 had filled in with accumulated sediments to the extent that the Parshall flume near the head of the canal was operating with excessive submergence.

An area land owner has constructed a dam that creates a pond on the Niobrara River that impounds water extending to the downstream side of Dunlap Diversion dam. In recent years of operation, ponded flow conditions downstream of the diversion dam have limited transport of sediments away from the structure on down the Niobrara River. Hence not only is MFID faced with dredging accumulated sediments from the canal, the district has also recently had to dredge sediments from the Niobrara River channel below the diversion dam. Figures 4 and 5 show the Dunlap Diversion Dam span across the Niobrara.

Figure 4. Dunlap Dam & bypass gate bay.

Figure 5. Over crest of Dunlap Dam

As presently configured, the diversion structure features a concrete overflow wall along with a radial gate to control the amount of water being passed. This radial gate in the river span of the dam is on the left side of the channel adjacent to the MFID canal heading. The canal heading is also controlled by a radial gate. Figures 6 and 7 show the canal heading and Parshall flume.

Figure 6. MFID canal heading gate bay

Figure 7. Parshall Flume below Dunlap Dam

White arrows in Figure 7 show berms of dredged sediments piled on the left bank of the canal. The blue arrow in Figure 7 shows the toe of a large pile of dredged sediments. Mel stated that he has considered installing a plank in the stop log slot in the canal heading gate bay (arrow in Figure 6). This might block diversion of the more sediment-laden flow near the bottom of the channel. NKAO and MFID have also discussed replacing the radial gate at the canal heading with an overshot to achieve the same objective. The limited available freeboard at the overflow wall crest observed at the time of the visit would suggest raising the dam crest may be necessary in order to create the additional upstream head that would be required for installing a stop-log sill or operating an overshot gate in the canal heading gate bay. The ability to increase the upstream

level may also enhance transport of sediments being passed downstream in the Niobrara away from Dunlap Dam.

During the 1990's Reclamation worked with Mirage flats in establishing remote monitoring and remote gate operating capabilities at three field sites, the Septic site, the Mirage-Fairfield split and the Sturgeon-Peters split. This system was set up to enable remote gate adjustment at each of these three sites from a PC at the district office. Sutron 8210 controllers were installed at each of the field sites with hard-line telephone communication systems.

In June of 2006, Tom Gill and Robert Einhellig of TSC and Clinton Powell of NKAO visited MFID to examine communications problems the district had encountered after replacing the office PC following a lightning storm during which a power surge caused the PC to fail. The Sutron tech support staff contacted during this visit stated that the Human-Machine Interface (HMI) software that MFID had been utilizing to communicate with the remote sites was no longer being supported by Sutron. Mel Brozek informed the Reclamation visitors that the Sutron control units had been removed from each of the field sites prior to his being hired by MFID.

Following our Tuesday discussions at the MFID office, Jack Wergin accompanied the rest of the group on return visits to Dunlap Diversion Dam and to the outlet works at Box Butte Dam. We then proceeded to view each of the previously automated sites along with stops at selected measurement locations in the distribution system. Following our Tuesday field activities, we returned to our place of lodging in Alliance NE then returned to Colorado on Wednesday.

5. Conclusions: The travelers observed clear evidence of the sediment transport as well as the canal seepage/high water table issues MFID is currently facing. Mel Brozek informed us that MFID is planning to lease a track excavator for one month this coming spring to dredge as much of the upper section of the canal as they can within the one-month time frame. Mel also plans to contact the owner of land in the vicinity of the canal seepage concerns to determine the current status of any monitoring wells in the area.

Recent turnover in MFID staff is likely a key factor in the lack of knowledge of the status (or whereabouts) of previously installed automation controllers. The fact that plug-in wiring terminals were left behind in the remote site instrument enclosures strongly suggests that for whatever reason the 8210 control units were removed, the intent was that the units would be reinstalled. Whatever the case, Sutron replaced the 8210 dataloggers with the 9210 model in its product line several years ago. As noted above Sutron stopped servicing the software used by MFID for a similar time period. Even if the 8210 units were still in place it would likely not be cost-effective to re-establish the desired level of functionality with this aged technology.

6. Action correspondence initiated: TSC visitors – in coordination with NKAO – will follow up in identifying alternatives and/or developing a suggested actions in addressing the sediment diversion and canal seepage issues. TSC will also assemble and forward to NKAO a list of equipment along with estimated cost for installing an upgraded remote monitoring and control system that will be readily expandable to meet MFID operational needs and objectives.

cc: Jack Wergin (NKAO)

SIGNATURES AND SURNAMES FOR:

Travel to: Mirage Flats Irrigation District

Date or Dates of Travel: January 23-25.

Names and Codes of Travelers: Tom Gill, 86-68460
Dale Lentz, 86-68460
Roger Burnett, 86-68210

Traveler: Tom Gill — 02/14/2012
Tom Gill, 86-68560 — Date

Traveler: Dale J. Lentz — 2/14/12
Dale Lentz, 86-68560 — Date

Traveler: Roger Burnett — 2/21/12
Roger Burnett, 86-68210 — Date

Noted and Dated by:

Robert Einhellig — 2/24/12
Robert Einhellig, Manager — Date
Hydraulic Investigations & Laboratory Services

Del Smith — 3/2/2012
Del Smith, Manager — Date
Water Resources Planning & Operations Support