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USACE Walla Walla District Biological Services: Temperature Monitoring Program at McNary Dam

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		Report Period:	June 17 to 23, 2016
Report No.	MCN TEMP 4-16		

Fish Collection

An estimated 299,594 juvenile salmonids bypassed the McNary Juvenile Fish Facility (JFF) (Table 1) and consisted of 99.7% subyearling Chinook salmon, 0.2% steelhead, and 0.1% subyearling Chinook salmon fry. There were total of nine juvenile system mortalities, which comprised seven sample mortalities and two facility mortalities (Figure 1).

River Conditions

Average river flow for this reporting period was 189,800 cubic feet per second (189.8 kcfs), with an average spill of 95.1 kcfs. The average powerhouse flow was 90.0 kcfs.

Weather Conditions

The weekly average daytime temperature for June 16 to 23 was 68.6 °F. The weekly average nighttime temperature was 63.0 °F. Temperatures ranged from a maximum of 87.8 °F at 1830 on June 22 to a minimum of 48.5 °F at 0630 on June 17.

Winds averaged 2.4 mph this week (Figure 2). The wind was highest at 2200 on June 19, with winds averaging 21 mph and gusts up to 36 mph.

Probe Operations

The probe at spillway 22 continued to malfunction and was replaced at 1200 on June 19. A probe was deployed on the southwest side of the barge dock in 5 feet of water at 1030 on June 19. The probe in the forebay at Unit 5 became lodged in the trolley pipe on June 19. It was dislodged and taken out of service for repairs from 1430 on June 19 to 1530 on June 22.

The weather station was inadvertently unplugged and ran on batteries for some time. The batteries failed at 2130 on June 20. The weather station was plugged back in at 1430 on June 21.

Water Temperatures

Water temperatures trended with air temperatures (Figures 3 and 4). The average gatewell temperature (weekly average 64.1 °F) was generally higher than the average temperatures in the forebay (weekly average 63.8 °F), collection channel (weekly average 63.3 °F), and JFF (weekly average 62.8 °F). JFF and Tailwater 14 had the lowest temperatures.

The increased diurnal pattern in water temperatures in the latter portion of the week affected the spread in water temperature across the dam. The temperature differential increased throughout the week across the forebay, gatewells, and, to a lesser extent, the collection channel and JFF (Figure 5). The forebay saw the largest average weekly temperature differential at 6.3 °F. The maximum forebay temperature differential was 13.1 °F and lasted from 1400 to 1500 on June 22 (F1 high; F9 and F11 low). Average weekly temperature differential across the gatewells was 5.1 °F. The maximum gatewell temperature differential was 9.2 °F and lasted from 1330 to 1430 on June 22 (U4 and U5 high; U8 and U9 low).

The warmer waters had a smaller effect on differential temperatures through the dam (Figures 6 and 7). The average weekly temperature differential between the gatewell and forebay was 1.8 °F. In eight units, the gatewell was warmer than the forebay on average (Units 2, 4, 5, 9, 10, 11, 12, and 13). In six units, the forebay was warmer than the gatewell on average (Units 1, 3, 6, 7, 8, and 14). The largest temperature differential was 7.7 °F at Unit 4 at 1530 on June 22 (gatewell greater than forebay). The average weekly temperature differential between the gatewell and collection channel was 1.4 °F. The gatewell was warmer than the collection channel at Units 1 and 12. The collection channel was warmer than the gatewell at Unit 8. The largest differential was 4.3 °F at Unit 1 from 1800 to 1900 on June 22.

The spillway temperatures followed the same trends seen in the powerhouse (Figure 8). Spillbay 1 had the highest average weekly temperature, at 66.1 °F. Spillbays 22 and 12 had the lowest weekly temperatures, at 63.2 °F and 62.3 °F, respectively.

Table 1
Bypass, Mortality, and River and Weather Conditions

Date	Fish Bypass	Mortality		Avg. River Flow	Avg. Turbine Flow	Avg. Spill	Air Temperature		Wind Speed	
		Sample	Facility				Avg.	Max	Avg.	Max
Jun 16 – 17				203.3	96.7	101.9	60.8	72.1	1.6	7.0
Jun 17 – 18	24,302	0	0	203.3	96.6	102.0	64.6	77.0	0.5	7.0
Jun 18 – 19				194.6	92.3	97.6	58.8	69.8	5.7	18.0
Jun 19 – 20	35,699	0	1	145.0	67.8	72.5	65.1	75.1	4.9	21.0
Jun 20 – 21				199.9	95.0	100.2	74.3	85.3	1.2	3.0
Jun 21 – 22	239,593	7	1	183.2	86.8	91.8	67.7	79.9	0.9	5.0
Jun 22 – 23				199.3	94.7	99.9	72.4	87.8	2.1	10.0
Weekly Avg.	**299,594**	**7**	**2**	**189.8**	**90.0**	**95.1**	**62.4**		**2.4**	

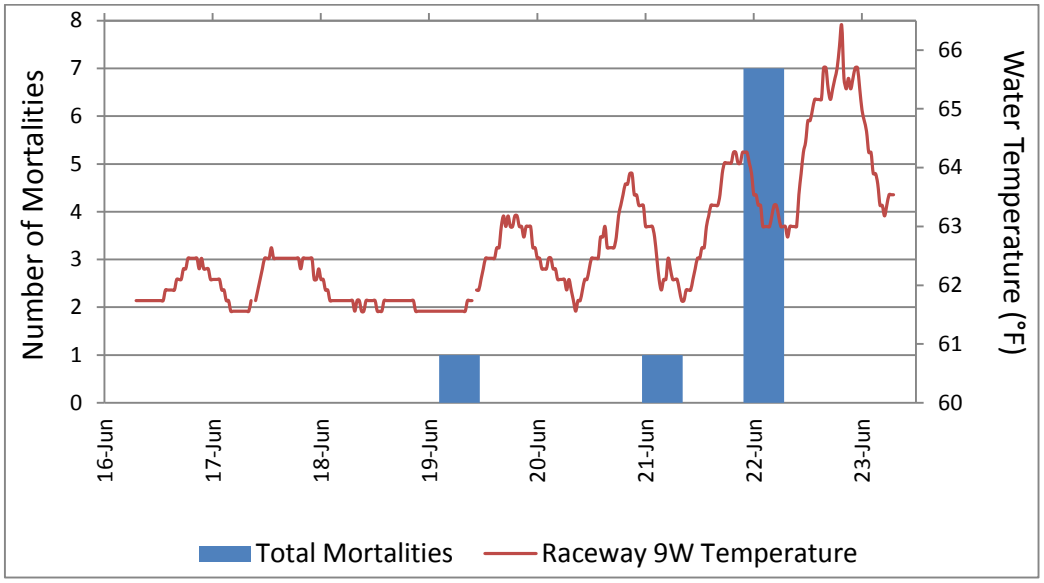

Figure 1
Juvenile Fish Facility Total System Mortalities and Raceway 9W Temperatures

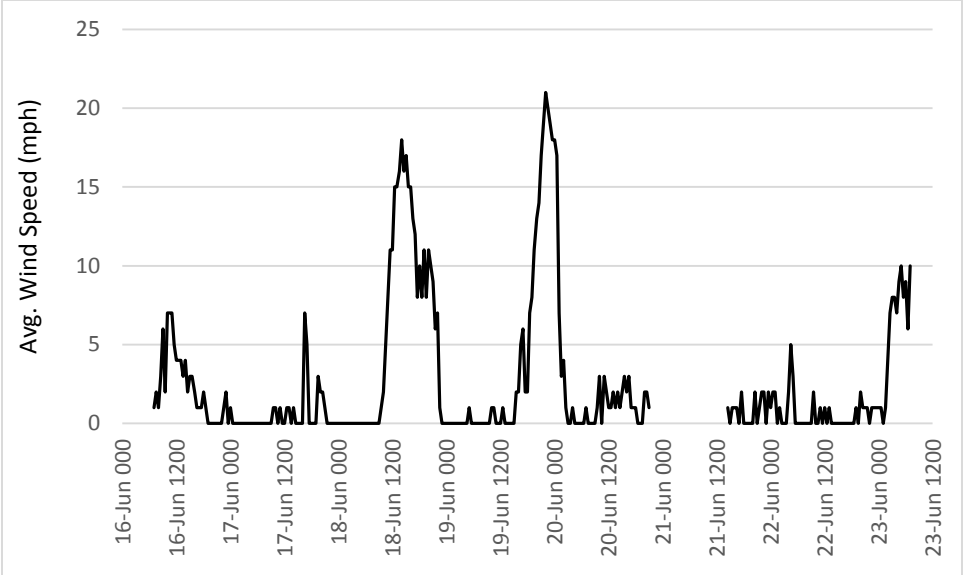

Figure 2

Average Wind Speed from 0700 June 16 to 0700 June 23

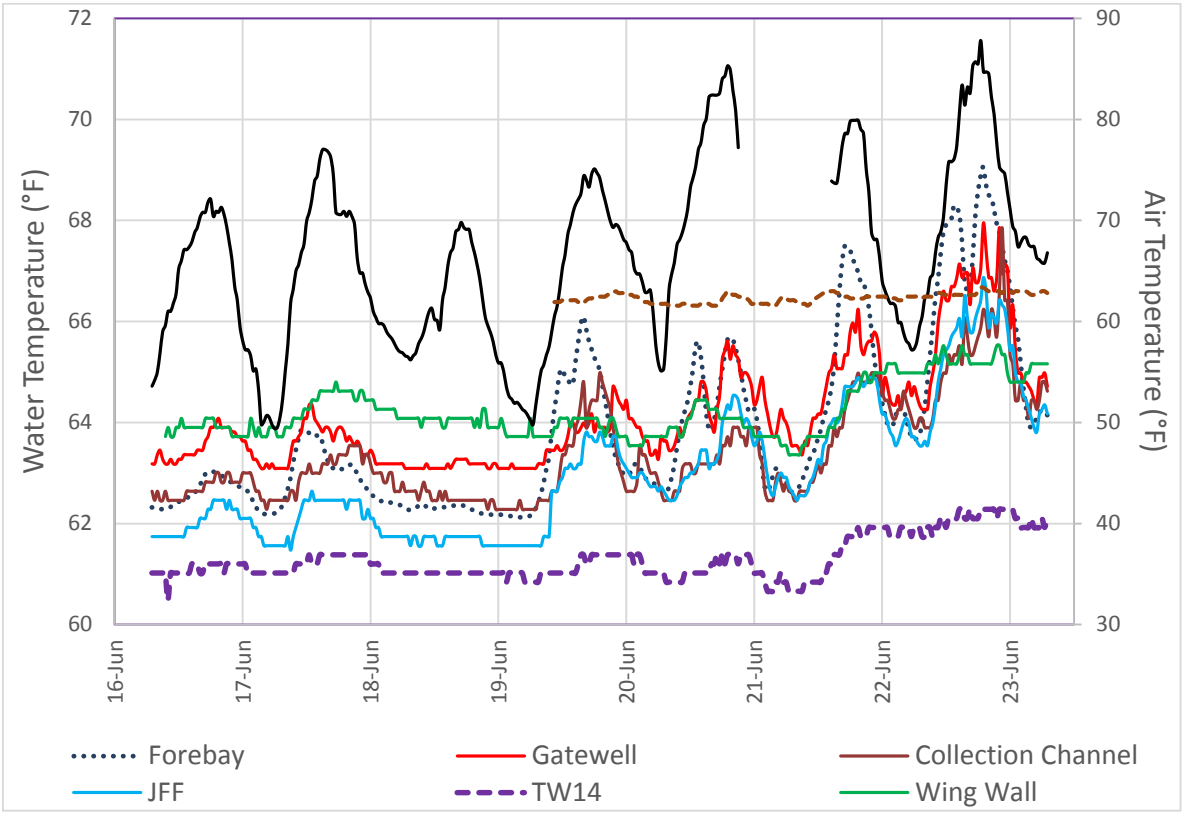

Figure 3

Average Air and Water Temperatures for Seven Dam Locations for 0700 on June 16 to 0700 on June 23

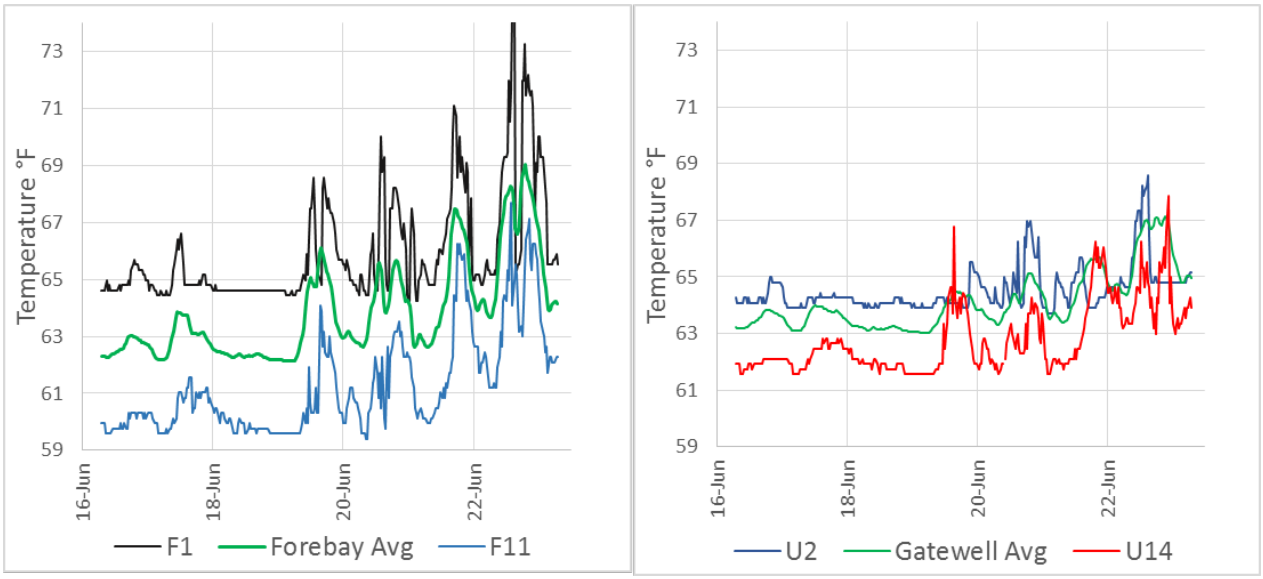

Figure 4
High, Average, and Low Forebay and Gatewell Temperatures

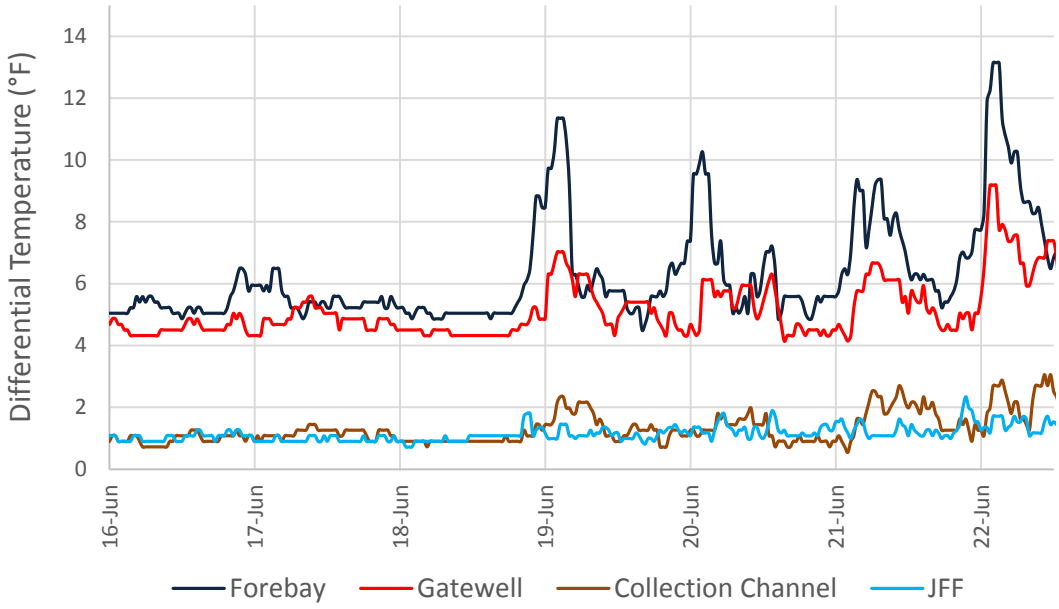

Figure 5
Average Differential Temperatures within Four Dam Locations

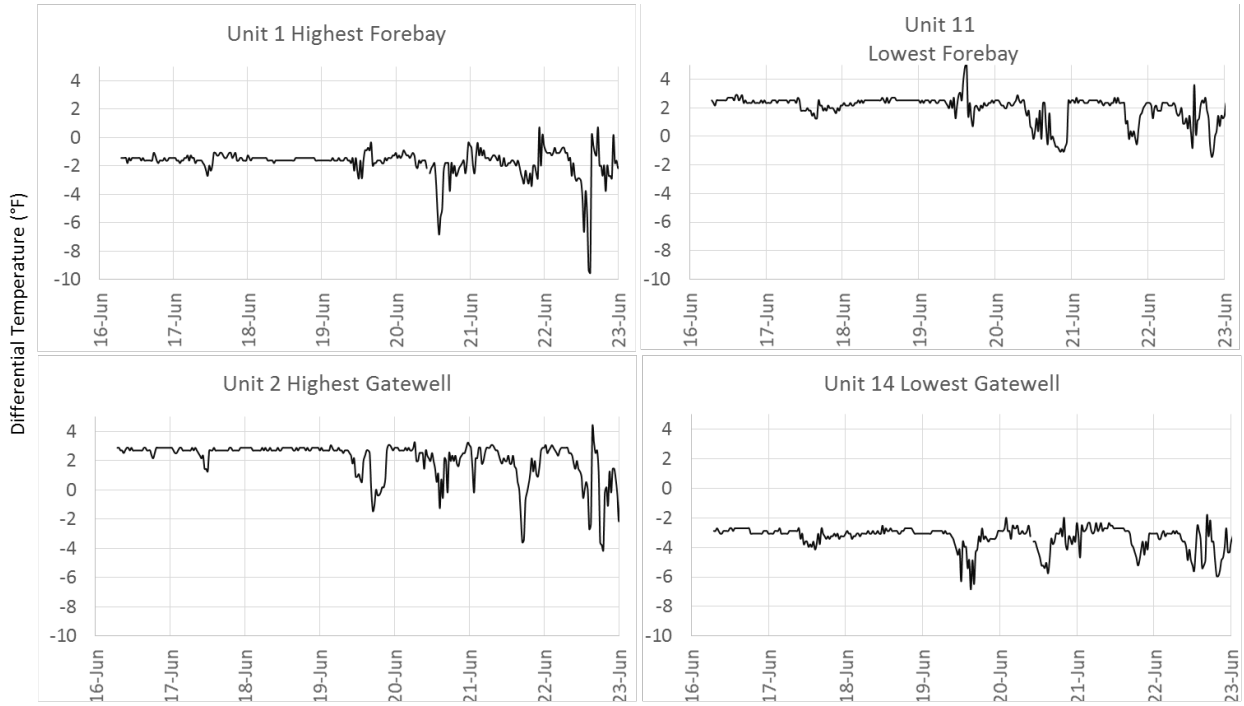

Figure 6

Gatewell and Forebay Differential Temperatures (Gatewell minus Forebay) for Units with the Highest and Lowest Weekly Average Temperature

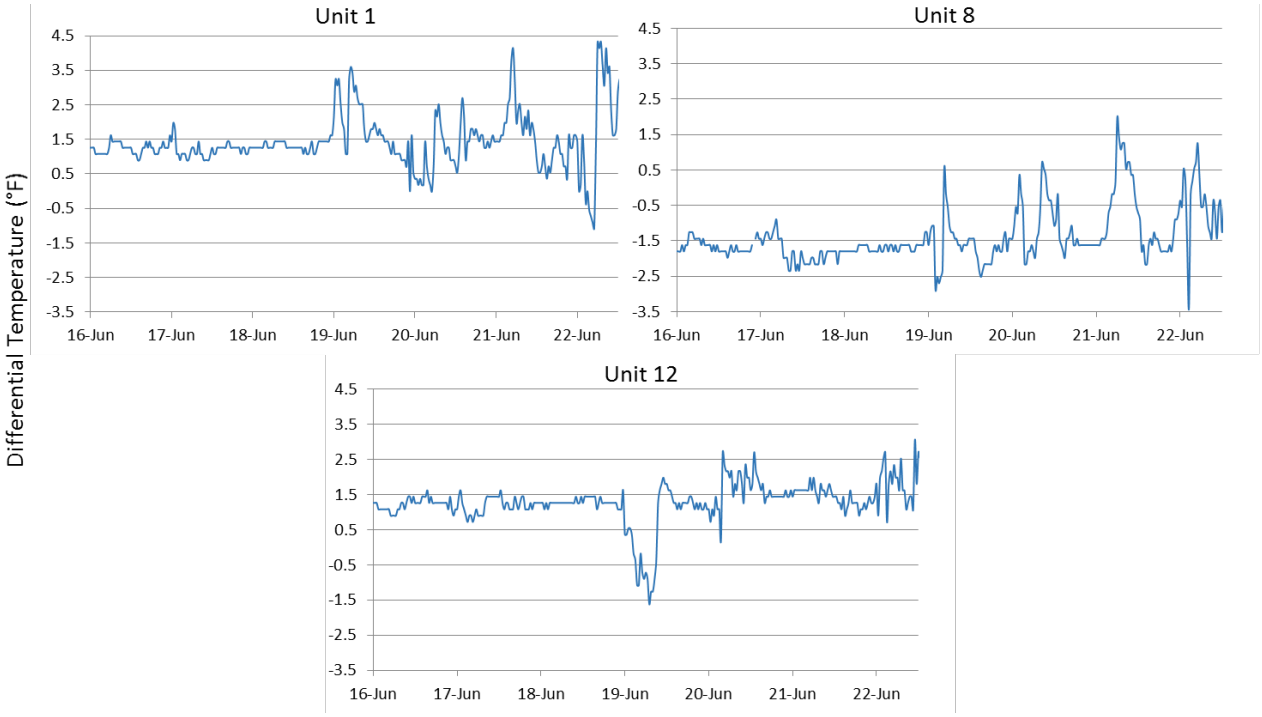

Figure 7

Gatewell and Collection Channel Differential Temperatures (Gatewell minus Collection Channel) for Units 1, 8, and 12

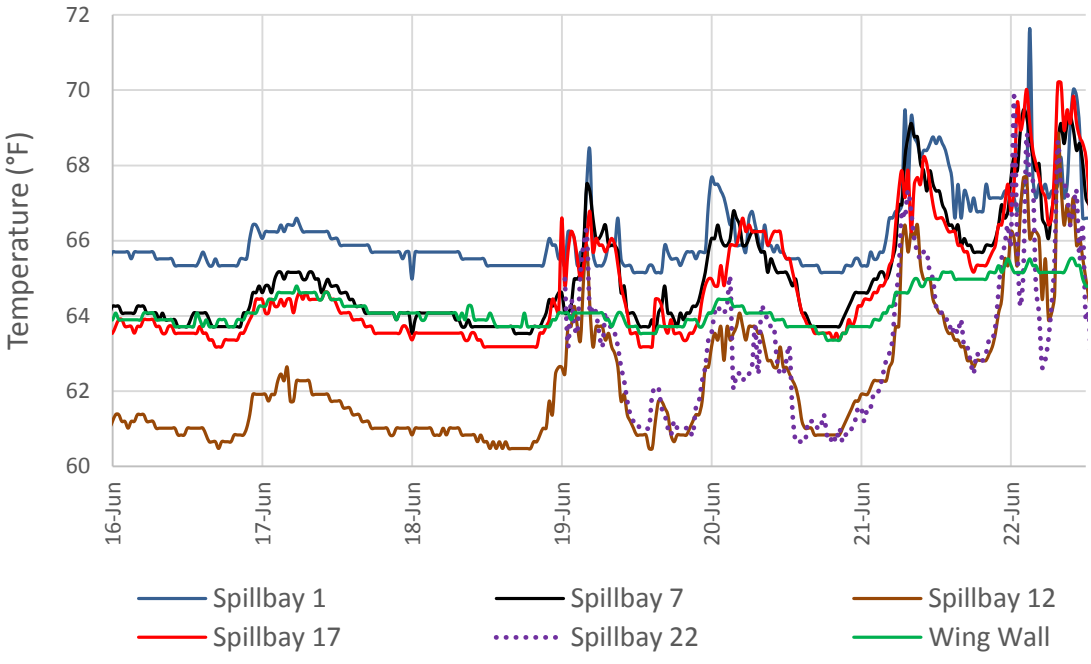

Figure 8

Temperatures for Five Spillbays and the Wing Wall from 0700 on June 16 to 0700 on June 23