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### McNary Temperature Report #10 August 15 - 21, 2014

An estimated total of 44,809 juvenile salmonids passed the McNary Juvenile Fish Facility (JFF) (Figure 1 and Table 1). Subyearling fall chinook accounted for 100.0% of the passage. Daily flows for this week averaged 151.8kcfs. Spill averaged 76.0kcfs (50.0%). The sample mortality averaged 1.02% for the week. System mortality averaged 0.02%. Mortalities are being enumerated from the separator, sample tanks and raceway 9W, which is the recovery holding raceway before fish are released back to the river.

Fish are bypassed to the river daily. The powerhouse implemented “Sawtooth” operations on July 15. McNary is balancing dissolved gas capacity against the number of units that can be put in stand-by. One orifice per gatewell slot is open. On August 5<sup>th</sup>, it was decided that the water temperatures in the sample holding tank were sufficiently high enough to implement the protocol for warm water conditions. Sampling has been diminished to 100 fish and GBT has been curtailed until further notice.

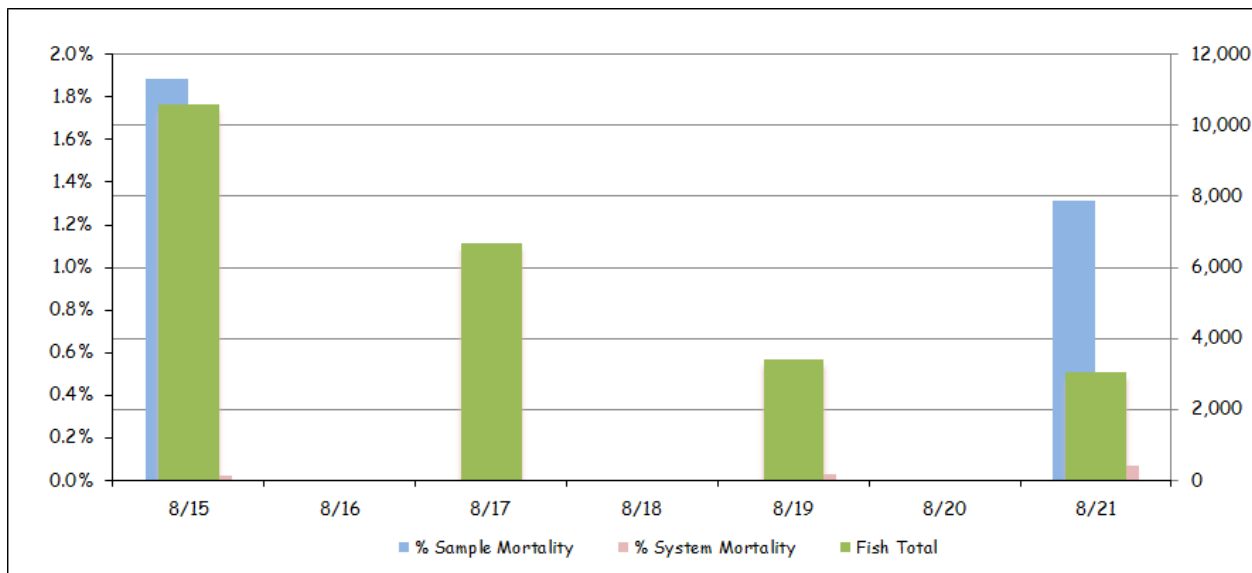
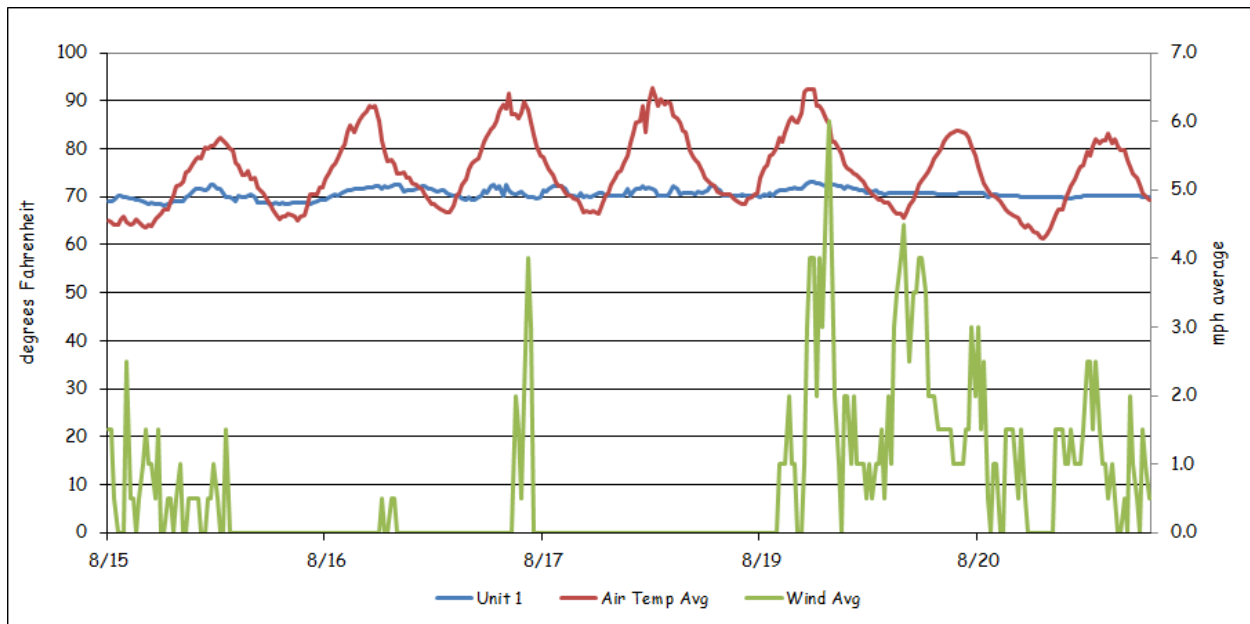


Figure 1: Collection and Mortality

**Table 1: Collection and Mortality With Daily and Weekly Averages**

	Mortality			Flow			Air Temp		Wind Speed	
	Collection	Sample	System	Total	Turbine	Spill	Avg.	Max.	Avg.	Max.
8/15/14	10,600	1.89%	0.02%	160.0	75.2	80.1	71.9	82.4	0.5	5.0
8/16/14				158.5	74.5	79.3	75.2	89.5	0.0	1.0
8/17/14	6,700	0.00%	0.00%	139.5	65.0	69.8	77.6	91.4	0.3	8.0
8/18/14				134.6	62.4	67.4	78.0	92.9	0.0	0.0
8/19/14	3,401	0.00%	0.03%	155.4	72.9	77.8	78.5	92.5	1.1	18.0
8/20/14				161.5	75.8	81.0	74.1	84.5	1.8	9.0
8/21/14	3,040	1.32%	0.07%	153.0	71.7	76.6	71.8	83.6	0.9	5.0
<b>Weekly Average</b>	5,935	1.02%	0.02%	151.8	71.1	76.0	75.3	92.9	0.7	18.0

During this report week, air temperatures averaged 75.3°F. Maximum hourly air temperature was 92.9°F on August 18 (Figure 2). The minimum temperature was 60.9°F on August 21 at 7:00am. Winds averaged 0.7mph, with gust peaking up to 18.0mph on August 19.



**Figure 2: Weather and Forebay Water Temperature**

There are 37 temperature probes located throughout the Project and the JFF. These probes are set to record temperatures at 30-minute intervals. These probes are located at the following locations:

- 1) Forebay, near elevation 335 approximately 5 feet below the surface. These are attached to the pier noses in front of turbine units 1, 3, 5, 7, 8, 10, 12, and 14.
- 2) In front of spillbays 22, 17, 12, 7 and 2, approximately 5 feet below the surface. These probes are hung in the center of the spillbay, on the tailrace side.
- 3) Attached to the handrail in the center of the “B” turbine gateway slots, approximately 2 to 3 feet below the surface, in all 14 turbine units.
- 4) Tailwater locations are at turbine unit 1 and 14 (tailrace), and the wingwall of the navigation lock. These were placed 5 feet below the water surface.

- 5) The collection channel had probes installed below turbine units 12, 8 and past unit 1 at the beginning of the transition screen.
- 6) The barge transportation dock.
- 7) Fish separator.
- 8) Sample fish recovery raceway #9W.
- 9) Sample holding tank.

Forebay water temperatures (Table 2) peaked this week with 80.6°F on August 18 at 4:00pm in front of unit 10. The average was 71.6°F across the forebay. Gatewell water temperatures for all units combined averaged 70.7°F (Table 3). Gatewell temperatures peaked with 75.6°F on August 18 in unit 14 at 5:00pm

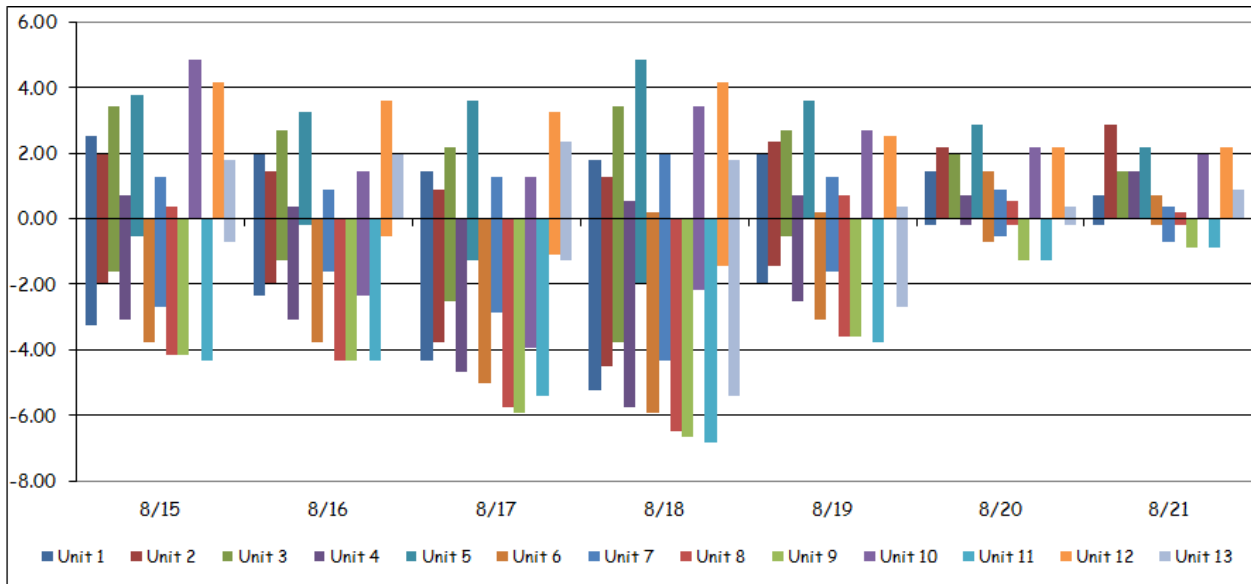
**Table 2: Forebay Water Temperatures**

	Daily Average								Daily Max
	1F	3F	5F	7F	8F	10F	12F	14F	
8/15/14	71.7	70.4	71.1	71.6	71.0	73.1	70.3	71.6	77.7
8/16/14	71.4	70.3	70.7	71.1	70.8	72.4	69.9	71.5	74.7
8/17/14	73.2	72.1	72.8	73.2	72.4	73.6	71.8	73.8	78.3
8/18/14	72.7	71.6	72.6	73.1	72.2	74.9	72.0	73.7	80.6
8/19/14	72.2	71.0	71.4	71.9	71.5	73.2	70.3	72.2	74.7
8/20/14	71.5	70.0	70.5	70.9	70.7	72.2	69.3	71.1	73.0
8/21/14	71.0	69.6	70.1	70.5	70.3	71.8	69.0	70.9	72.1
<b>Weekly Average</b>	71.9	70.7	71.3	71.8	71.3	73.0	70.4	72.1	80.6

**Table 3: Gatewell Water Temperatures for Units 1, 7 & 14**

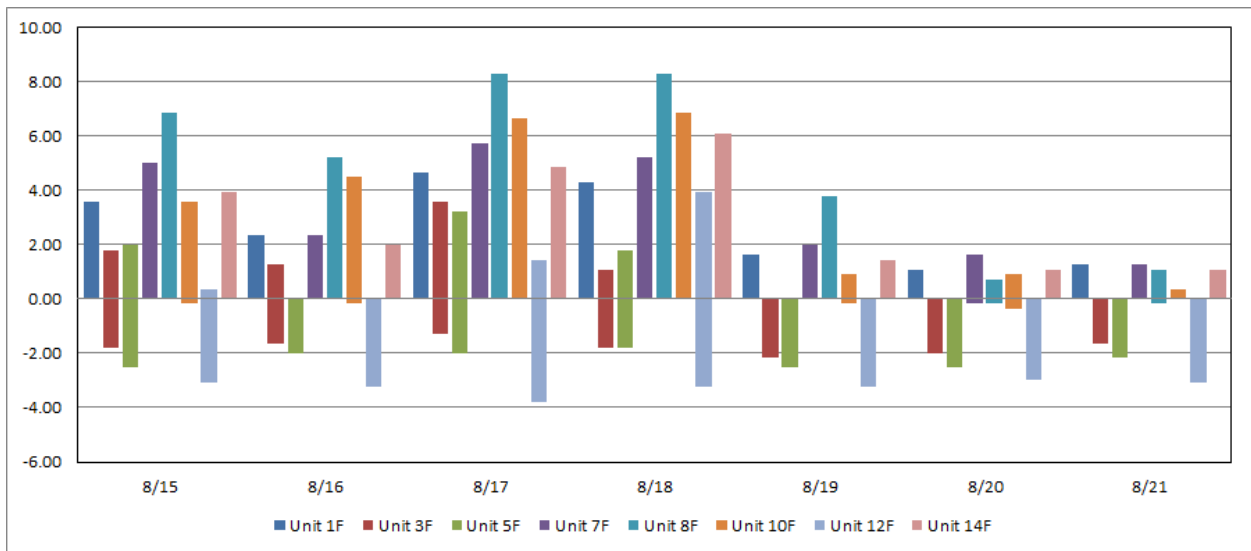
	Daily Avg.			Daily Max.			Daily Min.		
	1	7	14	1	7	14	1	7	14
8/15/14	69.9	69.7	70.1	72.5	71.6	72.5	68.2	68.9	68.7
8/16/14	70.3	70.0	70.3	72.5	72.0	72.5	68.5	68.7	69.3
8/17/14	70.9	70.8	71.7	72.5	72.7	74.5	69.4	69.3	69.6
8/18/14	70.9	71.1	71.7	72.3	72.5	75.6	70.0	70.0	70.0
8/19/14	71.4	71.1	71.1	73.0	72.1	73.0	70.0	70.0	70.0
8/20/14	70.7	70.5	70.2	71.8	71.1	70.5	70.0	69.6	70.0
8/21/14	70.1	69.7	69.9	70.3	70.2	70.2	69.6	69.4	69.6
<b>Weekly Average</b>	70.6	70.4	70.7	72.1	71.7	72.7	69.4	69.4	69.6

The differences in temperatures between the gatewell at unit 1 and the gatewell at unit 14 are illustrated in Figure 3. This graph takes the temperature in the gatewell and subtracts unit 14 from that gatewell (unit 1 – 14). It then continues down the powerhouse subtracting unit 14 from each consecutive unit. A negative number indicates that unit 14 was the warmer unit. Conversely, a positive number indicates that unit 14 was cooler. This shows the reader the amount of variance from one end of the powerhouse to the other that can be seen throughout a 24-hour period.



**Figure 3:** Average Gatewell Temperature Differentials for Units 1 - 14

Forebay differentials (Figure 4) are calculated by taking the forebay temperature and subtracting the corresponding gatewell temperature from it (1F – unit 1). A negative number would indicate that the gatewell was warmer. Conversely, a positive number indicates that the forebay is warmer. Again, this shows the reader the amount of variance that can be seen between the forebay and the gatewell throughout a 24-hour period.



**Figure 4:** Average Temperature Differentials Between Forebay and Gatewell

Average water temperature in the collection channel was 69.3°F (Table 4) for the week. A maximum temperature of 73.2°F was recorded below Unit 12 on August 17 at 9:00pm. Temperatures at the separator averaged 69.9°F for the week with a maximum daily temperature of 70.9°F (Table 5). The sample holding tank had a high of 71.2°F starting on August 18 from 10:00 until 1:30am on the morning of the 19<sup>th</sup>. And again in

the afternoon from 4:30 until 6:30pm. The average was 70.4°F. The temperature in raceway 9W averaged 68.4°F.

**Table 4: Collection Channel Average and Maximum Water Temperatures**

	Daily Avg.			Daily Max.		
	1	8	12	1	8	12
8/15/14	68.2	68.8	69.5	68.9	69.4	71.1
8/16/14	68.3	68.8	69.8	68.9	69.4	71.4
8/17/14	68.8	69.4	71.1	69.4	70.3	73.2
8/18/14	69.2	69.7	70.4	69.8	70.3	72.0
8/19/14	69.3	69.5	69.8	69.8	70.3	70.7
8/20/14	69.0	69.3	69.4	69.3	69.4	69.6
8/21/14	68.8	69.1	69.4	68.9	69.4	69.6
<b>Weekly Average</b>	68.8	69.2	69.9	69.3	69.8	71.1

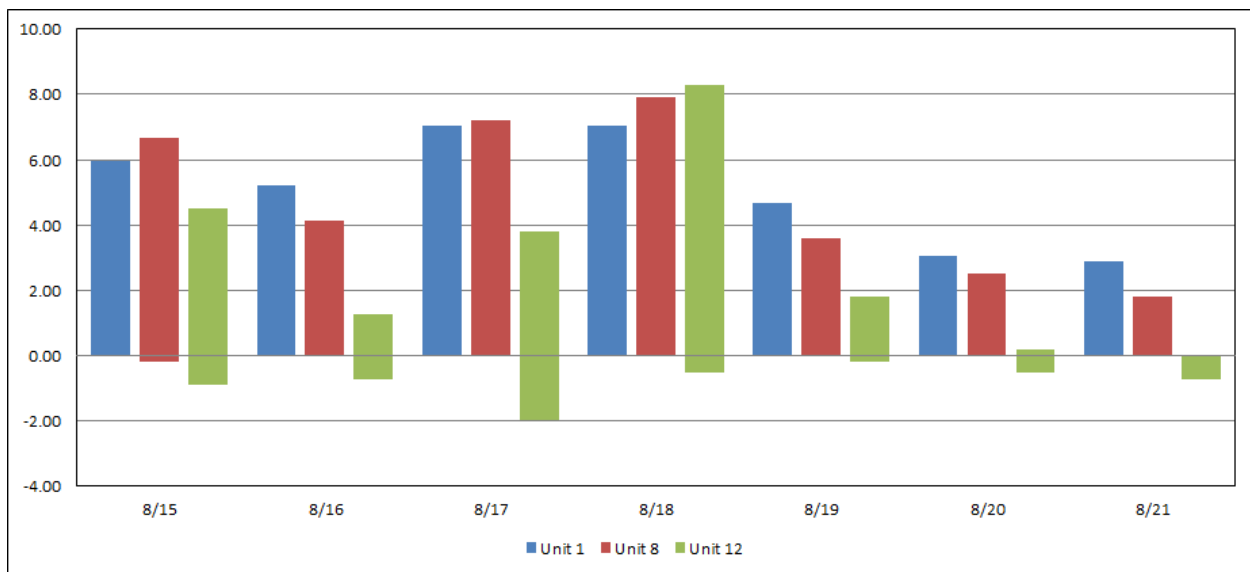
**Table 5: Separator, Sample Holding Tank and Recovery Raceway 9W Maximum and Average Water Temperatures**

	Daily Avg.			Daily Max.		
	Separator	Raceway 9W	Sample Tank	Separator	Raceway 9W	Sample Tank
8/15/14	69.3	68.2	69.8	70.0	68.9	70.5
8/16/14	69.4	68.4	69.9	70.0	68.9	70.5
8/17/14	69.9	68.9	70.4	70.7	69.6	71.1
8/18/14	70.3	69.2	70.8	70.7	69.8	71.2
8/19/14	70.4	69.3	70.9	70.9	69.8	71.2
8/20/14	70.2	69.1	70.6	70.5	69.3	70.9
8/21/14	69.9	68.8	70.3	70.2	68.9	70.5
<b>Weekly Average</b>	69.9	68.8	70.4	70.4	69.3	70.9

Collection channel differentials (Table 6) are calculated by taking the forebay temperature and subtracting the collection channel temperature from it at the three corresponding points. This is an average of the variances between the forebay and the collection channel. A negative number indicates that the collection channel was warmer. A positive number indicates the forebay was warmer. The graph (Figure 5) shows the variance throughout the week.

**Table 6:** Average Differences between Forebay and Collection Channel

	1	8	12
8/15/14	3.5	2.2	0.7
8/16/14	3.1	2.0	0.1
8/17/14	4.4	3.0	0.8
8/18/14	3.5	2.5	1.6
8/19/14	2.9	1.9	0.5
8/20/14	2.4	1.4	-0.2
8/21/14	2.1	1.2	-0.5
<b>Average</b>	3.1	2.0	0.4
<b>Maximum</b>	7.0	7.9	8.3
<b>Minimum</b>	0.9	-0.2	-2.0



**Figure 5:** Average Temperature Differentials Between Forebay and Collection Channel