

## 1. Introduction

The 2021 Upland Finfish Hatching and Rearing General NPDES Permit (Ecology, 2021) requires fifteen Washington Department of Fish and Wildlife (WDFW) hatcheries to monitor continuous temperature. Also, one hatchery is required to monitor temperature due to an Administrative Order. All sixteen hatcheries discharge to waterbodies with temperature impairments. This Sampling and Analysis Plan (SAP) describes temperature monitoring protocols, data quality and control, and data analysis plans for WDFW fish hatcheries. Figure 1 displays the locations of facilities required to monitor temperature.

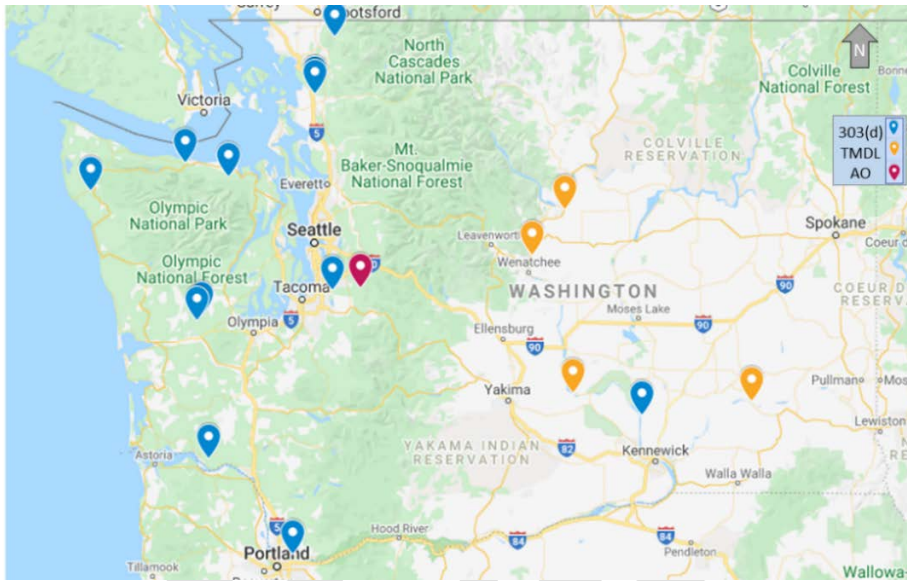


Figure 1. Map of WDFW Hatcheries required to monitor continuous temperature.

### 303(d) List –11 facilities

The eleven facilities listed in Table 1 discharge into waterbodies that do not meet water quality standards for temperature. These receiving waters are Category 5 on the 303(d) list. The effluent limit is 0.3° C above the receiving water.

Table 1. WDFW hatcheries with receiving waters on the 303(d) List.

Facility Name	303(d) Temperature Impaired Waterbody
Beaver Creek Hatchery	Beaver Creek, Elochoman River
Bingham Creek Hatchery	Bingham Creek
Bogachiel Hatchery	Bogachiel River
Dungeness Hatchery	Dungeness River
Elwha Hatchery	Elwha River
Kendall Creek Hatchery	Kendall Creek
Ringold Springs Hatchery	PE 16.4 WW
Samish Hatchery	Friday Creek, Samish River
Satsop Springs Hatchery	East Fork Satsop River
Soos Creek Hatchery	Big Soos Creek
Vancouver Hatchery	Columbia River

The permit lists Gray's Hatchery, however, WDFW requested inactive status on May 13, 2021.

*TMDL -4 facilities*

Four WDFW Hatcheries (Table 2) have temperature wasteload allocations (WLA) based on the Total Maximum Daily Load (TMDL) for the Columbia and Lower Snake Rivers (USEPA, 2021). The loading capacity during the critical period is 0.3° C human use allowance based on Washington and Oregon standards (Ecology, 2021).

Table 2. WDFW hatcheries with WLAs based on a TMDL.

Facility Name	Columbia and Lower Snake Rivers TMDL
Chelan	Columbia River
Eastbank	Columbia River
Lyons Ferry	Snake River
Priest Rapids	Columbia River

*Administrative Order*

Administrative Order #17969 (Ecology, 2020) requires Palmer Ponds Hatchery to monitor temperature of the effluent discharge to the Green River from May 1<sup>st</sup> to October 31<sup>st</sup>.

This sampling and analysis plan (SAP) describes temperature data requirements, methods for collection, and quality assurance, data management, and reporting protocols for WDFW facilities that discharge to temperature impaired waterbodies.

## 2. Objectives

The goal is to collect and submit accurate continuous temperature data to meet requirements of the NPDES Permit and Administrative Order. These data will be used to assess whether hatchery discharges are contributing to the impairment of receiving waters.

## 3. Study Design

### NPDES Permit Requirements

WDFW will characterize water temperature at hatcheries by collecting continuous temperature. The monitoring period, number of sites, and reporting requirements differ based whether the impaired receiving water is on the 303(d) List, has temperature wasteload allocations from a TMDL, or has an Administrative Order.

*303(d)*

Eleven facilities (Table 1) discharge to waterbodies identified as Category 5 for temperature impairment on the 303(d) list. The following monitoring is required by the NPDES General Permit:

- Monitor continuous temperature (30-minute intervals) effluent discharges prior to entering receiving waters **April 1<sup>st</sup> to November 30<sup>th</sup>**. No monitoring is required for discharges from drawdowns or from pollution abatement ponds.
- Collect effluent temperature with data logger with  $\pm 0.2^{\circ}$  C accuracy (influent is optional)
- Report daily maximum temperature from **April 1<sup>st</sup> to November 30<sup>th</sup>** on quarterly Discharge Monitoring Reports (DMRs)
- Report daily flow (MGD) during solids and nutrient sampling events and anytime flow significantly changes

*TMDL*

The Permit requires four WDFW hatcheries (Table 2) to monitor temperature, record flow, and calculate heat load. These facilities must meet WLA set in the Columbia and Lower Snake Rivers TMDL.

- Monitor continuous temperature (30-minute intervals) of all flow-through pond and raceway effluent discharges prior to entering receiving waterbodies from **July 1<sup>st</sup> to October 31<sup>st</sup>**
- Collect effluent temperature data logger with  $\pm 0.2^{\circ}$  C accuracy (influent is optional)
- Report daily flow (MGD) during solids and nutrient sampling events and anytime flow significantly changes
- Provide summary of the average monthly flow on quarterly DMRs
- Report the monthly heat load in million kcal/day (average monthly temperature  $^{\circ}$ C x average monthly flow in MGD x 3.776) on quarterly DMRs
- Meet the WLA (million kcal/day) from July to October -Chelan 1,140; Eastbank 1,950; Lyons Ferry 5,840; Priest Rapids 5,720

*Administrative Order*

Administrative Order Docket #17969 requires Palmer Hatchery to monitor continuous temperature:

- Monitor continuous temperature (30-minute intervals) at the effluent discharge prior to entering the Green River **May 1<sup>st</sup> to October 31<sup>st</sup>**
- Collect effluent temperature data logger with  $\pm 0.2^{\circ}$  C accuracy (influent is optional)
- Report daily maximum temperature from **May 1<sup>st</sup> to October 31<sup>st</sup>** on quarterly DMRs

Data Collection Method

WDFW will deploy Onset HOBO<sup>®</sup> Temperature Data Loggers at all effluent discharges during the required periods:

- 303(d): April 1<sup>st</sup> to November 30<sup>th</sup>
- TMDL: July 1<sup>st</sup> to October 31<sup>st</sup>
- Administrative Order: May 1<sup>st</sup> to October 31<sup>st</sup>

Table 3 lists the type of data logger used at each facility.

## 2022 WDFW HATCHERY CONTINUOUS TEMPERATURE SAMPLING AND ANALYSIS PLAN

Table 3. Model and Accuracy of HOBO Onset Temperature Data Loggers utilized at WDFW hatcheries.

Facility	Temperature Data Logger	Temperature Data Logger Accuracy
<b>303(d) List</b>		
Beaver Creek	HOBO U22-001 Water Temp Pro v2; Base-U-4 Optic Base Station	±0.2°C -40°C and 70°C
Bingham Creek	HOBO U22-001 Water Temp Pro v2; Base-U-4 Optic Base Station	±0.2°C -40°C and 70°C
Bogachiel	HOBO U22-001 Water Temp Pro v2; Base-U-4 Optic Base Station	±0.2°C -40°C and 70°C
Dungeness	HOBO MX2203 TidbiT MX Temperature 400' Data Logger (BLE)	±0.2°C from 0° to 70°C
Elwha	HOBO MX2203 TidbiT MX Temperature 400' Data Logger (BLE)	±0.2°C from 0° to 70°C
Kendall Creek	HOBO MX2203 TidbiT MX Temperature 400' Data Logger (BLE)	±0.2°C from 0° to 70°C
Ringold Springs	HOBO MX2203 TidbiT MX Temperature 400' Data Logger (BLE) for effluent; HOBO MX2202 Pendant for influent	±0.2°C from 0° to 70°C ±0.5°C from -20° to 70°C
Samish	HOBO U22-001 Water Temp Pro v2 and Base-U-4 Optic Base Station	±0.2°C -40°C and 70°C
Satsop Springs	HOBO MX2203 TidbiT MX Temperature 400' Data Logger (BLE)	±0.2°C from 0° to 70°C
Soos Creek	HOBO U22-001 Water Temp Pro v2 Base-U-4; Optic Base Station	±0.2°C -40°C and 70°C
Vancouver	HOBO U22-001 Water Temp Pro v2 Base-U-4; Optic Base Station	±0.2°C -40°C and 70°C
<b>TMDLs</b>		
Chelan	HOBO U22-001 Water Temp Pro v2; Base-U-4 Optic Base Station	±0.2°C -40°C and 70°C
Eastbank		
Lyons Ferry	HOBO UTBI-001 TidbiT v2 Water Temperature Data Logger	±0.21°C from 0° to 50°C
Priest Rapids	HOBO U22-001 Water Temp Pro v2; Base-U-4 Optic Base Station	±0.2°C -40°C and 70°C
<b>Administrative Order</b>		
Palmer Ponds	HOBO U22-001 Water Temp Pro v2; Base-U-4 Optic Base Station	±0.2°C -40°C and 70°C

Temperature Data Loggers will be configured:

- Monitor in °C every 30min at the hour and half hour. Set clock to Pacific Standard Time (PST) <https://www.time.gov/>. Ensure the logger will not automatically adjust to Daylight Savings Time (DST).
- Table 4 lists the names used for temperature data loggers and data files for each site at a facility. The default data file name is the logger's name. Loggers and data file names should include the four-letter facility abbreviation and the site name. The facility four letter abbreviation is necessary to identify files because most facilities use the same site names. Appendix A provides maps and location descriptions from NPDES Facility Site Plans and hatchery staff.
- Logger serial number should be included in the downloaded data.

# 2022 WDFW HATCHERY CONTINUOUS TEMPERATURE SAMPLING AND ANALYSIS PLAN

Table 4. Logger and Data File Names for Hatchery Continuous Temperature Monitoring Sites: four letter facility abbreviation plus site name.

Facility	Influent Site(s)	Effluent Site(s)
Beaver Creek	<b>BEAV-I-1</b> or <b>BEAV-I-2</b> -Beaver Cr until April or May; Elochoman R -summer to early fall	<b>BEAV-E</b> -located at E-1, E-2, or E-3 (only one used at a time)
Bingham Creek	Fish Science: Bingham Cr and EF Satsop R	<b>BING-E-1</b> all year; <b>BING-E-2</b> July-May (tied to annual release)
Bogachiel	<b>BOGA-R-US</b> -Bogachiel R monitored 4,170' upstream of effluent	<b>BOGA-E-FT</b> -on effluent side of fish trap upstream of E-4
Chelan	Groundwater from well and spring water not monitored	<b>CHEL-E#2</b> -Outfall to Beebe Cr, which flows to the Columbia R
Dungeness	<b>DUNG-I</b> -Dungeness R	<b>DUNG-E</b> -below adult pond to Hatchery Outlet Creek above the Dungeness R
Eastbank	<b>EAST-I</b> -Mechanical Room	<b>EAST-E</b> -outfall to Columbia R
Elwha	<b>ELWH-I-RC</b> -mixed surface and well water; Intake Feb-June; Mid to Lower Rearing Channel July-Jan; <b>ELWH-I-ER</b> surface water at Elwha R intake	<b>ELWH-E</b> -downstream end of adult trap or rearing channel (dependent on flow)
Kendall Creek	<b>KEND-I-S</b> gravity surface water intake <b>KEND-I-G</b> groundwater in incubation	<b>KEND-E-K</b> fish ladder
Lyons Ferry	<b>LYON-I</b> -Marmes Well Pump Station	<b>LYON-E</b> -Outfall to Snake R
Palmer Ponds	springs and groundwater seepage - not monitored	<b>PALM-E-GR</b> to Green R
Priest Rapids	<b>PRIE-I-S</b> surface water at adult pond headboxes <b>PREI-I-G</b> well water at adult pond headboxes	<b>PRIE-E-1</b> -Channel to Columbia R
Ringold Springs	<b>RING-I-1</b> -Main Intake <b>RING-I-2</b> -Lower Diversion	<b>RING-E-1</b> -adult trap
Samish	<b>I-FRI</b> -Friday Creek Sept-May; <b>I-SAM</b> -Samish R April-May &/or Sept-Oct, if used	Friday Cr: <b>E-FRI</b> Feb to March; <b>E2-FRI</b> -March to May; <b>E3-FRI</b> – April to May (monitor active discharge) <u>Samish R</u> : <b>E-SAM</b> April to May &/or Sept-Oct, if used
Satsop Springs	artesian springs and groundwater seepage - not monitored	<b>SATS-E</b> -outfall from Pond 1 thru female pens, spawning channel to EF Satsop R
Soos Creek	<b>SOOS-I</b> -Big Soos Cr intake	<b>SOOS-E-1</b> -all year <b>SOOS-E-2</b> -April to June from adult ponds
Vancouver	<b>VANC-I</b> -spring box influent	<b>VANC-C-RW</b> -north outfall to wetlands from raceways 17-20 <b>VANC-C-RP</b> - south outfall to wetlands from round ponds 1-12

### Deployment

Deploy data loggers at a depth to prevent them from becoming exposed to the water surface or air during low flow periods. Attach the logger to a permanent structure or weigh it down to prevent the current from moving the logger downstream or to the surface (keep it near the bottom). Deploy the logger in a well-mixed part of the influent or effluent. Avoid eddies or areas with reduced flows (Ward, 2018). Shield the logger from direct sunlight. If necessary, shade the logger with a radiation shield, like shown in Figure 2. If using a shade device, ensure the device does not block flow to the logger.



Figure 2. Examples of radiation shields (cap from RMRS, 2014) using an opaque color (avoid clear shields). Drill holes to facilitate water circulation.

## **4. Field Measurements and Hatchery Information**

See Table 4 and Appendix A for information about hatchery monitoring sites.

### Field Measurements

- Complete the Monitoring Log each time the logger is moved. Record start and end times when the logger is removed from the monitoring site and when it is re-deployed to flag inaccurate data. Also record changes to the environment, such as changes in flow velocity and depth at the deployment location. Record significant changes to the logger's deployment status, such as re-location to a new deployment site or poor monitoring conditions. Poor monitoring conditions include the logger collecting data near water's surface or in the air, in an eddy, or not shielded from direct sunlight.
- Once per quarter, record in the Monitoring Log, the temperature from a thermometer next to the actively logging temperature data logger. Compare the error rate to monitor for any changes over time.

### Download

- Download the temperature data logger each month.

## **5. Record Keeping and Reporting**

### Data Management

- Export the data as an Excel file (.csv or .xlsx). Each month save the temperature data for each site and complete the Monitoring Log in the Facility folder in the HQ temperature archive
- **Link to HQ temperature archive:** <\\ssv.wa.lcl\dfw files\FP\Hatcheries\Ann WQlab\DATA - water quality\TEMPERATURE>
- The HQ temperature archive also has a folder called 1-Temperature Monitoring Info with manuals, template of the Monitoring Log, instructions for the Quarterly Temperature



Monitoring QA/QC and Data Analysis, and examples: ["DATA - water quality\TEMPERATURE\1-Temperature Monitoring Info"](#)

#### Quality Control and Assurance

- Each month complete the Monitoring Log and flag inaccurate data.
- Accuracy of loggers can be certified through Onset. Annually check temperature data loggers and hatchery thermometer with NIST certified thermometer and record in Monitoring Log.

#### Data Analysis and Submittal

- Complete the applicable Quarterly Temperature Data Analysis (Appendix B) by the 10<sup>th</sup> of the month before the DMR is due
  - ✓ 303(d) Listed hatcheries calculate daily maximum temperature: [How to Calculate Daily Maximum Temperature.docx](#)
  - ✓ TMDL facilities with WLAs report daily average temperatures and heat load: [How to Calculate Daily Average Temperature and Heat Load for TMDLs](#)

Complete the Quarterly Data Analysis and save to the Facility folder linked above by the 10<sup>th</sup> of the month before the DMR is due. If no fish were present on station or water was not diverted, add that comment to DMR notes.

- Submit DMR and Quarterly Temperature Data Analysis by July 10<sup>th</sup> (DMR due date July 30<sup>th</sup>) for April to June data
- Submit DMR and Quarterly Temperature Data Analysis by October 10<sup>th</sup> (DMR due date October 30<sup>th</sup>) for July to September data
- Submit DMR and Quarterly Temperature Data Analysis by January 10<sup>th</sup> (DMR due date January 30<sup>th</sup>) for October to November data

## **6. Monitoring Team Responsibilities**

WDFW Headquarters Water Quality staff Ann Leroux and Renee Fields are responsible for preparing the SAP, coordinating permit activities with Ecology, archiving temperature data, assisting hatchery staff with DMRs, and checking DMRs for completeness and accuracy.

Table 5 lists hatchery staff responsible for monitoring temperature, recording information in the Monitoring Log, archiving temperature data locally and in HQ temperature archive, and timely submission of Quarterly Temperature Data Analysis and DMRs.

Table 5. Hatchery Staff responsible for temperature monitoring and DMRs.

Facility	Hatchery Contacts
Beaver Creek	Shane McEneny, Darin Hamilton, and Aaron Roberts
Bingham Creek	Joel Jaquez, Joe Rothrock, and Mike Lucero for hatchery; Devin West and John Winkowski for surface water
Bogachiel	Matt Heil and Chris Rockwell
Chelan	WDFW -Wesley Field, David Cox, and David Clark; Chelan PUD -Ian Adams
Dungeness	Jeff Benjamin and Jeff Gufler
Eastbank	WDFW -Denise McCarver and Mauro Solorio; Chelan PUD Ian Adams
Elwha	Troy Tisdale and Jeff Gufler
Kendall Creek	Kristopher Flowers, Jesse Lee, and Kevin Clark
Lyons Ferry	Derek Gloyn, Doug Maxey, Matthew Miller, Ace Trump, Carolyn Whitney
Palmer Ponds	Jordan Bjelland and Mike Wilson
Priest Rapids	Glen Pearson, Renee Shaw, and Brian Lyon
Ringold Springs	Megan Bromley, Mike Erickson, and Brian Lyon
Samish	Matt Waters and Kevin Clark
Satsop Springs	Steve Franks
Soos Creek	Chris Warwick, Joe Rankin, and Mike Wilson
Vancouver	Adam Sullivan, Brian Harvard, and John Allen

## 7. References

U. S. Environmental Protection Agency (USEPA). 2021. Columbia and Lower Snake Rivers Temperature Total Maximum Daily Load. Seattle, WA. <https://www.epa.gov/system/files/documents/2021-08/tmdl-columbia-snake-temperature-08132021.pdf>

Ward, W. J. 2018. Standard Operating Procedure EAP080, Version 2.1. Continuous Temperature Monitoring of Freshwater Rivers and Streams. Publication No. 18-03-205. Washington Department of Ecology. Olympia, Washington.

Washington Department of Ecology (Ecology). 2020. Administrative Order Docket #17969, WDFW Palmer Ponds (ID: 21061). Olympia,

Washington Department of Ecology (Ecology). 2021. Upland Finfish Hatching and Rearing General Permit. A National Pollution Discharge Elimination System and State Discharge General Permit. Olympia, Washington.



Appendix A. Hatchery Temperature Monitoring Site Information

Appendix B. Monitoring Log and Data Analysis Instructions for hatcheries with temperature impaired receiving waters on the 303(d) List or with TMDLs or an Administrative Order.

DRAFT

## Appendix A. Hatchery Site Information for Continuous Temperature Monitoring

<u>Facility Name</u>	<u>Page Number</u>
Beaver Creek Hatchery	11
Bingham Creek Hatchery	12
Bogachiel Hatchery	13
Chelan Hatchery	14
Dungeness Hatchery	15
Eastbank Hatchery	16
Elwha Hatchery	17
Kendall Creek Hatchery	18
Lyons Ferry Hatchery	19
Palmer Hatchery	20
Priest Rapids Hatchery	21
Ringold Hatchery	22
Samish Hatchery	23
Satsop Springs Hatchery	24
Soos Creek Hatchery	25
Vancouver Hatchery	26



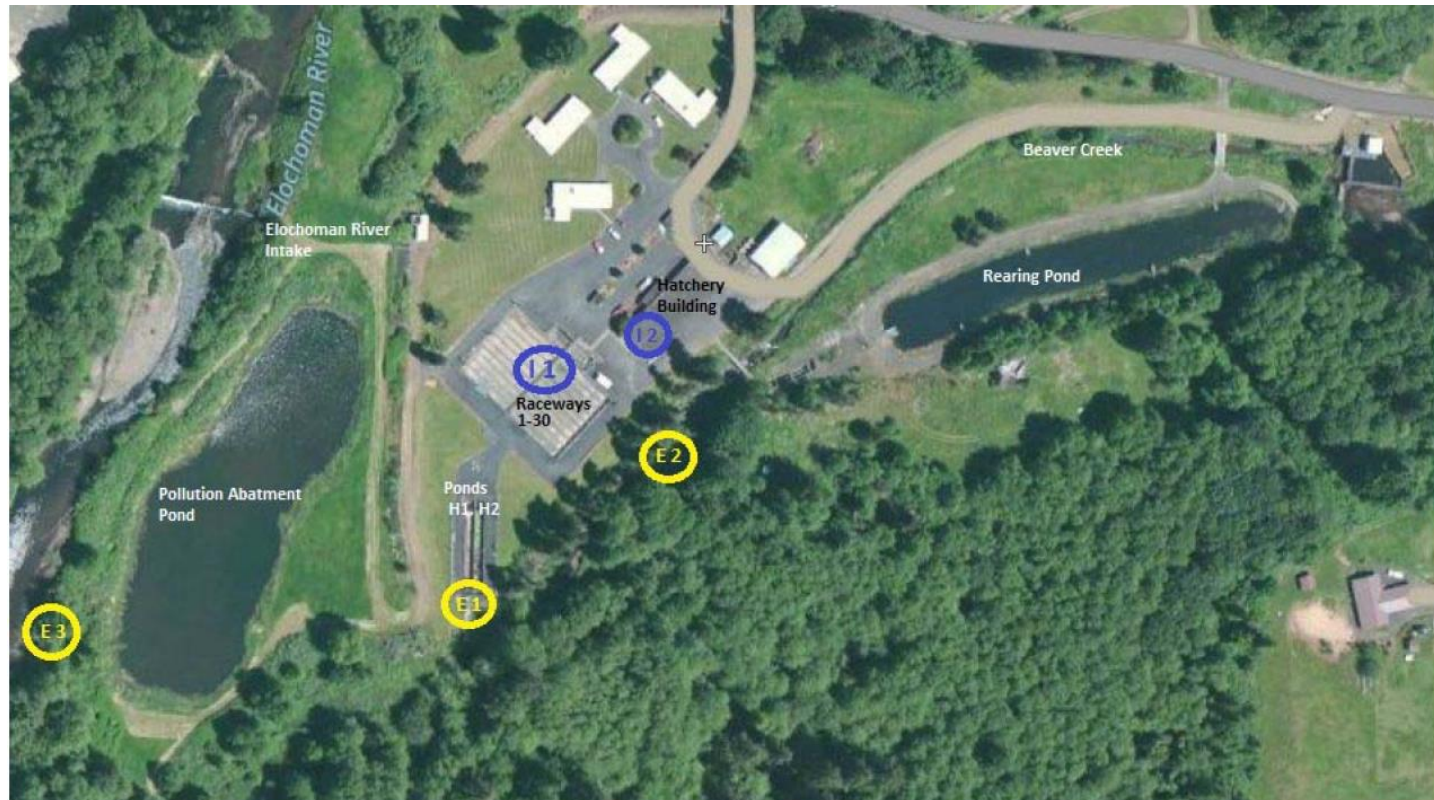
## Beaver Creek Hatchery WAG13-1027



Beaver Creek has fish on station year-round. The hatchery reports flow (MGD) on the DMR, for effluent sites during solids sampling events and anytime flow significantly changes.

**Effluent** -Beaver Creek Hatchery has three effluent sites, but discharges from one location at a time. The temperature data logger is deployed at the active effluent discharge from *April 1 to November 30*. The rearing pond effluent is re-used, diverted through the raceway headbox. The only time it discharges to the creek is when fish are released during a drawdown.

**Influent** -Beaver Creek and Elochoman River are surface water sources. One water source is used at a time. Beaver Creek water is gravity fed to the hatchery typically until April or May. During the summer, Beaver Creek Hatchery pumps Elochoman River water until October, rain dependent. Surface water is monitored at the active intake (I-1 or I-2) from *April 1 to November 30*. Well water is used incubation, intermediate raceways and raceways 1 and 11, with some recirculation to intermediate and full-size raceways. Staff records weekly well water temperatures on their Monitoring Log.



### Effluent Discharges

E1 to Beaver Creek from Rearing Pond, Ponds 1-30 and H-series Ponds

E2 to Beaver Creek from Rearing Pond, Ponds 1-30, recirculated to raceways except during drawdown for fish release

E3 Elochoman River Inline Settling Pond



## Bingham Creek Hatchery WAG13-1022



Bingham Creek Hatchery has fish on station year-round. Temperature is continuously monitored *April 1 to November 30* at both effluent outfalls. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes.

**Effluent** -Bingham Creek Hatchery has two effluent discharges. Year-round, E-1 discharges all water from the hatchery except the large rearing pond #21 and mitigation ponds. E-2 discharges from the large rearing pond #21 from July to May.

**Influent** –Bingham Creek and East Fork of the Satsop River are surface water sources. Fish Science monitors continuous temperature of the East Fork of the Satsop River and Bingham Creek (see map for locations). Well water is used November to July all over the hatchery, except in the large rearing pond #21 and mitigation ponds. Staff will record weekly well water temperatures on their Monitoring Log.



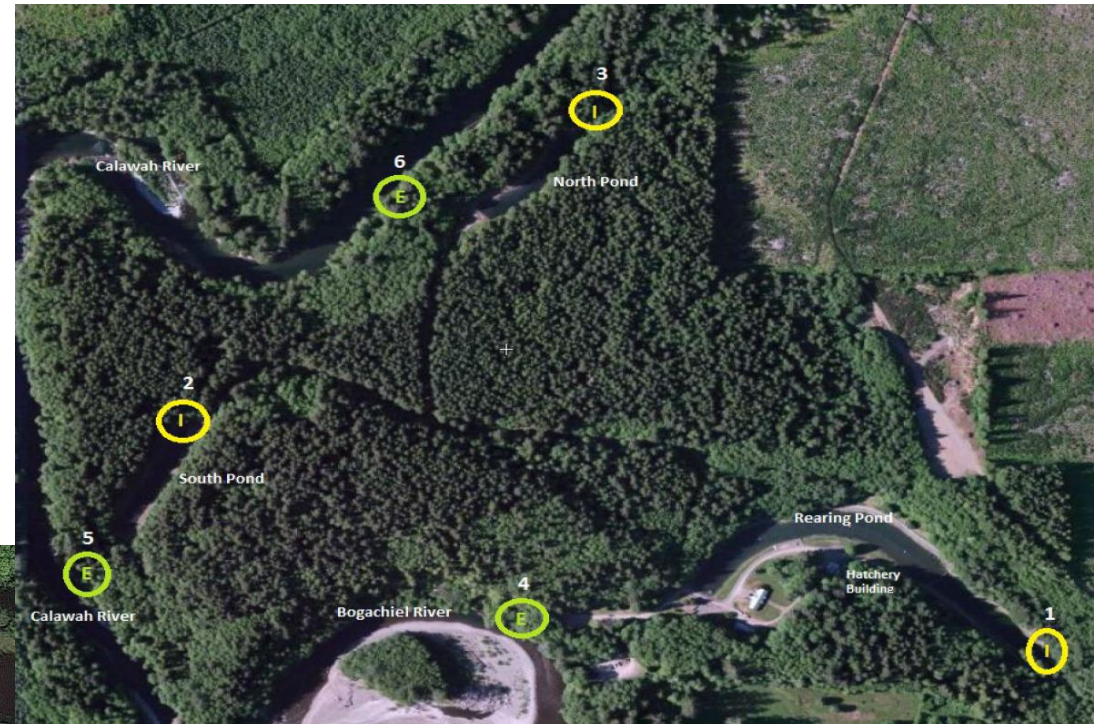
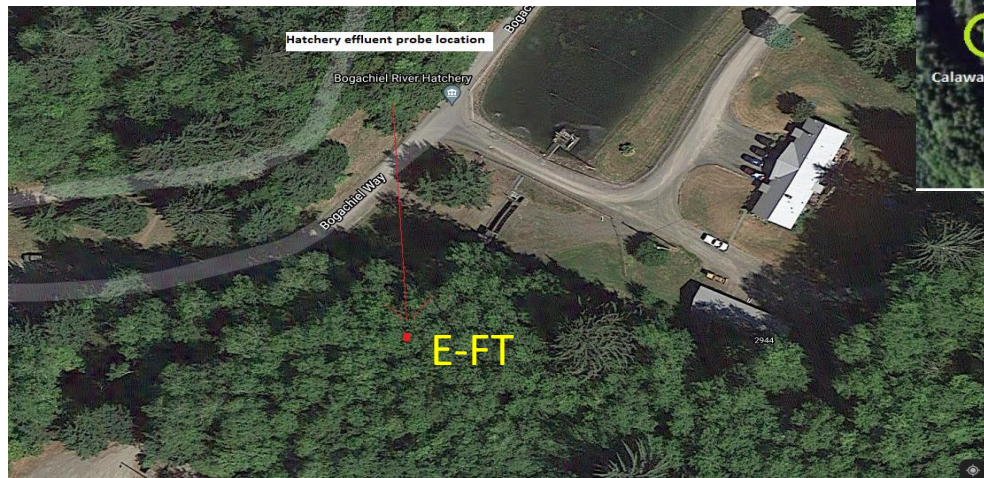


## Bogachiel Hatchery WAG13-1051



Bogachiel Hatchery has fish on station year-round. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes.

**Effluent** -Bogachiel Hatchery has one effluent that discharges to the Bogachiel River -E-4. Water from the rearing pond, incubation room, raceways 1-10, and two round ponds discharge through the fish trap to the outlet creek, which flows to the Bogachiel River. It discharges year-round because flow cannot be shutoff. Temperature will be continuously monitored *April 1 to November 30* at E-FT, on the effluent side of the fish trap. Effluent discharges to the Calawah River will not be monitored.



**Influent** –Bogachiel Hatchery is fed by springs. Groundwater inflow feeds all the ponds, which is the reason flow cannot be shutdown at effluent discharges. Springs also supply water to the incubation room. Staff will record weekly groundwater temperatures in the incubation on their Monitoring Log. Bogachiel Hatchery monitors temperature of the Bogachiel River approximately about 4,170 river feet upstream of E-4.



## Chelan Hatchery WAG13-5006



Chelan Hatchery is owned by Chelan PUD and operated by WDFW. Fish are on station all year. Continuous temperature is monitored at the effluent outfall E#2 during the critical period from *July 1 to October 31*. E#2 discharges year-round to Beebe Creek, which flows to the Columbia River. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes. Monthly heat load will be reported on the DMR.

**Effluent** –Chelan Hatchery has two effluent outfalls. At E#2, water from the PUD and WDFW sides of the facility are combined from the Upper and Lower Raceways, Adult, Vinyl, and Lower Round Ponds, as well as Incubation Troughs and Intermediate Tanks from the PUD hatchery. E#3 flows from December to May, discharging water from the Upper Round Pond and State Intermediate Tanks. E#3 will not be monitored because it does not flow during the critical period. Effluent from incubation (E-Inc) discharges water from November to June. This water is spring water from the main line to incubation (valve left slightly open in the winter for freeze protection) or from otolith marking. The water temperature is 40-50° C and will not be monitored.

**Influent** –Chelan Hatchery uses electromagnetic flow meters to monitor facility influent from each of its four sources of influent, the North Spring (I-NS), South Spring (I-SP), Domestic Well (I-CD-3), and Chelan Wellfield (I-W). Instantaneous flow are recorded daily. By summer 2022 the programming processes calculate average monthly flow. Influent water temperature will not be continuously monitored. Staff records weekly well water temperatures on their Monitoring Log.





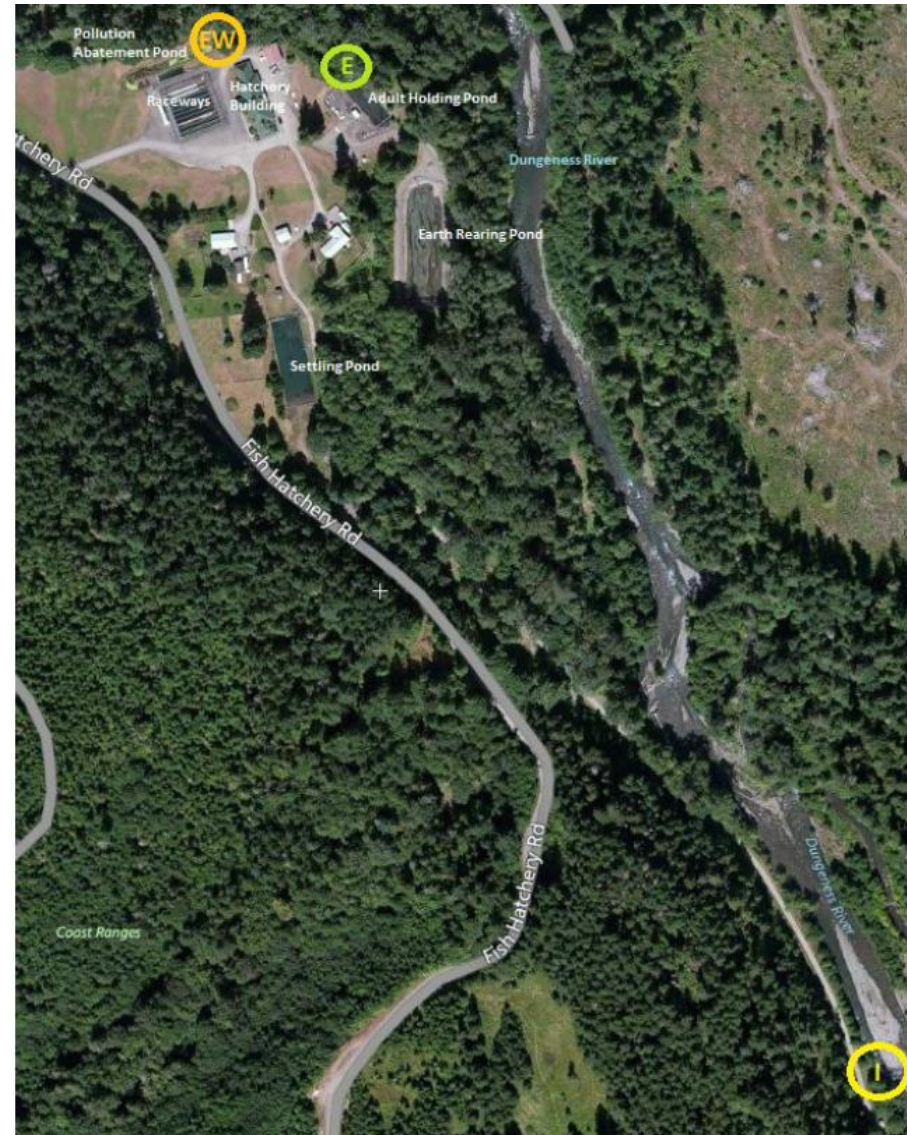
## Dungeness Hatchery WAG13-1037



Dungeness Hatchery has fish on station year-round. Temperature is continuously monitored *April 1 to November 30*. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes.

**Effluent** –Dungeness Hatchery has one effluent discharge below the adult pond, labelled at E on the map. The effluent discharges year-round into the Hatchery Outlet Creek, which flows to the Dungeness River. Continuous temperature is monitored at E.

**Influent** –Dungeness Hatchery uses surface water from the Dungeness River throughout the year. Influent water temperate is monitored continuously at the site labeled at I on the aerial image.





## Eastbank Hatchery WAG13-5011



Eastbank Hatchery has fish on station year-round. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes. Monthly heat load will be reported on the DMR.

**Effluent** –Eastbank Hatchery has one effluent discharge (labelled E on the map) to the Columbia River. Continuous temperature is monitored at E July 1 to October 31.

**Influent** –Continuous temperature is monitored in the mechanical room in the Incubation Building (labelled I on the map). Eastbank Hatchery uses four electromagnetic flow meters to monitor facility influent from each of its four groundwater wells. Instantaneous flow are recorded daily, and programming processes calculate average monthly flow in MGD.

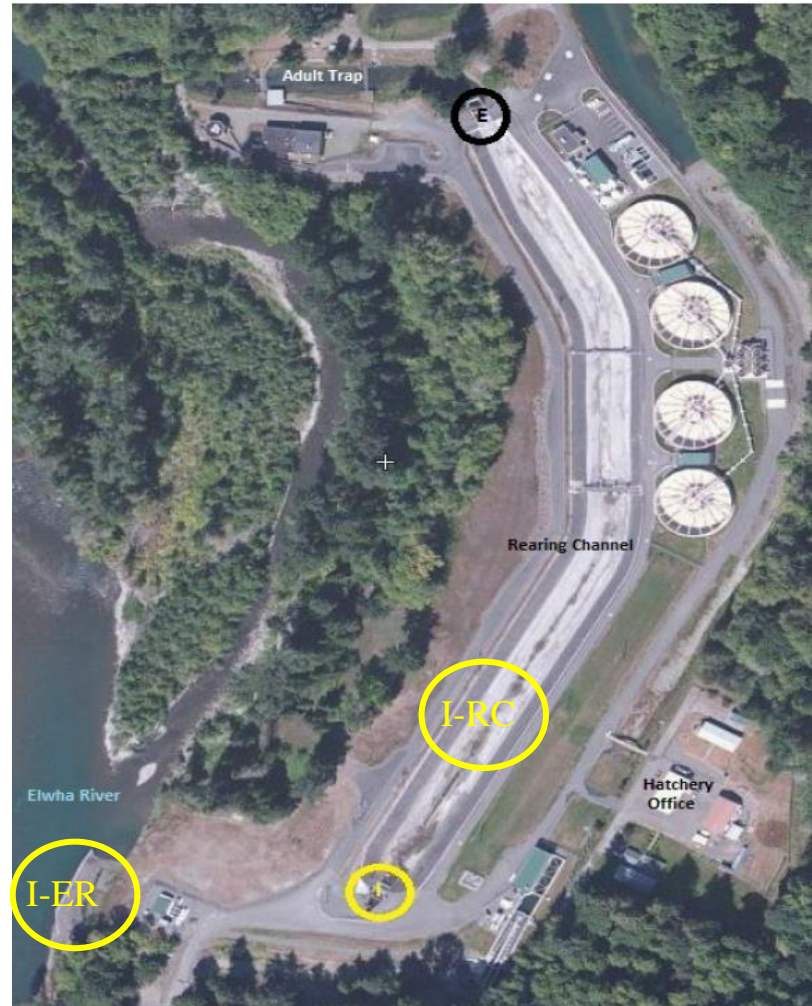


## Elwha Channel Hatchery WAG13-1043



Elwha Channel Hatchery has fish on station year-round. Continuous temperature is monitored *April 1 to November 30*. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes.

**Effluent** –Elwha Channel Hatchery has one effluent discharge located at the lower end of the rearing channel that flows through the adult trap to the Elwha River. Temperature is monitored at the site labeled E or at the adult trap, depending on flow conditions and water depth.



**Influent** –Elwha Channel Hatchery uses surface water from the Elwha River and groundwater from multiple wells year-round. Influent surface water temperature will be monitored at I-RC in the rearing channel where groundwater and surface water are mixed, downstream of the site labelled I. The logger will be deployed in the upper, middle, or lower rearing channel, dependent on conditions. Also, temperature will be monitored upstream of I, before mixing with groundwater in the rearing channel. This site, called I-ER, will monitor the temperature of Elwha River water before it enters the hatchery.



## Kendall Creek Hatchery WAG13-3007



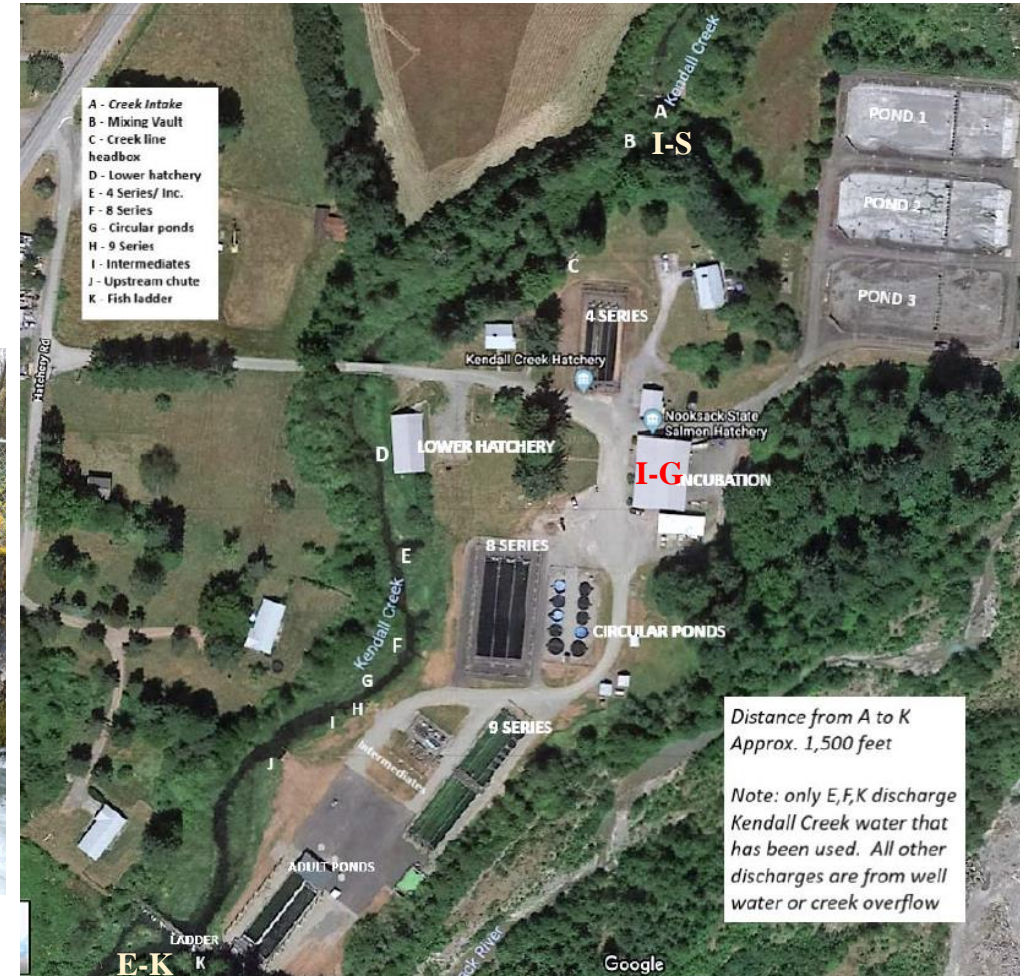
Kendall Creek Hatchery has fish on station year-round. Continuous temperature is monitored at effluent sites discharging from *April 1 to November 30*. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes.

**Effluent** –Kendall Creek Hatchery has seven effluent discharges labelled A to G on the facility map. Temperature is monitored at the fish ladder, site E-K. The only other effluent during the monitoring period is a small discharge of cold-water during otolith making, which will not be monitored. During the dry season starting as early as April, Kendall Creek does not have surface flow above hatchery effluent discharge.

**Influent** –Kendall Creek Hatchery uses groundwater from wells 1, 2, 3, 4, and 5. Groundwater temperature will be monitored at I-G in incubation. The hatchery uses surface water from Kendall Creek from late November to March. Surface water temperature will be monitored at I-S, the gravity intake from Kendall Creek.



Site K effluent discharge  
at the fish ladder





## Lyons Ferry Hatchery WAG13-7006



Lyons Ferry Hatchery has fish on station year-round. Continuous temperature is monitored from *July 1 to October 31* at the sites labeled Effluent and Influent on the facility site map. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes. Monthly heat load will be reported on the DMR.

**Effluent** –Lyons Ferry Hatchery has one effluent discharge to the Snake River. Temperature is monitored at the outfall above the Snake River.

**Influent** –Lyons Ferry Hatchery uses groundwater from wells. The influent site is the Marmes well pump station.



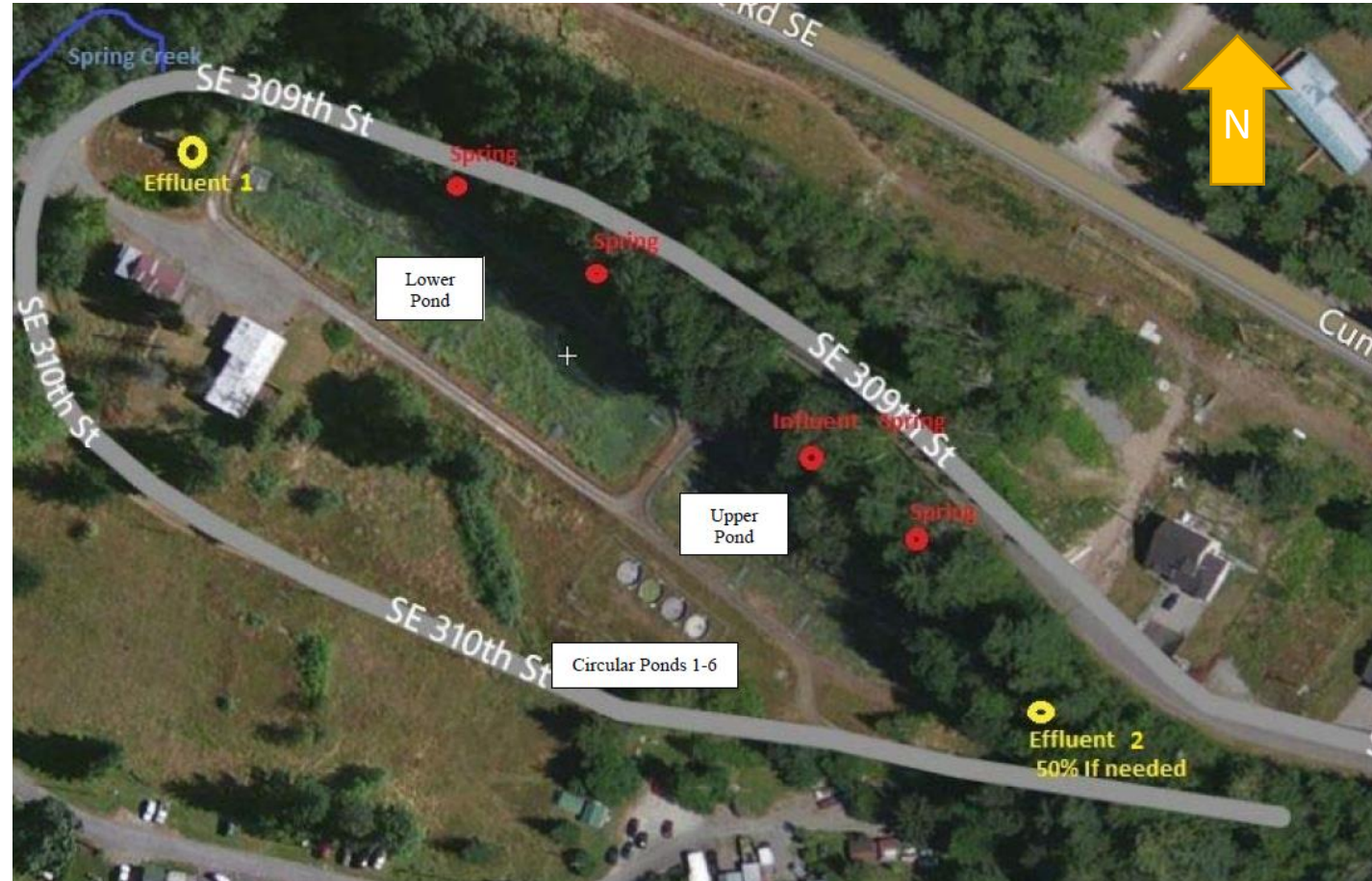
## Palmer Ponds Hatchery WAG13-3002



Palmer Ponds operates seasonally for WDFW, but also supports the Muckleshoot Tribe's fishery at the Green River. The hatchery reports flow (MGD) on the DMR for the Green River effluent site during solids and nutrients sampling events and anytime flow significantly changes.

**Effluent** –Administrative Order Docket #17969 requires Palmer Ponds Hatchery to monitor continuous temperature at the effluent to the Green River (Effluent 2 on the map) from *May 1 to October 31*. The monitoring site is in the vault culvert below the Upper Pond above the Green River.

**Influent** –Palmer Hatchery uses groundwater from springs year-round. Groundwater temperature is not monitored.

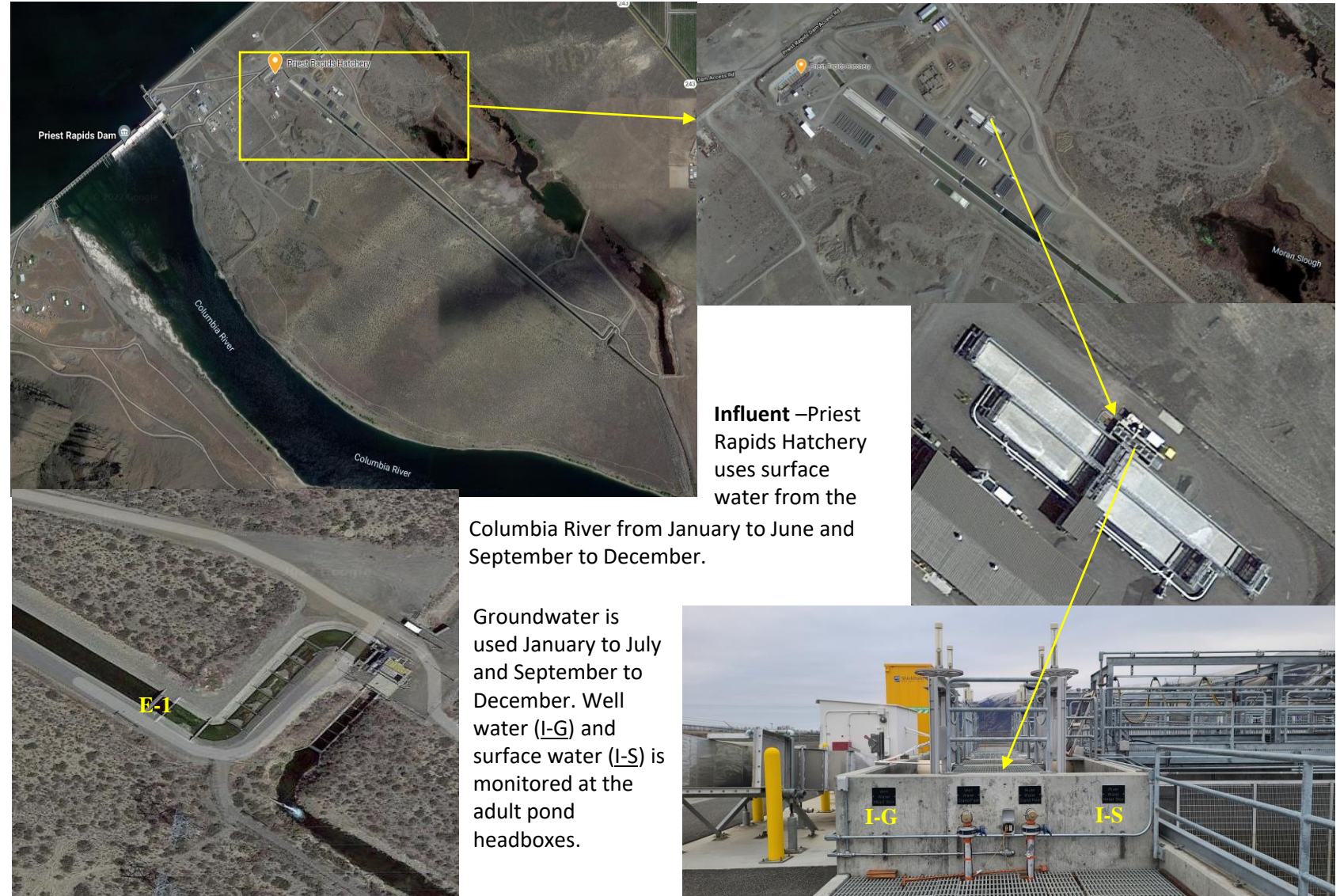




## Priest Rapids Hatchery WAG13-7013

Priest Rapids Hatchery has fish on station from January to June each year. Continuous temperature is monitored during the critical period from *July 1 to October 31*, except when water is not diverted from the Columbia River in July and August. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes. Notes are added to DMR when fish are not on station and when water is not diverted from the Columbia River. Monthly heat load will be reported on the DMR.

**Effluent** –Priest Rapids Hatchery has two effluent discharges to the Columbia River, labelled as E-1 and E-2 on the facility site map. E-1 discharges from January to July and again from September to December. E-2 typically discharges December to June. All E-2 effluent water is diverted to E-1. Continuous temperature is monitored in the large channel at E-1.





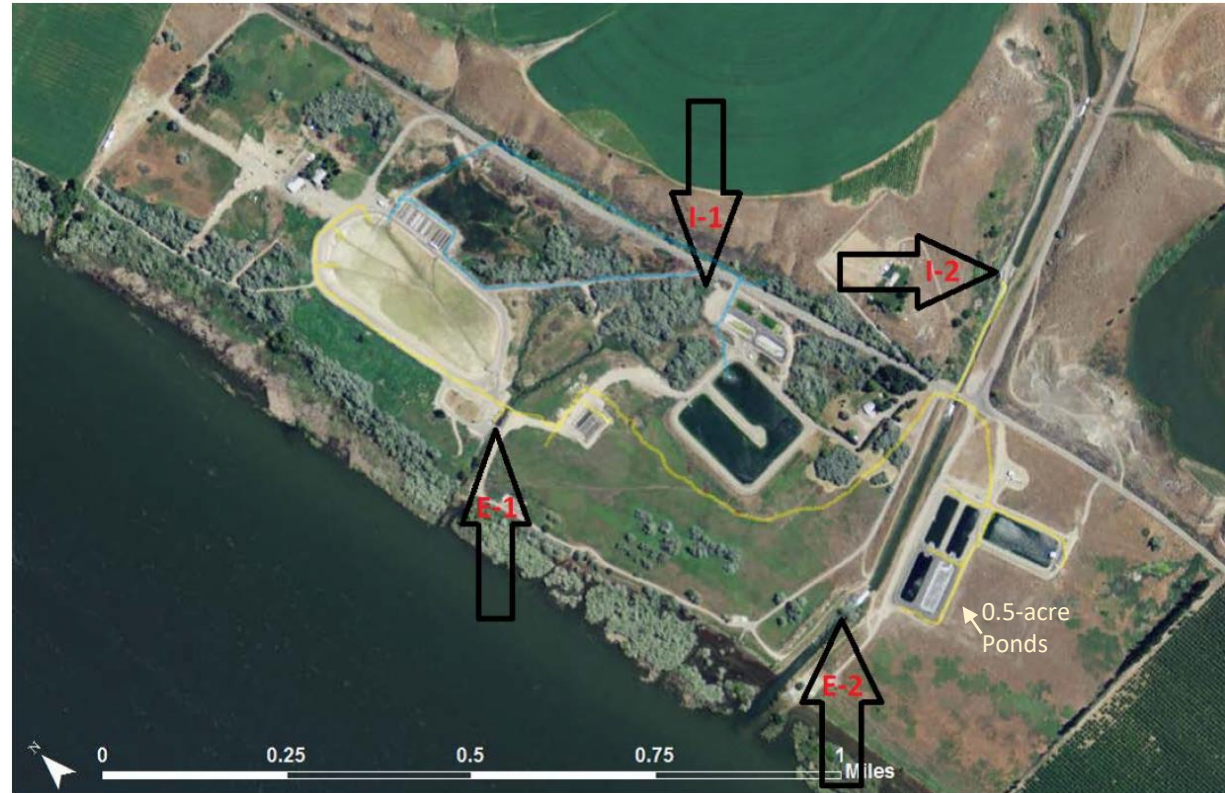
## Ringold Springs Hatchery WAG13-7009



Ringold Springs Hatchery has fish on station all year. Continuous temperature is monitored from *April 1 to November 30* at E-1. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes.

**Effluent** –Ringold Springs Hatchery has two effluent discharges. Site E-1 discharges all year to Ringold Hatchery Creek at the adult trap. The outfall pipe at E-2 discharges to the Ringold Wasteway Canal from the end of November until fish are released before mid April. Water exits the 0.5-acre ponds (east of E-2) through a vault to underground pipes to the outfall at the irrigation canal. The outfall pipe is frequently submerged, because the canal is full of irrigation water, backwater from the Columbia River, or both. The vault where water exits the 0.5-acre ponds upstream of E-2 is not a good monitoring location because of high turbulence and velocity within a deep concrete channel, which is covered by a 300-pound lid. Data is not collected at E-2 due to monitoring constraints and the limited time (less than 20 days total) that E-2 is flowing during the critical period. Ecology will be consulted if Ringold plans to increase use of the 0.5-acre ponds into the critical season in the future.

**Influent** –The hatchery uses groundwater from Ringold Springs. I-1 is at the main intake headbox. I-2 is the lower Ringold Springs diversion intake. Ringold will use HOBO MX2202 Pendant loggers with  $\pm 0.5^{\circ}$  C accuracy at the influent sites to avoid the purchasing cost of two new loggers for these optional sites.





**Samish Hatchery**  
**WAG13-3011**

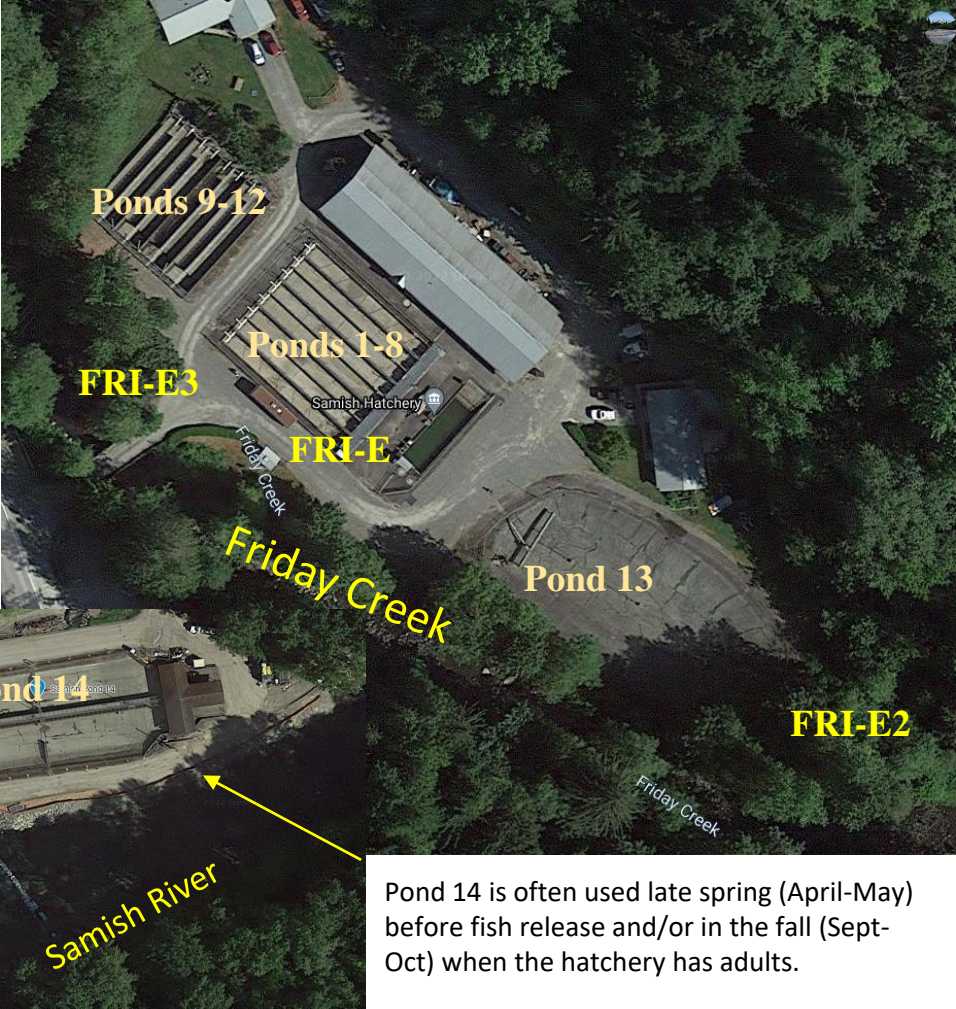


Samish Hatchery has fish on station from February to May. Continuous temperature is monitored *April 1 to November 30*. The hatchery reports flow (MGD) on the DMR for effluent sites during solids and nutrients sampling events and anytime flow significantly changes. Notes are added to DMR when fish are not on station and when water not diverted from Samish River.

**Influent** –Samish Hatchery uses surface water from Friday Creek from September to May. Influent (FRI-I) is monitored at the Friday Creek Intake upstream. If Samish River water is diverted to Pond 14, influent surface water is monitored at the intake SAM-I.

**Effluent** –Samish Hatchery has three effluent outfalls to Friday Creek. Temperature is monitored February to March at the southwest corner of Ponds 1-8 at site FRI-E. Ponds 9-12 are utilized between March and May and discharge to FRI-E3. Fish are clipped and released to Pond 13 in April and May.

Pond 13 discharges to FRI-E2. Pond 13 receives re-circulated water from Ponds 1-8, which causes the effluent at FRI-E to cease discharging. Temperature is monitored at all active discharges to Friday Creek.



Pond 14 is often used late spring (April-May) before fish release and/or in the fall (Sept-Oct) when the hatchery has adults.

When water is diverted from the Samish River to Pond 14 during the critical period, temperature is monitored at the effluent on the side of Pond 14 with the most flow. If water is not diverted from the Samish River to Pond 14, that will be noted in the DMR, and temperature will not be monitored at SAM-I or SAM-E.

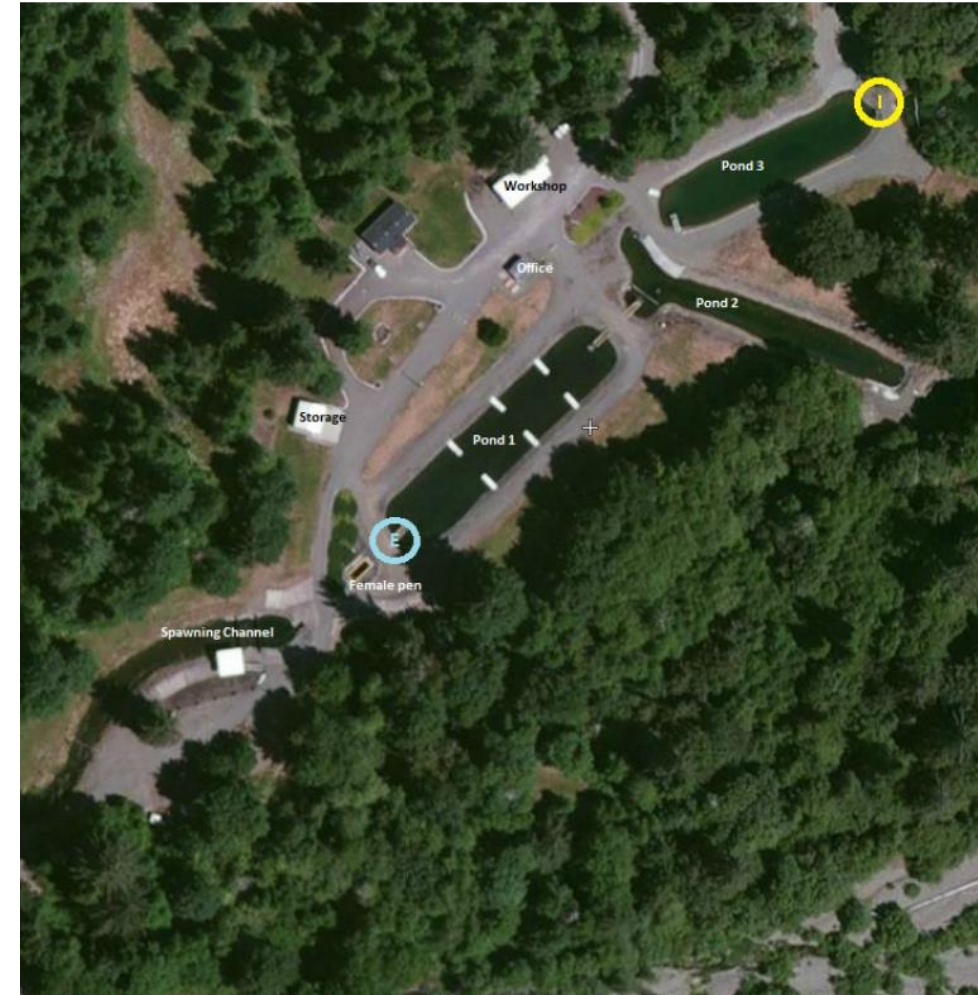
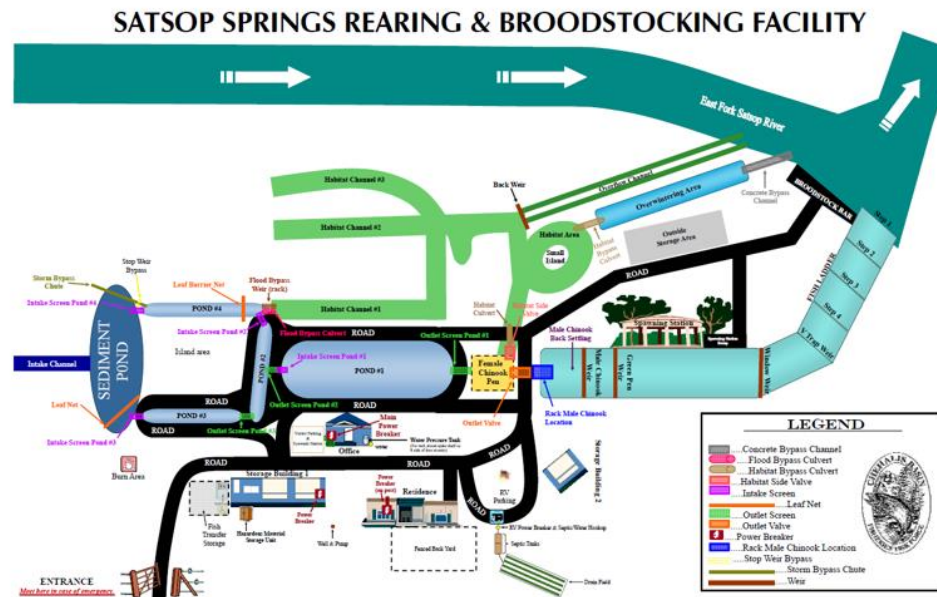


## Satsop Springs Hatchery WAG13-1023



Satsop Springs Hatchery has fish on station year-round. Continuous temperature is monitored at the effluent discharge from *April 1 to November 30*. The hatchery reports flow (MGD) on the DMR for effluent sites during solids sampling events and anytime flow significantly changes.

**Effluent** –Satsop Springs Hatchery has one effluent discharge labelled E on the map. Effluent discharges from Pond 1 and flows through the female pen and spawning channel to the East Fork of the Satsop River. The temperature data logger is deployed above where the effluent discharge mixes with the river up to site E. The monitoring site is chosen based on as sufficient depth, flow, accessibility, and ideally shaded from direct sunlight.



**Influent** –Satsop Springs Hatchery uses groundwater from artesian springs at the head of the intake channel. Also, groundwater upwells into the earthen ponds. Influent temperature is recorded weekly in the Monitoring Log.



## Soos Creek Hatchery WAG13-3014



Soos Creek Hatchery has fish on station January to August. Continuous temperature is monitored at all effluent outfalls discharging from *April 1 to November 30*. Staff will note on DMR when fish are not present on station. The hatchery reports flow (MGD) on the DMR for effluent sites during solids and nutrients sampling events and anytime flow significantly changes.

**Effluent** –Soos Creek Hatchery has two effluent discharges to Big Soos Creek. E-1 discharges water from Raceways 1-18 and Rearing Ponds. The monitoring location is at the southwest corner of the raceway. E-2 discharges water from Adult Ponds 1-5 in April, May, and June. The monitoring site is located at the southwest corner of the Adult Pond.

**Influent** –Soos Creek Hatchery uses surface water from Big Soos Creek. The influent monitoring site is location just upstream of the intake and labelled I on the map.





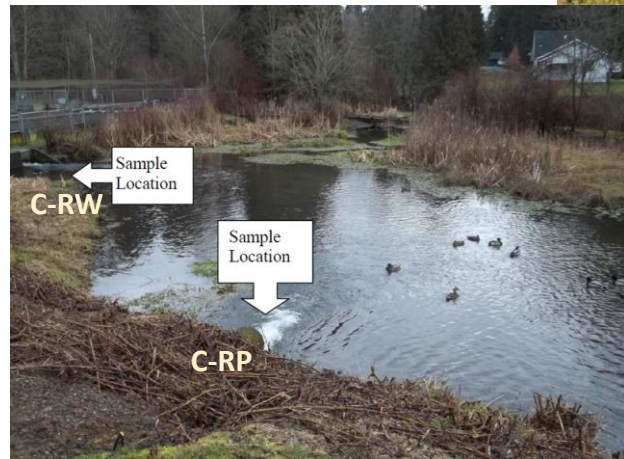
## Vancouver Hatchery WAG13-1032



Vancouver Hatchery has fish on station January to August. Continuous temperature is monitored at both effluent discharges from *April 1 to November 30*. The hatchery reports flow (MGD) on the DMR for effluent sites during solids and nutrients sampling events and anytime flow significantly changes.

**Effluent** –Vancouver Hatchery has two effluent outfalls to wetlands, shown in the photograph and labelled on the map with a red C. To differentiate the outfalls, the northern outfall from Raceways 17-20 will be called C-RW and the southern outfall from Round Ponds will be called C-RP.

**Influent** –Vancouver Creek Hatchery uses groundwater from the North Hatchery Springs and the East Well (Heron House). Surface water from Biddle Lake is used 10 months per year, from July or August to May or June. Influent from the spring will be monitored at the spring distribution box, labelled A on the map.



Temperature Data

Logger Name: BING\_E-1    Logger Serial #: 10186038    Staff Names:

Hatchery Name: Bingham Creek

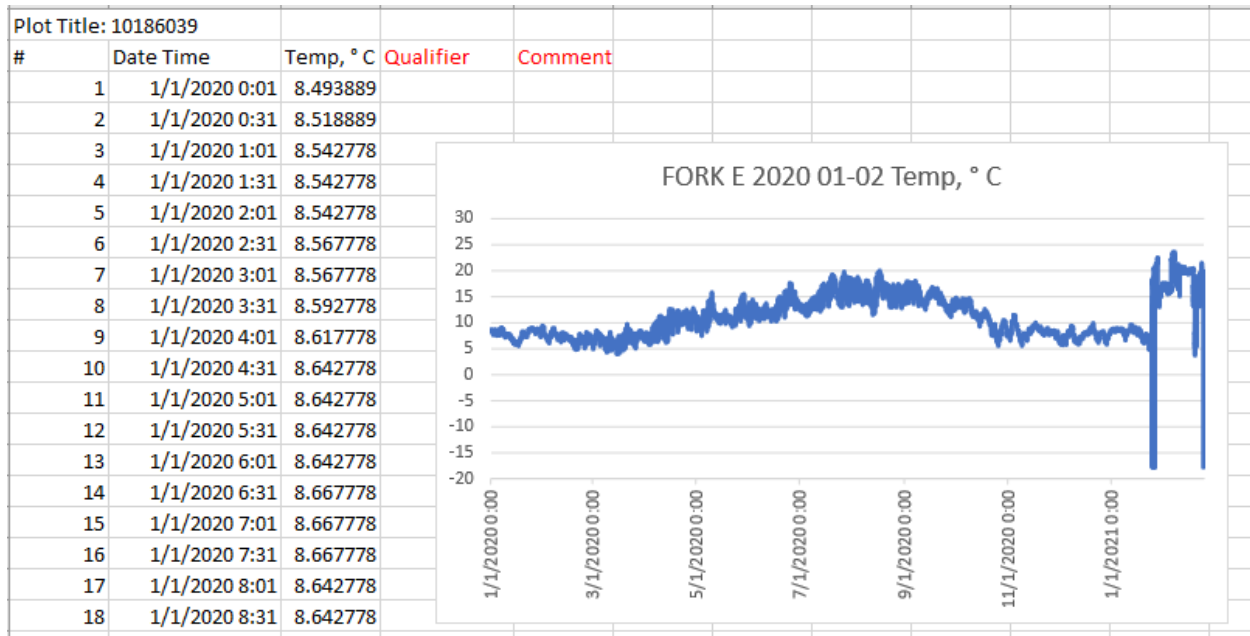
Date	Time	Site Name	Staff Initials	Thermometer Temp (°C) Check	Total Depth (ft)	Logger Depth (ft)	Activity/Comments
10/27/2021	2:30 PM	E-1	Example	11.3		2.1	temperture check at logger at HOBO when it logged at 2:30 PM
10/27/2021	2:37 PM	E-2	Example	NA		2.1	removed logger from water to download at 2:40; stopped logger at 3:05. Logger air temp at 3:00 PM; redeployed at 3:15.
11/1/2021	4:30 PM	E-1	Example	NA		5.3	high water at deployment site; logger approx this deep.
11/1/2021	5:00 PM	Well Water in Incubation	Example	45		0.5	pick same place to monitor each time; add comments about changes and observations here

## How to Calculate Maximum Daily Temperature

Enter information into the Monitoring Log. You may have to piece together data for the quarter from multiple downloads. A few days may be missing from the beginning or end of the month, depending on when and how often the logger is downloaded. Combine data for entire quarter into one Excel spreadsheet.

Insert two columns, the first called Qualifier and the second called Comment. Next to air temperatures or any data that was not collected in the usual deployments site, enter "bad data flag." In the Comment column, explain why it is bad data, such as "air temp." Inserting a line chart can help identify bad data.

**Keep these raw data intact (do not edit or delete).**



Open new worksheet -at the bottom of the spreadsheet

20241	19255	2/24/2021 3:31	-17.7778	bad data flag	temp data logger removed fro
20242	19256	2/24/2021 3:31	-17.7778	bad data flag	temp data logger removed fro
<div> <div>FORK-E-2020-01-02</div> <div>Sheet2</div> <div>+</div> </div>					

Name this new worksheet tab Water Temp and use this data set to calculate daily maximum temperature.

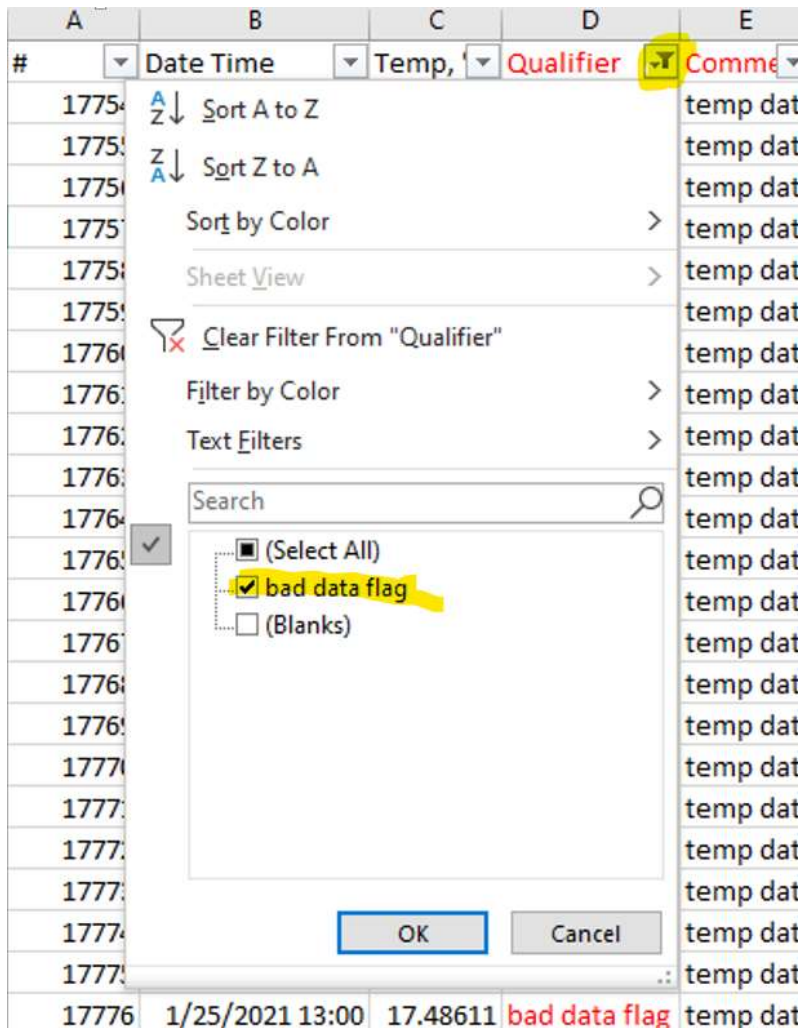
FORK-E-2020-01-02	Water Temp
Ready	

Copy all column headers and all raw temperature data and paste to new worksheet called Water Temp. With all Water Temp data selected, select Data, Filter.

## How to Calculate Maximum Daily Temperature



Filter the Qualifier column, select “bad data flag” and clear contents for all temperature records flagged as bad data.



Either select column headers and all data or ensure essential column headers (DateTime, Temp° C) are in row 1 (see example below) and select all by clicking upper left triangle (shown below).

#	Date Time	Temp, °C	Qualifier	Comment
1	1/1/2020 0:01	8.493889		

changed to

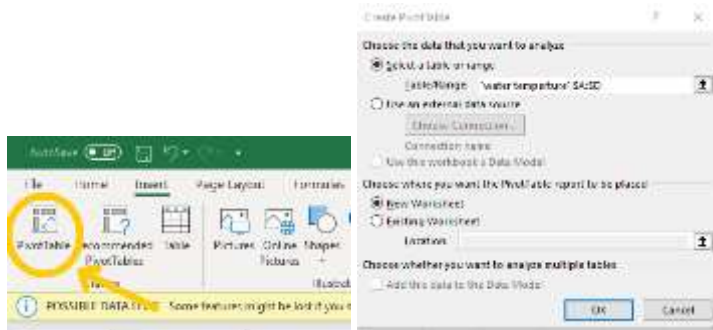
#	Date Time	Temp, °C	Qualifier	Comment
1	1/1/2020 0:01	8.493889		Plot Title: 10186039
2	1/1/2020 0:31	8.518889		



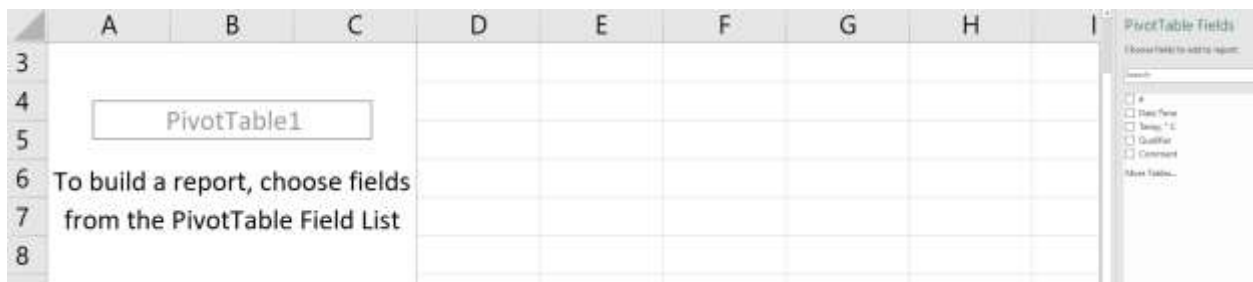
## How to Calculate Maximum Daily Temperature



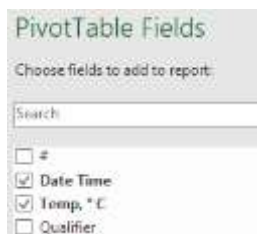
With all date-time and temperature data selected, insert pivot table, to a new worksheet.



A new worksheet will appear with pivot table on the left and Pivot Table Fields in a menu on the right.

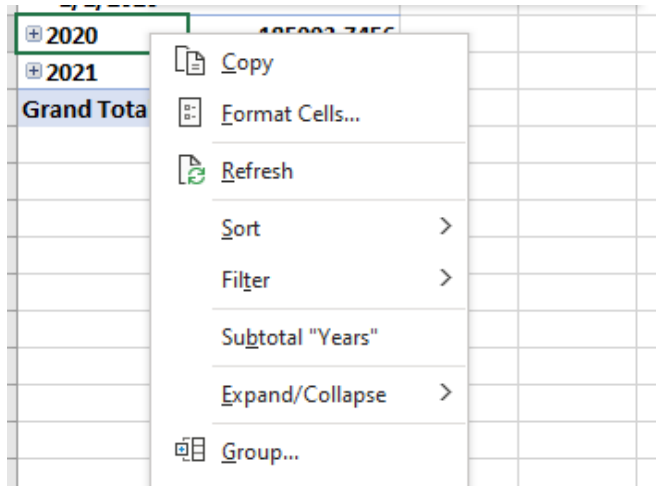


Select the boxes for Date Time and Temp.

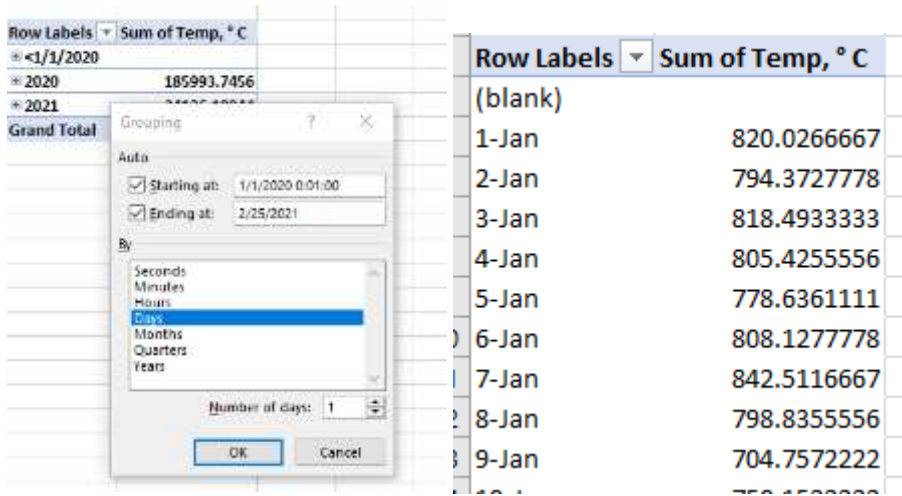


To summarize data by day, click on a date in the pivot table, right-click and select Group.

## How to Calculate Maximum Daily Temperature

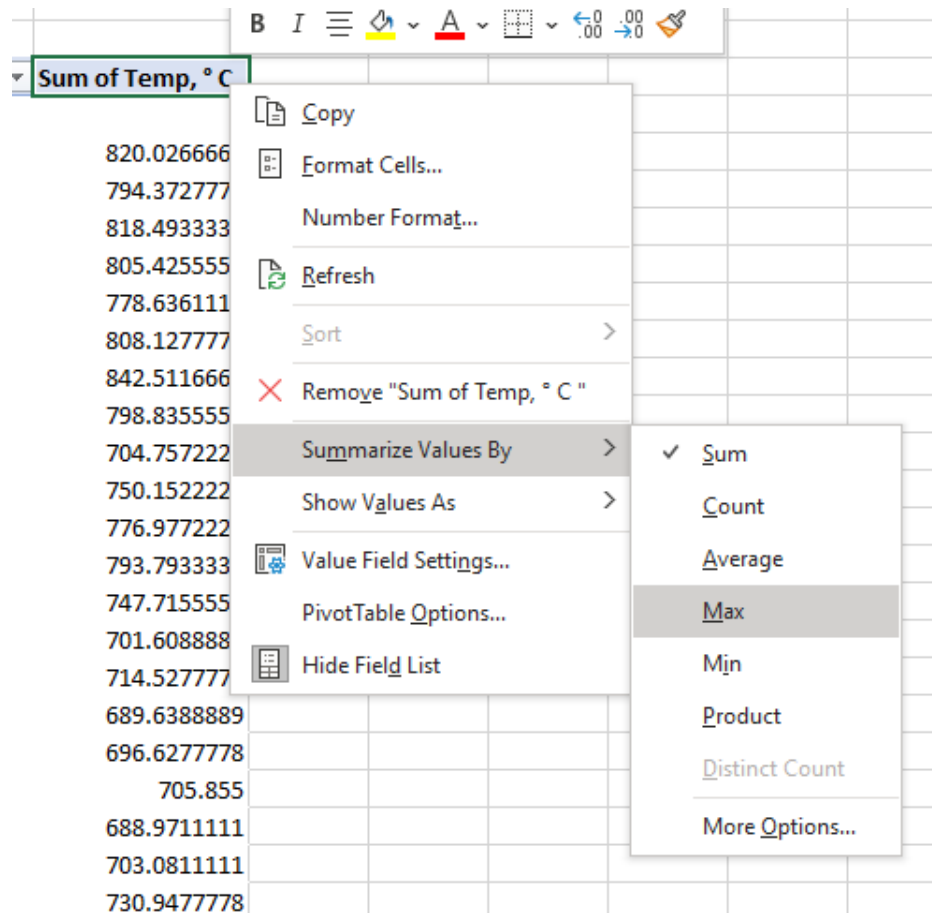


Select Day by highlighting it.

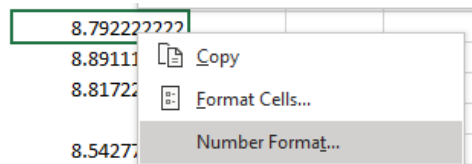


The numbers are huge in your table now. That's because they are sorted as SUM. We need the MAX temperature each day. Right click on "Sum of Temp, °C" and select Summarize Values By Max

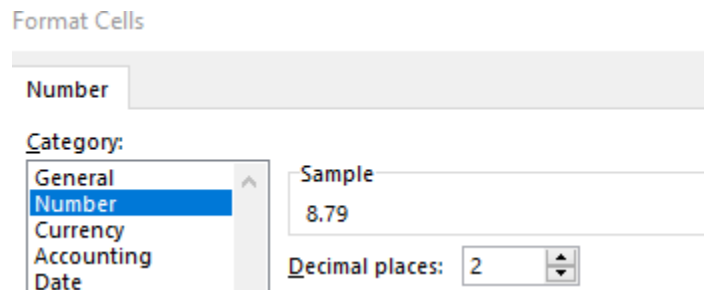
## How to Calculate Maximum Daily Temperature



To reduce the number of decimal places, select any temp, right-click, select Numbers Format.



Select Number and adjust to two decimal places.



## How to Calculate Maximum Daily Temperature

Name tab with Pivot Table: Max Daily Temp

		8.469
FORK EffluentJan-July2021	Max Daily Temp	Water Temp

Save your file so it is easy to identify Hatchery\_Site\_Year\_Months.xlsx (.csv file doesn't support all pivot table functions) to the local hatchery drive and in the relevant Facility folder here:

[FP\Hatcheries\Ann\\_WQlab\DATA - water quality\TEMPERATURE"](#)

File name examples:

- BING\_E-2\_2021\_04-07.xlsx
- FORK-E-2020-01-02
- SATS E 2021 04-07

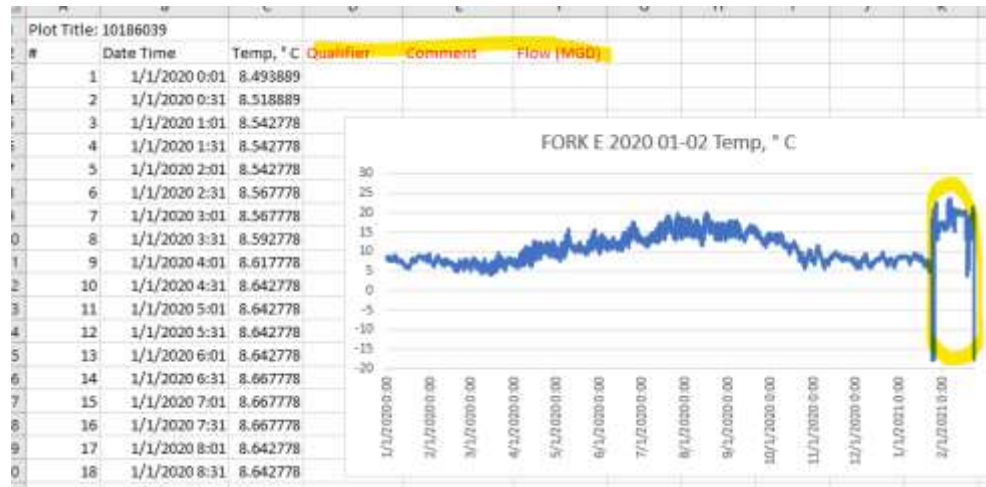
Log into Secure Access Washington to upload your numbers into your DMR. Renee and Ann in Water Quality can help calculate and check your data. Help us do that by submitting your data by the 10<sup>th</sup> of the month before the DMR is due.

😊 Thanks to Jordan Bjelland for providing these helpful tips! 😊

## How to Calculate Daily and Monthly Average Temperature and Heat Loads

Once per Month: Update the Monitoring Log. Download HOBO logger, export as Excel file like .csv. In HOBO excel file, insert three columns: Qualifier, Comment, and Flow (MGD). Enter millions of gallons per day in the flow column. Ensure temperature is recorded as °C.

Check monthly data for all dates and against Monitoring Log. Next to air temperatures or any data that was not collected at the usual deployment site, enter “bad data flag.” In the Comment column, explain why it is bad data, such as “air temp.” Inserting a line chart can help identify bad data. **Keep these raw data intact (do not edit or delete).**



Once per Quarter -by 10<sup>th</sup> of the month before DMR is due

1. Put together data for every day of the quarter

You may have to piece together data for the quarter from multiple downloads. A few days may be missing from the beginning or end of the month, depending on how often the logger is downloaded.

Open new worksheet -at the bottom of the spreadsheet

20241	19255	2/24/2021 3:31	-17.7778	bad data flag	temp data logger removed fro
20242	19256	2/24/2021 3:31	-17.7778	bad data flag	temp data logger removed fro
		FORK-E-2020-01-02	Sheet2		

Name this new worksheet tab Water Temp.

FORK-E-2020-01-02	Water Temp
Ready	

Copy column headers and all raw temperature data for the quarter and paste to new worksheet called Water Temp.

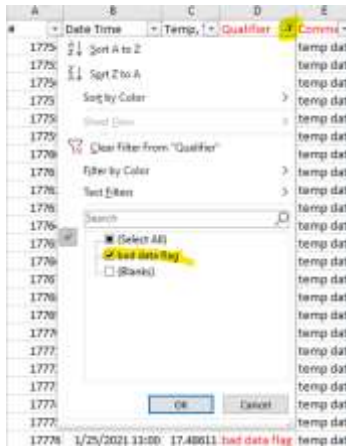
2. Delete bad data from data set used to calculate heat load.

Select all data on Water Temp tab, select Data, Filter.

## How to Calculate Daily and Monthly Average Temperature and Heat Loads



Filter the Qualifier column, select “bad data flag” and clear contents for all temperature records flagged as bad data.



3. Calculate daily and monthly average temperature, monthly average flow, and heat load.

Either select column headers (DateTime, Temp, Flow) and all data or ensure essential column headers (DateTime, Temp° C) are in row 1 (see example below) and select all by clicking upper left triangle (shown below).

#	Date Time	Temp, °C	Qualifier	Comment
1	1/1/2020 0:01	8.493889		

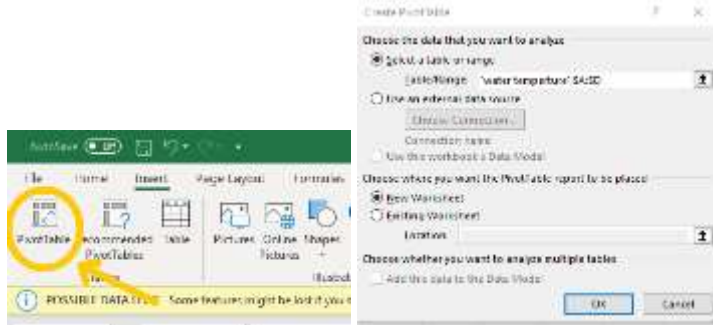
changed to

#	Date Time	Temp, °C	Qualifier	Comment
1	1/1/2020 0:01	8.493889		Plot Title: 10186039
2	1/1/2020 0:31	8.518889		

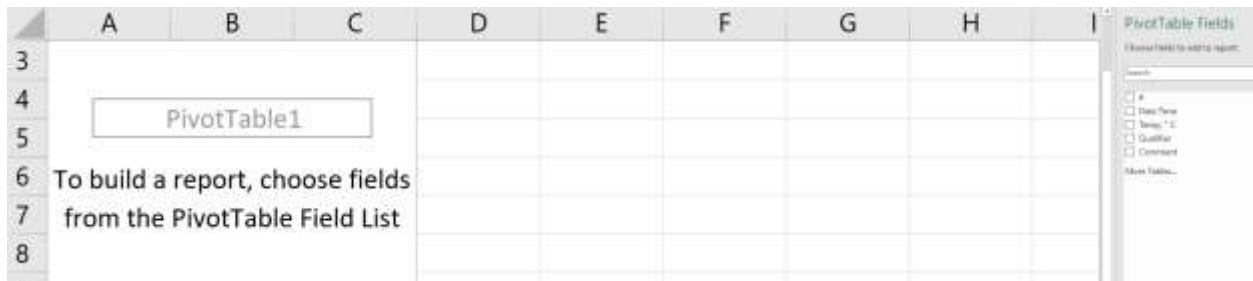


With all date-time and temperature data selected, insert pivot table, to a new worksheet.

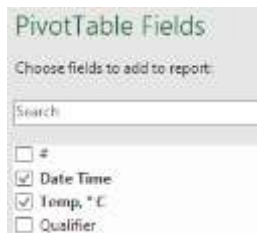
## How to Calculate Daily and Monthly Average Temperature and Heat Loads



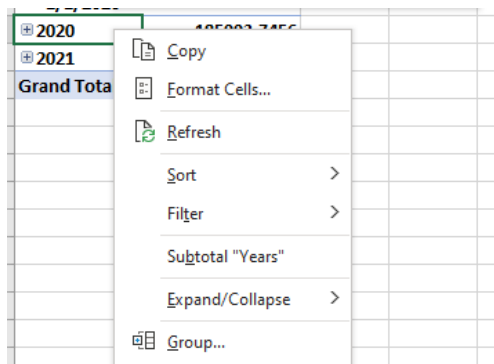
A new worksheet will appear with pivot table on the left and Pivot Table Fields in a menu on the right.



Select the boxes for Date Time and Temp.



To summarize data by day, click on a date in the pivot table, right-click and select Group.



Select Day by highlighting it.



## How to Calculate Daily and Monthly Average Temperature and Heat Loads

Row Labels	Sum of Temp, ° C
<1/1/2020	
2020	185993.7456
2021	778.8355556
Grand Total	

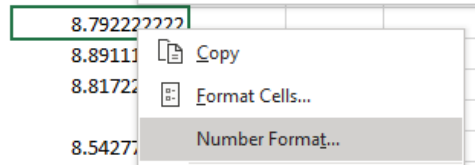
Row Labels	Sum of Temp, ° C
(blank)	
1-Jan	820.0266667
2-Jan	794.3727778
3-Jan	818.4933333
4-Jan	805.4255556
5-Jan	778.6361111
6-Jan	808.1277778
7-Jan	842.5116667
8-Jan	798.8355556
9-Jan	704.7572222

The numbers are huge in your table now. That's because they are sorted as SUM. We need the Average temperature each day. Right click on "Sum of Temp, °C" and select Summarize Values By Average

Sum of Temp, ° C	
820	
794	
818	
805	
778	
808	
842	
798	
704	
750	
776	
793	
747	
701	
714	
689	
696	
705.855	
688.9711111	
703.0811111	
730.9477778	
711.0466667	

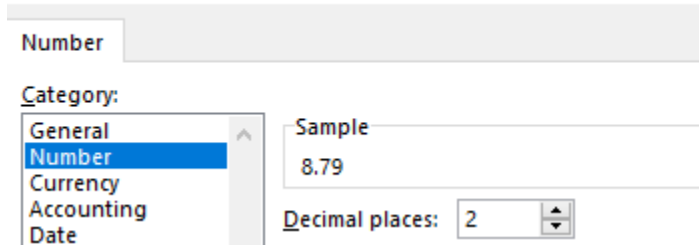
To reduce the number of decimal places, select any temp, right-click, select Numbers Format.

## How to Calculate Daily and Monthly Average Temperature and Heat Loads



Select Number and adjust to two decimal places.

### Format Cells

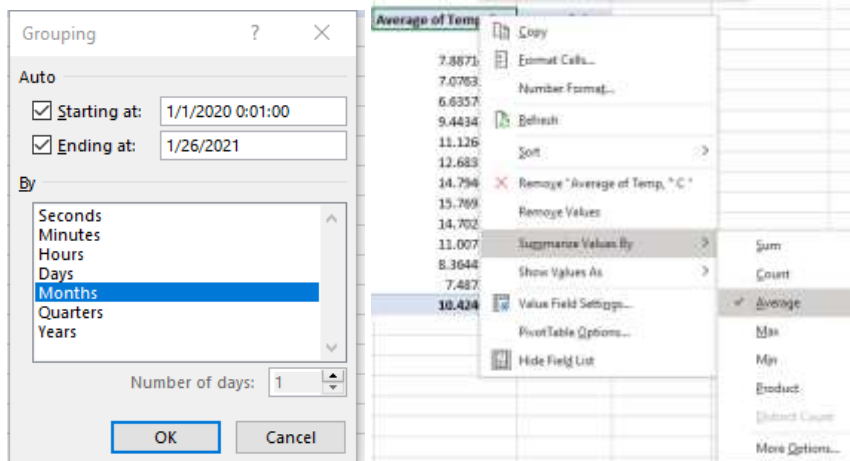


Name tab with Pivot Table: Daily Ave Temp

To calculate heat load, select all Water Temp data, Insert another Pivot Table on a new sheet.

Row Labels	Sum of Flow (MGD)	Sum of Temp, °C
(blank)		
Jan	73.3	20956.14944
Feb	25.75	9850.318333
Mar	32.6	9873.932778
Apr	25.6	13598.52722
May	36	16556.175
Jun	20.65	18264.58722
Jul	26.25	22013.61222
Aug	21.9	23465.33333
Sep	17.65	21171.42056
Oct	14.8	16379.40278
Nov	23	12044.86833
Dec	53.8	11141.47278
<b>Grand Total</b>	<b>371.3</b>	<b>195315.8</b>

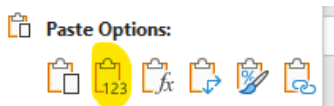
Group by Months and Summarize Temp and Flow by Average.



## How to Calculate Daily and Monthly Average Temperature and Heat Loads

Row Labels	Average of Flow (MGD)	Average of Temp, ° C
Jan	6.66	7.89
Feb	6.44	7.08
Mar	6.52	6.64
Apr	6.40	9.44
May	6.00	11.13
Jun	5.16	12.68
Jul	4.38	14.79
Aug	3.65	15.77
Sep	2.94	14.70
Oct	3.70	11.01
Nov	4.60	8.36
Dec	5.98	7.49

Copy and paste data as numbers below pivot table.



Add Conversion Factor Column and enter 3.776 for every month.

Multiple Average Flow x Average Temp x Conversion Factor = Monthly Heat Load (required **July to Oct**)<sup>b</sup>

Row Labels	Average of Flow (MGD)	Average of Temp, ° C	Conversion Factor	Heat Load (million kcal/day)
Jan	6.66	7.89	3.776	=B19*C19*D19
Feb	6.44	7.08	3.776	
Mar	6.52	6.64	3.776	

<sup>b</sup> Calculation of the average monthly heat load in million kcal/day is: [(average monthly temperature in °C) x (average monthly flow in MGD) x (3.776)]. More specifically, the average monthly heat load is calculated as the product of the average monthly temperature (°C) multiplied and the average monthly flow (MGD) with the conversion factor of 3.776. The average monthly temperature is the sum of average daily temperatures divided by the number of daily discharges measured in the month. The average monthly flow is the same value as historically reported as monthly average flow. It is the sum of all flows in the month divided by the number of days in the month.

Re-name tab "Heat Load."

Row Labels	Average of Flow (MGD)	Average of Temp, ° C	Conversion Factor	Heat Load (million kcal/day)
Jan	6.66	7.89	3.776	198.46
Feb	6.44	7.08	3.776	172.01
Mar	6.52	6.64	3.776	163.37
Apr	6.40	9.44	3.776	228.21
May	6.00	11.13	3.776	252.08
Jun	5.16	12.68	3.776	247.25
Jul	4.38	14.79	3.776	244.40
Aug	3.65	15.77	3.776	217.34
Sep	2.94	14.70	3.776	163.31
Oct	3.70	11.01	3.776	153.79
Nov	4.60	8.36	3.776	145.29



## How to Calculate Daily and Monthly Average Temperature and Heat Loads

Save your file so it is easy to identify Hatchery\_Site\_Year\_Months.xlsx (.csv file doesn't support all pivot table functions) to the local hatchery drive and in the relevant Facility folder here:

[FP\Hatcheries\Ann WQlab\DATA - water quality\TEMPERATURE"](#)

File name examples:

- CHEL\_E-2\_2021\_04-07.xlsx
- CHEL-E-3-2020-01-02.xlsx
- EAST I 2021 04-07.xlsx

Log into Secure Access Washington to upload your numbers into your DMR. Ann and Renee in Water Quality can help calculate and check your data. Help us do that by submitting your data by the 10<sup>th</sup> of the month before the DMR is due.

😊 Thanks to Jordan Bjelland for providing these helpful tips! 😊