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May 2, 2007

BOB SCHAFER
WATERMASTER
WATER DISTRICT No. 34
PO BOX 53
MACKAY, ID 83251-0053

Re: Guidance on Determining Natural Flow, Reach Losses, and Use of IDWR Water Rights Accounting

Mr. Schafer:

This letter is a follow-up to our phone conversation on April 24, 2007 and your phone conversation with Tim Luke of IDWR on April 20, 2007 regarding determination of reach gains and natural flow. The following provides guidance on determination of natural flow, record-keeping, and delivery of storage water.

Rule 25.02 of the Idaho Department of Water Resources Water Distribution Rules – Water District 34 (hereafter referred to as the Distribution Rules) states that the natural flow in each reach of the river will be computed as the natural flow entering the reach plus gains entering the reach minus losses from the reach. The natural flow in each reach is used to determine which rights that are being called for can be filled.

Several methods have been used in Water District No. 34 to compute natural flow. These methods typically involved hand calculations that compute aggregate losses over multiple reaches. Although these methods may have produced satisfactory results in the past, and may still be used as rough estimates, they are not sufficiently detailed to allocate water in times of scarcity and in a manner consistent with the Distribution rules. Instead, IDWR recommends the Watermaster of WD34 refer to the natural flow computed from the IDWR Big Lost River Water Rights Accounting (BLWRA) Program.

Natural flow should be calculated at least once a week, or more often as necessary. IDWR typically runs the BLWRA program every Wednesday during the irrigation season, but in times when natural flow is changing rapidly, or at the request of the watermaster, IDWR will run the program more frequently. The results are posted on the WD34 web page the same day. Attachment A is a printout of a typical day's output from the program showing how to determine natural flow, reach percent loss or gain, and available storage water in each reach. IDWR is currently working to update the output of the BLWRA program so many of the computations presented on Attachment A can be simply read from the output report. In the meantime, natural flow and percent loss calculations should be documented and kept on file at the WD34 office.

In order for the BLWRA program to produce accurate results, all input data should be as accurate as possible. To this end, it is essential that the watermaster oversee and periodically check the work of his staff to ensure that measurements of canal headings and river flows are made frequently and accurately, and that the data are input correctly and in a timely manner. Additionally, if the output of the BLWRA program results in natural flows and/or reach gains that appear inaccurate, the watermaster must promptly notify IDWR so the results can be verified or the problem can be corrected.

Additionally, the watermaster must correspond with BLRID periodically to verify that the BLWRA program is computing storage deliveries that are fairly consistent with deliveries computed by the BLRID. As the season progresses, this cross-checking will help to identify and correct errors and other sources of inaccuracy.

Please feel free to contact me if you have further questions on this matter.

Sincerely,

Tim Luke for

Nick Miller
Water Distribution Section

cc: IDWR Eastern Region
Big Lost River Irrigation District, 101 S Main Ave Mackay, ID 83251

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Attachment A

WATER DISTRICT 34 - BIG LOST RIVER FLOW ACCOUNTING - (v1.2PC) MAY 6, 2006 20060829

	REACH FLOWS IN CFS		ACTUAL DATE	NATURAL FLOW	ACTUAL FLOW	RMAINING NAT FLOW	EXCHANGE FLOW	STORED FLOW	RESRVOIR EVAP	NATURAL FLOW DIV	TOTAL RCH DIV	REACH GAIN	LAST RIGHT
8	BIG LOST AT HOWELL		MAY 3	801.2	796.0	800.6	0.0	-4.6	0.0	0.6	0.6	801.2	19160207
7	BIG LOST ABV MACKAY RES	*	MAY 4	495.9	390.8	339.6	0.8	51.2	0.0	155.7	160.7	-305.3	19160207
1	BIG LOST BLW MACKAY RES		MAY 4	502.3	379.0	112.9	0.0	266.1	6.7	233.1	7.7	6.4	19160207
2	BIG LOST AT LESLIE		MAY 4	660.4	439.0	176.1	0.0	262.9	0.0	95.0	95.0	158.2	19160207
3	BIG LOST BLW MOORE DIV		MAY 5	639.6	34.9	7.1	0.0	27.8	0.0	148.1	148.1	-20.9	19160207
5	BIG LOST BLW MUNSEY DIV		MAY 6	655.7	19.0	0.0	0.0	19.0	0.0	23.2	23.2	16.1	19160207
6	BIG LOST NR ARCO		MAY 6	705.9	62.0	50.3	0.0	11.7	0.0	0.0	0.0	50.2	19870806
									TOTALS	656.	435.	706.	

* - INDICATES FLOW ESTIMATED, NOT MEASURED

Outflow from the reach and inflow to the next reach

Remaining natural flow leaving each reach

Reach gain (negative is a loss)

1. Remaining Natural Flow (after diversions are subtracted) in each reach is the natural flow leaving the reach and is given in the "Remaining Natural Flow" column

2. Calculation of reach percent losses: =100* (reach gain / inflow).
   Note that inflow is equal to the outflow of the upstream reach
   - Above Howell - this is all gain, always since the inflow is assumed to be zero.
   - Howell to Mackay Reservoir: = 100* (305.3/796) = 38.3% Loss
   - Mackay Reservoir to 2B gage: = 100*(6.4/390.8) = 1.6% gain. Loss is 0%
   - 2B gage to Leslie gage: = 100*(158.2/379) = 41.7% gain. Loss is 0%
   - Leslie gage to Moore diversion: = 100*(20.9/439) = 4.7% Loss
   - Moore diversion to the Arco diversion: = 100*(16.1/34) = 47% gain. Loss is 0%
   - Arco diversion to Arco gage: = 100*(50.2/62) = 81% gain. Loss is 0%

3. Stored flow in each reach is given in the "Stored flow" column. Note that the BLWRA program does not distinguish between BLRID storage water and natural flow rotation deliveries, so the stored flow is an estimate of the combined flow of both types of stored water.

Attachment A (continued)

4. Conveyance losses to stored flow in each reach. These calculations can be provided to the BLRID, but BLRID is not required to allocate their storage water based on your estimates. However, deliveries of rotated natural flow storage are subject to losses computed using these calculations:

   Percent of stored flow lost to conveyance:

   1. First losing reach, loss is equal to percent reach loss (example is Leslie to Moore reach loses 4.7% of the flow out of Mackay Dam)
   2. Deliveries of water that pass through multiple losing reaches,
      Percent loss = (1-(1-(previous reachpercent losses/100)) * (1- (reach percent loss/100))

Reach	Reach loss (%)	Stored water lost between Dam and Point of Diversion (%)	Deliverable amount of rotated water
Mackay to 2B	x1	x1	= Dam release *(1-(x1/100))
2B to Leslie	x2	x2a = x2 +[(x1/100) * (1- (x2/100))*100]	= Dam release *(1-(x2a/100))
Leslie to Moore	x3	x3a = X3 +[(x2a/100) * (1- (x3/100)) *100]	= Dam release *(1-(x3a/100))
Moore to Arco	x4	x4a = X4 +[(x3a/100) * (1- (x4/100)) *100]	= Dam release *(1-(x4a/100))
Below Arco	x5	x5a = X5 +[(x4a/100) * (1- (x5/100)) *100]	= Dam release *(1-(x5a/100))

As an example, the table below shows how much of a 10 cfs dam release of stored rotation water a user could redivert if his point of diversion is in any of the five reaches below the dam. If the user's point of rediversion is in the Mackay or Leslie reach, he could redivert the entire 10 cfs, but if his point of rediversion is in the Moore, Arco, or below Arco reach, he may only redivert 9.55, 8.97, or 8.26 cfs. The reach loses in column 2 are example data and do not relate to the output example shown above.

Reach of delivery	Reach loss (%)	Total Stored water lost between Dam and Point of Diversion (%)	Deliverable amount of rotated water (cfs)
Mackay to 2B	0	0%	= 10*(1-(0/100)) = 10
2B to Leslie	0	x2a = 0%	= 10 *(1-(0/100)) = 10
Leslie to Moore	4.5	x3a = 4.5%	= 10 *(1-(4.5/100)) = 9.55
Moore to Arco	6.0	x4a = 6.0 + [(4.5/100) * (1- (6/100))] = 10.23%	= 10 *(1-(10.23/100)) = 8.97
Below Arco	8.0	x5a = 8.0 + [(10.23/100) * (1- (8/100))] = 17.4%	= 10 *(1-(17.4/100)) = 8.26