Sampling and Analysis Plan

Volunteer Water Quality Monitoring: Partnership for the Umpqua Rivers Water Quality Monitoring Plan

July 2022

Partnership for the Umpqua Rivers
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DEQ is a leader in restoring, maintaining and enhancing the quality of Oregon's air, land and water.

State of Oregon
Department of Environmental Quality

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Project Approvals

Prepared By:	______________________ Sandy Lyon, Partnership for the Umpqua Rivers Monitoring Coordinator	Date:	__________
Reviewed	______________________ Eric Riley, Partnership for the Umpqua Rivers Executive Director	Date:	__________
Reviewed	______________________ Sara Krepps, DEQ Quality Assurance Officer (QAO)	Date:	__________
Approved By:	______________________ Nick Haxton-Evans, DEQ Volunteer Monitoring Program Coordinator	Date:	__________

Signed Copy on File

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List of Tables and Figures

1. Project Management

1.1. Distribution List

The following personnel will be emailed regarding all aspects of this sampling and analysis plan (SAP). Deviations from this SAP must be communicated in writing (e-mail is acceptable) to all individuals identified in Table 1. Final reports from the DEQ Laboratory will be emailed and mailed to the project manager, regional monitoring coordinator, and laboratory monitoring coordinator/data manager.

Table 1 Distribution List

Name	Phone	Email
Sandy Lyon, Organization Project Manager	541-673-5756	sandy@umpquarivers.org
Nick Haxton-Evans, DEQ Volunteer Monitoring Program Coordinator	503-693-5731	nick.haxton-evans@deq.oregon.gov
Sara Krepps, DEQ Laboratory QAO	503-693-5722	sara.krepps@deq.oregon.gov
Ken Fetcho, OWEB, Effectiveness Monitoring Coordinator	974-345-7018	ken.fetcho@web.oregon.gov

1.2. Project/Task Organization

Sampling Organization(s): Partnership for the Umpqua Rivers
Denise Dammann Consulting

Analytical Organization:

Cole Ecological, Inc.
15 Bank Row, Suite B
Greenfield MA 01301
Ph: 413-774-5515
Contact: Mike Cole, President & Senior Scientist

1.3. Problem Definition/Background

I. PUR's General Volunteer Water Quality Monitoring Program:

The Partnership for the Umpqua Rivers (PUR) operates throughout the Umpqua Basin. Our area encompasses 2,569,527 acres of land and 1,740 stream miles of anadromous fish habitat. The Basin is the largest watershed draining into the sea south of the Columbia. It is one of Oregon's most important producers of spring Chinook, fall Chinook, winter steelhead, summer steelhead, coho, and sea-run cutthroat trout. The Umpqua system accounts for more total and wild coho than any other river system in Oregon and about 15% of coho coast-wide. The Umpqua River system originates just north of Crater Lake in the Cascade Mountains, cuts through the Coastal Range, and enters the Pacific Ocean near the town of Reedsport.

PUR's *Mission Statement* reads: "Through collaboration with diverse participants, the Partnership for the Umpqua Rivers maintains and improves water quality & fish populations from source to sea in the streams of the Umpqua. We educate people about the value of healthy streams; we work with willing landowners to improve stream conditions; we monitor the health of the streams and their fish populations. Through these actions, the Partnership contributes to the ecological and economic well-being of the basin."

PUR's Volunteer Monitoring Program has been strategically monitoring streams in the Umpqua Basin since 2004 under a previous Quality Assurance Plan with DEQ: DEQ-LAB-0035-SAP Sampling and Analysis Project Plan, Calapooya Creek Bacteria Monitoring Plan June 2004. Then DEQ-04-WQ-0041-QAPP Quality Assurance Project Plan For the Umpqua Basin Watershed Council Volunteer Monitoring Program, September 3, 2004, with Addendums in 2005, 2006, 2008, and 2012; followed by Quality Assurance Project Plan for the Partnership for the Umpqua Rivers, August 12, 2014, and addendums to this plan.
Our current goals are to continue and expand water quality monitoring by:

a. Adding watersheds that have not been monitored (due to the size of the Umpqua Basin, continue to add 5th field watersheds as possible working through the basin.) This will allow for the evaluation of conditions on a small scale and highlight areas of concern.
b. Intensively monitor 5th field watersheds for three years.
c. After 3 years of intensive monitoring, representative sites will be selected to maintain as reference sites but greatly reduce the number of sites. Keeping reference sites will permit watching for long-term trends and the ability to note any changes that might indicate a need to return to a smaller-scale investigation.
d. Maintain sites that will be useful for project implementation monitoring.
e. Balance the number of intensely monitored watersheds with those monitored for reference sites.
f. Sites will be monitored monthly year-round for turbidity, dissolved oxygen, conductivity, temperature, pH, nitrate, and blue/green algae. Select sites will be monitored for *E. coli*. Other select sites will be monitored for continuous summer temperatures.

PUR is targeting monitoring to complement, but not repeat, our partners' monitoring efforts. The data will be used by our project planners in determining the prioritization of future projects. Exceedance of DEQ recommended thresholds will be included for all parameters where DEQ has established criteria. Reports will be made public for use in understanding general water quality conditions throughout the Umpqua Basin. The Oregon DEQ will use the data to assess whether the streams of the Umpqua Basin are meeting water quality criteria to protect beneficial uses.

Having this data throughout our basin will contribute to understanding the effects of climate change in our watersheds and contribute to planning where restoration efforts would best be placed to help save our aquatic species.

II. Rice Creek Effectiveness Monitoring

Throughout coastal Oregon watersheds and specifically in the Umpqua Basin there is a lack of scientific data that shows the effectiveness of instream and riparian restoration best management practices (BMP) in high intrinsic, low gradient, coho bearing streams that run through agricultural ranch lands. PUR has a unique opportunity to demonstrate BMP effectiveness in one of the most highly degraded streams in the basin. The Rice Creek Effectiveness Monitoring project is collecting scientific data on water quality, stream processes, and macroinvertebrates before and after a full suite of restoration applications being implemented, including, fish habitat structure placement, livestock exclusion fencing, and riparian restoration. By partnering with a willing and gracious landowner, ODFW, BLM, and DEQ using the most suitable and approved protocols for all parameters monitored, we are documenting pre/post changes in both water quality and fish habitat quality throughout the treated stream reach. This monitoring will result in the distribution of the scientific documentation of the results of this effort and will be very important in recruiting new agricultural landowners for restoration efforts.

III. North and South Umpqua Basins Non-Point Turbidity, Nitrate, and Phycocyanin Source Monitoring Assessment

Nearly all of the South Umpqua Fourth Field Watershed is a surface drinking water source area, encompassing six (6) major drinking water systems (Myrtle Creek, Tri-City, Canyonville, Riddle, Winston-Dillard, and Roberts Creek Water Districts) and many other smaller systems. The South Umpqua Basin is listed as having the following water quality problems: sediment, bacteria, turbidity, nutrients, harmful algae blooms, pesticides, and other toxins. PUR's monitoring program has been collecting and submitting data to DEQ through their Volunteer Monitoring Program since 2004 with approved Quality Assurance Project Plans (QAPP). PUR partners with DEQ, Oregon Department of Agriculture (ODA), Oregon Health Authority (OHA), and Oregon Watershed Enhancement Board (OWEB).

This project consists of additional, beyond what is being monitored in project "I.", turbidity, nitrate, and phycocyanin (blue-green algae indicator) sampling in the South and North Umpqua River Subbasins to help identify areas in those basins that are likely sources of sediment and nutrients and resultant waterway contamination. To start identifying locations of interest, PUR will work with willing water treatment plants with drinking water intakes on the South Umpqua River upstream from Green's water system (Roberts Creek Water District) to obtain data on raw water turbidity levels, such as concentrations found at water intakes and time of year, in addition to other pertinent water quality data they might have. With this data, PUR can work to prioritize sampling locations. PUR currently has 14 reference sites located in the South Umpqua upstream of these water intakes that staff monitor monthly for turbidity and a suite of other parameters. Data from those sites and data obtained from drinking water plants will help us to select a set of new sites to be investigated, including fire-impacted areas in the North Umpqua. In 2021 this grant was modified to include the North Umpqua Watershed due to the Archie Creek Fire and its effect on water quality that will impact the Glide and Roseburg Water Districts. Sites will be varied as tracking of source input is carried out.

Success will be demonstrated by the submittal of all collected turbidity, blue-green algae (BGA) and nitrate data to DEQ under this approved SAP. The information collected will be useful in helping to identify areas of non-point pollution sources of concern and determine if and where employment of best management practices might reduce input to the streams of the South Umpqua and North Umpqua Watersheds, thus reducing impairments to beneficial uses and drinking water. Many of DEQ's Source Water Assessment Reports for drinking water supply areas in the South Umpqua Watershed identify potential contaminant sources such as agricultural activities, forest management, and urban development as possibly contributing to the turbidity contamination.

IV. Reference Site Update Umpqua Basin Stream Temperature

The Umpqua River Basin is a major costal fishery resource in Oregon and water temperature is a key management issue. Very little was known about summer stream temperatures throughout the Umpqua Basin and how much it varied in streams throughout this very large basin which extends from Diamond Lake to the ocean. Information was needed to inform management decisions by natural resource planners in planning restoration and preservation sites for endangered salmonids To help address this issue a project was started to in 1998 to identify the stream temperature characteristics in the Umpqua Basin by systematically collecting a large amount of synoptic time-series data from the sub-watersheds of the basin. For four years from 1998-2001, about 50 data loggers were deployed in two sub-watersheds to obtain representative data at sites located from the headwaters to the sub-watershed mouth. The emphasis was on maximum summer temperatures and the data was processed to display some of the distribution characteristics including the temporal and spatial variability of the daily maximum temperature statistic. The data and analysis was to provide a basis for addressing site specific temperature related issues, aquatic habitat evaluation, and a Temperature Management Plan for the Umpqua Watershed. From this study five sites were chosen for continued air and stream temperature monitoring based on the most representative varying climatic conditions and distance to divide (a surrogate for drainage area). The chosen sites were in Calapooya Creek, Camp Creek, North Myrtle Creek, Pass Creek, and Windy Creek. These have continued to be monitored since 1998 to record the seasonal pattern in the Umpqua Basin and updates of the original report have been produced annually. Monitoring has continued annually to document the patterns of stream temperatures in the Umpqua Basin. With over 20 years of data, this long-term data set provides a rare opportunity to study stream temperature patterns at these five reference sites.

Air and stream temperature monitoring of the five reference These data allow the user to make adjustments for seasonal variability when comparing stream temperature data from different years.
Since the reference temperature sites are in the Umpqua River and South Umpqua River Subbasins, partners working in the North Umpqua River Subbasin (BLM, The North Umpqua Foundation, PacifiCorp – The North Umpqua Hydroelectric Project, and USFS) expressed interest if the results from the reference temperature project would apply to streams in the North Umpqua River Subbasin and therefore the same models and relationships can be used for comparison. For this reason, four historic long-term stream temperature monitoring sites (called comparison sites) were selected based on fisheries, drainage area, disturbance history, proximity to restoration projects in Rock, Canton, and Pass Creeks, and applicability to sites within the newly designated Frank and Jeanne Moore Wild Steelhead Special Management Area. This historic (1999-2019) and current (2020) data from the BLM North Umpqua Subbasin monitoring sites were analyzed in the same manner as the reference temperature sties.

1.4. Project/Task Description

I. PUR's General Volunteer Water Quality Monitoring Project will monitor water quality for three years in the Little River 5th field watershed, continue monitoring the Rock Creek and Canton 5th field watersheds, and add the Steamboat 5th field watershed in January 2024. Reference Run sites are being monitored for the South Umpqua Reference, Umpqua Reference, and North Umpqua Reference runs.
Grab samples for all runs will be conducted weekly rotating through the watershed runs with each watershed being monitored once per month. Samples will be collected from well-mixed sites as near to the thalweg as possible. A stainless steel bucket, that is either rinsed once from water at each site, or rinsed thoroughly with D.I, water, will be used to collect water off of bridges; otherwise, the sonde is placed directly in the flow. A sample, using a sterile IDEXX 100ml bottle, will be taken for *E. coli* directly from the stream or before the sonde is inserted in the bucket. Conductivity, temperature, pH, turbidity, dissolved oxygen, nitrate, phycocyanin, and *E. coli* will be compared between locations and against designated water quality criteria. (Due to changes in ODEQ funding *E. coli* sampling will be cut back to chosen sites of interest.) Summary statistics for select continuous temperature sites seven-day maximum moving average and daily differences in min and max temps will be reported. All results are submitted to DEQ in their approved Excel Spreadsheet. A final report summarizing and analyzing the results is submitted to OWEB every 2-3 years as we complete three years of monitoring 5th field watersheds and report on the Reference Runs.

The only anticipated constraints are a few we have experienced in the past, which include road-work interference at a site and snow closures of roads. These tend to be temporary and we return to monitor the sites as soon as possible. Most of our sites are chosen to be from public lands and/or bridges. The few private lands we monitor are only with the written permission of the landowner.

II. Rice Creek Effectiveness Monitoring

We are monitoring the following parameters in Rice Creek:

a. Water Quality Monitoring. Conducted monthly, collecting grab samples of 6 parameters, (Temperature, pH, Conductivity, Dissolved Oxygen, Turbidity, and *E. coli*). We also take upstream and downstream photos at each site during each run.
b. Continuous Temperature Loggers. Deploy continuous temperature loggers recording every 30' each summer period for approximately 5 months.
c. Cross Sections and Pebble Counts. Cross-sections were established in 2017 placed around the structures, three cross-sections at each structure were set up, two structures per reach for a total of 18 cross-sections around 6 structures. During low flows after each year's winter rain events, the cross-sections are repeated to profile changes in the stream.
d. Pebble counts are collected each year in conjunction with the cross-section profile.
e. Habitat Surveys ODFW Modified. Once per year near early summer, physical stream characteristics are collected.
f. Sinuosity. Once per year, after winter flows, data is collected to show how much the stream has changed.
g. Wet/Dry Mapping & Pool Counts. In mid-September each year the areas of the disconnected channel have been mapped. In conjunction with this survey the number, location, size, and dept of pools over .8" deep are mapped.

h. Macroinvertebrate Sample Collections. Each year in late May composite kick samples have been collected for each of the three reaches following DEQ MOMs method as taught by Shannon Hubler and Steve Hanson at a local workshop the PUR hosted.
i. Photo Points. Photo point locations were established in 2016, each year we have taken high flow and low flow pictures.

The Water Quality Monitoring, Continuous Temperature Data, and Macroinvertebrate Data will be submitted to DEQ. The other parameters will be submitted to NRIMP and will be summarized in a final OWEB report. We have only one more year (2022) of data collection for this project.

The final report will be a comprehensive analysis of the changes that occurred over time post structure placements, fencing, and tree planting. This will include all parameters studied. We will consult with restoration specialists to learn if these results are what they expected from their designs so they we and they can learn from the results. We will make a presentation of the results and conclusions to be shared at professional meetings and with interested landowners.

Thanks to a generous, willing landowner we have been allowed consistent access to this property. A few things changed the timing of the project due to fire danger the first year and a greater length of time to complete the fence than projected. This wasn't all bad as we were able to monitor more "pre" years. Unfortunately, the structures and the fencing did not occur in the same year so the post-period began over several years. Because we had planned for this project to last five years we still were able to do post-monitoring several years with all practices having been implemented. Sheep breaking through the barbed wire fence has been a continuing unforeseen problem.

III. North and South Umpqua Basins Non-Point Turbidity, Nitrate, and Phycocyanin Source Monitoring Assessment

Task 1: With assistance from DEQ, obtain relevant raw water turbidity, nitrate, and blue-green algae data from water systems in the South and North Umpqua Rivers for recent years or as available and relevant.
Task 2: Purchase one YSI blue-green algae probe and two YSI nitrate probes. Identify additional turbidity sampling sites based on data collected by Recipient and/or drinking water providers. Modify sampling sites as needed.
Task 3: Summarize known land uses (e.g. agricultural, forestry, rural residential, etc.) and type of ownership (federal, private company, private resident, County, etc.) at each of the new turbidity sampling sites identified in Task 2.
Task 4: Collect and analyze 2-4 turbidity, nitrate, and phycocyanin samples at each sampling site over up to three (3) years, primarily during periods of known high turbidity (winter/rain events) and blue-green algae levels year-round.
Task 5: Analyze data to determine any trends or correlations and develop recommendations for subsequent project work.
Task 6: Share findings with DEQ and public water systems and develop a final report.

This project by its nature needs to be flexible in timing and location. The past two years have had infrequent storms of the magnitude we were hoping to track. Rather than tracking stream flows as a trigger to monitor we will track the turbidity at the North Umpqua River Near Idleyld Park, OR stream gage, and the Rock Creek Near Glide, OR stream gage. We will receive notification if either of these gages exceeds 10 NTUs. The South Umpqua is harder to track as there are no turbidity readings at any gages on the South Umpqua River. We will be notified if the gage height surpasses 4 feet for Cow Creek at Riddle . We will also watch weather reports for major rain events along the South Umpqua River. When these triggers occur, we will do our best to send a team up the South Umpqua from Winston and up the North Umpqua from Glide. Teams will attempt to safely gather data with our EXO2 Sonde recording turbidity, nitrate, and BGA from all suspicious tributaries as well as the main stem rivers working up the rivers until turbidity levels drop below 10. If nitrate or BGA are still rising, monitoring will be continued upstream until a reduction is observed with all parameters. Several runs will be done in this manner. Data will be compiled and sites will be determined that need further investigation up tributaries to determine a contributing source. The constraints to this project are the ability to respond promptly without conflicting schedules and the ability during a storm event to safely reach sites of interest to be monitored. A final report will include all data for sites monitored and a ranking of contributing sites with suggested best management practices to reduce their input. BGA readings will be taken with all PUR's General Volunteer Water Quality Monitoring Project Runs and will be investigated for source inputs if BGA is detected.

IV. Reference Site Update Umpqua Basin Stream Temperature

Pre-season temperature loggers will be checked for accuracy. Loggers will be deployed and audited in-stream and air at the five established sites in the Umpqua River and South Umpqua River Watersheds in May of each year. They will be audited and retrieved in September. Results will be off-loaded and stored on Denise Dammann's computer for later analysis. Temperature files containing the raw data will be sent to PUR for safe storage on the server. Denise will obtain continuous temperature data from partners for the 4 sites in the North Umpqua. Denise will them write an annual report that will (1) analyze stream temperature patterns at the reference sites for each year and the period of record (2) look at effects of air temperature, flow (if available), and day length on stream temperatures at each site (3) discuss several methods of using the reference temperature data in conjunction with project data throughout the basin to reduce annual variability and to expand on project data lacking multiyear data.

Table 2 Project Gant Chart Timeline

Major Tasks	Months for the year 2022-2024											
	J	F	M	A	M	J	J	A	S	O	N	D
Lab & Equipment Maintenance, Calibration & Ordering												
Monthly Water Quality Monitoring (1 or 2 runs/week)												
Data Entry and Quality Control Evaluation												
Meetings & Presentations: Council, with Partners, Hydro Breakfast, etc.												
Meet DEQ Ambient Monitoring Crew for Split Sampling												
Calibrate & Deploy Temperature Data Loggers												
Macroinvertebrate collection for Rice Creek												
Field Audit Temperature Data Loggers												

Retrieve Temperature Data Loggers and Offload Data												
Data Processing, Evaluation & Reporting												
Submit Data to DEQ												
Write OWEB Report												

1.5. Quality Objectives and Criteria

All data will be gathered and handled following DEQ's Standard Operating Procedure, Continuous Water Monitoring Procedures, May 2020. It is our goal to produce DEQ "A" quality data for temperature, pH, specific conductivity, turbidity, E. coli, nitrate, and dissolved oxygen. The phycocyanin data will be reported as a relative fluorescence measurement compared to a dye standard and corrected for non-blue-green algae chlorophyll interference. This will provide a presence/absence of blue-green algae as well as a relative amount on an RFU scale of 1-100. DEQ quality level will not be applied.

ODEQ Quality Assurance Project Plan, Volunteer Water Quality Monitoring, July 2021 Table 4 lists the precision and accuracy targets for standard water quality monitoring parameters collected. The accuracy and precision limits listed in the table represent "A" level data as defined by the DEQ's field Data Quality Matrix (DQM) Version 5.0 unless noted otherwise. Any data collected which does not meet the accuracy and precision limits defined below will be downgraded to a lower data quality level (DQL) following the DQM and will only be considered in analysis after considering the cause of the data quality downgrade.
PUR does not use all of the analytical methods and equipment recommended in Table 7 of the Quality Assurance Project Plan for Volunteer Water Quality Monitoring, July 2021. We use a NIST Traceable thermometer which is sent to DEQ as called for calibration certification. We use ONSET Temperature Data Loggers for continuous temperature monitoring. We follow the DEQ MOMS protocol, including the use of a 500µm Mesh D-Frame Kick Net. For all other parameters, PUR uses a YSI EXO2 Sonde with probes to monitor water quality. Listed below are YSI's data on the precision and accuracy of the parameters we monitor. All of these exceed those targets set in Table 1-3 of the ODEQ Quality Assurance Project Plan, Volunteer Water Quality Monitoring, July 2021.

Table 3 Datasonde EXO2 Parameter Specifications

Parameter	Sensor	Range	Accuracy	Resolution
Temperature	Conductivity / Temperature Sensor SKU: 599870	-5 to 35°C 35 to 50°C	±0.01°C[2] ±0.05°C[2]	0.001 °C
Conductivity	Conductivity / Temperature Sensor SKU: 599870	0 to 200 mS/cm	**0 to 100:** ±0.5% of reading or 0.001 mS/cm, w.i.g.; **100 to 200:** ±1% of reading	0.0001 to 0.01 mS/cm (range dependent)

pH	pH Sensor SKU:599701 guarded	0 to 14 units	±0.1 pH units within ±10˚C of calibration temp; ±0.2 pH units for entire temp range	0.01 units
Dissolved Oxygen	Optical Dissolved Oxygen Sensor SKU: 599100-01	0 to 50 mg/l	**0 to 20 mg/L:** ±0.1 mg/L or 1% of reading, w.i.g.; **20 to 50 mg/L:** ±5% of reading	0.001 m (0.001 ft) (auto-ranging)
Turbidity	Turbidity Sensor SKU: 599101-01	0 to 4000 FNU	**0 to 999 FNU:** 0.3 FNU or ±2% of reading, w.i.g.; **1000 to 4000 FNU:** ±5% of reading	0 to 999 FNU = 0.01 FNU; 1000 to 4000 FNU = 0.1 FNU
Blue-green Algae, Phycocyanin*	Total Algae Sensor SKU: 599102-01	0 to 100 g/L; 0 to 100 RFU	**Linearity:** R^2 >0.999 for serial dilution of Rhodamine WT solution from 0 to 100 µg/mL BGA-PC equivalents	0.01 µg/L; 0.01 RFU
Nitrate (freshwater only)	Nitrate Sensor SKU 599709	0 to 200 mg/L-N (0 to 30°C)	±10% of reading or 2 mg/L-N w.i.g.	0.01 mg/L
Depth-Medium	Integral, Non-vented Depth Senso	0 to 10 m (0 to 33 ft)	±0.04% FS (±0.004 m or ±0.013 ft)	0.001 ft (0.001 m)
Barometric Pressure	Integral Barometer	375 to 825 mmHg	±1.5 mmHg from 0 to 50°C	

* The phycocyanin data will be reported as relative fluorescence measurements compared to a dye standard and corrected for non-blue-green algae chlorophyll interference. This will provide a presence/absence of blue-green algae as well as a relative amount on an RFU scale of 1-100. PUR sends its macroinvertebrate samples to Cole Ecological, Inc. for identification. Cole Ecological is certified through the Society of Freshwater Science but not ORELAP certified which is not necessary for macroinvertebrate taxonomy.

Grab samples for all runs will be conducted weekly rotating through the watershed runs with each watershed being monitored once per month year-round. Samples will be collected from well-mixed sites as near to the thalweg as possible. It is recognized that grab samples are not ideal but for this study, we have found that they are sufficient at identifying water quality issues and help us to prioritize one stream over another over three years of monitoring. For project VI. It is not critical that we capture a storm event of a particular size, just that we can track turbidity, etc. when there is a big enough event for the levels to be elevated. For this, we will receive notification from stream gages in our study area that track turbidity when 10 NTUs is exceeded.

PUR does not follow the practices of calibration before and calibration checks after every run. We have now accumulated many years of data that this is not necessary as the YSI Sonde is extremely stable in our hands. All parameters consistently have reproduced standards before and after and from day to day. As will be defined in Section 2.5. All parameters are calibrated at least monthly except pH which is calibrated weekly as we have found it to be more likely to drift than any of the other probes which are extremely stable. During calibration the Sonde software produces a QC report for all probes, this QC Report is always checked, making sure all reports are acceptable, If the QC Report is "fail" action will be taken to correct the issue before any further data is collected, If the calibrations are out of quality assurance parameters, this will be noted, and the previous weeks' data while be downgraded from "A". We will standardize the two new probes when they arrive (nitrate and phycocyanin) before each run until we determine if they are equally stable or will require more frequent calibration.

1.6. Training Requirements and Certification

The Volunteer Monitoring Coordinator acting as the Project Manager and Quality Assurance Officer has 25 years of experience as a research technician and is well aware of the scientific approach to gathering data. She has been trained locally in water quality monitoring during our workshops and in the field with our science advisors, as well as working in the field and the lab with DEQ personnel. Since 2003 (19 years) she has been conducting water quality monitoring and submitting data to DEQ through her work with the watershed council. She also attends whatever trainings become available to improve the quality, storage, and display of data from the Umpqua Basin.

The Volunteer Monitoring Coordinator oversees and trains the Assistant Monitoring Coordinator who since 2012 (10 years) has been assisting with all monitoring activities and has been the primary person conducting field monitoring and data entry. He has an associate degree in Computer Information Systems and has a real aptitude for detail and quality control. In addition, he attends relevant training and classes as they become available such as the CONNECT and AFS Technical Trainings.

All volunteers are trained in the proper use of the equipment that they handle and are always accompanied by another trained staff member, I.e. Monitoring Coordinator or the Assistant Monitoring Coordinator.

1.7. Documentation and Records

PUR maintains a digital record-keeping system of all data, documents, and reports. Any document that might be in paper form is scanned into our server for preservation. All records are saved on our local server where they are immediately backed up to PUR's Cloud-based Dropbox. None of our data has been deleted so the controlled documents are kept far beyond the Storage Time required below.

Table 4 Controlled Documents

Document or Record Name and Description	Storage Location	Storage Time
DEQ Quality Assurance Project Plan (QAPP) (v.3**)** DEQ04-LAB-0047-QAPP project description and assurance procedures.	DEQ Internet Page	5 years
PUR's Sampling and Analysis Plan – listing specific sampling information for each of our activities.	PUR Monitoring Office, Computers, Server and off-site backup on Dropbox	5 years
DEQ Laboratory Mode of Operations Manual- Methods manual	PUR Monitoring Office	5 years
Equipment Notebooks - records of quality control checks, calibrations, and maintenance.	PUR Monitoring Office, Computers, Server and off-site backup on Dropbox	5 years

Document or Record Name and Description	Storage Location	Storage Time
Field Data or Chain of Custody Sheets/Electronic Files – Field forms containing sampling metadata and raw field data.	PUR Monitoring Computers, Server and off-site backup on Dropbox	5 years
DEQ data submission spreadsheets	PUR Monitoring Computers, Server and off-site backup on Dropbox	10 years
OWEB Reports	PUR Website: www.umpquarivers.org PUR Monitoring Computers, Server and off-site backup on Dropbox, OWEB's website	10 years

2. Data Generation and Acquisition

2.1. Sampling Process Design

Sampling design, collection, methods, and handling will be managed by the sampling organization identified in section 1.2. The sampling organization will ensure that all samples will be collected in the appropriate sample containers, preserved as identified in the appropriate reference methods, and transported to the analytical organization within the appropriate sample holding times, with the appropriate documentation, and under the appropriate sample transport conditions. Analytical laboratories assume no responsibility for the quality of data resulting from samples that were collected, shipped, or stored under inappropriate conditions.

I. PUR's General Volunteer Water Quality Monitoring Project

The goal of this project is to monitor the streams of fifth field watersheds in the Umpqua Basin. We will intensely monitor fifth field watersheds for three years then choose reference sites to monitor thereafter and move on to the next fifth field watershed for three years of monitoring. Reference sites will be chosen to best capture a snapshot of the watershed from a few locations based on the previously obtained data and knowledge of the watershed.

The original sites for intensive monitoring will be chosen to represent land-use areas and the mouths of major tributaries. Adaptations to sites may occur during the three-year intervals as knowledge is gained from monitoring. Sites are chosen in the public right of ways where possible but also from private lands where appropriate with landowner permission. We are careful to not pinpoint a single landowner. Monitoring will occur from bridges and streamsides as conditions dictate. A digital record file (Handbase) is created for monitoring location, time, if *e. coli* was sampled for, as well as weather conditions at the time. An estimate of streamflow is recorded and photo numbers of pictures taken at each monitoring site, each run upstream and downstream. (For example, see datasheet Figure 1).

Each watershed will be monitored monthly throughout the year. Each watershed will be monitored according to a standard monitoring schedule that is, as much as possible, not altered due to weather conditions. Monthly monitoring for three years has proven to capture most conditions from seasonal changes including high and low flow conditions.

Parameters to be monitored are temperature, dissolved oxygen, conductivity, turbidity, pH, and *E. coli*. We have ordered two additional probes - nitrate, and phycocyanin levels for estimation of blue/green algae levels. These probes have been back-ordered for several months but YSI predicts we will receive them in the next two weeks (by 3/15/2022). All parameters are recorded on-site to the EXO Handheld Display and Data Logger. *E. coli* samples are labeled and appropriately collected using sterile technique, capped, and placed on ice until return to the laboratory. Continuous summer temperatures will be recorded at 30-minute intervals. These parameters were chosen to best identify the health of a stream with the use of a Multi-parameter Sonde for accuracy and for rapid data gathering allowing us to cover many sites in a day's run. Runs are repeated following the same monitoring pattern each run. This allows for consistency of timing of a site over the seasons and the years. The analysis will take into consideration how site data is influenced by the time of day.

II. Rice Creek Effectiveness Monitoring

Since the goal of this project was to monitor the effectiveness of stream and riparian restoration in a highly degraded agricultural stream for years post-restoration, we chose to do high-intensity data collection in three separate restoration reaches within the project area (upper, middle, and lower). These reaches had quite different instream conditions so we wanted to see if restoration efforts affected them differently. We were also interested in recording if changes progressed in a downstream manner with the movement and capture of bedload. We met with many partners to determine what parameters might best capture this change over time. We settled on many parameters including data on water quality taken monthly year-round at the top and bottom of each reach: temperature, conductivity, turbidity, pH, dissolved oxygen, and *E. coli* Macroinvertebrate collections are taken each May as separate composites for each of the three reaches. Continuous summer temperatures are recorded at the top and bottom of each reach as well as above and below selected structures in each reach. (See Maps 9-12) Many stream processes are being studied as well but that data will be submitted to NRIMP rather than to DEQ. These include cross-sections above and below select structures in each reach as well as corresponding pebble counts, sinuosity measurement, habitat surveys, wet/dry mapping, and pool counts. We also are collecting data with landowner outreach in mind - utilizing photo points, new technology (GoPro Camera, UAV, and FLIR attachment to iPhone), and video to make data visually appealing. We will utilize GPS and GIS to ensure that the data collected will be location-based. This will ensure the ability that this data can be site-specific for long-term effectiveness monitoring.

III. North and South Umpqua Basins Non-Point Turbidity, Nitrate, and Phycocyanin Source Monitoring Assessment

This project by its nature needs to be flexible in timing and location. The project consists of tracking turbidity, nitrate, and phycocyanin (blue-green algae indicator) sources by sampling in the South and North Umpqua Subbasins to begin identifying areas in the basin that might be sources of sediment and nutrients and resultant waterway contamination. Locations will be determined as we gather information during rain events that demonstrate an elevation in turbidity as a marker. We will monitor the main stem and the mouths of tributaries that are accessible working our way upriver. As data is gathered, analyzed, and plotted on a map we will determine where further monitoring will help fill in the necessary information. The same process will occur if any phycocyanin levels are found at any time of year with our regular monitoring in the North and South Umpqua Rivers.

IV. Reference Site Update Umpqua Basin Stream Temperature

The original study, the Umpqua Basin Stream Temperature Characterization Project, was conducted from 1998-2001 sampling approximately every ten square miles, to establish the range of variability of stream temperature in the Umpqua Basin temporally and spatially (Smith, 2001a). Air and stream temperature continuous summer monitoring of five reference sites, chosen based on varying climatic conditions and distance to divide (a surrogate for drainage area), has continued annually to document the patterns of stream temperatures in the Umpqua Basin. With over 20 years of data, this long-term data set provides a rare opportunity to study stream temperature patterns at these five reference sites.

Since the reference temperature sites are in the Umpqua River and South Umpqua Subbasins, partners working in the North Umpqua Subbasin (BLM, The North Umpqua Foundation, PacifiCorp – The North Umpqua Hydroelectric Project, and USFS) expressed interest if the results from the reference temperature project would apply to streams in the North Umpqua Subbasin and therefore the same models and relationships can be used for comparison. For this reason, four historic long-term stream temperature monitoring sites (called comparison sites) were selected based on fisheries, drainage area, disturbance history, proximity to restoration projects in Rock, Canton, and Pass Creeks, and applicability to sites within the newly designated Frank and Jeanne Moore Wild Steelhead Special Management Area. This historic (1999-22019) and current (2020) data from the BLM North Umpqua monitoring sites were analyzed in the same manner as the reference temperature sties.

The locations to be sampled in projects I., II., and IV. are summarized in Table 2-1. Maps for these projects are included at the end of this document. (Maps 3-12).

Table 5 Summary of the sampling locations

DEQ Station ID	Organizational Site ID	Lat/Long	Station Description	Parameters
Rock Creek/Canton Creek 5th Fields Run				
32477-ORDEQ	RKC1	43.3329/123.0031	Rock Creek at Swiftwater Park	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	MSC1	43.3506/122.9902	McComas Creek at Anabel Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
27964-ORDEQ	KYC1	43.3525/-122.9881	Kelly Creek at Anabel Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*

	RKC2	43.3743/-122.9567	Rock Creek at BLM Rd. 29 0	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	SPC1	43.3793/-122.9538	Shoup Creek at Rock Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	MRC1	43.3886/-122.9439	Miller Creek at Rock Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	HNC1	43.3932/-122.9380	Harrington Creek at Rock Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	RKC3	43.3933 /122.9380	Rock Creek just upstream of Harrington	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	RKC4	43.3862/-122.9440	Rock Creek just downstream BLM project area	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	RKC5	43.4081/-122.9116	Rock Creek at East Fork Rock Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	EFRKC1	43.4042/-122.8997	East Fork Rock Creek at First Right Up East Fork Rock Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	NEFRKC1	43.4532/-122.8938	Northeast Fork Rock Creek at Rock Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
27880-ORDEQ	RKC6	43.4535/-122.8943	Rock Creek at Decommissioned Rd. Near Confluence NE. Rock	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	CNC1	43.3498/-122.7297	Canton Creek at Steamboat Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	CNC2	43.3715/-122.7464	Canton Creek at 1st Bridge Canton Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	CNC3	43.3792/-122.7609	Canton Creek a Canton Creek at 2nd Bridge Canton Creek Rd. near Scaredman	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*

	CNC4	43.4165/-122.7801	Canton Creek at 3rd Bridge Canton Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
27889-ORDEQ	TRC1	43.4245/-122.7773	Trapper Creek at Canton Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
27884-ORDEQ	CNC5	43.4564/-122.7606	Canton Creek off BLM Rd. 26.0	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
27894-ORDEQ	PSC1	43.4578/-122.7648	Pass Creek off Canton Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
Rock & Canton General Monitoring Temperature Recorder Monitoring Sites				
32446-ORDEQ	RKC1	43.3329/-123.0031	Rock Creek at Swiftwater Park	Continuous Summer Temperature
	HNC1	43.3932/-122.9380	Harrington Creek at Rock Creek Rd.	Continuous Summer Temperature
	RKC5	43.4081/-122.9116	Rock Creek at East Fork Rock Creek Rd.	Continuous Summer Temperature
	EFRKC1	43.4042/-122.8997	East Fork Rock Creek at First Right Up East Fork Rock Creek Rd.	Continuous Summer Temperature
UmpNF-016	CNC1	43.3495/-122.7317	Canton Creek about 500ft upstream bridge	Continuous Summer Temperature
	CNC4	43.4165/-122.7801	Canton Creek at 3rd Bridge Canton Creek Rd.	Continuous Summer Temperature

Little River Water Quality Monitoring Sites				
	LER1	43.2972/-123.1010	Little River at Hwy 138 Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	BNC1	43.2840/-123.0930	Buckhorn Creek at Little River Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	FLC1	43.2707/-123.0750	Fall Creek at Little River Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	LER2	43.2712/-123.0700	Little River at Little River Rd.	Conductivity, pH, Dissolved Oxygen, Temperature,

				Turbidity, Nitrate, BGA, *E. coli*
27878-ORDEQ	JMC1	43.2420/-123.0220	Jim Creek at Cavitt Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
28399-ORDEQ	CTC1	43.2380/-123.0170	Cavitt Creek at Cavitt Cr. County Park	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	CTC2	43.1956/-123.0240	Cavitt Creek at Cavitt Creek Rd	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	CTC3	43.1485/-122.9830	Cavitt Creek at NF-050 Rd, First Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
30150-ORDEQ	LER3	43.2383/-123.0120	Little River at New Bridge Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
28423-ORDEQ	LER4	43.2478/-122.9270	Little River at NF-2701 Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
28406-ORDEQ	EME1	43.2486/-122.9020	Emily Creek at Little River Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	NOC1	43.2318/-122.8740	Negro Creek near mouth off Cool Water Camp Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	LER6	43.2396/-122.8780	Little River at NF-2792 First Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
28423-ORDEQ	WEC1	43.2223/-122.8538	White Creek At NF-2792 Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
24141-ORDEQ	LER7	43.2057/-122.8230	Little River At NF-2719 at First Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
28412-ORDEQ	BKC1	43.2053/-122.8230	Black Creek at NF-2719003 Spur Road	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
24142-ORDEQ	LER8	43.2187/122.7553	Little River at NF-165 RD Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*

30153-ORDEQ	LER9	43.2218/-122.7340	Little River at NF-27 Rd Culvert	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
28417-ORDEQ	HKC1	43.2186/-122.7350	Hemlock Creek at NF-290 Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
	HKC2	43.1907/-122.7017	Hemlock Creek at Campground Entrance	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, Nitrate, BGA, *E. coli*
Little River Temperature Recorder Monitoring Sites				
	LER2	43.2712/-123.0700	Little River at Little River Rd.	Continuous Summer Temperature
28399-ORDEQ	CTC1	43.2380/-123.0170	Cavitt Creek at Cavitt Cr. County Park	Continuous Summer Temperature
	CTC2	43.1956/-123.0240	Cavitt Creek at Cavitt Creek Rd	Continuous Summer Temperature
30150-ORDEQ	LER3	43.2383/-123.0120	Little River at New Bridge Rd.	Continuous Summer Temperature
28406-ORDEQ	EME1	43.2486/-122.9020	Emile Creek at Little River Rd.	Continuous Summer Temperature
	LER6	43.2396/-122.8780	Little River at NF-2792 First Bridge	Continuous Summer Temperature
24142-ORDEQ	LER8	43.2187/122.7553	Little River at NF-165 RD Bridge	Continuous Summer Temperature
South Umpqua River Reference Run				
37486-ORDEQ	SU1	42.92716/-122.9514	South Umpqua Above Elk Creek	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and E. coli Nitrate and phycocyanin to be added
37485-ORDEQ	E1	42.9266/-122.9513	Elk Creek Near Mouth	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
13268-ORDEQ	DC4	42.9724/-123.1660	Days Creek At Hwy 1 bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
31693-ORDEQ	SU2	42.9728/-123.1720	South Umpqua River At Hwy 1 bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
10997-ORDEQ	COC1	42.9428/-123.3367	Cow Creek Near Mouth	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
36310-ORDEQ	SU6	42.9481/-123.3369	South Umpqua River At Lawson Bar	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
PWS00550:SRC-AA	SU8	43.0227/-123.2970	South Umpqua River Near Myrtle Creek Water Plant	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*

11316-ORDEQ	MC1	43.0220/-123.2954	Myrtle Creek At the mouth	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
33247-ORDEQ	SM1	43.0170/-123.2744	South Myrtle Creek At Neil Lane Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
37477-ORDEQ	NM1a	43.0233/-123.2832	North Myrtle Creek At Evergreen Park Near Mouth	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
25182-ORDEQ	SU11	43.0978/-123.4300	South Umpqua River At Brockway Road	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
140204-ORDEQ	LG3	43.1133/-123.5077	Lookingglass Creek At Hwy 42 Bridge West of Olalla Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
38316-ORDEQ	MG2	43.1615/-123.5033	Morgan Creek At lower Dairy Loop Rd. Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
12248-ORDEQ	LG1	43.1177/-123.4283	Lookingglass Creek At Hwy 42 Bridge Winston Near Mouth	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
40354-ORDEQ	SU14	43.2116/-123.3503	South Umpqua River At Oak Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
25950-ORDEQ	DC1	43.2125/-123.3399	Deer Creek at Fowler Street Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
30163-ORDEQ	SU15	43.2665/-123.4469	South Umpqua River At Singleton Park	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
South Umpqua River Reference Run Temperature Recorder Monitoring Sites				
40123-ORDEQ	SU1a	42.9272/-122.9514	South Umpqua River at RM 59	Continuous Summer Temperature
10997-ORDEQ	COC1	42.9428/-123.3367	Cow Creek Near Mouth	Continuous Summer Temperature
36310-ORDEQ	SU6	42.9481/-123.3369	South Umpqua River At Lawson Bar	Continuous Summer Temperature
PWS00550:SRC-AA	SU8	43.0227/-123.2970	South Umpqua River Near Myrtle Creek Water Plant	Continuous Summer Temperature
11316-ORDEQ	MC1	43.0220/-123.2954	Myrtle Creek At the mouth	Continuous Summer Temperature
12277-ORDEQ	LG1a	43.1172/-123.4404	Lookingglass Creek at Brockway Rd.	Continuous Summer Temperature
25180-ORDEQ	SU13.5	43.1946/-123.3546	South Umpqua River at Fairgrounds	Continuous Summer Temperature

25950-ORDEQ	DC1	43.2125/-123.3399	Deer Creek at Fowler Street Bridge	Continuous Summer Temperature
30163-ORDEQ	SU15	43.2665/-123.4469	South Umpqua River At Singleton Park	Continuous Summer Temperature
North Umpqua River Reference Run				
24533-ORDEQ	NUR1	43.2682/-123.4424	North Umpqua River at River Forks Par,	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
41104-ORDEQ	SNC1	43.3028/-123.3759	Sutherlin Creek at Del Rio Road	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
41092-ORDEQ	NUR4	43.3018/-123.2616	North Umpqua River at Private property 1532 Echo Dr.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
332159-ORDEQ	NUR6	43.3074/-123.1238	North Umpqua River at North Bank Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
North Umpqua River Reference Run Temperature Recorder Monitoring Sites				
24533-ORDEQ	NUR1	43.2682/-123.4424	North Umpqua River at River Forks Park	Continuous Summer Temperature
41104-ORDEQ	SNC1	43.3028/-123.3759	Sutherlin Creek at Del Rio Road	Continuous Summer Temperature
41092-ORDEQ	NUR4	43.3018/-123.2616	North Umpqua River at Private property 1532 Echo Dr.	Continuous Summer Temperature
Umpqua River Reference Run				
10996-ORDEQ	CC1	43.3666/-123.461	Calapooya Creek at Garden Valley Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
40506-ORDEQ	U1	43.2972/-123.47	Umpqua River at Cleveland Rapids Park	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
38319-ORDEQ	WFC2	43.4347/-123.588	Wolf Creek Upstream Little Wolf Creek	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
25175-ORDEQ	U3	43.5017/-123.4938	Umpqua River at Yellow Creek Boat Ramp	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
38046-ORDEQ	U5	43.6319/-123.567	Umpqua River at Mehl Creek Road Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
10437-ORDEQ	EC1	43.6346/-123.565	Elk Creek at State Hwy 38 10437-ORDEQBridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
	CC4	43.4433/-123.2424	Calapooya Creek at Driver Valley Road Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*

37507-ORDEQ	PEC1	43.6723/-123.6521	Paradise Creek at Hwy 38 Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
	LTRC1	43.6519/-123.7175	Lutsinger Creek at Lutsinger Creek Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
41099-ORDEQ	LEMC1	43.6552/-123.8271	Little Mill at W Scottsburg Rd.	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
37495-ORDEQ	U7	43.6498/-123.8392	Umpqua River at Scottsburg Park, Dock	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
33428-ORDEQ	CEC1	43.6597/-123.9219	Charlotte Creek at Hwy 38 Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
37399-ORDEQ	U8	43.7053/-124.0951	Umpqua River at Discovery Center Dock	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
26454-ORDEQ	SDC2	43.6782/-124.0868	Scholfield Creek at Thorton Oar Ln Bridge	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
Umpqua River Reference Run Temperature Recorder Monitoring Sites				
24405-ORDEQ	CC1a	43.3660/-123.4673	Calapooya Creek at Boat Ramp Near Mouth	Continuous Summer Temperature
37508-ORDEQ	U2	43.4055/-123.5368	Umpqua River at James Woods Boat Ramp	Continuous Summer Temperature
38319-ORDEQ	WFC2	43.4347/-123.588	Wolf Creek Upstream Little Wolf Creek	Continuous Summer Temperature
40520-ORDEQ	U4.5	43.6142/-123.6044	Umpqua River above Mehl Creek Road Bridge 2.5 mile	Continuous Summer Temperature
	LTRC1	43.6519/-123.7175	Lutsinger Creek at Lutsinger Creek Rd.	Continuous Summer Temperature
41099-ORDEQ	LEMC1	43.6552/-123.8271	Little Mill at W Scottsburg Rd.	Continuous Summer Temperature
37495-ORDEQ	U7	43.6498/-123.8392	Umpqua River at Scottsburg Park, Dock	Continuous Summer Temperature
37399-ORDEQ	U8	43.6498/-123.8392	Umpqua River at Discovery Center Dock	Continuous Summer Temperature
Rice Creek Effectiveness Monitoring				
2785-ORDEQ	R10	43.0230/-123.4695	Lower End BLM Land	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
40210-ORDEQ	RC9	43.0604/-123.4281	Upper-End Upper Reach Upper Kennerly Ranch	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*

41084-ORDEQ	RC8	43.0620/-123.4265	Lower End Upper Reach Upper Kennerly Ranch	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
41082-ORDEQ	RC7	43.0637/-123.4245	Upper-End Middle Reach Upper Kennerly Ranch	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
41080-ORDEQ	RC6	43.0650/-123.4228	Lower End Middle Reach Upper Kennerly Ranch	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
41078-ORDEQ	RC5	43.0660/-123.4219	Upper-End Lower Reach Upper Kennerly Ranch	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
41075-ORDEQ	RC4	43.0676/-123.4208	Lower End Lower Reach Upper Kennerly Ranch	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
12247- ORDEQ	RC1	43.0836/-123.4146	Rice Creek near Mouth at Wills Creek Road	Conductivity, pH, Dissolved Oxygen, Temperature, Turbidity, and *E. coli*
Rice Creek Temperature Recorder Monitoring Sites				
2785-ORDEQ	R10	43.0230/-123.4695	Lower End BLM Land	Continuous Summer Temperature
40210-ORDEQ	RC9	43.0604/-123.4281	Upper-End Upper Reach Upper Kennerly Ranch	Continuous Summer Temperature
41087-ORDEQ	SL12	43.0612/-123.4269	Lower End Upper Reach above upper structure	Continuous Summer Temperature
41086-ORDEQ	SL11	43.0613/-123.42.69	Lower End Upper Reach below upper structure	Continuous Summer Temperature
41085-ORDEQ	SL10	43.0616/-123.42.68	Bottom End Upper Reach above lower structure	Continuous Summer Temperature
41084-ORDEQ	RC8 SL9	43.0620/-123.4265	Bottom End Upper Reach below lower structure	Continuous Summer Temperature
41082-ORDEQ	RC7 SL6 SL7	43.0637/-123.4245	Upper-End Middle Reach above lower structure, below upper structure	Continuous Summer Temperature
41081-ORDEQ	SL5	43.0638/-123.424	Upper-End Middle Reach below lower structure	Continuous Summer Temperature
41080-ORDEQ	RC6	43.0650/-123.4228	Lower End Middle Reach Kennerly Ranch	Continuous Summer Temperature
	SL4	4.0660/-123.4222	Upper-End Lower Reach above structure	Continuous Summer Temperature

41079-ORDEQ	RC5 Pool	43.066/-123.4221	Upper-End Lower Reach, pool mid structures	Continuous Summer Temperature
41078-ORDEQ	RC5 Riffle SL3	43.0660/-123.4219	Upper-End Lower Reach below structure, top of the riffle	Continuous Summer Temperature
41077-ORDEQ	SL2	43.0671/-123.4211	Lower End Lower Reach above structure	Continuous Summer Temperature
41076-ORDEQ	SL1	43.672/-123.4206	Lower End Lower Reach below structure	Continuous Summer Temperature
41075-ORDEQ	RC4	43.0676/-123.4208	Lower End Lower Reach Kennerly Ranch	Continuous Summer Temperature
12247- ORDEQ	RC1	43.0836/-123.4146	Rice Creek near Mouth at Wills Creek Road	Continuous Summer Temperature
Rice Creek Macroinvertebrate Monitoring Sites				
	Lower Reach Composite	43.0676/-123.4208 to 43.0660/-123.4219	Lower Study Reach Kennerly Ranch	Macroinvertebrates
	Middle Reach Composite	43.0650/-123.422 to 43.0637/-123.4245	Middle Study Reach Kennerly Ranch	Macroinvertebrates
	Upper Reach Composite	43.0620/-123.4265 to 43.0604/-123.4281	Upper Study Reach Kennerly Ranch	Macroinvertebrates
Umpqua Basin Stream Temperature Characterization – Reference Sites				
30154	CalWT	43.4317/-123.3034	Calapooya Cr. near Oakland	Continuous Temperature
30147	CampWT	43.6102 /-123.8364	Camp Cr. near Scottsburg	Continuous Temperature
37477	NMyrtWT	43.0229 /-123.2839	North Myrtle Cr. at Myrtle Cr.	Continuous Temperature
30161	PassWT	43.6604/-123.3166	Pass Cr. at Drain	Continuous Temperature
30143	WindyWT	42.7463/-123.4141	Windy Cr. near Glendale	Continuous Temperature
23880	CAPA	43.4566/-122.7625	Canton Cr. above Pass Cr.	Continuous Temperature
23877	EFRC	43.4064/-122.9113	East Fork Rock Cr. above Rock Cr.	Continuous Temperature
27894	PASSNU	43.4567/122.7637	Pass Cr. above Canton Cr.	Continuous Temperature
23874	RCEF	43.4067/-122.9110	Rock Cr. above East Fork Rock Cr.	Continuous Temperature

UmpNF-088	SteamLR	43.4926/-122.5987	Upper Steamboat Cr. below Little Rock Cr.	Continuous Temperature

*If a Station ID number is not available during QAPP/SAP development, the DEQ Laboratory will generate the unique identifier before data processing.

2.2. Sampling Methods

- Grab sample monitoring, when possible, will be conducted by teams of two people following the same order of sites each run.
- Samples will be collected either by bucket from bridges, wading when weather permits, or grabber arm for *E. coli* IDEXX bottles and direct emersion of YSI Sonde.
  When a bucket is used it will be thoroughly rinsed with distilled water between sites, or rinsed with onsite water.
- *E. coli* sample bottles will be placed directly into an ice chest and kept on ice for delivery to the lab where they will be processed according to IDEXX protocols, routinely within 10 hours.
- Continuous temperature recordings will be logged every 30 minutes on the hour and half hour using Onset loggers and following the procedures in DEQ's Standard Operating Procedure, Continuous Water Monitoring Procedures, May 2020. The only samples that will be composited are benthic macroinvertebrate collections which will follow the Western Pilot Study: Field Operations Manual for Wadable Streams and the macroinvertebrate sampling protocol DEQ's PREDATOR: Development and use of RIVPACS-type macroinvertebrate models to assess the biotic condition of Wadable Oregon streams July 2008. This includes immediate preservation in 95% ethanol in the field.
- PUR utilizes an iPad PRO and Handbase program to create a spreadsheet recording all data collection times, locations, and conditions in the field. (See Figure 1 &2 for examples general monitoring log sheet and the continuous temperature log sheet.)

2.3. Sample Handling and Custody

Handbase forms, that we have created to include all information needed to be recorded in the field at every site, are opened on our iPad Pro for each monitoring run, and data is recorded at every site (See Appendix for example form). The time is recorded to correspond to the time recorded when the Sonde is logged. Site information is selected in a drop-down menu. Current conditions are also recorded. The Sonde logs the water quality data to a file on its Handheld device indicating the site ID and the time. Both the Sondes file and Handbase Database files are downloaded to the server upon returning to the office.

E. coli samples are labeled with each site ID on the lid and the jar before being put on ice. Date and time are recorded in the Handbase file. Samples are processed in our lab by the field personnel and read out into our *E. coli* results log sheet (For example see Figure 4).

The Continuous temperature data loggers' information is recorded into our Handbase file for temperature loggers (Figure 2) upon deployment, audit, and retrieval. Data is off-loaded using Hoboware and exported as an Excel file bearing the number of the data logger, then is filed into the appropriate monitoring run folder.
Macroinvertebrates are appropriately labeled inside and out with all information as per protocol. When samples are delivered to Cole Environmental one of their chain of custody forms is sent with the samples (Figure 5 for Cole Environmental Chain-of-Custody Form).

Table 6 Summary of sampling parameters

Sample Type	Container	Preservation	Holding Time
E. coli	Sterile IDEXX bottles	None	10 hours at most on ice
Macroinvertebrates	Typical Macro wide-mouth collection bottles	95% ethanol	Our holding time varies but is always >6 weeks
Sonde with probes	SS bucket at times otherwise directly in stream	None	None
Continuous Temperature	None	None	April – Oct

2.4. Analytical Methods

Macroinvertebrates and *E. coli* will follow the methods in the Quality Assurance Project Plan – Volunteer Water Quality Monitoring, July 2022. The only difference is that we have been unable to find a way to sterilize the IDEXX trays. To assure that no contamination will occur we keep the trays for several months before disposing of them in the trash. The use of a YSI Sonde and probes is not in the DEQ QAPP but is standardly accepted by worldwide organizations including DEQ and USGS that use them on their stream gages to report many water quality parameters. All data using the YSI Sonde is collected on-site in the field.

Table 7 Summary of analytical parameters and methods

Sample Type	Parameter	Reference Method (required)
Stream water	Temperature	EPA 170.1
Stream water	Conductivity	EPA 120.1
Stream water	Turbidity	ASTM D7315-07a
Stream water	pH	EPA 150.1 Standard Method2 4500-H+ B-2000 • ASTM Method D1293-99 (A or B) • USGS Method I-1586-85 (Wastewater)
Stream water	Dissolved oxygen	ASTM Method D888-09 (C)
Stream water	Nitrate	Manufacturer developed method
Stream water	Phycocyanin	Manufacturer developed method
Stream water	*E. coli*	SM 9223B

2.5. Quality Control

PUR follows the following quality control methods as found in the Quality Assurance Project Plan – Volunteer Water Quality Monitoring, July 2022: Duplicate, accuracy checks, split sampling with DEQ Ambient Monitoring Team. If quality control results show a problem, the data will be downgraded and we will investigate the source of the problem and see that it is corrected. All sources of possible problems will be investigated and help sought from the manufacturer, others using similar devices, and the volunteer monitoring specialist until the problem is solved.

For macroinvertebrates, we send our samples to Cole Ecological, Inc. which has worked with ODEQ for many years and we believe is ORELAP accredited. Dr. Cole, is one of the most highly certified taxonomists in the country, holding 5 taxonomic certifications from the Society for Freshwater Science. Dr. Cole's past and present clients requiring these services include universities; local, state, and federal agencies, watershed groups and other non-profit organizations, environmental and engineering firms, the energy industry, conservation districts, and native American tribal natural resource departments.

2.6. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

We follow the Quality Assurance Project Plan – Volunteer Water Quality Monitoring, July 2022 for Instrument/Equipment testing, inspection, and maintenance. PUR does not follow the practices of calibration before and calibration checks after every run. We have now accumulated many years of data exhibiting this is not necessary as the YSI Sonde is extremely stable in our hands. All parameters consistently have reproduced standards before and after and from day to day. PUR does not follow the practices of calibration before and calibration checks after every run. All parameters are calibrated at least monthly except pH which is calibrated weekly as we have found it to be more likely to drift than any of the other probes which are extremely stable. During calibration the Sonde software produces a QC report for all probes, this QC Report is always checked, making sure all probes' reports are acceptable. If the QC Report is "fail", action will be taken to correct the issue before any further data is collected, if the calibration was out of quality assurance parameters, this will be noted, and the previous weeks' data will be downgraded from "A". We will standardize the two new probes when they arrive (nitrate and phycocyanin) before each run until we determine if they are equally stable or will require daily calibration. Note that these probes can be deployed for extended periods without calibration as USGS does at many stream gages.

2.7. Instrument Calibration and Frequency

PUR follows the calibration requirements cited in Table 10 section 2.7 of the Quality Assurance Project Plan – Volunteer Water Quality Monitoring, July 2022.

2.8. Non-direct Measurements

PUR follows all Table 11- Supply inspection and acceptance requirements listed in Quality Assurance Project Plan – Volunteer Water Quality Monitoring, July 2022 except for the Field Sheets, clipboard, and pen, as we substitute our iPad Pro with the needed Handbase files to be filled out in the field.

2.9. Data Management

-*Trace the path of your data from recording the information in the field to its analysis and presentation.*

Data and metadata are collected electronically in the field either on the Sonde Handheld or in Handbase files on our iPad Pro. When returning to the office both these instruments' data files are off-loaded to our lab computer and synced with our server and Cloud Dropbox.

- *How will your data be stored? (Field sheets, electronically)*
  Data remains stored on the PUR server and Dropbox.
- *Identify who is responsible for the data for each step going from field to data storage.*
  PUR staff, usually the Assistant Monitoring Coordinator, is responsible for collecting all field data, offloading it from the respective devices, and filling it on our server (auto backed up to Dropbox) in the appropriate location.

- *Include a description, example, or reference of the electronic format of your data including metadata (data about site location and date).*
  The Sonde data is stored as a .sdl (YSI format) and then off-loaded using YSI's KOR EXO program and exported into a .xlsx (Excel format). The Handbase file is emailed off the iPad as a .hdb (Handbase format) file then opened in Handbase Windows Desktop software which is then exported as a .xlsx (Excel format). If E. coli samples are taken this is checked in the appropriate box in the Handbase file while in the field at the site, thus recording the time and site matching the site ID. Upon return to the lab, the samples are processed according to IDEXX, time and temperature of the incubator are recorded manually on our E. coli log sheet (see log sheet attached as Figure 3)When the form is complete it is scanned and saved on the server as a .pdf, in a folder for *E. coli* results. The original is stored in the lab in a ring binder by monitoring run. The MPN is calculated using IDEEX's program and the results are exported into a .xlsx (Excel format) file, we then merge all three .xlsx files (Sonde, Handbase, and E. coli Excel files) into one combined .xlsx (Excel format) file.
- *Include a list or reference a list of the data fields that will be stored in your data.*
  An example of what is stored in the compiled file is included in Figure 5.
- *How will data be checked for completeness, reasonableness, transcription errors, and calculation errors?*
  The data files are reviewed by the Monitoring Coordinator who checks for reasonableness and completeness. The only instance where transcription errors may occur is during the entering of *E. coli* data calculations, this is double-checked after entry into the IDEXX calculator.
- *Where will electronic data be stored and backed up?*
  Electronic data is stored on the PUR Server and backed up to Dropbox.
- *What type of computer hardware and software will be used to store and manage data?*
  PUR uses PCs that are kept updated by our IT Manager. Sonde and Handbase software are used to collect and offload data files which are then exported to the most recent update of Excel where data is stored and managed.
- *Clearly define or reference how data submitted to the DEQ will be formatted, what will be included and when it will be submitted. Be sure to include an image of a map accurately showing where stations are if you do not have an existing DEQ Station ID number assigned.*
- Data for each day of monitoring will be entered via copy and paste from our combined Excel file (Sonde, Handbase, and E. coli Excel files) into the most current Grab Data submission format as provided on the DEQ Volunteer Monitoring Program Resources webpage (https://www.oregon.gov/deq/wq/Pages/WQ-Monitoring-Resources.aspx) Quality control data is manually entered into DEQ's Accuracy_DQL-Calculator. This data entry is performed by PUR staff, usually the Assistant Monitoring Coordinator. The spreadsheet will be submitted to DEQ every 1 to 2 years coinciding with our OWEB grant requirements. Results will be submitted to OWEB in a final report format. Data collected under DEQ 319 grants will be submitted to DEQ as a final report – following DEQ's Exhibit E format.
- *What software will be used to analyze the data?*
  Excel, Temp_Tool_07, Tempture(2010), and Hoboware

3. Assessment and Oversight

Project assessment and oversight, including field activities, will be the responsibility of the project manager.

3.1. Assessment and Response Actions

PUR adheres to the “Assessment and Response Actions”, section 3.1 of the Volunteer Monitoring Program QAPP.

3.2. Reports to Management

PUR will follow protocols listed in Reports to Management section 3.2 of the Volunteer Monitoring Program QAPP. In addition to the accuracy of the standard readings, range readings for each probe are confirmed to be appropriate, such as cell constant, MV range, and gain. The Sonde produces a report indicating the condition of the probe and its calibration results. In the field, the Assistant Monitoring Coordinator is constantly observing the Handheld Screen with the Sonde output. He is watching for the stability of each probes readout in addition to any errors with the equipment before logging a sample. He observes changes from site to site and duplicate results. If a problem were to be observed he would immediately check the equipment for problems. If problems were to persist he would return to the lab and inform the Monitoring Coordinator. Together they would seek a solution.

4. Data Validation and Usability

Data quality levels (DQL) will be assigned following the DEQ guidance document *Data Validation and Qualification* (DEQ09-LAB-0006-QAG). Generally, only targeted DQLs of “A”, or “B” will be accepted unless the basis for the data acceptability is approved and documented by the project manager and DEQ Volunteer Monitoring Coordinator. All data verification, validation, and assessment activities for project purposes are the responsibility of the project manager.

4.1. Data Review, Validation, and Verification

PUR follows the procedures outlined in the “Data Review, Validation, and Verification”, section 4.1 of the Volunteer Monitoring Program QAPP. It should be noted that PUR will submit results from the Phycocyanin Probe but it will be for informational purposes only and we, nor the YSI Company, claim any quantitative precision for the results. The probe is regularly checked for consistency but not for accuracy beyond detect/non-detect and high/low.

4.2. Validation and Verification Methods

PUR adheres to the “Validation and Verification”, section 4.2 of the Volunteer Monitoring Program QAPP.

4.3. Reconciliation with Data Quality Objectives

PUR adheres to the “Reconciliation with Data Quality Objectives”, section 4.3 of the Volunteer Monitoring Program QAPP. No data less than level “B” will be included for analysis of water quality in OWEB or DEQ final reports. Any level below “A” is carefully checked by PUR monitoring staff to determine the cause as we have a history of producing “A” quality data.

5. Revision History

Table 8 Revision History

Revision	Date	Changes	Editor
1.0		New Document	Sandy Lyon

Figure 1 Contents of Water Quality Monitoring Handbase Digital Field Log Sheet

Field	Description of type of entry	Drop down window choices							
Sample #	Automatically fills in 1 followed by next in numerical order								
Site Description	Drop down list of Site ID# and description for database title								
Date/Time Sampled	Automatically fills incurrent time when each new sample # is opened								
Sampling Method	Drop down menu offering:	Directly from streambank	Directly from dock	Directly from boat	Bucket from bridge	Bucket from shoreline			
Upstream Photo #	Manually entered from camera								
DownStream Photo#	Manually entered from camera								
Cloud Cover	Drop down menu offering:			0%	25%	50%	75%	100%	Other as noted
Wind	Drop down menu offering:			Calm	Light Breeze	Moderate Breeze	Strong Wind		Other as noted
Precipitation	Drop down menu offering:			None	Drizzle	Light Rain	Heavy Rain	Snow/Sleet	Other as noted
Water Color	None	Blue/Green	Brown	Yellow	Very Milky	Slightly Milky	Green	Yellow/Brown	Other as noted
Flow (PUR)	Dry	Puddled	Barely Flowing	Low Flow	Moderate Flow	High Flow	Bank Full Flow	Flooding	Other as noted
Flow (DEQ)	High	Transitional	Typical	Dry	Low				Other as noted
Algae	None	Brown/Dead	Some Present	Strong Presence	Severe Bloom				Other as noted
Water Temp ^{o}C	Manually entered from NIST thermometer								
Air Temp ^{o}C	Manually entered from NIST thermometer								
Hach Turbidity NTU	Manually entered from Hach meter								
E. coli Taken	Check box								
Duplicate	Check box								
Comments	Can be manually entered								
Drawing	Can be manually entered								
GPS	Can be manually entered if a new site								
Personel	Drop down box to select from of all volunteers and staff	Joe Carnes	Sandy Lyon	M. A. Hansen	Dave Schwarlander	Etc.			
Personel	Drop down box to select from of all volunteers and staff	Joe Carnes	Sandy Lyon	M. A. Hansen	Dave Schwarlander	Etc.			
Personel	Drop down box to select from of all volunteers and staff	Joe Carnes	Sandy Lyon	M. A. Hansen	Dave Schwarlander	Etc.			

There is a different Database file for each monitoring run such that the drop down for Site Description contain the appropriate sites and ID#s

Figure 2 Program Contents for Temperature Logger Handbase Digital Field Log Sheet

Deployment Information
Project Name:
Reach Description:
Location Description:
Personnel:
Personnel:
Personnel:
Latitiutde:
Longitude:
Unit Type:
Unit #:
Date:
Time Deployed: o
Depth of Water:
Water Temperature F:
Time Water Temp Taken:
NIST Thermometer ID:
Photo #1
Photo #1 Notes:
Photo #2
Photo #2 Notes:
Sketch
Audit Information
Date:
Time:
Personnel:
Personnel:
Depth of Water:
NIST Thermometer ID:
Water Temperature °F:
Retrieval Information
Date:
Time:
Personnel:
Personnel:
Depth of Water:
NIST Thermometer ID:
Water Temperature °F:
Unit # Correct Check Box

Figure 3 *E. coli* Results Datasheet

E. coli

18hr. IDEXX ☐ 24hr. IDEXX ☐

Monitoring Date: ________________ **General Location:** ___________________
Time Samples Put in Incubator:_________ **Incubator Temperature at Start** _____
Date & Time Read ____________________ **Incubator Temperature at End** _____

Sample # **No Dilution ☐** **Diluted 1:10 ☐**
Yellow cells: # Large _________ # Small __________ MNP__________

Fluorescing cells*: # Large _________ # Small __________ MPN__________

Sample # **No Dilution ☐** **Diluted 1:10 ☐**
Yellow cells: # Large _________ # Small __________ MNP__________

Fluorescing cells*: # Large _________ # Small __________ MPN__________

Sample # **No Dilution ☐** **Diluted 1:10 ☐**
Yellow cells: # Large _________ # Small __________ MNP__________

Fluorescing cells*: # Large _________ # Small __________ MPN__________

Sample # **No Dilution ☐** **Diluted 1:10 ☐**
Yellow cells: # Large _________ # Small __________ MNP__________

Fluorescing cells*: # Large _________ # Small __________ MPN__________

Sample # **No Dilution ☐** **Diluted 1:10 ☐**
Yellow cells: # Large _________ # Small __________ MNP__________

Fluorescing cells*: # Large _________ # Small __________ MPN__________

Sample # **No Dilution ☐** **Diluted 1:10 ☐**
Yellow cells: # Large _________ # Small __________ MNP__________

Fluorescing cells*: # Large _________ # Small __________ MPN__________

Sample # **No Dilution ☐** **Diluted 1:10 ☐**
Yellow cells: # Large _________ # Small __________ MNP__________

Fluorescing cells*: # Large _________ # Small __________ MPN__________

Sample # **No Dilution ☐** **Diluted 1:10 ☐**
Yellow cells: # Large _________ # Small __________ MNP__________

Fluorescing cells*: # Large _________ # Small __________ MPN__________

** Include only fluorescing cells that are also yellow.*

Figure 4 Compiled Monitoring Run Excel Spreadsheet

		SENSOR SERIAL	14F102924	14F102924	19G102367	19G102367	19G102367	14F102924	14F102924	12C102135	19G10445	14F102924	17F100354	17F100354	17F100354	17F100354
Date (MM/DD/YYYY)	Time (HH:MM	Site Name	Cond µS/c	nLF Cond µS/	ODO % sat	ODO % local	ODO mg/L	Sal ppt	SpCond µS/c	Turbidity FNU	pH	Temp °C	GPS Latitu	GPS Longi	Altitude n	Baromete
3/18/2020	10:10:11	SU1	46.1	72.6	96.6	96.2	11.9	0.03	71.4	1.91	7.73	6.414	42.92707	-122.951	325.5	731.6
3/18/2020	10:16:32	E1	86.1	135	97.4	96.9	11.94	0.06	132.6	2.67	7.68	6.567	42.92649	-122.951	310.3	732.6
3/18/2020	10:44:44	DC4	92.4	142.2	99	98.5	11.94	0.07	139.6	5.77	7.8	7.233	42.97222	-123.167	200	739.4
3/18/2020	10:52:54	SU2	58.3	89.3	99.2	98.7	11.92	0.04	87.6	2.13	7.76	7.417	42.9728	-123.172	232.9	738.5
3/18/2020	11:20:22	COC1	84	123.9	100.7	100.2	11.7	0.06	121.6	1.3	7.91	8.765	42.94273	-123.337	206.2	740.9
3/18/2020	11:34:37	SU6	59.5	88.2	108.6	108.1	12.68	0.04	86.6	11.68	7.96	8.601	42.94823	-123.337	192.4	741.8
3/18/2020	11:59:17	SU8	68.7	101.3	106.8	106.3	12.4	0.05	99.4	1.21	8.06	8.784	43.02097	-123.299	175.6	743.6
3/18/2020	12:09:19	SM1	115.6	173.1	100.2	99.7	11.8	0.08	169.9	4.87	7.88	8.21	43.01696	-123.275	188.8	742.7
3/18/2020	12:19:17	NM1a	144.7	210.8	104.3	103.8	11.98	0.1	206.8	1.11	8.01	9.229	43.02324	-123.283	187.3	743
3/18/2020	12:37:22	MC1	131.5	191.8	103.8	103.3	11.94	0.09	188.2	3.05	8.01	9.181	43.0216	-123.295	183	743.2
3/18/2020	13:01:10	SU11	77	112.3	104.1	103.6	11.98	0.05	110.2	1.47	8.14	9.166	43.09781	-123.43	160.3	744.2
3/18/2020	13:14:55	LG3	73.1	107.2	107	106.5	12.38	0.05	105.2	5.99	7.95	8.972	43.11329	-123.508	191.5	741.5
3/18/2020	13:32:41	MG2	70.3	103.9	99.4	99	11.58	0.05	101.9	8.82	7.68	8.686	43.16162	-123.503	180.6	742.8
3/18/2020	13:53:44	LG1	83.4	117.6	105.2	104.7	11.75	0.05	115.4	5.79	7.75	10.421	43.11777	-123.429	155.3	744.2
3/18/2020	14:19:45	SU14	84.4	119.4	115.8	115.3	12.98	0.06	117.2	1.82	8.45	10.313	43.21139	-123.35	136.2	745.9
3/18/2020	14:31:20	DC1	172.8	246.6	106.9	106.4	12.06	0.12	242.1	2.72	8.1	9.982	43.21265	-123.34	135.8	746.6
3/18/2020	15:22:14	SU15	90.4	125.7	146.2	145.5	16.14	0.06	123.4	1.57	9.33	10.959	43.267	-123.446	105.4	748.4
3/18/2020	12:38:06	MC1	131.6	191.8	103.9	103.4	11.94	0.09	188.2	3.03	8.01	9.196	43.02151	-123.295	191.7	743.1

Sample #	Sample ID	Sample Da	MPN	Site Descriptio	Time Sam	Date	Sampling M	UpStream	DownStre	Cloud Cov	Wind	Precipitat	Water Col	Flow	Algae	Water Ter	E. coli Tak	Duplicate
1	SU1	03/18/202	6.3	SU1 South Ump	11:07 AM	3/18/2020	Bucket from	1060216	217	100%	Calm	None	Clear	Low Flow	None		1	0
2	EC1	03/18/202	12.2	E1 Elk Creek Ne	11:20 AM	3/18/2020	Directly fror	219	220	100%	Calm	None	Clear	Low Flow	None		1	0
3	DC4	03/18/202	36.4	DC4 Days Creel	11:44 AM	3/18/2020	Directly fror	221	222	50%	Calm	None	Clear	Low Flow	None		1	0
4				SU2 South Ump	11:51 AM	3/18/2020	Bucket from	223	224	25%	Light Bree	None	Clear	Low Flow	None		1	0
5	COC1	03/18/202	6.3	COC1 Cow Cree	12:17 PM	3/18/2020	Bucket from	225	226	0%	Light Bree	None	Clear	Low Flow	None		1	0
6	SU6	03/18/202	1	SU6 South Ump	12:34 PM	3/18/2020	Directly fror	227	228	25%	Calm	None	Clear	Low Flow	Some Present		1	0
7	SU8	03/18/202	5.2	SU8 South Ump	12:57 PM	3/18/2020	Directly fror	229	230	50%	Calm	None	Clear	Low Flow	None		1	0
8	SM1	03/18/202	17.1	SM1 South Myr	1:07 PM	3/18/2020	Directly fror	231	232	50%	Calm	None	Clear	Low Flow	None		1	0
9	UM1a	03/18/202	16.9	NM1a North M	1:17 PM	3/18/2020	Directly fror	233	234	50%	Calm	None	Clear	Low Flow	None		1	0
10	MC1	03/18/202	14.8	MC1 Myrtle Cre	1:37 PM	3/18/2020	Directly fror	0		25%	Light Bree	None	Clear	Low Flow	Some Present		1	0
12	SU11	03/18/202	4.1	SU11 South Um	2:12 PM	3/18/2020	No Value	0		No Value	No Value	No Value	No Value	No Value	No Value		0	0
13	LG3	03/18/202	9.7	LG3 Lookinggla	2:12 PM	3/18/2020	Bucket from	239	240	100%	Calm	None	Clear	Low Flow	None		1	0
14	MG2	03/18/202	25.6	MG2 Morgan C	2:29 PM	3/18/2020	Bucket from	241	242	25%	Calm	None	Clear	Low Flow	None		1	0
15	LG1	03/18/202	17.5	LG1 Lookinggla	2:52 PM	3/18/2020	Directly fror	243		25%	Calm	None	Clear	Low Flow	None		1	0
16	SU14	03/18/202	9.8	SU14	3:16 PM	3/18/2020	No Value	244		0%	Calm	None	Clear	Low Flow	None		1	0
17	DC1	03/18/202	32.7	DC1	3:30 PM	3/18/2020	Directly fror	245	246	25%	Calm	None	Clear	Low Flow	None		1	0
18	SU15	03/18/202	1	SU15	4:20 PM	3/18/2020	Directly fror	247	248	0%	Calm	None	Clear	Low Flow	None		1	0
11	MC1Dup	03/18/202	13.2	MC1 Myrtle Cre	1:37 PM	3/18/2020	Directly fror	0		No Value	No Value	No Value	No Value	No Value	No Value	58.6	1	1

Figure 5 Example of Cole Ecological Chain-of-Custody Form

Cole Ecological, Inc.
Macroinvertebrate Samples
Chain-of-Custody Form
Version: 13 April 2013

Client:	Partnership for the Umpqua Rivers	**CE Project Number:**	
Client Address:	1758 NE Airport Rd. Roseburg OR	**Destination CE Lab:**	Portland, OR
Client Contact Name:	Sandy Lyon	**CE Lab Contact:**	Chris Burtch
Client Contact Phone:	541-673-5756 ext. 5	**CE Contact Phone:**	406-270-3515
Client Contact Email:	Sandy@umpquarivers.org	**CE Contact Email:**	cburtch@coleecological.com

Instructions to client:
Please fill out, print, sign and send with samples
Email electronic version to mikebcole@comcast.net
Add additional rows to table, as needed

Client Sample Code identifies each individual sample collected and is a required field, while the station code idenitifies the sample location(s) from which (one or more) samples were collected and is optional

Count	CE Sample Code	Client Sample Code	Station Code	Waterbody Name	Collection Date	Habitat	# Sample Vessels	Duplicate Sample?	Sampling Method	Client Sample Notes
	EXAMPLE	*HGBM01-01-11*	*HGBMO1*	*Hinesburg Brook*	*9/19/01*	*riffle*	*2*	*N*	*8-kick composite*	
1	*PLEASE LEAVE*	RCL05-24-18	Lower Reach	Rice Creek	5/24/2018	riffle	1	N	8-kick composite	
2	*THIS COLUMN*	RCLD05-24-18	Lower Reach	Rice Creek	5/24/2018	riffle	2	Y	8-kick composite	
3	*BLANK*	RCM05-24-18	Middle Reach	Rice Creek	5/24/2018	riffle	1	N	8-kick composite	
4		RCU05-24-18	Upper Reach	Rice Creek	5/24/2018	riffle	1	N	8-kick composite	
5		RCL05-22-19	Lower Reach	Rice Creek	5/22/2019	riffle	2	N	8-kick composite	
6		RCM05-22-19	Middle Reach	Rice Creek	5/22/2019	riffle	1	N	8-kick composite	
7		RCU05-22-19	Upper Reach	Rice Creek	5/22/2019	riffle	2	N	8-kick composite	
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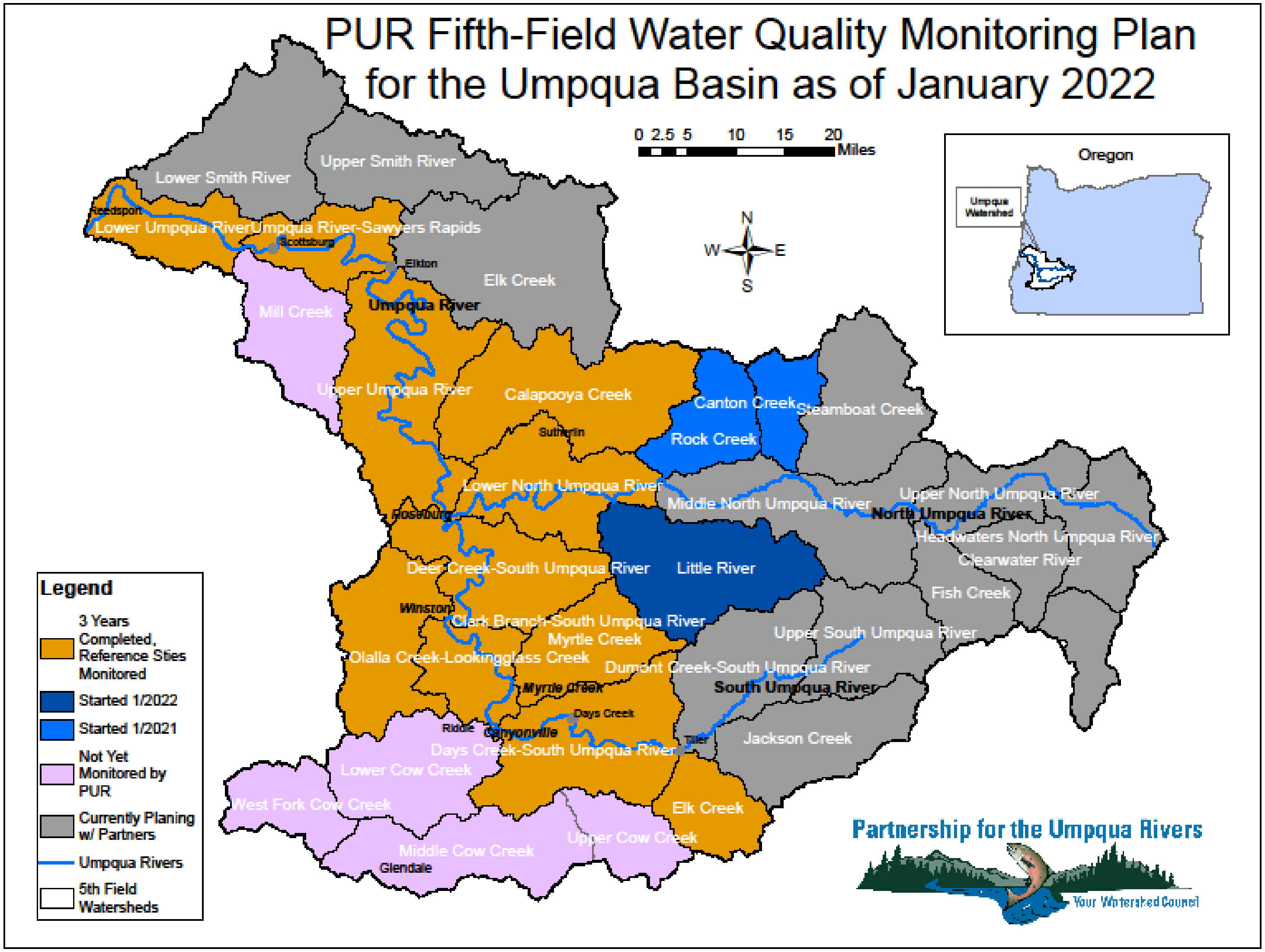
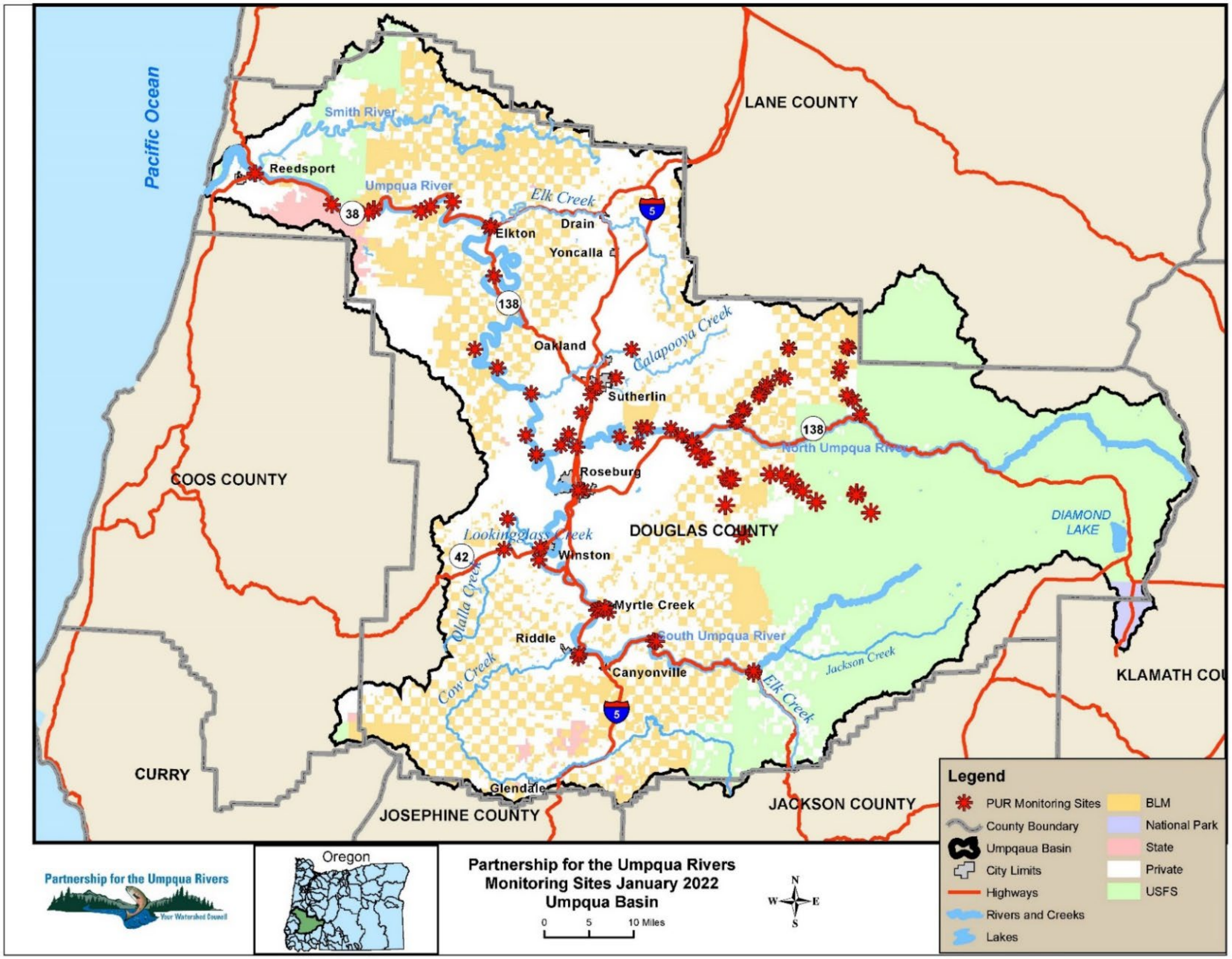
SIGNATURES:

Relinquished By/Affiliation:	Joe Carnes/Partnership for the Umpqua Rivers	Date:	7/9/2019	Comments:		Exhange 1
Received By/Affiliation:		Date:		Comments:		
Relinquished By/Affiliation:		Date:		Comments:		Exhange 2
Received By/Affiliation:		Date:		Comments:		
Relinquished By/Affiliation:		Date:		Comments:		Exchange 3
Received By/Affiliation:		Date:		Comments:		

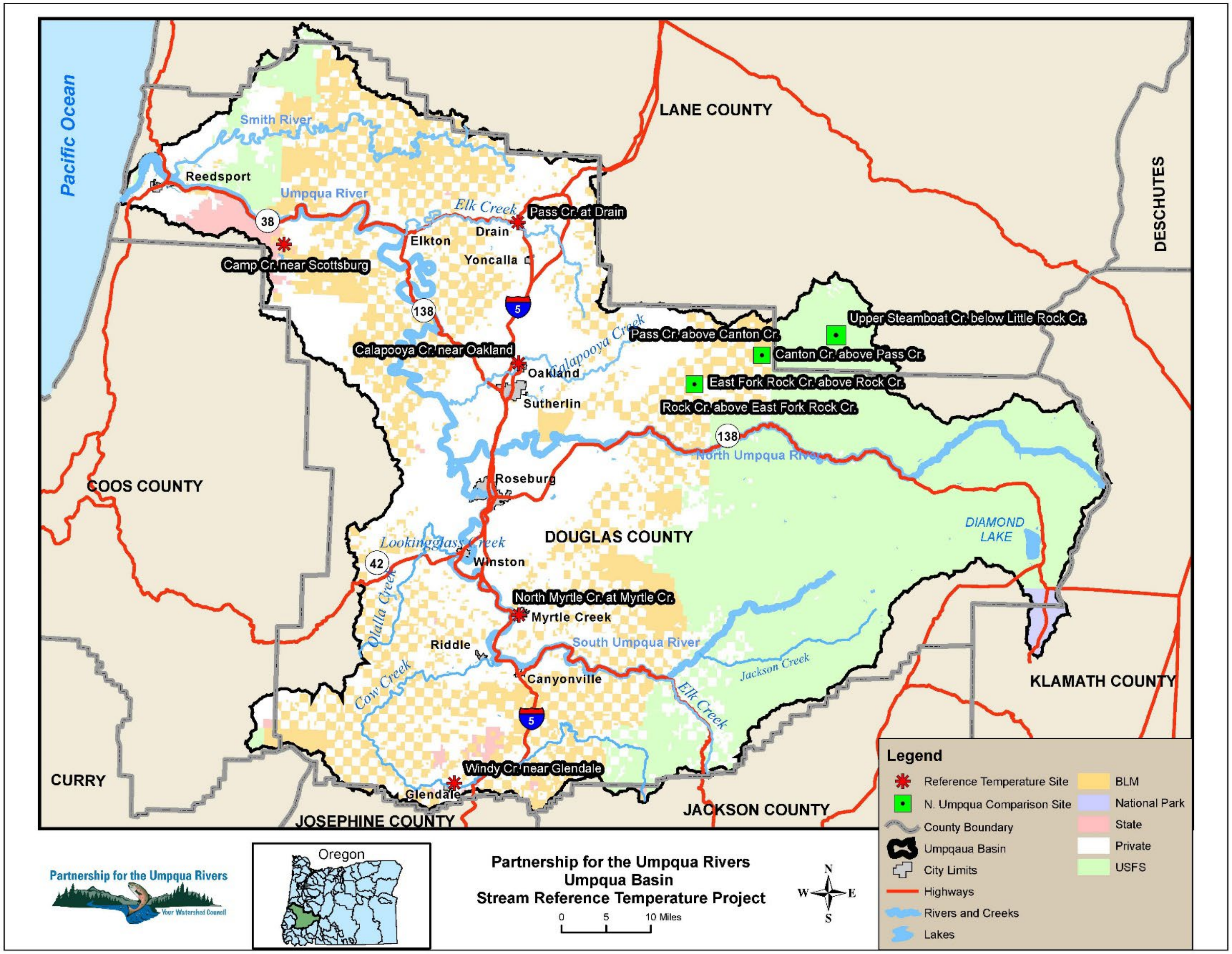
Map 1 Fifth Field Sites Monitoring Status



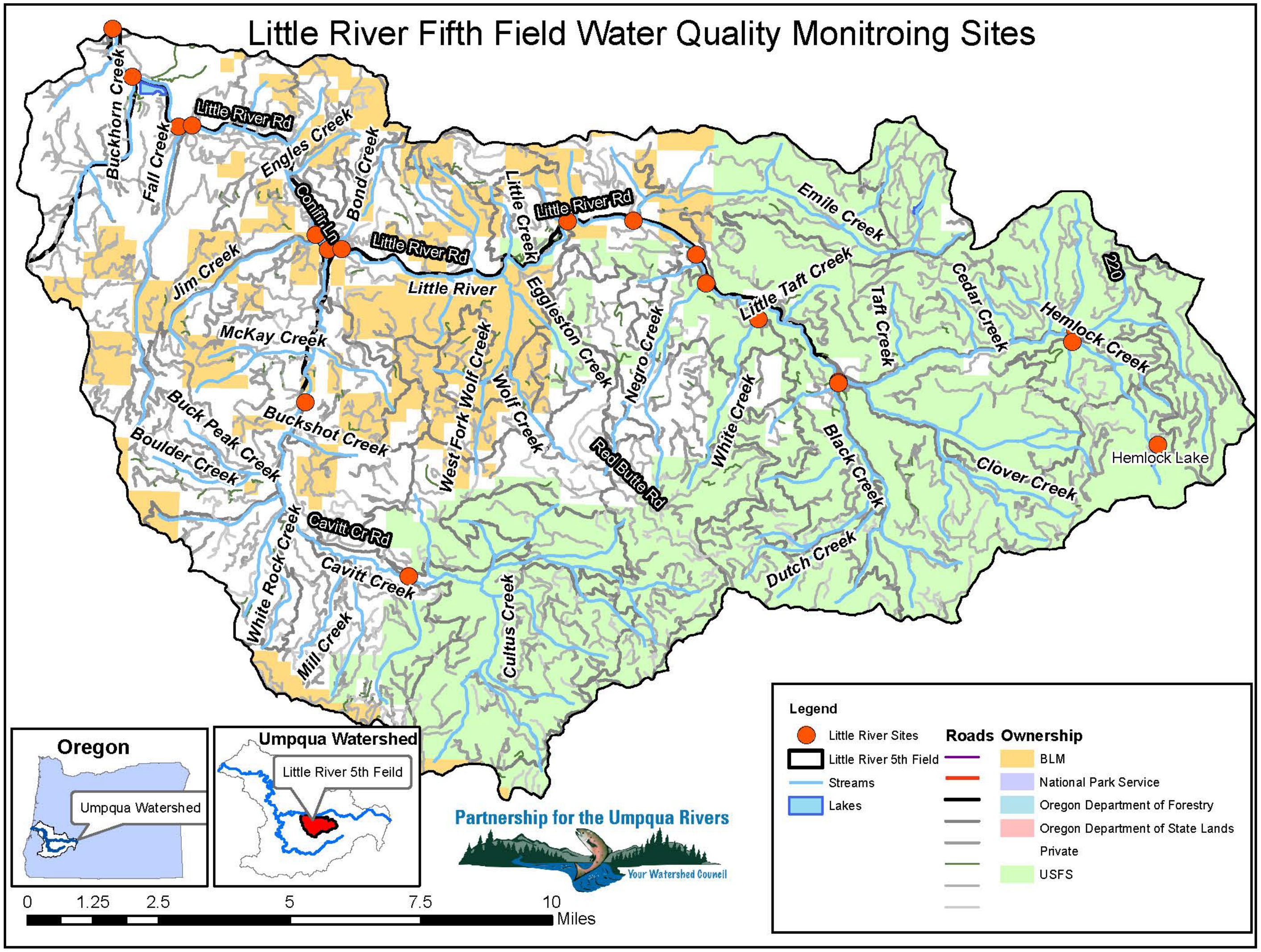
Map 2 Current Monitoring Sites as of 1/1/2022



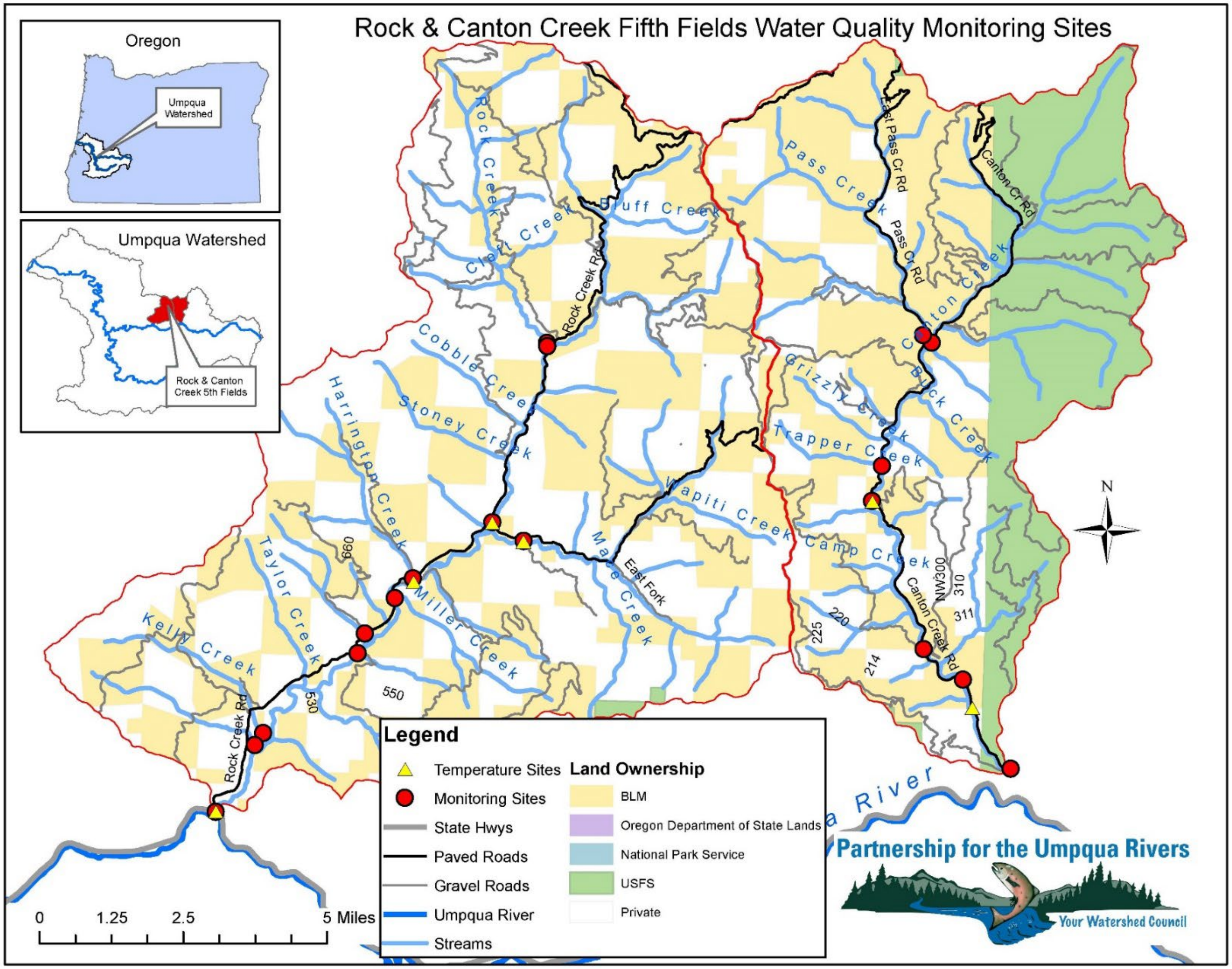
Map 3 Reference Temperature Project and North Umpqua Comparison Sites



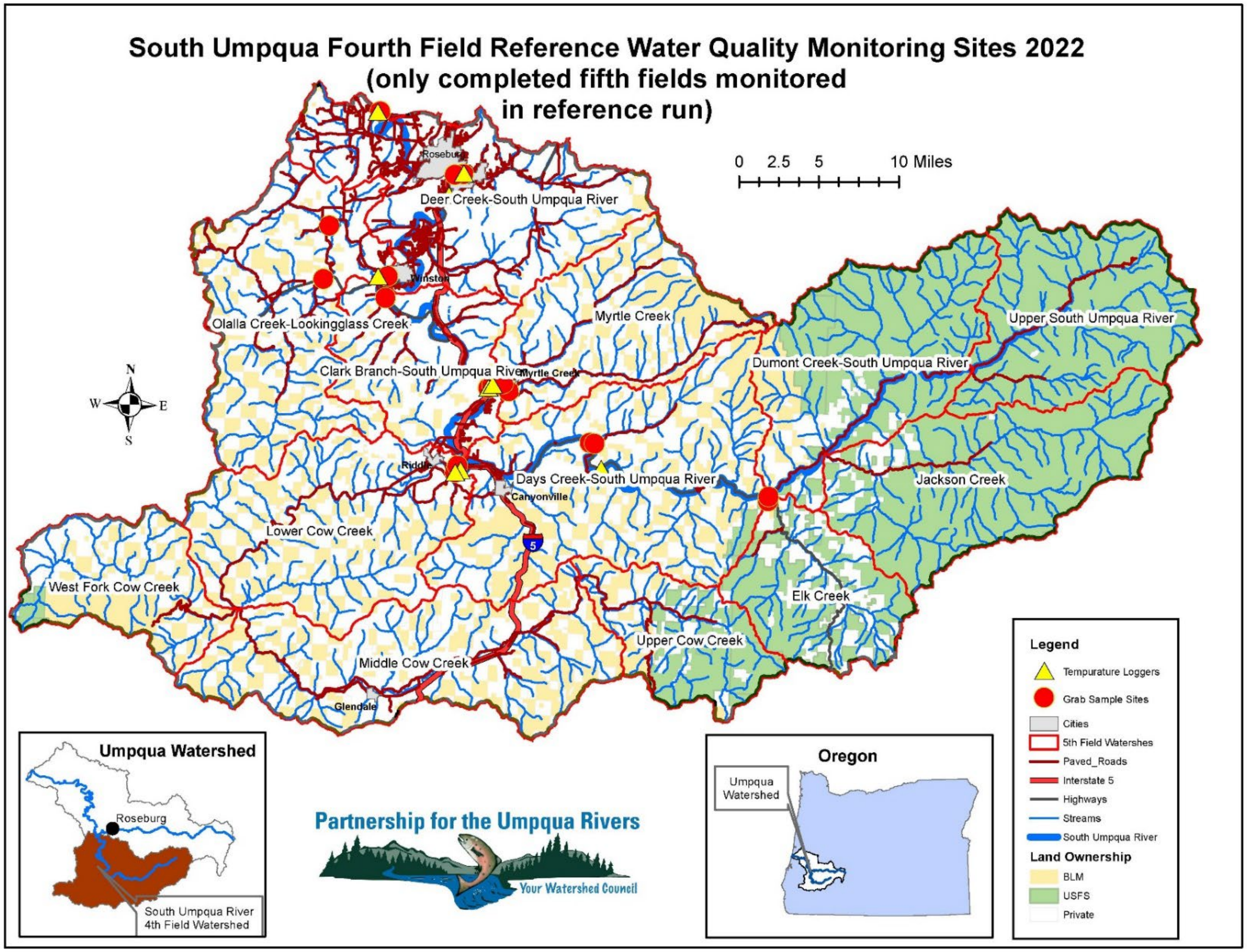
Map 4 Little River Monitoring Sites



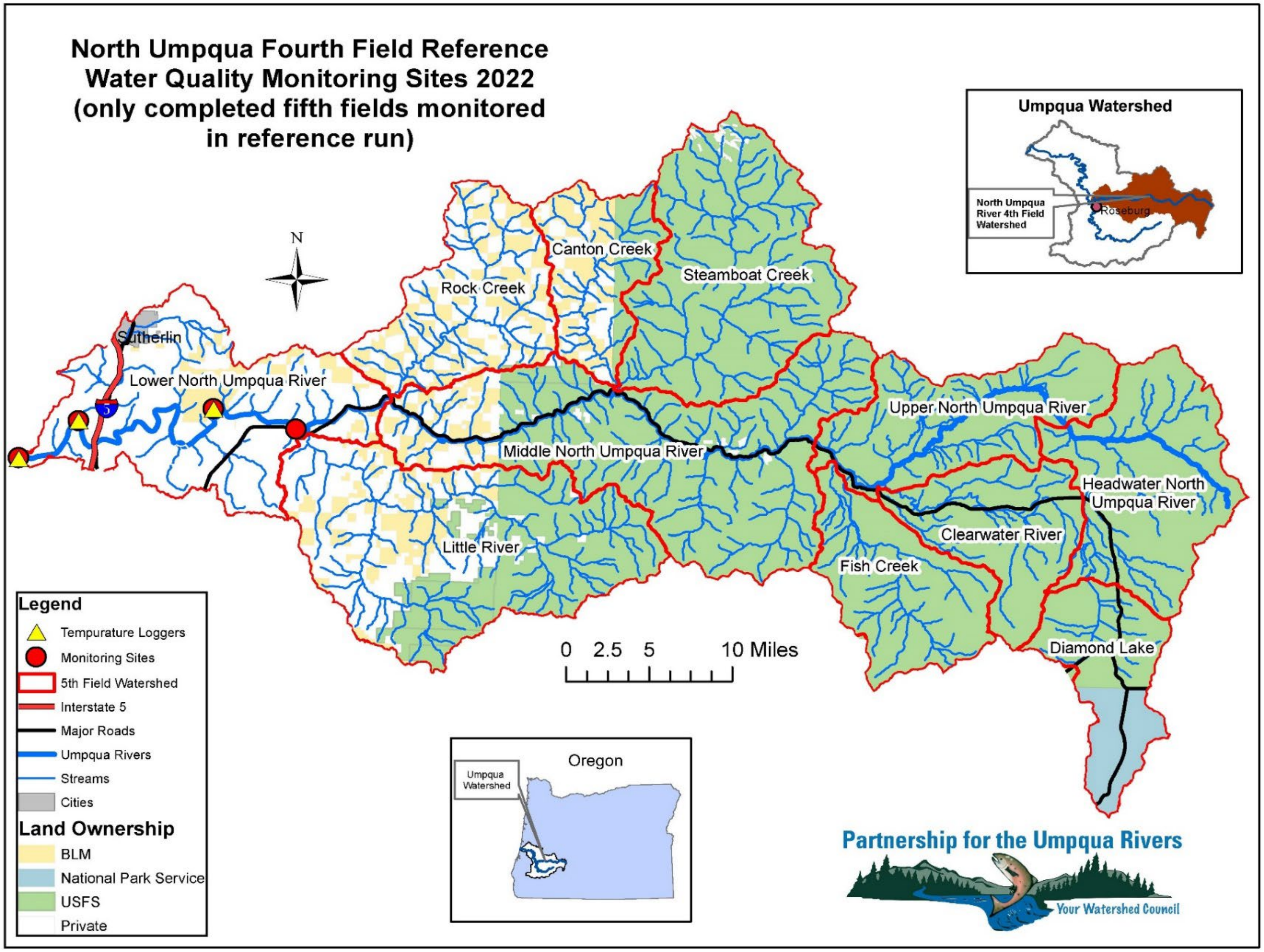
Map 5 Rock/Canton Creeks Monitoring Sites



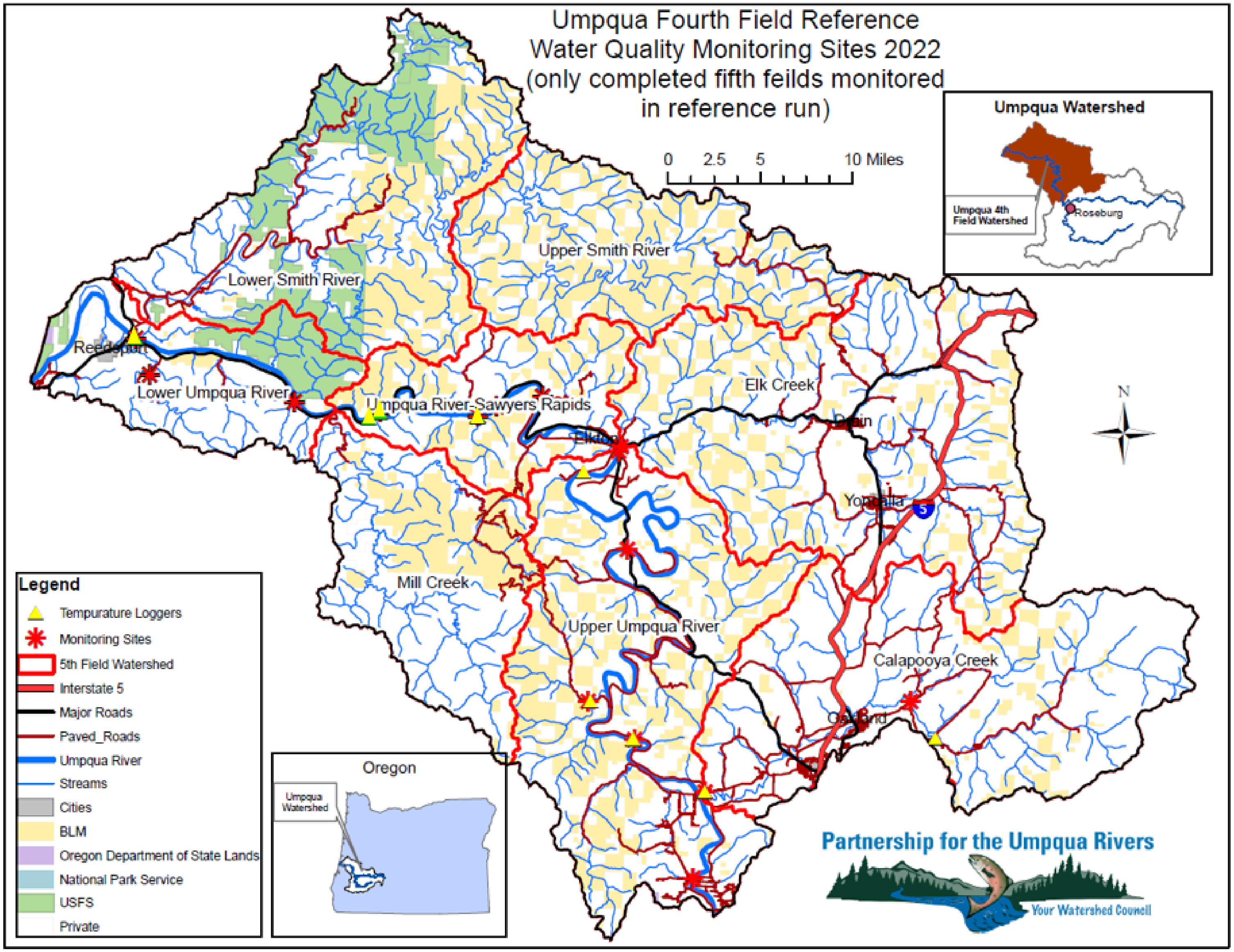
Map 6 South Umpqua Reference Sites



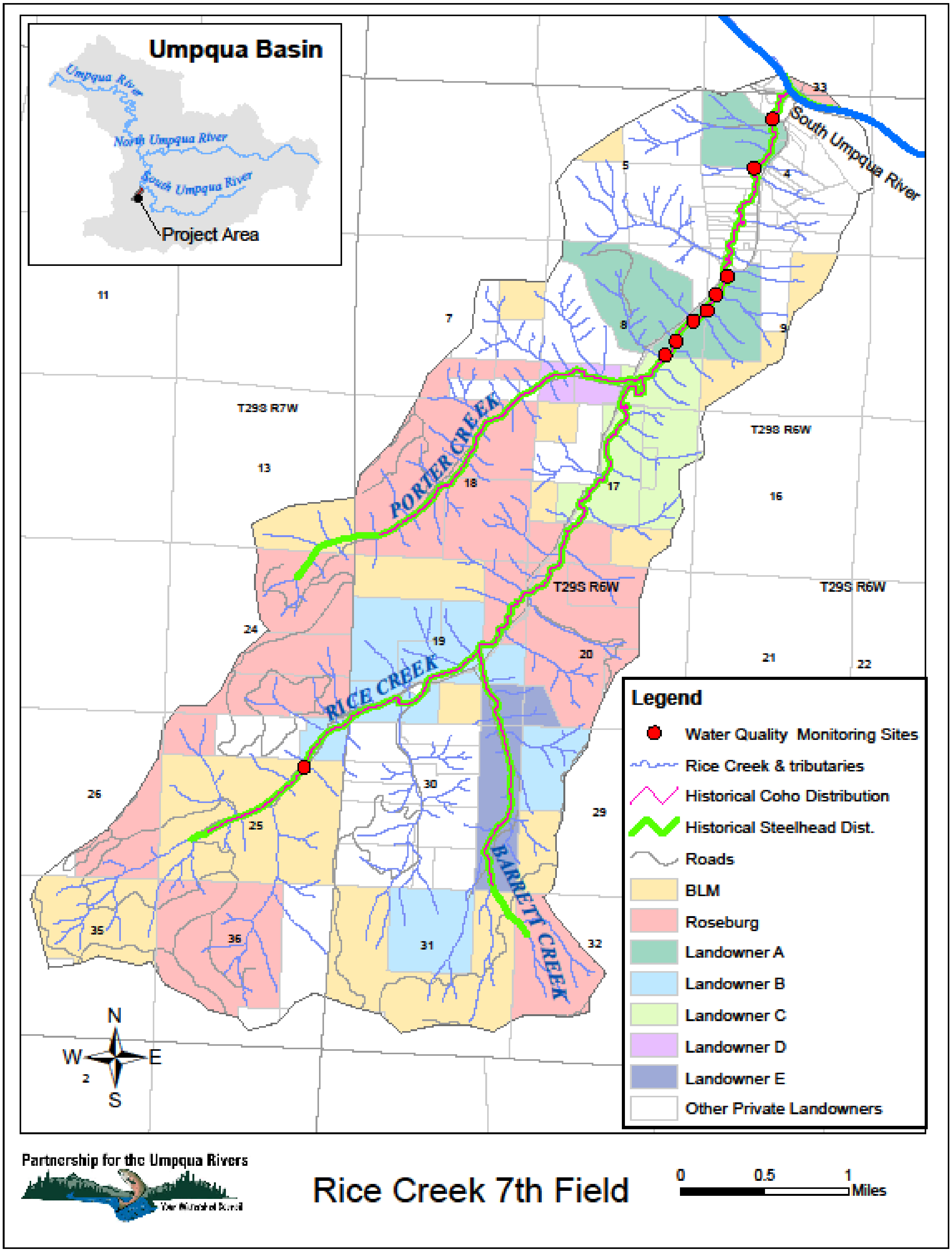
Map 7 Current North Umpqua Reference Sties



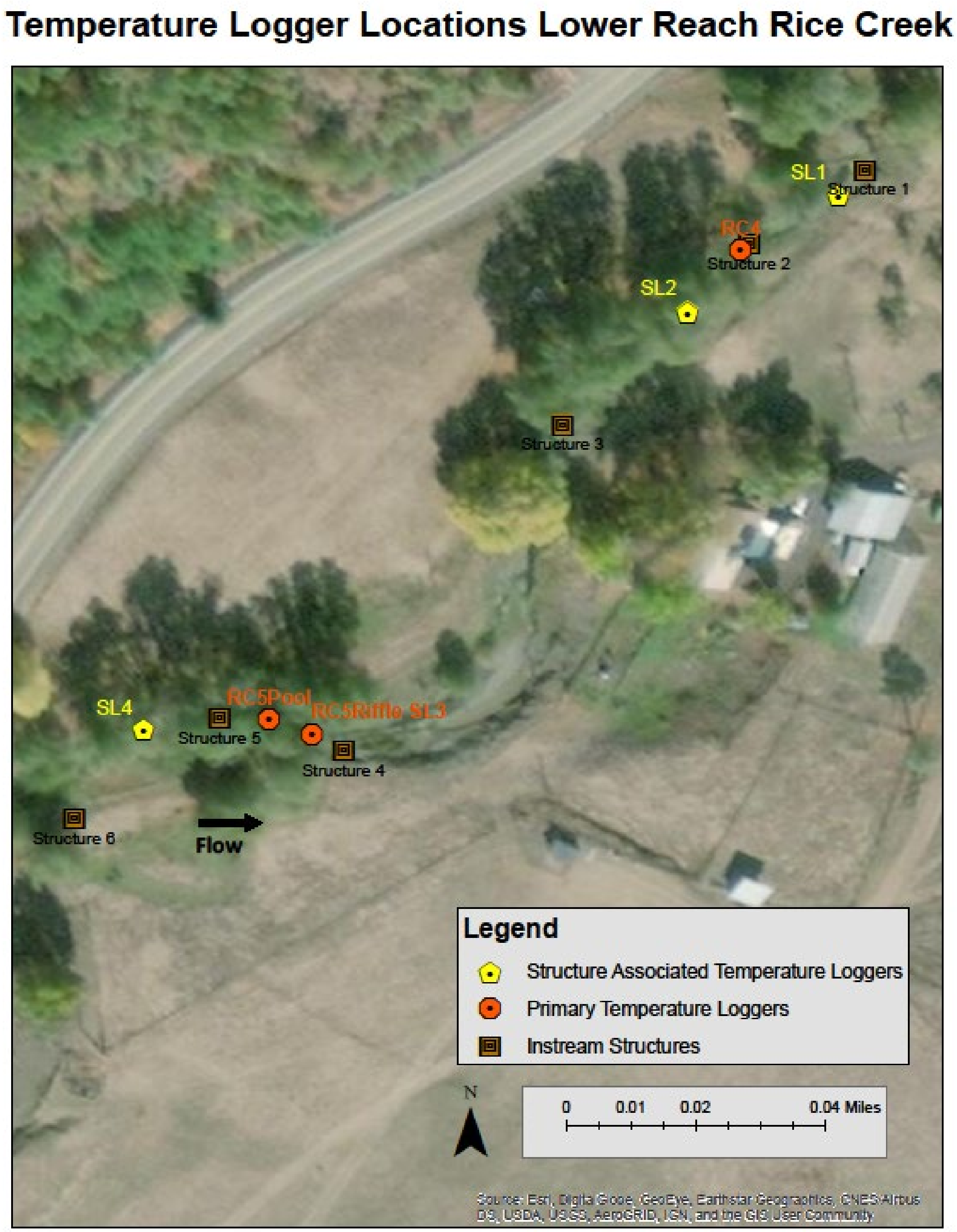
Map 8 Current Umpqua Reference Sties



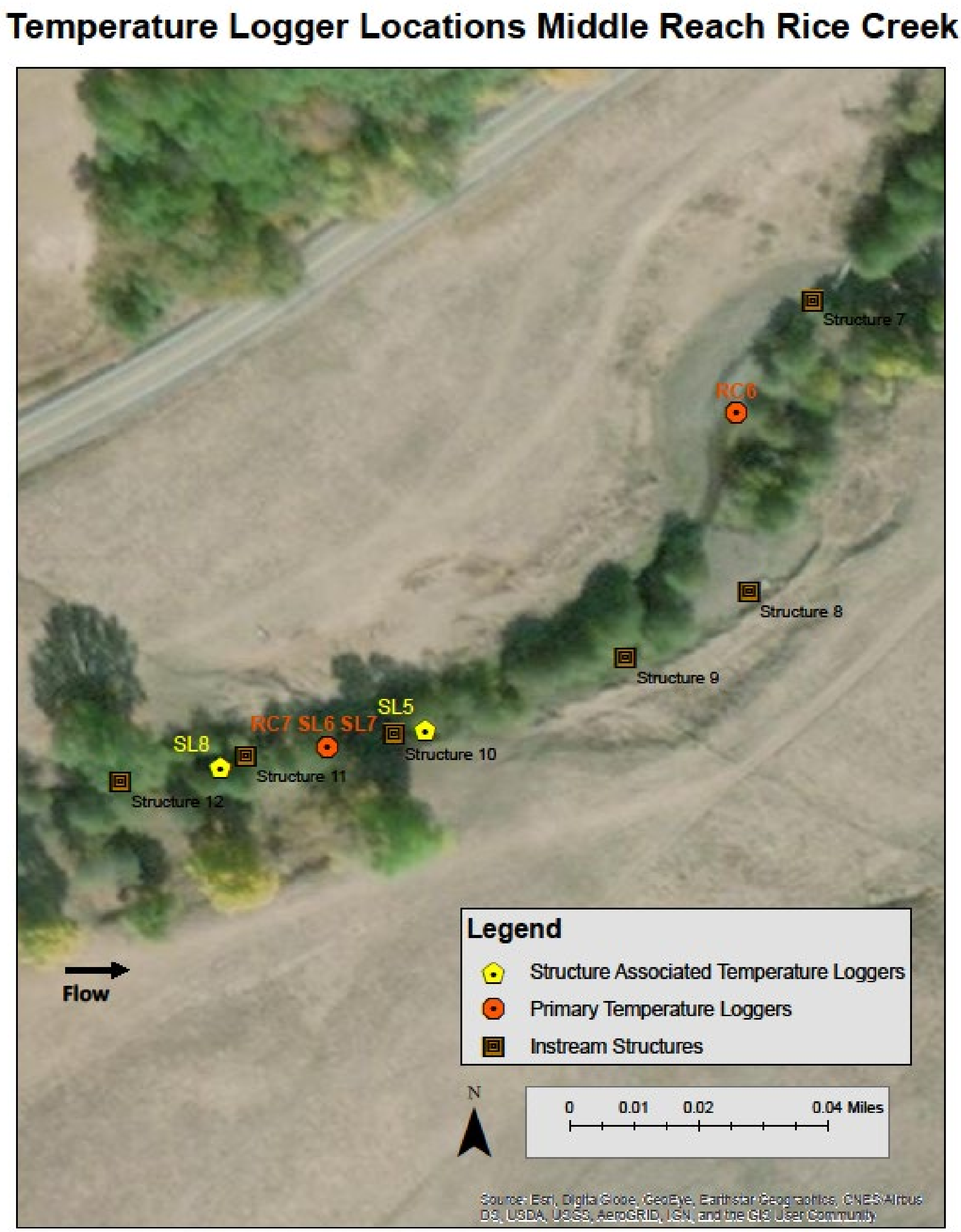
Map 9 Rice Creek Monitoring Locations



Map 10 Lower Reach Hobo Locations



Map 11 Middle Reach Hobo Locations



Map 12 Upper Reach Hobo Locations