

MEMO

STATE OF IDAHO


DEPARTMENT OF WATER RESOURCES

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DATE: OCTOBER 7, 2009

TO: TIM LUKE

FROM: Mat Weaver 

SUBJECT: Summary of water measurement support efforts in Basin 11 and Basin 13 for Calendar Year 2009

This memo is intended to summarize my on-going efforts in Administrative Basins 11 and 13 during 2009 in supporting water users in water measurement, verifying water measurement improvements, and evaluating existing diversions in need of water measurement devices. My primary efforts were concentrated in working with water users in the Central Division of the Bear River Basin (11). However, additional support and evaluation occurred on the Thomas Fork of the Bear River (Basin 11), Worm Creek (Basin 13), and the Cub River (Basin 13).

Pegram Area Water Measurement Support

On February 20, 2008 the Idaho Department of Water Resources (Department) issued a Preliminary Order requiring controlling works and measuring devices in Basin 11. A group of water users representing a number of diversions in the Pegram Area of the Bear River (Central Division) expressed their frustration in measuring water in the ditches and canal systems. They pointed to the small change in elevation through out the area and the subsequent inability of classic gravity driven measurement devices, such as weirs and flumes, to function in these low-energy environments, as the primary detail impeding water measurement.

These same users requested technical support from the Department in evaluating the diversions, conveyance systems, and existing measurement devices and making recommendations for improvements and appropriate water measurement devices. The diversions in question are referred to colloquially as the Nuffer, Miller, Ure, Jensen, Lloyd, and the Sorenson.

In 2008 the Department conducted a series of field surveys of each diversion and prepared technical reports for each, recommending diversion improvements and water measurement devices appropriate for each unique setting. The following table lists the diversion and the Department recommended water measurement devices.

Table 1 – Summary of Recommended Meas. Devices for Pegram Area Users

	Nuffer	Miller	Ure	Jensen	Lloyd	Sorenson
Meas. Device 1*	ADFM	ADFM	ADFM	Weir	ADFM	ADFM
Meas. Device 2**	BC Weir	BC Weir	None	ADFM	None	Weir

**The device recommended by the Department for use in water measurement.*

***An alternative device that could also function in adequately measuring water flow, but for reasons presented in the technical review memo was not recommended as a first choice by the Department.*

Due to the water user's unfamiliarity and general reluctance to use ADFM technology we agreed to participate in an ADFM pilot program with the users, whereby we would provide, maintain, and operate an ADFM on one of the diversions during the 2009 irrigation season. The Nuffer diversion was selected for the pilot program. Through out the irrigation season I maintained a Department ADFM (Unidata Starflow) at the diversion for water measurement. In addition, for three weeks I installed and maintained a second MACE Agriflow ADFM device at the site for redundant and comparative water measurement. With the support of the Watermaster, periodic current meterings of the diverted irrigation water were also taken as corroboration of the ADFM's accuracy. The following timeline outlines my key activities on the Nuffer during the 2009 irrigation season.

- 5/8/2009: Met with water users of Nuffer on site and coordinated location of new 72"x54" arch pipe below diversion point for location of ADFM.
- 6/17/2009: Installed Department ADFM (Unidata Starflow), data logger, and power supply in new squash pipe on Nuffer ditch. Current metered diversion.
- 6/19/2009: Installed MACE Agriflow ADFM, data logger, and power supply in new squash pipe (just upstream of Unidata) on Nuffer Ditch.
- 7/10/2009: Removed MACE ADFM system from Nuffer diversion. Current metered diversion.
- 9/9/2009: Current metered diversion.
- 9/10/2009: Retrieved Department ADFM system from Nuffer diversion, concluding pilot study.

At the conclusion of the pilot study the Nuffer diversion water users were agreeable to the future utilization of ADFM technology at their diversion. They are planning, with the support of grant money from the Watermaster, to outfit the Nuffer diversion with a telemetered ADFM system. The following figure summarizes the flow rate measurement data collected on the Nuffer diversion during the 2009 irrigation season.

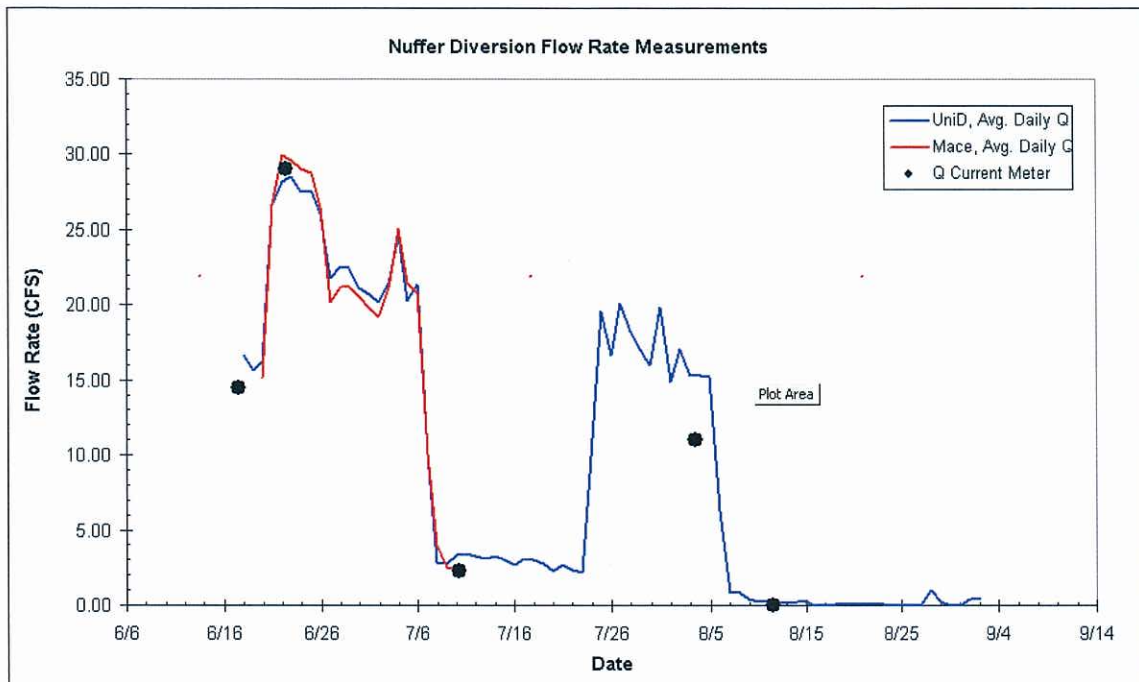


Figure 1 – Summary of Nuffer Diversion Flow Rate Measurements

Lloyd Diversion

On 9/10/2009 I observed that a prefabricated broad crested weir (BCW) had been installed on the Lloyd diversion ditch. It appeared to have been poorly installed on native material without a foundation or proper backfilling. I contacted the Watermaster and indicated that the BCW did not conform with our recommendation, was poorly installed, and was not acceptable to the Department. In his reply the Watermaster indicated that he had coordinated with the water users and they were going to remove the BCW and install an ADFM system similar to the Nuffer with the aid of similar grant money.

Miller and Sorenson Diversion

On several occasions throughout the summer of 2009 I visited the Sorenson and Miller diversions. In all instances I observed that no improvements to the diversion systems in any manner had occurred.

Thomas Fork Preliminary Water Measurement Evaluation

In September 16, 2008 the Department issued a letter to Water District 11-F (WD 11F) advising them of their statutory obligation to provide accounting of all water diversions within the Basin.

In February or March of 2009 the Department received a water measurement plan from the Watermaster indicating proposed measurement devices for each diversion in the District and the proposed year of installation. In this letter the Watermaster indicated acoustic Doppler flow meters (ADFM)s would be utilized at three diversions (Taylor Canal, Hall Ditch, and the Thomas Fork Canal).

On May 6, 2009 Dan Nelson and I accompanied Watermaster Joel Tuesher on a tour of the sites proposing ADFMs in the measurement plan, including an additional fourth site. The fourth site is possibly an undocumented point of diversion (POD) for WR 11-106 located just upstream of the Hamilton Dam (SESE T14SR46E9). The purpose of the tour was to visit each site and conduct a preliminary evaluation of the necessity and applicability of ADFMs at each location. In the event we felt ADFMs were not the only conceivable solution, we would propose alternate measurement devices. During this visit we confirmed that no measurement devices existed at any of the four locations. My preliminary evaluation of the Taylor Canal and Hall Ditch indicates that there is sufficient energy in each of the diversions for more traditional gravity driven measurement devices. My preliminary evaluation indicates that a gravity driven measurement device might be feasible at the Taylor Fork Canal diversion, but it also could be a reasonable candidate for an ADFM system; a more involved evaluation and preliminary design would be required if the department wished to make a final recommendation. My preliminary evaluation at the Hamilton Dam diversion indicates that in all likelihood an ADFM system is the only measurement device that will reliably obtain accurate flow measurements at this location. At the Taylor Canal, Thomas Fork Canal, and Hamilton Dam diversions sophisticated and elaborate fish screening devices are installed at the PODs that will potentially complicate the future design and installation of any measurement devices.

On July 9 and September 9, 2009, I revisited the Taylor Canal and Hamilton Dam diversion sites for evaluation of middle and late season conditions. In both instances I observed that no new measurement devices were in place. During my revisits I did not observe conditions that would cause me to contradict my initial conclusions.

Preston Montpelier Irrigation Company

On June 19, 2009, in the company of Watermaster Rock Holbrook (WD 11) I visited the primary water measurement location of the Preston Montpelier Irrigation Company, located just upstream of the Preston Canal crossing of Danish Avenue just east of Dingle, ID. I confirmed the rehabilitation of a contracted sharp crested weir, the installation of a new staff gage, a replanted gage house, and a new shaft encoder by Stevens Engineering with a Stevens Act System data logger. All components of the water measurement system appeared to be in a good state of condition and operation.

Worm Creek Inventory

On April 7, 2009, I assisted Dan Nelson with the inventory of all diversions from Worm Creek, a tributary stream to the Bear River. I was charged with the inventory of the upper diversions, consisting of all diversions upstream of Highway 91. Dan Nelson inventoried all diversion down stream of Highway 91. Our efforts were summarized in a memo prepared by Dan Nelson for Tim Luke, date unknown (May/June 2009?), with the subject line "Cub River and Thomas Fork Work in May".

Cub River Irrigation District – Upper Diversion Middle Ditch

On April 7, 2009, in the company of WD 13A Watermaster Troy Foster I visited the Cub River Irrigation District's upper diversion of their middle ditch. Troy Foster showed me

the new ADFM (Greyline) installation at the diversion dam and how to access the control house and obtain instantaneous measurements from both the data logger digital display and via the dial in number (208-852-1526 #1). During my first visit no water was being diverted. I returned to this diversion site three different times through out the summer, during my return visits I current metered the diverted flow for evaluation of the accuracy of the ADFM system. I plan to elaborate more on my findings regarding this ADFM installation site and others through out the state in a future technical memo summarizing the efficacy of the ADFM technology in general as a flow measurement solution. For now, the following table summarizes my findings from the three visits.

Table 2 – Summarization of Current Meter vs. ADFM Flow Rate Measurements

Date	Flowtracker, Q* (CFS)	ADFM, Q** (CFS)	% Error
6/17/2009	10.1	11.9	17.3%
7/9/2009	33.2	15.0	54.8%
9/10/2009	14.3	15.5	8.4%

*These values were obtained at a cross section located approximately 15 feet downstream of the first daylight point of the middle ditch, which is located approximately ¼ of a mile downstream from the upper diversion from the Cub River and the location of the ADFM device.

**These values represent an average of instantaneous flow rates taken every minute for ten consecutive minutes.

From these results it is evident that the ADFM is not accurately measuring the flow rate across the entire range of diverted flows. The percent error between reported flows from the ADFM and actual flows increases dramatically with flow rate. I have coordinated my findings with both the Watermaster and Intermountain Environmental (installation consultant). Intermountain Environmental has indicated they will be coordinating with the Cub River Irrigation District to make improvements to the ADFM system to increase accuracy during the up coming non-irrigation season (Winter 2009/2010).