MEMORANDUM

EUGENE WATER & ELECTRIC BOARD

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TO:	Commissioners Helgeson, Brown, Carlson, Mital and Simpson
FROM:	Mike McCann, Electric Generation Manager; Lisa McLaughlin, Environmental Supervisor
DATE:	December 22, 2017
SUBJECT:	Lower McKenzie River Water Temperature Study - 2017 Results
OBJECTIVE:	Information Only

Issue

This memo presents preliminary data from 2017 for an ongoing study on river temperatures in the lower McKenzie River in proximity to EWEB's Leaburg and Walterville hydroelectric projects.

Background

On March 7, 2017, staff submitted a memorandum for Board consideration on the impacts of the Leaburg and Walterville hydroelectric projects on river temperatures in the lower McKenzie River. The March 7th memorandum entitled *Lower McKenzie River Water Temperature* contained background information on the temperature studies that had been conducted previously in support of the relicensing of the projects and the development of the Total Maximum Daily Loads (TMDLs) for the McKenzie River. Due to lack of recent temperature data, staff recommended that EWEB initiate a water temperature monitoring study in order to better understand temperature dynamics and the potential effect of the Leaburg and Walterville hydroelectric projects on water temperatures in the McKenzie River. In response to this staff recommendation, EWEB initiated a temperature study between May and October of 2017. This memorandum provides a description of the study design and highlights some of the data that was generated.

Results

Between May 15th and June 6th of 2017, EWEB deployed 20 *Tidbit* temperature loggers at various locations within the project area. All of the loggers were retrieved on October 17th. The loggers were deployed upstream and downstream of EWEB facilities and were programmed to record temperature readings every half hour. Ten of the loggers were deemed to be the most critical in determining potential impacts to water temperature and are the subject of this analysis. Their location within the project area is depicted in Figure 1. In an effort to compare study results with previous DEQ modeling efforts, the average of seven consecutive daily maximum temperatures (7DADM) on a rolling basis was used for this analysis.

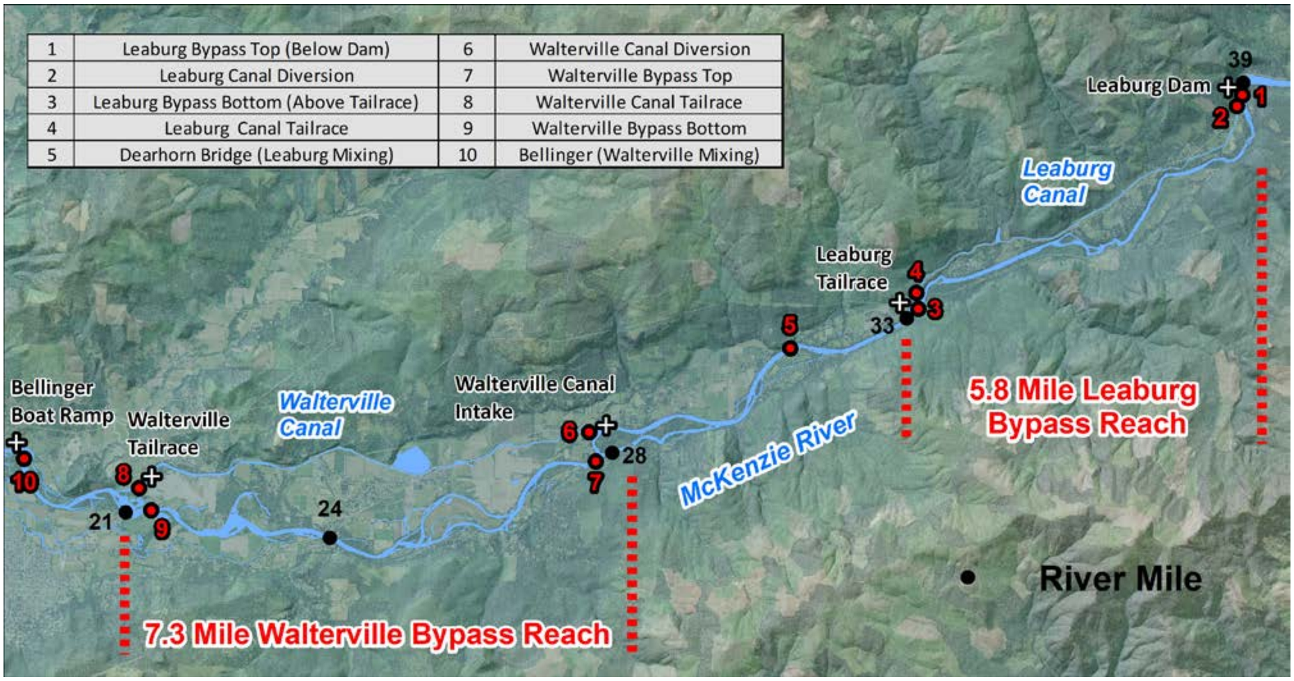

Figure 1. Locations of temperature loggers in the Leaburg-Walterville Project Area.

<u>Leaburg Project –</u>

In order to measure temperature impacts of the Leaburg Project, temperature loggers were placed at the top of the bypass reach below the dam (Logger 1), at the canal diversion (Logger 2), at the bottom of the bypass reach above the confluence with the tailrace (Logger 3) and in the tailrace below the powerhouse (Logger 4). Temperatures at the downstream locations were compared with their upstream counterparts to determine temperature variations in the canal and bypass reach. An additional logger (Logger 5) was placed at Dearhorn Bridge, approximately 2 miles downstream of the confluence of the Leaburg tailrace and the bypass, to measure if any potential temperature impacts were detectable below the mixing of the two flows.

In 2017, there was little discernable change in water temperature in the Leaburg bypass reach between the Leaburg canal diversion and the tailrace. The maximum change during the study period was 0.3 °C and the median change was 0 °C. There was also little discernable change in water temperature between the top of the Leaburg bypass reach and the bottom of the reach (Figure 2). The maximum change was 0.3 °C and the median change was 0 °C. There was slight warming observed at Deerhorn Bridge when compared to upstream sites but this warming may not be caused by EWEB's operations.

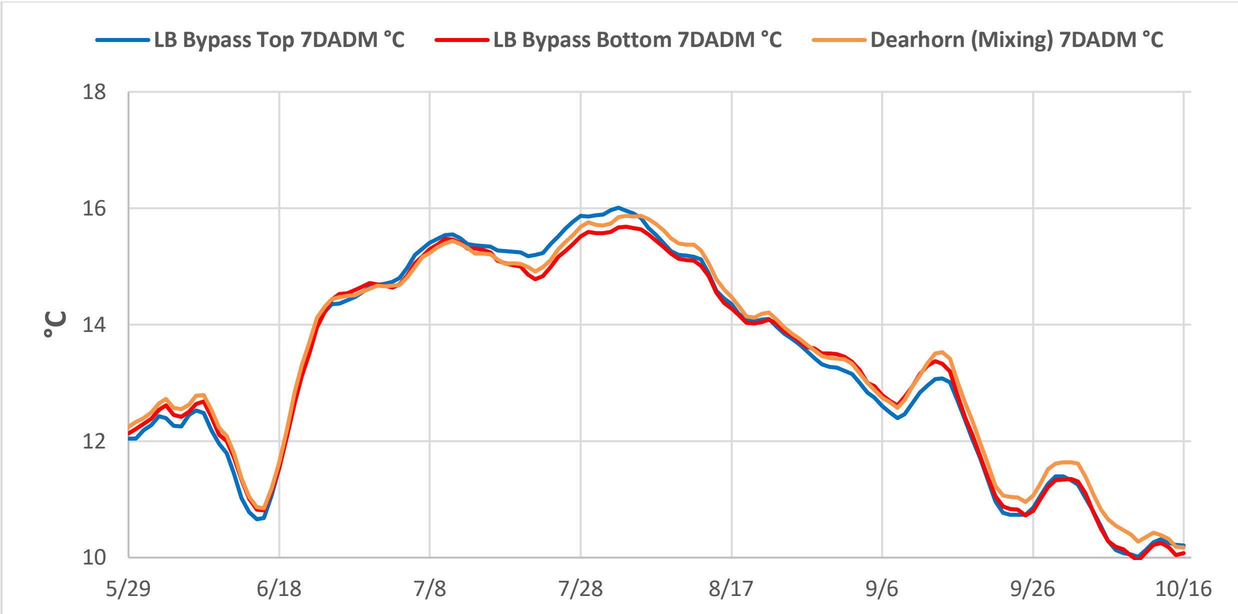

Figure 2. Comparison of temperatures (7DADM) at top of Leaburg bypass, bottom of Leaburg bypass, and Dearhorn Bridge.

<u>Walterville Project –</u>

To measure temperature impacts of the Walterville Project, temperature loggers were placed at the canal diversion (Logger 6), at the top of the bypass reach (Logger 7), in the tailrace above the barrier (Logger 8), and at the bottom of the bypass reach (Logger 9). Temperatures at the downstream locations were compared with their upstream counterparts to determine temperature variations in the canal and bypass reach. An additional logger (Logger 10) was placed at Bellinger Boat Ramp, approximately 2 miles downstream of the confluence of the tailrace and the bypass to measure if any potential temperature impacts were detectable below the mixing of the two flows.

In 2017, there was noticeable warming in the Walterville bypass reach between the canal diversion and the tailrace. The Walterville bypass reach experienced a maximum of 2.6 °C warming during the study period and the median change was 1.7 °C (Figure 4). The river at Bellinger Boat Ramp experienced a maximum of 1.4 °C cooling and a median of 0.9 °C, when compared to the warming that occurred in the bypass reach (Figures 3 and 4).

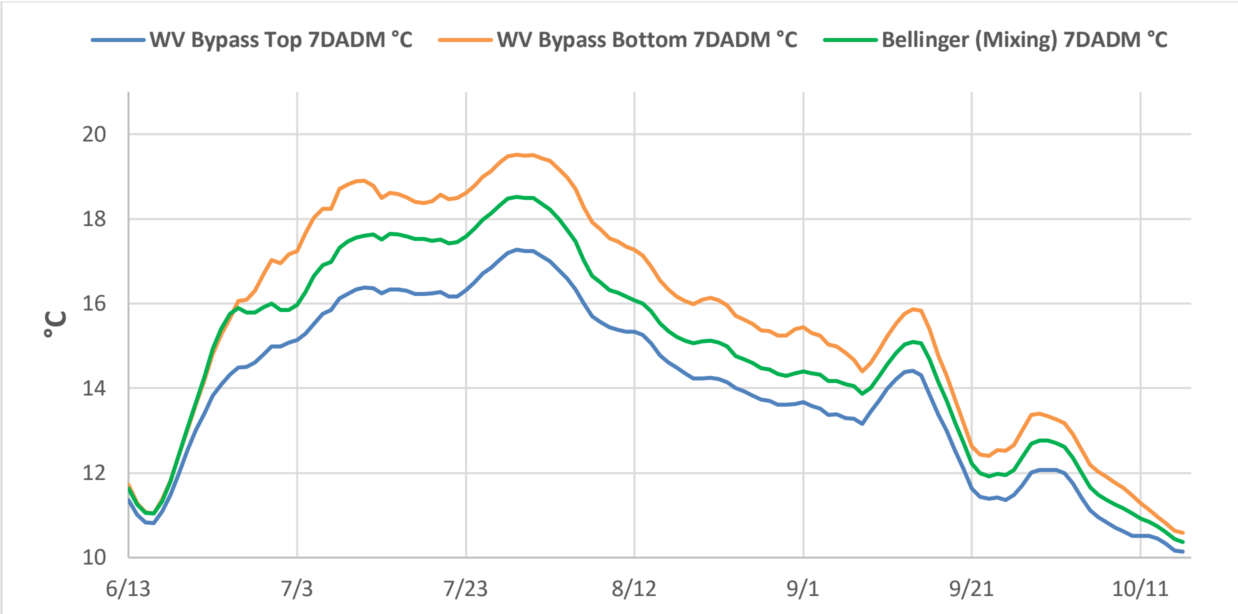

Figure 3. Comparison of temperatures (7DADM) at top of Walterville bypass, bottom of Walterville bypass and Bellinger Boat Ramp.

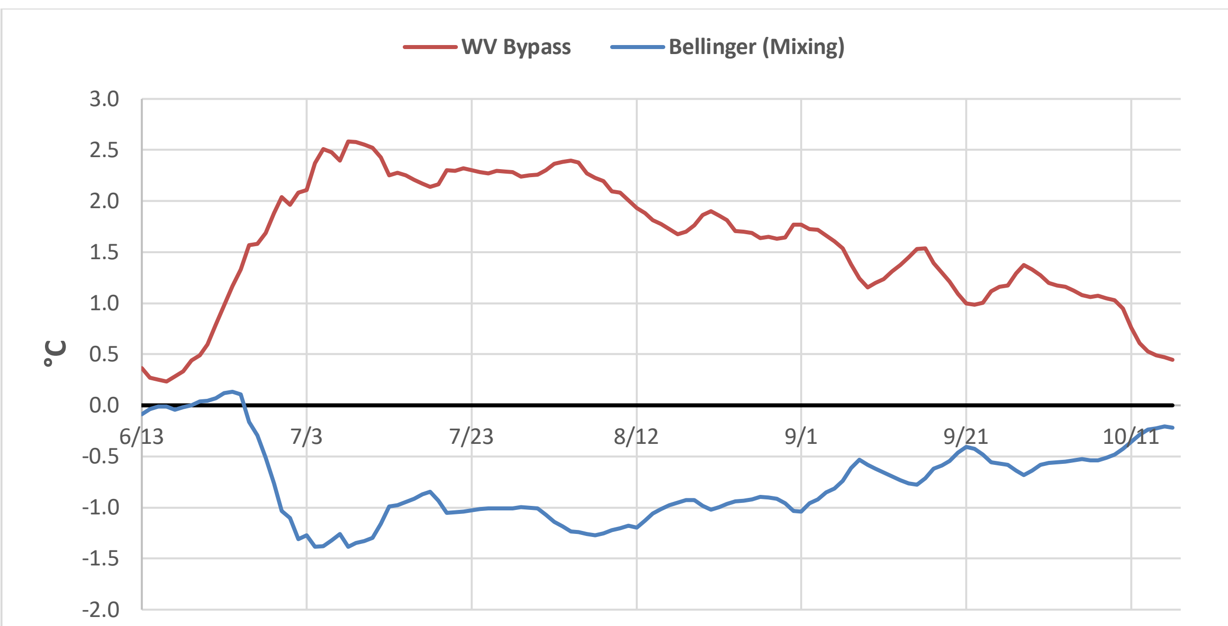

Figure 4. Comparison of warming (7DADM) in Walterville bypass reach and subsequent cooling at Bellinger Boat Ramp, below the mixing of the canal and bypass.

Discussion –

The 2017 results are similar to the findings of previous studies, in that the Leaburg Project had negligible temperature impacts while the Walterville Project looks to be a source of potential heating. The Walterville bypass reach experienced a maximum warming of 2.6 °C and a median of

1.7 °C during the study period. Even though the Walterville canal experienced some warming, there was up to 1.4 °C of cooling that occurred below the mixing of the canal and bypass at Bellinger Boat Ramp as the result of the thermal moderating effects of the canal. Water diverted through the canal is exposed to less solar radiation because flow velocities are greater and the canals are deeper and narrower than the bypass reach. Conversely, the increase in water temperature in the bypass reach is due to the reduction in flow which can result in reduced heat capacity, lower stream velocities and increased travel time. During the warm summer months, these factors allow for greater exposure to solar radiation heat loads and warmer temperatures in the bypass reach.

The warming that occurred in the Walterville bypass reach was likely exacerbated by the record breaking ambient temperatures in the Willamette Valley during the summer of 2017. The warming in the bypass is most readily observed when the reach recedes to just above the minimum flow of 1,000 cfs. This typically occurs in late June after the project outage. In 2017, this coincided with the first heat wave of the summer with consecutive days of air temperatures in the high 90s.

The varying temperature effects in the two bypass reaches are due in part to the geomorphology of the reaches themselves. The Leaburg bypass reach is located in the middle McKenzie River Basin and is characterized by narrow, confined, and stable riffle pool morphology which results in higher stream velocities and decreased travel times as compared to the Walterville bypass reach. The Walterville bypass is located in the lower McKenzie Basin and the reach is characterized by wide shallow glides, an unconfined floodplain containing numerous off-channels habitats and side-channels, all of which contribute to reduced stream velocities, increased travel time and therefore an increased potential for warming. The geomorphic features precede project operations and have likely contributed to historical variances in the temperature regimes of the reaches.

The results from this study are influenced by a combination of the operational, hydrological and atmospheric conditions that occurred during the 2017 study period. Further investigation into the temperature impacts of the projects will occur in 2018. A revised memorandum to the board will be issued at the conclusion of that year's study.

Requested Board Action

None. This memorandum is provided for informational purposes only.