Wallowa Falls Hydroelectric Project
FERC Project No. P-308
Updated Study Report
(Final Technical Report)

Water Resources

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Acronyms and Abbreviations

°C	degrees Centigrade
°F	degrees Fahrenheit
7-DAD Max	7-day average of the daily maximum temperature
cfs	cubic feet per second
CWA	Federal Clean Water Act
DO	dissolved oxygen
FERC	Federal Energy Regulatory Commission
ft	feet
ft^3	cubic feet
g	grams
ILP	Integrated Licensing Process
L	liter
m	Meter
mg	milligrams
mg/L	milligram per liter (equivalent to parts per million, or ppm)
mi	mile
msl	mean sea level (referring to elevation)
NA	not available or not applicable or not calculated because of three or fewer detections
NTU	Nephelometric Turbidity Units
PAD	Pre-Application Document
ppm	parts per million
Project	Wallowa Falls Hydroelectric Project
TDG	total dissolved gas

1.0 INTRODUCTION

1.1 Purpose

This Water Resources Updated Study Report (Final Technical Report) is related specifically to the Wallowa Falls Hydroelectric Project (Project) Water Resources Study—one of several resource studies conducted by PacifiCorp Energy (PacifiCorp) to support the relicensing of the Project in accordance with the Federal Energy Regulatory Commission's (FERC's) Integrated Licensing Process (ILP). The Water Resources Study was conducted by PacifiCorp to address FERC regulations (18 Code of Federal Regulations [CFR] 4.51) for hydrology and water quality information related to the Project, and requirements of Section 401 of the Federal Clean Water Act (CWA) for information on water quality conditions related to the Project.

The Water Resources Study was conducted according to the Water Resources Study Plan for the Project as contained in PacifiCorp's Revised Study Plans (PacifiCorp 2011). The Water Resources Study Plan describes the purpose, objectives, approach, and methods for the evaluation of hydrologic and water quality resources in the Project area. The hydrology information obtained in this study included collection of flow data to support PacifiCorp's license application to FERC, including: (1) a quantification of available flows for Project operations; (2) ranges in flows and monthly flow duration curves; and (3) flow information to support analysis of instream flow needs for water quality and aquatic biota (18 CFR 5.18(b)).

The water quality information obtained in this study included collection of data as required by FERC regulations (18 CFR 5.18(b)) to support Project relicensing documentation. This required water quality information is used to: (1) describe existing water quality conditions in the Project area; and (2) assess Project effects on water quality. The water quality information also supports certification that FERC will require from the Oregon Department of Environmental Quality (DEQ) that the Project meets applicable state water quality requirements pursuant to Section 401 of the Clean Water Act (hereafter referred to as "401 Certification").

1.2 Study Goal and Objectives

The goal of the study is to develop hydrology and water quality information to support: (1) a new FERC license application for continued future operation of the Project; and (2) 401 Certification from DEQ that the Project meets applicable state water quality requirements.

The study has two principal objectives:

1. Characterize and assess hydrology in the Project vicinity. This hydrologic information is needed to: (i) characterize flow conditions in the Project area and flow availability for Project operations; (ii) evaluate potential Project effects on flows and water quality (as related to flow); and (iii) support evaluation of flow effects and instream flow needs pertinent to aquatic biota (e.g., bull trout).

2. Monitor and evaluate key water quality parameters in the Project vicinity. The study monitored and evaluated key water quality parameters that may be affected by Project facilities and operations, including those for which DEQ has established numeric or narrative water quality criteria and that are important to inform evaluation of water quality conditions for aquatic species (e.g., bull trout).

1.3 Background

The Project facilities are located along and adjacent to the East Fork and West Fork of the Wallowa River upstream of Wallowa Lake, near the town of Joseph, Oregon. The East Fork and West Fork of the Wallowa River are relatively pristine streams that originate in the Eagle Cap Wilderness Area in the Wallowa Mountains. The East Fork and West Fork join about 0.5 miles below the Project powerhouse tailrace, and the Wallowa River continues to flow north about 0.6 miles into Wallowa Lake (Figure 1.1).

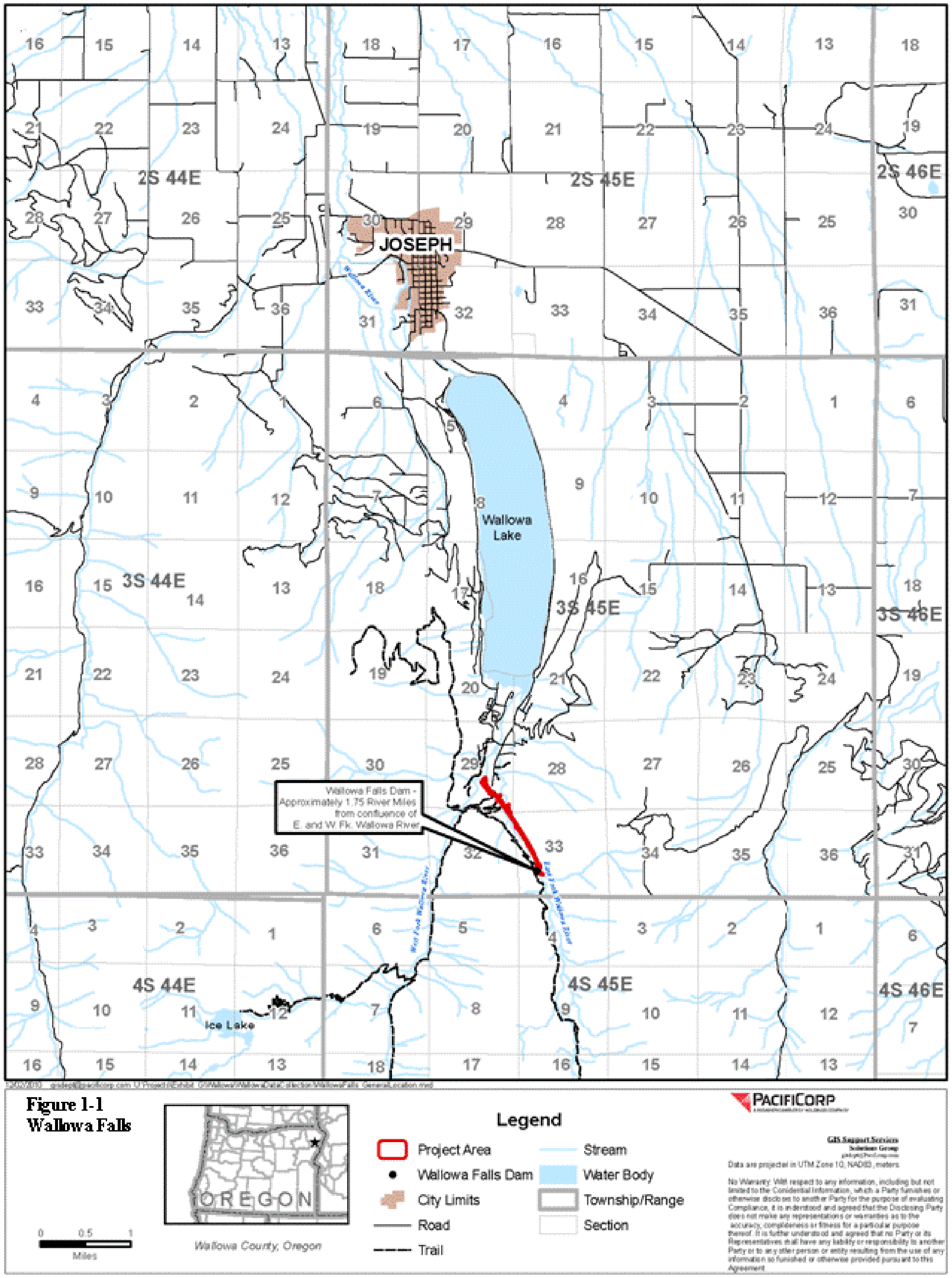
1.3.1 Hydrologic Conditions in the Study Area

Elevations in the area range from 4,440 feet at Wallowa Lake to nearly 9,000 feet at the headwaters in the wilderness area. Temperature and precipitation vary considerably with elevation. Average annual precipitation increases from 22 inches in the town of Joseph (near the outlet of Wallowa Lake) to more than 60 inches in the mountainous headwaters areas. On average, precipitation increases approximately 5 inches with each 1,000-foot rise in elevation (Nowak and Kuchenbecker 2004). Precipitation occurs in the mountains throughout the year but falls primarily as winter snow. Generally, peak snow occurs in the area around March and April.

The East Fork and West Fork of the Wallowa River are snowmelt runoff streams. As such, snow acts as an important flow regulator or storage mechanism, holding a significant proportion of the precipitation in the area during the winter and releasing it later in the year as it melts. Peak runoff occurs in later spring to early summer, generally from May through mid-July, from melting snowpack. By late July, little of the snow is left in the Wallowa Mountains. Runoff recedes to low flows by late summer, usually August and September. Flows can again increase in fall in response to autumn rains, but lower flows generally persist from late fall through winter due to freezing conditions in the contributing high-elevation watershed areas, which result in little or no direct runoff during this time.

Prior to the data obtained during this study, available flow information for the Project area was largely confined to U.S. Geological Survey (USGS) streamflow data gathered at two locations in the Project vicinity over a 44-year period from October 1924 through September 1952 and again from October 1966 through September 1983. The two historic USGS gages were located in the Project tailrace (USGS Station 13324500) and in the East Fork one quarter mile upstream of the confluence with the West Fork (USGS Station 13325000). The USGS also developed flow data for a third “reporting station” (USGS Station 13325001) that is a summation of data collected at the two gage sites. The data for the reporting station (USGS Station 13325001) represents the best historic data available characterizing the hydrology of the East Fork in the Project vicinity.

Figure 1.1 Wallowa Falls Hydroelectric Project Location.



Based on the previous 44-year period of record, average mean monthly flows in the East Fork ranged from 11 cfs in February and March to 61 cfs in June. Average monthly minimum flows in the East Fork ranged from 7.7 cubic feet-per-second (cfs) in March to 25.2 cfs in June, and average monthly maximum flows ranged from 14.6 in March to 142.2 cfs in June. During the 44-year period of record, monthly flows met or exceeded 14 cfs 90 percent of the time, 21 cfs 50 percent of the time, and 31 cfs 10 percent of the time. The results of the additional hydrology data collected in this study (from October 2011 to September 2013), including in comparison to the historic USGS data, are described in Section 3.1 below.

1.3.2 Water Quality Conditions in the Study Area

Overall water quality in the Wallowa River watershed is considered excellent, due to the relatively pristine location and physical characteristics of the watershed areas, most of which lies within the Eagle Cap Wilderness Area (Nowak and Kuchenbecker 2004). Because the East Fork and West Fork are supplied by direct snowmelt runoff or groundwater baseflow, they are consistently relatively cold throughout the year. The results of the water temperature data collected in this study (from about October 2011 to September 2013) are described in Section 3.2 below. The water temperature data shows that the seven-day average of the maximum daily temperature (7-DAD Max) in the Project area generally remains below about 8.0 degrees Celsius (°C) through June and after about mid-September. Even during the summer months of July and August, when air temperature and solar radiation are highest, available data shows that 7-DAD Max water temperatures remain below about 14.0°C, which is within the coldest (i.e., “cold”) of the five thermal classifications (i.e., cold, cold-cool, cool, cool-warm, and warm) for temperate streams in the U.S. and Canada developed by Chu et al. (2009).

Dissolved oxygen content in the water is consistently fully saturated (around 100 percent saturation), which is expected given the turbulent and pristine nature of the streams in the Project area. Dissolved oxygen sampling previously conducted by PacifiCorp showed dissolved oxygen concentrations of 8.9 to 9.1 milligrams per liter (mg/L) in samples taken in mid-summer in the East Fork upstream, within, and downstream of the Project forebay (Eddy 1985). Dissolved oxygen data collected in this study (during August 2012) showed concentrations between about 9 and 12 mg/L and saturation between about 98 and 105 percent (as further described in Section 3.3 below).

1.3.3 Project Nexus to Hydrology and Water Quality Conditions

1.3.3.1 Nexus Under Current Conditions

Nexus Relative to Flows

Relative to hydrology, the primary Project nexus under current conditions is the diversions of portions of the flow from the East Fork (and lesser diversions from Royal Purple Creek) for use at the Project powerhouse. The Project is operated in run-of-the-river mode with no peaking or flood control capability. Because of the diversion of flows to the powerhouse, Project operation causes a reduction in downstream in-channel flows in the East Fork below the East Fork diversion dam. This portion of the East Fork is referred to as the “bypassed reach”.

During standard operation (which is done in a remotely-controlled automated mode), the minimum hydraulic capacity of the powerhouse is approximately 3 cfs and the maximum hydraulic capacity is 16 cfs. Under typical operations, the total amount of flow diverted to the Project powerhouse ranges from about 3 to 14 cfs. For example, during Water Year 2012 (i.e., from October 2011 through September 2012), the average monthly powerhouse (turbine) discharge (and, hence, amount diverted) ranged from a high of 13.8 cfs in October 2011 to a low of about 1.3 cfs in September 2013. (Note: the low average in September 2013 was due to the fact that the Powerhouse was not operating during most days of that month).

The current FERC license for the Project requires that flow releases are provided from the East Fork diversion dam to maintain a continuous minimum instream flow in the bypassed reach of the East Fork. The required minimum instream flow release is in the amount of 0.5 cfs or the natural inflow to the reservoir, whichever is less, as measured immediately downstream from the diversion dam. However, instream flows in the bypassed reach typically exceed the required minimum instream flow release for three reasons:

- The required minimum flow is released through a fixed pipe at the diversion dam. To ensure continuous compliance with the existing minimum flow provision of 0.5 cfs, PacifiCorp typically releases an additional discharge of 0.3 cfs. Accordingly, actual flow released may range between 0.5 and 0.8 cfs, largely depending on season.

- Additional runoff and groundwater contributions to baseflow occur in the bypassed reach. The extent of groundwater contribution may be on the order of 1 to 4 cfs in lower flow months, with a larger amount of runoff and groundwater inflow possible during higher flow months, such as during spring snowmelt conditions (as discussed further in Section 3.1 below)

- During higher-flow times of the year (e.g., the snowmelt runoff period), flows arriving at the diversion dam from upstream are often in excess of 16 cfs, which is the maximum hydraulic capacity of (and hence diversion to) the powerhouse. At these times, all flows in excess of 16 cfs remain within the bypassed reach. This can occur in many months, but is particularly prevalent in the months of May, June, and July.

Nexus Relative to Water Quality

Relative to water quality, the primary Project nexus under current conditions also results from the diversions of portions of the flow from the East Fork (and to a lesser extent Royal Purple Creek) for use at the Project powerhouse. Project facilities and operations do not cause any direct discharge or load of water quality-related constituents to Project waters. However, the diversion of flow has the potential to affect physical flow conditions (e.g., flow quantity, depths, and velocities in the bypassed reach), which may in turn affect water quality parameters influenced by such conditions (such as, water temperature).

Also, under past operational practices, PacifiCorp flushed the forebay behind the East Fork diversion dam to reduce sediment build-up on an as-needed basis. The current FERC license restricts forebay flushing to the period of May 1 through August 30 of each year for the protection of kokanee eggs and sac fry in the gravel areas upstream of Wallowa Lake. Such flushing has the ability to increase suspended sediments and turbidity downstream of the diversion dam.

1.3.3.2 Nexus Under Proposed Project Operations

Relative to hydrology and water quality, the Project nexus under proposed Project operations will be generally similar to current conditions (as described in Section 1.3.3.1 above). However, several important new adjustments or measures are proposed that will further protect or enhance water resources as described in PacifiCorp's Preliminary Licensing Proposal (PLP; PacifiCorp 2013a). These adjustments and measures include:

- Re-routing of the Project tailrace, which will result in a return of Powerhouse (turbine) discharge flows to the lower 0.5 mile of the East Fork (rather than to the West Fork as occurs in the current configuration).
- An increase in the minimum flow release to a year-round minimum in-stream flow of 4 cfs (from the current release of about 0.5 to 0.8 cfs) or inflow from the East Fork to the Project forebay, whichever is less (as measured at the FERC-compliance gage immediately below the dam).
- Modifying the historic practice of flushing entrained native sediment from the forebay during the summer low flow period to flushing sediment from the forebay during the peak-spring runoff in the month of June. Flushing would also occur relatively quickly, lasting no more than 72 hours.
- Implementing a number of Best Management Practices (BMPs) for erosion, sediment, and spill prevention and control during proposed construction activities. These BMPs would be determined in consultation with and approved by applicable regulatory agencies, such as DEQ (related to applicable 401 Water Quality Certification) and the U.S. Army Corps of Engineers (related to applicable 404 Removal-Fill Permits).

1.3.3.3 Nexus of Project Facilities and Operations to State Water Quality Standards

The nexus of the Project facilities and operations (both current and proposed) to key water quality parameters addressed by state standards and criteria (OAR 340-041) are summarized in Table 1-1. On the basis of Project nexus and the rationale as described in Table 1-1, this study specifically focuses on the key water quality parameters of water temperature, dissolved oxygen, turbidity, and total dissolved gas (TDG). Further rationale and discussion of the focus on these particular parameters for this study are provided in Section 2.0 below.

Table 1-1 Rationale for Sampling Conducted in this Study of Water Quality Parameters Addressed In Standards or Criteria Under Oregon Administrative Rules (OAR).

Parameter	Sampling Done?	Rationale	Applicable Standard
Numeric Criteria			
Water Temperature	Yes	Project facilities and operations do not cause any direct thermal discharge or load to Project waters. Project operations can affect physical flow conditions (e.g., flow quantity, depths, and velocities in the bypassed reach). Such effects have the potential to affect water temperature by increasing the amount of solar radiation entering the water. Analysis of these potential effects is warranted as water temperature is an important parameter for supporting cold-water biota (e.g., bull trout) in Project waters.	OAR 340-041-0028
Dissolved Oxygen	Yes	Project facilities and operations do not contribute any oxygen-demanding substances in Project waters. Project operations can affect physical flow conditions (e.g., flow quantity, depths, and velocities in the bypassed reach). Such effects are unlikely to affect DO, although verification is warranted as DO is an important parameter for supporting cold-water biota (e.g., bull trout) in Project waters.	OAR 340-041-0016(1)
Turbidity	Yes	Increases in turbidity are possible when water is spilled from the diversion dams due to maintenance flushing of the forebay.	OAR 340-041-0036
Total Dissolved Gas	Yes	Total dissolved gas (TDG) supersaturation can occur at hydropower facilities when large volumes of water are spilled from dams and entrain significant volumes of atmospheric gases. TDG supersaturation typically occurs only at larger mainstem dams where relatively deep reservoirs or non-turbulent river reaches offer less-effective gas dissipation than shallow, more turbulent river reaches that facilitate degassing. Therefore, TDG supersaturation is not expected for this Project, although verification was conducted in this study as TDG is an important parameter for supporting cold-water biota (e.g., bull trout) in Project waters.	OAR 340-041-0031(2)
Nuisance Phytoplankton Growth	No	Project facilities and operations do not contribute to phytoplankton growth in Project waters. There are no Project-related discharges of nutrients or other conditions that would contribute to primary production.	OAR 340-041-0019
pH (Hydrogen Ion Concentration)	No	There are no Project-related discharges of nutrients or other conditions that contribute to primary production that could affect pH. Project facilities and operations do use or discharge any other substances to Project waters that could affect buffering capacity and pH.	OAR 340-041-0156(1)
Total Dissolved Solids	No	Project facilities and operations do not discharge substances to Project waters that could affect total dissolved solids. The Project does not engage in irrigation or water reuse that could act to increase total dissolved solids.	OAR 340-041-0156(2)

Table 1-1 Rationale for Sampling Conducted in this Study of Water Quality Parameters Addressed In Standards or Criteria Under Oregon Administrative Rules (OAR).

Parameter	Sampling Done?	Rationale	Applicable Standard
Toxic Substances	No	Project facilities and operations do not discharge any potentially-toxic substances to Project waters.	OAR 340-041-0033
Bacteria	No	Project facilities and operations do not contribute to bacteria levels in Project waters. There are no Project-related discharges of raw or treated sewage or animal wastes into Project waters. Composting or vault type toilets are used at Project facilities.	OAR 340-041-0009
Narrative Criteria			
Biocriteria	Yes	This criterion clarifies that waters of the State must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities. Compliance with this criterion can be determined based on data obtained from water temperature, DO, and other monitoring as described above, as well as fisheries and macroinvertebrate data collected for the Aquatics Study[a].	OAR 340-041-0011
Aesthetic Conditions	No	Project facilities and operations do not create or cause any known aesthetic conditions offensive to the human senses of sight, taste, smell, or touch. No sampling is necessary or proposed to address this criterion. Any potential for aesthetic effects related to turbidity can be inferred from data obtained from turbidity monitoring. Other aspects of aesthetics and visual character related to Project facilities are assessed under the Aesthetic and Visual Resources Study[b].	OAR 340-041-0007(14)
Dissolved Gases	No	Project facilities and operations do not create or cause dissolved gases that produce objectionable odors or result in deleterious effects on designated beneficial uses.	OAR 340-041-0031(1)
Tastes or Odors	No	Project facilities and operations do not create or cause taste or odors issues affecting water potability or fish consumption.	OAR 340-041-0007(11)
Discoloration, Scum, Oily Sleek	No	Project facilities and operations do not create or cause objectionable discoloration, scum, oily sheens, or floating solids.	OAR 340-041-0007(13)
Bottom or Sludge Deposits	No	Project facilities and operations do not create or cause formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to designated beneficial uses.	OAR 340-041-0007(12)
Development of Fungi	No	Project facilities and operations do not create or cause the development of fungi or other growths having deleterious effects on designated beneficial uses.	OAR 340-041-0007(10)
Radioisotopes	No	No radioisotopes are being added to the water by the Project, and there are no known naturally-occurring problems with radioisotopes.	OAR 340-041-0007(15)

[a] See the Aquatic Resources Updated Study Report (Final Technical Report) for details.

[b] See the Aesthetic and Visual Resources Updated Study Report (Final Technical Report) for details.

2.0 STUDY METHODS

2.1 Sampling Design

2.1.1 Study Parameters

The study assessed five flow and water quality parameters at seven sampling sites in the vicinity of the Project over a two-year study period. The first year of study occurred from about October 2011 to September 2012 (referred to as Water Year [WY] 2012), and the second year of study occurred from October 2012 to September 2013 (referred to as Water Year [WY] 2013). During the first year of the study (WY 2012), five flow and water quality parameters at seven sampling sites in the Project vicinity were monitored. The five flow and water quality parameters and associated methods are summarized in Table 2-1. During the second year of the study (WY 2013), flow and water temperature monitoring was continued at five of the sites.

Table 2-1 Parameters and Sampling Techniques for the Water Resources Study.

Parameters	Type	Sampling Technique
Flow	Continuous	Continuously recorded hourly values during WY 2012 and WY 2013 using stage gaging (at 5 sites).
Water temperature	Continuous	Continuously recorded hourly values during WY 2012 and WY 2013 using thermographs associated with flow dataloggers (at the 5 flow gage sites).
Water temperature	Continuous	Continuously recorded hourly values during WY 2012 using thermographs (at 3 other water temperature sites).
Dissolved oxygen	Continuous	Continuously recorded hourly values for 72-hour periods in each of the months of August, September, and October during WY 2012 (at 3 sites).
Total dissolved gas	Discrete	Grab samples taken twice daily on two consecutive days per month for June-September during WY 2012 using a TDG probe in the Project tailrace.
Turbidity	Continuous	The Water Resources Study Plan (PacifiCorp 2011) called for continuously recorded hourly values for multi-day period that extended before, during, and after maintenance flushing using datasondes (at 3 sites). Such maintenance flushing sampling did not occur during the year, but other investigative background sampling occurred in June 2012 as discussed further in Section 3.5 of this report.

2.1.2 Study Area and Sampling Locations

The study area pertinent to the evaluation of hydrology and water quality includes the following waters:

- East Fork Wallowa River and Royal Purple Creek inflows to Project diversions;
- East Fork Wallowa River bypassed reach;
- Project tailrace; and
- West Fork Wallowa River into which tailrace waters discharge.

The study includes seven monitoring and sampling sites. The seven sites are summarized in Table 2-2, and Figure 2.1 shows the locations of the sites. The sampling sites are chosen for their ability to represent conditions within the study area (as defined above) and to assess potential effects of Project facilities and operations on water quality.

Table 2-2 List of Sample Sites for the Water Resources Study

Sample Site	Associated Code
East Fork Wallowa River Inflow to Project Forebay	EFI
Royal Purple Creek Inflow to Project Diversion	RPI
East Fork Wallowa River Bypassed Reach – Upper End	BPU
East Fork Wallowa River Bypassed Reach – Lower End	BPL
Tailrace below Project Powerhouse	PHT
West Fork Wallowa River Upstream of Tailrace Discharge	WFI
Wallowa River Downstream of E.F. and W.F. Confluence	WRC

2.1.3 Sampling Timing and Duration

Sampling timing and duration varies by parameter and sampling locations, as summarized in Table 2-3. They are five types of sampling timing and duration:

1. Continuous (hourly) sampling during WY 2012 and WY 2013 of flow and water temperature (at flow gaging sites)

2. Continuous (hourly) sampling during WY 2012 of water temperature (at other water temperature sites)

3. Continuous (hourly) sampling for three 72-hour periods in later August through October of WY 2012 for dissolved oxygen

4. Discrete (twice daily) sampling for two-day periods each month from June to September of WY 2012 for TDG

5. Continuous (hourly) sampling for multi-day period during forebay maintenance (for turbidity) was originally planned. However, the maintenance sampling of turbidity did not occur, but other investigative background sampling occurred as discussed further in Section 3.5 of this report.

Figure 2.1 Locations of monitoring and sampling sites for the Water Resources Study.

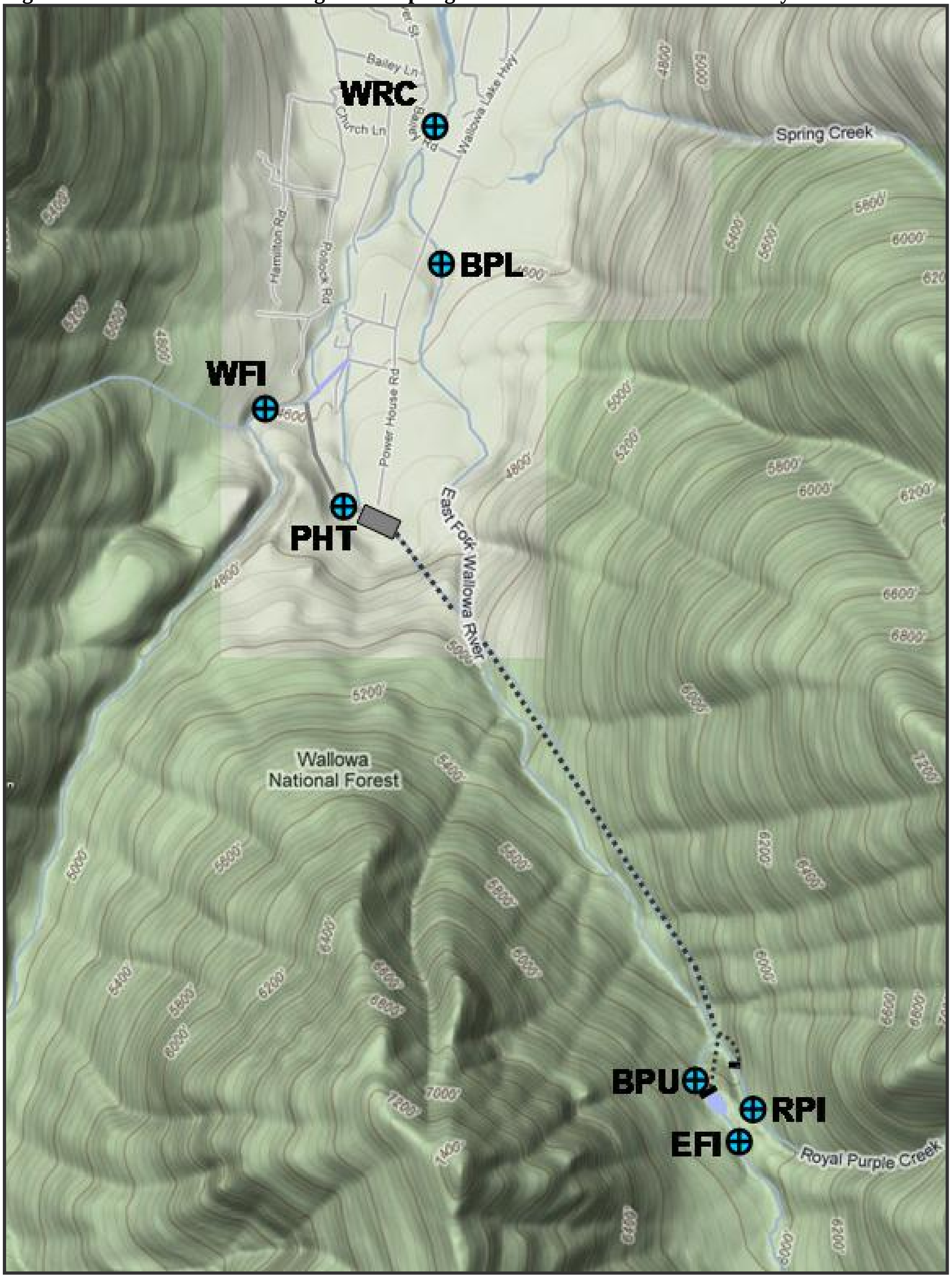


Table 2-3 List of Parameters, Sampling Events, and Sites for the Water Resources Study.

Parameters	Type	Sampling Events							Sites						
		Seasonal: January	Seasonal: April	Monthly: June	Seasonal: July	Monthly: August	Monthly: September	Seasonal: October	EFI	RPI	BPU	BPL	PHT	WFI	WRC
Flow	Continuous	—	—	—	—	—	—	—	●	●	●	●	●		
Water temperature	Continuous	—	—	—	—	—	—	—	●	●	●	●	●	●	●
Dissolved oxygen	Continuous					—	—	—	●		●	●			
TDG	Discrete			—	—	—	—						●		
Turbidity	Continuous				*Not Conducted*				●			●	●		

2.2 Study Methodology

2.2.1 Hydrology

Flow gaging was conducted at five sites, including sites EFI, RPI, BPU, BPL, and PHT as listed in Table 2-2 and shown in Figure 2.1. The EFI site represents the primary source of inflow to the Project. The RPI site is a secondary and relatively minor source of inflow to the Project. The BPU and BPL sites represent flows in the upper and lower ends of the Project bypassed reach, respectively, where Project effects on flow are most prevalent due to diversions from the diversion dam to the powerhouse. The PHT site represents the discharge from the Project powerhouse.

Flow gaging at sites EFI, RPI, BPU, and BPL was conducted based on open-channel stage-discharge monitoring methods in which stage (that is, water level or water depth) in the channel at these four sites is continuously monitored. Stage data was subsequently converted to an estimate of corresponding streamflow based on relationships (or "ratings") between streamflow and stage that were developed for each of the four sites (e.g., Gordon et al. 2004, Rantz et al. 1982). Stage (i.e., water level) measurements were recorded at hourly intervals at the four sites using an in-situ water level datalogger (e.g., Solinst Levelogger, various models), which includes a pressure transducer, temperature sensor, and internal datalogger.

To develop the stage-discharge ratings at sites EFI, RPI, BPU, and BPL, a series of at least three instantaneous flow measurements were made at or near the gage locations. These measurements were based on the area-velocity technique or volumetric measurements as appropriate for specific conditions for each of these sites (e.g., NNPSMP 2008, Gordon et al. 2004, Rantz et al. 1982).

Flow gaging at site PHT was conducted based primarily on monitoring of turbine generation. PacifiCorp has developed a performance curve for computing powerhouse flow as a function of turbine generation, and the curve was used to derive flow values at the PHT gaging site. As at the other sites, water level measurements were recorded at hourly intervals at the PHT site using an in-situ water level datalogger. These data were used to check or supplement the flow values derived using the performance curve for the PHT site. For example, the performance curve provides accurate flow values when the powerhouse is operational (turbine generation is occurring), but is not accurate during occurrences of non-generation, such as during powerhouse outages.

When the powerhouse is not actively generating power, either of two possible flow conditions occur at the PHT site: (1) a small volume of water continues to flow through the powerhouse and the tailrace, but is bypassed around the turbine; or (2) the canal headgate is closed and flows cease through the powerhouse and tailrace completely. To determine whether the first or second condition was in effect during powerhouse outages, the water level measurements at the PHT site (using the in-situ water level datalogger) were examined for the outage periods. During such periods, it was assumed that water levels less than or equal to 0.2 feet indicates that the tailrace was effectively dry; that is, diversions had ceased during the outage. For water levels greater than 0.2 feet, it was assumed that approximately 2 cfs (as estimated based on field observations) continues to flow through the powerhouse during the outage.

2.2.2 Water Quality

2.2.2.1 Water Temperature

Water temperature was monitored at seven sites, including sites EFI, RPI, BPU, BPL, PHT, WFI, and WRC as listed in Table 2-2 and shown in Figure 2.1. These seven sites provide comprehensive spatial coverage of water temperature conditions upstream, within, and downstream of the Project area. Water temperature monitoring occurred year-round, but the period of focus is from May to October, which is the portion of the year that includes: (1) presence of potentially-sensitive aquatic biota life stages (i.e., bull trout spawning and rearing; kokanee spawning); and (2) seasonally warmer meteorology and lower flow conditions, when potential Project effects on water temperatures, if present, are most likely to occur. While the period May to October is the focus, the water temperature collected for the other months provide additional background on ambient water temperatures during colder meteorological conditions.

Sites EFI, RPI, and WFI are representative of inflow water temperature conditions to waters in the Project vicinity. These inflow sites are used to help characterize natural thermal conditions in the watershed upstream of Project facilities. These sites also are used to compare with downstream sites to assess potential water temperature changes as flows travel through the Project area. Sites BPU and BPL are used to characterize water temperature in the East Fork bypassed reach and to assess potential effects on water temperatures in the reach due to diversion of flows from the reach to the powerhouse. Site PHT is used to characterize water temperature in flows discharged from the powerhouse and to assess potential effects due to diversion of flows through the powerhouse. Site WRC is used to characterize water temperature in the Wallowa River below the confluence of the East Fork and West Fork and to assess potential effects on the Project, if any, on water temperatures in the Wallowa River downstream of the Project area.

Water temperature data were collected using continuously-recording water temperature sensors (i.e., thermographs) installed at each site as indicated in Table 2-3. At sites EFI, RPI, BPU, BPL, and PHT, thermographs consisted of in-situ temperature sensors that are contained within water level dataloggers (e.g., Solinst Levelogger, various models) deployed at those sites for flow gaging (as described above in Section 2.2.1). At sites WFI and WRC, thermographs consisted of in-situ temperature dataloggers (e.g., Onset Tidbit UTBI-001). Temperature dataloggers were programmed to record temperature on an hourly basis, and were downloaded during scheduled sampling visits to the field as indicated in Table 2-3.

2.2.2.2 Dissolved Oxygen

Project effects on dissolved oxygen are unlikely for reasons as described in Table 1-1. However, dissolved oxygen monitoring was conducted to assess conditions in the East Fork bypassed reach for 72-hour periods in each of the months of August, September, and October during WY 2012. The East Fork bypassed reach is where Project operations have the most potential to affect physical flow conditions (e.g., flow quantity, depths, and velocities in the bypassed reach). Dissolved oxygen monitoring data are used to verify that changes in physical flow conditions do not affect dissolved oxygen saturation. The monitoring period coincides with timing of bull trout and kokanee spawning, and the associated application of the dissolved oxygen standard as indicated in Table 2-4.

Dissolved oxygen were monitored at three sites, including sites EFI, BPU, and BPL as listed in Table 2-2 and shown in Figure 2.1. Sites BPU and BPL are used to characterize dissolved oxygen conditions in the East Fork bypassed reach and to assess potential effects on dissolved oxygen in the reach due to diversion of flows from the reach to the powerhouse. Site EFI is representative of inflow dissolved oxygen conditions to the East Fork bypassed reach. This inflow site is being used to help characterize dissolved oxygen background conditions upstream of the bypassed reach.

Continuously-recording water quality datasondes were deployed for dissolved oxygen measurements at each of the sites. For dissolved oxygen data collection at sites EFI, BPU, and BPL, datasondes included in-situ optical dissolved oxygen sensors (e.g., YSI Model 6920). These datasondes were programmed to record sampled values on an hourly basis, and were downloaded at the conclusion of scheduled sampling periods as indicated in Table 2-3.

Table 2-4 Assessment of Parameters Relative to Standards Compliance.

Parameters	Unit	Key Statistic	Associated Standard
Water temperature	°C	7-day average of the maximum daily water temperature (7-DAD Max)	Criteria in OAR 340-041-0028: May not exceed 12.0°C (53.6°F) in streams identified as having bull trout spawning and juvenile rearing use. "Natural Conditions Criteria" provides that where the natural thermal potential of all or a portion of a water body exceeds the biologically-based criteria (as above), the natural thermal potential temperatures supersede the biologically-based criteria, and are deemed to be the applicable criteria[a]. When temperatures are colder than the biologically-based criteria (as above), waters may not be warmed by more than 0.3°C (0.5°F) above the colder water ambient temperature[b]. Also, exceedance of the biologically-based criteria (as above) is not considered a violation during conditions of highest air temperatures (the 90th percentile value of annual maximum seven-day average maximum air temperatures) or lowest flows (less than the 7Q10 low flow conditions) [c].
Dissolved oxygen	mg/L	Individual values as recorded	Criteria in OAR 340-041-0016: DO may not be less than 11.0 mg/L when trout spawning through fry emergence occurs. However, if the minimum intergravel DO is 8.0 mg/L or greater, then the DO criterion is 9.0 mg/l. Where ambient pressure and temperature conditions preclude attainment of the 11.0 mg/l or 9.0 mg/L criteria, DO levels must not be less than 95% saturation DO may not be less than 8.0 mg/L as an absolute minimum. Where ambient pressure and temperature conditions preclude attainment of the 8.0 mg/L, DO levels must not be less than 90% saturation.
TDG	percent saturation	Individual values as recorded	Criteria in OAR 340-041-0031: TDG may not exceed 110 percent of saturation (% saturation) relative to atmospheric pressure at the point of sample collection, except when stream flow exceeds the 10-year, 7-day average flood. However, TDG may not exceed 105 % saturation in waters of less than two feet in depth.
Turbidity	NTU[d]	Individual sample values as recorded	Criteria in OAR 340-041-0036: No more than a 10% cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity. However, limited duration activities necessary to address an emergency or to accommodate essential activities and which cause the standard to be exceeded may be authorized provided all practicable turbidity control techniques have been applied and applicable approval has been granted.

[a] If necessary, the "natural thermal potential temperatures" will be determined using data from the EFI, RPI, and WFI sites (to represent inflow sites unaffected by the Project).

[b] If necessary, the "colder water ambient temperature" will be determined using data from the EFI, RPI, and WFI sites (to represent inflow sites unaffected by the Project).

[c] If necessary, these conditions will be determined based on locally-available air temperature and flow data.

[d] Nephelometric Turbidity Unit.

2.2.2.3 Total Dissolved Gas (TDG)

Project effects on TDG are unlikely for reasons as discussed in Table 1-1. However, a monthly TDG sampling schedule was implemented to assess TDG conditions downstream of the Project powerhouse for the period of June through September during WY 2012 to verify that air entrainment from the powerhouse does not cause TDG supersaturation.

TDG was monitored at PHT as BPL as listed in Table 2-2 and shown in Figure 2.1 to characterize TDG in waters discharging from the powerhouse. TDG data was collected over a two-day period each month for June-September in WY 2012. Two discrete grab samples (morning and afternoon) were collected and recorded each day at site PHT using a monitoring instrument equipped with an in-situ TDG pressure transducer (e.g., Hydrolab Model MS-5 or DS-5).

2.2.2.4 Turbidity

The Water Resources Study Plan (PacifiCorp 2011) called for continuously recorded hourly values for a multi-day period during maintenance of the forebay at the East Fork diversion dam (likely in July or August) when accumulated sediments in the forebay are released downstream. PacifiCorp may flush the Project forebay to reduce sediment build-up on an as-needed basis. Under the current license, forebay flushing is restricted to the period of May 1 through August 30 of each year for the protection of kokanee eggs and sac fry in the gravel areas upstream of Wallowa Lake.

The Water Resources Study Plan (PacifiCorp 2011) called for turbidity to be monitored at three sites, including sites EFI, BPL and PHT (as listed in Table 2-2 and shown in Figure 2.1). Site EFI is representative of inflow turbidity conditions to the forebay, and would characterize background turbidity conditions upstream of the forebay. Site BPL would characterize turbidity concentrations in the East Fork that results from waters flushed from the forebay during the maintenance event. Site PHT would characterize turbidity concentrations in waters discharged from the powerhouse during the maintenance event.

As discussed further in Section 3.5 of this report, routine forebay maintenance flushing did not occur during the study. Consequently, proposed turbidity sampling as described above did not occur. However, other turbidity and flow monitoring was conducted by PacifiCorp during June 2012 to illustrate the influence of early season high flows on background turbidity levels; that is, levels that occur in the East Fork Wallowa River when forebay flushing is not occurring. The purpose of this monitoring is to develop a record of background turbidity and flow for a typical June runoff period prior to future forebay flushing events. This turbidity analysis and other aspects of sediment characteristics and transport related to future forebay flushing were conducted as part of sediment and substrate characterization studies as reported further in the PacifiCorp (2012).

2.3 Data Analysis

2.3.1 Analysis of Hydrology Data

For the gaged sites EFI, RPI, BPU, BPL, and PHT, average daily and average monthly flows were calculated from collected streamflow data values. Summary tables of the flow measurement data were produced, and included sample dates, times, locations, and results. Average daily and average monthly flows, and lowest and highest (peak) hourly flows for each site were computed and tabulated. Average daily flows for each site were graphed for assessment and discussion of trends (as presented in Section 3.1 of this report). Appendix A includes the average daily flow data for the gaged sites.

The record of average daily flows for site EFI was examined for correlation to records of daily flows from similar USGS gages data elsewhere in the region, an approach known as a basin transfer method (Sanborn and Bledsoe 2006, Gordon et al. 2004, Riggs 1973). This examination was used to assess the possibility of extending the record of average daily flows for site EFI to characterize the flows measured during this study in context with the range of historic flow conditions. However, the correlations of average daily flows for site EFI to other similar USGS gages in the region were insufficient for flow record extension as proposed. Therefore, as an alternative approach, the historic 44-year period-of-record (from October 1924 to September 1952 and again from October 1966 to September 1983) for the historic USGS gages in the East Fork (USGS Station 13325000) and Project tailrace (USGS Station 13324500) were used to characterize long-term flow conditions and trends. Because this historic record is dated (i.e., 50 to 90 years old), an examination was made of potential systematic trends of flows in the region that may affect the ability of these historic flow data to represent current and future flow conditions (as discussed further in Section 3.1.3 below).

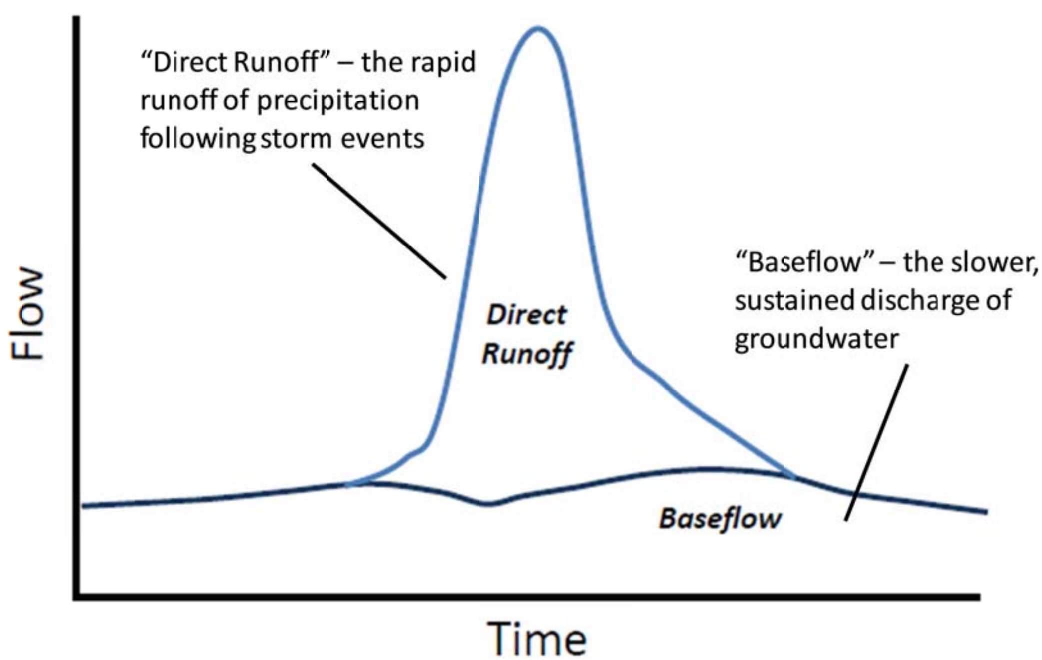
The historic 44-year period-of-record at the USGS gages was used to derive monthly flow duration curves. The flow duration curves provide a graphical representation of a ranking of all the daily flows for a given month over the period-of-record (Gordon et al. 2004, USGS 2001). The ranking is from the lowest to the highest for the given month or annually, where the rank is the percentage of time the flow value is equaled or exceeded. Flow duration curves by month characterize the percent of days for a particular month that a given flow is equaled or exceeded, and are useful for assessing flow availability for Project generation and instream flows.

"Baseflow" is the component of streamflow that is attributed to ground water discharge and other delayed runoff sources such as soil-related snowmelt runoff release into streams. Baseflow analysis provides insight into low flow conditions in a stream resulting from the gradual recession of discharge during periods with little or no precipitation (Tallaksen 1995). For this study, baseflow contributions to the East Fork were estimated using a software program called PART, a public domain computer program developed by the USGS that provides a computational methodology for separating the surface runoff and baseflow components of streamflow (Rutledge 1998) as conceptually depicted in Figure 2.2. Baseflow estimates derived through hydrograph separation have traditionally been considered a reasonable approximation of the volume of groundwater discharge to a stream (Tallaksen 1995, Rutledge 1998). Baseflow contributions to the East Fork were determined to assist in the assessment of instream water availability under low flow conditions, including possible gains or losses of flow, in the bypassed reach below the Project diversion.

The baseflow assessment was applied using daily flows for: (1) flows as measured at site EFI during WY 2012 and WY 2013; and (2) the daily sums of flows as measured at sites BPL and PHT during WY 2012 and WY 2013. The EFI site is used to assess baseflow contribution at the point of inflow to the Project area. The flows at sites BPL and PHT are used to assess baseflow contribution to a point at the lower end of the East Fork bypassed reach. The sums of flows at sites BPL and PHT were used to avoid over-estimation of net baseflow contribution between the inflow (EFI) and lower (BPL) sites that would occur if diversions to the Powerhouse (i.e., site PHT) were not factored into the assessment.

The baseflow assessment was used to compute average monthly baseflows (from the daily flow data sets) for months during summer/early fall (August-October) and late fall/winter (November-April) low flow periods. The months of the spring runoff higher-flow period (May-July) are dominated by snowmelt runoff and were excluded from the baseflow analysis. Baseflow recession computations, included as performed by the PART model, cannot differentiate between snowmelt processes and groundwater discharge, and snowmelt can mitigate the flashy signature of storm events, leading to over-estimation of baseflow (Sinclair and Pitz 1999).

Figure 2.2 Conceptual hydrograph showing assumed direct runoff and baseflow components.



2.3.2 Analysis of Water Quality Data

Tables of the water quality data were produced, including sample dates, times, locations, and results for inclusion as appendices to this report. Appendixes containing data are attached, including water temperature data (Appendix B), dissolved oxygen data (Appendix C), and TDG data (Appendix D). Minimum, mean, and maximum values, and other key water quality statistics were computed, including those listed in Table 2-4. Summary tables and graphs were compiled for assessment and discussion of water quality conditions and trends as presented in Sections 3.2 (water temperature), 3.3 (dissolved oxygen), and 3.4 (TDG).

For water temperature, the hourly data at the sites were used to compute summary statistics, including the minimum, mean, and maximum temperatures recorded for each day at each site, and the 7-day average of the daily maximum temperature (7 DAD Max). The 7 DAD Max is the arithmetic average of seven consecutive daily maximum temperature measurements. The 7 DAD Max for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the 3 days prior to, and the 3 days after, that date. As summarized previously in Table 2-4, the 7 DAD Max is a statistic described in the State of Oregon's water quality standards to assess water temperature protection of State waters based on salmon and trout (salmonid) use categories (OAR 340-041-0028).

As discussed in Section 1.3.3.3 above, the study focused on the key water quality parameters of water temperature, dissolved oxygen, turbidity, and TDG based on nexus to Project facilities and operations. Sections 3.2, 3.3, and 3.4 of this Updated Study Report (Final Technical Report) include discussions of water temperature, dissolved oxygen, and TDG relative to State of Oregon water quality standards (OAR 340-041) as summarized in Table 2-4.

A discussion of turbidity relative to the State of Oregon standard is not included in Section 3.5. As discussed further in Section 3.5, routine forebay maintenance flushing did not occur during the study. Consequently, turbidity sampling as originally proposed in the Water Resources Study Plan (PacifiCorp 2011) did not occur. Other turbidity monitoring was conducted by PacifiCorp during June 2012 to develop a record of background turbidity for a typical June runoff period prior to future forebay flushing events (PacifiCorp 2013b). Additional turbidity monitoring would be conducted in consultation with DEQ during forebay flushing in the future.

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3.0 RESULTS

Results of the data collection for the Water Resources Study are presented in the following sections by parameter.

3.1 Hydrology Data

3.1.1 Summary of Data Completeness

Completeness is the percentage of valid results obtained compared to the total number of planned hourly measurements to be taken at the gage sites for flow. Completeness is ideally 100 percent, but the actual completeness can be less than 100 percent if data cannot be obtained or is eliminated due to logistics, equipment, or analytical issues.

Hourly flow data collection completeness of 95 percent or greater was achieved for WY 2012 at gaging sites EFI, BPU and PHT, 83 percent at site BPL, and 35 percent at site RPI (Table 3-1). Data collection completeness of 95 percent or greater was achieved for WY 2013 at all five gaging sites (Table 3-2). Data collection completeness was less successful at gage site RPI (35 percent) for WY 2012 due mostly to lack of data collection during the early months of the study. Prior to May 2012, the levelogger and staff gage at site RPI were located just upstream of the small weir that serves as the intake diversion point at this site. The small weir was subject to accumulation of debris that affected the water levels over the levelogger. Subsequently, the levelogger and staff gage at site RPI were moved upstream approximately 10-20 feet, above the influence of the intake.

The RPI site is a secondary and relatively minor source of inflow to the Project. Continuous flow gaging at the RPI site was proposed as part of the Water Resources Study Plan for the Project (PacifiCorp 2011). However, the Water Resources Study Plan emphasized that accurate and reliable flow gaging at the RPI site may prove infeasible or incomplete due to constraints posed by the site's small channel and flow levels.

3.1.2 Annual and Mean Monthly Flows

The hourly flow data at the gage sites was used to compute average monthly flows and the annual average flow for WY 2012 and WY 2013 at the gage sites (Table 3-3). The overall average annual flow for WY 2012 at sites EFI, RPI, BPU, BPL, and PHT was 21.1, 1.8, 10.9, 19.5, and 10.5 cfs, respectively (Table 3-3). The overall average annual flow for WY 2013 at sites EFI, RPI, BPU, BPL, and PHT was 21.2, 1.1, 13.1, 15.7, and 8.1 cfs, respectively (Table 3-3).

Table 3-1 Completeness of Hydrology Data Collection by Study Site for WY 2012

			Percent of Hours Data Collected by Study Site				
Period	**Days**	**Hours**	**EFI**	**RPI**	**BPU**	**BPL**	**PHT**
October	31	744	40	0	100	0	100
November	30	720	100	0	100	1	100
December	31	744	100	0	100	100	100
January	31	744	100	0	100	100	100
February	29	696	100	0	100	100	100
March	31	744	100	0	100	100	100
April	30	720	100	0	100	100	100
May	31	744	100	5	100	100	100
June	30	720	100	99	100	100	100
July	31	744	100	100	100	100	100
August	31	744	100	100	100	100	100
September	30	720	100	100	100	100	100
Water Year	366	8784	95	34	100	83	100

Table 3-2 Completeness of Hydrology Data Collection by Study Site for WY 2013

			Percent of Hours Data Collected by Study Site				
Period	**Days**	**Hours**	**EFI**	**RPI**	**BPU**	**BPL**	**PHT**
October	31	744	97	97	97	0	100
November	30	720	100	100	100	1	100
December	31	744	91	91	87	100	100
January	31	744	89	90	74	100	100
February	28	672	99	97	96	100	100
March	31	744	100	99	96	100	100
April	30	720	100	100	100	100	100
May	31	744	100	100	100	100	100
June	30	720	100	100	100	100	100
July	31	744	100	100	100	100	100
August	31	744	81	77	100	100	100
September	30	720	100	100	100	100	100
Water Year	365	8760	95	95	95	96	100

Table 3-3 Average Monthly Flow (cfs) by Study Site During WY 2012 and WY 2012.

Month	Average Monthly Flow (cfs) by Study Site									
	EFI		RPI		BPU		BPL		PHT	
	WY 2012	WY 2013	WY 2012	WY 2013	WY 2012	WY 2013	WY 2012	WY 2013	WY 2012	WY 2013
October	15.1	18.1	NA	0.9	3.8	12.0	NA	14.8	13.8	4.1
November	14.5	19.7	NA	1.1	1.9	6.7	NA	9.6	13.7	9.6
December	14.4	19.7	NA	1.4	1.7	6.4	21.1	9.3	12.3	9.7
January	12.4	16.1	NA	1.2	6.4	2.7	24.0	4.6	5.3	10.8
February	11.3	13.7	NA	1.0	3.4	1.7	10.8	3.0	8.6	10.6
March	10.7	11.8	NA	0.9	1.4	5.2	6.6	7.3	10.5	6.7
April	16.5	11.7	NA	0.9	5.9	7.4	11.1	8.2	10.7	6.2
May	28.1	26.0	0.8	1.3	17.2	19.3	22.4	21.1	12.6	10.8
June	49.8	44.0	0.9	2.3	36.9	38.8	47.6	43.7	12.8	10.5
July	41.2	31.0	2.0	1.3	33.2	26.6	33.7	32.9	9.6	10.6
August	17.0	19.5	2.1	0.8	11.1	12.9	9.9	14.3	9.0	6.9
September	14.8	22.4	2.1	0.6	9.8	17.4	8.4	17.6	7.6	1.3
Average	20.8	21.2	1.8	1.1	11.1	13.1	19.5	15.7	10.5	8.1

3.1.3 Comparison to Historic Flow Conditions

Comparison of average monthly flows for WY 2012 and WY 2013 at the gage sites (Table 3-3) with the 10, 50, and 90 percent exceedance levels[1] of average monthly flows at the historic USGS gages (Table 3-4) were used to estimate whether flow conditions were near normal (if comparable to the median or 50-percent historic value), significantly above average or “wet” (if near to the 10-percent historic value), or significantly below average or “dry” (if near to the 90-percent historic value).

Such comparisons indicate that average annual inflows to the Project at the EFI site were near historic normals in both WY 2012 and WY 2013. During WY 2012, average monthly inflows to the Project at the EFI site were near historic normals in nearly all months, expect for April that was wet by comparison. During WY 2013, average monthly inflows to the Project at the EFI site were wet by comparison from October through February and then again in September, but then near normal in the other spring and summer months.

[1] The 10 percent exceedance level is the flow level that is equaled or exceeded by 10 percent of the monthly average flow values in the period of record. For example, a 10 percent exceedance level of 15 cfs in February means that, for a 50-year record, 5 of the monthly average flow values for February in the historic record equaled or exceeded 15 cfs and the other 45 values were less than 15 cfs. Likewise, the 90 percent exceedance level is the flow level that is equaled or exceeded by 90 percent of the monthly average flow values in the period of record. The 50 percent exceedance level is the median of the monthly average flow values in the period of record.

Table 3-4 Average Monthly Flow (cfs) by Percent Exceedance Levels for Historic USGS Gage in the Project Vicinity.

	Project Tailrace plus East Fork (USGS Station 13325001)			Project Tailrace (USGS Station 13324500)			East Fork (USGS Station 13325000)		
Month	**10%**	**50%**	**90%**	**10%**	**50%**	**90%**	**10%**	**50%**	**90%**
October	19.6	14.8	11.1	13.2	8.7	6.3	9.3	4.9	2.8
November	17.9	14.1	10.6	12.6	8.8	6.5	8.3	4.4	2.1
December	16.5	12.7	10.4	12.1	8.7	5.4	7.0	3.8	1.6
January	14.4	11.6	9.6	11.0	8.3	6.4	6.2	2.8	1.4
February	13.8	11.3	8.9	11.3	8.0	6.3	4.8	2.5	1.0
March	13.3	10.9	8.5	11.0	7.6	5.7	4.8	2.6	0.9
April	17.0	13.6	10.3	10.5	7.7	5.8	9.3	4.7	2.6
May	47.9	27.4	21.0	13.6	8.6	6.5	35.7	18.7	12.2
June	88.3	56.3	38.1	14.8	9.3	6.7	73.9	44.8	27.2
July	73.5	42.7	21.3	14.5	9.2	5.8	66.8	30.7	9.9
August	29.5	20.4	12.9	13.1	9.3	6.6	17.7	8.5	4.1
September	19.6	16.4	11.7	13.9	9.5	6.9	10.7	5.3	2.6
Average	30.9	21.0	14.5	12.6	8.6	6.2	21.2	11.1	5.7

Comparisons indicate that average annual flows further downstream in the bypassed reach at site BPL were wet in WY 2012 and near normal in WY 2013. During WY 2012, average monthly flows at site BPL were normal in the spring and summer months (i.e., May through September), but were wet by comparison in the winter months, particularly in December and January when average monthly flows were higher than any recorded previously at the historic USGS gages for those months. As described further in Section 3.1.3.3 below, these wet winter conditions were the result of substantial peak flows caused at lower elevations by rain-on-snow events that were recorded at the lower elevation BPL site during WY 2012. During WY 2013, average monthly flows at site BPL were wet by comparison from October through December, again in March-April, and then again in September, but otherwise near normal in the other winter, spring, and summer months. As described further in Section 3.1.3.3 below, these rain-on-snow events that were recorded at the lower elevation BPL site during WY 2012 were not as evident during WY 2013.

3.1.3.1 Are Historic Flow Data Representative of Current Conditions?

The above comparisons assume that the previous 44-year period of record at the historic USGS gages (from October 1924 to September 1952 and again from October 1966 through September 1983) is representative of current hydrologic conditions. This assumption was further examined based on a review of the literature and historic data trends to assess the extent to which climate or other landscape changes may be affecting trends in hydrologic conditions in the Project area.

In general, for the mountains of the Pacific Northwest, climate change induced hydrologic impacts are predicted to include reduced snow water equivalent (SWE), increased winter flows (runoff), reduced summer flows, and earlier peak streamflows (Mote et al. 2003, Hamlet et al. 2005, Dalton et al. 2013). Because snowpack serves to store water and release it as runoff later in the year, the combination of increased precipitation and reduced snowpack would be expected to result in a general shift in peak annual runoff to earlier in the year (Hamlet et al. 2005).

A plot of mean monthly flows for the previous 44-year period of record at the historic East Fork USGS gage shows an increasing trend over time in May (peak snowmelt runoff) flows, but no clear decreasing (or increasing) trend in September (summer low) flows (Figure 3.1). The increasing trend in May flows could be an artifact of generally lower flows resulting from prolonged drought conditions in the region from about 1928 to 1940 (del Mar 2005). Similar trends are evident for USGS streamflow data over the same period for the Lostine River (Figure 3.2), which flows relatively undisturbed directly from the Wallowa Mountains.

However, since 1968 (when the East Fork gage was no longer in service), systematic changes are not particularly evident from snowpack and hydrology data from the area. For example, SNOTEL data (NRCS 2013) from Mt. Howard (elevation 7,910 ft) indicate that annual peak SWE values since 1982 (when this SNOTEL site was installed) have not shown a clear decreasing (or increasing) trend (Figure 3.3). May flows in the Lostine River since 1968 also show no increasing trend; if anything, they show a slightly decreasing trend (Figure 3.4). These flow data conform to the analysis of Clark (1997) that showed no long-term changes in peak flows in the Lostine watershed since about 1950.

The information above indicates that the previous 44-year flow data records for the historic USGS gages in the East Fork are reasonably representative of current hydrologic conditions; that is, no substantive systematic shift in conditions has occurred since East Fork gage records stopped in 1983. However, this conclusion is not meant to imply that landscape or climate change effects on hydrology in the area may be occurring now or in the future.

Figure 3.1 Time-series and linear fits of mean flows for May (peak runoff) and September (summer low flow) for the 44-year record at the East Fork plus Project Tailrace USGS Station (13325001).

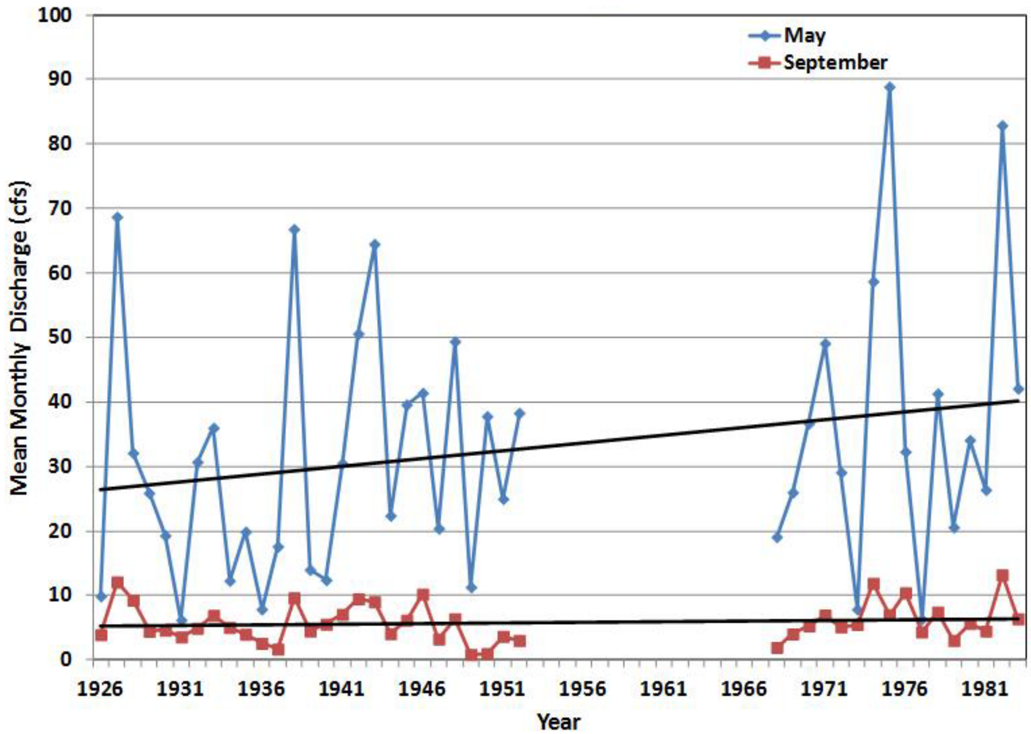


Figure 3.2 Time-series and linear fits of mean flows for May (peak runoff) and September (summer low flow) for the same period (as in Figure above) at the Lostine River USGS Station (13330000).

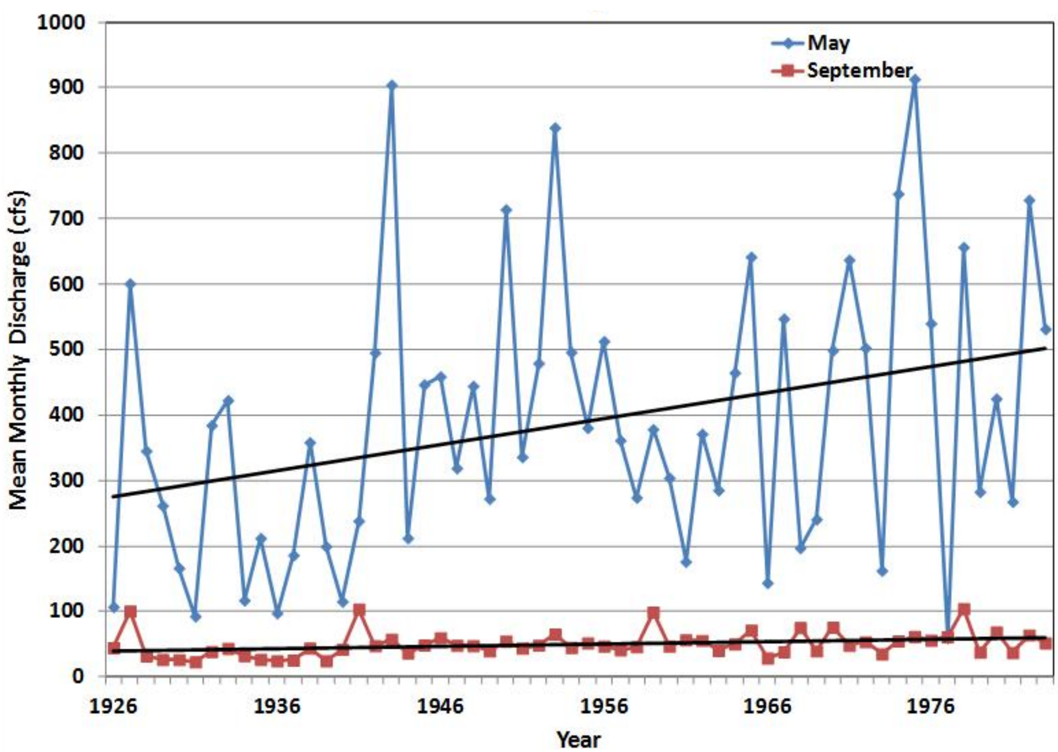


Figure 3.3 Time-series and linear fits of annual peak SWE (cm) values from Mt. Howard SNOTEL site since 1982 (when this SNOTEL site was installed).

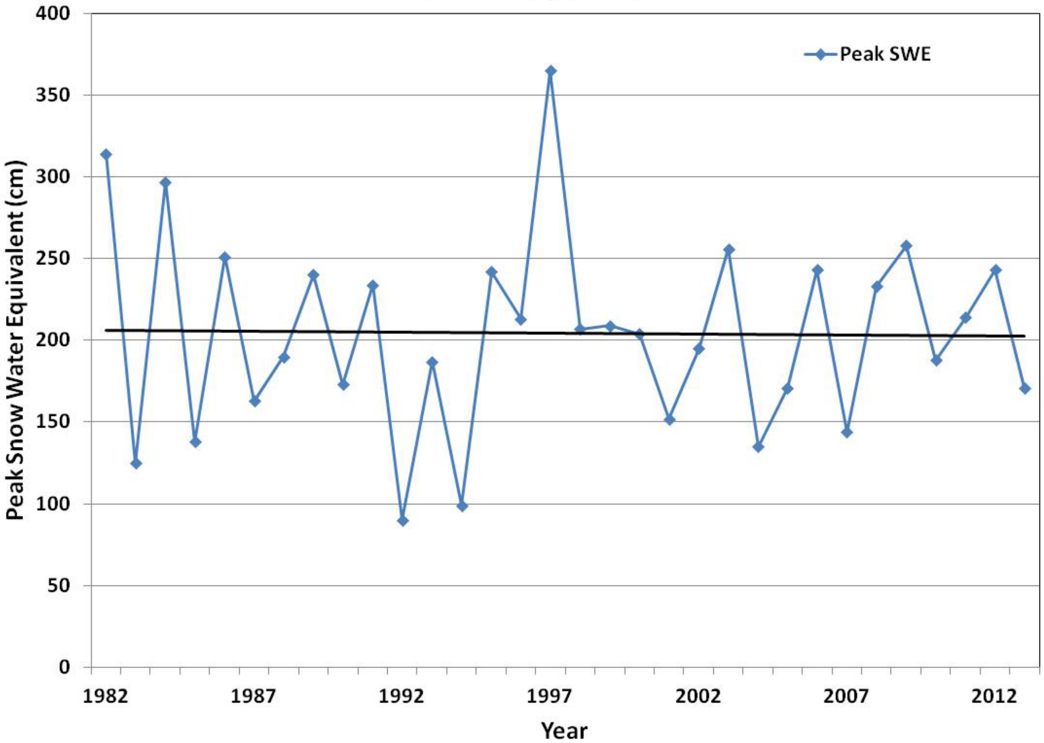
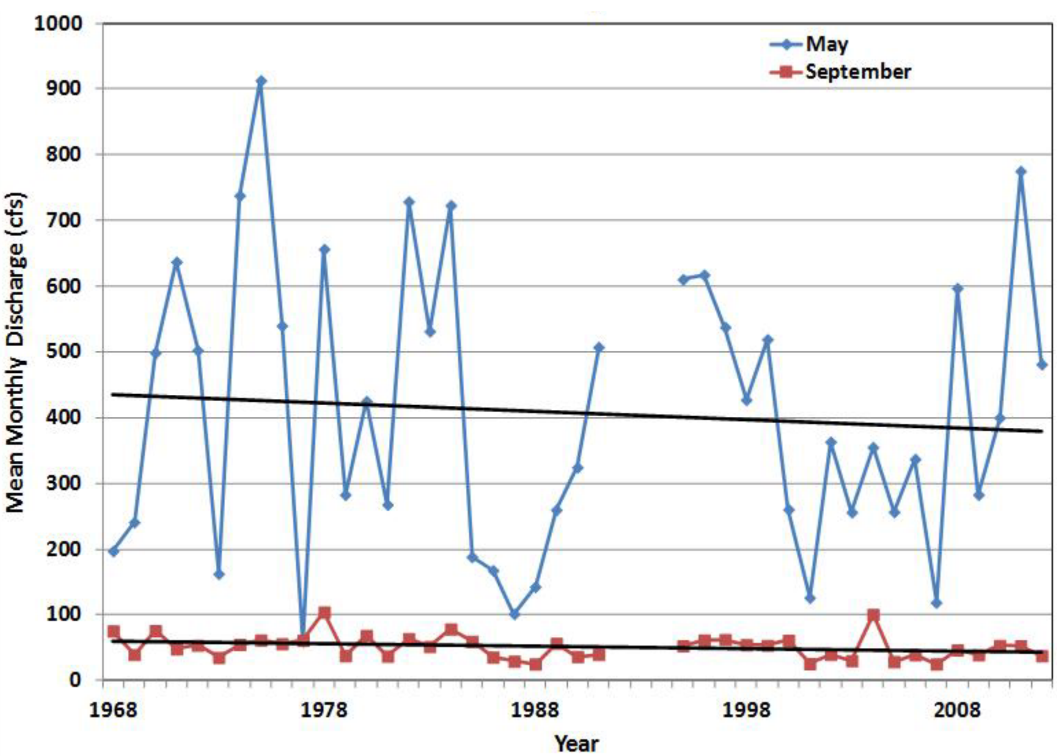


Figure 3.4 Time-series and linear fits of mean flows for May (peak runoff) and September (summer low flow) from 1968 to present at the Lostine River USGS Station (13330000).



3.1.4 Hydrographs of Average Daily Flows

The hourly flow data at the gage sites were used to compute average daily flows at the gage sites (by averaging the 24 hourly values for each day). Hydrographs of average daily flows during WY 2012 and WY 2013 are shown in Figures 3.5 and 3.6, respectively, for the Project forebay inflow sites EFI and RPI, and the powerhouse diversion site PHT. Hydrographs of average daily flows during WY 2012 and WY 2013 are shown in Figures 3.7 and 3.8, respectively, for the upper bypassed reach site BPU and lower bypassed reach site BPL. Appendix A includes the average daily flow data for the gage sites.

3.1.4.1 Inflow Conditions

The hydrographs of average daily flows for the inflow site EFI (Figures 3.5 and 3.6) indicate a snowmelt-dominated hydrograph with a distinct period of peak flows from May to August coincident with seasonal warming and snowmelt runoff. The peak flow period extends well into mid-summer because the contributing watershed area to site EFI includes high elevation areas to nearly 9,000 feet in the headwaters of the Eagle Cap Wilderness Area. The relatively high elevation watershed area represented at site EFI likely accounts for the lack of late fall or winter peak flows caused at lower elevations by rain-on-snow events, such as occurred at the lower elevation BPL site as described further in Section 3.1.3.3 below.

As expected, the magnitude of average daily flows for the inflow site RPI is minor in comparison to site EFI. The trend of average daily flows for the inflow site RPI showed a more modest snowmelt runoff peak during June and July as site EFI. The runoff peak at site RPI also appears to occur earlier than site EFI likely because the drainage area to site RPI is much smaller and covers a lesser range of elevations.

Figure 3.5 Hydrographs of average daily flows at sites EFI, RPI, and PHT during WY 2012.

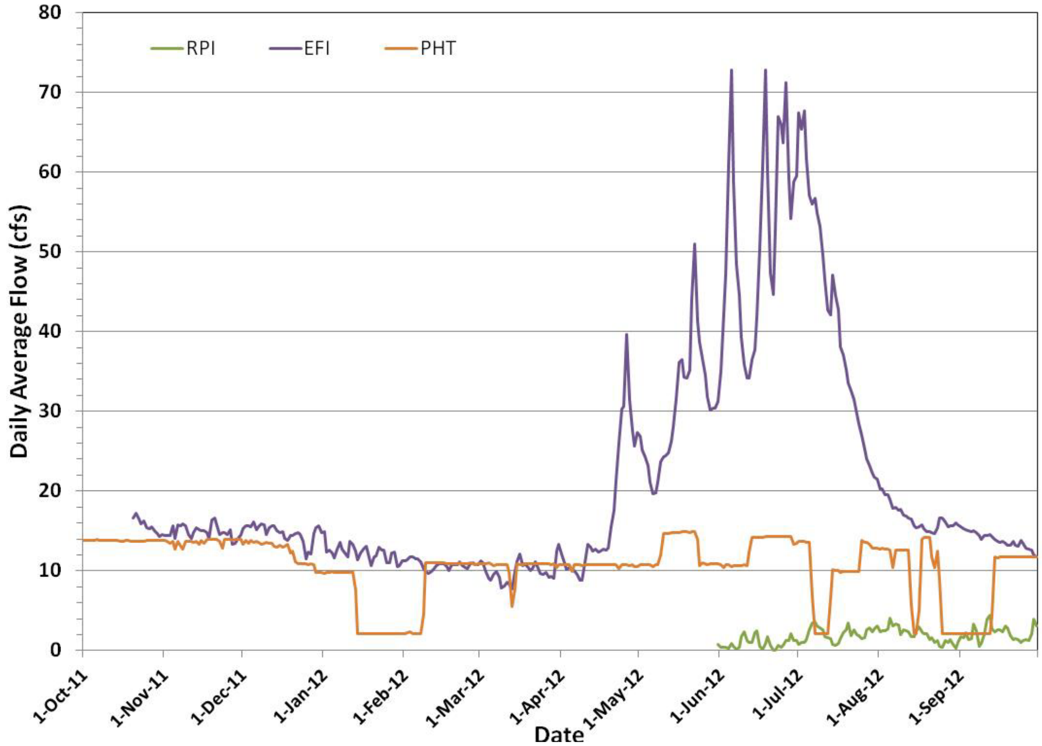


Figure 3.6 Hydrographs of average daily flows at sites EFI, RPI, and PHT during WY 2013.

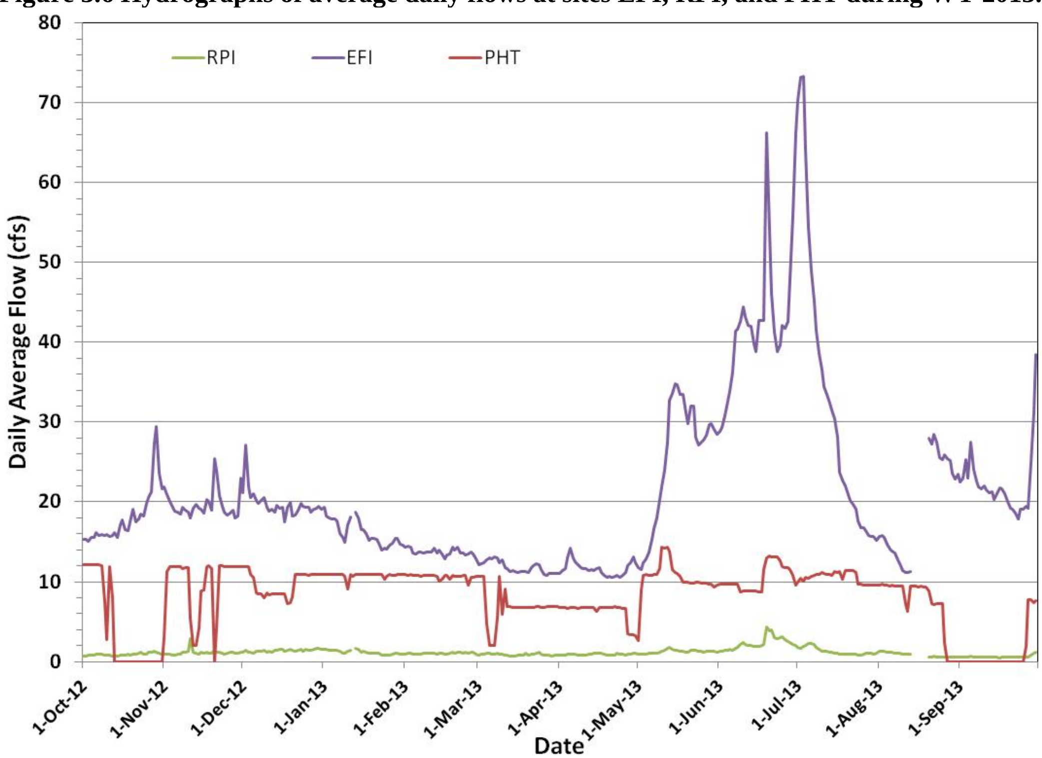


Figure 3.7 Hydrographs of average daily flows for sites BPU and BPL during WY 2012.

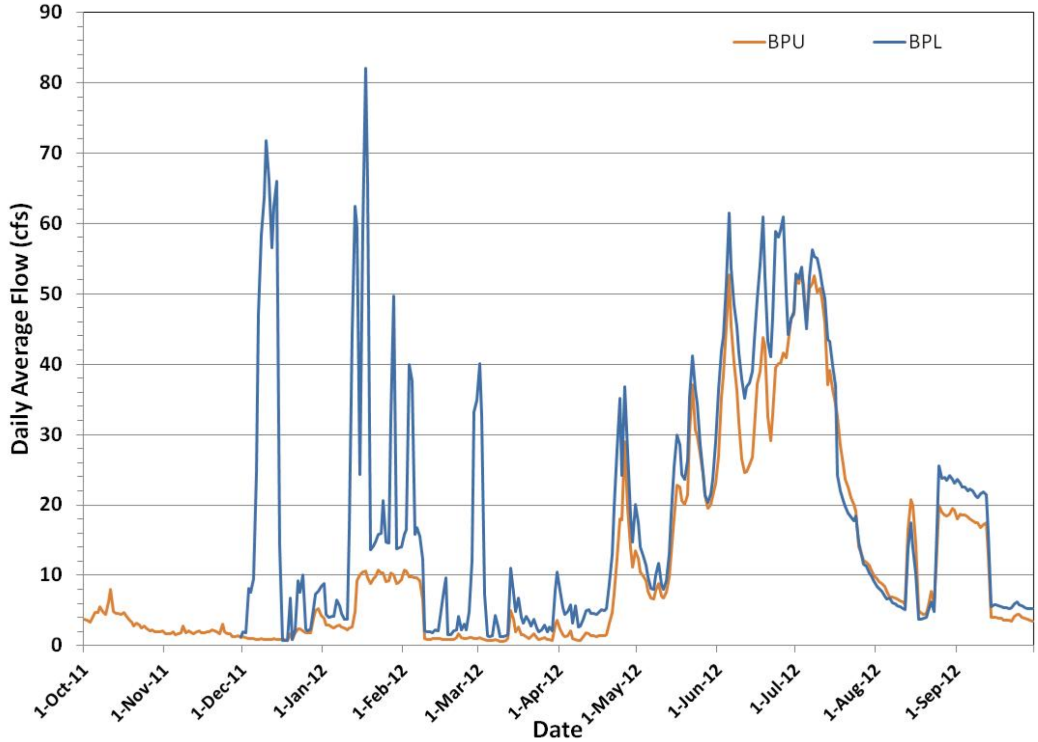
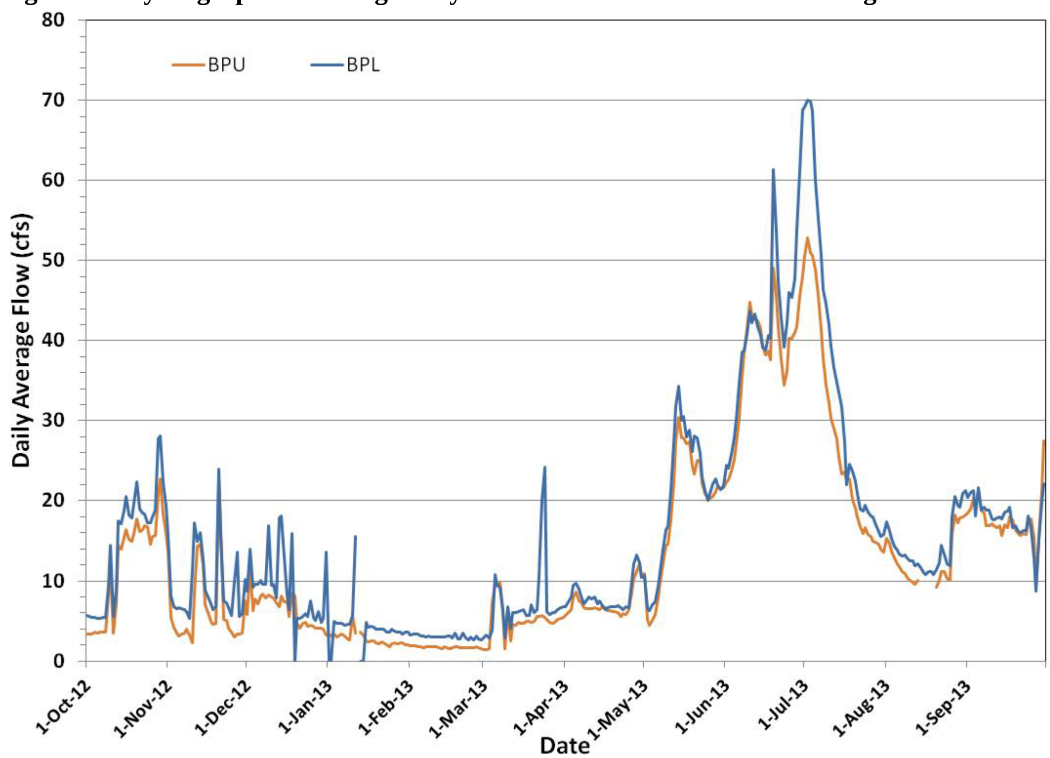


Figure 3.8 Hydrographs of average daily flows for sites BPU and BPL during WY 2013.



3.1.4.2 Flow-Related Powerhouse Operations

The hydrographs of average daily flows during WY 2012 and WY 2013 for site PHT are directly indicative of flow-related powerhouse operations (Figures 3.5 and 3.6). As expected, the PHT flows were relatively uniform throughout much of both years at flow levels between about 8 and 14 cfs, with some relatively short periods of negligible flow when powerhouse operations were stopped for maintenance purposes (for example, see the period of reduced PHT flows from mid-January to early-February, 2012 in Figure 3.5). The overall average annual flow for WY 2012 at the PHT site was 10.5 cfs, with average monthly flows that ranged from 5.3 cfs in January to 13.8 cfs in October (Table 3-3). The overall average annual flow for WY 2013 at the PHT site was 8.1 cfs, with average monthly flows that ranged from 1.3 cfs in September to 10.8 cfs in January and May (Table 3-3).

The low average monthly flow in September 2013 at site PHT was the result of 25 days of powerhouse outage during the month. Other instances of powerhouse outages during WY 2012 and WY 2013 can be seen in the hydrographs where average daily flows drop below 3 cfs (Figures 3.5 and 3.6). For example, during the generation outage between January 13 and February 8, 2012 (Figure 3.5), a small flow of 2 cfs continued through the powerhouse and the tailrace (although bypassed around the turbine). During the outages of July 1 through July 13, August 13 through August 16, and August 24 through September 12, 2012 (Figure 3.5), the canal headgate was closed and flows ceased through the powerhouse and tailrace completely.

3.1.4.3 Flow Conditions in the Bypassed Reach

The bypassed reach includes the East Fork downstream of the forebay dam to the confluence with the Wallowa River, which is characterized in this study by site BPU at the upper end of the reach (located just below the Project diversion dam) and site BPL at the lower end of the reach (located about 800 ft upstream of the confluence with the Wallowa River).

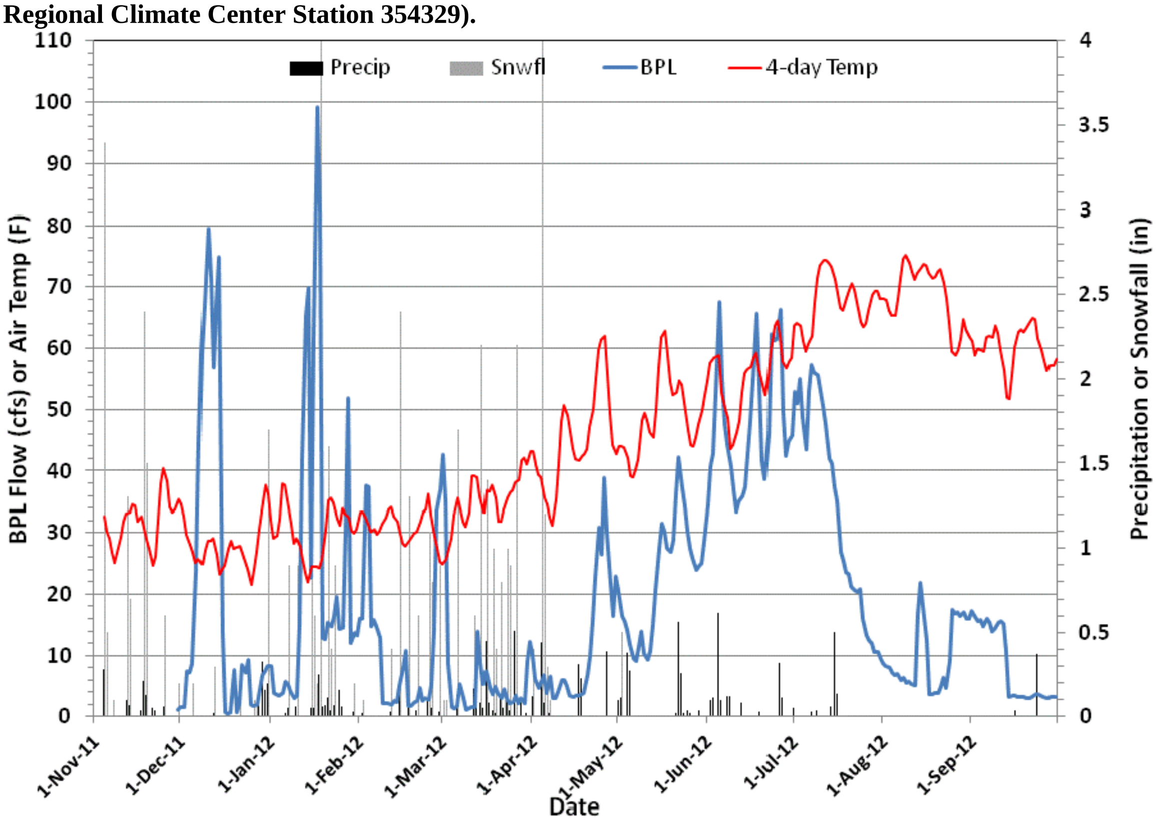
The hydrographs of average daily flows during WY 2012 and WY 2013 for site BPU at the upper end of the reach (Figures 3.7 and 3.8) show a distinct snowmelt-dominated period of peak flows from May to August coincident with seasonal warming and snowmelt runoff. As expected, the hydrographs for site BPU closely track the inflow hydrographs for site EFI, but with flows offset (lessened) by the amount of flow diverted to the Project powerhouse (as indicated by the hydrographs for site PHT in Figures 3.5 and 3.6).

The hydrographs of average daily flows during WY 2012 and WY 2013 for site BPL at the lower end of the reach (Figures 3.7 and 3.8) also show the snowmelt-dominated period of peak flows from May to August. However, in contrast to site BPU, the hydrograph for site BPL shows some distinct late fall and winter peak flows that were likely caused by rain-on-snow runoff from the lower elevation drainage area to the bypassed reach that lies between the upper and lower sites. The BPU site is located at an elevation of about 5,800 ft and the BPL site is located at an elevation of about 4,600 ft.

Based on elevation, the BPU site is well outside, and the BPL site quite near, the Rain-on-Snow (ROS) zone of between 3000 to 4500 ft elevation used for a previous watershed analysis in the area by the Wallowa-Whitman National Forest (Clark 1997).

Example evidence for rain-on-snow runoff activity during late fall and winter peak is presented in Figure 3.9 by overlaying on the WY 2012 hydrograph for site BPL the concurrent precipitation, snowfall, and air temperatures measured at the Joseph Ranger Station (Western Regional Climate Center Station 354329). This graphical comparison suggests that peak runoff events during this period correspond to temporary warming fronts (reaching relatively warm wintertime average air temperatures of 8°C) combined with rain. These warming fronts were preceded by episodes of snowfall accumulation that had occurred at the elevation of the lower gage site BPL.

Figure 3.9 Hydrograph of average daily flows during WY 2012 for site BPL with concurrent precipitation, snowfall, and air temperatures measured at the Joseph Ranger Station (Western Regional Climate Center Station 354329).



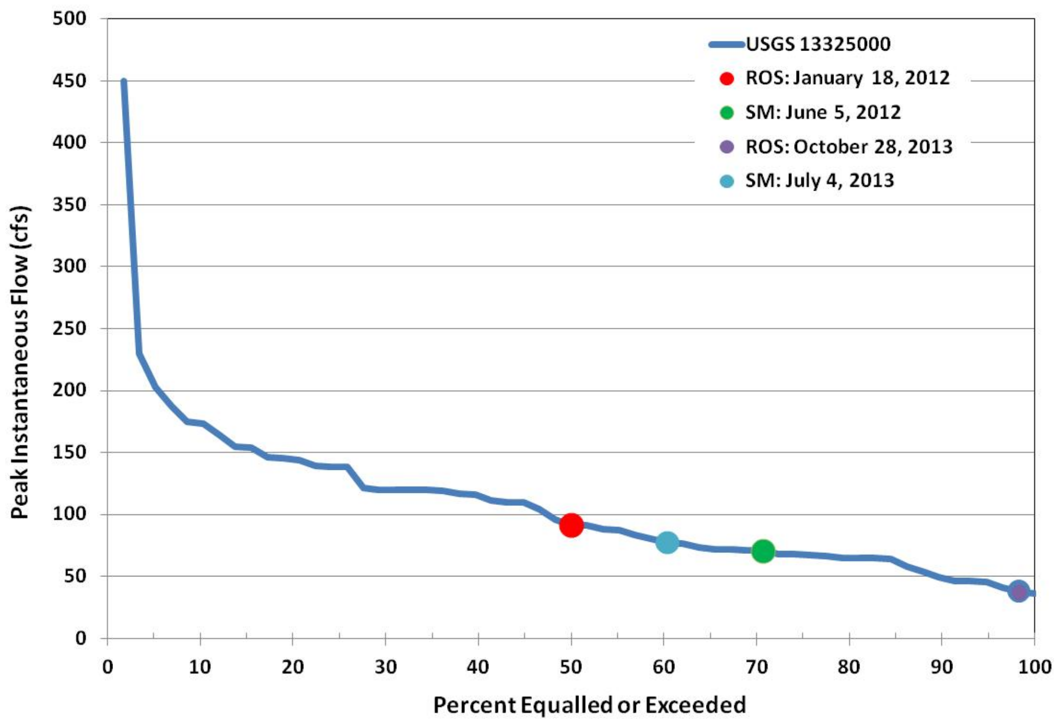
3.1.5 Annual Peak Flow Conditions

During WY 2012, the highest instantaneous (hourly) peak flow value recorded at the study sites was 92 cfs at site BPL on January 18, 2012. This occurred at the peak of one of the winter rain-on-snow runoff events. The highest instantaneous (hourly) peak flow value recorded during the spring snowmelt runoff period was 70 cfs at site BPL on June 5, 2012.

During WY 2013, the highest instantaneous (hourly) peak flow value recorded at the study sites was 78 cfs at site BPL on July 4, 2013 during the spring snowmelt runoff period. The highest instantaneous (hourly) peak flow value recorded at site BPL during winter rain-on-snow runoff events was 37 cfs on October 28, 2012.

These highest instantaneous (hourly) peak flow values are shown in Figure 3.10 on the exceedance curve of the peak flow series for the 44-year period of record at USGS Station 13325000 in the East Fork. Nearly all of the peak flows over the 44-year period of record at USGS Station 13325000 occurred during spring snowmelt runoff. For example, the four highest instantaneous peak flow value recorded in the East Fork were 450 cfs in July 1937, 230 cfs in June 1948, 203 cfs in June 1927, and 187 cfs in July 1975. The January 18, 2012 peak flow of 92 cfs is equivalent to about the 50 percent-exceedance peak flow from the historic record, and the July 4, 2013 peak flow of 78 cfs is equivalent to about the 60 percent-exceedance peak flow from the historic record.

Figure 3.10 Peak flow values during WY 2012 and WY 2013 on the exceedance curve of the peak flow series for the 44-year period of record at USGS Station 13325000 in the East Fork.



3.1.6 Baseflow Conditions

Example hydrograph baseflow separation results for site EFI (from the PART modeling as described in Section 2.3.1) are shown in Figure 3.11 during a portion of the fall/winter low flow period in WY 2012. Hydrograph separation results are shown for site BPL (based on daily BPL flows summed with the daily PHT flows) for the same example time period in Figure 3.12.

Average monthly baseflows (from the daily flow data sets) for months during summer/early fall (August-October) and late fall/winter (November-April) low flow periods are shown in Figure 3.13. The average monthly baseflows range from about 10 to 17 cfs at site EFI and 12 to 19 cfs at site BPL. The net average monthly baseflows between sites EFI and BPL (i.e., the difference between estimated baseflows at sites EFI and BPL) range from about 1 to 4 cfs. The net baseflow provides an estimate of the sustained groundwater discharge that occurs to the East Fork in-between the EFI and BPL locations during low flow seasons.

Figure 3.11 Example hydrograph baseflow separation results for site EFI (September 15-December 8, 2012).

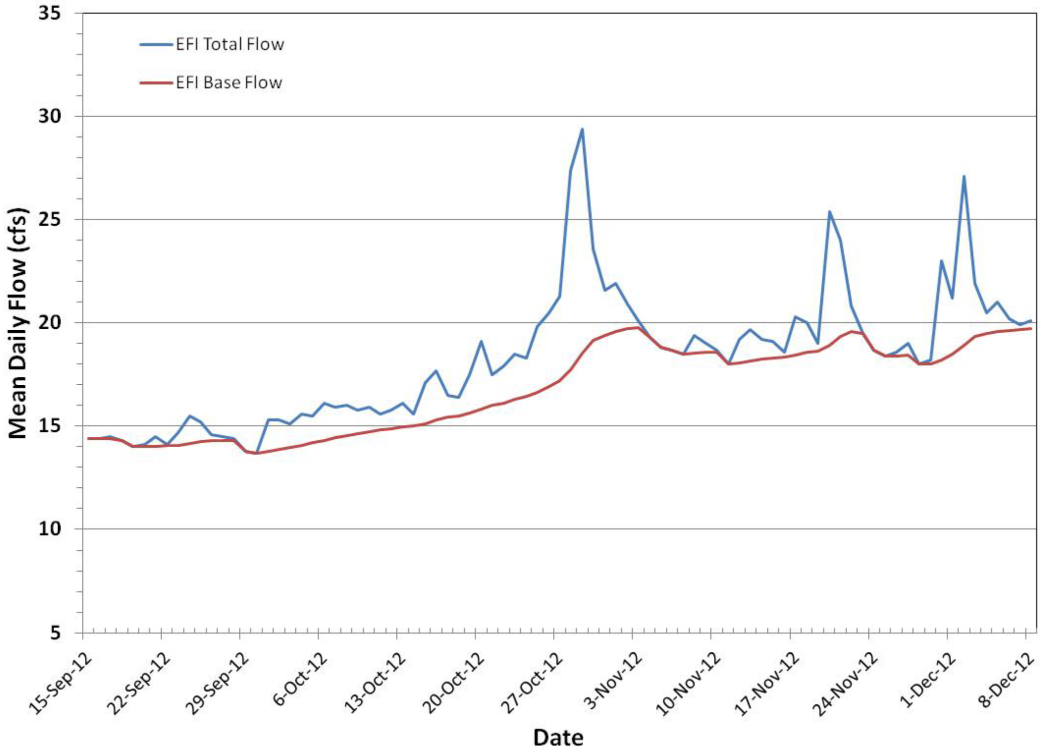


Figure 3.12 Example hydrograph baseflow separation results for site BPL, and including PHT flows (September 15-December 8, 2012).

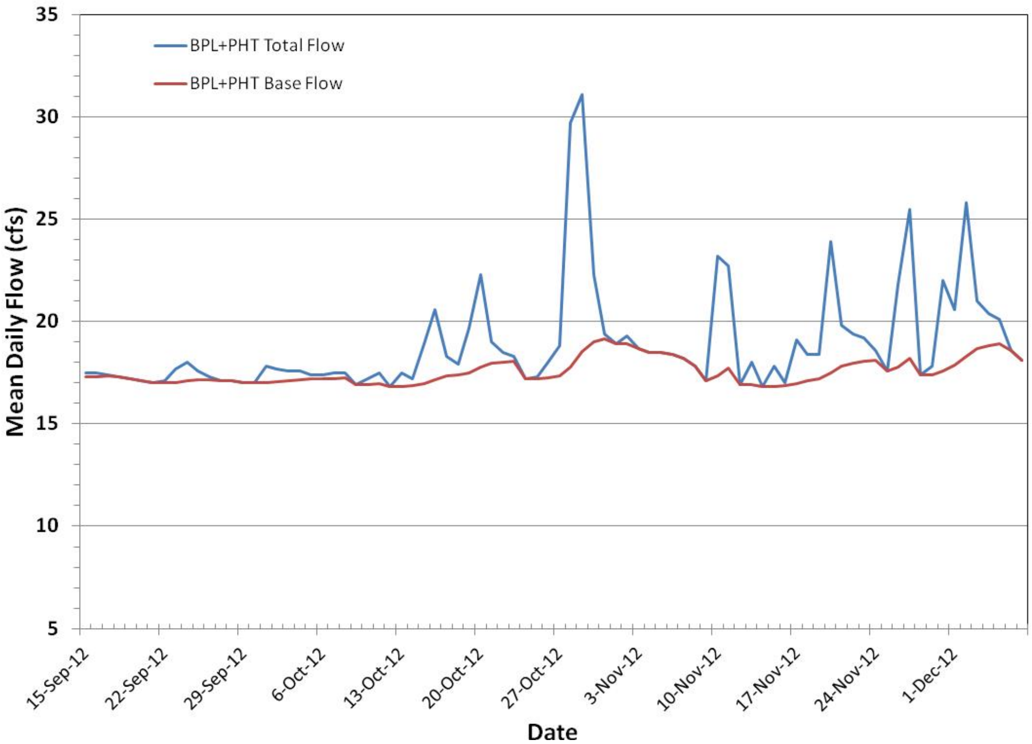
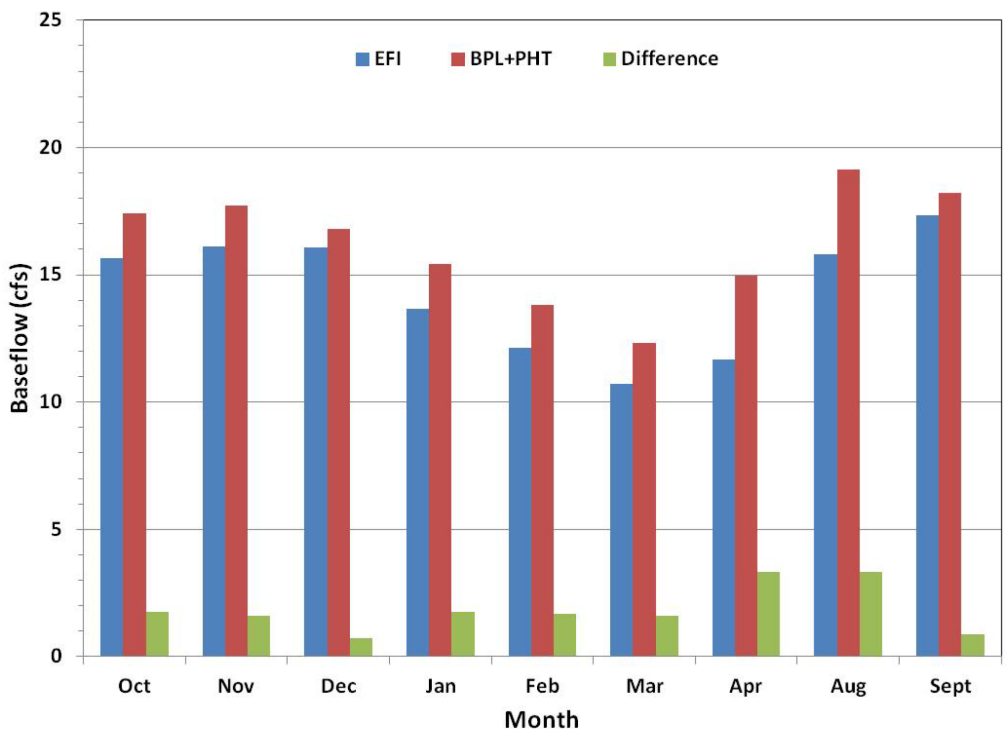


Figure 3.13 Example hydrograph baseflow separation results for site BPL, and including PHT flows (September 15-December 8, 2012).



3.1.7 Daily Flow Duration Curves by Month

As described in Section 3.2.1 above, the previous 44-year flow data records for the historic USGS gages in the East Fork are reasonably representative of current hydrologic conditions; that is, no substantive systematic shift in conditions has occurred since East Fork gage records stopped in 1983. As such, flow duration curves produced from this historic record are also considered representative of current hydrologic conditions.

Monthly flow duration curves for the East Fork are presented for fall months (October-December) in Figure 3.14, winter months (January-March) in Figure 3.15, spring months (April-June) in Figure 3.16, and summer months (July-September) in Figure 3.17. The shape of the curve is indicative of the hydrologic response of the basin during respective months. Curves with relatively steep slopes (e.g., June and July in Figures 3.16 and 3.17) result from streamflows that can vary markedly and are largely fed by direct snowmelt runoff. Curves with flat slopes (e.g., August and September in Figure 3.17) result from streamflows that vary little and are mostly sustained by baseflows (groundwater discharges).

Figure 3.14 Monthly flow duration curves for the East Fork for fall months (October-December).

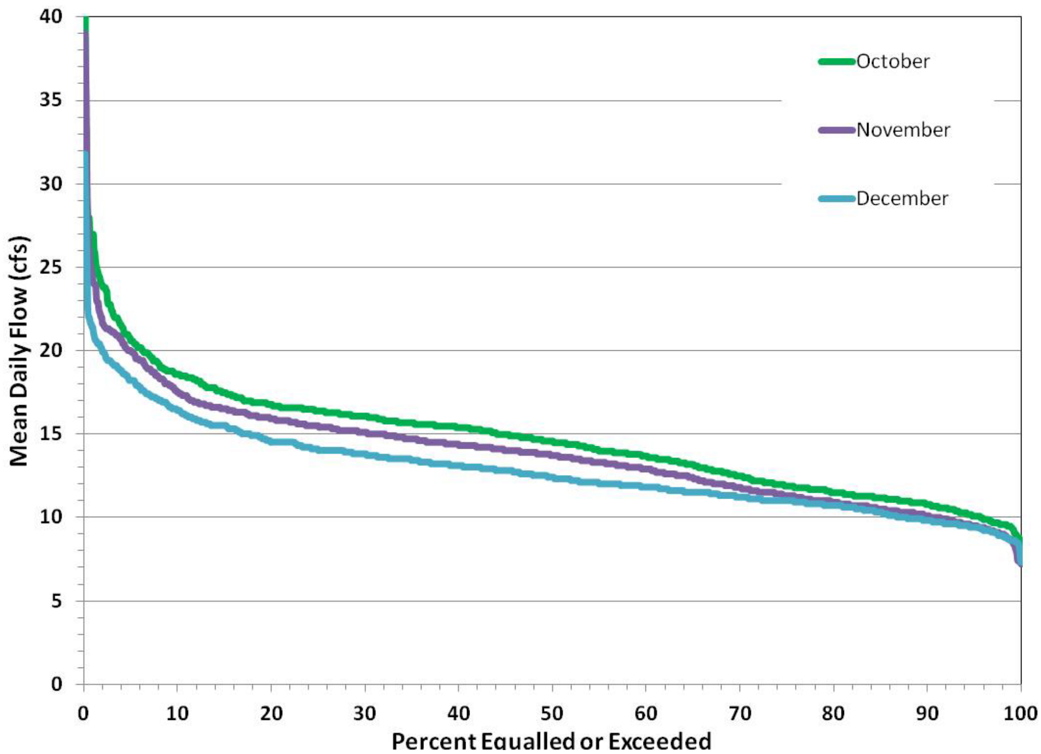


Figure 3.15 Monthly flow duration curves for the East Fork for winter months (January-March).

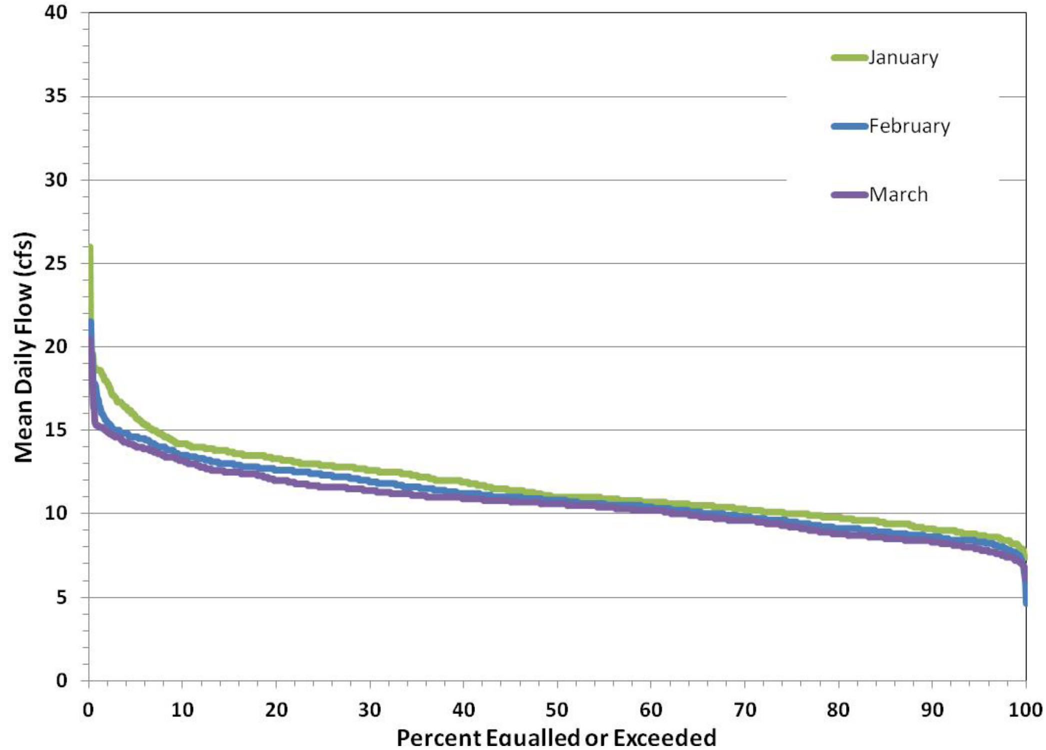


Figure 3.16 Monthly flow duration curves for the East Fork for spring months (April-June).

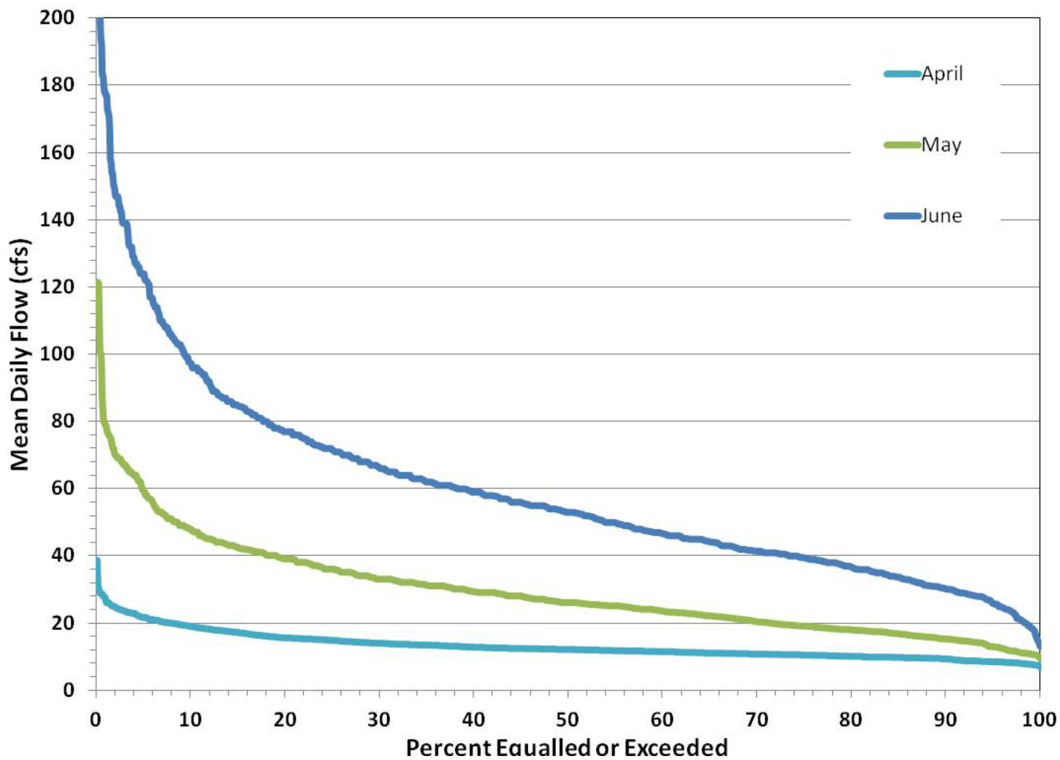
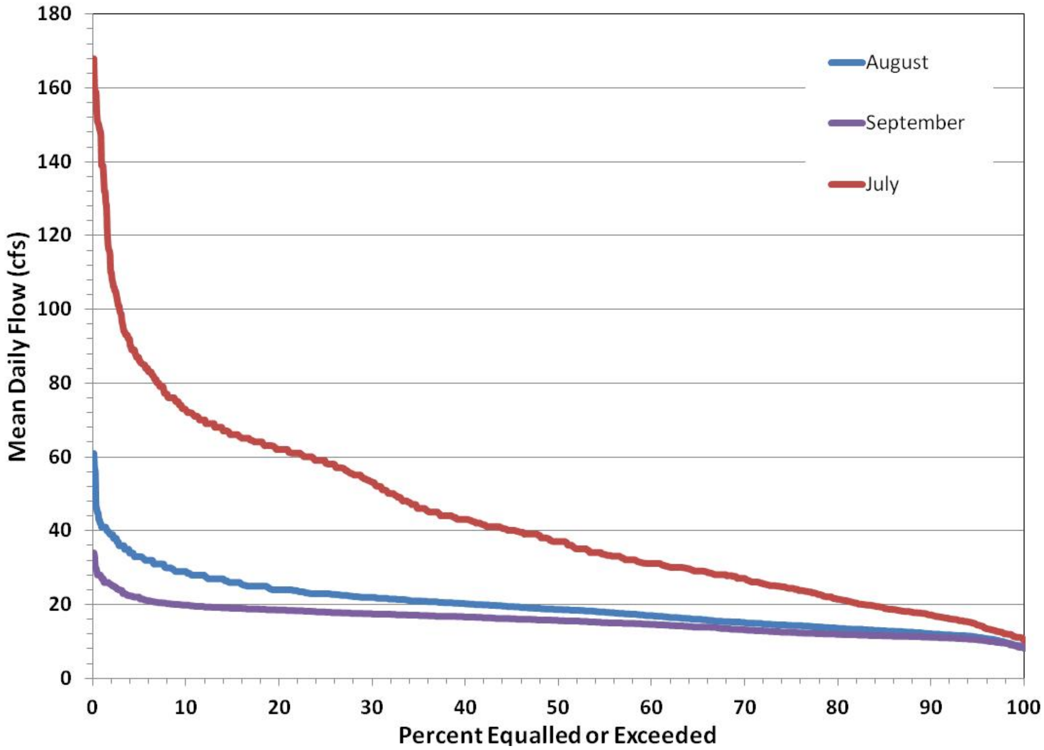


Figure 3.17 Monthly flow duration curves for the East Fork for summer months (July-September).



3.1.8 Project Effects on Flows

As discussed in Section 1.3.3 above, the primary Project flow-related effect is the diversions of portions of the flow from the East Fork Wallowa River to the powerhouse, which causes a reduction in downstream in-channel flows in the East Fork below the East Fork diversion dam. These diversions cause concomitant increases in flows in about 0.5 miles of the West Fork Wallowa River between the existing tailrace discharge location and the downstream confluence with the East Fork. These specific flow-related effects of current Powerhouse operations are discussed and depicted in hydrographs in Section 3.1.8.1 and 3.1.8.2 above.

As described in Section 1.3.3.2 above, PacifiCorp proposes to operate the Project in the future with modified instream flow releases in the East Fork bypassed reach, consisting of: (1) a flow of 4 cfs released year-around from the Project dam; and (2) re-routing of the Powerhouse tailrace so that all Powerhouse flows are returned to the East Fork. The goal of these measures is to manage flows in the East Fork in a manner that provides habitat suitable for the production of healthy and sustainable fish populations while continuing to maintain PacifiCorp's ability to generate hydroelectric power.

The effects of implementing the proposed instream flow measure would be to increase flows in the East Fork bypassed reach and correspondingly decrease flows in the West Fork (below the current tailrace discharge location). In the upstream portion of the East Fork bypassed reach (between the dam and the new tailrace discharge location), flows would be increased by about 3.2 to 3.5 cfs (i.e., the difference between the proposed 4 cfs minimum instream flow release and the 0.5 to 0.8 cfs that is currently released). In the downstream portion of the East Fork bypassed reach (between the new tailrace discharge location and the mouth), flows would be increased by the returned powerhouse diversion amounts (which are currently discharged to the West Fork). In the West Fork between the current tailrace discharge location and the confluence with the East Fork, flows would be decreased by the powerhouse diversion amounts (that would be discharged to the East Fork). In the Wallowa River downstream of the confluence of the East Fork and West Fork, no changes in flow would occur because the effects of Project operations on flows dissipate as the East Fork and West Fork join.

To quantify the estimated flow effects in the East Flow bypassed reach, the 44-year record of historic daily flows for the USGS East Fork and Powerhouse tailrace gages was used to synthesize flow records assuming a minimum flow release of 4 cfs (i.e., to represent the proposed operations) and a minimum flow release of 0.8 cfs (i.e., to represent the current baseline operations). The combined daily flow (for each day) for the USGS East Fork and Powerhouse tailrace gages provides the 44-year record of total daily flow for the East Fork (i.e., flows that would occur with no diversion). This record of total flows was then used in a spreadsheet using decision-based formulae to compute flows that assume diversions of 4 to 16 cfs to represent proposed operations and 0.8 to 16 cfs to represent current (or baseline) operations.

The proposed minimum flow release of 4 cfs year-around and tailrace reroute to the East Fork would result in the following changes in the magnitude of overall flows within the upstream portion (between the dam and the new tailrace discharge location) and downstream portion (below the new tailrace discharge location) of the East Fork bypassed reach when compared to existing conditions:

- An average increase from 20 cfs to 21 cfs (6 percent) in the upstream portion of the reach and 20 to 35 cfs (73 percent) in the downstream portion of the reach during the spring runoff higher-flow period (April-July);

- An average increase from 1.8 to 4.4 cfs (140 percent) in the upstream portion of the reach and 1.8 to 14.7 cfs (over 7-fold) in the downstream portion of the reach during the summer/early fall low-flow period (August-October);

- An average increase from 0.9 to 4.4 cfs (390 percent) in the upstream portion of the reach and 0.9 to 10.9 cfs (over 10-fold) in the downstream portion of the reach during the late fall/winter lower-flow period (November-March).

PacifiCorp used historic daily USGS flow data to calculate the percentage of flow in the West Fork Wallowa River contributed by the Project powerhouse tailrace. The historic USGS data consists of a 15-year period-of-record (1925-1941) when USGS gages were simultaneously operating in the East Fork (Gage No. 13325000), the Powerhouse tailrace (Gage No. 13324500), and the Wallowa River above Wallowa Lake (Gage No. 13325500). West Fork flows were determined by subtracting the daily flows at the first and second gages from the third. Assuming that this historic data is indicative of current conditions, changes in the magnitude of overall flows within the West Fork (below the current tailrace discharge location to the confluence with the East Fork) when compared to existing conditions would be:

- An overall average decrease (over the period-of-record) of 27 percent;
- An average decrease of 8 percent) during the spring runoff higher-flow period (April-July);
- An average decrease of 30 percent during the summer/early fall low-flow period (August-October);
- An average decrease of 42 percent during the late fall/winter lower-flow period (November-March).

3.2 Water Temperature

3.2.1 Summary of Data Completeness

Completeness is the percentage of valid results obtained compared to the total number of planned hourly water temperature measurements to be taken at the sites. Completeness is ideally 100 percent, but the actual completeness can be less than 100 percent if data cannot be obtained or is eliminated due to logistics, equipment, or analytical issues.

During the study, hourly water temperature data collection completeness of 95 percent or greater was achieved at sites EFI, BPU and BPL during WY 2012 (Table 3-5), and at sites EFI, RPI, and BPL during WY 2013 (Table 3-6). Water temperature data collection was less complete at sites RPI, WFI, and WRC during WY 2012, because activation of water temperature monitoring equipment at these sites did not occur until April at sites WFI and WRC, and May at site RPI. However, data collection completeness at these sites was high during the summer lower-flow months of WY 2012 (Table 3-5), when water temperatures are of most interest. Water temperature data collection was unsuccessful at sites WFI and WRC during most of WY 2013, due to loss of water temperature monitoring equipment at these sites.

Table 3-5 Completeness of Water Temperature Data Collection During WY 2012.

			Percent of Hours Data Collected by Study Site						
Period	**Days**	**Hours**	**EFI**	**RPI**	**BPU**	**BPL**	**PHT**	**WFI**	**WRC**
October	31	744	40	0	100	38	0	0	0
November	30	720	100	0	100	100	1	0	0
December	31	744	100	0	100	100	100	0	0
January	31	744	100	0	100	100	40	0	0
February	29	696	100	0	100	100	72	0	0
March	31	744	100	0	100	100	87	0	0
April	30	720	100	0	100	100	95	64	64
May	31	744	100	5	100	100	95	100	100
June	30	720	100	100	100	100	94	100	100
July	31	744	100	100	100	100	71	100	100
August	31	744	100	100	97	100	58	72	100
September	30	720	100	100	100	100	57	0	100
Water Year	366	8784	95	34	100	95	64	37	47

Table 3-6 Completeness of Water Temperature Data Collection During WY 2013.

			Percent of Hours Data Collected by Study Site						
Period	**Days**	**Hours**	**EFI**	**RPI**	**BPU**	**BPL**	**PHT**	**WFI**	**WRC**
October	31	744	97	97	97	99	24	0	76
November	30	720	100	100	100	100	100	0	0
December	31	744	100	100	100	100	100	0	0
January	31	744	100	100	100	100	100	0	0
February	28	672	100	100	100	100	100	0	0
March	31	744	100	100	100	100	100	0	0
April	30	720	100	100	100	100	100	0	0
May	31	744	100	100	100	100	100	0	0
June	30	720	100	100	100	100	100	0	0
July	31	744	100	100	90	100	100	0	0
August	31	744	100	100	0	100	80	0	0
September	30	720	100	100	0	100	14	0	0
Water Year	365	8760	100	100	82	100	85	0	6

3.2.2 Water Temperature Hourly Data and Summary Statistics

The hourly water temperature data at the sites were used to compute summary statistics, including the minimum, mean, and maximum temperatures recorded for each day at each site, and the 7-day average of the daily maximum temperature (7-DAD Max). The 7-DAD Max is the arithmetic average of seven consecutive daily maximum temperature measurements. The 7-DAD Max for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the 3 days prior to, and the 3 days after, that date. As summarized previously in Table 2-4, the 7-DAD Max is a statistic described in the State of Oregon's water quality standards to assess water temperature protection of State waters based on salmon and trout (salmonid) use categories (OAR 340-041-0028). The temperature data as presented below will be further assessed relative to the state water quality standard in the Water Resources Final Technical Report that PacifiCorp plans to issue in June 2013. Appendix B includes the the daily summary statistics based on the hourly water temperature data.

3.2.3 Annual and Seasonal Water Temperature Trends

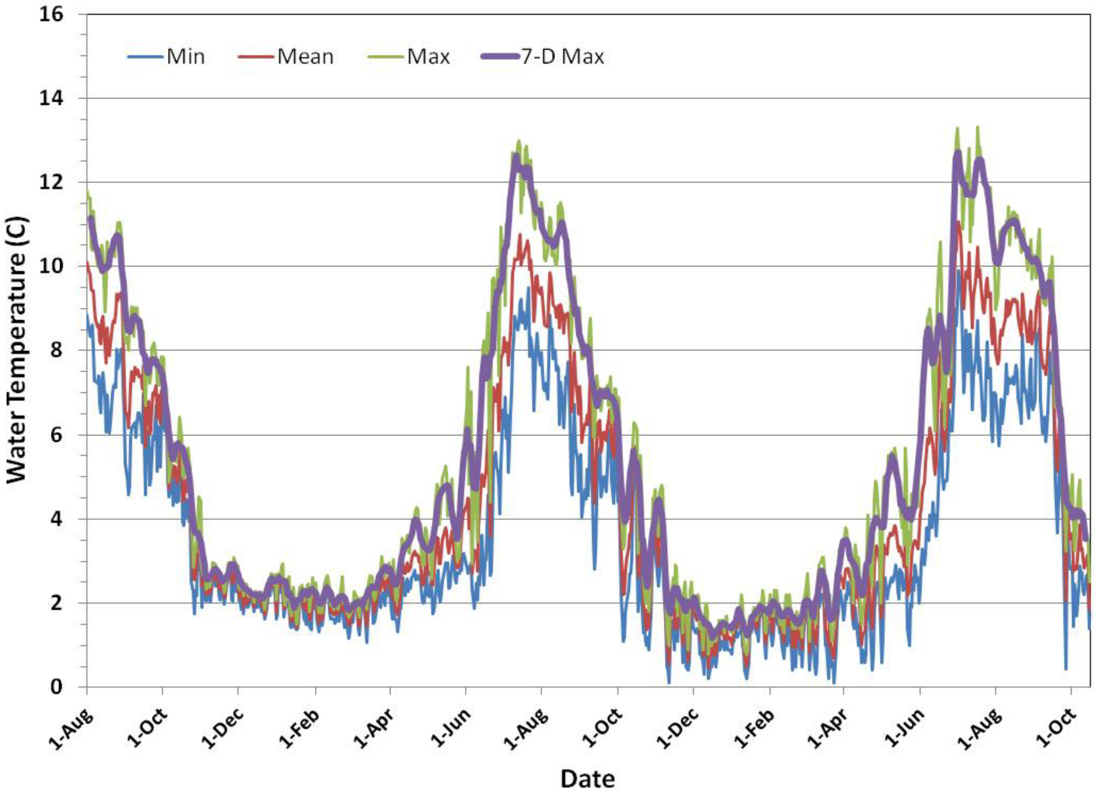
Site BPU has a long and complete record of water temperature data collected during the study, and provides an informative example of the overall annual and seasonal trends of water temperature in the study area (Figure 3.18). As expected, this overall annual trend of water temperature conditions indicates distinctive seasonal trends with warmest temperatures in summer and coldest temperatures in winter in the Project area.

As expected, the warmest temperatures of the year occur in July and August. The peak 7-DAD Max water temperature shown in Figure 3.18 for site BPU was 12.7°C, which occurred over the 7-day period centered on July 1, 2013. The peak 7-DAD Max water temperatures for other sites in the East Fork included 12.9°C, 13.4°C, and 14.0°C at sites EFI, RPI, and BPL over 7-day periods centered on July 21, 2012, July 1, 2013, and July 2, 2013, respectively. The peak 7-DAD Max water temperatures the WFI and WRC sites were 15.0°C and 14.2°C, respectively, over 7-day periods centered on August 9, 2012.

Minimum water temperatures ranged from about 0 to 2 °C from January to early March, and were similar among the sites. Daily average water temperature ranges were greatest during summer (up to around 11 to 13°C) and least during winter (about 2°C), which match the timing in summer and winter, respectively, of the largest and smallest daily ranges in air temperatures and solar radiation.

The observed water temperature conditions at the study sites are indicative of an overall cold thermal regime in the streams of the Project area. For example, of the five thermal classifications (i.e., cold, cold-cool, cool, cool-warm, and warm) for temperate streams in the U.S. and Canada developed by Chu et al. (2009), the coldest (i.e., "cold") classification includes locations that have daily maximum water temperatures of 15.9°C or less. Based on the data obtained in this study, all of the study sites fall within this "cold" classification.

Figure 3.18 Daily minimum, mean, maximum, and 7-DAD Max water temperature values at site BPU during August 2011 through September 2013.



The overall cold thermal regime in the streams of the Project area is driven primarily by the high-elevation location and associated climatic influence. Carr (2003) determined that location in the watershed and climatic influence, from both maximum and minimum air temperature, are dominant factors with respect to water temperature patterns of streams in northeastern Oregon. Carr (2003) showed that elevation, through its association with reach location in the watershed and attendant time of thermal energy exposure, is strongly correlated with the daily maximum stream temperature.

Elevation is expected to have a direct effect on the rate of stream heating, particularly in mountain landscapes, because the lapse rate of air temperature with elevation and orographic lifting of air parcels cause greater condensation and precipitation at high elevations (Isaak and Hubert 2001). Elevation change, through adiabatic heating processes, is known to express a linear relationship with air temperature. The adiabatic rate of heating and cooling typically ranges between 2°C and 3.5°C of air temperature change per 1,000 feet of elevation (Satterlund and Adams 1992).

The overall cold thermal regime in the streams of the Project area could also be affected by watershed aspect, which is thought to influence stream temperatures on the premise that orientation relative to the path of the sun will alter the amount and intensity of sunlight that a stream receives (Isaak and Hubert 2001). As such, streams within the northern hemisphere that have northerly aspects are generally believed to be coldest.

Both the East Fork and West Fork drainages in the Project area have roughly northerly aspects.

3.2.4 Water Temperature Conditions by Location

3.2.4.1 Inflow Water Temperature Conditions

The trends in 7-DAD Max water temperature values at sites EFI, RPI, and WFI during the study are shown in Figure 3.19. Each of these sites represents upstream conditions outside the potential influence of the Project. Sites EFI and RPI represent inflow water temperature conditions to the Project forebay in the East Fork drainage, and site WFI represents water temperature conditions in the West Fork upstream of the confluence of the Project tailrace and the East Fork bypassed reach.

Site WFI shows the higher maximum temperatures of all study sites during summer. It is likely that the higher 7-DAD Max water temperature values at WFI are the result of a larger watershed area draining to the WFI site compared to the drainage areas to sites EFI and RPI. The larger drainage area to site WFI means that site WFI has comparatively lower mean elevation, lower average gradient, greater stream width, and longer stream reach length than occur at sites EFI and RPI. As described above, the relative rate of stream heating is expected to increase as elevation decreases. In addition, in a mechanistic sense, greater stream width and longer stream reach length allow for a greater magnitude and duration of solar input to waters as they flow downstream (Isaak and Hubert 2001).

By contrast, site RPI shows the coolest temperatures of all sites during summer, and the reasons for cooler conditions at site RPI are likely because of conditions opposite to site WFI as described above. Royal Purple Creek is a relatively small, high-gradient stream. It is likely that lower 7-DAD Max water temperature values at RPI are the result of higher average gradient, much lesser stream width, and short stream reach length, which results in lesser rate of heating from solar input and air temperatures than at sites EFI and WFI.

3.2.4.2 Water Temperature Conditions in the Bypassed Reach

Figure 3.20 shows the trends in 7-DAD Max water temperature values at the bypassed reach sites BPU (at the upper end of the reach below the Project diversion dam) and BPL (at the lower end of the reach above the confluence with the Wallowa River). The 7-DAD Max water temperature trends for the upstream inflow sites EFI and RPI are also included in Figure 3.20 to provide direct comparisons of bypassed reach and inflow temperature conditions.

Figure 3.19 7-DAD Max water temperature values at sites WFI, EFI, and RPI.

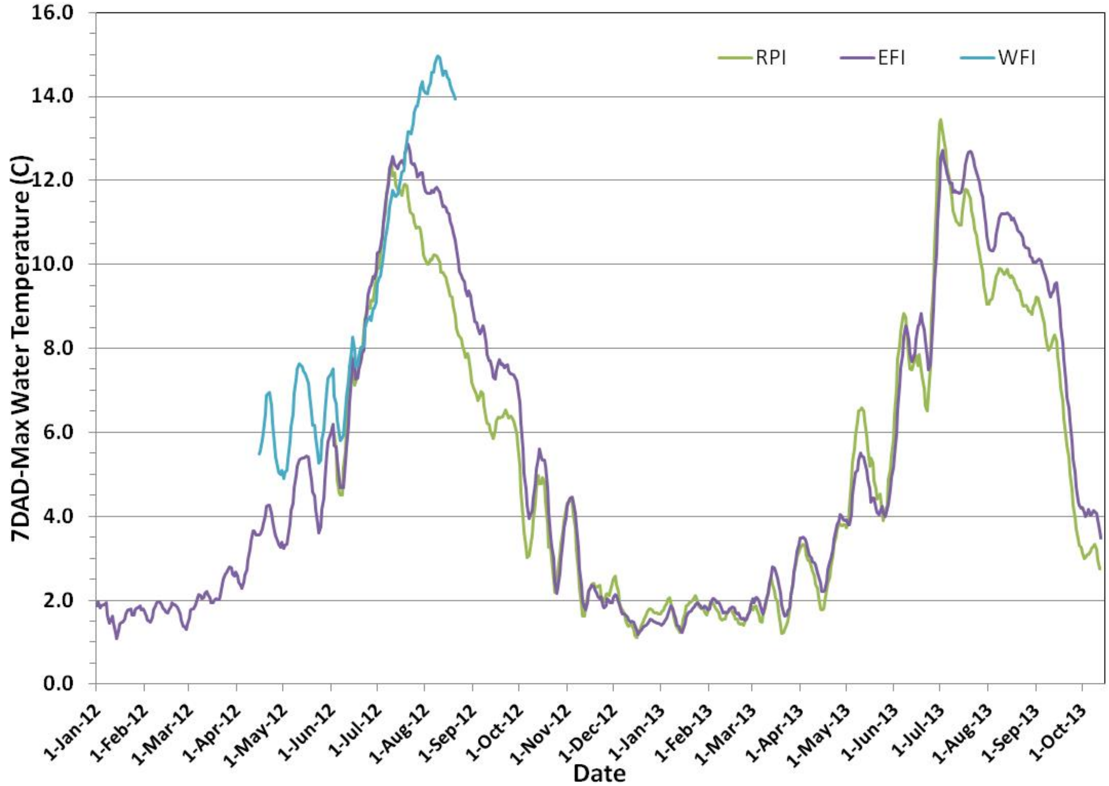
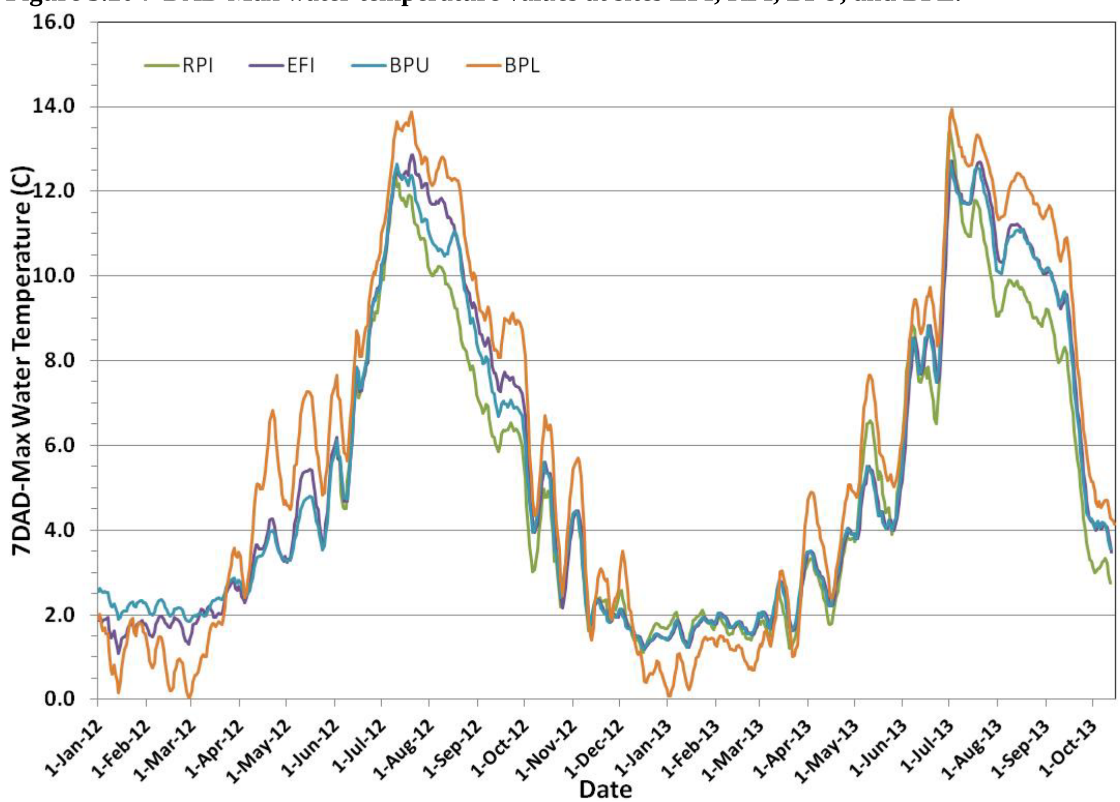


Figure 3.20 7-DAD Max water temperature values at sites EFI, RPI, BPU, and BPL.



The trend in 7-DAD Max water temperature values at site BPU closely follows the trend in values at site EFI, which is not surprising given the short distance separating these two sites and their equivalent elevations (see Figure 2.1). Although the trends are close, the 7-DAD Max water temperature values at site BPU are consistently slightly cooler than at upstream site EFI throughout much of the summer. Given that site BPU is downstream of site EFI, it is reasonable to expect that, if anything, the opposite should be the case—that is, the 7-DAD Max water temperature values at site BPU would be consistently slightly warmer than at upstream site EFI. The minor cooling between EFI and BPU may be the result of possible insulating effects of the water volume in the forebay that occurs between the EFI and BPU sites.

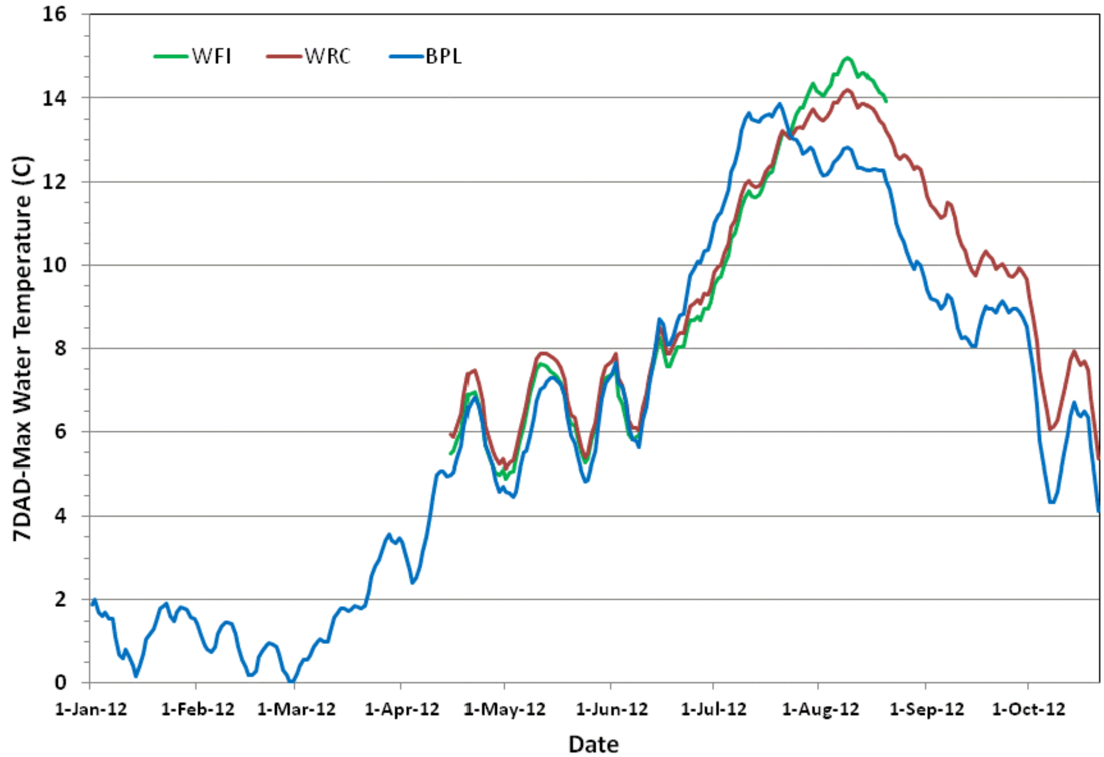
The comparison of water temperature trends between the BPU and BPL sites indicates that flows are consistently warmer at BPL from spring through summer. The warming of flows as they travel downstream in the bypassed reach, particularly during summer, is reasonable to expect given that the gradient of the reach drops from about 5,800 to 4,600 ft in elevation between the two sites. As discussed in Section 3.2.3 above, elevation is expected to have a direct effect of on the rate of stream heating, particularly in mountain landscapes, because of the adiabatic lapse rate, which can result in heating of air temperatures by about 3.5°C per 1,000 feet drop in elevation (Isaak and Hubert 2001, Satterlund and Adams 1992). The additional reach length between sites (about 2 mi) also increases the time that flows can be exposed to solar radiation and air temperatures during the day.

3.2.4.3 Water Temperature Conditions in the Adjacent Wallowa River

The trends in 7-DAD Max water temperature values at sites WFI, WRC, and BPL are compared in Figure 3.21. (Note: the graph contains only data from 2012, since data at WFI and WRC were not obtained in 2013.) Shown together, the graphs in Figure 3.22 allow comparison of water temperature trends in the West Fork and Wallowa River above (as represented by site WFI) and below (as represented by site WRC) the potential influence of the Project (as represented by site BPL).

The overall trends in 7-DAD Max water temperature values at these three sites are similar, except during summer, when values reach maximum level earlier at site BPL (i.e., in July versus August) and then gradually decline in later summer and fall at consistently cooler levels than at sites WFI and WRC. The reasons for these differences at site BPL are likely the same as described in Section 3.2.5.1 above in comparing sites EFI and WFI—that is, the relative rate of stream heating in the West Fork watershed is greater, particularly during summer, because of its larger watershed area (and comparatively lower mean elevation, lower average gradient, greater stream width, and longer stream reach length than occurs at the East Fork sites).

Figure 3.21 7-DAD Max water temperature values at sites WFI, WRC, and BPL during 2012.



The trend in 7-DAD Max water temperature values at site WRC closely follows the trend in values at site WFI, although the values at site WRC are consistently slightly cooler than at upstream site EFI during the peak summer warming period. As observed at site BPU (see Section 3.2.5.2 above), the opposite should perhaps be expected—that is, the 7-DAD Max water temperature values at the downstream site WRC would be consistently slightly warmer than at upstream site WFI. It is likely that the minor cooling between WFI and WRC is the result of the addition of cooler BPL and Project forebay return inflows occurring between the WFI and WRC sites.

3.2.5 Project Effects on Water Temperatures

3.2.5.1 Effects on Water Temperatures in the East Fork Wallowa River

As discussed in Section 1.3.3 above, the primary potential Project effect on water temperatures under current Project operational conditions is the diversion of flow from the East Fork that has the potential to affect physical flow conditions (e.g., flow quantity, depths, and velocities in the bypassed reach). Such physical flow effects have the potential to affect the thermal properties of waters by increasing the amount of heat entering the water from solar radiation or surrounding air temperatures.

As specified in Table 2-4 in Section 2.2.2 above, the State of Oregon standard indicates that streams identified as supporting use for bull trout spawning and juvenile rearing may not exceed 12 °C based on the 7-DAD Max water temperature (OAR 340-041-0028). As can be seen in Figures 3.19 to 3.21, 7-DAD Max water temperature values are less than 12 °C throughout most of the year at all sites, including those affected by flow diversions (i.e., sites BPU and BPL). As discussed in Section 3.2.4 above, all of the study sites, have relatively low maximum water temperatures that fall within a “cold” classification.

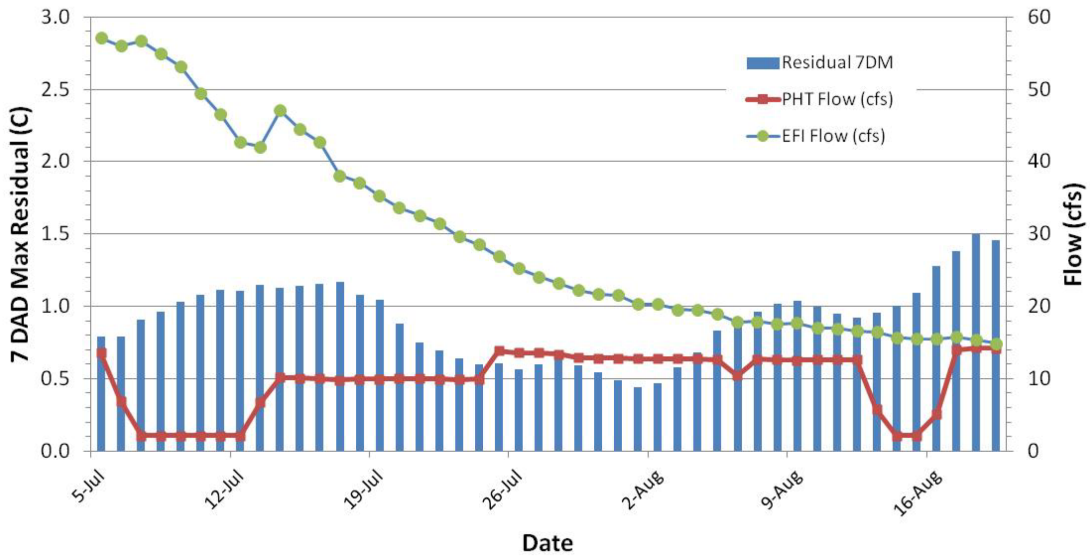
However, Figures 3.19 to 3.21 indicate that 7-DAD Max water temperature values exceeded 12 °C for a relatively short period in mid-summer at all sites. Figure 3.20 shows that 7-DAD Max water temperature values at diversion-affected sites BPU and BPL exceeded 12 °C for periods of about 2 to 4 weeks during mid-summer. For example, 7-DAD Max water temperature values at site BPU exceeded 12 °C for about 15 days in 2012 and 11 days in 2013 (in both cases, during July). 7-DAD Max water temperature values at site BPL exceeded 12 °C for about 45 days in 2012 and 23 days in 2013 (in both cases, during July to early August).

However, 7-DAD Max water temperature values also exceeded 12 °C for similar periods at the other inflow or background sites outside the bypassed reach. 7-DAD Max water temperature values at site EFI exceeded 12 °C for about 22 days in 2012 and 12 days in 2013 (in both cases, during July). 7-DAD Max water temperature values exceeded 12°C at site WRI for at least 36 days in 2012 (and likely longer had thermograph data collection succeeded past mid-August 2012), and at site WRC for 47 days in 2012. (Note: as discussed in Section 3.2.1, water temperature data were not obtained during 2013).

Figure 3.22 depicts data for the period during 2012 when 7-DAD Max water temperature values in the East Fork bypassed reach exceeded 12 °C. The columns on the graphs represent the difference (i.e., residuals) between the 7-DAD Max water temperature values at site EFI (representing natural inflow conditions) and site BPL (representing potential Project flow-related effects). These residuals indicate a range in warming of water temperature of about 0.5 to 1.5 °C from site EFI to site BPL during this period of time. As discussed in Section 3.2.3 above, the 1,200-ft change in elevation between sites EFI and BPL is expected to have a direct effect on the rate of stream heating due to adiabatic lapse rate of air temperature, which warms by about 2 to 3.5 °C per 1,000 feet of elevation.

The lines in Figure 3.22 show corresponding inflows to the Project area at EFI and the concomitant diverted flow amounts to the Powerhouse (site PHT). Two periods of Powerhouse outage occurred during this time: July 7 to July 12 and August 13 to August 16. Therefore, these two time periods are assumed to be indicative of natural background warming conditions when no Project operations were occurring. However, no systematic change in the residuals is evident when comparing the values at these non-operational times with the times before and after. The day-to-day variability in the residuals is likely otherwise due to day-to-day variability in meteorological conditions (e.g., air temperatures). As such, a significant Project-related effect is not evident over the period of time when 7-DAD Max water temperature values in the East Fork were greater than 12 °C. (Note: data for the similar period during 2013 is not depicted as the Powerhouse was operating throughout the period, so that no comparable non-operational conditions occurred.)

Figure 3.22 Residual 7-DAD Max water temperature between sites EFI and BPL and corresponding flows at sites EFI and PHT during July 5 – August 20, 2012.



Under proposed Project operations, the increase in flow in the East Fork bypassed reach (due to the increased minimum flow to 4 cfs and the tailrace re-route to the East Fork) could act to further moderate the rate of thermal change (due to meteorological conditions) as waters travel down through the reach. As such, it is possible that the increase in flow in the East Fork bypassed reach may result in cooler temperatures in summer and slightly warmer (non-freezing) temperatures in winter. However, the data shown in Figure 3.22 suggests that the magnitude of such temperature changes in summer are likely not significant (i.e., not likely measureable).

3.2.5.2 Effects on Water Temperatures in the West Fork Wallowa River

Under proposed Project operations, the absence of Powerhouse tailrace flows in the West Fork Wallowa River (due to the tailrace re-route) is likely to have the opposite effect on water temperatures as would occur in the East Fork. In the West Fork, slightly warmer temperatures in summer are likely to occur in the 0.5-mile distance between the existing tailrace discharge location and the confluence with the East Fork because the slightly cooler tailrace flows will be re-routed to the East Fork rather than discharged to the West Fork.

The magnitude of the slightly warmer water temperatures in the West Fork resulting from the proposed tailrace re-route was estimated by calculating the difference in thermal mass balance in the West Fork at the existing tailrace discharge location with and without Powerhouse tailrace discharges. The mass-balance equation is in the form of a simple mixing equation[2], $Q_{US}*T_{US} + Q_{PHT}*T_{PHT} = Q_{DS}*T_{DS}$, where Q represents flow, T

[2] Such mixing equations are typically used for water temperature computations (e.g., models), particularly to quantify values where tributaries or point discharges enter a reach. Because water temperature is not a conservative parameter, additional detailed heat budget computations (e.g., modeling) are often done for flows travelling downstream to assess warming or cooling of water temperatures due to meteorological and other conditions. However, for this assessment, additional detailed heat budget computations (e.g., modeling) were not done because the thermograph data suggests that

represents water temperature, PHT denotes the Powerhouse tailrace discharge, US denotes the West Fork upstream of the tailrace discharge, and DS denotes the West Fork downstream of the tailrace discharge.

The above equation was applied using water temperature data for the period July 1 to August 20, 2012, which includes the warmest period where water temperature data were simultaneously collected at sites WFI and PHT (to represent T_{US} and T_{PHT}, respectively, in the above equation). The concurrent PHT flow data for the period July 1 to August 20, 2012 were used to represent Q_{PHT} in the above equation. The PHT flow data incorporate a range of tailrace flow conditions, including some days of Powerhouse outages that approximate the effects of the decrease in flow in the West Fork that would occur under the proposed tailrace re-route.

Because concurrent flow data are not available in the West Fork Wallowa River for the period July 1 to August 20, 2012, flow values were synthesized from historic flow records to represent West Fork flows upstream of the tailrace discharge (i.e., Q_{US} in the above equation). The 44-year period of record for the historic USGS gages in the East Fork (as previously described above) includes a 10-year period (i.e. 1924-1933) when historic data were concurrently collected in the Wallowa River above Wallowa Lake (USGS Station 13325500). These 10 years of data were examined to identify a representative historic year (i.e., 1933) when East Fork average daily flows during summer most closely matched the East Fork average daily flows during summer 2012 (Figure 3.23). On the basis of this selection, the average daily flow values for the Wallowa River above Wallowa Lake (USGS Station 13325500) for the matching historic period were used as an estimated surrogate for Wallowa River flows during summer 2012. West Fork flows upstream of the tailrace discharge (i.e., Q_{US} in the above equation) were then synthesized by subtracting the average daily flows recorded at sites BPL and PHT during summer 2012 from these surrogate Wallowa River values.

Using the above equation, daily minimum, mean, and maximum water temperature values were calculated for the West Fork downstream of the Powerhouse tailrace location (i.e., T_{DS}). These calculated values were subtracted from the concurrent values for the West Fork upstream of the tailrace location based on the actual thermograph-derived values from site WFI (i.e., T_{US}). The subtracted values (i.e., differences) represent the amount of warming (or, in a few cases, cooling if the difference is less than zero) that occurs as a result of the tailrace discharge. The temperature differences are plotted in Figure 3.24 as a function of the percent of the flow in the West Fork that is comprised of Powerhouse tailrace flows (in percent). For example, a Powerhouse tailrace flow of 10 cfs comprises 25 percent of a West Fork flow of 40 cfs.

little, if any, additional thermal change occurs in the short the 0.5-mile distance between the existing tailrace discharge location and the confluence with the East Fork.

Figure 3.23 Comparison of average daily flow values from three sources: (1) the East Fork Wallowa River during summer 2012 (based on the sum of flows at sites PHT and BPL); (2) the East Fork during summer 1933 (from USGS Station 13325001); and the Wallowa River above Wallowa Lake during summer 1933 (USGS Station 13325500).

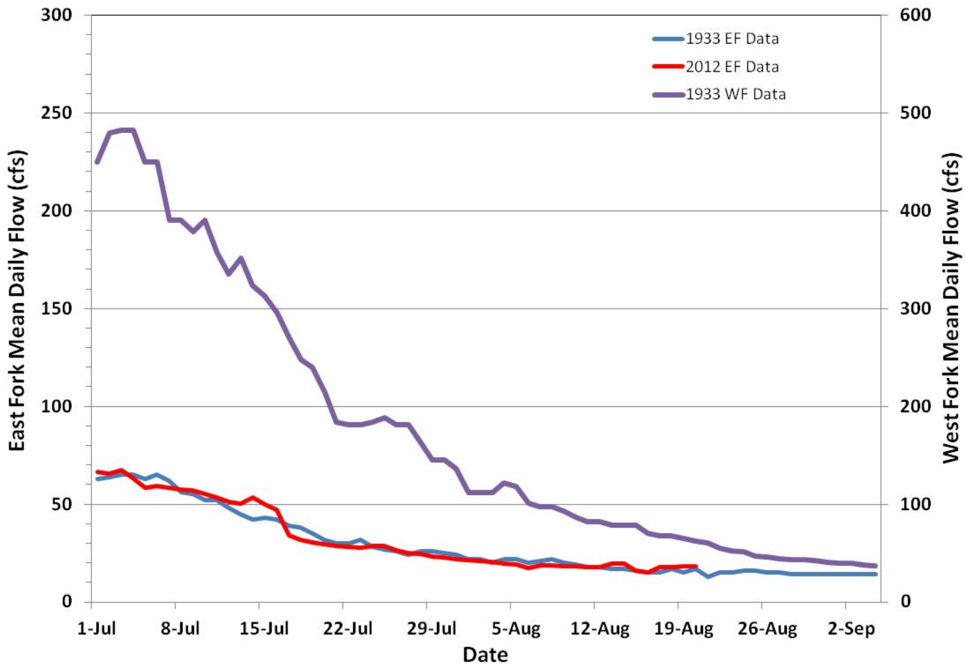
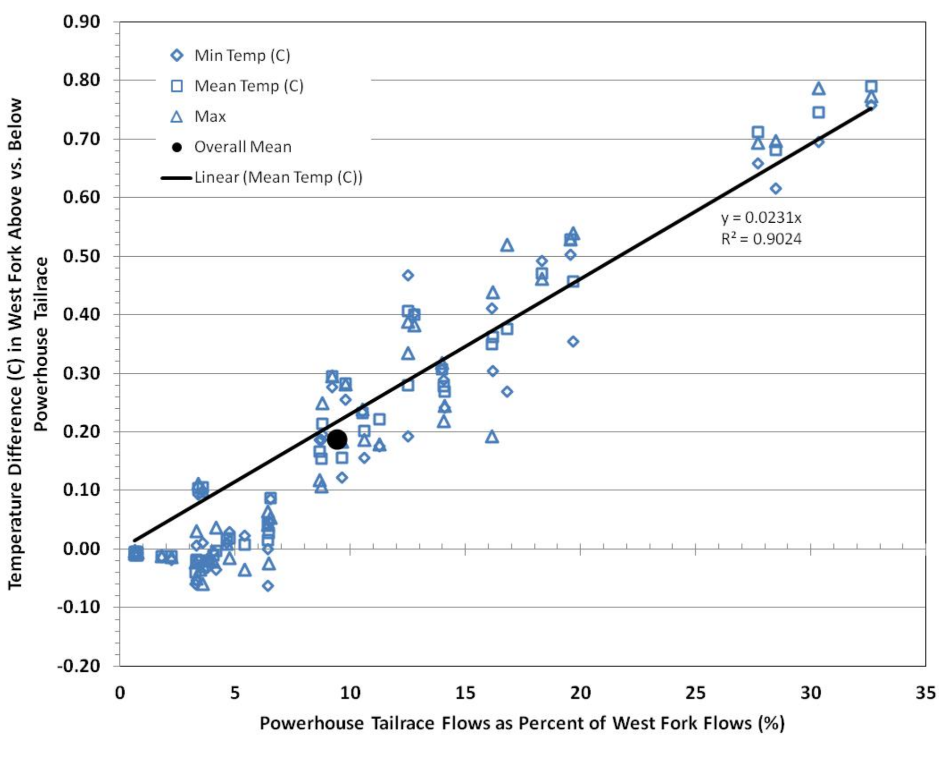


Figure 3.24 Differences in calculated water temperature values for the West Fork upstream and downstream of the Powerhouse tailrace location ($T_{US} – T_{DS}$) plotted as a function of the percent of the flow in the West Fork that is comprised of Powerhouse tailrace flows (in percent).



The temperature differences shown in Figure 3.24 indicates that during the warm period of July 1 to August 20, 2012, Powerhouse tailrace flows made up as much as about 33 percent of West Fork flow and cooled the West Fork by as much as about 0.8°C. As an overall mean during the period, Powerhouse tailrace flows made up about 10 percent of West Fork flow and cooled the West Fork by about 0.2°C. These results indicate that, absent Powerhouse tailrace flows, flows in the West Fork between the existing powerhouse tailrace and East Fork confluence will decrease on the order of 10 to 33 percent during the late summer warm period. Lower flows at this time will increase daily water temperatures within this reach of the West Fork by about 0.2°C on average, and as much as about 0.8°C.

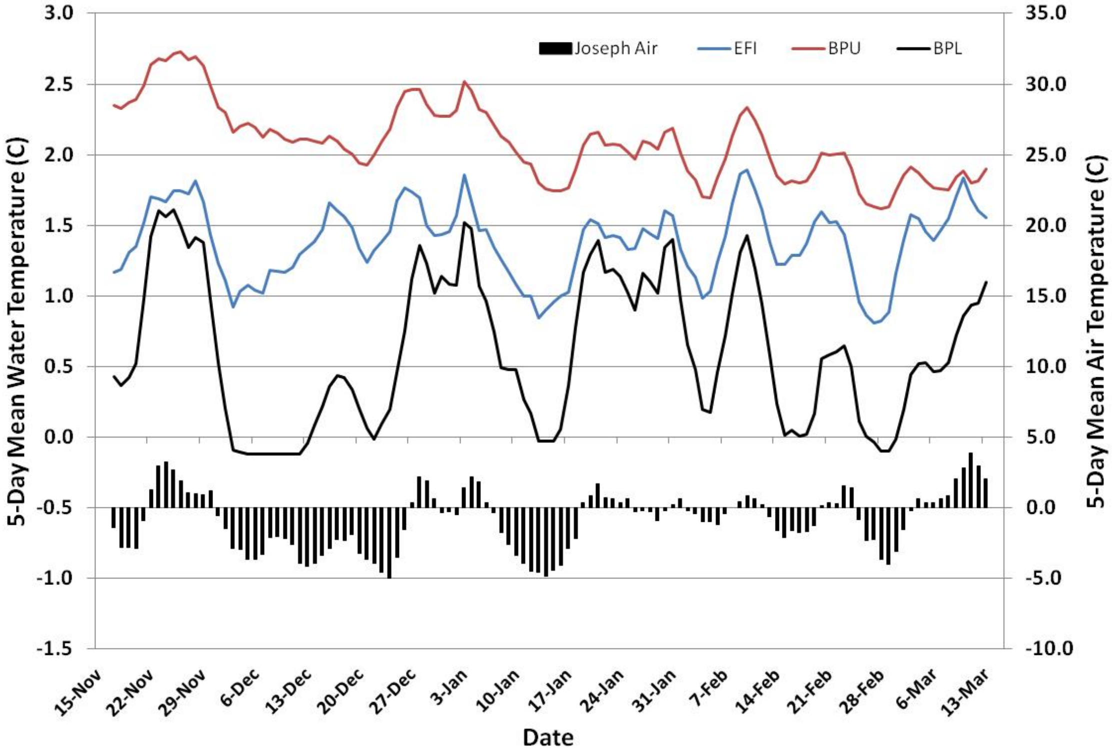
3.2.5.3 Possible Effects on Ice Formation in the East Fork

Anecdotal information from local residents living near the lower end of the East Fork Wallowa River indicates that instream ice formation occurs at times during winter, resulting in occasional backwatering of flows. Water temperature data collected at site BPL during this study indicate that water temperatures dropped to 0 to -0.1°C on several days during winter, confirming the likelihood of instream ice formation as anecdotally observed. As an illustration, daily mean water temperature values are shown in Figure 3.25 for sites BPL, BPU, and EFI for the period November 15-March 15, 2012, along with the concurrent mean air temperatures recorded at the Joseph Airport. As expected, freezing water temperatures at site BPL occurred coincident with subfreezing air temperatures (Figure 3.25). However, it is notable that water temperatures did not reach freezing levels (0°C or less) at either of the upstream, higher-elevations EFI and BPU sites on the East Fork (Figure 3.25).

The reasons for the episodes of freezing water temperatures at site BPL, but not at sites EFI and BPU, are not specifically known, but are likely a combination of factors. For example, key factors likely include: (1) a much larger relative magnitude of baseflow at site EFI that likely increases the groundwater-related thermal load present at site EFI; (2) thermal mass provided by the Project forebay’s water volume, which further retains thermal load at site BPU (which is located just below the forebay); (3) possible occurrence of winter air temperature inversion that causes cold air pooling around the area of site BPL; and (4) differences in stream hydraulics between BPL and the other upstream sites that may further affect the occurrence of ice formation.

The contributions of baseflow-related temperatures to a stream are highly variable and difficult to determine but can be significant, especially where the winter baseflow is primarily derived from groundwater (Maidment 1992), which is the case for the East Fork Wallowa River. The wintertime temperature of the groundwater that discharges to the East Fork (as baseflow) is not directly known, but is certainly above freezing, likely by at least a few degrees (°C). It is likely that the water temperature regime shown for site EFI in Figure 3.25 is representative of groundwater thermal contribution because: (1) the flow at site EFI is comprised entirely of baseflow at this time; and (2) the temperature regime at site EFI is upstream of, and therefore unaffected by, the presence of the Project forebay or diversion of flows.

Figure 3.25 Daily mean water temperature values at sites BPL, BPU, and EFI for the period November 15-March 15, 2012, along with the concurrent mean air temperatures recorded at the Joseph Airport.



The Project forebay's water volume appears to provide appreciable additional thermal load retention, as indicated by the slightly warmer water temperature regime shown in Figure 3.25 for site BPU (which is located just below the forebay). This thermal mass keeps the temperatures of water released at the Project dam to the upper East Fork bypassed reach at site BPU (and also water diverted to the Powerhouse) from dropping to freezing levels.

During typical low-flow wintertime Project operations, a substantial portion (about 90 percent) of the flow entering the Project forebay is diverted to the Powerhouse. As such, a substantial portion of the thermal load from upstream baseflow contributions (to site EFI) and the forebay thermal mass is also diverted. The reduced flows and thermal load to the East Fork downstream create a condition where remaining instream waters are more susceptible to potential freezing in the event of sustained subfreezing air temperatures.

As flows travel downstream into the lower portion of the East Fork bypassed reach, differences in stream hydraulics could also contribute to freezing water temperature conditions and ice formation. During winter low-flow conditions, the lower portion of the East Fork around site BPL is wider, shallower, and less turbulent compared to the upstream sites. Surface flow velocity plays an important role in ice formation (Maidment 1992). Conditions most suitable for ice formation occur where flows are slower (around

0.5 feet/second or less), permitting more efficient “supercooling”[3] of streams subjected to subfreezing air temperatures (Osterkamp et al. 1983). When the entire stream cross section reaches 0°C and then with a slight degree of further cooling (about -0.1°C), small ice particles, called frazil ice, begin to form (Maidment 1992).

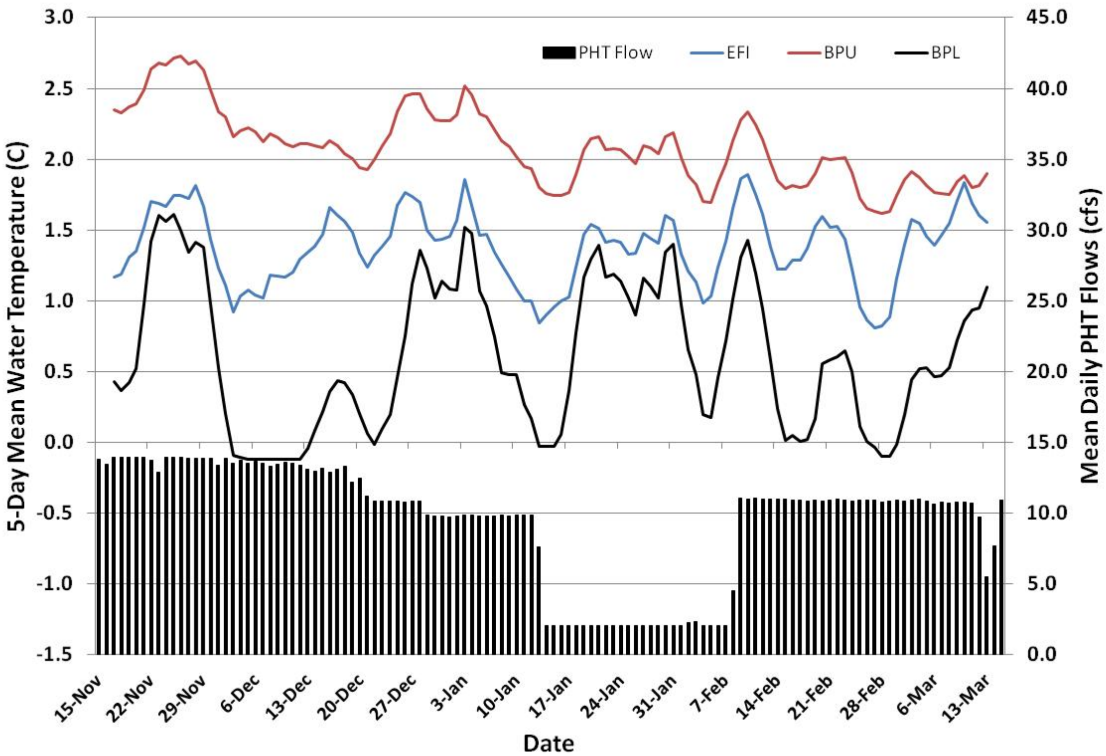
Although as a general rule air temperatures decrease with increased elevation, the reverse can occur due to wintertime air temperature inversions, resulting in conditions where subfreezing air temperatures can occur at site BPL but actually be above freezing at the upstream sites EFI and BPU. Wintertime air temperature inversions are common in mountain landscapes in the region, when arctic air pools in mountain valleys, causing a persistent temperature inversion to around 4,000 ft elevation (Ferguson 1999). Warmer fronts can then pass aloft over the entrapped cold air, resulting in warmer air temperatures at overlying elevations.

However, even when the upstream sites EFI and BPU have lower subfreezing air temperatures in winter than at the downstream site BPL, ice formation might not occur to the extent observed downstream due to the higher-gradient, more-turbulent nature of the upper portion of the East Fork bypassed reach. The supercooling that controls frazil formation is not great, so that slight changes in the frictional heat produced by more turbulent flows or rapids can appreciably delay or prevent frazil ice production (Maidment 1992).

As a companion to Figure 3.25, Figure 3.26 shows the same daily mean water temperature values for sites BPL, BPU, and EFI along with the concurrent flows diverted to the Powerhouse for the period November 15-March 15, 2012. In tandem, the two figures suggest that the drops in water temperatures to freezing levels at site BPL are generally more strongly correlated with air temperature than flow (Figure 3.26). However, Figure 3.26 includes a 25-day period from January 14 to February 7, 2012 when diversions of flow to the Powerhouse were not occurring. Mean air temperatures recorded at the Joseph Airport were subfreezing on 15 of the 25 days during this period (Figure 3.25), yet slightly warmer, and non-freezing, water temperatures occurred at BPL throughout the period. These slightly warmer water temperatures at BPL at this time indicate that higher bypass instream flow releases (as would occur under proposed Project operations) could play a further role in reducing ice formation in the East Fork bypassed reach.

[3] The supercooling of water is a necessary condition for the formation of ice (i.e., frazil and anchor ice) in running water (Osterkamp et al. 1983). When ice crystals begin to grow upon a solid particle, the heat of solidification must be carried away. This means that the temperature on one or both sides of the crystal surface must be lower than the temperature of the crystal surface itself, which is 0°C. Such loss of heat will produce supercooling slightly under 0°C (up to about -0.1°C) throughout the turbulent water mass.

Figure 3.26 Daily mean water temperature values at sites BPL, BPU, and EFI for the period November 15-March 15, 2012, along with the concurrent flows diverted to the Powerhouse.



3.3 Dissolved Oxygen

3.3.1 Summary of Data Completeness

As described in Section 2.1 above, continuous hourly sampling of dissolved oxygen was conducted for 72-hour periods in each of the months of August, September, and October 2012 at sites EFI, BPU, and BPL. For the August sampling event, data collection completeness of 100 percent was achieved at sites BPU and BPL. Due to sampling equipment malfunction, data collection was not completed at site EFI. For the September and October sampling events, data collection completeness of 100 percent was achieved at all three sites. Appendix C presents the hourly dissolved oxygen data for the sampling events.

3.3.2 Dissolved Oxygen Conditions

3.3.2.1 August 2012 Sampling Event

The dissolved oxygen measurements (in mg/L and percent-saturation) at sites BPU and BPL during the 72-hour sampling event of August 2012 are shown in Figures 3.27 and 3.28. The data indicate that dissolved oxygen during the sampling event of August 2012 were near full saturation (100 percent) throughout the sampling period at concentrations between about 9 and 10 mg/L. A daily pattern in dissolved oxygen concentration is evident, whereby higher concentrations occurred at around 6 to 8 A.M. and lower concentrations at around 3 to 5 P.M. This pattern coincides with the daily pattern in water temperature, which is the key factor controlling how much dissolved oxygen content water can hold. Temperature inversely controls the solubility of oxygen in water—as temperature increases, oxygen is less soluble.

Other important factors that influence dissolved oxygen include altitude, salinity, and stream structure. As atmospheric pressure increases due to elevation changes, oxygen solubility increases. As discussed further below, the relatively high elevation of the Project area is an important factor in interpreting the results of the dissolved oxygen data collected for this study. Stream structure also influences dissolved oxygen concentrations. Atmospheric oxygen becomes mixed into a stream at turbulent, shallow riffles, resulting in increased dissolved oxygen levels. Because of the high-gradient, turbulent nature of the streams in the Project area, it is expected that dissolved oxygen is maintained at full saturation (100 percent) at all times as a result of such turbulent mixing. Salinity also reduces the solubility of oxygen in water. However, because the streams in the Project area are very dilute with minimal salinity values, this factor can be disregarded in this case.

The biological processes of photosynthesis and respiration also affect dissolved oxygen concentrations in streams. As aquatic plants photosynthesize, they give off dissolved oxygen during daylight hours, and respiration from aquatic vegetation, microorganisms, and algae consume oxygen throughout the day and night. However, the streams in the Project area have low nutrient and aquatic plant productivity. As a result, little if any “signals” from these biological processes are expected in the trends of the dissolved oxygen observed in this study.

Figure 3.27 Dissolved oxygen measurements (in mg/l and percent-saturation) at site BPU during the 72-hour sampling event of August 2012.

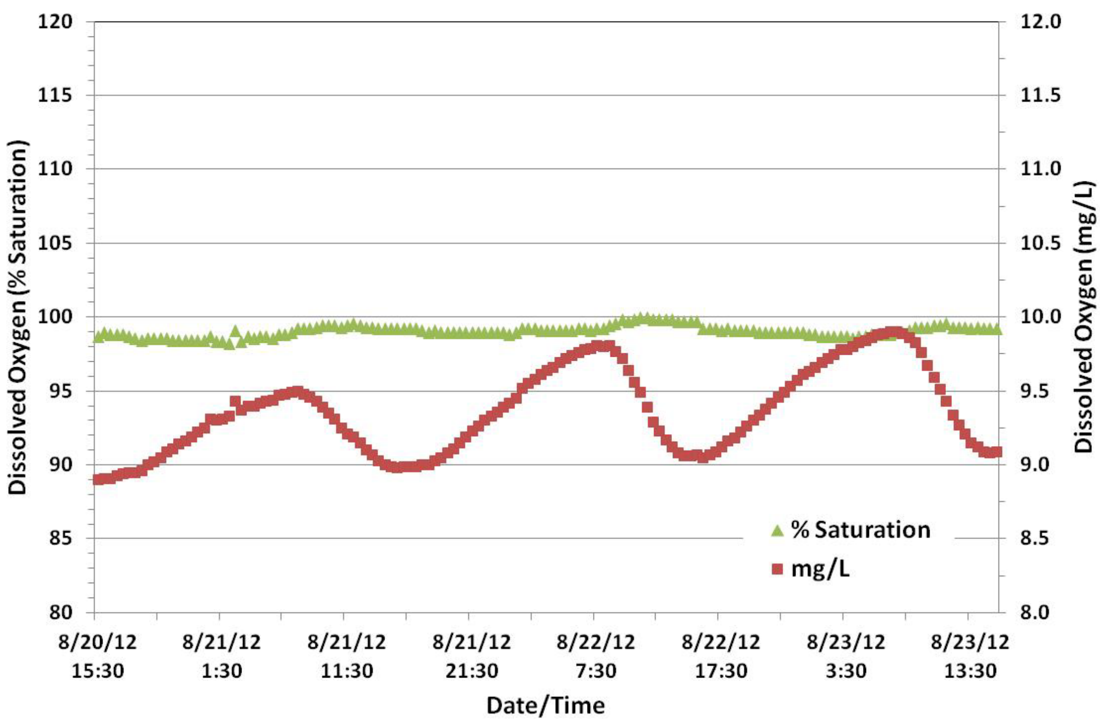
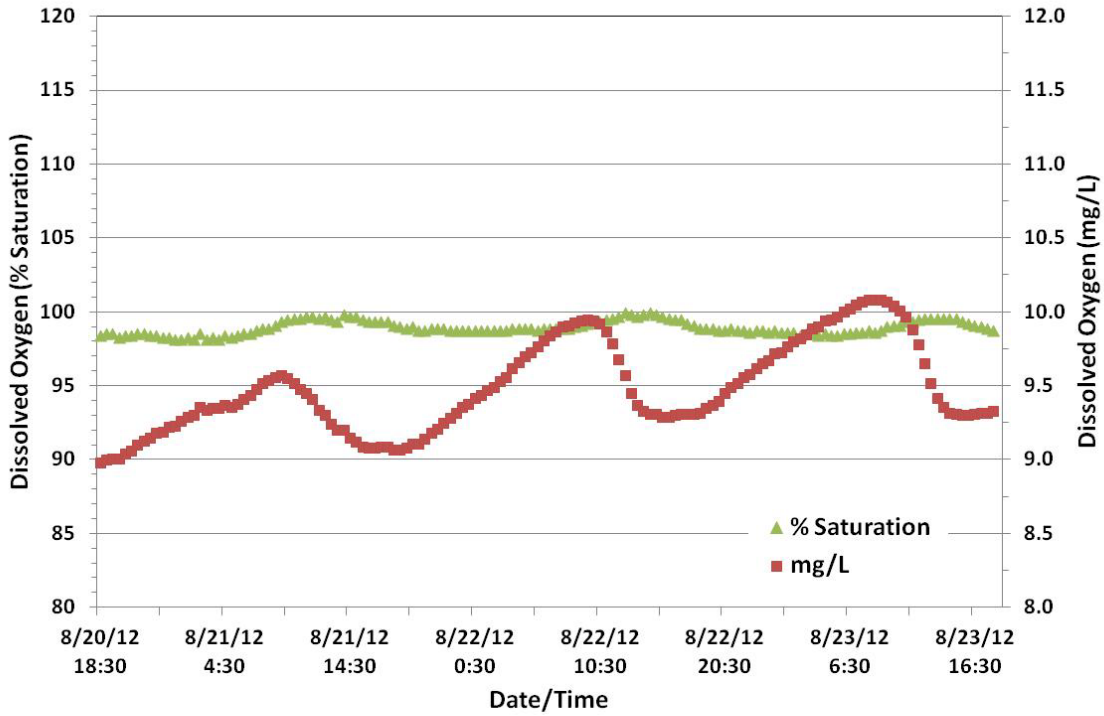


Figure 3.28 Dissolved oxygen measurements (in mg/l and percent-saturation) at site BPL during the 72-hour sampling event of August 2012.



3.3.2.2 September 2012 Sampling Event

The dissolved oxygen measurements (in mg/L and percent-saturation) at sites EFI, BPU, and BPL during the 72-hour sampling event of September 2012 are shown in Figures 3.29 to 3.31. Like the trends observed in August, dissolved oxygen measurements at sites BPU and BPL were near full saturation (100 percent) throughout the September sampling event. Concentrations at sites BPU and BPL maintained levels between about 9.5 and 10.3 mg/L. Dissolved oxygen measurements at site EFI actually exceeded 100 percent saturation—levels were consistently about 110 percent saturation, and concentrations between about 10.5 and 11.5 mg/L, throughout the September sampling event. The reasons for consistently higher dissolved oxygen measurements at site EFI are not specifically known, but are likely related to the higher elevation of this site (see additional discussion in Section 3.3.2.4 below).

Figure 3.29 Dissolved oxygen measurements (in mg/l and percent-saturation) at site EFI during the 72-hour sampling event of September 2012.

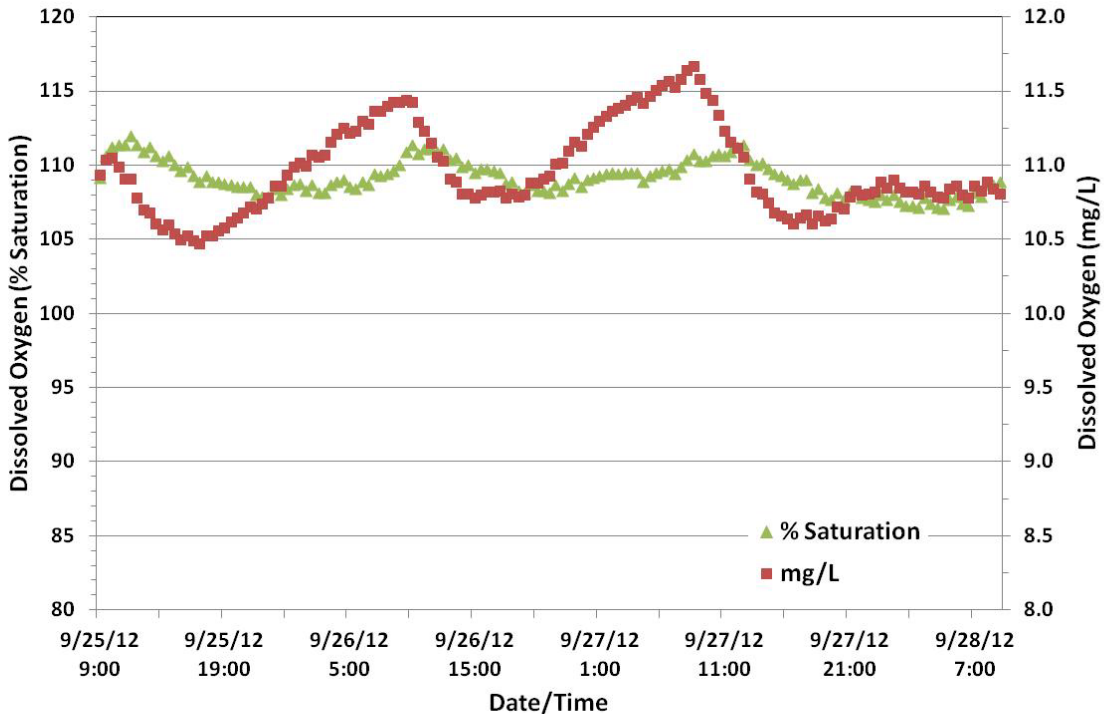


Figure 3.30 Dissolved oxygen measurements (in mg/l and percent-saturation) at site BPU during the 72-hour sampling event of September 2012.

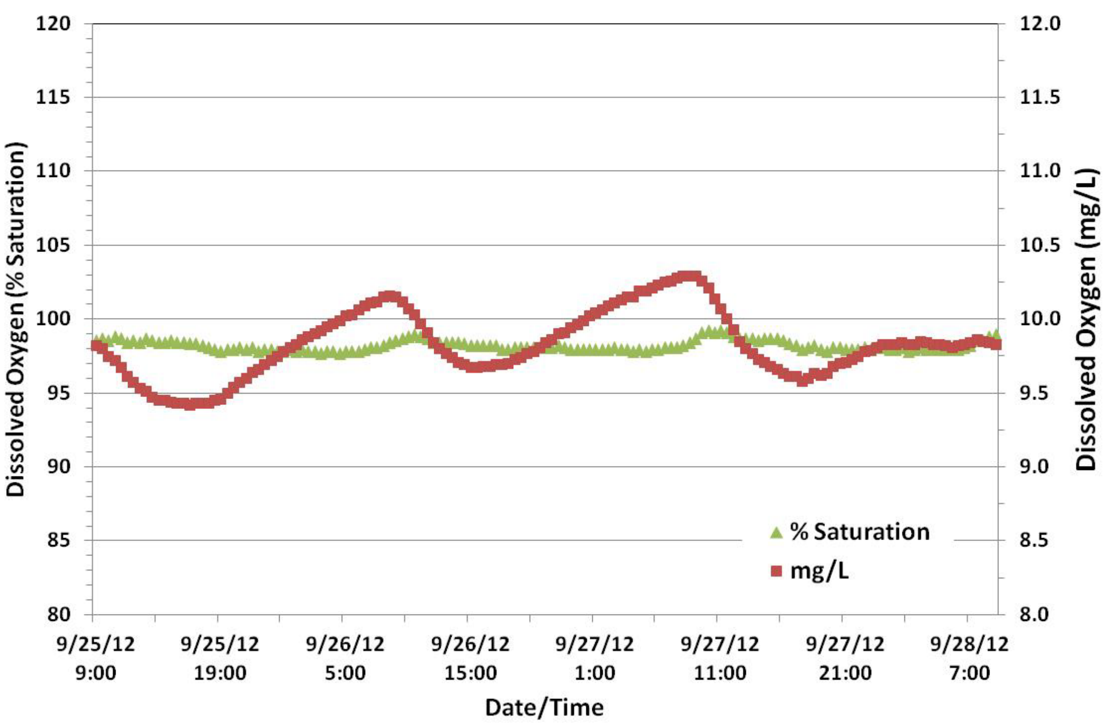
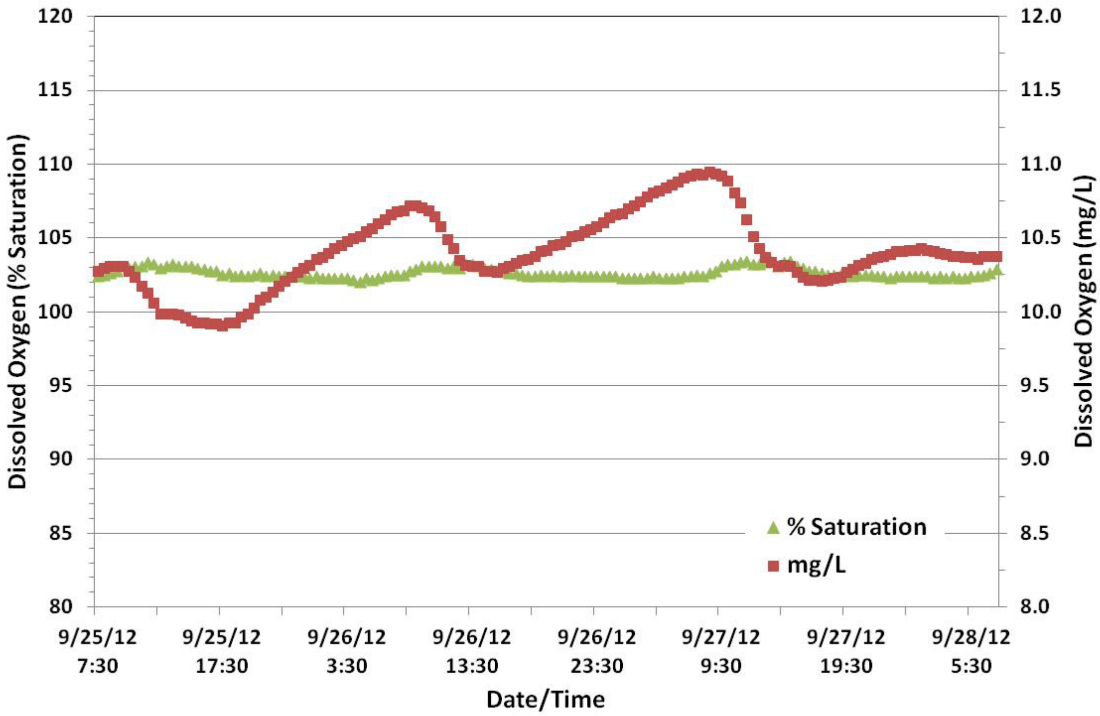


Figure 3.31 Dissolved oxygen measurements (in mg/l and percent-saturation) at site BPL during the 72-hour sampling event of 2012.



3.3.2.3 October 2012 Sampling Event

The dissolved oxygen measurements (in mg/L and percent-saturation) at sites EFI, BPU, and BPL during the 72-hour sampling event of October 2012 are shown in Figures 3.32 to 3.34. Like the trends observed in August and September, dissolved oxygen measurements at sites BPU and BPL were consistently slightly above full saturation (around 105 percent) throughout the October sampling event. Concentrations at sites BPU and BPL maintained levels between about 10 and 12 mg/L. As in September, dissolved oxygen measurements at site EFI during the October sampling event were consistently about 110 percent saturation, and concentrations between about 11.5 and 12.7 mg/L. The reasons for consistently higher dissolved oxygen saturation at site EFI are not specifically known, but are likely related to the higher elevation of this site (see additional discussion in Section 3.3.2.4 below).

Figure 3.32 Dissolved oxygen measurements (in mg/l and percent-saturation) at site EFI during the 72-hour sampling event of October 2012.

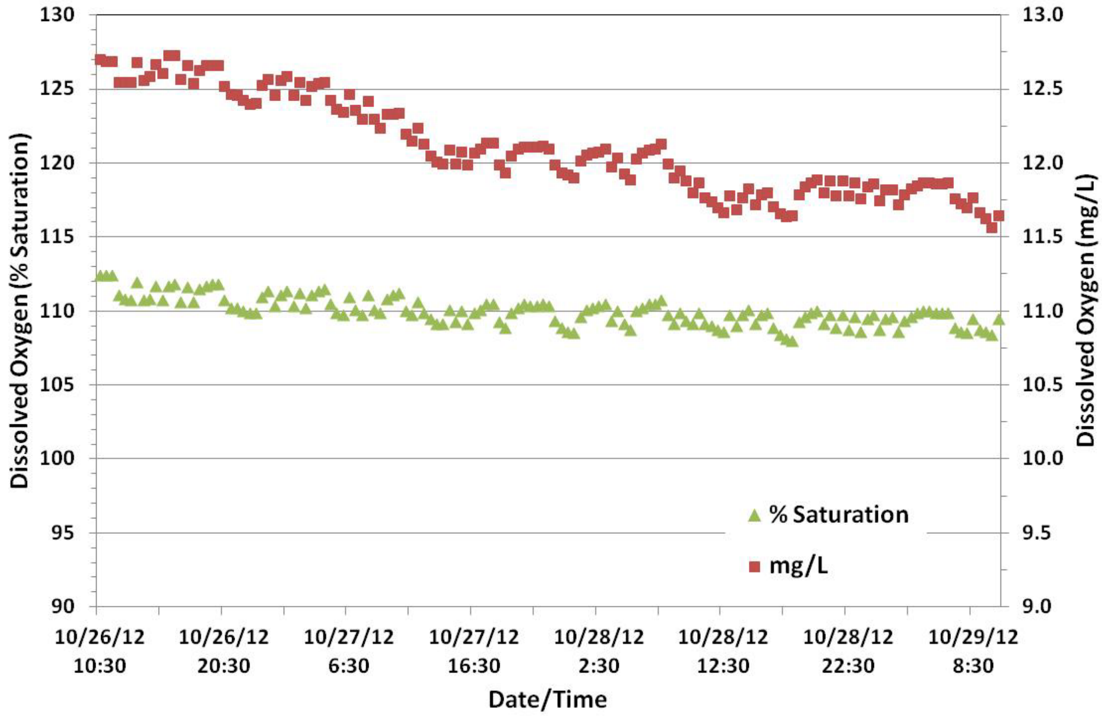


Figure 3.33 Dissolved oxygen measurements (in mg/l and percent-saturation) at site BPU during the 72-hour sampling event of October 2012.

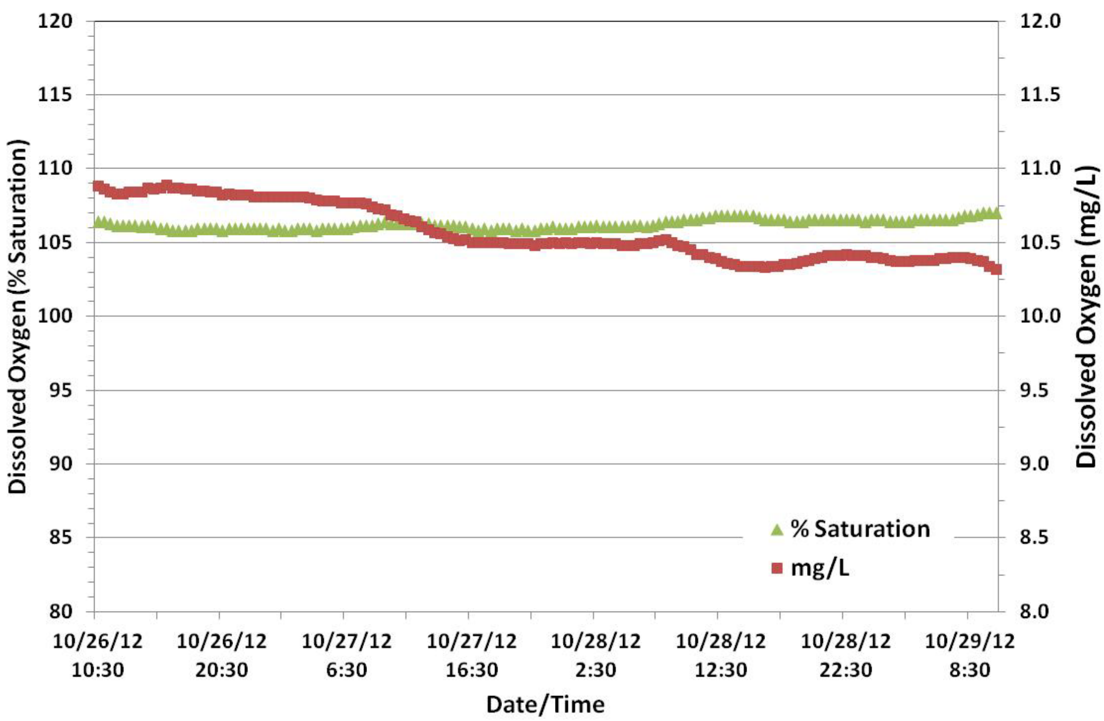
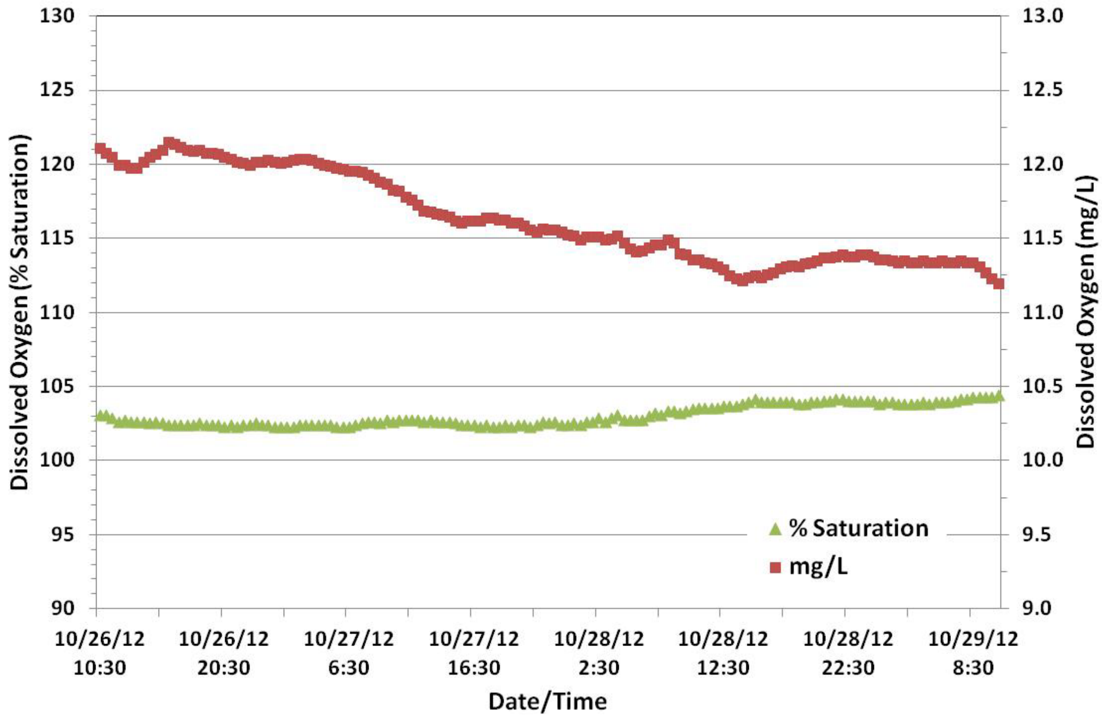


Figure 3.34 Dissolved oxygen measurements (in mg/l and percent-saturation) at site BPL during the 72-hour sampling event of October 2012.



3.3.2.4 Effects of Project Area Elevations on Dissolved Oxygen

As indicated above, the relatively high elevation of the Project area is an important factor in interpreting the results of the dissolved oxygen data collected for this study. There is a direct relationship between atmospheric pressure and dissolved oxygen—at higher elevations, where air pressure decreases relative to sea level, the relative oxygen solubility decreases. As shown in Figure 3.35, water can hold higher concentrations of dissolved oxygen at sea level than at higher elevations. For example, at a water temperature of 10°C, the 100 percent saturated dissolved oxygen level is achieved at a concentration of 11.3 mg/L in water at sea level, compared to 9.5 mg/L at an elevation of 4600 ft (at the BPL site) and 9.1 mg/L at an elevation of 5800 ft (at the BPU site). Thus, it is important to account for elevation effects when interpreting the dissolved oxygen conditions in the Project area. For example, Figure 3.36 shows the data for site BPL relative to saturation levels that specifically correspond to the BPL site elevation.

Figure 3.35 The relationships at differing elevation levels of dissolved oxygen concentration and water temperature equal to 100 percent saturation.

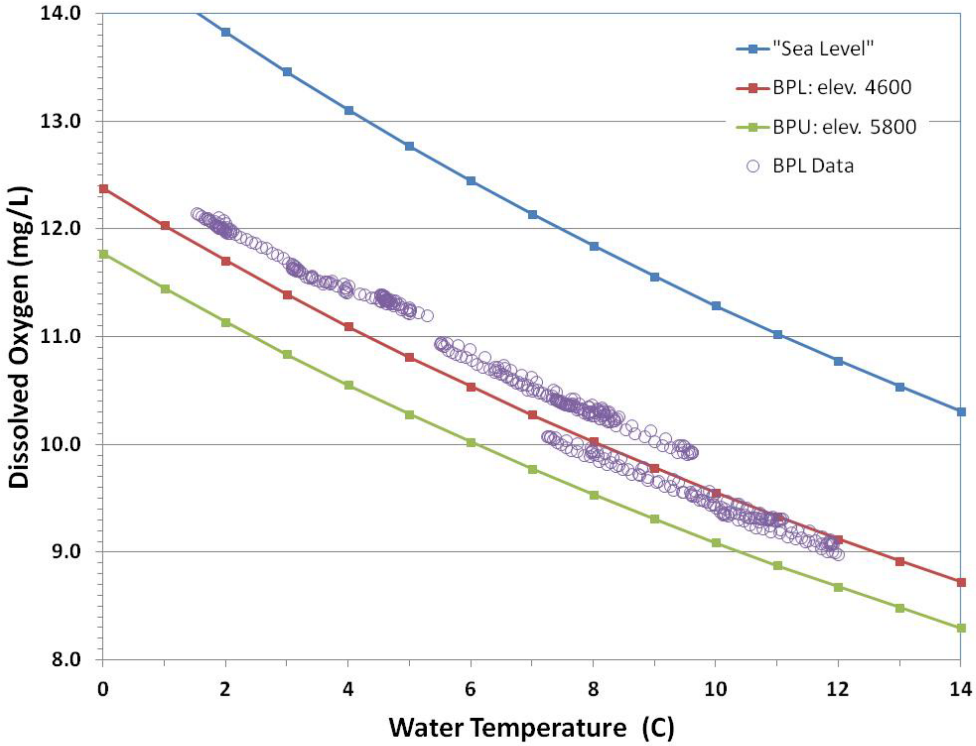
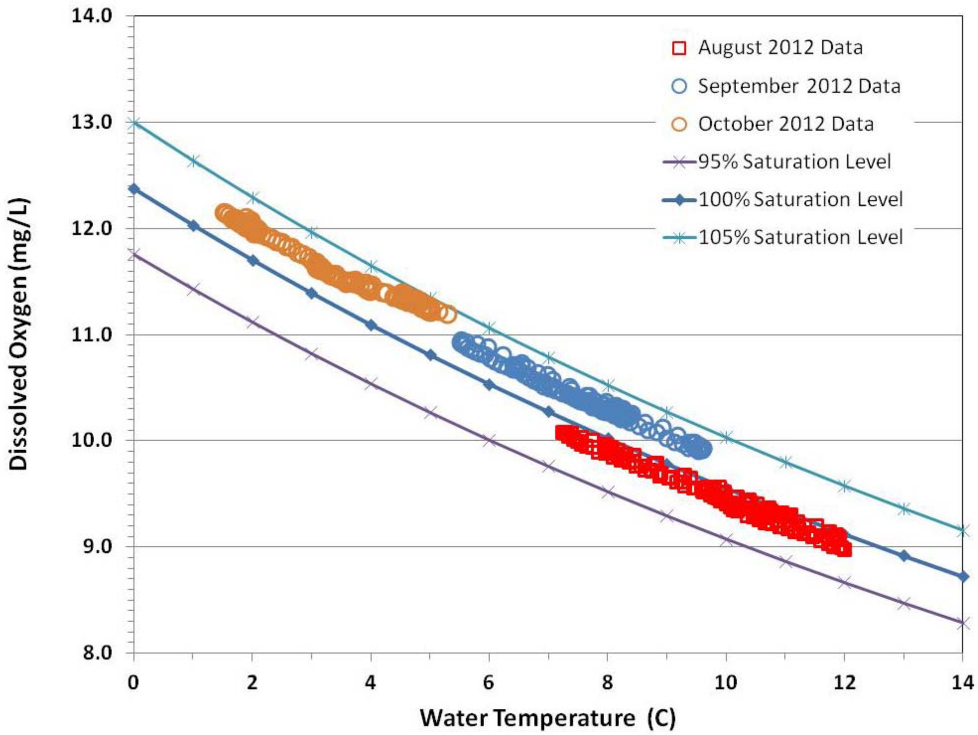


Figure 3.36 Example of the relationship at site BPL of dissolved oxygen concentration and water temperature equal to 95, 100, and 105 percent saturation levels.



3.3.3 Project Effects on Dissolved Oxygen

As discussed in Section 1.3.3 above, the primary potential Project effect on dissolved oxygen under current Project operational conditions is the diversion of flow from the East Fork that has the potential to affect physical flow conditions (e.g., flow quantity, depths, and velocities in the bypassed reach), which in turn could affect aeration of waters affected by such conditions. Such effects have the potential to affect dissolved oxygen by increasing the amount of oxygen entering the water from surrounding air. However, no effects on dissolved oxygen occur under current operations or are expected from the potential flow changes in this case. Project facilities and operations do not cause or contribute to any oxygen-demanding substances in Project waters. Furthermore, the relatively high gradient of stream channels in the Project area creates sufficient turbulence to maintain efficient aeration of Project waters.

As discussed above, the monitoring data indicate that dissolved oxygen is fully saturated (consistently 98 to 105 percent) in waters of the Project area. As specified in Table 2-4 in Section 2.2.2 above, the State of Oregon standard indicates that dissolved oxygen in streams may not be less than 95 percent saturation[4] when trout spawning through fry emergence occurs or less than 90 percent saturation[5] as an absolute minimum (OAR 340-041-0016). As evident in Figures 3.27 to 3.34, dissolved oxygen values were above 95 percent saturation at all times during this study.

3.4 Total Dissolved Gas

3.4.1 Summary of Data Completeness

As described in Section 2.1 above, discrete TDG measurements were taken twice daily on two consecutive days per month for June-September period in the Project tailrace. Data collection completeness of 100 percent was achieved at the tailrace site as planned for the June-September period. Appendix D presents the TDG data collected for this study.

3.4.2 Total Dissolved Gas Conditions

TDG measurements were made in the powerhouse tailrace to demonstrate that TDG supersaturation (i.e., TDG saturation greater than 110 percent) from potential turbine air entrainment is not a concern. Although air entrainment through turbines can lead to gas supersaturation, the situation is not common and increased gas pressure from this cause is usually not substantial (WDOE 2004).

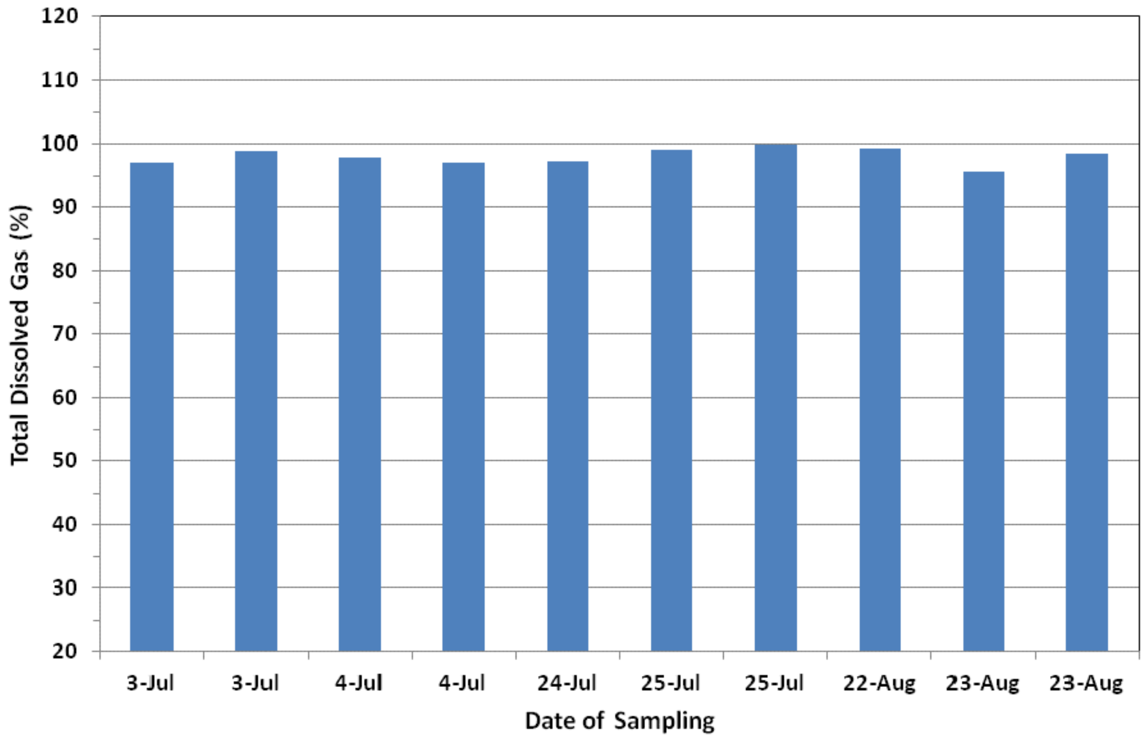
[4] 95 percent saturation applies where ambient pressure and temperature conditions preclude attainment of the 11.0 mg/l or 9.0 mg/L criteria, which is sometimes the case in the Project area due to elevation effects as discussed in Section 3.3.2.4.

[5] 90 percent saturation applies where ambient pressure and temperature conditions preclude attainment of 8.0 mg/L as an absolute minimum, which was never the case during this study and is not anticipate to occur, but is assumed for the analysis here due to elevation effects as discussed in Section 3.3.2.4.

The TDG measurements (in percent-saturation) at the powerhouse tailrace site are shown in Figure 3.37. The TDG measurements were all at or near 100 percent saturation (i.e., average of 98 percent saturation; range 96 to 100 percent saturation). As expected, these values indicate that TDG is not supersaturated, but instead is at near-saturation conditions.

As specified in Table 2-4 in Section 2.2.2 above, the State of Oregon standard indicates that TDG may not exceed 110 percent saturation[6] at the point of sample collection and may not exceed 105 percent saturation in waters less than two feet in depth (OAR 340-041-0031). The TDG measurements at the powerhouse tailrace were less than 105 percent saturation in all samples collected during this study.

Figure 3.37 TDG measurements taken twice daily on two consecutive days per month for June-September period in the Project Tailrace.



3.5 Turbidity

3.5.1 Turbidity Conditions Pertaining to Forebay Maintenance

Routine forebay maintenance flushing did not occur during the study period. Consequently, turbidity sampling as proposed under the Water Resources Revised Study Plan (PacifiCorp 2011) did not occur. PacifiCorp is in consultation with the U.S. Fish and Wildlife Service (USFWS), U.S. Army Corps of Engineers (USACE) and DEQ regarding necessary approval and permitting for future forebay flushing. In 2012, field activities

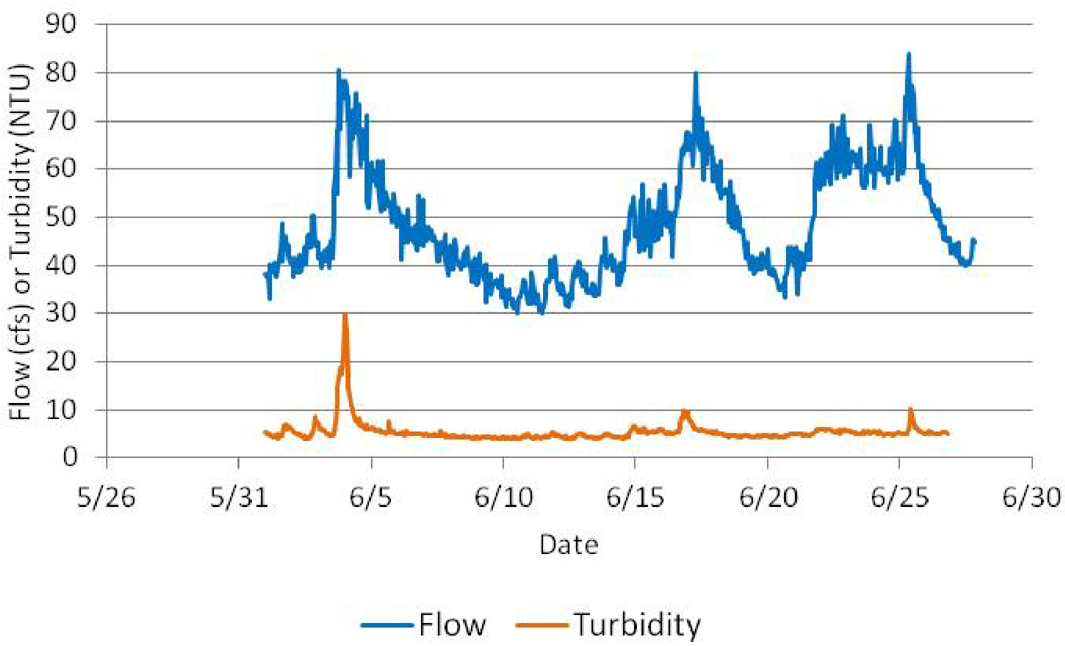
[6] Except when stream flows exceed the 10-year, 7-day average flood, which was not the case in this study.

(outside of the Water Resources Study reported herein) were conducted to support these permitting needs. These activities included a volumetric survey and sediment sampling in the forebay, and additional substrate characterization and water sampling in the bypassed reach. The status and results of these 2012 activities are discussed in PacifiCorp (2013b).

Among these studies, PacifiCorp conducted turbidity and flow monitoring during June 2012 at site BPL to illustrate the influence of early season high flows on fine sediment transport (PacifiCorp 2013b). The purpose of this monitoring was to develop a record of background turbidity and flow for a typical June runoff period prior to future forebay flushing events.

Turbidity and flow levels for the June 2012 monitoring effort are shown in Figure 3.38. The data indicate that natural turbidity conditions in the East Fork generally vary in response to streamflow runoff events. For example, during the June 2012 data collection, turbidity peaked to a relatively high level of 30 NTU that occurred over a short duration coincident with the first high-flow runoff event of the spring (often called a “first flush”). Subsequent high-flow events that occurred later in the month were of similar flow magnitude (around 80 cfs), but corresponding turbidity peaks only reached around 10 NTU. Between these peaks, turbidity levels were consistently relatively low (less than 5 NTU).

Figure 3.38. Continuous turbidity and flow monitoring results at site BPL in June 2012.



3.5.2 Turbidity Effects Related to Proposed Forebay Maintenance

To reduce impacts to aquatic resources that may result from forebay flushing, PacifiCorp has developed a Sediment Management Program (SMP). In contrast to the historic practice of flushing entrained native sediment from the forebay during the summer low-flow period, sediment from the forebay will be flushed during peak spring runoff in the month of June. Annual forebay flushing would result in the removal of approximately 250 to 500 cubic yards of accumulated sediment and the mobilization and transport of that sediment into the East Fork Wallowa River bypassed reach. Under the proposed SMP, flushing would also occur relatively quickly, lasting no more than 24 to 72 hours. The June 2012 turbidity and flow data (Figure 3.38) support PacifiCorp's plan to shift to high flow flushing (likely in June) to minimize effects on downstream turbidity resulting from forebay sediment flushing events in the future.

Because forebay flushing did not occur during the 2012-2013 study period, an assessment of forebay flushing effects relative to the State of Oregon turbidity standard (as summarized in Table 2-4) is not provided here. Additional turbidity monitoring would be conducted in consultation with DEQ during forebay flushing in the future.

4.0 SUMMARY OF CONCLUSIONS

This Water Resources Updated Study Report (Final Technical Report) presents the results of flow, water temperature, dissolved oxygen, TDG, and turbidity monitoring during 2012 and 2013 to characterize hydrology and water quality conditions in the Project area. As expected and as previously documented (e.g., Nowak and Kuchenbecker 2004), the data collected during this study confirm that overall water quality in the streams in the Project area is excellent, due to the relatively pristine location and physical characteristics of the watershed areas, most of which lie within the Eagle Cap Wilderness Area.

4.1 Flow

The overall average flows during the study at the five gaged study sites were 21, 18, 12, 9.3, and 1.8 cfs, respectively, at sites EFI, BPL, BPU, PHT, and RPI. Average annual flows at site EFI were near historic normal levels in both WY 2012 and WY 2013 (compared to the available 44-year historic data from nearby USGS gages). During WY 2012, average monthly inflows to the Project from the East Fork Wallowa River (as measured at site EFI) were near historic normal levels in nearly all months, except for April that was wet by comparison. During WY 2013, average monthly inflows to the Project at the EFI site were wet by comparison from October through February and then again in September, but otherwise near normal in the other spring and summer months.

Average annual flows further downstream in the East Fork bypassed reach (as measured at site BPL) were wet in WY 2012 and near normal in WY 2013. During WY 2012, average monthly flows at site BPL were normal in the spring and summer months (i.e., May through September), but were wet by comparison in the winter months. In December and January, average monthly flows were higher than any recorded previously at the historic USGS gages for those months. These wet winter conditions were the result of substantial peak flows caused at lower elevations by rain-on-snow events that were recorded at the lower-elevation BPL site during WY 2012. During WY 2013, average monthly flows at site BPL were wet by comparison from October through December, again in March-April, and then again in September, but otherwise near normal in the other winter, spring, and summer months. The rain-on-snow events recorded at site BPL site during WY 2012 were not as evident during WY 2013.

Examination of available snowpack and hydrology data from the surrounding area indicates that the previous 44-year flow data records for the historic USGS gages in the East Fork are representative of current hydrologic conditions; that is, no substantive systematic shift in conditions appears to have occurred since East Fork gage records stopped in 1983. However, this conclusion is not meant to imply that landscape or climate change effects on hydrology in the area may be occurring now or in the future.

Hydrograph separation analysis was used to estimate baseflow contributions to the East Fork, including the Project bypassed reach. The average monthly baseflows range from about 10 to 17 cfs at site EFI and 12 to 19 cfs at site BPL for months during summer/early fall (August-October) and late fall/winter (November-April) low flow periods. The net average monthly baseflows between sites EFI and BPL (i.e., the difference between estimated baseflows at sites EFI and BPL) range from about 1 to 4 cfs. The net baseflow provides an estimate of the sustained groundwater discharge that occurs to the East Fork in-between the EFI and BPL locations during low flow seasons.

The primary Project-related effects on flows are the diversions of portions of the flow from the East Fork to the Powerhouse, which causes a reduction in downstream in-channel flows in the East Fork below the Project Diversion dam. These diversions cause concomitant increases in flows in about 0.5 miles of the West Fork Wallowa River between the existing tailrace discharge location and the downstream confluence with the East Fork.

As described in Section 1, PacifiCorp proposes to operate the Project in the future with modified instream flow releases in the East Fork bypassed reach, consisting of: (1) a flow of 4 cfs released year-around from the Project Diversion; and (2) re-routing of the Powerhouse tailrace so that all Powerhouse flows are returned to the East Fork. The effects of implementing these proposed measures would be to increase flows in the East Fork bypassed reach and correspondingly decrease flows in the West Fork (below the current tailrace discharge location). In the upstream portion of the East Fork bypassed reach (between the dam and the new tailrace discharge location), flows would be increased by about 3.2 to 3.5 cfs (i.e., the difference between the proposed 4 cfs minimum instream flow release and the 0.5 to 0.8 cfs that is currently released).

In the downstream portion of the East Fork bypassed reach (between the new tailrace discharge location and the mouth), flows would be increased by the re-routed (returned) powerhouse diversion amounts (which are currently discharged to the West Fork). On average, flows in the lower portion of the East Fork bypassed reach would be increased from 20 to 35 cfs (73 percent) during the spring runoff high-flow period (April-July), 1.8 to 14.7 cfs (over 7-fold) during the summer/early fall low-flow period (August-October), and 0.9 to 10.9 cfs (over 10-fold) during the late fall/winter lower-flow period (November-March).

In the West Fork between the current tailrace discharge location and the confluence with the East Fork, flows would be decreased by the Powerhouse diversion amounts that would no longer be discharged to the West Fork. On average, flows would be decreased by about 8 percent during the spring runoff higher-flow period (April-July), 30 percent during the summer/early fall low-flow period (August-October), and 42 percent during the late fall/winter lower-flow period (November-March). In the Wallowa River downstream of the confluence of the East Fork and West Fork, no changes in flow would occur because the effects of Project operations on flows dissipate as the East Fork and West Fork join.

4.2 Water Temperature

The observed water temperature conditions at the study sites are indicative of an overall cold thermal regime in the streams of the Project area. For example, the peak 7-DAD Max water temperatures (occurring in mid-summer) for the study sites were 15.0°C, 14.2°C, 14.0°C, 13.4°C, 12.9°C, and 12.4°C at sites WFI, WRC, BPL, RPI, EFI, and BPU, respectively. Of the five thermal classifications (i.e., cold, cold-cool, cool, cool-warm, and warm) for temperate streams in the U.S. and Canada developed by Chu et al. (2009), the coldest (i.e., "cold") classification includes locations that have daily maximum water temperatures of 15.9°C or less. Based on the data obtained in this study, all of the study sites fall within this "cold" classification.

The overall cold thermal regime in the streams of the Project area is driven primarily by the high-elevation location and associated climatic influence. Carr (2003) determined that location in the watershed and climatic influence, from both maximum and minimum air temperature, are dominant factors with respect to water temperature patterns of streams in northeastern Oregon. Carr (2003) showed that elevation, through its association with reach location in the watershed and attendant time of thermal energy exposure, is strongly correlated with the daily maximum stream temperature. The northerly aspects of the watersheds in the Project area probably also influence the colder thermal conditions.

Based on comparison of the East Fork and West Fork sites, the water temperatures in the East Fork are generally cooler than the West Fork during summer. The data suggest that the cooler water temperatures in the East Fork are the result of a smaller watershed area draining to the EFI site compared to the WFI site. The larger drainage area to the WFI has comparatively lower mean elevation, lower average gradient, greater stream width, and longer stream reach length in the West Fork, which are factors that act to cause a relatively higher rate of stream heating as waters flow downstream (Isaak and Hubert 2001).

The comparison of water temperature trends in the East Fork bypassed reach (between the BPU and BPL sites) indicates that flows are consistently warmer at BPL from spring through summer. The warming of flows as they travel downstream in the bypassed reach, particularly during summer, is reasonable to expect given that the gradient of the reach drops from about 5,800 to 4,600 ft in elevation between the two sites. Elevation has a direct effect on the rate of stream heating, particularly in mountain landscapes, because of the adiabatic lapse rate, which can result in heating of air temperatures by about 3.5°C per 1,000 feet drop in elevation (Isaak and Hubert 2001, Satterlund and Adams 1992). The additional reach length between sites (about 2 miles) also increases the time that flows can be exposed to solar radiation and air temperatures during the day.

As described in Section 2.2.2, the State of Oregon standard indicates that streams identified as supporting use for bull trout spawning and juvenile rearing may not exceed 12°C based on the 7-DAD Max water temperature (OAR 340-041-0028). The observed 7-DAD Max water temperature values were less than (and therefore met) the 12°C criteria throughout most of the year at all study sites. However, 7-DAD Max water temperature values exceeded 12°C for relatively short periods (about 2 to 4 weeks) in mid-summer at all sites.

The primary potential Project effect on water temperatures under current Project operational conditions is the diversion of flow from the East Fork that has the potential to affect physical flow conditions (e.g., flow quantity, depths, and velocities) in the bypassed reach. Such physical flow effects have the potential to affect the thermal properties of waters by increasing the amount of heat entering the water from solar radiation or surrounding air temperatures.

Differences between the 7-DAD Max water temperature values at site EFI (representing natural East Fork inflow conditions) and site BPL (representing potential Project flow-related effects in the bypassed reach) indicate a range in warming of water temperature of about 0.5 to 1.5°C in the East Fork between these sites during mid-summer. However, as discussed in Section 3.2, no systematic changes in these differences were evident when comparing the values at times when Powerhouse diversions were occurring or not, which suggests there was no significant Project-related effect during the mid-summer period when the 7-DAD Max water temperatures in the East Fork were greater than 12°C. It is therefore assumed that the warming of about 0.5 to 1.5°C in the East Fork is mostly related to the 1,200-ft elevation change, which has a direct effect on the rate of stream heating due to adiabatic lapse rate of air temperature.

Under proposed Project operations, the increase in flow in the East Fork bypassed reach (due to the increased minimum flow to 4 cfs and the tailrace re-route to the East Fork) could act to further moderate the rate of thermal change (due to meteorological conditions) as waters travel down through the reach. As such, it is possible that the increase in flow in the East Fork bypassed reach may result in cooler temperatures in summer and slightly warmer (non-freezing) temperatures in winter. However, as discussed in Section 3.2, the magnitude of such temperature changes is summer are likely not significant (i.e., not likely measureable). Also, as discussed in Section 3.2, the slightly warmer (non-freezing) temperatures in winter could play a role in reducing ice formation that has been observed at times in the East Fork bypassed reach.

Under proposed Project operations, the absence of Powerhouse tailrace flows in the West Fork (due to the tailrace re-route) is likely to have the opposite effect on water temperatures as would occur in the East Fork. In the West Fork, slightly warmer temperatures in summer (about 0.2°C warmer on average) are likely to occur in the 0.5-mile distance between the existing tailrace discharge location and the confluence with the East Fork because the slightly cooler tailrace flows will be re-routed back to the East Fork rather than discharged to the West Fork.

4.3 Dissolved Oxygen

Dissolved oxygen values were near full saturation (100 percent) in all measurements at each of the sites during the sampling events of August, September, and October 2012 (at dissolved oxygen concentrations between about 9.0 and 12.0 mg/L). Because of the high-gradient, turbulent nature of the streams in the Project area, it is expected that dissolved oxygen is maintained at full saturation (100 percent) at all times as a result of turbulent mixing of atmospheric oxygen into the streams, particularly at turbulent, shallow riffles.

As discussed in Section 3.3, the relatively high elevation of the Project area is an important factor in interpreting the results of the dissolved oxygen data collected for this study. There is a direct relationship between atmospheric pressure and dissolved oxygen—at higher elevations, where air pressure decreases relative to sea level, the relative oxygen solubility decreases. As such, at these relatively high elevations, full saturation (100 percent) occurs at dissolved oxygen concentrations that are less than required to reach full saturation (100 percent) at sea level.

The primary potential Project effect on dissolved oxygen under current Project operational conditions is the diversions of flow from the East Fork that have the potential to affect physical flow conditions (e.g., flow quantity, depths, and velocities) in the bypassed reach, which in turn could affect aeration of waters affected by such conditions. However, no effects on dissolved oxygen occur under current operations, and no effects are expected from the proposed Project flow changes. Project facilities and operations do not cause or contribute to any oxygen-demanding substances in Project waters. Furthermore, the relatively high gradient of stream channels in the Project area creates sufficient turbulence to maintain efficient aeration of waters.

As described in Section 2.2.2, the State of Oregon standard indicates that dissolved oxygen in streams may not be less than 95 percent saturation[7] when trout spawning through fry emergence occurs or less than 90 percent saturation[8] as an absolute minimum (OAR 340-041-0016). As discussed in Section 3.3, the monitoring data indicate that dissolved oxygen is fully saturated (consistently 98 to 105 percent) in waters of the Project area. As such, the dissolved oxygen values measured at all times during this study meet the State standard's 90 or 95 percent saturation criteria.

4.4 Total Dissolved Gas

All TDG measurements (in percent-saturation) at the powerhouse tailrace site were at or near 100 percent saturation (i.e., average of 98 percent saturation; range 96 to 100 percent saturation). These values indicate that TDG supersaturation (i.e., TDG saturation greater than 110 percent) from potential turbine air entrainment is not a concern at the Project powerhouse.

As described in Section 2.2.2, the State of Oregon standard indicates that TDG may not exceed 110 percent saturation[9] at the point of sample collection and may not exceed 105 percent saturation in waters less than two feet in depth (OAR 340-041-0031). As such, the TDG values measured at all times during this study at the powerhouse tailrace meet the State standard's 105 or 110 percent saturation criteria.

[7] 95 percent saturation applies where ambient pressure and temperature conditions preclude attainment of the 11.0 mg/l or 9.0 mg/L criteria, which is sometimes the case in the Project area due to elevation effects as discussed in Section 3.3.

[8] 90 percent saturation applies where ambient pressure and temperature conditions preclude attainment of 8.0 mg/L as an absolute minimum, which was never the case during this study and is not anticipate to occur, but is assumed for the analysis here due to elevation effects as discussed in Section 3.3.

[9] Except when stream flows exceed the 10-year, 7-day average flood, which was not the case in this study.

4.5 Turbidity

Routine forebay maintenance flushing did not occur during the study period. Consequently, turbidity sampling as proposed under this study did not occur. Outside this study, PacifiCorp has developed a Sediment Management Program (SMP) to guide future forebay flushing events that would occur (including under proposed Project operations). As part of the SMP development, PacifiCorp conducted turbidity and flow monitoring during June 2012 at site BPL to develop a record of background turbidity for a typical June runoff period when future forebay flushing events would occur.

As described in Section 3.5, the June 2012 monitoring data indicate that natural turbidity conditions in the East Fork generally vary in response to streamflow runoff events, with the highest peak level (of 30 NTU) occurring over a short duration coincident with the first high-flow runoff event of the spring (i.e., the “first flush”). Base turbidity levels (when peak events were not occurring) were consistently relatively low (less than 5 NTU). The June 2012 monitoring data support the SMP’s planned shift to forebay flushing during high-flow runoff events (likely in June) to minimize potential effects on downstream turbidity.

Because forebay flushing did not occur during the 2012-2013 study period, an assessment of forebay flushing effects relative to the State of Oregon turbidity standard (as described in Section 2.2.2) is not provided here. Additional turbidity monitoring would be conducted in consultation with DEQ during forebay flushing in the future.

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Appendix A
Hydrology Data

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
10/5/2011			4.8		13.8
10/6/2011			4.8		13.9
10/7/2011			5.6		13.8
10/8/2011			4.8		13.9
10/9/2011			4.4		13.9
10/10/2011			6.2		13.8
10/11/2011			8.0		13.8
10/12/2011			4.8		13.8
10/13/2011			4.5		13.8
10/14/2011			4.6		13.8
10/15/2011			4.4		13.7
10/16/2011			4.7		13.7
10/17/2011			4.2		13.8
10/18/2011			3.8		13.8
10/19/2011			3.4		13.8
10/20/2011		16.6	2.9		13.8
10/21/2011		17.3	3.2		13.7
10/22/2011		16.6	2.9		13.7
10/23/2011		15.9	2.5		13.7
10/24/2011		16.2	2.8		13.7
10/25/2011		15.4	2.4		13.8
10/26/2011		15.3	2.2		13.9
10/27/2011		15.5	2.3		13.9
10/28/2011		15.0	2.0		13.9
10/29/2011		14.7	2.0		13.8
10/30/2011		14.3	2.0		13.8
10/31/2011		14.6	2.2		13.8
11/1/2011		14.4	1.7		13.8
11/2/2011		14.5	1.7		13.7
11/3/2011		14.4	1.6		13.4
11/4/2011		15.7	2.0		13.7
11/5/2011		14.1	1.6		12.7
11/6/2011		15.8	1.7		13.7
11/7/2011		15.7	1.8		13.1
11/8/2011		15.9	2.8		12.7
11/9/2011		15.7	1.9		13.7
11/10/2011		14.5	2.0		13.7
11/11/2011		14.1	1.8		13.7
11/12/2011		14.8	1.6		13.6
11/13/2011		15.4	1.9		13.7
11/14/2011		15.2	2.2		13.3
11/15/2011		15.0	1.8		13.8
11/16/2011		15.1	1.9		13.4

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
11/17/2011		14.8	2.0		14.0
11/18/2011		14.0	2.0		14.0
11/19/2011		16.4	2.3		14.0
11/20/2011		16.7	2.2		14.0
11/21/2011		15.8	1.9		14.0
11/22/2011		14.6	1.7		13.7
11/23/2011		14.7	3.0		12.9
11/24/2011		14.8	1.9		14.0
11/25/2011		14.5	1.7		13.9
11/26/2011		15.2	1.7		14.0
11/27/2011		13.3	1.3		13.9
11/28/2011		13.5	1.2		13.9
11/29/2011		14.1	1.4		13.9
11/30/2011		14.5	1.2	1.3	13.9
12/1/2011		15.3	1.3	1.9	13.4
12/2/2011		15.7	1.1	1.8	13.8
12/3/2011		15.7	1.0	8.1	13.5
12/4/2011		15.5	1.0	7.5	13.8
12/5/2011		16.1	1.0	9.6	13.6
12/6/2011		15.2	0.9	24.6	13.7
12/7/2011		15.6	0.9	47.0	13.6
12/8/2011		15.9	1.0	58.3	13.4
12/9/2011		15.7	0.9	63.7	13.5
12/10/2011		14.6	0.8	71.7	13.6
12/11/2011		15.3	0.9	66.2	13.5
12/12/2011		15.6	0.9	56.6	13.4
12/13/2011		15.6	1.0	62.5	13.1
12/14/2011		15.1	0.9	66.0	13.0
12/15/2011		14.8	0.9	14.4	13.2
12/16/2011		14.9	0.9	0.8	12.9
12/17/2011		14.0	0.8	0.8	13.1
12/18/2011		13.9	0.8	0.8	13.3
12/19/2011		14.4	1.7	6.8	12.2
12/20/2011		14.5	0.9	0.8	12.5
12/21/2011		14.6	1.9	2.2	11.2
12/22/2011		14.8	2.4	9.3	10.8
12/23/2011		14.5	2.3	7.7	10.9
12/24/2011		13.6	2.1	10.1	10.9
12/25/2011		11.5	1.8	2.3	10.9
12/26/2011		12.3	1.9	2.2	10.8
12/27/2011		12.1	1.8	2.3	10.8
12/28/2011		14.7	3.9	5.2	10.8
12/29/2011		15.4	4.9	7.4	9.9

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
12/30/2011		15.6	5.2	7.8	9.8
12/31/2011		14.8	4.4	8.4	9.8
1/1/2012		14.9	3.9	8.8	9.7
1/2/2012		12.4	3.0	4.4	9.8
1/3/2012		12.6	3.0	4.0	9.8
1/4/2012		12.2	2.7	4.2	9.9
1/5/2012		11.6	2.5	4.2	9.8
1/6/2012		12.7	2.9	6.4	9.8
1/7/2012		13.6	3.0	5.7	9.8
1/8/2012		12.8	2.7	4.6	9.8
1/9/2012		12.3	2.5	3.7	9.8
1/10/2012		11.7	2.3	3.7	9.8
1/11/2012		13.7	2.5	16.5	9.9
1/12/2012		13.3	2.6	44.5	9.9
1/13/2012		12.5	4.8	62.4	7.6
1/14/2012		11.4	9.2	59.5	2.1
1/15/2012		12.2	10.1	24.3	2.1
1/16/2012		12.7	10.5	59.0	2.1
1/17/2012		13.0	10.6	82.0	2.1
1/18/2012		12.1	9.7	65.7	2.1
1/19/2012		10.7	8.8	13.7	2.1
1/20/2012		11.7	9.6	14.2	2.1
1/21/2012		11.9	9.8	14.8	2.1
1/22/2012		12.9	10.7	15.8	2.1
1/23/2012		12.5	10.4	16.0	2.1
1/24/2012		12.6	10.3	20.7	2.1
1/25/2012		11.1	9.1	14.7	2.1
1/26/2012		11.0	9.2	14.6	2.1
1/27/2012		12.3	10.3	32.1	2.1
1/28/2012		12.4	10.1	49.7	2.1
1/29/2012		10.5	8.8	13.8	2.1
1/30/2012		10.6	8.9	13.9	2.1
1/31/2012		11.2	9.4	14.0	2.1
2/1/2012		11.2	10.8	15.8	2.1
2/2/2012		11.4	10.7	16.5	2.3
2/3/2012		11.7	9.8	40.0	2.4
2/4/2012		11.7	9.8	37.7	2.1
2/5/2012		11.5	9.6	15.8	2.1
2/6/2012		11.5	9.6	16.8	2.1
2/7/2012		11.1	9.3	15.6	2.1
2/8/2012		10.3	6.5	12.3	4.5
2/9/2012		9.9	1.0	2.1	11.1
2/10/2012		9.7	0.9	2.0	11.0

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
2/11/2012		9.9	0.9	1.9	11.0
2/12/2012		10.1	1.0	1.8	11.0
2/13/2012		10.6	1.0	2.2	11.0
2/14/2012		10.8	1.0	2.1	11.0
2/15/2012		10.9	1.0	4.1	11.0
2/16/2012		10.9	0.9	7.1	11.0
2/17/2012		10.5	0.9	9.7	10.9
2/18/2012		10.1	0.9	1.5	10.9
2/19/2012		10.7	0.9	1.6	10.9
2/20/2012		10.8	0.9	2.1	10.9
2/21/2012		10.7	1.2	2.2	10.9
2/22/2012		11.1	1.7	4.1	11.0
2/23/2012		10.6	1.2	2.2	11.0
2/24/2012		10.4	1.0	3.1	10.9
2/25/2012		10.3	1.0	2.3	10.9
2/26/2012		10.9	1.2	4.8	11.0
2/27/2012		11.0	1.1	12.1	10.9
2/28/2012		10.8	1.0	33.2	10.8
2/29/2012		10.8	1.0	34.9	10.9
3/1/2012		11.2	1.1	40.1	10.9
3/2/2012		11.0	1.0	32.7	10.9
3/3/2012		9.9	0.9	7.3	10.9
3/4/2012		9.1	0.8	1.4	11.0
3/5/2012		8.9	0.7	1.3	10.9
3/6/2012		9.6	0.8	1.5	10.7
3/7/2012		9.9	0.8	4.3	10.8
3/8/2012		9.2	0.7	2.7	10.7
3/9/2012		7.9	0.6	1.2	10.8
3/10/2012		8.1	0.6	1.3	10.8
3/11/2012		8.5	0.7	1.4	10.7
3/12/2012		8.4	1.0	1.6	9.8
3/13/2012		7.8	5.0	11.1	5.5
3/14/2012		10.0	3.7	7.4	7.7
3/15/2012		11.2	1.9	4.8	10.9
3/16/2012		12.2	2.6	6.8	10.8
3/17/2012		10.7	1.6	4.0	10.8
3/18/2012		10.9	1.5	3.2	10.9
3/19/2012		10.5	1.3	4.2	10.8
3/20/2012		10.0	1.1	3.4	10.9
3/21/2012		10.3	1.3	2.8	10.9
3/22/2012		11.1	1.7	3.8	10.8
3/23/2012		10.3	1.1	2.5	10.9
3/24/2012		9.7	0.9	2.0	10.9

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
3/25/2012		9.5	0.9	2.2	10.8
3/26/2012		9.7	1.2	3.0	10.8
3/27/2012		9.2	0.9	2.0	10.9
3/28/2012		9.3	0.9	2.6	10.8
3/29/2012		9.1	0.7	2.1	10.9
3/30/2012		12.5	2.9	7.8	10.4
3/31/2012		13.3	3.6	10.5	10.7
4/1/2012		12.1	2.3	7.9	10.8
4/2/2012		11.0	1.6	5.4	10.8
4/3/2012		10.2	1.3	4.4	10.8
4/4/2012		10.4	1.4	4.8	10.8
4/5/2012		10.3	2.2	5.9	9.9
4/6/2012		10.0	1.0	3.3	10.8
4/7/2012		9.6	0.9	5.7	10.8
4/8/2012		8.9	0.8	2.7	10.7
4/9/2012		8.9	0.8	2.8	10.7
4/10/2012		11.0	1.3	3.7	10.8
4/11/2012		13.3	1.8	5.0	10.7
4/12/2012		12.9	1.7	5.2	10.7
4/13/2012		12.5	1.4	4.5	10.7
4/14/2012		12.7	1.4	4.6	10.8
4/15/2012		12.3	1.3	4.5	10.7
4/16/2012		12.5	1.4	4.8	10.7
4/17/2012		12.7	1.4	5.1	10.7
4/18/2012		12.6	1.4	5.0	10.7
4/19/2012		12.9	1.5	5.2	10.8
4/20/2012		15.6	3.2	8.9	10.8
4/21/2012		17.6	4.8	13.0	10.8
4/22/2012		21.2	7.4	19.6	10.7
4/23/2012		26.1	12.4	27.7	10.3
4/24/2012		30.3	18.0	35.2	10.8
4/25/2012		30.6	17.9	24.2	10.8
4/26/2012		39.7	29.0	36.8	10.7
4/27/2012		31.4	19.5	27.5	10.7
4/28/2012		27.6	13.9	18.5	10.7
4/29/2012		25.6	11.2	14.7	10.5
4/30/2012		27.4	13.5	20.1	10.5
5/1/2012		26.8	12.4	17.4	10.8
5/2/2012		25.1	10.5	14.1	10.8
5/3/2012		24.2	10.0	12.8	10.8
5/4/2012		23.2	9.2	11.4	10.7
5/5/2012		21.1	7.7	9.8	10.8
5/6/2012		19.7	6.7	8.2	10.6

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
5/7/2012		19.7	6.7	8.0	10.7
5/8/2012		21.2	7.9	10.1	10.7
5/9/2012		23.7	8.8	11.7	12.0
5/10/2012		24.3	7.0	8.7	14.7
5/11/2012		24.4	6.8	8.0	14.7
5/12/2012		24.8	7.6	9.2	14.7
5/13/2012		26.3	9.8	13.0	14.7
5/14/2012		28.1	13.1	18.6	14.8
5/15/2012		31.6	18.2	25.4	14.8
5/16/2012		36.1	22.8	29.9	14.8
5/17/2012		36.5	22.6	28.6	14.9
5/18/2012		34.3	20.6	24.3	14.9
5/19/2012		34.2	20.1	23.6	14.9
5/20/2012		35.1	21.5	26.4	14.8
5/21/2012		44.1	30.4	35.2	14.9
5/22/2012		51.0	37.0	41.2	15.0
5/23/2012		41.4	30.6	36.4	14.0
5/24/2012		38.7	29.8	34.3	10.6
5/25/2012		36.6	27.2	28.6	11.0
5/26/2012		34.5	24.3	24.5	10.9
5/27/2012		31.8	21.3	21.4	10.8
5/28/2012		30.1	19.5	20.4	10.9
5/29/2012		30.3	20.0	21.6	10.9
5/30/2012		30.4	21.3	23.6	10.8
5/31/2012	0.8	31.3	23.1	29.0	10.8
6/1/2012	0.4	35.0	26.9	36.4	10.8
6/2/2012	0.5	42.2	35.4	42.0	10.4
6/3/2012	0.4	47.2	38.4	43.9	10.8
6/4/2012	0.3	61.0	45.3	51.4	10.7
6/5/2012	0.9	72.8	52.7	61.5	10.5
6/6/2012	0.5	58.8	45.5	53.7	10.7
6/7/2012	0.2	48.5	40.2	48.5	10.6
6/8/2012	0.4	44.6	36.3	45.3	10.6
6/9/2012	1.7	39.3	31.7	41.6	10.6
6/10/2012	2.4	35.8	26.6	37.8	10.8
6/11/2012	1.3	34.2	24.6	35.2	10.7
6/12/2012	1.1	34.1	24.7	36.8	12.4
6/13/2012	1.0	36.4	25.7	37.4	14.2
6/14/2012	2.2	37.7	26.8	39.0	14.2
6/15/2012	2.5	41.8	30.7	43.4	14.2
6/16/2012	0.5	50.4	37.2	49.3	14.2
6/17/2012	0.2	60.6	39.0	54.2	14.2
6/18/2012	0.9	72.8	43.8	61.0	14.3

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
6/19/2012	1.8	60.2	42.6	52.5	14.3
6/20/2012	0.6	47.3	32.6	43.3	14.3
6/21/2012	0.0	44.7	29.1	41.0	14.3
6/22/2012	0.1	52.6	32.9	46.6	14.3
6/23/2012	0.6	67.0	39.5	58.8	14.3
6/24/2012	0.4	66.0	40.1	58.1	14.3
6/25/2012	0.7	63.6	40.0	59.0	14.3
6/26/2012	1.3	71.2	41.5	60.9	14.3
6/27/2012	1.2	59.1	40.9	50.1	14.3
6/28/2012	2.1	54.1	43.1	44.2	14.3
6/29/2012	1.2	58.9	46.5	46.4	13.4
6/30/2012	1.3	59.6	47.1	47.5	13.5
7/1/2012	0.8	67.5	52.1	52.8	13.6
7/2/2012	1.1	65.4	51.5	52.1	13.7
7/3/2012	1.1	67.6	53.2	53.7	13.6
7/4/2012	1.4	61.7	51.2	49.9	13.6
7/5/2012	2.6	57.1	45.8	45.0	13.5
7/6/2012	3.5	56.0	50.8	52.5	6.9
7/7/2012	3.6	56.7	51.5	56.2	2.1
7/8/2012	3.1	54.9	52.6	55.3	2.1
7/9/2012	2.9	53.2	50.2	55.0	2.1
7/10/2012	2.6	49.5	50.8	53.1	2.1
7/11/2012	1.8	46.5	49.3	51.3	2.1
7/12/2012	1.7	42.7	45.8	49.3	2.1
7/13/2012	1.5	42.1	37.1	43.5	6.7
7/14/2012	0.8	47.1	39.2	43.3	10.2
7/15/2012	0.6	44.5	36.4	39.8	10.1
7/16/2012	0.9	42.7	34.4	37.0	10.0
7/17/2012	1.5	38.1	32.6	24.2	9.8
7/18/2012	2.2	37.1	28.5	22.0	9.9
7/19/2012	2.7	35.3	25.7	20.6	9.9
7/20/2012	3.4	33.6	23.7	19.8	10.0
7/21/2012	1.8	32.6	22.5	18.8	10.0
7/22/2012	2.6	31.5	21.0	18.2	9.9
7/23/2012	2.1	29.6	20.0	17.7	9.9
7/24/2012	1.9	28.5	19.2	18.5	9.9
7/25/2012	1.6	26.9	14.0	14.7	13.8
7/26/2012	1.7	25.2	12.9	12.8	13.5
7/27/2012	2.7	24.1	12.1	11.6	13.6
7/28/2012	2.9	23.2	11.8	11.3	13.4
7/29/2012	2.4	22.2	11.4	10.3	12.9
7/30/2012	2.7	21.7	10.8	10.0	12.8
7/31/2012	3.1	21.6	10.0	9.1	12.8

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
8/1/2012	2.3	20.3	9.5	8.5	12.8
8/2/2012	2.4	20.3	9.2	8.1	12.8
8/3/2012	2.5	19.6	8.8	7.7	12.8
8/4/2012	2.7	19.5	8.4	7.1	12.7
8/5/2012	4.1	19.0	7.7	6.6	12.6
8/6/2012	3.1	17.8	6.9	6.8	10.4
8/7/2012	3.4	17.9	6.9	6.1	12.7
8/8/2012	3.2	17.6	6.7	6.0	12.6
8/9/2012	2.0	17.7	6.7	5.7	12.5
8/10/2012	2.6	17.0	6.4	5.6	12.6
8/11/2012	2.5	16.9	6.2	5.3	12.6
8/12/2012	2.4	16.6	5.8	5.1	12.6
8/13/2012	1.7	16.5	16.6	13.8	5.7
8/14/2012	1.7	15.7	20.7	17.5	2.1
8/15/2012	2.4	15.4	19.9	14.0	2.1
8/16/2012	3.0	15.5	14.6	10.1	5.0
8/17/2012	2.3	15.8	5.0	3.7	13.9
8/18/2012	2.1	15.3	4.7	3.8	14.2
8/19/2012	2.2	14.9	4.5	3.9	14.2
8/20/2012	1.3	14.9	4.5	4.1	14.2
8/21/2012	1.6	14.7	5.7	4.9	11.8
8/22/2012	1.0	14.7	7.7	6.3	10.4
8/23/2012	1.3	15.5	5.9	4.8	12.5
8/24/2012	0.5	16.7	11.0	12.7	9.0
8/25/2012	0.4	16.6	19.9	25.5	2.1
8/26/2012	1.3	16.1	18.9	23.8	2.1
8/27/2012	1.0	15.6	18.5	23.9	2.1
8/28/2012	1.3	15.7	18.4	23.5	2.1
8/29/2012	0.8	15.6	18.7	24.2	2.1
8/30/2012	0.3	16.0	19.5	23.6	2.1
8/31/2012	1.1	15.7	19.2	23.0	2.1
9/1/2012	1.7	15.6	18.1	23.6	2.1
9/2/2012	1.7	15.3	18.8	23.1	2.1
9/3/2012	2.3	15.1	18.6	22.6	2.1
9/4/2012	1.4	15.0	18.6	22.5	2.1
9/5/2012	1.5	14.9	18.3	22.0	2.1
9/6/2012	3.3	15.1	18.0	22.3	2.1
9/7/2012	2.5	14.8	17.7	21.9	2.1
9/8/2012	0.6	14.4	17.5	21.3	2.1
9/9/2012	0.9	14.0	17.4	21.0	2.1
9/10/2012	2.0	14.4	16.8	21.6	2.1
9/11/2012	4.0	14.5	17.2	21.9	2.1
9/12/2012	4.4	14.6	17.5	21.4	2.1

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
9/13/2012	2.7	14.3	12.8	15.9	4.3
9/14/2012	2.4	13.9	4.0	5.6	11.7
9/15/2012	2.6	13.7	4.0	5.9	11.7
9/16/2012	2.6	13.6	4.0	5.8	11.7
9/17/2012	2.4	13.7	3.9	5.7	11.7
9/18/2012	3.1	13.5	3.8	5.5	11.7
9/19/2012	2.8	13.2	3.7	5.4	11.7
9/20/2012	1.8	13.2	3.7	5.4	11.7
9/21/2012	1.3	13.7	3.6	5.2	11.7
9/22/2012	1.5	13.2	3.5	5.4	11.7
9/23/2012	1.4	13.1	4.2	6.0	11.7
9/24/2012	1.0	13.9	4.5	6.2	11.8
9/25/2012	1.3	13.5	4.4	5.8	11.8
9/26/2012	1.4	12.8	4.1	5.6	11.7
9/27/2012	1.2	12.7	3.9	5.4	11.8
9/28/2012	2.1	12.5	3.8	5.3	11.7
9/29/2012	3.9	11.9	3.6	5.3	11.7
9/30/2012	3.1	11.8	3.5	5.3	11.7
10/1/2012	0.7	15.3	3.3	5.6	12.2
10/2/2012	0.7	15.3	3.4	5.6	12.2
10/3/2012	0.7	15.1	3.4	5.4	12.1
10/4/2012	0.8	15.6	3.6	5.5	12.1
10/5/2012	0.9	15.5	3.5	5.3	12.1
10/6/2012	0.9	16.1	3.6	5.3	12.1
10/7/2012	0.9	15.9	3.6	5.4	12.1
10/8/2012	0.9	16.0	3.6	5.4	12.1
10/9/2012	0.8	15.8	8.2	9.5	7.4
10/10/2012	0.8	15.9	12.1	14.5	2.7
10/11/2012	0.8	15.6	3.5	5.6	11.9
10/12/2012	0.7	15.8	7.1	8.8	7.9
10/13/2012	0.7	16.1	14.5	17.5	0.0
10/14/2012	0.7	15.6	14.0	17.2	0.0
10/15/2012	0.7	17.1	15.5	18.9	0.0
10/16/2012	0.8	17.7	16.4	20.6	0.0
10/17/2012	0.8	16.5	15.2	18.3	0.0
10/18/2012	0.9	16.4	14.9	17.9	0.0
10/19/2012	0.8	17.5	15.9	19.7	0.0
10/20/2012	0.9	19.1	17.8	22.3	0.0
10/21/2012	1.0	17.5	16.2	19.0	0.0
10/22/2012	1.1	17.9	16.4	18.5	0.0
10/23/2012	1.1	18.5	16.9	18.3	0.0
10/24/2012	0.9	18.3	16.7	17.2	0.0
10/25/2012	0.9	19.8	14.6	17.3	0.0

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
10/26/2012	1.1	20.5	15.5	18.0	0.0
10/27/2012	1.1	21.3	15.7	18.8	0.0
10/28/2012	1.3	27.4	20.8	27.7	0.0
10/29/2012	1.2	29.4	22.7	28.1	0.0
10/30/2012	1.0	23.6	18.3	22.3	0.0
10/31/2012	1.0	21.6	15.9	19.4	0.0
11/1/2012	1.0	21.9	13.7	15.8	3.1
11/2/2012	1.0	20.9	5.5	8.1	11.3
11/3/2012	0.9	20.1	4.2	6.8	11.9
11/4/2012	0.8	19.3	3.5	6.6	11.9
11/5/2012	0.8	18.8	3.2	6.6	11.9
11/6/2012	0.9	18.7	3.4	6.5	11.9
11/7/2012	0.9	18.5	3.4	6.4	11.8
11/8/2012	1.1	19.4	4.0	6.2	11.6
11/9/2012	1.2	19.0	3.3	5.3	11.8
11/10/2012	1.3	18.7	2.3	11.5	11.8
11/11/2012	2.9	18.0	8.6	17.3	5.4
11/12/2012	1.2	19.2	14.3	15.0	2.0
11/13/2012	1.0	19.7	14.6	16.0	2.0
11/14/2012	1.0	19.2	12.0	12.6	4.2
11/15/2012	1.2	19.1	7.0	8.9	8.9
11/16/2012	1.0	18.6	6.0	8.0	9.0
11/17/2012	1.1	20.3	4.9	7.2	11.9
11/18/2012	1.1	20.0	4.6	6.4	12.0
11/19/2012	1.1	19.0	4.7	6.7	11.6
11/20/2012	1.4	25.4	22.7	23.9	0.0
11/21/2012	1.2	24.0	16.6	15.5	4.3
11/22/2012	1.2	20.8	5.2	7.5	12.0
11/23/2012	1.0	19.5	5.0	7.2	12.0
11/24/2012	0.9	18.7	4.1	6.6	11.9
11/25/2012	1.0	18.4	3.6	5.7	11.9
11/26/2012	1.2	18.6	2.9	10.0	11.8
11/27/2012	1.2	19.0	3.4	13.6	11.9
11/28/2012	1.0	18.0	3.3	5.5	11.9
11/29/2012	1.0	18.2	3.5	6.0	11.9
11/30/2012	1.1	23.0	7.5	10.2	11.8
12/1/2012	1.1	21.2	5.8	8.8	11.8
12/2/2012	1.4	27.1	11.8	14.0	11.8
12/3/2012	1.1	21.9	6.3	9.2	11.9
12/4/2012	1.1	20.5	7.8	9.6	10.9
12/5/2012	1.1	21.0	7.1	9.5	10.6
12/6/2012	1.2	20.2	8.1	10.0	8.6
12/7/2012	1.3	19.9	8.3	9.5	8.5

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
12/8/2012	1.3	20.1	7.9	9.5	8.5
12/9/2012	1.4	20.5	8.2	16.9	7.9
12/10/2012	1.2	19.3	8.0	9.4	8.6
12/11/2012	1.3	18.9	7.9	9.6	8.4
12/12/2012	1.2	19.0	7.3	7.9	8.5
12/13/2012	1.4	18.7	6.8	17.8	8.5
12/14/2012	1.4	19.6	8.1	18.1	8.5
12/15/2012	1.5	19.2	7.4	13.0	8.5
12/16/2012	1.5	19.3	7.4	8.1	8.5
12/17/2012	1.3	17.5	5.6	6.4	8.5
12/18/2012	1.4	19.4	8.5	15.9	7.3
12/19/2012	1.5	19.9	8.1	NA	7.3
12/20/2012	1.4	18.2	4.6	5.3	8.2
12/21/2012	1.3	18.4	4.0	5.4	10.9
12/22/2012	1.4	19.0	4.7	5.5	10.9
12/23/2012	1.5	19.8	4.9	6.0	10.9
12/24/2012	1.3	19.4	4.4	5.6	10.9
12/25/2012	1.5	19.3	4.4	7.5	10.9
12/26/2012	1.5	19.4	4.3	5.4	10.8
12/27/2012	1.4	18.8	4.1	5.1	10.9
12/28/2012	1.5	19.1	4.1	6.2	10.9
12/29/2012	1.6	19.2	4.1	4.8	10.9
12/30/2012	1.7	19.4	4.0	5.4	10.9
12/31/2012	1.6	19.0	3.3	13.6	10.9
1/1/2013	1.6	19.4	3.3	NA	11.0
1/2/2013	1.5	18.2	3.1	NA	10.9
1/3/2013	1.4	18.0	3.4	4.9	10.9
1/4/2013	1.4	17.8	3.0	4.7	10.9
1/5/2013	1.4	17.9	3.2	4.7	10.9
1/6/2013	1.4	17.7	3.3	4.6	10.9
1/7/2013	1.3	16.1	3.2	4.4	10.9
1/8/2013	1.1	15.5	2.8	4.6	10.9
1/9/2013	1.1	14.9	2.7	4.5	10.6
1/10/2013	1.3	17.1	5.7	5.7	9.0
1/11/2013	1.4	18.1	3.5	15.5	10.9
1/12/2013					10.7
1/13/2013	1.7	18.8	3.6	NA	10.9
1/14/2013	1.5	18.0	3.3	NA	10.9
1/15/2013	1.2	16.5	2.5	4.8	11.0
1/16/2013	1.3	16.5	2.4	4.2	11.0
1/17/2013	1.2	16.0	2.5	4.3	10.9
1/18/2013	1.1	15.2	2.5	4.2	10.9
1/19/2013	1.1	15.4	2.2	4.0	10.9

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
1/20/2013	1.1	15.5	2.1	3.9	10.9
1/21/2013	1.1	15.2	2.4	3.9	10.9
1/22/2013	1.0	14.9	2.3	3.9	10.9
1/23/2013	0.8	13.9	2.0	3.6	10.9
1/24/2013	0.8	14.3	1.8	3.6	10.3
1/25/2013	0.8	14.1	2.1	4.0	10.6
1/26/2013	0.9	14.5	2.3	3.8	10.9
1/27/2013	1.0	14.9	2.1	3.6	10.9
1/28/2013	1.1	15.4	2.2	3.6	10.9
1/29/2013	1.0	15.4	2.2	3.4	10.9
1/30/2013	0.9	14.6	2.0	3.5	10.9
1/31/2013	0.9	14.6	2.0	3.6	10.9
2/1/2013	0.9	14.3	1.9	3.2	10.9
2/2/2013	1.0	14.5	1.9	3.4	10.8
2/3/2013	1.0	14.3	1.9	3.4	10.9
2/4/2013	0.9	13.6	1.8	3.4	10.8
2/5/2013	0.9	13.5	1.8	3.2	10.8
2/6/2013	0.9	13.7	1.6	3.1	10.8
2/7/2013	1.0	13.7	1.7	3.0	10.6
2/8/2013	1.0	13.5	1.8	3.1	10.8
2/9/2013	1.1	13.8	1.8	3.0	10.8
2/10/2013	1.1	13.7	1.8	3.1	10.8
2/11/2013	1.1	13.7	1.8	3.0	10.8
2/12/2013	1.0	14.2	1.7	3.0	10.8
2/13/2013	1.0	13.6	1.6	3.0	10.7
2/14/2013	1.0	14.0	1.8	3.0	10.1
2/15/2013	1.0	13.4	1.7	3.2	10.3
2/16/2013	0.9	12.9	1.5	3.1	10.7
2/17/2013	1.0	13.4	1.6	2.9	10.7
2/18/2013	1.1	13.5	1.7	3.5	10.3
2/19/2013	1.1	14.3	1.8	2.8	10.8
2/20/2013	1.1	13.9	1.7	2.8	10.6
2/21/2013	1.1	14.3	1.6	3.4	10.6
2/22/2013	1.1	13.6	1.6	2.9	10.7
2/23/2013	1.0	13.6	1.7	2.7	10.8
2/24/2013	1.1	13.4	1.7	3.0	10.7
2/25/2013	1.1	13.5	1.7	2.6	9.6
2/26/2013	1.1	13.7	1.7	3.2	10.6
2/27/2013	1.1	13.5	1.7	2.8	10.5
2/28/2013	0.9	12.8	1.5	2.6	10.7
3/1/2013	0.8	12.2	1.4	3.0	10.7
3/2/2013	0.9	12.2	1.4	3.3	10.7
3/3/2013	0.9	12.4	1.5	2.8	10.7

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
3/4/2013	1.0	12.8	7.3	3.8	4.7
3/5/2013	1.0	13.0	9.6	10.8	2.1
3/6/2013	0.9	12.9	9.5	9.5	2.1
3/7/2013	0.9	13.1	9.8	9.2	2.1
3/8/2013	1.0	13.0	6.3	6.2	5.6
3/9/2013	0.9	12.4	1.6	2.9	10.6
3/10/2013	0.9	12.7	6.1	6.8	6.0
3/11/2013	0.8	11.7	2.5	4.1	9.1
3/12/2013	0.7	11.7	4.6	6.0	6.9
3/13/2013	0.7	11.2	4.5	6.0	6.9
3/14/2013	0.7	11.4	4.8	6.2	6.8
3/15/2013	0.7	11.3	4.7	6.3	6.8
3/16/2013	0.8	11.2	4.7	6.4	6.8
3/17/2013	0.8	11.3	4.9	5.7	6.8
3/18/2013	0.9	11.3	4.9	5.7	6.8
3/19/2013	1.0	11.2	4.9	7.0	6.8
3/20/2013	0.8	11.2	5.0	6.0	6.8
3/21/2013	0.9	11.8	5.6	6.4	6.8
3/22/2013	0.9	12.0	5.6	10.7	6.8
3/23/2013	1.0	12.3	5.7	20.0	6.9
3/24/2013	1.2	12.2	5.4	24.2	6.9
3/25/2013	0.9	11.5	5.2	6.1	6.7
3/26/2013	0.8	10.9	4.8	5.8	6.8
3/27/2013	0.8	10.8	4.7	6.0	6.9
3/28/2013	0.8	11.0	4.9	6.0	6.9
3/29/2013	0.7	11.0	5.2	6.4	6.9
3/30/2013	0.8	11.0	5.3	6.7	6.8
3/31/2013	0.8	11.0	5.5	6.8	6.8
4/1/2013	0.8	11.0	5.6	6.7	6.8
4/2/2013	0.8	11.3	6.1	7.4	6.8
4/3/2013	0.8	11.6	6.5	8.0	6.7
4/4/2013	0.9	13.0	7.9	9.5	6.7
4/5/2013	1.0	14.2	8.5	9.6	6.8
4/6/2013	0.9	13.0	7.5	9.0	6.8
4/7/2013	0.9	12.5	7.3	8.2	6.7
4/8/2013	0.8	12.1	6.7	7.1	6.7
4/9/2013	0.8	11.8	6.5	7.7	6.8
4/10/2013	0.8	11.6	6.6	8.0	6.8
4/11/2013	0.8	11.7	6.6	7.8	6.8
4/12/2013	0.9	11.4	6.6	8.0	6.8
4/13/2013	0.9	11.5	6.5	7.1	6.7
4/14/2013	1.0	11.5	6.4	7.5	6.8
4/15/2013	1.1	11.6	6.8	7.0	6.3

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
4/16/2013	1.0	11.8	6.7	6.4	6.8
4/17/2013	1.0	11.2	6.3	6.7	6.8
4/18/2013	1.0	10.8	6.3	6.7	6.8
4/19/2013	0.8	10.6	6.2	6.8	6.8
4/20/2013	0.8	10.7	6.1	6.8	6.8
4/21/2013	0.8	10.6	6.0	6.8	6.8
4/22/2013	0.9	10.7	5.5	6.7	6.8
4/23/2013	1.1	10.7	5.9	6.4	6.8
4/24/2013	1.0	10.6	5.8	6.8	6.7
4/25/2013	0.9	10.7	6.4	6.7	6.7
4/26/2013	0.9	11.2	8.6	10.0	6.6
4/27/2013	0.9	12.0	10.3	12.2	3.4
4/28/2013	1.0	12.4	11.2	13.2	3.3
4/29/2013	1.0	13.1	12.1	12.3	3.3
4/30/2013	1.0	12.4	10.4	10.4	3.3
5/1/2013	0.9	11.8	10.9	10.7	2.6
5/2/2013	0.9	11.5	5.1	6.7	9.0
5/3/2013	0.9	12.4	4.5	6.3	10.8
5/4/2013	0.9	12.9	5.1	7.0	10.9
5/5/2013	1.0	13.7	5.9	7.4	10.8
5/6/2013	1.1	15.3	7.8	9.3	10.8
5/7/2013	1.0	16.6	9.8	11.2	10.9
5/8/2013	1.1	18.0	12.2	14.0	10.9
5/9/2013	1.2	20.3	14.4	16.4	11.7
5/10/2013	1.2	21.9	14.6	16.8	14.3
5/11/2013	1.4	24.0	17.7	21.3	14.2
5/12/2013	1.7	27.5	22.1	27.2	14.3
5/13/2013	1.7	32.8	27.4	31.7	13.8
5/14/2013	1.6	33.6	30.4	34.4	11.5
5/15/2013	1.4	34.8	27.9	30.1	11.1
5/16/2013	1.4	34.7	27.9	30.5	11.0
5/17/2013	1.3	33.5	27.1	28.0	10.7
5/18/2013	1.3	33.4	27.4	28.8	10.0
5/19/2013	1.2	31.2	24.3	26.1	10.0
5/20/2013	1.2	29.8	23.4	28.1	9.9
5/21/2013	1.4	32.0	25.0	27.9	9.8
5/22/2013	1.4	32.0	25.0	25.9	9.8
5/23/2013	1.4	28.2	22.3	23.0	9.9
5/24/2013	1.3	27.2	20.9	21.3	9.9
5/25/2013	1.3	27.5	20.4	20.1	9.8
5/26/2013	1.2	27.8	20.3	20.9	9.8
5/27/2013	1.2	28.3	20.6	22.1	9.8
5/28/2013	1.3	29.7	21.2	22.7	9.8

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
5/29/2013	1.3	29.8	21.9	21.9	9.7
5/30/2013	1.2	29.1	21.5	21.3	9.4
5/31/2013	1.2	28.5	21.7	21.8	9.6
6/1/2013	1.3	28.9	22.3	24.4	9.7
6/2/2013	1.3	29.3	22.6	24.1	9.8
6/3/2013	1.4	30.8	23.7	25.8	9.7
6/4/2013	1.4	32.6	25.2	27.9	9.7
6/5/2013	1.5	33.8	27.2	30.2	9.7
6/6/2013	1.5	36.3	30.3	34.7	9.7
6/7/2013	1.7	41.4	35.5	38.5	9.7
6/8/2013	1.8	41.7	38.4	38.7	9.7
6/9/2013	2.2	42.7	41.5	40.8	8.7
6/10/2013	2.3	44.5	44.8	43.7	8.9
6/11/2013	2.1	43.3	43.1	42.2	8.9
6/12/2013	2.1	42.2	42.9	43.3	8.9
6/13/2013	2.0	42.0	42.5	41.7	8.9
6/14/2013	1.9	39.8	41.5	40.6	8.8
6/15/2013	1.9	38.8	39.4	39.2	8.8
6/16/2013	1.9	42.8	38.2	38.8	8.8
6/17/2013	2.0	42.7	38.6	40.6	8.7
6/18/2013	2.1	42.7	37.7	40.3	11.5
6/19/2013	4.4	66.3	49.0	61.4	13.0
6/20/2013	3.8	54.1	45.6	53.9	13.2
6/21/2013	4.0	46.2	41.6	47.3	13.1
6/22/2013	3.0	41.2	37.7	42.8	13.1
6/23/2013	2.8	38.8	34.4	39.2	13.2
6/24/2013	3.0	39.7	36.1	42.2	12.7
6/25/2013	3.1	42.1	40.3	46.0	11.9
6/26/2013	2.8	41.8	40.3	45.4	11.7
6/27/2013	2.5	42.7	41.0	47.7	11.7
6/28/2013	2.4	47.8	41.8	53.7	11.5
6/29/2013	2.1	55.7	45.5	61.0	10.9
6/30/2013	2.0	66.1	48.1	68.8	9.5
7/1/2013	1.8	70.3	50.5	69.2	9.9
7/2/2013	1.7	73.2	52.8	70.0	10.4
7/3/2013	1.9	73.3	51.0	69.9	10.1
7/4/2013	2.0	64.2	50.7	68.7	10.6
7/5/2013	2.2	54.4	48.9	60.2	10.5
7/6/2013	2.3	49.0	45.6	55.2	10.7
7/7/2013	2.1	45.2	41.3	50.7	10.8
7/8/2013	1.7	41.6	37.8	46.4	10.9
7/9/2013	1.6	38.5	34.5	44.5	10.9
7/10/2013	1.3	36.6	32.2	42.0	11.1

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
7/11/2013	1.2	34.5	30.3	39.3	11.0
7/12/2013	1.2	33.5	29.1	36.6	10.9
7/13/2013	1.2	32.4	27.7	34.8	11.0
7/14/2013	1.2	31.5	25.6	33.6	10.8
7/15/2013	1.0	30.4	23.4	31.8	11.3
7/16/2013	1.1	28.1	23.6	27.3	11.1
7/17/2013	1.0	23.7	22.7	22.1	11.3
7/18/2013	1.0	22.7	22.7	24.6	10.3
7/19/2013	0.9	22.0	20.2	23.7	11.4
7/20/2013	0.9	20.9	19.1	22.6	11.4
7/21/2013	0.9	20.2	18.0	20.9	11.4
7/22/2013	0.9	19.7	16.7	19.0	11.4
7/23/2013	0.9	19.1	15.9	18.7	11.1
7/24/2013	0.8	17.7	16.6	19.5	9.7
7/25/2013	0.8	16.8	15.8	18.6	9.7
7/26/2013	0.9	16.8	15.6	18.1	9.6
7/27/2013	1.0	16.4	14.9	17.9	9.6
7/28/2013	1.1	15.8	14.8	17.0	9.6
7/29/2013	1.0	15.7	14.6	16.1	9.6
7/30/2013	1.0	15.6	13.9	15.5	9.6
7/31/2013	1.0	15.2	13.6	15.8	9.6
8/1/2013	1.2	15.7	15.3	17.4	9.5
8/2/2013	1.3	15.8	14.8	16.3	9.7
8/3/2013	1.3	15.5	13.7	15.3	9.6
8/4/2013	1.2	14.7	12.9	14.4	9.6
8/5/2013	1.2	14.1	12.2	13.8	9.5
8/6/2013	1.1	13.9	11.7	13.4	9.5
8/7/2013	1.1	13.6	11.2	13.1	9.5
8/8/2013	1.0	12.8	10.9	13.2	9.5
8/9/2013	1.0	12.2	10.4	12.8	9.5
8/10/2013	1.0	11.4	10.1	12.6	9.5
8/11/2013	1.0	11.2	9.8	12.5	7.3
8/12/2013	1.0	11.2	9.6	11.9	6.3
8/13/2013	1.0	11.3	10.1	12.1	9.4
8/14/2013				11.6	9.4
8/15/2013				11.0	9.4
8/16/2013				10.8	9.4
8/17/2013				11.2	9.4
8/18/2013				11.1	9.4
8/19/2013				10.8	9.4
8/20/2013	0.6	28.0	9.2	11.4	8.8
8/21/2013	0.6	27.3	10.0	12.3	7.2
8/22/2013	0.6	28.5	11.1	14.5	7.1

Table A-1. Average Daily Flow (cfs) at Gage Sites During Water Year 2012 and Water Year 2013. Wallowa Falls Hydroelectric Project Water Resources Study.

Date	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Upper (BPU)	Bypassed Reach: Lower (BPL)	Powerhouse Tailrace (PHT)
8/23/2013	0.6	27.5	11.2	13.3	7.3
8/24/2013	0.6	25.6	10.3	12.2	7.3
8/25/2013	0.6	25.3	10.1	11.9	7.2
8/26/2013	0.6	25.9	15.8	17.9	2.4
8/27/2013	0.6	25.4	18.2	20.5	0.0
8/28/2013	0.5	25.2	17.2	19.5	0.0
8/29/2013	0.5	23.6	17.8	19.2	0.0
8/30/2013	0.5	22.8	18.0	21.0	0.0
8/31/2013	0.5	23.5	18.2	21.3	0.0
9/1/2013	0.5	22.5	18.5	20.5	0.0
9/2/2013	0.5	23.0	18.9	21.0	0.0
9/3/2013	0.6	25.3	20.3	21.3	0.0
9/4/2013	0.5	22.9	19.0	18.1	0.0
9/5/2013	0.7	27.5	21.2	21.7	0.0
9/6/2013	0.6	24.0	18.9	18.8	0.0
9/7/2013	0.6	22.7	18.4	19.2	0.0
9/8/2013	0.5	21.9	16.9	18.9	0.0
9/9/2013	0.5	21.7	16.9	18.8	0.0
9/10/2013	0.5	22.0	17.1	17.8	0.0
9/11/2013	0.5	21.5	16.9	17.6	0.0
9/12/2013	0.5	21.2	16.6	17.9	0.0
9/13/2013	0.5	21.2	16.9	18.0	0.0
9/14/2013	0.5	20.3	15.6	17.8	0.0
9/15/2013	0.5	21.0	17.0	18.6	0.0
9/16/2013	0.5	21.8	16.6	18.7	0.0
9/17/2013	0.6	21.6	17.9	19.2	0.0
9/18/2013	0.5	21.0	17.6	16.7	0.0
9/19/2013	0.5	20.1	16.4	16.9	0.0
9/20/2013	0.5	19.3	15.9	16.1	0.0
9/21/2013	0.5	19.1	15.7	16.1	0.0
9/22/2013	0.5	18.6	15.9	16.3	0.0
9/23/2013	0.5	17.9	15.7	16.2	0.0
9/24/2013	0.6	19.0	17.6	18.1	0.0
9/25/2013	0.5	19.1	17.7	16.5	0.0
9/26/2013	0.5	19.5	15.5	12.9	1.9
9/27/2013	0.5	19.2	9.4	8.7	7.7
9/28/2013	0.8	24.9	15.6	15.2	7.7
9/29/2013	1.0	31.2	21.3	19.8	7.3
9/30/2013	1.1	38.5	27.5	22.1	7.6

Appendix B
Water Temperature Data

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
8/1/2011	8.6	10.0	11.6	
8/2/2011	8.3	9.8	11.6	
8/3/2011	8.5	9.5	10.5	
8/4/2011	8.6	9.4	10.4	11.0
8/5/2011	8.0	9.4	11.3	10.7
8/6/2011	7.3	9.0	10.9	10.5
8/7/2011	7.3	8.8	10.4	10.5
8/8/2011	7.2	8.6	10.0	10.4
8/9/2011	7.4	8.6	10.2	10.3
8/10/2011	6.8	8.2	10.0	10.2
8/11/2011	6.5	8.2	10.0	10.0
8/12/2011	7.3	8.7	10.5	9.9
8/13/2011	7.5	8.8	10.3	10.0
8/14/2011	6.9	8.1	9.0	10.0
8/15/2011	6.1	7.7	9.5	10.0
8/16/2011	7.0	8.6	10.6	10.0
8/17/2011	6.4	8.1	10.1	10.0
8/18/2011	6.1	7.9	10.1	10.3
8/19/2011	6.3	8.1	10.3	10.4
8/20/2011	7.0	8.6	10.6	10.4
8/21/2011	7.2	8.7	10.6	10.5
8/22/2011	7.2	8.7	10.2	10.6
8/23/2011	7.1	8.9	10.8	10.7
8/24/2011	8.1	9.4	10.8	10.7
8/25/2011	7.6	9.2	11.0	10.7
8/26/2011	7.9	9.3	11.0	10.7
8/27/2011	8.0	9.4	10.8	10.3
8/28/2011	8.0	9.2	10.5	10.0
8/29/2011	7.1	8.4	9.9	9.6
8/30/2011	6.5	7.4	8.4	9.2
8/31/2011	5.3	6.6	8.2	8.8
9/1/2011	5.0	6.4	8.3	8.6
9/2/2011	4.6	6.2	8.0	8.5
9/3/2011	4.8	6.5	8.6	8.5
9/4/2011	5.9	7.2	8.8	8.6
9/5/2011	6.2	7.5	9.0	8.7
9/6/2011	6.2	7.3	8.4	8.8
9/7/2011	6.3	7.6	9.0	8.8
9/8/2011	5.9	7.4	8.9	8.8
9/9/2011	6.3	7.5	9.0	8.7
9/10/2011	6.5	7.5	8.6	8.7
9/11/2011	6.5	7.4	8.5	8.6

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
9/12/2011	6.2	7.4	8.7	8.4
9/13/2011	5.8	7.1	8.3	8.1
9/14/2011	7.0	7.7	8.5	8.0
9/15/2011	5.8	6.7	7.5	7.9
9/16/2011	4.6	5.7	6.7	7.7
9/17/2011	6.1	6.7	7.6	7.5
9/18/2011	6.1	6.8	7.8	7.5
9/19/2011	4.8	6.0	7.2	7.6
9/20/2011	5.0	6.1	7.4	7.8
9/21/2011	5.5	6.6	8.1	7.8
9/22/2011	6.0	7.0	8.1	7.7
9/23/2011	5.9	7.0	8.2	7.8
9/24/2011	6.7	7.2	7.8	7.8
9/25/2011	5.1	6.4	7.2	7.7
9/26/2011	6.2	6.9	7.8	7.6
9/27/2011	6.3	6.7	7.2	7.6
9/28/2011	5.2	6.2	7.4	7.5
9/29/2011	6.3	7.0	7.9	7.5
9/30/2011	6.9	7.3	7.8	7.3
10/1/2011	6.1	6.7	7.2	7.2
10/2/2011	6.1	6.6	7.2	6.8
10/3/2011	6.2	6.3	6.6	6.4
10/4/2011	5.0	5.8	6.1	6.1
10/5/2011	4.5	4.7	4.9	5.9
10/6/2011	4.8	5.0	5.3	5.7
10/7/2011	5.0	5.3	5.8	5.5
10/8/2011	4.3	5.0	5.8	5.4
10/9/2011	5.1	5.3	5.5	5.6
10/10/2011	5.1	5.2	5.4	5.7
10/11/2011	4.4	4.9	5.4	5.8
10/12/2011	4.4	4.9	5.9	5.8
10/13/2011	5.2	5.7	6.4	5.8
10/14/2011	5.8	5.9	6.2	5.7
10/15/2011	5.3	5.8	6.0	5.7
10/16/2011	3.9	4.5	5.2	5.7
10/17/2011	3.9	4.4	5.0	5.6
10/18/2011	4.6	4.9	5.5	5.5
10/20/2011	4.0	4.7	5.5	5.3
10/21/2011	4.4	4.9	5.7	5.3
10/22/2011	3.9	4.7	5.4	5.0
10/23/2011	4.1	4.7	5.2	4.6
10/24/2011	2.5	3.9	4.6	4.3
10/25/2011	2.3	2.6	2.9	4.0

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
10/26/2011	1.8	2.6	3.3	3.8
10/27/2011	2.3	2.7	3.2	3.7
10/28/2011	2.2	2.9	3.5	3.7
10/29/2011	3.2	3.5	3.8	3.7
10/30/2011	2.8	3.6	4.5	3.6
10/31/2011	2.8	3.7	4.4	3.5
11/1/2011	1.9	2.4	2.8	3.4
11/2/2011	2.3	2.5	2.7	3.2
11/3/2011	2.5	2.7	2.9	2.9
11/4/2011	2.1	2.4	2.7	2.6
11/5/2011	2.1	2.2	2.3	2.6
11/6/2011	2.2	2.4	2.6	2.6
11/7/2011	2.1	2.2	2.4	2.6
11/8/2011	2.0	2.3	2.5	2.6
11/9/2011	2.3	2.5	2.7	2.7
11/10/2011	2.5	2.7	3.0	2.7
11/11/2011	2.6	2.8	3.0	2.8
11/12/2011	2.4	2.6	2.9	2.8
11/13/2011	2.6	2.7	2.8	2.8
11/14/2011	2.6	2.7	2.8	2.8
11/15/2011	2.2	2.4	2.6	2.7
11/16/2011	2.1	2.3	2.6	2.6
11/17/2011	2.5	2.6	2.7	2.5
11/18/2011	2.2	2.3	2.5	2.5
11/19/2011	2.0	2.1	2.3	2.5
11/20/2011	2.2	2.3	2.4	2.6
11/21/2011	2.4	2.5	2.7	2.6
11/22/2011	2.5	2.7	2.8	2.7
11/23/2011	2.8	2.9	3.0	2.8
11/24/2011	2.8	2.9	3.0	2.9
11/25/2011	2.1	2.5	2.8	2.9
11/26/2011	2.1	2.4	2.8	2.9
11/27/2011	2.8	2.9	3.1	2.9
11/28/2011	2.6	2.9	3.0	2.8
11/29/2011	2.3	2.6	2.9	2.8
11/30/2011	2.4	2.6	2.9	2.7
12/1/2011	2.1	2.1	2.4	2.6
12/2/2011	2.1	2.2	2.3	2.5
12/3/2011	1.9	2.2	2.5	2.5
12/4/2011	2.2	2.4	2.6	2.4
12/5/2011	1.8	1.9	2.2	2.4
12/6/2011	2.2	2.3	2.5	2.4
12/7/2011	2.2	2.3	2.5	2.3

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
12/8/2011	1.9	2.0	2.2	2.3
12/9/2011	2.0	2.1	2.2	2.3
12/10/2011	2.1	2.2	2.3	2.2
12/11/2011	2.1	2.2	2.2	2.2
12/12/2011	2.0	2.1	2.2	2.2
12/13/2011	1.8	1.9	2.0	2.2
12/14/2011	2.0	2.1	2.3	2.2
12/15/2011	2.2	2.2	2.3	2.2
12/16/2011	1.9	2.1	2.2	2.2
12/17/2011	2.0	2.1	2.1	2.2
12/18/2011	2.0	2.1	2.3	2.2
12/19/2011	1.8	2.0	2.2	2.1
12/20/2011	1.9	2.0	2.1	2.1
12/21/2011	1.8	1.9	2.0	2.2
12/22/2011	1.6	1.7	1.9	2.2
12/23/2011	1.9	2.1	2.3	2.3
12/24/2011	2.1	2.3	2.5	2.3
12/25/2011	2.4	2.5	2.6	2.4
12/26/2011	2.2	2.3	2.5	2.5
12/27/2011	2.4	2.5	2.7	2.6
12/28/2011	2.5	2.6	2.7	2.5
12/29/2011	2.3	2.4	2.5	2.5
12/30/2011	2.1	2.5	2.7	2.5
12/31/2011	1.6	1.8	2.1	2.5
1/1/2012	1.7	2.2	2.5	2.6
1/2/2012	2.5	2.6	2.7	2.6
1/3/2012	2.3	2.4	2.5	2.6
1/4/2012	2.5	2.7	2.9	2.5
1/5/2012	2.3	2.8	2.9	2.5
1/6/2012	1.7	1.9	2.2	2.5
1/7/2012	1.8	1.9	2.0	2.5
1/8/2012	2.0	2.3	2.6	2.4
1/9/2012	2.0	2.2	2.5	2.2
1/10/2012	2.0	2.4	2.6	2.2
1/11/2012	1.5	1.7	1.9	2.3
1/12/2012	1.4	1.5	1.7	2.2
1/13/2012	1.8	1.9	2.1	2.0
1/14/2012	2.1	2.2	2.4	1.9
1/15/2012	1.5	1.7	2.0	1.9
1/16/2012	1.4	1.4	1.5	2.0
1/17/2012	1.4	1.5	1.6	2.1
1/18/2012	1.7	1.9	2.2	2.1
1/19/2012	2.2	2.3	2.4	2.1

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
1/20/2012	2.2	2.3	2.4	2.2
1/21/2012	2.1	2.3	2.4	2.3
1/22/2012	1.6	1.8	2.1	2.3
1/23/2012	1.6	2.0	2.2	2.3
1/24/2012	1.5	1.8	2.2	2.2
1/25/2012	2.2	2.4	2.4	2.2
1/26/2012	1.9	2.3	2.5	2.3
1/27/2012	1.5	1.6	1.8	2.3
1/28/2012	1.4	1.8	2.3	2.3
1/29/2012	2.2	2.4	2.6	2.3
1/30/2012	2.1	2.3	2.4	2.3
1/31/2012	1.9	2.1	2.3	2.3
2/1/2012	2.1	2.2	2.5	2.2
2/2/2012	1.6	1.9	2.1	2.1
2/3/2012	1.3	1.5	1.8	2.0
2/4/2012	1.5	1.7	1.9	2.0
2/5/2012	1.6	1.7	1.9	2.0
2/6/2012	1.5	1.6	1.8	2.1
2/7/2012	1.7	1.9	2.1	2.2
2/8/2012	2.0	2.2	2.4	2.3
2/9/2012	2.2	2.4	2.6	2.3
2/10/2012	2.4	2.5	2.7	2.4
2/11/2012	2.3	2.4	2.5	2.4
2/12/2012	1.8	2.1	2.3	2.3
2/13/2012	1.6	1.8	1.9	2.2
2/14/2012	1.7	1.9	2.0	2.1
2/15/2012	1.6	1.7	1.9	2.0
2/16/2012	1.5	1.7	2.0	2.0
2/17/2012	1.6	1.9	2.1	2.0
2/18/2012	1.8	1.9	2.0	2.0
2/19/2012	1.7	1.8	1.9	2.1
2/20/2012	1.6	1.8	2.1	2.1
2/21/2012	2.0	2.2	2.4	2.2
2/22/2012	2.0	2.4	2.6	2.2
2/23/2012	1.6	1.8	2.0	2.2
2/24/2012	1.4	1.8	2.2	2.1
2/25/2012	1.6	1.8	2.1	2.0
2/26/2012	1.5	1.7	1.8	1.9
2/27/2012	1.2	1.5	1.7	1.9
2/28/2012	1.3	1.5	1.7	1.8
2/29/2012	1.6	1.7	1.8	1.9
3/1/2012	1.7	1.7	1.8	1.9
3/2/2012	1.5	1.7	1.9	2.0

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
3/3/2012	1.9	2.1	2.3	2.0
3/4/2012	1.9	2.0	2.2	2.0
3/5/2012	1.9	2.0	2.1	2.0
3/6/2012	1.4	1.5	1.8	2.0
3/7/2012	1.2	1.4	1.7	2.0
3/8/2012	1.6	1.8	2.1	2.0
3/9/2012	1.9	2.0	2.1	2.0
3/10/2012	1.9	2.0	2.1	2.0
3/11/2012	1.8	2.0	2.1	2.1
3/12/2012	1.4	1.6	2.0	2.2
3/13/2012	1.1	1.4	1.9	2.2
3/14/2012	1.7	2.0	2.4	2.3
3/15/2012	2.2	2.4	2.7	2.3
3/16/2012	2.0	2.4	2.6	2.4
3/17/2012	2.2	2.4	2.6	2.4
3/18/2012	1.5	1.9	2.2	2.4
3/19/2012	1.6	1.8	2.1	2.4
3/20/2012	1.7	1.9	2.1	2.4
3/21/2012	2.0	2.2	2.5	2.4
3/22/2012	2.3	2.4	2.5	2.5
3/23/2012	2.1	2.3	2.5	2.6
3/24/2012	1.9	2.3	2.9	2.7
3/25/2012	2.2	2.6	3.1	2.8
3/26/2012	2.3	2.5	2.9	2.8
3/27/2012	1.9	2.3	2.6	2.9
3/28/2012	2.4	2.5	2.8	2.9
3/29/2012	2.2	2.5	2.9	2.8
3/30/2012	2.3	2.6	2.8	2.8
3/31/2012	2.5	2.6	3.0	2.8
4/1/2012	2.1	2.4	2.7	2.8
4/2/2012	1.6	2.1	2.5	2.7
4/3/2012	2.1	2.5	3.0	2.5
4/4/2012	1.6	2.1	2.5	2.5
4/5/2012	1.6	1.8	2.1	2.4
4/6/2012	1.6	1.8	2.1	2.5
4/7/2012	1.3	1.7	2.3	2.6
4/8/2012	1.8	2.1	2.7	2.7
4/9/2012	1.9	2.4	3.0	2.9
4/10/2012	2.3	2.9	3.6	3.1
4/11/2012	2.6	2.9	3.5	3.3
4/12/2012	2.4	2.7	3.3	3.4
4/13/2012	2.2	2.7	3.3	3.4
4/14/2012	2.6	3.0	3.6	3.4

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
4/15/2012	2.3	2.8	3.2	3.4
4/16/2012	2.5	2.8	3.2	3.5
4/17/2012	2.4	2.8	3.6	3.6
4/18/2012	2.6	3.0	3.6	3.7
4/19/2012	2.6	3.1	3.7	3.8
4/20/2012	2.8	3.3	4.1	4.0
4/21/2012	2.6	3.1	4.2	4.0
4/22/2012	2.6	3.2	4.3	4.0
4/23/2012	2.7	3.1	4.2	3.9
4/24/2012	2.6	3.0	3.7	3.7
4/25/2012	2.7	3.1	3.8	3.5
4/26/2012	2.1	2.5	2.9	3.5
4/27/2012	2.0	2.4	3.0	3.4
4/28/2012	2.0	2.5	2.9	3.4
4/29/2012	2.3	3.0	3.8	3.3
4/30/2012	2.9	3.2	3.7	3.3
5/1/2012	2.2	2.8	3.4	3.3
5/2/2012	2.2	2.7	3.4	3.3
5/3/2012	2.5	2.7	3.0	3.3
5/4/2012	2.3	2.5	2.6	3.4
5/5/2012	1.8	2.4	3.2	3.6
5/6/2012	1.8	2.7	3.8	3.8
5/7/2012	2.0	3.1	4.3	3.9
5/8/2012	2.7	3.6	4.8	4.1
5/9/2012	2.8	3.5	4.7	4.3
5/10/2012	2.2	2.9	3.9	4.5
5/11/2012	2.0	2.9	4.2	4.6
5/12/2012	2.3	3.2	4.6	4.7
5/13/2012	2.5	3.5	5.0	4.7
5/14/2012	2.8	3.7	5.1	4.7
5/15/2012	3.0	3.8	5.3	4.8
5/16/2012	2.9	3.7	5.0	4.8
5/17/2012	3.0	3.4	4.1	4.8
5/18/2012	2.4	3.2	4.4	4.6
5/19/2012	2.4	3.3	4.7	4.4
5/20/2012	2.9	3.7	5.0	4.2
5/21/2012	3.2	3.6	4.2	4.1
5/22/2012	2.9	3.2	3.6	3.9
5/23/2012	2.6	3.0	3.6	3.7
5/24/2012	2.5	2.9	3.3	3.5
5/25/2012	2.7	2.8	3.0	3.6
5/26/2012	2.7	2.9	3.1	3.9
5/27/2012	2.8	3.3	3.9	4.2

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
5/28/2012	2.8	3.7	4.8	4.7
5/29/2012	3.1	4.0	5.5	5.3
5/30/2012	3.2	4.2	5.7	5.6
6/1/2012	2.9	4.4	6.6	5.8
6/2/2012	2.7	4.5	7.6	6.1
6/3/2012	2.9	3.8	4.8	5.8
6/4/2012	2.8	4.0	5.5	5.7
6/5/2012	3.0	4.5	7.0	5.4
6/6/2012	2.3	2.7	2.9	4.9
6/7/2012	1.9	3.3	5.6	4.7
6/8/2012	2.2	3.2	4.5	4.8
6/9/2012	2.5	3.2	4.2	4.7
6/10/2012	2.1	2.8	3.5	5.3
6/11/2012	2.6	3.9	5.8	5.7
6/12/2012	2.4	4.2	6.6	6.2
6/13/2012	3.6	5.0	7.2	6.8
6/14/2012	3.1	5.0	8.1	7.4
6/15/2012	2.4	4.8	8.2	7.9
6/16/2012	3.0	5.0	8.1	7.7
6/17/2012	3.0	5.1	7.9	7.3
6/18/2012	4.6	6.1	8.9	7.4
6/19/2012	3.6	4.6	5.8	7.6
6/20/2012	2.7	3.6	4.4	7.8
6/21/2012	2.8	5.1	8.3	8.0
6/22/2012	3.9	6.3	9.7	8.0
6/23/2012	5.4	7.1	9.7	8.6
6/24/2012	5.6	6.8	8.9	9.1
6/25/2012	5.2	6.9	9.5	9.2
6/26/2012	5.1	7.2	9.9	9.4
6/27/2012	4.9	6.1	7.4	9.4
6/28/2012	4.1	6.4	9.5	9.7
6/29/2012	5.3	7.8	10.9	9.6
6/30/2012	6.6	8.0	9.8	9.8
7/1/2012	6.2	8.3	10.6	10.2
7/2/2012	6.9	8.0	9.1	10.4
7/3/2012	5.9	8.1	11.0	10.5
7/4/2012	6.5	8.2	10.6	10.8
7/5/2012	5.1	7.7	10.7	11.1
7/6/2012	6.5	8.4	11.6	11.5
7/7/2012	7.0	9.1	12.0	11.8
7/8/2012	7.9	9.9	12.7	12.0
7/9/2012	8.3	10.0	12.2	12.3
7/10/2012	8.8	10.2	12.4	12.5

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
7/11/2012	8.7	10.1	12.5	12.6
7/12/2012	8.5	10.2	12.9	12.4
7/13/2012	8.7	10.6	13.0	12.4
7/14/2012	9.2	10.8	12.8	12.3
7/15/2012	9.2	10.0	11.3	12.3
7/16/2012	8.7	10.2	11.9	12.3
7/17/2012	8.9	10.2	11.7	12.3
7/18/2012	8.5	10.4	12.8	12.1
7/19/2012	8.7	10.5	12.9	12.3
7/20/2012	9.2	10.6	12.5	12.4
7/21/2012	9.5	10.4	11.9	12.3
7/22/2012	7.9	9.9	12.4	12.1
7/23/2012	8.3	10.2	12.5	11.8
7/24/2012	7.9	9.4	11.3	11.7
7/25/2012	6.6	8.7	11.0	11.6
7/26/2012	7.4	9.0	10.9	11.4
7/27/2012	8.1	9.7	11.8	11.3
7/28/2012	8.4	9.8	11.4	11.3
7/29/2012	8.0	9.4	11.2	11.3
7/30/2012	7.7	9.4	11.3	11.3
7/31/2012	8.0	9.5	11.5	11.1
8/1/2012	7.5	9.3	11.3	10.9
8/2/2012	7.1	8.9	10.8	10.8
8/3/2012	7.1	8.6	10.2	10.8
8/4/2012	7.2	8.6	10.1	10.7
8/5/2012	6.9	8.6	10.4	10.7
8/6/2012	7.7	9.3	11.0	10.6
8/7/2012	8.8	9.9	11.2	10.6
8/8/2012	8.4	9.7	11.1	10.6
8/9/2012	8.5	9.4	10.3	10.6
8/10/2012	7.8	9.1	10.4	10.5
8/11/2012	8.0	9.0	10.1	10.5
8/12/2012	7.5	8.8	10.0	10.5
8/13/2012	7.6	8.9	10.2	10.7
8/14/2012	7.6	9.1	11.4	10.8
8/15/2012	6.2	8.5	11.1	10.9
8/16/2012	7.3	9.1	11.5	11.0
8/17/2012	6.7	8.9	11.3	11.1
8/18/2012	6.2	8.4	10.7	10.9
8/19/2012	6.7	8.8	10.9	10.8
8/20/2012	7.4	8.9	10.5	10.6
8/21/2012	7.3	8.8	10.5	10.2
8/22/2012	7.7	8.9	10.3	9.9

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
8/23/2012	6.4	8.1	10.2	9.7
8/24/2012	4.8	6.5	8.2	9.6
8/25/2012	4.6	6.6	8.9	9.4
8/26/2012	5.7	7.4	9.3	9.1
8/27/2012	6.7	8.0	9.8	8.9
8/28/2012	5.7	7.4	9.2	9.0
8/29/2012	5.4	6.9	8.4	8.9
8/30/2012	4.7	6.5	8.4	8.7
8/31/2012	5.5	7.2	9.0	8.4
9/1/2012	5.5	6.8	8.2	8.2
9/2/2012	4.1	5.8	7.8	8.2
9/3/2012	4.3	6.0	7.8	8.1
9/4/2012	4.7	6.3	7.9	7.9
9/5/2012	4.5	6.3	8.0	8.0
9/6/2012	5.2	6.5	7.9	8.1
9/7/2012	4.6	6.2	7.9	8.0
9/8/2012	5.2	6.7	8.4	7.7
9/9/2012	6.7	7.5	8.8	7.4
9/10/2012	4.6	6.0	7.3	7.3
9/11/2012	3.5	4.7	5.9	7.2
9/12/2012	2.8	4.4	5.9	7.0
9/13/2012	3.3	4.9	6.7	6.8
9/14/2012	4.4	5.8	7.4	6.7
9/15/2012	5.4	6.3	7.2	6.8
9/16/2012	5.7	6.3	7.1	7.0
9/17/2012	4.5	5.6	6.6	7.0
9/18/2012	4.7	5.8	6.9	7.0
9/19/2012	5.0	6.0	7.1	7.0
9/20/2012	5.0	6.1	7.1	6.9
9/21/2012	4.7	5.9	6.9	7.0
9/22/2012	5.2	6.2	7.2	7.1
9/23/2012	5.9	6.3	6.7	7.0
9/24/2012	6.1	6.6	7.2	6.9
9/25/2012	5.9	6.6	7.4	6.9
9/26/2012	4.9	5.7	6.3	6.9
9/27/2012	4.4	5.5	6.5	6.8
9/28/2012	5.8	6.4	7.1	6.8
9/29/2012	5.6	6.4	7.1	6.7
9/30/2012	4.8	5.7	6.2	6.4
10/1/2012	4.4	5.6	6.9	6.0
10/2/2012	4.6	5.5	6.8	5.5
10/3/2012	2.2	3.2	4.3	5.0
10/4/2012	1.7	2.7	3.8	4.6

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
10/5/2012	1.1	2.2	3.3	4.3
10/6/2012	1.2	2.2	3.4	3.9
10/7/2012	1.8	2.8	4.0	4.0
10/8/2012	2.0	3.0	4.3	4.1
10/9/2012	2.3	3.3	4.5	4.4
10/10/2012	2.7	3.6	4.8	4.8
10/11/2012	2.7	3.7	4.7	5.1
10/12/2012	3.1	4.2	5.4	5.4
10/13/2012	4.7	5.3	5.8	5.6
10/14/2012	4.7	5.4	6.3	5.4
10/15/2012	5.2	5.7	6.2	5.3
10/16/2012	3.0	4.8	6.1	5.3
10/17/2012	1.8	2.6	3.2	5.2
10/18/2012	2.3	3.3	4.3	4.7
10/19/2012	4.0	4.8	5.5	4.1
10/20/2012	2.3	3.4	4.8	3.5
10/21/2012	1.3	2.0	2.6	3.5
10/22/2012	1.4	1.8	2.2	3.2
10/23/2012	1.1	1.5	2.0	2.7
10/24/2012	1.0	1.4	3.2	2.4
10/25/2012	1.2	1.9	2.2	2.5
10/26/2012	0.9	1.4	1.8	2.9
10/27/2012	1.7	2.3	2.8	3.2
10/28/2012	2.8	3.2	3.6	3.4
10/29/2012	3.3	3.7	4.5	3.7
10/30/2012	3.2	3.8	4.5	4.0
10/31/2012	3.6	4.1	4.7	4.2
11/1/2012	3.0	3.4	4.1	4.4
11/2/2012	2.4	2.9	3.6	4.4
11/3/2012	2.7	3.6	4.6	4.5
11/4/2012	3.3	4.0	4.7	4.3
11/5/2012	3.3	3.9	4.8	4.1
11/6/2012	3.2	3.9	4.7	3.8
11/7/2012	2.4	3.4	3.9	3.3
11/8/2012	1.5	1.8	2.2	2.7
11/9/2012	0.5	1.1	1.5	2.4
11/10/2012	0.4	0.8	1.1	2.0
11/11/2012	0.1	0.6	1.0	1.8
11/12/2012	1.0	1.7	2.1	1.8
11/13/2012	1.4	1.9	2.2	2.0
11/14/2012	1.6	2.2	2.6	2.2
11/15/2012	0.9	1.4	1.9	2.3
11/16/2012	1.9	2.4	2.9	2.4

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
11/17/2012	1.8	2.4	2.8	2.3
11/18/2012	1.1	1.4	1.7	2.3
11/19/2012	1.6	2.0	2.4	2.2
11/20/2012	1.7	2.0	2.1	2.1
11/21/2012	1.3	1.6	2.0	2.0
11/22/2012	0.6	1.0	1.3	2.1
11/23/2012	1.3	1.8	2.3	1.9
11/24/2012	2.0	2.2	2.5	1.8
11/25/2012	0.5	1.5	2.0	1.9
11/26/2012	0.4	0.6	0.9	2.0
11/27/2012	0.6	1.1	1.7	2.0
11/28/2012	1.5	1.9	2.3	1.9
11/29/2012	2.0	2.2	2.5	1.9
11/30/2012	1.6	1.9	2.1	2.1
12/1/2012	1.4	1.8	2.1	2.1
12/2/2012	1.3	1.7	1.9	2.1
12/3/2012	1.4	1.6	1.9	2.0
12/4/2012	1.3	1.8	2.2	1.9
12/5/2012	1.3	1.8	2.1	1.7
12/6/2012	0.8	1.1	1.4	1.7
12/7/2012	0.8	1.3	1.7	1.7
12/8/2012	0.6	0.7	0.9	1.6
12/9/2012	0.3	0.8	1.5	1.6
12/10/2012	1.5	1.6	1.9	1.5
12/11/2012	1.4	1.7	2.0	1.5
12/12/2012	0.9	1.5	1.8	1.5
12/13/2012	0.2	0.5	0.8	1.5
12/14/2012	0.5	1.2	1.5	1.4
12/15/2012	0.5	0.8	1.0	1.3
12/16/2012	1.0	1.2	1.3	1.2
12/17/2012	1.1	1.2	1.4	1.3
12/18/2012	0.6	0.8	1.1	1.3
12/19/2012	0.5	0.8	1.1	1.3
12/20/2012	1.0	1.2	1.4	1.4
12/21/2012	1.3	1.4	1.6	1.4
12/22/2012	0.9	1.3	1.5	1.4
12/23/2012	1.1	1.3	1.5	1.5
12/24/2012	1.1	1.4	1.6	1.5
12/25/2012	0.9	1.1	1.3	1.5
12/26/2012	1.2	1.4	1.6	1.5
12/27/2012	1.3	1.5	1.7	1.5
12/28/2012	0.9	1.2	1.4	1.4
12/29/2012	0.9	1.2	1.4	1.4

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
12/30/2012	0.9	1.2	1.4	1.4
12/31/2012	0.8	1.0	1.3	1.4
1/1/2013	1.1	1.2	1.3	1.5
1/2/2013	1.1	1.3	1.5	1.5
1/3/2013	1.3	1.5	1.6	1.6
1/4/2013	1.4	1.5	1.7	1.7
1/5/2013	1.2	1.4	1.7	1.8
1/6/2013	1.3	1.7	1.9	1.9
1/7/2013	1.3	1.7	1.9	1.8
1/8/2013	1.8	1.9	2.2	1.7
1/9/2013	1.0	1.7	2.0	1.6
1/10/2013	0.9	1.1	1.2	1.4
1/11/2013	0.4	0.7	0.9	1.4
1/12/2013	0.2	0.5	0.8	1.3
1/13/2013	0.4	0.6	0.9	1.2
1/14/2013	0.6	1.2	1.6	1.3
1/15/2013	1.4	1.6	1.7	1.5
1/16/2013	1.3	1.4	1.6	1.6
1/17/2013	1.4	1.5	1.7	1.7
1/18/2013	1.5	1.7	1.9	1.7
1/19/2013	1.4	1.5	1.8	1.7
1/20/2013	1.3	1.4	1.6	1.8
1/21/2013	1.3	1.5	1.7	1.8
1/22/2013	1.1	1.6	1.9	1.9
1/23/2013	1.7	1.9	2.0	1.9
1/24/2013	1.7	1.9	2.0	1.9
1/25/2013	1.9	2.1	2.3	1.9
1/26/2013	1.5	1.8	2.1	1.8
1/27/2013	1.0	1.2	1.4	1.8
1/28/2013	0.7	1.0	1.3	1.9
1/29/2013	1.3	1.4	1.7	1.8
1/30/2013	1.5	1.8	2.0	1.8
1/31/2013	1.3	1.8	2.2	1.8
2/1/2013	1.2	1.6	2.0	1.9
2/2/2013	1.0	1.3	1.7	2.0
2/3/2013	1.2	1.5	1.7	2.0
2/4/2013	1.7	2.0	2.3	2.0
2/5/2013	2.0	2.2	2.3	1.9
2/6/2013	1.5	1.8	2.0	1.9
2/7/2013	1.5	1.7	2.0	1.9
2/8/2013	1.3	1.4	1.5	1.8
2/9/2013	1.3	1.5	1.7	1.7
2/10/2013	1.0	1.3	1.5	1.7

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
2/11/2013	0.7	1.1	1.3	1.7
2/12/2013	1.1	1.5	1.9	1.7
2/13/2013	1.7	1.9	2.2	1.8
2/14/2013	1.0	1.5	1.8	1.8
2/15/2013	1.2	1.5	1.7	1.8
2/16/2013	1.5	1.9	2.2	1.8
2/17/2013	0.9	1.4	1.7	1.7
2/18/2013	0.4	1.0	1.4	1.7
2/19/2013	1.3	1.4	1.7	1.7
2/20/2013	0.8	1.2	1.6	1.6
2/21/2013	0.5	1.0	1.4	1.5
2/22/2013	1.2	1.5	1.8	1.6
2/23/2013	1.2	1.3	1.5	1.5
2/24/2013	0.8	1.1	1.4	1.5
2/25/2013	1.1	1.4	1.7	1.6
2/26/2013	0.5	0.9	1.2	1.7
2/27/2013	1.0	1.4	1.8	1.9
2/28/2013	1.5	1.9	2.1	2.0
3/1/2013	2.0	2.2	2.4	1.9
3/2/2013	2.0	2.3	2.7	2.1
3/3/2013	1.2	1.8	2.3	2.1
3/4/2013	0.4	0.8	1.1	2.0
3/5/2013	0.8	1.4	2.0	1.9
3/6/2013	1.5	1.7	1.8	1.7
3/7/2013	0.9	1.3	1.7	1.7
3/8/2013	0.5	1.1	1.6	1.9
3/9/2013	0.3	1.0	1.5	2.0
3/10/2013	0.6	1.3	2.0	2.2
3/11/2013	1.9	2.2	2.6	2.4
3/12/2013	1.9	2.3	2.9	2.6
3/13/2013	2.2	2.5	3.0	2.8
3/14/2013	2.2	2.6	3.1	2.8
3/15/2013	2.2	2.6	3.1	2.7
3/16/2013	1.7	2.1	2.8	2.5
3/17/2013	1.0	1.4	1.9	2.4
3/18/2013	1.0	1.3	2.0	2.2
3/19/2013	0.2	1.0	1.8	1.9
3/20/2013	1.4	1.8	2.2	1.7
3/21/2013	0.8	1.1	1.4	1.6
3/22/2013	0.5	0.8	1.1	1.6
3/23/2013	0.6	0.9	1.4	1.7
3/24/2013	0.1	0.7	1.4	1.8
3/25/2013	0.9	1.6	2.2	2.1

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
3/26/2013	1.6	2.1	2.5	2.4
3/27/2013	1.8	2.3	2.8	2.7
3/28/2013	2.2	2.6	3.3	3.0
3/29/2013	2.3	2.7	3.1	3.2
3/30/2013	1.9	2.5	3.4	3.3
3/31/2013	1.6	2.4	3.4	3.5
4/1/2013	1.8	2.6	3.6	3.5
4/2/2013	2.2	2.8	3.8	3.5
4/3/2013	2.1	2.8	3.7	3.5
4/4/2013	2.5	2.8	3.4	3.4
4/5/2013	2.2	2.6	3.3	3.2
4/6/2013	2.3	2.6	3.0	3.1
4/7/2013	1.8	2.3	2.9	3.0
4/8/2013	1.5	1.6	2.0	2.9
4/9/2013	1.4	2.1	3.1	2.9
4/10/2013	1.9	2.5	3.4	2.8
4/11/2013	1.3	2.1	2.8	2.7
4/12/2013	1.0	2.1	3.1	2.6
4/13/2013	1.5	2.0	2.6	2.4
4/14/2013	1.1	1.3	1.6	2.2
4/15/2013	0.6	1.0	1.5	2.2
4/16/2013	0.9	1.3	1.8	2.2
4/17/2013	0.6	1.3	2.1	2.4
4/18/2013	0.8	1.8	2.7	2.7
4/19/2013	2.3	2.7	3.3	2.9
4/20/2013	2.2	2.9	4.1	3.0
4/21/2013	1.8	2.6	3.6	3.2
4/22/2013	1.5	2.0	2.8	3.5
4/23/2013	0.4	1.4	2.4	3.7
4/24/2013	0.8	2.0	3.5	3.8
4/25/2013	1.8	2.9	4.5	3.9
4/26/2013	2.2	3.2	4.9	4.0
4/27/2013	2.4	3.4	4.8	4.0
4/28/2013	2.5	3.3	4.4	3.9
4/29/2013	2.1	3.0	3.8	3.9
4/30/2013	1.3	1.7	2.0	3.9
5/1/2013	0.6	1.7	3.0	3.8
5/2/2013	1.2	2.6	4.4	3.8
5/3/2013	2.3	3.4	5.0	4.0
5/4/2013	2.6	3.2	4.0	4.5
5/5/2013	2.1	3.2	4.4	4.9
5/6/2013	2.3	3.5	5.5	5.0
5/7/2013	2.4	3.6	5.3	5.1

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
5/8/2013	2.5	3.7	5.5	5.3
5/9/2013	2.6	3.6	5.6	5.5
5/10/2013	2.5	3.6	5.4	5.4
5/11/2013	2.7	3.9	5.7	5.4
5/12/2013	2.9	3.8	5.5	5.3
5/13/2013	2.7	3.6	5.0	5.1
5/14/2013	2.3	3.4	5.1	4.9
5/15/2013	2.1	3.2	4.7	4.6
5/16/2013	2.8	3.3	4.3	4.3
5/17/2013	2.7	3.1	3.8	4.4
5/18/2013	2.3	3.1	4.1	4.4
5/19/2013	2.4	2.9	3.4	4.2
5/20/2013	2.4	3.7	5.7	4.1
5/21/2013	2.8	3.6	5.1	4.0
5/22/2013	1.4	2.2	2.9	4.1
5/23/2013	1.0	2.3	3.7	4.2
5/24/2013	2.0	2.6	3.4	4.1
5/25/2013	1.9	3.1	4.6	4.0
5/26/2013	2.6	3.4	4.3	4.2
5/27/2013	2.3	3.4	4.6	4.3
5/28/2013	2.9	3.5	4.4	4.6
5/29/2013	2.5	3.4	4.4	4.9
5/30/2013	2.6	3.3	4.3	5.2
5/31/2013	2.0	3.7	5.9	5.5
6/1/2013	2.3	4.1	6.6	5.9
6/2/2013	3.0	4.3	6.0	6.5
6/3/2013	3.3	4.7	6.6	7.1
6/4/2013	2.9	4.9	7.8	7.5
6/5/2013	3.2	5.3	8.5	7.8
6/6/2013	3.8	5.6	8.4	8.3
6/7/2013	3.8	5.9	8.8	8.5
6/8/2013	3.5	5.8	8.8	8.5
6/9/2013	4.1	6.2	9.0	8.2
6/10/2013	3.8	5.9	8.4	7.9
6/11/2013	4.4	5.7	7.3	7.7
6/12/2013	4.0	5.3	6.7	7.7
6/13/2013	4.1	5.1	6.1	7.9
6/14/2013	3.6	5.3	7.5	8.2
6/15/2013	4.0	6.4	9.2	8.5
6/16/2013	5.3	7.6	10.2	8.6
6/17/2013	5.8	8.0	10.6	8.8
6/18/2013	6.6	7.7	9.5	8.6
6/19/2013	5.0	5.9	6.8	8.4

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
6/20/2013	4.7	6.1	8.0	8.2
6/21/2013	4.9	5.6	6.2	7.8
6/22/2013	4.9	6.3	7.8	7.5
6/23/2013	5.3	6.7	8.5	7.6
6/24/2013	6.6	7.1	7.7	8.0
6/25/2013	6.1	6.8	7.4	8.9
6/26/2013	6.2	6.9	7.6	9.6
6/27/2013	6.1	8.2	11.0	10.3
6/28/2013	7.3	9.6	12.5	11.1
6/29/2013	9.0	10.3	12.6	11.8
6/30/2013	8.6	10.4	13.0	12.6
7/1/2013	9.2	11.0	13.3	12.7
7/2/2013	9.9	11.1	12.8	12.5
7/3/2013	9.6	10.7	12.7	12.3
7/4/2013	9.0	10.2	12.2	12.2
7/5/2013	8.0	9.2	10.9	12.0
7/6/2013	7.0	9.0	11.4	11.9
7/7/2013	7.5	9.4	11.9	11.9
7/8/2013	8.5	9.9	12.1	11.7
7/9/2013	7.5	9.7	12.3	11.8
7/10/2013	8.4	10.3	12.8	11.7
7/11/2013	8.4	9.5	10.6	11.7
7/12/2013	7.7	9.2	11.3	11.7
7/13/2013	6.6	8.6	11.0	11.7
7/14/2013	7.4	9.3	11.9	11.8
7/15/2013	7.8	9.6	12.0	12.1
7/16/2013	8.3	10.0	12.2	12.3
7/17/2013	8.7	10.5	13.3	12.5
7/18/2013	7.5	9.8	12.7	12.5
7/19/2013	7.8	9.9	12.8	12.5
7/20/2013	7.4	9.6	12.5	12.5
7/21/2013	6.4	9.0	12.2	12.3
7/22/2013	6.3	8.9	12.0	12.2
7/23/2013	6.5	9.2	12.1	12.0
7/24/2013	7.5	9.6	11.9	11.9
7/25/2013	8.2	9.7	11.6	11.7
7/26/2013	7.3	9.3	11.6	11.6
7/27/2013	7.6	9.4	11.9	11.4
7/28/2013	6.1	8.4	11.1	11.1
7/29/2013	5.9	8.2	10.7	10.7
7/30/2013	7.0	8.8	10.9	10.4
7/31/2013	7.0	8.5	9.9	10.1
8/1/2013	7.0	7.9	9.0	10.1

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
8/2/2013	6.2	7.7	9.3	10.1
8/3/2013	5.7	7.8	10.0	10.1
8/4/2013	6.1	8.3	10.8	10.2
8/5/2013	6.8	8.5	10.4	10.5
8/6/2013	6.3	8.4	10.9	10.7
8/7/2013	6.5	8.5	10.9	10.8
8/8/2013	7.0	8.7	10.8	10.9
8/9/2013	7.7	9.2	11.1	10.9
8/10/2013	7.0	8.8	10.8	10.9
8/11/2013	7.4	9.2	11.4	11.0
8/12/2013	7.3	8.9	10.5	11.1
8/13/2013	7.2	9.0	11.0	11.1
8/14/2013	7.4	9.2	11.3	11.1
8/15/2013	7.2	9.2	11.3	11.0
8/16/2013	7.4	9.2	11.3	11.1
8/17/2013	7.7	9.1	10.7	11.1
8/18/2013	7.5	9.2	11.2	10.9
8/19/2013	6.9	8.8	11.0	10.8
8/20/2013	6.6	8.5	10.6	10.8
8/21/2013	6.3	8.4	10.3	10.8
8/22/2013	8.4	9.3	10.6	10.7
8/23/2013	7.7	9.1	10.9	10.5
8/24/2013	7.0	8.7	10.6	10.4
8/25/2013	7.1	8.7	10.4	10.4
8/26/2013	6.6	8.2	9.9	10.4
8/27/2013	6.4	8.2	10.2	10.3
8/28/2013	7.5	8.7	10.3	10.2
8/29/2013	7.8	8.9	10.6	10.1
8/30/2013	6.7	8.2	9.7	10.1
8/31/2013	6.6	8.3	10.3	10.1
9/1/2013	6.8	8.5	9.9	10.2
9/2/2013	8.4	9.0	9.7	10.2
9/3/2013	8.4	9.2	10.3	10.2
9/4/2013	8.3	9.3	10.6	10.0
9/5/2013	8.5	9.4	10.9	9.9
9/6/2013	6.8	8.1	9.4	9.8
9/7/2013	6.0	7.7	9.3	9.7
9/8/2013	6.2	7.6	9.1	9.5
9/9/2013	6.4	7.6	9.2	9.3
9/10/2013	5.8	7.4	9.1	9.4
9/11/2013	6.1	7.7	9.4	9.5
9/12/2013	6.6	8.1	9.6	9.6
9/13/2013	8.0	8.9	10.0	9.6

Table B-1. Daily Minimum, Mean, Maximum, and 7-DAD Max Water Temperature Values (°C) at Upper Bypassed Reach Site (BPU) During August 2011 Through September 2013.

Date	Daily Minimum	Daily Mean	Daily Maximum	7-D Max
9/14/2013	7.2	8.4	9.8	9.4
9/15/2013	7.4	8.7	10.2	9.0
9/16/2013	7.3	8.3	9.4	8.6
9/17/2013	6.1	6.7	7.4	8.2
9/18/2013	4.9	5.8	6.6	7.8
9/19/2013	3.7	5.1	6.7	7.3
9/20/2013	4.5	5.9	7.3	6.9
9/21/2013	5.9	6.3	7.0	6.7
9/22/2013	5.6	6.0	6.6	6.3
9/23/2013	4.7	5.7	6.6	5.8
9/24/2013	4.2	5.1	5.8	5.4
9/25/2013	1.7	3.3	4.2	5.1
9/26/2013	0.4	2.1	3.2	4.8
9/27/2013	3.3	3.8	4.4	4.4
9/28/2013	3.8	4.3	4.8	4.3
9/29/2013	3.0	3.5	4.2	4.3
9/30/2013	2.8	3.5	4.3	4.3

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
10/23/2011				4.5	
10/24/2011				4.1	4.9
10/25/2011				3.7	4.4
10/26/2011				3.5	4.1
10/27/2011				3.4	3.9
10/28/2011				3.3	3.9
10/29/2011				3.2	3.8
10/30/2011				3.1	3.7
10/31/2011				3.0	3.7
11/1/2011				2.8	3.4
11/2/2011				2.4	2.7
11/3/2011				2.0	2.0
11/4/2011				1.6	1.3
11/5/2011				1.6	0.9
11/6/2011				1.6	0.8
11/7/2011				1.6	0.7
11/8/2011				1.7	0.8
11/9/2011				1.8	1.0
11/10/2011				1.9	1.2
11/11/2011				2.0	1.5
11/12/2011				1.9	1.7
11/13/2011				1.9	1.5
11/14/2011				1.9	1.6
11/15/2011				1.8	1.4
11/16/2011				1.7	1.1
11/17/2011				1.6	0.9
11/18/2011				1.6	0.8
11/19/2011				1.7	1.0
11/20/2011				1.7	1.4
11/21/2011				1.8	1.5
11/22/2011				1.8	1.7
11/23/2011				1.9	1.8
11/24/2011				2.1	2.2
11/25/2011				2.1	2.4
11/26/2011				2.2	2.4
11/27/2011				2.2	2.2
11/28/2011				2.1	2.0
11/29/2011				2.0	1.7
11/30/2011				1.9	1.5
12/1/2011				1.8	1.1
12/2/2011				1.7	0.7
12/3/2011				1.6	0.3

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
12/4/2011				1.5	0.0
12/5/2011				1.5	-0.1
12/6/2011				1.5	-0.1
12/7/2011				1.5	-0.1
12/8/2011				1.5	-0.1
12/9/2011				1.5	-0.1
12/10/2011				1.4	-0.1
12/11/2011				1.4	-0.1
12/12/2011				1.6	0.0
12/13/2011				1.7	0.1
12/14/2011				1.7	0.2
12/15/2011				1.8	0.4
12/16/2011				1.8	0.5
12/17/2011				1.9	0.6
12/18/2011				1.8	0.7
12/19/2011				1.7	0.6
12/20/2011				1.7	0.5
12/21/2011				1.7	0.4
12/22/2011				1.7	0.4
12/23/2011				1.7	0.4
12/24/2011				1.7	0.5
12/25/2011				1.8	0.7
12/26/2011				1.9	1.1
12/27/2011				2.0	1.4
12/28/2011				1.8	1.5
12/29/2011				1.8	1.5
12/30/2011				1.9	1.7
12/31/2011				1.8	1.7
1/1/2012				1.9	1.9
1/2/2012				2.0	2.0
1/3/2012				1.8	1.7
1/4/2012				1.9	1.6
1/5/2012				1.9	1.7
1/6/2012				1.9	1.6
1/7/2012				1.9	1.5
1/8/2012				1.7	1.1
1/9/2012				1.4	0.7
1/10/2012				1.5	0.6
1/11/2012				1.6	0.8
1/12/2012				1.4	0.6
1/13/2012				1.2	0.4
1/14/2012				1.1	0.2

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
1/15/2012				1.3	0.4
1/16/2012				1.4	0.7
1/17/2012				1.5	1.1
1/18/2012				1.5	1.2
1/19/2012				1.5	1.3
1/20/2012				1.7	1.5
1/21/2012				1.8	1.8
1/22/2012				1.8	1.9
1/23/2012				1.8	1.9
1/24/2012				1.7	1.6
1/25/2012				1.7	1.5
1/26/2012				1.8	1.7
1/27/2012				1.8	1.8
1/28/2012				1.8	1.8
1/29/2012				1.9	1.8
1/30/2012				1.8	1.6
1/31/2012				1.8	1.6
2/1/2012				1.7	1.4
2/2/2012				1.6	1.2
2/3/2012				1.5	0.9
2/4/2012				1.5	0.8
2/5/2012				1.5	0.7
2/6/2012				1.6	0.9
2/7/2012				1.8	1.2
2/8/2012				1.9	1.4
2/9/2012				1.9	1.5
2/10/2012				2.0	1.5
2/11/2012				2.0	1.4
2/12/2012				1.9	1.2
2/13/2012				1.8	0.9
2/14/2012				1.8	0.6
2/15/2012				1.7	0.4
2/16/2012				1.7	0.2
2/17/2012				1.8	0.2
2/18/2012				1.8	0.3
2/19/2012				1.9	0.6
2/20/2012				1.9	0.8
2/21/2012				1.9	0.9
2/22/2012				1.8	1.0
2/23/2012				1.8	0.9
2/24/2012				1.7	0.9
2/25/2012				1.5	0.7

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
2/26/2012				1.4	0.3
2/27/2012				1.4	0.2
2/28/2012				1.3	0.0
2/29/2012				1.4	0.0
3/1/2012				1.6	0.2
3/2/2012				1.8	0.4
3/3/2012				1.8	0.6
3/4/2012				1.8	0.6
3/5/2012				1.9	0.7
3/6/2012				2.1	0.9
3/7/2012				2.1	1.0
3/8/2012				2.1	1.1
3/9/2012				2.0	1.0
3/10/2012				2.1	1.0
3/11/2012				2.2	1.2
3/12/2012				2.2	1.6
3/13/2012				2.1	1.7
3/14/2012				2.1	1.8
3/15/2012				1.9	1.8
3/16/2012				1.9	1.7
3/17/2012				2.0	1.8
3/18/2012				2.0	1.9
3/19/2012				2.0	1.8
3/20/2012				2.0	1.8
3/21/2012				2.1	1.9
3/22/2012				2.4	2.2
3/23/2012				2.5	2.6
3/24/2012				2.6	2.8
3/25/2012				2.7	3.0
3/26/2012				2.8	3.2
3/27/2012				2.8	3.4
3/28/2012				2.8	3.6
3/29/2012				2.6	3.4
3/30/2012				2.6	3.4
3/31/2012				2.7	3.5
4/1/2012				2.6	3.4
4/2/2012				2.4	3.0
4/3/2012				2.4	2.7
4/4/2012				2.3	2.4
4/5/2012				2.4	2.5
4/6/2012				2.6	2.8
4/7/2012				2.7	3.1

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
4/8/2012				3.0	3.5
4/9/2012				3.2	4.0
4/10/2012				3.4	4.5
4/11/2012				3.6	5.0
4/12/2012				3.6	5.1
4/13/2012				3.6	5.1
4/14/2012				3.5	5.0
4/15/2012	5.5	5.9		3.6	5.0
4/16/2012	5.5	5.9		3.6	5.1
4/17/2012	5.8	6.2		3.7	5.4
4/18/2012	6.0	6.4		3.8	5.7
4/19/2012	6.4	6.9		4.0	6.1
4/20/2012	6.9	7.4		4.2	6.6
4/21/2012	6.9	7.5		4.3	6.7
4/22/2012	7.0	7.5		4.3	6.8
4/23/2012	6.6	7.2		4.1	6.6
4/24/2012	6.2	6.7		3.9	6.2
4/25/2012	5.7	6.2		3.6	5.7
4/26/2012	5.4	5.8		3.5	5.4
4/27/2012	5.2	5.5		3.4	5.2
4/28/2012	5.1	5.4		3.3	4.9
4/29/2012	5.0	5.2		3.3	4.6
4/30/2012	5.1	5.3		3.4	4.7
5/1/2012	4.9	5.1		3.2	4.6
5/2/2012	5.0	5.3		3.3	4.6
5/3/2012	5.1	5.3		3.3	4.5
5/4/2012	5.4	5.6		3.5	4.6
5/5/2012	5.8	6.0		3.8	5.1
5/6/2012	6.1	6.4		4.1	5.5
5/7/2012	6.4	6.6		4.3	5.6
5/8/2012	6.9	7.1		4.7	5.9
5/9/2012	7.3	7.5		5.0	6.3
5/10/2012	7.5	7.7		5.2	6.7
5/11/2012	7.6	7.9		5.3	7.0
5/12/2012	7.6	7.9		5.4	7.1
5/13/2012	7.6	7.9		5.4	7.2
5/14/2012	7.5	7.8		5.4	7.3
5/15/2012	7.4	7.8		5.4	7.3
5/16/2012	7.3	7.7		5.4	7.2
5/17/2012	7.2	7.5		5.4	7.1
5/18/2012	6.9	7.2		5.2	6.9
5/19/2012	6.5	6.8		4.8	6.4

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
5/20/2012	6.2	6.4		4.6	5.9
5/21/2012	6.2	6.3		4.5	5.7
5/22/2012	5.9	6.0		4.2	5.4
5/23/2012	5.5	5.6		3.8	5.1
5/24/2012	5.3	5.4		3.6	4.8
5/25/2012	5.3	5.5		3.7	4.9
5/26/2012	5.8	5.9		4.2	5.2
5/27/2012	6.1	6.2		4.4	5.5
5/28/2012	6.5	6.6		4.9	6.1
5/29/2012	7.1	7.3		5.5	6.8
5/30/2012	7.3	7.6		5.8	7.2
6/1/2012	7.4	7.7		6.0	7.4
6/2/2012	7.5	7.9		6.2	7.7
6/3/2012	6.9	7.3	5.9	5.7	7.2
6/4/2012	6.7	7.1	5.6	5.7	7.1
6/5/2012	6.3	6.7	4.9	5.3	6.7
6/6/2012	5.9	6.3	4.5	4.9	6.1
6/7/2012	5.8	6.1	4.5	4.7	5.8
6/8/2012	5.9	6.1	4.5	4.7	5.8
6/9/2012	5.9	6.0	5.2	4.7	5.6
6/10/2012	6.5	6.6	5.5	5.3	6.3
6/11/2012	6.8	6.9	6.1	5.6	6.6
6/12/2012	7.2	7.3	6.8	6.2	7.1
6/13/2012	7.6	7.7	7.5	6.7	7.6
6/14/2012	8.0	8.2	7.8	7.3	8.3
6/15/2012	8.3	8.5	7.5	7.8	8.7
6/16/2012	8.0	8.3	7.1	7.6	8.6
6/17/2012	7.6	7.9	7.2	7.3	8.1
6/18/2012	7.6	7.9	7.4	7.3	8.1
6/19/2012	7.8	8.1	7.6	7.5	8.3
6/20/2012	8.0	8.3	7.7	7.7	8.6
6/21/2012	8.0	8.4	7.8	7.9	8.8
6/22/2012	8.0	8.4	8.4	7.9	8.8
6/23/2012	8.5	8.8	8.7	8.5	9.4
6/24/2012	8.7	9.0	8.8	8.9	9.7
6/25/2012	8.7	9.1	9.0	9.3	9.9
6/26/2012	8.8	9.2	8.9	9.5	10.1
6/27/2012	8.7	9.1	9.1	9.5	10.1
6/28/2012	9.0	9.3	9.1	9.7	10.3
6/29/2012	9.0	9.3	9.3	9.7	10.4
6/30/2012	9.1	9.4	9.8	9.8	10.6
7/1/2012	9.5	9.8	9.9	10.3	11.0

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
7/2/2012	9.7	10.0	9.9	10.3	11.2
7/3/2012	9.7	10.0	10.3	10.4	11.3
7/4/2012	10.0	10.3	10.6	10.7	11.5
7/5/2012	10.2	10.5	11.0	11.0	11.8
7/6/2012	10.6	10.9	11.2	11.4	12.2
7/7/2012	10.8	11.1	11.7	11.6	12.4
7/8/2012	11.1	11.4	12.0	11.9	12.8
7/9/2012	11.4	11.7	12.3	12.2	13.2
7/10/2012	11.6	11.9	12.4	12.4	13.5
7/11/2012	11.8	12.0	12.1	12.6	13.6
7/12/2012	11.6	11.9	12.2	12.4	13.5
7/13/2012	11.6	11.9	11.9	12.4	13.5
7/14/2012	11.7	11.9	11.8	12.3	13.4
7/15/2012	11.8	12.0	11.8	12.4	13.5
7/16/2012	12.1	12.2	11.7	12.4	13.6
7/17/2012	12.2	12.4	11.6	12.5	13.6
7/18/2012	12.2	12.4	11.9	12.4	13.6
7/19/2012	12.6	12.7	11.9	12.6	13.7
7/20/2012	13.0	13.1	11.9	12.8	13.9
7/21/2012	13.2	13.2	11.6	12.9	13.7
7/22/2012	13.1	13.1	11.3	12.7	13.4
7/23/2012	13.1	13.0	11.2	12.4	13.1
7/24/2012	13.3	13.1	11.2	12.4	13.0
7/25/2012	13.6	13.3	11.0	12.4	13.0
7/26/2012	13.8	13.3	10.9	12.2	12.9
7/27/2012	13.8	13.3	10.9	12.1	12.7
7/28/2012	14.0	13.4	10.9	12.1	12.7
7/29/2012	14.2	13.7	10.8	12.2	12.8
7/30/2012	14.4	13.8	10.5	12.2	12.8
7/31/2012	14.2	13.6	10.2	11.9	12.5
8/1/2012	14.1	13.5	10.1	11.7	12.2
8/2/2012	14.1	13.5	10.0	11.7	12.1
8/3/2012	14.2	13.6	10.0	11.7	12.2
8/4/2012	14.3	13.7	10.1	11.7	12.3
8/5/2012	14.6	13.9	10.1	11.8	12.5
8/6/2012	14.6	13.9	10.2	11.7	12.5
8/7/2012	14.8	14.0	10.2	11.8	12.7
8/8/2012	14.9	14.1	10.2	11.8	12.8
8/9/2012	15.0	14.2	10.2	11.8	12.8
8/10/2012	14.9	14.1	10.1	11.7	12.7
8/11/2012	14.8	14.0	9.8	11.6	12.6
8/12/2012	14.5	13.8	9.8	11.4	12.3

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
8/13/2012	14.6	13.9	9.8	11.4	12.3
8/14/2012	14.6	13.9	9.7	11.3	12.3
8/15/2012	14.5	13.8	9.6	11.3	12.3
8/16/2012	14.4	13.7	9.4	11.2	12.3
8/17/2012	14.3	13.7	9.2	11.0	12.3
8/18/2012	14.1	13.4	9.2	10.9	12.3
8/19/2012	14.1	13.4	9.0	10.8	12.3
8/20/2012	13.9	13.2	8.8	10.6	12.0
8/21/2012		13.1	8.4	10.4	11.8
8/22/2012		12.9	8.2	10.1	11.4
8/23/2012		12.6	8.1	9.8	11.0
8/24/2012		12.5	8.0	9.7	10.7
8/25/2012		12.6	7.8	9.7	10.5
8/26/2012		12.6	7.6	9.6	10.3
8/27/2012		12.5	7.4	9.4	10.1
8/28/2012		12.3	7.6	9.2	9.9
8/29/2012		12.3	7.5	9.4	10.1
8/30/2012		12.3	7.2	9.3	10.0
8/31/2012		11.9	6.9	9.1	9.7
9/1/2012		11.6	6.7	8.8	9.4
9/2/2012		11.4	6.7	8.6	9.2
9/3/2012		11.3	6.6	8.6	9.2
9/4/2012		11.3	6.5	8.5	9.1
9/5/2012		11.1	6.6	8.3	9.0
9/6/2012		11.2	6.7	8.4	9.1
9/7/2012		11.5	6.7	8.5	9.3
9/8/2012		11.4	6.4	8.4	9.2
9/9/2012		11.1	6.1	8.1	8.8
9/10/2012		10.8	5.9	7.8	8.5
9/11/2012		10.5	5.9	7.7	8.2
9/12/2012		10.3	5.9	7.7	8.3
9/13/2012		10.1	5.7	7.5	8.2
9/14/2012		9.9	5.6	7.3	8.1
9/15/2012		9.8	5.8	7.3	8.1
9/16/2012		9.9	6.1	7.5	8.4
9/17/2012		10.2	6.2	7.7	8.8
9/18/2012		10.3	6.2	7.7	9.0
9/19/2012		10.3	6.2	7.6	9.0
9/20/2012		10.2	6.2	7.6	9.0
9/21/2012		9.9	6.3	7.5	8.9
9/22/2012		10.0	6.4	7.6	9.0
9/23/2012		10.0	6.3	7.6	9.1

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
9/24/2012		9.9	6.3	7.4	9.0
9/25/2012		9.7	6.4	7.4	8.9
9/26/2012		9.7	6.3	7.4	9.0
9/27/2012		9.8	6.2	7.3	8.9
9/27/2012		9.8	6.3	7.4	8.9
9/28/2012		9.9	6.2	7.3	8.9
9/29/2012		9.8	6.0	7.2	8.7
9/30/2012		9.6	5.7	7.1	8.5
10/1/2012		9.2	5.2	6.7	8.1
10/2/2012		8.7	4.6	6.2	7.5
10/3/2012		8.2	4.0	5.6	6.6
10/4/2012		7.5	3.6	5.0	5.8
10/5/2012		6.9	3.3	4.6	5.2
10/6/2012		6.5	3.0	4.3	4.7
10/7/2012		6.1	3.1	3.9	4.3
10/8/2012		6.1	3.2	4.0	4.4
10/9/2012		6.3	3.5	4.1	4.6
10/10/2012		6.5	3.9	4.4	4.9
10/11/2012		6.9	4.3	4.8	5.5
10/12/2012		7.4	4.7	5.1	5.9
10/13/2012		7.7	5.0	5.4	6.4
10/14/2012		7.9	4.8	5.6	6.7
10/15/2012		7.7	4.8	5.4	6.4
10/16/2012		7.6	4.9	5.3	6.4
10/17/2012		7.7	4.8	5.3	6.5
10/18/2012		7.5	4.3	5.2	6.3
10/19/2012		6.8	3.8	4.7	5.6
10/20/2012		6.1	3.3	4.1	4.9
10/21/2012		5.4	3.3	3.5	4.1
10/22/2012			3.0	3.3	3.9
10/23/2012			2.5	3.0	3.5
10/24/2012			2.2	2.5	2.8
10/25/2012			2.4	2.2	2.5
10/26/2012			2.7	2.3	2.8
10/27/2012			3.1	2.6	3.2
10/28/2012			3.4	3.0	3.8
10/29/2012			3.7	3.4	4.3
10/30/2012			3.9	3.7	4.7
10/31/2012			4.2	4.0	5.1
11/1/2012			4.3	4.2	5.4
11/2/2012			4.4	4.4	5.6
11/3/2012			4.4	4.4	5.6

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
11/4/2012			4.3	4.5	5.7
11/5/2012			4.0	4.3	5.6
11/6/2012			3.7	4.1	5.2
11/7/2012			3.2	3.8	4.8
11/8/2012			2.7	3.3	3.9
11/9/2012			2.3	2.7	3.1
11/10/2012			1.9	2.4	2.5
11/11/2012			1.6	2.0	1.9
11/12/2012			1.6	1.8	1.5
11/13/2012			1.8	1.8	1.4
11/14/2012			2.1	2.0	1.7
11/15/2012			2.2	2.2	2.3
11/16/2012			2.3	2.3	2.6
11/17/2012			2.4	2.4	2.8
11/18/2012			2.4	2.3	3.0
11/19/2012			2.3	2.3	3.1
11/20/2012			2.3	2.2	3.0
11/21/2012			2.3	2.1	2.9
11/22/2012			2.4	2.0	2.8
11/23/2012			2.1	2.1	2.9
11/24/2012			2.0	1.9	2.3
11/25/2012			2.0	1.8	1.9
11/26/2012			2.1	1.9	1.9
11/27/2012			2.2	2.0	2.2
11/28/2012			2.1	2.0	2.4
11/29/2012			2.2	1.9	2.4
11/30/2012			2.4	1.9	2.6
12/1/2012			2.5	2.1	3.0
12/2/2012			2.6	2.1	3.4
12/3/2012			2.4	2.1	3.5
12/4/2012			2.2	2.0	3.2
12/5/2012			1.9	1.9	3.0
12/6/2012			1.8	1.7	2.6
12/7/2012			1.8	1.7	2.2
12/8/2012			1.7	1.7	2.1
12/9/2012			1.5	1.6	1.9
12/10/2012			1.4	1.6	1.5
12/11/2012			1.4	1.5	1.3
12/12/2012			1.4	1.5	1.1
12/13/2012			1.4	1.5	1.1
12/14/2012			1.3	1.5	1.1
12/15/2012			1.2	1.4	1.0

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
12/16/2012			1.1	1.3	0.7
12/17/2012			1.2	1.2	0.4
12/18/2012			1.3	1.3	0.4
12/19/2012			1.4	1.3	0.5
12/20/2012			1.5	1.3	0.6
12/21/2012			1.6	1.4	0.6
12/22/2012			1.6	1.4	0.6
12/23/2012			1.7	1.4	0.6
12/24/2012			1.8	1.5	0.8
12/25/2012			1.8	1.5	0.9
12/26/2012			1.8	1.5	0.9
12/27/2012			1.7	1.5	0.7
12/28/2012			1.7	1.5	0.6
12/29/2012			1.7	1.4	0.4
12/30/2012			1.7	1.4	0.4
12/31/2012			1.7	1.4	0.2
1/1/2013			1.7	1.4	0.1
1/2/2013			1.8	1.5	0.1
1/3/2013			1.8	1.5	0.2
1/4/2013			1.9	1.6	0.3
1/5/2013			2.0	1.7	0.5
1/6/2013			2.1	1.8	0.8
1/7/2013			1.9	1.9	1.1
1/8/2013			1.8	1.8	1.1
1/9/2013			1.6	1.7	1.0
1/10/2013			1.4	1.6	0.9
1/11/2013			1.4	1.4	0.7
1/12/2013			1.3	1.4	0.5
1/13/2013			1.2	1.3	0.4
1/14/2013			1.4	1.2	0.2
1/15/2013			1.5	1.3	0.3
1/16/2013			1.7	1.5	0.5
1/17/2013			1.9	1.6	0.6
1/18/2013			1.9	1.7	0.8
1/19/2013			1.9	1.7	1.0
1/20/2013			2.0	1.7	1.0
1/21/2013			2.0	1.8	1.1
1/22/2013			2.1	1.8	1.2
1/23/2013			2.1	1.9	1.3
1/24/2013			2.0	1.9	1.4
1/25/2013			1.9	1.9	1.5
1/26/2013			1.8	1.9	1.4

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
1/27/2013			1.8	1.8	1.4
1/28/2013			1.8	1.8	1.4
1/29/2013			1.7	1.9	1.4
1/30/2013			1.6	1.8	1.4
1/31/2013			1.7	1.8	1.3
2/1/2013			1.9	1.8	1.3
2/2/2013			2.0	1.9	1.4
2/3/2013			1.9	2.0	1.5
2/4/2013			1.9	2.0	1.5
2/5/2013			1.8	2.0	1.5
2/6/2013			1.8	1.9	1.4
2/7/2013			1.7	1.9	1.4
2/8/2013			1.6	1.9	1.4
2/9/2013			1.5	1.8	1.3
2/10/2013			1.5	1.7	1.2
2/11/2013			1.6	1.7	1.2
2/12/2013			1.6	1.7	1.2
2/13/2013			1.7	1.7	1.2
2/14/2013			1.8	1.8	1.2
2/15/2013			1.8	1.8	1.3
2/16/2013			1.7	1.8	1.2
2/17/2013			1.6	1.8	1.2
2/18/2013			1.6	1.7	1.1
2/19/2013			1.6	1.7	0.9
2/20/2013			1.4	1.7	0.9
2/21/2013			1.4	1.6	0.8
2/22/2013			1.5	1.5	0.7
2/23/2013			1.4	1.6	0.8
2/24/2013			1.5	1.5	0.7
2/25/2013			1.6	1.5	0.7
2/26/2013			1.6	1.6	0.8
2/27/2013			1.8	1.7	0.9
2/28/2013			1.9	1.9	1.1
3/1/2013			1.8	2.0	1.3
3/2/2013			1.8	1.9	1.3
3/3/2013			1.9	2.1	1.4
3/4/2013			1.8	2.1	1.6
3/5/2013			1.7	2.0	1.6
3/6/2013			1.5	1.9	1.5
3/7/2013			1.5	1.7	1.3
3/8/2013			1.7	1.7	1.3
3/9/2013			1.8	1.9	1.5

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
3/10/2013			2.0	2.0	1.7
3/11/2013			2.2	2.2	1.9
3/12/2013			2.4	2.4	2.3
3/13/2013			2.5	2.6	2.7
3/14/2013			2.4	2.8	3.0
3/15/2013			2.2	2.8	3.0
3/16/2013			2.1	2.7	2.9
3/17/2013			2.0	2.5	2.7
3/18/2013			1.7	2.4	2.6
3/19/2013			1.4	2.2	2.3
3/20/2013			1.2	1.9	1.8
3/21/2013			1.2	1.7	1.3
3/22/2013			1.3	1.6	1.0
3/23/2013			1.4	1.6	1.0
3/24/2013			1.5	1.7	1.2
3/25/2013			1.8	1.8	1.3
3/26/2013			2.1	2.1	1.7
3/27/2013			2.4	2.4	2.3
3/28/2013			2.7	2.7	3.0
3/29/2013			2.9	3.0	3.6
3/30/2013			3.0	3.2	4.1
3/31/2013			3.2	3.3	4.4
4/1/2013			3.2	3.5	4.7
4/2/2013			3.3	3.5	4.8
4/3/2013			3.3	3.5	4.9
4/4/2013			3.3	3.5	4.9
4/5/2013			3.1	3.4	4.8
4/6/2013			2.9	3.2	4.4
4/7/2013			3.0	3.1	4.2
4/8/2013			2.8	3.0	4.1
4/9/2013			2.7	2.9	3.8
4/10/2013			2.6	2.9	3.7
4/11/2013			2.4	2.8	3.6
4/12/2013			2.3	2.7	3.3
4/13/2013			2.1	2.6	3.1
4/14/2013			1.8	2.4	2.9
4/15/2013			1.8	2.2	2.4
4/16/2013			1.8	2.2	2.4
4/17/2013			2.0	2.2	2.4
4/18/2013			2.3	2.4	2.6
4/19/2013			2.4	2.7	3.0
4/20/2013			2.6	2.9	3.3

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
4/21/2013			2.8	3.0	3.4
4/22/2013			3.1	3.2	3.8
4/23/2013			3.3	3.5	4.1
4/24/2013			3.5	3.7	4.4
4/25/2013			3.7	3.8	4.6
4/26/2013			3.9	3.9	4.8
4/27/2013			3.8	4.0	5.1
4/28/2013			3.8	4.0	5.1
4/29/2013			3.8	3.9	4.9
4/30/2013			3.8	3.9	4.9
5/1/2013			3.7	3.9	4.9
5/2/2013			3.8	3.8	4.8
5/3/2013			4.2	3.8	4.8
5/4/2013			4.8	4.0	5.2
5/5/2013			5.3	4.5	5.8
5/6/2013			5.6	4.9	6.5
5/7/2013			5.9	5.0	6.9
5/8/2013			6.3	5.1	7.1
5/9/2013			6.5	5.3	7.4
5/10/2013			6.5	5.5	7.7
5/11/2013			6.6	5.4	7.7
5/12/2013			6.5	5.4	7.5
5/13/2013			6.3	5.3	7.3
5/14/2013			5.9	5.1	7.0
5/15/2013			5.6	4.9	6.6
5/16/2013			5.2	4.6	6.3
5/17/2013			5.4	4.3	5.8
5/18/2013			5.3	4.4	5.8
5/19/2013			4.8	4.4	5.7
5/20/2013			4.6	4.2	5.5
5/21/2013			4.4	4.1	5.3
5/22/2013			4.5	4.0	5.2
5/23/2013			4.5	4.1	5.2
5/24/2013			4.1	4.2	5.3
5/25/2013			3.9	4.1	5.1
5/26/2013			4.1	4.0	5.0
5/27/2013			4.3	4.2	5.2
5/28/2013			4.9	4.3	5.3
5/29/2013			5.1	4.6	5.6
5/30/2013			5.4	4.9	5.9
5/31/2013			5.8	5.2	6.1
6/1/2013			6.4	5.5	6.4

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
6/2/2013			7.0	5.9	6.8
6/3/2013			7.8	6.5	7.3
6/4/2013			8.0	7.1	8.0
6/5/2013			8.4	7.5	8.5
6/6/2013			8.7	7.8	8.8
6/7/2013			8.8	8.3	9.2
6/8/2013			8.7	8.5	9.4
6/9/2013			8.3	8.5	9.4
6/10/2013			7.8	8.2	9.2
6/11/2013			7.5	7.9	8.8
6/12/2013			7.5	7.7	8.6
6/13/2013			7.6	7.7	8.7
6/14/2013			7.8	7.9	8.9
6/15/2013			7.8	8.2	9.2
6/16/2013			7.6	8.5	9.5
6/17/2013			7.8	8.6	9.5
6/18/2013			7.5	8.8	9.7
6/19/2013			7.3	8.6	9.5
6/20/2013			7.0	8.4	9.3
6/21/2013			6.6	8.2	9.0
6/22/2013			6.5	7.8	8.6
6/23/2013			6.9	7.5	8.3
6/24/2013			7.5	7.6	8.5
6/25/2013			8.8	8.0	9.0
6/26/2013			9.4	8.9	9.9
6/27/2013			10.4	9.6	10.6
6/28/2013			11.5	10.3	11.3
6/29/2013			12.4	11.1	12.1
6/30/2013			13.3	11.8	13.0
7/1/2013			13.4	12.6	13.7
7/2/2013			13.2	12.7	14.0
7/3/2013			13.0	12.5	13.7
7/4/2013			12.7	12.3	13.6
7/5/2013			12.3	12.2	13.5
7/6/2013			12.1	12.0	13.2
7/7/2013			11.9	11.9	13.1
7/8/2013			11.6	11.9	13.0
7/9/2013			11.3	11.7	12.8
7/10/2013			11.1	11.8	12.8
7/11/2013			11.0	11.7	12.7
7/12/2013			11.0	11.7	12.6
7/13/2013			10.9	11.7	12.6

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
7/14/2013			10.9	11.7	12.6
7/15/2013			11.3	11.8	12.6
7/16/2013			11.6	12.1	12.9
7/17/2013			11.8	12.4	13.1
7/18/2013			11.8	12.6	13.3
7/19/2013			11.7	12.7	13.3
7/20/2013			11.6	12.7	13.3
7/21/2013			11.3	12.7	13.2
7/22/2013			11.1	12.5	13.0
7/23/2013			10.8	12.4	12.9
7/24/2013			10.7	12.2	12.8
7/25/2013			10.5	12.1	12.7
7/26/2013			10.2	11.9	12.6
7/27/2013			10.0	11.8	12.4
7/28/2013			9.8	11.6	12.3
7/29/2013			9.5	11.3	12.1
7/30/2013			9.2	11.0	11.8
7/31/2013			9.0	10.7	11.5
8/1/2013			9.0	10.4	11.3
8/2/2013			9.1	10.4	11.4
8/3/2013			9.2	10.3	11.4
8/4/2013			9.3	10.3	11.4
8/5/2013			9.6	10.5	11.4
8/6/2013			9.7	10.7	11.6
8/7/2013			9.8	11.0	11.9
8/8/2013			9.9	11.1	12.0
8/9/2013			9.9	11.2	12.2
8/10/2013			9.8	11.2	12.2
8/11/2013			9.8	11.2	12.3
8/12/2013			9.8	11.2	12.3
8/13/2013			9.9	11.2	12.4
8/14/2013			9.8	11.2	12.4
8/15/2013			9.7	11.1	12.4
8/16/2013			9.7	11.1	12.3
8/17/2013			9.7	11.1	12.3
8/18/2013			9.6	11.0	12.2
8/19/2013			9.5	10.9	12.1
8/20/2013			9.4	10.8	12.1
8/21/2013			9.4	10.8	12.0
8/22/2013			9.2	10.7	12.0
8/23/2013			9.0	10.6	11.9
8/24/2013			9.0	10.5	11.7

Table B-2. 7-DAD Max Water Temperature Values (°C) at Sites WFI, WRC, RPI, EFI, and BPL During the Study Period. (See Table B-1 for 7-DAD Max Values at Site BPU).

Date	West Fork Inflow (WFI)	Wallowa River (WRC)	Royal Purple Inflow (RPI)	East Fork Inflow (EFI)	Bypassed Reach: Lower (BPL)
8/25/2013			9.0	10.4	11.7
8/26/2013			9.0	10.4	11.7
8/27/2013			8.9	10.4	11.6
8/28/2013			8.9	10.2	11.5
8/29/2013			8.8	10.1	11.4
8/30/2013			9.0	10.1	11.4
8/31/2013			9.1	10.1	11.4
9/1/2013			9.2	10.1	11.5
9/2/2013			9.2	10.1	11.6
9/3/2013			9.1	10.1	11.7
9/4/2013			8.9	10.1	11.6
9/5/2013			8.8	9.9	11.4
9/6/2013			8.6	9.8	11.2
9/7/2013			8.3	9.7	11.0
9/8/2013			8.1	9.6	10.8
9/9/2013			8.0	9.4	10.5
9/10/2013			8.0	9.2	10.4
9/11/2013			8.1	9.3	10.5
9/12/2013			8.3	9.4	10.6
9/13/2013			8.3	9.5	10.9
9/14/2013			8.2	9.6	10.9
9/15/2013			7.8	9.3	10.7
9/16/2013			7.4	8.9	10.3
9/17/2013			7.1	8.5	9.7
9/18/2013			6.7	8.1	9.3
9/19/2013			6.3	7.7	8.9
9/20/2013			5.9	7.2	8.3
9/21/2013			5.7	6.8	7.9
9/22/2013			5.4	6.6	7.6
9/23/2013			5.0	6.3	7.2
9/24/2013			4.6	5.8	6.7
9/25/2013			4.3	5.4	6.4
9/26/2013			4.0	5.0	6.1
9/27/2013			3.7	4.7	5.8
9/28/2013			3.5	4.4	5.5
9/29/2013			3.3	4.3	5.3
9/30/2013			3.3	4.2	5.2

Appendix C
Dissolved Oxygen Data

Table C-1. Dissolved Oxygen Measurements (in mg/L and % saturation) at East Fork Inflow Site (EFI) During the 72-hour Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)
9/25/2012	9:00	6.0	10.9	109.2
9/25/2012	9:30	6.2	11.0	110.7
9/25/2012	10:00	6.4	11.1	111.3
9/25/2012	10:30	6.6	11.0	111.4
9/25/2012	11:00	6.9	10.9	111.4
9/25/2012	11:30	7.2	10.9	112.0
9/25/2012	12:00	7.4	10.8	111.4
9/25/2012	12:30	7.5	10.7	110.9
9/25/2012	13:00	7.7	10.7	111.3
9/25/2012	13:30	7.8	10.6	110.7
9/25/2012	14:00	7.8	10.6	110.3
9/25/2012	14:30	7.8	10.6	110.7
9/25/2012	15:00	7.8	10.5	110.0
9/25/2012	15:30	7.8	10.5	109.7
9/25/2012	16:00	7.8	10.5	109.9
9/25/2012	16:30	7.7	10.5	109.3
9/25/2012	17:00	7.6	10.5	108.9
9/25/2012	17:30	7.6	10.5	109.3
9/25/2012	18:00	7.5	10.5	108.9
9/25/2012	18:30	7.3	10.6	108.9
9/25/2012	19:00	7.2	10.6	108.8
9/25/2012	19:30	7.0	10.6	108.7
9/25/2012	20:00	6.9	10.7	108.5
9/25/2012	20:30	6.7	10.7	108.5
9/25/2012	21:00	6.6	10.7	108.5
9/25/2012	21:30	6.4	10.7	108.0
9/25/2012	22:00	6.3	10.7	107.9
9/25/2012	22:30	6.1	10.8	107.9
9/25/2012	23:00	6.0	10.9	108.4
9/25/2012	23:30	5.9	10.9	108.0
9/26/2012	0:00	5.8	10.9	108.4
9/26/2012	0:30	5.7	11.0	108.7
9/26/2012	1:00	5.6	11.0	108.8
9/26/2012	1:30	5.5	11.0	108.3
9/26/2012	2:00	5.3	11.1	108.7
9/26/2012	2:30	5.2	11.1	108.2
9/26/2012	3:00	5.2	11.1	108.2
9/26/2012	3:30	5.1	11.2	108.7
9/26/2012	4:00	5.0	11.2	108.9
9/26/2012	4:30	4.9	11.3	109.0
9/26/2012	5:00	4.8	11.2	108.5
9/26/2012	5:30	4.7	11.2	108.4

Table C-1. Dissolved Oxygen Measurements (in mg/L and % saturation) at East Fork Inflow Site (EFI) During the 72-hour Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)
9/26/2012	6:00	4.7	11.3	108.9
9/26/2012	6:30	4.6	11.3	108.7
9/26/2012	7:00	4.6	11.4	109.4
9/26/2012	7:30	4.5	11.4	109.3
9/26/2012	8:00	4.5	11.4	109.4
9/26/2012	8:30	4.5	11.4	109.7
9/26/2012	9:00	4.6	11.4	110.0
9/26/2012	9:30	4.9	11.4	110.9
9/26/2012	10:00	5.1	11.4	111.4
9/26/2012	10:30	5.4	11.3	110.8
9/26/2012	11:00	5.7	11.2	111.1
9/26/2012	11:30	6.0	11.2	111.1
9/26/2012	12:00	6.2	11.1	110.9
9/26/2012	12:30	6.4	11.0	111.1
9/26/2012	13:00	6.5	10.9	110.4
9/26/2012	13:30	6.7	10.9	110.5
9/26/2012	14:00	6.8	10.8	109.9
9/26/2012	14:30	6.8	10.8	110.0
9/26/2012	15:00	6.7	10.8	109.5
9/26/2012	15:30	6.7	10.8	109.8
9/26/2012	16:00	6.7	10.8	109.8
9/26/2012	16:30	6.6	10.8	109.7
9/26/2012	17:00	6.5	10.8	109.5
9/26/2012	17:30	6.5	10.8	108.8
9/26/2012	18:00	6.4	10.8	108.9
9/26/2012	18:30	6.3	10.8	108.3
9/26/2012	19:00	6.2	10.8	108.2
9/26/2012	19:30	6.0	10.9	108.7
9/26/2012	20:00	5.9	10.9	108.3
9/26/2012	20:30	5.8	10.9	108.3
9/26/2012	21:00	5.7	10.9	108.2
9/26/2012	21:30	5.6	11.0	108.7
9/26/2012	22:00	5.4	11.0	108.3
9/26/2012	22:30	5.3	11.1	108.8
9/26/2012	23:00	5.2	11.2	109.2
9/26/2012	23:30	5.1	11.1	108.5
9/27/2012	0:00	5.0	11.2	109.0
9/27/2012	0:30	4.9	11.3	109.2
9/27/2012	1:00	4.8	11.3	109.3
9/27/2012	1:30	4.7	11.3	109.4
9/27/2012	2:00	4.6	11.4	109.5
9/27/2012	2:30	4.5	11.4	109.4
9/27/2012	3:00	4.5	11.4	109.5

Table C-1. Dissolved Oxygen Measurements (in mg/L and % saturation) at East Fork Inflow Site (EFI) During the 72-hour Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)
9/27/2012	3:30	4.4	11.4	109.5
9/27/2012	4:00	4.3	11.5	109.5
9/27/2012	4:30	4.3	11.4	108.9
9/27/2012	5:00	4.2	11.5	109.3
9/27/2012	5:30	4.2	11.5	109.5
9/27/2012	6:00	4.1	11.5	109.7
9/27/2012	6:30	4.1	11.6	109.8
9/27/2012	7:00	4.1	11.5	109.4
9/27/2012	7:30	4.0	11.6	109.9
9/27/2012	8:00	4.0	11.6	110.4
9/27/2012	8:30	4.1	11.7	110.8
9/27/2012	9:00	4.2	11.6	110.3
9/27/2012	9:30	4.5	11.5	110.3
9/27/2012	10:00	4.8	11.4	110.7
9/27/2012	10:30	5.2	11.3	110.8
9/27/2012	11:00	5.5	11.2	110.7
9/27/2012	11:30	5.8	11.2	110.9
9/27/2012	12:00	6.1	11.1	111.3
9/27/2012	12:30	6.4	11.1	111.4
9/27/2012	13:00	6.6	10.9	110.4
9/27/2012	13:30	6.8	10.8	110.0
9/27/2012	14:00	6.8	10.8	110.2
9/27/2012	14:30	6.9	10.8	109.8
9/27/2012	15:00	7.1	10.7	109.4
9/27/2012	15:30	7.1	10.7	109.3
9/27/2012	16:00	7.1	10.6	109.0
9/27/2012	16:30	7.1	10.6	108.8
9/27/2012	17:00	7.0	10.7	109.0
9/27/2012	17:30	7.0	10.7	109.0
9/27/2012	18:00	6.9	10.6	108.2
9/27/2012	18:30	6.8	10.7	108.4
9/27/2012	19:00	6.7	10.6	107.8
9/27/2012	19:30	6.6	10.6	107.7
9/27/2012	20:00	6.4	10.7	108.2
9/27/2012	20:30	6.3	10.7	107.7
9/27/2012	21:00	6.2	10.8	108.2
9/27/2012	21:30	6.1	10.8	108.3
9/27/2012	22:00	6.0	10.8	107.8
9/27/2012	22:30	5.9	10.8	107.7
9/27/2012	23:00	5.9	10.8	107.5
9/27/2012	23:30	5.8	10.9	108.0
9/28/2012	0:00	5.8	10.9	107.7
9/28/2012	0:30	5.8	10.9	108.0

Table C-1. Dissolved Oxygen Measurements (in mg/L and % saturation) at East Fork Inflow Site (EFI) During the 72-hour Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)
9/28/2012	1:00	5.8	10.9	107.5
9/28/2012	1:30	5.8	10.8	107.3
9/28/2012	2:00	5.8	10.8	107.3
9/28/2012	2:30	5.8	10.8	107.2
9/28/2012	3:00	5.8	10.9	107.8
9/28/2012	3:30	5.8	10.8	107.4
9/28/2012	4:00	5.8	10.8	107.2
9/28/2012	4:30	5.8	10.8	107.1
9/28/2012	5:00	5.9	10.8	107.7
9/28/2012	5:30	5.9	10.9	107.9
9/28/2012	6:00	5.9	10.8	107.4
9/28/2012	6:30	5.9	10.8	107.3
9/28/2012	7:00	5.9	10.9	108.2
9/28/2012	7:30	5.9	10.8	107.9
9/28/2012	8:00	6.0	10.9	108.8
9/28/2012	8:30	6.2	10.8	108.7
9/28/2012	9:00	6.4	10.8	108.9

Table C-2. Dissolved Oxygen Measurements (in mg/L and % saturation) at East Fork Inflow Site (EFI) During the 72-hour Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)
10/26/2012	10:30	1.7	12.7	112.5
10/26/2012	11:00	1.7	12.7	112.5
10/26/2012	11:30	1.7	12.7	112.5
10/26/2012	12:00	1.7	12.6	111.1
10/26/2012	12:30	1.6	12.6	110.9
10/26/2012	13:00	1.6	12.6	110.7
10/26/2012	13:30	1.6	12.7	112.0
10/26/2012	14:00	1.5	12.6	110.7
10/26/2012	14:30	1.5	12.6	110.9
10/26/2012	15:00	1.5	12.7	111.7
10/26/2012	15:30	1.4	12.6	110.7
10/26/2012	16:00	1.4	12.7	111.7
10/26/2012	16:30	1.4	12.7	111.9
10/26/2012	17:00	1.5	12.6	110.6
10/26/2012	17:30	1.5	12.7	111.6
10/26/2012	18:00	1.6	12.5	110.6
10/26/2012	18:30	1.6	12.6	111.5
10/26/2012	19:00	1.6	12.7	111.7
10/26/2012	19:30	1.6	12.7	111.9
10/26/2012	20:00	1.6	12.7	111.9
10/26/2012	20:30	1.7	12.5	110.7
10/26/2012	21:00	1.7	12.5	110.2
10/26/2012	21:30	1.7	12.5	110.2
10/26/2012	22:00	1.7	12.4	110.0
10/26/2012	22:30	1.7	12.4	109.9
10/26/2012	23:00	1.7	12.4	109.9
10/26/2012	23:30	1.7	12.5	111.0
10/27/2012	0:00	1.7	12.6	111.4
10/27/2012	0:30	1.7	12.5	110.4
10/27/2012	1:00	1.7	12.6	111.1
10/27/2012	1:30	1.7	12.6	111.4
10/27/2012	2:00	1.7	12.5	110.4
10/27/2012	2:30	1.7	12.6	111.2
10/27/2012	3:00	1.7	12.4	110.2
10/27/2012	3:30	1.8	12.5	111.1
10/27/2012	4:00	1.8	12.5	111.4
10/27/2012	4:30	1.8	12.6	111.5
10/27/2012	5:00	1.8	12.4	110.5
10/27/2012	5:30	1.8	12.4	109.9
10/27/2012	6:00	1.9	12.4	109.8
10/27/2012	6:30	1.9	12.5	111.0
10/27/2012	7:00	1.9	12.4	110.1
10/27/2012	7:30	2.0	12.3	109.8

Table C-2. Dissolved Oxygen Measurements (in mg/L and % saturation) at East Fork Inflow Site (EFI) During the 72-hour Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)
10/27/2012	8:00	2.1	12.4	111.1
10/27/2012	8:30	2.1	12.3	110.1
10/27/2012	9:00	2.2	12.2	109.9
10/27/2012	9:30	2.3	12.3	110.9
10/27/2012	10:00	2.3	12.3	111.1
10/27/2012	10:30	2.4	12.3	111.2
10/27/2012	11:00	2.4	12.2	110.0
10/27/2012	11:30	2.4	12.2	109.8
10/27/2012	12:00	2.5	12.2	110.6
10/27/2012	12:30	2.5	12.1	109.9
10/27/2012	13:00	2.6	12.1	109.5
10/27/2012	13:30	2.7	12.0	109.1
10/27/2012	14:00	2.7	12.0	109.1
10/27/2012	14:30	2.7	12.1	110.1
10/27/2012	15:00	2.8	12.0	109.3
10/27/2012	15:30	2.7	12.1	110.0
10/27/2012	16:00	2.7	12.0	109.1
10/27/2012	16:30	2.7	12.1	109.9
10/27/2012	17:00	2.7	12.1	110.1
10/27/2012	17:30	2.7	12.1	110.5
10/27/2012	18:00	2.7	12.1	110.5
10/27/2012	18:30	2.8	12.0	109.3
10/27/2012	19:00	2.8	11.9	108.9
10/27/2012	19:30	2.8	12.1	109.9
10/27/2012	20:00	2.8	12.1	110.2
10/27/2012	20:30	2.8	12.1	110.5
10/27/2012	21:00	2.8	12.1	110.4
10/27/2012	21:30	2.8	12.1	110.4
10/27/2012	22:00	2.8	12.1	110.5
10/27/2012	22:30	2.8	12.1	110.4
10/27/2012	23:00	2.8	12.0	109.4
10/27/2012	23:30	2.8	11.9	108.9
10/28/2012	0:00	2.8	11.9	108.6
10/28/2012	0:30	2.8	11.9	108.5
10/28/2012	1:00	2.8	12.0	109.6
10/28/2012	1:30	2.8	12.1	110.1
10/28/2012	2:00	2.9	12.1	110.2
10/28/2012	2:30	2.8	12.1	110.4
10/28/2012	3:00	2.8	12.1	110.5
10/28/2012	3:30	2.8	12.0	109.4
10/28/2012	4:00	2.9	12.0	110.0
10/28/2012	4:30	2.9	11.9	109.1
10/28/2012	5:00	2.9	11.9	108.8

Table C-2. Dissolved Oxygen Measurements (in mg/L and % saturation) at East Fork Inflow Site (EFI) During the 72-hour Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)
10/28/2012	5:30	2.9	12.0	110.0
10/28/2012	6:00	2.9	12.1	110.2
10/28/2012	6:30	2.8	12.1	110.5
10/28/2012	7:00	2.8	12.1	110.5
10/28/2012	7:30	2.8	12.1	110.7
10/28/2012	8:00	2.9	12.0	109.8
10/28/2012	8:30	3.0	11.9	109.1
10/28/2012	9:00	3.1	12.0	109.9
10/28/2012	9:30	3.2	11.9	109.4
10/28/2012	10:00	3.3	11.8	109.1
10/28/2012	10:30	3.4	11.9	109.9
10/28/2012	11:00	3.4	11.8	109.1
10/28/2012	11:30	3.4	11.7	109.0
10/28/2012	12:00	3.5	11.7	108.8
10/28/2012	12:30	3.6	11.7	108.6
10/28/2012	13:00	3.6	11.8	109.8
10/28/2012	13:30	3.6	11.7	109.0
10/28/2012	14:00	3.6	11.8	109.8
10/28/2012	14:30	3.6	11.8	110.1
10/28/2012	15:00	3.6	11.7	109.1
10/28/2012	15:30	3.6	11.8	109.8
10/28/2012	16:00	3.5	11.8	109.9
10/28/2012	16:30	3.5	11.7	108.9
10/28/2012	17:00	3.5	11.7	108.4
10/28/2012	17:30	3.5	11.6	108.1
10/28/2012	18:00	3.4	11.7	108.0
10/28/2012	18:30	3.4	11.8	109.3
10/28/2012	19:00	3.4	11.8	109.6
10/28/2012	19:30	3.3	11.9	109.9
10/28/2012	20:00	3.3	11.9	110.0
10/28/2012	20:30	3.3	11.8	109.1
10/28/2012	21:00	3.3	11.9	109.8
10/28/2012	21:30	3.3	11.8	108.9
10/28/2012	22:00	3.3	11.9	109.8
10/28/2012	22:30	3.3	11.8	108.8
10/28/2012	23:00	3.3	11.9	109.6
10/28/2012	23:30	3.3	11.8	108.6
10/29/2012	0:00	3.3	11.8	109.5
10/29/2012	0:30	3.3	11.9	109.8
10/29/2012	1:00	3.3	11.8	108.8
10/29/2012	1:30	3.4	11.8	109.5
10/29/2012	2:00	3.4	11.8	109.6
10/29/2012	2:30	3.4	11.7	108.6

Table C-2. Dissolved Oxygen Measurements (in mg/L and % saturation) at East Fork Inflow Site (EFI) During the 72-hour Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)
10/29/2012	3:00	3.4	11.8	109.4
10/29/2012	3:30	3.4	11.8	109.6
10/29/2012	4:00	3.4	11.9	109.9
10/29/2012	4:30	3.4	11.9	110.0
10/29/2012	5:00	3.4	11.9	110.0
10/29/2012	5:30	3.4	11.9	109.9
10/29/2012	6:00	3.4	11.9	109.9
10/29/2012	6:30	3.4	11.9	109.9
10/29/2012	7:00	3.4	11.8	108.9
10/29/2012	7:30	3.4	11.7	108.6
10/29/2012	8:00	3.4	11.7	108.5
10/29/2012	8:30	3.5	11.8	109.5
10/29/2012	9:00	3.6	11.7	108.8
10/29/2012	9:30	3.7	11.6	108.6
10/29/2012	10:00	3.8	11.6	108.4
10/29/2012	10:30	3.9	11.7	109.5

Table C-3. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of August 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
8/20/2012	15:30	10.3	8.9	98.7
8/20/2012	16:00	10.4	8.9	98.9
8/20/2012	16:30	10.3	8.9	98.8
8/20/2012	17:00	10.3	8.9	98.8
8/20/2012	17:30	10.2	8.9	98.8
8/20/2012	18:00	10.1	9.0	98.7
8/20/2012	18:30	10.1	9.0	98.6
8/20/2012	19:00	10.0	9.0	98.4
8/20/2012	19:30	9.8	9.0	98.6
8/20/2012	20:00	9.7	9.0	98.6
8/20/2012	20:30	9.6	9.1	98.6
8/20/2012	21:00	9.4	9.1	98.6
8/20/2012	21:30	9.3	9.1	98.4
8/20/2012	22:00	9.2	9.1	98.4
8/20/2012	22:30	9.0	9.2	98.4
8/20/2012	23:00	8.9	9.2	98.4
8/20/2012	23:30	8.7	9.2	98.4
8/21/2012	0:00	8.6	9.3	98.4
8/21/2012	0:30	8.5	9.3	98.7
8/21/2012	1:00	8.4	9.3	98.3
8/21/2012	1:30	8.3	9.3	98.3
8/21/2012	2:00	8.2	9.3	98.2
8/21/2012	2:30	8.1	9.4	99.1
8/21/2012	3:00	8.1	9.4	98.3
8/21/2012	3:30	8.0	9.4	98.7
8/21/2012	4:00	8.0	9.4	98.6
8/21/2012	4:30	8.0	9.4	98.7
8/21/2012	5:00	7.9	9.4	98.7
8/21/2012	5:30	7.9	9.4	98.6
8/21/2012	6:00	7.8	9.5	98.8
8/21/2012	6:30	7.8	9.5	98.8
8/21/2012	7:00	7.8	9.5	98.9
8/21/2012	7:30	7.8	9.5	99.2
8/21/2012	8:00	7.9	9.5	99.2
8/21/2012	8:30	8.0	9.5	99.2
8/21/2012	9:00	8.2	9.4	99.3
8/21/2012	9:30	8.4	9.4	99.4
8/21/2012	10:00	8.6	9.4	99.4
8/21/2012	10:30	8.8	9.3	99.4
8/21/2012	11:00	9.0	9.3	99.3
8/21/2012	11:30	9.2	9.2	99.4
8/21/2012	12:00	9.4	9.2	99.6
8/21/2012	12:30	9.5	9.2	99.4

Table C-3. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of August 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
8/21/2012	13:00	9.7	9.1	99.3
8/21/2012	13:30	9.8	9.1	99.3
8/21/2012	14:00	9.9	9.0	99.2
8/21/2012	14:30	10.1	9.0	99.2
8/21/2012	15:00	10.1	9.0	99.2
8/21/2012	15:30	10.2	9.0	99.2
8/21/2012	16:00	10.2	9.0	99.2
8/21/2012	16:30	10.1	9.0	99.2
8/21/2012	17:00	10.1	9.0	99.2
8/21/2012	17:30	10.1	9.0	99.1
8/21/2012	18:00	10.0	9.0	98.9
8/21/2012	18:30	9.9	9.0	99.1
8/21/2012	19:00	9.8	9.1	98.9
8/21/2012	19:30	9.6	9.1	98.9
8/21/2012	20:00	9.5	9.1	98.9
8/21/2012	20:30	9.3	9.2	98.9
8/21/2012	21:00	9.1	9.2	98.9
8/21/2012	21:30	9.0	9.2	98.9
8/21/2012	22:00	8.8	9.3	98.9
8/21/2012	22:30	8.6	9.3	98.9
8/21/2012	23:00	8.5	9.3	98.9
8/21/2012	23:30	8.3	9.4	98.9
8/22/2012	0:00	8.2	9.4	98.9
8/22/2012	0:30	8.0	9.4	98.8
8/22/2012	1:00	7.9	9.5	98.9
8/22/2012	1:30	7.7	9.5	99.2
8/22/2012	2:00	7.6	9.6	99.2
8/22/2012	2:30	7.5	9.6	99.2
8/22/2012	3:00	7.4	9.6	99.1
8/22/2012	3:30	7.2	9.6	99.1
8/22/2012	4:00	7.1	9.7	99.1
8/22/2012	4:30	7.0	9.7	99.1
8/22/2012	5:00	6.9	9.7	99.1
8/22/2012	5:30	6.8	9.7	99.1
8/22/2012	6:00	6.7	9.8	99.2
8/22/2012	6:30	6.6	9.8	99.2
8/22/2012	7:00	6.6	9.8	99.1
8/22/2012	7:30	6.5	9.8	99.2
8/22/2012	8:00	6.6	9.8	99.2
8/22/2012	8:30	6.6	9.8	99.4
8/22/2012	9:00	6.9	9.8	99.6
8/22/2012	9:30	7.1	9.7	99.8
8/22/2012	10:00	7.5	9.6	99.7

Table C-3. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of August 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
8/22/2012	10:30	7.8	9.6	99.8
8/22/2012	11:00	8.2	9.5	99.9
8/22/2012	11:30	8.6	9.4	99.9
8/22/2012	12:00	9.0	9.3	99.8
8/22/2012	12:30	9.3	9.2	99.8
8/22/2012	13:00	9.6	9.2	99.8
8/22/2012	13:30	9.8	9.1	99.8
8/22/2012	14:00	9.9	9.1	99.7
8/22/2012	14:30	10.0	9.1	99.7
8/22/2012	15:00	10.0	9.1	99.7
8/22/2012	15:30	10.0	9.1	99.7
8/22/2012	16:00	9.9	9.1	99.2
8/22/2012	16:30	9.8	9.1	99.2
8/22/2012	17:00	9.7	9.1	99.2
8/22/2012	17:30	9.5	9.1	99.1
8/22/2012	18:00	9.4	9.2	99.2
8/22/2012	18:30	9.2	9.2	99.1
8/22/2012	19:00	9.0	9.2	99.1
8/22/2012	19:30	8.8	9.3	99.1
8/22/2012	20:00	8.7	9.3	99.1
8/22/2012	20:30	8.5	9.3	98.9
8/22/2012	21:00	8.3	9.4	98.9
8/22/2012	21:30	8.1	9.4	98.9
8/22/2012	22:00	7.9	9.5	98.9
8/22/2012	22:30	7.8	9.5	98.9
8/22/2012	23:00	7.6	9.5	98.9
8/22/2012	23:30	7.4	9.6	98.9
8/23/2012	0:00	7.3	9.6	98.9
8/23/2012	0:30	7.1	9.6	98.8
8/23/2012	1:00	7.0	9.7	98.8
8/23/2012	1:30	6.8	9.7	98.7
8/23/2012	2:00	6.7	9.7	98.7
8/23/2012	2:30	6.6	9.8	98.7
8/23/2012	3:00	6.5	9.8	98.7
8/23/2012	3:30	6.4	9.8	98.7
8/23/2012	4:00	6.4	9.8	98.6
8/23/2012	4:30	6.3	9.8	98.7
8/23/2012	5:00	6.2	9.8	98.7
8/23/2012	5:30	6.2	9.9	98.8
8/23/2012	6:00	6.1	9.9	98.8
8/23/2012	6:30	6.1	9.9	98.8
8/23/2012	7:00	6.1	9.9	98.8
8/23/2012	7:30	6.1	9.9	98.9

Table C-3. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of August 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
8/23/2012	8:00	6.1	9.9	98.9
8/23/2012	8:30	6.3	9.9	99.1
8/23/2012	9:00	6.5	9.8	99.3
8/23/2012	9:30	6.8	9.8	99.3
8/23/2012	10:00	7.2	9.7	99.3
8/23/2012	10:30	7.5	9.6	99.4
8/23/2012	11:00	7.9	9.5	99.4
8/23/2012	11:30	8.3	9.4	99.6
8/23/2012	12:00	8.6	9.3	99.3
8/23/2012	12:30	8.9	9.3	99.3
8/23/2012	13:00	9.2	9.2	99.3
8/23/2012	13:30	9.4	9.2	99.2
8/23/2012	14:00	9.6	9.1	99.3
8/23/2012	14:30	9.7	9.1	99.2
8/23/2012	15:00	9.7	9.1	99.2
8/23/2012	15:30	9.7	9.1	99.2

Table C-4. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
9/25/2012	9:00	6.2	9.8	98.6
9/25/2012	9:30	6.4	9.8	98.7
9/25/2012	10:00	6.6	9.8	98.6
9/25/2012	10:30	6.7	9.7	98.8
9/25/2012	11:00	6.9	9.7	98.7
9/25/2012	11:30	7.1	9.6	98.4
9/25/2012	12:00	7.3	9.6	98.6
9/25/2012	12:30	7.4	9.5	98.4
9/25/2012	13:00	7.6	9.5	98.7
9/25/2012	13:30	7.7	9.5	98.6
9/25/2012	14:00	7.7	9.5	98.4
9/25/2012	14:30	7.8	9.5	98.4
9/25/2012	15:00	7.8	9.4	98.6
9/25/2012	15:30	7.8	9.4	98.4
9/25/2012	16:00	7.8	9.4	98.4
9/25/2012	16:30	7.8	9.4	98.3
9/25/2012	17:00	7.8	9.4	98.3
9/25/2012	17:30	7.7	9.4	98.2
9/25/2012	18:00	7.6	9.4	98.1
9/25/2012	18:30	7.5	9.5	97.9
9/25/2012	19:00	7.4	9.5	97.8
9/25/2012	19:30	7.3	9.5	97.9
9/25/2012	20:00	7.2	9.5	97.9
9/25/2012	20:30	7.0	9.6	98.1
9/25/2012	21:00	6.9	9.6	97.9
9/25/2012	21:30	6.8	9.6	98.1
9/25/2012	22:00	6.6	9.7	97.8
9/25/2012	22:30	6.5	9.7	97.9
9/25/2012	23:00	6.4	9.7	97.9
9/25/2012	23:30	6.3	9.8	97.8
9/26/2012	0:00	6.1	9.8	97.8
9/26/2012	0:30	6.0	9.8	97.9
9/26/2012	1:00	5.9	9.8	97.8
9/26/2012	1:30	5.8	9.9	97.9
9/26/2012	2:00	5.7	9.9	97.8
9/26/2012	2:30	5.6	9.9	97.8
9/26/2012	3:00	5.5	9.9	97.7
9/26/2012	3:30	5.4	10.0	97.8
9/26/2012	4:00	5.3	10.0	97.8
9/26/2012	4:30	5.2	10.0	97.7
9/26/2012	5:00	5.2	10.0	97.8
9/26/2012	5:30	5.1	10.0	97.8
9/26/2012	6:00	5.0	10.1	97.8

Table C-4. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
9/26/2012	6:30	5.0	10.1	97.9
9/26/2012	7:00	4.9	10.1	98.1
9/26/2012	7:30	4.9	10.1	98.1
9/26/2012	8:00	4.8	10.2	98.2
9/26/2012	8:30	4.9	10.2	98.4
9/26/2012	9:00	5.0	10.2	98.6
9/26/2012	9:30	5.1	10.1	98.7
9/26/2012	10:00	5.3	10.1	98.8
9/26/2012	10:30	5.6	10.0	98.9
9/26/2012	11:00	5.8	10.0	98.8
9/26/2012	11:30	5.9	9.9	98.7
9/26/2012	12:00	6.1	9.8	98.4
9/26/2012	12:30	6.3	9.8	98.4
9/26/2012	13:00	6.4	9.8	98.4
9/26/2012	13:30	6.5	9.7	98.4
9/26/2012	14:00	6.6	9.7	98.4
9/26/2012	14:30	6.7	9.7	98.3
9/26/2012	15:00	6.7	9.7	98.2
9/26/2012	15:30	6.7	9.7	98.2
9/26/2012	16:00	6.7	9.7	98.2
9/26/2012	16:30	6.7	9.7	98.2
9/26/2012	17:00	6.6	9.7	98.2
9/26/2012	17:30	6.6	9.7	97.9
9/26/2012	18:00	6.5	9.7	97.9
9/26/2012	18:30	6.4	9.7	98.1
9/26/2012	19:00	6.4	9.7	98.1
9/26/2012	19:30	6.3	9.8	98.1
9/26/2012	20:00	6.2	9.8	98.1
9/26/2012	20:30	6.1	9.8	98.1
9/26/2012	21:00	6.0	9.8	98.1
9/26/2012	21:30	5.9	9.9	98.1
9/26/2012	22:00	5.8	9.9	98.2
9/26/2012	22:30	5.7	9.9	98.1
9/26/2012	23:00	5.6	9.9	97.9
9/26/2012	23:30	5.5	10.0	97.9
9/27/2012	0:00	5.3	10.0	97.9
9/27/2012	0:30	5.2	10.0	97.9
9/27/2012	1:00	5.1	10.0	97.9
9/27/2012	1:30	5.1	10.1	97.9
9/27/2012	2:00	4.9	10.1	97.9
9/27/2012	2:30	4.9	10.1	98.1
9/27/2012	3:00	4.8	10.1	97.9
9/27/2012	3:30	4.7	10.2	97.9

Table C-4. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
9/27/2012	4:00	4.7	10.2	97.8
9/27/2012	4:30	4.6	10.2	97.9
9/27/2012	5:00	4.5	10.2	97.8
9/27/2012	5:30	4.5	10.2	97.9
9/27/2012	6:00	4.4	10.2	97.9
9/27/2012	6:30	4.4	10.3	98.1
9/27/2012	7:00	4.3	10.3	98.1
9/27/2012	7:30	4.3	10.3	98.1
9/27/2012	8:00	4.3	10.3	98.2
9/27/2012	8:30	4.4	10.3	98.4
9/27/2012	9:00	4.5	10.3	98.7
9/27/2012	9:30	4.7	10.3	99.1
9/27/2012	10:00	5.0	10.2	99.2
9/27/2012	10:30	5.2	10.1	99.1
9/27/2012	11:00	5.5	10.1	99.2
9/27/2012	11:30	5.7	10.0	99.1
9/27/2012	12:00	5.9	9.9	98.8
9/27/2012	12:30	6.2	9.9	98.7
9/27/2012	13:00	6.4	9.8	98.7
9/27/2012	13:30	6.5	9.8	98.7
9/27/2012	14:00	6.6	9.7	98.6
9/27/2012	14:30	6.8	9.7	98.7
9/27/2012	15:00	6.9	9.7	98.7
9/27/2012	15:30	7.0	9.7	98.7
9/27/2012	16:00	7.0	9.6	98.6
9/27/2012	16:30	7.0	9.6	98.3
9/27/2012	17:00	7.0	9.6	98.2
9/27/2012	17:30	7.0	9.6	97.9
9/27/2012	18:00	6.9	9.6	98.1
9/27/2012	18:30	6.9	9.6	98.2
9/27/2012	19:00	6.8	9.6	97.9
9/27/2012	19:30	6.7	9.6	97.8
9/27/2012	20:00	6.6	9.7	98.1
9/27/2012	20:30	6.5	9.7	98.1
9/27/2012	21:00	6.5	9.7	97.9
9/27/2012	21:30	6.4	9.7	97.9
9/27/2012	22:00	6.3	9.8	97.9
9/27/2012	22:30	6.2	9.8	98.1
9/27/2012	23:00	6.1	9.8	97.9
9/27/2012	23:30	6.1	9.8	98.1
9/28/2012	0:00	6.0	9.8	98.1
9/28/2012	0:30	6.0	9.8	97.9
9/28/2012	1:00	6.0	9.8	97.9

Table C-4. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
9/28/2012	1:30	6.0	9.8	98.1
9/28/2012	2:00	5.9	9.8	97.8
9/28/2012	2:30	6.0	9.8	97.9
9/28/2012	3:00	5.9	9.9	98.1
9/28/2012	3:30	6.0	9.8	97.9
9/28/2012	4:00	6.0	9.8	97.9
9/28/2012	4:30	6.0	9.8	97.9
9/28/2012	5:00	6.0	9.8	97.9
9/28/2012	5:30	6.0	9.8	97.9
9/28/2012	6:00	6.0	9.8	97.9
9/28/2012	6:30	6.0	9.8	98.1
9/28/2012	7:00	6.0	9.8	98.2
9/28/2012	7:30	6.1	9.9	98.6
9/28/2012	8:00	6.2	9.9	98.6
9/28/2012	8:30	6.2	9.8	98.8
9/28/2012	9:00	6.4	9.8	98.9

Table C-5. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
10/26/2012	10:30	1.7	10.9	106.4
10/26/2012	11:00	1.8	10.9	106.4
10/26/2012	11:30	1.8	10.8	106.3
10/26/2012	12:00	1.8	10.8	106.2
10/26/2012	12:30	1.8	10.8	106.2
10/26/2012	13:00	1.8	10.8	106.2
10/26/2012	13:30	1.8	10.8	106.2
10/26/2012	14:00	1.7	10.8	106.0
10/26/2012	14:30	1.7	10.9	106.2
10/26/2012	15:00	1.7	10.9	106.0
10/26/2012	15:30	1.6	10.9	105.9
10/26/2012	16:00	1.5	10.9	105.9
10/26/2012	16:30	1.5	10.9	105.8
10/26/2012	17:00	1.6	10.9	105.8
10/26/2012	17:30	1.6	10.9	105.8
10/26/2012	18:00	1.6	10.9	105.8
10/26/2012	18:30	1.6	10.9	105.9
10/26/2012	19:00	1.6	10.9	105.9
10/26/2012	19:30	1.7	10.8	105.9
10/26/2012	20:00	1.7	10.8	105.9
10/26/2012	20:30	1.7	10.8	105.8
10/26/2012	21:00	1.7	10.8	105.9
10/26/2012	21:30	1.7	10.8	105.9
10/26/2012	22:00	1.7	10.8	105.9
10/26/2012	22:30	1.7	10.8	105.9
10/26/2012	23:00	1.8	10.8	105.9
10/26/2012	23:30	1.8	10.8	105.9
10/27/2012	0:00	1.8	10.8	105.9
10/27/2012	0:30	1.8	10.8	105.8
10/27/2012	1:00	1.8	10.8	105.9
10/27/2012	1:30	1.8	10.8	105.8
10/27/2012	2:00	1.8	10.8	105.8
10/27/2012	2:30	1.8	10.8	105.9
10/27/2012	3:00	1.8	10.8	105.9
10/27/2012	3:30	1.8	10.8	105.9
10/27/2012	4:00	1.8	10.8	105.8
10/27/2012	4:30	1.9	10.8	105.9
10/27/2012	5:00	1.9	10.8	105.9
10/27/2012	5:30	1.9	10.8	105.9
10/27/2012	6:00	1.9	10.8	105.9
10/27/2012	6:30	1.9	10.8	105.9
10/27/2012	7:00	2.0	10.8	106.0
10/27/2012	7:30	2.0	10.8	106.2

Table C-5. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
10/27/2012	8:00	2.1	10.8	106.2
10/27/2012	8:30	2.1	10.7	106.2
10/27/2012	9:00	2.2	10.7	106.3
10/27/2012	9:30	2.3	10.7	106.4
10/27/2012	10:00	2.3	10.7	106.3
10/27/2012	10:30	2.4	10.7	106.3
10/27/2012	11:00	2.4	10.7	106.3
10/27/2012	11:30	2.5	10.7	106.3
10/27/2012	12:00	2.5	10.6	106.3
10/27/2012	12:30	2.6	10.6	106.3
10/27/2012	13:00	2.7	10.6	106.3
10/27/2012	13:30	2.7	10.6	106.2
10/27/2012	14:00	2.8	10.6	106.2
10/27/2012	14:30	2.8	10.5	106.2
10/27/2012	15:00	2.8	10.5	106.2
10/27/2012	15:30	2.8	10.5	106.0
10/27/2012	16:00	2.8	10.5	106.0
10/27/2012	16:30	2.8	10.5	105.9
10/27/2012	17:00	2.8	10.5	105.8
10/27/2012	17:30	2.8	10.5	105.9
10/27/2012	18:00	2.8	10.5	105.8
10/27/2012	18:30	2.8	10.5	105.9
10/27/2012	19:00	2.9	10.5	105.9
10/27/2012	19:30	2.9	10.5	105.9
10/27/2012	20:00	2.9	10.5	105.8
10/27/2012	20:30	2.9	10.5	105.9
10/27/2012	21:00	2.9	10.5	105.8
10/27/2012	21:30	2.9	10.5	105.8
10/27/2012	22:00	2.9	10.5	105.9
10/27/2012	22:30	2.9	10.5	105.9
10/27/2012	23:00	2.9	10.5	106.0
10/27/2012	23:30	2.9	10.5	105.9
10/28/2012	0:00	2.9	10.5	105.9
10/28/2012	0:30	2.9	10.5	105.9
10/28/2012	1:00	2.9	10.5	106.0
10/28/2012	1:30	2.9	10.5	106.0
10/28/2012	2:00	2.9	10.5	106.0
10/28/2012	2:30	2.9	10.5	106.2
10/28/2012	3:00	3.0	10.5	106.0
10/28/2012	3:30	3.0	10.5	106.0
10/28/2012	4:00	3.0	10.5	106.0
10/28/2012	4:30	3.0	10.5	106.0
10/28/2012	5:00	3.0	10.5	106.0

Table C-5. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
10/28/2012	5:30	3.0	10.5	106.2
10/28/2012	6:00	3.0	10.5	106.2
10/28/2012	6:30	3.0	10.5	106.0
10/28/2012	7:00	2.9	10.5	106.2
10/28/2012	7:30	2.9	10.5	106.3
10/28/2012	8:00	3.0	10.5	106.4
10/28/2012	8:30	3.0	10.5	106.4
10/28/2012	9:00	3.1	10.5	106.4
10/28/2012	9:30	3.2	10.5	106.5
10/28/2012	10:00	3.3	10.5	106.5
10/28/2012	10:30	3.4	10.4	106.5
10/28/2012	11:00	3.4	10.4	106.7
10/28/2012	11:30	3.5	10.4	106.7
10/28/2012	12:00	3.6	10.4	106.8
10/28/2012	12:30	3.6	10.4	106.8
10/28/2012	13:00	3.7	10.4	106.8
10/28/2012	13:30	3.7	10.4	106.8
10/28/2012	14:00	3.7	10.3	106.8
10/28/2012	14:30	3.7	10.3	106.8
10/28/2012	15:00	3.7	10.3	106.8
10/28/2012	15:30	3.7	10.3	106.7
10/28/2012	16:00	3.7	10.3	106.5
10/28/2012	16:30	3.7	10.3	106.5
10/28/2012	17:00	3.6	10.3	106.5
10/28/2012	17:30	3.6	10.4	106.5
10/28/2012	18:00	3.6	10.4	106.4
10/28/2012	18:30	3.5	10.4	106.4
10/28/2012	19:00	3.5	10.4	106.4
10/28/2012	19:30	3.5	10.4	106.5
10/28/2012	20:00	3.5	10.4	106.5
10/28/2012	20:30	3.4	10.4	106.5
10/28/2012	21:00	3.4	10.4	106.5
10/28/2012	21:30	3.4	10.4	106.5
10/28/2012	22:00	3.4	10.4	106.5
10/28/2012	22:30	3.4	10.4	106.5
10/28/2012	23:00	3.4	10.4	106.5
10/28/2012	23:30	3.4	10.4	106.5
10/29/2012	0:00	3.4	10.4	106.4
10/29/2012	0:30	3.4	10.4	106.5
10/29/2012	1:00	3.4	10.4	106.5
10/29/2012	1:30	3.5	10.4	106.5
10/29/2012	2:00	3.5	10.4	106.4
10/29/2012	2:30	3.5	10.4	106.4

Table C-5. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Upper Site (BPU) During the 72-Hr Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
10/29/2012	3:00	3.5	10.4	106.4
10/29/2012	3:30	3.5	10.4	106.4
10/29/2012	4:00	3.5	10.4	106.5
10/29/2012	4:30	3.5	10.4	106.5
10/29/2012	5:00	3.5	10.4	106.5
10/29/2012	5:30	3.5	10.4	106.5
10/29/2012	6:00	3.5	10.4	106.5
10/29/2012	6:30	3.5	10.4	106.5
10/29/2012	7:00	3.5	10.4	106.5
10/29/2012	7:30	3.5	10.4	106.7
10/29/2012	8:00	3.5	10.4	106.8
10/29/2012	8:30	3.6	10.4	106.8
10/29/2012	9:00	3.7	10.4	106.9
10/29/2012	9:30	3.7	10.4	107.0
10/29/2012	10:00	3.8	10.3	107.0
10/29/2012	10:30	4.0	10.3	107.0

Table C-6. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of August 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
8/20/2012	18:30	12.0	9.0	98.4
8/20/2012	19:00	11.9	9.0	98.5
8/20/2012	19:30	11.9	9.0	98.5
8/20/2012	20:00	11.8	9.0	98.3
8/20/2012	20:30	11.7	9.0	98.4
8/20/2012	21:00	11.6	9.1	98.4
8/20/2012	21:30	11.5	9.1	98.5
8/20/2012	22:00	11.3	9.1	98.5
8/20/2012	22:30	11.2	9.2	98.4
8/20/2012	23:00	11.0	9.2	98.4
8/20/2012	23:30	10.9	9.2	98.3
8/21/2012	0:00	10.8	9.2	98.3
8/21/2012	0:30	10.7	9.2	98.2
8/21/2012	1:00	10.6	9.3	98.2
8/21/2012	1:30	10.5	9.3	98.3
8/21/2012	2:00	10.4	9.3	98.2
8/21/2012	2:30	10.2	9.4	98.5
8/21/2012	3:00	10.2	9.3	98.2
8/21/2012	3:30	10.1	9.4	98.3
8/21/2012	4:00	10.1	9.4	98.2
8/21/2012	4:30	10.1	9.4	98.4
8/21/2012	5:00	10.1	9.4	98.3
8/21/2012	5:30	10.1	9.4	98.4
8/21/2012	6:00	10.0	9.4	98.5
8/21/2012	6:30	9.9	9.4	98.5
8/21/2012	7:00	9.8	9.5	98.8
8/21/2012	7:30	9.7	9.5	98.9
8/21/2012	8:00	9.6	9.5	98.9
8/21/2012	8:30	9.6	9.6	99.1
8/21/2012	9:00	9.7	9.6	99.3
8/21/2012	9:30	9.8	9.6	99.5
8/21/2012	10:00	9.9	9.5	99.6
8/21/2012	10:30	10.2	9.5	99.6
8/21/2012	11:00	10.3	9.5	99.7
8/21/2012	11:30	10.5	9.4	99.7
8/21/2012	12:00	10.8	9.3	99.6
8/21/2012	12:30	11.0	9.3	99.7
8/21/2012	13:00	11.2	9.2	99.5
8/21/2012	13:30	11.3	9.2	99.3
8/21/2012	14:00	11.5	9.2	99.8
8/21/2012	14:30	11.7	9.2	99.7
8/21/2012	15:00	11.9	9.1	99.7

Table C-6. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of August 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
8/21/2012	15:30	11.9	9.1	99.5
8/21/2012	16:00	11.9	9.1	99.3
8/21/2012	16:30	11.9	9.1	99.3
8/21/2012	17:00	11.8	9.1	99.3
8/21/2012	17:30	11.9	9.1	99.3
8/21/2012	18:00	11.9	9.1	99.1
8/21/2012	18:30	11.8	9.1	99.0
8/21/2012	19:00	11.7	9.1	98.9
8/21/2012	19:30	11.6	9.1	99.0
8/21/2012	20:00	11.5	9.1	98.8
8/21/2012	20:30	11.4	9.1	98.8
8/21/2012	21:00	11.2	9.2	98.9
8/21/2012	21:30	11.1	9.2	98.9
8/21/2012	22:00	10.9	9.3	98.9
8/21/2012	22:30	10.7	9.3	98.8
8/21/2012	23:00	10.5	9.3	98.8
8/21/2012	23:30	10.4	9.4	98.8
8/22/2012	0:00	10.2	9.4	98.8
8/22/2012	0:30	10.1	9.4	98.8
8/22/2012	1:00	10.0	9.4	98.8
8/22/2012	1:30	9.9	9.5	98.8
8/22/2012	2:00	9.7	9.5	98.8
8/22/2012	2:30	9.6	9.5	98.8
8/22/2012	3:00	9.5	9.6	98.8
8/22/2012	3:30	9.3	9.6	98.9
8/22/2012	4:00	9.1	9.7	98.9
8/22/2012	4:30	8.9	9.7	98.9
8/22/2012	5:00	8.7	9.7	98.9
8/22/2012	5:30	8.6	9.8	98.8
8/22/2012	6:00	8.4	9.8	98.9
8/22/2012	6:30	8.3	9.8	98.9
8/22/2012	7:00	8.2	9.9	98.9
8/22/2012	7:30	8.1	9.9	98.9
8/22/2012	8:00	8.0	9.9	98.9
8/22/2012	8:30	8.0	9.9	99.0
8/22/2012	9:00	8.0	9.9	99.1
8/22/2012	9:30	8.0	10.0	99.2
8/22/2012	10:00	8.1	9.9	99.3
8/22/2012	10:30	8.2	9.9	99.3
8/22/2012	11:00	8.4	9.9	99.5
8/22/2012	11:30	8.8	9.8	99.6
8/22/2012	12:00	9.3	9.7	99.7
8/22/2012	12:30	9.9	9.6	99.9

Table C-6. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of August 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
8/22/2012	13:00	10.4	9.5	99.8
8/22/2012	13:30	10.7	9.4	99.7
8/22/2012	14:00	10.9	9.3	99.8
8/22/2012	14:30	11.1	9.3	99.9
8/22/2012	15:00	11.1	9.3	99.8
8/22/2012	15:30	11.0	9.3	99.7
8/22/2012	16:00	11.0	9.3	99.6
8/22/2012	16:30	10.9	9.3	99.5
8/22/2012	17:00	10.9	9.3	99.5
8/22/2012	17:30	10.8	9.3	99.2
8/22/2012	18:00	10.7	9.3	99.1
8/22/2012	18:30	10.6	9.3	98.9
8/22/2012	19:00	10.5	9.4	98.9
8/22/2012	19:30	10.3	9.4	98.9
8/22/2012	20:00	10.1	9.4	98.8
8/22/2012	20:30	10.0	9.5	98.8
8/22/2012	21:00	9.8	9.5	98.9
8/22/2012	21:30	9.6	9.5	98.8
8/22/2012	22:00	9.5	9.6	98.8
8/22/2012	22:30	9.3	9.6	98.6
8/22/2012	23:00	9.2	9.6	98.8
8/22/2012	23:30	9.0	9.7	98.8
8/23/2012	0:00	8.9	9.7	98.6
8/23/2012	0:30	8.8	9.7	98.8
8/23/2012	1:00	8.6	9.7	98.6
8/23/2012	1:30	8.5	9.8	98.6
8/23/2012	2:00	8.4	9.8	98.6
8/23/2012	2:30	8.2	9.8	98.4
8/23/2012	3:00	8.1	9.9	98.5
8/23/2012	3:30	8.0	9.9	98.5
8/23/2012	4:00	7.8	9.9	98.4
8/23/2012	4:30	7.7	9.9	98.5
8/23/2012	5:00	7.6	10.0	98.4
8/23/2012	5:30	7.6	10.0	98.4
8/23/2012	6:00	7.5	10.0	98.5
8/23/2012	6:30	7.4	10.0	98.5
8/23/2012	7:00	7.3	10.1	98.6
8/23/2012	7:30	7.3	10.1	98.6
8/23/2012	8:00	7.3	10.1	98.8
8/23/2012	8:30	7.2	10.1	98.6
8/23/2012	9:00	7.3	10.1	98.8
8/23/2012	9:30	7.4	10.1	99.0
8/23/2012	10:00	7.6	10.0	99.1

Table C-6. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of August 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
8/23/2012	10:30	7.7	10.0	99.1
8/23/2012	11:00	8.0	10.0	99.3
8/23/2012	11:30	8.3	9.9	99.3
8/23/2012	12:00	8.8	9.8	99.5
8/23/2012	12:30	9.4	9.7	99.6
8/23/2012	13:00	10.0	9.5	99.6
8/23/2012	13:30	10.4	9.4	99.6
8/23/2012	14:00	10.7	9.4	99.6
8/23/2012	14:30	10.9	9.3	99.6
8/23/2012	15:00	10.9	9.3	99.6
8/23/2012	15:30	10.9	9.3	99.3
8/23/2012	16:00	10.8	9.3	99.2
8/23/2012	16:30	10.8	9.3	99.1
8/23/2012	17:00	10.7	9.3	99.0
8/23/2012	17:30	10.6	9.3	98.9
8/23/2012	18:00	10.5	9.3	98.8

Table C-7. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
9/25/2012	7:30	7.9	10.3	102.4
9/25/2012	8:00	7.9	10.3	102.5
9/25/2012	8:30	7.9	10.3	102.7
9/25/2012	9:00	8.0	10.3	102.8
9/25/2012	9:30	8.1	10.3	103.1
9/25/2012	10:00	8.2	10.3	103.0
9/25/2012	10:30	8.4	10.2	103.1
9/25/2012	11:00	8.6	10.2	103.1
9/25/2012	11:30	8.9	10.1	103.4
9/25/2012	12:00	9.2	10.1	103.2
9/25/2012	12:30	9.4	10.0	103.0
9/25/2012	13:00	9.4	10.0	103.1
9/25/2012	13:30	9.5	10.0	103.2
9/25/2012	14:00	9.5	10.0	103.1
9/25/2012	14:30	9.5	10.0	103.1
9/25/2012	15:00	9.6	9.9	103.1
9/25/2012	15:30	9.6	9.9	103.0
9/25/2012	16:00	9.6	9.9	102.9
9/25/2012	16:30	9.6	9.9	102.8
9/25/2012	17:00	9.6	9.9	102.8
9/25/2012	17:30	9.5	9.9	102.5
9/25/2012	18:00	9.5	9.9	102.7
9/25/2012	18:30	9.4	9.9	102.4
9/25/2012	19:00	9.3	10.0	102.5
9/25/2012	19:30	9.1	10.0	102.4
9/25/2012	20:00	9.0	10.0	102.5
9/25/2012	20:30	8.8	10.1	102.7
9/25/2012	21:00	8.7	10.1	102.4
9/25/2012	21:30	8.5	10.1	102.5
9/25/2012	22:00	8.4	10.2	102.4
9/25/2012	22:30	8.2	10.2	102.4
9/25/2012	23:00	8.1	10.2	102.4
9/25/2012	23:30	8.0	10.3	102.4
9/26/2012	0:00	7.9	10.3	102.4
9/26/2012	0:30	7.7	10.3	102.3
9/26/2012	1:00	7.6	10.4	102.4
9/26/2012	1:30	7.5	10.4	102.3
9/26/2012	2:00	7.4	10.4	102.3
9/26/2012	2:30	7.3	10.4	102.3
9/26/2012	3:00	7.2	10.5	102.3
9/26/2012	3:30	7.1	10.5	102.3
9/26/2012	4:00	7.0	10.5	102.2
9/26/2012	4:30	6.9	10.5	102.1

Table C-7. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
9/26/2012	5:00	6.8	10.6	102.3
9/26/2012	5:30	6.7	10.6	102.2
9/26/2012	6:00	6.7	10.6	102.3
9/26/2012	6:30	6.6	10.6	102.4
9/26/2012	7:00	6.5	10.7	102.5
9/26/2012	7:30	6.5	10.7	102.5
9/26/2012	8:00	6.4	10.7	102.5
9/26/2012	8:30	6.4	10.7	102.8
9/26/2012	9:00	6.4	10.7	102.9
9/26/2012	9:30	6.6	10.7	103.1
9/26/2012	10:00	6.6	10.7	103.1
9/26/2012	10:30	6.8	10.7	103.1
9/26/2012	11:00	7.1	10.6	103.1
9/26/2012	11:30	7.4	10.5	103.0
9/26/2012	12:00	7.6	10.4	103.1
9/26/2012	12:30	7.9	10.4	103.0
9/26/2012	13:00	8.1	10.3	103.2
9/26/2012	13:30	8.2	10.3	103.2
9/26/2012	14:00	8.2	10.3	103.1
9/26/2012	14:30	8.2	10.3	103.0
9/26/2012	15:00	8.2	10.3	102.9
9/26/2012	15:30	8.1	10.3	102.8
9/26/2012	16:00	8.0	10.3	102.8
9/26/2012	16:30	7.9	10.3	102.7
9/26/2012	17:00	7.8	10.3	102.7
9/26/2012	17:30	7.7	10.4	102.5
9/26/2012	18:00	7.6	10.4	102.4
9/26/2012	18:30	7.6	10.4	102.4
9/26/2012	19:00	7.5	10.4	102.5
9/26/2012	19:30	7.4	10.4	102.4
9/26/2012	20:00	7.3	10.5	102.5
9/26/2012	20:30	7.2	10.5	102.4
9/26/2012	21:00	7.2	10.5	102.4
9/26/2012	21:30	7.1	10.5	102.5
9/26/2012	22:00	7.0	10.5	102.4
9/26/2012	22:30	6.9	10.6	102.4
9/26/2012	23:00	6.9	10.6	102.4
9/26/2012	23:30	6.8	10.6	102.4
9/27/2012	0:00	6.7	10.6	102.4
9/27/2012	0:30	6.6	10.6	102.4
9/27/2012	1:00	6.5	10.7	102.4
9/27/2012	1:30	6.4	10.7	102.3
9/27/2012	2:00	6.3	10.7	102.3

Table C-7. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of September 2012.

Date	**Time**	**Water Temperature (°C)**	**Dissolved Oxygen (mg/L)**	**Dissolved Oxygen (% Saturation)**
9/27/2012	2:30	6.2	10.7	102.3
9/27/2012	3:00	6.1	10.8	102.3
9/27/2012	3:30	6.0	10.8	102.3
9/27/2012	4:00	5.9	10.8	102.4
9/27/2012	4:30	5.8	10.8	102.3
9/27/2012	5:00	5.8	10.8	102.3
9/27/2012	5:30	5.7	10.9	102.3
9/27/2012	6:00	5.6	10.9	102.3
9/27/2012	6:30	5.6	10.9	102.4
9/27/2012	7:00	5.5	10.9	102.4
9/27/2012	7:30	5.5	10.9	102.5
9/27/2012	8:00	5.5	10.9	102.4
9/27/2012	8:30	5.5	11.0	102.7
9/27/2012	9:00	5.6	10.9	102.8
9/27/2012	9:30	5.8	10.9	103.1
9/27/2012	10:00	6.0	10.9	103.2
9/27/2012	10:30	6.2	10.8	103.2
9/27/2012	11:00	6.5	10.7	103.4
9/27/2012	11:30	7.0	10.6	103.5
9/27/2012	12:00	7.4	10.5	103.2
9/27/2012	12:30	7.7	10.4	103.2
9/27/2012	13:00	8.0	10.4	103.4
9/27/2012	13:30	8.1	10.3	103.5
9/27/2012	14:00	8.1	10.3	103.1
9/27/2012	14:30	8.2	10.3	103.4
9/27/2012	15:00	8.3	10.3	103.5
9/27/2012	15:30	8.3	10.3	103.1
9/27/2012	16:00	8.3	10.2	103.0
9/27/2012	16:30	8.4	10.2	102.8
9/27/2012	17:00	8.3	10.2	102.8
9/27/2012	17:30	8.3	10.2	102.7
9/27/2012	18:00	8.3	10.2	102.5
9/27/2012	18:30	8.2	10.2	102.5
9/27/2012	19:00	8.1	10.2	102.5
9/27/2012	19:30	8.0	10.3	102.5
9/27/2012	20:00	7.9	10.3	102.4
9/27/2012	20:30	7.8	10.3	102.5
9/27/2012	21:00	7.8	10.3	102.5
9/27/2012	21:30	7.7	10.4	102.5
9/27/2012	22:00	7.6	10.4	102.4
9/27/2012	22:30	7.5	10.4	102.4
9/27/2012	23:00	7.5	10.4	102.3
9/27/2012	23:30	7.4	10.4	102.4

Table C-7. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of September 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
9/28/2012	0:00	7.4	10.4	102.4
9/28/2012	0:30	7.4	10.4	102.4
9/28/2012	1:00	7.4	10.4	102.4
9/28/2012	1:30	7.4	10.4	102.4
9/28/2012	2:00	7.4	10.4	102.4
9/28/2012	2:30	7.4	10.4	102.3
9/28/2012	3:00	7.5	10.4	102.4
9/28/2012	3:30	7.5	10.4	102.3
9/28/2012	4:00	7.5	10.4	102.4
9/28/2012	4:30	7.5	10.4	102.3
9/28/2012	5:00	7.6	10.4	102.3
9/28/2012	5:30	7.6	10.4	102.4
9/28/2012	6:00	7.6	10.4	102.4
9/28/2012	6:30	7.6	10.4	102.5
9/28/2012	7:00	7.7	10.4	102.7
9/28/2012	7:30	7.8	10.4	102.9
9/28/2012	8:00	7.9	10.4	103.1
9/28/2012	8:30	8.1	10.3	103.2
9/28/2012	9:00	8.2	10.3	103.4
9/28/2012	9:30	8.4	10.3	103.4

Table C-8. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
10/26/2012	10:30	1.9	12.1	103.1
10/26/2012	11:00	2.0	12.1	103.1
10/26/2012	11:30	2.0	12.1	102.9
10/26/2012	12:00	2.0	12.0	102.7
10/26/2012	12:30	2.1	12.0	102.8
10/26/2012	13:00	2.1	12.0	102.7
10/26/2012	13:30	2.1	12.0	102.7
10/26/2012	14:00	2.0	12.0	102.7
10/26/2012	14:30	1.9	12.1	102.5
10/26/2012	15:00	1.8	12.1	102.7
10/26/2012	15:30	1.7	12.1	102.5
10/26/2012	16:00	1.5	12.2	102.4
10/26/2012	16:30	1.6	12.1	102.4
10/26/2012	17:00	1.6	12.1	102.4
10/26/2012	17:30	1.7	12.1	102.4
10/26/2012	18:00	1.7	12.1	102.4
10/26/2012	18:30	1.7	12.1	102.5
10/26/2012	19:00	1.7	12.1	102.4
10/26/2012	19:30	1.7	12.1	102.4
10/26/2012	20:00	1.8	12.1	102.4
10/26/2012	20:30	1.8	12.1	102.3
10/26/2012	21:00	1.8	12.0	102.4
10/26/2012	21:30	1.9	12.0	102.3
10/26/2012	22:00	2.0	12.0	102.4
10/26/2012	22:30	2.0	12.0	102.4
10/26/2012	23:00	1.9	12.0	102.5
10/26/2012	23:30	1.9	12.0	102.4
10/27/2012	0:00	1.9	12.0	102.4
10/27/2012	0:30	1.9	12.0	102.3
10/27/2012	1:00	1.9	12.0	102.3
10/27/2012	1:30	1.9	12.0	102.3
10/27/2012	2:00	1.9	12.0	102.3
10/27/2012	2:30	1.8	12.0	102.4
10/27/2012	3:00	1.9	12.0	102.4
10/27/2012	3:30	1.9	12.0	102.4
10/27/2012	4:00	1.9	12.0	102.4
10/27/2012	4:30	2.0	12.0	102.4
10/27/2012	5:00	2.0	12.0	102.4
10/27/2012	5:30	2.0	12.0	102.3
10/27/2012	6:00	2.0	12.0	102.3
10/27/2012	6:30	2.0	12.0	102.3
10/27/2012	7:00	2.1	12.0	102.4
10/27/2012	7:30	2.2	12.0	102.5

Table C-8. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
10/27/2012	8:00	2.2	11.9	102.7
10/27/2012	8:30	2.3	11.9	102.7
10/27/2012	9:00	2.4	11.9	102.5
10/27/2012	9:30	2.5	11.9	102.8
10/27/2012	10:00	2.6	11.8	102.7
10/27/2012	10:30	2.7	11.8	102.8
10/27/2012	11:00	2.8	11.8	102.8
10/27/2012	11:30	2.8	11.8	102.8
10/27/2012	12:00	2.9	11.7	102.8
10/27/2012	12:30	3.0	11.7	102.7
10/27/2012	13:00	3.1	11.7	102.8
10/27/2012	13:30	3.1	11.7	102.7
10/27/2012	14:00	3.1	11.7	102.7
10/27/2012	14:30	3.1	11.7	102.7
10/27/2012	15:00	3.2	11.6	102.5
10/27/2012	15:30	3.2	11.6	102.4
10/27/2012	16:00	3.2	11.6	102.4
10/27/2012	16:30	3.2	11.6	102.4
10/27/2012	17:00	3.1	11.6	102.3
10/27/2012	17:30	3.1	11.6	102.4
10/27/2012	18:00	3.1	11.6	102.3
10/27/2012	18:30	3.1	11.6	102.3
10/27/2012	19:00	3.1	11.6	102.4
10/27/2012	19:30	3.2	11.6	102.3
10/27/2012	20:00	3.2	11.6	102.4
10/27/2012	20:30	3.3	11.6	102.4
10/27/2012	21:00	3.3	11.6	102.3
10/27/2012	21:30	3.4	11.6	102.4
10/27/2012	22:00	3.4	11.6	102.7
10/27/2012	22:30	3.4	11.6	102.5
10/27/2012	23:00	3.4	11.6	102.7
10/27/2012	23:30	3.4	11.6	102.4
10/28/2012	0:00	3.5	11.5	102.4
10/28/2012	0:30	3.5	11.5	102.5
10/28/2012	1:00	3.6	11.5	102.4
10/28/2012	1:30	3.6	11.5	102.7
10/28/2012	2:00	3.6	11.5	102.7
10/28/2012	2:30	3.7	11.5	102.9
10/28/2012	3:00	3.7	11.5	102.7
10/28/2012	3:30	3.7	11.5	102.9
10/28/2012	4:00	3.7	11.5	103.1
10/28/2012	4:30	3.8	11.5	102.8
10/28/2012	5:00	3.9	11.4	102.8

Table C-8. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
10/28/2012	5:30	4.0	11.4	102.8
10/28/2012	6:00	4.0	11.4	102.8
10/28/2012	6:30	4.0	11.4	103.0
10/28/2012	7:00	4.0	11.5	103.2
10/28/2012	7:30	4.0	11.5	103.1
10/28/2012	8:00	3.9	11.5	103.4
10/28/2012	8:30	4.0	11.5	103.4
10/28/2012	9:00	4.2	11.4	103.2
10/28/2012	9:30	4.3	11.4	103.4
10/28/2012	10:00	4.4	11.4	103.5
10/28/2012	10:30	4.4	11.4	103.6
10/28/2012	11:00	4.5	11.3	103.6
10/28/2012	11:30	4.5	11.3	103.6
10/28/2012	12:00	4.6	11.3	103.6
10/28/2012	12:30	4.7	11.3	103.7
10/28/2012	13:00	4.9	11.3	103.7
10/28/2012	13:30	5.0	11.2	103.7
10/28/2012	14:00	5.0	11.2	103.8
10/28/2012	14:30	5.0	11.2	104.0
10/28/2012	15:00	5.0	11.3	104.2
10/28/2012	15:30	5.0	11.2	104.0
10/28/2012	16:00	4.9	11.3	104.0
10/28/2012	16:30	4.9	11.3	104.0
10/28/2012	17:00	4.8	11.3	104.0
10/28/2012	17:30	4.8	11.3	104.0
10/28/2012	18:00	4.7	11.3	104.0
10/28/2012	18:30	4.7	11.3	103.8
10/28/2012	19:00	4.7	11.3	103.8
10/28/2012	19:30	4.6	11.3	104.0
10/28/2012	20:00	4.6	11.4	104.0
10/28/2012	20:30	4.6	11.4	104.1
10/28/2012	21:00	4.6	11.4	104.1
10/28/2012	21:30	4.6	11.4	104.2
10/28/2012	22:00	4.6	11.4	104.2
10/28/2012	22:30	4.6	11.4	104.1
10/28/2012	23:00	4.5	11.4	104.1
10/28/2012	23:30	4.5	11.4	104.1
10/29/2012	0:00	4.5	11.4	104.1
10/29/2012	0:30	4.6	11.4	104.1
10/29/2012	1:00	4.6	11.4	103.8
10/29/2012	1:30	4.6	11.4	104.0
10/29/2012	2:00	4.6	11.4	104.0
10/29/2012	2:30	4.6	11.3	103.8

Table C-8. Dissolved Oxygen Measurements (in mg/L and % saturation) at the Bypassed Reach Lower Site (BPL) During the 72-Hr Sampling Event of October 2012.

Date	Time	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)
10/29/2012	3:00	4.6	11.4	103.8
10/29/2012	3:30	4.6	11.3	103.8
10/29/2012	4:00	4.6	11.3	103.8
10/29/2012	4:30	4.6	11.4	104.0
10/29/2012	5:00	4.6	11.3	103.8
10/29/2012	5:30	4.6	11.3	104.0
10/29/2012	6:00	4.6	11.4	104.0
10/29/2012	6:30	4.7	11.3	104.0
10/29/2012	7:00	4.7	11.3	104.1
10/29/2012	7:30	4.7	11.4	104.2
10/29/2012	8:00	4.7	11.3	104.2
10/29/2012	8:30	4.8	11.3	104.3
10/29/2012	9:00	4.9	11.3	104.3
10/29/2012	9:30	5.0	11.3	104.3
10/29/2012	10:00	5.1	11.2	104.3
10/29/2012	10:30	5.3	11.2	104.4

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Appendix D
Total Dissolved Gas Data

Table D-1. Total Dissolved Gas (TDC) Measurements Taken Twice Daily on Two Consecutive Days per Month for June-September Period in the Project Tailrace.

Date	Time	TDG (% saturation)
July 3, 2012	12:30	97.0
July 3, 2012	19:00	99.0
July 4, 2012	11:00	98.0
July 4, 2012	20:00	97.0
July 24, 2012	8:00	98.8
July 24, 2012	18:15	97.2
July 25, 2012	8:40	99.1
July 25, 2012	20:40	100.0
August 22, 2012	7:20	99.4
August 22, 2012	19:00	99.7
August 23, 2012	9:30	95.7
August 23, 2012	20:15	98.5
September 26, 2012	10:45	99.5
September 26, 2012	14:00	98.3
September 27, 2012	9:30	100.0
September 27, 2012	17:00	97.8