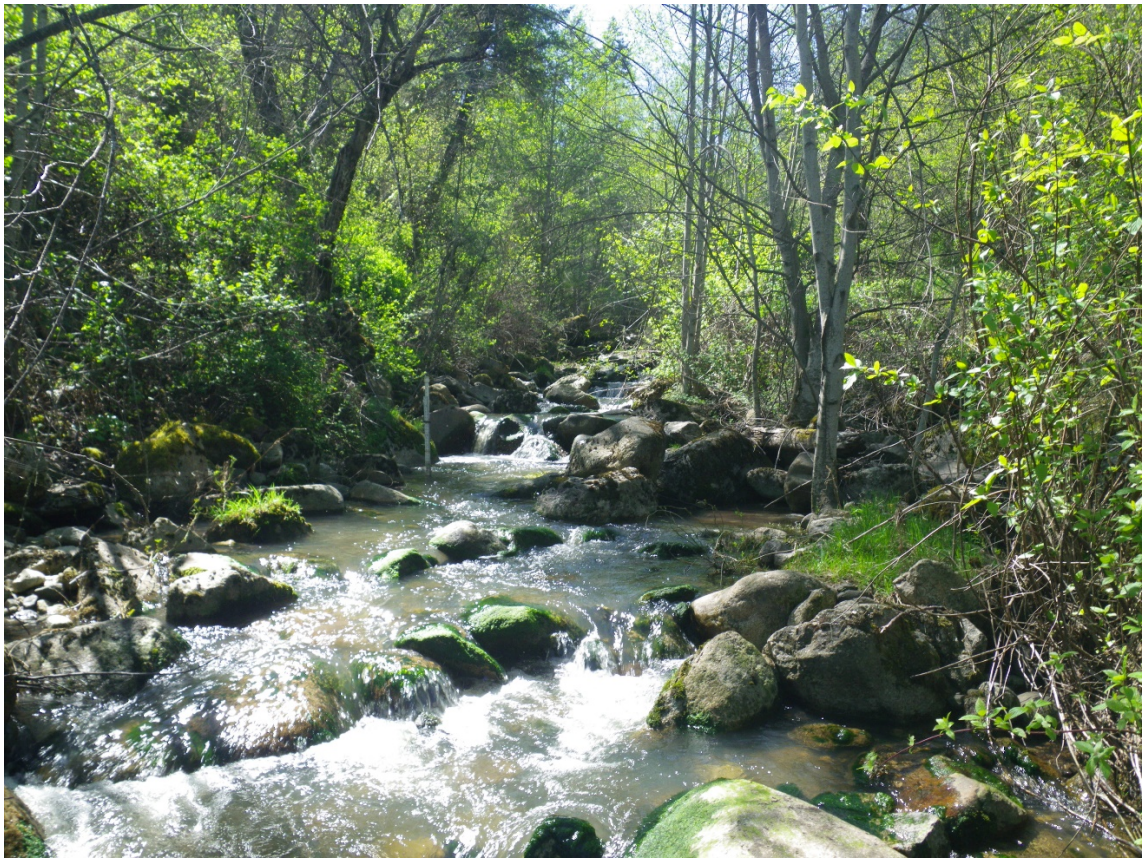
Lapwai Creek, Idaho
Water Quality Monitoring Project, 2016-17



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Casey McCormack and Alicia Helfrick conducted the fieldwork for this project.

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Acronyms and Abbreviations

BMP(s)	Best Management Practices
BOR	Bureau of Reclamation
C	Celsius
cfs	Cubic Feet per Second
cfu	Colony Forming Units
CMC	Criterion Maximum Concentration
CWA	Clean Water Act
CWAL	Cold Water Aquatic Life
IDEQ	Idaho Department of Environmental Quality
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
IDAPA	Idaho Administrative Procedure Act
mg/L	Milligrams per Liter
MPN	Most Probable Number
NH_3	Ammonia
NO_3+NO_2	Nitrate-Nitrite
NPT	Nez Perce Tribe
NRCS	Natural Resources Conservation Service
NTU	Nephelometric Turbidity Unit
OP	Ortho Phosphorus
PCR	Primary Contact Recreation
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
Reservation	Nez Perce Reservation of 1863
SC	Specific Conductance
SCC	Soil Conservation Commission
SS	Salmonid Spawning
SWCD	Soil and Water Conservation District
TAS	Treatment in a Manner Similar to a State
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
Tribe	Nez Perce Tribe
TSS	Total Suspended Solids
USGS	US Geological Survey
WAG	Watershed Advisory Group
WRD	Water Resources Division

Introduction

The Nez Perce Tribe (Tribe) is a federally recognized Indian Tribe with an aboriginal territory of more than 13 million acres extending from northeastern Oregon and southeastern Washington, through north-central Idaho, to southwestern Montana. The Tribe's 1855 treaty with the United States acknowledged and guaranteed a variety of retained off-reservation fishing, hunting, and gathering rights. The current Nez Perce Reservation of 1863 (Reservation) is approximately 770,483 acres in size, and many tribal members continue to practice a subsistence-based lifestyle to this day. Clean water is valued for its cultural, spiritual, and economic uses, and the Tribe has a vested interest in protecting the quality of water both on Reservation and throughout the Clearwater, Snake, and Columbia River Basins.

The Nez Perce Tribe (NPT) Water Resources Division (WRD) applied for and received Treatment in a Manner Similar to a State (TAS) to implement the Clean Water Act §106 Water Quality Monitoring Program in 1990. In 1999, the WRD began collecting water quality data for Reservation waterbodies. Table 1 displays Tribal water resources found within the boundaries of the Reservation.

Table 1. Atlas of Tribal Water Resources

Topic	Value
Reservation Area (acres)	770,483
Reservation Population (persons)	18,437
Number of watersheds within or intersecting the reservation boundary	19
Total Miles of Rivers and Streams - *Miles of perennial streams* - *Miles of intermittent streams (does not include unnamed streams)*	1,590 *602** *85**
Number of Lakes/Reservoirs/Ponds	8
Acres of Lakes/Reservoirs/Ponds	2,883

*the remaining stream miles are unknown for perennial vs. intermittent

Lapwai Creek Watershed Description

The Lapwai Creek watershed is located in the lower Clearwater River drainage (Hydrologic Unit Code: 1706030612). The watershed is approximately 174,600 acres in size, located in both Nez Perce and Lewis counties, and is contained almost entirely within the Reservation boundary. Lapwai Creek is a 4th order tributary flowing 31 miles in a northwesterly direction to its confluence with the Clearwater River at the town of Spalding, ID. Elevations in the watershed range from 800 feet near the mouth to over 4,800 feet in the headwaters. The headwaters of Lapwai Creek flow approximately 5.5 miles before being impounded in Winchester Lake, at the town of Winchester, ID. Due to the presence of Winchester Lake, the watershed is typically broken into two sections for monitoring and evaluation: upper Lapwai Creek and lower Lapwai Creek. The water quality data in this report was collected in the lower Lapwai Creek watershed.

Climate

The region's climate pattern is maritime-influenced with average annual temperature, precipitation and snowfall increasing with elevation. Average annual temperatures range from 43-53°F with average total precipitation amounts ranging from 13-24 inches. Craig Mountain is an important driver of hydrology in the Lapwai Creek watershed. Historically, snow-melt fed the streams through most of the year. Recently, however, the basin has shifted to a rain-dominated system characterized by flashy high flows and extremely low summer base-flows (Nez Perce Tribe; Nez Perce Soil and Water Conservation District, 2009).

Land Ownership

The Dawes General Allotment Act of 1887 gave allotments to individual tribal members, opening up the remainder of the Reservation to non-Tribal settlement. Today, approximately 15% of the Reservation is tribally owned and managed, while 81% is privately owned. The remaining four percent is split up among the Bureau of Land Management, US Forest Service, State of Idaho, and US Fish and Wildlife Service.

Land Uses

Agriculture is the dominant land use in the watershed. Forty percent of the land is utilized for small grain agricultural production and 11% is in grassland/pasture, most often used for cattle grazing. A total of over 100 livestock grazing operations occur in the Lapwai Creek watershed year-round. Cattle grazing is typically dispersed, with cattle grazing in the canyons during the spring months, mountains during the summer and fall, and feedlots during the winter months. Of feedlots located in Nez Perce County, nearly 41% allow cattle to access streams while only 16% provide off-site water sources (Nez Perce Soil and Water Conservation District, 1998). Currently, there are 1,379 animal unit months (AUMs) being grazed in the Lapwai Creek drainage on Tribal land. This is the highest AUM rate found within the Reservation boundary, most of which are located near the headwaters of the Lapwai Creek Catchment. According to the Nez Perce Soil and Water Conservation District's (District) *Confined Animal Feeding Operation*

Inventory and Analysis report, water quality in the main stem of Lapwai Creek is considered to be high risk for impairment resulting from high cattle densities, lack of off-site water, and a high soil leaching index throughout most of the watershed (Nez Perce Soil and Water Conservation District, 1998).

The loss of streamside vegetation, as a result of dryland agriculture and grazing, can lead to increased water temperature resulting from increased surface exposure to radiant heat. A properly functioning riparian zone acts as a buffer for the stream. Removal of these buffers can result in faster delivery of runoff to streams and decreased filtration of pollutants, resulting in increased sediment and nutrient loads (Richardson, Rasmussen, & Chandler, 2009). Livestock grazing has altered or eradicated most native vegetation on the rangeland area previously browsed by wildlife (Platts, 1991), especially within riparian areas. Erosion and soil compaction increase in areas where heavy grazing is occurring, affecting both terrestrial and aquatic productivity, promoting weed infestations, and reducing groundwater recharge leading to a decrease in summer base flows. Increases in nutrient loads and *E. coli* concentrations are also common effects of the presence of cattle in riparian areas or streambeds (Richardson, Rasmussen, & Chandler, 2009).

Fisheries

Several Endangered Species Act (ESA) listed fish species are present in the Lapwai Creek drainage, including steelhead (*Oncorhynchus mykiss*), Chinook salmon (*Oncorhynchus tshawytscha*), Westslope Cutthroat Trout (*Onchorhynchus clarki lewisi*), and the recently introduced Coho salmon (*Onchorhynchus kisutch*) (Nez Perce Tribe; Nez Perce Soil and Water Conservation District, 2009). Other fish present in the watershed include species of dace, sculpin, and suckers (Chandler & Richardson, Fish distribution and relative abundance within small streams of the Big Canyon Creek and Lapwai Creek watersheds, 2006).

Lapwai Creek Monitoring Overview

From October 2016 through September 2017, the WRD CWA §106 staff collected monthly water quality data from eighteen monitoring sites located in eight different streams in the Lapwai Creek watershed (Table 2).

Table 2. Monitoring sites description and location.

Stream Name	Site Descriptions	site ID	Latitude	Longitude
Rock Creek	on Winchester Grade (Hwy 95)	06601A	46.33180833	-116.5974135
Mission Creek	at McCormack Ridge Road	05315A	46.188904	-116.647981
Mission Creek	at mouth	05301A	46.367047	-116.735687
Webb Creek	downstream Soldiers Meadow	08814A	46.16888291	-116.7377644
Webb Creek	near mouth	08801A	46.326094	-116.832153
East Fork Sweetwater Creek	at Flatiron Rd. (2nd crossing)	10802A	46.246525	-116.812908
West ForkSweetwater Creek	at Flatiron Rd. crossing	10905A	46.206849	-116.817244
Sweetwater Creek	at mouth	08101A	46.369196	-116.79563
Spring Creek	at community sweat lodge	Nez 931	46.394573	-116.797155
Garden Gulch Creek	near Mouth	02701A	46.39531334	-116.794297
Tom Beall Creek	near mouth	08501A	46.415693	-116.795615
Lapwai Creek	downstream Winchester WWTP outlet	03825A	46.239107	-116.617783
Lapwai Creek	on Winchester grade	03821A	46.298801	-116.593558
Lapwai Creek	upstream Culdesac WWTP	03814A	46.374277	-116.671248
Lapwai Creek	downstream Culdesac WWTP	03812A	46.373125	-116.69809
Lapwai Creek	at Garden Gulch Rd. bridge	03805A	46.393866	-116.798247
Lapwai Creek	at USGS gaging station (Red Duck Ln.)	03802A	46.426671	-116.805911
Lapwai Creek	at mouth on NPS property	03801A	46.44862	-116.817903

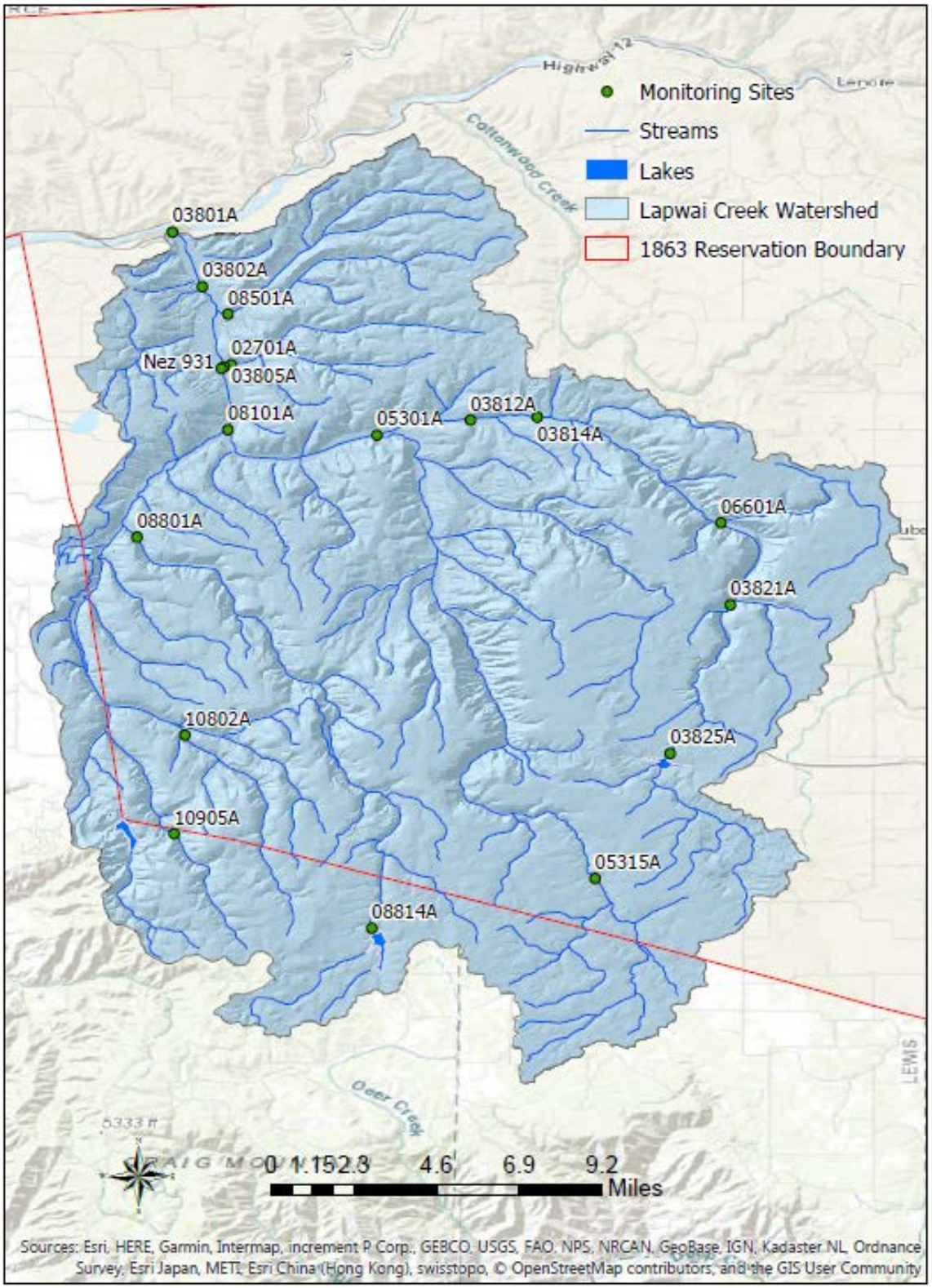

Figure 1. Lapwai Creek Water Quality Monitoring Sites, 2017.

Water Quality Monitoring Program and Assessment Methodology

The purpose of the Nez Perce Tribal water quality monitoring and assessment program is to determine whether water quality criteria are being met and designated uses are being supported in waterbodies across the Reservation.

Establishing a baseline of water quality conditions for all Reservation waters and periodically reassessing the water quality to look at trends are important program objectives, as is utilizing water quality data to identify waters in need of pollutant reduction projects.

Water Quality Limited Segments

The Clean Water Act (CWA) requires restoration and maintenance of the chemical, physical, and biological integrity of the nation's water (Public Law 92-500 Federal Water Pollution Control Act Amendments of 1972). Section §303(d) of the CWA establishes requirements for states and tribes to identify and prioritize waterbodies that are water quality limited (i.e., do not meet water quality standards).

Early studies indicate that water quality in Lapwai Creek is limited by extreme annual stream flow variation, low summer flows, high summer water temperature, and lack of instream cover. In general, the watershed has poor to moderate fish habitat, channelization, low bank stability, high fecal coliform concentrations, and seasonally high turbidity, suspended sediment, and nutrient concentrations (Kucera, Johnson, & Bear, 1983).

Studies have also found that water quality in Sweetwater Creek, a major tributary to Lapwai Creek, is impaired by extreme annual stream flow variation, low summer flows, high summer water temperature, and lack of instream cover, as well as siltation (Kucera, Johnson, & Bear, 1983). Multiple Lewiston Orchards Irrigation District (LOID) water diversion dams are present throughout the watershed which have historically diverted the majority of water out of the system for local irrigation and drinking water supply purposes. Recently, the LOID diversions have been gradually decreasing as a result of the Snake River Basin Adjudication (SRBA) court ruling, which requires specific minimum instream flows for the Sweetwater Creek watershed, among others.

Webb Creek, a major tributary to Sweetwater Creek, has been found to be impaired by low summer flows, high summer water temperature, lack of instream cover, and heavy siltation (Kucera, Johnson, & Bear, 1983). Recently, additional water has been released from Soldiers Meadow Reservoir, located in the headwaters of Webb Creek and part of the LOID diversion system, as a result of the SRBA settlement.

Water quality in Mission Creek, another major tributary to Lapwai Creek, is impaired by annual stream flow variation, low summer flows, high summer water temperature, and low instream cover, and heavy siltation (Kucera, Johnson, & Bear, 1983).

Other monitored tributaries to Lapwai Creek include Tom Beall, Garden Gulch, Spring, and Rock Creeks.

The State of Idaho does not list salmonid spawning and incubation (SS) as a designated beneficial use in the Lapwai Creek watershed; however, the majority of the Lapwai Creek watershed is federally identified as critical habitat for federally listed (Endangered Species Act (ESA)) Snake River Basin Steelhead, as well as ESA-listed Snake River Chinook salmon and recently introduced ESA-listed Coho salmon. Therefore, this document will assume SS as a designated beneficial use throughout the Lapwai Creek watershed.

Additionally, in 2002 the Nez Perce Tribe Executive Council assigned the Primary Contact Recreation (PCR) designated beneficial use to all water bodies of the Reservation (Resolution #NP03-136); therefore, PCR will be considered a designated beneficial use for all monitoring locations in the Lapwai Creek watershed.

Sampling Protocols

WRD staff have a Quality Assurance Project Plan (QAPP) which has been reviewed and approved by the US Environmental Protection Agency (EPA). WRD staff follow methods and protocols found in the US Geological Survey (USGS) *National Field Manual for the Collection of Water Quality Data* (TWRI Book 9, 1999-2004) when collecting water quality data in Reservation waters.

Approximately four liters of stream water were collected at each site using a DH-48 depth-integrating suspended-sediment sampler. The samples were collected and transferred into a 2.5-gallon polyethylene churn splitter. The polyethylene churn splitter was rinsed with ambient water at each location prior to sample collection. The resultant composite sample was thoroughly homogenized before filling the appropriate sample containers. Water quality samples were then shipped to Boise, ID overnight to be analyzed at the Bureau of Reclamation (BOR) Pacific Northwest Regional Laboratory.

Bacteriological samples (*E. coli*) were collected directly from the thalweg into sterile sample containers. These samples were also shipped to Boise, ID overnight to be analyzed at the BOR Pacific Northwest Regional Laboratory where most probable number (MPN) multiple tube fermentation was used to determine *E. coli* levels in the water sample. Bacteriological samples were also analyzed at the WRD lab using a Colilert reactive agent and 97 well trays cooked at 35°C for 24 hours.

A list of parameters, sample sizes, preservation, holding times, and analytical methods is displayed in Table 3. All sample containers were labeled with waterproof markers with the following information: site name and identification, sample identification, date of collection, and time of collection. Samples were placed on ice and shipped to the laboratory the same day as collection. Chain-of-custody forms accompanied each sample shipment.

Table 3. Water quality parameters for laboratory analysis.

Parameters	Sample Size	Preservation	Holding Time	Method
Total Suspended Solids (TSS)	1 qt cubitainer	Store at <4°C	7 days	I-3765-85
Nitrogen Components: Nitrate+Nitrite (NO_3+NO_2) Ammonia (NH_3)	1 qt cubitainer	Cool <4°C, H_2SO_4 pH < 2	28 Days	EPA 353.2 EPA 350.1
Total Phosphorus (TP)	250 mL Boston Round	Cool <4°C, H_2SO_4 pH < 2	28 Days	EPA 365.1
Ortho-phosphate (OP)	1 Qt Cubitainer	Store at <4°C	48 Hours	EPA 365.1
Escherichia coli (*E. coli)*	250 mL Widemouth	Cool <4°C	24 Hours	9223B, 9213D

Field Measurements

At each location, dissolved oxygen, specific conductance, total dissolved solids (TDS), pH, air and water temperature, and turbidity were measured in the field. Calibration of all field equipment was in accordance with the manufacturer's specifications. Field measurement parameters, equipment, and calibration techniques are shown in Table 4.

Table 4. Field Measurements.

Parameters	Instrument	Calibration
Dissolved Oxygen	YSI ProODO	Ambient air calibration
Temperature	YSI ProODO	Centigrade thermometer
Specific Conductance	Oakton PCSTestr 35	Specific Conductance (25°C standard)
pH	Oakton PCSTestr 35	Standard buffer (7,10) bracketing for linearity
TDS	Oakton PCSTestr 35	
Turbidity	Hach Model 2100P	Formazin Primary Standard

All field measurements were recorded on printed data sheets along with pertinent observations about the site, including weather conditions, flow rates, personnel on site, and any problems observed that might affect water quality. Onset U20 Water Level Loggers were installed to monitor continuous water level and temperature near the mouths of Mission and Spring Creeks. In addition, portable ISCO 3700 automatic water samplers were installed at the mouth of Sweetwater Creek (08101A) and Lapwai at the USGS station (03802A) to collect continuous water level and temperature, as well as to take water samples to be tested for turbidity and TSS in order to create a standard curve for sediment. Onset Pro v2 continuous temperature loggers were installed at all other monitoring sites.

Flow Measurements

Flow measurements were taken at each site using a Marsh McBirney Flow Mate Model 2000 flow meter. The six-tenths depth method was used for depths less than 2.5 feet; the two-tenths and eight-tenths depths method was used for depths great than or equal to 2.5 feet. A bridge board was also used during high flow events. A transect line was established at each monitoring station, across the width of the stream at an angle perpendicular to the flow, for the calculation of cross-sectional area. Discharge was computed by summing the products of the partial areas (partial sections) of the flow cross-sections and the average velocities for each of those sections. Stream discharge was reported as cubic feet per second (cfs).

Quality Assurance and Quality Control (QA/QC)

The BOR Pacific Northwest Regional Laboratory utilizes methods approved and validated by the EPA. A method validation process, including precision and accuracy performance evaluations and method detection limit studies, is an element of the BOR Pacific

Northwest Regional Laboratory Standard Methods. Method performance evaluations include quality control samples analyzed with a batch to ensure sample data integrity. Internal laboratory spikes and duplicates are part of the BOR Pacific Northwest Regional Laboratory's quality assurance program. Laboratory QA/QC results generated from this project can be provided upon request.

QA/QC procedures from the field-sampling portion of this project included a duplicate sample and a blank sample (one set per sampling event). The field blanks consisted of laboratory-grade deionized water, transported to the field and poured off into the appropriate sample containers. The blank sample was used to determine the integrity of the field team's handling of samples, the condition of the sample containers and deionized water supplied by the laboratory, and the accuracy of the laboratory methods. Duplicate samples were obtained by filling two sets of sample containers with homogenized composite water from the same sampling site. The duplicate and blank samples were not identified as such to laboratory personnel to ensure laboratory precision.

Data Handling

All of the field data and analytical data generated from each survey were reviewed in the WRD office by both field staff and the Water Resources Specialist. These duplicate internal reviews ensure that all necessary observations, measurements, and analytical results were properly recorded. The analytical results were evaluated for completeness and accuracy. Any suspected errors were investigated and resolved, if possible. The data were then stored electronically and made available to interested entities upon request.

Pollutants of Concern and Associated Water Quality Criteria

This monitoring program was intended to evaluate water quality in the Lapwai Creek watershed.

This report reviews monitored results for the following parameters at all monitoring locations:

-Total phosphorus (TP)
-Orthophosphorus (OP)
-Bacteria (*Escherichia coli*)
-Nitrogen components— NO_3+NO_2; NH_3
-Total suspended sediment (TSS)
-Instantaneous water temperature
-Continuous water temperature
-pH
-Turbidity
-Dissolved oxygen (DO), mg/L
-DO, percent (%) saturation
-Specific conductance

-Total dissolved solids (TDS)
-Stream discharge

The Bureau of Reclamation (BOR) Pacific Northwest Regional Laboratory, in Boise Idaho, conducted all inorganic parameter testing and bacteria analysis. WRD field staff performed all other measurements.

Dissolved Oxygen

Dissolved oxygen (DO) is found in microscopic bubbles of oxygen that are mixed in the water and occur between water molecules. DO is a very important indicator of a waterbody's ability to support aquatic life. Fish "breathe" by absorbing dissolved oxygen through their gills. Oxygen enters the water by absorption directly from the atmosphere or via photosynthesis by aquatic plants and algae. Oxygen is removed from the water by respiration and decomposition of organic matter. The US Environmental Protection Agency (EPA) standard for DO states that dissolved oxygen must exceed 8.0 mg/L for cold water biota, and in addition must exceed 90% saturation during the salmonid spawning and incubation (SS) designated period.

Water Temperature

Water temperature is a very important indicator of overall water quality. Many of the physical, biological, and chemical characteristics of a waterbody are directly affected by temperature. For example, temperature influences the following:

- amount of oxygen that can be dissolved in water,
- photosynthetic rate of algae and larger aquatic plants,
- metabolic rates of aquatic organisms, and
- sensitivity of organisms to toxic wastes, parasites, and diseases.

Cool water can hold more oxygen than warm water because gases are more easily dissolved in cool water. The reduction of oxygen solubility at high water temperatures can compound the stress on fish caused by marginal dissolved oxygen concentrations.

The cold water aquatic life (CWAL) criteria for Idaho streams states that water temperatures must be 22°C or less with a maximum daily average of no greater than 19°C (Idaho Administrative Code). All of the waterbodies monitored during this project are also listed for salmonid spawning (SS), which means that daily maximum water temperatures must be 13°C or less with a maximum daily average no greater than 9°C during salmonid spawning and incubation periods (Idaho Administrative Code). For the analytical purposes of this report the salmonid spawning and incubation period will be considered from October 1 through August 14 (Miller, Iverson, & Essig, 2014)(Table 5).

Table 5. General spawning and incubation periods for select salmonids found in the Clearwater River and its tributaries*.

Spawning and Incubation Periods in the Lapwai Creek Watershed												
Salmonid Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug*	Sep	Oct**	Nov	Dec
Steelhead/Rainbow Trout		✓	✓	✓	✓	✓	✓	✓				
Chinook Salmon	✓	✓	✓	✓	✓	✓				✓	✓	✓
Coho Salmon	✓	✓	✓	✓						✓	✓	✓

*Salmonid spawning and incubation (SS) target temperature ends August 15 for steelhead.
** Salmonid spawning and incubation (SS) target temperature begins October 15 for Chinook and Coho Salmon.

Specific Conductance

Specific conductance (SC) is a measure of the ability of water to conduct an electrical current. Conductivity increases with increasing concentrations and mobility of dissolved ions. These ions, which come from the breakdown of compounds, conduct electricity because they are negatively or positively charged when dissolved in water. Therefore, conductivity is an indirect measure of the presence of dissolved solids such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, and iron, and can be used as an indicator of water pollution.

No surface water standards or criteria exist that set limits on SC.

pH

pH represents the effective concentration (activity) of hydrogen ions (H+) in water. The activity of hydrogen ions can be expressed most conveniently in logarithmic units, so pH is defined as the negative logarithm of the activity of H+ ions:

pH = -log [H+],
where [H+] is the concentration of H+ ions in moles per liter.

The State of Idaho surface water quality criteria for Aquatic Life Use designations state that Hydrogen Ion Concentration (pH) values must fall within the range of 6.5-9.0 (Idaho Administrative Code).

Total Suspended Solids and Turbidity

Total suspended solids (TSS) includes both sediment and organic material suspended in water. Suspended sediment can cause problems for fish by clogging gills. In addition, excessive sediment provides a medium for the accumulation and transport of other constituents such as phosphorus and bacteria. Literature suggests that levels below 25 mg/L are ideal for the protection of fisheries and produce no harmful effects on fish or fisheries (DFO, 2000). This was the target criterion that was used for data analysis.

The State of Idaho water quality standard for Turbidity states that measurements shall not exceed background turbidity by more than 50 nephelometric turbidity units (NTU) instantaneously or more than 25 NTU for more than ten consecutive days (Idaho Administrative Code). The 25th percentile of turbidity data collected by EPA over the last decade for Ecoregion 10, ecoregion III was 1.45 NTU (US EPA, 2000). So, for the sake of this analysis, any reading over 51.45 NTU will be considered an exceedance over background turbidity levels.

Nitrate+Nitrite (NO_3+NO_2) and Ammonia (NH_3)

Nitrate (NO_3), nitrite (NO_2), and ammonia (NH_3) are considered inorganic forms of nitrogen. Excessive concentrations of nitrate and/or nitrite can be harmful to humans and wildlife. The EPA Ecoregion guidance criterion for NO_3 + NO_2 is 0.072 mg/L (US EPA, 2000); however, the target for the analysis of the data in this report is 0.3 mg/L, which is thought to be more representative of conditions on the ground and was the target criterion used in several regional watershed TMDLs.

High concentrations of nitrate and/or nitrite can produce "brown blood disease" in fish. Nitrite enters the bloodstream through the gills and turns the blood a chocolate-brown color. As in humans, nitrite reacts with hemoglobin to form methemoglobin. Brown blood cannot carry sufficient amounts of oxygen, and affected fish can suffocate despite adequate oxygen concentration in the water. This accounts for the gasping behavior often observed in fish with brown blood disease, even when oxygen levels are relatively high (Mississippi State University, 1998).

Ammonia is the least stable form of nitrogen in water. High concentrations can affect hatching and growth rates of fish, as changes in tissues of the gills, liver, and kidneys may occur during structural development. The target criterion for ammonia for this report is not to exceed the calculated criterion maximum concentration (CMC), which is dependent on pH (Idaho Administrative Code).

Phosphorus

In freshwater lakes and rivers, phosphorus is often found to be the growth-limiting nutrient because it occurs in the smallest concentrations relative to the needs of plants. If excessive amounts of phosphorus and nitrogen are added to the water, algae and aquatic plants can be produced in large quantities. When these algae die, bacteria decompose them and use up oxygen. As a result, dissolved oxygen concentrations can drop too low for fish to breathe which can cause fish kills. The loss of oxygen in the bottom waters can free phosphorus previously trapped in the sediments, further increasing the available phosphorus concentrations.

Phosphorus can exist in inorganic and organic forms, as well as in a dissolved or particulate phase. Some important sources of phosphorus include commercial fertilizers and manure, land application of biosolids, wastewater treatment plant effluent, erosion from livestock grazing, non-agricultural fertilization, and septic systems.

Dissolved inorganic phosphorus, or Orthophosphorus (OP), is a component of the total phosphorus concentration and can be detected separately. Primary sources of OP in aquatic systems are from agricultural run-off, lawn pesticides, and raw sewage. OP is of particular concern in aquatic systems as it is in the form that algae and plants can take up directly. The ratio of orthophosphorus to total phosphorus can help determine potential sources of pollution and to what extent they are occurring.

The EPA Ecoregion guidance criterion for total phosphorus is 0.03 mg/L (US EPA, 2000). The target for the analysis of the data in this report is 0.1 mg/L, which is thought to be more representative of conditions on the ground and was the target criterion used in several regional watershed TMDLs.

Bacteria (*E. coli*)

The coliform bacteria group consists of several genera of bacteria belonging to the family *Enterobacteriaceae*. These mostly harmless bacteria live in soil, water, and the digestive system of animals. *Escherichia coli* (*E. coli)* is a type of fecal coliform bacteria commonly found in the intestines of animals and humans, and the presence of *E. coli* in water is a strong indication of recent sewage or animal waste contamination.

The State of Idaho's *E. coli* standard for primary contact recreation is not to exceed 406 colony forming units (cfu)/100 mL at any time and not to exceed 576 cfu/100 mL at any time for secondary contact (Idaho Administrative Code); however, a single exceedance over the criterion does not constitute a violation of water quality standards (Idaho Administrative Code). Five samples must be taken within a 30-day period to assess against the geometric mean criterion of 126 cfu/100 mL to determine a violation.

An assessment of the geometric mean criterion was not conducted during this study due to time considerations and limited resources; however, the instantaneous measurements collected will allow for identification of streams where follow-up monitoring should occur. All streams on the Nez Perce Reservation were evaluated using the primary contact recreation criterion of 406 cfu/100mL. Two samples were taken at each monitoring location during each sampling event; one was analyzed in-house by NPT WRD staff and the other was shipped to the BOR lab for analysis.

Applicable Criterion/Standards and Analysis Techniques

The Nez Perce Tribe does not have approved water quality standards, so target criteria for this water quality assessment are based upon a combination of EPA guidelines, literature review, and State of Idaho water quality standards.

The data were analyzed, and descriptive statistics such as maximum, minimum, median, and mean values for each parameter measured were determined. The number of exceedances was calculated based on the number of sampling events whose respective

values exceeded water quality targets or criteria. Parameters exceeding target criteria 10% or more of the time will be classified as "not fully supporting" the associated designated beneficial use.
All of the waterbodies in this assessment had the designated beneficial uses of:

- Salmonid Spawning (SS),
- Cold Water Aquatic Life (CWAL),
- Primary Contact Recreation (PCR),
- Agricultural and industrial water supply,
- Aesthetics, and
- Wildlife habitat.

Table 6 shows the first three beneficial uses on the list above, along with associated numeric criteria used to evaluate the support status of these water bodies.

Table 6. Pollutant targets used to measure exceedances.

Parameter	Designated Use	Benchmarks/ Criteria	Citation
pH	All	pH between 6.5 and 9.0	(Idaho Administrative Code)
Temperature	SS	13 ˚C or less daily maximum; 9 ˚C or less daily average	(Idaho Administrative Code)
	CWAL	22 ˚C or less daily maximum; 19 ˚C or less daily average	
Dissolved Oxygen	SS	> 8.0 mg/L, >90% and <110% of saturation	(US EPA, 1986)
	CWAL	> 8.0 mg/L, ≤110% saturation	
Turbidity	All	≤ 51.45 NTU	(US EPA, 2000) (Idaho Administrative Code)
Total Suspended Solids	All	≤ 25 mg/L above background for short-term (e.g. <24 hours)	(DFO, 2000)
Ammonia	All	$\leq CMC = \frac{0.275}{1+10^{7.204-pH}} + \frac{39.0}{1+10^{pH-7.204}}$	(Idaho Administrative Code)
Total Phosphorus	All	≤ 0.1 mg/L	(US EPA, 1986)
NO_3+NO_2	All	≤ 0.3 mg/L	(Cline, 1973)
E. coli	PCR	≤ 406 cfu/ 100 mL instantaneous; 126 cfu/ 100 mL geometric mean*	(Nez Perce Tribe, 2002)

SS: Salmonid Spawning; CWAL: Cold Water Aquatic Life; PCR: Primary Contact Recreation; NTU: nephelometric turbidity units; CMC = Acute Criterion Maximum Concentration (one hour average is not to exceed value).

Data Analysis Results

Data are displayed from the Lapwai watershed headwaters to the mouth, beginning with all monitored tributary watersheds.

Rock Creek at the Mouth (Winchester Grade) (06601A)

Rock Creek is a small tributary to Lapwai Creek originating near Ruebens, ID. Rock Creek enters Lapwai Creek near the bottom of the Winchester Grade and in between two mainstem Lapwai Creek monitoring sites: Lapwai Creek on the Winchester Grade (03821A) and Lapwai Creek upstream of the Culdesac WWTP (03814A). One monitoring site was established at the mouth of Rock Creek just off of Highway 95. Table 7 presents descriptive statistics for data collected from the monitoring station located on Rock Creek.

Instantaneous temperature measurements exceeded the 13°C daily maximum SS criteria three times (21.4%) and no CWAL were documented during the monitoring period (Table 7, Figure 2A). Continuous temperature was recorded but will not be analyzed, due to equipment malfunction.

Nitrate+nitrite and total phosphorus exceeded associated target criteria eight (57.1%) and seven (50%) times, respectively, during the monitoring period (Table 7). Both parameters were associated with spring runoff, though nitrate+nitrite peaked just before the highest recorded flow, likely a result of runoff from early snowmelt (Figures 2B and 2C).

Percent DO fell below the 90% criterion for SS twice during the monitoring period (Table 7). The exceedances occurred during low flow conditions; however, low percent DO conditions were not recorded during all low flow sampling conditions, suggesting a potential impairment. No beneficial use designation will be made until more data is collected.

These exceedances suggest that Rock Creek is not fully supporting its SS (temperature) or CWAL (nitrate+nitrite, total phosphorus) beneficial uses.

Recommended actions include excluding cattle from wetland and riparian habitat, creating buffers around streams and wetlands in agricultural use areas, and increasing riparian vegetation for stream shade and bank stabilization.

Table 7. Descriptive statistics for Rock Creek on the Winchester Grade (06601A), 2016-17.

Rock Creek on Winchester Grade (06601A)	Temp	DO	DO	pH	Turbidity	*E-coli* (BOR)	*E-coli* (NPT)	NO_3+NO_2	OP	TP	TSS	Flow
	(°C)	(mg/L)	%	(H+)	(NTU)	(#/100mL)	(#/100mL)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
max	19.0	12.8	101.9	7.8	87.6	156	581	5.23	0.17	0.37	25.0	102.6
min	3.2	8.7	87.3	6.9	1.7	4	< 1	0.08	0.06	0.07	< 1	0.2
mean	11.3	10.5	93.5	7.4	14.0	60	140	0.90	0.09	0.13	4.3	13.9
median	12.2	10.1	92.5	7.5	3.8	50	73	0.34	0.08	0.10	2.0	1.6
#exceedance	3	0	2	0	1	0	2	8	3	7	0	
%exceedance	21.4%	0.0%	14.3%	0.0%	7.1%	0.0%	14.3%	57.1%	21.4%	50.0%	0.0%	
# samples	14	14	14	14	14	10	14	14	14	14	14	9

Temp: instantaneous water temperature; DO: dissolved oxygen; NO_3+NO_2: nitrate+nitrite; OP: orthophosphorus; TP: total phosphorus; TSS: total suspended sediments

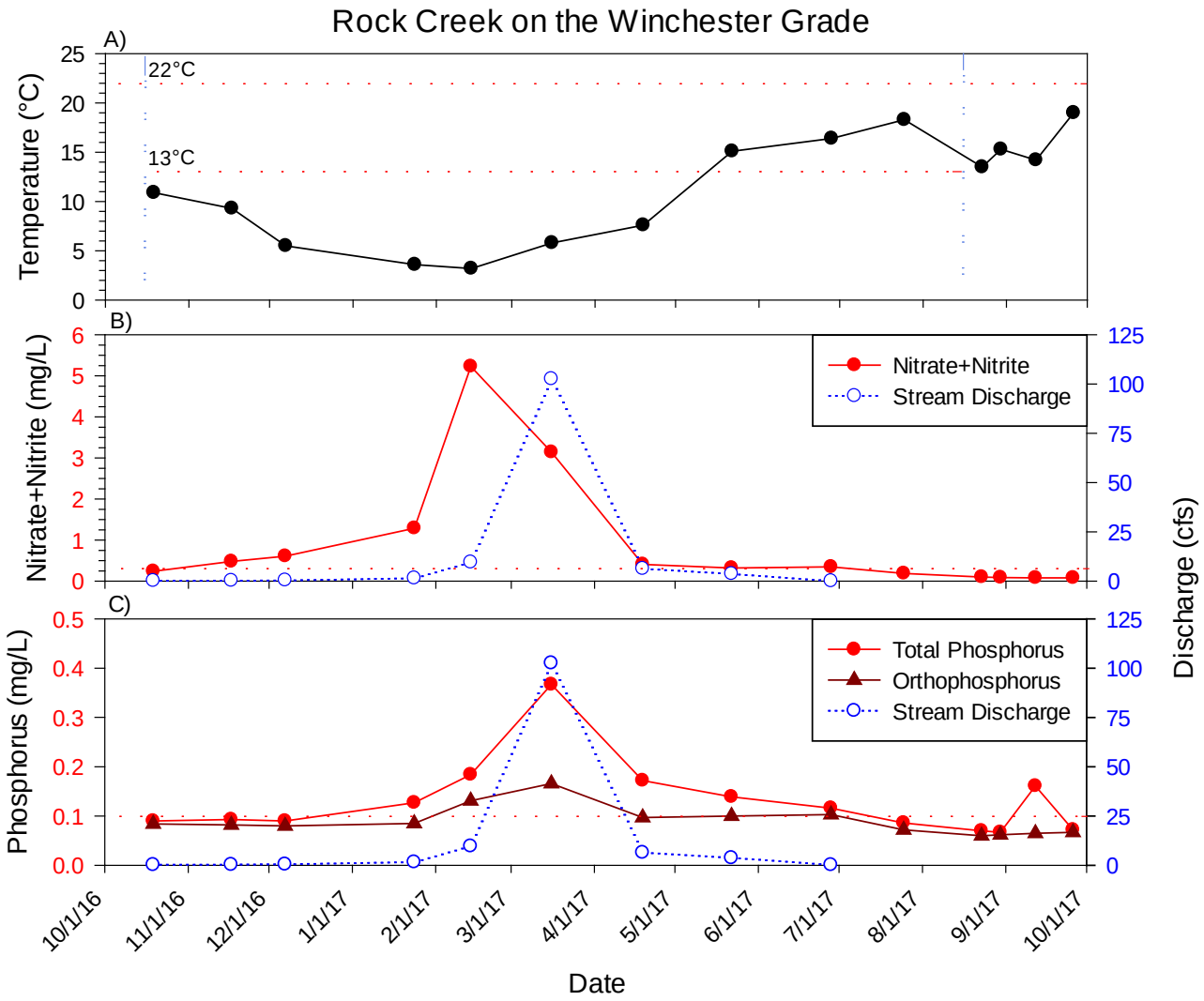

Figure 2. (A) Instantaneous temperature, (B) flow and NO_3+NO_2, and (C) flow and phosphorus data collected at the mouth of Rock Creek located on the Winchester Grade, 2016-2017. The red dashed lines indicate the associated water quality criteria: Daily Maximum Temperature - 13°C for SS and 22°C for CWAL; NO_3+NO_2 - 0.3 mg/L; and total phosphorus - 0.1 mg/L. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

Mission Creek Watershed (05315A and 05301A)

Mission Creek is a major tributary to Lapwai Creek which originates near Forest, ID. Mission Creek enters Lapwai Creek between the towns of Culdesac and Sweetwater, and in between two mainstem Lapwai Creek monitoring sites: Lapwai Creek downstream of the Culdesac WWTP (03812A) and Lapwai at Garden Gulch Rd. (03805A). Two monitoring sites were established in the watershed: Mission Creek headwaters (05315A), located at the McCormack Ridge Road bridge crossing, and Mission Creek at the Mouth (05301A), just upstream from highway 95. Table 8 presents descriptive statistics for data collected from the two Mission Creek monitoring stations.

Instantaneous temperature measurements exceeded the 13°C daily maximum SS criteria on at least 20% of sampling events in both sampling locations. Instantaneous water temperature in the headwater monitoring site (05315A) also exceeded the 22°C daily maximum CWAL criteria once, but was less than 10% total exceedance (Table 8, Figure 3A). Continuous temperature exceeded the 13°C daily maximum and 9°C maximum daily average for SS on over 60% of days sampled at both monitoring sites. Both monitoring sites also exceeded the 22°C daily maximum and 19°C maximum daily average for CWAL on at least 14% of days monitored (Table 9, Figure 4).

Total phosphorus also exceeded the target criterion of 0.1 mg/L at both sites, with four exceedances in the headwaters (30.8%) and three exceedances at the mouth of Mission Creek (20%) (Table 8, Figure 3B).

No exceedances of nitrate+nitrite were documented in the headwaters site; however, nitrate+nitrite concentrations did exceed the 0.3 mg/L target criterion at the mouth on all fifteen sampling events, with concentrations ranging from 0.74 to 3.8 mg/L and a median concentration of 1.64 mg/L (Table 8, Figure 3C).

Additional parameters exceeded associated target criteria in the headwaters sampling location: percent DO did not meet the minimum of 90% for SS on five sampling events (38.5%), sediment (turbidity and TSS) both exceeded associated criteria twice (15.4%), and *E. coli* concentrations exceeded the 406 cfu/100mL instantaneous maximum on five sampling events (41.7%, NPT samples) (Table 8).

These results indicate that the Mission Creek watershed, as a whole, is not fully supporting its designated beneficial uses of SS (temperature) or CWAL (total phosphorus), and the lower portion of the watershed is not fully supporting its designated beneficial use of CWAL due to excess nitrate+nitrite concentrations. In addition, data indicates that the upper portions of the watershed are not fully supporting the SS (% DO) and CWAL (sediment) designated beneficial uses. *E. coli* concentrations also exceeded the instantaneous criterion on multiple occasions; however, geometric means were not calculated so a PCR designation cannot be determined at this time.

Recommended actions include excluding cattle from wetland and riparian habitat, creating buffers around streams and wetlands in agricultural use areas, and increasing riparian vegetation for stream shade and bank stabilization.

Table 8. Descriptive statistics for two monitoring sites within the Mission Creek Watershed, 2016-17.

Mission Creek Subwatershed												
	Temp	DO	DO	pH	Turbidity	*E-coli* (BOR)	*E-coli* (NPT)	NO_3+NO_2	OP	TP	TSS	Flow
	(°C)	(mg/L)	%	(H+)	(NTU)	(#/100mL)	(#/100mL)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mission Creek at McCormack Ridge Road - Headwaters (05315A)												
max	22.2	12.0	107.9	8.1	56.9	5400	> 2419.6	0.22	0.10	0.30	43	110
min	1.1	8.5	79.0	6.8	6.3	60	19	< 0.01	0.02	0.05	4	0.04
mean	12.0	10.3	94.2	7.3	21.0	1138	400	0.04	0.04	0.11	14	12
median	14.2	10.2	97.2	7.3	17.9	500	250	0.02	0.03	0.09	10	0.19
#exceedance	3	0	5	0	2	4	5	0	1	4	2	
%exceedance	23.1%	0.0%	38.5%	0.0%	15.4%	57.1%	41.7%	0.0%	8.3%	30.8%	15.4%	
# samples	13	13	13	13	13	7	12	12	12	13	13	13
Mission Creek at Mouth (05301A)												
max	21.5	13.6	125.8	8.3	94.0	800	579	3.80	0.10	0.36	138	434
min	4.3	9.8	96.3	7.3	1.3	< 20	3	0.74	0.06	0.07	2	0.77
mean	12.5	11.3	105.3	7.8	11.0	174	139	1.83	0.07	0.11	13	44
median	12.2	11.0	100.1	7.9	2.2	100	60	1.64	0.07	0.09	4	4
#exceedance	3	0	0	0	1	1	1	15	0	3	1	
%exceedance	20.0%	0.0%	0.0%	0.0%	6.7%	10.0%	6.7%	100.0%	0.0%	20.0%	6.7%	
# samples	15	15	15	15	15	10	15	15	15	15	15	15

Temp: instantaneous water temperature; DO: dissolved oxygen; NO_3+NO_2: nitrate+nitrite; OP: orthophosphorus; TP: total phosphorus; TSS: total suspended sediments.

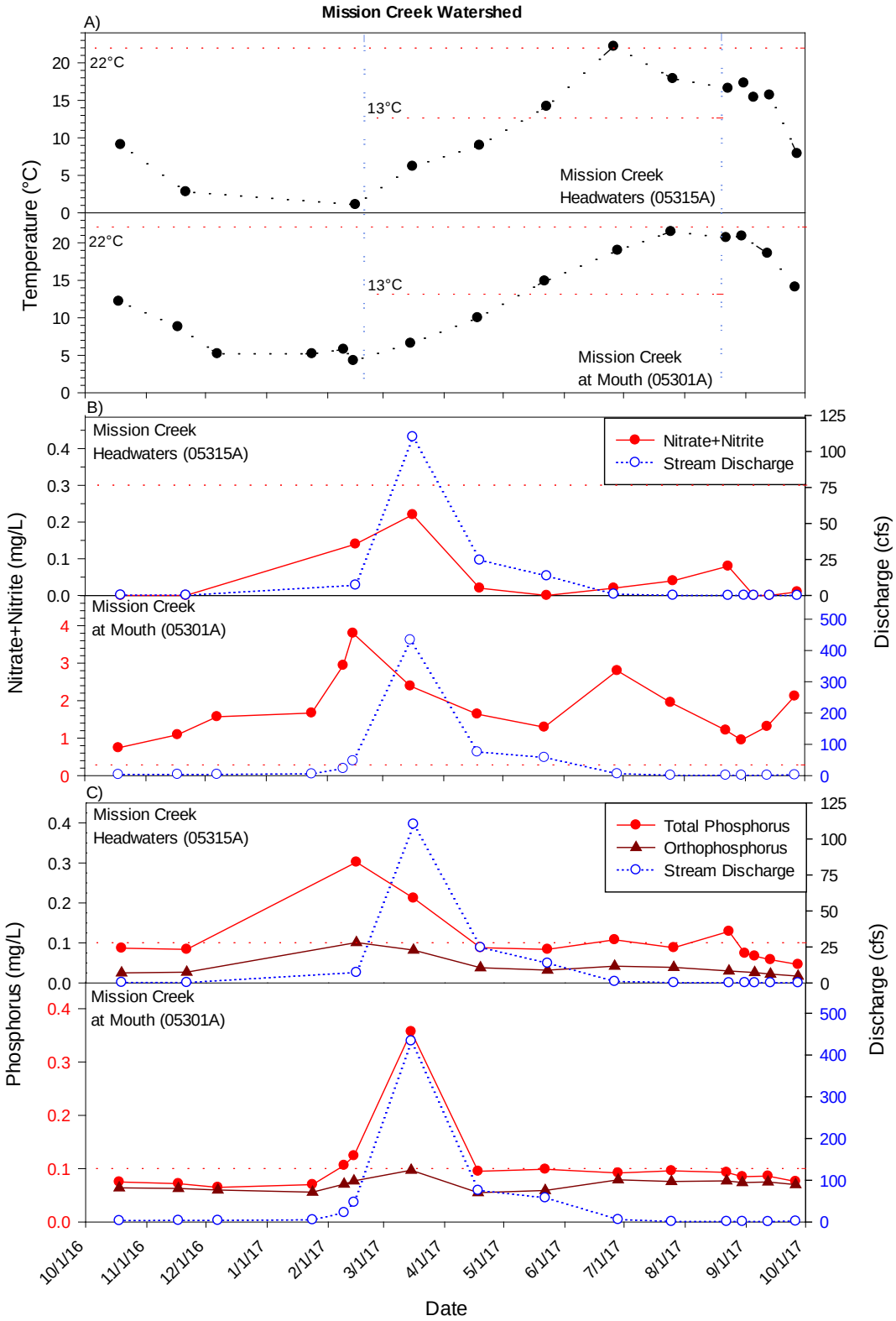

Figure 3. (A) Instantaneous temperature, (B) flow and NO3+NO2, and (C) flow and phosphorus data collected at two monitoring sites on Mission Creek, 2016-2017. The red dashed lines indicate the associated water quality criteria: Temperature - 13°C for SS and 22°C for CWAL; NO3+NO2 - 0.3 mg/L; and total phosphorus - 0.1 mg/L. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14). Note: scales may vary between sites.

Table 9. Continuous temperature exceedances for the two monitoring sites on Mission Creek, from April/May – November, 2017.

Mission Creek Subwatershed Continuous Temperature Data Summary	Criteria	Salmonid Spawning and Incubation			Cold Water Aquatic Life		
		Daily Min	Daily Max	Daily Average	Daily Min	Daily Max	Daily Average
		13°	13°	9°	22°	22°	19°
	Mission Creek Headwaters (05315A)						
	# Exceedance	52	92	97	0	60	29
	Days Monitored	145	145	145	207	207	207
	% Exceedance	35.9%	63.4%	66.9%	0.0%	29.0%	14.0%
	Mission Creek at Mouth (05301A)						
	# Exceedance	69	90	116	0	44	38
	Days Monitored	131	131	131	193	193	193
	% Exceedance	52.7%	68.7%	88.5%	0.0%	22.8%	19.7%

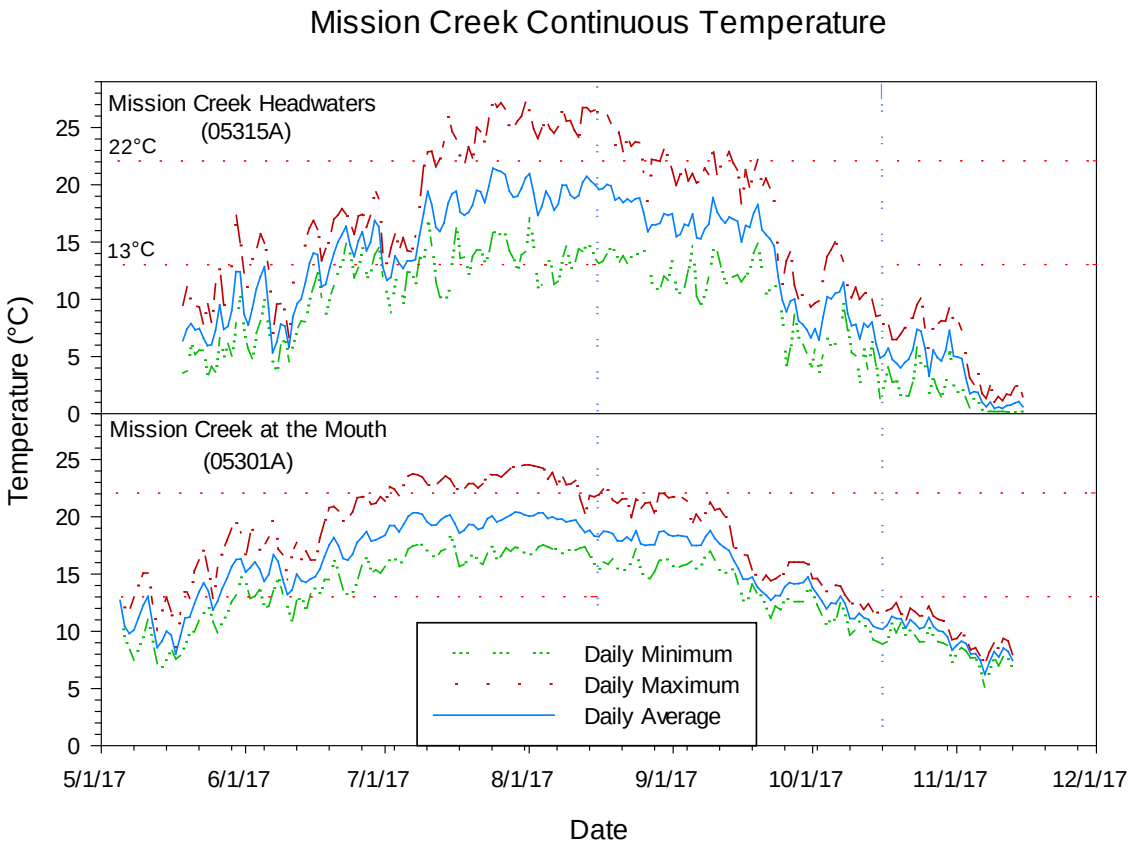

Figure 4. Continuous water temperature data collected from two monitoring sites in the Mission Creek watershed, 2017. Monitoring locations are displayed from the headwaters (top) to the mouth (bottom) of the Mission Creek watershed. The red dashed lines indicate the associated daily maximum temperature criteria - 13°C for SS and 22°C for CWAL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

Sweetwater Creek Subwatershed (10802A, 10905A, 08814A, 08801A, and 08101A)

Sweetwater Creek is a major tributary to Lapwai Creek which originates near Waha, ID. Sweetwater Creek enters Lapwai Creek near the town of Sweetwater in between two mainstem Lapwai Creek monitoring sites: Lapwai Creek downstream of the Culdesac WWTP (03812A) and Lapwai at Garden Gulch Rd. (03805A). The watershed contains one natural lake (Waha Lake) and one mound-impounded reservoir (Soldiers Meadow). Five monitoring sites were established in the watershed: East Fork Sweetwater Creek on Flatiron Road (10802A); West Fork Sweetwater Creek on Flatiron Road (10905A); Webb Creek downstream of Soldiers Meadow Reservoir (08814A); Webb Creek near the mouth (08801A); and Sweetwater Creek at the mouth (08101A). Table 10 presents descriptive statistics for data collected from the five Sweetwater Creek monitoring stations.

From 1906 until 2005, the majority of the water in the Sweetwater Creek watershed was diverted by the Lewiston Orchards Irrigation District (LOID) for agricultural use, often dewatering the lower portions of the watershed during the summer months. Starting in 2001 the Bureau of Reclamation (Reclamation) proceeded with the NEPA process for operations of the Lewiston Orchards Project and was successfully challenged by the Tribe until a stay of litigation occurred in 2010. In 2005, 1 cfs was voluntary provided by Reclamation and in 2010 a minimum flow criteria was established (summer base flow of 1 cfs in Webb Creek and 2.5 cfs in Sweetwater Creek). In 2015, construction of a Pilot well started and the project was completed in 2017. In 2017, an additional 4.5 cfs was added to the established minimum flows. In 2017, Reclamation completed NEPA on the Lewiston Orchards Project Title Transfer and Water Exchange Project. The selected alternative was a well field to produce 18 cfs and to add water to the streams as wells are completed. Upon perfecting its 18 cfs groundwater right LOID will no longer be diverting water from the Sweetwater watershed and all diversion infrastructure, Soldiers Meadow Reservoir, Reservoir A, and water rights associated with the Lewiston Orchards Project will be transferred over to the Bureau of Indian Affairs to be held in trust for the Tribe.

Instantaneous temperature measurements exceeded the 13°C daily maximum SS criteria on at least two sampling events (>10% exceedance) in all sampling locations, except at Webb Creek below Soldiers Meadow Reservoir (08814A) where no instantaneous exceedances were documented (Table 10, Figure 5). Similarly, continuous temperature monitoring showed that all monitoring sites except for Webb Creek below Soldiers Meadow Reservoir exceeded the 13°C daily maximum SS criteria on least 10% of days monitored; however, all sites exceeded the 9°C maximum daily average SS criteria, with percent exceedances ranging from 22% at Webb Creek below Soldiers Meadow Reservoir (08814A) to over 75% at the mouth of Sweetwater Creek. Continuous temperatures also exceeded the CWAL temperature criteria at two sites: East Fork Sweetwater Creek (10802A) and Webb Creek near the Mouth (08801A),

though exceedances occurred during less than 10% of the monitoring period (Table 11, Figure 6). Therefore, based on temperature, the entire Sweetwater Creek watershed is not fully supporting its SS designated beneficial use, but is fully supporting its CWAL designated beneficial use.

Nitrate+nitrite concentrations exceeded the target criterion of 0.3 mg/L at three monitoring sites, with exceedance rates ranging from 43% at the East Fork Sweetwater Creek (10802A) to 100% at the mouths of both Webb (08801A) and Sweetwater (08101A) Creeks. The highest concentration was documented at the mouth of Webb Creek at 6.82 mg/L, though median concentrations are similar at the mouths of both Webb (1.6 mg/L) and Sweetwater (1.52 mg/L) Creeks (Table 10, Figures 7-8). Relatively low concentrations in most portions of the headwaters, where cattle grazing is prevalent, suggests most nitrate+nitrite pollutant are originating from crop land in the mid-to-lower portions of the watershed. Much of the watershed flows through steep canyon habitat, with crop land on the plateaus above, suggesting that much of the pollutant load is being carried from small, perennial tributaries draining agricultural fields or by groundwater infiltration.

Total phosphorus also exceeded the target criterion of 0.1 mg/L at all monitoring sites, with exceedances ranging from 20% in West Fork Sweetwater Creek (10905A) to over 65% in East Fork Sweetwater Creek (10802A). The highest concentration (0.76 mg/L) was recorded at the mouth of Sweetwater Creek (08101A) (Table 10, Figures 9-10).

E. coli concentrations exceeded the instantaneous 406 cfu/100mL criterion at two sites: East Fork Sweetwater Creek and the mouth of Sweetwater Creek; however, no geometric means were not calculated so additional monitoring is advised (Table 10, Figure 11).

DO fell below the 8.0 mg/L criterion twice on Webb Creek below Soldiers Meadow Reservoir, and percent DO fell below the 90% saturation criterion necessary for SS at West Fork Sweetwater Creek (62.5% exceedance) and Webb Creek below Soldiers Meadow Reservoir (66.7% exceedance) (Table 10).

TSS also exceeded the 25 mg/L criterion at two monitoring sites: East Fork Sweetwater Creek (13.3% exceedance) and at the mouth of Sweetwater Creek (20% exceedance) (Table 10).

Data indicate that the Sweetwater Creek watershed, as a whole, is not fully supporting its designated beneficial uses of SS (temperature) and CWAL (total phosphorus). In addition, East Fork Sweetwater Creek, the downstream portion of Webb Creek, and the mainstem of Sweetwater Creek are not fully supporting the CWAL designated beneficial use because of excess nitrogen concentrations. East Fork Sweetwater Creek and the mainstem of Sweetwater Creek are also not fully supporting the CWAL designated beneficial use because of sediment (TSS). DO prevents the upper portion of Webb Creek (below Soldiers Meadow) from fully supporting its SS (% DO) and CWAL (DO) designated beneficial uses, and the West Fork Sweetwater Creek from fully supporting its SS (% DO) designated beneficial use. *E. coli* concentrations also exceeded the instantaneous criterion at two monitoring sites; however, geometric means were not calculated so a PCR designation cannot be determined at this time.

Recommended actions include excluding cattle from wetland and riparian habitat, buffering streams and wetlands in agricultural areas, increasing riparian vegetation, and increasing bank stability.

Table 10. Descriptive statistics for five monitoring sites within the Sweetwater Creek watershed, 2016-17.

Sweetwater Creek Subwatershed												
	Temp	DO	DO	pH	Turbidity	*E-coli* (BOR)	*E-coli* (NPT)	NO_3+NO_2	OP	TP	TSS	Flow
	(°C)	(mg/L)	%	(H+)	(NTU)	(#/100mL)	(#/100mL)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
East Fork Sweewater Creek (10802A)												
max	21.0	12.8	104.1	8.3	156.0	760	1733	0.42	0.13	0.31	174.0	36.0
min	1.6	8.6	91.1	7.4	1.5	6	9	0.02	0.05	0.07	0.0	0.1
mean	11.1	10.8	95.9	8.0	18.2	206	251	0.22	0.09	0.13	18.7	4.3
median	10.7	10.6	94.8	8.1	4.6	60	97	0.20	0.08	0.13	3.0	0.6
#exceedance	3	0	0	0	1	2	3	6	5	10	2	
%exceedance	18.8%	0.0%	0.0%	0.0%	6.3%	22.2%	18.8%	42.9%	35.7%	66.7%	13.3%	
# samples	16	16	16	15	16	9	16	14	14	15	15	16
West Fork Sweetwater Creek (10905A)												
max	16.5	12.2	96.3	8.0	34.0	180	162	0.12	0.08	0.13	26.0	11.3
min	1.6	8.7	85.8	6.9	3.5	4	0	< 0.01	0.05	0.07	2.0	0.0
mean	9.3	10.5	90.2	7.6	8.6	53	43	0.04	0.07	0.09	5.5	1.7
median	8.6	10.4	89.0	7.5	5.6	40	23	0.02	0.07	0.09	4.0	0.2
#exceedance	2	0	10	0	0	0	0	0	0	3	1	
%exceedance	12.5%	0.0%	62.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	6.7%	
# samples	16	16	16	15	16	9	16	14	14	15	15	14
Webb Creek downstream of Soldiers Meadow Reservoir (08814A)												
max	17.4	13.1	108.5	8.9	29.1	12	38	0.18	0.06	0.14	8.0	11.6
min	2.2	7.9	81.4	6.3	4.1	< 2	< 1	0.02	0.02	0.05	2.0	0.1
mean	10.5	10.2	89.9	7.1	11.9	5	10	0.09	0.04	0.09	4.4	4.7
median	9.5	10.1	88.6	6.7	8.2	4	4	0.06	0.04	0.09	4.0	4.1
#exceedance	0	2	8	1	0	0	0	0	0	3	0	
%exceedance	0.0%	16.7%	66.7%	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%	25.0%	0.0%	
# samples	12	12	12	12	12	7	10	12	12	12	12	12
Webb Creek at Mouth (08801A)												
max	17.7	14.0	101.0	8.1	107.0	1280	248	6.82	0.19	0.34	146.0	109.5
min	1.3	9.2	94.3	7.3	2.7	< 2	4	0.48	0.03	0.05	4.0	1.4
mean	9.6	11.3	97.4	7.7	16.6	294	70	1.72	0.07	0.11	17.5	13.9
median	8.8	11.2	96.9	7.6	8.1	160	47	1.60	0.06	0.09	6.0	3.9
#exceedance	2	0	0	0	1	1	0	15	1	5	1	
%exceedance	13.3%	0.0%	0.0%	0.0%	6.7%	12.5%	0.0%	100.0%	6.7%	33.3%	6.7%	
# samples	15	15	15	15	15	8	15	15	15	15	15	15
Sweetwater Creek at Mouth (08101A)												
max	17.1	14.1	103.6	8.5	244.0	500	1046	2.19	0.08	0.76	385.0	217.3
min	2.0	9.6	96.3	7.2	1.7	80	25	0.40	0.04	0.05	1.0	4.9
mean	9.9	11.5	100.0	8.0	25.5	225	224	1.49	0.06	0.13	34.6	33.8
median	10.2	11.1	99.7	7.9	8.6	100	173	1.52	0.06	0.08	8.0	10.7
#exceedance	2	0	0	0	1	2	2	15	0	6	3	
%exceedance	13.3%	0.0%	0.0%	0.0%	6.7%	18.2%	13.3%	100.0%	0.0%	40.0%	20.0%	
# samples	15	15	15	15	15	11	15	15	15	15	15	15

Temp: instantaneous water temperature; DO: dissolved oxygen; NO3+NO2: nitrate+nitrite; OP: orthophosphorus; TP: total phosphorus; TSS: total suspended sediments.

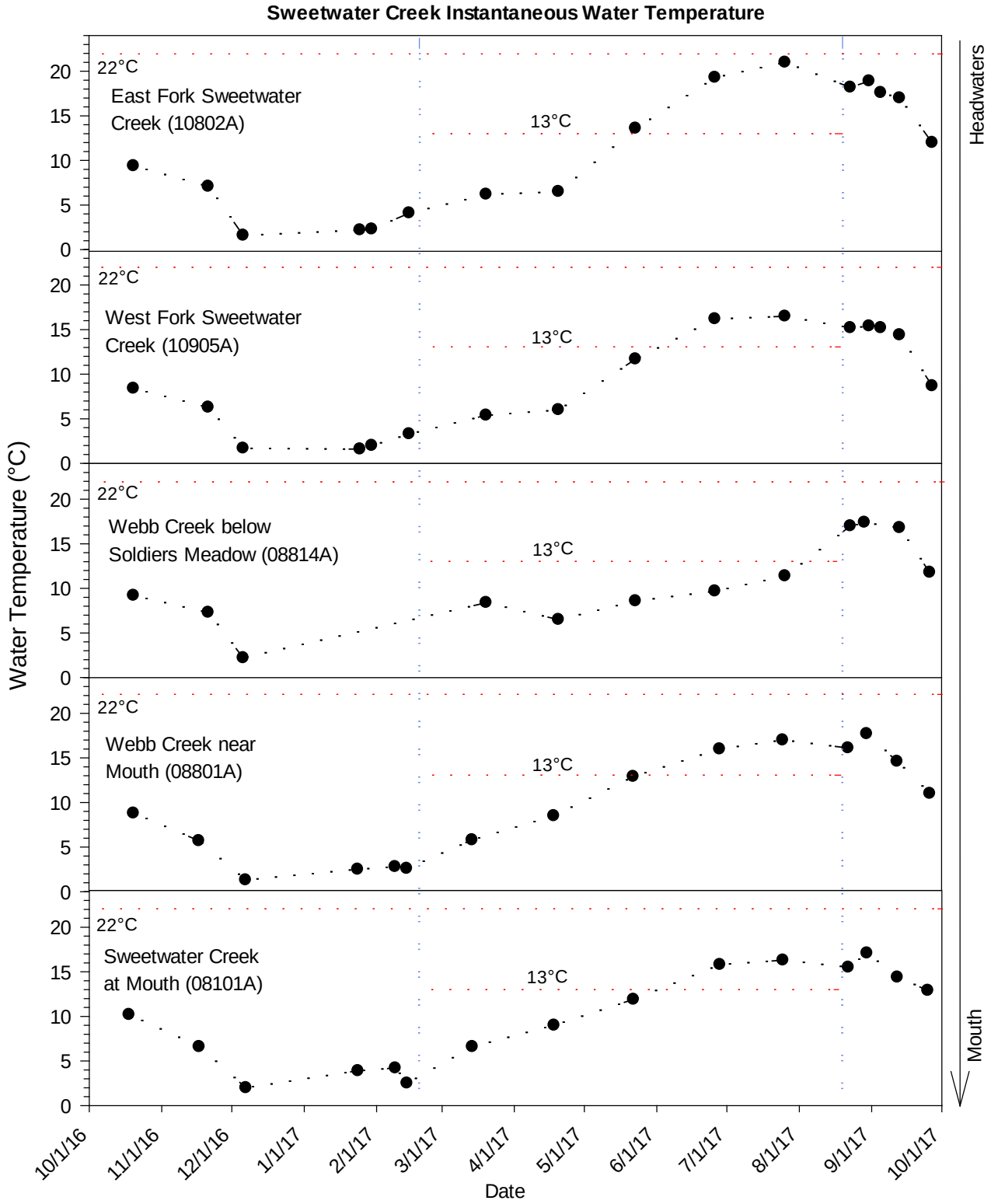

Figure 5. Instantaneous water temperature data collected at five monitoring sites in the Sweetwater Creek watershed, 2016-2017. Monitoring locations are displayed from the headwaters (top) to the mouth (bottom) of the Sweetwater Creek watershed. The red dashed lines indicate the associated daily maximum temperature criteria - 13°C for SS and 22°C for CWAL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

Table 11. Continuous temperature exceedances for the five monitoring sites in the Sweetwater Creek watershed, 2017.

Sweetwater Creek Subwatershed Continuous Temperature Data Summary	Criteria	Salmonid Spawning and Incubation			Cold Water Aquatic Life		
		Daily Min	Daily Max	Daily Average	Daily Min	Daily Max	Daily Average
		13°	13°	9°	22°	22°	19°
	East Fork Sweetwater Creek (10802A)						
	# Exceedance	44	74	89	0	11	0
	Days Monitored	145	145	145	207	207	207
	% Exceedance	30.3%	51.0%	61.4%	0.0%	5.3%	0.0%
	West Fork Sweetwater Creek (10905A)						
	# Exceedance	20	57	77	0	0	0
	Days Monitored	145	145	145	207	207	207
	% Exceedance	13.8%	39.3%	53.1%	0.0%	0.0%	0.0%
	Webb Creek downstream Soldiers Meadow (08814A)						
	# Exceedance	2	8	32	0	0	0
	Days Monitored	145	145	145	207	207	207
	% Exceedance	1.4%	5.5%	22.1%	0.0%	0.0%	0.0%
	Webb Creek near Mouth (08801A)						
	# Exceedance	58	87	100	0	0	2
	Days Monitored	144	144	144	206	206	206
	% Exceedance	40.3%	60.4%	69.4%	0.0%	0.0%	1.0%
	Sweetwater Creek at Mouth (08101A)						
	# Exceedance	66	87	103	0	0	0
	Days Monitored	135	135	135	196	196	196
	% Exceedance	48.9%	64.4%	76.3%	0.0%	0.0%	0.0%

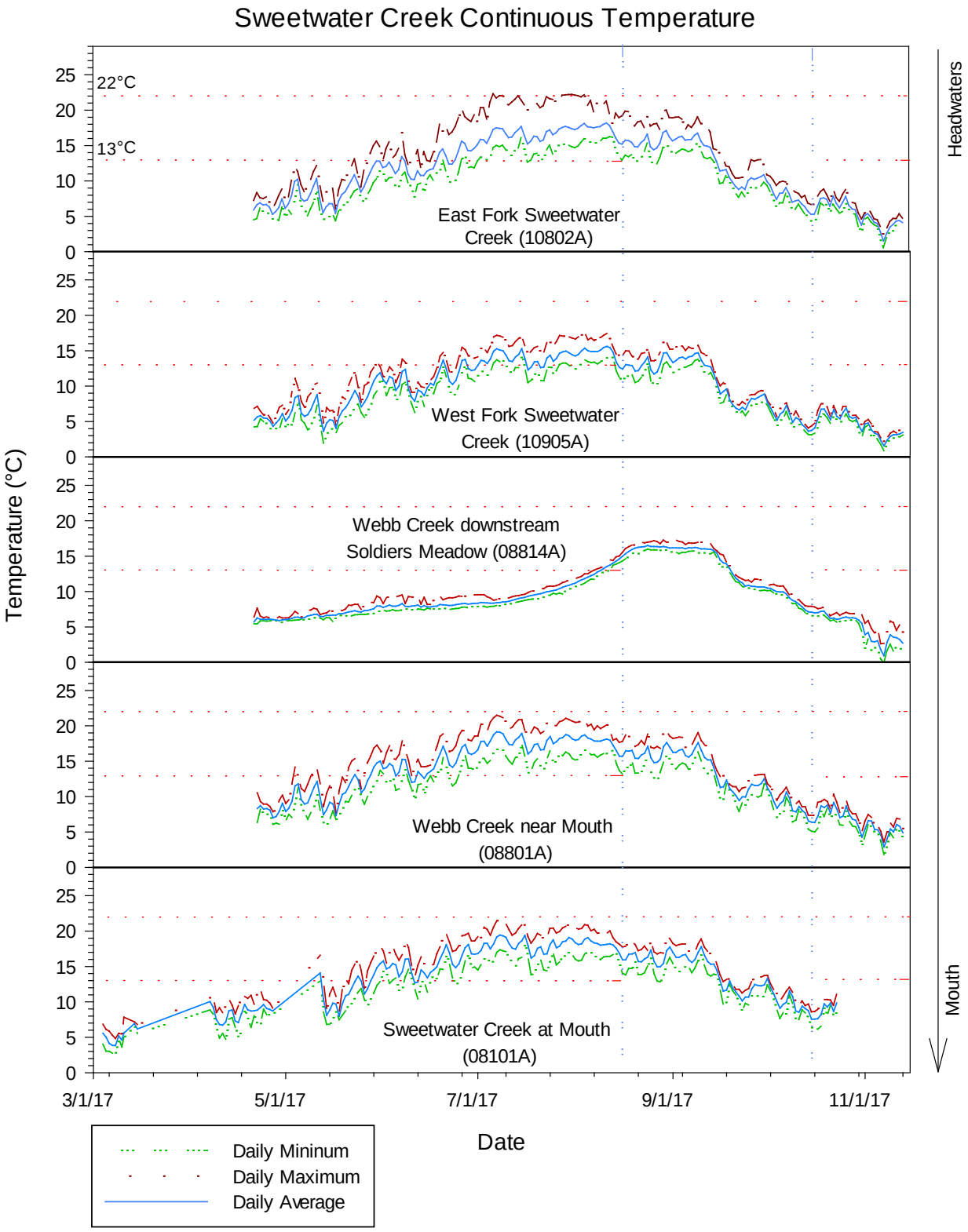

Figure 6. Continuous water temperature data collected at five monitoring sites in the Sweetwater Creek watershed, 2017. Monitoring locations are displayed from the headwaters (top) to the mouth (bottom) of the Sweetwater Creek watershed. The red dashed lines indicate the associated daily maximum temperature criteria - 13°C for SS and 22°C for CWAL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

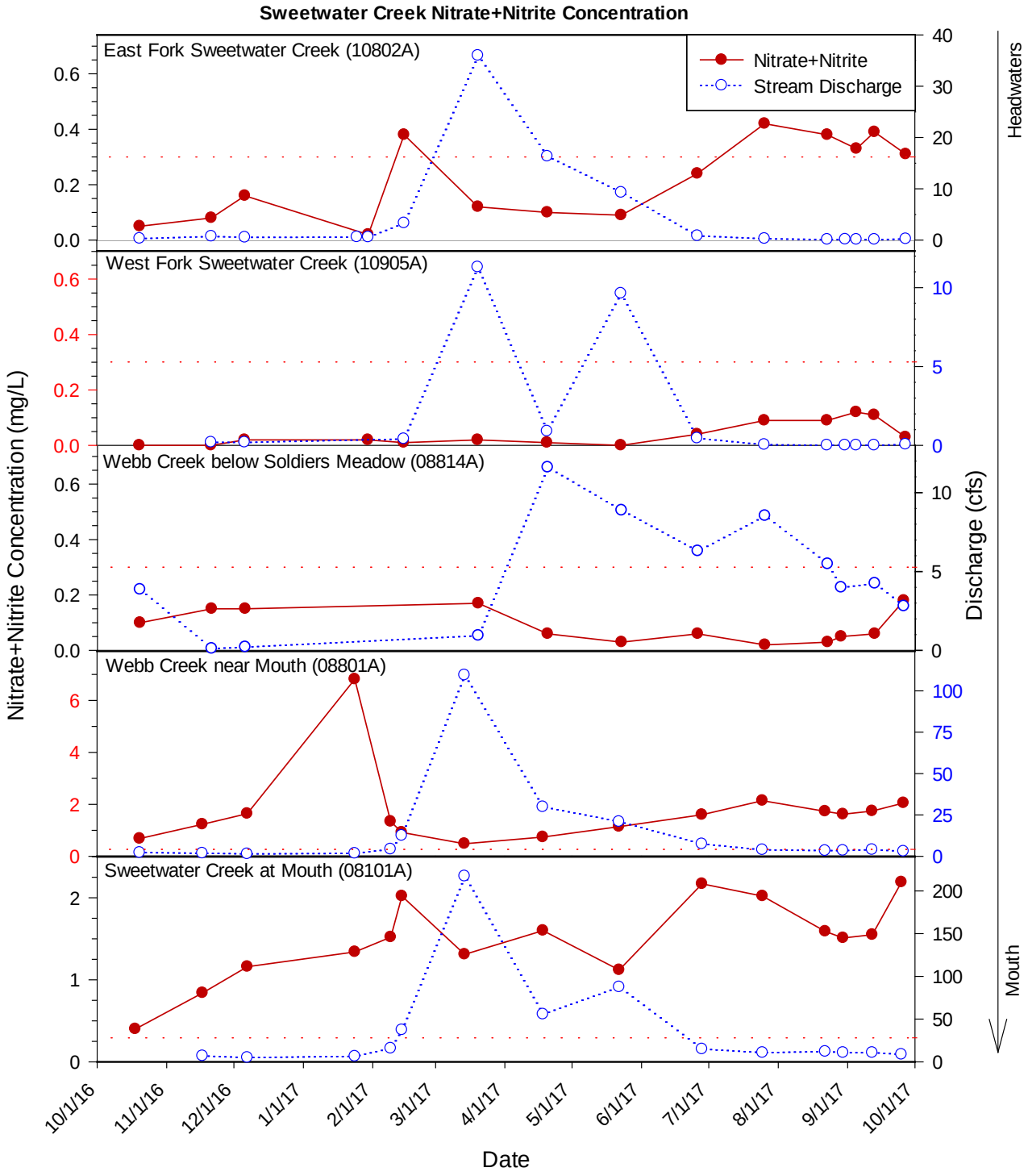

Figure 7. Nitrate+nitrite and stream flow data collected at five monitoring sites in the Sweetwater Creek watershed, 2016-2017. Monitoring locations are displayed from the headwaters (top) to the mouth (bottom) of the Sweetwater Creek watershed. The red dashed lines indicate the nitrate+nitrite water quality target criterion – 0.3 mg/L. Note: scales may vary between sites.

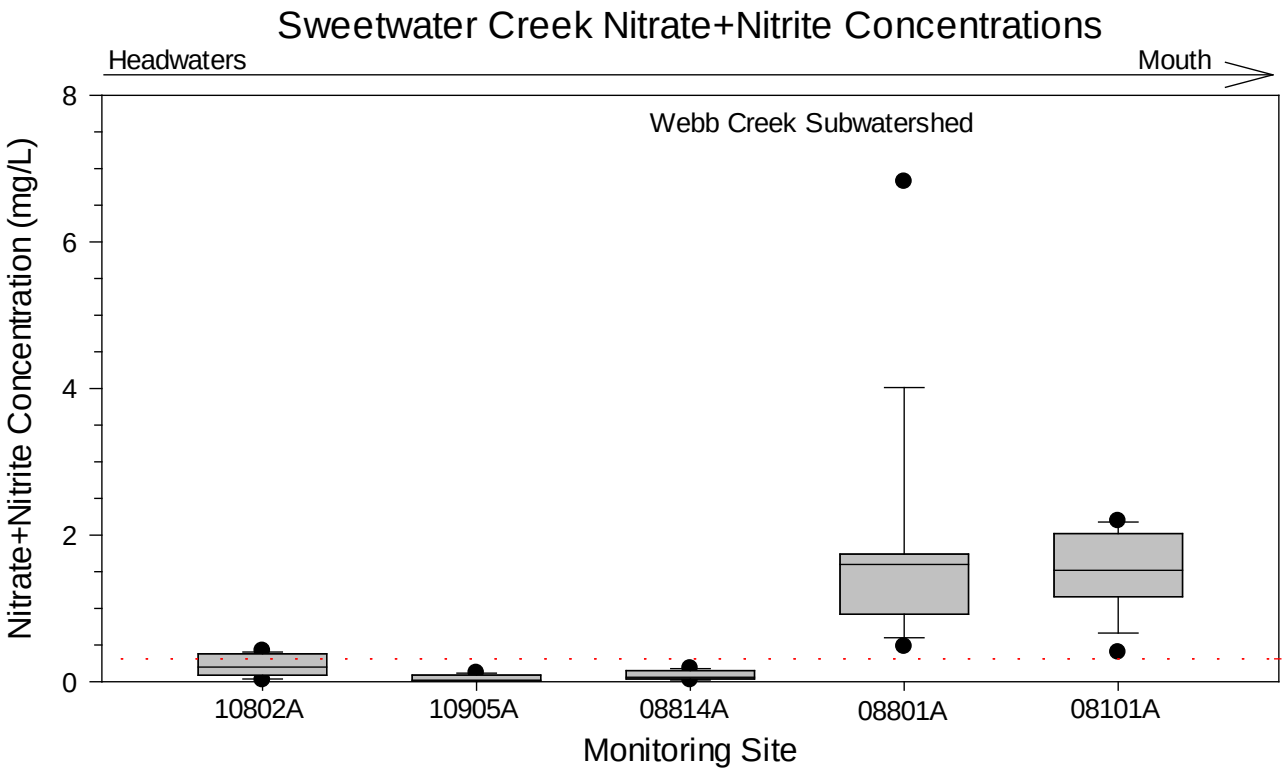

Figure 8. Nitrate+nitrite data collected at five monitoring sites in the Sweetwater Creek watershed, 2016-2017. Monitoring locations are displayed from the headwaters (left) to the mouth (right) of the Sweetwater Creek watershed. The red dashed line indicates the nitrate+nitrite water quality target criterion – 0.3 mg/L.

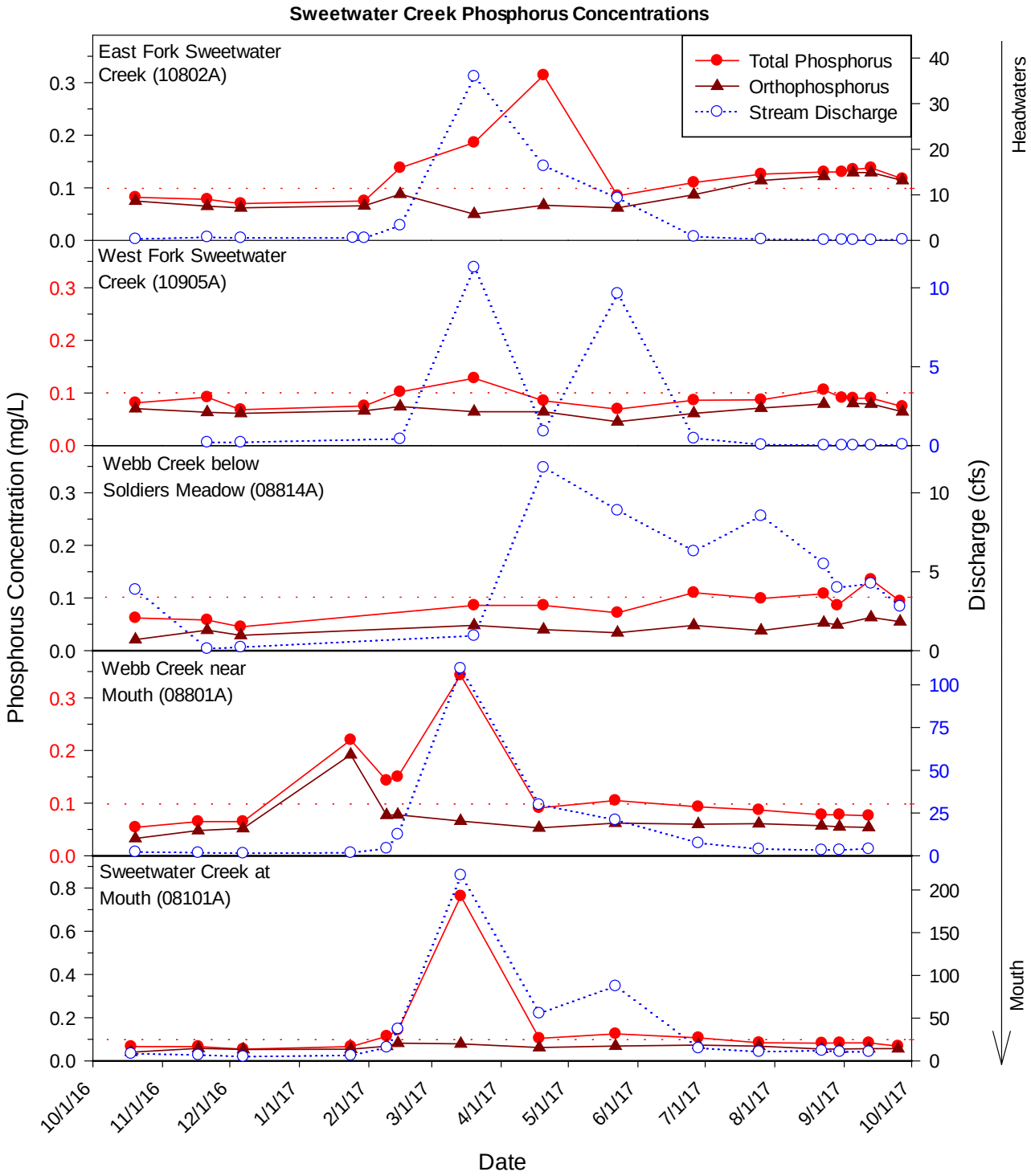

Figure 9. Total phosphorus, orthophosphorus, and stream flow data collected at five monitoring sites in the Sweetwater Creek watershed, 2016-2017. Monitoring locations are displayed from the headwaters (top) to the mouth (bottom) of the Sweetwater Creek watershed. The red dashed lines indicate the total phosphorus water quality target criterion – 0.1 mg/L. Note: scales may vary between sites.

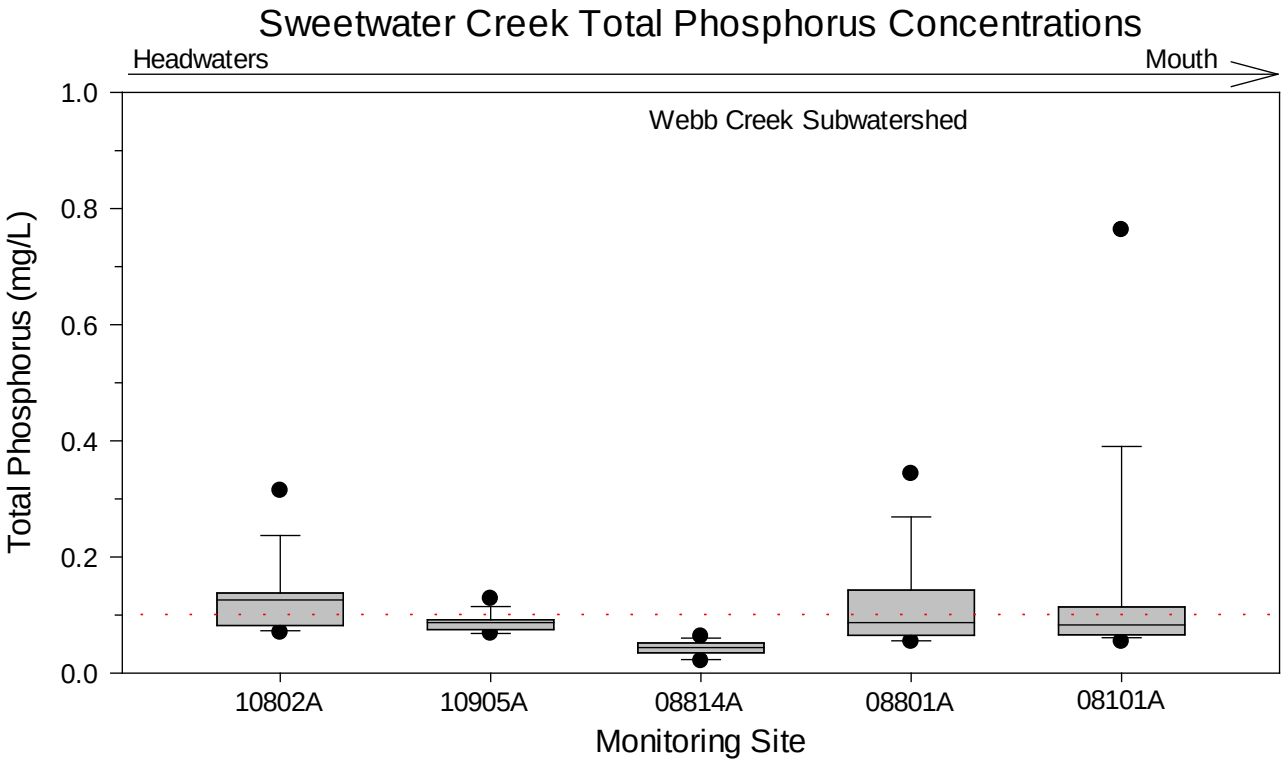

Figure 10. Total phosphorus data collected at five monitoring sites in the Sweetwater Creek watershed, 2016-2017. Monitoring locations are displayed from the headwaters (left) to the mouth (right) of the Sweetwater Creek watershed. The red dashed line indicates the total phosphorus water quality target criterion– 0.1 mg/L.

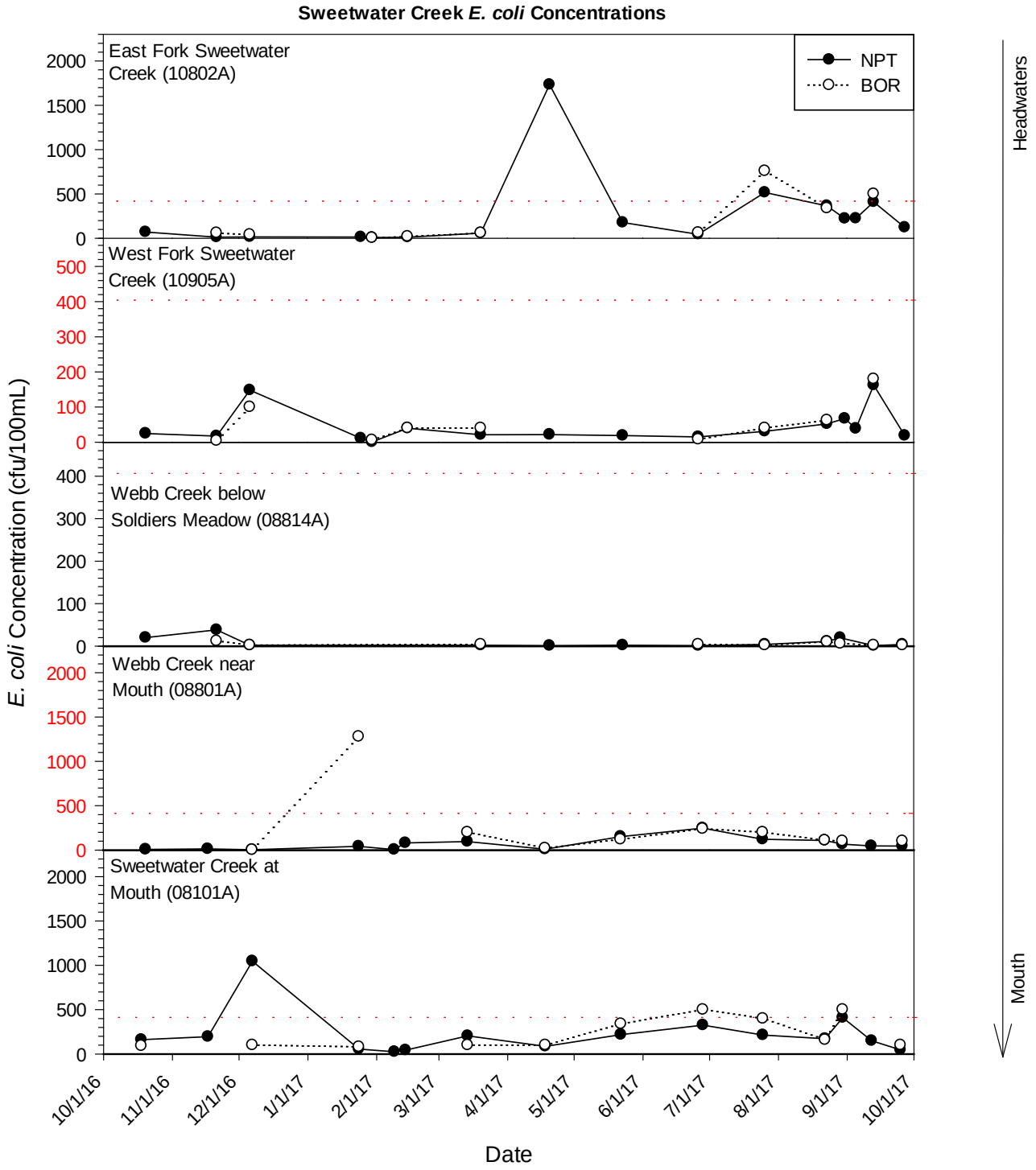

Figure 11. *E. coli* concentrations collected at five monitoring sites in the Sweetwater Creek watershed, 2016-2017. Monitoring locations are displayed from the headwaters (top) to the mouth (bottom) of the Sweetwater Creek watershed. The red dashed lines indicate the instantaneous *E. coli* water quality criterion – 406 cfu/100mL. Note: scales may vary between sites.

Spring Creek at the Community Sweat Lodge (Nez 931)

Spring Creek is a small tributary to Lapwai Creek originating from several springs less than one mile from its confluence with Lapwai Creek in Lapwai, ID. Spring Creek enters Lapwai Creek in between two mainstem Lapwai Creek monitoring sites, Lapwai Creek at Garden Gulch Road (03805A) and Lapwai Creek at the USGS gaging station (03802A). Spring Creek has historically been and continues to be of significant cultural importance. Currently a community sweat lodge is located near the mouth of Spring Creek, where tribal members gather and use, drink, and swim in the water for cultural purposes. One monitoring site was established near the mouth of Spring Creek at the community sweat lodge off of Garden Gulch Road. Table 12 presents descriptive statistics for data collected from the monitoring station located on Spring Creek.

Instantaneous temperature measurements exceeded the 13°C daily maximum SS criteria on three sampling events (20% exceedance) (Table 12, Figure 12A). Continuous temperature monitoring showed exceedances of the 13°C daily maximum SS criterion on 78 of the 131 days monitored (60%) and exceedances of the 9°C maximum daily average SS criterion on all 131 days monitored (Table 13, Figure 13). No CWAL temperature exceedances were documented at this monitoring site throughout the monitoring period.

Nitrate+nitrite concentrations exceeded the target criterion of 0.3 mg/L on all sampling events. The median concentration was 1.46 mg/L with concentrations ranging from 0.61 to 7.46 mg/L (Table 12, Figure 12B). Since Spring Creek is spring fed, these high concentrations are likely resulting from areal groundwater contamination originating from agricultural land uses.

Total phosphorus also exceeded the target criterion of 0.1 mg/L on four sampling events (29% exceedance), with overall concentrations ranging from 0.06 mg/L to 0.12 mg/L (Table 12, Figure 12C).

E. coli concentrations only exceeded the instantaneous 406 cfu/100mL criterion on one sampling event (<10% exceedance); therefore, there is no immediate tribal health concern (Table 12, Figure 12D).

DO fell below the 90% saturation SS criterion on twelve sampling events (80%). Low DO, is likely a result of the spring-fed system and the resulting wetlands at its main source (Table 12).

Data indicate that the Spring Creek watershed is not fully supporting its designated beneficial uses of SS (temperature, DO) and CWAL (nitrate+nitrite, total phosphorus).

Recommended actions include buffering streams and wetlands in surrounding agricultural areas and increasing riparian vegetation to decrease solar radiation.

Table 12. Descriptive statistics for data collected near the mouth of Spring Creek, 2016-17.

Spring Creek (Nez 931)	Temp	DO	DO	pH	Turbidity	*E-coli* (BOR)	*E-coli* (NPT)	NO_3+NO_2	OP	TP	TSS	Flow
	(°C)	(mg/L)	%	(H+)	(NTU)	(#/100mL)	(#/100mL)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
max	14.8	12.0	104.0	7.6	4.5	640	579	7.46	0.11	0.12	11.0	3.3
min	8.8	8.2	76.0	6.7	1.1	4	< 1	0.61	0.05	0.06	0.0	1.2
mean	12.2	9.2	85.4	7.3	2.2	135	96	2.26	0.08	0.09	3.5	1.7
median	12.6	8.7	82.2	7.3	1.9	64	64	1.46	0.08	0.09	2.0	1.5
#exceedance	3	0	12	0	0	1	1	14	2	4	0	
%exceedance	20.0%	0.0%	80.0%	0.0%	0.0%	7.7%	6.7%	100.0%	14.3%	28.6%	0.0%	
# samples	15	15	15	15	15	13	15	14	14	14	14	14

Temp: instantaneous water temperature; DO: dissolved oxygen; NO3+NO2: nitrate+nitrite; OP: orthophosphorus; TP: total phosphorus; TSS: total suspended sediments.

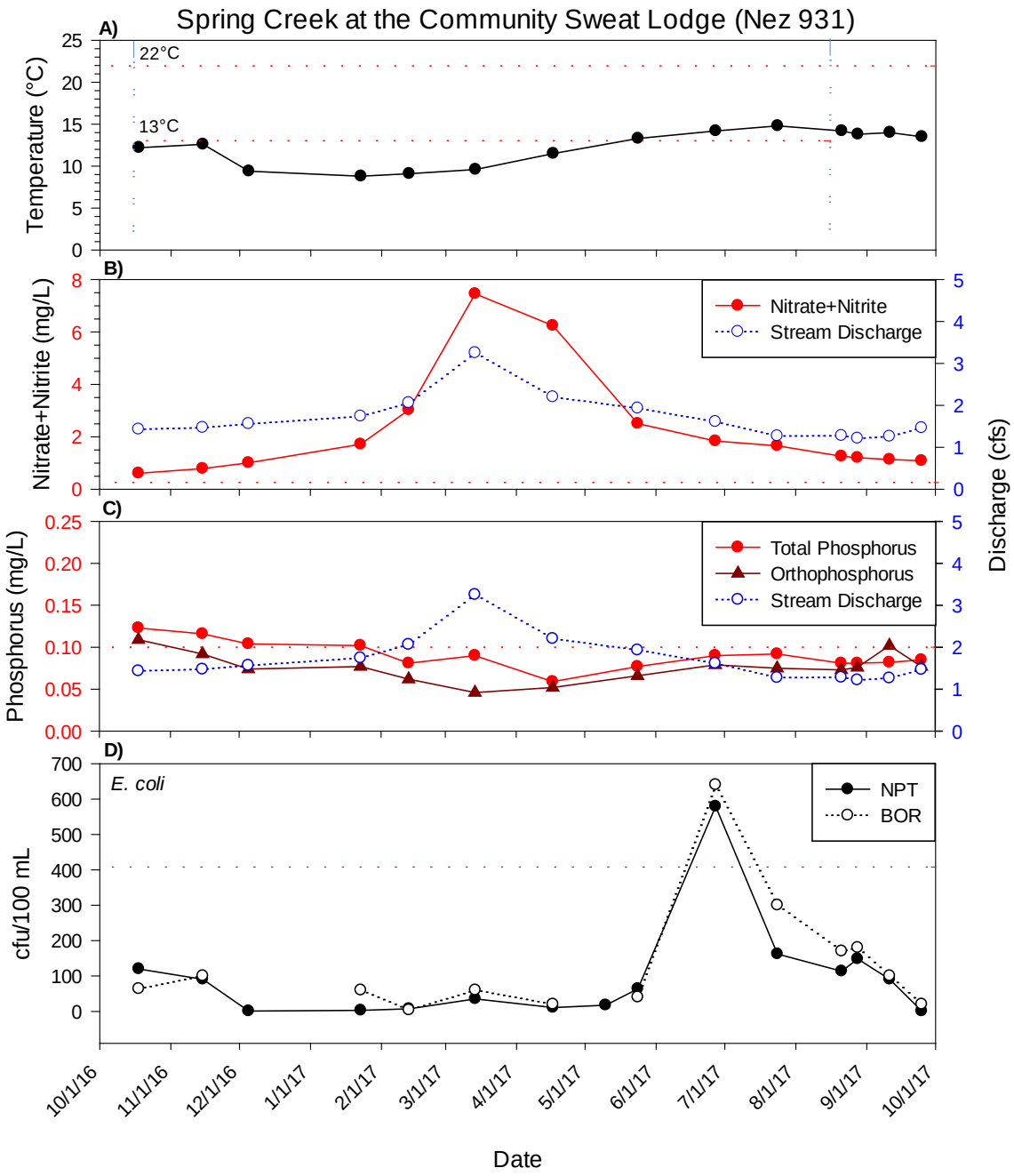

Figure 12. (A) Instantaneous water temperature, (B) flow and NO_3+NO_2, (C) flow, total phosphorus, and orthophosphorus, and (D) *E. coli* data collected near the mouth of Spring Creek at the community sweat lodge, 2016-2017. The red dashed lines indicate the associated water quality criteria: Temperature - 13°C for SS and 22°C for CWAL; NO_3+NO_2 - 0.3 mg/L; total phosphorus - 0.1 mg/L; and *E. coli* – 406 cfu/100mL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

Table 13. Continuous temperature exceedances for Spring Creek at the mouth (Nez 931) from May – November, 2017.

Criteria	Daily Min	Daily Max	Daily Average
SS	**13°**	**13°**	**9°**
# exceedance	0	78	131
Total days	131	131	131
% exceedance	0.0%	59.5%	100.0%
CWAL	**22°**	**22°**	**19°**
# exceedance	0	0	0
Total days	193	193	193
% exceedance	0.0%	0.0%	0.0%

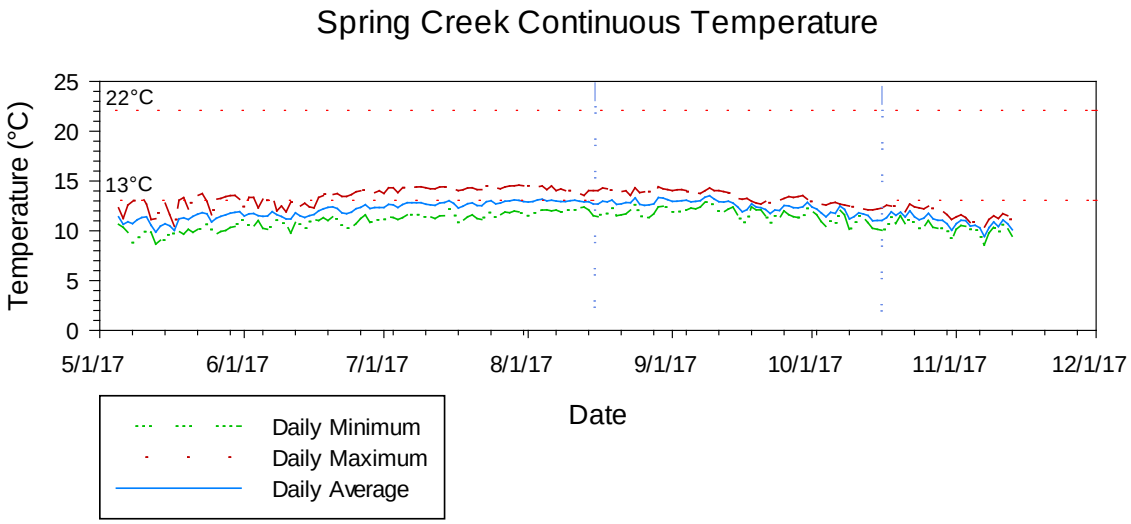

Figure 13. Continuous water temperature data collected near the mouth of Spring Creek, 2016-2017. The red dashed lines indicate the associated daily maximum temperature criteria - 13°C for SS and 22°C for CWAL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

Garden Gulch Creek (02701A)

Garden Gulch Creek is a small tributary to Lapwai Creek originating on the plateau east of Lapwai, ID. It enters Lapwai Creek just downstream of Spring Creek and in between two mainstem Lapwai Creek monitoring stations: Lapwai Creek at Garden Gulch Road (03805A) and Lapwai Creek at the USGS gaging station (03802A). The Garden Gulch watershed is heavily impacted by agriculture (cropland and cattle grazing) and is primarily privately owned. One monitoring site was established near the mouth of Garden Gulch Creek (02701A). Table 14 presents descriptive statistics for data collected from the monitoring station located on Garden Gulch Creek.

Instantaneous temperature measurements exceeded the 13°C daily maximum SS criteria on three sampling events (20% exceedance) (Table 14, Figure 14A). Continuous temperature monitoring showed exceedances of the 13°C daily maximum SS criterion on 113 of the 144 days monitored (78%) and exceedances of the 9°C maximum daily average SS criterion on all but five days monitored (97%). The 22°C daily maximum CWAL criterion was also exceeded on 21 of the 204 days monitored (10.2%), and the 19°C maximum daily average CWAL criterion was exceeded on four days (<10%) (Table 15, Figure 15). Lack of riparian vegetation and stream buffers, as well as cattle grazing are the probable causes of high instream temperatures.

Both nitrate+nitrite and total phosphorus exceeded the associated target criteria on all sampling events (Table 14). The median nitrate+nitrite concentration was 7.0 mg/L with concentrations ranging from 5.8 mg/L to 18.3 mg/L (Figure 14B). In addition, the total phosphorus median concentration was 0.27 mg/L and with concentrations ranging from 0.18 mg/L to 0.58 mg/L (Figure 14C). Poor agricultural management, excessive fertilizer use, lack of riparian buffers, and cattle access to streams and wetlands are the likely causes of extremely high nutrient concentrations.

E. coli concentrations exceeded the instantaneous 406 cfu/100mL criterion on nine sampling events (60% exceedance) (Table 14, Figure 14D). Year-round cattle access to streams and wetlands is the probable source of *E. coli* contamination.

DO fell below the 90% saturation SS criterion on five sampling events (33%) (Table 14, Figure 14E). Low percent DO occurred primarily at the lowest recorded flows. Low summer base flows coupled with high nutrients and temperature creates the potential for excess algal growth which could be causing the DO exceedances.

Turbidity and TSS exceeded associated criteria on two (13%) and four (27%) sampling events, respectively. Probable causes of excess sediment include lack of riparian vegetation and stream buffers and cattle accessing streams and wetlands.

Data indicate that the Garden Gulch Creek watershed is not fully supporting its designated beneficial uses of SS (temperature, % DO) and CWAL (temperature, nitrate+nitrite, total phosphorus, sediment). *E. coli* concentrations also exceeded the instantaneous criterion on multiple occasions; however, geometric means were not calculated so a PCR designation cannot be determined at this time.

Recommended actions include excluding cattle from wetland and riparian habitat, buffering streams and wetlands in agricultural areas, increasing riparian vegetation, increasing bank stability, educating landowners on proper nutrient and fertilizer application, and implementing a nutrient management plan.

Table 14. Descriptive statistics for the data collected near the mouth of Garden Gulch Creek, 2016-17.

Garden Gulch Creek (02701A)	Temp	DO	DO	pH	Turbidity	*E-coli* (BOR)	*E-coli* (NPT)	NO_3+NO_2	OP	TP	TSS	Flow
	(°C)	(mg/L)	%	(H+)	(NTU)	(#/100mL)	(#/100mL)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
max	20.5	11.7	99.2	8.2	72.5	3000	1986	18.30	0.35	0.58	120.0	19.0
min	7.0	8.3	88.0	7.7	1.2	80	< 1	5.84	0.18	0.19	2.0	0.05
mean	12.9	9.9	92.4	7.9	16.5	975	724	8.51	0.24	0.31	29.5	2.3
median	11.8	9.7	93.0	8.0	5.9	1000	613	7.00	0.24	0.27	10.0	0.5
#exceedance	3	0	5	0	2	8	9	15	15	15	4	
%exceedance	20.0%	0.0%	33.3%	0.0%	13.3%	66.7%	64.3%	100.0%	100.0%	100.0%	26.7%	
# samples	15	15	15	15	15	12	14	15	15	15	15	16

Temp: instantaneous water temperature; DO: dissolved oxygen; NO3+NO2: nitrate+nitrite; OP: orthophosphorus; TP: total phosphorus; TSS: total suspended sediments.

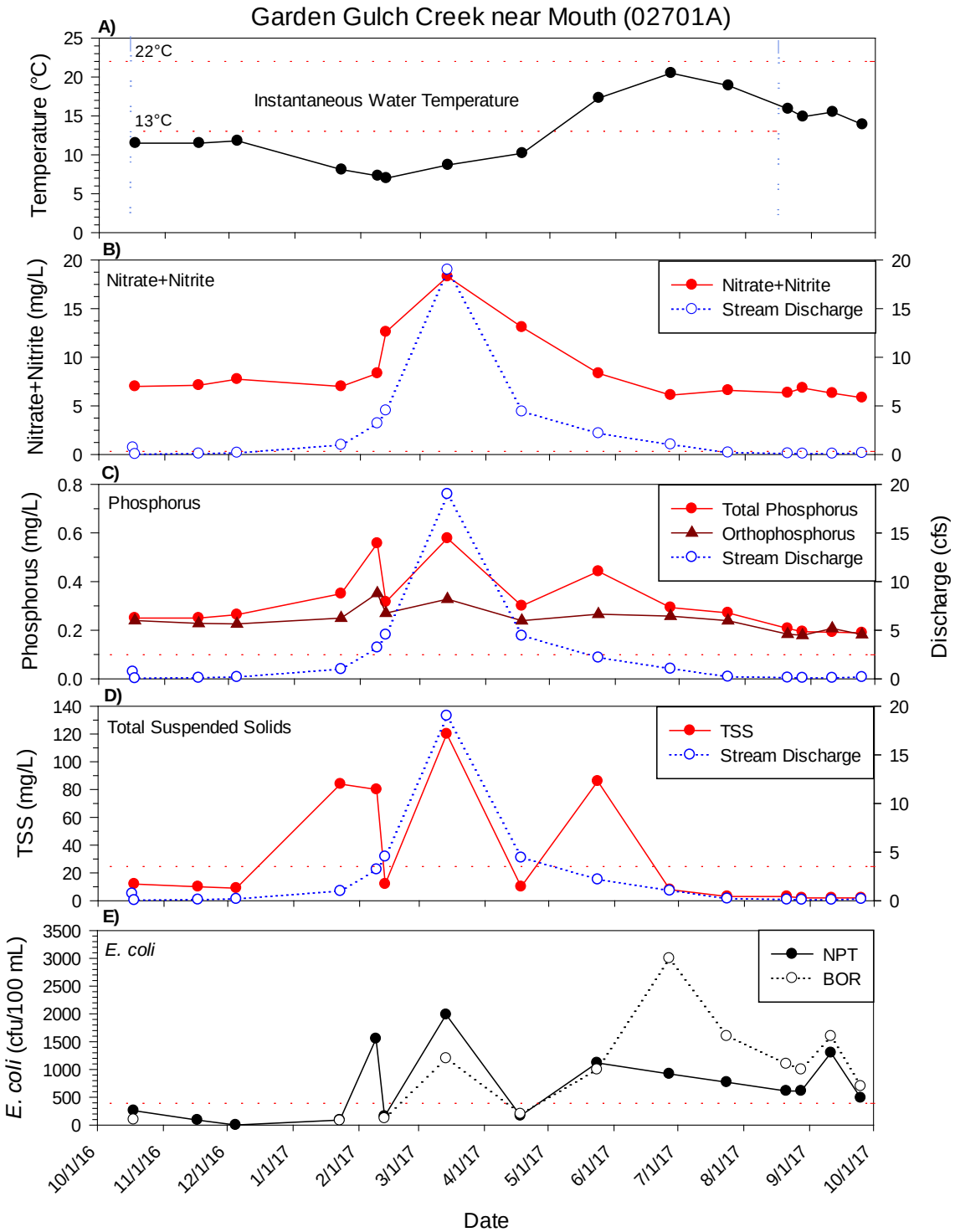

Figure 14. (A) Instantaneous water temperature, (B) flow and NO_3+NO_2, (C) flow, total phosphorus, and orthophosphorus, (D) total suspended sediment and flow, and (E) *E. coli* data collected near the mouth of Garden Gulch Creek, 2016-2017. The red dashed lines indicate the associated water quality criteria: Temperature - 13°C for SS and 22°C for CWAL; NO_3+NO_2 - 0.3 mg/L; total phosphorus - 0.1 mg/L; TSS – 25mg/L; and *E. coli* – 406 cfu/100mL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

Table 15. Continuous temperature exceedances for Garden Gulch Creek at the mouth (02701A) from April – November, 2017.

Criteria	Daily Min	Daily Max	Daily Average
SS	**13°**	**13°**	**9°**
# exceedance	67	113	139
Total days	144	144	144
% exceedance	46.5%	78.5%	96.5%
CWAL	**22°**	**22°**	**19°**
# exceedance	0	21	4
Total days	206	206	206
% exceedance	0.0%	10.2%	1.9%

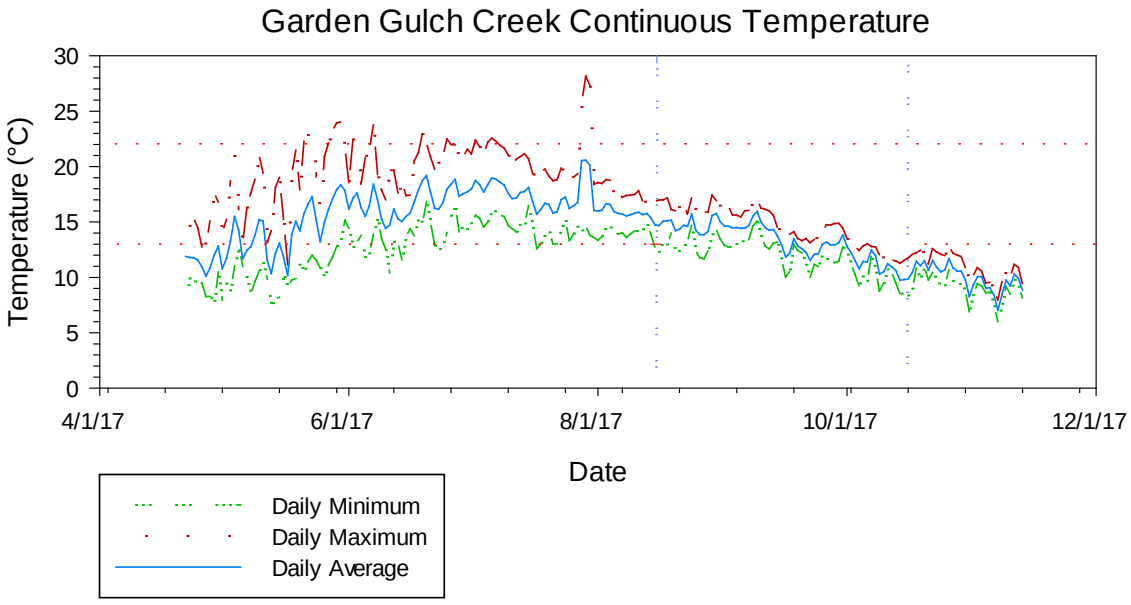

Figure 15. Continuous water temperature data collected near the mouth of Garden Gulch Creek, 2016-2017. The red dashed lines indicate the associated daily maximum temperature criteria - 13°C for SS and 22°C for CWAL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

Tom Beall Creek (08501A)

Tom Beall Creek is a small tributary to Lapwai Creek originating on the plateau east of Lapwai, ID. It enters Lapwai Creek downstream of Spring and Garden Gulch Creeks, and in between two mainstem Lapwai Creek monitoring stations: Lapwai Creek at Garden Gulch Road (03805A) and Lapwai Creek at the USGS gaging station (03802A). The Tom Beall watershed is heavily impacted by agriculture (cropland and cattle grazing) and is split between tribal and private ownership. One monitoring site was established near the mouth of Tom Beall Creek (08501A). Table 16 presents descriptive statistics for data collected from that monitoring station.

Instantaneous temperature measurements exceeded the 13°C daily maximum SS criteria on three sampling events (20% exceedance) (Table 16, Figure 16A). Continuous temperature monitoring showed exceedances of the 13°C daily maximum SS criterion on 110 of 144 days monitored (76%) and exceedances of the 9°C maximum daily average SS criterion on 133 of the 144 days monitored (92%) (Table 17, Figure 17). No CWAL exceedances were documented during the monitoring period. Lack of riparian vegetation and stream buffers, as well as cattle grazing are the probable cause of high instream temperatures.

Nitrate+nitrite concentrations exceeded the target criterion of 0.3 mg/L on all sampling events. The median concentration was over 9 mg/L with concentrations ranging from 4 mg/L to 21.1 mg/L (Table 16, Figure 16B). In addition, total phosphorus also exceeded the target criterion of 0.1 mg/L on all sampling events, with a median concentration of 0.22 mg/L and a range of 0.12 mg/L to 0.96 mg/L (Table 16, Figure 16C). Poor agricultural management, excessive fertilizer use, lack of riparian buffers, and cattle accessing streams and wetlands are the likely causes of high nutrient concentrations.

TSS exceeded associated criteria on seven (47%) sampling events (Table 16, Figure 16D). Probable causes of excess sediment include lack of riparian vegetation and stream buffers and cattle access to streams and wetlands.

E. coli concentrations exceeded the instantaneous 406 cfu/100mL criterion on seven sampling events (44% exceedance) (Table 16, Figure 16E). Year-round cattle access to streams and wetlands is the probable source of *E. coli* contamination.

Data indicate that the Tom Beall Creek watershed is not fully supporting its designated beneficial uses of SS (temperature) and CWAL (nitrate+nitrite, total phosphorus, sediment). *E. coli* concentrations also exceeded the instantaneous criterion on multiple occasions; however, geometric means were not calculated so a PCR designation cannot be determined at this time.

Recommended actions include excluding cattle from wetland and riparian habitat, buffering streams and wetlands in agricultural areas, increasing riparian vegetation, increasing bank stability, educating landowners on proper nutrient and fertilizer application, and implementing a nutrient management plan.

Table 16. Descriptive statistics for the data collected near the mouth of Tom Beall Creek, 2016-17.

Tom Beall Creek (08501A)	Temp	DO	DO	pH	Turbidity	*E-coli* (BOR)	*E-coli* (NPT)	NO_3+NO_2	OP	TP	TSS	Flow
	(°C)	(mg/L)	%	(H+)	(NTU)	(#/100mL)	(#/100mL)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
max	17.5	12.8	100.4	8.6	122.0	1280	816	21.10	0.30	0.96	632.0	34.4
min	4.7	9.3	90.3	8.0	1.6	40	1	4.03	0.11	0.12	2.0	0.7
mean	11.3	10.7	96.5	8.3	17.9	422	354	10.23	0.18	0.28	79.6	5.8
median	12.1	10.2	97.1	8.3	4.4	350	319	9.07	0.16	0.22	16.0	1.7
#exceedance	3	0	0	0	1	5	7	15	15	15	7	
%exceedance	20.0%	0.0%	0.0%	0.0%	6.7%	41.7%	43.8%	100.0%	100.0%	100.0%	46.7%	
# samples	15	15	15	15	15	12	16	15	15	15	15	14

Temp: instantaneous water temperature; DO: dissolved oxygen; NO3+NO2: nitrate+nitrite; OP: orthophosphorus; TP: total phosphorus; TSS: total suspended sediments.

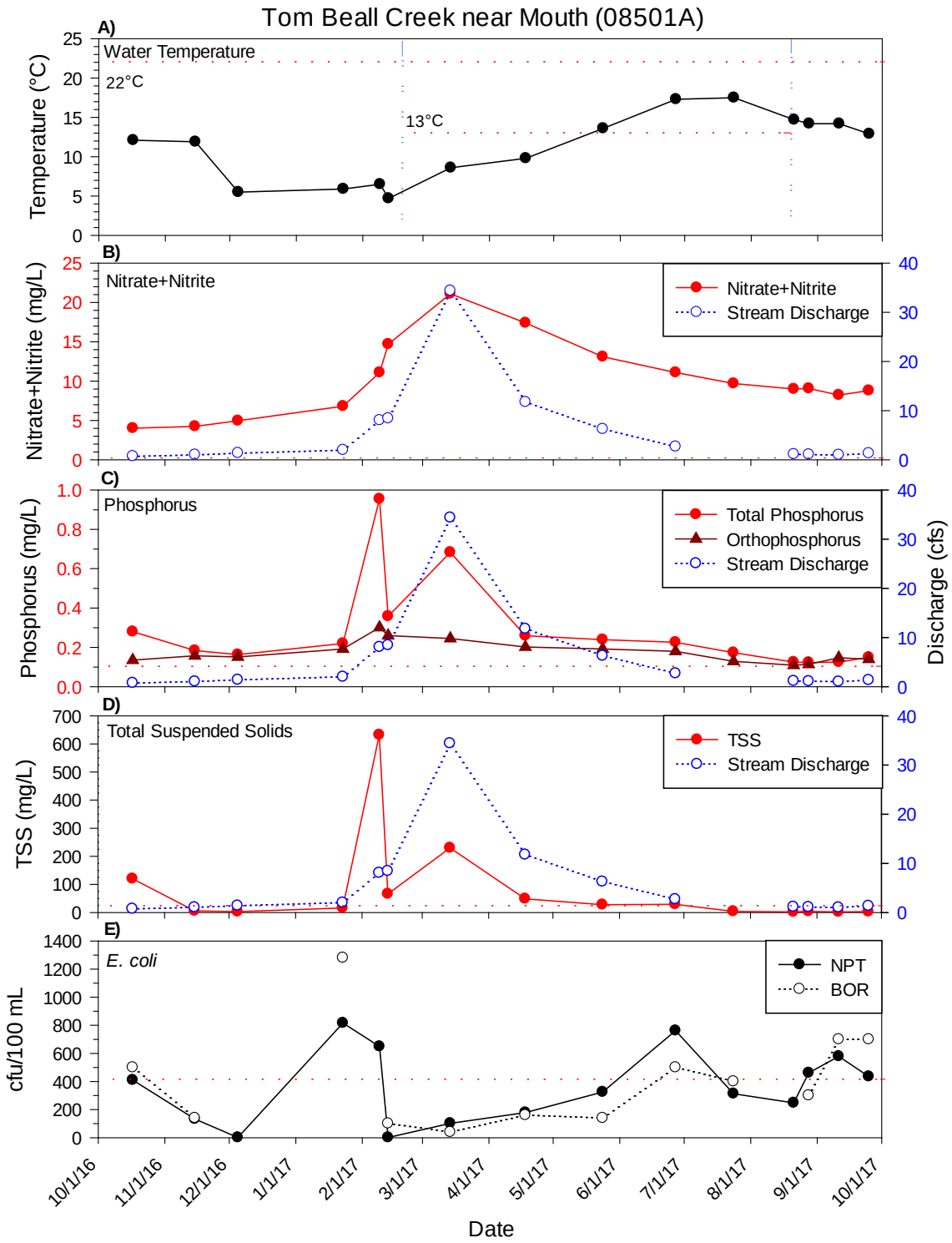

Figure 16. (A) Instantaneous water temperature, (B) flow and NO_3+NO_2, (C) flow, total phosphorus, and orthophosphorus, (D) total suspended sediment and flow, and (E) *E. coli* data collected near the mouth of Tom Beall Creek, 2016-2017. The red dashed lines indicate the associated water quality criteria: Temperature - 13°C for SS and 22°C for CWAL; NO_3+NO_2 - 0.3 mg/L; total phosphorus - 0.1 mg/L; TSS – 25mg/L; and *E. coli* – 406 cfu/100mL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

Table 17. Continuous temperature exceedances for Tom Beall Creek at the mouth (08501A) from April – November, 2017.

Criteria	Daily Min	Daily Max	Daily Average
SS	**13°**	**13°**	**9°**
# Exceedance	64	110	133
Days Monitored	144	144	144
% Exceedance	44.4%	76.4%	92.4%
CWAL	**22°**	**22°**	**19°**
# Exceedance	0	0	0
Days Monitored	206	206	206
% Exceedance	0.0%	0.0%	0.0%

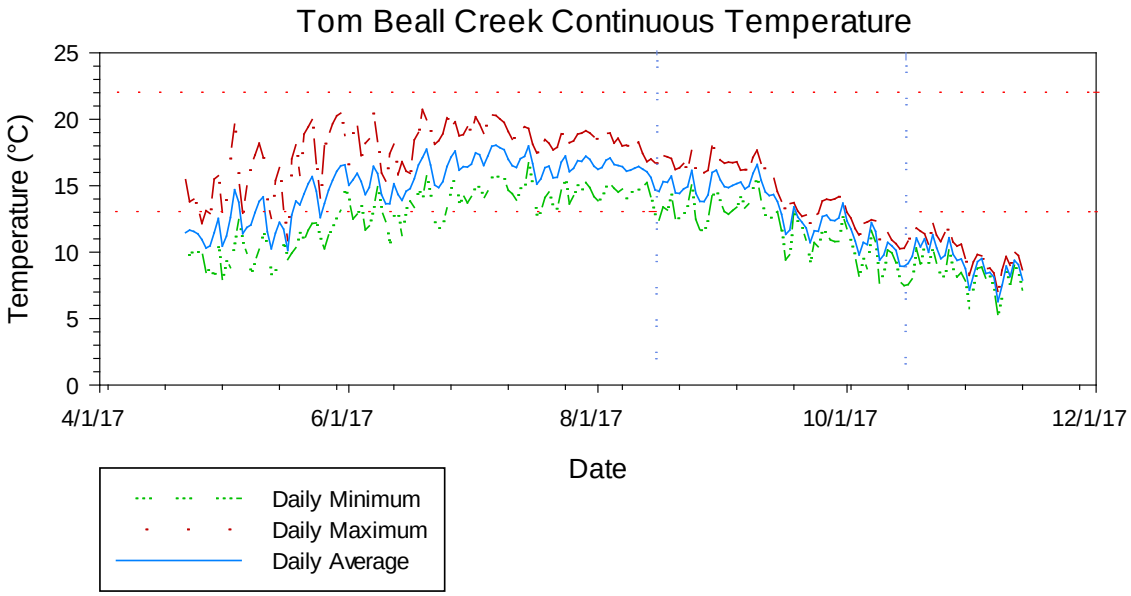

Figure 17. Continuous water temperature data collected near the mouth of Tom Beall Creek, 2016-2017. The red dashed lines indicate the associated daily maximum temperature criteria - 13°C for SS and 22°C for CWAL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

Lapwai Creek Mainstem

The sampled mainstem reach of Lapwai Creek originates at Winchester Lake in Winchester, ID and flows 25 miles predominantly northwest to its confluence with the Clearwater River near the town of Myrtle. Seven monitoring sites were established on the mainstem of Lapwai Creek: Lapwai Creek below Winchester Dam (03825A), Lapwai Creek on the Winchester Grade (03821A), Lapwai Creek upstream of the Culdesac WWTP (03814A), Lapwai Creek downstream of the Culdesac WWTP (03812A), Lapwai Creek at Garden Gulch Road (03805A), Lapwai Creek at the USGS Station (03802A), and Lapwai Creek near the Mouth (03801A). Continuous temperature was monitored at all sites. One temperature logger, below the Winchester Dam (03825A), was found out of the water during collection so that data was not analyzed. Table 18 presents descriptive statistics for instantaneous data collected from the seven mainstem Lapwai Creek monitoring stations.

Instantaneous water temperature exceeded the 13°C daily maximum SS criterion at all monitoring sites, with exceedance rates ranging from 12-21% (Table 18, Figures 18-19). Similarly, continuous temperature monitoring showed that all monitoring sites exceeded the 13°C daily maximum SS criterion. All monitoring sites also exceeded the 9°C maximum daily average SS criterion during at least half of the days monitored. A total of four monitoring sites exceeded the 22°C daily maximum and 19°C maximum daily average CWAL criteria; however, only Lapwai Creek at the mouth (03801A) exceeded the 22°C daily maximum criterion on more than 10% of days monitored. In addition, Lapwai Creek at the mouth (03801A) and Lapwai Creek at Garden Gulch Road (03805A) exceeded the 19°C maximum daily average CWAL criteria on at least 10% of days monitored (Table 19, Figure 20). Therefore, based on temperature, the entire mainstem of Lapwai Creek watershed is not fully supporting its SS designated beneficial use, and mainstem from the mouth to Mission Creek is not fully supporting its CWAL designated beneficial use.

Nitrate+nitrite concentrations exceeded the target criterion of 0.3 mg/L at all sites and on all but three monitoring events at the monitoring site downstream of Winchester Lake (03825A). Median concentrations ranged from 0.95 mg/L upstream of the Culdesac WWTP (03814A) to 2.08 mg/L at the USGS Station (03802A), and maximum detected concentrations were over 4 mg/L at all mainstem monitoring sites (Table 18, Figures 21-22). Most nitrates likely originated from surrounding crop land, both flowing into Winchester Lake, and directly from the fields via small tributaries.

All monitoring sites exceeded the 0.1 mg/L total phosphorus target criterion on at least 40% of sampling events. The highest concentration (1.5 mg/L) was recorded below the Winchester Dam, likely due to near-anoxic water discharging from the base of the dam or from Winchester's WWTP effluent which is dumped into the dam's spillway. Otherwise, median concentrations ranged from 0.09 mg/L to 0.15 mg/L throughout the remainder of the mainstem of Lapwai Creek (Table 18, Figure 23-24).

DO did not meet associated criteria below Winchester Lake (03825A) on most sampling events. Low DO was likely a result of near anoxic water release from the dam and/or from Winchester WWTP effluent. pH also fell below its 6.5 lower range criteria on two sampling events (12.5% exceedance) below the Winchester Dam (Table 18).

TSS also exceeded the 25 mg/L criterion at two monitoring sites: East Fork Sweetwater Creek (13.3% exceedance) and at the mouth of Sweetwater Creek (20% exceedance) (Table 18).

Data indicate that the mainstem of Lapwai Creek, as a whole, is not fully supporting its SS (temperature) or CWAL (nitrate+nitrite, total phosphorus) designated beneficial uses. In addition, the portion of Lapwai Creek from the mouth to the confluence of Mission Creek is not fully supporting its CWAL designated beneficial use (temperature). The portion below Winchester Lake is also not supporting its SS (% DO) or CWAL (DO (mg/L), pH) designated beneficial uses.

Recommended actions include excluding cattle from wetland and riparian habitat, buffering streams and wetlands in agricultural areas, increasing riparian vegetation, and increasing bank stability.

Table 18. Descriptive statistics from the seven mainstem Lapwai Creek monitoring stations, 2016-17.

Lapwai Creek Mainstem												
	Temp	**DO**	**DO**	**pH**	**Turbidity**	***E-coli* (BOR)**	***E-coli* (NPT)**	**NO_3+NO_2**	**OP**	**TP**	**TSS**	**Flow**
	(°C)	**(mg/L)**	**%**	**(H+)**	**(NTU)**	**(#/100mL)**	**(#/100mL)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(mg/L)**	**(cfs)**
Lapwai Creek Downstream Winchester Lake/WWTP outlet (03825A)												
max	15.6	10.4	78.5	7.5	34.3	896	1120	4.87	0.26	1.50	32.0	72.1
min	3.6	1.3	12.0	6.3	5.3	6	2	0.10	0.06	0.29	5.0	0.1
mean	10.0	4.2	36.4	6.9	13.5	136	177	1.48	0.16	0.65	12.3	5.6
median	10.8	3.6	29.4	6.8	11.9	24	25	0.96	0.19	0.54	11.0	0.7
#exceedance	2	14	16	2	0	1	2	13	12	16	1	
%exceedance	12.5%	87.5%	100.0%	12.5%	0.0%	9.1%	11.8%	81.3%	75.0%	100.0%	6.3%	
# samples	16	16	16	16	16	11	17	16	16	16	16	16
Lapwai Creek on Winchester Grade (03821A)												
max	18.4	12.6	100.2	8.3	50.5	500	613	3.68	0.21	0.34	33.0	7.0
min	1.3	8.8	89.6	7.3	3.0	< 2	< 1	0.58	0.09	0.11	2.0	0.4
mean	9.1	10.9	93.0	7.9	11.5	73	64	1.49	0.15	0.22	12.2	2.2
median	9.8	10.8	92.7	7.9	10.1	9	14	1.11	0.14	0.21	10.0	1.1
#exceedance	2	0	1	0	0	1	1	16	14	17	2	
%exceedance	11.8%	0.0%	5.9%	0.0%	0.0%	10.0%	5.3%	100.0%	87.5%	100.0%	11.8%	
# samples	17	17	17	17	17	10	19	16	16	17	17	14

Lapwai Creek Upstream of Culdesac WWTP (03814A)												
max	21.0	99.7	114.2	8.7	68.2	300	276	4.27	0.13	0.29	59.0	288.5
min	2.8	9.9	95.6	7.4	1.7	< 2	1	0.51	0.05	0.07	2.0	0.4
mean	12.0	17.2	104.5	8.2	8.9	91	65	1.38	0.09	0.12	8.1	26.6
median	11.4	10.9	103.9	8.3	2.8	80	32	0.95	0.09	0.12	4.0	2.7
#exceedance	3	0	0	0	1	0	0	14	6	9	1	
%exceedance	20.0%	0.0%	0.0%	0.0%	6.7%	0.0%	0.0%	100.0%	42.9%	64.3%	7.1%	
# samples	15	15	15	15	15	12	16	14	14	14	14	14
Lapwai Creek Downstream of Culdesac WWTP (03812A)												
max	19.3	13.9	119.9	8.5	73.2	500	201	4.55	0.19	0.31	66.0	50.9
min	3.9	9.4	95.5	7.3	1.3	2	< 1	0.66	0.09	0.12	2.0	0.6
mean	12.3	11.3	104.5	8.0	8.1	119	64	1.89	0.14	0.17	7.9	10.6
median	12.4	11.1	104.9	8.0	2.0	50	41	1.61	0.14	0.15	4.0	3.3
#exceedance	3	0	0	0	1	1	0	14	12	14	1	
%exceedance	20.0%	0.0%	0.0%	0.0%	6.7%	9.1%	0.0%	100.0%	85.7%	100.0%	7.1%	
# samples	15	15	15	15	15	11	15	14	14	14	14	14
Lapwai Creek at Garden Gulch Road (03805A)												
max	22.4	13.9	108.1	8.5	170.0	400	172	4.89	0.12	0.33	85.0	184.0
min	4.5	9.4	93.9	7.4	1.3	< 20	19	0.48	0.06	0.07	2.0	12.3
mean	13.3	10.8	101.9	8.1	16.9	126	66	2.33	0.08	0.11	12.0	56.6
median	14.6	10.2	103.3	8.1	4.3	100	64	2.02	0.07	0.09	7.0	22.2
#exceedance	3	0	0	0	1	0	0	14	1	6	1	
%exceedance	20.0%	0.0%	0.0%	0.0%	6.7%	0.0%	0.0%	100.0%	7.1%	42.9%	7.1%	
# samples	15	15	15	15	15	14	17	14	14	14	14	12

Lapwai Creek at USGS Gaging Station (03802A)												
max	20.4	14.1	113.6	8.6	100.0	240	199	4.86	0.12	0.28	77.0	626.3
min	3.9	9.6	96.7	7.2	1.6	12	< 1	0.48	0.06	0.08	3.0	11.9
mean	11.5	11.4	103.1	8.0	19.4	94	75	2.40	0.08	0.11	12.3	140.3
median	11.6	11.0	102.6	8.1	5.1	80	74	2.08	0.07	0.09	7.0	27.8
#exceedance	3	0	0	0	3	0	0	15	2	7	1	
%exceedance	17.6%	0.0%	0.0%	0.0%	16.7%	0.0%	0.0%	100.0%	13.3%	46.7%	6.7%	
# samples	17	17	17	17	18	13	15	15	15	15	15	16
Lapwai Creek at Mouth (03801A)												
max	19.3	14.0	117.9	8.4	57.4	360	326	4.89	0.12	0.33	85.0	184.0
min	3.4	10.4	98.1	7.3	1.4	20	< 1	0.48	0.06	0.07	2.0	12.3
mean	11.8	11.6	106.4	8.0	9.3	130	82	2.33	0.08	0.11	12.0	56.6
median	12.7	11.1	106.4	8.1	3.7	100	53	2.02	0.07	0.09	7.0	22.2
#exceedance	3	0	0	0	1	0	0	14	1	6	1	
%exceedance	21.4%	0.0%	0.0%	0.0%	7.1%	0.0%	0.0%	100.0%	7.1%	42.9%	7.1%	
# samples	14	14	14	14	14	13	14	14	14	14	14	12

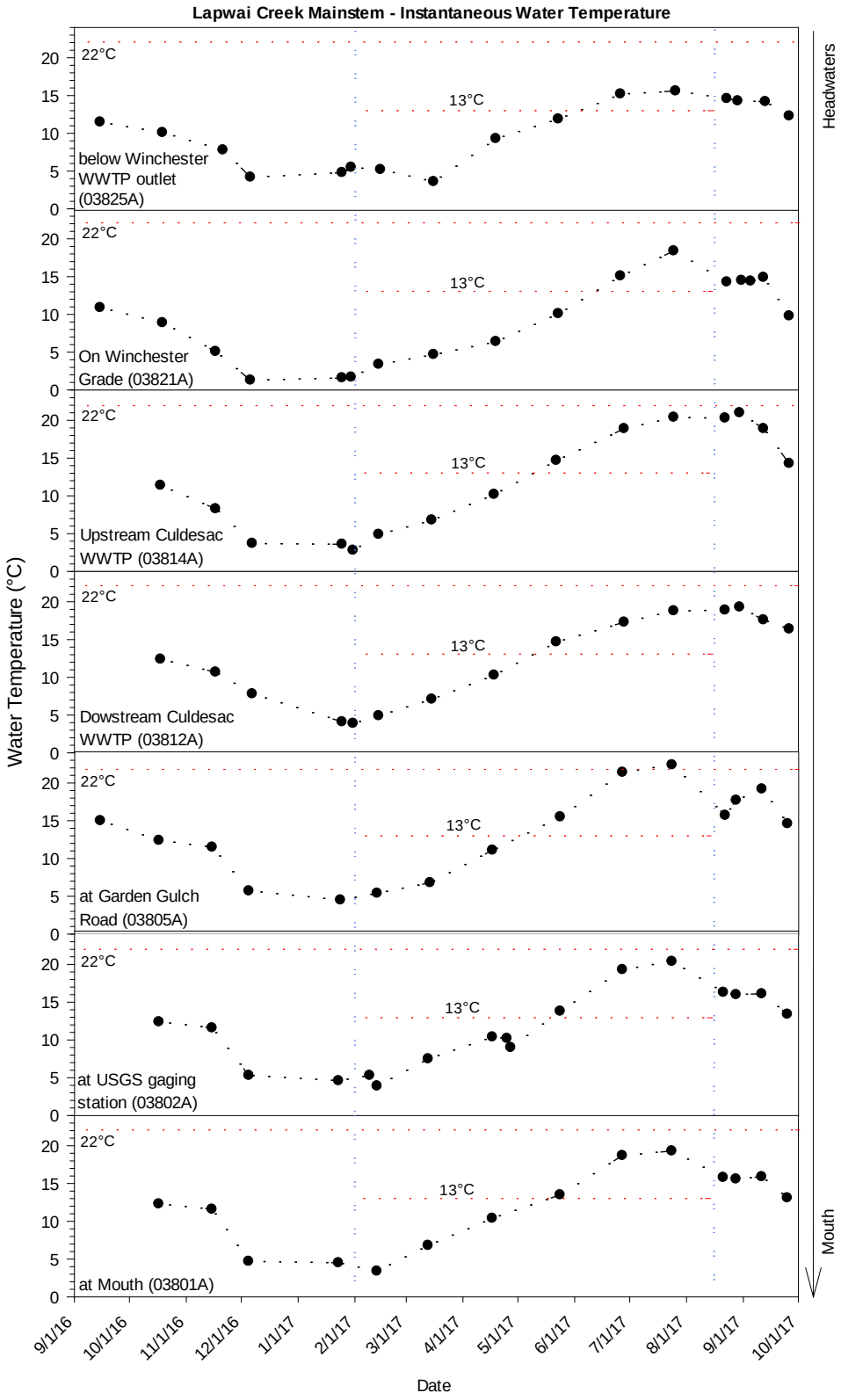

Figure 18. Instantaneous water temperature data collected at seven monitoring sites on the mainstem of Lapwai Creek, 2016-2017. Monitoring locations are displayed from the headwaters (top) to the mouth (bottom). The red

dashed lines indicate the associated daily maximum temperature criteria - 13°C for SS and 22°C for CWAL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14).

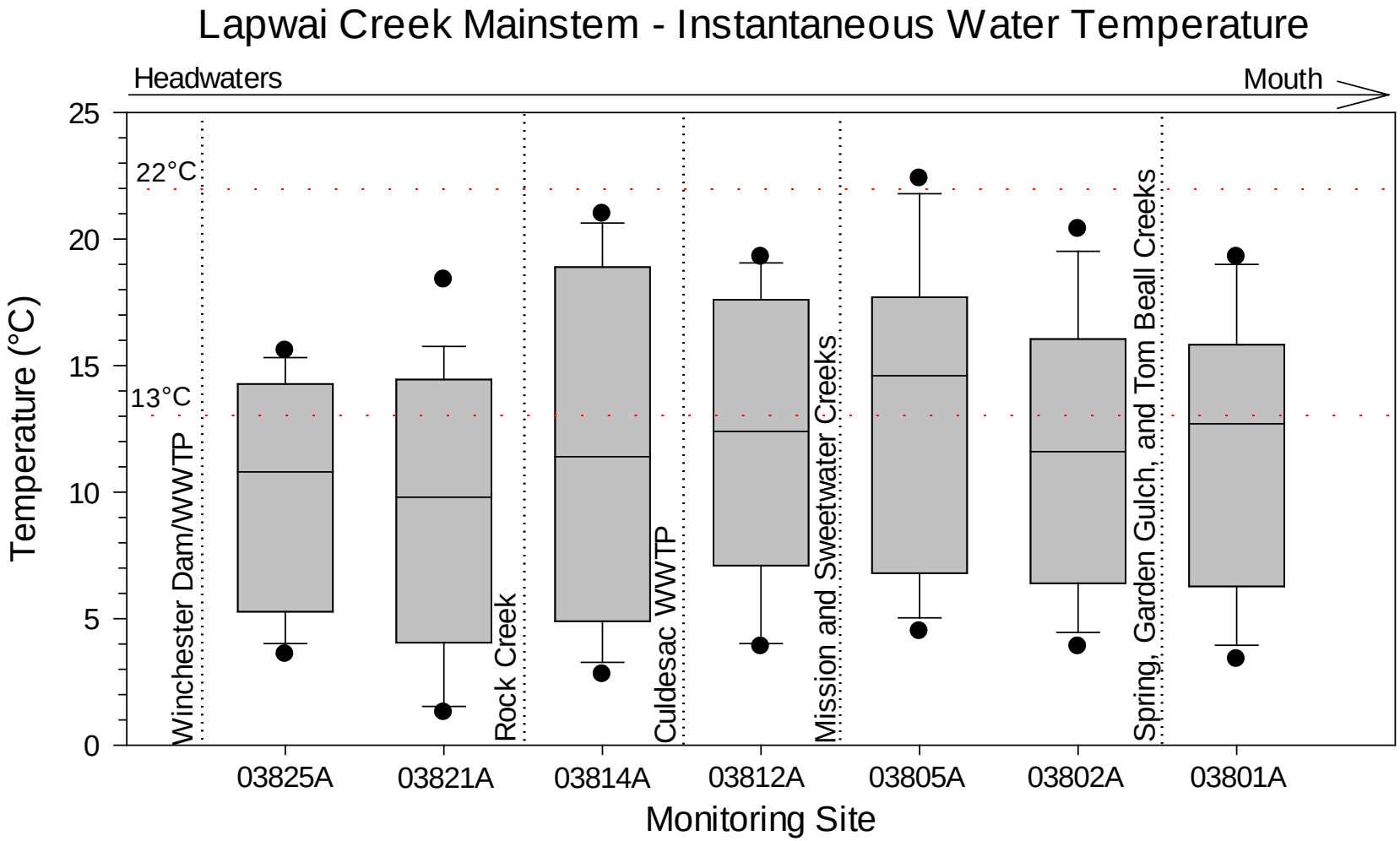

Figure 19. Instantaneous temperature data collected at seven monitoring sites on the mainstem of Lapwai Creek, 2016-2017. Monitoring locations are displayed from the headwaters (left) to the mouth (right). The red dashed lines indicate the associated daily maximum temperature criteria - 13°C for SS and 22°C for CWAL.

Table 19. Continuous temperature exceedances from six monitoring sites on the mainstem of Lapwai Creek from 2016-2017. The continuous temperature logger located at the monitoring site below Winchester dam/WWTP outlet (03825A) was not submerged in the water when collected, so data was not included in this analysis.

Mainstem Lapwai Creek Continuous Temperature Data Summary	Criteria	Salmonid Spawning and Incubation			Cold Water Aquatic Life		
		Daily Min	Daily Max	Daily Average	Daily Min	Daily Max	Daily Average
		13°	13°	9°	22°	22°	19°
	on the Winchester Grade (03821A)						
	# Exceedance	45	80	90	0	0	0
	Days Monitored	144	144	144	206	206	206
	% Exceedance	31.25%	55.56%	62.50%	0.00%	0.00%	0.00%
	Upstream of the Culdesac WWTP (03814A)						
	# Exceedance	60	89	120	0	9	3
	Days Monitored	144	144	144	206	206	206
	% Exceedance	41.67%	61.81%	83.33%	0.00%	4.37%	1.46%
	Downstream of the Culdesac WWTP (03812A)						
	# Exceedance	59	106	137	0	0	0
	Days Monitored	144	144	144	206	206	206
	% Exceedance	40.97%	73.61%	95.14%	0.00%	0.00%	0.00%
	at Garden Gulch Road (03805A)						
	# Exceedance	72	94	114	0	17	20
	Days Monitored	131	131	131	193	193	193
	% Exceedance	54.96%	71.76%	87.02%	0.00%	8.81%	10.36%
	at the USGS gaging station (03802A)						
	# Exceedance	57	81	123	0	20	21
	Days Monitored	247	247	247	308	308	308
	% Exceedance	23.08%	32.79%	49.80%	0.00%	6.49%	6.82%
	at the Mouth (03801A)						
	# Exceedance	75	99	134	0	44	42
	Days Monitored	144	144	144	206	206	206
	% Exceedance	52.08%	68.75%	93.06%	0.00%	21.36%	20.39%

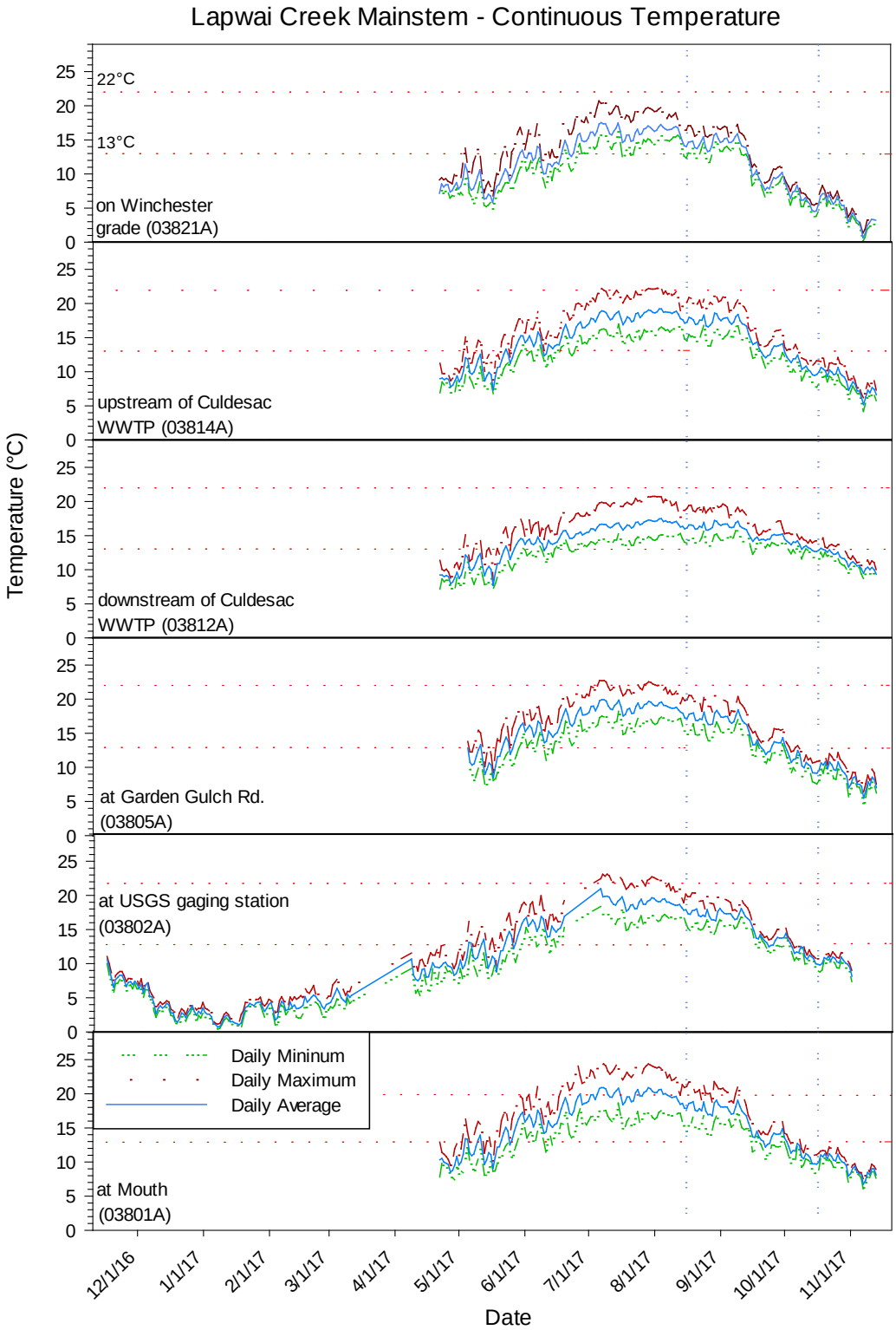

Figure 20. Continuous water temperature data collected at seven monitoring sites on the mainstem of Lapwai Creek, 2016-2017. Monitoring locations are displayed from the headwaters (top) to the mouth (bottom). The red dashed lines indicate the associated daily maximum temperature criteria - 13°C for SS and 22°C for CWAL. The blue dashed lines indicate the salmonid spawning and incubation period (October 15 – August 14). The continuous temperature logger located at the monitoring site below Winchester dam/WWTP outlet (03825A) was not submerged in the water when collected, so data was not included in this analysis.

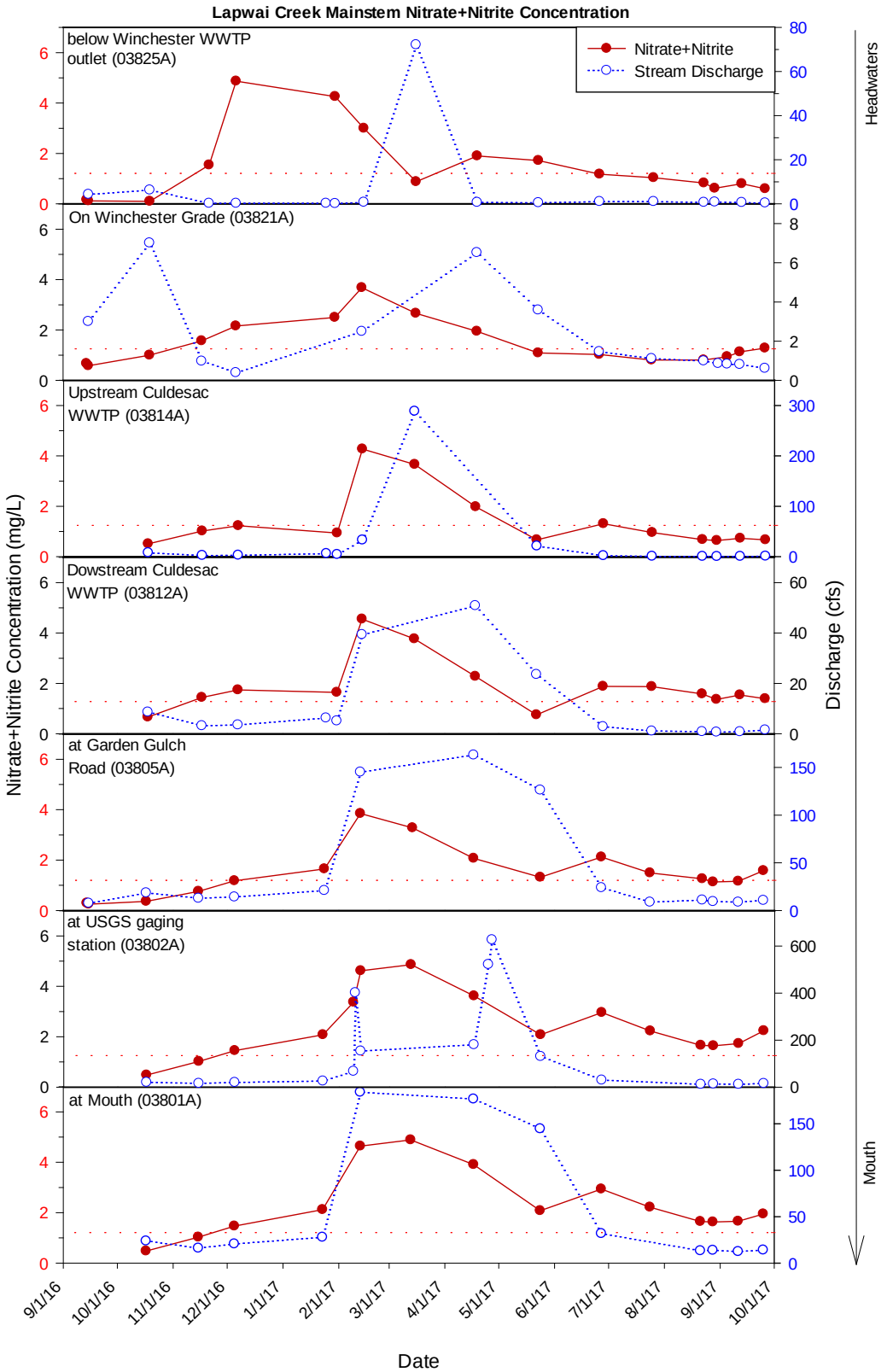

Figure 21. Nitrate+nitrite and stream flow data collected at seven monitoring sites on the mainstem of Lapwai Creek, 2016-2017. Monitoring locations are displayed from the headwaters (top) to the mouth (bottom). The red

dashed lines indicate the nitrate+nitrite water quality target criterion – 0.3 mg/L. Note: scales may vary between sites.

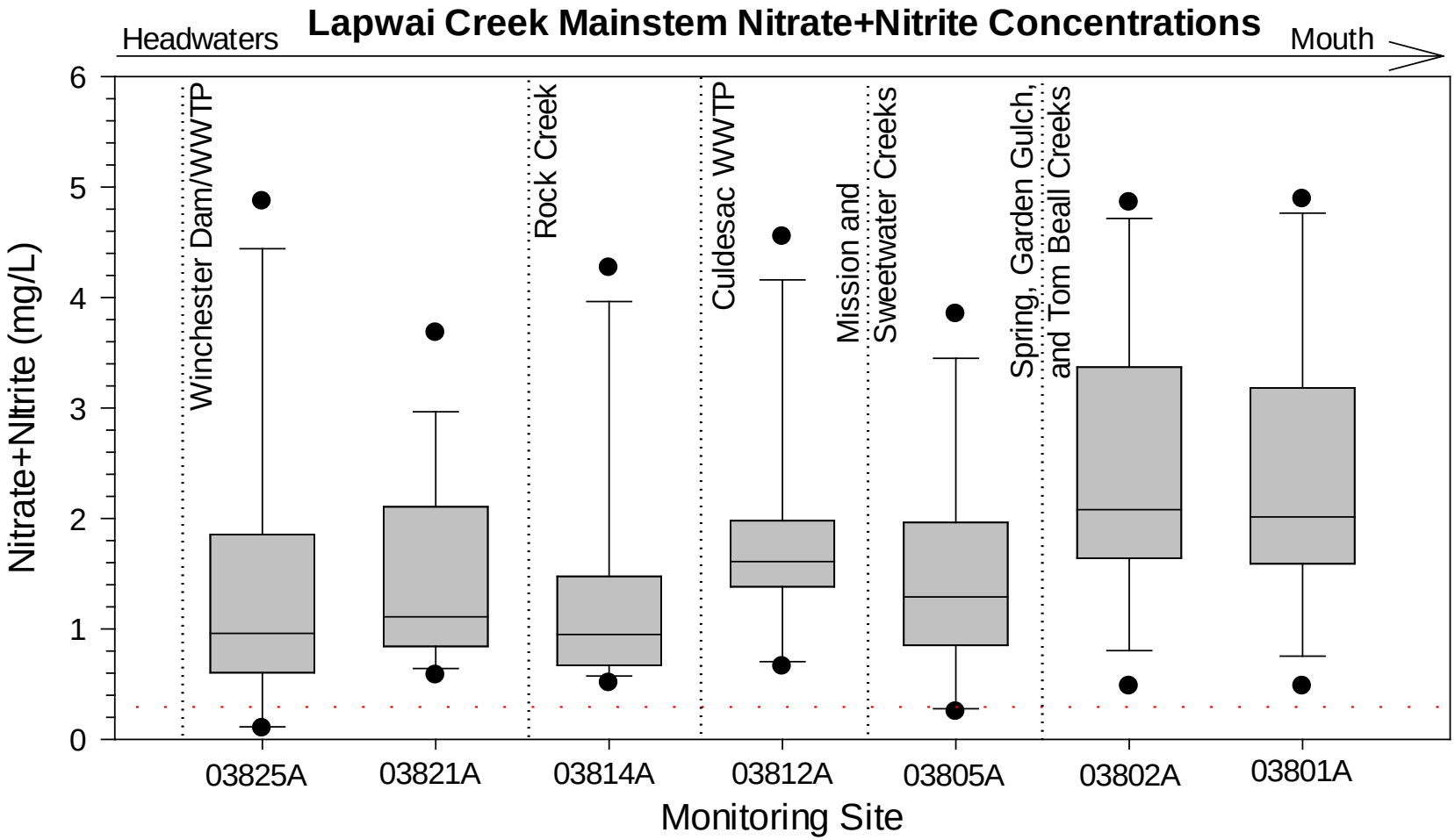

Figure 22. Nitrate+nitrite data collected at seven monitoring sites on the mainstem of Lapwai Creek, 2016-2017. Monitoring locations are displayed from the headwaters (left) to the mouth (right). The red dashed line indicate the total phosphorus water quality target criterion – 0.1 mg/L.

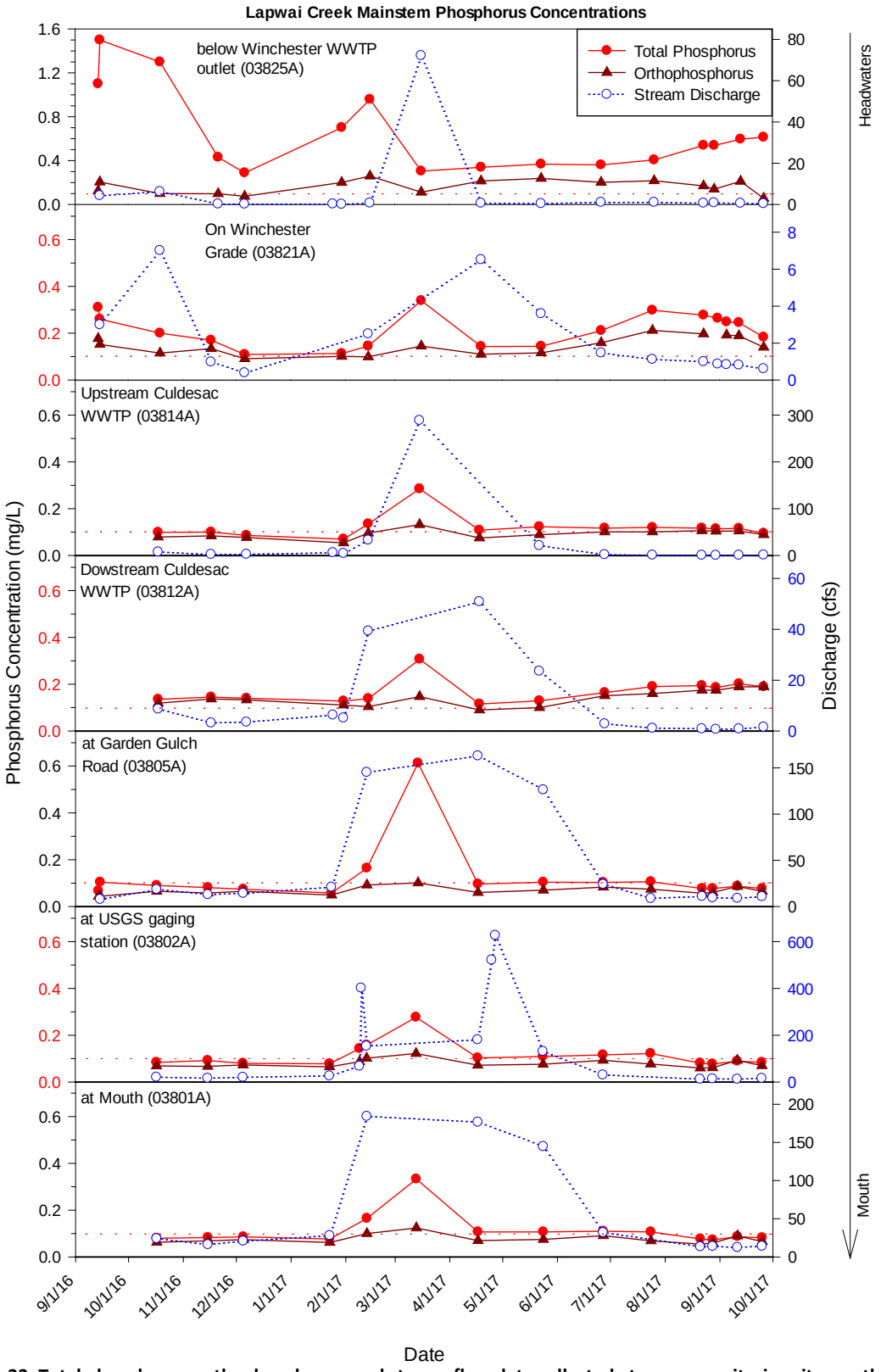

Figure 23. Total phosphorus, orthophosphorus, and stream flow data collected at seven monitoring sites on the mainstem of Lapwai Creek, 2016-2017. Monitoring locations are displayed from the headwaters (top) to the mouth

(bottom). The red dashed lines indicate the total phosphorus water quality target criterion – 0.1 mg/L. Note: scales may vary between sites.

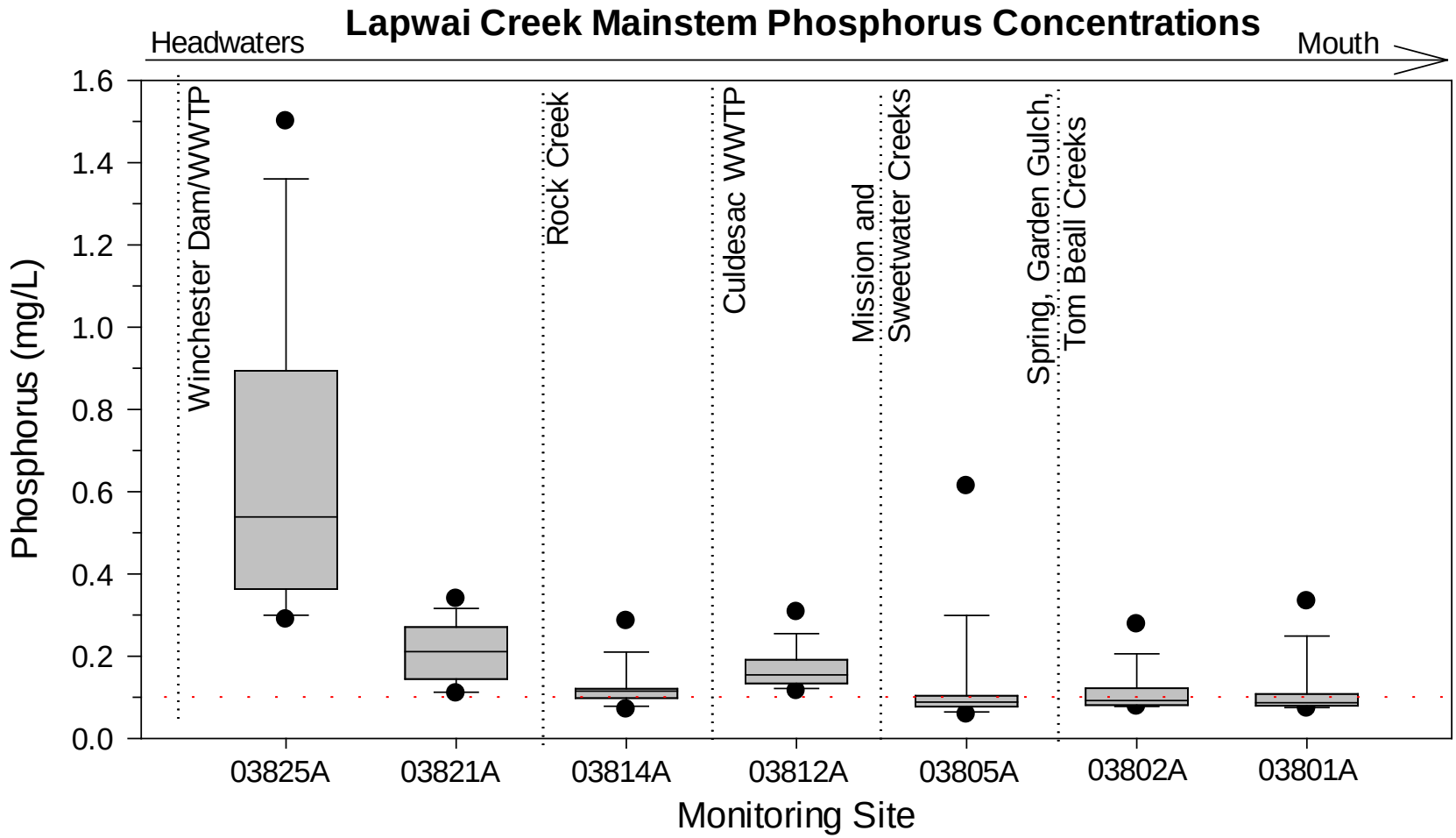

Figure 24. Total phosphorus data collected at seven monitoring sites on the mainstem of Lapwai Creek, 2016-2017. Monitoring locations are displayed from the headwaters (left) to the mouth (right). The red dashed line indicate the total phosphorus water quality target criterion – 0.1 mg/L.

Designated Beneficial Use Support Status

Designated beneficial use support status determinations for the Lapwai Creek watershed and tributaries have been developed based on the water quality data collected during this study. Table 20 lists the assessment units and their designated beneficial use status and Figure 25 displays the monitored assessment units. For PCR, five samples taken within 30 days must exceed the target criterion. In this study, bacteria samples were taken only once per month; therefore, support determination could not be assigned for PCR designated use.

Table 20. Designated beneficial use support status for assessed waterbodies.

Assessment Unit	Waterbody Name	Assessment Waters	Designated Beneficial Uses	Use Support Decision	Parameter
R-1	Rock Creek	Source to mouth	Salmonid Spawning	Not Fully Supporting	Temperature
			Cold Water Aquatic Life	Not Fully Supporting	Nitrate+nitrite, total phosphorus
			Primary Contact Recreation	N/A	N/A
M-1	Mission Creek	Mission Creek Quarry (6.7 miles upstream) to mouth	Salmonid Spawning	Not Fully Supporting	Temperature
			Cold Water Aquatic Life	Not Fully Supporting	Nitrate+nitrite, total phosphorus
			Primary Contact Recreation	N/A	N/A
M-2	Mission Creek	Top of canyon (13.6 miles upstream) to Mission Creek Quarry (6.7 miles upstream)	Salmonid Spawning	Not Fully Supporting	Temperature
			Cold Water Aquatic Life	Not Fully Supporting	Total phosphorus
			Primary Contact Recreation	N/A	N/A
M-3	Mission Creek	Source to top of the canyon (13.6 miles upstream)	Salmonid Spawning	Not Fully Supporting	Temperature, % DO
			Cold Water Aquatic Life	Not Fully Supporting	pH, nitrate+nitrite, total phosphorus
			Primary Contact Recreation	N/A	N/A
SW-1	Sweetwater Creek	Westfork Sweetwater Creek to mouth	Salmonid Spawning	Not Fully Supporting	Temperature
			Cold Water Aquatic Life	Not Fully Supporting	Nitrate+nitrite, total phosphorus, TSS
			Primary Contact Recreation	N/A	N/A

Assessment Unit	Waterbody Name	Assessment Waters	Designated Beneficial Uses	Use Support Decision	Parameter
SW-2	West Fork Sweetwater Creek	Source to mouth	Salmonid Spawning	Not Fully Supporting	Temperature, % DO
			Cold Water Aquatic Life	Not Fully Supporting	Total phosphorus
			Primary Contact Recreation	N/A	N/A
SW-3	East Fork Sweetwater Creek	Source to mouth	Salmonid Spawning	Not Fully Supporting	Temperature
			Cold Water Aquatic Life	Not Fully Supporting	Nitrate+nitrite, total phosphorus, TSS
			Primary Contact Recreation	N/A	N/A
SW-4	Webb Creek	Mid-watershed (approximately 6.9 miles upstream) to mouth	Salmonid Spawning	Not Fully Supporting	Temperature
			Cold Water Aquatic Life	Not Fully Supporting	Nitrate+nitrite, total phosphorus
			Primary Contact Recreation	N/A	N/A
SW-5	Webb Creek	Top of canyon (10.5 miles upstream) to Mid-watershed (approximately 6.9 miles upstream)	Salmonid Spawning	Not Fully Supporting	Temperature
			Cold Water Aquatic Life	Not Fully Supporting	Total phosphorus
			Primary Contact Recreation	N/A	N/A
SW-6	Webb Creek	Soldiers Meadow Reservoir to top of canyon (10.5 miles upstream)	Salmonid Spawning	Not Fully Supporting	Temperature, % DO
			Cold Water Aquatic Life	Not Fully Supporting	Total phosphorus
			Primary Contact Recreation	N/A	N/A
SC-1	Spring Creek	Source to mouth	Salmonid Spawning	Not Fully Supporting	Temperature, % DO
			Cold Water Aquatic Life	Not Fully Supporting	Nitrate+nitrite, total phosphorus
			Primary Contact Recreation	N/A	N/A
GG-1	Garden Gulch Creek	Source to mouth	Salmonid Spawning	Not Fully Supporting	Temperature, % DO
			Cold Water Aquatic Life	Not Fully Supporting	Temperature, nitrate+nitrite, total phosphorus, sediment
			Primary Contact Recreation	N/A	N/A

Assessment Unit	Waterbody Name	Assessment Waters	Designated Beneficial Uses	Use Support Decision	Parameter
TB-1	Tom Beall Creek	Source to mouth	Salmonid Spawning	Not Fully Supporting	Temperature
			Cold Water Aquatic Life	Not Fully Supporting	Nitrate+nitrite, total phosphorus, sediment
			Primary Contact Recreation	N/A	N/A
LC-1	Lapwai Creek	Mission Creek to mouth	Salmonid Spawning	Not Fully Supporting	Temperature
			Cold Water Aquatic Life	Not Fully Supporting	Temperature, nitrate+nitrite, total phosphorus
			Primary Contact Recreation	N/A	N/A
LC-2	Lapwai Creek Mainstem	First Highway 95 crossing to Mission Creek	Salmonid Spawning	Not Fully Supporting	Temperature
			Cold Water Aquatic Life	Not Fully Supporting	Nitrate+nitrite, total phosphorus
			Primary Contact Recreation	N/A	N/A
LC-3	Lapwai Creek	Winchester Lake to first Highway 95 crossing	Salmonid Spawning	Not Fully Supporting	Temperature, % DO
			Cold Water Aquatic Life	Not Fully Supporting	DO, pH, nitrate+nitrite, total phosphorus
			Primary Contact Recreation	N/A	N/A

DO - dissolved oxygen; TSS - total suspended solids.

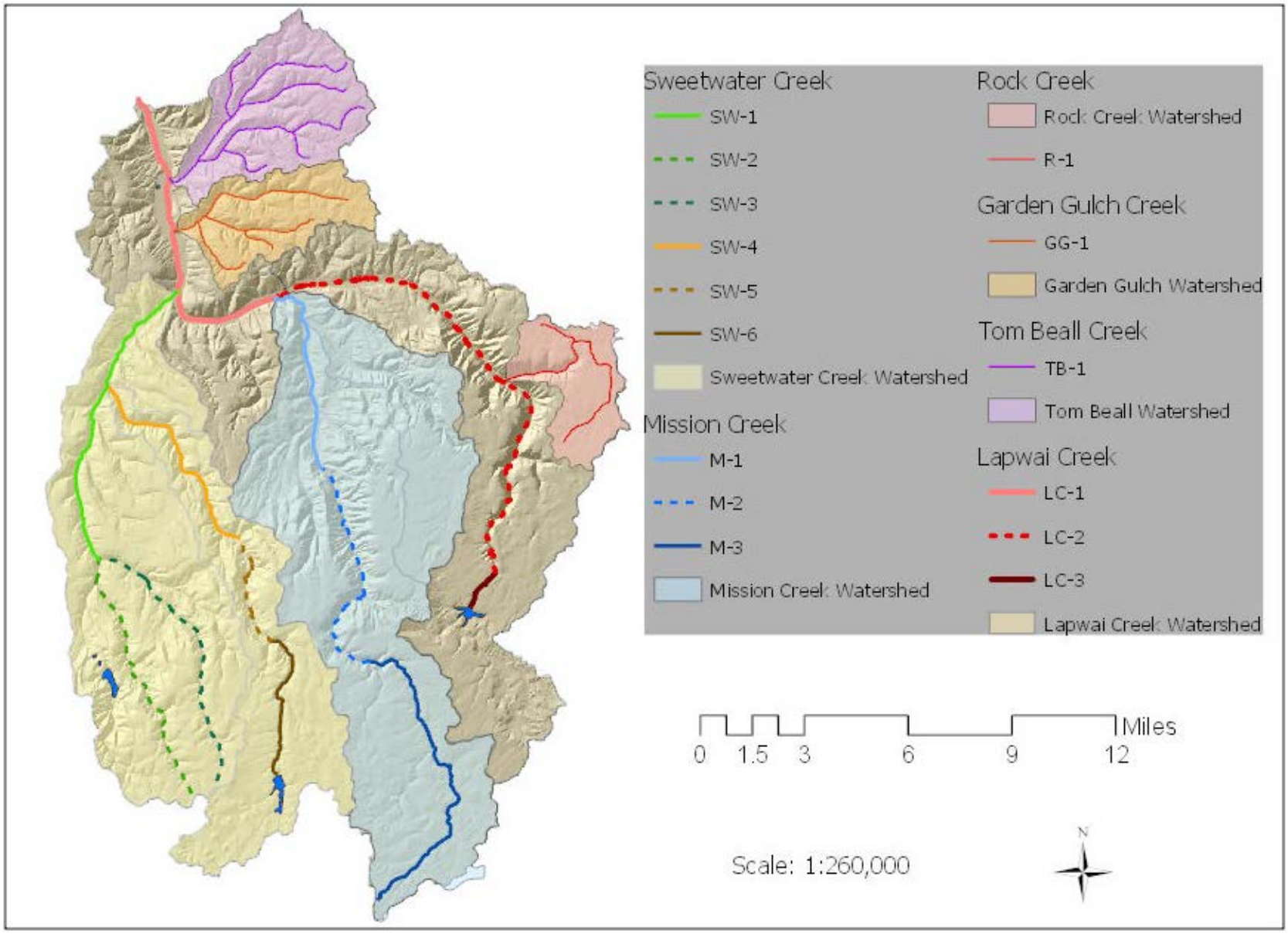

Figure 25. Lapwai Creek assessment units by subwatershed.

Conclusions

The water quality assessment of the mainstem and tributaries of Lapwai Creek was successfully carried out as planned. Protocols were followed, QA/QC standards were met, and specific information per parameter for each subwatershed was collected. High stream temperatures and nutrient concentrations were the primary pollutants documented throughout the Lapwai Creek watershed during this study.

Aquatic organisms from microbes to fish are dependent on certain temperature ranges for their optimal health. Aquatic insects are sensitive to temperature and will move in a stream in order to find their optimal temperature. Because of this, cold water aquatic life is a designated beneficial use for Lapwai Creek and its tributaries, and the associated temperature requirements are 22°C daily maximum and 19°C maximum daily average. The lower portion of Lapwai Creek (assessment unit LC-1) and the entire Mission Creek watershed exceeded these temperature requirements, indicating that these segments are not fully supporting the cold water aquatic life designated beneficial use.

Temperature is also critical for fish spawning and embryo development. If stream temperatures are outside of optimal levels for prolonged periods of time, organisms become stressed and may die or be unable to reproduce. Salmonid spawning and incubation is also a designated beneficial use for Lapwai Creek and its tributaries, and requires relatively stringent associated temperatures of 13°C daily maximum and 9°C maximum daily average. All monitoring sites in the Lapwai Creek watershed exceeded the salmonid spawning and incubation temperature criteria for the majority of the salmonid spawning and incubation period.

Nitrate+nitrite concentrations exceeded the 0.3 mg/L criterion at the majority of monitoring sites in the Lapwai Creek watershed. No exceedances were documented in three headwater monitoring sites: West Fork Sweetwater Creek (10905A), Webb Creek below Soldiers Meadow Reservoir (08814A), and Mission Creek at McCormack Ridge Road. Concentrations at the remaining 15 monitoring sites exceeded the target criterion on nearly all monitoring events, and two creeks (Tom Beall (08501A) and Garden Gulch (02701A)) exceeded the state of Idaho's drinking water standard of 10 mg/L on six and three sampling events with maximum concentrations of 21.1 and 18.3 mg/L, respectively. Throughout the Lapwai Creek watershed, the highest nitrate+nitrite concentrations were documented during spring runoff suggesting high levels of nutrient runoff from surrounding land uses, particularly cultivated agriculture.

High total phosphorus concentrations are also a persistent issue throughout the Lapwai Creek watershed. Every monitoring site exceeded the 0.1 mg/L target criterion during the monitoring period, with a minimum exceedance rate of 20%. The highest median concentration was from Lapwai Creek below the Winchester Dam (03825A), and is likely the combined result of near anoxic conditions at the dam's outlet and potentially high

concentrations from the Winchester WWTP effluent, which discharges onto the Winchester dam spillway. Extremely high concentrations of total phosphorus were also detected on Tom Beall (08501A) and Garden Gulch (02701A) Creeks, likely originating from poorly managed cropland. Little to no riparian buffer exists in both watersheds, allowing for high levels of fertilizer and/or pesticide runoff from the agricultural fields. Furthermore, orthophosphorus, or dissolved phosphorus, was a major contributor to total phosphorus loads in all sites, further suggesting that the majority of total phosphorus is originating from nearby agriculture fields, rather than a result of erosion and sediment input.

Percent dissolved oxygen dropped below the 90% saturation required for salmonid spawning and incubation in several sites, including Mission Creek at McCormack Ridge Road (005315A), West Fork Sweetwater Creek (10905A), Webb Creek below Soldiers Meadow Reservoir (08814A), Spring Creek (Nez 931), Garden Gulch Creek (02701A), and Lapwai Creek below Winchester Dam (03825A). Dissolved oxygen (mg/L) also dropped well below the 8 mg/L CWAL criterion at Lapwai below Winchester Dam (03825A) on all but two sampling events.

Escherichia coli (*E. coli)* is a type of fecal coliform bacteria commonly found in the intestines of animals and humans. The presence of *E. coli* in water is a strong indication of recent sewage or animal waste contamination. *E. coli* exceedances were documented at multiple monitoring sites throughout the Lapwai Creek watershed, including Mission Creek at McCormack Ridge Road (05315A), East Fork Sweetwater Creek (10802A), Sweetwater Creek at the mouth (08101A), Tom Beall Creek (08501A), and Garden Gulch Creek (02701A). Most of these monitoring sites were located within or downstream of heavily grazed areas that allow cattle direct access to the creeks and offer limited off-site water availability. While a PCR beneficial use designation cannot be determined from this study, recreation resulting in ingestion of water is not recommended in the above mentioned monitoring locations.

Total suspended solids (TSS) include both sediment and organic material suspended in water. TSS can cause problems for fish by clogging gills and for aquatic plants by limiting growth because of reduced light penetration. In addition, TSS provides a medium for the accumulation and transport of other constituents such as nitrogen, phosphorus, and bacteria. TSS exceedances were documented at the same monitoring sites in which *E. coli* exceedances occurred, including Mission Creek at McCormack Ridge Road (05315A), East Fork Sweetwater Creek (10802A), Sweetwater Creek at the mouth (08101A), Tom Beall Creek (08501A), and Garden Gulch Creek (02701A). This suggests that heavily grazed portions of the watershed in which cattle have direct access to the streams is the primary source of TSS pollution.

Recommendations

Stream temperature and total phosphorus are major problems throughout the entire Lapwai Creek watershed. In addition, concentrations of nitrate+nitrite, TSS, and *E. coli* and turbidity exceeded associated criteria in portions of the watershed. Every stream monitored in this study is water quality limited and will benefit from strategic implementation of BMPs to reduce nutrient, sediment, bacterial, and thermal loading.

All monitored pollutants likely originated from overuse of pesticides and fertilizers on poorly managed cultivated agriculture, as well as allowed cattle access to the creeks throughout the watershed. The loss of streamside vegetation, as a result of dryland agriculture and grazing, can lead to increased water temperature resulting from increased surface exposure to radiant heat. A properly functioning riparian zone acts as a buffer for the stream. Removal of these buffers can result in faster delivery of runoff to streams and decreased filtration of pollutants, resulting in increased sediment and nutrient loads (Richardson, Rasmussen, & Chandler, Lapwai Creek Watersehd Ecological Restoration Strategy, 2009). Livestock grazing has altered or eradicated most native vegetation on the rangeland area previously browsed by wildlife (Platts, 1991), especially within riparian areas. Erosion and soil compaction increase in areas where heavy grazing is occurring, affecting both terrestrial and aquatic productivity, promoting weed infestations, and reducing groundwater recharge leading to a decrease in summer base flows. Increases in nutrient loads and *E. coli* concentrations are also common effects of the presence of cattle in riparian areas or streambeds and cropland agriculture (Richardson, Rasmussen, & Chandler, Lapwai Creek Watersehd Ecological Restoration Strategy, 2009).

Therefore, recommended actions throughout the Lapwai Creek watershed include excluding cattle from wetland and riparian habitat, buffering streams and wetlands (particularly in agricultural areas), increasing riparian vegetation, increasing bank stability, allowing floodplain access where feasible, and implementing a nutrient management plan.

Continued implementation of targeted stream restoration efforts to reduce nutrients and temperatures will also be important. Based on stream inventory and prioritization efforts, stakeholders (NPT, Natural Resources Conservation Service (NRCS), Soil Conservation Commission (SCC), Idaho Department of Environmental Quality (IDEQ), Soil and Water Conservation Districts (SWCDs), and private land owners) should fund, devise, and construct high quality stream improvements designed to promote water quality enhancement, as well as continued program development used to educate local farmers on the importance of proper riparian buffers, cattle exclusion, pesticide and fertilizer application, and other proper land management practices.

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Appendix A: Raw Data

Tributaries

Table 21. Raw data for Rock Creek on the Winchester Grade (06601A).

06601A: Rock Creek on the Winchester Grade															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/19/2016	10:30	10.9	228	87.3	9.7	7.4	2	9	12	0.24	0.08	0.09	< 0.01	2	0.2
11/17/2016	13:35	9.3	210	92.6	10.7	7.6	3	< 1	N/A	0.48	0.08	0.09	< 0.01	2	0.3
11/21/2016	9:40	N/A	N/A	N/A	N/A	N/A	N/A	3	4	N/A	N/A	N/A	N/A	N/A	N/A
12/7/2016	13:45	5.5	182	91.1	11.5	7.7	5	2	40	0.61	0.08	0.09	< 0.01	2	0.5
1/24/2017	14:45	3.6	121	92.0	12.2	7.7	18	4	<20	1.29	0.09	0.13	0.01	2	1.6
2/14/2017	13:20	3.2	143	95.3	12.8	7.5	26	118	N/A	5.23	0.13	0.18	< 0.01	4	9.6
3/16/2017	9:50	5.8	116	94.5	11.8	7.2	88	491	N/A	3.14	0.17	0.37	0.05	25	102.6
4/19/2017	9:50	7.6	146	94.8	11.3	7.5	26	126	100	0.41	0.10	0.17	0.01	9	6.4
5/22/2017	14:35	15.1	132	99.8	10.0	7.8	14	140	100	0.32	0.10	0.14	< 0.01	5	3.7
6/28/2017	14:30	16.4	186	97.2	9.5	7.3	4	69	60	0.35	0.10	0.12	0.02	2	0.2
7/25/2017	14:00	18.3	214	92.2	8.7	7.5	3	77	68	0.19	0.07	0.09	< 0.01	2	N/A
8/23/2017	9:30	13.5	216	90.4	9.4	6.9	2	260	156	0.10	0.06	0.07	< 0.01	2	N/A
8/30/2017	14:45	15.3	218	101.9	10.2	7.2	2	52	20	0.09	0.06	0.07	< 0.01	2	N/A
9/12/2017	14:50	14.2	222	92.3	9.4	7.1	2	435	N/A	0.08	0.07	0.16	< 0.01	1	N/A
9/26/2017	12:10	19.0	237	87.3	9.2	7.5	2	23	40	0.08	0.07	0.07	< 0.01	<1	N/A

Table 22. Raw data for Mission Creek at McCormack Ridge Road (05315A).

05315A: Mission Creek at McCormack Ridge Road															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/19/2016	14:20	9.1	102	97.2	11.2	7.7	24	214	124	< 0.01	0.03	0.09	< 0.01	8	0.3
11/21/2016	11:00	2.8	98	88.9	12.0	7.8	25	1553	1080	< 0.01	0.03	0.08	0.02	10	0.2
2/15/2017	10:50	1.1	76	80.1	11.6	8.1	57	91	< 100	0.14	0.10	0.30	0.02	36	7.2
3/16/2017	13:15	6.2	57	85.8	10.7	6.8	53	66	N/A	0.22	0.08	0.21	0.02	43	110.2
4/19/2017	14:00	9.0	73	97.8	11.3	7.3	20	37	60	0.02	0.04	0.09	< 0.01	9	24.5
5/23/2017	12:00	14.2	84	107.9	11.1	7.3	18	19	N/A	< 0.01	0.03	0.08	< 0.01	12	13.6
6/26/2017	12:10	22.2	100	97.8	8.5	7.5	21	548	500	0.02	0.04	0.11	0.02	16	1.0
7/26/2017	11:30	17.9	113	101.0	9.6	7.4	12	816	700	0.04	0.04	0.09	0.02	10	0.1
8/23/2017	12:00	16.6	127	87.6	8.5	7.2	13	> 2419.6	5400	0.08	0.03	0.13	0.01	16	0.0
8/31/2017	11:30	17.3	121	106.5	10.2	7.2	9	579	N/A	N/A	N/A	0.07	N/A	8	0.1
9/5/2017	11:50	15.4	122	95.9	9.6	7.2	6	411	N/A	< 0.01	0.03	0.07	< 0.01	4	0.0
9/13/2017	11:30	15.7	126	99.3	9.8	7.1	6	285	100	< 0.01	0.02	0.06	0.01	4	0.0
9/27/2017	9:30	7.9	108	79.0	9.4	6.9	9	186	N/A	0.01	0.02	0.05	< 0.01	5	0.1

Table 23. Raw data for Mission Creek near mouth (05301A).

05301A: Mission Creek near mouth															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/18/2016	13:10	12.2	285	98.6	10.6	7.8	1	18	100	0.74	0.06	0.08	< 0.01	2	3.1
11/17/2016	11:35	8.8	279	99.8	11.6	7.9	2	58	N/A	1.09	0.06	0.07	0.01	5	3.7
12/7/2016	11:30	5.2	288	100.1	12.7	7.9	1	50	120	1.57	0.06	0.07	0.01	3	3.7
1/24/2017	13:50	5.2	247	106.6	13.6	8.3	2	50	< 20	1.67	0.06	0.07	0.01	2	5.2
2/9/2017	12:40	5.8	206	98.6	12.3	8.0	10	579	N/A	2.94	0.07	0.11	0.01	7	22.3
2/14/2017	11:15	4.3	180	98.7	12.8	7.7	17	3	N/A	3.80	0.08	0.12	0.01	6	47.0
3/15/2017	10:30	6.6	110	96.3	11.8	7.3	94	185	140	2.39	0.10	0.36	0.02	138	433.7
4/18/2017	13:30	10.0	146	97.4	11.0	7.6	14	345	800	1.64	0.06	0.10	< 0.01	8	75.4
5/22/2017	12:15	14.9	159	107.5	10.9	7.9	12	387	100	1.29	0.06	0.10	< 0.01	8	57.7
6/28/2017	11:45	19.0	289	105.3	9.8	7.8	2	145	100	2.80	0.08	0.09	0.02	5	5.7
7/25/2017	11:45	21.5	322	113.3	10.0	7.9	2	65	72	1.95	0.08	0.10	0.02	4	0.9
8/22/2017	12:45	20.7	314	125.8	11.3	8.1	2	60	44	1.21	0.08	0.09	< 0.01	4	1.0
8/30/2017	12:10	20.9	315	122.2	10.9	8.0	2	62	200	0.95	0.07	0.09	0.02	4	0.9
9/12/2017	11:30	18.6	322	108.7	10.2	7.8	2	51	N/A	1.31	0.08	0.09	0.02	3	0.8
9/26/2017	10:10	14.1	329	99.9	10.3	7.7	2	31	60	2.12	0.07	0.08	0.01	2	1.9

Table 24. Raw data for Webb Creek below Soldiers Meadow Reservoir (08814A).

08814A: Webb Creek below Soldiers Meadow Reservoir															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/20/2016	11:40	9.2	55	86.5	10.0	7.3	8	20	N/A	0.10	0.02	0.06	0.10	4	3.9
11/21/2016	12:20	7.3	69	108.5	13.1	8.9	4	38	12	0.15	0.04	0.06	0.01	2	0.1
12/6/2016	13:00	2.2	75	89.7	12.3	8.3	4	2	2	0.15	0.03	0.05	0.02	3	0.2
3/20/2017	11:30	8.4	61	96.2	11.3	6.7	29	2	< 4	0.17	0.05	0.09	0.03	6	0.9
4/20/2017	13:40	6.5	50	86.9	10.7	6.8	21	1	N/A	0.06	0.04	0.09	0.02	4	11.6
5/23/2017	13:00	8.6	49	94.5	11.0	6.5	16	2	N/A	0.03	0.03	0.07	0.03	3	8.9
6/26/2017	13:20	9.7	54	89.6	10.2	6.3	17	< 1	4	0.06	0.05	0.11	0.07	3	6.3
7/26/2017	12:30	11.4	58	90.2	9.9	6.8	13	4	2	0.02	0.04	0.10	0.14	8	8.5
8/23/2017	12:50	17.0	61	81.4	7.9	6.7	8	11	10	0.03	0.05	0.11	0.25	6	5.5
8/29/2017	12:00	17.4	58	82.6	7.9	6.7	6	20	6	0.05	0.05	0.09	0.22	4	4.0
9/13/2017	12:35	16.8	61	87.6	8.5	6.6	8	< 1	< 2	0.06	0.06	0.14	0.51	5	4.2
9/26/2017	14:15	11.8	56	85.4	9.3	7.0	7	4	2	0.18	0.06	0.09	0.32	5	2.8

Table 25. Raw data for Webb Creek near the mouth (08801A).

08801A: Webb Creek near mouth															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/20/2016	9:45	8.8	147	97.8	11.4	7.7	4	7	N/A	0.68	0.03	0.05	0.01	6	2.2
11/17/2016	10:45	5.7	188	101.0	12.7	8.1	3	14	N/A	1.23	0.05	0.07	< 0.01	4	1.7
12/7/2016	10:40	1.3	214	99.5	14.0	8.1	3	4	< 2	1.64	0.05	0.07	0.01	5	1.4
1/24/2017	12:45	2.5	196	95.8	13.1	7.8	3	42	1280	6.82	0.19	0.22	0.01	16	1.7
2/9/2017	11:50	2.8	160	94.3	12.8	7.8	21	6	N/A	1.34	0.08	0.14	0.02	21	4.3
2/14/2017	10:30	2.6	121	97.0	13.2	7.7	30	80	N/A	0.92	0.08	0.15	0.01	6	12.6
3/14/2017	14:25	5.8	77	95.3	11.9	7.3	107	96	200	0.48	0.07	0.34	0.01	146	109.5
4/18/2017	11:41	8.5	105	95.3	11.2	7.6	15	9	< 20	0.74	0.05	0.09	< 0.01	6	29.8
5/22/2017	11:20	12.9	138	101.0	10.7	7.3	15	152	120	1.14	0.06	0.11	< 0.01	10	20.9
6/28/2017	10:45	16.0	166	99.9	9.9	7.6	12	248	240	1.60	0.06	0.09	0.02	14	7.4
7/25/2017	10:50	17.0	179	96.7	9.4	7.5	9	122	200	2.14	0.06	0.09	< 0.01	6	3.9
8/22/2017	11:30	16.1	161	98.2	9.7	7.8	8	108	110	1.73	0.06	0.08	< 0.01	6	3.3
8/30/2017	10:50	17.7	158	96.8	9.2	7.5	8	67	100	1.62	0.06	0.08	0.01	6	3.4
9/12/2017	10:25	14.6	158	96.9	9.9	7.6	8	47	N/A	1.74	0.05	0.08	< 0.01	7	3.9
9/26/2017	9:20	11.0	185	94.8	10.5	7.5	4	46	100	2.05	0.04	0.06	< 0.01	4	3.0

Table 26. Raw data for East Fork Sweetwater (10802A).

010802A: East Fork Sweetwater Creek															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/20/2016	14:30	9.4	198	94.6	10.8	8.2	3	71	N/A	0.05	0.08	0.08	< 0.01	2	0.3
11/21/2016	13:45	7.1	175	93.8	11.4	8.3	8	13	60	0.08	0.07	0.08	< 0.01	8	0.7
12/6/2016	14:45	1.6	186	91.1	12.8	8.3	4	16	40	0.16	0.06	0.07	< 0.01	2	0.6
1/25/2017	14:45	2.2	178	91.2	12.5	8.1	6	15	N/A	N/A	N/A	N/A	N/A	N/A	0.6
1/30/2017	10:50	2.3	180	92.1	12.6	7.9	5	9	6	0.02	0.07	0.08	< 0.01	2	0.6
2/15/2017	13:30	4.1	130	94.6	12.4	N/A	25	14	20	0.38	0.09	0.14	0.01	7	3.3
3/20/2017	14:15	6.2	74	99.9	12.4	7.4	48	59	60	0.12	0.05	0.19	0.02	54	36.0
4/20/2017	11:15	6.5	94	93.0	11.4	7.5	156	1733	N/A	0.10	0.07	0.31	0.01	174	16.3
5/23/2017	14:40	13.6	110	98.9	10.3	7.5	16	179	N/A	0.09	0.06	0.09	< 0.01	10	9.3
6/26/2017	14:45	19.3	187	94.7	8.7	7.8	9	46	64	0.24	0.09	0.11	0.01	8	0.8
7/26/2017	14:15	21.0	237	96.6	8.6	8.0	3	517	760	0.42	0.11	0.13	0.01	3	0.3
8/23/2017	14:35	18.2	250	94.8	8.9	8.3	2	365	340	0.38	0.12	0.13	< 0.01	2	0.1
8/31/2017	14:00	18.9	258	101.2	9.4	8.1	2	222	N/A	N/A	N/A	0.13	N/A	3	0.2
9/5/2017	13:20	17.6	251	96.8	9.3	8.2	1	225	N/A	0.33	0.13	0.14	< 0.01	4	0.1
9/13/2017	14:30	17.0	260	104.1	10.1	8.3	2	411	500	0.39	0.13	0.14	< 0.01	2	0.1
9/27/2017	11:35	12.0	259	96.8	10.4	8.2	2	124	N/A	0.31	0.11	0.12	< 0.01	< 1	0.2

Table 27. Raw data for West Fork Sweetwater Creek (10905A).

10905A: West Fork Sweetwater Creek															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/20/2016	13:30	8.4	196	89.1	10.5	8.0	4	25	N/A	< 0.01	0.07	0.08	< 0.01	3	0.1
11/21/2016	13:15	6.3	192	88.3	10.9	8.0	3	17	4	< 0.01	0.06	0.09	< 0.01	2	0.2
12/6/2016	14:15	1.7	186	86.4	12.0	8.0	4	148	100	0.02	0.06	0.07	0.01	2	0.2
1/25/2017	14:10	1.6	161	85.8	12.0	8.0	6	11	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1/30/2017	11:40	2.0	159	88.5	12.2	7.9	5	0	6	0.02	0.07	0.08	< 0.01	2	N/A
2/15/2017	12:40	3.3	170	90.7	12.1	N/A	13	40	40	0.01	0.07	0.10	< 0.01	3	0.4
3/20/2017	13:10	5.4	73	96.3	12.2	7.3	34	21	40	0.02	0.06	0.13	0.02	26	11.3
4/20/2017	12:15	6.0	167	88.9	11.1	7.6	10	21	N/A	0.01	0.06	0.09	< 0.01	4	0.9
5/23/2017	14:00	11.7	83	94.8	10.3	6.9	14	19	N/A	< 0.01	0.05	0.07	< 0.01	7	9.6
6/26/2017	14:15	16.2	114	89.2	8.8	7.1	11	15	8	0.04	0.06	0.09	< 0.01	6	0.5
7/26/2017	13:40	16.5	141	93.8	9.2	7.3	7	31	40	0.09	0.07	0.09	< 0.01	3	0.0
8/23/2017	14:00	15.2	144	86.8	8.7	7.5	8	52	62	0.09	0.08	0.11	< 0.01	10	0.0
8/31/2017	13:00	15.4	150	94.3	9.4	7.5	6	67	N/A	N/A	N/A	0.09	N/A	4	0.0
9/5/2017	14:25	15.2	146	87.3	8.8	7.4	5	38	N/A	0.12	0.08	0.09	< 0.01	4	0.0
9/13/2017	13:45	14.4	148	95.6	9.8	7.6	4	162	180	0.11	0.08	0.09	< 0.01	2	0.0
9/27/2017	10:55	8.7	137	87.3	10.2	7.3	5	19	N/A	0.03	0.06	0.07	< 0.01	4	0.1

Table 28. Raw data for Sweetwater Creek near the mouth (08101A).

08101A: Sweetwater Creek at mouth															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/18/2016	12:25	10.2	187	98.7	11.1	8.1	3	162	92	0.40	0.04	0.07	< 0.01	6	8.4
11/17/2016	10:05	6.6	244	103.6	12.7	8.3	2	196	N/A	0.84	0.06	0.07	0.01	2	6.9
12/7/2016	10:00	2.0	266	101.6	14.1	8.2	2	1046	100	1.16	0.05	0.05	0.02	2	4.9
1/24/2017	11:45	3.9	257	103.0	13.5	8.5	2	55	80	1.34	0.05	0.07	0.02	1	6.2
2/9/2017	11:10	4.2	232	102.1	13.3	8.4	10	25	N/A	1.52	0.07	0.11	< 0.01	9	15.8
2/14/2017	9:45	2.5	199	99.7	13.6	7.9	25	44	N/A	2.02	0.08	0.14	< 0.01	12	37.2
3/14/2017	13:00	6.6	122	96.3	11.8	7.5	244	205	100	1.31	0.08	0.76	0.02	385	217.3
4/18/2017	11:10	9.0	172	97.8	11.3	7.9	16	86	100	1.60	0.06	0.10	< 0.01	13	55.6
5/22/2017	10:00	11.9	166	101.1	10.9	7.2	24	219	340	1.12	0.07	0.13	< 0.01	31	87.5
6/28/2017	9:45	15.8	258	101.2	10.1	7.8	11	326	500	2.17	0.07	0.11	0.01	2	14.9
7/25/2017	10:00	16.3	240	98.2	9.6	7.8	8	214	400	2.02	0.07	0.08	< 0.01	9	10.6
8/22/2017	10:30	15.5	210	99.7	9.9	8.0	9	173	160	1.59	0.06	0.08	< 0.01	8	11.9
8/30/2017	9:45	17.1	212	99.2	9.6	7.9	16	411	500	1.51	0.06	0.08	0.02	26	10.6
9/12/2017	9:20	14.4	203	99.0	10.1	7.8	8	150	N/A	1.55	0.06	0.08	< 0.01	8	10.7
9/25/2017	14:30	12.9	257	98.7	10.4	8.2	3	47	100	2.19	0.06	0.07	0.01	5	8.6

Table 29. Raw data for Spring Creek near the mouth (Nez 931).

Nez 931: Spring Creek near mouth (at community sweat house)															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/18/2016	11:00	12.2	253	76.0	8.2	7.4	2	120	64	0.61	0.11	0.12	< 0.01	5	1.4
11/15/2016	14:00	12.6	275	77.2	8.2	7.6	2	91	100	0.79	0.09	0.12	< 0.01	4	1.5
12/5/2016	13:45	9.4	287	87.7	10.0	7.6	5	< 1	N/A	1.01	0.07	0.10	0.02	11	1.6
1/23/2017	14:30	8.8	293	93.8	10.9	7.6	4	3	60	1.72	0.08	0.10	< 0.01	9	1.7
2/13/2017	13:30	9.1	326	104.0	12.0	7.6	2	7	4	3.03	0.06	0.08	< 0.01	3	2.1
3/14/2017	11:15	9.6	419	81.2	9.3	7.3	4	36	60	7.46	0.05	0.09	0.02	5	3.3
4/17/2017	14:00	11.5	413	95.4	10.4	7.4	3	11	< 20	6.25	0.05	0.06	< 0.01	2	2.2
5/10/2017	12:30	12.6	364	82.0	8.8	6.7	2	18	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5/24/2017	13:30	13.3	346	87.4	9.2	7.2	2	64	40	2.51	0.07	0.08	0.01	2	1.9
6/27/2017	13:45	14.2	338	85.1	8.7	7.1	1	579	640	1.84	0.08	0.09	0.02	2	1.6
7/24/2017	14:15	14.8	314	84.8	8.6	7.2	2	162	300	1.66	0.08	0.09	< 0.01	2	1.3
8/21/2017	15:00	14.2	300	81.2	8.3	7.2	1	114	170	1.26	0.07	0.08	0.01	2	1.3
8/28/2017	14:10	13.8	293	80.8	8.4	7.3	1	148	180	1.21	0.08	0.08	0.01	0	1.2
9/11/2017	13:40	14.0	293	82.0	8.4	7.2	1	91	100	1.14	N/A	N/A	0.01	0	1.3
9/25/2017	13:10	13.5	284	82.2	8.6	7.5	1	1	< 20	1.09	0.08	0.09	< 0.01	2	1.5

Table 30. Raw data for Garden Gulch Creek (02701A).

02701A: Garden Gulch Creek near mouth															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/18/2016	9:45	11.5	542	88.6	9.7	8.1	9	261	100	7.00	0.24	0.25	< 0.01	12	0.0
11/17/2016	9:30	11.5	585	94.1	10.3	8.1	5	89	N/A	7.12	0.23	0.25	0.02	10	0.1
12/5/2016	14:20	11.8	606	95.5	10.3	8.1	4	< 1	N/A	7.75	0.23	0.26	0.02	9	0.2
1/23/2017	14:00	8.1	498	93.0	11.0	7.9	21	91	80	7.00	0.25	0.35	< 0.01	84	1.0
2/9/2017	13:20	7.3	489	93.3	11.3	8.0	57	1553	N/A	8.35	0.35	0.56	0.03	80	3.2
2/13/2017	13:00	7.0	524	96.1	11.7	8.0	7	158	120	12.60	0.27	0.32	< 0.01	12	4.5
3/14/2017	10:15	8.7	485	95.4	11.1	8.0	73	1986	1200	18.30	0.33	0.58	0.02	120	19.0
4/18/2017	10:20	10.2	505	99.2	11.2	8.2	7	166	200	13.10	0.24	0.30	< 0.01	10	4.4
5/24/2017	13:00	17.3	505	94.6	9.1	8.0	50	1120	1000	8.35	0.27	0.44	0.02	86	2.2
6/27/2017	13:00	20.5	533	92.3	8.3	8.0	6	921	3000	6.11	0.26	0.29	0.01	8	1.0
7/24/2017	13:35	18.9	521	89.2	8.3	7.7	2	770	1600	6.61	0.24	0.27	< 0.01	3	0.2
8/21/2017	14:20	15.9	5	88.0	8.7	7.7	2	613	1100	6.35	0.18	0.21	< 0.01	3	0.1
8/28/2017	13:25	14.9	543	88.2	8.9	7.8	1	613	1000	6.84	0.18	0.19	0.01	2	0.1
9/11/2017	13:10	15.5	562	89.0	8.9	7.7	2	1300	1600	6.31	N/A	N/A	< 0.01	2	0.1
9/25/2017	12:40	13.9	548	90.1	9.3	7.9	1	488	700	5.84	0.18	0.19	< 0.01	2	0.2

Table 31. Raw data for Tom Beall Creek near the mouth (08501A).

08501A: Tom Beall Creek near mouth															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/17/2016	12:45	12.1	375	90.3	9.7	8.2	27	411	500	4.03	0.14	0.28	< 0.01	120	0.7
11/15/2016	13:20	11.9	442	91.2	9.9	8.3	3	133	140	4.25	0.16	0.18	< 0.01	6	1.0
12/5/2016	13:00	5.5	477	100.4	12.7	8.6	2	< 1	N/A	4.97	0.15	0.16	0.01	3	1.4
1/23/2017	12:40	5.9	485	98.5	12.3	8.5	11	816	1280	6.82	0.19	0.22	0.01	16	2.0
2/9/2017	13:55	6.5	497	95.9	11.8	8.3	4	649	N/A	11.10	0.30	0.96	0.03	632	8.0
2/13/2017	12:10	4.7	549	99.6	12.8	8.3	29	< 1	< 100	14.70	0.26	0.36	< 0.01	66	8.4
3/14/2017	9:30	8.6	539	95.6	11.2	8.1	122	102	40	21.10	0.25	0.68	0.02	230	34.4
4/18/2017	9:40	9.8	575	97.3	11.0	8.1	24	179	160	17.40	0.20	0.26	< 0.01	49	11.7
5/24/2017	12:00	13.6	562	98.2	10.2	8.3	14	326	140	13.10	0.19	0.24	0.01	28	6.3
6/27/2017	11:50	17.3	558	98.0	9.4	8.0	19	762	500	11.10	0.18	0.23	0.01	29	2.7
7/24/2017	12:30	17.5	505	97.1	9.3	8.3	3	313	400	9.70	0.13	0.17	< 0.01	4	N/A
8/21/2017	13:00	14.7	493	96.2	9.8	8.2	2	248	N/A	9.00	0.11	0.13	< 0.01	2	1.1
8/22/2017	11:30	N/A	N/A	N/A	N/A	N/A	N/A	461	300	N/A	N/A	N/A	N/A	N/A	N/A
8/28/2017	12:10	14.2	488	95.6	9.9	8.4	4	579	700	9.07	0.11	0.12	0.01	4	1.1
9/11/2017	11:30	14.2	490	97.1	10.0	8.3	2	435	700	8.24	N/A	N/A	< 0.01	2	1.0
9/25/2017	11:30	12.9	485	97.2	10.3	8.4	2	240	200	8.80	0.14	0.15	< 0.01	3	1.3

Mainstem Lapwai Creek

Table 32. Raw data for Lapwai Creek below Winchester Dam/WWTP (03825A).

03825A: Lapwai Creek below Winchester Dam/WWTP															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
9/14/2016	11:20	N/A	N/A	N/A	N/A	N/A	N/A	4	16	0.16	0.12	1.10	4.05	22	N/A
9/15/2016	12:00	11.5	233	12.0	1.3	6.6	19	13	N/A	0.12	0.21	1.50	4.08	32	4.3
10/19/2016	13:20	10.1	192	29.4	3.3	7.2	11	17	6	0.10	0.10	1.30	1.08	14	6.3
11/21/2016	10:05	7.8	362	27.5	3.3	7.5	8	159	140	1.54	0.10	0.43	1.34	10	0.3
12/6/2016	11:35	4.2	337	31.3	4.1	7.4	7	248	200	4.87	0.08	0.29	1.02	5	0.2
1/25/2017	12:00	4.8	389	30.7	3.9	7.2	5	128	N/A	N/A	N/A	N/A	N/A	N/A	0.2
1/30/2017	13:20	5.5	378	29.4	3.7	7.1	6	63	120	4.26	0.20	0.70	1.44	6	0.1
2/15/2017	10:00	5.2	467	28.4	3.6	7.1	16	1120	896	3.00	0.26	0.96	1.78	18	0.7
3/16/2017	11:50	3.6	159	78.5	10.4	7.1	34	99	N/A	0.88	0.11	0.30	0.62	17	72.1
4/19/2017	12:15	9.3	206	74.8	8.6	6.9	18	10	< 20	1.90	0.22	0.34	0.05	6	0.7
5/23/2017	11:00	11.9	206	66.3	7.2	6.4	12	17	N/A	1.72	0.24	0.37	0.06	6	0.5
6/26/2017	11:20	15.2	184	52.4	5.3	6.5	10	2	40	1.18	0.20	0.36	0.12	7	1.0
7/26/2017	10:20	15.6	194	35.2	3.5	6.3	11	816	24	1.04	0.22	0.41	0.52	8	1.0
8/23/2017	10:55	14.6	211	23.2	2.4	6.6	15	13	12	0.83	0.17	0.54	0.69	12	0.7
8/29/2017	10:30	14.3	217	22.1	2.3	6.6	15	272	16	0.62	0.14	0.54	1.64	12	0.8
9/13/2017	10:20	14.2	226	19.9	2.0	6.5	12	25	24	0.80	0.21	0.60	1.83	10	0.6
9/26/2017	13:15	12.3	256	20.5	2.2	6.8	18	4	< 4	0.60	0.06	0.61	2.58	12	0.4

Table 33. Raw data for Lapwai Creek on the Winchester Grade (03821A).

03821A: Lapwai Creek on the Winchester Grade															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
9/14/2016	11:50	N/A	N/A	N/A	N/A	N/A	N/A	613	500	0.67	0.18	0.31	1.09	31	N/A
9/15/2016	13:15	10.9	221	92.2	10.2	8.3	15	272	N/A	0.58	0.15	0.26	1.48	25	3.0
10/19/2016	11:40	8.9	200	93.3	10.8	8.1	6	2	2	1.00	0.12	0.20	< 0.01	10	7.0
11/17/2016	14:05	5.1	354	94.2	12.0	8.2	4	1	N/A	1.57	0.13	0.17	< 0.01	5	1.0
11/21/2016	9:45	N/A	N/A	N/A	N/A	N/A	N/A	3	2	N/A	N/A	N/A	N/A	N/A	N/A
12/6/2016	10:15	1.3	651	89.6	12.6	8.3	3	2	< 2	2.16	0.09	0.11	< 0.01	5	0.4
1/25/2017	11:15	1.6	785	90.3	12.6	8.0	3	3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1/30/2017	14:20	1.7	6	90.5	12.6	8.0	3	< 1	< 2	2.50	0.10	0.11	0.02	2	N/A
2/14/2017	14:15	3.4	520	93.5	12.5	7.8	12	< 1	N/A	3.68	0.10	0.15	< 0.01	5	2.5
3/16/2017	11:00	4.7	182	93.5	12.0	7.5	51	73	N/A	2.66	0.15	0.34	0.24	33	N/A
4/19/2017	10:30	6.4	250	93.8	11.6	7.7	12	1	8	1.95	0.11	0.14	< 0.01	4	6.5
5/23/2017	10:10	10.1	205	100.2	11.3	7.3	10	4	N/A	1.09	0.12	0.14	0.01	3	3.6
6/26/2017	10:15	15.1	240	92.7	9.4	7.6	7	14	10	1.03	0.16	0.21	0.02	8	1.5
7/25/2017	14:30	18.4	215	93.7	8.8	7.9	15	84	140	0.81	0.21	0.30	< 0.01	16	1.1
8/23/2017	9:55	14.3	215	90.4	9.3	7.8	15	48	40	0.81	0.20	0.28	< 0.01	18	1.0
8/31/2017	9:45	14.5	225	97.7	10.0	7.5	13	32	N/A	N/A	N/A	0.26	N/A	15	0.9
9/5/2017	10:25	14.4	221	91.9	9.4	7.8	11	36	N/A	0.94	0.19	0.25	0.01	12	0.8
9/12/2017	14:10	14.9	226	92.4	9.3	7.9	9	16	N/A	1.13	0.19	0.25	0.02	10	0.8
9/26/2017	12:30	9.8	261	91.2	10.3	8.0	8	15	24	1.28	0.14	0.18	< 0.01	5	0.6

Table 34. Raw data for Lapwai Creek upstream of the Culdesac WWTP (03814A).

03814A: Lapwai Creek upstream Culdesac WWTP															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/18/2016	14:45	11.4	222	99.2	10.9	8.2	2	31	28	0.51	0.08	0.10	0.01	4	7.7
11/17/2016	12:50	8.3	250	105.2	12.4	8.4	3	2	N/A	1.02	0.08	0.10	0.01	6	2.5
11/21/2016	9:25	N/A	N/A	N/A	N/A	N/A	N/A	3	4	N/A	N/A	N/A	N/A	N/A	N/A
12/7/2016	12:50	3.7	285	101.1	13.4	8.4	2	1	< 2	1.23	0.08	0.09	< 0.01	4	2.9
1/25/2017	10:30	3.6	373	98.6	10.1	8.1	6	2	N/A	N/A	N/A	N/A	N/A	N/A	6.1
1/31/2017	11:45	2.8	338	103.7	14.0	8.5	4	10	2	0.94	0.05	0.07	< 0.01	4	4.3
2/14/2017	12:40	4.9	249	98.8	12.7	7.7	13	14	N/A	4.27	0.10	0.14	0.01	4	32.9
3/15/2017	13:00	6.8	155	95.6	11.7	7.4	68	276	120	3.66	0.13	0.29	0.08	59	288.5
4/18/2017	15:00	10.2	186	102.1	11.5	8.4	13	13	< 20	1.98	0.08	0.11	< 0.01	10	N/A
5/22/2017	13:45	14.7	172	105.1	10.7	8.0	9	78	60	0.67	0.09	0.12	< 0.01	5	21.2
6/28/2017	13:35	18.9	263	107.3	10.0	8.2	3	135	100	1.31	0.10	0.12	0.01	5	2.0
7/25/2017	13:15	20.4	262	110.0	9.9	8.3	2	167	180	0.96	0.10	0.12	< 0.01	3	0.8
8/22/2017	14:30	20.3	256	112.7	10.2	8.7	2	138	180	0.68	0.11	0.12	< 0.01	3	0.7
8/30/2017	13:50	21.0	259	114.2	10.2	8.6	2	96	300	0.64	0.10	0.11	0.02	2	0.4
9/12/2017	13:15	18.9	257	109.4	10.2	8.4	2	47	N/A	0.73	0.11	0.12	< 0.01	3	0.6
9/26/2017	11:20	14.3	266	103.9	10.6	8.3	2	33	100	0.67	0.09	0.10	< 0.01	2	1.1

Table 35. Raw data for Lapwai Creek downstream of the Culdesac WWTP (03812A).

03812A: Lapwai Creek downstream Culdesac WWTP															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/18/2016	14:00	12.4	228	95.5	10.2	7.9	1	16	14	0.66	0.12	0.14	0.02	4	8.6
11/17/2016	12:10	10.7	264	100.4	11.1	8.0	1	18	N/A	1.44	0.14	0.15	0.01	2	3.2
12/7/2016	12:15	7.8	282	100.3	11.9	8.1	1	8	2	1.74	0.13	0.14	0.01	2	3.5
1/25/2017	9:45	4.1	385	98.7	13.0	7.8	2	2	N/A	N/A	N/A	N/A	N/A	N/A	6.2
1/31/2017	10:30	3.9	351	105.9	13.9	8.0	2	10	8	1.64	0.11	0.13	< 0.01	4	5.1
2/14/2017	12:00	4.9	264	98.2	12.6	7.6	12	< 1	N/A	4.55	0.10	0.14	< 0.01	4	39.4
3/15/2017	11:45	7.1	160	95.8	11.6	7.3	73	147	300	3.77	0.15	0.31	0.07	66	N/A
4/18/2017	14:20	10.3	199	104.9	11.8	8.3	9	185	500	2.28	0.09	0.12	< 0.01	5	50.9
5/22/2017	13:00	14.7	186	105.7	10.7	8.0	8	74	100	0.75	0.10	0.13	0.01	4	23.5
6/28/2017	12:45	17.3	290	109.7	10.5	8.0	3	50	48	1.88	0.15	0.16	0.01	3	2.8
7/25/2017	12:30	18.8	306	114.4	10.7	8.2	2	15	80	1.87	0.16	0.19	< 0.01	2	1.1
8/22/2017	13:40	18.9	306	119.9	11.1	8.5	2	79	50	1.58	0.18	0.19	< 0.01	3	0.8
8/30/2017	13:00	19.3	307	116.8	10.8	8.3	1	41	44	1.36	0.17	0.19	0.02	4	0.6
9/12/2017	12:30	17.6	313	105.3	10.1	8.1	2	201	N/A	1.54	0.19	0.20	0.02	4	0.8
9/26/2017	10:45	16.4	309	96.3	9.4	7.9	2	120	160	1.39	0.19	0.19	< 0.01	4	1.5

Table 36. Raw data for Lapwai Creek at Garden Gulch Road (03805A).

03805A: Lapwai Creek at Garden Gulch Road															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
9/14/2016	14:40	N/A	N/A	N/A	N/A	N/A	N/A	68	180	0.29	0.04	0.07	< 0.01	5	N/A
9/15/2016	14:50	15.0	189	104.7	10.6	8.2	10	64	N/A	0.25	0.04	0.10	0.02	28	7.6
10/17/2016	12:50	12.4	215	95.9	10.2	8.0	3	32	200	0.36	0.07	0.09	< 0.01	10	18.5
11/15/2016	15:15	11.5	271	93.9	10.2	8.1	2	29	< 20	0.76	0.06	0.08	< 0.01	3	12.8
12/5/2016	14:00	5.7	277	104.3	13.1	8.5	1	34	N/A	1.18	0.07	0.07	0.02	2	14.1
1/24/2017	10:50	4.5	307	107.4	13.9	8.3	1	19	< 20	1.65	0.05	0.06	0.02	2	20.9
2/13/2017	14:15	5.4	230	99.7	12.6	7.9	18	22	62	3.85	0.09	0.16	< 0.01	9	145.1
3/14/2017	12:00	6.8	146	96.0	11.7	7.4	170	119	400	3.28	0.10	0.61	0.03	254	N/A
4/17/2017	14:45	11.1	176	103.9	11.4	8.0	12	24	100	2.07	0.06	0.10	< 0.01	9	163.0
5/10/2017	13:00	N/A	N/A	N/A	N/A	N/A	N/A	47	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5/24/2017	14:15	15.5	184	102.0	10.2	8.1	11	64	80	1.32	0.07	0.10	0.02	10	126.2
6/27/2017	14:30	21.4	278	106.2	9.4	8.1	5	172	120	2.12	0.08	0.10	0.02	6	23.8
7/24/2017	14:50	22.4	257	108.1	9.4	8.1	4	82	200	1.49	0.07	0.11	< 0.01	6	8.7
8/22/2017	9:15	15.7	234	94.8	9.4	7.5	4	130	130	1.26	0.06	0.08	< 0.01	5	10.9
8/28/2017	14:50	17.7	230	107.1	10.2	8.3	4	105	92	1.13	0.06	0.08	0.01	4	9.3
9/11/2017	14:35	19.2	241	101.7	9.4	8.0	5	81	100	1.16	0.09	0.09	0.02	6	8.7
9/25/2017	13:45	14.6	280	103.3	10.5	8.2	3	36	60	1.58	0.07	0.08	< 0.01	4	10.5

Table 37. Raw data for Lapwai Creek at the USGS Station (03802A).

03802A: Lapwai Creek at the USGS Station															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/17/2016	12:00	12.4	227	101.3	10.8	8.1	2	41	60	0.48	0.07	0.08	< 0.01	4	20.4
11/15/2016	11:40	11.6	293	100.9	11.0	8.3	2	32	12	1.02	0.07	0.09	< 0.01	6	15.6
12/5/2016	11:30	5.3	306	107.5	13.6	8.4	2	< 1	N/A	1.45	0.07	0.08	0.02	3	19.9
1/23/2017	11:50	4.6	325	108.9	14.1	8.6	2	4	120	2.08	0.07	0.08	< 0.01	3	26.0
2/9/2017	10:15	5.3	3	102.0	12.9	8.1	17	68	N/A	3.37	0.09	0.14	0.01	23	67.4
2/10/2017	14:45	N/A	N/A	N/A	N/A	N/A	100	N/A	N/A	N/A	N/A	N/A	N/A	N/A	401.2
2/13/2017	11:10	3.9	260	100.3	13.8	7.9	19	101	120	4.62	0.10	0.16	< 0.01	11	153.4
3/13/2017	13:30	7.5	197	97.2	11.7	7.5	52	118	40	4.86	0.12	0.28	0.02	77	N/A
4/17/2017	11:50	10.4	233	100.6	11.3	7.9	12	77	80	3.62	0.07	0.10	< 0.01	10	180.3
4/25/2017	11:30	10.2	164	96.7	10.9	7.2	42	N/A	N/A	N/A	N/A	N/A	N/A	N/A	521.3
4/27/2017	11:30	9.0	160	98.4	11.4	7.3	65	N/A	N/A	N/A	N/A	N/A	N/A	N/A	626.3
5/24/2017	10:50	13.8	218	104.7	10.8	8.0	11	70	44	2.08	0.08	0.11	< 0.01	8	130.2
6/27/2017	11:05	19.3	327	103.9	9.6	7.9	5	199	220	2.96	0.09	0.12	0.02	8	29.7
7/24/2017	12:00	20.4	300	113.6	10.3	8.4	5	74	120	2.23	0.08	0.12	< 0.01	8	N/A
8/21/2017	11:15	16.3	278	104.8	10.3	8.3	3	81	84	1.66	0.06	0.08	0.02	7	11.9
8/28/2017	23:56	16.0	276	102.6	10.1	8.3	4	99	240	1.64	0.06	0.08	0.02	5	13.3
9/11/2017	23:56	16.1	284	103.3	10.2	8.1	4	130	60	1.73	0.09	0.09	0.02	6	11.9
9/25/2017	10:55	13.4	310	106.0	11.1	8.2	3	30	24	2.24	0.07	0.08	0.04	5	15.4

Table 38. Raw data for Lapwai Creek near the mouth (03801A).

03801A: Lapwai Creek near the mouth															
Date	Time	Temperature, water	Specific conductance	Dissolved oxygen (DO)	Dissolved oxygen (DO)	pH	Turbidity	*Escherichia coli* (NPT)	*Escherichia coli* (BOR)	NO_3+NO_2	Ortho-P	T-Phos	NH_3-Diss	TSS	Discharge
		°C	µS	% Sat.	mg/L	H+	NTU	cfu/100mL	cfu/100mL	mg/L	mg/L	mg/L	mg/L	mg/L	cfs
10/17/2016	10:35	12.3	231	100.7	10.8	7.9	3	49	20	0.48	0.06	0.08	< 0.01	4	23.8
11/15/2016	10:20	11.6	300	112.8	12.3	8.4	1	31	32	1.03	0.07	0.08	0.02	2	16.0
12/5/2016	10:10	4.7	317	105.2	13.6	8.2	2	20	N/A	1.47	0.07	0.09	0.03	4	20.6
1/23/2017	10:50	4.5	335	107.9	14.0	8.4	2	22	60	2.12	0.06	0.08	0.02	3	27.9
2/13/2017	10:00	3.4	262	100.4	13.4	7.9	20	< 1	80	4.64	0.10	0.17	< 0.01	11	184.0
3/13/2017	10:00	6.8	196	98.1	12.0	7.3	57	132	100	4.89	0.12	0.33	0.02	85	N/A
4/17/2017	10:20	10.4	242	101.5	11.4	7.8	10	5	100	3.91	0.07	0.11	0.01	9	176.6
5/24/2017	10:00	13.5	222	103.1	10.7	8.0	11	57	120	2.08	0.08	0.11	< 0.01	7	144.6
6/27/2017	10:00	18.7	331	111.6	10.4	8.2	4	172	180	2.94	0.09	0.11	0.02	8	31.8
7/24/2017	10:15	19.3	311	117.9	10.8	8.3	5	101	300	2.22	0.07	0.11	< 0.01	8	N/A
8/21/2017	10:10	15.8	286	104.3	10.4	8.1	4	326	360	1.65	0.06	0.08	0.02	7	13.3
8/28/2017	9:55	15.6	281	107.5	10.7	8.2	4	130	120	1.63	0.06	0.07	0.02	6	13.7
9/11/2017	9:45	15.9	288	109.3	10.8	8.0	4	36	160	1.66	0.09	0.09	0.03	8	12.3
9/25/2017	9:45	13.1	313	108.6	11.4	8.1	4	64	60	1.95	0.07	0.08	< 0.01	6	14.0