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October 22, 2014

TO: Bob Montgomery, P.E., Project Manager, Anchor QEA LLC
Pradeep Mugunthan, P.E., Water Quality Technical Lead, Anchor QEA

FROM:  Dustin Bilhimer, WRIA 23 TMDL Coordinator, SWRO - WQ

SUBJECT: Extended Chehalis River Temperature Data Monitoring Results

All tidbits were removed from the Chehalis River, Elk Creek, South Fork Chehalis River, and the Black River on September 25th, 2014; except for the air tidbit at the station upstream of Pe Ell which was retrieved on October 7, 2014. Two instream tidbits were not recovered due to theft, these were: Chehalis River at Galvin Road, and the Newaukum River. Included with this memo is a zip file containing: original temperature data files, excel spreadsheets used for the data validation review, a post-deployment accuracy check spreadsheet, and a table of the tidbit removal times and point reference temperature measurements made during retrievals.

All of the recovered tidbits were found in the water and the comparison of the air and instream temperatures did not show any time during which the instream tidbits were out of the water. Reference instream temperatures were taken with an alcohol thermometer at all stations except CHL-US-BLK, BLK-RT12, and CHL-OAK. These three stations were not measured because the reference thermometer was lost after the Galvin Road site and we finished removing those three stations to finish before the down pouring rain started which held off until the very last site. We went back to the Galvin Rd site to look for the thermometer after retrieving the last tidbit and found that blackberry thorns had snagged the rope lanyard on the thermometer and pulled it out of our gear bucket without me or my field companion noticing. We did not go back and measure reference temperatures at the last three sites.

At the six stations where we did measure reference temperatures, 5 were within the manufacturer's measurement error range of 0.2°C. One station (Chehalis downstream of Pe Ell) had a difference of 0.28°C but the reference temperature measurement was made about 100ft downstream of the instream tidbit location and in shallower water which resulted in a small measurement bias. This tidbit passed the accuracy check so I feel the data can be used with confidence it was operating within manufacturer's specifications.

The standard operating procedure (see Gillingham et al, 2013) for post-deployment accuracy checks of each tidbit was followed using a NIST reference thermometer to compare tidbit temperatures in two water baths (0.05°C and 22.35°C). All tidbits passed the accuracy check except for tidbit #10385396 (instream tidbit for Chehalis River upstream of Newaukum River).



Tidbit #10385396 downloaded properly and a review of the deployment data appears to be consistent with the diurnal and monthly temperature patterns (see attached tables) in comparison with air temperatures measured at the Adna station; but the tidbit malfunctioned during the accuracy check and would not sync properly resulting in bad timestamps that were months ahead of where it should have been.

Table 1: Tidbit post-deployment accuracy check results; the average absolute difference of the tidbit measured temperature compared to the NIST reference temperature must be within the manufacturer’s specified measurement error range (0.2°C) to pass the accuracy check. Tidbit with serial number #10385396 did not properly sync and was not able to be checked.

Tidbit Serial Number	#9800562	#103835394	#10385397	#10385398	#10385400	#10385401	#10385402	#10385403	#10385405
Avg Abs Diff – All Baths	0.02	0.13	0.05	0.04	0.09	0.03	0.03	0.07	0.06
Avg Abs Diff – Ambient Bath	0.02	0.13	0.04	0.03	0.08	0.04	0.03	0.05	0.05
Avg Abs Diff – Ice Bath	0.02	0.13	0.07	0.05	0.09	0.01	0.04	0.09	0.07

All of the remaining instream tidbits passed my data validation review. Temperature measurements were removed from the .xls file versions when the thermistor recorded temperatures after it was removed from the water. Diurnal and monthly temperature graphs showed similar patterns compared to the air temperature data with a significant cooling break in the pattern from August 12 through 16 which corresponded to a regional cooling pattern during this same time period.

This dataset can be combined with the temperature data collected during the August 2013 to July 2014 study period without further qualification. If you have further questions, just let me know.

Attachment

- cc: Rich Doenges, Section Manager, SWRO-Water Quality Program
- Bob Cusimano, Section Manager, Environmental Assessment Program
- Carol Smith, Program Manager, Environmental Assessment Program
- Paul Pickett, P.E., Environmental Assessment Program
- Andrew Kolosseus, Unit Supervisor, SWRO-Water Quality Program
- Bill Ward, Environmental Assessment Program
- Betsy Dickes, SWRO-Water Quality Program

References:

Gillingham, David; Fields, Cindy; and Mugunthan, Pradeep. 2013. Final Quality Assurance Project Plan Chehalis Basin Flood Hazard Mitigation Alternatives Analysis Project. Anchor QEA, LLC. Seattle, Washington.

