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Quality Assurance Project Plan

Humptulips River
Temperature Monitoring

June 2010

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Humptulips River Temperature Monitoring

June 2010

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Abstract

The Humptulips River lies in the southwestern portion of the Olympic Peninsula in Washington State Department of Ecology's (Ecology) Water Resource Inventory Area 22, the Lower Chehalis basin. The river is considered water quality impaired for temperature. There were total maximum daily load studies (TMDL) conducted by Ecology in the lower (Pelletier and Seiders, 2000) and the upper (Cleland, 2001) watersheds. Monitoring found that the Humptulips River had water temperatures warmer than the state water quality standards. The objective for this study is to continuously monitor temperature through the summer of 2010 to determine if water quality temperatures are meeting state water quality standards.

Each study conducted by Ecology must have an approved Quality Assurance (QA) Project Plan. The QA Project Plan describes the objectives of the study and the procedures to be followed to achieve those objectives. After completion of the study, a final report describing the study results will be posted to the Internet.

Background

The Humptulips River lies in the southwestern portion of the Olympic Peninsula in Ecology's WRIA 22 (Figure 1). The total drainage area of the basin is 276 square miles with roughly 130 of those square miles north of Highway 101 in the upper watershed area of the East and West Forks of the river. The Humptulips River is considered the westernmost tributary of the Chehalis River system. The Humptulips River does not flow directly into the Chehalis River but joins the waters of Grays Harbor on the North Bay side.

Ecology conducted total maximum daily load studies (TMDL) in the lower (Pelletier and Seiders 2000) and the upper (Cleland, 2001) watersheds. Monitoring found that the Humptulips River had water temperatures warmer than the state water quality standards. The three lower river sites were included on the list of water quality impaired waterbodies (303(d) list) in 1996; the upper watershed sites were included in 2004. The 2008 Water Quality Assessment categorizes all segments as 4A, i.e., water quality impaired, but with a TMDL being implemented.

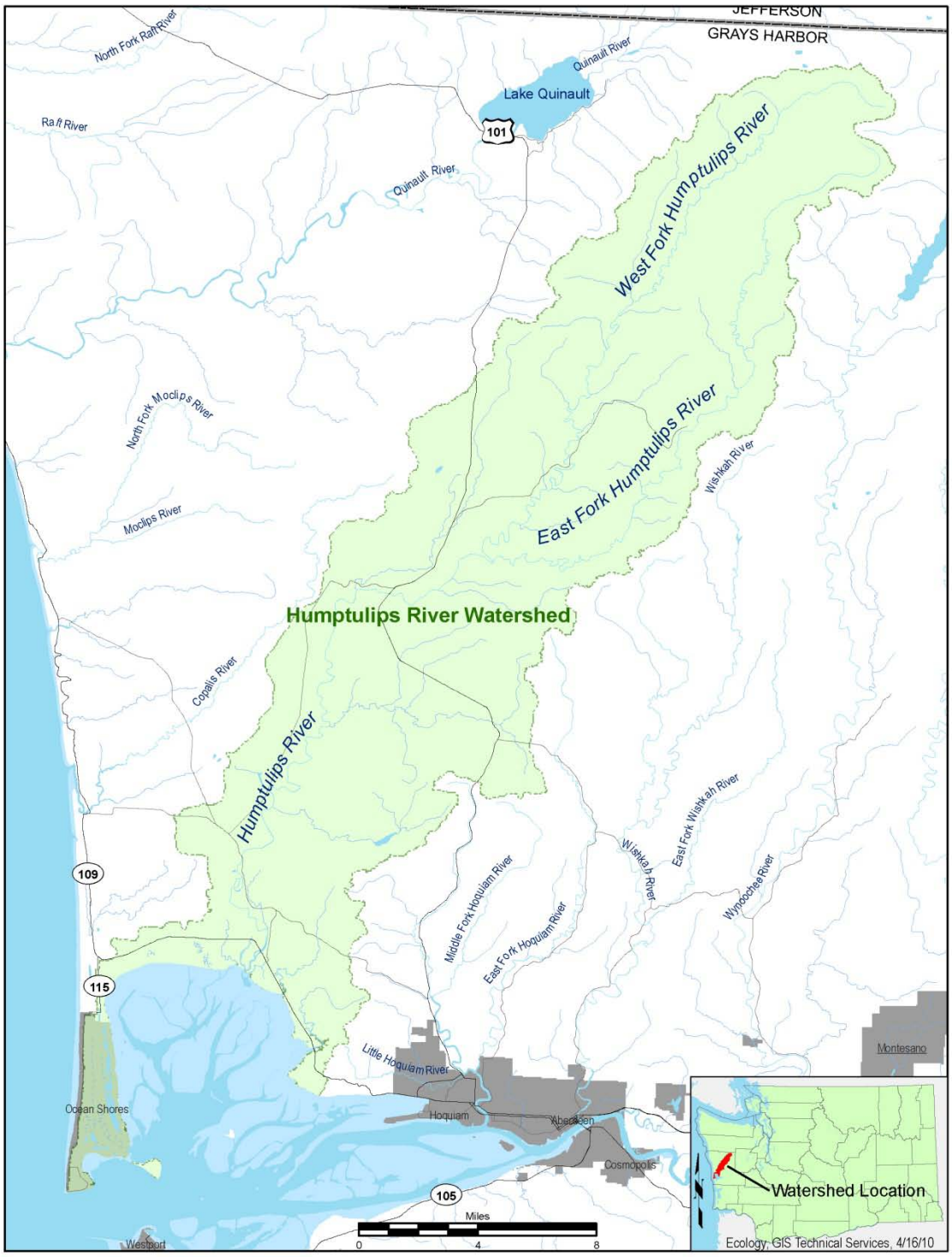

Figure 1. The Humptulips River Watershed. *The watershed lies in the southwestern portion of the Olympic Peninsula.*

Project Description

Ecology plans to conduct temperature monitoring in the Humptulips watershed. The objectives for this study are:

1. Characterize water temperatures during the summer from June through September 2010.
2. Compare water temperature with the appropriate water quality standards. Determine if water quality standards are being met.

Continuous water temperature data will be collected at all sampling sites (Table 1, Figure 2). Air temperatures will be taken at all sites except for those sites within 0.5 miles of another site unless best professional judgment determines the conditions to be considerably different than upstream. Current conditions will be determined and data compared to the appropriate water quality standards (Ecology, 2006).

The water quality standard for temperature for the majority of the Humptulips River is:

- 16 °C for core summer salmonid habitat
- 13°C from September 15 through July 1for salmonid spawning and incubation

The lower most reach of the river, from Grays Harbor to approximately river mile 6, has only the single temperature criteria of 16 °C (Payne, 2006).

Table 1. List of Sampling Sites for the Humptulips River Temperature Monitoring

Project Site Name 303 (d) Listing ID #	Name or River Mile (RM) mentioned in the 303 (d) list	TMDL SITE NAME (approximate)	Site Description	Latitude	Longitude
9482	01-HUMP	*NA*	Humptulips River near mouth at Hwy 109 bridge	47° 3' 4.6"	124° 2' 28.8"
7737	WDFW	*NA*	Humptulips River inflow to Hatchery	47° 13' 53.7 "	123° 58' 27.4"
6581	22A070	22A070	Humptulips River near Humptulips at Hwy 101 bridge	47° 13' 47.3"	123° 57' 42.6"
33667	RM 13.938	USFS3	WF Humptulips River near Newbury and Rainbow Creeks	47° 19' 48.2"	123° 49' 53.2"
33668	RM 18.365	USFS6	WF Humptulips River just upstream of Elk Creek	47° 22' 55.7"	123° 47' 13.4"
33673	RM 30.62	USFS9	WF Humptulips River near Campbell Tree Grove	47° 29' 21.4"	123° 39' 40.3"
33659	RM 15.537	USFS1	EF Humptulips River Downstream of Go Forth Creek	47° 19' 57.8"	123° 43' 40.6"
33662	RM 18.699	T13	EF Humptulips River Upstream of Flatbottom Creek	47° 22' 2.7"	123° 43' 26.3"
33660	RM 26.62	USFS12	EF Humptulips River near Stovepipe mountain	47° 26' 2.1"	123° 40' 56.1"
33661	RM 29.24	USFS13	EF Humptulips River in Upper basin near Campbell Grove	47° 26' 42.3"	123° 38' 10.3"

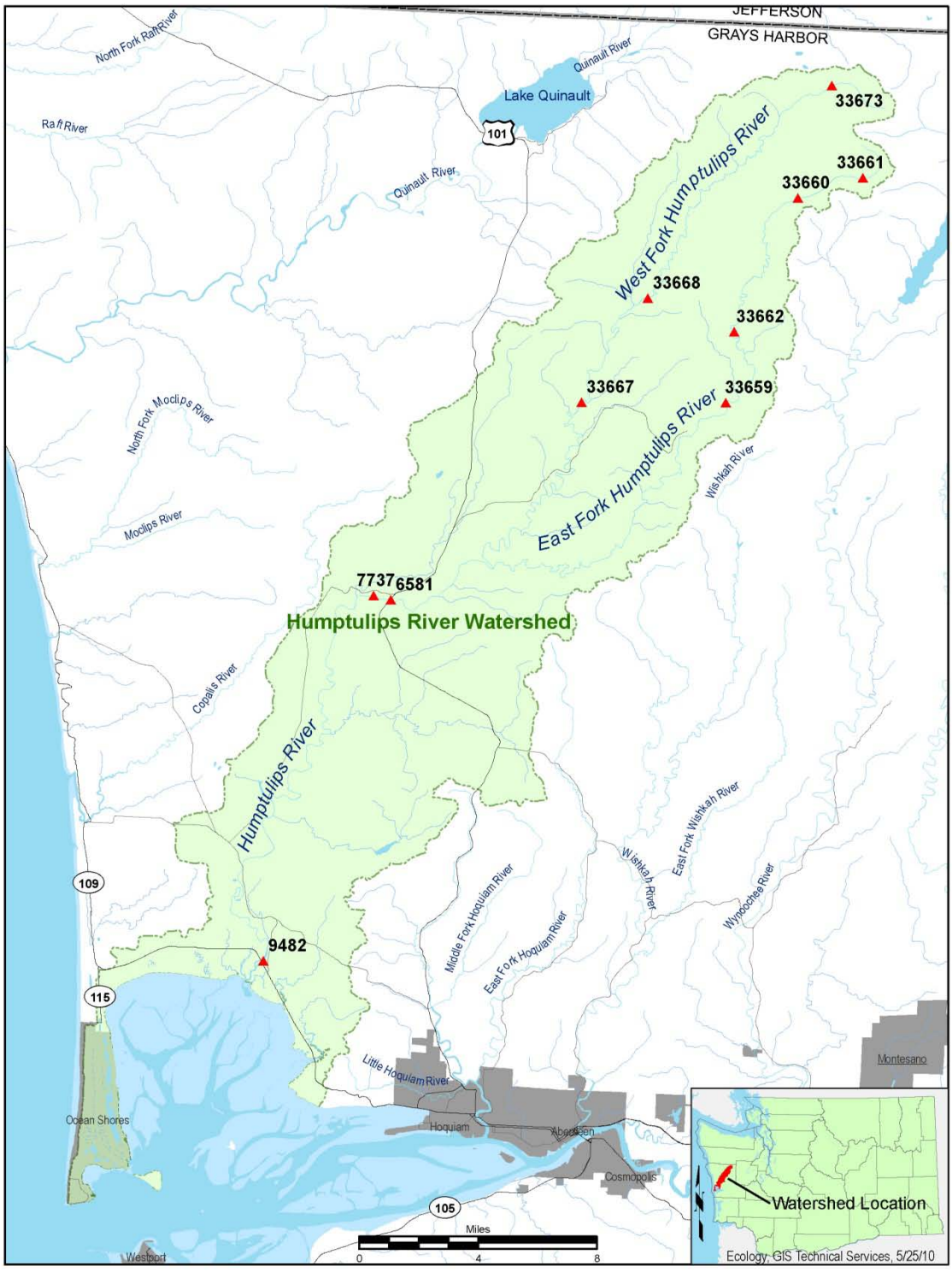

Figure 2. Sample locations on the Humptulips River. *The site names are the 303(d) listing numbers for that specific reach of the river.*

Organization and Schedule

Table 2 describes those involved in this project and their respective responsibilities.

Table 2. Organization of Project Staff and Resources

Staff	Title	Responsibilities
David Rountry Water Quality Program Southwest Region Phone: (360) 407-6276	Client	Clarifies scope of the project. Provides internal review of the QAPP and approves the final QAPP. Provides field assistance. Reviews and approves draft and final report.
Betsy Dickes Water Quality Program Southwest Region Phone: (360 407-6296	Project Manager & Principal Investigator	Writes the QAPP. Oversees field sampling and transportation of samples to the laboratory. Conducts quality assurance review of data. Analyzes and interprets data, and enters data into EIM. Writes the draft and final report.
Variable Ecology Staff	Field Assistant	Assists with field work.
Kim McKee Water Quality Program Southwest Region Phone: (360) 407-6407	Unit Supervisor	Provides internal review of the QAPP, approves the budget, tracks progress, and approves the final QAPP. Reviews and approves draft and final report.
Garin Schrieve Water Quality Program Southwest Region Phone: (360) 407-6271	Section Manager	Reviews the project scope and budget, reviews the draft QAPP, and approves the final QAPP. Reviews and approves draft and final report.
Mike Herold, Headquarters, Water Quality Program Phone: (360) 407-6434	Quality Assurance Officer	Reviews and approves the draft QAPP.
Roberta Woods Water Quality Program Southwest Region Phone: (360) 407-6269	Plain Talk Editor	Reviews the draft QAPP and edits for clarity and consistency.
Shawna Beers Water Quality Program Southwest Region Phone: (360) 407-6270	Secretary Lead	Formats draft QAPP and report.
Kelsey Highfill Water Quality Program Phone: (360) 407-6722	Communication Consultant	Formats final QAPP and report. Arranges to enter documents onto the web.

EIM – Environmental Information Management system.
QAPP – Quality Assurance Project Plan.

Below is a schedule for project completion (Table 3).

Table 3. Proposed Project Schedule

Field and laboratory work	Due date	Lead staff
Field work completed	October 2010	Betsy Dickes
Environmental Information System (EIM) database		
EIM user study ID	BEDI0017	
EIM data loaded	July 2011	Betsy Dickes
Final report		
Author lead	Betsy Dickes	
Schedule		
Draft due to supervisor	February 2011	
Draft due to client/peer reviewer	March 2011	
Draft due to external reviewer(s)	April 2011	
Final (all reviews done) due to publications coordinator (Kelsey)	June 2011	
Final report due on web	July 2011	

Quality Objectives

The data quality objectives are described in Table 4.

Table 4. Data Quality Objectives for the Thermographs

Equipment	Accuracy	Resolution
Certified Reference Thermometer HB Instrument Co.	± 0.1°C	0.1 °C
Field Thermometer Brooklyn Thermometer Co.	± 0.2 °C	0.1 °C
Temperature Logger (Water) Onset Water Temp Prov2 Logger	±0.2°C at 0 to 50°C (± 0.36°F at 32° to 122°F)	0.2 °C
Temperature Logger (Air) Onset Water Temp Prov2 Logger	± 0.4 °C	0.4 °C

The accuracy and instrument bias measurement quality objectives (MQOs) of each temperature logger is verified through both pre- and post-deployment calibration checks following the procedures described in the *Continuous Temperature Sampling Protocols for the Environmental*

Monitoring and Trends Section (Ward, 2005) and in the *TFW Stream Temperature Survey Manual* (Schuett-Hames et al., 1999). The procedures require the temperature loggers be tested in controlled water temperature baths that bracket the expected monitoring range (near 0ºC and near 20ºC). The results are then compared to those obtained with a NIST certified reference thermometer. All temperature loggers that fail to meet the instrument accuracy (Table 4) will be checked a second time. Temperature loggers that fail a second pre-deployment check will not be used.

Temperature loggers that fail a second post-deployment check (this rarely occurs) will have their data adjusted or rejected based on the following:

> If the difference between the pre- and post-deployment calibration check results for a temperature logger is at or below the instrument accuracy, then the instrument bias will be corrected by adding to the raw data the difference between the mean of the pre- and post-deployment calibration check results and the certified reference thermometer. For example, the temperature logger accuracy is ±0.2°C. If the mean pre-deployment calibration check difference is -0.19°C, it meets instrument accuracy; if the mean of post-deployment calibration check difference is -0.23°C, it fails instrument accuracy. Therefore a correction factor of +0.21°C is needed to correct the data for instrument bias (-19°C + (-0.23°C)/2).

Sampling bias is minimized by following the deployment procedures described by Ward (2005). These procedures specify site selection and deployment methods designed to ensure that the temperature logger results are representation of stream conditions throughout the entire monitoring period and not biased by the effects of solar radiation or low streamflow conditions.

Sampling Design

Ecology selected sites based on its list for water quality limited waters (303(d) list). The sites were identified using Ecology's 303(d) mapping tool and verification with the TMDL.

Representativeness

Established protocols will be followed (Bilhimer & Stohr, 2009; Ward, 2005; Schuett-Hames, et al., 1999; Ecology, 1993). The continuous temperature data collected may not be considered representative of a watershed or the state as a whole, but will be considered representative of the stream reach being sampled.

Comparability

All measurements and analytical procedures will be documented so that the data can be compared with samples collected and analyzed in a like manner.

Completeness

The data quality objectives for completeness measure the amount of valid data needed to meet the project objectives. The goals for the collected data will be to determine compliance with current water quality standards. The use of continuous stream temperature data for water quality

standards compliance is based on the ability to evaluate the temperature criteria defined by Washington's Water Quality Standards (Chapter 173-201A WAC). The temperature criteria established for protection of aquatic life is measured by the 7-day average of the daily maximum temperatures (7-DADMax). Assessing compliance with this standard requires that the 7-DADMax be calculated using the 7-day period that contains the maximum annual stream temperature.

The stream water temperature data may have periods of time with data gaps caused by instrument malfunction or from the probe being exposed to air when flows drop below the deployment location. If these data gaps exist, the continuous air temperature data collected from the station or a nearby one will be used to determine if the data gap occurred during the hottest time of the year. If the data gap spans the hottest time period, then the entire stream temperature data set may not be used for assessing standards compliance. However, if there are other periods of the year that also exceed the 7-DADMax, then the data set may be used for compliance assessment. The assumption is that the highest annual stream temperature will coincide with the highest air temperature.

Sampling and Measurement Procedures

Field sampling and measurement protocols will follow those described in the following publications:

1. *Timber-Fish-Wildlife (TFW) Stream Temperature Survey Manual* (Schuett-Hames et al., 1999).
2. *Continuous Temperature Sampling Protocols for the Environmental Monitoring and Trends Section* (Ward, 2005).
3. *Standard Operating Procedures for Continuous Temperature Monitoring of Fresh Water Rivers and Streams Conducted in a Total Maximum Daily Load (TMDL) Project for Stream Temperature* (Bilhimer & Stohr, 2009).
4. *Field Sampling and Measurement Protocols for the Watershed Assessments Section* (Ecology, 1993).

Temperature thermographs will be installed where water and air temperatures are representative of the surrounding environment and are shaded from direct sunlight.

To minimize the spread of invasive species, field work will proceed from upstream to downstream and waterproof boots will not have felt soles (Ward, 2010). Boots will be washed in hot water and thoroughly dried between sampling events after each field day. This washing activity will occur in the Ecology Headquarters Chain of Custody room.

Quality Control Procedures

Field sampling variation will be addressed by field checks of the instruments with a calibrated, handheld thermometer (Ecology, 1993) at the thermograph site upon deployment, retrieval, and mid-season. The Onset® Loggers will be calibrated before deployment and after recovery according to the TFW stream temperature protocols (Schuett-Hames et al., 1999) to document

instrument bias and performance at representative temperatures. A reference thermometer certified by the National Institute of Standards and Technology **(**NIST) will be used for the calibration. At the completion of the monitoring project the raw data will be adjusted for instrument bias, based on the calibration results, if the bias is greater than +/-0.2°C (Schuett-Hames et al.,1999).

Data Management Procedures

The raw data will be summarized into the 7-day average of the daily maximum temperature using Excel and Access (Microsoft, 2007). The data will be used to determine whether the water temperature meets the appropriate state water quality criteria.

Audits and Reports

The Project Manager will submit the final technical study report to the client per the project schedule (Table 3). The daily minimum, maximum, and mean values will be entered into EIM after the report has been submitted for final formatting and publishing.

Data Verification and Validation

The Project Manager is responsible for verifying that field data entries are complete and correct.

Data verification involves examining the data for errors, omissions, and compliance with quality control (QC) acceptance criteria. Once measurement results have been recorded, they are verified to ensure that:

- Data are consistent, correct, and complete, with no errors or omissions.
- Results for QC samples accompany the sample results.
- Established criteria for QC results were met.
- Data qualifiers are properly assigned where necessary.
- Methods and protocols specified in the QA Project Plan were followed.

Data for instream temperature monitoring stations will be verified against the corresponding air temperature station. This will ensure the stream temperature record represents water temperatures and not temperatures recorded while the Onset® Logger was out of the water. The measurement accuracy of the Onset® Loggers will be verified using a NIST certified reference thermometer as well as instream temperature verification.

Data validation will involve professional judgment and will be used to determine whether data quality objectives have been met. The project manager will examine the complete data package in detail to determine whether the procedures specified in the QA Project Plan were followed.

Data Quality (Usability) Assessment

The Project Manager will verify that all measurements and data quality objectives have been met for each monitoring station. This determination will be made by examining the data and all of the associated QC information. Data that does not meet the project data quality criteria will be qualified or rejected as appropriate. The field investigator will produce a station QA report that will include site descriptions, data QA notes, and graphs of all continuous data. Temperature data will be summarized and stored in Ecology's Environmental Information Management system.

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