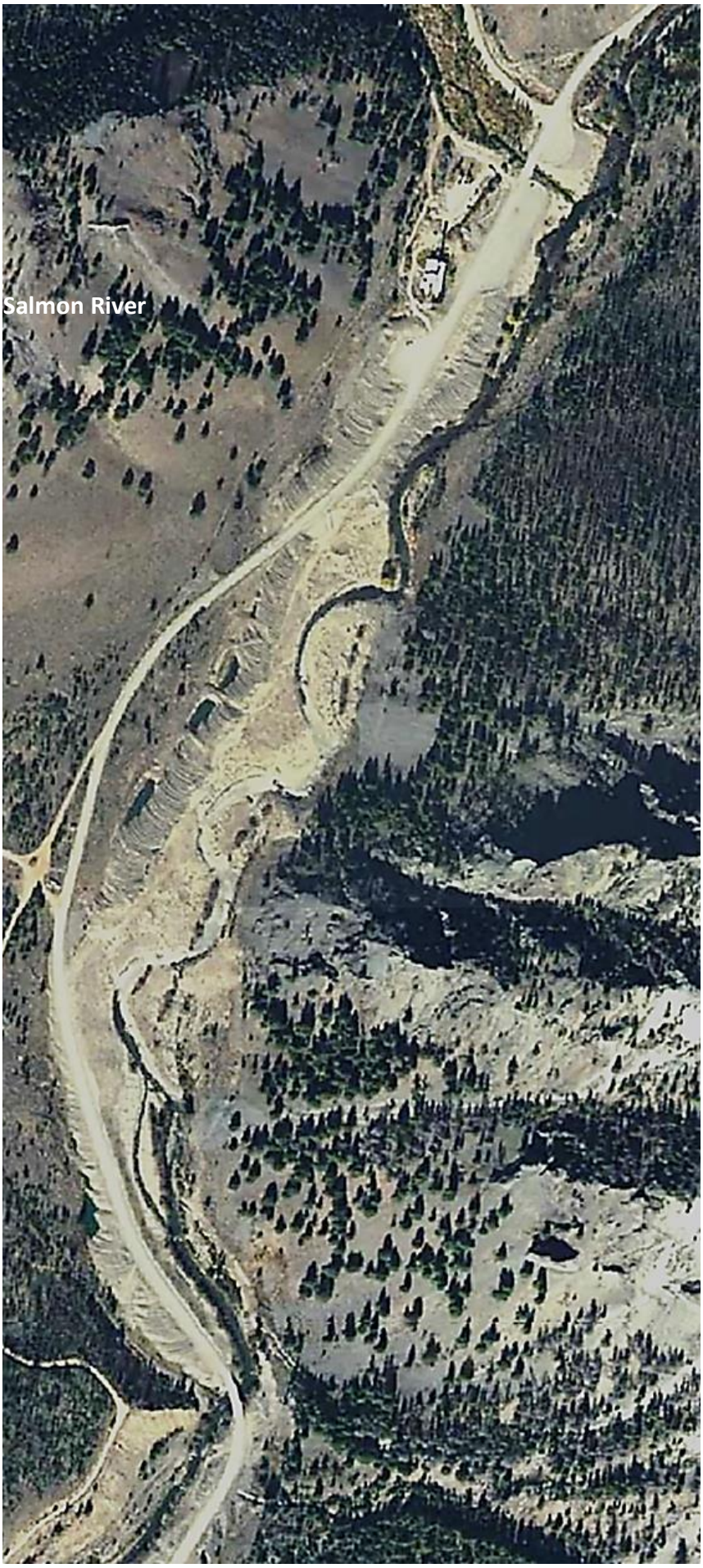
Yankee Fork Restoration Project

Baseline water quality data--Yankee Fork Salmon River



February 1, 2021-January 31, 2022

Shoshone Bannock Tribes

Fort Hall, Idaho

Contract # 71277

Project # 2002-059-00

Annual Report 2021

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Portland, Oregon

Prepared by:

Julia Markham

Josh Gable and Alexis Mendez

Evelyn Galloway

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Cover photo: Aerial photo taken of the Yankee Fork Salmon River in 2021 from just upstream of Jordan Creek entering at top right downstream to the bridge crossing below the townsite of Bonanza, courtesy of USDA Farm Service Agency, National Agriculture Imagery Program (NAIP).

Juvenile Chinook salmon photo appearing on figures 106-109, pages 167 and 168, was taken by Bart Gamett, Fish Biologist, USDA Salmon Challis National Forest, during fish salvage operations in the Bonanza Rehabilitation Project reach of the Yankee Fork on July 8-9, 2020.

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Galloway 2021. "Yankee Fork Restoration Project, Baseline water quality data--Yankee Fork Salmon River, February 1, 2020-January 31, 2021", Shoshone Bannock Tribes, Fort Hall, Idaho, Contract # 67810, Project # 2002-05-900, Annual Report 2020, Bonneville Power Administration, Portland, Oregon. Prepared by: Julia Markham, Alexis Mendez, Josh Gable, Evelyn Galloway, March 2022. https://www.cbfish.org/Document.mvc/Viewer/P150049

Annual Reports can be found by searching "Yankee Fork" or "Evelyn Galloway" in the Bonneville Power Administration Columbia Basin Fish and Wildlife database:
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Data used for this report and draft copy of report can be found by searching titles beginning with "Yankee Fork Restoration Project" published in 2020, 2021 and 2022 in the online database Streamnet Fish Data for the Northwest Data Store: https://app.streamnet.org/datastore_search_classic.cfm

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ABSTRACT

Discharge, water temperature, water quality, snorkel and macroinvertebrate surveys have been conducted for the Yankee Fork Restoration Project Monitoring and Evaluation Program, from 2006 to 2021, in the Yankee Fork Salmon River, tributaries and pond series side channels. Yankee Fork discharge maximum ranged from 655cfs in 2021 to 3380cfs in 2017, and minimum ranged from 17.8 in 2020 to 65.4 in 2017. Record low flows in 2021 extended the Bonanza Rehabilitation Project dry reach approximately 67m downstream, but remedial actions taken in 2020 recovered loss by seepage along approximately 113m of channel at the upper end of the losing reach. Water temperatures at 44 different sites throughout the watershed remained relatively cool. All meet the IDEQ standards for cold water aquatic life of 22°C maximum and 19°C maximum daily average, except for the outlet of a stagnant pool in Pond Series 2 reaching 23.7°C and Jordan Creek at its mouth reaching 22.7°C midsummer this year in 2021. The Yankee Fork mainstem above Eightmile Creek, and the cold tributaries Cearley Creek, the unnamed tributary to PS2, Jerrys Creek, Ramey Creek, Rankin Creek and Silver Creek consistently meet PACFISH rearing, migration and spawning recommended standards supporting Chinook salmon at all life stages. Mainstem sites downstream from Eightmile Creek including the warmer tributaries Eightmile Creek, Jordan Creek and West Fork exceedance of PACFISH standards varies from year to year depending primarily upon discharge. Compiled statistic fifteen-year trend shows fluctuation but is static, with 2007 as the warmest, and 2017 the coldest following a record snowpack. Mainstem water temperatures are highest at and just below the lower end of the dredged reach at Dredge Camp and Polecamp Flat Campground. Sites monitored overwinter, December and January, vary in temperatures from the mainstem at or just above freezing, to spring influenced tributaries monthly averages ranging from 0.21°C in Ramey Creek, to 4.09°C in Cearley Creek. From 2006 to 2020 multi-parameter SONDE probes measured specific conductivity, pH, turbidity and dissolved oxygen at 4 mainstem Yankee Fork sites, at West Fork, Jordan Creek and briefly in 2013 at the pond series 1 through 4 outlets. Specific conductivity average ranged from 0.052 mS/cm at bridge above Custer to 0.113 mS/cm at Jordan Creek, all falling at the low end of the general range that EPA has found for rivers of the United States, and all falling below the range EPA has studied for inland fresh waters supporting good mixed fisheries. pH at all sites is within the IDEQ Cold Water Aquatic Life Use recommended range of 6.5-9.0, except three short-lived sporadic readings associated with turbidity events, 6.0 at Jordan in 2009, 6.1 at the bridge below Bonanza in 2008, and 9.1 at West Fork in 2010. Turbidity ranged from 0 to above the detection limit of the instruments at 1000 NTU, routinely exceeded the IDEQ Cold Water Aquatic Life Use recommended instantaneous maximum standard of 50 NTU, and on 12 occasions exceeded the IDEQ daily average standard of 25NTU for greater than 10 consecutive days during spring runoff and storm events. All sites maintained dissolved oxygen levels above the IDEQ recommended minimum of 6.0mg/L, except for 48 hours, July 2 to July 4 in 2013 at the Pond Series 2 outlet which fell to a low of 4.79mg/L, and in that same year at Pond Series 1 outlet which dropped briefly to 5.91mg/L on July 17, and to 5.70mg/L on July 27 in 2013. Chinook salmon population estimates, from repeat snorkel surveys coordinated with habitat surveys at Columbia Habitat Monitoring Program (CHaMP) YFSR and Pond Series control and treatment sites, from 2013 to 2020, show a downward trend despite efforts at habitat improvements and supplementation through outplants and smolt release. Benthic riffle targeted macroinvertebrate Puget Sound Lowland 10-50 B-IBI Scores, from repeat samples collected at these same CHaMP sites, from 2014 to 2019, show the Pond Series clustered with lower scores rating on average "poor", and YFSR through the dredged reach, more scattered and rating on average "good". Beaver are showing an increasingly strong presence in all pond series and side channels since rehabilitation treatments were completed.

INTRODUCTION

In the late 1800's gold was discovered within the Yankee Fork basin. A toll road from Challis to Bonanza was completed in 1879, which brought additional miners and equipment into the Yankee Fork Salmon River (YFSR) watershed. Mining for gold in this area became one of the largest impacts to the stream ecosystems as reported by Overton and Brannon (1997) stating "Mining and mine-related activities (roads, settlements, fuel) have been the most pervasive and have altered large portions of the Yankee Fork landscape. Mine-related ground disturbance has removed hill slope and riparian vegetation, exposed and compacted soils, and altered drainage patterns."

In the early 1940's, 10 km of the YFSR was mined for gold using a floating dredge; the dredge was assembled in 1939 and is 112 feet long, 64 feet in height, 54 feet wide, and weighs 988 tons. The dredge's 72 eight-cubic feet buckets dug 10-35 feet into the streambed to recover gold by washing and separating rock from dirt then returning the material back onto the valley floor as piles of tailings. The result of this activity has drastically impacted the stream ecosystem by altering the river sinuosity, floodplain, and substrate, including fish spawning and rearing habitats. The use of mercury was helpful in recovering gold, but it was a contaminant to the river ecosystem and its biota, which also impacted the ecosystem. Initial operation of the dredge mining located in the Yankee Fork started in August 1940 at Pole Flat Campground. Operations ceased at Jerrys Creek in October 1942 due to the World War II. In March 1946 gold dredging resumed along the Yankee Fork, extending on up Jordan Creek 1.3 miles and then brought back down, reaching its present location between the townsite of Bonanza and Jordan Creek in 1952 (Packard 1983). The dredge machine was retired and eventually donated to the USDA Forest Service and is now a historical site and museum that is administered by the Yankee Fork Gold Dredge Association.

Objectives of the Yankee Fork Restoration Project (project) is to (1) restore the physical processes that create and maintain a self-sustaining stream ecosystem and (2) restore physical processes that address biological limiting factors, including fish rearing and spawning habitat and riparian habitat/floodplain. The project is currently gathering baseline data on the YFSR to determine the status of habitat and water quality within the river ecosystem. The data will be used to determine the effects of restoration actions by comparing pre-restoration water quality conditions and post-restoration water quality conditions.

STUDY AREA

The Yankee Fork of the Salmon River is located in Central Idaho in the Upper Salmon River Basin, and is one of the major tributaries of the Salmon River (Figure 1), Hydrologic unit code (HUC) 1706020105. The drainage area of the Yankee Fork is 492 km2 (190 mi2) at the confluence with the Salmon River and has an estimated discharge with a 2-year recurrence interval of 1480 cubic feet per second (cfs) (CH2M Hill, Inc. 2008). The Upper Salmon Basin receives the majority of its precipitation from winter and spring Pacific storms (Thakray, GD 2004). The river is located within the Salmon-Challis National Forest and was formed through extensive volcanic activity occurring 45-50 million years ago (Overton 1997).

The species of interest for the project is the Snake River spring/summer Chinook salmon (*Oncorhynchus tshawytscha*) and the Steelhead trout (*Oncorhynchus mykiss*); the Chinook and Steelhead are currently listed as threatened under the Endangered Species Act. Additionally, the Yankee Fork Salmon River was classified as critical habitat December 1993. The majority of the YFSR is owned by the U.S. Forest Service (administered by Salmon-Challis National Forest); approximately 6 miles of the YFSR, including the floodplain adjacent to the channel, are privately owned through patented mining claim holders including the JR Simplot Company. Other miners own patented claims between Adair Creek and Fourth of July Creek and along Jordan Creek. Near the headwaters of Jordan Creek, HECLA Mining Co. has performed rehabilitation actions at the Grouse Creek Mine since it closed in 1997, and in 1992 rehabilitated the lower 1/2 mile of Jordan Creek at the Yankee Fork confluence for mitigation purposes.

Monitoring sites within the YFSR drainage from 2006 to 2020 includes 15 sites on the YFSR mainstem extending from Ninemile Creek down to the bridge below Flat Rock Campground, and on 9 tributaries to the YFSR within the project area including Eightmile Creek, Jordan Creek, West Fork Yankee Fork (WFYF), Cearley Creek, Jerrys Creek, Ramey Creek, Rankin Creek, and Silver Creek. Multiple monitoring sites are also located in Pond Series 1, 2 and 3. All these sites have human disturbances such as roads, trails, housing/campground development, historic logging, grazing, mining, etc.

METHODS

DISCHARGE

From 2006 to 2014 26 different sites within the Yankee Fork Salmon River (YFSR) watershed have randomly been measured for discharge levels through the field season from April to November. Mainstem YFSR sites included the bridge below Flat Rock Campground (below dredge mined area), the bridge below Bonanza townsite, and above and below West Fork Yankee Fork (3 sites within dredge mined area), and bridge on Yankee Fork road above Custer area, Five Mile Creek area, upstream and downstream of Eight Mile Creek confluence (4 sites upstream of dredge mining impacts). Yankee Fork tributary sites included Silver Creek and Jerrys Creek (both disconnected by dredge material), Rankin Creek, Ramey Creek, Cearley Creek, West Fork Yankee Fork, Jordan Creek, and Eight Mile Creek. Additionally, discharges were measured at the Pond Series 1 (PS1) outlet, Pond Series 2 (PS2) inlet, outlet, and the unnamed tributary to Pond Series 2, and Pond Series 3 (PS3) inlet, midpoint and outlet (Table 5). A USGS gaging station (No. 13296000) was installed in October 2011 on the Yankee Fork upstream of the confluence with the Salmon River, recording discharge, gage height and temperature for the drainage, except for periods when ice affects the station.

Discharge measurements were taken using either a Marsh-McBriney Flo-Mate model 2000 portable flowmeter, Marsh-McBriney Inc. (Table 1) or a SonTek RiverSurveyor system S5 (5 beam) Acoustic Doppler Current Profiler (ADCP) mounted on a SonTek cataboat during high spring flows. Discharge measurements were randomly collected throughout the field season and at each site. Each time discharge was measured the staff gauge level was recorded if available. Sites with staff gauges were: Yankee Fork at bridge below Flat Rock Campground, Polecamp Flat Campground, bridge

below Bonanza and bridge on Yankee Fork road above Custer, at the mouth of the West Fork Yankee Fork and at the mouth of Jordan Creek. All staff gauges were read during high water and in-between discharge measurements throughout the spring, summer and fall, and periodically during winter months.

For measurement of discharge using the Marsh-McBriney Flo-Mate model 2000 portable flow meter suitable transects were identified and a measuring tape (foot-10ths) was stretched across the channel perpendicular to the stream flow; 20-25 measurements (cells) were recorded along the transect at 60% surface depth or an average of 20% and 80% surface depths, depending on overall water column depth, with velocity, depth and distance recorded into a field notebook. Data was transferred into a Microsoft Excel spreadsheet to calculate the overall discharge Q, in cubic feet per second (cfs).

Additional high flow measurements were performed using a SonTek S5 RiverSurveyor system (5 beam) Acoustic Doppler Current Profiler (ADCP). Data from the S5 ADCP was downloaded to a laptop and analyzed using the SonTek *RiverSurveyor Live for PC* software. Operation of the equipment was utilized during periods of high discharge when use of the manual meter was impractical. At certain sites during high flows, the measurement transect needed to be shifted up or downstream from the usual site, though remained in the general area. Procedure followed the USGS recommendations for operation of the ADCP device, as noted in the manual "Measuring discharge with acoustic Doppler current profilers from a moving boat: U.S. Geological Survey Techniques and Methods 3A–22" (Mueller, et al 2009). In 2011, at the bridge below Flat Rock Campground staff gauge readings were recorded at the time the discharge was measured and was graphed with discharge measurements in an effort to establish a rating curve. A power-fit trend line was applied to the graphed data, which produced an equation that was used to estimate discharge from additional staff gauge readings for the Flat Rock site.

On 9/28/2016, during planning phase of the Bonanza Rehabilitation Project, the Bureau of Reclamation (BOR) performed seepage run discharge measurements at 6 sites in the Yankee Fork along the Bonanza reach starting at just below Jordan Creek down to below the bridge on the Yankee Fork road below Bonanza. On 9/15/2020, following Phase III of the Project when the Yankee Fork was shifted to its new channel and flows went subsurface, BOR repeated the seepage run through this reach measuring discharge at 10 sites, and in 2021 repeated the run on 7/28 at 10 sites, on 8/4 at 13 sites and on 9/15 at 13 sites (Table 5; Figures 8 & 12). To monitor groundwater flow direction and water levels in the floodplain through the Bonanza reach prior to rehabilitation, on September 1, 2016 BOR installed six 2" slotted PVC piezometer wells, 5 to the west off river right and 1 to the east off river left. "Materials encountered during excavation was predominantly Poorly Graded Gravel With Sand And Cobble (GP)sc. Ground water inflows during the excavations caused caving of the test pit walls and limited the advancement of the excavations. This resulted in shallow excavations that were less than 12-feet deep. Layers of clean sand, gravel, and cobble were exposed and provided preferential ground water flow paths leading to erosion and caving" (Lyon 2022). During the Bonanza Rehabilitation Project construction, the wells in the floodplain to the west of the river were destroyed. In 2020 following Phase III when the

Yankee Fork was shifted to its new channel and flows went subsurface, ten new, relatively shallow, due to caving issues, 2" diameter slotted PVC piezometer observation wells were installed in the floodplain to the west of the river on August 24 and 31, logged using the Unified Soil Classification Method and photographed. These wells were too shallow and went dry on August 14, 2021. On September 14, 2021 13 new piezometer observation wells made of 3" perforated steel pipe, with pointed tips capable of penetrating through the coarse gravels with cobbles and boulders, were installed using a Caterpillar 318BL trackhoe with a modified plate compacter to a depth of about 15 feet (Figure 8). The following day, on September 15, 2021, loggers were placed in these wells to monitor conductivity for a SBT/BOR tracer study. On September 16, 2021, the conductivity loggers were removed and ONSET HOBO Water Level (Model U20L-04) data loggers were deployed in eleven of the thirteen new wells, preset to launch at 3:00 pm with static water levels being recorded every six hours to capture diurnal fluctuations. On October 6, 2021 these water level data loggers were removed and replaced by the conductivity loggers for measurement of baseline conditions until November 18, 2021 when they were reinstalled (Lyon 2022; Table 5).

Two tracer studies were conducted through the Bonanza Rehabilitation Project reach in 2021, one on August 4 and one on September 15. Both data logger and SONDE conductivity meters were used and were calibrated and synchronized prior to deployments. On August 4 conductivity data loggers were installed in 9 out of the 13 PVC piezometer observation wells (excluding the uppermost wells OW20-8, 9 and 10), and a combination of data logger and SONDE's placed at 20 surface water sites, including 1 roving reference for baseline, in both mainstem Yankee Fork and dredge ponds. On September 15 data loggers were installed in all 13 new steel piezometer wells and the 1 PVC well remaining from 2016, and a combination of data logger and SONDE's placed at 16 surface water sites as before, with one as reference. For each tracer study SBT released into the Yankee Fork river, adjacent to the dredge below the mouth of Jordan Creek, two 100 gallon (378.5L) containers of solution each containing NaCl dissolved to a salinity of 5.6ppt or specific conductivity at 10,000µS/cm and ~225g of Fluorescein, beginning at the center of the channel and working out to either bank. Conductivity data loggers and SONDE's were removed and data downloaded. On October 6 data loggers were reinstalled in the observation wells until November 18 when they were pulled to collect baseline conductivity conditions. BOR is currently analyzing results (Kohler 2021; Lyon 2022).

TEMPERATURE

From 2007 to 2021 Onset© HOBO or Tidbit thermal data loggers were deployed at 74 different monitoring sites in the Yankee Fork Salmon River, tributaries to the Yankee Fork, in Side Channels 1 and 2, and Pond Series 1, 2 and 3. Thermal dataloggers are placed at locations within the mainstem Yankee Fork to record baseline water temperature conditions above, within and below the dredge tailings. Mainstem YFSR sites upstream of the dredged section include above Ninemile Creek, above Eightmile Creek, near Fivemile Creek, at the bridge on Yankee Fork road above Custer and above Jordan Creek. Mainstem YFSR sites within the dredged section include below Jordan, at bridge below Bonanza, above Side Channel 1 inlet, above Side Channel 2 inlet, above and below the West Fork Yankee Fork, at Pond Series 3 inlet, at

the second bridge below WFYF, at bridge between the Pond Series 2 inlet and Pond Series 3 outlet, at Pond Series 2 outlet, and above the Dredge Camp. Mainstem YFSR sites downstream of the dredged section are at Polecamp Flat Campground, approx. 200m below, and at the bridge below Flat Rock Campground in the canyon narrows approx. 1 km below. Yankee Fork tributary sites include Eightmile Creek, Jordan Creek, the unnamed intermittent tributary / spring / Yankee Fork subflow entering along the river right bank at the bridge below Bonanza, WFYF, Cearley Creek, the unnamed tributary to Pond Series 2, Jerrys Creek, Ramey Creek, Rankin Creek, and Silver Creek. Side channel sites include the upper end and outlet of Side Channel 1 and the outlet of Side Channel 2 within the new West Fork Reconnect floodplain. Pond Series sites include Pond Series 3 inlet, historical culvert site, upper-mid, mid at the historical big pond outlet, and outlet at the historical lower pond outlet or at the PIT tag array; Pond Series 2 inlet, mid-point at the 4th check structure downstream from inlet, and outlet; and Pond Series 1 at the upper pond northwest shore and outlet, the lower pond inlet and outlet, and the outlet at the Yankee Fork road.

Temperature data loggers are deployed continuously throughout most of the warm season, capturing baseline water temperature characteristics at the most critical/stressful time of year for salmonids during rearing, migration and spawning life stages. Data loggers were also deployed, with mixed success due to ice buildup, at select sites to monitor overwinter temperatures.

Models of Onset© HOBO dataloggers used were the U22-001 Water Temp Pro v2, U23-004 Temperature/External (for measurement of both air and water simultaneously), WTA08 StowAways or the UA-002-64 Pendent temp/light (Table 2). HOBOs were anchored within the flowing portion of the channel by wiring to rebar stakes, sometimes tethered, and programmed to record water temperatures originally at 1 hour, and later at 30-minute increments within a 24-hour period throughout the field season. The United States Forest Service (USFS), Salmon Challis National Forest, stream temperature data used in this report were collected using Onset© TidbiT v2 dataloggers programmed to record water temperature every 15 minutes, deployed suspended in a tethered open-ended steel pipe (USFS 2012-2013).

Data from HOBO and Tidbit temperature data loggers were downloaded to either the Onset BoxCar or more currently HOBOware Pro software programs and exported to Microsoft Excel. Where HOBOs were not available or dysfunctional some years, or to provide comparisons for an accuracy check, or for new or more complete temperature profiles, SONDE, Pressure Transducer or USFS Tidbit data were used. The monthly minimum, maximum, average and median water temperatures are calculated for each HOBO site and tabulated. The seasonal maximum, maximum daily average, maximum 7-day running average maximum, the maximum 7-day running average maximum during the approximate Chinook salmon spawning timeframe within the YFSR, from Aug. 1 through Sept. 14, the number of days over the entire season the 7-day running average maximum exceeded the Chinook salmon migration and rearing Pacific Salmon Conservation Strategy (PACFISH) recommended maximum threshold of 17.8°C, and the number of days the 7-day running average maximum exceeded the Chinook salmon spawning PACFISH recommended maximum threshold of 15.6°C during the estimated spawning timeframe for the YFSR, from Aug.1 through Sept. 14, were extracted from the

data sets and tabulated in order to monitor current conditions, trends and to compare results to the Idaho Department of Environmental Quality (IDEQ) temperature criteria standards, and to the PACFISH standards (IDEQ 2009; PACFISH 1995). The 7-day running average maximum temperatures for all years at each site are graphed. Included on these graphs for reference is the PACFISH recommended temperature guidelines for Chinook salmon rearing/migration and spawning (PACFISH 1995; Table 4). The 7-day running average of daily average temperatures are calculated and graphed from November through March for overwinter temperature comparisons between sites.

WATER QUALITY / SONDES

From 2006 to 2018 Multi-parameter YSI 6600 SONDE (YSI-Corp) were used to collect baseline water quality conditions, and to monitor changes during and after rehabilitation work, at four locations in the mainstem Yankee Fork Salmon River below, within and above the dredge tailings, and in two major tributaries along the dredged section of the Yankee Fork, Jordan Creek and the West Fork. The lowest mainstem YFSR SONDE was placed at the bridge below Flat Rock Campground, 2.3 km downstream of the lower extent of the dredge tailings. The SONDE placed at the first bridge below the WFYF, 7.6 km upstream of the bridge below Flat Rock Campground, was a little more than halfway through the 10 km dredged reach. The SONDE at the bridge below Bonanza, 2.6 km above the bridge below West Fork, was 1.3 km downstream from the upper extent of dredge tailings. The highest mainstem SONDE was at the bridge on the Yankee Fork road above the Custer townsite, 4.4 km upstream of the dredge mining tailings. The SONDE placed at the mouth of Jordan Creek, which enters the YFSR at the upper extent of dredge tailings, is located at the bottom end of 2.1 km (1.3 miles) of dredge mined tailings on Jordan Creek itself of which the lower half mile was restored by Hecla in 1993 (BOR 2012). The SONDE deployed at the mouth of the West Fork, and later in 2016 moved to Virginia's cabin, drains a large watershed with no dredge mine tailings. In 2013 SONDE's were placed for brief durations in the outlets of Pond Series 1, 2, 3 and 4; and in 2016 a SONDE was placed for a brief duration in Pond Series 1 at the lower pond outlet check structure.

The SONDE, equipped with individual sensors that collect temperature, specific conductivity, pH, turbidity and dissolved oxygen, were set to record at 15 to 30-minute intervals and deployed and recalibrated on an average of two to three week intervals throughout the field season (April-October). The SONDE sensor capabilities are defined in Table 3. SONDE's were deployed using aluminum boom housings anchored to bridges, or PVC housings anchored to bridge or bank rip rap, which held the sensors in the water column and provide security to the equipment. The SONDE at the mouth of the West Fork was first attached to the SBT juvenile rotary screw trap and later moved to a PVC housing attached to rebar driven mid channel. Data was collected starting in April each year, after ice is no longer present on the river and continued through October when ice began to form. SONDE's were maintained and calibrated in accordance with manufacture specifications. Each unit was recalibrated every two to three weeks continuously throughout the field

season, depending on the water clarity or how quickly the SONDE's were drifting in parameters, or due to algae buildup. SONDE's were generally removed and replaced at each location on the same date. The calibration process takes approximately 45 minutes for each SONDE and each sensor was recalibrated using appropriate fresh standards. Sensors and wiper brushes were replaced when needed from 2006 to 2009, and were later replaced at each recalibration. On-site recalibration of dissolved oxygen was conducted before deploying SONDE, to account for the differences in atmospheric pressure at each bridge site.

Data from the SONDE's was downloaded to a laptop computer in the field before each recalibration using the YSI Inc. computer program Eco-Watch 3.18.00. SONDE's were redeployed with a delayed start time to avoid erroneous data from air exposure and to allow time for SONDE probe equilibration with water conditions. The data files for each location for each year were exported and complied into Microsoft Excel workbooks. Breaks in data collection during recalibration were analyzed and any data that appeared to be influenced by air exposure during those times was deleted. Recalibration time gaps were manually filled back into the data set to maintain a consistent number of data points per day for efficient calculations of daily minimum, average, and maximums. Data was graphed against date-time and examined for outliers. The YSI owner's manual and YSI corp. technical support was consulted for help on detecting outliers.

Temperature outliers were detected by observation of spikes on the graphs associated with air exposure during SONDE recalibration or air exposure referenced in logbooks. Air exposure of water temperature coincides with air exposure to the conductivity since both are located on the same probe and designed to read simultaneously. This probe is situated highest in the water column therefore is more easily subject to air exposure during disturbance of the boom or when water drops such as occurred in Jordan Creek. In most cases it was decided that if water temperature was affected by air it was assumed that all probes were exposed to air so all other water quality data was removed at those times; subsequent outlier investigations of shallow, subsiding Pond Series outlet flows we utilized the relative position of each probe and its elevation difference, or height in the water column, or relative submersion of each probe, to decide which parameter outlier to remove.

Specific conductivity outliers are detected as sudden drops in values usually seen when the probe is exposed to air during recalibration. Natural drops in specific conductivity correlate with turbidity events and are distinguished from outliers by observation of the correlation when specific conductivity is plotted against turbidity events, or by observing unusually high or low values in the statistical summary calculations.

The turbidity probe showed outliers as recurring, repetitive high values within a fairly narrow range near or above the detection limit of the instrument of 1000NTU, associated with turbidity events. The YSI owner's manual and YSI corp. technical support both cautioned that these high values could be either actual particles drifting in front of the detector,

air bubbles on the detector or could be the wiper stuck or mis-parked in front of the detector optics (YSI technical support 1/11/2010; YSI n.d.). Turbidity values that repeated within a narrow range, that alternated with very low or relatively low values were assumed to be stuck wiper readings and were deleted from the dataset. Natural appearing spikes of turbidity showing tails that rise and fall with random highs above 1000NTU were left in the data set because YSI corp. technical support stated that "The specified range for accurate readings on the probe is 1000NTU but the probe will go higher if the optics are blocked for some reason or another." (YSI Technical Support 1/11/2010). In 2006, 2007, 2008, 2009 and 2015, at all monitoring sites, recurring, repetitive turbidity readings were observed near the detection limit of 1000 NTU (each SONDE instrument pegs at different values), associated with turbidity events that seemed pegged or stuck. These "pegged" values were determined to be erroneously high measurements resulting from deposit build up on the SONDE turbidity sensor or a malfunction with the sensor wiper blade assembly occluding the sensor during the sampling period. An effort was made to clean the data of these high mis-parked wiper blade readings, but some may have been missed in an effort to preserve the peaks of true turbidity events. From 2010 to 2018 all turbidity sensor optic wipers were replaced at each recalibration and very few to no high pegged readings have been detected in the data sets from all sites. Negative turbidity values were changed to zero based on our understanding and YSI Corporation technical support knowledge that negative turbidity readings cannot exist and are most likely associated with incorrect calibration (YSI Manual n.d.); and USGS who recommends reporting data only within the detection limit of the instrument (USGS 2005). The detection limit of turbidity for the YSI 6600 SONDE is 0-1000NTU (YSI Manual n.d.).

In 2020 Jim Gregory with Lost River Fish Ecology, INC. and Caselle Wood with Trout Unlimited deployed two OTT HydroMet Hydrolab HL4 Multiparameter Water Quality SONDES in the Yankee Fork, one at 200 ft upstream from the Bonanza Rehabilitation Project reach upper point of disturbance, approximately 1160 feet downstream of Jordan Creek, on river left (44.3759, -114.7231), and another 800 feet downstream of the Project reach at 100 feet downstream from the bridge below Bonanza on river left (44.3677, -114.7251), to monitor turbidity generated by instream work. The OTT HydroMet Hydrolab HL4 turbidity sensor utilizes a small aperture to reduce false readings from particulates and other debris, a user-programmable self-cleaning system that can perform up to 10 cleaning cycles before each reading to remove fouling or debris that could potentially affect readings, and a fixed wiper parking position to ensure consistent data collection after each cycle. The Hydrolab HL4 turbidity sensors manufacture specification range is from 0 to 3000 NTU; accuracy is ± 1% up to 100 NTU, ± 3% from 100 to 400 NTU, and ± 5% from 400 to 3000 NTU; and resolution is 0.1 NTU from 0 to 400 NTU and 1 NTU for >400 NTU. The Hydrolab HL4 temperature sensor has a range of -5°C to 50°C, with accuracy of +/-0.10°C and resolution of 0.01°C (OTT 2020). Recalibration of each of the HL4 meters in 2020 occurred once each during the summer. The upper meter was recalibrated on July 10 and the lower meter was recalibrated on July 13. Turbidity data was cleaned of outliers, which were sudden high recordings assumed to be from a temporary passing object such as a leaf, not associated with plumes which would have a gradual rise and gradual fall in turbidity readings. Values only >50 NTU were removed in order to have a consistent repeatable reference-based cleaning strategy, to assure the more accurate assessment of compliance with IDEQ's >50 NTU instantaneous standard,

and to avoid unnecessarily removing of valid data. From both the upstream HL4 and lower HL4 cleaned datasets values >50NTU were extracted, totaled, tabulated and graphed. Values >50NTU recorded at the lower HL4 were totaled and tabulated for the timeframe that excluded natural events as determined by turbidity recorded at the upper HL4. For both upper and lower sites the daily average was calculated and graphed, the maximum daily average was tabulated, and the number of events where 10 consecutive days exceeded 25NTU was totaled and tabulated. The Idaho Department of Environmental Quality (IDEQ) monitored turbidity exceedances and standards compliance of the Bonanza Rehabilitation Project using a method of analysis based on the definition for the Zone-of-Initial-Dilution (ZID), Idaho Administrative Code IDAPA 58.01.02.010.117: "Zone of Initial Dilution (ZID). An area within a Department authorized mixing zone where acute criteria may be exceeded. This area shall be no larger than necessary and be sized to prevent lethality to swimming or drifting organisms by ensuring that organisms are not exposed to concentrations exceeding acute criteria for more than one (1) hour more than once in three (3) years. The actual size of the ZID will be determined by the Department for a discharge on a case-by-case basis, taking into consideration mixing zone modeling and associated size recommendations and any other pertinent chemical, physical, and biological data available. (4-11-15)" (IDAPA 58.01.02); and standards criteria specified in IDAPA 58.01.02.250.02.e: "Turbidity, below any applicable mixing zone set by the Department, shall not exceed background turbidity by more than fifty (50) NTU instantaneously or more than twenty-five (25) NTU for more than ten (10) consecutive days. (8-24-94)" (IDAPA 58.01.02). To determine exceedances of the IDEQ turbidity >50 NTU instantaneous standard by the work done for the Bonanza Rehabilitation Project in 2020, values of >50 NTU recorded at the lower HL4 turbidity meter, during the work window from July 8 to August 20, excluding the natural event that occurred on 7/24 (based on natural events recorded at the upper HL4) were averaged with readings immediately following recorded over 1 hours timeframe, and those hourly averaged values exceeding 50 NTU were totaled, tabulated and graphed. In determining the 800 feet downstream ZID/Mixing Zone used to monitor turbidity generated by the Bonanza Rehabilitation Project activities in 2020, Troy Saffle, IDEQ explains: "There isn't a ton of policy or 'science'. We field fit each project to maximize the settling distance, usually near the downstream property boundary. Hopefully that distance does allow for settling in depositional areas. Jim [Gregory, Lost River Fish Ecology, Inc.] and Cassie [Wood, Trout Unlimited] suggested the spot after I explained what we needed [...] Although Mixing Zones are often thought of only with discharge permits, we apply a similar process to turbidity monitoring criteria's acute numbers so that we have the ability to comply and not shut down stream and streambank work. The ZID (aka Mixing Zone) is determined case-by-case by DEQ" (Saffle 2020). In 2020 all turbidity raw recordings and calculated values are included in tables and/or on graphs and reported in this document as potentially required based on EPA action exceptions stated in its December 16, 2019 Review and Clean Water Act Action on Idaho's New and Revised Water Quality Standards, Idaho Rule Docket 58-0102-1401, which includes changes made to the definition of Zone-of-Initial-Dilution (ZID), submitted on October 26, 2016: "The EPA's action applies only to waterbodies in the State of Idaho and does not apply to waters that are within Indian Country as defined in 18 U.S.C. § 1151. In addition, nothing in this action shall constitute an approval or disapproval of a water quality standard that applies to waters within Indian

Country. The EPA, or authorized Indian Tribes, as appropriate, will retain responsibilities for water quality standards for waters within Indian Country." (EPA 2019)

Two types of Dissolved Oxygen sensors have been deployed: The 6562 Rapid Pulse Polarographic (2006 to2010), and the 6150 ROX Optical (from 2011 to 2018). For interpretation of data from the 6562 Rapid Pulse Polarographic probe, which measures diffusion of oxygen through a Teflon membrane, probe failures were detected using its correlation to the DO charge: "*The DO charge is a measure of the function of the probe. It can change a bit in different DO levels but you should not see big spikes in it. A charge of about 35 - 70 is considered to be acceptable. Normally if you see your DO charge start declining that is an indication that you may have a hole in the DO membrane. As it goes up that is an indication that the probe needs to be resurfaced with the 2400 grit sanding disks."* (YSI technical support 1/14/2010). All DO data with a DO charge below 35% was removed. When a 6150 ROX Optical dissolved oxygen probe fails to recalibrate, it is sent back to YSI for replacement.

Summary statistics are calculated for all year's data at each site for temperature, specific conductivity, pH, turbidity and dissolved oxygen; results graphed and compared to applicable PACFISH, IDEQ or EPA threshold standards.

FISH

Aquatic habitat sample sites within the Yankee Fork Salmon River watershed have been selected and surveyed for habitat conditions by Watershed Solutions, Inc. (WSI), according to a study design developed by WSI in their document "Fish Habitat Monitoring Plan for the Yankee Fork Watershed, Status, Trend and Effectiveness Monitoring" (WSI 2013), using the Columbia Habitat Monitoring Program (CHaMP) sampling protocol and sample design (CHaMP 2013).

Snorkel surveys have been conducted by the Shoshone Bannock Tribes at all CHaMP habitat survey sites within the Yankee Fork Salmon River watershed from 2013 to 2021 using the method provided in the document: "PROTOCOL FOR MONITORING EFFECTIVENESS OF IN-STREAM HABITAT PROJECTS (Channel Reconfiguration, Deflectors, Log and Rock Control Weirs, Roughened Channels, and Woody Debris Removal), MC-2" (SRFB MC-2 2011).

"The Yankee Fork Fish Habitat Monitoring study design will combine CHaMP with a modified before-after-control-impact (BACI) study design, used frequently for impact monitoring. Fish habitat data will be collected at control and impact sites before restoration and after restoration activities. These sites will be determined by using similar geomorphic reach types as established by the Bureau of Reclamation (Reclamation, 2012b and 2012c). The Lower Yankee Fork Implementation Plan 2008-2018 will inform the monitoring study design, specifically the spatial and temporal allocation of sites in the watershed. Fish habitat monitoring in the Yankee Fork watershed will begin in 2013 and continue through 2018. The first year, 25 sites will be sampled (15 effectiveness monitoring sites and 10 status and trend sites); ten sites

will be added in 2014 and again in 2015 for a total of 45 sites, based on the CHaMP three-year rotating panel design. Subsequent years will be re-visits to these 45 sample sites." (WSI 2013).

From 2013 to 2021 a total of 55 different sites within the YFSR watershed have been established and CHaMP habitat surveyed and snorkeled according to the three-year rotating panel design. In 2015 three of these sites were shortened to subsamples, 133 and 901 along the lower and upper reaches of Pond Series 2, respectively, and 1129 along the lower reach of Pond Series 3, replacing the original full reaches in subsequent surveys. In 2016, with the rehabilitation of the West Fork Yankee Fork confluence, site 1709 changed from mainstem Yankee Fork habitat to a side channel habitat of the Yankee Fork, called Side Channel 1. In 2017 two more sites were shortened to subsamples, Site 2159 along the upper reach of Pond Series 3, and Site 713 in Pond Series 1 above the lower pond, which was "shortened to omit the two very large ponds at the Top of Site that were not impacted by restoration" (Heitke 2018). In 2020 after completion of the Bonanza Rehabilitation Project the YFSR Site 1196, starting at the bridge below Bonanza, was extended upstream ~500 meters, to meet the bottom of Site 595 which was extended downstream ~200 meters; ~315 meters of side channel was added to Site 1196 and ~500m of side channel added to Site 595 (Heitke 2021).

CHaMP habitat Site bankfull surface areas (m^2) and Site bankfull volumes (m^3), and snorkel surveys were compiled for all years from 2013 to 2020, and Chinook salmon and Rainbow trout/Steelhead (O. mykiss) surface area and volume densities were calculated. In 2017 the CHaMP GIS team "retired" the bankfull volume and bankfull depth metrics so fish densities were presented only for bankfull surface areas for that year (Heitke 2018). In 2018 and 2019 bankfull volume and bankfull depth measurements were resumed but in 2020 was discontinued again (Table 15; Heitke 2021).

MACROINVERTEBRATES

From 2014 to 2020 benthic targeted riffle macroinvertebrate samples were collected at all or a subset of CHaMP Sites that were also being surveyed for habitat during that same year, using the protocol outlined in the document "BPA MBACI Protocol for Monitoring the Effectiveness of Off Channel Habitat / Floodplain Enhancement Projects" (MBACI 2014). Eight, 1ft. x 1ft. (30.5cm x 30.5cm), D-frame kick net samples, using a 500µm mesh net size, were collected randomly at all riffles within each CHaMP Site and composited. Samples were shipped via chain of custody to Rhithron Associates, Inc., 33 Fort Missoula Road, Missoula, Montana for analysis. " Standard sorting protocols were applied in an attempt to achieve representative subsamples of a minimum of 500 organisms. Caton sub-sampling devices (Caton 1991), divided into 30 grids, each approximately 6 cm by 6 cm were used. Each individual sample was thoroughly mixed in its jar(s), poured out and evenly spread into the Caton tray, and individual grids were randomly selected. The contents of each grid were examined under stereoscopic microscopes using 10x-30x magnification. The final grid was completely sorted of all organisms, and number of grids sorted was recorded. Sample sorting continued until either the 500 organism target was achieved and the last grid was completed or the entire sample was processed. All invertebrates

from each selected grid were placed in 80% ethanol for subsequent identification. All unsorted sample fractions were re-preserved and stored at the Rhithron laboratory; unsorted sample fractions will be stored for a period of 3 months from completion. Organisms were individually examined by certified taxonomists, using 10x – 80x stereoscopic dissecting scopes (Leica S8APO) and identified to the lowest practical level, using appropriate published taxonomic references and keys." (Rhithron 2020). Sample results from Rhithron were compiled, metrices were extracted or calculated for, and presented in a table (Table 16). The sample biomass and total abundance were corrected for lab subsampling using the grid factor provided in the results for each sample, and adjusted to a unit area of 1 meter^2 by dividing by the surface area of each sample which was 8 x 30.2cm^2 or 0.74m^2. Metrics tabulated were: Total sample biomass (mg), total taxa richness, total abundance, EPT taxa richness, % EPT taxa abundance, % Ephemeroptera (mayflies) by abundance, % Plecoptera (stoneflies) by abundance, % Trichoptera (caddisflies) by abundance, % Chironomidae (midges) by abundance, % Dominant taxa (3), % Total pollution tolerant by abundance, % Total pollution sensitive (intolerant) by abundance, % Total unknown pollution tolerance by abundance, weighted average (by abundance) of Tolerance Values and rating, % Unknown Tolerance Value by abundance, % Semivoltine (> 1 year life cycle) by abundance, % Univoltine (1 year life cycle) by abundance, % Multivoltine (< 1 year life cycle) by abundance, % Predator by abundance, % Collector (total) by abundance, % Shredder by abundance, % Scraper by abundance, the B-IBI Score and rating, and the Idaho observed vs. expected (O/E) model calculations.

Ratings for the weighted average of Tolerance Values were found in the document "An Improved Biotic Index of Organic Stream Pollution," by Willian L. Hilsenhoff (Hilsenhoff 1987). Ratings for the B-IBI Score were taken from the Puget Sound Lowlands Stream Benthos 10-50 B-IBI: Fine Resolution (Species-Family) table found online through pugetsoundstreambenthos.org (Puget 2020). “The pollution tolerant percent and pollution sensitive (intolerant percent) are binary (true/ false) and summed for the relative abundance of these taxa within a given sample and I would not necessarily expect these two measures to correlate well to a continuous gradient of say a weighted average (WA) of the Tolerance values. They also generally relate to two different “pollution classes” the B-IBI is directly correlated to the urban gradient in Washington state. The Tolerance values are a mixture of values from multiple sources (e.g. EPA, Idaho, Washington, BPJ) and are more often referred to as being correlated to saprobity (organic enrichment). […] The B-IBI that we have reported to you is from the Puget Sound Stream Benthos work (10-50). […] Although the PSL (Puget Sound Lowlands) B-IBI contains metrics that almost universally respond to most human disturbance gradients the scoring criteria and ‘biological condition’ categories are calibrated to Puget Sound Lowland streams and may not be the best metric/ index to use in the Yankee Fork of the Salmon River. There are other indices that have been developed that may be more regionally responsive to gradients [found in the] YFSR including the Idaho O:E, or the Idaho River Index" (Sullivan 2020).

Predictor variables needed for the Idaho O/E model calculations were compiled for Stream and River classifications according to Table 4-19 and Table 4-20 in the Idaho Department of Environmental Quality (IDEQ) document "Biological Assessment Frameworks and Index Development for Rivers and Stream in Idaho" (Jessup 2011). Classification of sites as either Stream or River were determined using the rating system found in the Table 1-2 of this same document (Jessup 2011). Stream order for the Yankee Fork, based on Strahler 1957, was determined to be 5 below the West Fork (Strahler 1957). CHaMP habitat survey data was used for average wetted width at baseflow and average depth (thalweg) at baseflow. Using the stream order, average baseflow wetted widths and thalweg depths all sites were classified as either Stream or River. Predictor variables compiled for Stream classified Sites were Latitude, Longitude, Julian day that the macroinvertebrate sample was collected, elevation of sample site in feet, and the average bankfull width in meters (from CHaMP habitat survey data). Predictor variables for River classified Sites were Latitude, Longitude, Julian day that the macroinvertebrate sample was collected, elevation of sample site in feet, average wetted width at baseflow in meters, Strahler 1957 stream order, membership in Mountain site class (Figure 3-5, Jessup 2011), average annual precipitation from 1971-2000 in millimeters and average annual maximum air temperature from 1971-2000 in Celcius. PRISM Climate Group, Northwest Alliance for Computational Science and Engineering, Oregon State University, online database search for average annual precipitation and maximum air temperatures, from 1971-2000, for entire Custer County, Idaho and at the Site level (Site 725) were found to be no different, with average annual precipitation at 316.6mm, and average annual maximum air temperature at 12.3 ^{o}C (PRISM 2020) [Note that these values are not reflective of current annual precipitation and maximum air temperatures which are higher according to the Bonanza RAWS online database https://wrcc.dri.edu/]. Using these predictor variables Rhithron Associates, Inc. calculated the Idaho O/E values for each Site. "Predictive Models are used to compare observed biological taxa (O) to those expected (E) in a system based on site environmental settings and assemblages in reference sites […]. The ratio, O/E, should be close to 1.0 when the biological assemblage is unimpaired" (Jessup 2011).

RESULTS

DISCHARGE

Discharge measurements, recorded by the USGS gauging station 13296000, near the mouth of the Yankee Fork Salmon River, since its installation, late in 2011, during times free from ice influences, from April 1 to October 31, have ranged from a minimum of 17.8cfs recorded April 2, 2020, to a maximum of 3380cfs recorded on June 1, 2017. Annual *calendar* mean flows ranged from a low of 136.4cfs in 2021 to a high of 425.5cfs in 2017, and averaged over 9 years at 227.7cfs. Peak runoff events, occurring from as early as April 26 in 2012 to as late as June 5 in 2019, range from a high of 3380cfs in 2017 to a low of 655cfs in 2021, and averaged over the last 10 years at 1784cfs. Minimum or base flows, occurred in

late Fall from as early as September 11 in 2013 to as late as October 28 in 2011, 2015 and 2019, and occurring in Spring on April 2 in 2020, and April 3 in both 2014 and 2018, ranged from a low of 17.8cfs on April 2, 2020 to a high of 65.4cfs on October 15, 2017, and over the past 9 years averaged 46.8cfs. During the critical time of year when Chinook spawning occurs, estimated by SBT to be from August 1 to September 14, the average discharge over that timeframe ranged from a low of 56.7cfs in 2021 to a high of 117cfs in 2017 (Table 6; Figure 11; USGS 2021).

A special study by USGS, from data collected 2012 to 2018 at transects located on the Yankee Fork at the bridge below Bonanza and at the bridge below the West Fork, and at the mouth of the West Fork, show that the West Fork contributes an average of 47% to the total Yankee Fork flow, and ranged from 38-62%. Discharge measurements taken by SBT in the Yankee Fork at the bridge below Bonanza and at mouth of West Fork, in 2007, 2008, 2010, 2011 and 2013 shows similar results to USGS and that the West Fork contributed an average of 45%, ranging from 39-51% (Table 8).

During the critical time of year, minimum or base flows on the mainstem Yankee Fork, measured by SBT, using data from approximately September to mid April, at the bridge below Flat Rock Campground, 2008-2013, ranged 58-112cfs and averaged 76cfs; at Polecamp Flat Campground, 2006-2008, ranged 42-114cfs and averaged 76cfs; at bridge below West Fork, 2008-2009, ranged 63-80cfs and averaged 72cfs; and above the big West Fork tributary, at bridge below Bonanza, 2006-2012, ranged 13-49cfs and averaged 33cfs; at bridge on the Yankee Fork road above Custer, 2010-2012, ranged 24-36cfs and averaged 30cfs; above Fivemile Creek, 2006, 2008, 2009, 2011-2013, ranged 19-37cfs and averaged 28cfs; and above Eightmile Creek, 2011-2013, ranged 13-22cfs and averaged 18cfs (Table 8).

The West Fork, largest tributary to the Yankee Fork, almost doubling its size throughout most of the year, discharge measured by SBT from 2007-2014, and by USGS during its special study of its contribution, in 2018, ranged from a low of 20cfs in 2009 to a high of 593cfs during spring runoff in 2018. The minimum or base flow, from data collected September to April, ranged 20-46cfs and averaged 29cfs. Jordan Creek, second largest tributary to the Yankee Fork, entering from the northwest at the top of the dredged reach, measured by SBT 2006-2014, shows what seems a flashier or extreme discharge system, ranged from a low of 1.37cfs in September 2012 to a high of 162cfs during June runoff in 2010, and minimum or baseflows ranged 1.37-8.40cfs and averaged 3.63cfs. Third largest tributary, Ramey Creek, entering the Yankee Fork from the east through the Dredge Camp, measured by SBT 2011-2013, ranged from a low of 1.82cfs in September 2012 to a high of 62.24cfs during spring runoff June 2011, and minimum or baseflow ranged 1.82-3.36cfs and averaged 2.62cfs. Rankin Creek, fourth largest tributary, entering from the west at the bottom of the dredged reach, measured 2010-2013, ranged from a low of 1.08cfs in September 2012 to a high of 25.36cfs during June spring runoff 2011, and minimum or baseflows ranged 1.08-2.27cfs and averaged 1.43cfs. Eightmile Creek, at about 6 miles upstream of Jordan, entering from the north, measured by SBT 2011-2014 during normal to low flow (no high flow data), and at the same time as the Yankee Fork above Eightmile, contributes an average of approximately 21% to the total Yankee Fork flow; discharge ranged from 3.29-8.39cfs, and minimum or base flows ranged 3.29-5.73cfs and averaged higher than Jordan Creek at 4.64cfs. (Table 8)

Three small cold spring-fed dominated tributaries, Cearley Creek, Jerrys Creek and Silver Creek, entering the Yankee Fork from the east along the lower half of the dredged reach, with channels displaying less annual but more storm surge type channel-forming flow features – incised – down cut channel features, maintain more consistent flows less related to seasonal snow melt driven fluctuations seen at other sites in the watershed. Cearley Creek, entering at the upper end of Pond Series 3, measured 2011-2014, ranged from a low 0.26cfs in February 2013 to a high of 1.63cfs in April 2012, and averaged 0.88cfs. Jerrys Creek, just upstream from the Dredge Camp, buried by dredge material and disconnected at its mouth, entering the Yankee Fork at an unknown location, measured in 2008-2014 at the mouth of the canyon, ranged from a low of 0.0028cfs in March 2013 to a high of 3.34cfs in May 2009 and averaged 0.63cfs. Silver Creek, lowest tributary of the dredged reach, also buried by dredge material and disconnected at its mouth, and entering the Yankee Fork at an unknown location, measured 2008-2014 at just above where it disappears, ranged from a low of 0.25cfs in July 2013 to a high of 9.11cfs in May 2008 and averaged 2.21cfs. (Table 8)

Pond Series 1 outlet, measured 2010-2013 just upstream of the culvert under the Yankee Fork road, ranging from 0.02cfs to 26.78cfs and averaging 9.22cfs, perennially dried from flows sinking into the dredge material and facilitated by upstream beaver activity. In 2017 the Pond Series 1 Rehabilitation Project established perennial flow and connectivity to the Yankee Fork by rerouting the channel away from dredge material, filling in half of the pond above and diverting ground water flow loss by installing lateral clay plugs (Gregory 2017; Figure 6). Since rehabilitation beaver activity with a dam built at the upstream end of the new outlet channel has backed up water into the adjacent tailings resulting in resumed flow seepage loss through the tailings and diminished flows at outlet (Gregory 2022). Pond Series 2 inlet, accessed by the Yankee Fork only during high flow, discharge was measured on May 2, 2012 at 2.01cfs. The unnamed tributary entering Pond Series 2 at its upper end, measured at its mouth 3 times, 2012-2013, ranged from 0.23cfs to 2.85cfs and averaged 1.89cfs. Pond Series 2 outlet, measured 4 times, 2012-2013, ranged from a low of 0.14cfs in February of 2013 to a high of 4.63csf in May 2012 and averaged 2.52cfs. Pond Series 3 inlet, measured 2 times in 2013 after the Pond Series 3 Rehabilitation Project, ranged from 6.56cfs on April 10 to 28.47cfs on May 16. Pond Series 3 midpoint, also measured 2 times in 2013, was 0.62cfs on February 28 and 8.34cfs on April 10. Pond Series 3 outlet, measured 4 times prior to the Pond Series 3 Rehabilitation Project, from April to July, ranging from 1.08-2.82cfs, increased in 2013, after rehabilitation with deepening of the inlet, and despite a temporary coffer dam still in place at the inlet, to ranging from 0.65cfs late February to 7.86cfs in early April. The April 10, 2013 discharge measurements taken at Pond Series 3 inlet, midpoint, outlet and at Cearley reveal that significant groundwater or Yankee Fork subflows discharge at midpoint (Table 8). Temperature data collected in Pond Series 3, from 2012 to 2020 (see discussion below), suggests that flows in this pond series are declining, and CHaMP discharge data, collected at Site 1129 at the lower end, from 2013 to 2019, at irregular times from as early as June 28 to as late as August 22, roughly correlates in that it shows that this pond series responds less each year to annual fluctuations in Yankee Fork discharge, most notably observed during the record flows of 2017. During the Pond Series 3 Rehabilitation Project an inlet control structure, consisting of ecology blocks and sheet pile, was designed and installed to control flow into the project. The control structure creates

a back-water area upstream which results in sediment deposition that ultimately blocks inflow at low flows. (Table 8; Figures 76-85; Heitke 2021; Gregory 2022; Mendez 2022)

During the West Fork Confluence Restoration Project, the Yankee Fork, at about 140 meters downstream of the Preachers Cove outlet, was moved to a newly constructed channel following a historic route along the west side of the confluence alluvial fan floodplain, and the confluence with the West Fork was moved back up the West Fork channel about 560 meters (Figure 5). The old Yankee Fork channel that ran down the east side of this fan was reconstructed to be Side Channel 1. Side Channel 2, ~225m long, was constructed in the floodplain between the new Yankee Fork channel and Side Channel 1, starting ~50m downstream of the Yankee Fork – Side Channel 1 split, and reentering the Yankee Fork about halfway down its new channel. During the final phase of the restoration project, after the Yankee Fork had been shifted to its new channel on July 14th 2016, coffer dams were placed across the head end and bottom end of Side Channel 1, for its reconstruction, and left in place over the winter of 2016 to 2017. Side Channel 1 was designed to hold approximately 10% of the flow but the record spring runoff of 2017 blew out a large portion of this work as well as most of both coffer dams. Discharge measurements taken by CHaMP crews in 2017 at Site #1971 in the new Yankee Fork mainstem channel, downstream of the Side Channel 2 outlet, on 7/31 at 63.8cfs, and in Side Channel 1 at Site #1709 on 7/30 at 27.8cfs, reveal that flows in Side Channel 1 were much higher than hoped for and held about 30% of the flow of the Yankee Fork (Heitke 2018; Table 8). On 8/9/2017 remnants of both the upper and lower coffer dams were removed which further increased flows from the YFSR into Side Channel 1 (Gregory 2018). In 2018 CHaMP crews remeasured the discharge at Site #1971 on 7/30 at 39.1cfs., and at Site #1709 on 7/29 at 19.2cfs, showing that Side Channel 1 then held about 33% of the flow of the Yankee Fork (Heitke 2019; Table 8). In 2019 discharge at these two sites were measured one month apart so were not comparable (Table 8). In 2020, during the survey of Side Channel 1 Site #1709, conducted on 9/12, about a month and a half later than previous years surveys, flows were found at 0cfs, dramatically unexpected (but possibly already a chronic issue), as described by CHaMP Watershed Analyst, Jeremiah Heitke: "[W]e walked all of Side Channel 1 before sampling it on 9/12/2020. [T]here was definitely no continuous flow through the channel, and it went dry in numerous locations. [S]ite 1709 had standing water in beaver impacted areas, with a trickle of flow throughout, however there wasn't enough water anywhere (volume or depth) to measure flow. [A]bove 1709, the channel was dry. [...;] the channel is split at the bottom of the site, [and] the river left channel was bone dry[...]. [W]e walked the channel again in mid-October and it was even more dry" (Heitke 2021; Table 8).

The Bonanza Rehabilitation Project from Jordan Creek down to the bridge on the Yankee Fork road downstream from Bonanza consisted of 4 Phases of work, spread out over 4 years, from 2018 to 2021. During Phase I in 2018 dredge tailings were removed from areas on the west side of the river along an approximately 657m long section of floodplain situated in the middle 1/3 of the project reach. During Phase II in 2019 three new meander channel segments were constructed through the cleared floodplain area, connected on their western outside bends to a bypass channel. Large woody debris was added to the non-floodplain sections. During Phase III in 2020 beginning on 7/8, when the Yankee

Fork was diverted to the series of newly constructed channel segments and bypass channels, the majority of flows along disturbed section of the project reach went subsurface, as evidenced by the abrupt change in diel temperature fluctuation observed by SBT temperature datalogger at the bridge below Bonanza (see temperature section below). As construction continued surface flows through the bypass and then new channel continued to decline as discharge in the Yankee Fork dropped, until 9/12 (62.6 cfs at USGS gauge), according to drone flight images taken on that day, when the entire flow went subsurface, intermittently, starting at a 50 to 100 foot section of bank on the outside bend of the uppermost engineered meander pool (A), down to where it reemerged approximately 450 meters downstream at the top of the lowest engineered meander pool (E). Three meander pools, isolated within this section were deep enough to have access to the water table, and continued to express surface flow (Pools B, C and D). Later, on 10/26 (45.5 cfs at USGS gauge), during subfreezing air temperatures, the Yankee Fork was observed to be dry below Pool E and estimated dry down to just below the new channel split, where the two channels rejoin, at 160 meters above the bridge, for a total approximate length of intermittent channel of 700 meters. On the following day, 10/27 (63.2cfs at USGS gauge), when air temperatures were back up above freezing, surface flows were observed to resume below Pool E, and it is believed that surface flows on the previous day, exposed to subzero air temperatures, were reduced by being immobilized/ stored as ice (Figure 12; Gregory 2021; personal observations 9/19/2020). Seepage runs through the Bonanza reach from Jordan Creek down to the bridge on the Yankee Fork road below Bonanza, conducted by BOR September 28, 2016 prior to rehabilitation, and September 15, 2020, and July 28 and Aug 4 of 2021 following rehabilitation, show that in 2016 the "[m]odel indicated that Groundwater capacity was around 7-10 cfs and that would come to equilibrium after project construction. [But the 2020] Post-Project construction [seepage run] has shown a ground water capacity around 30cfs due to much higher conductivity rates than hypothesized pre-project" (Table 7; Figure 12; Knutson 2021). September 12, 2020 drone flight images, 2021 NAIP imagery, seepage run results and data collected from piezometer observation wells, shows that there is an upper reach of the Yankee Fork, from just upstream of the rehabilitation disturbed area, downstream to the bottom or tail of Pool A, that is a losing reach, recharging the aquifer 29-30cfs in a southwest direction; a middle reach, from the bottom or tail of Pool A downstream to the top of Pool E that is dry; and a lower reach, from the top of Pool E downstream to below the unnamed tributary/ springs / Yankee Fork subflow outlet, that is a gaining reach, where the aquifer discharges 30cfs in a southeast direction (Figure 12; Table 7; Gregory, et al 2021). On August 20, 2020, using a track hoe, a trench was dug in the floodplain to the southwest of Pool C and a dirt plug installed, and weed-free straw was tamped into the lower river right stream bank of Pool C, both having no effect on flows. On August 22, 2020 a 6" diesel powered pump (DV150c 6”x6”) was placed in an isolated channel on the lower west side of the project area with exposed sub-flow and water was pumped back up to the uppermost meander pool (A). "Pumping worked for a while [...], though transmissivity through the tailings was high enough that it appeared that pumping altered the groundwater energy grade line, which led to further dewatering areas to which we were pumping water" (Gregory, et al 2021; Figure 12). The unnamed tributary / spring, draining the basin above the Bonanza townsite, entering the Yankee Fork just below the bridge on the Yankee Fork road below Bonanza, and supplemented by subflow

from the Yankee Fork, has not been measured for discharge, being problematic since it emerges at river level in a fan from under dredge material, but flows taken above and below the bridge in 2016, 2020 and 2021 by BOR, and concurrently on 10/3/2020 by CHaMP, for seepage runs through the Bonanza reach, show a difference of 3-4cfs (Heitke 2021; Table 7; Figure 12). According to Josh Gable, SBT Field Biologist, around 2010 this tributary /spring went unnoticed but by 2013 to 2014 flows gradually become more persistent, lasting longer into the summer months, and was believed to be partially to predominantly supplemented by ground water flow from the Yankee Fork (Gable 2020). In 2019, during the Bonanza Rehabilitation Project work upstream and to the east, disturbance of dredge material while digging pools were believed to have changed the flow path of the Yankee Fork, and coincidentally flows at the outlet of this tributary were observed to increase fourfold (Gregory 2020; Galloway 2020). The late September 2020 seepage run documented an approximately 9cfs loss along the top 113m river right bank of the project reach where at about half way down a bypass channel had exited. In an attempt to reduce flow loss in this location the river was coffered off, and 20 cubic yards of crushed rock material, <1/2 inch in diameter, was bucket compacted in along the bank. The 2021 seepage runs documented a reduced loss, down to 0-1cfs, along this same 113m section of bank. The estimated total distance of losing and dry reach through the Bonanza Rehabilitation Project reach in 2020 was 685m and in 2021, excluding the approximately 67m extension downstream of dry reach to the top of pool E in 2021 due to record low discharge, was 572m, indicating a remediation of surface flow along approximately 113m of channel (Gregory et al 2022a; Table 7; Figure 12).

TEMPERATURE

The Yankee Fork Salmon River mainstem, tributaries and pond series water temperatures were monitored intermittently, throughout the year, from 2006 through 2021, and monthly minimums, maximums, averages, and medians were summarized into two tables, a spring/summer/fall table covering April through October, and an overwinter table covering from November through March. During spring, summer and fall, from April through October, water temperatures in the mainstem Yankee Fork ranged from -0.77 to 21.38°C; monthly minimum water temperatures ranged from -0.77 to 11.63°C, monthly maximum ranged from 4.62 to 21.38°C, monthly average temperatures ranged from 1.53 to 15.08°C, and monthly median temperatures ranged from 0.89 to 14.80°C. The YFSR tributary water temperatures ranged from -0.44 to 22.72°C; monthly minimum ranged from -0.44 to 11.72°C, monthly maximum ranged from 2.94 to 22.72°C, monthly average ranged from 1.48 to 14.26°C, and the monthly median ranged from 1.22 to 13.75°C. YFSR side channel water temperatures ranged from -0.77 to 19.95°C; monthly minimum ranged from -0.77 to 11.92°C, monthly maximum ranged from 7.08 to 19.95°C, monthly average ranged from 3.28 to 14.64°C, and the monthly median ranged from 3.26 to 14.13°C. Water temperatures in the Pond Series side channels ranged from -0.89 to 23.68°C; monthly minimum ranged from -0.89 to 12.50°C, monthly maximum ranged from 2.52 to 23.68°C, monthly

average water temperatures ranged from 1.74 to 16.67°C, and the monthly median ranged from 1.55 to 16.24°C (Table 9).

Idaho Department of Environmental Quality (IDEQ) has designated surface water use for the Yankee Fork Salmon River Watershed, within the hydrologic unit code (HUC) 17060201, Upper Salmon Subbasin, in rule section 130.03 Units S-32 through S-46 as: Cold water (COLD): water quality appropriate for the protection and maintenance of a viable aquatic life community for cold water species, salmonid spawning (SS): waters which provide or could provide a habitat for active self-propagating populations of salmonid fishes. IDEQ criteria for Cold Water Aquatic Life Use recommend maximum water temperatures of 22°C or less with a maximum daily average of no more than 19°C (IDAPA 58.01.02, Table 4). Mid-summer stream temperature maximums at all sites for all years monitored in the Yankee Fork watershed fall at or below the IDEQ cold water aquatic life recommended maximum of 22°C, except for Pond Series 2 midpoint which exceeded it in 2013 at 23.1°C and in 2021 at 23.7°C. Pond Series 2 outlet peaked to this standard this year, in 2021, at 22.3°C. Jordan Creek peaked to this standard in two years, at 22.3°C in 2007, 22.2°C in 2013, then exceeded it at 22.7°C this year in 2021. The maximum daily average at all sites for all years monitored fall below the IDEQ cold water aquatic life recommended maximum of 19°C, and ranged from 6.2°C in Silver Creek in 2020 to 18.3°C at PS2 midpoint in 2013 (Table 11).

The U.S. Forest Service (USFS) and Bureau of Land Management (BLM) in conjunction with the National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) provide recommended water temperature maximums recognized as critical temperatures above which would limit the normal productivity or survivability during different life stages for Chinook salmon. For Chinook salmon PACFISH guidelines recommend that the maximum 7-day running average maximum stream temperature should not exceed 17.8°C during rearing and migration, and should not exceed 15.6°C during spawning (PACFISH 1995, NMFS 1996, Table 4). The onset of Chinook spawning in the YFSR watershed varies, but has been agreed upon by Shoshone Bannock Tribes Biologists, who have monitored the Yankee Fork for Chinook spawning for over 20 years, as occurring as early as August 1 and extending through September 14th (Bacon 2013).

Sites on the YFSR mainstem, tributaries and Pond Series were graphed and tabulated with the 7-day running average maximum temperatures for all years monitored, and compared to PACFISH Chinook salmon migration, rearing and spawning thresholds:

The Yankee Fork at Ninemile Creek, approximately 8 miles above the upper extent of dredge tailings, monitored from March 2009 through May of 2010, 7-day running average maximum temperatures reached a maximum of only 12.1°C, well below the midseason PACFISH Chinook migration and rearing recommended maximum and also well below the PACFISH Chinook spawning recommended maximum, during the Chinook spawning window from August 1 through September 14 (Table 11, Figure 36). Overwinter Dec. and Jan. monthly average temperatures at this site, from 2009 to

2010, ranged from 0.58°C to 1.08°C (Table 10, Figure 86). The Yankee Fork above Eightmile Creek, approximately 6 miles above the dredge tailings, monitored from 2011 to 2014, during the fall of 2015 and from 2017 to 2021, 7-day running average maximum temperatures, with seasonal maximums, ranging from 13.4°C to 16.2°C, remained below the midseason PACFISH Chinook migration and rearing recommended maximum, and typically fall below the PACFISH Chinook spawning recommended maximum by the Chinook spawning window from August 1 through September 14, except in 2021 when warmer temperatures extended into this time frame and exceeded this standard for 5 days (Table 11, Figure 13). Overwinter Dec. and Jan. monthly average temperatures from 2011 to 2012 and 2012 to 2013, ranged from 0.09°C to 0.24°C (Table 10, Figures 86 & 87). Eightmile Creek, entering the Yankee Fork from the north, having a southern exposure, and with a base flow of ~10% of the Yankee Fork, monitored from 2011 to 2013, 2015 to 2018 and in 2020 and 2021, contributes slightly warmer water to the mainstem at this location. The 7-day running average maximum temperatures during midseason, ranging from 14.6°C to 17.9°C, exceeded the PACFISH migration and rearing recommended maximum for 4 days in 2016, and during the Chinook spawning window from August 1 through September 14 exceeded the PACFISH Chinook spawning recommended maximum for 3 days in 2012, 3 days in 2013, 25 days in 2015, 22 days in 2016, 15 days in 2018, 14 days in 2020 and 16 days in 2021 (Table 11, Figure 14). The Yankee Fork at Fivemile Creek was monitored at the first bend below the confluence in 2007, 2009 and 2010, and at the first bridge above the confluence in 2015, 2016 and from 2018 to 2021. The 7-day running average maximum temperatures, with midseason maximums ranging from 15.5°C to 18.3°C, had not exceeded the PACFISH Chinook migration and rearing recommended maximum standard until this year of 2021 for a total of 13 days, and did exceed the PACFISH Chinook spawning recommended maximum standard, from August 1 to September 14, in all but two years, for 16 days during 2007, 2 days in 2010, for at least 6 days in 2015, 13 days in 2016, 5 days in 2018, 20 days in 2020 and 18 days in 2021 (Table 11, Figure 15). The Yankee Fork at the bridge on Yankee Fork road above Custer, monitored in 2010, 2011, 2012 and 2015, the midseason 7-day running average maximum temperatures, with peaks ranging from 15.1°C to 16.0°C, did not exceed the PACFISH Chinook migration and rearing recommended maximum standard, but exceeded the PACFISH Chinook spawning recommended maximum standard, from August 1 to September 14 for 5 days in 2012 and 7 days in 2015 (Table 11, Figure 16). Overwinter monthly average temperatures at Custer Bridge for December 2011 and January 2012 ranged from 0.07°C to 0.13°C (Table 10, Figure 86). The Yankee Fork at Fivemile Creek compared to the Yankee Fork approximately 3 miles downstream at Custer Bridge, both monitored a full season in 2010, and during the spawning season in 2015, show that stream temperatures at the bridge above Custer were slightly cooler than at Fivemile Creek. Cooling of stream temperatures through this reach are likely a combination of shading and ground water discharge while the stream passes through a bedrock gorge (Table 11, Figures 39 & 44).

The Yankee Fork above Jordan Creek, at approximately 150 meters above the confluence, just above the upper extent of the dredge tailings, was monitored in 2007, from 2010 to 2018 and in 2020. The maximum 7-day running average maximum temperatures, ranging from 15.2°C to 18.5°C, exceeded the PACFISH Chinook migration and rearing recommended maximum standard for 12 days in 2007, for 4 days in 2013 and 1 day in 2015. The PACFISH Chinook

spawning recommended maximum was exceeded, from August 1 to September 14, for 23 days in 2007, 9 days in 2010, 9 days in 2012, 19 days in 2013, 13 days in 2015, 9 days in 2016, 9 days in 2018 and for 16 days in 2020 (Table 11, Figure 17). Data from a USFS Tidbit deployed in the Yankee Fork 11 meters above the confluence of Jordan under the first shrub off the fish left bank, overwinter from 2012 to 2013 and on through the season of 2013, was previously used to estimate overwinter temperature conditions for this site. Mid-season temperatures in 2013 from this Tidbit compared to the mid-season temperatures from the SBT HOBO deployed approximately 140 meters above it were not significantly different so it was assumed overwinter temperatures were a good estimation of winter conditions at this site. Since then, with two winters monitored at the SBT site, it can be seen that the Tidbit overwinter data are noticeably different, likely more influenced by the Jordan Creek plume at that time of year, so will no longer be included in this report. Monthly average temperatures overwinter at the SBT HOBO site, in Dec. and Jan., 2013 to 2014 and 2016 to 2017, ranged from 0.12°C to 0.14°C (Table 10, Figures 88 & 90). Jordan Creek, entering from the north, with a base flow of ~10% of the Yankee Fork, was monitored at its mouth in 2007 and 2009 using intermittent SONDE temperature probe data, in 2010, 2011, 2012, 2015, 2016, 2017, 2018, 2020 and 2021 using SBT HOBO data loggers, and in 2013 using a Forest Service Tidbit placed at the same location as the SBT HOBO. Jordan Creek, dredged mined from its mouth up approximately 2 km, and rehabilitated from the mouth up about 450 meters by Hecla Mining Co. in 1992, is the warmest tributary in the Yankee Fork watershed and one of the warmest sites monitored in the watershed along with Pond Series 2 midpoint. The 7-day running average maximum temperatures, with midseason maximums ranging from 17.5°C to 21.5°C, exceeded the midseason PACFISH Chinook migration and rearing recommended maximum 9 out of 10 years, for at least 2 days in 2007, at least 9 days in 2009, for 8 days in 2010, 6 days in 2011, 17 days in 2012, for at least 67 days in 2013 (deployed late), for at least 9 days 2015 (deployed late), for 20 days in 2016, 24 days in 2018, 30 days in 2020 and 55 days in 2021. During the Chinook spawning window, from August 1 through September 14, the 7-day running average maximum exceeded the PACFISH Chinook spawning recommended maximum all 12 years, for at least 2 days in 2007, at least 24 days in 2009, for 29 days in both 2010 and 2011, for 12 days in 2012, 45 days in 2013, 30 days in 2015, 32 days in 2016, 38 days in 2017, 25 days in 2018, 44 days in 2020 and 45 days in 2021 (Table 11, Figure 18). Monthly average temperatures overwinter from 2016-2017 ranged from 0.13°C to 0.20°C (Table 10, Figure 90). The Yankee Fork below Jordan, monitored by the SBT HOBO in 2009 and 2019 at ~20m below the mouth, and in 2013 by the USFS Tidbit at ~170m below the mouth, showed that the 7-day running average maximum temperatures, with maximums ranging from 16.3°C to 18.5°C, peaked right at the midseason PACFISH Chinook migration and rearing recommended maximum in 2009 and exceeded this maximum for 7 days in 2013. The PACFISH Chinook spawning recommended maximum was exceeded in all 3 years, from August 1 through September 14, for 11 days in 2009, 21 days in 2013 and for 8 days in 2019 In 2009, and with data borrowed from the USFS for 2013 for Jordan Creek and Yankee Fork below Jordan compared to the SBT HOBO above Jordan shows that Jordan Creek is significantly warmer than the Yankee Fork and does warm the Yankee Fork, as seen by comparison of temperatures above Jordan to below Jordan, despite its small discharge (Table 11, Figures 38, 42 & 48).

Approximately 1 mile downstream from Jordan Creek the Yankee Fork at bridge below Bonanza, monitored mid-channel initially at the SONDE boom from 2006 to 2018 using intermittent SONDE temperature probe data, coupled with HOBO data loggers attached to the SONDE boom in 2010, 2012, 2013, and 2014, and then across the channel, following the shift in thalweg to river left (see discussion below), using the HOBO datalogger study site data collected in 2016, 2018, 2020 and 2021 adjacent to or below the river left pier. Using only data from the SONDE boom location up until 2015 (preferentially HOBO if available), and in 2017 when flows were higher and less influenced by the unnamed tributary/spring/subflow entering on river right, and, after the thalweg shift to river left, from adjacent to or below the river left pier in 2016 and 2018 prior to the effects from the Bonanza Rehabilitation Project, the 7 day running average maximum temperatures, with maximum ranging from 14.9°C in 2017 to 18.7°C in 2007, exceeded the PACFISH Chinook migration and rearing recommended maximum in only two years, in 2007 for at least 6 days, and in 2013 for 4 days, and during the Chinook spawning window, from August 1 through September 14, exceeded the PACFISH Chinook spawning recommended maximum 10 out of 14 years, for at least 1 day in 2006, at least 4 days in 2007, for at least 7 days in 2008, for 4 days in 2009, 2 days in 2010, 8 days in 2012, 19 days in 2013, for at least 7 days in 2015, for 9 days in 2016, and for 11 days in 2018 (Table 11, Figure 19). Overwinter monthly average temperatures adjacent to the river left pier, in Dec. and Jan., from 2015 to 2016, 2016 to 2017 and in Jan. 2018, slightly elevated compared to other mainstem sites, an indication of close spring /subflow influence at that location, with low flows and ice buildup at that time of year, ranged from 0.23°C to 0.37°C (Table 10, Figures 89-91).

A temporary HOBO datalogger was deployed about 5 meters upstream and 8 meters to river left of the SONDE boom at the bridge below Bonanza, within the thalweg, adjacent to the river left pier, from December of 2015 continuously thru to March of 2017, and then from January to October of 2018, to study the Bonanza Bridge unnamed tributary/spring/groundwater influence on water temperatures laterally across the channel during the summer, and to monitor temperatures over-winter. All data collected during the Yankee Fork Restoration Project, where HOBO and SONDE were deployed at the same location, was compiled, all data with recal gap errors were removed, differences were calculated for each mid-season maximum statistic of yearly maximum, yearly maximum 7-day running average maximum, maximum 7-day running average maximum during Chinook spawning season from August 1 to September 14, and maximum daily average, and the differences were averaged for each site. In both 2016 and 2018, during mid-season, the HOBO adjacent to the river left pier recorded slightly higher annual temperature maximums than the SONDE, with an average difference of 0.6°C both years, compared to 20 other HOBO and SONDE site differences seen over the years, which ranged from an average of 0°C to an average of 0.3°C. Results indicate that the spring is slightly cooling the water temperatures mid-season at the mid-channel SONDE boom site. In 2006 when the Bonanza Bridge SONDE boom was installed it was placed mid-channel within the main flow or thalweg. During the big spring runoff of 2017, debris, from wood placed for the Large Woody Debris Project in the upper watershed in 2015 and 2016, racked up on the river right pier causing flows to push against, loosen and mobilize gravel along the river right abutment. In 2017 the SONDE boom could be set down, suspended into the flow, with a little manual excavation of the bed. During spring

runoff of 2018 the loosened gravel from 2017 mobilized and re-shifted, further aggrading the river right side of the channel, extening more deposits out under the SONDE boom, so in 2018 the SONDE boom was parked directly on top the substrate and let be since sensors were submerged. The depth of water at the SONDE boom is now shallower, and is no longer situated within the thalweg, which has shifted to river left (Gable 2019). This shift has accentuated the effects of the spring on mid-season temperatures recorded at the SONDE boom as can been seen by the greater differences between the pier and boom sites in 2018 compared to 2016 (Table 11, Figures 45 & 47). In 2018 another temporary study HOBO was placed at the bridge below Bonanza approximately 2 meters downstream of the river left pier, approximately in a direct line laterally across the channel from the SONDE boom, in boulder rip-rap off the river left side of the channel, but still within the thalweg flow. Temperatures recorded at this site are almost indistinguishable from temperatures recorded by the HOBO placed adjacent to the river left pier, indicating they are both positioned within the same flow. Data collected adjacent to or below the river left pier are now more accurate of mainstem temperatures at this location and are used in place of the boom temperatures starting in 2016, except for 2017 where only SONDE boom data was collected, still included because of the higher discharge that summer and dilution of spring/sub flow effects.

2020 water temperatures at this site changed dramatically at the initiation of Phase III of the Bonanza Rehabilitation Project when the Yankee Fork was diverted to the newly constructed channel segments and bypass channel, and the majority of flows went subsurface. This event and change in temperatures is clearly documented by the sudden suppression of diel temperature variation on July 8 as seen on the graph comparing the Yankee Fork temperatures from above Jordan Creek to the temperatures at the bridge below Bonanza, and seen as overall significantly cooler 7-day running average temperatures when compared to previous years and other mainstem Yankee Fork sites in 2020, and also by its approximately 1 day offset seasonal signature profile compared to other sites in 2020, caused by sub surface flow travel delay (Figures 8, 19, 21 & 36-49). In 2021 the temperature datalogger above Jordan Creek became buried in sediment from summer storm events so only early season data from this site is available to compare to the temperatures at the bridge below Bonanza; this data, in addition to comparisons with Yankee Fork above Fivemile Creek and at the first bridge below West Fork show that sometime around early June temperatures at the bridge below Bonanza began to be influenced by subsurface flows, and relatively early due to a lower discharge year (Figure 22).

In 2011 water temperatures retrieved from a Pressure Transducer (PT) stationed just off the river right bank, ~40 meters downstream of the bridge below Bonanza, compared to the Yankee Fork above Jordan and mid-river at the Bonanza Bridge SONDE boom, monitored also in 2011, were noticeably cooler. The 7-day running average maximum water temperatures at this PT site in 2011, with a cooler maximum of 14.1°C compared to Bonanza Bridge mid-channel at 15.0°C, (Table 11, Figure 40), and overwinter temperatures monitored by HOBO at this PT site from 2010 to 2011, Dec. and Jan. monthly average ranging from 0.64°C to 0.79°C, noticeably warmer and more constant than mainstem sites monitored during that same winter, indicated a close spring or ground water /subflow source (Table 10, Figure 86). Intermittently along an approximately 50-100m stretch of the west or river right bank, both upstream and downstream

of the bridge below Bonanza, an unnamed tributary / spring / Yankee Fork sub flow emerges from the base of the dredge tailings at river level. The primary outlet of this flow, just downstream of the bridge river right pier, coincides with an unnamed intermittent tributary drainage shown on the 1964 USGS map with its source to the west of Rookie Point above the Bonanza town site. This channel, now buried in dredge material at its mouth, running along the base of the steep eroded toe of the Bonanza alluvial fan, and hemmed in by dredge material to the east, is elevated above the valley floor, filling in with material from the canyon wall, expresses flow along its length intermittently and ephemerally in stagnant shallow pools. According to Josh Gable, Field Biologist with the YFRP, around 2010 this spring went unnoticed but by 2013 to 2014 became more noticeable, and he believes flows have gradually become more persistent, lasting longer into the summer months, and is partially to predominantly supplemented by ground water flow from the YFSR (Gable 2020). In 2019 ground work began on the Bonanza Rehabilitation Project, disturbing dredge material directly to the east of the Yankee Fork road paralleling the entire length of this channel, and extending upstream for a total of about 0.5 mile. Coinciding with this work, flows at the main outlet of this unnamed tributary/spring/subflow were observed to increase fourfold (Galloway 2020). During construction of riffle habitat, at a location directly across from the spring channel, more ground water was tapped than expected creating a plume of sediment that entered the Yankee Fork. "*The turbidity entered the Yankee Fork at a lot of places from the bridge upstream. Water in the spring […] (which we call Bonanza Springs) was clear. I think the flow path for underground water is down-valley for the most part. Bonanza Springs probably gets the tributary water […], but also likely gets a lot of underground water coming down under the Bonanza project floodplain. When we dug our pools we may have changed the flow paths some so that water under the floodplain had more access to the west side that would increase [the springs] flow*." (Gregory 2020). HOBO dataloggers were placed directly in the main outflow at the downstream side of the Bonanza Bridge river right pier, late season in 2015 and overwinter into spring of 2016, mid-season 2018, late season 2019, and mid-season 2020 and 2021. Temperatures at this site are much colder than at Bonanza Bridge mid-thalweg, and have the unique profile of a spring or close groundwater source with little to no diel variation. Overall temperatures and diel fluctuation did not change in 2019 even with the fourfold increase from Yankee Fork subflow. No changes to flows were observed in 2020 with the completion of Phase III of the Bonanza Rehabilitation Project. (Galloway 2021). In 2015 no midseason maximum temperatures were obtained due to late deployment, but during the spawning window, from August 1 through September 14, the 7-day running average maximum, peaking at 11.8°C, was well below the PACFISH Chinook spawning recommended maximum. In 2018, 2020 and 2021, three full seasons of deployment, maximum 7-day running average maximum temperatures ranged from 11.2°C to 13.9°C, remaining well below both the PACFISH migration and rearing and PACFISH spawning maximum temperature thresholds (Table 11, Figure 20). Overwinter, from 2015 to 2016, Dec. and Jan., monthly average temperatures, ranging from 1.37°C to 1.59°C, were relatively warm and also indicative of a close spring/groundwater source (Table 10, Figure 89).

After the West Fork Confluence Restoration Project was completed in 2016 a new temperature monitoring site was established in the Yankee Fork above Side Channel 1 inlet. The HOBO installed in 2017 prior to runoff was lost, in 2019

the HOBO survived, in 2020 it stopped after being shocked during electrofishing surveys and subsequently found permanently impaired when in 2021 it stopped shortly after launching. The 7-day running average maximum temperatures at this location in 2019 peaked at 16.9°C, staying below the PACFISH Chinook migration and rearing recommended maximum, but exceeded the PACFISH Chinook spawning recommended maximum, during the spawning window, from August 1 through September 14, for 23 days (Table 11, Figure 23). In 2019 a new temperature monitoring site was established at the upper end of Side Channel 1 at CHaMP Site 1709 Unit 2. In 2019, 2020 and 2021, 7-day running average maximum stream temperatures, with maximums ranging from 16.4°C to 18.2°C, exceeded the PACFISH Chinook migration and rearing recommended threshold for at least 13 days in 2021, with 4 days air exposed data removed due to beaver activity, and during the spawning window, from August 1 through September 14, exceeded the PACFISH spawning recommended maximum threshold for 15 days in 2019, 34 days in 2020 and 19 days in 2021 (Table 11, Figure 24). Since having been reengineered to a side channel in 2016, beaver have established a strong presence at this site and in 2020 with low flows, exacerbated dry sections of channel with their dams (Heitke 2021; Galloway 2022). The Yankee Fork above West Fork, monitored prior to the confluence restoration, in 2009, 2012, 2015, and during 2016 up until July 13, at which time it was retrieved for Side Channel 1 reconstruction, 7-day running average maximum temperatures, with maximums ranging from 15.6°C to 18.2°C, exceeded the midseason PACFISH Chinook migration and rearing recommended maximum for 4 days in 2015, and exceeded the PACFISH Chinook spawning recommended maximum, during the spawning window, from August 1 through September 14, for 9 days in 2009, 10 days in 2012, and for 33 days in 2015 (Table 11, Figure 25). Overwinter monthly average temperatures, in Dec. and Jan., from 2012 to 2013, ranged from 0.27°C to 0.30°C (Table 10, Figure 87). After restoration this site, moved 60 meters upstream, was continued to be monitored as the Side Channel 1 outlet. The HOBO, deployed at this new location in 2017, prior to runoff, became temporarily buried in sediment, from May 6 to July 27, but still provided seasonal maximums; and in 2020 and 2021 this site monitoring was resumed using the relocated cable attachment established in 2017. Temperatures in 2017, with record discharge and the side channel carrying an estimated 30% of the flow were similar to the Yankee Fork at first bridge below the West Fork during midseason, to being slightly cooler at the end of the season. In 2020, with flows in Side Channel 1 found significantly reduced, measured later in the season by CHaMP on 9/12 at 0cfs, temperatures are much warmer than this site in 2017, were second highest recorded of sites monitored in 2020, surpassed only by Jordan, and in 2021 with temperatures again high, similar in magnitude to the West Fork at mouth but of longer duration, surpassed only by Jordan and the lower Pond Series 2, have conditions that are potentially lethal to rearing juvenile salmonids. The 7-day running average maximum temperatures, with maximums ranging from 15.6°C in 2017 to 19.2°C in 2020, did not exceed the PACFISH Chinook migration and rearing recommended threshold in 2017, but did exceed this standard for 22 days in 2020, and for 40 days in 2021, and during the Chinook salmon spawning window, from August 1 through September 14, exceeded the PACFISH spawning recommended maximum threshold for 1 day in 2017, 40 days in 2020 and 30 days in 2021 (Table 11, Figure 25).

At a new site, Side Channel 2 outlet, established in 2019, at which time the HOBO malfunctioned, but monitored successfully in 2020 and 2021, 7-day running average maximum stream temperatures were relatively cool, with maximums ranging from 15.7°C to 17.1°C, remained below the PACFISH Chinook migration and rearing recommended threshold, and exceeded the PACFISH Chinook spawning recommended threshold for only 4 days in 2020 and 20 days in 2021 (Table 11, Figure 26). After creation in 2016, beaver have established themselves in this side channel (Galloway 2022).

The West Fork Yankee Fork is a major tributary to the Yankee Fork, contributing approximately 47% to the discharge of the mainstem, with a range of 38% (May 2018) to 62% (April 2014) (Table 6). In the final phase of the West Fork Confluence Restoration project, starting on May 4, 2016, during spring high water runoff, Yankee Fork water, released to the new channel through a head gate controlled culvert restricted to an estimated 29cfs (1/2 of the 24"culvert flow), entered the West Fork, at its new confluence, and comprised ~7% of the flow of the West Fork, and as water levels dropped into the summer season, by July 13th comprised ~33% of the flow of the West Fork, and on July 14, when the old Yankee Fork channel was coffered off and the entire flow of the Yankee Fork shifted over to the new channel, comprised ~55% of the now totally combined flow, which is typical of the Yankee Fork proportion to the West Fork. HOBO temperature data collected at the old mouth of the West Fork in 2016 from May 4th up until it was pulled on August 3rd was influenced by these varying amounts of Yankee Fork water during the confluence restoration. The West Fork at old mouth, prior to the West Fork Confluence Restoration Project, was monitored every year from 2007 to 2011, in 2013, 2014, 2015, overwinter 2015 to 2016, and through 2016 to early fall where on August 3 the HOBO was pulled and the site discontinued. In 2012 the HOBO at the mouth was found out of water during peak season temperatures, but a Forest Service Tidbit located ~40 meters upstream of the mouth, compared to the SONDE temperature probe data, and to salvageable data from the HOBO itself, showed no significant difference, so was able to be used as a substitute. The 7-day running average maximum water temperatures at this site, with maximums ranging from 15.8°C to 19.6°C, exceeded the PACFISH Chinook migration and rearing recommended maximum in 4 out of 10 years; for 34 days in 2007, for 11 days in 2009, for 14 days in 2013, and for 6 days in 2015. The PACFISH Chinook spawning recommended maximum, from August 1 through September 14, was exceeded every year, for 38 days in 2007, 30 days in 2008, 14 days in 2009, 14 days in 2010, 3 days in 2011, 11 days in 2012, 40 days in 2013, 16 days in 2014, 31 days in 2015, and for the first two days in August of 2016 at which time the HOBO was removed (Tables 11, Figures 27 & 28). Overwinter monthly average temperatures in Dec. and Jan., from 2012 to 2013, 2013 to 2014 and 2015 to 2016, ranged from 0.08°C to 0.28°C (Table 10, Figures 87-89). The West Fork new mouth, established as a new site in 2019, monitored in that year intermittently due to the HOBO being lost, but monitored successfully for a full season in 2020 using two adjacent HOBOs, and in 2021, 7-day running average temperatures, with a maximum ranging from 18.5°C in 2020 to 19.0°C in 2021, exceeded the PACFISH Chinook migration and rearing recommended maximum threshold for 8 days in 2020 and 22 days in 2021, and during the spawning window, from August 1 through September 14, exceeded the PACFISH Chinook spawning recommended maximum for 28 days in 2020 and 20 days in 2021 (Table 11, Figures 27 & 28). The

West Fork at Virginia's cabin, 290m upstream from the new mouth, monitored from 2015 to 2021, 7-day running average maximum water temperatures, with maximums ranging from 16.4°C to 18.9°, exceeded the PACFISH Chinook migration and rearing recommended maximum, for 14 days in 2015, 2 days in 2016, 8 days in 2020 at least 20 days in 2021, and exceeded the PACFISH Chinook spawning recommended maximum, from August 1 through September 14, every year, for 33 days in 2015, 20 days in 2016, 5 days in 2017, 21 days in 2018, 28 days in 2019, 30 days in 2020 and 20 days in 2021 (Table 11, Figure 29). Overwinter monthly average temperatures in Dec. and Jan., from 2015 to 2016, 2016 to 2017, and in Jan. 2018, ranged from -0.04°C to 0.24°C (Table 10, Figures 89-91). Comparing data between the West Fork old mouth and at Virginia's cabin, in 2015 and 2016, shows that midseason water temperatures in the West Fork at the old mouth were cooler both years than at Virginia's, even during the West Fork confluence work in 2016 where Yankee Fork water influenced temperatures, and, overwinter water temperatures were warmer at the old mouth compared to Virginia's, both indicating that there was possibly cooler YFSR subsurface flows, and/or ground water/subsurface flows from the intermittent/ ephemeral Preachers Cove drainage basin, being discharged in the area of the old mouth (Tables 9, 10 &11, Figures 27, 29, 44, 45 & 89). During late summer of 2016 Chinook salmon were observed holding below the coffer dam across the outlet of the old Yankee Fork channel / Side Channel 1, which had been temporarily dewatered for restoration work, seemingly attracted by colder subsurface flows coming out from under, and seeping into the lower end of that channel (Gable 2017). Comparison of the West Fork new mouth to Virginia's cabin in 2020 and 2021 shows that temperatures at the mouth are similar to slightly warmer (Tables 9 & 11, Figures 27, 29, 49 & 50). The West Fork contributes slightly warmer water to the mainstem compared to the Yankee Fork above the West Fork, both monitored together in 2009, 2012, 2015 and 2017 with mid-season maximum temperatures more similar to the Yankee Fork at PS2 Outlet, Dredge Camp and Polecamp Flat Campground, but often cooling down sooner at the end of the season, to temperatures below these three sites (Table 11, Figures 38, 41, 44 and 46).

The Yankee Fork at first bridge below West Fork was monitored in 2009 at ~100 meters downstream of the bridge off of the river right bank, in 2016 as a combination of the HOBO data collected at the old mouth of the West Fork after July 13th, when the entire flow of the Yankee Fork was shifted to the new channel, and data collected when it was moved downstream to the bridge, and in 2017, 2018, 2020 and 2021 at the bridge. The 7-day running average maximum temperatures, with maximums ranging from 15.7°C to 18.4°C, remained below the midseason PACFISH Chinook migration and rearing recommended maximum all years until 2021 when it exceeded this standard 17 days, and exceeded the PACFISH Chinook spawning recommended maximum, during the spawning window from August 1 through September 14, for 10 days in 2009, for at least 11 days in 2016, for 2 days in 2017, 15 days in 2018, 26 days in 2020 and 21 days in 2021 (Table 11, Figure 30). Overwinter monthly average temperatures in Dec. and Jan., from 2016 to 2017, and in Jan. of 2018, ranged from 0.01°C to 0.07°C (Table 10, Figures 90 & 91). Comparing the 7-day running average maximum temperatures above and below the West Fork to the West Fork in 2009 showed that the Yankee Fork below West Fork site temperatures were about midway between those of the West Fork and the main stem above the West Fork, which were significantly different through the warmest part of the season. All three sites became similar in

temperature through August, and towards the end of the season the West Fork became cooler than the Yankee Fork above West Fork (Table 11, Figure 38).

Data from the Yankee Fork at the second bridge below the West Fork, monitored by the USFS mid-season during 2012 and overwinter from 2012 to 2013, borrowed by SBT YFRP to use as a substitute for inlet temperatures on that first year that the Pond Series 3 was monitored, 7-day running average maximum temperatures, with a maximum of 17.3°C, remained below the midseason PACFISH Chinook migration and rearing recommended maximum, but exceeded the PACFISH Chinook spawning recommended maximum, during the spawning window from August 1 through September 14, for 11 days (Table 11, Figures 41 & 76). Overwinter monthly average water temperatures in Dec. and Jan., from 2012 to 2013, ranged from 0.09°C to 0.16°C (Table 10, Figure 87). The YFSR at the bridge between the PS2 inlet and the PS3 outlet, was monitored in 2013, 2014, 2015, 2016 and 2017. The 7-day running average maximum temperatures, with maximums ranging from 16.2°C to 19.1°C, exceeded the PACFISH Chinook migration and rearing recommended maximum for 17 days in 2013, for 10 days in 2015, and exceeded the PACFISH Chinook spawning recommended maximum, during the spawning window from August 1 through September 14, for 44 days in 2013, for 17 days in 2014, for 33 days in 2015, for 10 days in 2016, and for 4 days in 2017 (Table 11, Figure 31). Overwinter temperatures, monitored three years in a row from 2011 to 2014 and then again from 2016 to 2017, Dec. and Jan. monthly averages ranged from -0.40°C to 0.35°C (Table 10, Figures 86-88 & 90). Approximately 0.4 miles further downriver, the Yankee Fork at Pond Series 2 outlet, monitored in 2013, 2014 and in 2015 after which it was determined redundant and discontinued, 7-day running average maximum water temperatures, with maximums ranging from 17.3°C to 19.7°C, exceeded the PACFISH Chinook migration and rearing recommended maximum for 30 days in 2013 and for 13 days in 2015, and exceeded the PACFISH Chinook spawning recommended maximum, during the spawning window from August 1 through September 14, for 45 days in 2013, for 18 days in 2014 and for 34 days in 2015 (Table 11, Figures 42-44). Overwinter temperatures, monitored from 2013 to 2014, Dec. and Jan. monthly averages both were at 0.12°C (Table 10, Figure 88).

The Yankee Fork at Dredge Camp**,** monitored every year from 2007 to 2017 except in 2012, and then in 2020, 7-day running average maximum temperatures, with maximums ranging from 16.3°C to 20.1°C, exceeded the PACFISH Chinook migration and rearing recommended maximum in 6 of the 11 years monitored, for 49 days in 2007, 5 days in 2008, 32 days in 2013, 11 days in 2015, for 8 days in 2016 and 12 days in 2020. The 7-day running average maximum temperatures exceeded the PACFISH Chinook spawning recommended maximum during the spawning window, from August 1 through September 14, all 11 years ranging from a high of 45 days during the warmer season of 2013 down to 6 days during the cooler season of 2017 (Table 11, Figure 32). An April 2012 download salvaged overwinter data from the Dredge Camp site HOBO, but consistent below zero temperatures and extreme spikes below zero recorded suggest that the HOBO was in solid ice over most of the winter (Table 10, Figure 86). The Yankee Fork at Polecamp Flat Campground, at just below the most downstream extent of the dredge tailings, was monitored from 2007 to 2010, and

in 2013, 2014, 2015, overwinter from 2015 into 2016, overwinter from 2016 into the season of 2017, from Jan. through October in 2018, and in 2020 and 2021. The 7-day running average maximum temperatures, with maximums ranging from 15.4°C in 2017 to 20.1°C in 2021, exceeded the midseason PACFISH Chinook migration and rearing recommended maximum 8 out of 12 years, for 26 days in 2007, 6 days in 2008, 1 day in 2010, 12 days in 2013, 9 days in 2015, 2 days in 2016, 18 days in 2020 and for 53 days in 2021, and exceeded the PACFISH Chinook spawning recommended maximum, from August 1 through September 14, in 11 out of 12 years, for 38 days in 2007, 31 days in 2008, 16 days in 2009, 24 days in 2010, 45 days in 2013, 22 days in 2014, 33 days in 2015, 23 days in 2016, 21 days in 2018, 41 days in 2020 and for 37 days in 2021 (Table 11, Figures 33 & 34). Overwinter monthly average water temperatures in Dec. and Jan., from 2015 to 2017, and in Jan. of 2018, ranged from 0.19°C to 0.46°C (Table 10, Figures 89-91). The Yankee Fork at bridge below Flat Rock Campground, the lowest site monitored on the Yankee Fork mainstem at about 1.4 miles below the dredge tailings in the lower river canyon gorge, was monitored all 15 years from 2006 to 2020 using intermittent SONDE temperature data for 2006, 2007, 2008, 2009, 2012, 2015, 2016, 2017 and 2018, HOBO data for 2010, 2013, 2014, 2019, 2020 and 2021, and Pressure Transducer data for 2011. The 7-day running average maximum, with maximums ranging from 16.1°C in 2017 to 19.9°C in 2021, exceeded the PACFISH Chinook migration and rearing recommended maximum in 5 out of 15 years, for at least 9 days in 2007, for 13 days in 2013, for at least 8 days in 2015, for at least 2 days in 2016, for 18 days in 2020, and an unknown number of days in 2021 because it was found out of water on both 6/17 and 8/13, so no data prior to 8/13 can be used; and exceeded the PACFISH Chinook spawning recommended maximum, during the spawning window of August 1 through September 14, in all years, ranging from a low of 3 days in 2017 to a high of 38 days in both 2013 and 2019 (Table 11, Figure 35). Cooler waters found at this site compared to upstream sites are most likely influenced by increased ground water discharge from bedrock constraints and shading within the canyon gorge.

Temperature comparisons of YFSR mainstem sites from Ninemile Creek down to the bridge below Flat Rock Campground, including the West Fork Yankee Fork were graphed for each year from 2007 to 2021, using the 7-day running average maximum temperatures from July through September, and showing the Chinook spawning window from August 1 to September 14 delineated with a red box. Data shows that the water temperatures increase in the Yankee Fork mainstem as the water flows downstream. At the upper sites, at Ninemile Creek and above Eightmile Creek, water temperatures have been optimal throughout the summer and fall months, remaining below the PACFISH recommendations for all years, except in 2021, where the persistence of higher temperatures during this year caused exceedance of the spawning recommended temperature threshold above Eightmile. As you travel downstream the temperatures increase and exceed the PACFISH water temperature thresholds for the late summer months and early fall. At a crucial time period for the Chinook salmon spawning season, from early August through mid- September, temperatures at the lower sites, from the bridge below Flat Rock Campground up to the Dredge Camp, at the lower end of the dredge section, exceeded the PACFISH Chinook recommended spawning maximum threshold every year monitored except for the high water year 2017 at Polecamp Flat (Figures 36-50). Water temperatures vary greatly over the season from year to year. Comparing composited yearly maximum statistics for water temperatures for all

mainstem Yankee Fork sites, including the major tributary West Fork, maximum air temperatures from the Bonanza RAWS station and available discharge data for the approximate chinook salmon spawning time frame, from August 1 to September 14, from the USGS gauge 1329600 near the mouth, from 2006 to 2021, shows that water temperatures in the Yankee Fork are driven more by snowpack, current and subsequent years aquifer recharge and resulting discharge rather than air temperatures. The 15 year overall trend is static, fluctuating from high to low every 3 to 5 years, with 2007 water temperatures the warmest year followed by a gradual decline to the cooler seasons of 2009-2011. Water temperatures in 2013 jumped upward, correlating with a sudden drop in discharge, and for the next 4 years maintained somewhat at that level, oscillating up and down with discharge. In 2017, despite air temperatures peaking at the second highest level, water temperatures dropped to the coldest of the 15 years clearly caused by prolonged snowmelt and recharged groundwater aquifers, from a higher than average snowfall during the winter of 2016 to 2017. Temperatures in 2018 moderately rebounded and now with 2019, 2020 and 2021 is showing an upward trend (Figure 51, USGS 2021, WRCC 2021).

Six small tributaries that enter along the lower half of the dredged section of the Yankee Fork, Cearley Creek, the unnamed tributary to PS2, Jerrys Creek, Ramey Creek, Rankin Creek and Silver Creek, were monitored intermittently from 2009 to 2021 during midseason and overwinter. All of these tributaries have significant cold water temperature profiles compared to the mainstem, indicating relatively close spring sources, and all contribute important rearing habitat and mid-season cold water refuge directly to or indirectly as subflow through dredge material to the lower YFSR. The 7-day running average maximum water temperatures for all of these tributaries are well below the PACFISH Chinook migration/rearing recommended maximum threshold. Cearley Creek, entering at the upper end of Pond Series 3, with an average baseflow of ~0.7cfs, monitored from 2013 to 2021, maximum 7-day running average maximum temperatures ranged from 8.6°C to 10.6°C (Tables 8 & 11, Figure 52). Overwinter monthly average temperatures in Dec. and Jan., from 2012 to 2014, ranged from 3.82°C to 4.09°C (Table 10, Figures 87 & 88). The unnamed tributary to Pond Series 2, entering from the west at the upper end of Pond Series 2, monitored from 2012 to 2015, and in 2017 and 2018, maximum 7-day running average maximum temperatures ranging from 11.8°C in 2013 to 12.8°C in 2014 and 2015 (Tables 8 & 11, Figures 60 & 53). Overwinter monthly average temperatures in Dec. and Jan., from 2011 to 2014, ranged from 0.28°C to 1.73°C (Table 10, Figures 86-88). Jerrys Creek, upstream of Dredge Camp, disconnected at its mouth from the Yankee Fork by dredge material, with an average baseflow of ~0.1cfs, monitored in 2009, 2010 and 2014, 2018, 2019, 2020 and 2021, maximum 7-day running average maximum temperatures ranged from 9.6°C in 2019 and 2020 to 13.0°C in 2021 (Tables 8 & 11, Figure 53). Overwinter monthly average temperatures, in Dec. and Jan., from 2011 to 2012, 2013 to 2014, 2016 to 2017, and in Jan. of 2018 ranged from 1.21°C to 3.77°C (Table 10, Figures 86, 88, 90 & 91). Ramey Creek, entering the Yankee Fork at the Dredge Camp, with an average baseflow of ~2.9cfs, monitored in 2012 and 2013, maximum 7-day running average maximum temperatures ranged from 14.4°C to 16.0°C (Tables 8 & 11, Figure 54). Overwinter monthly average temperatures, in Dec. and Jan., from 2012 to 2013, ranged from 0.21°C to 0.48°C (Table 10, Figure 87). Rankin Creek, entering the Yankee Fork from the west side, downstream of the Dredge Camp,

with an average baseflow of ~1.52cfs, monitored from 2010 to 2013, maximum 7-day running average maximum temperatures ranged from 11.4°C to 13.7°C (Tables 8 & 11, Figure 55). Overwinter monthly average temperatures, in Dec. and Jan., from 2012 to 2013, ranged from 0.30°C to 0.62°C (Table 10, Figure 87). Silver Creek, disconnected from the Yankee Fork by dredge material, with an average baseflow of ~0.5cfs, monitored in 2009, 2011, 2013 to 2015 and in 2020, maximum 7-day running average maximum temperatures ranged from 7.3°C to 10.3°C (Tables 8 & 11, Figure 56). Overwinter monthly average temperatures, in Dec. and Jan. during three seasons, from 2011 to 2014, ranged from 1.96°C to 2.56°C (Table 10, Figures 86-88). Snowmelt, from the winter of 2016 to 2017, that extended well into the summer season kept mainstem and major tributaries of the YFSR significantly cooler through the entire season of 2017 compared to all previous years monitored. In contrast, 2017 was observed to be one of the warmer seasons for both the Cearley Creek and Jerrys Creek, suggesting they were more affected by air temperatures because of their unvarying spring sourced discharges. Jerrys Creek temperatures in the following years, 2018 to 2020 steadily declined as air temperatures rose in 2018, dropped in 2019 then rose to halfway between the two in 2020, suggesting effects from a natural delay in aquifer recharge from 2017 with subsequent increases in discharge (Table 11).

The Pond Series 1 upper pond northwest shore was monitored by SBT HOBO midseason in 2011 and overwinter from 2011 to 2012, at which time it was lost, and during midseason in 2013 using a USFS Tidbit. Visitors at this popular fishing pond unintentionally removed the Tidbit during 2013 creating data gaps from air exposure during the warmer part of the season, so the maximum might have been missed. The 7-day running average maximum water temperatures remained cold throughout both seasons, show very little diel variation which is indicative of a close spring or ground water source, reaching an approximate maximum of 12.3°C both years, and remaining well below the PACFISH Chinook migration, rearing and spawning recommended maximum thresholds (Table 11, Figure 57). Overwinter temperatures from 2011 to 2012, Dec. and Jan. monthly averages ranged from 2.26-1.55°C (Table 10, Figure 86). The maximum 7-day running average maximum temperature, at Pond Series 1 upper pond outlet check structure, approximately 170 meters downstream, also monitored midseason in 2013 by a USFS Tidbit, reaching 20.7°C, was 8.4°C higher than at the northwest shore, demonstrating the significant warming and potentially lethal effect of stagnant water in ponds, exceeded the PACFISH Chinook migration and rearing recommended maximum threshold by 16 days, and exceeded the PACFISH Chinook spawning recommended maximum threshold, during the Chinook spawning window, from August 1 to September 14, by 26 days (Table 11). Pond Series 1 lower pond inlet, at the new culvert installed in 2017 during the Pond Series 1 Rehabilitation Project, monitored in 2020 and 2021, 7-day running average maximum temperatures, with a maximum ranging from 13.9°C to 14.4°C, remained well below both the PACFISH Chinook migration and rearing and PACFISH Chinook spawning recommended maximum thresholds (Table 11, Figure 58). Since rehabilitation, in 2020 and 2021, observations during deployment of this new temperature monitoring site have revealed that at low flows the large hydrologically unnatural for channel size dredge material substrate in this section of channel creates a fish migration barrier, and the datalogger at the downstream end of the culvert is prone to air exposure (Mendez 2022; Galloway 2022). The Pond Series 1 lower pond outlet check structure, approximately 160 meters downstream from the inlet,

monitored by SBT HOBO in 2015 prior to the Pond Series 1 Rehabilitation Project in 2017, 7-day running average maximum temperatures, also significantly warmed by stagnant pond water, reached a maximum of 19.0°C, exceeding the PACFISH Chinook migration and rearing recommended maximum threshold for 22 days, and exceeding the PACFISH Chinook spawning recommended maximum threshold, from August 1 to September 14, for 41days (Table 11). Temperatures at this site in 2015, through May and June, differed noticeably from the signature profiles observed during that same timeframe at all other sites for that year. Temperatures rose more gradually and had diminished diel variation, indicating possible burial in substrate, which was likely, given the annually recurring beaver activity observed at that check structure (Gable 2017). The Pond Series 1 outlet, at the Yankee Fork road culvert, was monitored prior to rehabilitation by SBT HOBO in 2011 and overwinter from 2011 into March of 2012, at which time it was lost, by USFS Tidbit during midseason in 2012, by a Lost River Fish Ecology, Inc. (LRFE) HOBO overwinter 2012 to 2013 and through July of 2013, at which time it was estimated that it became exposed to air, by USFS Tidbit midseason during that same year of 2013 up through July when it was also estimated to be exposed to air, by SBT HOBO in 2014 up until about July 22 when it became exposed to air, and then after rehabilitation, from 2018 to 2021, for a full season by two different dataloggers in 2018, one set in Jan 2018 and allowed to overwinter through until July 31 of 2019, and another separate datalogger for a full season in 2019, and then for a full season in 2020 and 2021. Monitoring at this site has been problematic. Prior to rehabilitation, flows upstream of the road culvert frequently went subsurface into the dredge material during mid-summer causing diminished flows to sometimes a dewatered channel at the culvert, and this condition was often exacerbated by beaver activity at the lower pond outlet check structure ~80 meters upstream (Gable 2017). No maximum temperature data was collected for 2014 due to the channel going dry early in the season. The 7-day running average maximum temperatures at this site, with maximums at 14.2°C in 2011 and 14.4°C in 2012, during two of the cooler seasons, did not exceed the PACFISH Chinook migration, rearing or spawning recommended maximum thresholds. In 2013, despite uncertainty of when the LRFE HOBO and USFS Tidbit became exposed to air, both estimated to be at the end of July, the 7-day running average maximums, of 18.4°C and 18.8°C, occurring on July 25 and July 24 respectively, correlate well with each other and also with when this maximum occurred at all other sites within the watershed, so most likely water temperatures did exceed the PACFISH Chinook migration and rearing recommended maximum threshold that year, for at least 5 and 6 days respectively. In 2017, during the Pond Series 1 Rehabilitation Project, in an effort to establish perennial flow in the outlet channel by reducing water escaping into the dredge tailings under the Yankee Fork road, two clay plugs were placed laterally across the lower end of the lower pond, the space behind or downstream of them filled to create a wetland, and a new outlet channel was dug, rerouted away from the dredge tailings, out through un-dredge-mined-disturbed valley floor (Gregory 2017, Figure 6). In 2018, post rehabilitation, flows at the culvert were continuous throughout the season, but temperatures may have been moderated by continued beaver dam construction directly upstream, with the primary dam, at 3-4 feet high, being only 1 to 2 meters above the HOBO at the culvert opening, and backing up water as far as the new culvert above the pond. This dam was dismantled several times in 2018, and subsequently as noticed in 2021, to facilitate operations of the

Supplementation Project but it was usually rebuilt by the next day, and was fully intact by the end of the season (Gable 2019; Mendez 2022). A dam built at the upstream end of the new outlet channel has backed up water into the adjacent tailings resulting in resumed flow seepage loss through the tailings and diminished flows at outlet (Gregory 2022). The two dataloggers deployed at this site in 2018 recorded noticeably different temperatures and has since been traced to manufacture calibration differences in recording temperatures and it is unknown which is more accurate since our program currently does not have a National Institute of Standards and Technology (NIST) thermometer; both are included in this report. The 7-day running average maximum temperatures, ranging from 16.7°C to 19.2°C, exceeded the PACFISH Chinook migration and rearing recommended maximum threshold for 11 days in 2021, and exceeded the PACFISH Chinook spawning recommended maximum, during the Chinook spawning window of August 1 through September 14, for 11 and 22 days in 2018, for 38 days in 2019, 22 days in 2020 and 39 in 2021 (Table 11, Figure 59). Overwinter Dec. and Jan. monthly average temperatures, prior to rehabilitation 2011 to 2012 and 2012 to 2013 ranged from 0.95°C to 1.60°C, and after rehabilitation during Jan. of 2018 and 2018-2019 ranged from 1.00°C to 1.84°C (Table 10, Figures 86, 87 & 91).

The Pond Series 2 inlet, monitored at the downstream end of the culvert under the private cabin access road, from November 2011 through October 2012, 7-day running average maximum temperatures during 2012 remained cold throughout the season, reaching a maximum of only 10.8°C, and stayed well below the PACFISH Chinook migration and rearing or spawning maximum temperature thresholds. Maximum water temperatures at this site occurred unusually early, affected by temperatures from the YFSR which accessed Pond Series 2 during high flows around mid-June. Midseason temperatures, compared to the unnamed tributary, mid and outlet sites, are significantly colder indicating a spring/groundwater influence at this site. Late fall temperatures at this site were influenced by beaver dam activity at the culvert which reversed flows back out the inlet, drawing with it the relatively warmer outflow of the PS2 unnamed tributary, so temperatures in late fall match those of the unnamed tributary (Table 11, Figure 63). Overwinter, from 2011 to 2012, monthly averages for December and the partial month of January range from 1.24°C to 1.27°C (Table 10, Figure 86). Pond Series 2 midpoint at the pond outlet of the now historic 4th check structure downstream from the inlet, was monitored prior to and during the Pond Series 2 Rehabilitation Project, from November 2011 over two winters to September of 2013; then after rehabilitation, from November of 2013 to November of 2014, midseason 2015, overwinter 2015 to 2016, and then midseason each year from 2016 to 2018 and in 2021. Prior to rehabilitation, the 7-day running average maximum temperatures, with maximums ranging from 18.2°C in 2012, to 22.7°C in 2013, the highest temperature recorded in the watershed during 16 years monitoring, exceeded the PACFISH Chinook migration and rearing maximum threshold for 11 days in 2012 and 68 days in 2013, and exceeded the PACFISH Chinook spawning maximum temperature threshold, during the spawning window, from August 1 to September 14, for 12 days in 2012 and for 45 days in 2013. After rehabilitation the maximum 7-day running average maximum temperatures did not significantly change, ranging from 18.9°C in 2014 to 22.0°C in 2021, exceeded the PACFISH Chinook migration and rearing maximum threshold for 11 days in 2014, 11 days in 2015, 15 days in 2017, 26 days in 2018 and at least 35 days in

2021, and exceeded the PACFISH Chinook spawning maximum temperature threshold, during the spawning window from August 1 to September 14, for 21 days in 2014, 22 days in 2015, 15 days in 2017, 25 days in 2018 and at least 5 days in 2021 (Table 11, Figure 61). This site, along with Jordan Creek, is one of the warmest recorded in the YFSR watershed. Prior to rehabilitation of this Pond Series, which was completed in September of 2013, by mid to late summer, flows at the outlet of this dredge pond were very slow to almost stagnant, and directly downstream of this site surface flows typically went subsurface. In September of 2013 the check structure and cement sill were removed from the pond outlet, and downstream of the check structure the gradient was dug down along 20-30 meters of channel to reestablish perennial flows. Although flows below this site are now continuous all year, the volume of water flowing through this rehabilitated channel is unchanged from when flows did occur prior to restoration, and still each year after runoff when the YFSR ceases to access this pond series at its inlet, and limited to only what is contributed by subflow and the unnamed tributary, temperatures are still representative of potentially lethal conditions at a stagnant pond outlet. From about 2016 to 2021 beaver have reoccupied this pond series and created pools where flowing channels were established after rehabilitation. In 2021 a dam was built just upstream of this site which reduced flows downstream exposing the datalogger to air. The dam was dismantled but was shortly rebuilt and later another dam was built directly over the site again exposing the datalogger to air. The rebar with datalogger attached was removed and laid down in a section of flowing channel and rocked down (Mendez and Galloway 2022). Overwinter Dec. and Jan. monthly averages, prior to rehabilitation over two winters from 2011 to 2013, ranged from 0.13°C to 0.23°C, and after rehabilitation, from 2013 to 2014, and 2015 to 2016, ranged from 0.10°C to 0.41°C (Table 10, Figures 86-90). Pond Series 2 outlet was monitored prior to rehabilitation, from November 2011 through September of 2013, and after rehabilitation, from November of 2013 to November of 2014, and midseason in 2015, 2017, 2018 and 2021. Prior to rehabilitation, the 7-day running average maximum water temperatures, with maximums ranging from 14.8°C in 2012 to 19.1°C in 2013, exceeded the PACFISH Chinook migration and rearing maximum threshold for 23 days in 2013, and exceeded the PACFISH Chinook spawning maximum temperature threshold, during the spawning window from August 1 to September 14, for 45 days in 2013. After rehabilitation, maximum 7-day running average maximum temperatures, ranging from 15.8°C to 21.1°C exceeded the PACFISH Chinook migration and rearing maximum for 57 days in 2021, and exceeded the PACFISH Chinook spawning maximum temperature threshold, during the spawning window from August 1 to September 14, for 18 days in 2015, 13 days in 2017, 8 days in 2018 and 20 days in 2021 (Table 11, Figure 62). Overwinter, Dec. and Jan. monthly average water temperatures, prior to rehabilitation for two winters from 2011 to 2013 ranged from 0.93 to 1.31; and after rehabilitation from 2013 to 2014, and during December of 2015, ranged from 0.79°C to 1.11°C (Tables 10, Figures 86-89). Temperatures at the PS2 outlet prior to rehabilitation did not seem significantly different than after rehabilitation, and had been noticeably cooler than at the PS2 midpoint, recovering within the ~360 meters of channel that separates the two sites to conditions that are suitable for rearing juvenile Chinook salmon, until 2021 when conditions changed to less suitable from a combination of high air temperatures,

record low discharge and the reestablishment of beaver habitat creating unpredictable / variable and sometimes stagnant flows.

The Pond Series 3 inlet was monitored in 2012 in the YFSR with a HOBO placed near the inlet to PS3, which was found out of the water on September 7, so maximum temperatures were lost, but comparison of data after this date to the temperatures found in the Yankee Fork at the second bridge below the West Fork, also monitored in 2012 by USFS Tidbit, show no significant difference, so was used as a substitute. From 2012 to 2013 overwinter into midseason 2013 the PS3 inlet temperature was monitored at a new location, at ~4 meters above the mouth of Cearley Creek, off of the river left bank, but was noticeably influenced by unexpected upstream pooling of Cearley Creek outflow blocked by ice during midwinter, but by midseason was dominated by flows from the YFSR. In 2014 a new site was established approximately 70 meters upstream from Cearley, at the top of the PS3 channel, at where it splits off from the YFSR, off of the river right bank or at the post Pond Series 3 Rehabilitation Project control structure placed at the inlet, and monitored by USFS Tidbit during midseason in 2014, and by SBT HOBO in 2015, 2016, 2019, 2020 and 2021. The 7-day running average maximum water temperatures over all six years, with maximums ranging from 17.1°C to 19.6°C, exceeded the PACFISH Chinook migration and rearing maximum threshold for 23 days in 2013, 6 days in 2015, 3 days in 2016, 7 days in 2020 and 39 days in 2021, and exceeded the PACFISH Chinook spawning maximum temperature threshold, during the spawning window from August 1 to September 14, in all years, for 11 days in 2012, 45 days in 2013, 15 days in 2014, 32 days in 2015, 24 days in 2016, 27 days in 2019, 37 days in 2020 and 35 days in 2021 (Table 11, Figure 72). The overwinter monthly average water temperature in the YFSR at this site for Jan. of 2012 was 0.33°C. The overwinter monthly average water temperature in the PS3 inlet at ~4m upstream of the mouth of Cearley Creek for Jan. of 2013 was 1.6°C, clearly dominated by temperatures from the outflow from Cearley Creek (Table 10, Figures 86 & 87). Pond Series 3 at the now historic culvert at the road crossing site below the mouth of Cearley Creek was monitored prior to rehabilitation, from November 2011 through September 2012, at which time the HOBO was removed for two months during the rehabilitation work, then after rehabilitation, continuously from December 2012 through November 2014, then midseason each year from 2015 to 2018, in 2020 and 2021. Midseason in 2012, prior to rehabilitation, this site had one of the coldest temperature profiles of all sites monitored in the Yankee Fork watershed, definitely affected and at that time dominated by the outflow from Cearley Creek, and the 7-day running average maximum water temperatures, with a maximum of only 9.3°C, did not exceed the PACFISH Chinook migration and rearing or spawning maximum thresholds. This profile changed dramatically after rehabilitation. With increased flows entering Pond Series 3 from the YFSR, from 2013 through to 2021, the midseason 7-day running average maximum temperatures, with maximums ranging from 14.5°C to 19.1°C, exceeded the PACFISH migration and rearing maximum threshold for 18 days in 2013, 4 days in 2015 and 5 days in 2021, and exceeded the PACFISH Chinook spawning maximum temperature threshold, during the spawning window, from August 1 to September 14, for 43 days in 2013, 16 days in 2015, 5 days in 2016, 13 days in 2020 and 2 days in 2021 (Table 11, Figure 73). Overwinter, Dec. and Jan. monthly average water temperatures prior to rehabilitation from 2011 to 2012 ranged from 3.12°C to 3.57°C; and after rehabilitation from 2012

to 2013, 2013 to 2014, 2015 to 2016 and in January of 2018 ranged from 0.61 to 3.59°C, still affected to varying degrees by Cearley during midwinter base flows and the unpredictable buildup of ice dams (Table 10, Figures 86-89 & 91). A temporary study site at the Pond Series 3 upper midpoint, ~130 meters downstream of the historic culvert site, near the bottom end of the new roughened channel created during the 2012 rehabilitation work, and downstream of a significant groundwater/sub-flow discharge area, was monitored from December 2012 through November 2013. The midseason 7-day running average maximum stream temperatures were significantly cooler than at the historic culvert site, with a maximum of 18.0°C, exceeding the PACFISH Chinook migration and rearing maximum threshold for only 1 day, compared to 18 days at the historic culvert site, and exceeding the PACFISH Chinook spawning maximum temperature threshold, during the spawning window, from August 1 to September 14, for only 10 days, compared to 43 days at the historic culvert site (Table 11, Figure 77). Overwinter at this study site, from 2012 to 2013, Dec. and Jan. monthly average water temperatures ranged from 0.69°C to 0.94°C (Table 10, Figure 87). Pond Series 3 midpoint at the now historic big pond outlet check structure, was monitored prior to rehabilitation from November 2011 through September 2012, at which time the HOBO was removed for rehabilitation work, then after rehabilitation, continuously from December 2012 through November 2014, then midseason in 2015 and overwinter from 2015 to 2016. Prior to rehabilitation, the 7-day running average maximum water temperatures in 2012, peaking at 17.8°C, exceeded the PACFISH Chinook migration and rearing maximum temperature threshold 1 day, and exceeded the PACFISH Chinook spawning maximum temperature threshold, during the spawning window, from August 1 to September 14, for 12 days. After rehabilitation, with the filling in of the big pond, and increased flows at this site, the 7-day running average maximum water temperatures from 2013 to 2015, with maximums ranging from 16.0°C to 17.5°C, did not exceed the PACFISH Chinook migration and rearing maximum temperature threshold, and exceeded the PACFISH Chinook spawning maximum temperature threshold, during the spawning window, from August 1 to September 14, for 10 days in 2013 and for 11 days in 2015 (Table 11, Figure 74). Overwinter monthly average temperatures for Dec. and Jan. prior to rehabilitation from 2011 to 2012, ranged from -0.01°C to 0.54°C, and after rehabilitation, from 2012 to 2013, 2013 to 2014 and 2015 to 2016 ranged from 0.45°C to 0.91°C (Table 10, Figures 87-89). The Pond Series 3 outlet, at the now historic lower pond outlet check structure, or last check structure downstream from the inlet, was monitored prior to rehabilitation from November 2011 until June of 2012 when the HOBO memory ran out, and post rehabilitation, continuously from December 2012 through November 2014, from April of 2015 continuously through midseason of 2017, from January through midseason of 2018, and for the full season of 2019. The 7-day running average maximum water temperatures after rehabilitation, 2013 to 2019, after the lower pond was filled in and flows increased, with maximums ranging from 14.6°C to 16.8°C, did not exceed the PACFISH Chinook migration and rearing maximum temperature threshold, but exceeded the PACFISH Chinook spawning maximum temperature threshold, during the spawning window, from August 1 to September 14, for 10 days in 2013, 10 days in 2015, and for 2 days in 2018 (Table 11, Figure 75). In 2021 beaver built a large dam directly over this site and incorporated the datalogger, so no mid season water temperatures were collected for this site this year (Mendez 2022). Overwinter Dec. and Jan. monthly averages

prior to rehabilitation, from 2011 to 2012, ranging from 0.95°C to 1.62°C, were not significantly different after rehabilitation, during two winters from 2012 to 2014, and from 2016 to 2017, which ranged from 0.53°C to 1.58°C (Table 10, Figures 86-88).

The Pond Series 3 Rehabilitation Project, which increased flows by enlarging the inlet, and decreased volumes by filling in the ponds, changed the midseason longitudinal thermal profile of the channel from temperatures increasing as one moves downstream, to temperatures decreasing as one moves downstream. Despite the fact that the historic culvert site sits directly below the cold, spring fed Cearley Creek, there was enough volume of water coming in the inlet from the YFSR to warm this site above the midpoint, during midseason. This change can be seen on the comparison graphs right after the rehabilitation project, where all sites were very close in temperature all through the season, but now, looking at the progression of annual Pond Series 3 site comparison graphs, from 2012 to 2021, it can be seen that the culvert site, by mid to late season, is cooling off sooner each year compared to the midpoint and outlet, influenced more each year by Cearley Creek, indicating that there is less and less influence that the Yankee Fork river water has on this pond series coming in at the inlet. Inlet flows, have decreased over the years, filled in by spring runoff silt depositing in the channel above the inlet flow control structure and in the pond series lower gradient, giving Cearley more expression (Figures 76-85; Gregory 2021, 2022; Mendez 2022). The midpoint, after rehabilitation, no longer at the outlet of a giant warm pond with low to stagnant flows, is much reduced in volume, and therefore more affected by what has now been revealed as a significant volume of cold subsurface flows coming from the Yankee Fork mainstem, through the dredge material, emerging along the river right side of the channel, starting at the bottom end of the rehab-roughened channel (the upper midpoint monitoring site), and observed upwelling ~85 meters further downstream at ~180 meters upstream of the midpoint site. The volume of subflow from the Yankee Fork discharging in this area is significant enough now to rewarm the temperature of the water, mid to late season, compared to the historic culvert site, cooled in the upper part of the pond series by reduced inlet flows and increasing effects of Cearley Creek (Table 11, Figures 76-85). The increased effects of subsurface flows from the YFSR as one moves down the channel can also be seen as higher overwinter Jan. and Dec. monthly average temperatures recorded at the outlet compared to the midpoint (Table 10, Figures 87-89).

WATER QUALITY / SONDES

Idaho Department of Environmental Quality (IDEQ) has designated surface water use for the Yankee Fork Salmon River Watershed, within the hydrologic unit code (HUC) 17060201, Upper Salmon Subbasin, in rule section 130.03 Units S-32 through S-46 as: Cold water (COLD): water quality appropriate for the protection and maintenance of a viable aquatic life community for cold water species, Salmonid spawning (SS): waters which provide or could provide a habitat for

active self-propagating populations of salmonid fishes, and Primary contact recreation (PCR): water quality appropriate for prolonged and intimate contact by humans or for recreational activities when the ingestion of small quantities of water is likely to occur (In addition, IDEQ designated use specifically for 130.03 Unit S-32 Yankee Fork, Jordan Creek to mouth as: Domestic (DWS): water quality appropriate for drinking water supplies; but since it is not designated as a Small Public Water Supply under 252.01.b.i., no more stringent turbidity standards apply - only additional radioactive materials and radioactivity standards apply) (IDAPA 58.01.02). IDEQ criteria for Cold Water Aquatic Life Use recommend water temperatures of 22°C or less with a maximum daily average of no more than 19°C; hydrogen ion concentration (pH) values should fall within the range of six point five (6.5) to nine point zero (9.0); and turbidity levels should not exceed 50 Nephelometric Turbidity Units (NTU) instantaneously or the daily average should not be more than 25 NTU for more than a period of 10 consecutive days; and dissolved oxygen (DO) concentrations should remain above 6 mg/L (IDAPA 58.01.02).

No IDEQ standards are available for specific conductivity, but The Environmental Protection Agency (EPA) reports that "The conductivity of rivers in the United States generally ranges from 50 to 1500 µmhos/cm [0.05 to 1.5 mS/cm]. Studies of inland fresh waters indicate that streams supporting good mixed fisheries have a range between 150 to 500 µmhos/cm [0.15 to 0.5 mS/cm]. Conductivity outside this range could indicate that the water is not suitable for certain species of fish or macroinvertebrates." (Monitoring and Assessing Water Quality, EPA 2006).

From 2006 to 2016 gaps in data collection occurred associated with high spring runoff events, SONDE removal during recalibration, probe failures and replacements. At times these gaps were significant. The number and duration of these data gaps at all sites has declined over the years owing to a change-out of the 6562 Rapid Pulse Polarographic oxygen probe (used 2006-2010) to the new 6150 ROX Optical oxygen probe (as of 2011 used exclusively), an increased understanding of data needs, increased familiarity with the instruments and quicker more efficient recalibration techniques.

In 2013, during midsummer, SONDE's were placed in the outlets of PS1, PS2, PS3 and PS4. The SONDE at the outlet of PS1 was subjected to intermittent periods of air exposure due to flows going subsurface and beaver activity in the area, so ended up deployed only for an estimated 10-12 days during July 11th to July 28th. The SONDE at PS2 outlet was deployed from June 13 to July 10, at which time it was removed to be deployed elsewhere, and then redeployed at this site from August 9 to August 27, for a total of 47 days. The SONDE at PS3 outlet was deployed from May 10 to July 10 and then from August 9 to August 24 for a total of 78 days. The SONDE at PS4 was deployed from July 11 through July 31 for a total of 21 days. In 2016 the SONDE that was placed in Pond Series 1 at the lower pond outlet, where there were continuous flows, for a total of 58 days from April 28 to June 24, did not have a functioning pH probe so no pH data was collected at this site that year (Table 12).

In 2016 a new SONDE monitoring site on the West Fork was established at Virginia's cabin, ~290m above the new mouth. The SONDE deployed at this site did not have a pH meter but by August 30 was replaced by a SONDE that did. On May 10, 2016 during spring high water runoff, the SONDE at the old mouth of the West Fork, which was attached to a t-post as it had been in 2015 fell over, and the SONDE probes became compacted with debris until June 23 when it was retrieved. Data collected during that timeframe was found to be abnormal and in error so was removed from analysis. Data collected from July 14, at which time the entire Yankee Fork was shifted to its new channel, until August 1, when this SONDE was pulled, is included with the data at a new site, the Yankee Fork at first bridge below West Fork, where this SONDE was later redeployed on August 3. In 2016, during the West Fork confluence rehabilitation project, water was initially let thru the headgate into the newly constructed channel on May 4. The total construction window was from July 11 – Sept 15, 2016. The old mainstem channel was coffered off and the berm was removed at the head end of the new Yankee Fork channel allowing full flow into the new channel on 7/14 (fish salvage occurred in the old channel on 7/14). Instream work on the old West Fork channel was complete by August 11. Work on the new "Side Channel 1" (in the area of the old mainstem channel) was performed after that, with coffer dams in place at the head and tail of the channel which were left in place over the winter of 2016 to 2017. The data collected at the old mouth of the West Fork from deployment on March 31 to May 4 when a small portion of the Yankee Fork was released into its new channel until May 10 when the t-post collapsed, and then data from June 23 when it was retrieved to July 13th, just prior to the full release, and subsequent data collected at first bridge below West Fork, was compared to data from the SONDE at Virginia's cabin as well as the SONDE at bridge below Bonanza to determine effects of turbidity from the restoration activities, discussed below.

In 2017 and 2018 the SONDE at the first bridge below the West Fork Yankee Fork was not sent back to YSI for Bench Check of Specific Conductivity, pH and Dissolved Oxygen probes prior to deployment. The main function of this SONDE was to measure Turbidity in conjunction with USGS suspended sediment grab sample measurements at this location. Therefor no other water quality data, other than turbidity, are reported for this SONDE in this report.

All data collected over the last 13 years from 2006 to 2018 at each site, for temperature, specific conductivity, pH, turbidity and dissolved oxygen is summarized for various applicable parameters relative to IDEQ and EPA standards in Table 13.

Temperature

From 2006 to 2018 depending on where even small data gaps occur in the SONDE deployment, seasonal temperature extremes may not be completely or accurately detected. But even with these data gaps the SONDE temperature data provides valuable estimates of seasonal extremes, as seen for the detection of the warmest water temperatures during 2007. SONDE temperature data was used to fill in where data gaps occurred in Onset HOBO, Tidbit or Pressure

Transducer deployment. If the temperature probe on the SONDE was deployed for a long enough duration during the hottest time of the year and/or during certain time frames associated with the onset of Chinook spawning then accurate summary statistics were calculated and applied to standards. All useful temperature data from the SONDEs are included in graphs, tables and discussion of results in the temperature analysis section above.

Specific Conductivity

Specific conductivity measurements in the Yankee Fork at the bridge below Flat Rock Campground from 2006 to 2018 ranged from 0 to 0.186 mS/cm (0.084 mS/cm average), at the first bridge below the West Fork Yankee Fork, monitored from July 14 to August 30, 2016 ranged from 0.081 to 0.097 mS/cm (0.091 mS/cm average), at the bridge below Bonanza from 2006 to 2018 ranged from 0.001 to 0.241 mS/cm (0.078 mS/cm average), and at the bridge on the Yankee Fork road above Custer from 2010 to 2012 ranged from 0 to 0.073 mS/cm (0.052 mS/cm average). At the mouth of Jordan Creek from 2006 to 2012 specific conductivity ranged from 0 to 0.277 mS/cm (0.113 mS/cm average). At the old mouth of the West Fork Yankee Fork from 2010 to 2016 specific conductivity ranged from 0 to 0.233 mS/cm (0.081 mS/cm average), and from 2016 to 2018 at Virginia's cabin on the West Fork Yankee Fork specific conductivity ranged from 0.043 to 0.099 mS/cm (0.076 mS/cm average). Specific Conductivity in 2013 and 2016 at the PS1 outlet ranged from 0.056 to 0.132 mS/cm (0.090 mS/cm average). In 2013 at the PS2 outlet ranged from 0.102 to 0.144 mS/cm (0.123 mS/cm average), at PS3 outlet ranged from 0.037 to 0.126 mS/cm (0.083 mS/cm average), and at the PS4 outlet ranged from 0.086 to 0.105 mS/cm (0.097 mS/cm average). The averages for all sites fall within the general range of specific conductivity for rivers of the United States, but tend to be below the range observed for streams of good mixed fisheries. At all sites specific conductivity is observed to sporadically drop to very low and zero values, often correlated to increases in turbidity. Unusually low readings of specific conductivity correlating with high turbidity events that occur at the same time can be caused by charged ions binding with the suspended sediments (Bechtold 2010). Comparing the year to year averages of specific conductivity between sites the Yankee Fork at the bridge below Bonanza and bridge below Flat Rock Campground and the West Fork Yankee Fork appear to have values within a similar range of variability; Jordan Creek and the Pond Series averages tend to be higher than these three sites, and the Yankee Fork at bridge above Custer averages tend to be lower. On October 16, 2012 at the mouth of the West Fork a brief spike in specific conductivity occurred reaching 0.233mS/cm, also seen at the SONDE down at the bridge above Flat Rock Campground at 0.169mS/cm, both correlating with a plume of ash which passed through from a storm over the Halstead Fire area. (Table 13, Figures 92-94).

pH

pH in the Yankee Fork at the bridge below Flat Rock Campground from 2006 to 2018 ranged from 6.49 to 8.95 (7.78 average), at the first bridge below the West Fork Yankee Fork, from July 14 to August 30, 2016 ranged from 7.41 to 7.90 (7.61 average), and at the bridge below Bonanza from 2006 to 2018 ranged from 6.14 to 8.71 (7.65 average); from 2010

to 2012 at the bridge on the Yankee Fork road above Custer pH ranged from 7.20 to 8.01 (7.68 mean). At the mouth of Jordan Creek, from 2006 to 2012, pH ranged from 6.02 to 8.70 (7.71 average); at the old mouth of the West Fork Yankee Fork from 2010 to 2016 pH ranged from 6.76 to 9.12 (7.68 average), and at Virginia's cabin on the West Fork Yankee Fork, from August 30 to November 3, 2016, in 2017 and 2018, pH ranged from 7.27 to 8.29 (7.75 average). pH in 2013 at the PS1 outlet ranged from 6.88 to 8.03 (7.36 average); at the PS2 outlet ranged from 7.02 to 8.41 (7.44 average); at PS3 outlet ranged from 6.93 to 7.85 (7.40 average); and at the PS4 outlet ranged from 7.13 to 7.63 (7.32 average). Overall average recorded pH levels at all five sites are within the IDEQ recommended range. A few sporadic values fall outside the recommended range. Comparing diel fluctuations in pH from site to site it appears that the Yankee Fork at the bridge above Custer and Jordan Creek at its mouth vary less than sites downstream in the watershed; of the two sites, pH in the Yankee Fork at the bridge above Custer appears to fluctuate within the tightest range. Variability over the season follows a yearly signature pattern repeated, to different levels of magnitude, between the Jordan Creek, Yankee Fork at bridge below Boanza, West Fork and Yankee Fork at bridge below Flat Rock Campground sites. This yearly pattern is barely discernible in the Yankee Fork at the bridge above Custer site. The West Fork appears to have the greatest diel fluctuation in pH range. Comparison of the average pH year to year between sites shows no significant difference, and yearly average pH in the Yankee Fork at the bridge below Flat Rock Campground varies over the greatest range. (Table 13, Figures 95-97)

Turbidity

Turbidity in the Yankee Fork at the bridge below Flat Rock Campground, from 2006 to 2018, ranged from 0 to 1180.9 NTU (20.7 NTU average, 1.2 NTU median), exceeded the IDEQ recommended instantaneous maximum of 50 NTU 5613 times, and with a maximum daily average of 688.8 NTU exceeded the IDEQ recommended daily average maximum of 25 NTU for greater than 10 consecutive days 5 times, during events in 2008, 2009, 2012, 2013 and 2018. From 7/11/2017 to 8/24/2017 during the Pond Series 1 rehabilitation project, the outflow channel was rerouted through 260 meters of new channel, dredge leakage plugs were installed spanning the lower half of the lower pond then back filled with dredge material to create a wetland, and a culvert was installed above the lower pond for a new road crossing. During that timeframe turbidity recorded at the bridge below Flat Rock Campground SONDE was insignificant other than a peak observed on 7/28/2017, which was also seen by the SONDES at the first bridge below the West Fork and at the bridge below Bonanza, so was determined to be from a natural event. Turbidity in the Yankee Fork at the first bridge below the West Fork Yankee Fork, from July 14 to August 30, 2016, in 2017 and 2018, ranged from 0.2 to 657.6 NTU (7.7 NTU average, 1.5 NTU median), exceeded the IDEQ recommended instantaneous maximum of 50 NTU 605 times, and with a maximum daily average of 233.1 NTU, did exceed the IDEQ recommended maximum of 25 NTU for greater than 10 consecutive days during spring runoff of 2017. Turbidity levels, from July 14, 2016 through August 30, 2016, were elevated above those recorded at the Virginia's cabin on the West Fork and at the bridge below Bonanza, by sediment released during rehabilitation/reconstruction work in the old West Fork channel from July 14 to August 11, where levels

spiked above the IDEQ recommended instantaneous maximum of 50 NTU 41 times, and from rehabilitation/reconstruction work in the Yankee Fork Side Channel 1 after August 11, where flows, being recharged by subflow /groundwater from either or both mainstem and Preachers Cove along the lower 500 meters (lower 2/3rds) of this channel, emerged through the coffer dam carrying sediment. On 8/9/2017 the West Fork Confluence Project finish work was completed with the only in-stream work being Side Channel upper and lower coffer dam removal. Turbidity readings from suspended sediment generated from this work peaked at 45.3 NTU, and the daily average was 3.4 NTU, both well within IDEQ standards. Turbidity at the bridge below Bonanza, from 2006 to 2018, ranged from 0 to 1260.2 NTU (11.0 NTU average, 1.4 NTU median), exceeded the IDEQ recommended instantaneous maximum of 50 NTU 3158 times, and with a maximum daily average of 716.6 NTU, exceeded the IDEQ recommended maximum of 25 NTU for greater than 10 consecutive days 2 times, during an event in 2009 and during runoff in 2017. Turbidity in the Yankee Fork at the bridge on the Yankee Fork road above Custer, from 2010 to 2012, ranged from 0 to 1163.3 NTU (3.6 NTU average, 0.6 median), exceeded the IDEQ recommended instantaneous maximum of 50 NTU 244 times, had a maximum daily average of 223.6 NTU, and did not exceed the IDEQ recommended maximum of 25 NTU for greater than 10 consecutive days. Turbidity at the mouth of Jordan Creek, from 2006 to 2013, ranged from 0 to 1218.8 NTU (37.7 NTU average, 0.3 median), exceeded the IDEQ recommended instantaneous maximum of 50 NTU 3523 times, and with a maximum daily average of 1078.3 NTU, exceeded the IDEQ recommended maximum of 25 NTU for greater than 10 consecutive days during 4 different time periods, 3 occurring in 2009 during one continuous high turbidity event starting mid-May and lasting into the first week of August, and 1 occurring during an event in 2012. Turbidity at the old mouth of the West Fork Yankee Fork, from 2010 to 2015, and during 2016 up until July 14, ranged from 0 to 1189.0 NTU (6.1 NTU average, 1.1 median), exceeded the IDEQ recommended instantaneous maximum of 50 NTU 795 times, and with a maximum daily average of 258.7 NTU did not exceed the IDEQ recommended maximum of 25 NTU for any period greater than 10 consecutive days. Turbidity levels recorded at this site in 2016, from May 4, when water was released into the new channel, contributing ~7% of the flow, up to May 10 when the t-post fell over, coincide with levels recorded at the same time at Virginia's cabin on the West Fork and at the bridge below Bonanza, including an event seen on May 7, indicating that any suspended sediment delivered into the old West Fork channel from the watering up of the new channel was insignificant and did not mask water quality at this site from detecting natural events occurring higher up in the watershed. Turbidity levels, from June 23 when the t-post was recovered until July 14 when the entire Yankee Fork was released into the new channel, contributing 55% of the flow, coincide with two spikes observed at the new mouth but are diminished in magnitude by the uneventful water seen at the bridge below Bonanza. In 2016 Turbidity at Virginia's cabin on the West Fork Yankee Fork from 2016 to 2018 ranged from 0 to 534.7 NTU (5.8 NTU average, 0.9 NTU median), exceeded the IDEQ recommended instantaneous maximum of 50 NTU 624 times, and with a maximum daily average of 322.4 NTU, exceeded the IDEQ recommended maximum of 25 NTU for greater than 10 consecutive days 1 time during the spring runoff of 2017. Turbidity in 2013 and 2016 at the PS1 outlet ranged from 0 to 281.5 NTU (2.1 NTU average, 0.9 NTU median). In 2013 turbidity at the PS2 outlet ranged from 0 to 37.6 NTU (1.2 NTU average, 0.6

NTU median), at PS3 outlet ranged from 0 to 1250.0 NTU (9.6 NTU average, 2.1 NTU median), and at the PS4 outlet ranged from 1.8 to 59.6 NTU (6.9 NTU average, 5.2 NTU median). Turbidity at all sites annually exceed the IDEQ recommended instantaneous maximum of 50 NTU on a regular basis, often spiking to levels at or above the upper detection limit of the instrument of 1000 NTU. As well as from spring runoff, blowouts on the Yankee Fork from storm events are common and well known for their high sediment loads and visual effects on the water clarity of the main Salmon River. From 2006 to 2010, when SONDES were deployed intermittently, depending upon where data gaps occurred, turbidity may not be accurately represented since it varies substantially and unpredictably over a season. Data for those years does not provide complete information on the frequency and duration of turbidity events for the seasons but it does provide a rough estimate of potential range or severity of suspended sediment concentration levels (Table 13, Figures 98-100).

In 2020 turbidity generated by instream activities during Phase III of the Bonanza Rehabilitation Project was monitored by HydroLab HL4 multiparameter Sondes deployed above and below the disturbed area of the project reach. Phase III instream work window officially began on 7/8/2020 when the Yankee Fork was diverted to the series of newly constructed channel segments and bypass channels, at which time the majority of flows went subsurface. Construction continued which connected the three new meander channel segments to the main original channel to form the eastern meander bends, 3 log jam landslides were created along the canyon wall to the east each terminating at projected deflection points for the 3 new meander bends, ~800 meters of side channels were created, Large Woody Debris (LWD) were added as single and jams, a channel split was constructed at the bottom of the reach and beaver dam analog added, and 3 willows were planted. The bypass channel and segments of main channel were filled in and the entire flow of the Yankee Fork was diverted to the new channel on August 13 at which time the instream work window on the project design officially ended. During this work surface flows through the bypass and then new channel continued to decline as discharge in the Yankee Fork dropped, until and around 9/12 (62.6 cfs at USGS gauge), according to drone flight images taken on that day, when the entire flow went subsurface, intermittently, starting at a 50 to 100 foot section of bank on the outside bend of the uppermost engineered meander pool (A), down to where it reemerged approximately 450 meters downstream at the top of the lowest newly engineered meander pool (E). Three meander pools, isolated within this section were deep enough to have access to the water table, and continued to express surface flow (Pools B, C and D). After August 13 instream work continued until October 28 in efforts to maintain surface flows and to salvage fish stranded in isolated pools: 8/20 using a track hoe a trench was dug in the floodplain to the southwest of Pool C to install a dirt plug and weed free straw was tamped into the lower river right stream bank of Pool C; 8/22 a 6" diesel powered pump (DV150c 6”x6”) was installed in an isolated channel on the lower west side of project area with exposed sub-flow to pump water back up to the uppermost meander pool (A); 9/10 a track hoe was used to trench down along riffle thalwegs to lower the stream bed elevation and concentrate surface flows; 9/11 plastic sheets were installed in these trenches; and on 9/22, 9/25, 9/30, 10/5, 10/8 and 10/28 fish salvage electrofishing was conducted from pool A above the dry reach, and from pool C isolated within the dry reach (Figures 8 & 12; Gregory, et al

2021). Both HL4 sondes, deployed on 5/26/2020, were pulled in June for 20 days from 6/10 to 6/30, then redeployed on 7/1 after which they continuously monitored turbidity generated by instream activities within the project throughout the season, except for 2 days in August from 8/15 to 8/16, and 5 days in September from 9/20 to 9/24. In 2020 turbidity recorded in the Yankee Fork Salmon River by the HL4 multiparameter SONDE 200 feet above the Bonanza Rehabilitation Project reach ranged from 0 to 1417 NTU (5.2 NTU average, 2.3 NTU median), and at the HL4 multiparameter SONDE 800 feet below the Bonanza Rehabilitation Project reach (100 feet below the bridge below Bonanza townsite) ranged from 0 to 1249 NTU (4.2 NTU average, 1.8 NTU median). Comparing the data and graphs of the raw turbidity readings between the upstream HL4 and the lower HL4 it can be seen that the lower HL4 meter regularly recorded sudden lower fixed / pegged tenths values throughout its entire period of deployment. These pegged readings can be seen as distinct lines of points along the x axis at 0.6, 0.5, 0.4, 0.3, 0.2 and 0.1 NTU (also pegged at 0 NTU not shown on a base 10 logarithmic graph). The two instruments operated differently and the lower one appears to have a recording malfunction. Despite this malfunction the lower HL4 accurately captured in timing and assumed dissipation in magnitude the natural events of peak runoff occurring around 5/27 to 5/30, and rain events on 7/24 and 10/14 relative to those same events seen at the upstream HL4 meter. Graphing the upstream HL4 temperature sensor data with the SBT HOBO data collected above Jordan and the lower HL4 temperature sensor data with the SBT HOBO data collected at the bridge below Bonanza showed the upstream temperature sensor was out of the water from 7/2 to 7/8 and the lower temperature sensor was out of the water from 7/2 to 7/8 and from 7/30 to 8/11. When deployed vertically the HL4 Hydrolab SONDE temperature sensor is positioned approximately 2-3 inches [Jim Gregory estimates it is 8 inches higher; Gregory 2021] higher in the water column than the turbidity sensor. Jim Gregory with Lost River Fish Ecology, Inc., who helped in deploying and monitoring these instruments, stated: "The turbidity reading portion of the sonde was never out of the water. Turbidity readings are temperature compensated, so when the temp[erature] sensor was out of the water turbidity may be off slightly" (Gregory 2021). The maximum daily average at the upstream HL4 site was 123.9 NTU, and at the downstream HL4 site was 45.9 NTU. At both sites the daily average did not exceed the IDEQ standard of 25 NTU for more than 10 consecutive days. Turbidity exceeded the IDEQ instantaneous standard of 50 NTU, over the entire period of deployment, at the upstream site a total of 89 times, and at the downstream site a total of 146 times. Over the entire period of deployment during timeframes not associated with natural turbidity events, which occurred from 5/27 to 5/30 during runoff, and rain events on 7/24 and 10/14, based on the upper turbidity meter, 50 NTU was exceeded at the downstream site a total of 63 times. During the Bonanza Rehabilitation Project official work window, from 7/8 to 8/13, and excluding the rain event that occurred on 7/24, the downstream turbidity meter readings exceeded 50 NTU 36 times. Of these 36 readings, each one averaged with readings following over a 1 hour time frame, 6 exceeded 50 NTU and were reportable to IDEQ (ZID analysis: IDAPA 58.01.02, Saffle 2021). These 6 turbidity exceedances are associated with 4 events, the first at 51.8 NTU from a brief plume on 7/22 with readings that were not clearly isolated/erratic so could not remove as outliers, the second at 64.7 NTU on 8/3 when "we started to connect the main channel, at the bottom of our project, with the recent main channel" (Gregory 2021), the third at 61.8 NTU on 8/7

associated clearly with a plume but having one reading above 50 NTU that could not be removed as an outlier, and the last where 3 exceedances occurred at 56.7 NTU, 54.7 NTU and 51.5 NTU on 8/10 when the project "dug the last section of pool at Landslide #3" (Gregory 2021). Immediately prior to the work window, turbidity at the downstream HL4 exceeded 50 NTU 25 times during two events of unknown origin, one overnight from 7/6 to 7/7, and then one during mid-day on 7/7. These exceedances did not coincide with a small event detected at the upstream turbidity meter overnight from 7/7 to 7/8, which was not detected at the downstream turbidity meter, of unknown origin, and not associated with rain events recorded at the Bonanza RAWS station [Troy Saffle, IDEQ said he would send information on if HECLA discharged at its diffusers below Jordan at that time. Still waiting. J. Markham]. Turbidity from instream and below water table work that was done after the official work window, from August 14 to October 28, excluding the natural rain event that occurred on October 14, exceeded 50 NTU only two times, both on August 20 during excavation and dirt plug filling of a floodplain trench below Pool C and packing of weed-free straw into the lower river right bank of Pool C. The hourly average following each of these exceedances did not exceed 50 NTU so were not reportable to IDEQ (ZID analysis: IDAPA 58.01.02, Saffle 2021, Tables 12 & 13, Figures 101 & 102). On 9/2/2020 two Chinook salmon redds were surveyed by the SBT within the lower end of the project area, in the riffle downstream from the lowest newly constructed meander pool (E), just above the new channel split (44.37071, -114.72601 and 44.37069, -114.72602). These redds were not found on the two previous surveys on 8/5 and 8/19, so they were constructed sometime between 8/19 and 9/2, and after 8/19, the only turbidity generated by instream work was on 8/20, which exceeded 50 NTU 2 times, and exceeded 50NTU using the ZID analysis 0 times (Figure 8 & 102; Jackson 2021).

Dissolved Oxygen

Dissolved oxygen in the Yankee Fork at the bridge below Flat Rock Campground, from 2006 to 2018, ranged from 7.09 to 12.58 mg/L (9.61 mg/L average, 9.59 mg/L median); at the first bridge below the West Fork Yankee Fork, from July 14 to August 30, 2016, ranged from 7.14 to 9.65 mg/L (8.07 mg/L average, 8.01 mg/L median); at the bridge below Bonanza, from 2006 to 2018, ranged from 6.98 to 14.61 mg/L (9.53 mg/L average, 9.50 mg/L median); and at the bridge on the Yankee Fork road above Custer from 2010 to 2012 ranged from 7.56 to 13.14 mg/L (9.76 mg/L average, 9.71 mg/L median). From 2006 to 2012 dissolved oxygen levels in the mouth of Jordan Creek ranged from 6.78 to 14.70 mg/L (9.58 mg/L average, 9.57 mg/L median). At the old mouth of the West Fork Yankee Fork, from 2010 to 2016, dissolved oxygen levels ranged from 6.85 to 14.41 mg/L (9.47 mg/L average, 9.41 mg/L median), and at Virginia's cabin on the West Fork Yankee Fork in 2016 and 2018 ranged from 7.27 mg/L to 11.69 mg/L (9.47 mg/L average, 9.49 mg/L median). Dissolved Oxygen levels in 2013 and 2016 at the PS1 outlet ranged from 5.70 to 10.59 mg/L (8.73 mg/L average, 8.91 mg/L median). In 2013 at the PS2 outlet dissolved oxygen levels ranged from 4.79 to 10.27 mg/L (7.61 mg/L average, 7.69 mg/L median), at PS3 outlet ranged from 6.01 to 10.36 mg/L (8.48 mg/L average, 8.53 mg/L median), and at the PS4 outlet ranged from 6.23 to 8.71 mg/L (7.34 mg/L average, 7.30 mg/L median). Minimum levels at all sampling locations for all years monitored remained above the recommended IDEQ minimum standard requirements of 6 mg/L except at

the PS1 outlet which dropped to a low of 5.70 mg/L in 2013, and at the PS2 outlet which dropped to a low of 4.79 mg/L. Oxygen levels at all sites correlate with temperature changes over the season, and diel variation is less at the colder bridge below Bonanza site, and larger in the warmer Pond Series (Table 13, Figures 103-105).

FISH

From 2013 to 2020, all CHaMP Sites that were monitored for habitat were also snorkeled. In 2021 with the discontinuation of contracted CHaMP habitat monitoring, sites that were snorkeled were also surveyed by SBT. Site units were identified for habitat type, delineated and measured for thalweg length and wetted width. Using the CHaMP and SBT habitat survey measurements of wetted surface area, as the most consistently measured dimension throughout the years, Chinook salmon (*Oncorhynchus tshawytscha)* and Steelhead (*Oncorhynchus mykiss)* population abundance estimates in m^2 were calculated, and select Site Chinook salmon abundances were graphed on base 10 logarithmic scale, grouped into four different areas within the watershed: Yankee Fork above the dredged reach from just upstream of Eightmile Creek down to Jordan Creek including the two lower sampling Sites in Eightmile Creek and the lowest sampling Site in Jordan Creek, Yankee Fork within the dredged reach from Jordan Creek down to West Fork, West Fork from the mouth up to Cabin Creek including the two lowest sampling Sites in Lightning Creek, and Pond Series 1, 2 and 3 with adjacent Yankee Fork mainstem sites. In years where CHaMP Sites were snorkeled, when no habitat surveys were made, abundance estimates were calculated based on a previous year habitat survey data. Eleven Yankee Fork Salmon River CHaMP Sites within the dredged reach, both control and treated, from Jerrys Creek up to Jordan Creek, with 8 sites snorkeled sporadically over a range of 3 to 5 years, and 3 sites snorkeled every year, show a distinct similar trend of a decline over the last 3 to 5 years in Chinook salmon population densities. This trend was also seen in the Yankee Fork above the dredged reach at Site 323 below Adair Creek, at the lowest site on the West Fork Site 1013, and in Pond Series sites that were snorkeled multiple years. Sluters Pitt Site 595 at Bonanza was an exception over the three previous years, from 2017 to 2019, maintaining at roughly the same level, but overall significantly lower than in 2013 and 2014. Upper and mid Preaches Cove Sites, 2166 and 835 respectively, after receiving large woody debris (LWD) treatments in 2014, showed a possibly related small increase in 2015, but again followed the watershed trend in decline after that. (Table 15, Figures 106-109).

In 2020 during Phase III of the Bonanza Rehabilitation Project, starting on July 8, surface flows through the bypass and then new channel continued to decline as discharge in the Yankee Fork dropped, until August 19 when surface flow at the riffle between Pool C and Pool D was estimated at 1cfs and evaluated at too low for adult Chinook salmon upstream migration, and at the minimum for downstream migration of juveniles (76.8 cfs at USGS gauge), to 9/2 when flows were evaluated as too low for downstream migration of juveniles and fluvial Bull trout (70.3 cfs at USGS gauge), to around

9/12 (62.6 cfs at USGS gauge) when the entire flow went subsurface, according to drone flight images taken on that day, reemerging at the lowest newly constructed meander pool (E). After the end of the official work window, on August 13, instream work continued until October 28 in efforts to maintain surface flows and to salvage and transport out-migrating fish stranded in Pool A and Pool C above the migration barrier. On September 1, 2020 permission from National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) was given to the SBT for transfer and release of adult Chinook salmon from the weir and adult trap located at Polecamp Flat Campground to above the Bonanza Rehabilitation Project reach, and during the latter half of the Chinook spawning window, from 8/26 to 9/4, a total of 10 adult males were released, and on 9/10 one more adult male and one adult female were released. (Gregory, et al 2021; Table 17)

SBT 4 pass Chinook salmon redd count surveys in 2020, on 8/5, 8/19, 9/2 and 9/15, from Custer down to the West Fork, and three pass surveys, from 8/4 to 9/2, from Twelvemile Creek down to Custer, including one final pass on 9/16, along the sweet spawning grounds from Eightmile Creek down to Fivemile Creek, found no redds above the Bonanza Rehabilitation Project reach, but on 9/2 found two Chinook salmon redds at the lower end of the project area, in the riffle downstream from the lowest newly constructed meander pool (E), just above the new channel split (44.37071, -114.72601 and 44.37069, -114.72602). On 9/11 two live adult Chinook salmon were observed in Pool A, on 9/16 one live adult Chinook salmon was observed in Pool A, and on 9/19 one live adult Chinook salmon was observed in Pool A. On 9/30 2 dead adult Chinook salmon were observed in Pool A, on 10/5 two more dead Chinook salmon were observed in Pool A, and of these 4 carcasses, 3 were recovered and determined to be males, and none were female (Figure 8; Gregory, et al 2021).

On 9/11/2020 strips of plastic liner material were installed along sections of trenched riffle thalwegs and connection was reestablished "for a brief period, but leakage of water over the edge of the plastic and plastic liners end[ed] in areas that ultimately became dry [and] provided a route for downstream migrants to become stranded and ultimately desiccated" (Gregory, et al 2021). Six fish salvage operations were performed in Pool A and Pool C starting on 9/22/2020 and ending on 10/28/2020. Pool A is directly above the migration barrier caused by the Bonanza Rehabilitation Project and Pool C is the second downstream of four isolated pools within the dry channel migration barrier. A total of 550 out-migrating Chinook salmon juvenile fish were caught and transported to the river below the barrier. With 63 Chinook salmon juveniles transported on 9/22, 26 on 9/25, 159 on 9/30, 202 on 10/5, 92 on 10/8 and 8 on 10/28, there appears to have been a pre-winter out-migration pulse peaking at the end of September to beginning of October. This pulse correlates with what has been documented from years of data collected at the SBT juvenile rotary screw trap at Polecamp Flat Campground where "In terms of juvenile [out]migration our largest pulse tends to be sub-yearlings in the fall (sept-oct). There is a smaller pulse of smolts occurring in April" (Jackson 2021). The September-October pulse of Chinook salmon pre-smolts captured in salvage pools A and C should then represent the larger proportion of offspring from the two Chinook salmon redds found by SBT survey above Bonanza in 2019, while the smaller proportion of

juveniles from these redds, remaining overwinter in the river above Bonanza, should out-migrate as smolts in April of 2021, when flows are high and there is connection through the rehabilitation project. The carcass of the female that had been transported above the Bonanza Rehabilitation Project reach on 9/10/2020 was not recovered, and her redd was not found, and assuming correctly that her redd was missed, her pre-smolts will out-migrate late September to early October of 2021, and potentially be blocked through the project by low flows and dry channel at that time of year. On October 26, 2020, at the tail of Pool E, surface flow over the two Chinook salmon redd pillows was observed to be dry but ground water continued to flow through the pits, and below this point the river was estimated to be dry to halfway between Pool E and the bridge – at approximately where the two engineered channel splits rejoin at the bottom of the island. The following day, on October 27, surface flows resumed over the redds and it is believed that surface flows on the previous day, exposed to subzero air temperatures, were reduced by being immobilized/ stored as ice. Extremely low flows through the project area during this cold snap caused some pools to go dry that had not gone dry before and some fish were observed to have been desiccated. (Figure 8 & 12; Gregory, et al 2021; Table 17)

Snorkel survey by SBT of the CHaMP Site 777 Control on 9/10/20 found no fish as it did in 2019. Side Channel 1 at CHaMP Site 1709, despite low flows in 2020, snorkel surveys on 9/10 found 182 juvenile Chinook salmon and 316 juvenile Steelhead. Along the Bonanza Rehabilitation Project reach from Jordan Creek down to the bridge above Bonanza there are 3 CHaMP Sites. The upper CHaMP Site 851 was not changed during the project work in 2020 and during the snorkel survey on 9/23 no fish were found, similar to what was seen in its last survey in 2018. CHaMP Site 595, at Sluters Pit, mid reach, starting at its upper end at the bottom of 851, just above the disturbed section of the project reach, in 2020 shifted west, reshaped and extended/elongated ~200 meters downstream with 3 new big meander bends, 3 new deep wood formed pools, two at the base of engineered Landslides #1 and #2, and ~500 meters of new side channel habitat, snorkel surveyed on 9/24, where water was present, through Pool B, Pool A, then skipping a small section of dry channel above Pool A on up to the top of the reach, found no juvenile Chinook salmon or Steelhead but did find one adult Chinook salmon in Pool A. The presence of the small dry section above Pool A, designated Unit 10, noted during this snorkel survey in 2020, shows that the salvage Pool A was also isolated at times during this year. The lower CHaMP Site 1196, starting at its lower end at the bridge below Bonanza, in 2020, split at its upper end into two channels, extended upstream ~500 meters with 2 big meander bends, 3 pools, one a deep wood formed at the base of the engineered Landslide #3, and ~315 meters of new side channel habitat, snorkel surveyed on 9/23, where water was present, from the bridge up through to the top of the lowest pool, Pool E, skipping over a dry section, then up through the isolated Pool D, skipping another dry section, then up through the isolated salvage Pool C, found no fish. No bankfull density estimates are available yet for Sites 595 and 1196, with CHaMP habitat bankfull surface area reporting being delayed by complications: "[T]hose sites have a range of flow conditions from flowing, partially flowing, to completely dry. [O]ur models used to generate metrics are built on the assumption that sites have the same amount of water flowing throughout their course (usually a reasonable assumption). [C]onsequently, it has been a nightmare to generate meaningful metrics for those sites" (Heitke 2021). (Table 15; Figure 8, 106 & 109; Heitke 2021).

In 2021 fish salvage at the Bonanza Rehabilitation Project reach, from pools A and C with efforts expanded to include pool B, pool D and a glide below pool D, conducted weekly from mid August to mid October, captured and transported downstream 42 juvenile Chinook salmon. Additional flow augmentation was employed using tarps to aid fish passage but at this time no further details have been provided as to its efficacy. On August 19, 2021, the same day that salvage operations began, Site 595 Sluters Pitt at Bonanza was snorkeled. The snorkel crew avoided the the salvage crews which were primarily shocking pool habitat, but turbidity generated by salvage work in addition to background turbidity made visibility poor. All surface water was snorkeled through the site and thalweg length was measured only in wetted channel (Galloway 2022). Site 1196 at the bridge below Bonanza was snorkeled on August 5, 2021 before salvage work, and as at 595 all surface flow was surveyed and thalweg length measured only for wetted channel (Galloway 2022). An adult Chinook salmon picket weir and trap was installed at the head crest of pool E on July 18, 2021, then moved downstream to the tail crest of pool E on August 24, 2021 and left in place until September 15, 2021. No adult Chinook salmon were trapped, or observed in or near the Bonanza Rehabilitation Project reach in 2021. One Chinook salmon redd observed just upstream of the bridge below Bonanza on September 4, 2021, was one of a total of 8 redds surveyed in 2021 for the watershed, all found below the Bonanza Rehabilitation Project reach (Gregory et al 2022b).

Chinook population dynamics in this watershed are driven not so much by changes in habitat, but by natural anadromy of the species – natural movement in and out of habitat, which also includes effects from past and ongoing efforts by the SBT Yankee Fork Supplementation Project, and factors outside the basin. Future study needs to include smolt-to-adult return (SAR) data from adult and juvenile traps at Polecamp Flat Campground and redd counts.

MACROINVERTEBRATES

From 2014 to 2019 benthic target riffle macroinvertebrate samples were collected at all CHaMP Sites that were also habitat surveyed that same year. Multiple metrics, pulled directly off the Rhithron sampling results or calculated were compiled into Table 16. This table provides Scores from 3 different methods: Weighted Average of Tolerance Values based on the 1987 Hilsenhoff tolerance values assigned to taxon correlated to saprobity (organic enrichment, the B-IBI correlated to the urban pollution gradient of Puget Sound lowland streams, and the Idaho O/E based on a comparison to other streams in Idaho having natural conditions. Despite abundances noticeable sharp decline at some sites in 2018 and 2019, which could be a result of changing personnel and sampling efficiency, score ratings over the watershed are relatively high in the upper watershed and West Fork and overall average "good/fair". Ratings based on organic enrichment as a pollution tolerance could be misleading in a system that is already oligotrophic, depleted of organic nutrients from factors including loss of allochthonous food sources – woody debris from past mining operations clearcutting of timber in the upper watershed, loss of river- floodplain nutrient exchange through the dredged reach and more recently the loss in nutrients from adult anadromous fish returns. The B-IBI rating based on Puget Sound urban

pollution tolerance could be applicable through pollutants found similarly in the YFSR watershed such as salt used in dust abatement treatments of the road, recirculation of mercury still present from past gold extraction processes and other heavy metals and acids leached from exposed mine tailings. The B-IBI also includes in its rating the factors taxa richness, E, P and T, and total EPT, clinger and semivoltine richness, predator and dominant taxa percent, so is more wholistic. The Puget Sound Lowland 10-50 B-IBI Scores, from repeat samples collected at CHaMP sites, from 2014 to 2019, show the Pond Series clustered with lower scores, rating on average 25 which is "Poor: Overall taxa diversity depressed; proportion of predators greatly reduced as is long-lived taxa richness; few stoneflies or intolerant taxa present; dominance by three most abundant taxa often very high" (Puget 2020), and YFSR through the dredged reach, (including Side Channel 1) more scattered with an average rating of 39 "Good: Slightly divergent from least disturbed condition; absence of some long-lived and intolerant taxa; slight decline in richness of mayflies, stoneflies, and caddis flies; proportion of tolerant taxa increases" (Puget 2020). CHaMP Sites in the YFSR above the dredged reach, including tributaries McKay, Tenmile, Eightmile, Fivemile and Jordan, all sampled only 1 time except 559 YFSR below Fivemile and 323 YFSR below Adair, both sampled two times, B-IBI Scores were less scattered, but averaged the same as the dredged reach at 40 Good. The West Fork from Cabin Creek to the mouth and Lightning Creek CHaMP Sites, all sampled one time except for 1013 at the mouth sampled twice, B-IBI Score averaged higher at 43 but is rated the same as the YFSR sites at Good. The highest score of all samples was 50 Excellent at 323 YFSR below Adair Creek in 2019, and the lowest score was 14 Very Poor at 133 subsample of Pond Series 2 lower reach in 2018. Idaho O/E Model Calculation scores were calculated by Rhithron and graphed with the same watershed groupings as used for presentation of B-IBI scores. Idaho O/E scores, from repeat sampling in dredged reaches, from Jerrys to Jordan, 2014 to 2019, averaged 0.52, and ranged from a low of 0.18 from samples collected at Site 835, mid Preachers Cove, in 2014, prior to rehabilitation placement of LWD and boulders, since rebounded from a high of 0.43 the year following to 0.36 in 2019, to a high of 0.98 from samples at Site 1709, Side Channel 1, in 2017 immediately following redesign to a side channel type habitat and record spring runoff. Idaho O/E scores above the dredged reach from, Jordan to McKay, sampled 2016 to 2019, including tributaries McKay, Tenmile, Eightmile, Fivemile and Jordan, all sampled only 1 time, and 559 YFSR below Fivemile and 323 YFSR below Adair, both sampled two times, averaged 0.58, and ranged from a low of 0.20 from samples at Site 1512, Yankee Fork below Eightmile Creek, in 2016, to a high of 0.81 from samples at Site 608, in the mouth of Tenmile Creek, in 2016. West Fork watershed Idaho O/E scores, from Sites each sampled only one time, 2016 to 2017, and from the mouth sampled twice, 2017 and 2019, averaged the highest at 0.61, and ranged from a low of 0.22 from samples collected at Site 1013 at the mouth of the West Fork in 2017, to a high of 1.09 at Site 654 in the West Fork below the confluence with Deadwood Creek. Pond Series Idaho O/E scores, from repeat samples collected 2016 to 2019, averaged the lowest at 0.41, and ranged from a low of 0.15 from samples at Site 1129, lower Pond Series 3, subsample in 2015, to a high of 0.72 from samples collected from Site 713, Pond Series 1, in 2019 subsample reach, after rehabilitation, and showing a sudden improvement from scores ranging from 0.37 to 0.40, 2016 to 2018. (Table 16; Figures 110 &111; Puget 2020; Jessup 2011).

DISCUSSION

The Yankee Fork watershed's water quality is currently optimal and falls within ranges of the IDEQ, PACFISH, INFISH and USFWS standards, with recommended thresholds only exceeded minimally considering the anthropogenic and periodic natural disturbance present within the drainage. Between 2012 and 2018 Pond Series 3, Pond Series 2, Preachers Cove area, West Fork Yankee Fork confluence and Pond Series 1 rehabilitation projects were implemented to improve side channel and mainstem habitat, creating habitat complexity, rearing habitat, connecting groundwater channels and wetlands to provide high flow refugia, which in turn can provide immediate and sustainable habitat for juvenile salmonids and other fishes. Other projects are planned within the dredge-impacted areas of the drainage and having to begin a habitat restoration with optimal water quality is an advantage for the fish and wildlife and will benefit the system and other future enhancements. The goals of the project are to restore the physical processes that create and maintain a self-sustaining stream ecosystem and restore physical processes that address biological limiting factors: rearing habitat, spawning habitat and riparian habitat and floodplain; and determining what the current conditions are and to build upon the optimal conditions, which will help to determine future enhancement actions and adaptive management practices. The team is working to improve habitat for anadromous and native fishes within the drainage and already having late season flows and optimal water temperatures, and building upon these matrixes, the project can assist with sustainable habitat for salmonids and other native fishes. Monitoring and evaluating projects will require additional measurements to capture differences in our actions and help determine the responses of the ecosystem.

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87437 Kempten, Germany, Tel.: + 49 - (0)831 5617 – 0, Fax: + 49 - (0)831 5617 – 209, info@ott.com, Managing Director: Dr.-Ing. Anton Felder, Jörg Mayer, Commercial register: Registergericht Kempten HRB 7687, VAT identification number: DE 258 217 067, AT U67 233 889. Contact person and person responsible for the journalistic and editorial content of the internet site of the provider (under the terms Telemediengesetz (TMG) - German Media Service Treaty): Martin Stümpfle, Ludwigstr. 16, 87437 Kempten, Germany. website: https://www.ott.com/products/sensors-108/turbidity-sensor-158/

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TABLES

Marsh-McBriney, INC. model 2000 portable flow meter specification velocity measurement	
Method	Electromagnetic
Zero Stability	+/- 0.05 ft/sec
Accuracy	+/- @% of reading + zero stability
Range	-0.5 to + 19.99 ft/sec (-0.15 m/sec to +6 m/sec

Table 1. Marsh-McBriney flow meter specification

Measurement range	Temperature: -20° to 70°C (-4 to 158° F) Light: 0 to 320,000 lux (0 to 30,000 lumens/ft2)
Accuracy	Temperature: +/-0.47 °C at 25° C(+/- 0.85° F at 77° F) Light intensity: Designed for measurement of relative light levels
Resolution	Temperature: 0.10°C at 25° C(0.18°F at 77°F)
Drift	Less than 0.1°C/year (0.2°/year)
Response time	Airflow of 2m/s (4.4 mph): 10 minutes, typical to 90% water: 5 minutes, typical to 90%
Time accuracy	+/-1 minutes per month at 25°C (77 F)
Operating range	In water/ice: -20° to 50° C (-4° to 122° F) In air: -20° to 70° C (-4° to 158°F)
Water depth rating	30 m from -20° to 20° C (100 ft from -4° to 68° F)
NIST traceable certification	Available for temperature only at additional charge; temperature range -20° to 70° (-4° to 158° F)
Battery life	1 year typical use
Memory	UA-002-64: 64K bytes (approximately 28K combined temperature and light readings or events)
Materials	Polypropylene case; stainless steel screws: Buna-N o-ring
Weight	18 g (0.6 oz)
Dimensions	58 x 33 x 23 mm (2.3 x 1.3 x 0.9 inches)
CE	The CE Marking identifies the product as complying with all relevant directives in the European Union (EU)

Table 2. HOBO pendant temperature/light data logger specifications

Sensor	range	resolution	accuracy
Temperature	-5 to 50C	0.01 C	+/- 0.15 C
pH	0 to 14 units	0.01 units	+/-0.2 units
conductivity	0 to 100 mS/cm(2)	0.001 to 0.1 mS/cm(2)	+/- 0.5% of reading + 0.001mS/cm
Turbidity	0 to1,000 NTU	0.1 NTU	+/- 0.3 NTU or 2% (1,5)
Dissolved Oxygen	0 to 500 % or 50 mg/L	0.1 % or 0.01 mg/L	Accuracy, 0 to 200% or 20 mg/L: ±1% or 1%(1); 0.1 mg/L or 1%(1)
memory	150,000 data points		

Table 3. Sondes sensors capabilities.

IDEQ Cold Water Maximum Temperature Criteria and PACFISH Temperature Maximum Threshold Standards

Agency	Regulatory Document	Target	Life Stage	Temperature Threshold (°C)	Parameter
IDEQ	IDAPA 58.01.02	Cold Water Aquatic Life	all stages	22	maximum
				19	maximum daily average
USFS/BLM	PACFISH (PACFISH 1995)	Chinook	rearing/ migration	17.8	maximum 7-day running average maximum
			spawning	15.6	maximum 7-day running average maximum

Table 4. IDEQ and PACFISH Recommended Stream Temperatures Guidelines for Fish Life Stages. The PACFISH guidelines recommend that where applicable on a stream that any 7 consecutive day averages of daily maximum temperatures not exceed these limits during Chinook life stages. Temperatures shown are guidelines and should be used only as reference; they are recommended but not absolute temperature thresholds. These temperature criteria can be adjusted for each watershed, and not all standards apply to each stream temperature monitoring station.

2006-2021 SBT, USGS, BOR and CHaMP Yankee Fork Restoration Project Discharge Cross Section Transect Site and Piezometer Observation Well Locations

Discharge Transect Site	Latitude	Longitude	Agency	Year(s)
Yankee Fork above Eightmile Creek	44.42647	-114.61944	SBT	2011-2013
Yankee Fork below Eightmile Creek	–	–	SBT	2011
Yankee Fork ~20m below bridge above Fivemile Creek	44.40942	-114.64592	SBT	2011-2014
Yankee Fork ~50m above Fivemile Creek	44.40540	-114.65520	SBT	2006-2009
Yankee Fork at bridge below Bonanza	44.36800	-114.72503	SBT USGS	2006-2013 2012-2018
Side Channel 1 below inlet at CHaMP Site 1709	44.35171	-114.72803	CHaMP	2016-2020
Yankee Fork above Side Channel 1 outlet at CHaMP Site 1971	44.35427	-114.73061	CHaMP	2016-2019
Yankee Fork above dispersed campsite above West Fork	44.35080	-114.72740	SBT	2006, 2008, 2009
Yankee Fork below West Fork confluence	44.34932	-114.72674	SBT USGS	2008, 2009 2012-2018
Yankee Fork above weir at staff gauge at Polecamp Flat Campground	44.30444	-114.72053	SBT	2006-2009
Yankee Fork 50m above bridge below Flat Rock Camp	44.28800	-114.72040	SBT	2008-2012
Yankee Fork at USGS gauge ~640m above mouth	44.27410	-114.73440	USGS	2012-2021
Yankee Fork at HWY75 bridge at mouth	44.27010	-114.73400	SBT	2009
Yankee Fork below Jordan Creek	44.37816	-114.72108	BOR	2016-2021
Yankee Fork ~100m above Avalanche 1 pool	44.37600	-114.72291	BOR	2020-2021
Yankee Fork at head crest of Avalanche 1 pool	44.37502	-114.72302	BOR	2020-2021
Yankee Fork across lower half of Avalanche 1 pool	44.37490	-114.72342	BOR	2020-2021
Yankee Fork at tail of Avalanche 1 pool	44.37483	-114.72372	BOR	2021
Yankee Fork at head crest of upper meander pool (A)	44.37445	-114.72423	BOR	2020-2021
Yankee Fork upper mid pre-rehabilitation	44.37436	-114.72348	BOR	2016
Yankee Fork at tail of upper meander pool (A)	44.37372	-114.72395	BOR	2020-2021
Yankee Fork lower mid pre-rehabilitation	44.37352	-114.72385	BOR	2016
Yankee Fork at tail of Avalanche 2 pool (B)	44.37322	-114.72452	BOR	2021
Yankee Fork at tail of middle meander pool (C)	44.37238	-114.72504	BOR	2021
Yankee Fork at tail of Avalanche 3 pool (D)	44.37169	-114.72592	BOR	2021

Yankee Fork across lower half of lower meander pool (E)				44.37101	-114.72621	BOR	2020-2021
Yankee Fork below island confluence				44.36934	-114.72566	BOR	2020
Yankee Fork halfway between island and bridge below Bonanza				44.36898	-114.72533	BOR	2021
Yankee Fork above bridge below Bonanza				44.36832	-114.72481	BOR	2016-2021
Yankee Fork below subflow/spring outlet below bridge below Bonanza				44.36779	-114.72525	BOR	2016-2021
Eightmile Creek at mouth				44.42667	-114.62073	SBT	2011-2014
Jordan Creek at mouth				44.37862	-114.72160	SBT	2006-2014
West Fork at mouth				44.34916	-114.72654	SBT USGS	2007-2014 2018
West Fork 20m above Deadwood Creek				44.37551	-114.77766	SBT	2006-2007
Cearley Creek near mouth of canyon				44.34492	-114.72395	SBT	2011-2014
Jerrys Creek at ATV trail ford				44.33309	-114.71996	SBT	2008-2014
Ramey Creek near mouth				44.32101	-114.71849	SBT	2011-2013
Rankin Creek near mouth				44.31755	-114.71729	SBT	2010-2013
Silver Creek at ATV trail ford				44.31651	-114.71461	SBT	2008-2014
Pond Series 1 outlet at upstream end of culvert				44.30649	-114.71903	SBT	2006, 2010-2013
Pond Series 2 inlet at upstream end of culvert				44.33870	-114.72292	SBT	2012
Pond Series 2 unnamed tributary below high gradient				44.33857	-114.72322	SBT	2012-2013
Pond Series 2 outlet				44.33287	-114.72301	SBT	2012-2013
Pond Series 3 inlet at flow control structure				44.34561	-114.72405	SBT	2013
Pond Series 3 mid-point below roughened channel at CHaMP Site 2159				44.34387	-114.72405	SBT CHaMP	2013 2013, 2014, 2017, 2019
Pond Series 3 outlet at CHaMP Site 1129				44.33941	-114.72174	SBT CHaMP	2012-2013 2013-2019
Piezometer Observation Well	**Type**	**Depth**	**Bank**	**Latitude**	**Longitude**	**Agency**	**Year(s)**
OW-20-10T	2” slotted PVC	<12 feet	West	44.37530	-114.72385	BOR	2020-2021
OW-20-9T	2” slotted PVC	<12 feet	West	44.37523	-114.72354	BOR	2020-2021
OW-20-8T	2” slotted PVC	<12 feet	West	44.37497	-114.72390	BOR	2020-2021
OW-16-5T	2” slotted PVC	<12 feet	East	44.37463	-114.72355	BOR	2016, 2020-2021
OW-20-6T	2” slotted PVC	<12 feet	West	44.37375	-114.72434	BOR	2020-2021
OW-20-7T	2” slotted PVC	<12 feet	West	44.37365	-114.72467	BOR	2020-2021
OW-20-1T	2” slotted PVC	<12 feet	West	44.37303	-114.72548	BOR	2020-2021
OW-20-2T	2” slotted PVC	<12 feet	West	44.37257	-114.72563	BOR	2020-2021
OW-20-3T	2” slotted PVC	<12 feet	West	44.37223	-114.72547	BOR	2020-2021
OW-20-4T	2” slotted PVC	<12 feet	West	44.37199	-114.72568	BOR	2020-2021
OW-20-5T	2” slotted PVC	<12 feet	West	44.37201	-114.72595	BOR	2020-2021
OW-21-10	3” perforated steel	~15 feet	West	44.37456	-114.72431	BOR	2021
OW-21-13	3” perforated steel	~15 feet	East	44.37439	-114.72394	BOR	2021
OW-21-11	3” perforated steel	~15 feet	East	44.37427	-114.72347	BOR	2021
OW-21-9	3” perforated steel	~15 feet	West	44.37416	-114.72446	BOR	2021
OW-21-7	3” perforated steel	~15 feet	West	44.37370	-114.72487	BOR	2021
OW-21-6	3” perforated steel	~15 feet	West	44.37345	-114.72445	BOR	2021
OW-21-8	3” perforated steel	~15 feet	West	44.37331	-114.72521	BOR	2021
OW-21-5	3” perforated steel	~15 feet	East	44.37285	-114.72516	BOR	2021

OW-21-12	3” perforated steel	~15 feet	West	44.37283	-114.72567	BOR	2021
OW-21-4	3” perforated steel	~15 feet	West	44.37221	-114.72562	BOR	2021
OW-21-3	3” perforated steel	~15 feet	West	44.37196	-114.72625	BOR	2021
OW-21-1	3” perforated steel	~15 feet	West	44.37162	-114.72656	BOR	2021
OW-21-2	3” perforated steel	~15 feet	East	44.37147	-114.72617	BOR	2021

Table 5. 2006-2021 summary of SBT, USGS, BOR and CHaMP discharge cross section transect locations in Yankee Fork Salmon River, tributaries and Pond Series side channels, and piezometer observation well locations through the Bonanza Rehabilitation Project reach.

2011-2021 USGS Gauge 13296000 Yankee Fork Discharge at Mouth Summary (cfs)						
date	**max**	**date**	**min***	**average during Chinook spawning Aug 1 - Sept 14**	**year**	**Annual *Calendar* Mean**
–	–	10/28/2011	49.5	–	–	–
4/26/2012	2980	10/24/2012	32.8	88.7	2012	260.5
5/14/2013	1600	9/11/2013	51.0	62.9	2013	157.4
5/25/2014	2110	4/3/2014	57.1	93.7	2014	235.3
5/6/2015	732	10/28/2015	52.6	68.2	2015	161.6
5/8/2016	1570	9/30/2016	58.1	75.3	2016	230.3
6/1/2017	3380	10/15/2017	65.4	116.9	2017	424.5
5/23/2018	2040	4/3/2018	57.4	93.2	2018	259.6
6/5/2019	1510	10/28/2019	25.8	83.7	2019	218.1
5/31/2020	1260	4/2/2020	17.8	78.3	2020	193.6
5/19/2021	655	9/17/2021	43.8	56.7	2021	136.4
min	**655**		**17.8**	**56.7**		**136.4**
max	**3380**		**65.4**	**116.9**		**424.5**
average	**1784**		**46.5**	**81.8**		**227.7**
*data from April 1 to October 31 to avoid influences from ice						

Table 6. 2011-2021 USGS Gauge 13296000 Yankee Fork Salmon River at mouth discharge summary

2016-2021 Yankee Fork BOR Discharge Seepage Runs through the Bonanza Rehabilitation Project reach and daily average discharge at USGS Gauge 1329600 (cfs)					
Location description of discharge site on Yankee Fork (Figures 8 & 12)	**9/28/2016**	**9/15/2020**	**7/28/2021**	**8/4/2021**	**9/15/2021**
Below Jordan Creek	28	28		33	20
~100m above Avalanche 1 pool		28	29	32	20
At head crest of Avalanche 1 pool		19	27	33	20
Across lower half of Avalanche 1 pool		15	22	25	14
At tail of Avalanche 1 pool					5
At head crest of upper meander pool (A)		4	11	15	4
	22				
At tail of upper meander pool (A)		0	1	5	0
	24				
At tail of Avalanche 2 pool (B)			1	4	
At tail of middle meander pool (C)			0	4	
At tail of Avalanche 3 pool (D)			3	4	
Across lower half of lower meander pool (E)		16		19	7
Below island confluence		18			
Halfway between island and bridge below Bonanza				27	14
Above bridge below Bonanza	31	30		32	19
Below subflow/spring outlet below bridge below Bonanza	35	34		35	23
Estimated seepage loss through project reach	6	28	29	29	20
USGS Gauge 1329600 daily average	61	60	69	67	46

Table 7. 2016-2021 Bureau of Reclamation (BOR) discharge seepage run measurements taken in the Yankee Fork Salmon River upstream, through and downstream of the Bonanza Rehabilitation Project reach prior to rehabilitation in 2016 and after in 2020 and 2021, seepage loss estimate and corresponding readings taken at USGS Gauge 13296000 at mouth of Yankee Fork.

2006-2020 Yankee Fork Restoration Project SBT, Select CHaMP Site and USGS Special Study Discharge Measurements (cfs)																															
Date	Yankee Fork at mouth	Yankee Fork at bridge below Flat Rock Campground	Yankee Fork at Polecamp Flat Campground above wier	Yankee Fork at bridge below West Fork	West Fork at mouth	West Fork above Deadwood Creek	Yankee Fork above West Fork	Yankee Fork above Side Channel 1 outlet at CHaMP 1971	Side Channel 1 at CHaMP 1709	Yankee Fork at bridge below Bonanza	Yankee Fork at bridge on Yankee Fork road above Custer	Yankee Fork above Fivemile	Yankee Fork below Eightmile	Yankee Fork above Eightmile	Eightmile Creek at mouth	Jordan Creek at mouth	Cearley Creek at mouth	Jerrys Creek at mouth	Ramey Creek at mouth	Rankin Creek at mouth	Silver Creek at mouth	Pond Series 1 outlet	Pond Series 2 inlet	unnamed tributary to Pond Series 2 at mouth	Pond Series 2 outlet	Pond Series 3 inlet	Pond Series 3 midpoint (CHaMP 2159)	Pond Series 3 outlet (CHaMP 1129)	% of West Fork contribution to YF
4/12/2006			91.6																											
4/25/2006			332.7																											
5/3/2006			367.9																											
6/20/2006						186.2						154.5																		
6/28/2006						156.4	106.9			159.7						29.84														
7/5/2006												71.4																		
7/8/2006							103.1																							
7/13/2006						59.8																								
7/16/2006			163.9				87.2															3.58								
7/16/2006																						8.16								
8/21/2006			79.7																											
8/28/2006			78.7			27.9	29.3			35.6						3.29														
9/19/2006						17.1																								
9/25/2006							22.9																							
9/26/2006						23.7				27.4						3.02														
10/9/2006										48.8		28.4																		
10/11/2006			67.0																											
10/17/2006										25.4		21.6																		
10/18/2006			66.7																											
10/21/2006						18.0																								
10/27/2006												22.1																		
10/28/2006										27.9																				
10/29/2006			59.7																											
4/13/2007			164.6		84.7																									
4/25/2007			264.6		130.6							71.9				35.05														
6/1/2007			423.7		211.3							166.8																		

8/2/2007			95.6									23.4																	
9/11/2007																1.97													
9/21/2007			67.2							32.1						3.46													
10/3/2007			68.2																										
10/10/2007			69.7		20.7					32.2						2.92													39
10/30/2007					24.8																								
4/10/2008			41.6							16.8								0.16			0.34								
4/17/2008			154.1		58.7																								
4/24/2008			135.2		49.6					58.4						15.28													46
5/1/2008		272.7	267.4		102.0																								
5/20/2008																		2.34			9.11								
6/4/2008																		0.76			4.97								
7/8/2008		306.0																											
7/9/2008			287.5		136.5					152.9						21.55		0.28											47
7/16/2008																					0.90								
8/29/2008		93.3																											
9/21/2008			103.9		32.0		47.9			43.2		32.8				4.59													40
9/22/2008		84.9																0.08			0.35								
10/17/2008		68.5	72.1	63.4	24.3		34.8					25.1				2.80													41
11/1/2008		60.2																											
5/14/2009			382.2																										
5/20/2009																		3.34			6.48								
5/26/2009																		0.47			6.75								
6/4/2009																		0.24			5.40								
6/16/2009																		0.23											
6/23/2009					235.3																								
6/25/2009												245.0				59.09		0.67			2.88								
6/27/2009			610.5																										
7/9/2009										166.5		379.4																	
7/10/2009																		0.42			1.24								
7/14/2009			273.1		109.4							404.3				68.75													
7/26/2009										92.7																			
7/28/2009		170.6																											
7/29/2009				145.1	57.2		83.7																						41
8/5/2009																5.40		0.40			0.73								
8/14/2009		126.0	143.5									48.5																	
8/15/2009		118.0	137.7	100.4	40.0		54.7																						42
8/18/2009	102.5	118.9	132.4																										
8/19/2009																5.46		0.40			1.00								
9/5/2009			100.1																										
9/14/2009		84.1	85.3																										

9/15/2009				80.0	28.8		50.6					37.1																	36
9/16/2009																8.40		0.31			1.15								
10/15/2009	120.7	112.0	113.5		45.7							35.9				7.25													
11/19/2009			72.3																										
11/22/2009					20.2																								
3/24/2010		59.7								39.4						5.12													
5/3/2010		184.4			75.6					80.6	47.0					17.95													48
5/5/2010																		0.26		3.33	0.84								
5/20/2010					301.6											88.39													
5/21/2010																				9.14									
5/22/2010																		0.53			1.62								
5/26/2010		**324.1**								**128.6**	93.0																		
5/26/2010											**95.5**																		
6/4/2010		**1235.7**								**836.6**																			
6/8/2010		**1772.8**								**857.3**	**597.7**					**162.05**													
6/16/2010		**1180.6**			**480.0**					**627.2**	**448.2**																		43
6/18/2010																		0.78			3.37	15.71							
6/25/2010		**857.7**								**431.1**	**351.5**																		
6/27/2010					312.6																								42
6/28/2010																61.75		0.42			1.84								
7/10/2010					120.2											20.35				4.49									
7/11/2010		267.2									93.8																		
7/15/2010		219.0																											
7/16/2010										103.9	78.0																		
7/17/2010																		0.15		3.17	1.19								
7/26/2010		165.6								85.4	68.6																		
7/27/2010					59.1															2.47									41
7/29/2010																7.79		0.09			0.71								
8/10/2010		136.8																											
8/11/2010					47.4					60.6	52.1					6.22				2.28									44
8/12/2010																		0.12			0.82								
8/24/2010		93.3								45.1	38.4																		
8/25/2010					33.0											2.85				1.48									42
8/26/2010																		0.06			0.46								
9/8/2010		79.1			35.1					43.2	34.4					3.03		0.13		1.27	0.55								45
9/25/2010		70.6								34.9	29.9																		
9/26/2010					24.7											2.25		0.06		1.16	0.37								41
10/13/2010		64.4			24.0					33.1	26.1					2.06													42
10/14/2010																		0.06		1.33	0.42								
11/2/2010					25.7											2.32		0.07		1.27	0.39								40
11/3/2010		73.0								38.6	26.1																		

12/2/2010		68.3																												
12/15/2010		58.0								23.4																				
3/9/2011										13.4																				
4/7/2011		69.0																												
4/19/2011					34.9											7.10														
4/20/2011																		0.84		2.71	0.96									
4/21/2011		83.2																												
5/12/2011																		3.22			3.05									
5/17/2011		**964.6**								**418.0**																				
5/29/2011																						13.01								
6/4/2011																		1.72			4.02									
6/8/2011		**1334.7**								**732.5**		**460.5**																		
6/13/2011											**637.2**	**520.1**																		
6/14/2011																		1.00			7.45	26.78								
6/24/2011		**1856.6**								**976.2**		**655.7**																		
6/25/2011																		0.62	62.24	25.36	7.31									
6/27/2011																					5.02	21.88								
7/6/2011		**947.4**								**463.4**		286.5																		
7/14/2011		520.3								232.7	187.1	143.3																		
7/20/2011																15.33														
7/26/2011		235.7			97.2							68.5						0.31	10.28		1.40									
7/28/2011																				3.24										
8/3/2011		188.9								85.0	71.5	58.7																		
8/16/2011					48.8											5.20		0.12	4.12	1.90	0.62									44
8/17/2011		136.3								62.6	55.7	42.9																		
9/14/2011		83.0			31.3					40.7	34.7	27.9				1.78														43
9/21/2011																		0.08	2.64	1.52	0.55									
10/5/2011		109.2			46.4					43.8	35.9	33.0				4.67														51
10/6/2011																	0.54	0.12	3.13	1.77	0.62	0.11								
10/11/2011													29.7	22.4	5.73															
10/17/2011																	0.56	0.05												
10/18/2011		86.2								38.3	33.4	28.3									0.79	0.07								
10/19/2011					31.7											3.23			3.36	1.45										
11/8/2011					23.7											1.59			2.70	1.23										
11/9/2011																	0.48	0.06			0.50	0.02								
4/19/2012					103.1											34.25			16.99	9.78										43
4/20/2012		350.0								135.5																				
4/21/2012																	1.14	2.67			2.54	11.32		2.60	3.20			1.94		
4/29/2012																	1.63	2.42										2.82		
5/2/2012																					4.06	14.70	2.01	2.85	4.63					
5/15/2012																	1.57	1.23										2.74		

5/16/2012																					7.37								
6/5/2012	1686			*1270*						*708*																			44
6/21/2012	648			*504*						*260*																			48
7/1/2012																	1.06	0.26	11.54		1.20	8.31						1.08	
7/9/2012	252			*226*						*110*																			51
7/26/2012		135.0								64.6	50.8	66.2	41.0	32.3	8.39														
7/27/2012					53.7											5.28			4.41	1.92									45
7/28/2012																		0.14			0.54	1.80							
8/14/2012	97.9			*93.3*						*44.7*																			52
9/21/2012		67.0								34.6	24.4	21.5		19.3	3.29														
9/22/2012					25.2											1.37	1.57	0.02	1.82	1.08	0.36								42
10/2/2012	67.0			*56.7*						*30.2*																			47
11/19/2012	63.7			*54.0*						*21.2*																			61
3/23/2013					30.1																								
3/27/2013																		0.0028	3.02	2.27	0.39								
3/28/2013										26.1							0.26					0.30		0.23	0.14		0.62	0.65	
4/10/2013																	0.33									6.56	8.34	7.86	
4/11/2013																						5.64							
4/16/2013	142			*115*						*44.6*																			61
4/30/2013	412			*358*						*135*																			62
5/13/2013	1017			*914*						*445*																			51
5/16/2013																										28.47			
5/17/2013																						16.20			2.12				
5/18/2013																		0.0869	21.26		1.78								
5/21/2013	688			*632*						*338*																			47
6/17/2013	245			*220*						*122*																			45
7/15/2013																												4.23	
7/17/2013					40.1					45.7		39.6		23.3	7.29	7.29													47
7/18/2013																		0.10	3.03	1.14	0.25								
7/22/2013																											4.05		
10/23/2013					33.4											4.05		0.0057	2.04	1.33	0.30								
10/24/2013												19.4		12.8	4.89	4.89													
10/29/2013	76.2			*69.4*						*30.9*																			55
4/8/2014	128			*111*						*55.6*																			50
4/22/2014	638			*627*						*237*																			62
5/6/2014																		2.90			2.52								
5/18/2014	1475			*1320*						*560*																			58
5/24/2014	1670			*1500*						*934*																			38
5/29/2014	1710			*1420*						*726*																			49
6/4/2014	1032			*1030*						*566*																			45
6/19/2014	436			*424*						*221*																			48

8/26/2014												29.8																	
6/28/2014																												10.1	
7/13/2014																											10.4		
8/27/2014					24.55										6.73	5.20	0.52	0.08			0.70								
5/5/2015	629			*595*						*280*																			53
5/12/2015	516									*205*																			
5/13/2015				*463*																									
6/16/2015	282			*258*						*141*																			45
8/14/2015																												1.1	
5/19/2016				*1090*						*589*																			46
5/20/2016	1060																												
5/25/2016				*525*						*289*																			45
5/26/2016	578																												
6/9/2016	778			*712*						*417*																			41
8/22/2016																												0.4	
5/15/2017				*1270*						*791*																			38
5/16/2017	1400																												
5/31/2017				*2600*						*1570*																			40
6/1/2017	3090																												
6/27/2017	1090			*1021*						*584*																			43
7/6/2017	583			*520*						*316*																			39
7/26/2017				*185*						*98.2*																			47
7/27/2017	202																												
7/29/2017																												6.0	
7/30/2017									27.8																		4.9		
7/31/2017								63.8																					
5/15/2018	1060			*995*	*474*					*532*																			48
5/21/2018				*1560*	*593*					*956*																			38
5/22/2018	1600																												
5/30/2018				*1270*	*528*					*787*																			42
5/31/2018	1380																												
6/6/2018				*831*	*337*					*497*																			41
6/7/2018	817																												
6/13/2018				*476*	*181*					*258*																			38
6/14/2018	490																												
6/18/2018	561			*527*	*201*					*303*																			38
6/28/2018	345			*298*	*114*					*179*																			38
7/11/2018	211			*180*	*74.5*					*94.8*																			41
7/12/2018																												4.2	
7/29/2018									19.2																				
7/30/2018								39.1																					

7/10/2019																													6.3	
7/23/2019																												6.3		
7/25/2019									18.5																					
8/24/2019								22.7																						
9/12/2020									0																					
min		58.0	41.6	54.0	20.2	17.1	22.9	22.7	0	13.4	24.4	19.4	29.7	12.8	3.29	1.37	0.26	0.0028	1.82	1.08	0.25	0.02		0.23	0.14	6.56	0.62	0.40	38	
max		1856.6	610.5	2600	593.0	186.2	106.9	63.8	27.8	1570	637.2	655.7	41.0	32.3	8.39	162.05	1.63	3.34	62.24	25.36	9.11	26.78		2.85	4.63	28.47	10.41	10.13	62	
average		341.1	168.9	635.9	118.7	69.9	62.1	41.9	16.4	265.2	133.8	133.4	35.3	22.0	6.05	17.31	0.88	0.63	10.17	3.52	2.21	9.22		1.89	2.52	17.52	5.78	3.81	46	
base flow min*		58.0	41.6	54.0	20.2	17.1	22.9			13.4	24.4	19.4		12.8	3.29	1.37	0.26	0.0028	1.82	1.08	0.30	0.02					0.62	0.65		
base flow max*		112.0	113.5	111.0	46.4	23.7	50.6			55.6	35.9	37.1		22.4	5.73	8.40	1.57	0.31	3.36	2.27	1.15	0.30					8.34	7.86		
base flow avg*		76.3	76.0	72.4	29.3	19.6	39.0			33.4	30.6	27.8		18.1	4.64	3.54	0.62	0.09	2.67	1.43	0.51	0.12					4.48	4.26		

Values in **bold type** are Acoustic Doppler Current Profiler (ADCP) generated data. Values in *italic type* are data from a USGS special study. *Base flow estimates are from September to early April (shaded in light grey).

Table 8. 2006-2020 YFRP SBT, select CHaMP Site and USGS study sites, Yankee Fork Salmon River, tributary and Pond Series discharge summary data

2007-2021 Yankee Fork Salmon River Watershed *Spring, Summer and Fall* Monthly Stream Temperature Data Summary (°C)

	Apr				May				June				July				Aug				Sept				Oct			
Site/Year	**min**	**max**	**avg**	**med**	**min**	**max**	**avg**	**med**	**min**	**max**	**avg**	**med**	**min**	**max**	**avg**	**med**	**min**	**max**	**avg**	**med**	**min**	**max**	**avg**	**med**	**min**	**max**	**avg**	**med**
Yankee Fork above Ninemile Creek																												
2009	-0.06	6.18	2.45	2.34	0.00	7.92	3.57	3.18	2.56	11.73	5.37	4.90	3.64	12.94	7.87	7.65	4.06	12.34	7.69	7.44	2.50	10.61	6.58	6.48	-0.09	5.44	2.72	2.88
2010	-0.03	6.94	2.39	2.21	**0.00**	**9.53**	**3.38**	**3.14**																				
Yankee Fork above Eightmile Creek																												
2011	**0.23**	**6.27**	**1.90**	**1.55**	0.34	8.78	4.01	3.68	2.41	10.55	5.34	4.93	3.68	13.94	8.42	8.18	5.14	14.13	9.06	8.88	3.68	11.82	7.42	7.38	0.34	9.97	4.20	4.21
2012	0.01	6.57	2.40	2.20	1.00	9.28	4.18	3.79	1.87	12.79	6.32	5.86	4.21	15.28	9.55	9.28	4.00	14.90	8.96	8.78	2.52	12.30	6.79	6.78	-0.10	9.37	3.06	3.05
2013	-0.03	9.51	2.67	2.29	0.02	10.20	4.84	4.64	**2.90**	**16.42**	**7.86**	**7.59**	5.69	16.56	10.62	10.37	5.57	15.84	9.82	9.51	2.40	14.36	7.57	7.70	0.11	6.94	2.73	2.57
2014													**4.93**	**15.09**	**9.82**	**9.57**	5.24	15.47	9.33	9.08	2.09	12.21	7.61	7.68	0.78	9.77	4.57	4.47
2015																	5.04	15.57	8.96	8.68	2.94	13.37	7.35	7.08	0.45	10.65	5.20	5.04
2017									**2.73**	**12.01**	**6.45**	**6.06**	**5.96**	**13.94**	**9.42**	**9.18**	5.76	13.85	9.14	8.98	1.55	12.69	6.72	6.57	0.23	6.27	3.03	3.05
2018					**3.89**	**10.46**	**6.35**	**6.06**	3.16	13.56	7.88	7.58	4.83	15.57	10.21	9.97	4.42	15.19	9.28	8.98	1.76	12.11	6.59	6.57	0.23	8.58	3.97	4.00
2019									2.84	12.69	7.05	6.78	**2.20**	**15.09**	**9.73**	**9.57**	5.35	15.00	9.79	9.57	0.34	13.56	7.15	6.98	-4.27	6.37	2.13	2.09
2020									**1.98**	**15.00**	**7.24**	**6.88**	4.00	15.66	9.63	9.37	5.66	15.57	10.09	9.87	2.73	13.17	7.20	6.98	0.23	8.88	3.86	3.89
2021					**1.00**	**12.79**	**5.78**	**5.24**	2.73	17.57	9.93	9.67	6.88	17.95	11.54	11.24	4.10	17.28	10.05	9.87	0.89	13.65	6.99	6.78	**-0.10**	**8.28**	**4.44**	**4.31**
Eightmile Creek at mouth																												
2011	**0.12**	**6.17**	**1.59**	**1.22**	0.23	7.98	3.19	2.84	1.66	9.57	4.69	4.21	3.16	15.09	8.45	7.98	6.37	15.76	10.06	9.57	5.04	13.37	8.54	8.18	0.67	11.33	4.76	4.73
2012													4.66	16.34	10.20	9.85	5.90	16.18	10.23	9.85	4.56	13.76	8.01	7.54	**0.44**	**11.49**	**4.13**	**3.72**
2013	0.02	8.49	2.15	1.64	0.02	9.16	4.04	3.72	2.40	16.18	7.02	6.69	6.94	17.01	11.20	10.64	7.02	16.30	10.79	10.27	3.56	15.18	8.76	8.73	0.58	8.12	3.21	2.85
2015																	6.06	17.76	10.04	9.37	3.68	16.52	8.24	7.58	3.58	12.40	7.33	7.18
2016									**3.79**	**16.24**	**9.58**	**9.08**	4.93	18.81	10.55	9.77	5.24	19.19	10.52	9.77	2.94	15.76	7.85	7.18	**2.30**	**10.55**	**5.14**	**4.78**

2017									**2.20**	**10.55**	**4.97**	**4.52**	4.31	15.47	9.75	9.87	5.35	15.28	9.95	10.16	2.52	14.61	7.68	7.58	**0.45**	**7.98**	**3.16**	**2.84**
2018					**3.05**	**9.18**	**4.72**	**4.31**	2.41	14.04	6.78	6.27	4.83	17.48	11.00	10.36	5.76	17.38	10.65	10.06	3.05	14.61	7.73	7.38	0.89	10.65	4.53	4.42
2020									**1.87**	**15.38**	**6.61**	**6.17**	3.89	17.09	10.04	9.67	7.18	17.09	11.19	10.65	4.00	15.00	8.34	7.88	0.56	10.75	4.70	4.62
2021					**1.00**	**10.16**	**4.69**	**4.10**	2.73	17.19	8.80	8.48	7.68	18.14	11.97	11.53	5.45	18.43	10.99	10.65	2.41	15.09	8.09	7.58	**0.01**	**10.65**	**5.48**	**5.04**
Yankee Fork at first bend below Fivemile Creek (2007-2010) and at first bridge above Fivemile Creek (2015-2021)																												
2007	**2.30**	**10.16**	**5.56**	**4.93**	0.45	11.72	5.34	4.93	3.26	16.33	8.70	8.08	7.08	19.00	12.74	12.69	6.47	17.48	11.64	11.48	2.30	16.14	8.44	7.88	0.78	9.08	3.99	3.89
2009									**4.10**	**13.46**	**8.18**	**7.68**	4.52	16.71	10.02	9.67	5.24	16.62	10.30	9.87	3.68	14.52	8.79	8.38	0.12	7.98	3.14	3.16
2010	**-9.94**	**7.58**	**1.58**	**1.55**	0.12	10.55	3.80	3.58	2.20	12.79	5.78	5.24	4.62	16.52	9.89	9.57	5.45	16.43	10.08	9.57	**1.22**	**14.42**	**7.18**	**6.88**	**0.12**	**9.87**	**4.15**	**3.68**
2015																	6.06	16.43	9.95	9.67	3.68	14.23	8.04	7.78	3.58	10.85	7.09	7.28
2016									**4.31**	**16.90**	**10.48**	**10.26**	5.35	18.24	11.04	10.55	4.93	17.38	10.59	10.26	3.26	14.42	7.68	7.38	0.56	9.47	4.40	4.31
2018													**6.57**	**16.71**	**11.27**	**10.85**	4.93	16.90	10.15	9.67	1.76	13.94	7.04	6.88	0.01	9.77	3.97	4.00
2019									**2.52**	**11.43**	**6.24**	**5.76**	**5.66**	**16.24**	**10.51**	**10.11**	5.76	16.52	10.61	10.16	0.34	15.28	7.74	7.38	0.01	7.78	2.12	1.98
2020									**1.87**	**14.52**	**7.15**	**6.78**	4.21	17.48	10.32	9.97	6.27	17.67	11.15	10.65	2.84	15.57	7.89	7.38	0.12	10.55	4.06	4.10
2021					**1.00**	**12.11**	**5.56**	**4.99**	2.84	19.00	9.95	9.57	7.68	19.85	12.60	12.11	4.62	19.76	11.12	10.85	**3.47**	**15.66**	**8.78**	**8.38**				
Yankee Fork at bridge on Yankee Fork road above Custer townsite																												
2010					**0.12**	**10.26**	**3.90**	**3.68**	3.58	12.21	5.73	5.04	4.73	16.14	9.94	9.67	5.86	15.57	10.10	9.67	3.79	13.56	7.58	7.28	0.34	11.24	4.76	4.62
2011	**0.01**	**6.06**	**1.84**	**1.55**	0.34	8.18	3.80	3.79	1.96	9.31	5.11	4.81	4.08	14.71	8.69	8.32	5.86	15.38	9.98	9.67	4.21	12.59	8.07	7.98	0.01	10.26	4.26	4.31
2012	0.01	6.78	2.51	2.41	0.89	9.77	4.38	4.00	1.98	12.88	6.48	5.96	4.83	16.62	10.72	10.36	5.04	16.52	10.23	10.01	3.47	12.98	7.77	7.63	0.01	10.55	3.40	3.26
2015																	6.37	16.43	10.25	10.06	3.89	14.33	8.27	8.08	3.79	10.94	7.32	7.58
Yankee Fork above Jordan Creek																												
2007									**4.73**	**16.71**	**10.52**	**10.26**	7.58	19.85	13.66	13.46	6.88	18.52	12.08	12.01	1.33	17.00	8.36	7.88	0.01	8.38	3.64	3.58
2010	0.23	8.78	2.13	1.66	0.23	12.01	4.21	3.89	2.41	13.65	6.26	5.66	5.04	17.48	10.75	10.55	6.06	16.81	10.77	10.36	3.89	13.85	7.97	7.88	0.23	10.85	4.84	4.83
2011	**-0.10**	**6.47**	**1.63**	**1.44**	0.45	9.08	3.93	3.58	2.20	10.36	5.39	5.04	3.89	15.28	9.13	8.78	6.27	16.24	10.50	10.36	4.10	13.17	8.42	8.58	-0.10	10.26	4.18	4.42
2012	**0.56**	**7.88**	**3.33**	**2.84**	1.00	10.06	4.69	4.21	2.20	14.13	6.87	6.37	5.45	17.38	11.40	11.14	5.14	17.00	10.77	10.75	3.58	13.75	8.20	8.38	0.01	10.46	3.38	3.37
2013	0.12	10.55	3.17	2.73	0.12	11.04	5.27	5.04	3.37	18.62	8.90	8.48	8.18	18.81	13.04	12.98	7.38	17.76	12.29	12.21	3.68	16.05	9.45	9.67	0.12	6.88	2.97	2.94
2014	0.12	9.28	2.68	2.41	1.44	9.97	4.79	4.31	3.26	13.08	6.86	6.57	5.66	17.09	11.74	11.53	6.47	16.43	11.34	11.24	3.16	13.37	9.10	9.28	0.56	10.16	5.08	5.04
2015	0.12	10.65	3.84	3.37	2.20	11.53	5.86	5.60	4.10	18.81	9.89	9.37	7.18	18.71	12.28	12.01	7.08	16.33	10.83	10.94	4.10	13.85	8.67	8.58	0.67	11.04	5.79	5.76
2016	**2.41**	**7.88**	**4.15**	**3.89**	2.09	10.75	5.52	5.14	3.58	16.52	8.78	8.23	6.17	18.24	11.79	11.63	5.76	17.00	11.41	11.53	3.79	14.42	8.20	8.28	0.67	9.77	4.54	4.52
2017	**0.12**	**7.98**	**3.51**	**3.26**	1.55	9.47	4.56	4.10	2.84	11.82	6.36	5.96	5.66	15.66	10.53	10.26	7.18	15.86	10.94	10.85	1.98	14.42	7.93	7.88	0.12	6.37	2.92	2.94
2018	0.12	7.78	2.95	2.73	2.09	9.67	5.22	5.04	3.16	14.04	8.02	7.73	5.66	17.00	11.90	11.72	5.45	17.19	11.14	10.94	2.20	13.17	7.69	7.68	0.12	9.18	4.18	4.31
2020									**2.52**	**14.61**	**7.60**	**7.28**	4.62	17.57	11.18	10.99	7.58	17.67	12.33	12.30	3.26	14.33	8.56	8.48	0.12	9.08	4.17	4.52
2021					**1.11**	**12.59**	**5.91**	**5.35**	3.16	19.19	10.75	10.65																
Jordan Creek at mouth																												
2007					**3.35**	**12.44**	**6.31**	**5.28**	**3.56**	**18.53**	**8.82**	**7.99**	**7.39**	**22.32**	**14.26**	**13.52**	**10.76**	**18.47**	**13.09**	**12.17**	**2.06**	**18.63**	**8.58**	**7.74**				
2009					**0.76**	**8.87**	**4.75**	**4.33**	**3.10**	**14.56**	**6.45**	**5.88**	**5.01**	**19.58**	**11.14**	**10.60**	**1.89**	**19.79**	**11.14**	**10.85**	**4.00**	**17.67**	**10.15**	**9.55**	**0.22**	**10.07**	**4.10**	**3.71**
2010	0.12	11.24	2.02	1.55	0.12	10.94	3.98	3.79	2.73	13.37	6.32	5.66	5.14	18.52	11.17	10.94	6.47	19.09	11.88	11.24	4.10	17.09	9.01	8.48	0.34	14.80	5.88	5.55
2011	0.01	7.18	1.69	1.22	0.23	8.48	3.83	3.58	2.41	11.14	5.67	5.14	4.10	17.19	9.69	9.18	6.37	19.00	11.72	11.24	4.83	16.33	9.86	9.47	0.34	13.85	5.10	5.09
2012	**1.00**	**7.38**	**3.35**	**2.94**	1.22	10.85	4.74	4.31	2.20	14.71	6.69	5.96	4.93	19.57	12.08	11.63	5.96	19.28	11.92	11.63	4.62	15.76	9.33	9.18	0.23	12.69	4.32	4.21
2013									**7.29**	**19.34**	**12.63**	**12.29**	6.71	22.15	13.09	12.34	6.71	21.37	12.82	12.12	3.25	20.29	10.06	9.81	0.14	9.36	3.40	3.06
2015	0.23	10.85	3.72	3.26	2.52	11.82	5.78	5.45	**4.21**	**15.28**	**8.01**	**7.58**					6.98	19.09	11.59	11.24	4.31	17.09	9.51	9.18	**4.42**	**13.27**	**8.49**	**8.48**
2016	0.45	7.78	3.82	3.68	2.52	10.85	5.49	5.04	3.68	17.38	8.62	7.93	6.37	20.23	12.33	11.82	6.88	19.38	12.45	12.11	4.73	16.05	9.37	9.08	1.33	11.63	5.27	5.14
2017	0.67	7.48	3.43	3.16													7.68	18.05	12.13	11.72	2.30	18.05	9.05	8.78	0.12	9.28	3.35	3.16

2018	0.12	6.98	2.78	2.62	2.30	9.28	5.32	5.14	3.16	14.71	8.14	7.78	5.86	19.09	12.63	12.30	5.86	19.95	12.39	11.92	2.62	16.05	8.84	8.68	0.34	11.92	4.92	4.93
2019	**1.11**	**7.68**	**3.56**	**3.05**	0.78	9.97	4.89	4.62	3.05	13.65	6.75	6.27	**3.89**	**18.52**	**10.72**	**10.36**					1.11	18.81	9.48	8.98	-1.68	9.97	2.62	2.30
2020									**3.26**	**15.28**	**7.52**	**7.08**	4.31	19.95	11.42	10.94	7.48	20.52	13.10	12.40	3.58	19.19	9.58	8.88	0.12	13.27	5.03	5.04
2021					**1.66**	**11.92**	**5.60**	**5.04**	3.05	21.00	10.31	9.72	8.58	22.53	14.24	13.65	5.55	22.72	13.03	12.79	1.44	17.95	9.38	8.83	0.56	12.21	4.88	4.42
Yankee Fork ~20m below Jordan Creek (2009, 2019) and ~170m below Jordan Creek (2013)																												
2009					**1.98**	**10.55**	**5.17**	**4.62**	3.16	13.94	6.54	6.06	5.04	18.43	11.15	10.65	5.66	17.57	11.50	11.14	3.89	15.09	9.78	9.87	0.01	8.38	3.21	3.26
2013									**7.90**	**18.65**	**13.06**	**12.88**	8.02	19.18	13.07	12.97	7.42	17.96	12.40	12.29	3.59	16.49	9.44	9.61	0.00	7.19	2.94	2.90
2019	**0.56**	**8.18**	**3.37**	**2.94**	0.45	9.47	4.83	4.62	2.84	13.17	6.84	6.57	5.76	16.90	11.15	11.09	6.67	17.48	11.97	11.92	0.78	15.19	8.59	8.58	0.01	11.24	2.12	2.09
Yankee Fork at bridge below Bonanza townsite mid-channel at SONDE boom (2006-2018) and shift with thalweg to river left adjacent to or below river left pier (2016, 2018-2021)																												
2007 boom									**3.45**	**16.40**	**9.23**	**8.65**	**7.95**	**19.63**	**13.76**	**13.60**	**7.55**	**18.40**	**12.17**	**12.05**	**2.23**	**14.32**	**8.00**	**7.61**	**0.17**	**8.51**	**3.81**	**3.86**
2008 boom									**3.26**	**13.82**	**7.39**	**7.08**	**6.96**	**16.07**	**11.34**	**11.29**	**6.58**	**16.96**	**11.60**	**11.55**	**3.64**	**13.39**	**8.80**	**8.83**	**0.16**	**4.83**	**2.11**	**2.14**
2009 boom					**0.46**	**9.82**	**4.86**	**4.42**	**3.05**	**13.71**	**6.33**	**5.82**	**4.86**	**17.26**	**10.65**	**10.40**	**5.59**	**16.71**	**11.06**	**10.76**	**4.18**	**14.53**	**9.93**	**9.93**	**0.15**	**7.13**	**3.22**	**3.27**
2010 boom	-0.10	11.04	1.87	1.33	0.08	11.13	4.19	4.04	2.29	12.82	6.21	5.62	5.02	16.58	10.73	10.59	6.33	15.94	10.87	10.59	3.91	13.57	8.12	8.12	0.38	11.42	4.90	4.71
2011 boom	**-0.02**	**6.76**	**1.78**	**1.44**	**0.26**	**9.06**	**3.97**	**3.64**	**2.29**	**10.50**	**5.57**	**5.19**	**3.79**	**15.61**	**9.34**	**9.06**	**6.29**	**16.07**	**10.79**	**10.72**	**4.47**	**13.04**	**8.79**	**8.92**	**0.27**	**10.82**	**4.49**	**4.67**
2012 boom	**0.78**	**7.78**	**3.52**	**3.05**	1.22	10.46	4.89	4.52	2.30	14.33	7.08	6.57	5.45	17.28	11.75	11.63	5.86	16.81	11.15	11.14	4.00	13.85	8.56	8.68	0.34	10.75	3.77	3.79
2013 boom	0.23	10.16	3.25	2.84	0.23	11.24	5.37	5.14	3.47	18.43	9.06	8.68	8.18	18.81	13.22	13.17	8.18	17.38	12.57	12.50	4.52	16.71	9.84	10.06	0.56	7.48	3.27	3.16
2014 boom	**0.23**	**9.37**	**3.22**	**2.84**	1.55	9.97	4.89	4.52	3.47	13.37	7.06	6.78	5.86	17.28	12.05	11.92	7.28	16.24	11.65	11.53	4.10	13.08	9.39	9.57	1.44	10.06	5.51	5.45
2015 boom	**0.04**	**10.47**	**3.71**	**3.33**	**2.18**	**11.39**	**5.78**	**5.54**	**4.01**	**18.26**	**9.91**	**9.54**	**7.51**	**18.30**	**12.25**	**12.11**	**7.88**	**15.98**	**10.90**	**10.96**	**4.54**	**13.99**	**8.82**	**8.78**	**2.19**	**10.64**	**6.08**	**6.20**
2016 boom	**0.57**	**8.22**	**3.61**	**3.36**	**1.93**	**10.94**	**5.44**	**5.03**	**3.58**	**16.54**	**8.63**	**8.13**	**6.15**	**17.52**	**11.77**	**11.75**	**6.78**	**15.98**	**10.19**	**9.94**	**1.75**	**11.26**	**6.90**	**6.86**	**1.75**	**8.85**	**4.71**	**4.73**
2016 adj.	0.67	8.48	3.83	3.58	2.09	11.24	5.63	5.24	3.79	16.90	8.95	8.48	6.27	18.24	12.07	12.01	6.67	16.62	11.78	11.82	4.52	14.13	8.60	8.58	1.66	10.06	4.87	4.83
2017 boom	**1.17**	**7.83**	**3.80**	**3.48**	**2.01**	**9.05**	**4.48**	**4.01**	**2.81**	**11.69**	**6.26**	**5.87**	**5.64**	**15.20**	**10.53**	**10.42**	**7.64**	**14.06**	**10.91**	**11.01**	**0.72**	**10.98**	**5.09**	**4.93**	**0.50**	**6.18**	**3.11**	**3.10**
2018 boom	**0.10**	**7.25**	**2.79**	**2.52**	**2.07**	**9.53**	**5.15**	**4.94**	**3.07**	**13.59**	**8.01**	**7.80**	**5.86**	**16.14**	**11.75**	**11.78**	**5.85**	**16.61**	**11.26**	**11.09**	**0.77**	**12.64**	**7.00**	**6.97**	**0.60**	**9.14**	**4.37**	**4.43**
2018 adj.	0.23	7.48	2.97	2.73	2.20	9.77	5.34	5.14	3.16	14.33	8.20	7.93	5.86	17.38	12.25	12.21	5.86	17.09	11.49	11.33	2.84	12.98	8.04	8.03	0.67	9.37	4.44	4.52
2018 below													**7.68**	**17.48**	**12.73**	**12.69**	5.76	17.19	11.54	11.33	2.94	13.17	8.10	8.08	0.78	9.47	4.50	4.52
2019 adj.																					1.98	14.80	9.05	8.98	0.34	6.78	2.64	2.62
2020 below									**2.73**	**15.00**	**7.77**	**7.38**	4.73	14.90	11.43	11.92	10.16	15.00	13.01	13.08	6.47	13.17	9.21	8.88	1.00	8.48	4.97	5.55
2021 below					**2.09**	**11.43**	**6.01**	**5.66**	4.31	15.57	10.89	11.24	11.63	16.81	14.24	14.23	7.08	17.28	12.73	12.88	4.10	12.21	10.11	10.26				
unnamed intermittent tributary / spring / Yankee Fork subflow emerging along river right bank at bridge below Bonanza townsite																												
2015																	10.55	12.11	10.70	10.94	8.48	11.33	9.44	9.28	7.68	8.78	8.21	8.18
2016	2.09	4.42	3.42	3.47	4.21	5.86	5.11	5.14	**5.55**	**6.98**	**6.24**	**6.27**																
2018													**7.88**	**11.53**	**9.55**	**9.77**	9.57	11.33	10.33	10.36	7.28	9.97	8.82	8.98	5.04	7.88	6.21	5.86
2019																					7.98	10.65	9.41	9.37	3.16	7.98	5.56	5.35
2020									**5.45**	**9.08**	**6.98**	**6.78**	6.98	12.50	10.20	10.85	11.33	13.46	12.32	12.30	7.38	11.53	9.34	9.08	2.09	7.68	5.58	5.96
2021					3.68	7.58	5.62	5.66	**6.78**	**12.98**	**9.57**	**9.47**	11.72	13.75	13.01	13.08	10.55	14.13	12.46	12.59	7.18	11.04	9.36	9.57	4.00	7.08	5.41	5.04
Yankee Fork ~40m below bridge below Bonanza townsite on river right																												
2011	**0.45**	**5.14**	**1.98**	**1.76**	**0.24**	**8.25**	**3.83**	**3.58**	2.40	9.99	5.42	5.09	**3.92**	**13.98**	**8.98**	**8.82**	6.63	14.91	10.40	10.38	4.03	14.38	9.11	9.21	**-4.57**	**14.67**	**5.13**	**5.18**
Yankee Fork above Side Channel 1 inlet																												
2019					**0.56**	**9.47**	**5.07**	**4.83**	**3.05**	**11.63**	**6.81**	**6.47**	**6.88**	**17.95**	**11.98**	**11.82**	7.88	18.14	12.23	12.11	2.41	15.57	9.15	8.98	0.01	7.18	2.71	2.73
Side Channel 1 at CHaMP Site 1709 Unit 9																												
2019					**1.44**	**9.67**	**5.27**	**4.99**	3.05	13.27	7.30	7.08	4.62	16.90	11.33	11.33	8.08	17.28	12.44	12.35	2.30	16.52	9.43	9.28	0.67	7.98	3.28	3.26
2020									**3.26**	**15.00**	**8.35**	**8.08**	5.24	17.76	12.05	11.96	10.06	18.05	13.49	12.93	5.24	16.43	9.87	9.57	1.00	12.11	5.72	5.66
2021					**2.20**	**11.43**	**6.35**	**6.01**	4.73	17.76	11.26	11.43	**9.57**	**18.33**	**14.44**	**14.13**	9.08	19.09	13.32	13.37	4.42	15.19	9.68	9.28	**-0.77**	**10.26**	**6.17**	**5.86**

Yankee Fork above West Fork prior to confluence restoration (2009-2016) and as Side Channel 1 outlet after restoration (2017, 2020-2021)																												
2009													4.83	17.57	10.89	10.65	5.76	17.28	11.28	10.94	4.21	15.28	9.65	9.47	-0.55	8.18	3.40	3.47
2012													5.44	17.63	11.88	11.71	5.82	17.34	11.23	11.18	4.06	14.17	8.68	8.63	**0.00**	**12.03**	**4.05**	**3.91**
2013	0.14	9.14	3.28	3.09	0.77	11.54	5.38	5.26	**3.35**	**14.39**	**8.56**	**8.34**																
2015	0.12	10.75	4.07	3.68	2.41	11.72	6.09	5.86	4.21	18.62	10.22	9.77	7.88	18.81	12.74	12.55	8.08	17.67	11.38	11.14	4.83	15.86	9.28	9.08	2.09	12.30	6.50	6.47
2016	0.67	8.68	3.91	3.68	2.09	11.33	5.70	5.24	3.89	16.71	9.05	8.58	**6.47**	**16.52**	**11.22**	**11.14**												
2017	3.26	7.28	4.67	4.52													8.08	15.95	11.52	11.53	3.05	14.23	8.64	8.78	0.56	7.08	3.48	3.47
2020													**9.28**	**19.00**	**13.18**	**12.50**	9.67	19.38	13.79	13.08	5.86	17.19	10.18	9.77	1.33	11.53	6.05	6.06
2021					**2.20**	**12.11**	**6.54**	**6.17**	4.83	19.00	11.50	11.53	11.43	19.38	14.64	14.04	8.48	19.95	13.45	13.37	4.21	15.66	9.85	9.47	2.20	10.46	5.37	5.04
Side Channel 2 outlet																												
2020																	10.85	15.95	13.12	12.88	**5.76**	**16.33**	**10.37**	**10.36**				
2021													11.92	17.28	14.14	13.75	10.16	17.09	13.26	13.37	6.17	13.85	9.93	9.77	**0.01**	**9.57**	**6.92**	**6.67**
West Fork at old mouth - after May 4, 2016 combined with gradually increased amounts of Yankee Fork water until July 14 when the entire flow was diverted into its new channel, during completion of the West Fork confluence restoration project (numbers highlighted in gradually darkening shades of grey), after which this site was then discontinued.																												
2007	**2.09**	**10.55**	**5.27**	**4.62**	0.89	12.59	5.60	5.04	3.89	18.14	9.51	8.78	7.68	20.62	14.01	13.70	7.18	19.38	12.39	12.21	1.98	18.14	8.84	8.28	0.34	9.37	4.18	4.10
2008	**0.12**	**7.88**	**2.23**	**1.55**	0.01	8.98	4.05	3.79	2.30	14.13	6.49	5.91	5.86	18.14	11.12	10.75	6.27	18.24	11.84	11.53	3.47	14.61	8.35	8.18	-6.25	11.72	4.16	3.79
2009					**1.76**	**10.94**	**5.04**	**4.52**	3.16	16.52	6.84	6.17	5.35	19.76	11.41	11.04	6.17	18.90	11.52	11.14	4.62	15.38	9.67	9.47	0.78	7.58	3.86	3.89
2010	0.34	12.40	2.23	1.66	0.23	10.75	4.10	3.89	**2.52**	**14.80**	**6.31**	**5.76**	5.35	17.28	11.16	10.94	6.57	17.19	11.38	11.04	4.21	14.42	8.49	8.38	0.78	11.82	5.49	5.35
2011	0.23	7.48	2.03	1.55	0.23	8.98	3.82	3.47	2.20	10.75	5.56	5.04	3.79	16.05	9.41	9.08	6.57	16.71	11.05	10.85	4.62	13.94	9.03	8.98	1.55	11.43	5.49	5.55
2012	**0.45**	**7.38**	**3.20**	**2.73**	1.22	9.97	4.74	4.31	2.41	14.23	6.94	6.37	**5.55**	**17.86**	**11.57**	**11.24**	**6.27**	**17.57**	**10.74**	**10.65**	4.42	14.04	8.80	8.88	0.56	11.24	4.13	4.10
2013	0.23	9.28	3.04	2.62	0.23	11.24	5.33	5.04	3.47	18.43	9.42	9.08	7.88	19.57	13.46	13.27	7.68	18.52	12.75	12.69	4.10	17.38	9.95	10.06	**2.41**	**6.67**	**4.71**	**4.62**
2014	0.01	7.08	2.52	2.52	1.44	9.28	4.64	4.21	3.26	13.94	7.20	6.88	5.76	18.33	12.29	12.21	6.98	18.05	11.82	11.63	3.05	14.33	9.35	9.47	0.89	10.85	5.39	5.24
2015	0.01	8.78	3.48	3.58	1.98	12.11	5.80	5.55	4.31	19.19	10.41	9.87	6.78	19.57	12.62	12.40	6.57	17.48	11.03	10.85	4.00	15.47	8.96	8.78	0.56	11.63	5.94	5.86
2016	0.12	6.78	3.45	3.37	2.52	11.43	5.43	4.99	4.10	15.95	8.81	8.28	7.08	17.95	11.89	11.72												
West Fork at new mouth																												
2019																									**-1.46**	**6.78**	**2.24**	**2.20**
2020 (1)									**3.58**	**15.47**	**8.28**	**7.88**	**5.04**	**18.62**	**11.68**	**11.72**	7.88	18.81	12.93	12.69	4.00	16.05	9.03	8.68	**0.23**	**10.26**	**4.69**	**4.93**
2020 (2)																	7.98	18.81	12.98	12.69	**4.52**	**16.05**	**9.94**	**9.77**				
2021													9.08	20.14	14.05	13.75	6.37	19.66	12.56	12.55	2.41	15.28	8.87	8.58	**-0.44**	**9.47**	**5.77**	**5.66**
West Fork at Virginia's cabin																												
2016	0.34	8.58	3.69	3.37	2.09	11.63	5.56	5.04	3.89	17.28	9.09	8.48	6.06	19.00	12.07	11.82	5.45	17.95	11.61	11.53	4.21	15.00	8.67	8.48	1.11	10.55	4.96	4.93
2017	0.23	7.88	3.32	2.94													7.48	16.81	11.61	11.43	2.30	15.57	8.52	8.38	0.12	7.78	3.09	3.05
2018	0.12	7.38	2.68	2.41	1.98	10.55	5.47	5.14	3.47	15.28	8.77	8.38	6.17	18.14	12.71	12.59	5.76	18.33	11.84	11.53	1.44	14.71	8.10	8.18	-2.26	11.82	4.58	4.73
2019	0.56	7.68	3.23	2.73	0.34	10.16	4.92	4.62	2.84	13.75	7.37	7.08	6.06	17.76	11.54	11.24	7.08	18.05	12.29	12.01	1.44	16.43	9.23	9.08	0.12	7.38	2.48	2.52
2020									**3.58**	**15.47**	**8.18**	**7.68**	4.93	18.81	11.81	11.63	7.68	19.00	12.91	12.69	3.68	16.14	8.99	8.68	0.12	10.26	4.63	4.83
2021					**3.16**	**12.69**	**6.22**	**5.45**	**3.47**	**17.00**	**9.69**	**9.18**	**6.78**	**20.42**	**13.93**	**13.75**	5.96	19.95	12.56	12.59	**3.58**	**15.47**	**9.22**	**9.08**				
Yankee Fork at first bridge below West Fork – at ~100m below first bridge (2009), at old mouth of West Fork after entire Yankee Fork flow was released to new channel (July 2016), and at first bridge below (August 2016-2021)																												
2009													5.04	18.52	11.25	10.94	5.86	17.38	11.36	11.04	4.10	15.38	9.66	9.47	0.01	7.88	3.47	3.47
2016													**7.38**	**17.95**	**12.60**	**12.59**	**6.98**	**17.09**	**11.75**	**11.72**	4.83	14.61	8.78	8.63	1.87	10.65	5.01	4.93
2017	0.12	7.68	3.35	3.05	1.98	9.47	4.68	4.21	**2.84**	**12.21**	**6.57**	**6.17**	**5.86**	**16.05**	**10.92**	**10.75**	**7.68**	**16.05**	**11.45**	**11.43**	2.73	14.80	8.54	8.58	0.23	7.48	3.29	3.26
2018	0.01	7.58	2.87	2.52	2.09	10.06	5.41	5.14	3.26	14.42	8.44	8.18	6.17	17.28	12.49	12.50	6.47	17.48	11.80	11.53	3.26	14.42	8.37	8.28	0.67	10.26	4.74	4.83
2019	**1.55**	**4.62**	**2.78**	**2.73**	**1.55**	**9.87**	**5.34**	**5.04**	3.05	13.46	7.44	7.18	**6.37**	**16.43**	**10.58**	**10.36**					2.62	16.05	9.56	9.37	-4.03	7.88	2.88	2.94

2020									**3.68**	**15.00**	**8.14**	**7.78**	5.14	17.00	11.79	11.82	9.47	17.86	13.20	12.88	5.14	15.66	9.42	9.18	0.78	10.55	5.14	5.35
2021					**1.98**	**11.72**	**6.18**	**5.76**	4.31	18.33	11.11	11.14	10.65	19.00	14.33	13.94	8.08	19.38	13.06	13.03	3.79	15.28	9.38	8.98	2.09	9.97	5.08	4.83
Yankee Fork at second bridge below West Fork																												
2012									**5.39**	**14.53**	**9.41**	**8.94**	5.41	18.01	11.85	11.60	5.85	17.61	11.20	11.08	4.12	14.19	8.67	8.67	**0.08**	**11.54**	**4.06**	**4.01**
2013	0.08	9.71	3.14	2.72	0.11	11.32	5.34	5.13	**3.41**	**14.72**	**8.71**	**8.52**																
Yankee Fork at bridge between Pond Series 2 inlet and Pond Series 3 outlet																												
2013	0.12	9.57	3.21	2.84	0.23	11.24	5.41	5.24	3.58	18.33	9.37	9.08	8.38	19.57	13.59	13.46	8.08	18.81	12.92	12.79	4.31	18.24	10.11	10.26	0.12	7.88	3.46	3.37
2014	0.12	9.18	2.82	2.41	1.55	10.06	4.92	4.52	3.47	13.75	7.34	6.98	5.96	18.24	12.49	12.50	7.18	18.14	12.05	11.82	3.58	14.71	9.68	9.67	1.22	11.72	5.73	5.55
2015	0.12	10.65	3.98	3.58	2.30	11.92	6.11	5.86	4.42	19.09	10.48	10.06	7.58	19.47	12.93	12.69	7.58	18.24	11.54	11.24	4.73	16.33	9.47	9.18	1.76	12.21	6.60	6.52
2016	0.34	8.38	3.86	3.68	2.52	10.94	5.81	5.45	4.62	16.14	9.29	8.88	7.08	18.05	12.47	12.40	7.98	17.00	12.26	12.21	5.04	15.28	9.16	8.98	2.09	11.14	5.35	5.35
2017	0.23	8.08	3.66	3.37	2.20	9.77	4.99	4.52	3.05	12.59	6.87	6.37	6.17	16.62	11.42	11.33	7.98	16.62	11.86	11.82	2.94	15.57	8.93	8.88	0.45	8.28	3.64	3.58
Yankee Fork at Pond Series 2 outlet																												
2013	0.01	9.77	3.24	2.84	0.12	11.33	5.40	5.14	3.47	18.62	9.40	9.08	8.28	20.14	13.64	13.46	8.08	19.28	12.96	12.69	4.42	18.33	10.20	10.26	0.12	8.28	3.56	3.47
2014	0.01	9.18	2.82	2.41	1.55	10.06	4.93	4.52	3.47	13.75	7.35	6.98	5.96	18.14	12.51	12.50	7.28	18.24	12.09	11.82	3.68	15.00	9.72	9.67	1.33	12.01	5.79	5.55
2015	0.12	10.65	4.02	3.58	2.20	11.92	6.13	5.86	4.42	19.38	10.52	10.06	7.58	19.76	13.00	12.69	7.48	18.52	11.55	11.24	4.62	16.71	9.44	9.18	1.33	12.79	6.50	6.37
Yankee Fork at Dredge Camp																												
2007	**2.30**	**10.65**	**5.58**	**5.04**	0.78	12.21	5.73	5.35	3.89	18.33	9.58	9.08	8.08	21.38	14.49	14.23	7.68	20.33	12.91	12.50	2.20	19.47	9.26	8.68	0.01	11.24	4.36	4.21
2008	**0.23**	**9.57**	**2.93**	**2.20**	0.34	9.08	4.65	4.36	2.62	14.23	6.93	6.37	6.47	18.24	11.75	11.53	6.57	19.09	12.54	12.40	3.58	15.00	8.84	8.68	0.23	14.23	4.31	4.00
2009					**1.98**	**10.65**	**5.31**	**4.83**	3.26	14.71	6.80	6.27	5.55	18.71	11.54	11.24	6.27	18.62	11.92	11.53	4.42	16.90	10.25	9.87	0.23	8.88	3.96	4.00
2010					**-0.10**	**11.33**	**4.21**	**4.00**	2.62	12.11	6.15	5.66	5.66	16.62	11.01	10.94	6.98	18.71	11.62	11.43	4.10	16.33	8.66	8.38	0.56	13.85	5.49	5.24
2011	-0.10	9.08	2.17	1.55	0.34	9.97	4.11	3.68	2.30	10.75	5.67	5.24	3.79	16.33	9.70	9.47	6.67	17.67	11.37	11.24	**4.73**	**14.90**	**9.34**	**9.18**	-0.10	12.69	4.94	5.04
2012	**-0.10**	**6.88**	**1.53**	**0.89**																								
2013	0.12	9.87	3.36	2.94	0.23	11.43	5.53	5.35	3.68	18.71	9.56	9.28	8.58	20.04	13.86	13.75	8.38	19.47	13.19	13.08	4.52	18.43	10.40	10.55	0.23	8.18	3.63	3.53
2014	**0.45**	**6.37**	**3.21**	**3.16**	2.20	9.57	5.03	4.62	3.58	13.85	7.49	7.18	6.17	18.33	12.73	12.69	7.68	18.62	12.36	12.11	4.21	15.47	10.06	9.97	1.76	12.30	6.13	5.86
2015	0.34	9.18	4.15	3.89	3.26	10.94	6.22	6.06	5.24	18.33	10.60	10.16	8.18	19.57	13.27	13.08	7.88	19.00	11.89	11.63	4.83	17.09	9.72	9.37	1.55	13.17	6.77	6.67
2016	0.45	8.78	3.95	3.68	2.20	11.63	5.80	5.35	4.21	17.28	9.35	8.88	6.67	19.57	12.56	12.40	7.18	18.52	12.29	12.11	5.04	15.47	9.26	8.98	2.09	11.72	5.36	5.24
2017	0.23	8.08	3.68	3.37	2.20	9.77	4.96	4.42	3.05	12.59	6.86	6.37	6.06	16.81	11.46	11.38	8.18	17.00	12.01	11.92	3.26	16.14	9.08	9.08	0.56	8.38	3.81	3.68
2020									**3.79**	**15.95**	**8.26**	**7.88**	5.24	18.14	12.04	12.01	9.08	19.47	13.48	12.98	4.93	17.19	9.69	9.28	0.12	11.82	5.33	5.45
2021					**1.87**	**12.11**	**6.26**	**5.76**	4.21	19.66	11.35	11.33	**10.36**	**20.42**	**14.75**	**14.23**	**7.68**	**21.09**	**12.55**	**12.21**	3.47	17.38	9.59	9.08	1.98	11.14	5.28	4.93
Yankee Fork at Polecamp Flat Campground																												
2007	**2.73**	**10.55**	**5.73**	**5.30**	1.22	11.82	5.87	5.55	4.31	16.81	9.68	9.28	8.68	20.23	14.45	14.23	8.58	19.09	13.11	12.88	3.37	18.43	9.77	9.28	1.11	10.65	4.99	4.93
2008	**0.12**	**8.88**	**2.92**	**2.30**	1.00	7.48	4.63	4.52	3.68	12.11	6.75	6.47	7.38	16.90	11.09	10.94	7.18	19.09	12.63	12.50	4.42	15.38	9.15	8.98	1.00	12.69	4.77	4.42
2009					**2.20**	**10.36**	**5.34**	**5.04**	3.79	14.42	6.91	6.37	6.17	18.33	11.52	11.24	6.88	18.33	11.97	11.63	5.35	16.14	10.48	10.26	0.78	8.88	4.41	4.52
2010	0.12	7.68	2.41	2.20	1.22	9.28	4.45	4.31	2.84	13.17	6.55	5.96	5.86	17.09	11.25	11.24	7.38	18.71	11.91	11.53	4.83	15.86	9.19	8.88	1.33	13.75	6.09	5.96
2013	0.12	9.37	3.36	3.05	0.45	11.04	5.59	5.45	4.00	18.05	9.61	9.28	8.98	19.28	13.79	13.65	8.88	18.62	13.22	13.08	5.14	17.00	10.69	10.94	0.78	8.38	4.04	4.00
2014	**0.23**	**8.88**	**3.26**	**2.84**	1.76	9.87	5.08	4.68	3.68	13.46	7.55	7.28	6.47	17.86	12.64	12.59	7.88	18.14	12.40	12.16	4.52	15.19	10.17	10.06	2.09	12.30	6.41	6.17
2015	0.12	10.36	4.16	3.79	2.41	11.92	6.30	6.06	4.73	18.62	10.69	10.26	8.28	19.38	13.19	12.98	8.08	18.24	11.90	11.63	5.55	16.14	9.88	9.57	2.20	12.59	7.08	6.98
2016	0.67	8.58	3.98	3.68	2.30	11.43	5.86	5.45	4.42	16.90	9.41	8.98	7.08	18.90	12.57	12.40	7.58	17.76	12.36	12.21	5.66	15.28	9.52	9.28	2.73	11.92	5.72	5.55
2017	0.34	7.88	3.69	3.37	2.30	9.57	5.01	4.52	3.26	12.30	6.94	6.57	6.37	15.86	11.43	11.43	8.68	15.95	11.96	11.92	3.68	15.66	9.23	9.28	0.89	8.68	4.00	3.95
2018	0.12	7.88	3.13	2.84	2.30	10.36	5.68	5.45	3.79	14.42	8.84	8.58	6.78	18.05	12.97	12.98	7.08	18.33	12.42	12.11	3.68	15.57	9.01	8.88	0.78	11.63	5.37	5.45
2019																					2.94	17.28	10.08	9.87	0.23	9.47	3.48	3.47
2020									**3.89**	**16.43**	**8.47**	**8.08**	5.45	18.71	12.12	11.92	8.98	19.57	13.58	13.08	5.14	17.48	9.96	9.47	0.78	11.92	5.65	5.66

2021					**1.87**	**12.21**	**6.31**	**5.86**	4.31	19.85	11.39	11.33	10.36	20.42	14.71	14.28	7.48	21.28	13.51	13.46	3.37	16.90	9.89	9.47	2.09	11.63	5.59	5.24
Yankee Fork at bridge below Flat Rock Campground																												
2007									**5.57**	**17.09**	**11.34**	**11.32**	**8.47**	**20.42**	**14.72**	**14.59**	**8.14**	**19.26**	**13.07**	**12.93**	**2.54**	**15.57**	**8.89**	**8.46**	**0.33**	**9.69**	**4.78**	**4.80**
2008					**0.12**	**9.63**	**4.63**	**4.40**	**3.52**	**13.85**	**7.23**	**6.75**	**6.61**	**16.83**	**11.84**	**11.89**	**7.58**	**17.33**	**12.69**	**12.64**	**4.40**	**14.30**	**9.51**	**9.24**				
2009					**1.95**	**10.09**	**5.32**	**4.91**	**3.27**	**14.04**	**6.83**	**6.34**	**5.67**	**17.82**	**11.57**	**11.38**	**6.49**	**17.82**	**12.01**	**11.70**	**4.69**	**15.37**	**10.26**	**10.12**	**-0.04**	**8.02**	**4.02**	**4.15**
2010	-5.62	11.72	2.34	1.98	-0.03	10.93	4.39	4.14	3.56	13.02	7.49	7.27	5.72	17.51	11.48	11.38	6.91	17.25	11.65	11.32	**4.27**	**14.96**	**8.84**	**8.64**	**1.40**	**12.29**	**5.86**	**5.75**
2011	**0.00**	**7.73**	**2.63**	**2.21**	0.59	10.78	4.34	4.01	2.40	10.86	5.96	5.58	**4.13**	**13.05**	**8.44**	**8.17**	**7.11**	**17.40**	**11.83**	**11.76**	5.18	14.31	9.74	9.71	0.06	12.40	5.32	5.40
2012	**1.14**	**7.65**	**3.61**	**3.10**	**1.07**	**10.16**	**4.86**	**4.44**	**2.29**	**14.00**	**7.21**	**6.75**	**5.83**	**17.99**	**12.15**	**12.02**	**6.21**	**17.89**	**11.63**	**11.51**	**4.49**	**14.02**	**9.01**	**9.07**	**-0.14**	**11.55**	**4.14**	**4.11**
2013	-0.77	9.67	3.45	3.16	0.34	10.94	5.67	5.55	4.10	18.33	9.79	9.47	8.98	19.47	14.11	14.04	8.68	18.24	13.38	13.37	**8.78**	**17.09**	**13.31**	**13.46**				
2014	**0.12**	**9.18**	**3.37**	**3.05**	1.66	10.06	5.17	4.73	3.68	13.56	7.66	7.38	6.47	18.24	12.94	12.88	5.24	18.33	12.51	12.40	4.10	15.00	10.19	10.16	1.55	12.01	6.20	5.96
2015	**-0.06**	**10.30**	**4.03**	**3.67**	**2.24**	**11.93**	**6.22**	**5.98**	**4.54**	**18.62**	**10.86**	**10.62**	**8.02**	**19.52**	**13.20**	**12.98**	**7.66**	**17.94**	**11.72**	**11.58**	**4.85**	**15.92**	**9.66**	**9.46**	**1.27**	**12.16**	**6.66**	**6.57**
2016	**0.35**	**8.50**	**3.88**	**3.64**	**2.09**	**11.37**	**5.80**	**5.39**	**4.15**	**17.00**	**9.32**	**8.90**	**6.75**	**18.99**	**12.64**	**12.53**	**6.96**	**17.80**	**11.01**	**10.73**	**1.85**	**13.26**	**7.73**	**7.45**	**1.85**	**9.70**	**5.34**	**5.28**
2017	**1.31**	**7.85**	**4.07**	**3.76**	**2.11**	**9.50**	**4.90**	**4.42**	**3.33**	**12.31**	**7.37**	**6.97**	**6.16**	**16.58**	**11.47**	**11.45**	**8.02**	**16.37**	**11.94**	**11.85**	**0.29**	**11.66**	**5.65**	**5.44**	**0.07**	**8.39**	**3.54**	**3.51**
2018	**-0.06**	**7.89**	**3.05**	**2.73**	**2.14**	**10.29**	**5.60**	**5.40**	**3.55**	**14.41**	**8.84**	**8.64**	**6.58**	**17.98**	**13.00**	**12.98**	**6.83**	**18.30**	**12.33**	**12.12**	**0.45**	**14.90**	**7.93**	**7.74**	**0.14**	**11.06**	**5.13**	**5.29**
2019					**1.44**	**9.97**	**5.47**	**5.24**	3.26	13.37	7.60	7.48	6.57	18.05	12.12	12.11	8.18	18.71	13.11	12.88	2.62	17.00	10.03	9.87	-1.11	8.88	3.12	3.26
2020									**4.00**	**15.19**	**8.53**	**8.18**	**5.55**	**19.00**	**11.42**	**11.53**	8.88	19.66	13.84	13.46	4.93	17.28	10.03	9.67	0.12	11.53	5.55	5.55
2021																					2.94	16.62	9.90	9.57	1.76	10.94	5.49	5.14
Cearley Creek at mouth																												
2013	3.26	9.47	5.29	4.93	3.89	10.75	6.48	6.17	5.14	10.65	7.15	6.78	5.96	9.67	7.31	7.08	5.96	8.88	7.10	6.98	5.35	8.68	6.81	6.78	4.62	7.18	5.59	5.55
2014	2.84	7.58	4.51	4.21	4.21	8.58	5.83	5.66	5.45	8.48	6.60	6.37	5.86	8.78	7.11	6.88	6.17	8.58	7.03	6.88	5.14	8.08	6.63	6.67	5.04	7.48	6.00	5.96
2015	3.58	9.28	5.56	5.24	4.73	9.77	6.50	6.27	5.66	10.55	7.28	6.98	6.06	9.97	7.30	7.08	5.96	9.08	7.08	6.88	5.66	8.88	6.80	6.67	4.93	8.28	6.31	6.22
2016	2.73	10.36	5.71	5.45	4.93	9.97	6.51	6.17	5.76	9.57	7.14	6.88	5.76	9.57	7.29	6.98	5.66	9.37	7.20	6.98	5.35	9.18	6.80	6.67	4.21	8.08	6.01	5.96
2017	3.79	7.38	5.21	5.04	4.62	9.57	6.40	6.06	5.55	9.87	7.31	7.08	6.57	9.77	7.69	7.38	6.37	9.08	7.37	7.18	5.76	8.88	6.94	6.88	4.93	7.68	6.00	5.96
2020													**6.57**	**8.98**	**7.50**	**7.33**	6.27	9.18	7.44	7.28	**5.55**	**8.88**	**6.98**	**6.78**				
2021													6.57	10.65	8.23	7.98	5.86	10.26	7.77	7.68	4.62	9.47	6.85	6.67	4.73	7.88	6.02	5.96
Jerrys Creek at mouth																												
2009					**4.73**	**10.36**	**7.25**	**7.18**	4.83	12.21	7.37	7.08	5.76	10.94	8.27	8.18	6.06	10.26	8.19	8.18	5.04	9.77	7.46	7.48	1.87	6.78	4.84	5.04
2010	**0.01**	**7.78**	**3.11**	**2.94**	1.33	7.88	3.90	3.79	3.68	11.33	6.54	6.17	5.35	11.72	8.08	7.78	5.24	10.94	7.78	7.58	4.21	9.57	6.49	6.47	2.62	8.58	5.18	4.93
2012	**2.20**	**7.28**	**3.91**	**3.68**	2.52	9.08	5.59	5.45	**4.31**	**10.46**	**7.05**	**6.88**																
2014	2.20	5.04	3.33	3.26	2.84	8.28	5.09	4.93	4.83	8.98	6.82	6.78	6.17	10.06	8.36	8.38	7.08	9.67	8.22	8.18	5.45	8.48	7.18	7.28	4.83	7.68	6.10	6.06
2015	1.76	6.57	3.67	3.47	3.58	8.28	5.66	5.66	5.66	9.97	7.47	7.28	6.47	10.36	7.92	7.78	5.45	10.55	7.44	7.18	4.93	9.97	6.91	6.78	3.79	8.78	6.03	5.96
2016	2.84	6.78	4.20	4.10	3.47	9.37	5.91	5.76	5.24	10.94	7.67	7.38	6.17	11.14	8.21	7.88	5.76	10.46	7.93	7.68	5.55	9.97	7.14	7.08	4.42	8.38	5.98	5.96
2017	3.05	6.06	4.47	4.42	3.37	9.97	5.67	5.35	4.62	11.63	7.74	7.48	6.78	11.82	9.17	8.98	7.28	10.94	8.88	8.78	5.66	9.87	7.81	7.88	4.00	7.08	5.46	5.45
2018	1.66	6.37	3.35	3.16	2.84	9.97	6.02	6.06	4.62	10.36	7.55	7.38	6.06	10.65	8.54	8.48	6.78	10.16	8.32	8.18	5.24	9.08	7.07	7.08	4.31	7.68	5.79	5.76
2019	**2.20**	**6.17**	**3.96**	**3.68**	1.76	8.58	5.40	5.35	4.62	9.87	7.09	6.88	6.06	9.87	7.81	7.68	6.47	9.67	8.08	7.98	5.35	9.37	7.43	7.38	2.41	7.18	5.19	5.24
2020									**4.93**	**8.88**	**6.52**	**6.47**	5.66	9.57	7.34	7.18	5.96	10.06	7.76	7.58	4.52	9.47	6.75	6.67	2.52	7.68	5.45	5.55
2021					**3.05**	**8.48**	**4.93**	**4.73**	3.89	12.21	7.10	6.57	5.76	14.33	8.92	8.48	4.10	13.37	8.75	8.68	1.33	12.59	6.63	6.42	1.87	7.48	4.80	4.83
Ramey Creek at mouth																												
2012	**1.33**	**7.68**	**3.71**	**3.47**	1.66	9.67	4.79	4.31	**2.52**	**11.82**	**6.30**	**5.86**	5.23	15.03	10.30	10.08	5.62	15.13	9.95	9.84	3.93	11.42	7.49	7.57	**0.02**	**9.85**	**3.75**	**3.64**
2013	0.05	8.64	2.74	2.45	0.05	11.15	5.20	4.96	3.17	16.37	8.43	8.02	6.79	16.68	11.39	11.14	6.51	15.49	10.53	10.35	3.70	14.05	8.69	8.69	0.33	6.76	3.25	3.20
2015	0.12	11.92	3.59	3.16	2.30	11.14	5.85	5.55	**4.10**	**14.42**	**7.72**	**7.38**																
Rankin Creek at mouth																												

2010	**-0.03**	**5.02**	**1.48**	**1.24**	0.00	7.07	3.12	3.12	4.19	9.85	6.59	6.36	5.85	12.20	9.24	9.19	5.95	11.57	8.81	8.89	3.99	8.84	6.42	6.48	0.52	8.32	4.33	4.06
2011	**0.12**	**2.94**	**1.53**	**1.66**	1.00	6.57	3.22	3.05	**2.73**	**8.58**	**5.10**	**5.04**	**6.57**	**11.33**	**9.32**	**9.57**	6.17	12.11	9.31	9.47	4.52	9.57	7.29	7.38	0.01	8.78	4.22	4.42
2012	**1.11**	**5.55**	**2.69**	**2.52**	1.11	9.08	4.65	4.42	2.94	11.53	7.07	6.88	5.55	12.88	10.16	10.16	4.42	12.98	9.27	9.37	2.41	10.46	6.81	7.13	**0.01**	**8.58**	**2.84**	**2.73**
2013	0.05	6.51	1.88	1.72	0.05	9.31	5.35	5.39	3.91	13.79	8.65	8.49	6.79	14.00	10.71	10.79	6.56	12.39	9.76	9.85	3.46	12.39	8.10	8.17	0.02	5.46	2.40	2.37
Silver Creek at mouth																												
2009					**2.52**	**9.57**	**5.05**	**4.62**	2.73	10.94	5.69	5.45	3.79	10.65	7.24	7.08	4.21	9.77	6.82	6.78	**3.37**	**8.58**	**6.02**	**5.96**	2.84	5.55	3.85	3.79
2011	**1.87**	**4.21**	**2.75**	**2.73**	1.55	6.57	3.14	2.84	1.87	9.77	4.74	4.42	3.68	10.65	6.82	6.57	4.42	9.18	6.53	6.47	3.89	7.48	5.53	5.45	2.52	6.88	4.30	4.31
2012	**1.44**	**4.93**	**3.01**	**2.84**	1.22	7.68	3.74	3.37	**1.87**	**9.18**	**5.13**	**4.83**																
2013	1.55	5.76	3.09	2.94	1.98	7.28	4.03	3.89	2.84	7.98	5.28	5.04	4.73	10.55	7.57	7.48	4.42	8.78	6.29	6.12	3.58	8.38	5.71	5.55	2.41	4.93	3.53	3.47
2014	1.33	4.73	2.51	2.41	1.55	6.78	3.45	3.16	2.73	8.38	5.23	5.04	4.21	9.18	6.61	6.47	4.93	8.88	6.59	6.47	2.73	8.18	5.70	5.86	2.73	6.78	4.35	4.31
2015	1.33	6.57	3.00	2.73	1.66	8.88	4.56	4.42	3.68	10.16	6.50	6.37	4.62	8.78	6.42	6.27	4.42	8.18	5.94	5.86	3.79	7.88	5.63	5.55	2.94	7.48	4.90	4.83
2020									**2.94**	**7.58**	**5.07**	**4.93**	3.58	6.78	5.41	5.35	**4.21**	**6.88**	**5.56**	**5.45**								
Pond Series 1 upper pond northwest shore																												
2011									**5.14**	**7.18**	**6.10**	**6.27**	6.78	12.88	8.56	8.28	8.78	12.88	9.48	9.37	8.58	11.04	9.32	9.28	6.27	9.57	7.61	7.48
2012	**1.55**	**2.52**	**2.02**	**2.09**																								
2013									**8.64**	**10.17**	**9.45**	**9.50**	9.78	11.69	10.77	10.76	**10.96**	**12.39**	**11.44**	**11.42**	**8.00**	**12.65**	**10.67**	**11.37**	5.23	8.42	6.86	6.86
Pond Series 1 upper pond outlet check structure																												
2012													8.25	14.96	11.01	10.93												
Pond Series 1 lower pond inlet at culvert																												
2020																	10.55	14.80	12.34	12.21	**8.78**	**14.61**	**11.01**	**10.85**				
2021													9.97	14.13	12.21	12.11	**8.48**	**14.23**	**11.03**	**10.65**	6.88	10.75	8.95	8.98	**6.27**	**9.37**	**7.43**	**7.38**
Pond Series 1 lower pond outlet check structure prior to rehabilitation																												
2015	1.87	8.98	4.16	4.00	4.31	9.08	6.10	5.96	6.57	14.13	9.07	8.78	8.98	20.33	12.32	11.63	8.88	19.00	12.94	12.59	7.28	17.00	11.40	11.04	4.83	13.94	8.71	8.58
2016					**3.76**	**8.48**	**5.65**	**5.57**	**6.07**	**12.49**	**8.23**	**7.91**																
Pond Series 1 outlet at Yankee Fork road culvert prior to rehabilitation (2011-2014), and post rehabilitation (2018-2021)																												
2011									**5.35**	**8.18**	**6.54**	**6.47**	**6.67**	**12.11**	**8.96**	**8.78**	9.47	14.61	11.05	10.55	2.62	14.52	10.36	9.97	**4.52**	**13.46**	**7.96**	**7.88**
2012	**0.89**	**3.79**	**1.74**	**1.55**									8.15	14.27	10.51	10.35	9.51	14.72	11.40	11.08								
2013 LRFE	1.22	5.96	3.00	2.84	3.26	7.88	5.43	5.55	5.66	15.09	8.73	8.48	**8.38**	**21.38**	**12.45**	**11.72**												
2013 USFS									**8.17**	**15.10**	**10.87**	**10.47**	5.18	21.03	12.22	11.49												
2014	**1.33**	**5.96**	**2.68**	**2.52**	2.84	6.98	4.80	4.73	5.35	9.97	7.22	7.18	**7.58**	**13.56**	**10.02**	**9.97**												
2018 (1)													**8.98**	**16.14**	**11.90**	**11.33**	9.18	17.57	12.58	12.21	6.27	15.38	10.23	10.16	4.10	11.14	7.20	7.28
2018 (2)	1.11	5.04	2.75	2.62	3.37	7.68	5.35	5.35	6.06	12.21	8.27	8.08	8.28	15.86	11.55	11.14	8.58	18.24	12.46	12.11	5.66	16.33	10.19	9.97	4.00	12.11	7.16	7.18
2019	1.00	4.83	2.47	2.30	2.73	6.88	4.93	4.93	5.45	10.94	7.44	7.38	7.58	16.05	10.94	10.75	8.38	18.33	13.46	13.17	3.89	17.95	10.91	10.85	-1.46	8.38	4.38	4.52
2020									6.27	10.85	7.85	7.68	7.48	16.43	10.36	10.06	9.87	17.19	12.57	11.92	6.67	16.62	10.79	10.46	3.37	12.30	7.39	7.28
2021					**3.79**	**9.57**	**5.98**	**5.66**	6.06	14.23	9.20	9.08	9.77	15.47	12.25	11.92	8.78	20.14	13.01	12.30	6.47	19.00	11.09	10.16	5.45	14.80	8.07	7.58
Pond Series 2 inlet prior to rehabilitation																												
2012	**1.33**	**7.38**	**3.63**	**3.16**	1.44	9.77	4.92	4.62	2.30	11.92	6.94	7.08	7.08	11.33	9.62	9.77	6.06	11.33	8.96	8.98	4.31	9.77	7.01	6.98	1.00	8.08	3.97	4.10
unnamed tributary to Pond Series 2 at mouth																												
2012	1.11	5.55	2.49	2.30	1.44	10.26	4.97	4.62	3.26	12.01	8.06	7.98	6.06	12.88	10.68	10.85	5.45	12.50	9.31	9.28	4.00	9.97	7.12	7.38	1.11	8.18	3.74	3.58
2013	0.78	5.76	2.18	2.09	0.67	9.97	5.59	5.76	4.21	11.53	8.39	8.38	6.88	12.30	9.79	9.87	6.78	10.26	8.89	9.08	4.00	11.63	8.06	8.08	0.89	5.86	3.17	3.16
2014	1.44	4.00	2.57	2.52	1.76	9.37	4.41	4.00	4.52	11.04	7.89	7.88	6.37	13.65	10.69	10.94	6.47	12.79	10.09	10.26	2.52	10.65	7.71	7.98	1.66	8.18	4.89	4.93
2015	0.23	7.08	2.56	2.30	2.30	11.04	6.32	6.27	5.86	13.17	9.56	9.57	6.57	12.69	10.11	10.26	5.96	11.92	8.48	8.58	4.42	10.06	7.25	7.28	1.22	9.18	5.26	5.14

2016	**-2.03**	**6.17**	**2.49**	**2.84**																								
2017	**1.66**	**4.31**	**2.87**	**2.84**	2.41	10.46	4.74	4.42									6.98	12.21	10.02	10.26	2.84	11.53	7.52	7.68				
2018	0.34	5.76	2.24	1.98	1.87	11.63	6.06	6.06	**4.42**	**12.11**	**9.12**	**9.08**	**7.08**	**12.40**	**10.27**	**10.46**	5.66	12.98	9.41	9.37	**2.09**	**10.16**	**6.45**	**6.57**				
2019	**0.56**	**4.73**	**2.71**	**2.52**	0.89	9.67	4.73	4.62	**3.79**	**12.01**	**8.71**	**8.88**									1.76	11.14	7.54	7.48	0.12	4.52	2.13	2.20
2020									**4.52**	**11.53**	**8.10**	**8.08**	**5.24**	**11.04**	**9.08**	**9.28**												
2021	**0.78**	**4.83**	**1.84**	**1.71**	0.89	10.36	4.77	4.62																	1.44	6.37	3.85	3.68
Pond Series 2 midpoint at 4th check structure downstream from inlet prior to rehabilitation (2012-2013), and post rehabilitation (2014-2021)																												
2012	0.45	7.38	2.43	2.09	1.22	11.43	5.17	4.73	2.52	16.62	8.79	8.73	10.16	19.76	14.80	14.71	7.88	18.43	12.49	12.30	1.33	15.38	8.79	9.18	0.34	10.65	3.97	3.89
2013	0.78	10.94	4.33	4.00	2.20	12.88	7.40	7.38	7.08	20.90	13.00	12.59	11.24	23.10	16.67	16.24	11.14	21.09	15.61	15.28	5.04	19.19	11.83	12.30				
2014	0.34	9.87	2.22	1.76	0.89	10.06	4.67	4.31	3.47	15.47	7.91	7.68	6.27	19.57	13.00	12.69	7.18	19.00	12.06	11.82	3.16	13.85	9.13	9.28	1.44	10.75	5.38	5.14
2015	0.12	11.43	3.44	2.84	1.98	12.50	6.43	6.27	4.73	20.04	11.27	10.65	6.98	21.00	12.99	12.59	7.48	17.48	11.13	11.04	4.31	15.38	8.86	8.58	1.44	11.33	6.20	6.27
2016	0.56	9.67	3.49	3.26	1.98	14.42	6.09	5.66	4.83	20.52	10.97	10.36																
2017	0.78	8.08	3.15	2.62	1.87	10.06	4.92	4.42									10.16	21.47	14.96	14.52	2.41	16.81	6.64	6.27				
2018	0.23	7.98	2.23	1.76	1.66	10.65	5.69	5.55	**3.68**	**12.40**	**8.58**	**8.38**	**7.38**	**18.71**	**13.01**	**12.69**	6.37	21.95	13.29	12.69	**2.52**	**15.95**	**8.82**	**8.68**				
2019	**0.56**	**8.88**	**3.31**	**2.62**	0.56	10.06	5.11	4.93	**3.16**	**15.00**	**8.38**	**8.18**									1.66	16.81	8.94	8.78	0.12	7.08	2.10	1.87
2021													9.87	22.62	15.66	15.19									2.62	6.88	4.56	4.42
Pond Series 2 outlet prior to rehabilitation (2012-2013), and post rehabilitation (2014-2021)																												
2012	0.56	6.78	2.84	2.62	2.94	8.58	5.41	5.24	4.83	11.33	8.22	8.18	9.97	15.57	12.89	12.88	10.16	15.00	12.60	12.59	8.18	13.08	10.27	10.36	2.73	10.85	6.09	6.17
2013	1.66	9.28	4.57	4.52	3.58	9.77	6.98	7.08	7.58	17.00	11.14	10.85	12.40	19.19	15.71	15.57	11.92	18.62	15.11	15.09	6.67	17.38	12.25	12.79	2.09	10.16	5.24	5.14
2014	0.45	8.18	2.72	2.30	1.76	8.18	4.74	4.62	4.83	12.69	7.45	7.28	6.88	16.33	11.58	11.24	8.18	16.81	12.00	11.63	5.04	14.23	10.06	10.16	2.84	11.33	6.60	6.37
2015	0.89	9.87	4.16	3.79	3.26	9.37	6.42	6.37	6.67	16.90	10.01	9.37	8.88	17.95	12.83	12.50	8.68	16.90	11.84	11.72	6.06	15.19	9.90	9.87	2.94	12.01	7.23	7.18
2016	**2.73**	**7.68**	**4.38**	**4.15**	2.94	10.16	6.08	5.86	**6.17**	**11.53**	**8.62**	**8.48**																
2017	**1.11**	**7.98**	**3.48**	**3.05**	2.52	9.67	5.13	4.62									7.68	16.90	11.73	11.38	4.62	16.05	9.49	9.08				
2018	0.23	7.18	3.07	2.73	2.73	8.98	5.57	5.66	**5.14**	**9.87**	**7.99**	**8.08**	**8.78**	**16.52**	**12.75**	**12.84**	7.28	16.43	11.98	11.92	**4.10**	**14.71**	**9.27**	**9.28**				
2019	**-0.89**	**7.28**	**3.15**	**2.62**	**2.41**	**9.08**	**5.31**	**5.14**	**4.00**	**12.01**	**7.75**	**7.78**																
2021	**0.67**	**8.68**	**3.55**	**3.47**	**3.37**	**9.28**	**6.24**	**6.17**	**6.88**	**22.33**	**11.45**	**10.36**	**9.37**	**21.47**	**14.58**	**14.33**	7.08	20.71	12.93	12.98	**2.62**	**14.33**	**8.42**	**8.38**	2.20	8.78	5.04	4.83
Pond Series 3 inlet - Yankee Fork at inlet (2012), at ~4m above Cearley Creek (2013), and at inlet of channel (2014-2021)																												
2012	0.12	7.88	2.85	2.52	1.66	10.06	4.83	4.42	2.20	14.42	7.02	6.47																
2013	0.01	9.87	3.10	2.73	0.01	11.33	5.32	5.14	3.37	18.71	9.27	8.88	7.98	19.95	13.49	13.32	7.78	19.38	12.71	12.50	4.10	18.52	9.96	9.97	0.01	7.98	3.34	3.26
2014									**5.02**	**13.71**	**8.64**	**8.22**	5.80	18.25	12.29	12.22	7.17	18.03	11.89	11.66	3.51	14.63	9.44	9.49				
2015	0.12	10.75	4.02	3.58	2.30	11.92	6.13	5.86	4.42	19.09	10.44	9.97	7.68	19.47	12.85	12.69	7.28	18.05	11.26	11.04	3.68	15.09	8.93	8.88	-1.23	11.82	5.08	5.04
2016	0.56	8.68	3.88	3.58	2.09	11.72	5.78	5.35	4.00	17.38	9.24	8.68	6.47	19.19	12.39	12.21	7.18	18.24	12.14	12.01	4.93	15.76	9.13	8.88	1.76	12.30	5.21	5.14
2019					**1.44**	**9.87**	**5.31**	**5.04**	3.16	13.56	7.47	7.18	6.37	18.33	11.75	11.53	**7.98**	**18.52**	**12.70**	**12.30**	1.87	17.19	9.67	9.37				
2020																	9.08	18.81	13.33	12.88	**3.79**	**17.00**	**10.59**	**10.16**				
2021													10.55	19.95	14.52	14.04	7.68	20.71	13.15	13.08	3.16	18.05	9.74	9.28	1.76	10.75	5.02	4.62
Pond Series 3 at culvert below Cearley Creek prior to rehabilitation (2012), and at historic culvert site below Cearley post rehabilitation (2013-2021)																												
2012	**3.47**	**8.48**	**4.82**	**4.73**	5.35	7.08	6.29	6.37	6.37	8.28	7.04	6.98	7.28	9.47	8.18	8.18	7.98	9.37	8.50	8.48	**7.58**	**8.48**	**8.03**	**7.98**				
2013	0.23	10.06	3.40	2.94	0.23	11.43	5.57	5.35	3.68	18.62	9.47	9.18	8.08	19.57	13.44	13.27	7.78	19.38	12.54	12.30	4.42	18.14	9.77	9.77	0.45	8.28	3.69	3.58
2014	0.67	9.28	4.27	3.89	1.76	10.16	5.08	4.62	3.58	13.65	7.40	7.08	6.06	17.38	11.90	11.82	7.08	16.71	11.02	10.85	4.10	13.75	8.70	8.48	2.30	10.85	5.99	5.86
2015	0.23	10.85	4.14	3.68	2.41	12.01	6.22	5.96	4.52	18.62	10.42	9.97	7.38	18.90	12.31	12.11	6.98	16.52	10.23	9.87	4.83	14.33	8.73	8.48	3.26	11.53	6.63	6.47
2016	0.89	8.78	4.01	3.68	2.20	11.63	5.80	5.35	4.10	16.62	9.17	8.68	6.57	17.57	11.71	11.53	6.78	16.24	11.12	10.94	5.04	13.94	8.57	8.38	2.52	10.75	5.42	5.35
2017	0.56	8.08	3.76	3.47	2.30	9.77	4.99	4.52	3.16	12.50	6.85	6.37	6.06	15.19	10.80	10.75	7.28	14.80	10.21	9.97	3.89	12.59	7.71	7.68	2.73	8.78	4.90	4.73

2018	0.67	7.88	3.35	3.05	2.30	10.36	5.66	5.35	3.68	14.42	8.66	8.38	6.47	16.43	11.57	11.33	5.86	14.13	8.91	8.38	4.21	12.40	7.03	6.47	3.26	10.06	6.08	5.96
2020													**7.88**	**17.38**	**11.87**	**11.48**	6.88	17.00	10.66	10.16	4.83	13.08	7.36	6.88	2.09	9.57	5.53	5.55
2021													8.38	19.00	12.77	12.21	5.86	17.00	10.31	10.06	3.47	13.65	7.60	7.18	2.94	10.16	5.48	5.14
Pond Series 3 upper midpoint at lower end of rehab-roughened channel, downstream of significant Yankee Fork subsurface flow discharge area, post rehabilitation																												
2013	0.01	9.77	3.21	2.78	0.12	11.14	5.36	5.14	3.47	18.05	9.22	8.88	8.18	18.43	13.12	12.98	8.38	16.71	12.23	12.21	5.04	15.57	9.80	10.16	1.33	7.18	3.77	3.68
Pond Series 3 midpoint at big pond outlet check structure prior to rehabilitation (2012), and at historic big pond outlet check structure post rehabilitation (2013-2015)																												
2012	**2.62**	**9.08**	**5.82**	**5.91**	4.73	10.75	7.77	7.78	6.88	13.56	10.54	10.75	12.50	18.81	15.22	15.19	9.28	17.76	12.43	11.43	**8.18**	**10.55**	**9.29**	**9.28**				
2013	0.01	9.08	3.12	2.78	0.23	10.75	5.31	5.14	3.68	17.00	9.14	8.88	8.58	17.86	13.04	12.88	8.98	16.71	12.36	12.21	4.52	16.05	10.06	10.36	**1.98**	**3.58**	**2.91**	**3.00**
2014	0.34	8.78	3.16	2.73	1.44	9.87	4.81	4.42	3.37	12.98	7.16	6.88	6.06	16.71	11.84	11.82	7.78	16.24	11.27	11.04	4.21	15.95	9.22	9.08	3.47	10.65	6.67	6.57
2015	0.01	10.26	3.84	3.47	2.20	11.63	5.95	5.66	4.31	17.67	10.15	9.77	8.08	18.05	12.34	12.11	8.58	16.14	11.01	10.75	6.27	14.52	9.47	9.18	5.14	11.24	7.63	7.58
Pond Series 3 outlet at lower pond outlet check structure prior to rehabilitation (2012), and at historic lower pond outlet check structure and at PIT tag array post rehabilitation (2013-2021)																												
2012	**1.22**	**9.67**	**4.66**	**4.52**	4.31	11.72	7.66	7.38	**6.27**	**14.71**	**9.93**	**9.57**																
2013	0.78	8.88	3.58	3.31	1.00	10.65	5.78	5.66	4.31	16.52	9.55	9.37	9.57	17.19	13.45	13.46	9.87	16.90	12.89	12.69	5.35	16.14	11.02	11.33	2.52	8.58	4.78	4.62
2014	1.00	9.08	3.69	3.26	1.98	10.36	5.35	4.93	3.79	13.56	7.68	7.38	6.37	16.81	12.27	12.21	8.68	15.95	11.80	11.63	7.08	13.75	10.15	10.06	4.73	10.94	7.74	7.88
2015	0.56	10.16	4.28	3.89	3.05	11.53	6.47	6.27	5.14	16.62	10.54	10.26	**9.18**	**20.81**	**13.16**	**12.88**	9.57	16.14	11.62	11.33	7.58	14.80	10.25	9.97	5.55	11.92	8.53	8.48
2016	1.11	8.78	4.17	3.89	2.41	11.63	6.02	5.66	4.62	16.24	9.37	8.98	7.38	16.43	12.04	11.92	10.16	14.80	12.04	11.92	8.48	13.37	9.93	9.67	4.62	11.33	6.74	6.57
2017	1.00	8.08	3.97	3.68	2.73	10.26	5.35	4.83	3.37	12.11	7.19	6.88	6.57	15.00	11.22	11.24	9.28	15.09	11.50	11.24	6.47	15.19	9.74	9.77	3.16	10.06	5.95	5.86
2018	**1.33**	**9.97**	**3.69**	**3.26**	2.52	10.94	5.97	5.76	4.00	14.23	8.95	8.78	7.48	16.33	12.28	12.11	**9.87**	**16.81**	**12.36**	**11.87**								
2019	**1.22**	**7.58**	**3.67**	**3.26**	1.11	10.26	5.40	5.14	3.37	13.46	7.71	7.48	6.88	15.76	11.29	11.14	10.06	15.86	12.46	12.21	7.18	14.80	10.90	10.65	3.16	10.85	6.41	6.37
2020									**4.21**	**14.90**	**8.58**	**8.28**	**5.76**	**17.09**	**11.81**	**11.63**	**10.65**	**17.09**	**13.24**	**12.98**	7.48	16.33	11.05	10.75	3.47	12.30	7.60	7.58
2021					**2.30**	**11.72**	**6.41**	**5.96**	5.04	17.86	11.17	11.24	**9.47**	**18.81**	**14.20**	**14.13**												

The **bold** numbers are incomplete months, due to early or late installation, malfunction or air exposure, or removal for SONDE recalibration**.** Blue highlighted cells are water temperatures with values of less than -1 considered outliers, from either exposure to air or being frozen in ice, and not included in results. Numbers highlighted in gradually darkening shades of grey is the timeframe in which the Yankee Fork was slowly released to its new channel and combined with West Fork below its new mouth. Numbers in red are water temperatures downstream of the Bonanza Rehabilitation Project reach affected by subsurface flows.

Table 9. Yankee Fork Salmon River watershed Spring, Summer and Fall monthly minimum, maximum, average, and median water temperatures from 2007 through 2021, utilizing Onset HOBO and Tidbit temperature data loggers, Pressure Transducer and SONDE temperature probes. The black bold numbers are summary statistics for months that were monitored for less than the full number of days due to mid-month deployment or retrieval, data removed because of malfunction or air exposure, or removal for SONDE recalibration. Numbers highlighted in blue are temperatures with values less than -1, considered outliers, where HOBO was either exposed to air or frozen down in solid ice, and not included in results. Numbers highlighted in gradually darkening shades of grey is the timeframe in which the Yankee Fork was slowly released to its new channel and combined with West Fork below its new mouth. Numbers in red are water temperatures downstream of the Bonanza Rehabilitation Project reach affected by subsurface flows.

2009-2019 Yankee Fork Salmon River Watershed *Overwinter* Monthly Stream Temperature Data (°C)																				
	Nov				**Dec**				**Jan**				**Feb**				**Mar**			
Site/Years	**min**	**max**	**avg**	**med**	**min**	**max**	**avg**	**med**	**min**	**max**	**avg**	**med**	**min**	**max**	**avg**	**med**	**min**	**max**	**avg**	**med**
Yankee Fork above Ninemile Creek																				
2009-2010	-0.09	3.46	0.83	0.61	-0.06	2.53	0.58	0.00	-0.06	2.13	1.08	1.21	-0.09	2.69	0.70	0.65	0.00	3.83	1.34	1.43
Yankee Fork above Eightmile Creek																				
2011-2012	**0.01**	**2.52**	**0.34**	**0.12**	0.01	1.22	0.14	0.12	0.01	0.34	0.09	0.12	0.01	1.66	0.27	0.12	0.01	3.68	1.00	1.00
2012-2013	0.02	5.18	1.24	0.80	0.05	1.91	0.24	0.11	0.05	1.29	0.16	0.08	0.02	1.67	0.22	0.08	0.02	5.46	0.91	0.44
Eightmile Creek at mouth																				
2012-2013	0.08	5.57	1.55	1.40	0.05	2.10	0.44	0.36	0.05	1.83	0.31	0.19	0.02	2.26	0.41	0.22	0.00	5.87	0.71	0.33
Yankee Fork at bridge on Yankee Fork road above Custer townsite																				
2011-2012	**0.01**	**2.94**	**0.30**	**0.12**	0.01	0.34	0.07	0.01	0.01	0.45	0.13	0.12	0.01	0.89	0.32	0.23	0.01	3.05	0.60	0.45
Yankee Fork above Jordan Creek																				
2013-2014	0.12	3.05	0.46	0.12	0.12	0.23	0.14	0.12	0.12	0.23	0.12	0.12	0.12	0.23	0.13	0.12	0.12	2.94	0.56	0.23
2016-2017	0.12	4.10	1.20	0.78	0.12	0.23	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	5.66	1.50	1.33
Yankee Fork at bridge below Bonanza townsite mid-thalweg adjacent to river left pier																				
2015-2016					**0.23**	**0.45**	**0.27**	**0.23**	0.23	0.34	0.24	0.23	0.23	0.89	0.28	0.23	**0.23**	**4.93**	**1.31**	**1.22**
2016-2017	0.23	4.52	1.57	1.22	0.23	0.67	0.37	0.34	0.23	0.34	0.23	0.23	0.12	0.45	0.24	0.23	**0.23**	**5.04**	**0.97**	**0.34**
2017-2018									**0.12**	**0.34**	**0.23**	**0.23**	0.12	1.33	0.26	0.23	0.12	3.58	0.59	0.23
unnamed intermittent tributary / spring / Yankee Fork subflow emerging along river right bank at bridge below Bonanza townsite																				
2015-2016					**1.44**	**1.98**	**1.59**	**1.55**	1.11	1.55	1.37	1.44	**1.00**	**3.37**	**1.17**	**1.11**				
Yankee Fork ~40m below bridge below Bonanza townsite on river right																				
2010-2011	**0.77**	**5.13**	**1.91**	**1.66**	0.56	1.11	0.79	0.78	0.45	0.89	0.64	0.67	0.34	0.78	0.57	0.56	0.56	1.76	0.82	0.78
Yankee Fork above West Fork																				
2012-2013	-0.03	5.64	1.26	0.69	0.02	1.70	0.27	0.22	0.16	0.38	0.30	0.30	0.16	0.52	0.35	0.38	0.02	4.32	0.58	0.30
West Fork at old mouth																				
2012-2013	0.02	5.28	1.09	0.22	0.05	1.53	0.12	0.08	0.08	0.14	0.10	0.11	0.08	0.16	0.09	0.08	0.05	6.15	0.50	0.11
2013-2014	**0.12**	**0.56**	**0.22**	**0.23**	-0.66	0.67	0.08	0.12	-0.10	0.56	0.13	0.12	0.01	0.45	0.12	0.12	0.01	4.21	0.56	0.23
2015-2016					**0.12**	**0.56**	**0.28**	**0.23**	0.01	0.56	0.18	0.12	-0.66	0.78	0.16	0.12	0.01	4.83	1.27	0.89
West Fork at Virginia's cabin																				
2015-2016					**-0.89**	**0.23**	**-0.04**	**0.01**	-0.33	0.23	0.06	0.12	-0.10	0.23	0.15	0.12	-2.61	6.37	1.22	0.89
2016-2017	**0.12**	**4.83**	**1.54**	**1.11**	**0.23**	**0.34**	**0.24**	**0.23**	0.23	0.23	0.23	0.23	0.23	0.34	0.23	0.23	0.23	5.55	1.59	1.22
2017-2018									**0.12**	**0.23**	**0.23**	**0.23**	-0.21	2.20	0.34	0.23	-0.33	4.93	0.69	0.23
Yankee Fork at first bridge below West Fork																				
2016-2017	-0.10	4.31	1.42	1.11	0.01	0.78	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.12	0.01	0.01	-0.10	5.45	1.43	1.11
2017-2018									**0.01**	**0.56**	**0.07**	**0.01**	0.01	1.76	0.17	0.01	0.01	4.73	0.59	0.12
Yankee Fork at second bridge below West Fork																				
2012-2013	0.08	5.64	1.27	0.63	0.05	1.48	0.16	0.11	0.08	0.14	0.09	0.11	0.08	0.16	0.09	0.08	0.05	6.20	0.52	0.11
Yankee Fork at bridge between Pond Series 2 inlet and Pond Series 3 outlet																				
2011-2012	**0.12**	**2.20**	**0.37**	**0.23**	0.23	0.56	0.30	0.34	**0.23**	**0.45**	**0.35**	**0.34**								
2012-2013					**0.12**	**0.34**	**0.23**	**0.23**	0.12	0.45	0.23	0.23	0.12	0.67	0.24	0.23	**0.12**	**6.78**	**0.65**	**0.23**
2013-2014	0.12	4.42	0.70	0.12	-1.11	0.34	-0.25	-0.21	-1.46	0.12	-0.40	-0.33	-0.21	0.12	0.01	0.01	0.12	4.42	0.54	0.12

2016-2017	0.23	4.73	1.77	1.44	0.23	1.00	0.31	0.34	0.23	0.45	0.32	0.34	0.23	0.56	0.30	0.34	0.23	5.86	1.64	1.33
Yankee Fork at Pond Series 2 outlet																				
2013-2014	0.01	4.83	0.72	0.23	0.01	0.34	0.12	0.12	0.01	0.12	0.12	0.12	0.01	0.12	0.12	0.12	0.01	4.52	0.53	0.12
Yankee Fork at Dredge Camp																				
2011-2012	**-0.10**	**3.37**	**0.19**	**0.01**	**-1.34**	**0.12**	**-0.34**	**-0.10**	**-3.67**	**-0.10**	**-0.71**	**-0.55**	-0.33	-0.10	-0.23	-0.21	-0.44	1.66	-0.16	-0.21
Yankee Fork at Polecamp Flat Campground																				
2015-2016					**0.12**	**1.11**	**0.46**	**0.45**	0.12	1.11	0.37	0.34	0.12	1.66	0.37	0.34	0.12	5.35	1.49	1.22
2016-2017	0.12	4.93	1.93	1.66	**0.12**	**1.22**	**0.46**	**0.45**	0.12	0.67	0.19	0.12	0.12	1.55	0.26	0.23	0.12	5.76	1.52	1.00
2017-2018									**0.12**	**0.67**	**0.24**	**0.23**	0.12	1.00	0.23	0.23	0.01	6.06	0.70	0.23
Yankee Fork at bridge below Flat Rock Campground																				
2010-2011	**0.00**	**5.77**	**1.42**	**0.52**	0.02	1.04	0.22	0.14	0.02	0.19	0.09	0.08	0.02	0.14	0.06	0.05	**-0.06**	**1.70**	**0.20**	**0.05**
Cearley Creek at mouth																				
2012-2013					**3.05**	**5.04**	**4.09**	**4.21**	2.20	5.66	4.00	4.00	2.30	5.55	4.00	4.00	2.30	7.88	4.55	4.52
2013-2014	3.37	6.06	4.82	4.83	2.62	5.35	4.04	4.00	2.52	5.24	3.82	3.79	2.41	5.66	4.20	4.31	2.62	6.47	4.44	4.42
Jerrys Creek at mouth																				
2011-2012	**2.30**	**4.73**	**3.77**	**3.89**	1.44	4.10	2.84	2.84	0.34	3.89	2.82	2.84	1.66	4.00	2.94	3.00	1.22	3.79	3.01	3.16
2013-2014	**0.56**	**4.21**	**2.04**	**1.98**	0.01	3.79	1.38	1.22	0.01	3.05	1.21	1.22	0.01	3.47	2.36	2.73	1.55	3.47	2.87	3.05
2016-2017	**2.09**	**5.96**	**4.13**	**4.10**	1.11	4.21	3.39	3.58	2.94	4.21	3.77	3.79	2.09	4.00	3.43	3.37	2.94	5.35	3.93	3.89
2017-2018									**1.87**	**4.21**	**3.23**	**3.26**	1.22	4.21	2.85	2.94	1.55	3.47	2.76	2.84
Ramey Creek at mouth																				
2012-2013	0.02	5.80	1.61	1.56	0.02	2.53	0.48	0.11	0.05	1.13	0.21	0.08	0.05	1.10	0.22	0.08	0.05	5.08	0.79	0.55
Rankin Creek at mouth																				
2012-2013	0.05	4.35	1.27	1.07	0.05	1.78	0.62	0.66	0.08	0.88	0.30	0.14	0.08	0.88	0.33	0.27	0.05	2.16	0.49	0.38
Silver Creek at mouth																				
2011-2012	**1.66**	**4.21**	**3.09**	**3.16**	1.44	3.47	2.56	2.62	0.56	3.26	2.31	2.41	0.78	3.47	2.33	2.41	0.56	3.89	2.75	2.84
2012-2013					**1.44**	**3.37**	**2.47**	**2.57**	0.23	3.58	2.32	2.30	0.67	3.68	2.25	2.30	0.78	4.83	2.60	2.62
2013-2014	1.22	4.31	3.05	3.16	0.23	3.79	2.14	2.20	0.23	3.58	1.96	1.98	0.12	3.68	2.47	2.62	1.44	3.79	2.73	2.73
Pond Series 1 upper pond northwest shore																				
2011-2012	**3.26**	**5.14**	**4.00**	**3.89**	1.66	3.68	2.26	2.09	**1.33**	**1.87**	**1.55**	**1.55**	1.22	1.66	1.35	1.33	1.22	2.09	1.47	1.44
Pond Series 1 outlet at Yankee Fork road culvert prior to rehabilitation (2011-2013), and after rehabilitation (2017-2019)																				
2011-2012	**1.44**	**5.24**	**3.26**	**3.16**	0.89	3.16	1.60	1.55	**0.34**	**1.66**	**0.95**	**0.89**	0.45	2.09	0.92	0.89	0.45	4.00	1.19	1.00
2012-2013					**1.22**	**1.76**	**1.35**	**1.22**	0.56	1.87	1.10	1.11	0.45	2.30	1.02	0.89	0.34	4.10	1.35	1.11
2017-2018									0.45	1.76	1.00	1.00	0.45	2.30	0.99	0.89	0.23	3.79	1.13	1.00
2018-2019	2.30	7.18	3.74	3.47	**0.78**	**3.47**	**1.84**	**1.76**	0.56	1.76	1.02	1.00	0.34	1.66	0.82	0.78	0.45	3.16	1.05	0.89
Pond Series 2 inlet prior to rehabilitation																				
2011-2012	**1.98**	**4.00**	**2.54**	**2.41**	0.23	2.09	1.24	1.22	**0.23**	**1.87**	**1.27**	**1.44**								
unnamed tributary to Pond Series 2 at mouth																				
2011-2012	**0.23**	**1.55**	**0.77**	**0.78**	0.23	1.33	0.28	0.23	**0.23**	**1.22**	**0.61**	**0.56**	0.23	1.22	0.86	0.89	0.34	1.87	1.32	1.44
2012-2013					**1.22**	**2.20**	**1.73**	**1.76**	1.33	2.30	1.62	1.55	1.44	2.41	1.88	1.87	1.00	2.41	1.78	1.76
2013-2014	**1.00**	**3.16**	**1.42**	**1.22**	0.89	1.76	1.35	1.33	1.22	2.30	1.72	1.66	1.22	2.41	1.98	2.09	0.67	2.73	2.22	2.20
Pond Series 2 midpoint at 4th check structure downstream from inlet prior to rehabilitation (2011-2013), and post rehabilitation (2013-2016)																				

2011-2012	**0.34**	**2.73**	**0.72**	**0.56**	-0.21	0.56	0.21	0.23	**0.12**	**0.23**	**0.23**	**0.23**	0.12	0.34	0.21	0.23	0.01	1.33	0.43	0.34
2012-2013					**0.01**	**0.23**	**0.13**	**0.12**	-5.75	0.45	-1.91	-1.80	0.12	0.56	0.26	0.23	0.23	2.94	0.69	0.56
2013-2014	**0.01**	**0.34**	**0.11**	**0.12**	0.01	0.56	0.17	0.12	0.01	0.89	0.41	0.45	0.12	1.11	0.62	0.67	0.01	2.52	1.03	0.89
2015-2016					**-2.84**	**0.56**	**0.10**	**0.23**	0.01	0.67	0.26	0.23	0.01	1.33	0.36	0.34	0.01	4.42	1.17	1.00
Pond Series 2 outlet prior to rehabilitation (2011–2013), and post rehabilitation (2013–2016)																				
2011-2012	**0.56**	**4.42**	**2.18**	**2.09**	0.45	2.30	1.31	1.33	**0.23**	**1.76**	**0.93**	**0.89**	0.23	1.98	0.75	0.67	0.23	3.37	1.09	1.00
2012-2013					**0.23**	**2.09**	**0.94**	**0.78**	0.23	2.30	1.07	1.00	0.12	2.30	0.69	0.56	0.12	5.04	1.28	1.11
2013-2014	**0.23**	**4.83**	**2.16**	**2.09**	0.12	2.73	1.11	1.11	0.12	1.98	0.79	0.78	0.12	2.62	0.99	1.00	0.23	3.68	1.62	1.55
2014-2015	**2.20**	**5.96**	**3.95**	**3.89**																
2015-2016					**0.12**	**2.20**	**1.07**	**1.00**												
Pond Series 3 inlet - Yankee Fork at inlet prior to rehabilitation (2011-2012), and at ~4m above Cearley Creek prior to rehabilitation (2012-2013)																				
2011-2012									**0.23**	**0.45**	**0.33**	**0.34**	0.12	0.56	0.31	0.34	**0.12**	**3.89**	**0.56**	**0.23**
2012-2013									-0.77	5.04	1.61	1.44	1.55	5.35	3.73	3.79	0.23	7.68	4.47	4.52
Pond Series 3 at culvert below Cearley Creek prior to rehabilitation (2011-2012), and at historic culvert site below Cearley post rehabilitation (2012-2018)																				
2011-2012	**3.68**	**5.86**	**4.69**	**4.62**	2.62	4.52	3.57	3.58	**2.62**	**3.68**	**3.12**	**3.16**	2.84	3.79	3.28	3.26	2.73	5.55	3.73	3.79
2012-2013					**0.45**	**1.00**	**0.72**	**0.67**	0.01	5.76	2.03	1.55	-0.55	6.88	3.62	3.68	1.11	8.48	4.57	4.52
2013-2014	0.45	5.14	1.51	1.22	0.56	5.14	2.01	1.66	1.87	5.55	3.59	3.68	1.55	6.78	4.05	4.15	2.09	7.28	4.47	4.42
2015-2016					**0.78**	**1.76**	**1.23**	**1.22**	0.67	1.44	0.99	1.00	0.34	2.62	0.77	0.78	0.67	5.55	2.07	1.76
2017-2018									**0.45**	**1.87**	**0.61**	**0.56**	-1.11	7.58	2.23	1.66	0.56	10.65	2.71	2.20
Pond Series 3 upper midpoint at lower end of rehab-roughened channel, downstream of significant Yankee Fork subsurface flow discharge area, post rehabilitation																				
2012-2013					**0.34**	**1.22**	**0.69**	**0.67**	0.34	2.73	0.94	0.89	0.34	2.62	1.15	1.00	1.22	4.52	2.49	2.52
Pond Series 3 midpoint at big pond outlet check structure prior to rehabilitation (2011-2012), and at historic big pond outlet check structure post rehabilitation (2012–2016)																				
2011-2012	**0.78**	**4.21**	**1.93**	**1.66**	**-0.21**	**1.55**	**0.54**	**0.56**	**-0.33**	**0.23**	**-0.01**	**0.01**								
2012-2013					**0.01**	**1.11**	**0.45**	**0.45**	0.01	2.94	0.79	0.67	0.34	3.16	1.23	1.11	0.45	5.66	2.07	1.87
2013-2014	0.23	4.62	1.49	1.33	0.01	1.55	0.76	0.78	0.34	1.87	0.91	0.95	0.23	2.62	1.15	1.11	0.89	4.10	1.99	1.87
2015-2016					**0.23**	**1.98**	**0.90**	**0.89**	0.12	1.66	0.65	0.67	-0.10	2.30	0.53	0.45	0.34	5.14	1.77	1.55
Pond Series 3 outlet at lower pond outlet check structure prior to rehabilitation (2011-2012), and at historic lower pond outlet check structure and at PIT tag array post rehabilitation (2012–2017)																				
2011-2012	**1.87**	**4.52**	**3.09**	**2.94**	1.00	2.41	1.62	1.55	**0.56**	**1.33**	**0.95**	**0.89**	0.56	1.33	0.82	0.78	**0.56**	**3.79**	**1.31**	**1.11**
2012-2013					**0.67**	**1.76**	**1.07**	**1.11**	0.67	2.30	1.23	1.11	0.78	2.52	1.55	1.55	1.00	4.93	2.30	2.20
2013-2014	1.11	5.66	2.58	2.41	0.78	2.52	1.58	1.55	0.89	2.62	1.49	1.44	0.78	3.47	1.49	1.44	1.11	4.83	2.38	2.09
2015-2016					**0.89**	**2.94**	**1.59**	**1.55**	0.67	2.73	1.24	1.22	0.45	3.16	1.11	1.00	0.78	5.86	2.32	2.09
2016-2017	1.33	4.83	2.88	2.94	**0.56**	**2.62**	**0.91**	**0.78**	0.45	0.78	0.53	0.56	0.45	1.33	0.60	0.56	0.45	5.86	1.93	1.66

The **bold** numbers are summary statistics for months that were monitored for less than the full number of days due to early or late installation/removal or removal due to malfunction or air exposure, or removal for SONDE recalibration. Blue highlighted cells are water temperatures with values of less than -1 considered outliers, from either exposure to air or frozen in ice, and not included in results.

Table 10. 2009-2019 Overwinter monthly minimum, maximum, average, and median water temperatures within the Yankee Fork Salmon River watershed, utilizing Onset HOBO and Tidbit temperature data loggers.

2007-2021 Yankee Fork Restoration Project Annual *Maximum* Stream Temperature Data Summary (°C)												
Site/Year	**logger**	**serial#/ID**	**monitor rate**	**dates deployed**	**Latitude**	**Longitude**	**max (yearly)**	**max daily avg (yearly)**	**max 7-day running avg max (yearly)**	**#days 7-day avg max >17.8°C (yearly)**	**max 7-day running avg max (Aug 1 - Sept 14)**	**#days 7-day avg max >15.6°C (Aug 1 - Sept 14)**
Yankee Fork at Ninemile Creek												
2009	HOBO	2286127, 2286128	30 min	3/3/09-5/25/10	44.45037	-114.59866	12.9	9.2	12.1	0	11.4	0
Yankee Fork above Eightmile Creek												
2011	HOBO	1058439	30 min	4/8-11/8	44.42635	-114.6204	14.1	10.5	13.4	0	13.2	0
2012	HOBO	1058433	30 min	11/10/11-10/31/12			15.3	11.1	14.3	0	14.3	0
2013	Tidbit	USFS #12-12	15 min	10/24/12-11/5/13	44.42643	-114.62032	16.6	11.6	16.2	0	15.1	0
2014	HOBO	10192267	30 min	7/19-11/4			15.5	10.9	14.1	0	13.5	0
2015	HOBO	10192267	30 min	8/1/-11/1			–	–	–	–	**15.0**	**0**
2017	HOBO	9998881	30 min	5/24-10/31			13.9	10.1	13.4	0	13.2	0
2018	HOBO	9998881	30 min	5/23-10/31			15.6	11.2	15.0	0	14.4	0
2019	HOBO	9998881	30 min	5/30-11/4	44.42642	-114.61972	15.1	11.0	14.3	0	14.3	0
2020	HOBO	9998881	30 min	6/9-11/3			15.7	11.6	15.2	0	15.2	0
2021	HOBO	9998881	30 min	5/11-10/12			18.0	12.9	16.6	0	16.1	5
Eightmile Creek at mouth												
2011	HOBO	1058435	30 min	4/8-11/7	44.42666	-114.62074	15.8	11.2	15.0	0	15.0	0
2012	Tidbit	USFS #12-19	15 min	6/29-10/22	44.42673	-114.62085	16.3	12.1	15.7	0	15.7	3
2013	Tidbit	USFS #12-19	15 min	10/24/12-11/5/13			17.0	12.1	16.7	0	15.8	3
2015	HOBO	9847302	30 min	8/1-10/10			–	–	–	–	**17.4**	**25**
2016	HOBO	9998877	30 min	6/25-10/10			19.2	12.3	17.9	4	17.9	22
2017	HOBO	9998877	30 min	5/24-10/31			15.5	11.5	14.6	0	14.6	0
2018	HOBO	9998877	30 min	5/23-10/31			17.5	12.4	16.6	0	16.6	15
2020	HOBO	9998876	30 min	6/9-11/3			17.1	12.4	16.6	0	16.6	14
2021	HOBO	9998876	30 min	5/11-10/12			18.4	13.2	17.4	0	17.4	16
Yankee Fork at first bend below Fivemile Creek (2007-2010), and at first bridge above Fivemile Creek (2015-2021)												
2007	HOBO	1058438	1 hour	4/26-11//17	44.40489	-114.65587	19.0	13.9	17.6	0	16.8	16
2009	HOBO	2292165, 2292164	1 hour	6/26-11/17			16.7	12.1	15.5	0	15.1	0
2010	HOBO	2292165	30 min	4/3-11/4			16.5	11.7	15.7	0	15.7	2
2015	HOBO	9847300	30 min	8/1/-10/10	44.40934	-114.64578	–	–	–	–	**16.3**	**6**
2016	HOBO	9998881	30 min	6/25-11/2			18.2	12.9	17.2	0	17.0	13
2018	HOBO	20241379	30 min	7/7-10/31			16.9	12.1	16.1	0	16.0	5

2019	HOBO	20241379	30 min	5/30-11/4			16.5	11.8	15.6	0	15.6	0
2020	HOBO	20241382	30 min	6/9-11/3			17.7	12.8	17.1	0	17.1	20
2021	HOBO	20241382	30 min	5/11-9/16			19.9	14.2	18.3	13	18.3	18
Yankee Fork at bridge on Yankee Fork road above Custer townsite												
2010	HOBO	1058435	30 min	5/3-11/8	44.39596	-114.67525	16.1	11.8	15.1	0	15.1	0
2010	SONDE		30 min	4/23-11/8			**15.9**	**11.6**	**15.0**	**0**	**15.0**	**0**
2011	PT	184413	10 min	4/21-11/17			15.5	11.5	14.6	0	14.6	0
2011	HOBO		30 min	4/1-11/8			15.4	11.5	14.5	0	14.5	0
2011	SONDE		30 min	6/4-11/16			**15.5**	**11.5**	**14.6**	**0**	**14.6**	**0**
2012	HOBO	1058430	30 min	11/10/11-10/31/12			16.6	12.6	16.0	0	16.0	5
2012	SONDE		30 min	4/21-10/31			**16.6**	**12.5**	**15.9**	**0**	**15.9**	**4**
2015	HOBO	9847304	30 min	8/1/-10/10			—	—	—	—	**16.3**	**7**
Yankee Fork above Jordan Creek												
2007	HOBO	1058434	30 min	6/14-11/17	44.37953	-114.72037	19.9	14.7	18.5	12	17.4	23
2010	HOBO	2292166	30 min	3/17-11/8			17.5	12.5	16.6	0	16.3	9
2011	HOBO	1058434	30 min	4/1-11/7			16.2	12.2	15.2	0	15.2	0
2012	HOBO	2292165	30 min	4/12-10/31			17.4	13.3	16.7	0	16.7	9
2013	HOBO	10173199	30 min	3/29-11/14			18.8	14.1	18.2	4	16.8	19
2014	HOBO	10173199	30 min	11/16/13-11/4/14			17.1	13.2	16.3	0	15.1	0
2015	HOBO	10173199	30 min	4/1-10/31			18.8	14.6	18.0	1	16.8	13
2016	HOBO	10173199	30 min	4/21-11/2			18.2	13.8	17.1	0	16.6	9
2017	HOBO	10173199	30 min	11/4/16-10/31/17			15.9	12.0	15.3	0	15.3	0
2018	HOBO	10173199	30 min	3/29-10/31			17.2	13.3	16.5	0	16.4	9
2020	HOBO	10173199	30 min	6/9-11/3			17.7	14.1	17.2	0	17.2	16
Jordan Creek at mouth												
2007	SONDE		30 min	5/31-9/29	44.37852	-114.72151	**22.3**	**15.4**	**21.0**	—	**17.7**	—
2009	SONDE		30 min	5/13-11/17			**19.8**	**13.7**	**18.4**	**9**	**17.9**	**24**
2010	HOBO	2292162	30 min	3/25-11/8	44.37862	-114.72160	19.1	13.6	18.4	8	18.4	29
2011	HOBO	2292161	30 min	4/1-11/7			19.0	13.7	18.2	6	18.2	29
2011	SONDE		30 min	4/7-10/31			**18.8**	**13.3**	**17.9**	**1**	**17.9**	**14**
2012	HOBO	1058436	30 min	4/12-11/2			19.6	14.2	18.8	17	18.8	12
2012	SONDE		30 min	4/22-10/31			**19.4**	**14.1**	**18.7**	**12**	**18.7**	**8**
2013	Tidbit	USFS #12-27	15min	6/28-11/5	44.37861	-114.72162	22.2	14.4	21.5	67	20.5	45
2015	HOBO	9797412	30 min	4/2-6/11, 8/1-10/11			—	—	—	—	**18.9**	**30**
2016	HOBO	10192267	30 min	3/31-11/2			20.2	14.6	19.0	20	18.8	32
2017	HOBO	10192267	30 min	11/4-5/6, 7/28-10/31			18.0	13.2	17.5	0	17.5	38

2018	HOBO	10192267	30 min	3/29-10/31			19.9	14.7	18.7	24	18.7	25
2020	HOBO	10192267	30 min	6/9-11/3	44.37871	-114.72185	20.5	14.8	20.1	30	20.1	44
2021	HOBO	10192267	30 min	5/10-11/5			22.7	16.0	21.3	55	21.3	45
Yankee Fork ~20m below Jordan Creek (2009, 2019), and ~170m below Jordan Creek (2013)												
2009	HOBO	2292161	1 hour	5/15-11/17	44.37799	-114.72109	18.4	13.5	17.3	0	16.7	11
2013	Tidbit	USFS #12-01	15min	6/28-11/5	44.37613	-114.72275	19.2	14.1	18.5	7	17.0	21
2019	HOBO	10192267	30 min	4/11-11/4			17.5	13.4	16.3	0	16.3	8
Yankee Fork at bridge below Bonanza townsite mid-channel at SONDE boom (2006-2018) and shift with thalweg to river left adjacent to (adj.) or below (↓) river left pier (2016, 2018-2021)												
2006	SONDE		15 min	5/3-11/2	44.36803	-114.72501	**17.9**	**15.6**	**15.6**	**0**	**15.6**	**1**
2007	SONDE		30 min	5/31-11/7			**19.6**	**14.8**	**18.7**	**6**	**17.1**	**4**
2008	SONDE		30 min	6/15-11/7			**17.0**	**13.6**	**16.1**	**0**	**16.1**	**7**
2009	SONDE		30 min	5/13-10/28			**17.3**	**12.9**	**16.0**	**0**	**15.7**	**4**
2010	HOBO	1058441, 2279650	30 min	5/2-11/8			16.6	12.6	15.8	0	15.7	2
2010	SONDE		30 min	4/2-10/18			**16.6**	**12.6**	**15.7**	**0**	**15.6**	**1**
2011	SONDE		30 min	4/7-11/16			**16.1**	**12.5**	**15.0**	**0**	**15.0**	**0**
2012	HOBO	2292162	30 min	4/12-10/31			17.3	13.7	16.5	0	16.5	8
2012	SONDE		30 min	4/21-10/31			**17.1**	**13.4**	**16.2**	**0**	**16.2**	**7**
2013	HOBO	10173198	30 min	3/29-11/20			18.8	14.2	18.1	4	16.5	19
2013	SONDE		30 min	4/25-11/6			**18.5**	**14.0**	**17.9**	**2**	**16.1**	**9**
2014	HOBO	10173198	30 min	4/10-11/4			17.3	13.4	16.6	0	15.0	0
2014	SONDE		30 min	5/14-11/4			**17.1**	**13.2**	**16.4**	**0**	**14.8**	**0**
2015	SONDE		30 min	4/2-11/1			**18.3**	**14.2**	**17.7**	**0**	**16.1**	**7**
2016	SONDE		30 min	4/1-11/1			**17.5**	**13.7**	**16.5**	**0**	**15.4**	**0**
2016 adj.	HOBO	10173198	30 min	12/9/15-3/22/17	44.36801	-114.72493	18.2	14.1	17.1	0	16.7	9
2017	SONDE		30 min	4/20-10/31			**15.2**	**12.0**	**14.9**	**0**	**14.9**	**0**
2018	SONDE		30 min	3/30-10/31			**16.6**	**13.3**	**15.9**	**0**	**15.9**	**5**
2018 adj.	HOBO	2292167	30 min	1/19-10/31			17.4	13.6	16.8	0	16.4	10
2018 ↓	HOBO	20281701	30 min	7/7-10/31	44.36799	-114.72500	17.5	13.6	17.0	0	16.5	11
2020 ↓	HOBO	10173198	30 min	6/9-11/12			15.0	14.3	14.3	0	14.3	0
2021 ↓	HOBO	10173198	30 min	5/10-9/14			17.3	15.4	16.2	0	16.2	9
unnamed intermittent tributary / spring / Yankee Fork subflow emerging along river right bank at bridge below Bonanza townsite												
2015	HOBO	9797413	30 min	8/1-10/10	44.36804	-114.72506	—	—	—	—	**11.8**	**0**
2018	HOBO	20241382	30 min	7/7-10/31			11.5	10.8	11.2	0	11.2	0
2020	HOBO	20241382	30 min	6/9-11/4			13.5	13.0	13.2	0	13.2	0
2021	HOBO	20241379	30 min	5/10-11/5			14.1	14.0	13.9	0	13.9	0

Yankee Fork ~40m below bridge below Bonanza townsite on river right												
2011	PT	184285	10 min	11/18/10-11/14/11	44.36763	-114.72538	14.9	11.9	14.1	0	14.1	0
Yankee Fork above Side Channel 1 inlet												
2019	HOBO	10179359	30 min	4/26-11/4	44.35574	-114.72855	18.1	13.4	16.9	0	16.9	23
Side Channel 1 at CHaMP Site 1709 Unit 9												
2019	HOBO	20031149	30 min	5/3-11/4	44.35443	-114.72938	17.3	13.6	16.4	0	16.4	15
2020	HOBO	10192268	30 min	6/10-11/3			18.0	14.9	17.8	0	17.8	34
2021	HOBO	10192268	30 min	5/10-10/13			19.1	15.4	18.2	**13**	18.2	19
Yankee Fork above West Fork prior to confluence restoration (2009-2015), and Side Channel 1 outlet after restoration (2017, 2020-2021)												
2009	HOBO	1058432	1 hour	7/1-11/17	44.34963	-114.72611	17.6	13.1	16.5	0	16.1	9
2012	Tidbit	USFS #12-13	15 min	6/29-10/22	44.34970	-114.72605	17.6	13.9	16.9	0	16.9	10
2015	HOBO	2292158	30 min	4/2-11/1			18.8	14.8	18.2	4	17.5	33
2017	HOBO	2292167	30 min	3/30-10/31	44.35011	-114.72647	16.0	12.6	15.6	0	15.6	1
2020	HOBO	11002731	30 min	7/10-11/3			19.4	15.3	19.2	22	19.2	40
2021	HOBO	11002731	30 min	5/10-11/5			19.9	15.5	19.1	40	19.1	30
West Fork at mouth, at old location prior to restoration (2007-2015), and at new location post restoration (2020-2021)												
2007	HOBO	1058433	30 min	4/26-11/17	44.34916	-114.72655	20.6	15.0	19.6	34	18.4	38
2008	HOBO	1058440	1 hour	4/18-11/22			18.2	13.1	17.4	0	17.4	30
2009	HOBO	2292160	1 hour	5/15-11/17			19.8	13.6	18.6	11	18.2	14
2010	HOBO	1058439	30 min	3/19-11/8			17.3	13.0	16.7	0	16.7	14
2011	HOBO	2292167	30 min	4/1-11/7			16.7	12.6	15.8	0	15.8	3
2011	SONDE		30 min	4/8-10/31			**16.7**	**12.5**	**15.7**	**0**	**15.7**	**3**
2012	SONDE		30 min	4/22-10/31			**17.7**	**13.4**	**16.9**	**0**	**16.9**	**8**
2012	Tidbit	USFS #12-21	15 min	6/29-10/22	44.34954	-114.72708	17.8	13.6	17.0	0	17.0	11
2013	HOBO	10192268	30 min	3/29-10/4			19.6	14.8	19.1	14	17.7	40
2013	SONDE		30 min	4/25-11/6			**19.3**	**14.5**	**18.8**	**10**	**17.3**	**22**
2014	HOBO	1058436	30 min	11/23/13-11/4/14			18.3	13.7	17.2	0	16.3	16
2014	SONDE		30 min	5/14-11/4			**18.2**	**13.6**	**17.1**	**0**	**16.2**	**8**
2015	HOBO	1058436	30 min	4/1-11/1			19.6	15.1	18.8	6	17.7	31
2020 (1)	HOBO	20782401	30 min	6/11-11/3	44.35274	-114.73075	18.8	14.8	18.4	8	18.4	28
2020 (2)	HOBO	9797412	30 min	7/28-9/17			18.8	14.8	18.5	8	18.5	28
2021	HOBO	20782401	30 min	7/1-10/12			20.1	15.5	19.0	22	18.5	20
West Fork at Virginia's cabin												
2015	HOBO	10192268	30 min	4/2-11/1	44.35396	-114.73398	19.9	15.2	18.9	14	18.5	33
2016	HOBO	10192268	30 min	12/9/15-11/2/16			19.0	14.1	17.9	2	17.7	20
2016	SONDE		30 min	4/29-11/2			**18.8**	**13.8**	**17.6**	**0**	**17.0**	**11**

2017	HOBO	10998621	30 min	11/4-5/6, 7/28-10/31			16.8	12.9	16.4	0	16.4	5
2017	SONDE		30 min	4/20-10/31			**16.6**	**12.7**	**16.2**	**0**	**16.2**	**4**
2018	HOBO	10998621	30 min	1/19-10/31			18.3	14.0	17.6	0	17.5	21
2018	SONDE		30 min	4/1-10/31			**18.2**	**13.8**	**17.4**	**0**	**17.3**	**13**
2019	HOBO	10998621	30 min	4/17-11/4			18.0	13.5	17.1	0	17.1	28
2020	HOBO	10998621	30 min	6/10-11/3			19.0	14.8	18.6	8	18.6	30
2021	HOBO	10998621	30 min	5/19-9/24			20.4	15.5	18.8	**20**	18.7	20
Yankee Fork at first bridge below West Fork – at ~100m below first bridge (2009), at old mouth of West Fork after entire Yankee Fork flow was released to new channel (July 2016), and at first bridge below (August 2016-2021)												
2009	HOBO	1058433	1 hour	7/1-11/17	44.34781	-114.72455	18.5	13.6	17.5	0	16.8	10
2016	HOBO	1058436	30 min	7/14-11/2	44.34932	-114.72674	18.0	13.9	16.6	0	**16.5**	**11**
2017	HOBO	1058436	30 min	11/4/16-10/31/17	44.34858	-114.72520	16.0	12.6	15.7	0	15.7	2
2017	SONDE		30 min	4/21-10/31			**16.0**	**12.5**	**15.6**	**0**	**15.6**	**0**
2018	HOBO	1058436	30 min	1/19-10/31			17.5	13.8	16.9	0	16.7	15
2018	SONDE		30 min	5/4-10/31			**17.4**	**13.7**	**16.8**	**0**	**16.6**	**15**
2020	HOBO	20261608	30 min	6/9-11/3			17.9	14.7	17.5	0	17.5	26
2021	HOBO	20261608	30 min	5/10-11/5			19.4	15.4	18.4	17	18.4	21
Yankee Fork at second bridge below West Fork												
2012	Tidbit	USFS #12-28	15 min	6/29-10/22	44.34498	-114.72462	18.0	13.9	17.3	0	17.3	11
Yankee Fork at bridge between Pond Series 2 inlet and Pond Series 3 outlet												
2013	HOBO	2292157	30 min	12/22/12-11/21/13	44.33874	-114.72189	19.6	14.9	19.1	17	18.0	44
2014	HOBO	2292157	30 min	11/23/13-11/4/14			18.2	13.9	17.2	0	16.3	17
2015	HOBO	2292157	30 min	4/2-11/1			19.5	15.1	18.8	10	18.1	33
2016	HOBO	2292157	30 min	3/31-11/2			18.0	14.4	17.0	0	16.6	10
2017	HOBO	2292157	30 min	11/4/16-10/31/17			16.6	13.0	16.2	0	16.2	4
Yankee Fork at Pond Series 2 outlet												
2013	HOBO	2292165	30 min	12/22/12-11/21/13	44.33341	-114.7221	20.1	14.9	19.7	30	18.4	45
2014	HOBO	2292165	30 min	11/23/13-11/5/14			18.2	13.9	17.3	0	16.5	18
2015	HOBO	2292165	30 min	4/2-11/1			19.8	15.2	19.1	13	18.4	34
Yankee Fork at Dredge Camp												
2007	HOBO	1058432	30 min	4/26-11/17	44.32732	-114.72165	21.4	15.7	20.1	49	19.0	42
2008	HOBO	1058431	1 hour	4/18-11/22			19.1	13.8	18.1	5	18.1	31
2009	HOBO	2292159	1 hour	5/15-11/17			18.7	13.8	17.7	0	17.3	18
2010	HOBO	1058441	30 min	5/2-11/8			18.7	13.0	16.3	0	16.3	15
2011	HOBO	1058441	30 min	4/1-9/6			17.7	13.1	16.5	0	16.5	8
2013	HOBO	10201677	30 min	3/29-11/13			20.0	15.2	19.6	32	18.5	45

2014	HOBO	10201677	30 min	4/10-11/4			18.6	14.2	17.5	0	16.8	23
2015	HOBO	10201677	30 min	4/2-11/1			19.6	15.3	18.3	11	18.3	34
2016	HOBO	10201677	30 min	3/31-11/1			19.6	14.6	18.2	8	17.7	25
2017	HOBO	10201677	30 min	3/30-10/31			17.0	13.2	16.4	0	16.4	6
2020	HOBO	10201677	30 min	6/9-11/4			19.5	15.0	18.7	12	18.7	40
2021	HOBO	10201677	30 min	5/10-11/5			21.1	15.9	—	—	—	—
Yankee Fork at Polecamp Flat Campground												
2007	HOBO	1058430	30 min	4/26-11/18	44.30352	-114.72030	20.2	15.7	19.0	26	18.3	38
2008	HOBO	1058435	1 hour	4/18-11/22			19.1	13.9	18.4	6	18.4	31
2009	HOBO	2292158	1 hour	5/15-11/17			18.3	13.7	17.2	0	16.9	16
2010	HOBO	2292160	30 min	3/17-11/8			18.7	13.4	17.9	1	17.9	24
2013	HOBO	10179359	30 min	3/29-11/13			19.3	15.0	18.8	12	17.8	45
2014	HOBO	10179359	30 min	4/10-11/4			18.1	14.0	17.1	0	16.7	22
2015	HOBO	10179359	30 min	4/2-11/1			19.4	15.2	18.7	9	18.0	33
2016	HOBO	10179359	30 min	12/9/15-11/2/16			18.9	14.5	18.0	2	17.5	23
2017	HOBO	10179359	30 min	11/4/16-10/31/17			16.0	12.9	15.4	0	15.4	0
2018	HOBO	10179359	30 min	1/19-10/31			18.3	14.4	17.8	0	17.8	21
2020	HOBO	10179359	30 min	6/9-11/4			19.6	15.0	19.0	18	19.0	41
2021	HOBO	10179359	30 min	5/10-11/5			21.3	15.9	20.1	53	20.1	37
Yankee Fork at bridge below Flat Rock Campground												
2006	SONDE		15 min	6/17-11/2	44.28745	-114.72042	**19.2**	**16.6**	**17.7**	**0**	**17.7**	**13**
2007	SONDE		30 min	6/16-11/7			**20.4**	**16.0**	**19.2**	**9**	**18.4**	**15**
2008	SONDE		30 min	5/2-9/8			**17.3**	**15.4**	**16.9**	**0**	**16.9**	**10**
2009	SONDE		30 min	5/15-11/17			**17.8**	**13.8**	**17.0**	**0**	**17.0**	**14**
2010	HOBO	1058435, 2273592	30 min	3/25-11/8			17.5	13.4	16.7	0	16.7	17
2010	SONDE		30 min	4/2-11/8			**17.5**	**13.3**	**16.4**	**0**	**16.4**	**4**
2011	PT	143174	10 min	4/15-11/17			17.4	13.5	16.8	0	16.8	8
2012	SONDE		30 min	4/21-10/31			**18.0**	**14.3**	**17.2**	**0**	**17.2**	**8**
2013	HOBO	10201675	30 min	3/29-9/7			19.5	15.3	18.9	13	17.7	38
2013	SONDE		30 min	4/25-11/6			**19.2**	**15.0**	**18.6**	**10**	**17.5**	**29**
2014	HOBO	10201675	30 min	4/10-11/4			18.3	14.5	17.5	0	16.8	22
2014	SONDE		30 min	5/14-11/4			**18.1**	**14.3**	**17.3**	**0**	**16.5**	**16**
2015	SONDE		30 min	4/2-11/3			**19.5**	**15.4**	**18.8**	**8**	**18.0**	**25**
2016	SONDE		30 min	4/1-11/1			19.0	14.6	18.1	**2**	**17.1**	**15**
2017	SONDE		30 min	4/20-10/31			16.7	13.1	16.1	**0**	**16.1**	**3**
2018	SONDE		30 min	3/30-10/31			18.3	14.5	17.6	0	17.6	19

2019	HOBO	2273356	1 hour	5/3-11/4			18.7	14.3	17.4	0	17.4	38
2020	HOBO	20782404	30 min	6/9-11/4			19.7	15.4	19.2	**18**	19.2	37
2021	HOBO	20782404	30 min	5/10-11/5			19.9	15.7	17.8	—	19.8	15
Cearley Creek at mouth												
2013	HOBO	1058433	30 min	12/22/12-11/21/13	44.34492	-114.72395	10.7	7.7	10.4	0	8.6	0
2014	HOBO	1058433	30 min	11/23/13-11/5/14			8.8	7.4	8.6	0	8.2	0
2015	HOBO	1058433	30 min	4/1-11/1			10.6	7.8	9.8	0	8.9	0
2016	HOBO	1058433	30 min	3/31-11/1			10.4	7.6	9.4	0	9.2	0
2017	HOBO	10173198	30 min	3/30-10/31			9.9	8.0	9.7	0	9.0	0
2020	HOBO	9847295	30 min	7/28-9/17			–	–	–	0	8.9	0
2021	HOBO	9847295	30 min	7/1-11/5			10.7	8.8	10.6	0	9.9	0
Jerrys Creek at mouth												
2009	HOBO	2292156	1 hour	5/27-11/17	44.33309	-114.71997	12.2	9.0	11.6	0	10.0	0
2010	HOBO	1058434	30 min	4/7-11/8			11.7	8.9	11.3	0	11.0	0
2014	HOBO	1058430	30 min	11/23/13-11/5/14			10.1	8.9	9.9	0	9.3	0
2015	HOBO	1058430	30 min	4/1-11/1			10.8	8.4	10.2	0	10.2	0
2016	HOBO	1058430	30 min	3/31-11/1			11.1	8.8	10.8	0	10.6	0
2017	HOBO	1058430	30 min	11/5/16-10/31/17			11.8	9.6	11.6	0	10.8	0
2018	HOBO	1058430	30 min	1/6-11/1			10.7	9.0	10.4	0	10.1	0
2019	HOBO	1058430	30 min	4/18-11/4			9.9	8.6	9.6	0	9.6	0
2020	HOBO	1058430	30 min	6/8-11/4			10.1	8.3	9.6	0	9.6	0
2021	HOBO	1058430	30 min	5/9-11/5			14.3	10.5	13.0	0	13.0	0
Ramey Creek at mouth												
2012	Tidbit	USFS #12-09	15 min	6/29-10/22	44.32101	-114.71849	15.1	11.9	14.4	0	14.4	0
2013	Tidbit	USFS #12-09	15 min	10/24/12-11/5/13			16.7	12.4	16.0	0	14.8	0
Rankin Creek at mouth												
2010	HOBO	2286127	30 min	4/7-11/8	44.31755	-114.7173	12.2	10.7	11.6	0	11.5	0
2011	HOBO	2292159	30 min	4/20-11/7			12.1	10.5	11.4	0	11.4	0
2012	HOBO	2292161	30 min	4/12-11/2			13.0	11.3	12.2	0	12.1	0
2013	Tidbit	USFS #12-24	15 min	10/24/12-11/5/13	44.31752	-114.7173	14.0	12.0	13.7	0	12.1	0
Silver Creek at mouth												
2009	HOBO	2292157, 1058439	1 hour	5/27-11/17	44.31651	-114.71462	10.9	8.3	10.2	0	9.3	0
2011	HOBO	2292158	30 min	4/20-11/7			10.7	7.5	9.9	0	8.7	0
2013	HOBO	2292161	30 min	12/22/12-11/21/13			10.6	9.0	10.3	0	8.6	0
2014	HOBO	2292161	30 min	11/23/13-11/5/14			9.2	7.6	8.9	0	8.5	0
2015	HOBO	2292161	30 min	4/1-11/1			10.2	7.3	8.9	0	7.9	0

2020	HOBO	2292161	30 min	6/9-8/15			7.6	6.2	7.3	0	6.8	0
Pond Series 1 upper pond northwest shore												
2011	HOBO	9753770	30 min	6/15-10/26	44.31254	-114.71604	12.9	10.3	12.3	0	12.3	0
2013	Tidbit	USFS #12-23	15 min	6/28-11/5	44.31256	-114.71607	12.7	12.1	12.3	0	12.3	0
Pond Series 1 upper pond outlet check structure												
2013	Tidbit	USFS #12-18	15 min	6/28-11/5	44.31092	-114.71615	22.6	14.3	20.7	16	17.7	26
Pond Series 1 lower pond inlet at culvert												
2020	HOBO	9847300	30 min	7/29-9/17	44.3083	-114.7179	14.8	13.0	14.4	0	14.4	0
2021	HOBO	9847300	30 min	7/1-11/5			14.2	13.6	13.9	0	13.9	0
Pond Series 1 lower pond outlet check structure prior to rehabilitation												
2015	HOBO	2292168	30 min	4/1-11/1	44.30713	-114.71848	20.3	14.8	19.0	22	19.0	41
Pond Series 1 outlet at Yankee Fork road culvert prior to rehabilitation (2011- 2013), and post rehabilitation (2018-2021)												
2011	HOBO	9753769	30 min	6/15-10/26	44.30649	-114.71905	14.6	11.7	14.2	0	14.2	0
2012	Tidbit	USFS #12-29	15 min	6/30/12-8/31/12	44.30649	-114.71905	14.7	12.3	14.4	0	14.4	0
2013	HOBO	LRFE 2273356	1 hr	12/30/12-7/27/13	44.30649	-114.71905	21.4	14.4	18.4	5	—	—
2013	Tidbit	USFS #12-08	15 min	6/28-7/27			21.0	14.2	18.8	6	—	—
2018(1)	HOBO	20261608	30 min	7/7-11/2			17.6	13.8	17.0	0	17.0	11
2018(2)	HOBO	11002731	30 min	1/6/18-7/31/19			18.2	13.4	16.7	0	16.7	22
2019	HOBO	20261608	30 min	4/11-11/4			18.3	14.8	17.6	0	17.6	38
2020	HOBO	20782403	30 min	6/9-11/4			17.2	13.3	16.9	0	16.9	22
2021	HOBO	20782403	30 min	5/10-11/5			20.1	14.4	19.2	11	19.2	39
Pond Series 2 inlet prior to rehabilitation												
2012	HOBO	9797415, 9998882	30 min	11/3/11-11/2/12	44.33871	-114.72291	11.9	10.6	10.8	0	10.8	0
unnamed tributary to Pond Series 2 at mouth												
2012	HOBO	9797413, 9998881	30 min	11/3/11-11/2/12	44.33857	-114.72322	12.9	11.8	12.5	0	12.1	0
2013	HOBO	9998881	30 min	12/21/12-11/8/13			12.3	11.3	11.8	0	10.6	0
2014	HOBO	9998881	30 min	11/16/13-11/5/14			13.7	12.0	12.8	0	12.2	0
2015	HOBO	9998881	30 min	4/1-11/1			13.2	12.4	12.8	0	11.7	0
2017	HOBO	9847300	30 min	3/30-6/8, 7/28-10/6			12.5	11.1	12.2	0	12.2	0
2018	HOBO	9847300	30 min	3/31-6/9, 7/19-9/28			13.0	11.2	12.2	0	12.2	0
Pond Series 2 midpoint at 4th check structure downstream from inlet prior to rehabilitation (2012-2013), and post rehabilitation (2014-2021)												
2012	HOBO	9847304, 9998877	30 min	11/3/11-11/2/12	44.33599	-114.72303	19.8	16.8	18.2	11	18.2	12
2013	HOBO	9998877	30 min	12/21/12-9/30/13			23.1	18.3	22.7	68	20.7	45
2014	HOBO	9998877	30 min	11/23/13-11/5/14			19.6	14.9	18.9	11	16.6	21
2015	HOBO	9998877	30 min	4/1-11/1			21.0	15.5	20.1	11	17.4	22
2017	HOBO	9797415	30 min	3/30-6/8, 7/28-10/6			21.5	16.0	20.3	**15**	20.3	**15**

2018	HOBO	9797415	30 min	3/31-6/9, 7/19-9/28			22.0	16.4	21.0	26	21.0	25
2021	HOBO	20782400	30 min	4/8-11/5			23.7	17.7	22.0	**35**	19.7	**5**
Pond Series 2 outlet prior to rehabilitation (2012-2013), and post rehabilitation (2014-2021)												
2012	HOBO	9847295, 9998876	30 min	11/3/11-11/2/12	44.33287	-114.72301	15.6	14.6	14.8	0	14.5	0
2013	HOBO	9998876	30 min	12/21/12-11/14/13			19.2	16.8	19.1	23	18.1	45
2014	HOBO	9998876	30 min	11/23/13-11/5/14			16.8	13.1	15.8	0	15.6	0
2015	HOBO	9998876	30 min	4/1-11/1			18.0	15.0	17.2	0	17.1	18
2017	HOBO	9797412	30 min	3/30-6/8, 7/28-10/6			16.9	12.8	15.9	0	15.9	13
2018	HOBO	9797412	30 min	3/31-6/9, 7/19-9/28			16.5	13.4	16.2	0	16.0	8
2021	HOBO	20782402	30 min	4/3-11/5			22.3	16.4	21.1	57	19.1	20
Pond Series 3 inlet at ~4m above Cearley Creek (2013), and at inlet of channel (2014-2021)												
2013	HOBO	1058430	30 min	12/22/12-11/21/13	44.34496	-114.72397	19.9	14.8	19.4	23	18.5	45
2014	Tidbit	USFS #10144952	15 min	6/20-9/30	44.34558	-114.72401	18.2	13.7	17.1	0	16.3	15
2015	HOBO	2292167	30 min	4/2-11/1	44.34571	-114.72417	19.5	15.1	18.7	6	17.8	32
2016	HOBO	2292167	30 min	3/31-11/1	44.34558	-114.72401	19.2	14.4	17.9	3	17.6	24
2019	HOBO	2292163	30 min	5/3-10/1			18.5	13.9	17.5	0	17.5	27
2020	HOBO	9847302	30 min	7/28-9/17			18.8	14.9	18.0	7	18.0	37
2021	HOBO	9847302	30 min	7/1-11/5			20.7	15.6	19.6	39	19.6	35
Pond Series 3 culvert below Cearley Creek prior to rehabilitation (2012), and at historic culvert site below Cearley Creek post rehabilitation (2013-2021)												
2012	HOBO	9847302, 2292163	30 min	11/2/11-9/11/12	44.34468	-114.72396	9.5	8.8	9.3	0	9.3	0
2013	HOBO	2292163	30 min	12/22/12-11/21/13			19.6	14.7	19.1	18	18.5	43
2014	HOBO	2292163	30 min	11/23/13-11/5/14			17.4	13.2	16.4	0	15.0	0
2015	HOBO	2292163	30 min	4/1-11/1			18.9	14.7	18.2	4	16.8	16
2016	HOBO	2292163	30 min	12/10/15-11/1/16			17.6	13.3	16.6	0	16.2	5
2017	HOBO	2292163	30 min	3/30-10/31			15.2	15.2	14.5	0	14.5	0
2018	HOBO	2292163	30 min	1/6-11/1			16.4	12.7	16.0	0	14.3	0
2020	HOBO	2273356	30 min	7/9-11/4			17.4	12.8	16.7	0	16.7	13
2021	HOBO	2273356	30 min	7/1-11/5			19.0	14.7	18.1	5	15.9	2
Pond Series 3 upper midpoint at lower end of rehab-roughened channel, downstream of significant Yankee Fork subsurface flow discharge area, post rehabilitation												
2013	HOBO	1058436	30 min	12/22/12-11/21/13	44.34355	-114.72391	18.4	14.3	18.0	1	16.1	10
Pond Series 3 midpoint at big pond outlet check structure prior to rehabilitation (2012), and at historic big pond outlet check structure post rehabilitation (2013-2015)												
2012	HOBO	9847300, 1058432	30 min	11/2/11-9/11/12	44.34181	-114.72264	18.8	17.6	17.8	1	17.3	12
2013	HOBO	1058432	30 min	12/22/12-11/21/13			17.9	14.1	17.5	0	16.1	10
2014	HOBO	1058432	30 min	11/23/13-11/5/14			16.7	13.1	16.0	0	15.1	0
2015	HOBO	1058432	30 min	4/1-11/1			18.0	14.3	17.5	0	16.1	11
Pond Series 3 outlet at historic lower pond outlet check structure (2012-2016), and at PIT tag array post rehabilitation (2017-2019)												

2013	HOBO	1058439	30 min	12/22/12-11/21/13	44.33941	-114.72174	17.2	14.4	16.8	0	16.1	10
2014	HOBO	1058439	30 min	11/23/13-11/5/14			16.8	13.5	16.2	0	14.8	0
2015	HOBO	1058439	30 min	4/1-11/1			17.2	14.6	16.6	0	16.0	10
2016	HOBO	1058439	30 min	12/10/15-11/1/16			16.4	13.4	16.1	0	15.4	0
2017	HOBO	1058439	30 min	11/4/16-10/31/17	44.33896	-114.72158	15.2	12.3	14.6	0	14.6	0
2018	HOBO	1058439	30 min	1/6-11/1			16.8	13.0	15.9	0	15.8	2
2019	HOBO	1058439	30 min	4/11-11/4	44.33949	-114.72173	15.9	12.9	15.2	0	15.2	0

Values in **black bold** type are estimates from SONDE data sets where recalibration gaps may have occurred in data collection during peak summer temperatures, or from HOBO/Tidbit with data gaps or deployed late or retrieved early during peak summer temperatures. Data highlighted in light grey are HOBO and SONDE comparisons noted in results section for the Bonanza Bridge site and values in **red bold** type are erroneous maximum data from SONDE where the recalibration gap did occur during peak temperatures. Numbers in red are water temperatures downstream of the Bonanza Rehabilitation Project reach affected by subsurface flows.

Table 11. Yankee Fork Salmon River watershed annual maximum stream temperatures from 2007 to 2021, utilizing Onset HOBO and Tidbit temperature data loggers, Pressure Transducer and SONDE temperature probes. Summer seasonal maximum, max daily average, maximum 7-day running average maximum, and the maximum 7-day running average maximum during the estimated Chinook spawning window for the YFSR from August 1 to September 14; the number of days the 7-day running average maximum exceeded the PACFISH Chinook migration and rearing threshold of 17.8°C, over entire season, and the number of days that the 7-day running average maximum exceeded the PACFISH Chinook spawning threshold of 15.6°C from August 1 through September 14.

2006-2020 Yankee Fork Salmon River, Tributaries and Pond Series Water Quality SONDE Deployment and Recalibration Summary

Site/Year	# days deployed	monitor rate	Deployment Periods/Recalibration Breaks																		
Yankee Fork at bridge below Flat Rock Campground - in the narrow canyon below the dredge tailings (44.28744, -114.72041)																					
2006	116	15 min	6/16-6/21	7/5-7/8	7/17-7/20	7/26-8/5	8/10-11/3														
2007	130	30 min	6/15-7/7	7/11-7/25	7/28-8/9	8/16-8/31	9/6-9/20	9/21-10/4	10/5-10/18	10/20-11/8											
2008	91	30 min	5/1-5/20	5/26-6/6	6/14-6/29	7/8-7/22	7/29-8/13	8/29-9/9													
2009	185	30 min	5/14-5/29	5/29-6/16	6/16-6/26	6/26-7/9	7/9-7/23	7/23-8/6	8/6-8/19	8/19-9/4	9/4-9/15	9/15-10/8	10/8-10/29	11/4-11/18							
2010	216	30 min	4/1-4/21	4/22-5/4	5/4-5/18	5/18-6/3	6/3-6/10	6/10-6/16	6/24-7/8	7/8-7/21	7/21-8/4	8/4-8/18	8/18-9/2	9/2-9/15	9/15-9/28	9/28-10/12	10/12-10/25	10/25-11/9			
2011	226	30 min	4/6-4/20	4/20-5/4	5/4-5/19	5/19-6/2	6/2-6/14	6/14-6/29	6/29-7/13	7/13-7/27	7/27-8/10	8/11-8/30	8/30-9/19	9/20-10/11	10/11-11/1	11/1-11/17					
2012	196	30 min	4/20-5/2	5/2-5/21	5/21-6/6	6/6-6/21	6/21-7/17	7/17-8/9	8/9-9/6	9/6-9/26	9/26-10/11	10/11-11/1									
2013	198	30 min	4/24-5/8	5/08-5/21	5/21-6/3	6/3-7/10	7/10-8/3	8/3-8/27	8/27-9/26	9/26-11/7											
2014	176	30 min	5/13-6/3	6/4-6/29	6/30-7/31	7/31-8/24	8/26-9/21	9/21-10/19	10/19-11/5												

2015	218	30 min	4/1-4/22	4/23-5/5	5/6-6/9	6/11-6/30	7/1-7/20	7/21-8/17	8/18-9/9	9/9-10/1	10/1-10/20	10/21-11/4									
2016	216	30 min	3/31-4/11	4/12-4/27	4/28-5/9	5/10-5/25	5/26-6/8	6/9-6/23	6/24-8/1	8/3-8/29	8/30-10/1	10/2-10/19	10/20-11/2								
2017	190	30 min	4/19-5/5	5/6-5/22	5/23-5/30	6/7-6/20	6/21-7/6	7/6-7/25	7/26-8/16	8/16-9/6	9/7-10/5	10/6-11/1									
2018	218	30 min	3/29-4/11	4/12-5/2	5/3-5/22	5/23-6/4	6/5-6/18	6/19-7/10	7/11-8/1	8/2-8/21	8/22-10/16	10/17-11/1									
Yankee Fork at bridge below West Fork - middle of dredge tailings (44.34858, -114.72520)																					
2016	47	30 min	7/14-8/1†	8/3-8/30																	
2017^	196	30 min	4/19-5/5	5/6-5/22	5/23-6/6	6/7-6/20	6/21-7/6	7/6-7/25	7/26-8/16	8/16-9/6	9/7-10/5	10/6-11/1									
2018^	183	30 min	5/3-5/22	5/23-6/4	6/5-6/18	6/19-7/10	7/11-8/1	8/2-8/21	8/22-10/16	10/17-11/1											
Yankee Fork at bridge below Bonanza townsite - within the upper portion of the dredge tailings (44.36802, -114.72501)																					
2006	124	15 min	5/2-5/4	5/17-5/19	5/22-5/25	6/16-6/21	7/5-7/8	7/17-7/20	7/26-9/15	9/20-11/3											
2007	137	30 min	5/24-5/25	5/30-6/10	6/15-7/7	7/11-7/25	7/28-8/9	8/16-8/31	9/6-9/20	9/21-10/4	10/5-10/12	10/20-11/8									
2008	72	30 min	6/14-6/29	7/29-8/13	8/29-9/9	10/25-11/22															
2009	146	30 min	5/12-5/29	5/29-6/16	6/16-6/26	6/26-7/9	7/9-7/21	7/23-8/6	8/6-8/19	8/19-9/4	9/4-9/15	10/8-10/29									
2010	207	30/15 min	4/1-4/21	4/22-5/4	5/4-5/18	5/18-6/3	6/3-6/10	6/10-6/12	6/12-6/13	6/13-6/14	6/14-6/15	6/24-7/8	7/8-7/21	7/21-8/4	8/4-8/18	8/18-9/2	9/2-9/15	9/15-9/28	9/28-10/12	10/12-10/19	10/25-11/9
2011	226	30 min	4/6-4/20	4/20-5/4	5/4-5/19	5/19-6/3	6/3-6/14	6/14-6/29	6/29-7/13	7/13-7/27	7/27-8/10	8/10-8/30	8/30-9/20	9/20-10/11	10/11-11/1	11/1-11/17					
2012	196	30 min	4/20-5/2	5/2-5/21	5/21-6/6	6/6-6/21	6/21-7/17	7/17-8/9	8/9-9/6	9/6-9/26	9/26-10/11	10/11-11/1									
2013	198	30 min	4/24-5/8	5/08-5/21	5/21-6/3	6/3-7/10	7/10-8/3	8/3-8/27	8/27-9/26	9/26-11/7											
2014	177	30 min	5/13-6/3	6/4-6/29	6/30-7/31	7/31-8/24	8/25-9/21	9/21-10/19	10/19-11/5												
2015	218	30 min	4/1-4/22	4/23-5/5	5/6-6/9	6/10-6/30	7/1-7/20	7/21-8/17	8/18-9/9	9/9-10/1	10/1-10/21	10/22-11/4									
2016	216	30 min	3/31-4/11	4/12-4/27	4/28-5/9	5/10-5/25	5/26-6/8	6/9-6/23	6/24-8/1	8/3-8/29	8/30-10/1	10/2-10/19	10/20-11/2								
2017	197	30 min	4/19-5/5	5/6-5/22	5/23-6/6	6/7-6/20	6/21-7/6	7/6-7/25	7/26-8/16	8/16-9/6	9/7-10/5	10/6-11/1									
2018	218	30 min	3/29-4/11	4/12-5/2	5/3-5/22	5/23-6/4	6/5-6/18	6/19-7/10	7/11-8/1	8/2-8/21	8/22-10/16	10/17-11/1									
Yankee Fork Salmon River 200 feet upstream of the Bonanza Rehabilitation Project reach - approximately 1160 feet downstream of Jordan Creek (44.3759, -114.7231)																					
2020	137	15/5 min	5/26-11/7	5/26-6/9	7/1-8/14	8/17-9/19															
Yankee Fork Salmon River 800 feet downstream of the Bonanza Rehabilitation Project reach - 100 feet downstream of the bridge below Bonanza townsite (44.3677, -114.7251)																					

2020	138	15/5 min	5/26-11/8	5/26-6/9	7/1-8/14	8/17-9/19															
Yankee Fork at bridge on Yankee Fork road above Custer townsite – above the dredge tailings (44.39595, -114.67525)																					
2010	201	30 min	4/22-5/4	5/4-5/18	5/18-6/3	6/3-6/10	6/10-6/24	6/24-7/8	7/8-7/21	7/21-8/4	8/4-8/18	8/18-9/2	9/2-9/15	9/15-9/28	9/28-10/12	10/12-10/23	10/25-11/9				
2011	168	30 min	6/3-6/14	6/14-6/29	6/29-7/13	7/13-7/27	7/27-8/10	8/10-8/30	8/30-9/20	9/20-10/11	10/11-11/1	11/1-11/17									
2012	196	30 min	4/20-5/2	5/2-5/21	5/21-6/6	6/6-6/21	6/21-7/17	7/17-8/9	8/9-9/6	9/6-9/26	9/26-10/11	10/11-11/1									
West Fork at old mouth (44.34915, -114.72655)																					
2010	155	30 min	5/4-5/18	5/18-6/3	7/8-7/21	7/21-8/4	8/4-9/2	9/2-9/15	9/15-10/12	10/12-10/25	10/25-11/9										
2011	219	30 min	4/6-4/20	4/20-5/4	5/4-5/19	5/19-6/2	6/2-6/14	6/14-6/29	6/29-7/13	7/13-7/27	7/27-8/10	8/10-8/30	8/30-9/20	9/20-10/11	10/11-11/1						
2012	194	30 min	4/21-4/26	5/2-5/21	5/21-6/6	6/6-6/21	6/21-7/17	7/17-8/9	8/9-9/6	9/6-9/26	9/26-10/10	10/10-11/1									
2013	198	30 min	4/24-5/8	5/08-5/21	5/21-6/3	6/3-7/10	7/10-8/3	8/3-8/27	8/27-9/26‡	9/26-11/7											
2014	177	30 min	5/13-6/3	6/4-6/29	6/30-7/31	7/31-8/24	8/25-9/21	9/21-10/19	10/19-11/5												
2015	217	30 min	4/1-4/22	4/23-5/5	5/6-6/9	6/10-6/30	7/1-7/20	7/21-8/17	8/18-9/9	9/9-10/1	10/1-10/20	10/21-11/3									
2016	124	30 min	3/31-4/11	4/12-4/27	4/28-6/23	6/24-7/13															
West Fork at Virginia's cabin ~290m above new mouth (44.35396, -114.75398)																					
2016	189	30 min	4/28-6/23	6/24-8/1	8/3-8/29	8/30-10/1	10/2-10/19	10/20-11/3													
2017	197	30 min	4/19-5/5	5/6-5/22	5/23-6/6	6/7-6/20	6/21-7/6	7/6-7/25	7/26-8/16	8/16-9/6	9/7-10/5	10/6-11/1									
2018	216	30 min	3/31-4/11	4/12-5/2	5/3-5/22	5/23-6/4	6/5-6/18	6/19-7/10	7/11-8/1	8/2-8/21	8/22-10/16	10/17-11/1									
Jordan Creek below bridge at mouth - at upper extent of the Yankee Fork dredge tailings and below the Jordan Creek dredge tailings and restoration area (44.37852, -114.72151)																					
2006	14	15 min	5/17-5/19	5/22-5/25	6/15-6/21																
2007	107	30 min	5/24-5/25	5/30-6/10	6/15-7/7	7/11-7/25	7/28-8/9	8/16-8/31	9/6-9/20	9/21-10/1											
2008	37	30 min	7/8-7/22	11/1-11/22																	
2009	170	30 min	5/12-5/29	5/29-6/16	6/16-6/26	6/26-7/9	7/9-7/23	7/23-8/6	8/6-8/19	8/19-9/4	9/4-9/15	9/15-10/8	10/30-11/18								
2010	192	30 min	4/2-4/21	4/22-5/4	6/3-6/10	6/10-6/24	6/24-7/8	7/8-7/21	7/21-8/4	8/4-8/18	8/18-9/2	9/2-9/15	9/15-9/28	9/28-10/12	10/12-10/25	10/25-11/9					
2011	219	30 min	4/6-4/20	4/21-5/4	5/4-5/19	5/19-6/2	6/2-6/14	6/14-6/29	6/29-7/13	7/13-7/27	7/27-8/10	8/10-8/30	8/30-9/20	9/20-10/11	10/11-11/1						
2012	195	30 min	4/21-5/2	5/2-5/21	5/21-6/6	6/6-6/21	6/21-7/17	7/17-8/9	8/9-9/6	9/6-9/26	9/26-10/11	10/11-11/1									
Pond Series 1 outlet at upstream end of culvert under Yankee Fork road, at lower extent of dredge tailings (44.30648, -114.71905)																					

2013	10-12	30 min	7/11-7/31**																			
Pond Series 1 lower pond outlet check structure, at lower extent of dredge tailings (44.30713, -114.71848)																						
2016	58	30 min	4/28-5/9	5/10-6/8	6/9-6/24																	
Pond Series 2 outlet - middle of dredge tailings, near Yankee Fork confluence (44.33287, -114.72301)																						
2013	47	30 min	6/13-7/10	8/9-8/27																		
Pond Series 3 outlet - middle of dredge tailings, near outlet, downstream of area of construction (44.33941, -114.72174)																						
2013	78	30 min	5/10-6/13	6/13-7/10	8/9-8/24																	
Pond Series 4 outlet - middle of dredge tailings, near outlet and confluence with Yankee Fork (44.34451, -114.72568)																						
2013	21	30 min	7/11-7/31																			

‡8/27/2013-10/2/2013 West Fork at mouth SONDE temporarily moved to the downstream end of the lowest WFYF CHaMP site, ~750m upstream from mouth
†7/14/2016-8/1/2016 data from SONDE at mouth of West Fork was included in Yankee Fork below West Fork data after entire Yankee Fork was released into new channel
**Pond Series 1 outlet SONDE sensors out of water intermittently
^ Yankee Fork below West Fork SONDE deployed during 2017 and 2018 main function was to measure Turbidity in conjunction with USGS suspended sediment grab sample

Table 12. Locations, years, number of days deployed, monitoring rate per hour and dates between recalibrations that SONDES were deployed in the Yankee Fork Salmon River mainstem, Yankee Fork Tributaries and Pond Series side channels, from 2006 to 2020.

2006-2020 Yankee Fork Restoration Project Water Quality SONDE Data Summary

		Temperature (Celsius)					Specific Conductivity (mS/cm)					pH					Turbidity (NTU)								DO (mg/L)				
Site/Year	# days deployed	min	max	avg	med	std	min	max	avg	med	std	min	max	avg	med	std	min	max	avg	med	std	max daily avg	# times recording >50 NTU	# times daily avg >25NTU for >10 consecutive days	min	max	avg	med	std
Yankee Fork at bridge below Flat Rock Campground - in the narrow canyon below the dredge tailings (44.28744, -114.72041)																												
2006	116	-0.02	*19.23	8.75	8.90	4.24	0.051	0.146	0.100	0.102	0.010	7.6	8.7	8.0	7.9	0.2	0.0	856.0	2.5	0.6	26.5	136.8	64	0	7.72	12.43	10.04	10.10	1.10
2007	130	0.00	20.42	9.72	9.86	4.87	0.068	0.145	0.099	0.102	0.010	7.2	8.5	7.8	7.8	0.2	0.0	952.1	8.0	0.6	62.6	365.7	103	0	7.10	12.25	9.38	9.22	1.26
2008	91	0.12	*17.33	8.60	8.36	3.95	0.001	0.121	0.060	0.060	0.030	6.5	8.0	7.4	7.4	0.3	0.0	961.6	87.6	7.3	202.4	688.8	802	1	7.62	11.89	9.92	10.03	0.86
2009	185	-0.04	17.82	8.03	7.98	4.29	0.000	0.124	0.083	0.094	0.025	7.0	8.6	7.9	7.9	0.2	0.0	1168.0	45.4	0.0	172.6	560.7	875	1	7.09	12.18	9.13	9.02	1.06
2010	216	-0.08	17.45	7.09	6.93	4.11	0.001	0.107	0.087	0.093	0.015	7.3	9.0	7.9	7.8	0.2	0.0	1180.9	10.5	0.0	83.2	562.5	245	0	7.84	11.89	9.84	9.84	0.90
2011	226	-0.01	17.35	6.71	6.46	4.06	0.001	0.124	0.081	0.088	0.020	7.1	8.3	7.6	7.6	0.2	0.0	1033.6	13.4	0.0	73.6	379.7	358	0	7.75	12.58	10.17	10.17	1.00
2012	196	-0.14	17.99	7.92	7.79	3.95	0.000	0.169	0.077	0.085	0.020	7.4	8.4	7.8	7.8	0.2	0.2	1039.6	30.2	1.2	131.4	632.8	576	1	7.65	11.80	9.58	9.53	0.90
2013	198	-0.20	19.23	8.83	8.84	4.75	0.003	0.107	0.077	0.086	0.021	7.0	8.5	7.8	7.7	0.2	0.6	1107.8	16.9	2.1	86.7	338.9	357	1	7.40	12.11	9.46	9.36	1.07

2014	176	0.40	18.12	9.13	9.11	3.77	0.012	0.108	0.075	0.088	0.025	7.1	8.1	7.6	7.6	0.2	0.0	1081.1	30.8	1.4	123.3	593.5	657	0	7.50	11.16	9.25	9.22	0.82
2015	218	-0.06	19.52	9.04	8.88	4.21	0.054	0.186	0.098	0.091	0.037	7.4	8.5	7.9	7.9	0.2	0.6	1030.7	6.4	3.1	31.1	131.3	83	0	7.35	12.20	9.38	9.36	0.96
2016	216	0.35	18.99	8.36	7.93	3.93	0.003	0.111	0.082	0.088	0.018	7.20	8.35	7.69	7.65	0.22	0.6	1072.3	22.4	3.7	96.2	642.7	541	0	7.47	11.91	9.61	9.64	0.89
2017	190	0.07	16.73	7.92	7.56	3.96	0.007	0.102	0.082	0.088	0.015	7.10	8.65	7.82	7.80	0.16	0.0	1069.5	10.8	1.2	49.2	418.8	365	0	7.80	12.11	9.65	9.63	0.94
2018	218	-0.06	18.30	8.05	7.65	4.15	0.001	0.109	0.080	0.091	0.022	6.70	8.42	7.73	7.77	0.26	0.0	1052.6	25.9	1.2	117.4	612.6	587	1	7.68	11.83	9.49	9.48	0.90
cumulative	***2376***	***-0.20***	***20.42***	***8.24***	***8.07***	***4.25***	***0.000***	***0.186***	***0.084***	***0.090***	***0.024***	***6.49***	***8.95***	***7.78***	***7.79***	***0.25***	***0.0***	***1180.9***	***20.7***	***1.2***	***103.0***	***688.8***	***5026***	***4***	***7.09***	***12.58***	***9.61***	***9.59***	***1.02***
Yankee Fork at bridge below West Fork - middle of dredge tailings (44.34858, -114.72520)																													
2016	47	6.39	17.99	12.09	11.97	2.49	0.081	0.097	0.091	0.091	0.004	7.41	7.90	7.61	7.57	0.12	0.8	427.1	5.4	1.8	18.6	63.3	41	0	7.14	9.65	8.07	8.01	0.49
2017	196	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.5	657.6	12.2	2.1	31.3	233.1	549	1	–	–	–	–	–
2018	183	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.2	395.6	3.3	1.1	10.0	89.9	15	0	–	–	–	–	–
cumulative	***426***	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	***0.2***	***657.6***	***7.7***	***1.5***	***23.5***	***233.1***	***605***	***1***	–	–	–	–	–
Yankee Fork at bridge below Bonanza townsite - within the upper portion of the dredge tailings (44.36802, -114.72501)																													
2006	124	0.12	*17.89	7.94	8.31	3.96	0.002	0.176	0.095	0.097	0.013	7.3	8.7	7.7	7.7	0.2	0.0	831.3	19.6	1.2	101.3	436.6	481	0	7.61	11.99	9.63	9.49	0.96
2007	137	0.06	19.63	8.92	8.96	4.60	0.055	0.164	0.097	0.095	0.023	6.7	8.4	7.6	7.5	0.3	0.0	957.7	28.8	1.5	132.2	360.4	286	0	7.13	14.61	9.70	9.32	1.55
2008	72	0.10	*16.96	7.59	7.86	4.32	0.043	0.241	0.078	0.079	0.015	6.1	7.7	7.3	7.3	0.1	0.0	954.2	18.8	1.0	98.9	326.8	102	0	6.98	11.39	9.44	9.56	0.96
2009	146	0.12	*17.26	7.89	7.66	3.80	0.030	0.118	0.073	0.078	0.014	7.4	8.5	7.8	7.7	0.2	0.0	1073.9	19.6	0.0	61.9	244.1	401	1	7.68	12.06	9.71	9.73	1.01
2010	207	0.04	*16.56	6.37	6.20	3.97	0.002	0.134	0.081	0.082	0.013	7.3	8.3	7.7	7.7	0.1	0.0	1062.2	4.1	0.0	36.3	219.2	120	0	7.74	11.38	9.74	9.77	0.88
2011	226	-0.02	16.07	6.08	5.76	3.86	0.026	0.135	0.073	0.070	0.015	7.3	8.1	7.7	7.7	0.1	0.0	1206.9	5.7	0.6	29.6	122.7	147	0	8.02	11.76	10.03	10.07	0.86
2012	196	0.15	17.05	7.41	7.31	3.76	0.001	0.101	0.067	0.068	0.010	7.5	8.2	7.7	7.6	0.1	0.5	1180.1	5.4	1.2	30.2	93.3	118	0	7.70	11.37	9.49	9.45	0.87
2013	198	-0.02	18.54	8.23	8.32	4.49	0.003	0.106	0.074	0.074	0.010	7.0	8.7	7.6	7.5	0.3	0.7	1260.2	6.0	1.7	39.7	192.3	121	0	7.38	12.05	9.32	9.20	1.02
2014	177	0.63	17.09	8.35	8.38	3.49	0.003	0.084	0.065	0.072	0.014	7.2	7.9	7.4	7.4	0.1	0.2	246.7	3.4	1.1	7.9	36.4	27	0	7.70	11.14	9.22	9.16	0.75
2015	218	0.04	18.30	8.34	8.18	3.83	0.032	0.147	0.087	0.079	0.025	7.3	8.5	7.7	7.7	0.2	0.0	1221.4	17.3	2.1	80.7	462.2	524	0	7.44	11.93	9.24	9.12	0.88
2016	216	0.57	17.52	7.72	7.33	3.66	0.050	0.116	0.078	0.078	0.010	7.17	8.12	7.63	7.60	0.13	0.8	1216.1	8.4	2.3	38.5	95.3	247	0	7.47	11.53	9.44	9.47	0.86
2017	197	0.50	15.20	7.10	6.58	3.57	0.044	0.094	0.072	0.074	0.010	7.38	8.48	7.63	7.60	0.14	0.7	1233.0	11.3	1.6	37.8	205.0	449	1	7.42	11.53	9.48	9.64	0.93
2018	218	0.10	16.61	7.25	6.89	3.77	0.033	0.114	0.073	0.075	0.011	7.25	7.91	7.58	7.57	0.11	0.1	1252.5	10.9	1.7	77.8	716.6	135	0	7.51	11.55	9.44	9.51	0.88
cumulative	***2332***	***-0.02***	***19.63***	***7.57***	***7.44***	***3.98***	***0.001***	***0.241***	***0.078***	***0.077***	***0.017***	***6.14***	***8.71***	***7.65***	***7.63***	***0.20***	***0.0***	***1260.2***	***11.0***	***1.4***	***64.2***	***716.6***	***3158***	***2***	***6.98***	***14.61***	***9.53***	***9.50***	***0.98***
Yankee Fork Salmon River 200 feet upstream of the Bonanza Rehabilitation Project reach - approximately 1160 feet downstream of Jordan Creek (44.3759, -114.7231)																													
2020	137	-1.54	17.78	9.48	9.81	4.49	–	–	–	–	–	–	–	–	–	–	0.2	1417.0	5.2	2.3	41.6	123.9	89	0	–	–	–	–	–
Yankee Fork Salmon River 800 feet downstream of the Bonanza Rehabilitation Project reach - 100 feet downstream of the bridge below Bonanza townsite (44.3677, -114.7251)																													
2020	138	0.81	15.55	8.83	9.65	3.75	–	–	–	–	–	–	–	–	–	–	0.0	1249.0	4.2	1.8	15.4	45.9	146	0	–	–	–	–	–
																							63[1]						
																							36[2]						
																							6[3]						
Yankee Fork at bridge on Yankee Fork road above Custer townsite – above the dredge tailings (44.39595, -114.67525)																													

2010	201	-0.02	15.94	6.52	6.35	3.46	0.003	0.064	0.054	0.057	0.008	7.4	8.0	7.7	7.7	0.1	0.0	513.2	2.5	0.0	19.8	145.6	85	0	7.59	13.14	9.67	9.62	0.93
2011	168	-0.05	15.47	6.56	6.65	3.69	0.000	0.073	0.052	0.055	0.008	7.4	8.0	7.7	7.7	0.1	0.0	1163.3	3.3	0.3	29.2	139.9	38	0	8.05	12.21	9.99	9.89	0.95
2012	196	-0.05	16.58	6.87	6.68	3.63	0.000	0.065	0.052	0.055	0.008	7.2	8.0	7.7	7.6	0.1	0.2	872.0	5.1	1.2	27.6	223.6	121	0	7.75	11.73	9.64	9.61	0.86
cumulative	***565***	***-0.05***	***16.58***	***6.65***	***6.54***	***3.59***	***0.000***	***0.073***	***0.052***	***0.056***	***0.008***	***7.2***	***8.0***	***7.7***	***7.7***	***0.1***	***0.0***	***1163.3***	***3.6***	***0.6***	***25.7***	***223.6***	***244***	***0***	***7.59***	***13.14***	***9.76***	***9.71***	***0.92***
West Fork at old mouth – attached to juvenile screw trap 2010-2014, and attached to t-post off river right bank 2015-2016 (44.34915, -114.72655)																														
2010	155	0.02	16.97	7.36	7.35	3.89	0.052	0.094	0.083	0.088	0.009	7.4	9.1	7.9	7.8	0.3	0.0	676.0	1.9	0.0	16.8	49.8	48	0	7.57	14.41	9.89	9.63	1.31
2011	219	0.01	16.72	6.53	6.19	3.79	0.000	0.104	0.074	0.083	0.020	7.3	8.5	7.8	7.7	0.2	0.0	897.5	4.6	0.0	21.9	74.6	98	0	7.86	12.11	9.85	9.90	0.88
2012	194	-0.06	17.72	7.41	7.31	3.85	0.042	0.233	0.076	0.080	0.019	7.4	8.1	7.7	7.7	0.2	0.0	919.1	3.8	0.7	21.7	129.6	53	0	7.64	11.32	9.48	9.46	0.88
2013	198	-0.10	19.26	8.32	8.25	4.71	0.045	0.129	0.080	0.083	0.015	6.8	8.4	7.7	7.6	0.2	0.0	1078.4	7.7	1.8	43.1	212.3	103	0	7.25	12.06	9.39	9.38	1.02
2014	177	0.17	18.17	8.51	8.44	3.75	0.003	0.104	0.080	0.087	0.018	6.9	8.0	7.5	7.5	0.2	0.1	804.8	8.9	1.2	42.5	258.7	167	0	7.54	11.12	9.10	9.04	0.81
2015	217	-0.04	19.28	8.52	8.29	4.09	0.053	0.191	0.096	0.093	0.040	6.9	8.3	7.7	7.6	0.2	0.0	1189.0	5.9	3.0	24.0	127.3	64	0	6.85	11.85	9.10	9.03	0.97
2016	61	0.06	16.95	6.41	5.30	4.16	0.050	0.089	0.068	0.067	0.009	7.00	7.97	7.45	7.39	0.19	0.6	340.1	18.8	9.6	27.4	88.6	262	0	7.78	11.64	9.83	10.07	0.98
cumulative	***1221***	***-0.10***	***19.28***	***7.72***	***7.51***	***4.12***	***0.000***	***0.233***	***0.081***	***0.083***	***0.024***	***6.76***	***9.12***	***7.68***	***7.67***	***0.24***	***0.0***	***1189.0***	***6.1***	***1.1***	***29.9***	***258.7***	***795***	***0***	***6.85***	***14.41***	***9.47***	***9.41***	***1.03***
West Fork at Virginia's cabin ~290m above new mouth (44.35396, -114.75398)																														
2016	189	0.85	18.77	8.26	7.74	3.72	0.048	0.099	0.077	0.083	0.016	7.50	8.12	7.75	7.69	0.13	0.1	352.6	3.7	1.0	8.9	46.1	31	0	7.27	11.48	9.36	9.43	0.84
2017	197	-0.03	16.63	7.24	6.75	3.97	0.043	0.095	0.073	0.079	0.016	7.43	8.29	7.78	7.74	0.16	0.0	534.7	10.4	0.9	26.7	322.4	588	1	7.69	11.69	9.57	9.59	0.92
2018	216	-0.04	18.17	7.54	7.13	4.19	0.044	0.096	0.077	0.084	0.016	7.27	8.25	7.72	7.72	0.19	0.1	224.3	3.5	0.9	6.5	29.6	5	0	7.57	11.55	9.47	9.46	0.87
cumulative	***602***	***-0.04***	***18.77***	***7.67***	***7.25***	***4.00***	***0.043***	***0.099***	***0.076***	***0.083***	***0.016***	***7.27***	***8.29***	***7.75***	***7.73***	***0.17***	***0.0***	***534.7***	***5.8***	***0.9***	***16.8***	***322.4***	***624***	***1***	***7.27***	***11.69***	***9.47***	***9.49***	***0.88***
Jordan Creek below bridge at mouth - at upper extent of the Yankee Fork dredge tailings and below the Jordan Creek dredge tailings and restoration area (44.37852, -114.72151)																														
2006	14	3.31	*12.28	6.58	6.05	2.33	0.070	0.110	0.085	0.084	0.005	7.6	7.9	7.7	7.7	0.1	0.0	853.8	18.5	1.5	84.0	39.0	37	0	9.76	10.94	10.42	10.48	0.32
2007	107	2.06	*22.32	10.12	9.31	4.36	0.003	0.238	0.109	0.091	0.044	7.5	8.3	7.8	7.8	0.2	0.0	924.5	0.2	0.6	62.9	150.9	106	0	6.89	11.18	8.92	8.97	0.81
2008	37	-0.01	*17.56	5.58	3.48	5.21	0.000	0.263	0.146	0.158	0.042	6.8	7.6	7.3	7.4	0.1	0.0	890.5	38.3	2.5	127.1	384.3	139	0	7.11	11.41	9.66	10.12	1.34
2009	170	-5.45	19.79	7.91	7.69	4.46	0.000	0.277	0.103	0.093	0.072	6.0	8.7	7.9	7.9	0.2	0.0	1218.8	135.5	3.1	287.3	1078.3	1930	3	6.80	13.27	9.40	9.37	1.12
2010	192	-0.04	18.88	7.26	7.16	4.31	0.001	0.168	0.128	0.139	0.028	6.2	8.3	7.7	7.6	0.1	0.0	1199.2	6.0	0.0	51.6	288.3	127	0	6.78	14.70	10.21	10.29	1.42
2011	219	-0.20	18.76	6.63	6.07	4.09	0.004	0.198	0.113	0.119	0.031	7.0	8.2	7.7	7.7	0.1	0.0	1210.1	17.7	0.3	85.9	762.0	469	0	7.21	11.61	9.69	9.76	0.99
2012	195	-0.05	19.42	7.85	7.53	4.09	0.000	0.184	0.106	0.118	0.035	7.4	8.0	7.7	7.7	0.1	0.0	1044.8	21.1	0.7	82.4	407.5	715	1	7.05	11.55	9.18	9.13	0.98
cumulative	***934***	***-5.45***	***22.32***	***7.50***	***7.13***	***4.36***	***0.000***	***0.277***	***0.113***	***0.120***	***0.045***	***6.0***	***8.7***	***7.7***	***7.7***	***0.2***	***0.0***	***1218.8***	***37.7***	***0.3***	***149.0***	***1078.3***	***3523***	***4***	***6.78***	***14.70***	***9.58***	***9.57***	***1.19***
Pond Series 1 outlet at upstream end of culvert under Yankee Fork road, at lower extent of dredge tailings (44.30648, -114.71905)																														
2013	12	9.84	16.99	12.17	11.54	1.80	0.056	0.107	0.089	0.105	0.022	6.9	8.0	7.4	7.3	0.2	0.3	281.5	3.2	0.6	17.0	25.7	3	0	5.70	10.59	7.50	7.30	1.31
Pond Series 1 lower pond outlet check structure, at lower extent of dredge tailings (44.30713, -114.71848)																														
2016	58	3.76	12.49	6.65	6.28	1.68	0.079	0.132	0.090	0.089	0.008	—	—	—	—	—	0.1	141.3	1.9	1.0	4.1	10.2	2	0	7.19	10.43	8.91	9.00	0.62
Pond Series 2 outlet - middle of dredge tailings, near Yankee Fork confluence (44.33287, -114.72301)																														
2013	47	8.77	18.65	13.86	14.03	2.35	0.102	0.144	0.123	0.119	0.014	7.0	8.4	7.4	7.4	0.2	0.0	37.6	1.2	0.6	2.6	12.5	0	0	4.79	10.27	7.61	7.69	1.02
Pond Series 3 outlet - middle of dredge tailings, near outlet, downstream of area of construction (44.33941, -114.72174)																														

2013	78	2.45	17.43	9.35	9.38	3.47	0.037	0.126	0.083	0.081	0.019	6.9	7.9	7.4	7.4	0.1	0.4	1250.0	9.6	2.1	70.1	277.0	43	0	6.01	10.36	8.48	8.53	1.06
Pond Series 4 outlet - middle of dredge tailings, near outlet and confluence with Yankee Fork (44.34451, -114.72568)																												
2013	21	11.39	17.76	14.80	14.77	1.34	0.086	0.105	0.097	0.098	0.005	7.1	7.6	7.3	7.3	0.1	1.8	59.6	6.9	5.2	5.6	14.8	2	0	6.32	8.71	7.34	7.30	0.53

*****Estimates only from data sets where recalibration gaps occurred in data collection during peak summer temperatures.
[1]number of readings >50NTU over entire season not associated with natural turbidity events, which occurred on 7/24 and 10/14, based on upstream turbidity meter.
[2]number of readings >50NTU during entire work window (7/8-10/28) not associated with the natural turbidity events that occurred on 7/24 and 10/14, based on upstream turbidity meter.
[2]number of times the average of values >50NTU through following hour exceeded 50NTU (ZID analysis), during entire work window (7/8-10/28) not associated with the natural turbidity events that occurred on 7/24 and 10/14, based on upstream turbidity meter.

Table 13. Summary of water quality SONDE data collected 2006-2020. Yearly and cumulative maximum, minimum, average, median and standard deviations for water temperatures, specific conductivity, pH, turbidity and dissolved oxygen; including the turbidity yearly and cumulative maximum daily average, the number of times the turbidity daily average exceeded 25NTU for greater than 10 consecutive days, and the number of times turbidity recording exceeded 50NTU.

2013-2020 Yankee Fork Restoration Project CHaMP Habitat Monitoring Efforts To-Date According to Split Panel Design								
Panel	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Annual	133	133	133 subsample	133 subsample	133 subsample	133 subsample	133	
			175					
	213	213	213	213	213		213	
			323		323		323	
			427	427				
			559	559			559	
	595	595		595	595	595		595 extended
				713	713 subsample	713 subsample	713 subsample	
	725	725	725	725	725			
	777	777	777	777	777	777	777	777
	835	835	835	835	835	835	835	
	1129	1129	1129 subsample	1129 subsample	1129 subsample	1129 subsample	1129 subsample	
			1328					
	1503	1503	1503	1503	1503	1503	1503	
	1709 YF	1709 YF	1709 YF	1709 side channel 1	1709 side channel 1	1709 side channel 1	1709 side channel 1	1709 side channel 1
Panel 1	106			106				
	214							
	427							
	482			482				
	559							
				654				

	828							
	836							
	1512			1512				
	1524			1524				
				1529				
				1633				
	1711			1711				
Panel 2		218			218			
		231			231			
		320			320			
		323						
		436			436			
		727			727			
		841			841			
		1288			1288			
		1411			1411			
		1582			1582			
				2010				
Panel 3			174			174		
			362					
			608			608		
			643					
			950					
			1078					
			1138			1138		
			1408			1408		
			1840					
			2044					
Step	851	851		851	851	851		851
Panels	901	901	901 subsample			901 subsample	901 subsample	
	1013	1013		1013	1013		1013	
	1196	1196			1196	1196		1196 extended
				1971	1971	1971	1971	1971
	2159	2159			2159 subsample		2159 subsample	
	2166	2166	2166	2166		2166	2166	

Table 14. Columbia Habitat Monitoring Program (CHaMP) habitat monitoring efforts to-date according to the split panel design 2013-2020.

2013-2021 Yankee Fork Restoration Project Summary of Columbia Habitat Monitoring Program (CHaMP) Habitat Survey Selected Sites Metrics and Shoshone Bannock Tribes Snorkel Survey Chinook salmon and *Oncorhynchus mykiss* Abundance

Site	Location	Treatment or Control	Latitude	Longitude	Habitat Survey Date	# Units	Discharge (cfs)	Thalweg Length (m)	Sinuosity	Average Bankfull Width (m)	Average Wetted Width (m)	Average Thalweg Depth (m)	Wetted Area (m^2)	#Pools	Pool Residual Depth (m)	#LWD/ 100m Bankfull	% Length Undercut	Snorkel Survey Date	# Units	#Chinook salmon	#Chinook salmon/ m^2 wetted area	#*Oncorhynchus mykiss*	#*Oncorhynchus mykiss*/ m^2 wetted area
840	Yankee Fork above McKay Cr.		44.51951	-114.55561	–	–	–	–	–	–	–	–	–	–	–	–	–	7/29/2015	17	0	0	0	0
436	Mckay Creek at mouth		44.48751	-114.54807	8/24/2014	14	2.8	125.3	1.3	4.8	2.9	0.2	359.3	5	0.16	1	21.34	7/23/2014	14	0	0	0	0
					–	–	–	–	–	–	–	–	–	–	–	–	–	9/19/2016	15	0	0	0	0
					7/15/2017	15	8.7	127.1	1.3	6.1	3.5	0.3	436.8	6	0.12	0	3.88	7/19/2017	15	0	0	0	0
608	Tenmile Creek at mouth		44.46841	-114.58562	7/26/2015	17	1.4	110.1	1.1	3.6	3.0	0.2	332.8	6	0.14	36	17.76	8/3/2015	17	2	0.0060	1	0.0030
					6/30/2018	10	7.9	116.2	1.1	5.0	3.6	0.3	413.7	1	0.41	73	13.83	7/10/2018	10	0	0	3	0.0073
2010	Yankee Fork below Tenmile Cr.		44.45952	-114.58693	8/20/2016	13	17.4	194.5	1.3	9.9	7.7	0.3	1540.5	4	0.26	34	26.03	8/31/2016	13	1	0.0006	2	0.0013
320	Yankee Fork above Ninemile Creek		44.45473	-114.59409	9/5/2014	10	17.7	135.7	1.1	10.8	9.0	0.3	1215.3	6	0.23	32	14.73	9/18/2014	10	9	0.0074	2	0.0016
					–	–	–	–	–	–	–	–	–	–	–	–	–	9/17/2016	11	0	0	0	0
					7/12/2017	7	60.9	136.7	1.1	11.8	10.0	0.5	1354.3	2	0.22	41	18.94	7/20/2017	8	17	0.0126	0	0
1078	Yankee Fork above Eightmile Cr.	C	44.42738	-114.61590	6/26/2015	14	31.7	300.2	1.4	10.1	8.1	0.4	2375.9	5	0.38	21	13.08	7/15/2015	14	15	0.0063	1	0.0004
828	Eightmile Cr. below Park Creek		44.46535	-114.66261	9/6/2013	11	0.8	121.4	1.3	4.5	2.4	0.1	295.1	4	0.11	9	9.11	9/19/2013	11	0	0	0	0
727	Eightmile Creek 0.6 mile above mouth	T	44.43348	-114.62464	8/25/2014	14	4.6	196.0	1.2	9.8	5.9	0.2	1137.8	8	0.32	50	11.23	7/23/2014	15	6	0.0053	2	0.0018
					–	–	–	–	–	–	–	–	–	–	–	–	–	9/15/2016	9	1	**0.0009**	0	0
					7/11/2017	17	30.6	198.9	1.2	12.7	7.7	0.5	1461.3	8	0.36	41	26.62	7/19/2017	18	4	0.0027	0	0
					2020 large woody debris added by SBT Salmon River Basin Nutrient Enhancement Project																		
1138	Eightmile Creek at mouth	T	44.42914	-114.62113	9/28/2015	10	3.7	161.0	1.1	8.0	5.2	0.3	834.4	4	0.63	6	0	9/30/2015	10	454	0.5441	0	0
					7/1/2018	9	22.7	159.9	1.1	11.5	7.2	0.4	1153.5	4	0.96	20	2.86	7/11/2018	9	0	0	1	0.0009
					2020 large woody debris added by SBT Salmon River Basin Nutrient Enhancement Project																		
1512	Yankee Fork below Eightmile Creek	T	44.42579	-114.62102	8/26/2013	10	20.8	275.7	1.1	16.7	11.3	0.3	3171.5	6	0.26	29	11.46	9/18/2013	10	279	0.0880	9	0.0028
					7/30/2014 to 8/15/2014 LWD placed by track-hoe, hand and helicopter																		
					7/25/2016	11	32.6	279.1	1.1	14.9	12.3	0.3	3515.5	5	0.36	33	18.03	8/2/2016	11	22	0.0063	14	0.0040
231	Yankee Fork 0.4 mile above Sixmile Creek	T	44.41433	-114.63318	6/30/2014	14	99.7	419.9	1.3	16.8	11.2	0.5	4608.3	6	0.44	30	9.72	7/8/2014	16	1864	0.4045	149	0.0323
					7/30/2014 to 8/15/2014 LWD placed by track-hoe, hand and helicopter																		
					9/7/2017	11	34.2	423.9	1.3	13.4	9.7	0.5	4023.5	4	0.74	14	7.67	9/7/2017	11	320	0.0795	75	0.0186
1524	Yankee Fork 0.2 mile above	T	44.41211	-114.63607	9/17/2013	11	21.0	289.2	1.2	12.9	8.5	0.4	2437.9	5	0.48	35	1.36	9/18/2013	11	416	0.1706	33	0.0135

	Sixmile Creek				7/30/2014 to 8/15/2014 LWD placed by track-hoe, hand and helicopter																		
					7/24/2016	9	32.8	299.5	1.2	17.0	9.5	0.4	2717.5	5	0.65	39	2.91	8/2/2016	*11*	19	0.0070	3	0.0011
1804	Sixmile Cr. 1.3 mi above mouth		44.40095	-114.62204	7/28/2015	20	1.2	122.4	1.3	4.5	3.0	0.2	395.3	7	0.13	52	0	8/4/2015	20	0	0	20	0.0506
175	Yankee Fork below Greylock Cr.	T	44.41108	-114.63964	7/30/2014 to 8/15/2014 LWD placed by track-hoe, hand and helicopter																		
					6/24/2015	14	51.5	340.4	1.1	17.1	12.4	0.4	4101.3	8	0.42	34	3.18	7/15/2015	14	51	0.0124	9	0.0022
559	Yankee Fork above Fivemile Creek	T	44.40883	-114.65125	8/27/2013	10	23.7	318.9	1.4	17.4	9.2	0.3	2941.0	5	0.40	18	4.84	9/18/2013	10	606	0.2061	130	0.0442
					7/30/2014 to 8/15/2014 LWD placed by track-hoe, hand and helicopter																		
					7/13/2015	15	36.9	331.3	1.5	16.9	10.1	0.4	3333.8	5	0.62	24	7.41	7/15/2015	15	14	0.0042	33	0.0099
					7/12/2016	12	45.1	314.2	1.4	19.9	11.7	0.4	3698.1	6	0.41	25	11.52	7/18/2016	12	3	0.0008	1	0.0003
					–	–	–	–	–	–	–	–	–	7	–	–	–	9/29/2016	12	9	**0.0024**	3	**0.0008**
					9/4/2019	10	33.7	267.6	1.1	16.6	10.1	0.4	2712.1	6	0.48	9	5.44	8/22/2019	10	0	0	1	0.0004
836	Fivemile Cr. 2.8 mi above mouth		44.37747	-114.61649	9/7/2013	16	0.2	114.5	1.2	3.2	1.8	0.1	207.6	7	0.12	59	18.31	10/2/2013	16	0	0	0	0
2044	Fivemile Cr. 2 mi above mouth		44.38780	-114.62612	7/29/2015	13	1.3	112.8	1.2	4.5	3.2	0.2	372.3	5	0.15	54	3.08	8/4/2015	13	0	0	0	0
1582	Fivemile Creek 0.5 mi above mouth		44.39795	-114.64926	8/26/2014	14	1.7	127.0	1.1	5.1	2.9	0.1	365.3	7	0.13	63	1.68	7/22/2014	15	0	0	0	0
					7/16/2017	12	8.6	131.5	1.2	4.6	3.4	0.3	463.4	5	0.21	38	3.38	7/19/2017	13	0	0	0	0
427	Yankee Fork below 4th of July Creek	T	44.39532	-114.67643	10/5/2013	8	42.0	247.1	1.1	12.5	9.0	0.5	2220.0	2	0.26	7	2.05	10/8/2013	8	1	0.0005	0	0
					7/6/2015-8/15/2015 LWD placed by track-hoe, hand and helicopter																		
					8/28/2015	16	22.2	254.1	1.0	11.7	9.1	0.4	2293.9	6	0.18	10	0.89	7/22/2015	16	226	0.0985	115	0.0501
					8/22/2016	14	24.8	249.8	1.0	12.0	9.2	0.4	2295.8	3	0.14	11	0	8/30/2016	14	9	0.0039	18	0.0078
1328	Yankee Fork above Swift Gulch	T	44.39381	-114.68039	7/6/2015-8/15/2015 LWD placed by track-hoe, hand and helicopter																		
					7/11/2015	8	48.6	215.5	1.1	13.3	10.2	0.5	2152.7	0	NA	8	0.88	8/18/2015	8	59	0.0274	53	0.0246
323	Yankee Fork below Adair Creek	T	44.38381	-114.70524	6/28/2014	8	142	388.1	1.2	17.7	12.3	0.5	5798.2	1	0.35	5	7.87	7/9/2014	8	151	0.0260	40	0.0069
					7/6/2015-8/15/2015 LWD placed by track-hoe, hand and helicopter																		
					8/15/2015	12	27.9	389.8	1.2	13.7	10.6	0.4	5188.3	0	NA	8	4.87	7/23/2015	12	337	0.0650	143	0.0276
					8/22/2017	9	54.4	414.8	1.3	13.3	9.8	0.5	4061.3	2	0.38	20	5.84	8/23/2017	10	97	0.0239	11	0.0027
					8/23/2019	10	32.5	413.4	1.3	14.4	9.7	0.5	4348.7	3	0.46	23	4.55	8/21/2019	*12*	51	0.0117	35	0.0080
174	Jordan Creek below Montana Gulch		44.42885	-114.72706	7/9/2015	16	2.9	116.6	1.3	6.9	3.9	0.2	517.0	9	0.19	23	4.06	9/22/2015	*15*	0	0	5	0.0097
					6/29/2018	22	11.8	98.8	1.2	8.0	5.0	0.4	622.8	11	0.24	32	8.08	7/10/2018	22	1	0.0016	20	0.0321
1408	Jordan Creek above Red Rock Creek		44.39460	-114.72914	6/27/2015	12	8.4	151.6	1.0	6.3	5.0	0.3	755.6	4	0.13	2	0	7/16/2015	12	0	0	5	0.0066
					6/27/2018	8	23.4	154.6	1.0	7.5	5.6	0.4	851.8	2	0.21	1	0	7/11/2018	8	1	0.0012	14	0.0164
851	Yankee Fork below Jordan Creek	C	44.37752	-114.72128	9/8/2013	8	17.0	295.1	1.1	13.6	9.8	0.3	2908.7	2	0.26	3	0	9/17/2013	8	147	0.0505	14	0.0048
					9/19/2014	11	27.6	301.1	1.1	16.2	11.1	0.4	3248.6	2	0.42	3	0	9/17/2014	11	277	0.0853	74	0.0228
					9/21/2016	4	25.9	298.5	1.1	14.7	10.9	0.4	3198.1	1	0.41	3	0	8/23/2016	4	3	0.0009	25	0.0078
					9/9/2017	7	44.5	303.2	1.1	15.6	11.4	0.4	3353.9	1	0.26	8	0	9/19/2017	7	3	0.0009	0	0.0000
					8/29/2018	6	40.3	302.0	1.1	14.7	11.4	0.4	3352.2	1	0.61	4	0	8/21/2018	6	0	0	1	0.0003
					9/30/2020	6	26.2	299.4	1.1	14.6	10.6	0.4	3122.9	1	0.19	13	0	9/23/2020	7	0	0	0	0
595	Yankee Fork Sluters Pitt at	T	44.37417	-114.72337	9/8/2013	9	20.7	299.8	1.1	14.0	9.9	0.3	2903.6	1	0.25	8	0	9/17/2013	10	146	0.0503	25	0.0086

	at Bonanza				9/20/2014	11	25.8	301.6	1.1	14.9	10.4	0.4	3039.8	1	0.16	6	0	9/17/2014	11	210	0.0691	94	0.0309
					8/23/2016	10	22.5	302.1	1.1	14.2	10.7	0.4	3161.0	1	0.19	5	0	8/31/2016	10	3	0.0009	26	0.0082
					9/9/2017	11	40.9	302.4	1.1	15.7	11.2	0.5	3327.1	2	0.40	9	0	9/19/2017	11	5	0.0015	8	0.0024
					8/29/2018	8	35.1	303.0	1.1	15.2	11.3	0.5	3343.5	1	–	4	0	8/9/2018	8	11	0.0033	22	0.0066
					7/8/2020-8/13/2020 removed dredge material, increased mainstem in meanders ~200m downstream, added ~500m side channel, added LWD as singles, jams, 2 avalanches and spawning gravels to 1 pool tail																		
595e	Yankee Fork Sluters Pitt at	T	44.37417	-114.72337	9/12/2020	12	–	386.6	1.4	14.6	7.5	0.5	2614.4	3	1.19	95	0	9/24/2020	15	1	0.0004	0	0
	Bonanza extended				8/19/2021	14	–	266.0*	–	–	9.1	–	2379.5	3	–	–	–	8/19/2021	14	1	0.0004	16	0.0067
1196	Yankee Fork at bridge below	T	44.36772	-114.72505	9/10/2013	6	20.1	319.1	1.1	16.7	11.0	0.3	3465.9	1	0.56	2	0	9/19/2013	6	321	0.0926	11	0.0032
	Bonanza				9/21/2014	6	27.9	324.1	1.1	15.9	11.8	0.4	3754.0	1	0.68	0	0	9/17/2014	6	216	0.0575	56	0.0149
					9/26/2017	10	53.6	307.3	1.1	16.1	13.7	0.5	3859.8	4	0.34	1	0	9/27/2017	6	42	0.0109	5	0.0013
					8/29/2018	6	35.4	287.1	1.1	16.5	12.4	0.4	3449.9	1	0.55	0	0	8/9/2018	6	0	0	2	0.0006
					7/8/2020-8/13/2020 removed dredge material, increased mainstem ~500m upstream in meanders, and down in split, added ~315m side channel, added boulders, LWD singles, jams, 1 avalanche, and spawning gravels to 2 pool tails																		
1196e	Yankee Fork at bridge below	T	44.36772	-114.72505	9/9/2020	18	30.9	660.9	1.2	15.7	8.4	0.4	6326.5	6	0.62	98	0	9/23/2020	*21*	0	0	0	0
	Bonanza extended				8/5/2021	25	–	848.0*	–	–	6.3	–	5985.2	8	–	–	–	8/18/2021	25	41	0.0069	90	0.0150
2166	Yankee Fork upper Preachers	T	44.36576	-114.72739	10/8/2013	5	56.8	377.6	1.1	20.2	12.7	0.4	4704.9	0	NA	1	3.46	10/9/2013	5	3	0.0006	0	0
	Cove reach				7/24/2014	12	48.7	379.6	1.1	17.9	13.3	0.4	4924.0	3	0.21	5	3.11	8/13/2014	13	191	0.0388	137	0.0278
					9/2/2014 - 9/11/2014 Preachers Plus Project - LWD and boulders installed from Bonanza Bridge downstream 1/2 mi																		
					9/17/2015	14	38.7	375.9	1.1	16.5	12.5	0.4	4648.8	4	0.26	13	2.07	8/4/2015	15	304	0.0654	195	0.0419
					9/6/2016	8	33.7	376.2	1.1	17.3	13.0	0.4	4829.1	0	NA	15	2.44	9/14/2016	8	6	0.0012	12	0.0025
					–	–	–	–	–	–	–	–	–	–	–	–	–	9/27/2016	8	4	**0.0008**	13	**0.0027**
					8/28/2018	10	46.8	376.6	1.1	17.8	12.6	0.5	4694.9	3	0.44	22	3.30	8/15/2018	*7*	1	0.0002	11	0.0023
					8/6/2019	10	53.1	372.7	1.1	17.3	12.7	0.4	4701.2	3	0.30	55	1.21	8/20/2019	10	0	0.0000	2	0.0004
835	Yankee Fork middle Preachers	T	44.36218	-114.72910	10/9/2013	8	51.7	355.3	1.1	17.4	13.2	0.4	4647.2	0	NA	3	0.29	10/9/2013	8	2	0.0004	3	0.0006
	Cove reach				8/8/2014	10	47.3	359.0	1.1	17.2	13.5	0.4	4787.1	3	0.15	7	0.72	8/11/2014	10	345	0.0721	272	0.0568
					9/2/2014 - 9/11/2014 Preachers Plus Project - LWD and boulders installed from Bonanza Bridge downstream 1/2 mi																		
					9/12/2015	13	25.6	356.9	1.1	16.8	13.1	0.4	4627.3	4	0.23	12	1.19	7/22/2015	13	439	0.0949	204	0.0441
					9/3/2016	9	34.2	359.8	1.1	16.9	12.9	0.4	4557.1	1	–	13	1.21	9/7/2016	9	71	0.0156	243	0.0533
					8/18/2017	11	63.2	355.6	1.1	16.9	12.6	0.5	4435.6	4	0.39	16	1.42	8/23/2017	11	70	0.0158	51	0.0115
					8/1/2018	11	54.0	356.5	1.1	17.1	12.9	0.5	4544.4	4	0.27	22	1.44	8/8/2018	*10*	5	0.0011	7	0.0015
					8/8/2019	12	53.1	361.5	1.1	16.1	12.3	0.5	4314.6	–	–	35	2.02	8/20/2019	12	2	0.0005	2	0.0005
777	Yankee Fork lower Preachers	C	44.35806	-114.72829	10/13/2013	6	43.9	344.9	1.0	15.8	11.9	0.4	4068.7	0	NA	2	0	10/9/2013	6	0	0	0	0
	Cove reach				7/13/2014	6	48.1	346.7	1.0	17.5	12.3	0.4	4171.6	0	NA	1	0	8/12/2014	6	235	0.0563	243	0.0583
					8/25/2015	6	30.4	343.3	1.0	16.4	12.2	0.3	4151.0	0	NA	1	0	7/21/2015	6	192	0.0463	223	0.0537
					9/7/2016	6	32.1	342.4	1.0	16.8	12.3	0.3	4174.2	0	NA	1	0	9/16/2016	6	8	0.0019	43	0.0103
					8/20/2017	6	60.3	348.8	1.0	17.6	12.6	0.4	4293.3	0	NA	2	0	8/23/2017	6	1	0.0002	8	0.0019
					8/1/2018	6	59.8	343.9	1.0	15.4	12.7	0.5	4316.1	0	NA	1	0	8/2/2018	6	2	0.0005	1	0.0002

					8/10/2019	6	53.1	346.7	1.0	17.5	12.4	0.4	4238.7	0	NA	0	0	8/20/2019	6	0	0	0	0
					9/10/2020	6	36.1	346.2	1.0	15.3	12.0	0.3	4081.6	0	NA	1	0	9/10/2020	6	0	0	0	0
1971	Yankee Fork new channel above West Fork including Side Channel 2	T	44.35427	-114.73061	7/20/2015 - 9/4/2015 new engineered channel with pools, riffles, LWD, boulders, spawning gravels and Side Channel 2																		
					7/24/2016	9	51.1	312.8	1.2	11.7	9.4	0.7	4533.1	2	0.81	86	0	8/3/2016	10	40	0.0088	34	0.0075
					7/31/2017	12	63.8	322.1	1.3	15.8	10.1	0.6	4236.3	4	0.71	87	0	8/2/2017	13	474	0.1119	133	0.0314
					7/30/2018	13	39.1	312.7	1.2	14.8	9.4	0.5	3811.7	5	0.64	73	0.33	8/1/2018	14	11	0.0029	9	0.0024
					8/24/2019	13	22.7	315.1	1.3	15.3	9.1	0.5	3775.8	5	0.50	88	0	8/14/2019	*14*	4	0.0011	9	0.0024
					9/9/2021	22	–	487.0	–	–	6.2	–	5244.7	6	–	–	–	9/9/2021	22	1	0.0002	9	0.0017
1709	Yankee Fork above West Fork	T	44.35171	-114.72803	10/3/2013	5	65.1	306.5	1.1	17.3	12.7	0.4	3899.5	1	0.20	0	0	10/8/2013	5	1	0.0003	2	0.0005
					8/21/2014	12	51.5	311.0	1.1	18.3	13.2	0.4	4087.3	4	0.17	1	0.41	9/3/2014	12	239	0.0585	89	0.0218
					8/29/2015	5	27.5	307.7	1.0	15.1	11.5	0.3	3775.5	0	NA	0	0	7/21/2015	*12*	221	0.0585	474	0.1255
					7/11/2016 to 8/29/2016 0.5 miles of Yankee Fork channel narrowed and reconstructed to form Side Channel 1																		
1709 SC1	Side Channel 1 below West Fork	T	44.35171	-114.72803	9/20/2016	26	–	300.1	1.1	2.8	2.1	0.2	631.7	12	0.41	26	1.34	10/11/2016	26	0	0	4	0.0063
					May-June 2017 spring runoff blows out installed features and engineered channel configuration in Side Channel 1																		
					7/30/2017	13	27.8	299.3	1.1	15.1	11.2	0.5	3566.7	5	0.27	44	1.12	8/2/2017	13	214	0.0600	32	0.0090
					7/29/2018	22	19.2	296.5	1.1	13.9	10.4	0.5	2977.9	12	0.26	32	6.84	7/31/2018	22	43	0.0144	41	0.0138
					7/25/2019	14	18.5	294.5	1.1	12.8	11.2	0.6	3589.7	8	0.33	25	0	8/22/2019	14	15	0.0042	239	0.0666
					9/12/2020	11	–	293.8	1.1	20.2	11.2	0.6	3737.0	7	0.55	19	0	9/10/2020	11	182	0.0487	316	0.0846
214	West Fork below Hindman Lake		44.38673	-114.89046	9/19/2013	11	6.4	118.5	1.2	4.2	3.4	0.3	399.8	4	0.14	58	10.46	10/2/2013	11	0	0	0	0
950	Cabin Creek 2.5 mi above mouth		44.42220	-114.85226	7/23/2015	18	3.2	165.6	1.1	6.2	4.5	0.2	726.6	7	0.19	68	6.07	8/5/2015	18	0	0	19	0.0261
482	West Fork below Cabin Creek		44.39625	-114.82510	9/18/2013	8	12.0	198.5	1.2	8.6	6.2	0.3	1228.5	3	0.23	17	15.57	9/24/2013	8	2	0.0016	2	0.0016
					8/5/2016	11	17.2	196.2	1.2	9.1	6.4	0.3	1251.0	3	0.26	21	24.04	8/17/2016	11	0	0	62	0.0496
218	West Fork 0.6 mile above Lightning Creek		44.39180	-114.80418	9/6/2014	13	14.0	286.5	1.4	9.8	6.9	0.4	1897.6	7	0.54	22	27.17	9/10/2014	13	10	0.0053	50	0.0263
					8/12/2017	14	28.6	279.5	1.3	10.9	7.8	0.4	2640.1	7	0.30	31	17.02	8/15/2017	18	0	0	137	0.0519
1411	West Fork 86m above Lightning Creek		44.38768	-114.79705	9/7/2014	9	15.5	291.4	1.3	11.5	8.9	0.3	2496.9	5	0.35	37	16.94	9/9/2014	10	17	0.0068	86	0.0344
					8/10/2017	15	29.4	298.3	1.3	17.1	8.9	0.4	3035.1	10	0.22	41	10.93	8/16/2017	17	2	0.0007	96	0.0316
1288	Lightning Creek 2.1 miles above mouth		44.41149	-114.78628	9/8/2014	15	4.1	153.8	1.1	7.4	4.6	0.3	718.9	7	0.16	41	1.94	8/27/2014	15	0	0	12	0.0167
					8/11/2017	11	9.9	151.3	1.1	7.5	6.0	0.3	909.5	5	0.15	21	1.65	8/15/2017	11	0	0	16	0.0176
362	Lightning Cr. 1 mi above mouth		44.39792	-114.78708	7/24/2015	11	8.6	170.3	1.2	8.5	6.1	0.2	1042.2	5	0.13	25	4.17	7/29/2015	11	0	0	4	0.0038
106	Lightning Creek 0.75 mile above mouth		44.39509	-114.78818	9/21/2013	12	4.8	162.4	1.1	7.2	4.9	0.2	789.5	8	0.18	22	2.96	9/24/2013	12	0	0	3	0.0038
					8/4/2016	16	5.8	168.5	1.1	7.9	5.6	0.2	926.5	4	0.23	18	4.23	8/16/2016	16	0	0	45	0.0486
1633	West Fork below Lightning		44.38205	-114.78992	8/6/2016	7	22.5	267.5	1.2	16.5	9.3	0.3	2406.9	2	0.35	12	6.07	8/17/2016	7	7	0.0029	142	0.0590
1711	West Fork above Deadwood		44.37528	-114.78004	9/22/2013	8	18.3	294.0	1.2	16.6	8.2	0.4	2305.0	4	0.66	45	2.56	9/25/2013	8	5	0.0022	11	0.0048
					8/7/2016	11	28.2	294.6	1.2	14.5	9.5	0.4	2702.9	5	0.68	46	0.79	8/18/2016	11	30	0.0111	169	0.0625
654	West Fork below Deadwood		44.37319	-114.76635	9/2/2016	13	25.3	254.8	1.9	13.0	9.2	0.3	2496.3	4	0.43	18	2.62	8/18/2016	*14*	22	0.0088	214	0.0857
643	West Fork 0.6 mi above Sawmill		44.36322	-114.74226	9/10/2015	7	18.3	291.7	1.6	13.7	10.6	0.3	3038.5	2	0.24	12	1.36	8/11/2015	7	196	0.0645	357	0.1175
1529	West Fork 40m above Sawmill		44.35769	-114.73797	7/26/2016	17	36.0	304.9	1.2	16.6	10.3	0.4	3294.3	7	0.33	17	18.50	8/30/2016	18	75	0.0228	224	0.0680

	Creek				–	–	–	–	–	–	–	–	–	–	–	–	–	9/18/2016	18	200	**0.0607**	238	**0.0722**
					–	–	–	–	–	–	–	–	–	–	–	–	–	9/28/2016	18	25	**0.0076**	71	**0.0216**
1013	West Fork at mouth	C	44.35320	-114.73263	8/24/2013	9	28.4	299.1	1.1	15.9	13.0	0.4	3733.5	4	0.32	14	7.00	9/5/2013	9	173	0.0463	59	0.0158
					10/7/2014	9	20.8	298.6	1.0	15.5	11.7	0.4	3543.3	3	0.36	19	9.80	8/7/2014	9	238	0.0672	58	0.0164
					6/29/2016	8	62.0	296.3	1.1	17.7	14.1	0.5	4072.1	3	0.45	12	6.57	7/12/2016	8	0	0	6	0.0015
					–	–	–	–	–	–	–	–	–	–	–	–	–	8/1/2016	8	4	**0.0010**	51	**0.0125**
					8/23/2017	6	39.3	324.0	1.1	16.4	12.1	0.5	4024.4	1	0.44	14	9.24	9/26/2017	10	454	0.1128	41	0.0102
					8/21/2019	7	26.7	300.8	1.1	18.1	13.0	0.4	3751.1	2	0.42	11	10.22	8/21/2019	7	12	0.0032	6	0.0016
213	Yankee Fork below West Fork	C	44.34794	-114.72449	10/13/2013	12	86.6	458.7	1.2	21.0	14.6	0.5	6878.6	3	0.65	3	0.55	10/8/2013	12	9	0.0013	0	0
					10/8/2014	11	51.3	461.4	1.2	19.0	14.2	0.5	6693.0	4	0.61	4	0	9/19/2014	11	419	0.0626	95	0.0142
					9/27/2015	10	54.0	457.5	1.2	18.1	14.4	0.5	6766.3	3	0.48	1	0.37	7/28/2015	10	124	0.0183	99	0.0146
					9/22/2016	9	54.2	458.9	1.2	17.3	14.0	0.5	6592.4	3	0.62	1	0	9/13/2016	9	4	0.0006	95	0.0144
					–	–	–	–	–	–	–	–	–	–	–	–	–	9/30/2016	9	0	0	9	**0.0014**
					9/25/2017	9	89.4	452.5	1.2	19.0	14.7	0.5	6725.2	3	0.27	2	0.63	9/21/2017	9	71	0.0106	15	0.0022
					–	–	–	–	–	–	–	–	–	–	–	–	–	8/15/2018	10	2	**0.0003**	1	**0.0001**
					9/5/2019	9	62.8	–	–	–	–	–	–	–	–	–	–	8/13/2019	9	5	**0.0007**	6	**0.0009**
725	Yankee Fork adjacent to PS3	C	44.34222	-114.72447	8/6/2013	11	61.4	503.3	1.2	20.7	14.6	0.4	7059.0	2	0.38	2	0.20	9/5/2013	11	158	0.0224	96	0.0136
					9/22/2014	11	54.4	501.6	1.2	20.7	14.9	0.5	7177.4	3	0.36	2	0.38	9/19/2014	11	173	0.0241	51	0.0071
					9/26/2015	12	45.1	496.5	1.1	19.9	14.9	0.4	7186.0	3	0.27	2	0	8/18/2015	12	100	0.0139	302	0.0420
					9/19/2016	12	56.5	496.8	1.1	20.4	15.2	0.5	7265.1	2	0.45	3	0.21	9/13/2016	12	1	0.0001	78	0.0107
					9/6/2017	11	87.1	501.4	1.2	20.2	16.5	0.6	7891.9	3	0.34	5	1.47	9/26/2017	11	12	0.0015	30	0.0038
					–	–	–	–	–	–	–	–	–	–	–	–	–	8/14/2018	9	0	0	4	**0.0005**
2159	Pond Series 3 full upper reach	T	44.34325	-114.72360	9/1/2012 - 11/20/2012 dredge material and check structures removed, dredge ponds filled, channel engineered with pools, riffles, backwater alcoves, added LWD and spawning gravels, installed inlet flow check structure																			
					7/22/2013	30	4.0	429.2	1.1	5.3	3.8	0.4	1910.6	14	0.46	9	2.71	8/14/2013	30	9	0.0047	2	0.0010
					7/3/2014	20	10.4	426.7	1.1	7.3	4.6	0.4	2344.2	12	0.54	13	6.24	7/10/2014	20	1203	0.5132	1543	0.6582
					–	–	–	–	–	–	–	–	–	–	–	–	–	9/20/2014	20	356	**0.1519**	182	**0.0776**
					–	–	–	–	–	–	–	–	–	–	–	–	–	7/14/2015	20	222	**0.0947**	396	**0.1689**
2159s	Pond Series 3 upper reach subsample	T	44.34325	-114.72360	7/30/2017	8	4.9	191.3	1.1	15.6	6.1	0.8	2215.1	4	0.85	25	5.27	8/1/2017	9	107	0.0483	47	0.0212
					7/23/2019	8	6.3	193.9	1.1	7.1	4.9	0.8	1535.5	5	0.72	13	13.70	8/27/2019	*10*	18	0.0117	2862	1.8639
					8/25/2021	8	–	245.3	–	–	5.3	–	1802.4	4	–	–	–	8/25/2021	8	57	0.0316	417	0.2314
1129	Pond Series 3 full lower reach	T	44.33943	-114.72179	9/1/2012 - 11/20/2012 dredge material and check structures removed, dredge ponds filled, channel engineered with pools, riffles, backwater alcoves, added LWD and spawning gravels, installed inlet flow check structure																			
					7/15/2013	25	4.2	420.7	1.0	6.6	4.5	0.7	2310.8	15	0.61	17	0	8/14/2013	17	607	0.2627	312	0.1350
					–	–	–	–	–	–	–	–	–	–	–	–	–	10/17/2013	25	37	**0.0160**	14	**0.0061**
					6/28/2014	18	10.1	419.1	1.0	6.5	4.8	0.7	2539.4	15	0.56	23	0.95	7/7/2014	18	387	0.1524	2570	1.0121
					–	–	–	–	–	–	–	–	–	–	–	–	–	9/20/2014	25	109	**0.0429**	64	**0.0252**
					–	–	–	–	–	–	–	–	–	–	–	–	–	7/14/2015	25	230	**0.0906**	604	**0.2379**

					–	–	–	–	–	–	–	–	–	–	–	–	–	8/5/2015	25	330	**0.1300**	2061	**0.8116**
					–	–	–	–	–	–	–	–	–	–	–	–	–	8/3/2016	18	17	**0.0162**	188	**0.1790**
1129s	Pond Series 3 lower reach subsample	T	44.33943	-114.72179	8/14/2015	9	1.1	197.3	1.0	5.8	3.7	0.5	734.7	4	0.31	17	0	9/22/2015	9	80	0.1089	165	0.2246
					8/22/2016	7	0.4	204.0	1.0	5.6	4.3	0.6	987.4	4	0.34	30	0	8/23/2016	7	10	0.0101	220	0.2228
					–	–	–	–	–	–	–	–	–	–	–	–	–	10/25/2016	7	48	**0.0486**	104	**0.1053**
					7/29/2017	6	6.0	198.1	1.0	5.8	4.3	0.6	1020.7	4	0.53	25	0	8/1/2017	6	41	0.0402	0	0
					7/12/2018	9	4.2	198.5	1.0	5.5	4.1	0.6	893.8	5	0.46	26	0	7/18/2018	9	7	0.0078	626	0.7004
					7/10/2019	10	6.3	203.6	1.0	–	4.3	0.6	1050.5	5	0.40	21	0	8/27/2019	10	1	0.0010	1324	1.2604
					8/25/2021	4	–	280.9	–	–	4.8	–	1337.9	4	–	–	–	8/25/2021	4	13	0.0097	522	0.3902
1503	Yankee Fork above Jerrys	C	44.33542	-114.72111	8/5/2013	6	70.5	416.4	1.1	20.1	15.8	0.4	6812.0	1	1.03	–	0	9/5/2013	6	69	0.0101	35	0.0051
					10/2/2014	7	56.3	435.9	1.2	21.3	16.3	0.5	6750.8	1	0.81	3	0.90	9/18/2014	7	105	0.0156	14	0.0021
					9/24/2015	8	57.2	421.5	1.1	20.0	16.6	0.5	6751.1	1	0.69	2	0.25	8/18/2015	8	68	0.0101	279	0.0413
					6/28/2016	8	200	420.1	1.1	21.5	17.7	0.6	7218.0	1	0.16	2	1.37	7/25/2016	8	23	0.0032	41	0.0057
					9/24/2017	8	91.8	430.5	1.2	21.3	17.0	0.5	7079.6	1	0.61	4	1.35	9/20/2017	8	3	0.0004	2	0.0003
					8/28/2018	8	70.8	413.1	1.1	20.9	16.8	0.5	6853.7	1	–	2	0.24	8/14/2018	8	0	0	2	0.0003
					8/25/2019	11	66.2	438.1	1.2	21.4	16.7	0.5	6806.5	2	0.48	10	0	8/14/2019	11	38	0.0056	20	0.0029
901	Pond Series 2 full upper reach	T	44.33763	-114.72311	7/24/2013	30	–	339.4	1.1	5.8	3.6	0.3	1370.7	14	0.28	1	0.06	10/1/2013	30	data	lost	data	lost
					10/1/2013 - 10/13/2013 old check structures removed, beaver dams removed, regraded 1 channel segment to establish perennial flow, 2 ponds filled and channels engineered, excavated floodplains, added LWD																		
					7/15/2014	40		349.0	1.2	4.5	2.5	0.2	925.5	22	0.22	23	0.21	7/22/2014	41	109	0.1178	365	0.3944
					–	–	–	–	–	–	–	–	–	–	–	–	–	8/5/2015	41	6	**0.0065**	430	**0.4646**
901s	Pond Series 2 upper reach subsample	T	44.33763	-114.72311	8/15/2015	20	–	212.6	1.2	5.0	3.6	0.3	798.0	9	0.29	34	0	8/11/2015	20	31	0.0388	238	0.2982
					7/15/2018	21	–	213.7	1.2	4.4	3.4	0.3	753.8	10	0.24	34	1.15	7/17/2018	21	0	0	1	0.0013
					7/12/2019	24	–	215.1	1.2	5.0	3.2	0.3	724.0	12	0.20	20	0.34	8/27/2019	24	0	0	3	0.0041
133	Pond Series 2 full lower reach	T	44.33472	-114.72303	8/4/2013	30	–	328.5	1.1	8.1	7.2	0.7	2398.5	14	0.28	8	0.49	10/1/2013	30	data	lost	data	lost
					10/1/2013 - 10/13/2013 old check structures removed, beaver dams removed, regraded 1 channel segment to establish perennial flow, 2 ponds filled and channels engineered, excavated floodplains, added LWD																		
					7/13/2014	36	–	336.9	1.1	3.9	3.3	0.2	1516.4	21	0.22	38	0.15	7/9/2014	36	208	0.1372	42	0.0277
					–	–	–	–	–	–	–	–	–	–	–	–	–	7/13/2015	36	60	**0.0396**	596	**0.3930**
					–	–	–	–	–	–	–	–	–	–	–	–	–	8/5/2015	36	53	**0.0350**	804	**0.5302**
133s	Pond Series 2 lower reach subsample	T	44.33472	-114.72303	8/10/2015	24	–	217.7	1.1	5.6	4.1	0.3	1261.5	13	0.19	54	0.27	8/11/2015	24	16	0.0127	390	0.3092
					6/27/2016	26	–	218.6	1.1	5.9	4.5	0.2	1307.8	15	0.17	46	0	7/11/2016	26	4	0.0031	309	0.2363
					7/13/2017	26	–	217.0	1.1	7.8	4.3	0.3	1292.3	14	0.20	60	0.23	7/18/2017	26	121	0.0936	31	0.0240
					7/13/2018	20	–	223.3	1.1	7.6	4.8	0.4	1367.8	10	0.23	60	0.25	7/17/2018	20	3	0.0022	1	0.0007
					7/14/2019	17	–	219.3	1.1	6.0	5.0	0.4	1432.2	9	0.29	40	0	8/21/2019	*18*	2	0.0014	39	0.0272
713	Pond Series 1 full reach	T	44.30859	-114.71746	7/11/2016	36	–	560.0	1.1	13.2	10.6	1.2	6161.6	20	1.03	5	0.37	7/12/2016	36	75	0.0122	3594	0.5833
					7/11/2017 to 8/24/2017 downstream end of lower pond filled for wetland including 2 clay dredge leakage plugs/diversion dams, outlet channel rerouted out of dredge material, LWD added																		
713s	Pond Series 1 subsample	T	44.30859	-114.71746	9/11/2017	21	1.3	394.8	1.2	9.1	7.4	1.0	3020.6	11	0.90	18	0	9/27/2017	21	33	0.0109	377	0.1248

					8/29/2018	13	–	393.8	1.2	9.0	7.2	0.8	2903.4	7	0.95	15	0	8/21/2018	13	13	0.0045	655	0.2256
					7/23/2019	13	–	393.3	1.2	11.1	8.8	0.8	3452.9	9	0.89	16	0.76	8/27/2019	13	12	0.0035	242	0.0701
841	Yankee Fork below Flat Rock	C	44.29027	-114.71874	10/5/2014	7	64.4	325.0	1.1	16.4	11.8	0.7	3770.9	1	0.74	3	0	9/20/2014	7	2	0.0005	9	0.0024
					9/25/2017	9	106	319.9	1.1	16.3	12.4	0.8	3910.7	1	0.23	8	0.40	9/28/2017	9	8	0.0020	40	0.0102
Values in **bold** are estimated densities based on previous or subsequent years surveyed values for habitat surface area. *Wetted thalweg length only.																							

Table 15. Summary of Columbia Habitat Monitoring Program (CHaMP) and snorkel monitoring sites, locations, dates surveyed, selected habitat metrics, and fish abundance 2013-2021. Site number, stream name and location description, site category if treatment or control, site coordinates, date habitat surveyed, number of habitat units delineated, discharge, thalweg length, sinuosity, average bankfull and wetted widths, wetted area, number of pools, residual pool depths, percent length undercut, date snorkeled, number of snorkel units delineated, Chinook salmon and *Oncorhynchus mykiss* numbers and abundance per wetted surface area. Table also includes treatment dates and general description of habitat changes made.

2014-2019 Yankee Fork Restoration Project CHaMP Site Benthic Macroinvertebrate Targeted Riffle Sample Results (m^2)

Site	Date	Total biomass (mg)	Total taxa richness	Total abundance	EPT taxa richness	% EPT abundance	% Ephemeroptera (mayflies) by abundance	% Plecoptera (stoneflies) by abundance	% Trichoptera (caddisflies) by abundance	% Chironomidae (midges) by abundance	% Dominant taxa (3)	% Total pollution tolerant by abundance[1]	% Total pollution sensitive (intolerant) by abundance[1]	% Total unknown pollution tolerance by abundance[1]	Weighted Average of Tolerance Values[2]	Weighted Average of Tolerance Values Rating[2]	% Unknown Tolerance Value by abundance[2]	% Semivoltine (> 1 year life cycle) by abundance	% Univoltine (1 year life cycle) by abundance	% Multivoltine (< 1 year life cycle) by abundance	% Predator by abundance	% Collector (total) by abundance	% Shredder by abundance	% Scraper by abundance	B-IBI Score[3]	B-IBI Score Rating[3]	Idaho O:E Model Calculations
106	8/16/2016	71.4	26	253	12	18.2	2.7	9.6	5.9	6.4	65.8	0	2.7	97.3	**5**	good	3.7	2.7	80.7	15.5	27.8	65.8	4.3	1.6	**30**	fair	**0.40**
133	8/4/2016	293.4	35	829	11	3.4	1.1	0.4	2.0	46.7	56.7	24.5	0.5	75.0	**4**	very good	1.4	23.2	21.0	55.3	26.1	62.5	3.1	8.2	**28**	fair	**0.41**
133	10/4/2017	33.5	15	122	2	3.3	0	1.1	2.2	3.3	81.1	10.0	0	90.0	**4**	very good	2.2	72.2	10.0	15.6	16.7	72.2	2.2	8.9	**18**	poor	**0.48**
133	10/11/2018	7.3	2	12	0	0	0	0	0	0	100	11.1	0	88.9	**9**	very poor	0	11.1	88.9	0	0	0	0	11.1	**14**	very poor	**0.42**
133	9/17/2019	24.3	16	104	7	20.8	9.1	10.4	1.3	7.8	61.0	33.8	2.6	63.6	**4**	very good	1.3	66.2	23.4	10.4	11.7	55.8	10.4	22.1	**18**	poor	**0.44**
174	9/13/2018	273.1	30	286	10	19.3	15.6	2.4	1.4	36.3	54.2	9.4	5.2	85.4	**6**	fair	3.3	3.8	36.8	57.5	14.2	27.8	48.6	8.0	**24**	poor	**0.62**
213	10/12/2016	451.9	46	825	23	62.8	25.6	8.9	28.2	8.4	36.0	3.2	17.2	79.6	**3**	excellent	7.5	30.2	41.2	22.6	47.5	21.8	16.3	14.2	**46**	excellent	**0.85**
213	9/27/2017	186.1	49	1006	28	73.8	35.9	15.0	22.9	17.2	31.7	0.7	14.8	84.4	**3**	excellent	1.1	12.8	54.4	32.2	22.5	39.9	15.8	20.7	**48**	excellent	**0.79**
213	8/17/2018	45.4	39	501	24	84.4	65.5	5.7	13.2	6.2	52.6	0.8	8.4	90.8	**3**	excellent	2.2	10.2	43.4	44.2	15.6	48.2	6.7	28.3	**40**	good	**0.81**
213	9/11/2019	188.0	54	500	27	63.5	34.3	12.7	16.5	14.3	30.3	1.1	27.8	71.1	**3**	excellent	1.4	17.3	53.2	28.4	35.9	30.3	4.6	28.9	**46**	excellent	**0.88**

218	9/8/2017	747.1	53	3168	34	56.9	23.4	23.4	10.1	2.6	42.6	0	11.2	88.8	**3**	excellent	0.5	6.0	78.2	14.8	27.4	50.6	6.4	14.6	**48**	excellent	**0.62**
231	10/5/2017	84.6	29	364	13	22.7	0.4	12.3	10.0	1.5	62.8	0.4	8.6	91.1	**4**	very good	3.3	23.4	63.2	11.5	28.6	64.3	0.4	5.2	**36**	fair	**0.54**
320	9/20/2017	1275.4	47	4695	30	79.6	54.9	15.9	8.8	7.1	50.6	0	30.6	69.4	**3**	excellent	1.0	13.8	45.3	40.2	18.5	48.2	10.5	21.1	**46**	excellent	**0.43**
323	9/20/2017	60.1	57	755	29	57.4	41.9	7.9	7.7	7.9	39.4	0.2	8.4	91.4	**4**	very good	0.9	5.7	52.8	40.8	27.4	48.8	7.2	15.4	**48**	excellent	**0.51**
323	9/10/2019	240.9	57	836	32	62.7	43.1	11.8	7.8	13.1	24.8	1.5	36.2	62.3	**3**	excellent	0.6	10.1	60.8	28.0	25.6	27.1	10.1	35.3	**50**	excellent	**0.76**
427	10/11/2016	72.3	50	693	27	56.5	30.8	9.6	16.2	22.0	32.0	0.4	35.7	63.9	**3**	excellent	1.6	13.8	49.9	27.7	29.6	18.5	31.2	17.3	**48**	excellent	**0.79**
436	8/31/2017	711.2	46	1193	26	67.4	43.8	17.5	6.1	12.7	33.1	0	30.2	69.8	**3**	excellent	1.3	11.1	56.5	31.3	22.2	47.2	10.7	19.3	**42**	good	**0.69**
482	8/17/2016	59.1	42	488	24	61.2	41.8	6.9	12.5	8.6	48.5	0	26.3	73.7	**3**	excellent	4.4	1.7	79.8	17.5	18.8	32.4	11.9	36.8	**42**	good	**0.73**
559	10/11/2016	411.4	50	703	28	54.2	13.1	18.5	22.7	7.5	38.3	0.2	18.1	81.7	**3**	excellent	3.7	36.0	35.2	15.2	39.0	34.6	13.7	8.7	**48**	excellent	**0.68**
559	8/29/2019	518.0	45	854	22	71.5	11.9	14.4	45.3	8.6	49.5	0.2	42.0	57.8	**3**	excellent	0.5	21.0	63.1	15.0	32.3	28.3	0.5	38.1	**46**	excellent	**0.42**
595	9/30/2014	353.9	39	963	22	85.1	55.4	7.5	22.1	8.9	41.9	0.2	12.1	87.7	**2**	excellent	0.4	18.9	62.1	10.0	21.6	32.3	22.3	23.0	**42**	good	**0.26**
595	10/20/2016	453.9	48	424	21	40.4	9.6	5.7	25.2	22.0	36.6	1.0	18.2	80.9	**4**	very good	5.7	28.3	21.3	32.8	41.7	26.8	23.2	6.1	**44**	good	**0.68**
595	9/26/2017	73.3	50	906	26	60.5	40.8	7.3	12.3	27.0	31.5	0.4	16.5	83.2	**4**	very good	1.1	7.3	40.6	51.7	13.6	54.4	10.9	20.4	**46**	excellent	**0.48**
595	10/5/2018	123.6	19	80	15	89.8	37.3	32.2	20.3	6.8	44.1	0	55.9	44.1	**1**	excellent	0	23.7	64.4	8.5	49.2	11.9	8.5	30.5	**32**	fair	**0.51**
608	10/4/2018	475.3	19	472	15	98.0	51.6	44.7	1.7	1.7	75.1	0	86.0	14.0	**1**	excellent	0.3	2.6	95.1	2.3	10.0	2.9	37.0	50.1	**26**	poor	**0.81**
654	8/18/2016	186.9	42	1225	22	57.4	47.4	4.8	5.1	6.3	61.9	1.3	19.7	79.0	**3**	excellent	0.2	6.1	80.5	12.1	10.5	45.0	3.9	39.7	**42**	good	**1.09**
713	8/8/2016	977.3	21	1255	3	6.8	0.5	0	6.3	86.2	85.8	3.2	0	96.8	**4**	very good	1.1	0	11.3	87.8	4.8	87.6	6.1	0	**16**	very poor	**0.40**
713	10/5/2017	141.5	19	132	2	2.0	0	0	2.0	11.2	72.4	52.0	0	48.0	**8**	poor	2.0	5.1	71.4	22.4	58.2	37.8	1.0	1.0	**18**	poor	**0.39**
713	10/4/2018	74.6	27	119	4	9.1	0	4.5	4.5	36.4	43.2	15.9	0	84.1	**6**	fair	2.3	9.1	44.3	44.3	43.2	43.2	10.2	2.3	**26**	poor	**0.37**
713	9/11/2019	70.9	27	108	6	11.3	7.5	1.3	2.5	42.5	36.3	13.8	2.5	83.8	**6**	fair	1.3	1.3	27.5	70.0	36.3	38.8	22.5	1.3	**24**	poor	**0.72**
725	10/12/2016	928.4	46	3191	23	73.7	49.4	8.2	16.2	10.9	41.4	1.3	10.7	88.0	**2**	excellent	5.3	15.4	59.9	23.6	26.0	21.8	8.0	44.1	**46**	excellent	**0.92**
725	10/3/2017	727.0	52	2464	29	83.0	45.9	20.5	16.6	6.4	35.5	1.1	8.4	90.5	**2**	excellent	0.7	14.8	65.3	19.2	22.7	30.0	17.2	29.8	**48**	excellent	**0.88**
725	8/24/2018	14.7	13	49	11	94.4	38.9	55.6	0	2.8	58.3	0	50.0	50.0	**1**	excellent	0	2.8	94.4	2.8	16.7	8.3	41.7	33.3	**26**	poor	**0.84**
727	8/31/2017	245.8	47	1578	25	53.0	14.9	34.9	3.3	13.9	42.2	0	7.0	93.0	**3**	excellent	10.5	4.0	59.6	36.0	63.9	19.3	9.9	7.0	**44**	good	**0.69**
777	9/4/2014	449.8	43	1099	20	81.4	46.3	4.1	31.0	12.4	53.7	0	29.7	70.3	**2**	excellent	1.5	16.2	64.6	12.9	18.1	21.2	6.8	53.3	**40**	good	**0.30**
777	10/20/2015	948.6	36	2323	16	79.4	36.0	4.0	39.4	11.5	55.8	1.6	10.5	88.0	**2**	excellent	0	38.2	44.7	16.1	41.2	41.0	6.3	11.2	**36**	fair	**0.26**
777	9/4/2018	0.7	7	14	0	0	0	0	0	10.0	60.0	10.0	0	90.0	**5**	good	10.0	40.0	10.0	50.0	50.0	40.0	0	10.0	**20**	poor	**0.31**
777	10/2/2019	125.0	16	64	7	59.6	2.1	19.1	38.3	2.1	55.3	4.3	19.1	76.6	**3**	excellent	2.1	61.7	23.4	12.8	72.3	23.4	0	4.3	**26**	poor	**0.42**
835	9/3/2014	286.2	31	657	18	75.5	46.3	3.5	25.7	9.5	53.3	0	24.3	75.7	**2**	excellent	14.6	30.0	44.9	10.1	28.2	37.4	1.6	32.7	**36**	fair	**0.18**
835	7/28/2015	2275.7	54	7662	23	66.0	40.0	2.6	23.3	22.8	37.9	1.8	10.9	87.3	**4**	very good	3.0	18.2	28.7	30.0	22.9	51.1	4.1	20.1	**46**	excellent	**0.43**
835	9/4/2018	3.2	5	11	1	12.5	0	0	12.5	0	75.0	12.5	0	87.5	**7**	fairly poor	12.5	25.0	0	75.0	87.5	0	0	12.5	**18**	poor	**0.35**
835	10/2/2019	302.3	28	289	14	20.1	6.1	4.2	9.8	1.4	67.3	4.7	2.3	93.0	**4**	very good	5.1	51.9	11.7	36.0	46.3	44.9	0.5	8.4	**34**	fair	**0.36**
841	10/5/2017	48.0	33	238	17	55.1	12.5	5.7	36.9	6.3	34.7	11.4	18.8	69.9	**3**	excellent	7.4	26.1	47.7	24.4	35.8	17.0	14.2	33.0	**42**	good	**0.75**

851	9/30/2014	123.8	38	531	25	81.4	58.3	4.8	18.3	5.6	45.0	0	12.2	87.8	**3**	excellent	3.1	11.5	73.0	7.6	13.0	17.8	39.7	28.5	**40**	good	**0.37**
851	10/20/2016	110.7	30	119	15	46.6	4.5	9.1	33.0	10.2	38.6	3.4	12.5	84.1	**3**	excellent	2.3	44.3	22.7	15.9	40.9	39.8	6.8	8.0	**38**	good	**0.52**
851	9/26/2017	190.3	55	1113	30	55.6	36.1	7.8	11.7	24.4	37.3	0.2	15.8	84.0	**4**	very good	0.7	5.8	45.4	47.5	20.2	49.7	9.8	19.9	**48**	excellent	**0.47**
851	10/5/2018	192.6	19	114	18	98.8	69.0	16.7	13.1	0	60.7	0	51.2	48.8	**1**	excellent	0	15.5	77.4	6.0	23.8	8.3	6.0	61.9	**34**	fair	**0.48**
901	10/11/2018	9.9	7	14	3	60.0	30.0	30.0	0	20.0	60.0	0	40.0	60.0	**2**	excellent	10.0	0	80.0	20.0	20.0	0	50.0	30.0	**20**	poor	**0.55**
901	9/17/2019	161.5	36	358	19	43.0	15.8	22.3	4.9	9.1	48.7	15.5	12.8	71.7	**3**	excellent	2.6	44.9	39.6	14.3	14.3	42.3	21.9	21.5	**40**	good	**0.61**
1013	10/4/2017	325.1	47	2093	27	59.3	38.6	12.9	7.9	16.4	30.5	1.2	7.4	91.4	**3**	excellent	2.3	10.2	58.8	30.6	18.7	46.7	11.8	22.4	**46**	excellent	**0.22**
1013	9/12/2019	392.9	50	976	23	50.2	30.1	11.9	8.1	6.5	41.9	2.0	15.1	79.4	**3**	excellent	2.2	30.1	46.1	22.5	32.7	39.0	6.1	17.7	**44**	good	**0.34**
1129	10/21/2015	539.2	37	2873	10	5.1	4.1	0.2	0.9	41.4	71.1	1.6	0.7	97.7	**6**	fair	1.4	0.9	46.7	51.0	41.1	25.6	29.5	3.2	**30**	fair	**0.15**
1129	10/20/2016	32.8	26	176	5	6.9	1.5	0	5.4	8.5	53.1	13.8	3.1	83.1	**5**	good	0.8	25.4	39.2	33.1	46.2	22.3	3.1	4.6	**26**	poor	**0.22**
1129	10/13/2017	89.7	28	411	5	2.0	1.3	0.3	0.3	8.9	64.8	6.6	1.0	92.4	**6**	fair	0.7	6.3	67.8	25.3	60.2	22.7	8.2	5.3	**24**	poor	**0.27**
1129	10/5/2018	167.0	24	128	17	90.5	37.9	26.3	26.3	7.4	50.5	0	25.3	74.7	**2**	excellent	0	23.2	66.3	9.5	44.2	8.4	7.4	40.0	**34**	fair	**0.31**
1129	9/11/2019	16.6	25	105	7	23.1	19.2	0	3.8	50.0	50.0	7.7	11.5	80.8	**5**	good	2.6	6.4	26.9	62.8	15.4	42.3	15.4	23.1	**22**	poor	**0.29**
1138	9/14/2018	94.2	23	97	19	93.1	40.3	45.8	6.9	5.6	38.9	0	36.1	63.9	**1**	excellent	0	6.9	84.7	8.3	50.0	11.1	12.5	26.4	**38**	good	**0.47**
1196	9/30/2014	124.9	41	840	23	78.1	54.5	3.9	19.7	11.7	54.5	0	10.2	89.8	**3**	excellent	0.6	9.1	73.7	12.8	13.4	15.4	47.7	22.3	**40**	good	**0.44**
1196	10/4/2017	35.5	44	343	26	61.4	37.0	9.1	15.4	18.1	33.5	1.2	12.2	86.6	**4**	very good	2.8	15.7	40.2	43.7	28.0	47.2	6.7	16.9	**48**	excellent	**0.49**
1196	10/5/2018	69.2	42	338	19	41.6	21.2	6.0	14.4	33.2	26.0	8.0	7.6	84.4	**4**	very good	1.2	22.4	29.6	46.0	24.0	35.6	18.4	17.6	**46**	excellent	**0.44**
1288	9/8/2017	204.5	60	2423	30	56.5	16.5	27.9	12.1	12.5	29.0	0.0	19.5	80.5	**3**	excellent	19.9	4.8	52.2	32.3	44.4	23.6	21.6	10.4	**48**	excellent	**0.39**
1408	9/13/2018	35.9	23	104	18	90.9	49.4	19.5	22.1	2.6	39.0	0	45.5	54.5	**1**	excellent	0	15.6	76.6	6.5	31.2	10.4	11.7	46.8	**36**	fair	**0.54**
1411	9/8/2017	564.5	51	2833	30	81.6	38.3	31.8	11.4	4.7	32.7	0.4	18.1	81.6	**2**	excellent	7.5	7.2	75.1	9.3	30.6	33.1	8.2	27.7	**48**	excellent	**0.61**
1503	9/27/2017	218.4	59	1454	30	65.0	44.8	8.9	11.3	18.1	32.4	1.4	13.4	85.2	**3**	excellent	1.4	8.0	56.1	35.5	15.3	49.8	8.4	25.1	**48**	excellent	**0.27**
1503	8/17/2018	28.8	44	454	25	67.9	46.4	5.1	16.4	18.8	46.1	1.5	13.7	84.8	**4**	very good	0.6	10.4	37.2	51.2	14.3	57.4	11.3	16.4	**44**	good	**0.33**
1503	9/10/2019	390.4	50	932	26	74.1	50.5	11.0	12.7	14.4	39.5	0.8	19.5	79.8	**3**	excellent	1.1	11.5	64.7	23.6	24.6	36.5	6.6	31.6	**48**	excellent	**0.64**
1512	8/8/2016	65.5	23	215	10	28.3	0	1.3	27.0	7.5	61.6	0.6	3.1	96.2	**3**	excellent	5.7	56.6	20.8	22.0	27.7	58.5	12.6	1.3	**32**	fair	**0.20**
1524	8/8/2016	76.4	30	182	12	34.8	20.0	5.9	8.9	8.1	47.4	0	5.2	94.8	**4**	very good	7.4	25.2	37.8	34.1	36.3	35.6	6.7	20.7	**28**	fair	**0.39**
1529	10/12/2016	217.2	53	708	28	61.3	24.8	11.1	25.4	5.2	35.3	1.7	10.9	87.4	**2**	excellent	2.7	31.9	44.3	11.5	28.4	34.7	7.6	29.2	**48**	excellent	**0.60**
1582	8/31/2017	264.9	50	1462	26	75.8	21.8	37.9	16.1	3.9	44.7	0.4	44.7	54.9	**2**	excellent	3.5	4.1	76.5	12.4	18.9	21.6	33.8	23.5	**44**	good	**0.64**
1633	8/18/2016	40.0	30	166	18	74.0	57.7	10.6	5.7	13.8	36.6	1.6	31.7	66.7	**2**	excellent	0	9.8	61.8	26.8	15.4	35.0	12.2	37.4	**34**	fair	**0.67**
1709	9/26/2017	483.7	62	1687	27	47.5	30.3	10.2	7.0	34.9	29.2	0.9	7.6	91.5	**4**	very good	3.9	8.1	40.3	47.3	13.1	57.9	12.8	13.7	**46**	excellent	**0.98**
1709	9/13/2018	188.2	29	176	22	90.8	56.9	16.2	17.7	1.5	43.8	0.8	13.1	86.2	**1**	excellent	0.8	19.2	68.5	10.8	26.2	18.5	3.1	51.5	**44**	good	**0.94**
1709	9/13/2019	0.1	3	9	0	0	0	0	0	0	100	0	0	100	**8**	poor	14.3	0	0	100	100	0	0	0	**18**	poor	**0.23**
1711	8/18/2016	326.5	53	995	27	74.3	60.4	10.4	3.5	14.8	38.9	0.2	21.5	78.3	**2**	excellent	0.2	4.1	70.9	22.8	8.9	37.4	6.5	47.0	**44**	good	**1.08**
1971	8/4/2016	208.9	32	1522	17	23.6	16.0	0.9	6.7	4.8	79.6	0.2	4.8	95.0	**5**	good	4.3	6.4	82.8	6.2	7.8	80.6	1.6	9.4	**28**	fair	**0.52**

1971	9/23/2017	431.1	39	473	19	36.0	5.1	9.1	21.7	1.4	45.7	6.0	6.0	88.0	**4**	very good	1.7	44.3	21.4	33.4	48.3	37.1	0.3	11.7	**42**	good	**0.59**
1971	10/4/2018	537.7	27	232	20	92.4	49.4	27.9	15.1	4.1	44.2	0.6	25.6	73.8	**1**	excellent	0	19.2	70.9	9.3	40.1	7.0	7.0	45.3	**42**	good	**0.64**
1971	9/12/2019	241.8	34	299	16	49.8	7.2	27.6	14.9	18.6	35.3	5.0	14.0	81.0	**3**	excellent	3.2	25.3	42.1	32.6	52.9	29.4	4.1	12.7	**40**	good	**0.54**
2010	10/11/2016	782.9	41	1404	24	56.5	27.3	7.0	22.2	5.1	31.0	0.2	28.7	71.1	**2**	excellent	16.1	24.7	35.9	18.2	41.3	36.6	6.1	7.6	**42**	good	**0.75**
2159	10/13/2017	343.6	55	1838	11	15.6	3.1	11.9	0.6	33.3	34.0	2.6	0.0	97.4	**5**	good	2.0	4.8	41.0	52.4	37.1	32.7	23.0	2.8	**34**	fair	**0.41**
2159	9/9/2019	47.7	55	682	20	24.2	20.8	2.2	1.2	61.4	50.7	0	8.3	91.7	**5**	good	0.4	3.4	24.4	71.9	4.6	50.1	34.1	8.9	**38**	good	**0.49**
2166	9/3/2014	546.4	36	2635	17	41.7	27.9	0.9	13.0	44.3	49.9	0	15.2	84.8	**4**	very good	0.2	4.4	46.3	44.6	5.0	58.1	13.0	23.1	**32**	fair	**0.19**
2166	8/27/2015	821.4	45	4532	19	57.8	35.6	2.1	20.0	31.1	31.5	0.4	16.6	83.0	**4**	very good	0.5	14.1	40.6	32.6	15.2	52.8	14.8	15.7	**42**	good	**0.49**
2166	8/30/2018	194.7	41	305	24	80.5	35.0	18.1	27.4	5.3	35.8	2.2	16.4	81.4	**2**	excellent	1.8	31.9	49.1	16.4	38.5	28.3	7.5	25.7	**44**	good	**0.38**
2166	10/2/2019	343.4	48	704	23	52.2	9.4	16.5	26.3	11.5	38.8	2.7	15.9	81.4	**3**	excellent	1.7	31.1	46.3	19.0	45.3	40.1	2.9	11.5	**44**	good	**0.41**

[1] Values based on the Puget Sound Lowlands Stream Benthos database of classifications of Pollution Tolerance, Tolerant (T) or Sensitive / Intolerant (S) (Puget Sound 2020), [2] values and ratings based on Hilsenhoff 1987 biotic index 1-10 classification of macroinvertebrate tolerance of organic waste (Hilsenhoff 1987), [3] values and ratings based on the Puget Sound Lowlands Stream Benthos 10-50 B-IBI: Fine Resolution (Species-Family) (Puget Sound 2020).

Table 16. Summary of Columbia Habitat Monitoring Program (CHaMP) macroinvertebrate sampling results 2014-2019. Site number, date sampled, total sample biomass (mg), total taxa richness, total abundance, EPT taxa richness, % EPT taxa abundance, % Ephemeroptera (mayflies) by abundance, % Plecoptera (stoneflies) by abundance, % Trichoptera (caddisflies) by abundance, % Chironomidae (midges) by abundance, % Dominant taxa (3), % Total pollution tolerant by abundance, % Total pollution sensitive (intolerant) by abundance, % Total unknown pollution tolerance by abundance, weighted average of Tolerance Values and rating, % Unknown Tolerance Value by abundance, % Semivoltine (> 1 year life cycle) by abundance, % Univoltine (1 year life cycle) by abundance, % Multivoltine (< 1 year life cycle) by abundance, % Predator by abundance, % Collector (total) by abundance, % Shredder by abundance, % Scraper by abundance, the B-IBI Score and rating, and the Idaho observed vs. expected (O:E) model calculations.

2020-2021 Bonanza Rehabilitation Project Summary of Fish Salvage Mitigation																		
date	source pool(s) /trap	E-shock passes	**Chinook salmon adult female**	**Chinook salmon adult male**	Chinook salmon Age 0	Chinook salmon Age 1+	Chinook salmon juvenile*	O. mykiss Age 0	O. mykiss Age 1+	O. mykiss juvenile*	Bull trout juvenile (<100 mm)	Bull trout sub-adult (100-300 mm)	Bull trout*	Cutthroat trout	Mountain whitefish	Sculpin	Unidentified	Juvenile Chinook mortality
8/26/2020	Polecamp Flat trap	NA		**1**														
9/1/2020	Polecamp Flat trap	NA		**1**														
9/3/2020	Polecamp Flat trap	NA		**4**														
9/4/2020	Polecamp Flat trap	NA		**4**														
9/10/2020	Polecamp Flat trap	NA	**1**	**1**														
9/22/2020	A, C	—					63			22			18					—
9/25/2020	A, C	—					26			5			1					—
9/30/2020	A, C	—					159			15			51				15	—
10/5/2020	A, C	—					202			9			13				6	—
10/8/2020	A, C	—					92			2			3				2	—
10/28/2020	A, C	—					8			1			2				4	—
2020 TOTAL			**1**	**11**			550			54			88				27	—
8/19/2021	D-E glide, D (no fish)	2, 1			6			11								12		
8/19/2021	C	3			2			12	4						2	6	1	
8/19/2021	A, B (no fish)	3			1			5	7			1			3	14	3	
8/24/2021	D-E glide, D	2			3			1	1							9	2	
8/24/2021	A	3			2	2		8	6					3	11	28		
8/31/2021	A	3			11	8		9	19			1			19	37	2	2
9/7/2021	A	2						5	1							13		
9/17/2021	A	2			3			1	23			4		3	25	6	1	
9/21/2021	A	3			2	1		7	7			1			3			
9/30/2021	A	3						2	7						2	2		
10/5/2021	A	2						6	6			1				2		
10/12/2021	A	2			1			2	2									
2021 TOTAL					31	11		69	83			8		6	65	129	9	2
TOTAL							592			206			96	6	65	129		2
*size class not identified																		

Table 17. Bonanza Rehabilitation Project Mitigation fish salvage summary, 2020-2021. Date, source pool(s)/glide (see Figure 8) or trap, number of electroshock passes; number of adult Chinook salmon transported upstream (in **bold** type); number of juvenile Chinook salmon, *Oncorhynchus mykiss*, Bull trout, Cutthroat trout, Mountain whitefish, and Sculpin transported downstream; and number of reported juvenile Chinook salmon mortalities.

FIGURES

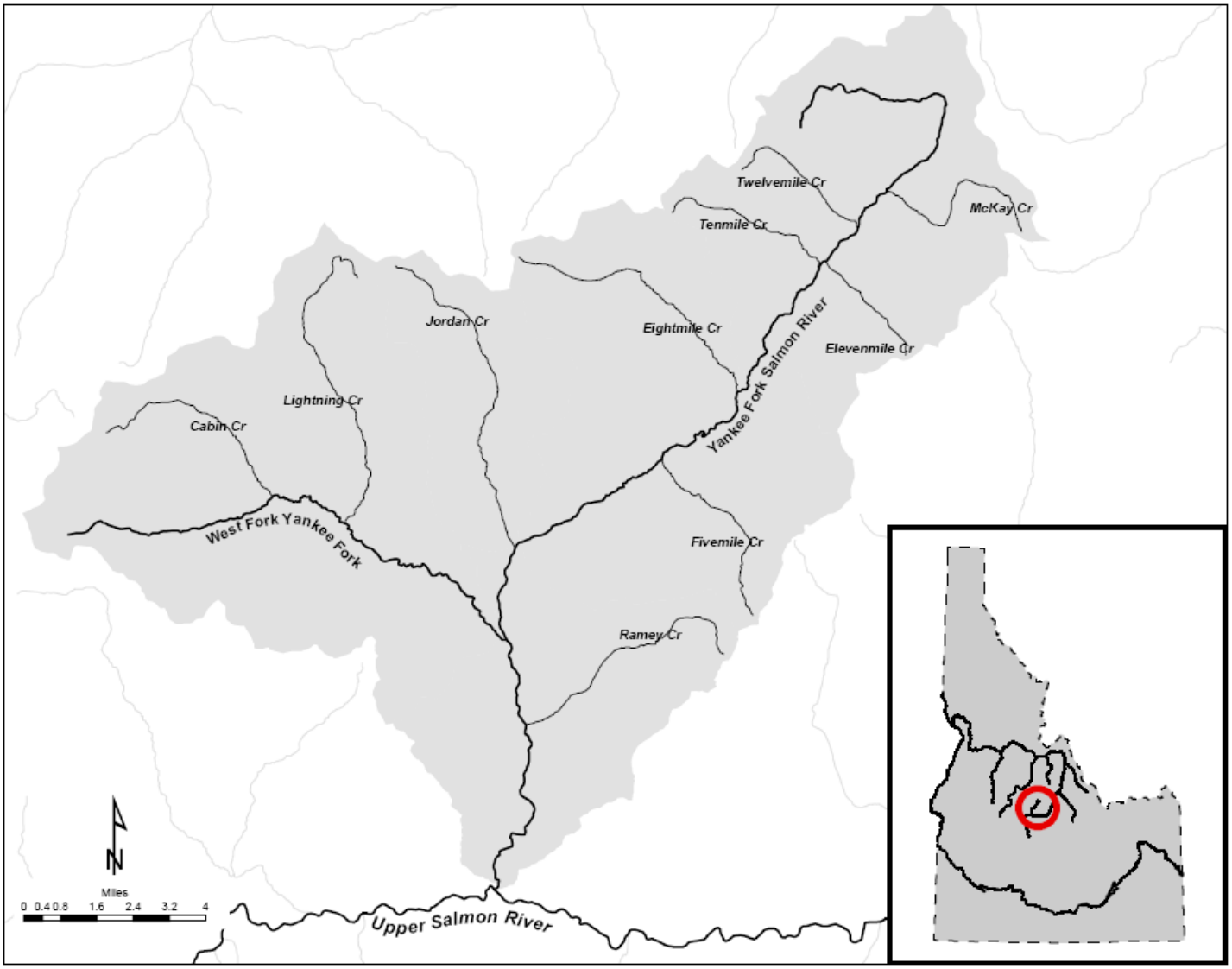


Figure 1. Yankee Fork Salmon River location within central Idaho, major tributary to Salmon River. Map by HHayball.

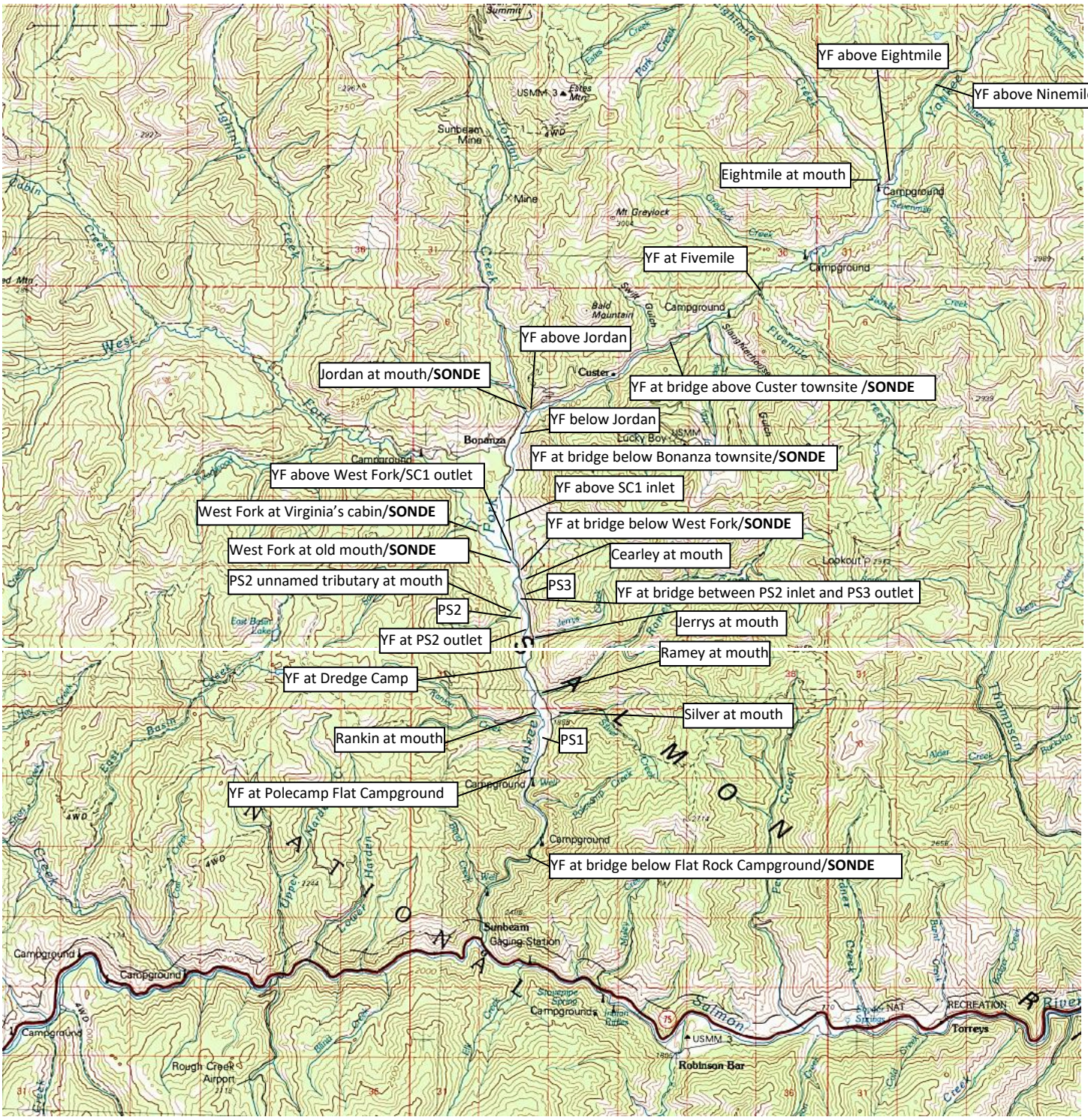


Figure 2. Topographic map of Yankee Fork Salmon River with stream temperature gauge and the seven SONDE locations at bridge on Yankee Fork road above Custer, Jordan Creek bridge at mouth, bridge below Bonanza, West Fork Yankee Fork at Virginia's cabin, West Fork Yankee Fork at mouth, Yankee Fork at bridge below West Fork and Yankee Fork at bridge below Flat Rock Campground.

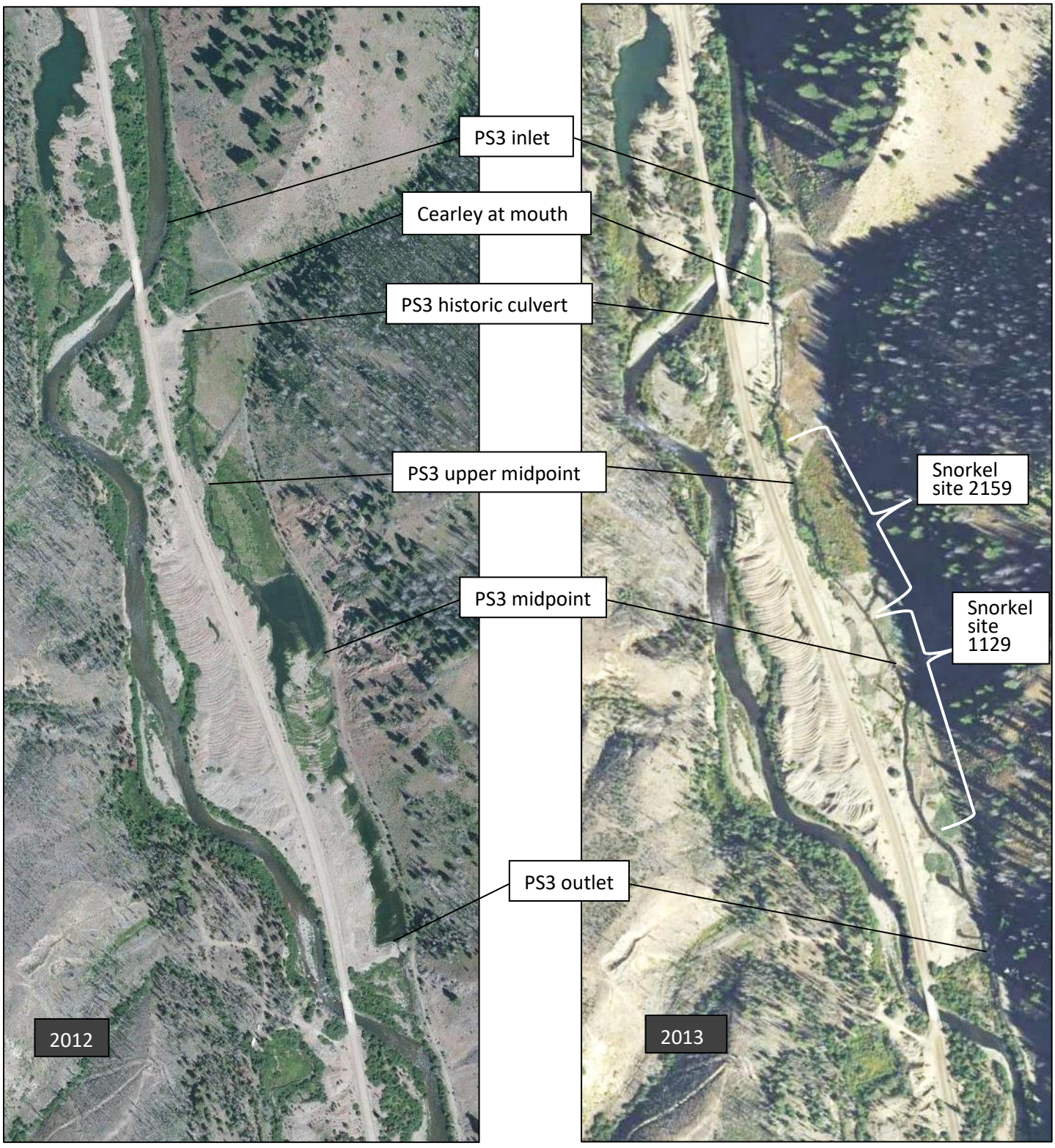


Figure 3. Aerial photo maps of Pond Series 3 before and after rehabilitation with stream temperature gauge and snorkel site locations.

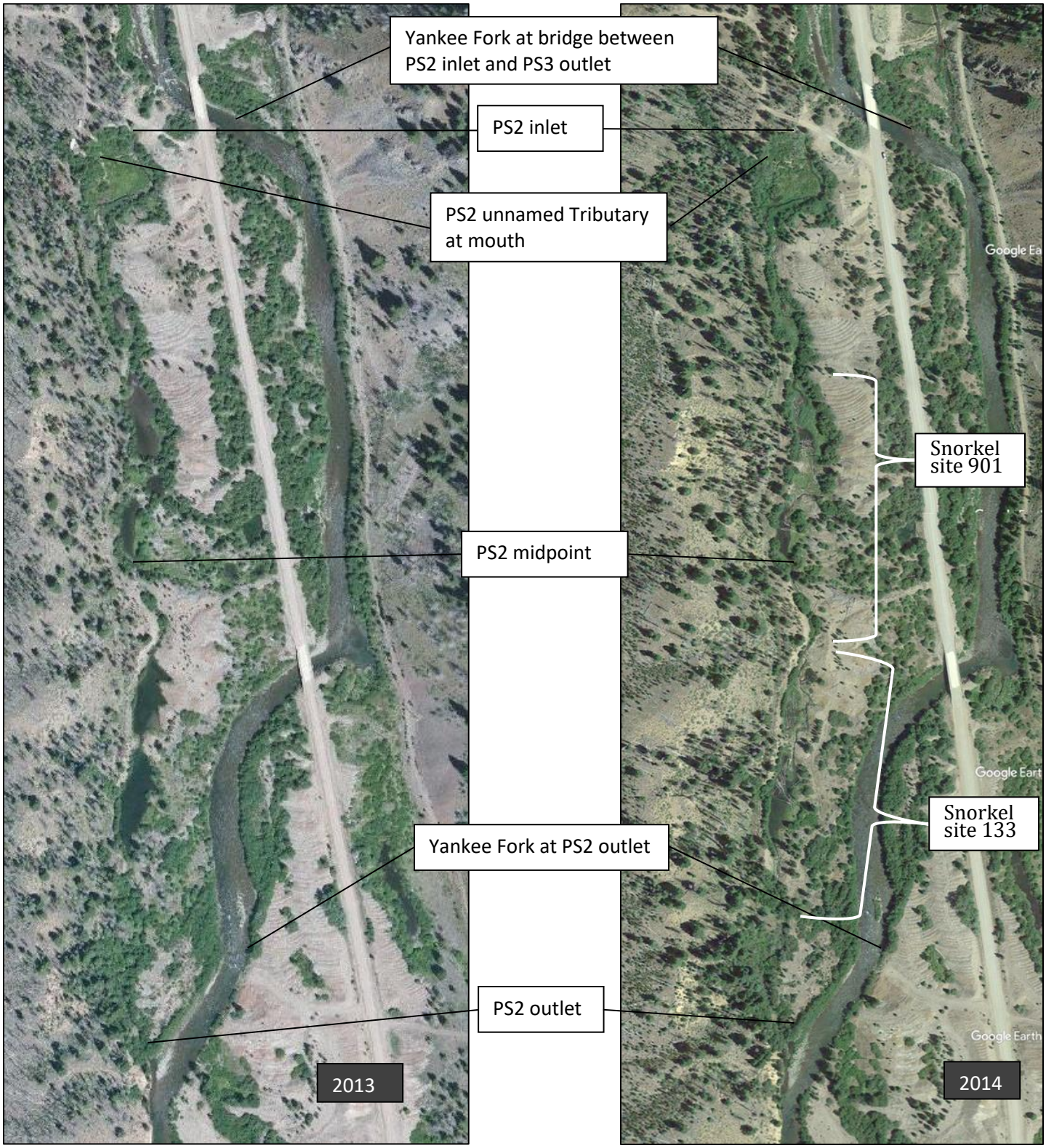


Figure 4. Aerial photo maps of Pond Series 2 prior to and after rehabilitation with stream temperature gauge locations.

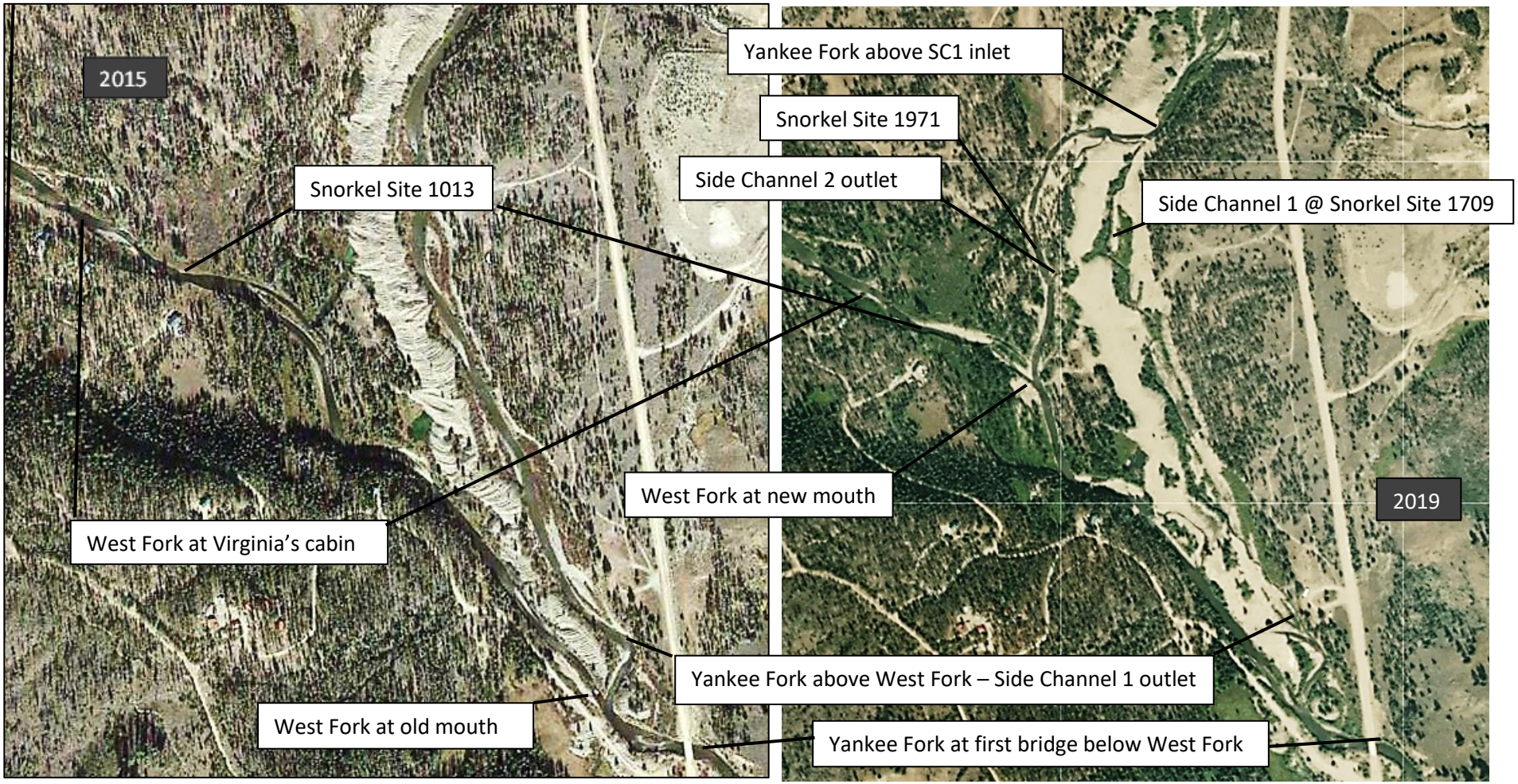


Figure 5. Aerial photos of the West Fork Yankee Fork and Yankee Fork Salmon River confluence area in 2015, prior to the West Fork Reconnect Project, and after in 2019, with stream temperature gauge and snorkel and habitat survey site locations.

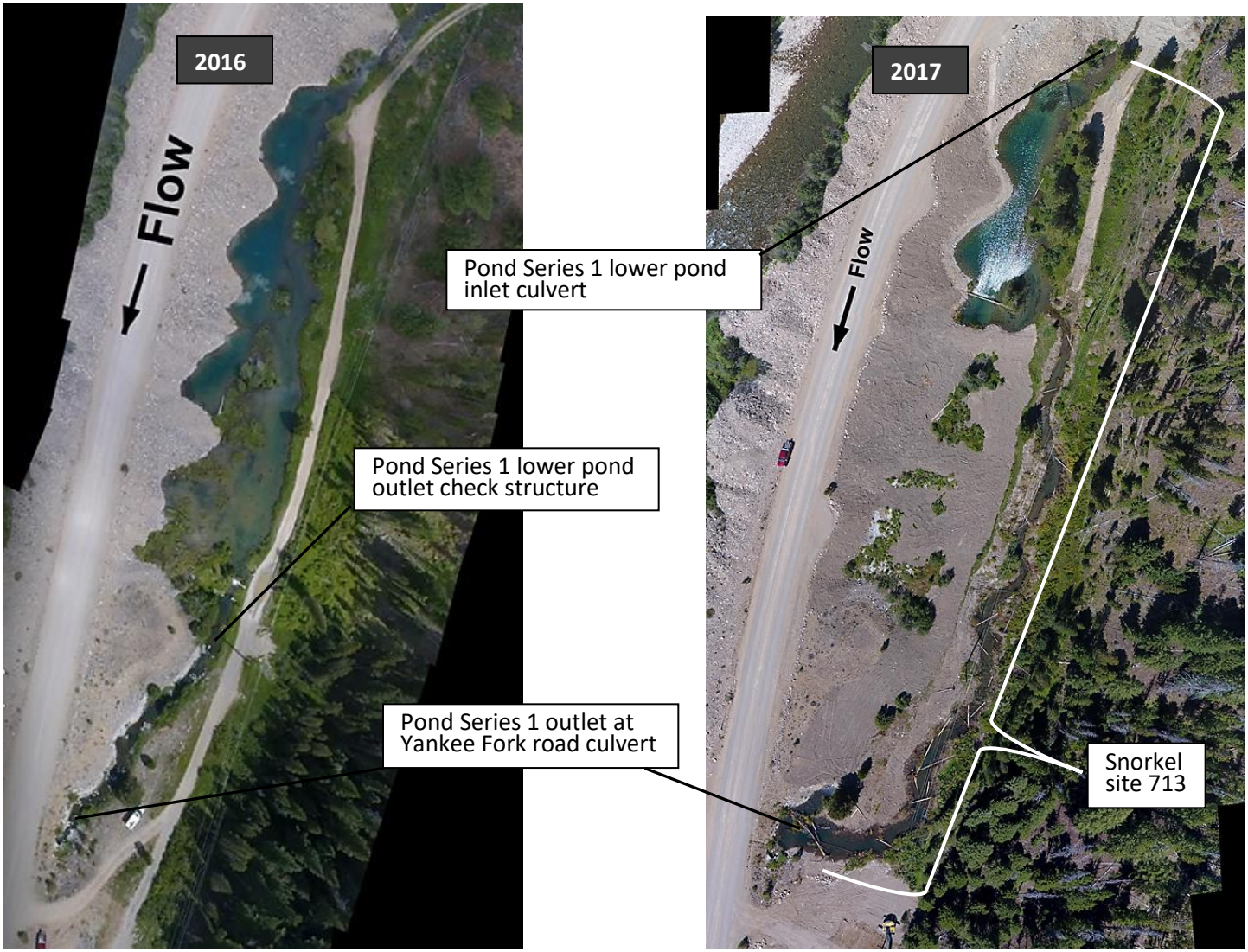


Figure 6. Aerial photo maps of Pond Series 1 prior to and after rehabilitation with stream temperature gauge and snorkel and habitat survey site locations.

Figure 7. Bridge below Flat Rock Campground sonde housing *("boom")*

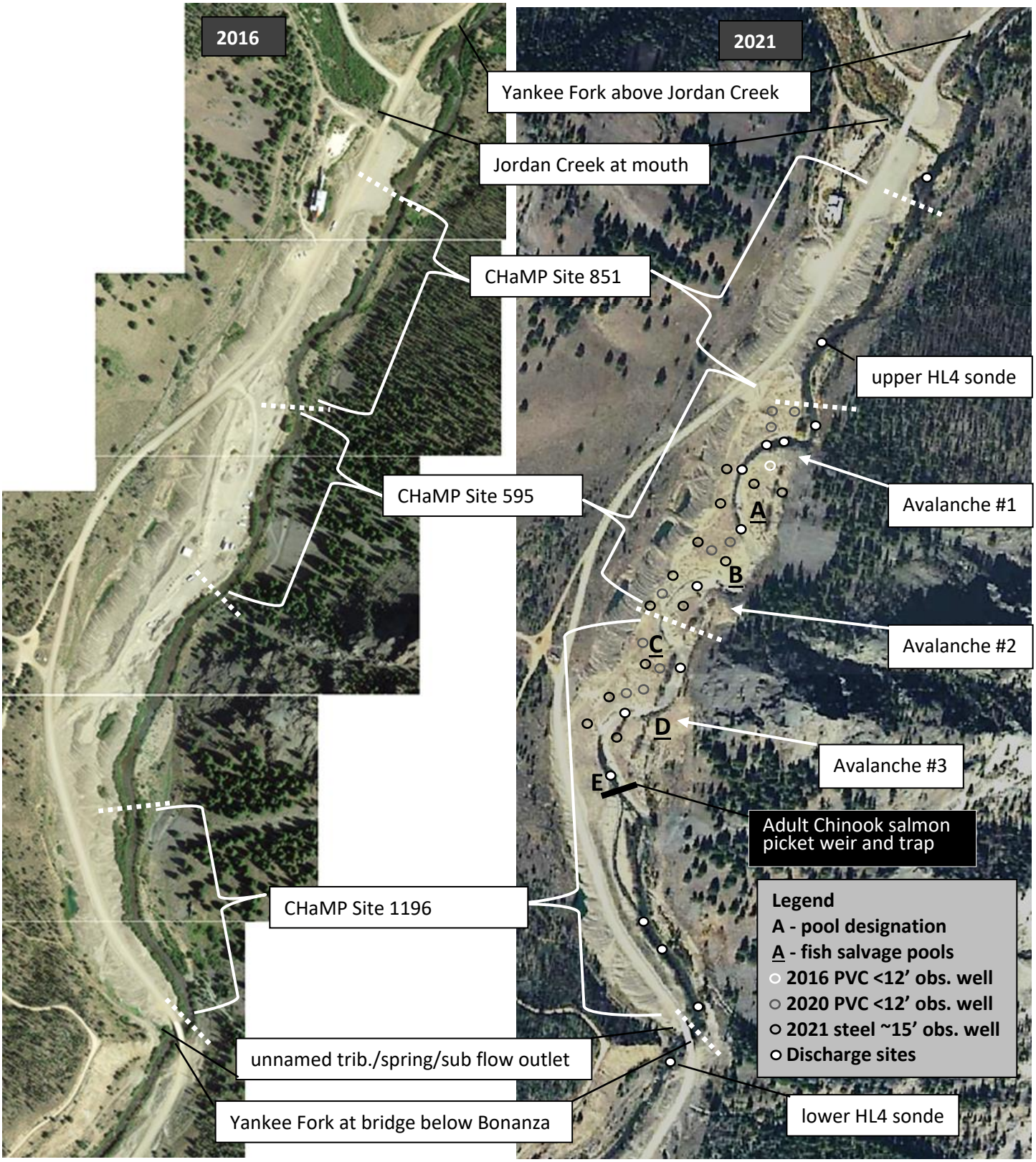


Figure 8. Aerial photos of the Yankee Fork Salmon River Bonanza Rehabilitation Project reach, prior to work in 2016 and after in 2021, showing stream temperature datalogger locations, CHaMP Sites 1196, 595 and 851 reach changes; and in 2021 showing dry river sections, disconnected and isolated pools through the project area labeled A thru E, with fish salvage pools underlined, adult Chinook salmon picket wier and trap, engineered avalanches #1, #2 and #3, HL4 sonde locations monitoring turbidity above and below instream work, seepage run discharge monitoring sites, and piezometer observation wells: 1 remaining from 2016, 10 installed in 2020 and 13 installed in 2021.

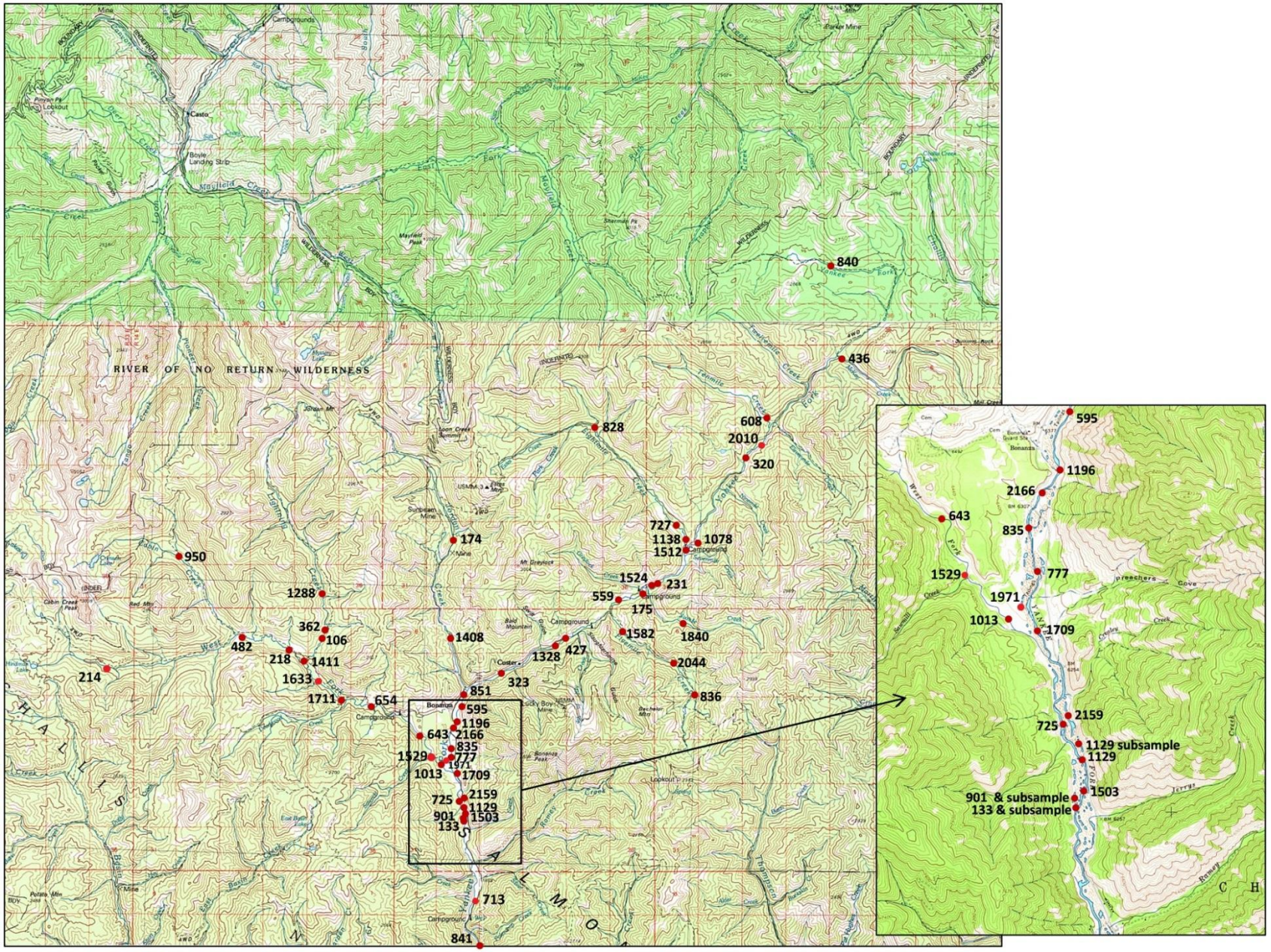


Figure 9. Topographic map of the Yankee Fork Salmon River watershed with CHaMP habitat and snorkel survey site locations.

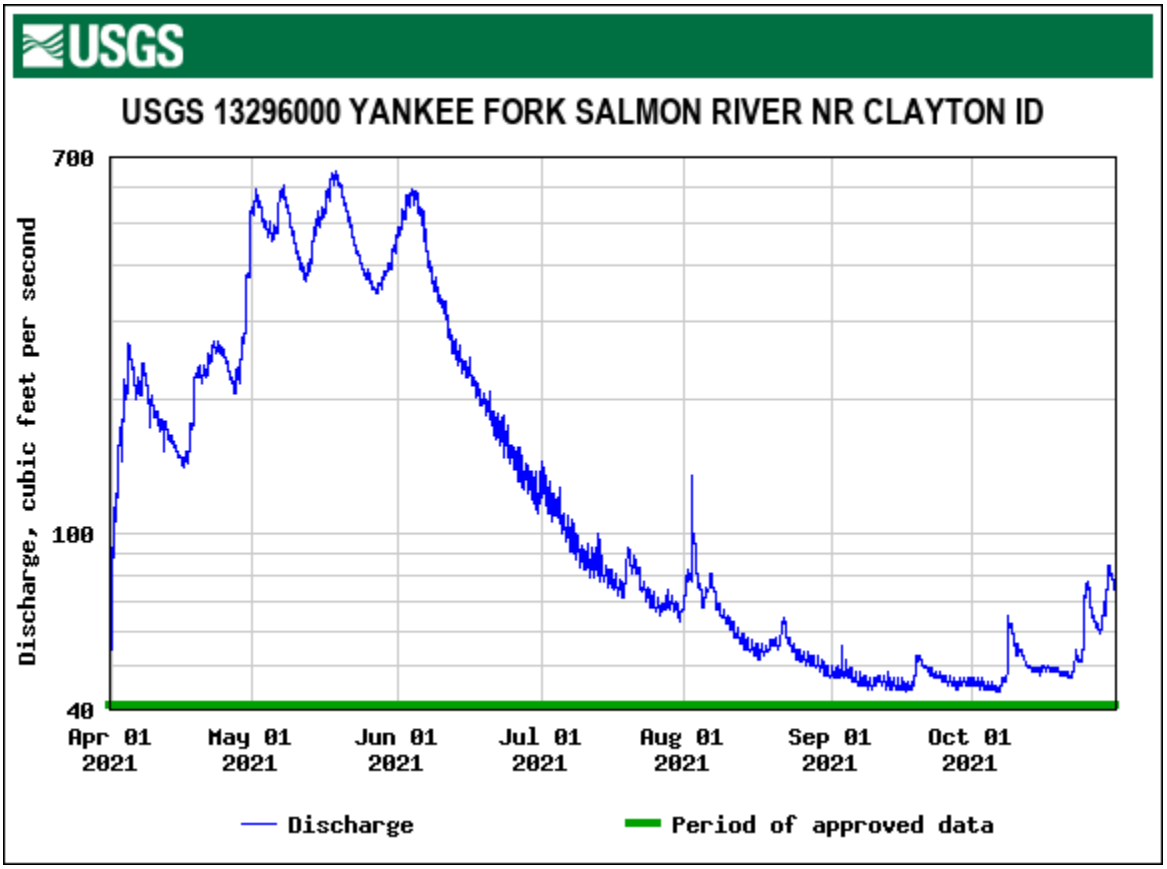


Figure 10. Discharge at USGS Yankee Fork gage station, 2021.

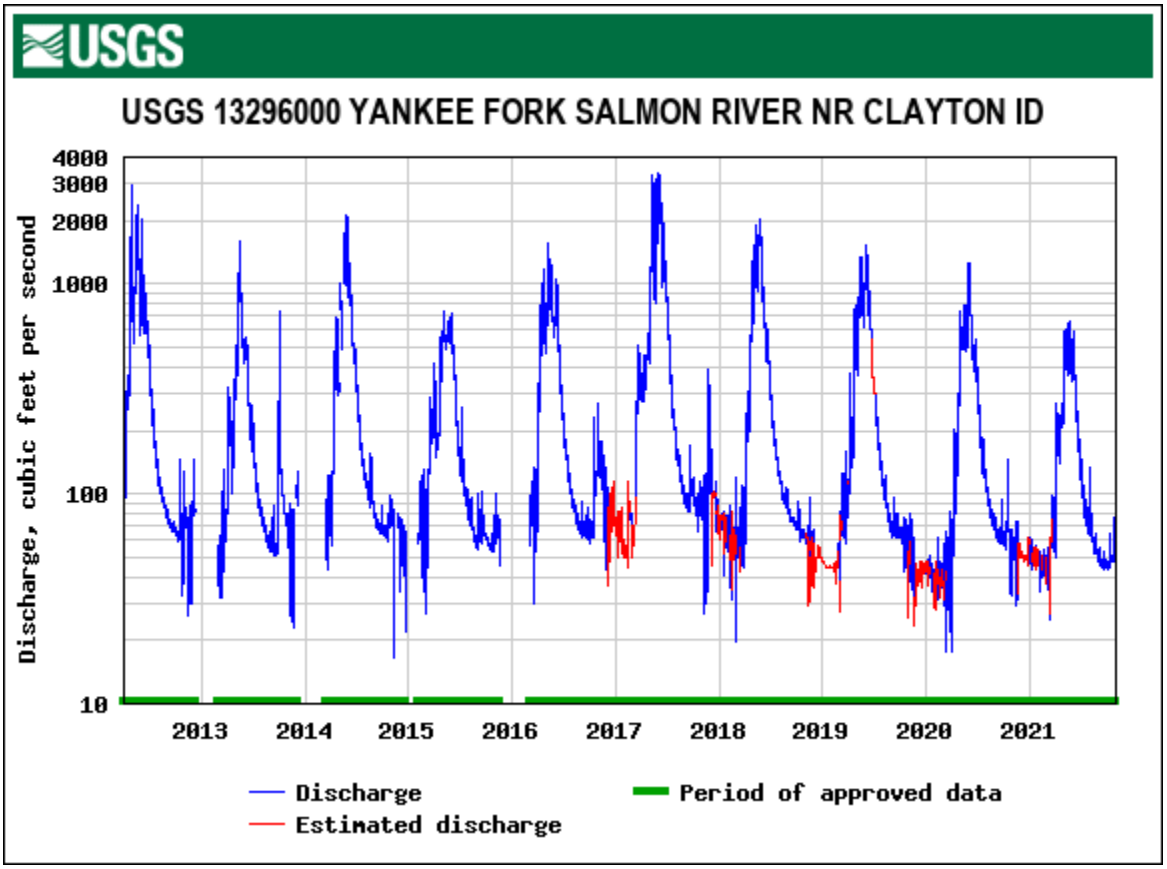


Figure 11. Discharge at USGS Yankee Fork gage station, 2012-2021.

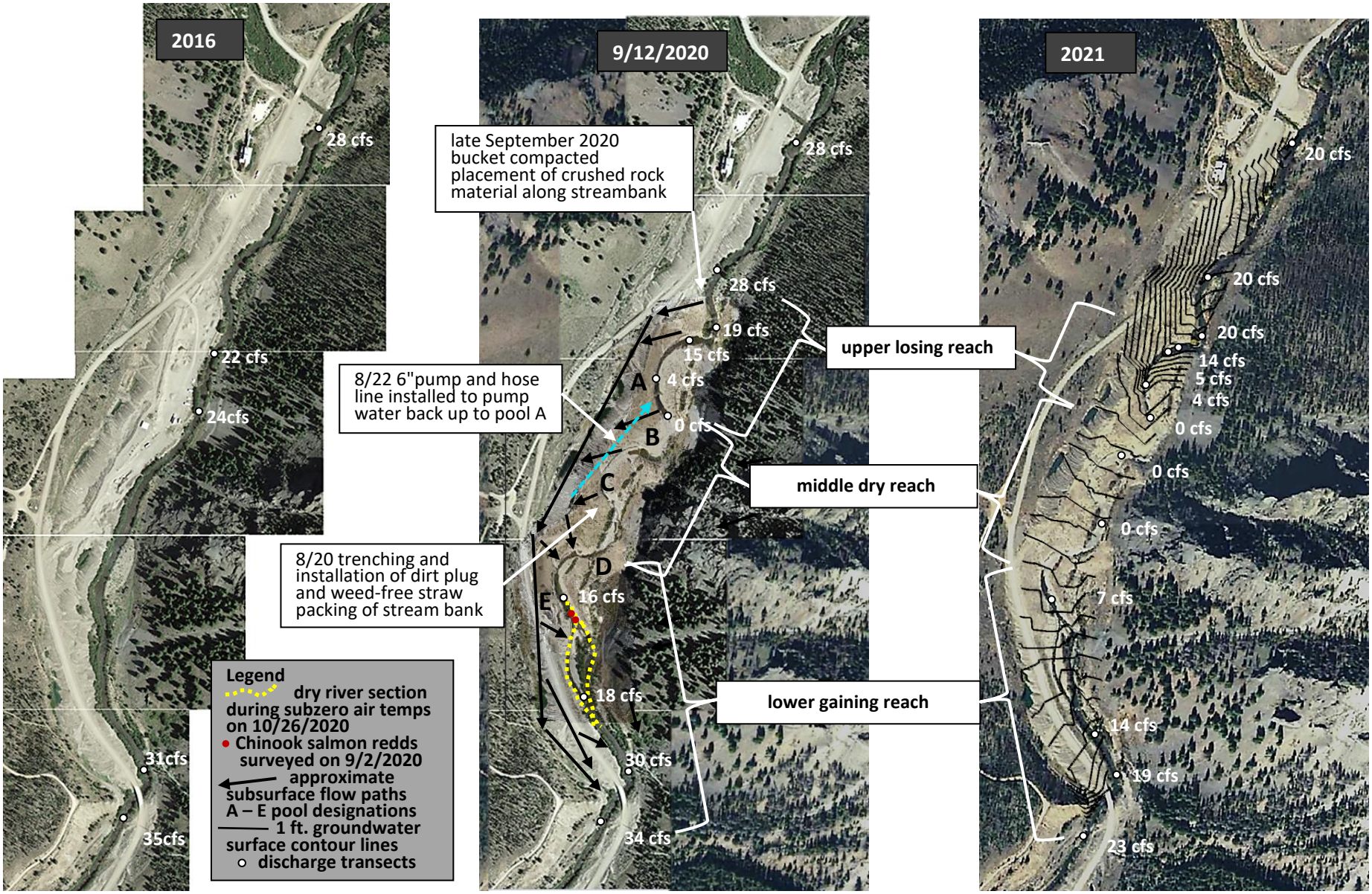


Figure 12. Aerial photos of the YFSR Bonanza Rehabilitation Project reach, in 2016 prior to rehabilitation showing BOR 9/28 seepage run; after on 9/12/2020 showing BOR 9/15 seepage run, floodplain trenching and installation of a dirt plug and straw packing of lower river right stream bank at Pool C on 8/20, pump and line installed on 8/22 (blue dashed line), late September placement location of bucket compacted crushed rock along streambank, two Chinook salmon redds surveyed 9/2 (red dots), temporary dry river sections on 10/26 during subzero air temperatures (yellow dashed lines), direction of ground water flow (black arrows) and losing, dry and gaining reaches; and in 2021 showing 9/15 BOR seepage run and groundwater contour lines generated using 13 steel ~15' observation wells installed on 9/14 and 1 PVC <12' remaining from 2016.

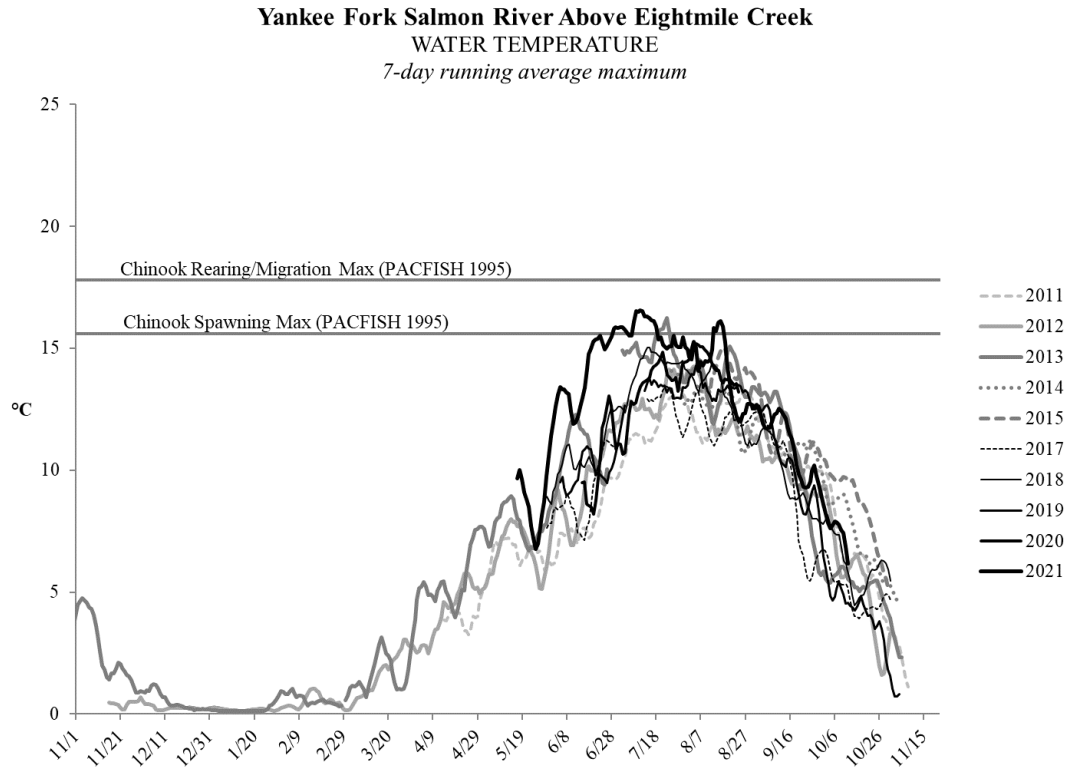


Figure 13. Yankee Fork Salmon River above Eightmile Creek, 7-day running average maximum water temperatures, in 2011, 2012 2013, 2014, 2015, 2017, 2018, 2019, 2020 and 2021 using both Onset HOBO (SBT) and Tidbit (USFS) dataloggers.

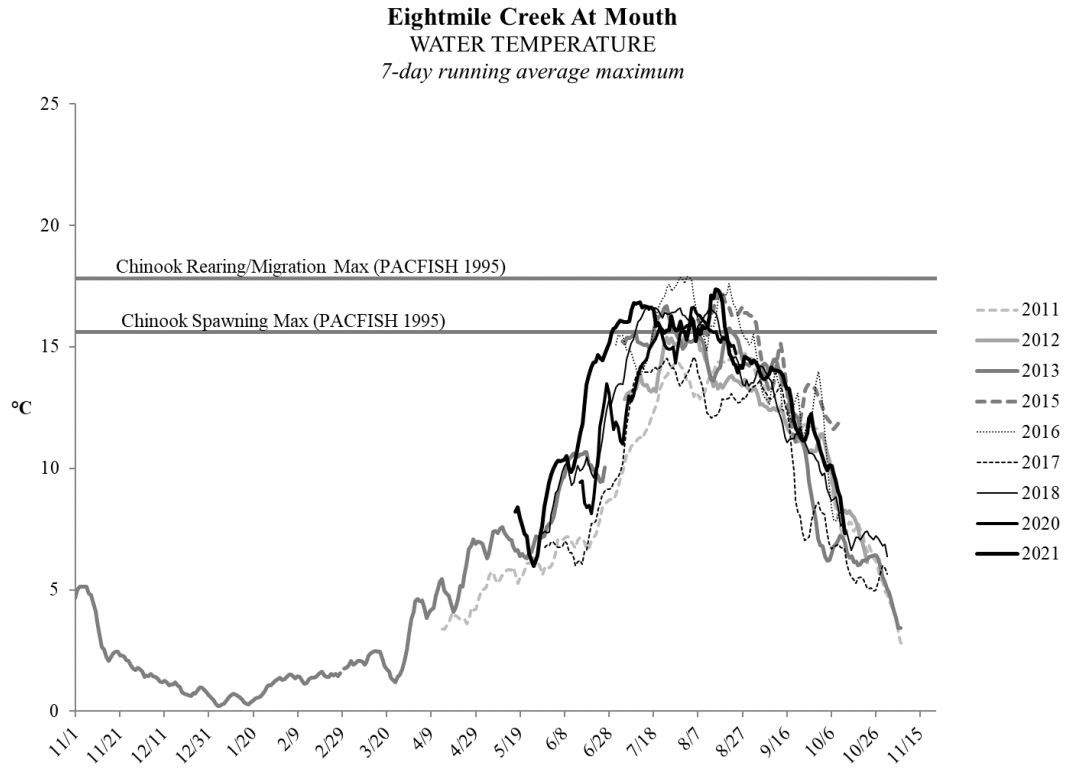


Figure 14. Eightmile Creek at mouth, 7-day running average maximum water temperatures, in 2011, 2012, 2013, 2015, 2016, 2017, 2018, 2020 and 2021 using both Onset HOBO (SBT) and Tidbit (USFS) dataloggers.

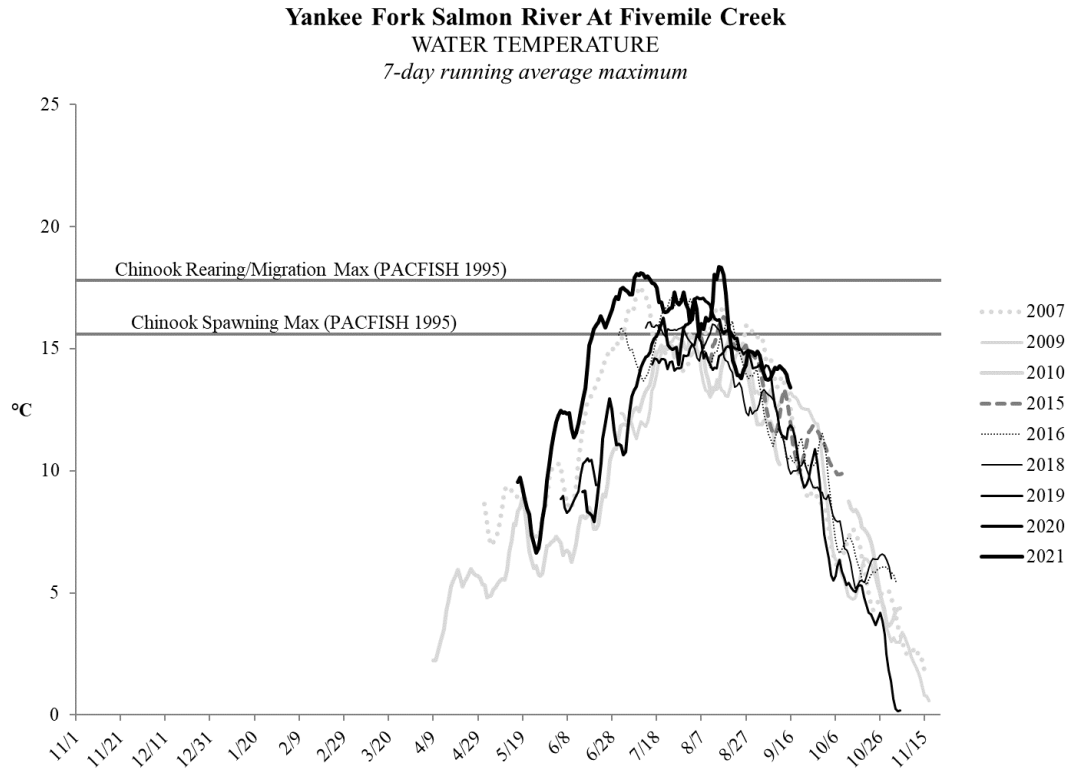


Figure 15. Yankee Fork Salmon River at first bend below Fivemile Creek (2007-2010) and at first bridge above Fivemile Creek (2015-2021), 7-day running average maximum water temperatures, using Onset HOBO dataloggers.

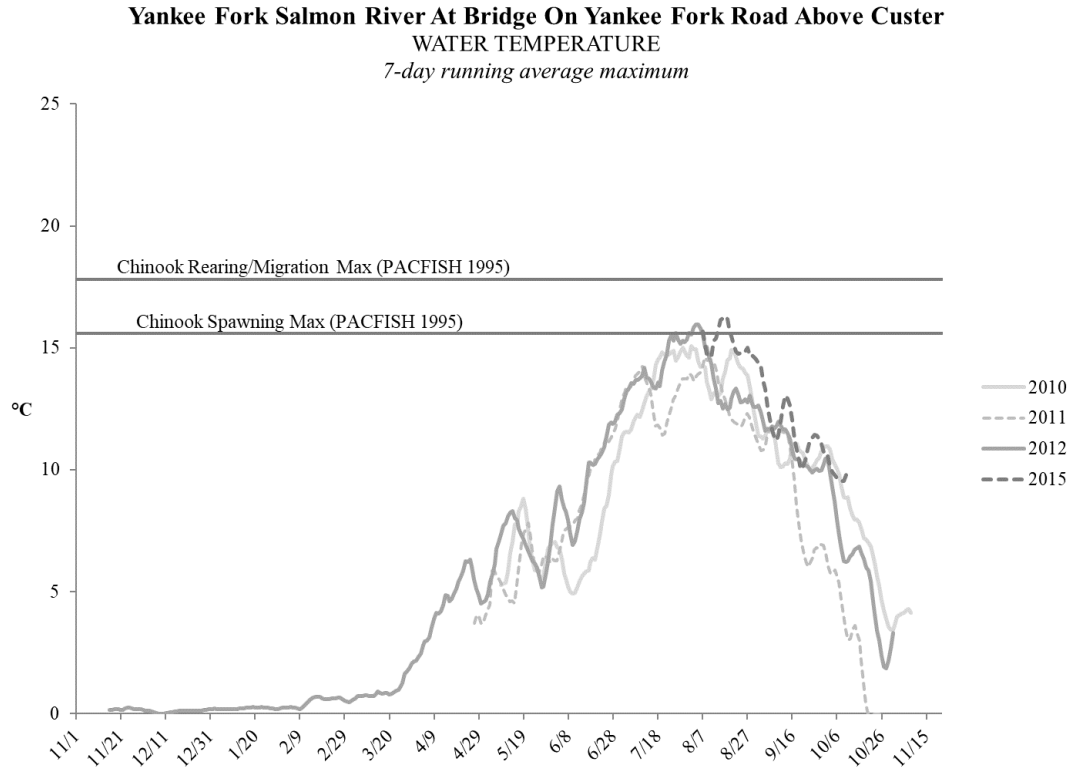


Figure 16. Yankee Fork Salmon River at bridge on Yankee Fork road above Custer townsite, 7-day running average maximum water temperatures, in 2010, 2011, 2012 and 2015, using Onset HOBO dataloggers.

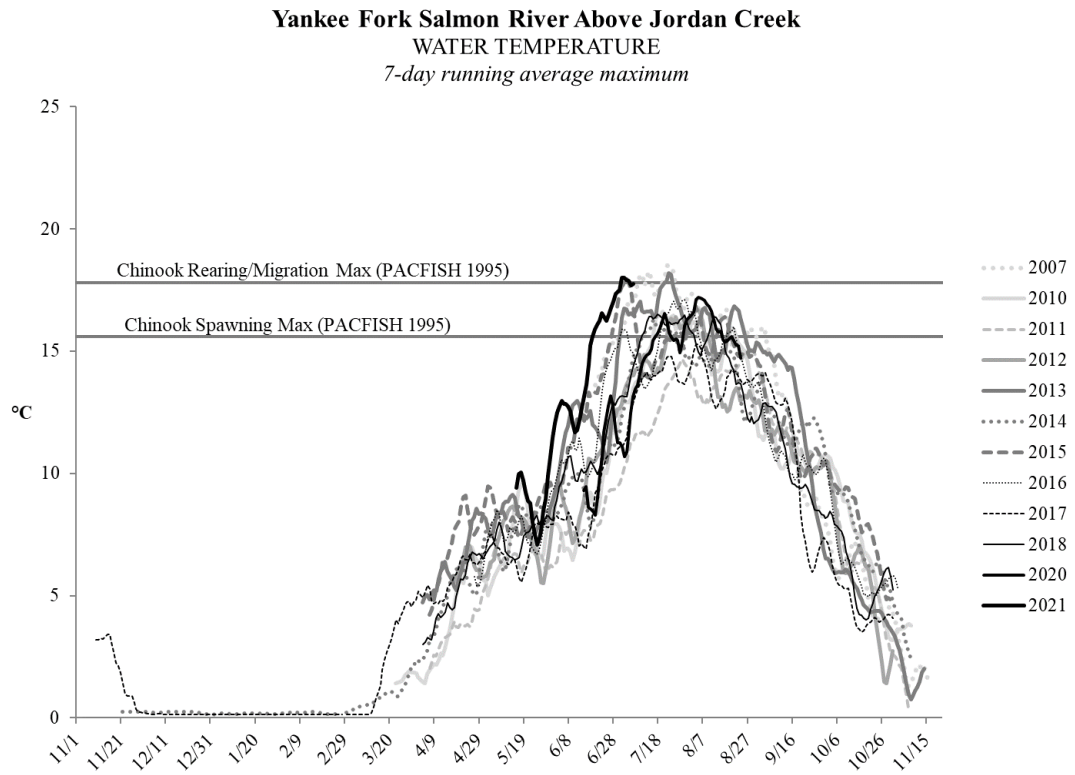


Figure 17. Yankee Fork Salmon River above Jordan Creek, 7-day running average maximum water temperatures, in 2007, from 2010 to 2018 and in 2020 and 2021 using Onset HOBO dataloggers.

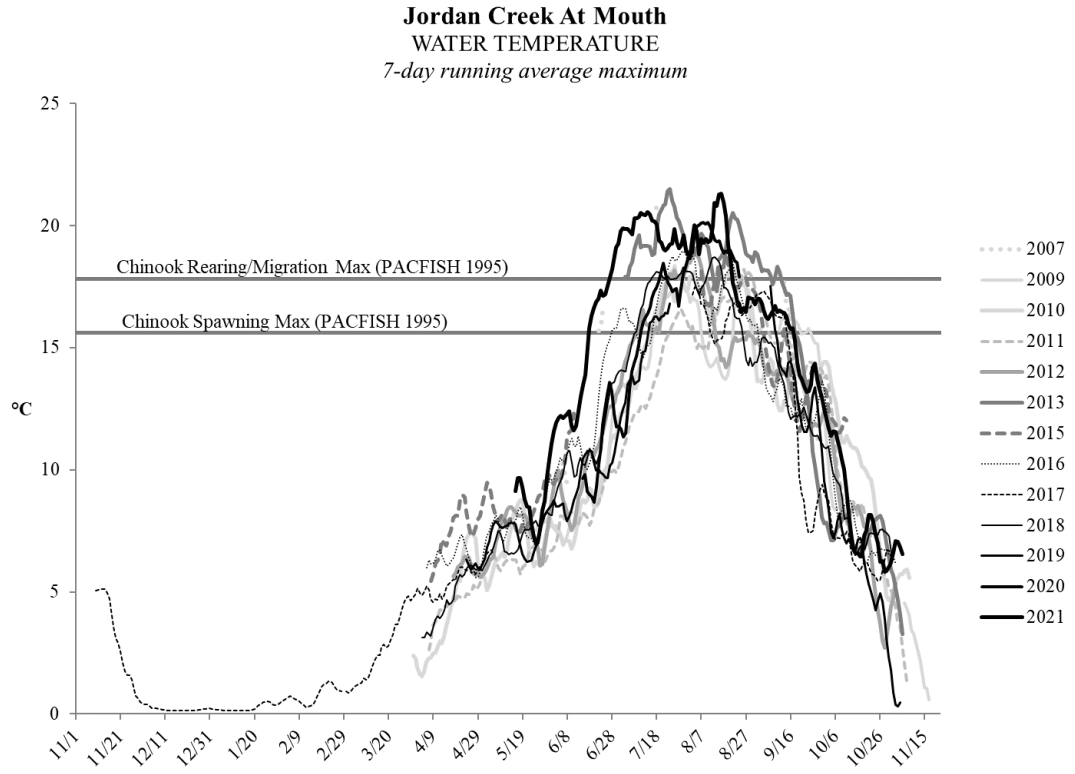


Figure 18. Jordan Creek at mouth, 7-day running average maximum water temperatures from 2007 to 2013, 2015, 2016, 2017, 2018, 2020 and 2021 using both Onset HOBO (SBT) and Tidbit (USFS) dataloggers and SONDE temperature probe.

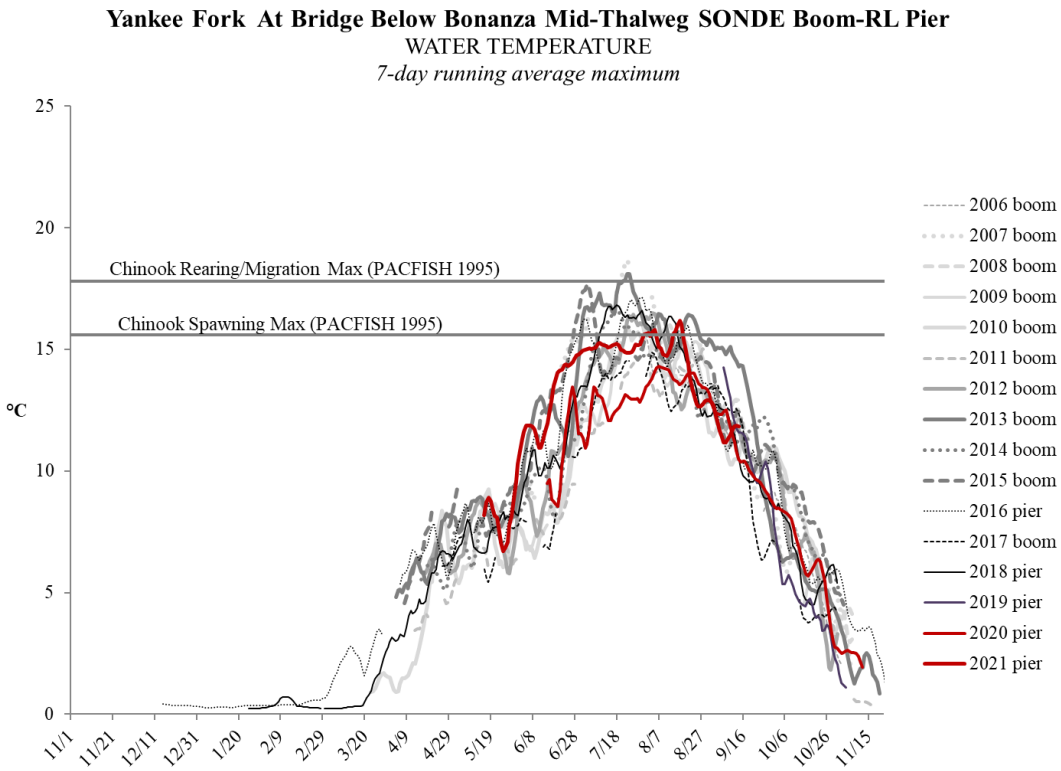


Figure 19. Yankee Fork Salmon River at bridge below Bonanza townsite mid-thalweg, at the SONDE boom mid-channel from 2006 to 2015 and in 2017, and then shifted with thalweg to river left to adjacent to or below the river left pier in 2016 and 2018 to 2021, 7-day running average maximum water temperatures, using both Onset HOBO dataloggers and SONDE temperature probe. Temperatures from 2020-2021 affected by upstream subsurface flows are not representative of long term trend at this site (red).

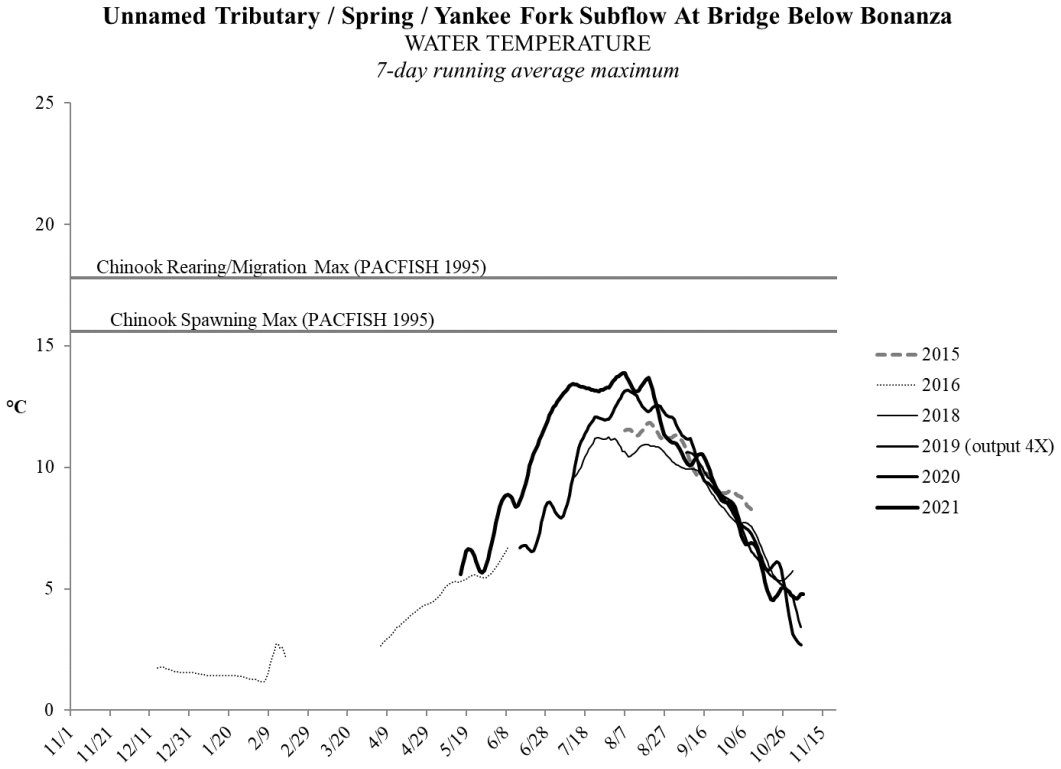


Figure 20. Unnamed tributary / spring and Yankee Fork river subflows, which increased in 2019 fourfold, emerging on river right at bridge below Bonanza townsite, 7-day running average maximum water temperatures, in 2015, 2016, 2018, 2019 and 2021, using Onset HOBO datalogger.

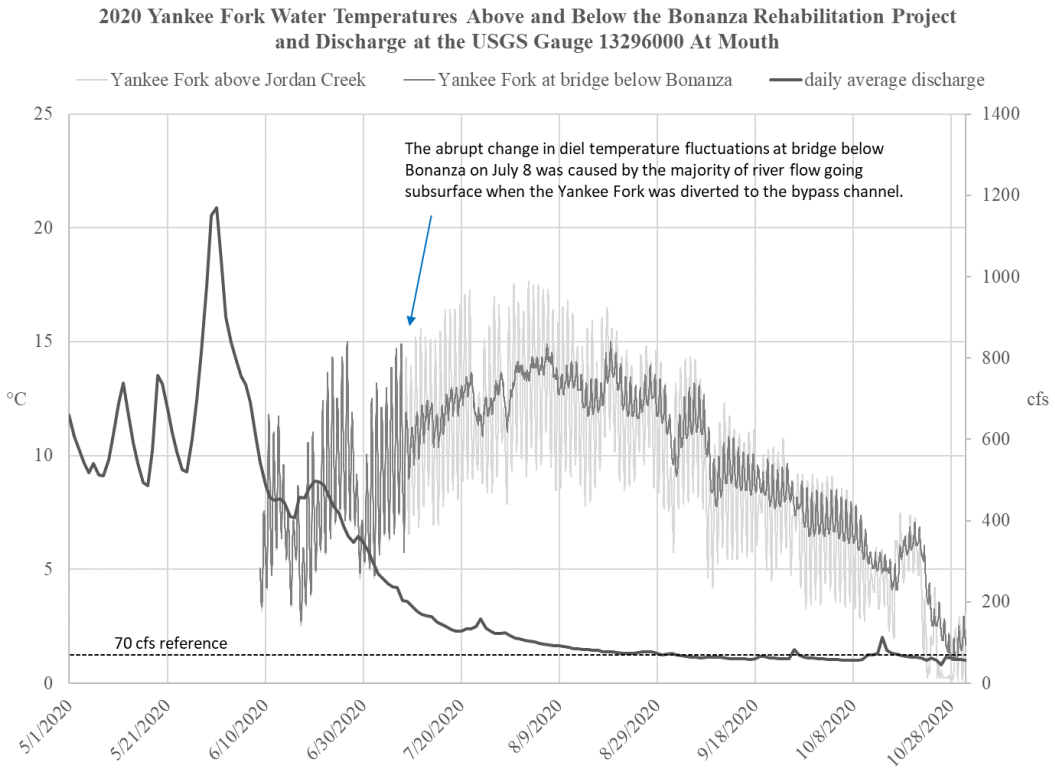


Figure 21. 2020 Yankee Fork above Jordan Creek and at bridge below Bonanza stream temperature comparisons and daily average discharge at USGS Gauge 13296000 at mouth, and 70 cfs reference line for when entire flow went subsurface through the Bonanza Rehabilitation Project reach.

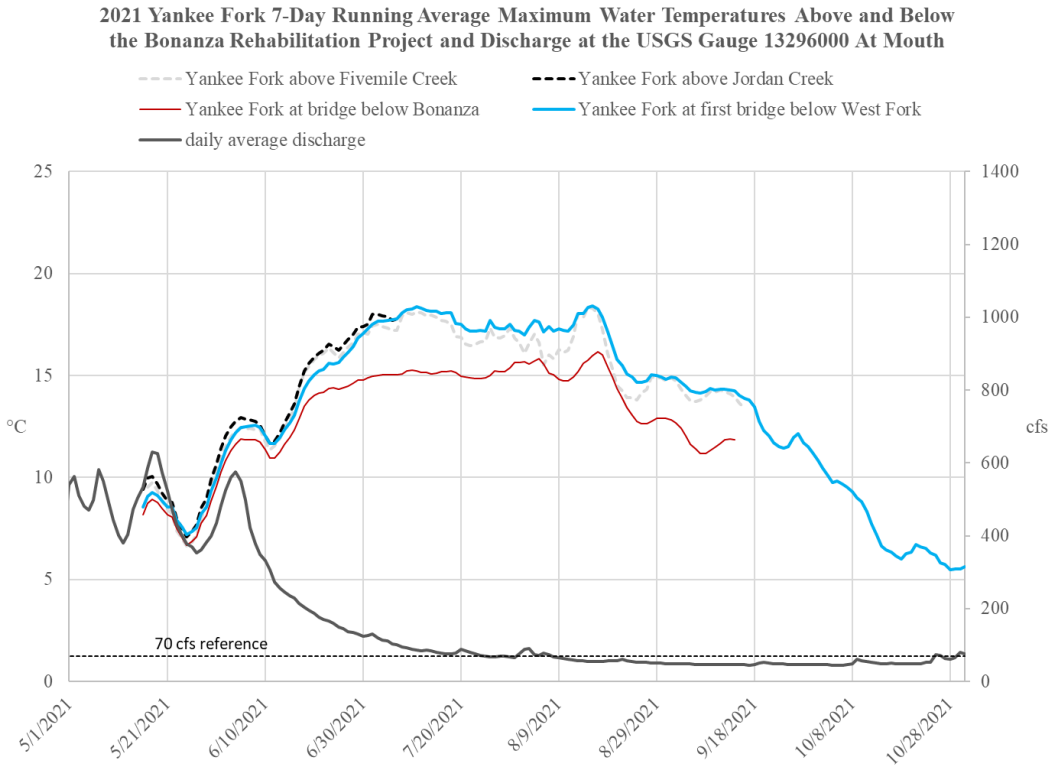


Figure 22. 2021 Yankee Fork above Fivemile Creek, above Jordan Creek, at bridge below Bonanza, and at first bridge below West Fork 7-day running average maximum stream temperature comparisons and daily average discharge at USGS Gauge 13296000 at mouth, and 70 cfs reference line for when entire flow went subsurface through the Bonanza Rehabilitation Project reach in 2020.

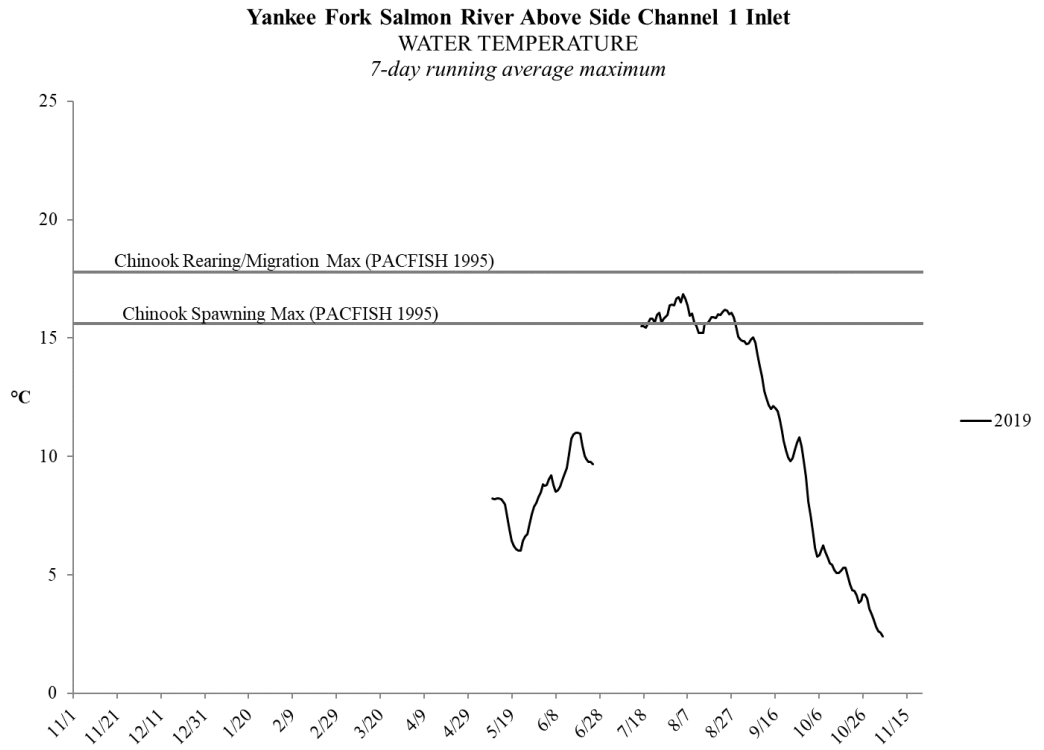


Figure 23. Yankee Fork Salmon River above Side Channel 1 inlet, 7-day running average maximum water temperatures, in 2019, using Onset HOBO datalogger.

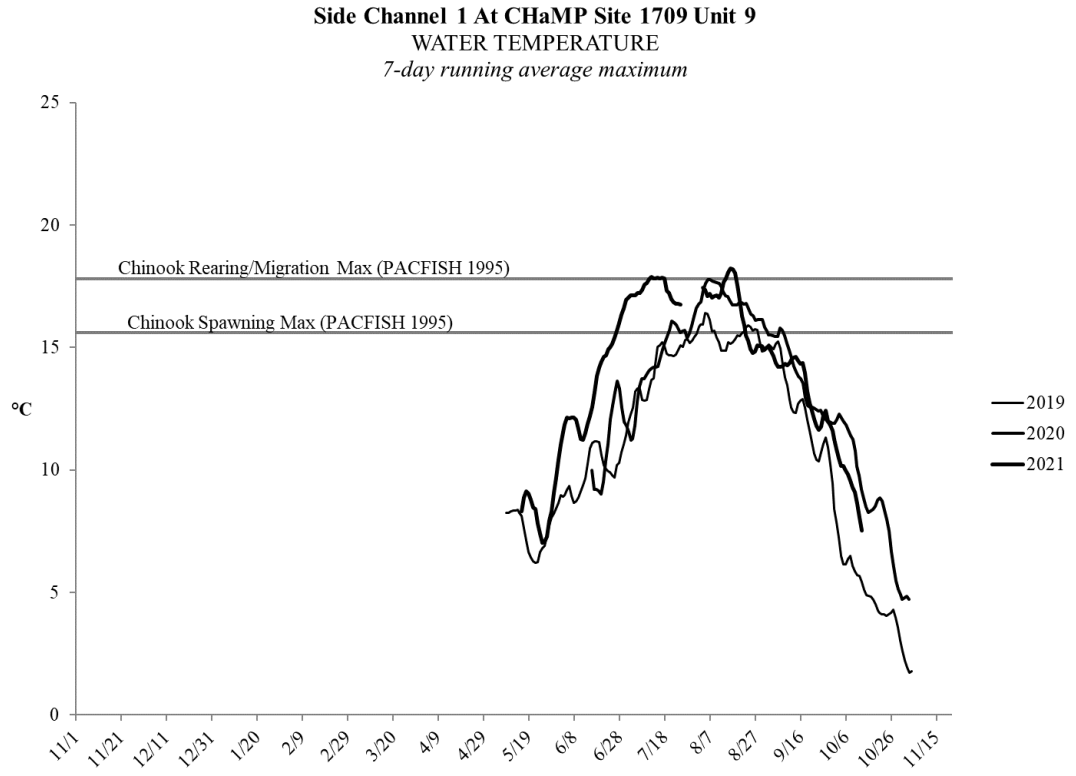


Figure 24. Side Channel 1 at CHaMP Site 1709 Unit 9, 7-day running average maximum water temperatures, in 2019, 2020 and 2021, using Onset HOBO dataloggers.

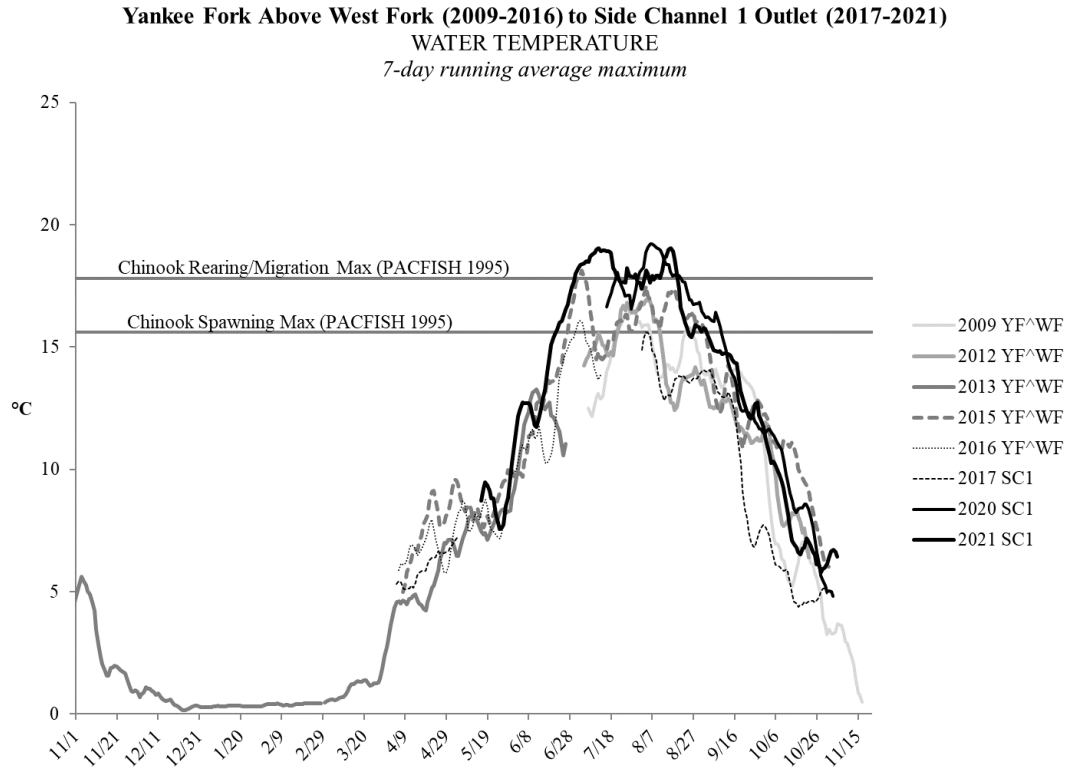


Figure 25. Yankee Fork Salmon River above the West Fork prior to the West Fork confluence restoration, from 2009 to 2016, and post restoration as the outlet of Side Channel 1 in 2017, 2020 and 2021, 7-day running average maximum water temperatures, using both Onset HOBO (SBT) and Tidbit (USFS) dataloggers.

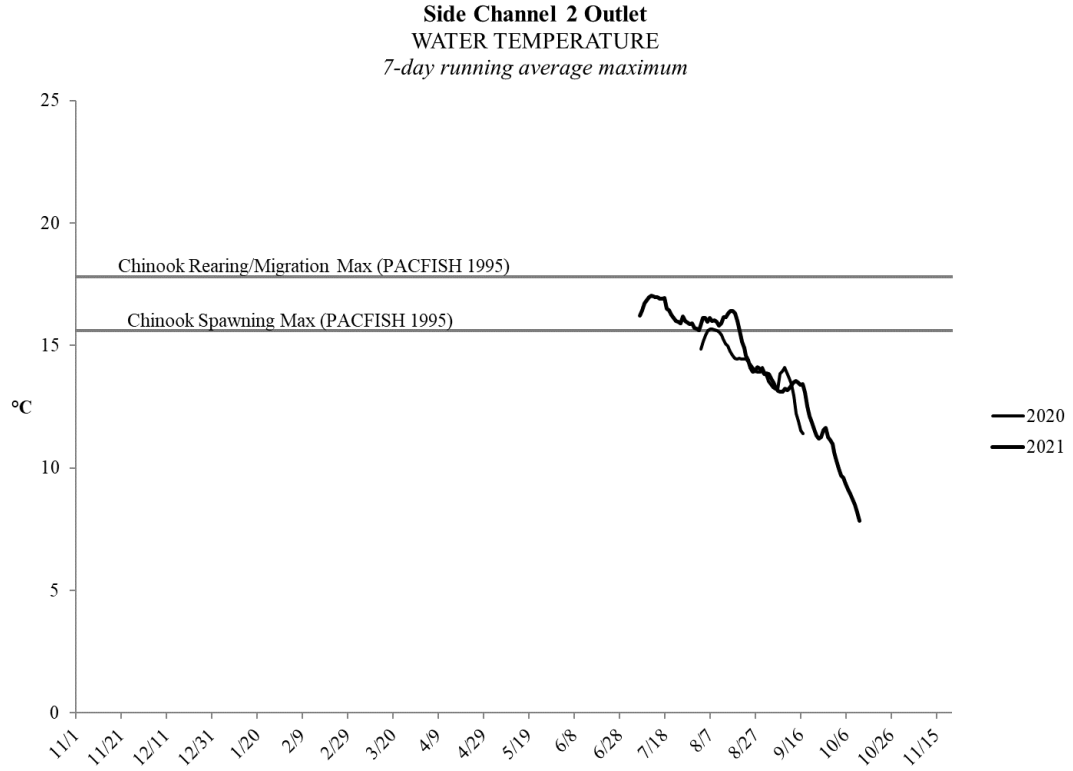


Figure 26. Side Channel 2 outlet, 7-day running average maximum water temperatures, in 2020 and 2021, using Onset HOBO datalogger.

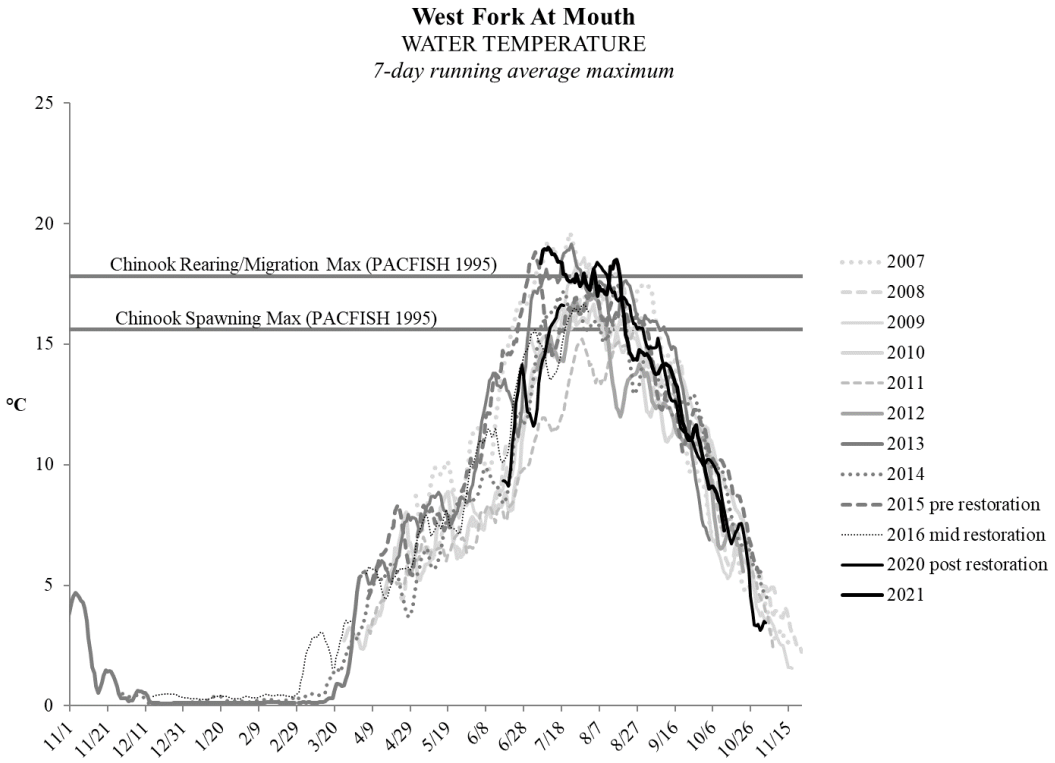


Figure 27. West Fork Yankee Fork at mouth at old location prior to the West Fork Confluence Restoration Project, from 2007 to 2015, then gradually combined with YFSR water during the West Fork confluence restoration project in 2016, and after restoration at new location in 2020 and 2021, 7-day running average maximum water temperatures, using Onset HOBO (SBT) and Tidbit (USFS) dataloggers and SONDE temperature probe.

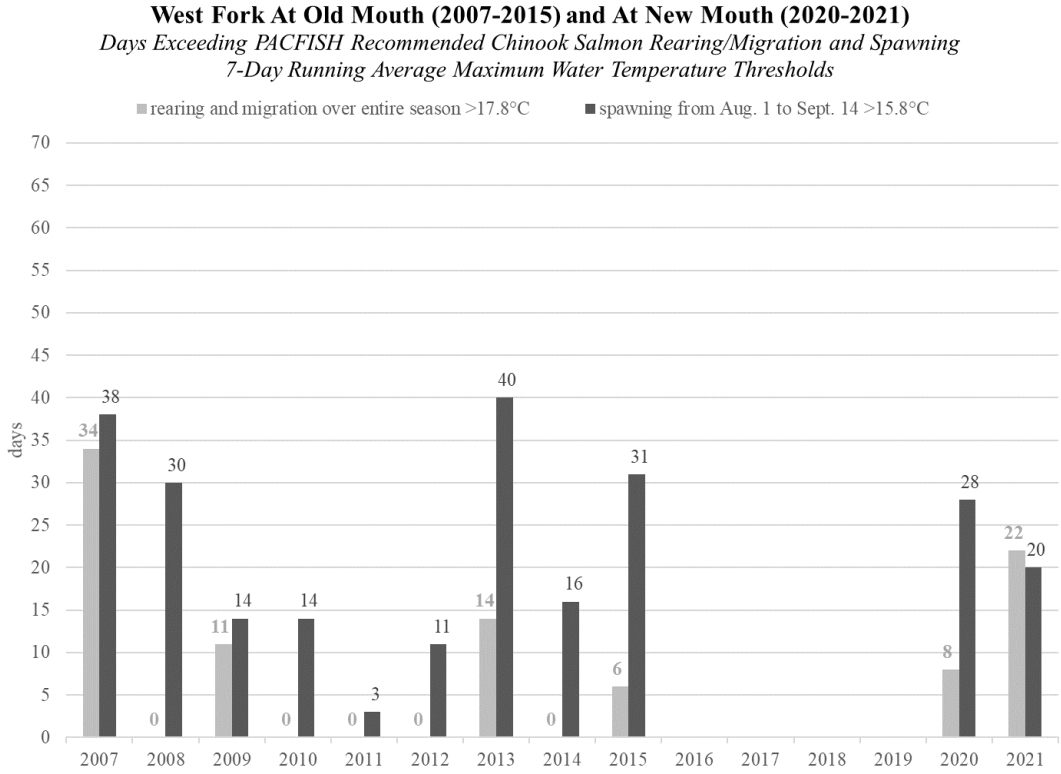


Figure 28. West Fork Yankee Fork at old mouth, 2007-2015, and new mouth from 2020-2021, number of days the 7-day running average maximum water temperatures exceeded PACFISH recommended thresholds of 17.8°C for Chinook salmon rearing/ migration over entire season, and 15.8°C during spawning, from August 1 to September 14, using Onset HOBO dataloggers.

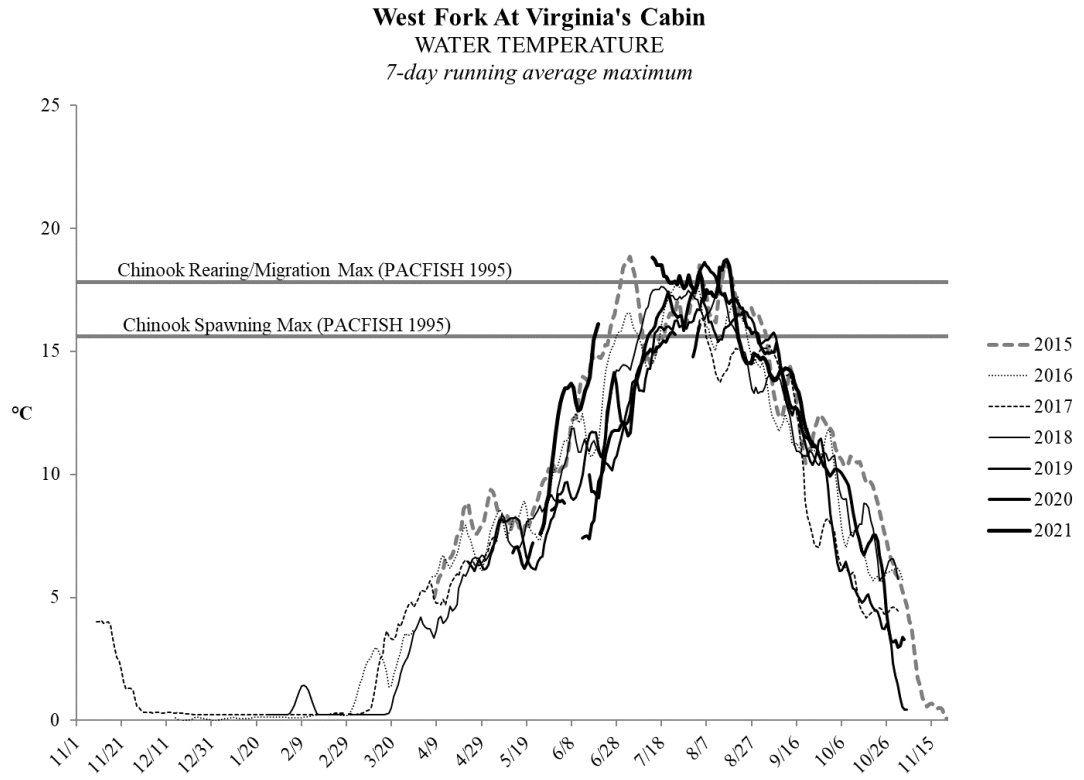


Figure 29. West Fork Yankee Fork at Virginia's cabin, ~290m above new mouth, from 2015 to 2021, 7-day running average maximum water temperatures, using Onset HOBO dataloggers.

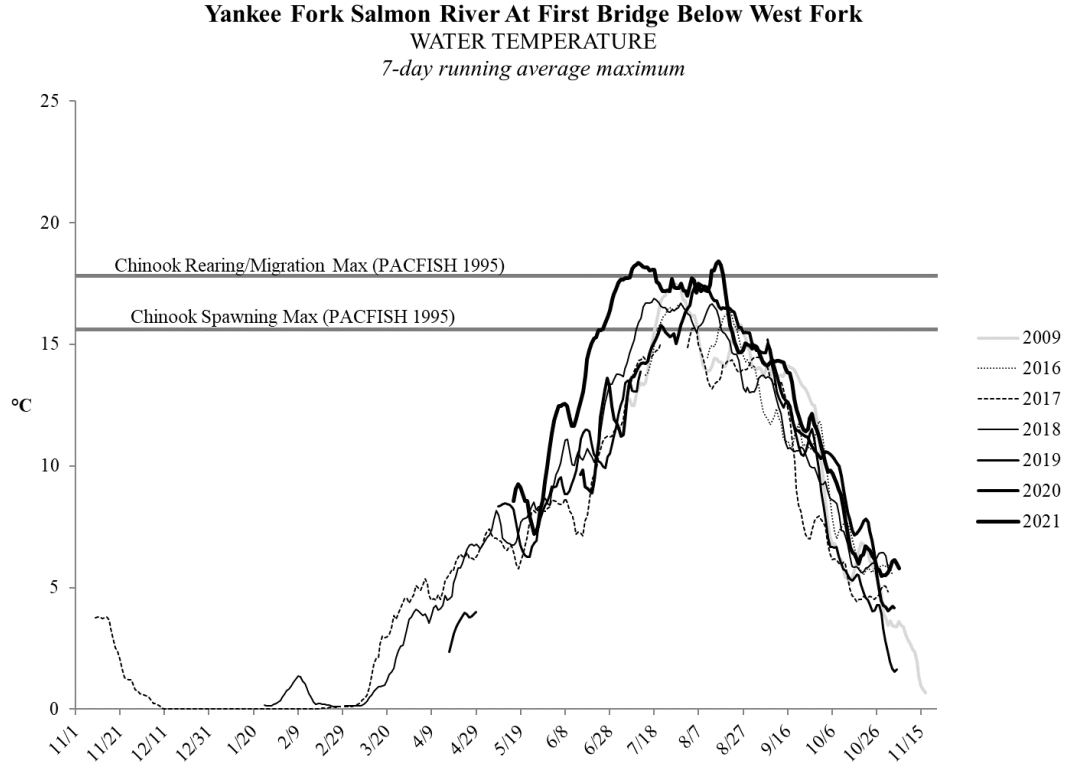


Figure 30. Yankee Fork Salmon River at ~100m below first bridge below West Fork in 2009, at old mouth of West Fork after entire Yankee Fork flow was released to new channel in 2016, and at the first bridge below West Fork from 2016 to 2021, 7-day running average maximum water temperatures, using Onset HOBO dataloggers.

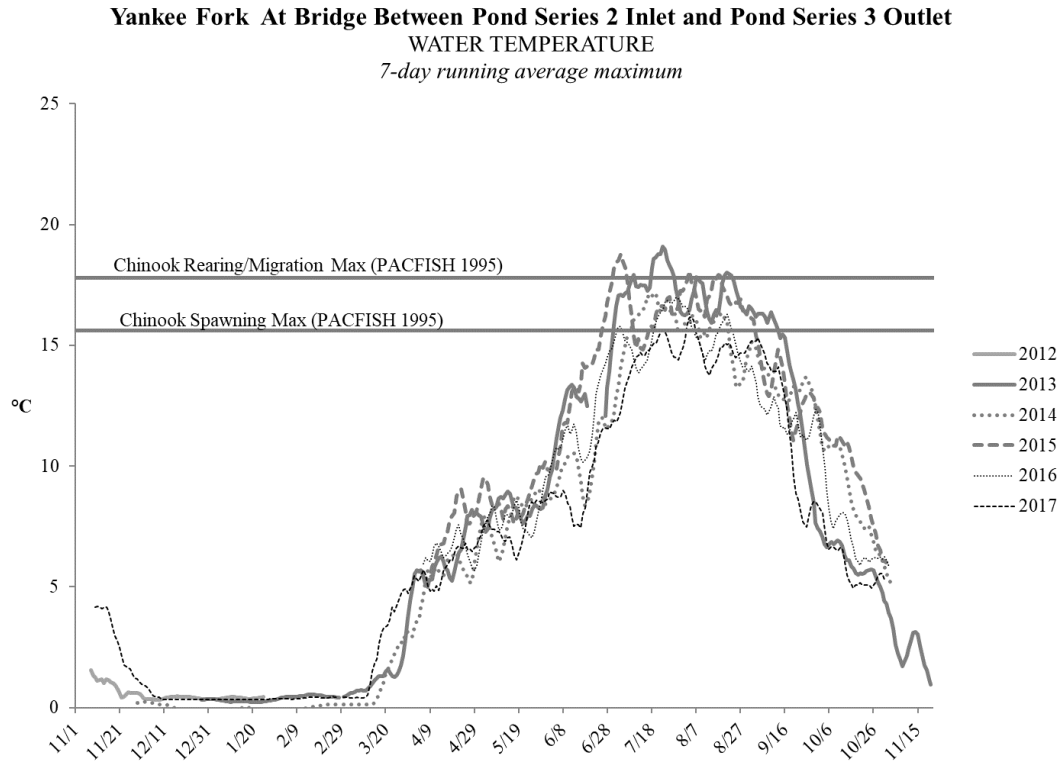


Figure 31. Yankee Fork Salmon River at bridge between the inlet of Pond Series 2 and the outlet of Pond Series 3, 7-day running average maximum stream temperatures, in 2012, 2013, 2014, 2015, 2016 and 2017, using Onset HOBO dataloggers.

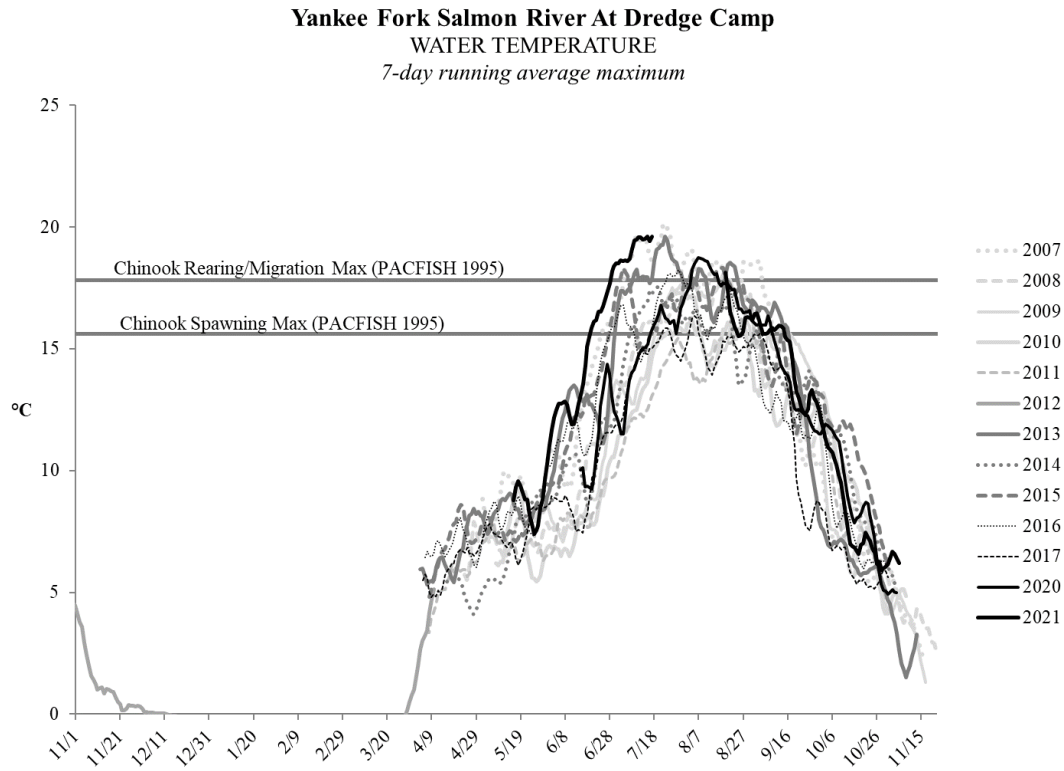


Figure 32. Yankee Fork Salmon River at valley constriction upstream of the Dredge Camp, 7-day running average maximum water temperatures from 2007 to 2017, in 2020 and 2021, using Onset HOBO dataloggers.

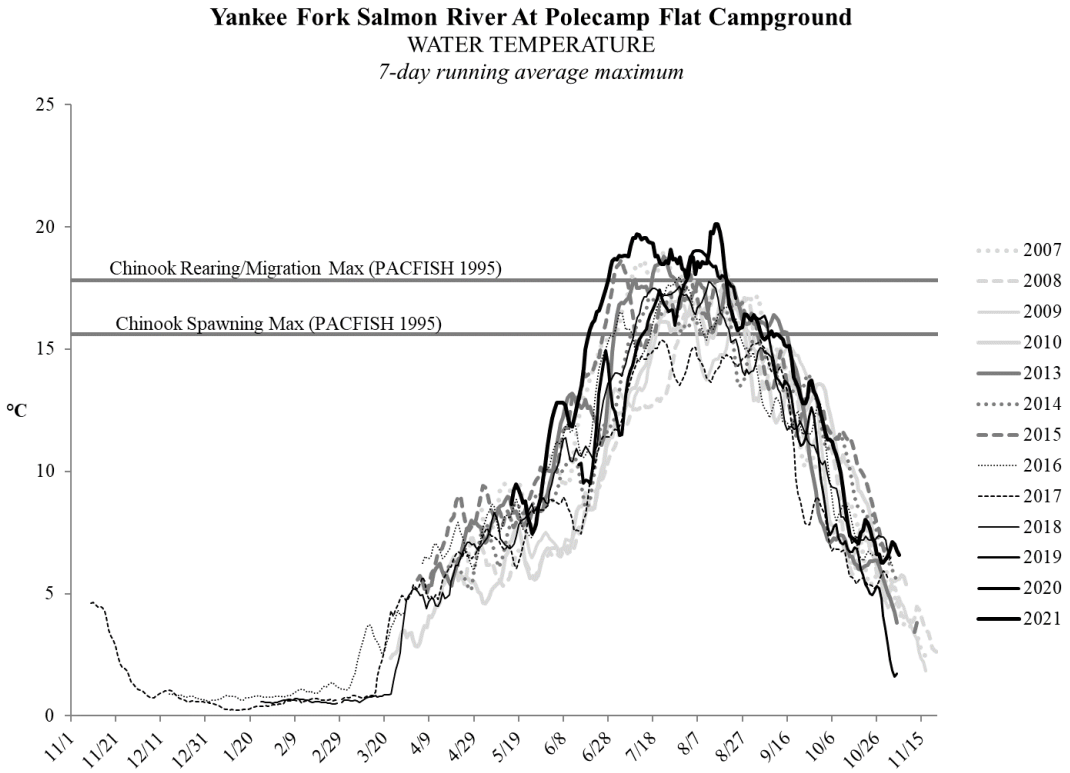


Figure 33. Yankee Fork Salmon River at Polecamp Flat Campground, 7-day running average maximum water temperatures, from 2007 through 2010, and from 2013 through 2021, using Onset HOBO dataloggers.

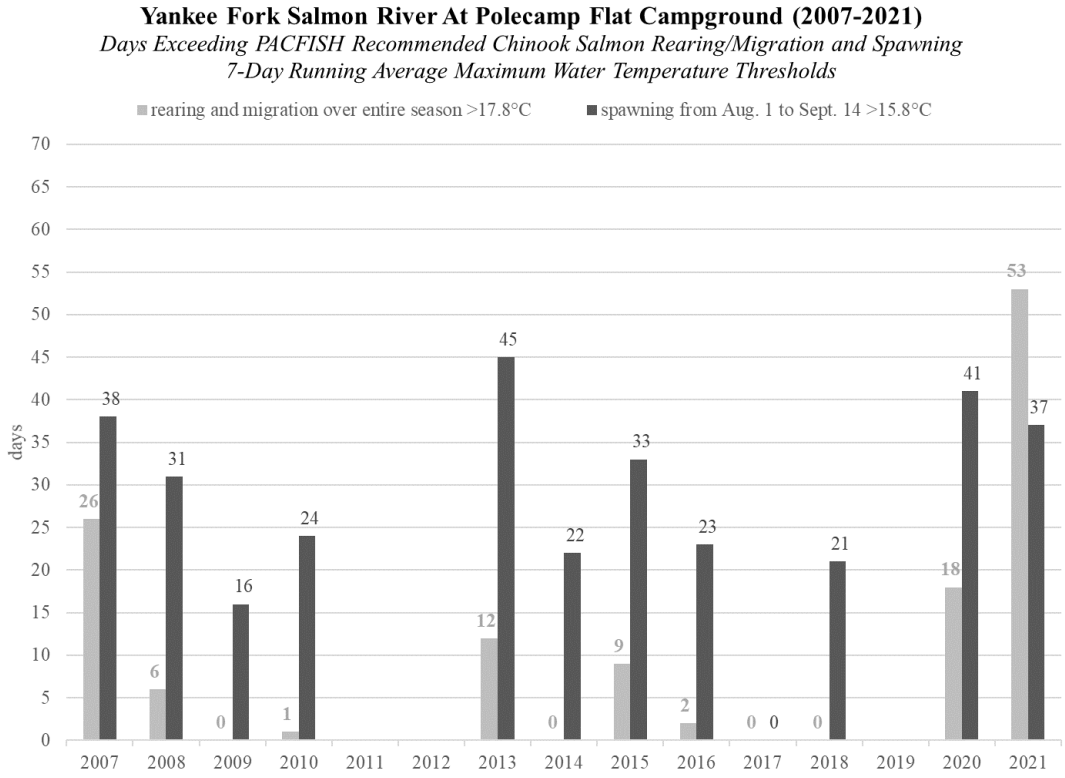


Figure 34. Yankee Fork at Polecamp Flat Campground, 2007 to 2021, number of days the 7-day running average maximum water temperatures exceeded PACFISH recommended thresholds of 17.8°C for Chinook salmon rearing/migration over entire season, and 15.8°C during spawning, from August 1 to September 14, using Onset HOBO dataloggers.

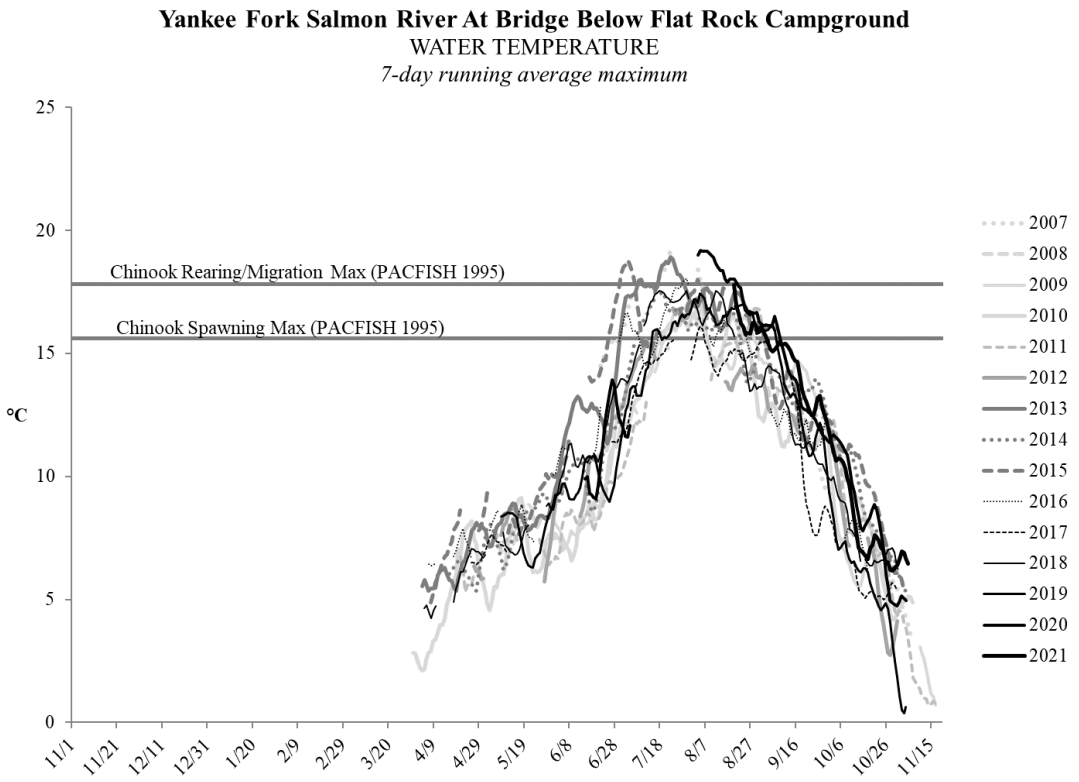


Figure 35. Yankee Fork Salmon River at bridge below Flat Rock Campground, 7-day running average maximum water temperature, from 2007 through 2021, using both Onset HOBO dataloggers and SONDE temperature probe.

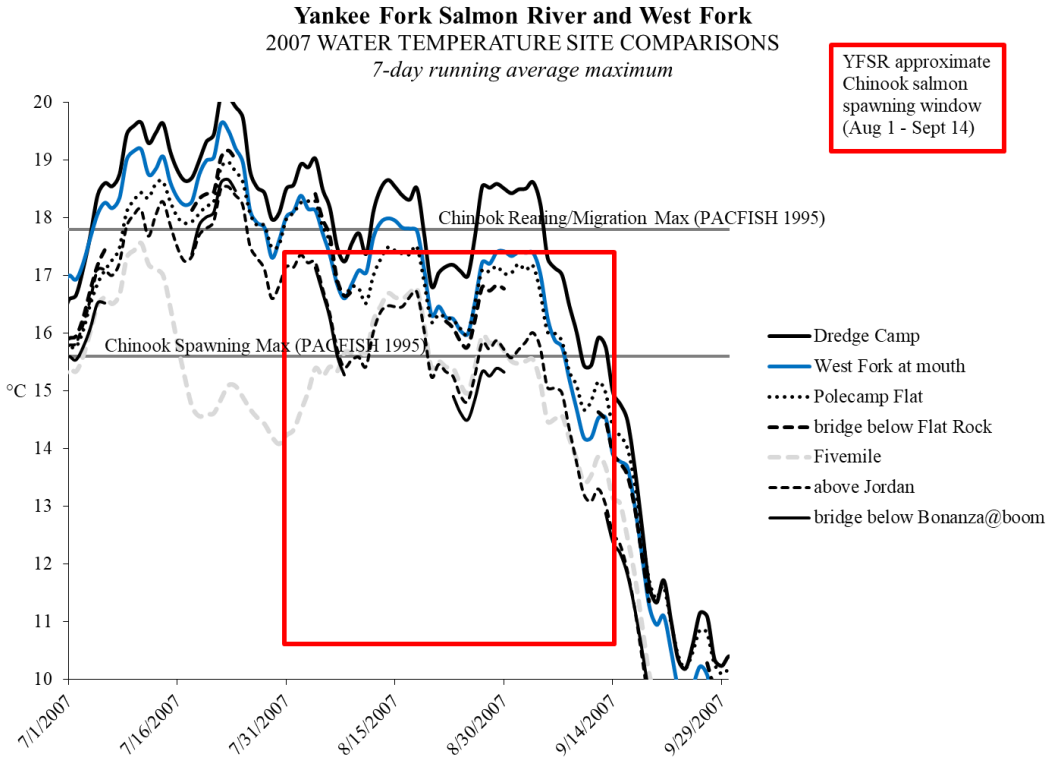


Figure 36. 2007 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

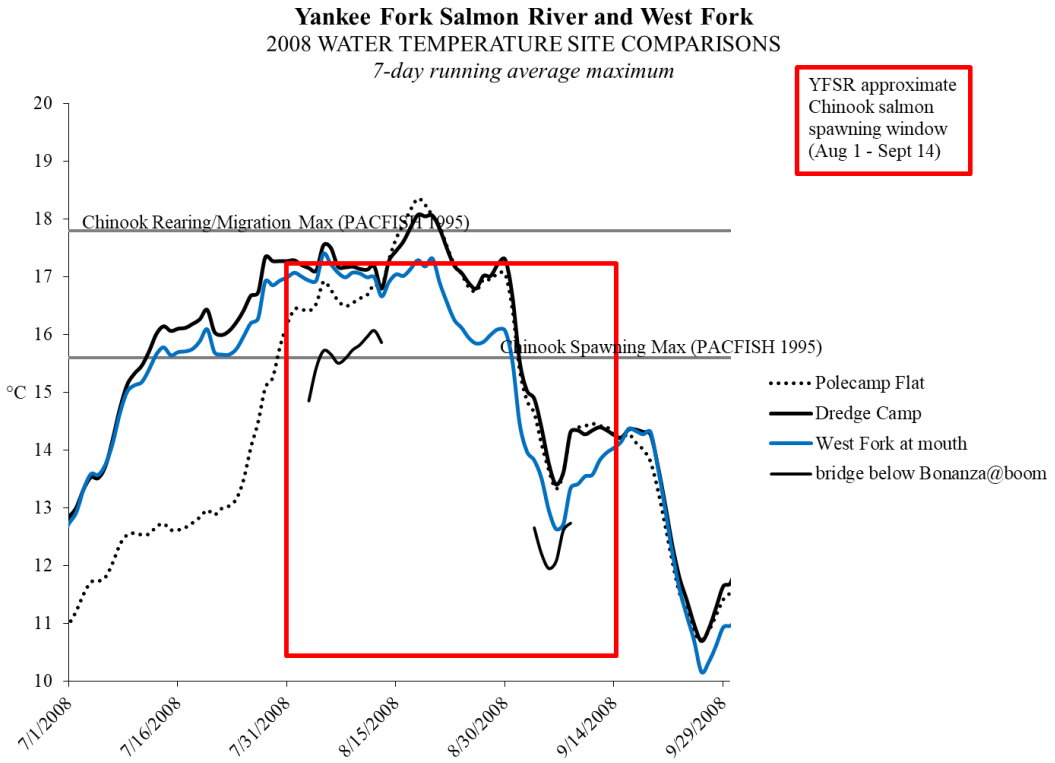


Figure 37. 2008 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

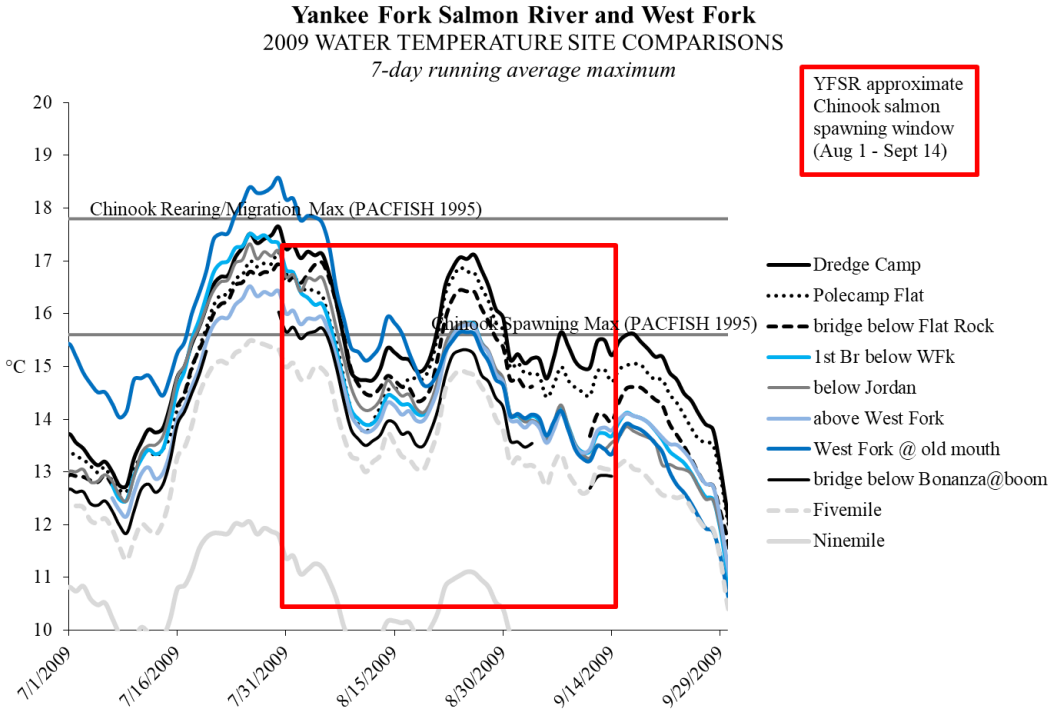


Figure 38. 2009 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

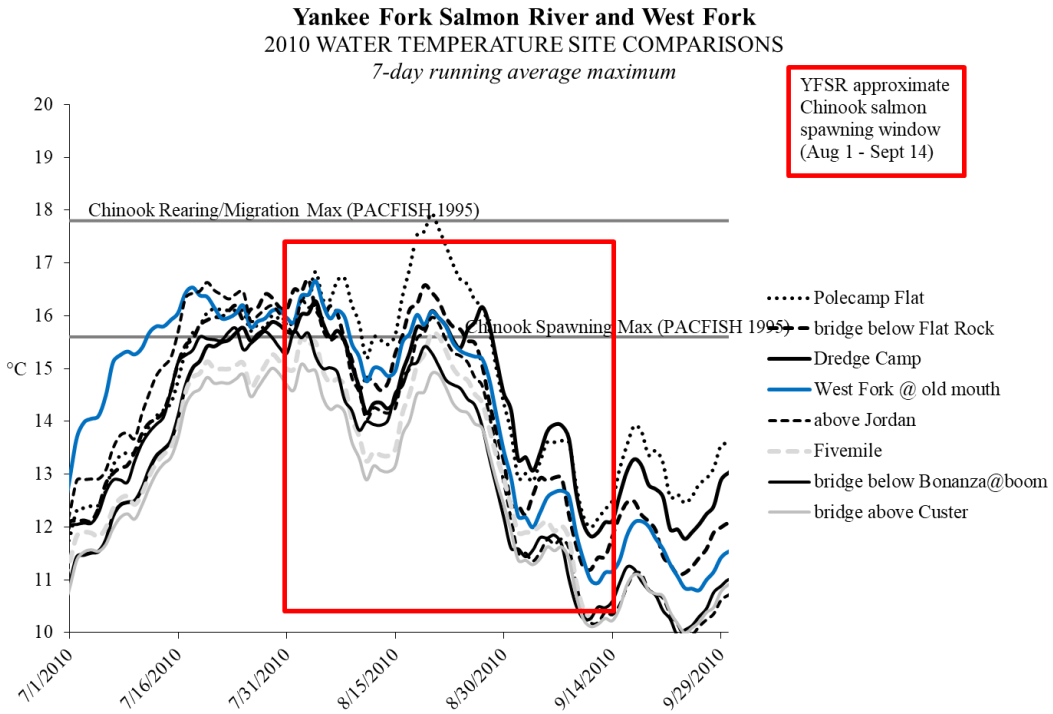


Figure 39. 2010 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

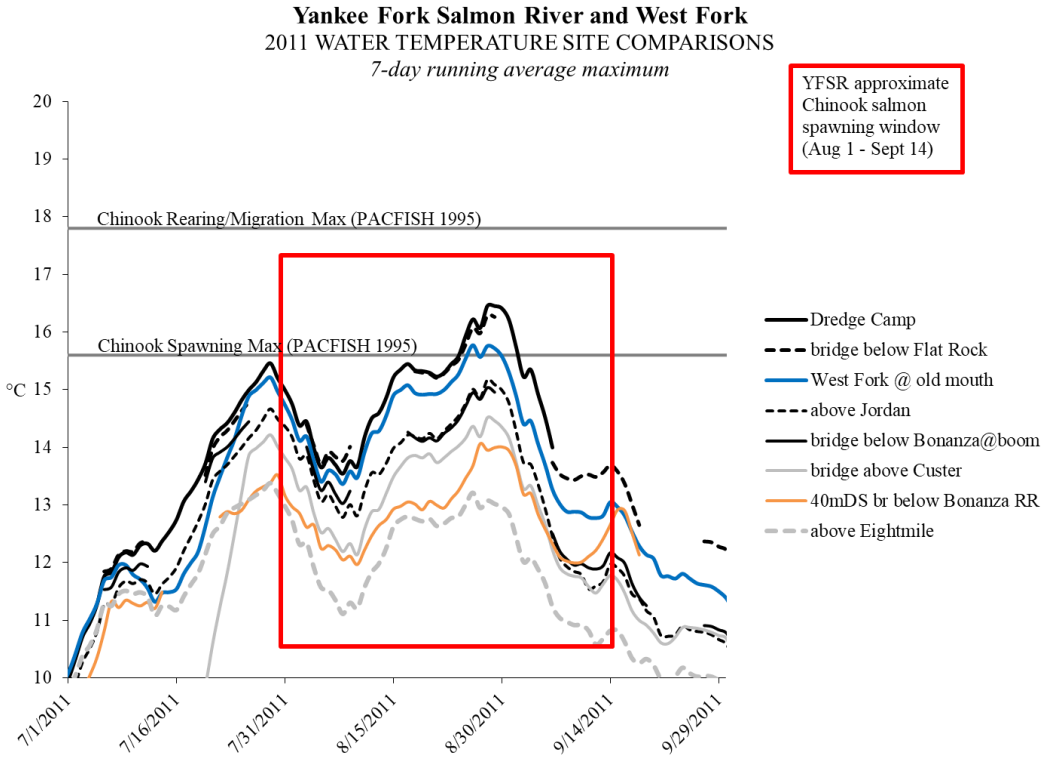


Figure 40. 2011 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

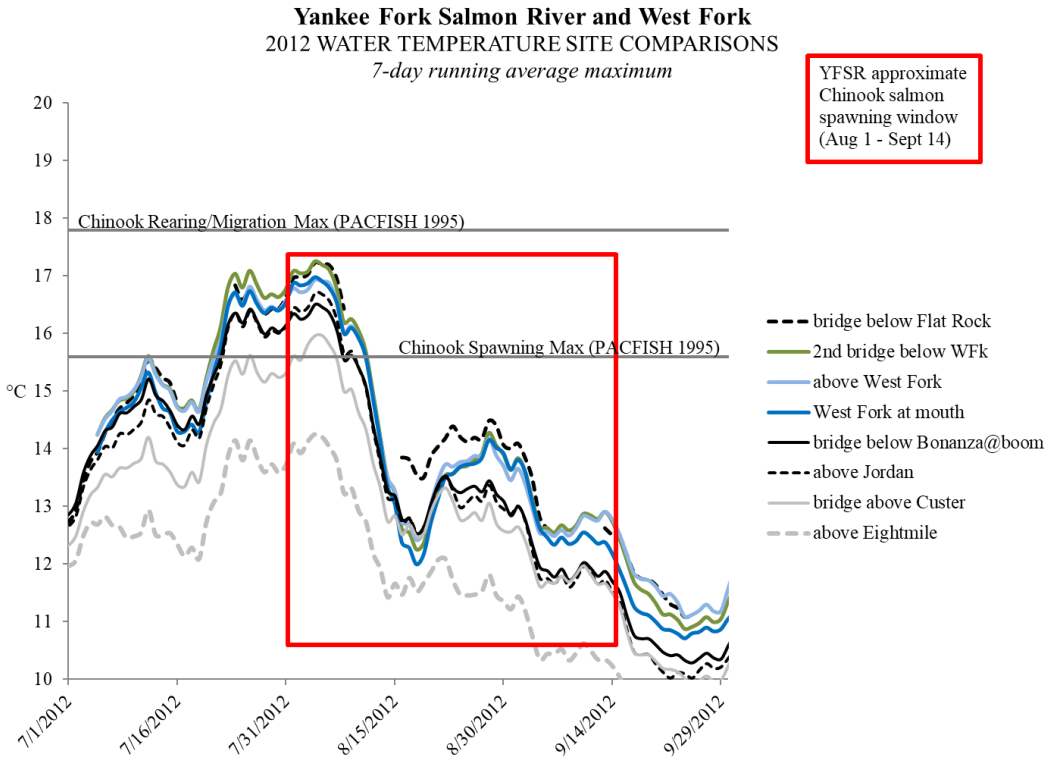


Figure 41. 2012 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

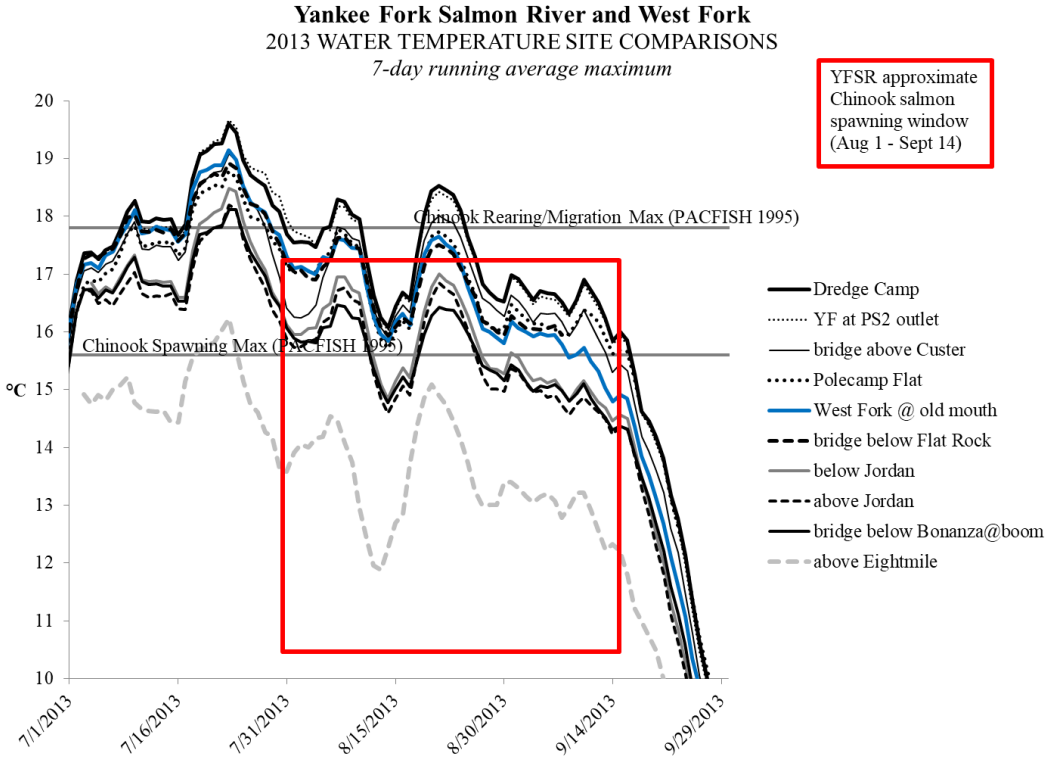


Figure 42. 2013 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

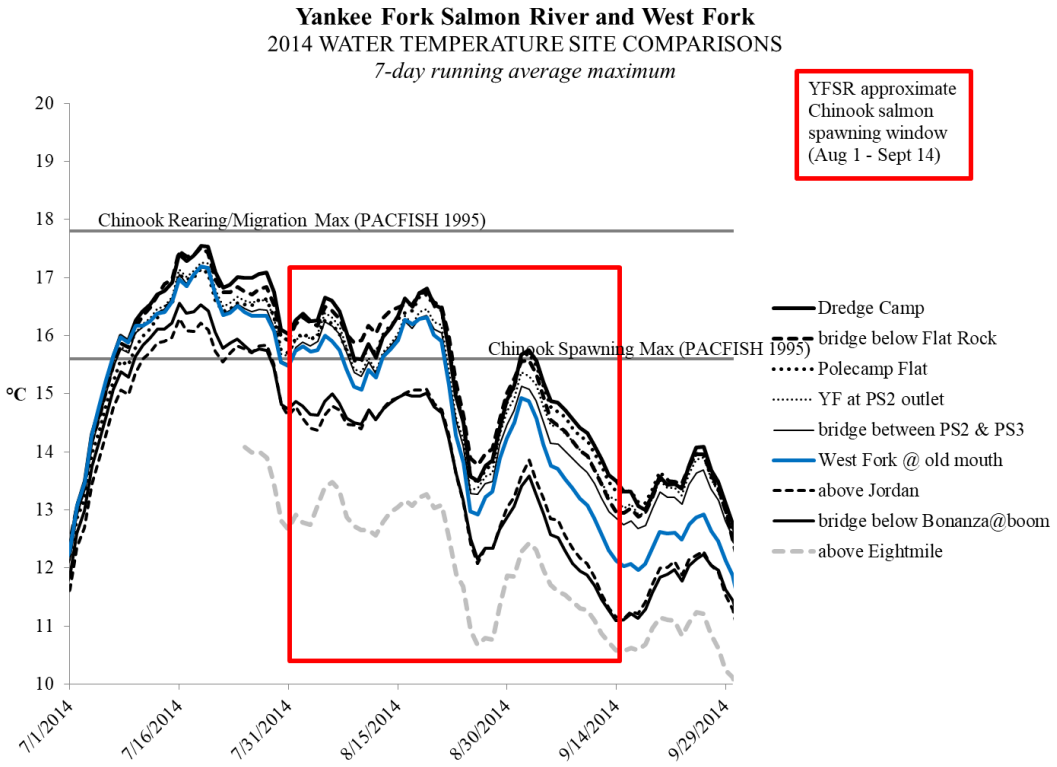


Figure 43. 2014 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

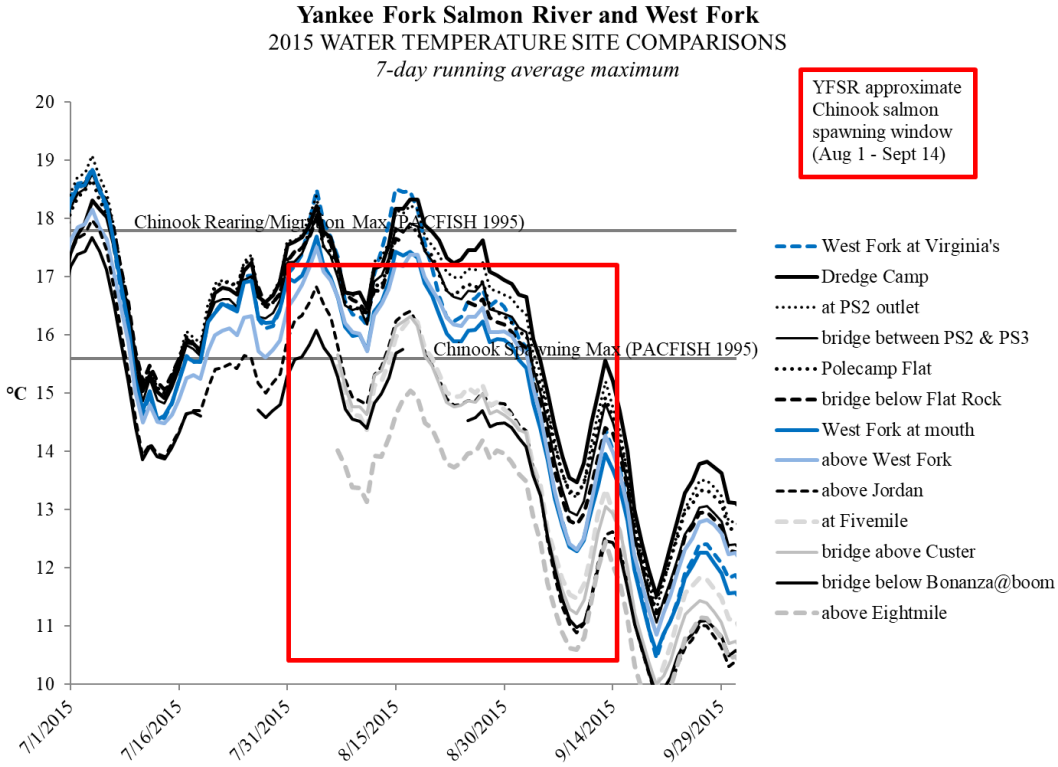


Figure 44. 2015 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

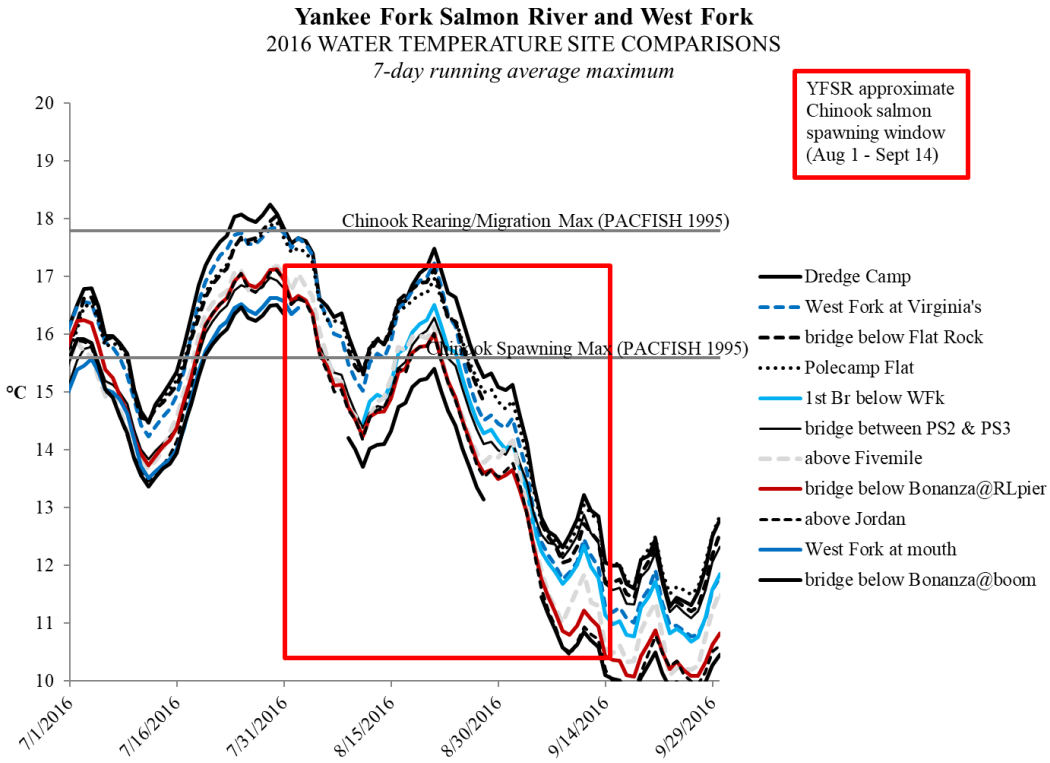


Figure 45. 2016 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

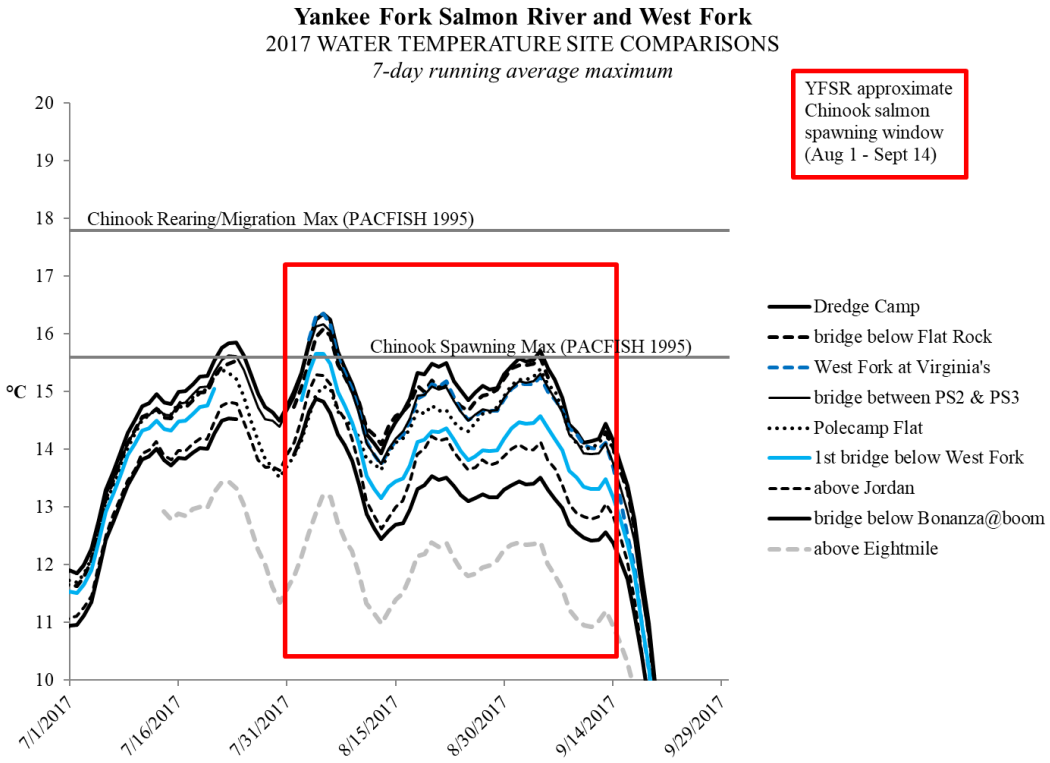


Figure 46. 2017 Yankee Fork Salmon River and West Fork Yankee Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

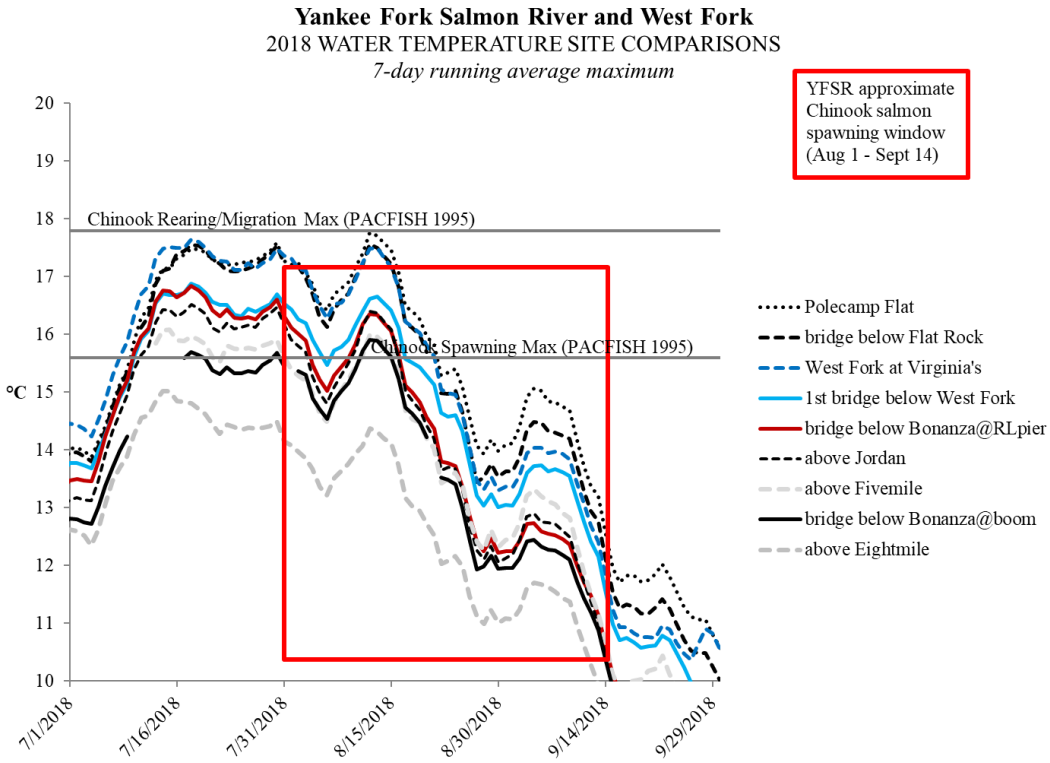


Figure 47. 2018 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

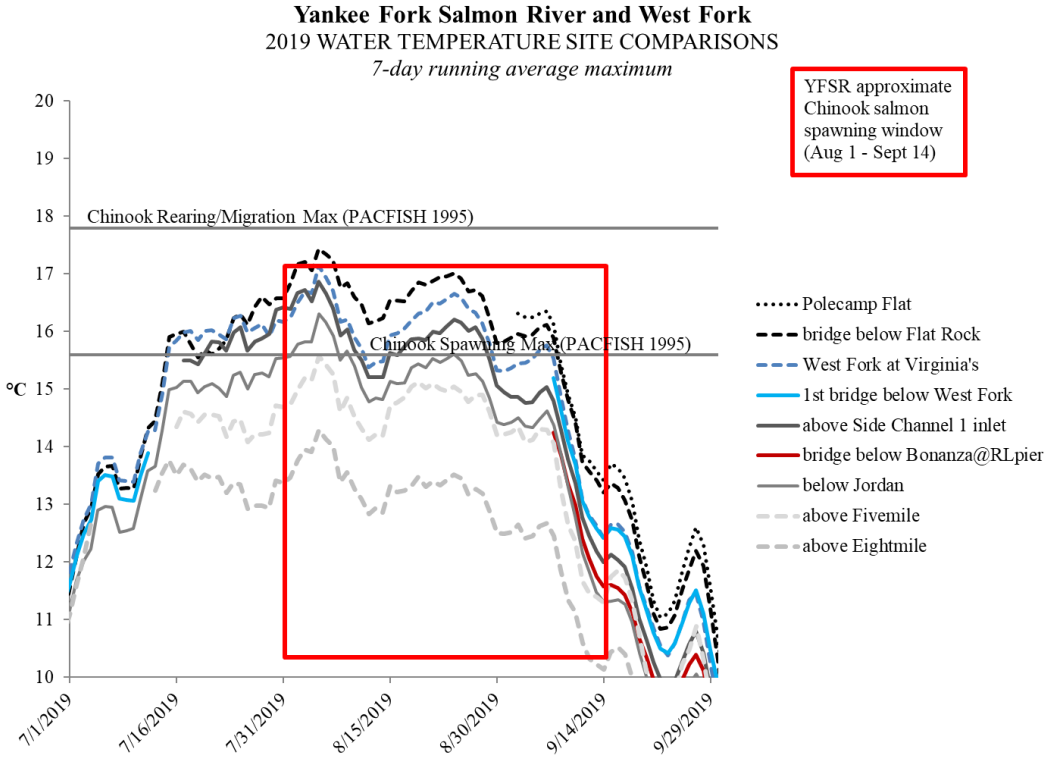


Figure 48. 2019 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

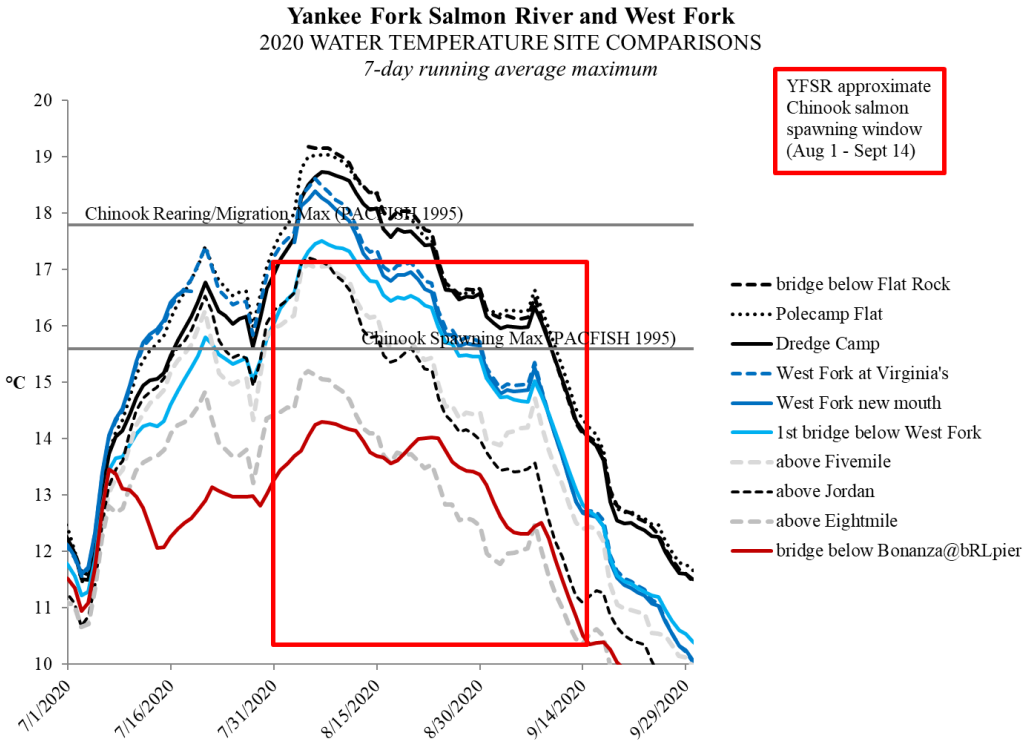


Figure 49. 2020 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

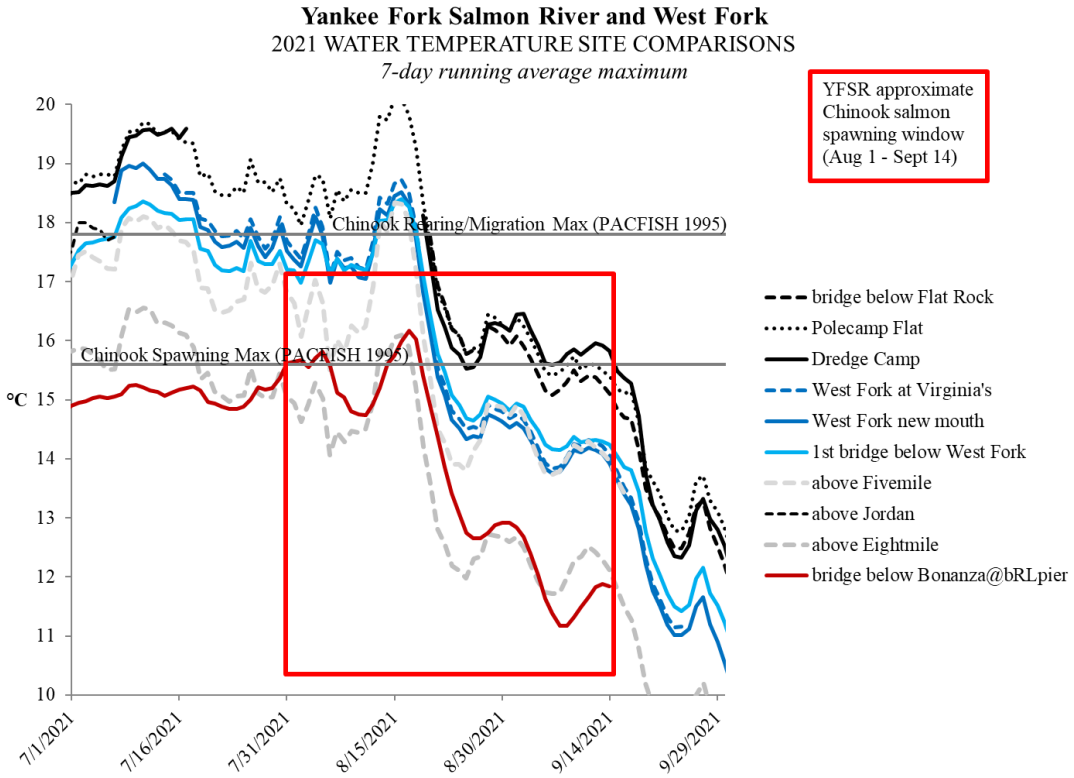


Figure 50. 2021 Yankee Fork Salmon River and West Fork, 7-day running average maximum water temperature comparisons above, within and below the dredged reach. The box shows the approximate spawning window for Chinook salmon in the Yankee Fork Salmon River, from the first week of August through the second week of September (August 1 – September 14).

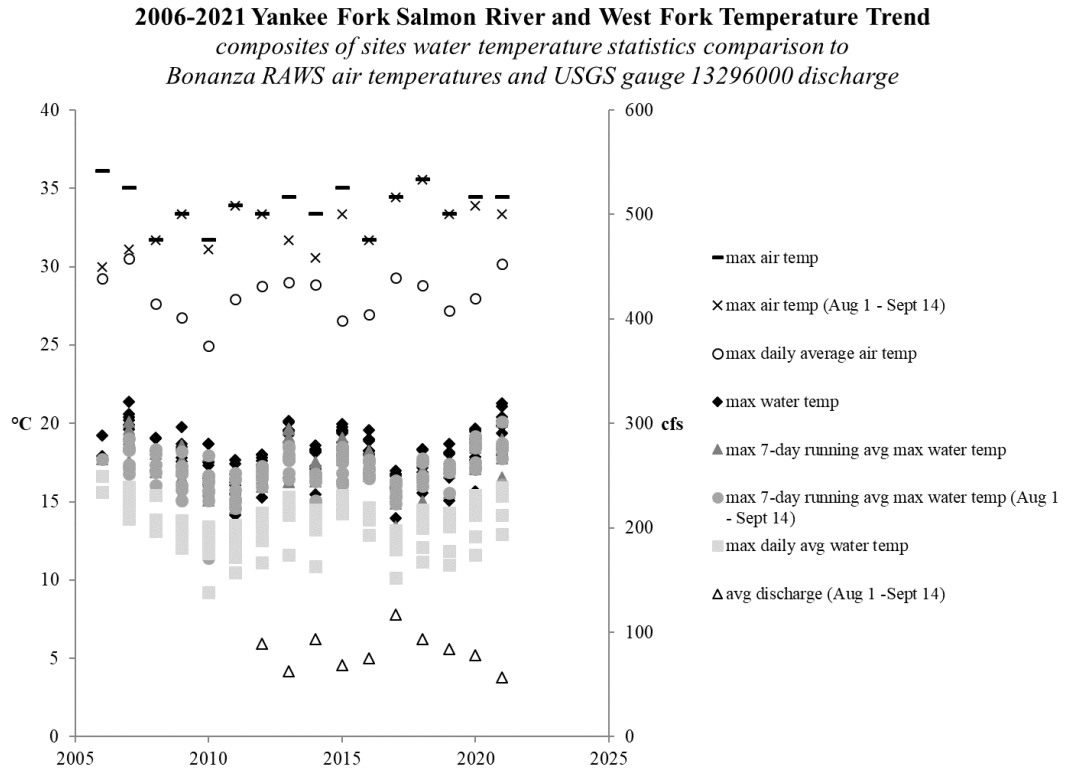


Figure 51. 2006-2021 Yankee Fork Salmon River and West Fork water temperature trend. Annual composited site maximum, maximum 7-day running average maximum, maximum 7-day running average maximum from August 1 to September 14, and maximum daily average water temperatures; Bonanza RAWS station annual maximum, maximum from August 1 to September 14 and maximum daily average air temperatures; and USGS gauge 1329600 average discharge from August 1 to September 14.

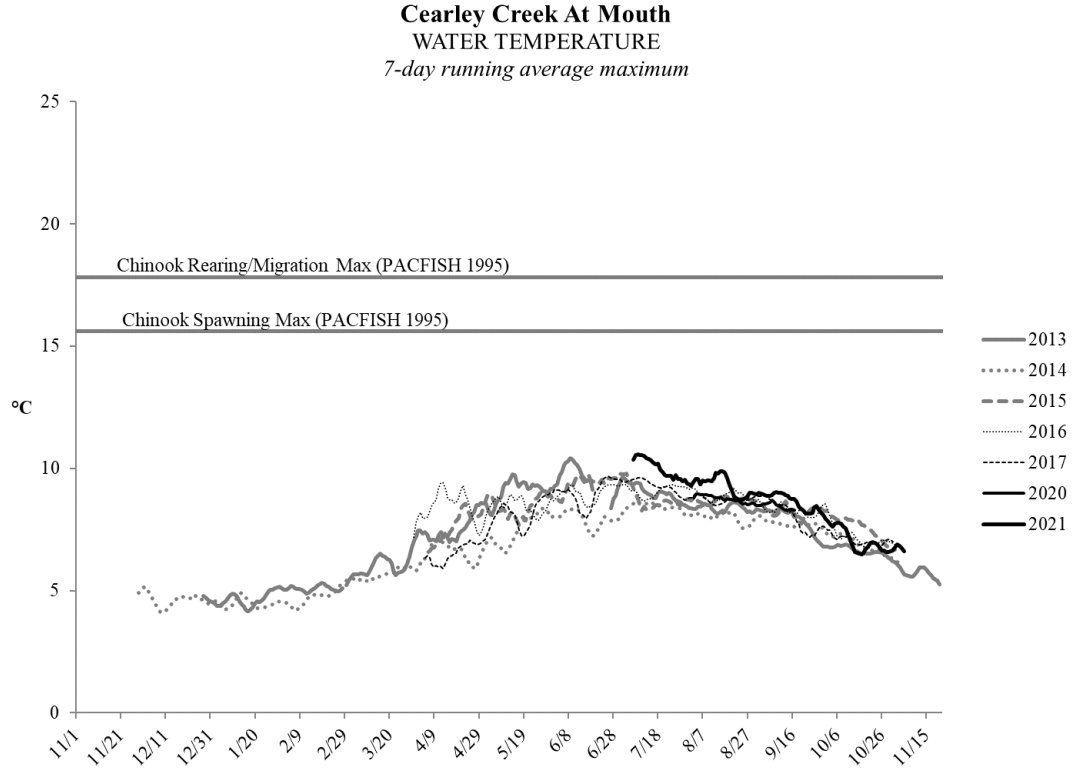


Figure 52. Cearley Creek, tributary to Pond Series 3, at mouth, 7-day running average maximum water temperatures, in 2013, 2014, 2015, 2016, 2017, 2020 and 2021, using Onset HOBO dataloggers.

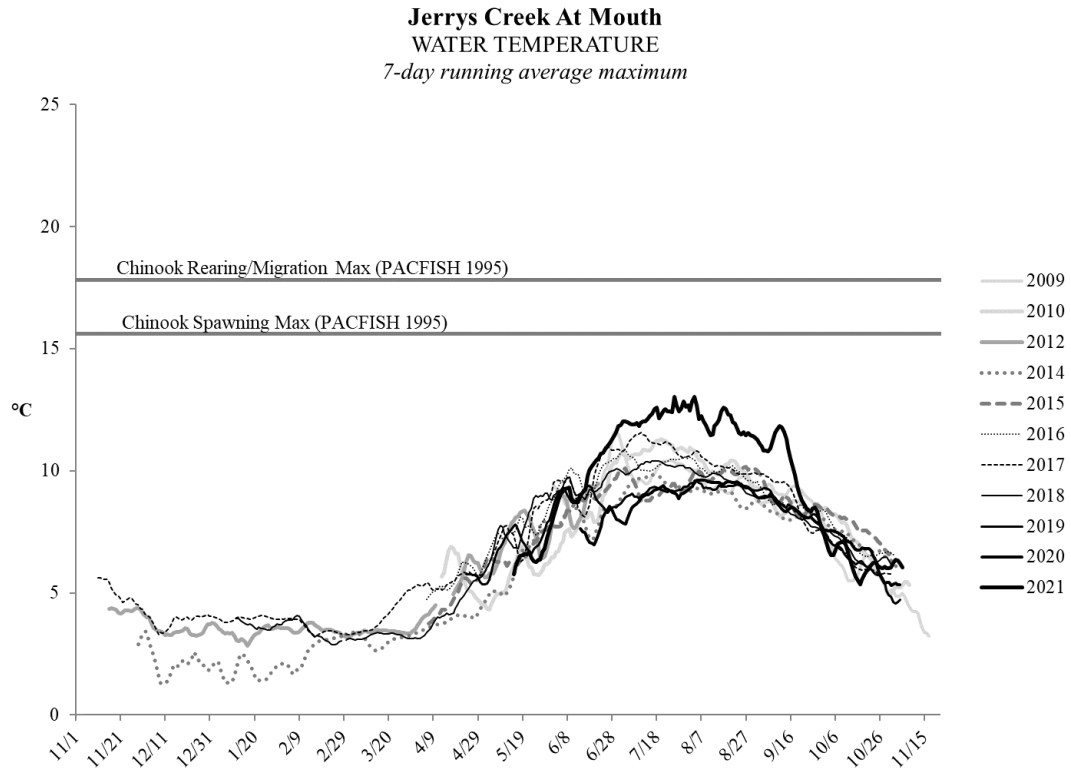


Figure 53. Jerrys Creek at mouth, 7-day running average maximum water temperatures, in 2009, 2010, 2012 and 2014 through 2021, using Onset HOBO dataloggers.

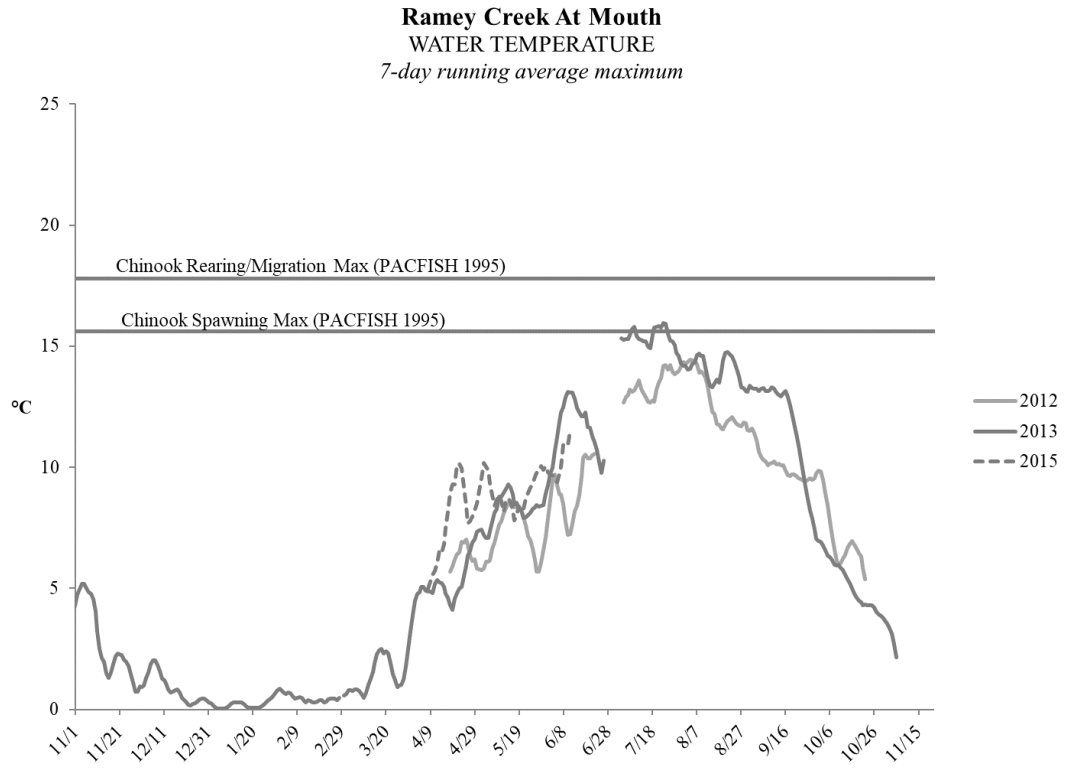


Figure 54. Ramey Creek at mouth, 7-day running average maximum water temperatures, in 2012, 2013 and 2015, using both Onset HOBO (SBT) and Tidbit (USFS) dataloggers.

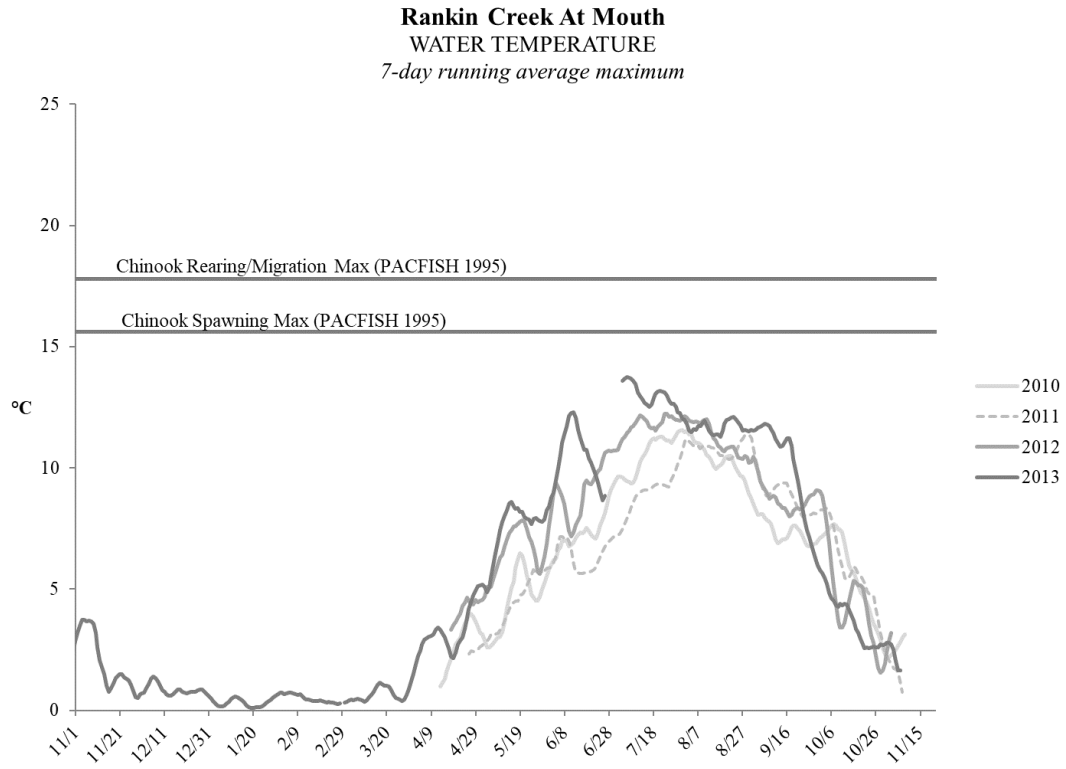


Figure 55. Rankin Creek at mouth, 7-day running average maximum water temperatures, in 2010, 2011, 2012 and 2013, using both Onset HOBO (SBT) and Tidbit (USFS) dataloggers.

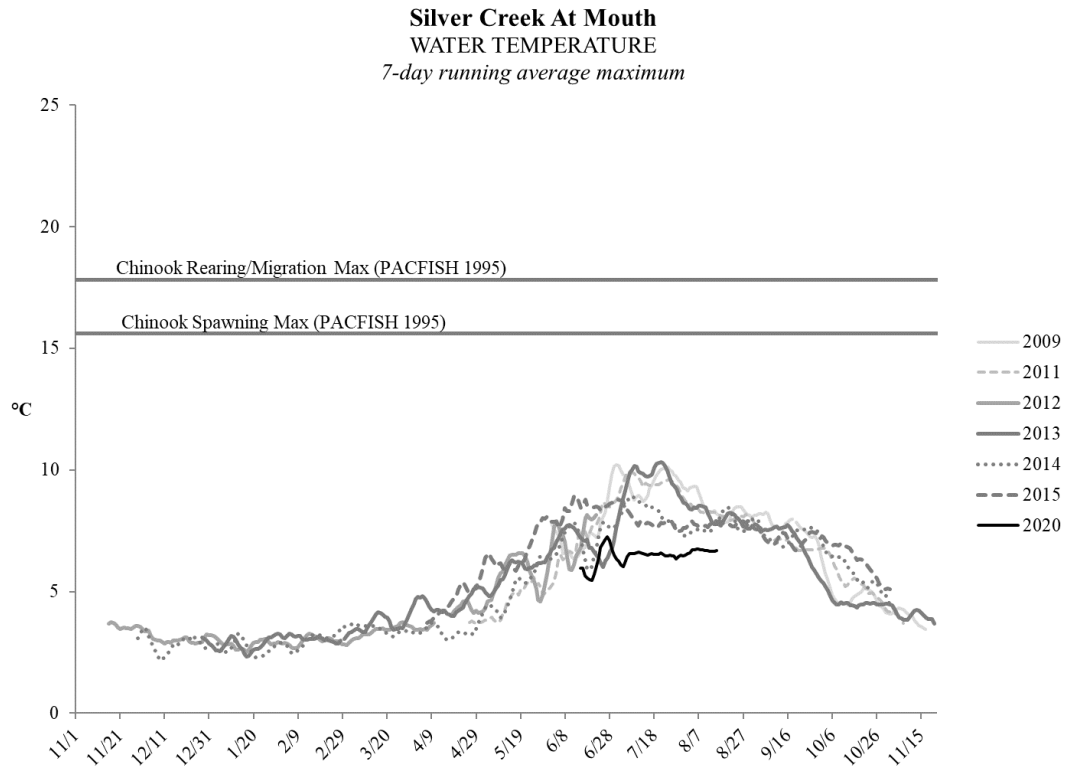


Figure 56. Silver Creek at mouth, 7-day running average maximum water temperatures, in 2009, 2011, 2012, 2013, 2014, 2015 and 2020, using Onset HOBO dataloggers.

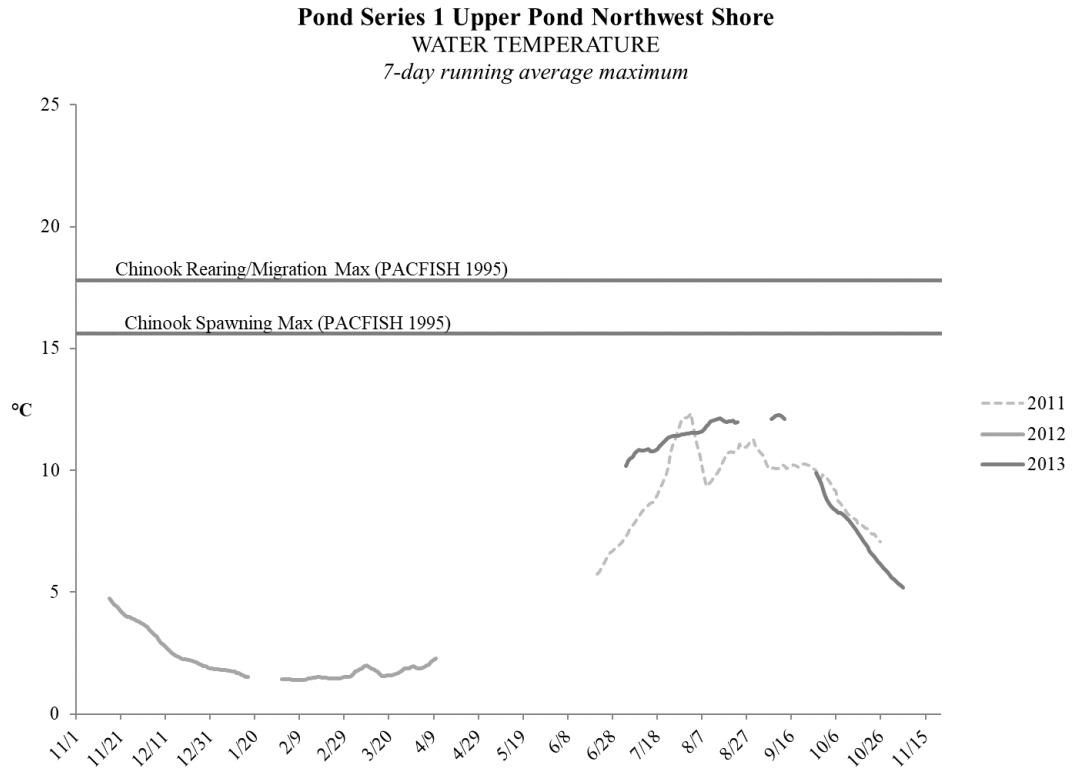


Figure 57. Pond Series 1 upper pond northwest shore, 7-day running average maximum water temperatures, in 2012 and 2013, using both Onset HOBO (SBT) and Tidbit (USFS) dataloggers.

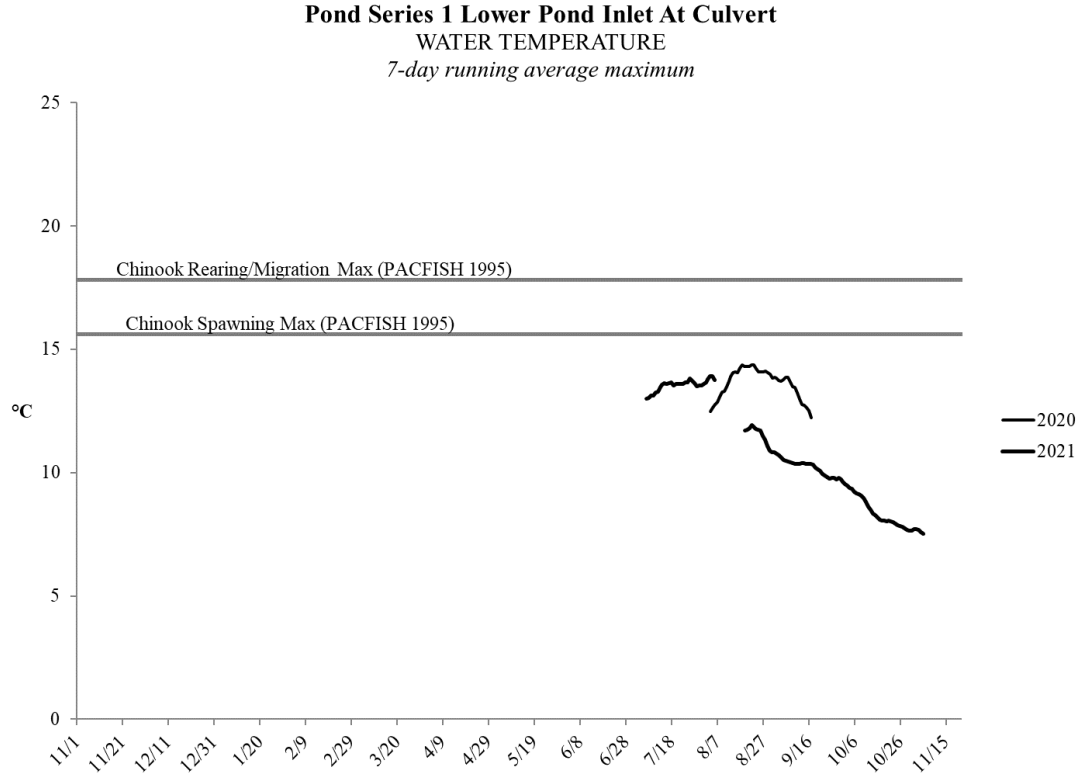


Figure 58. Pond Series 1 lower pond inlet culvert, 7-day running average maximum water temperatures, in 2020 and 2021, using Onset HOBO datalogger.

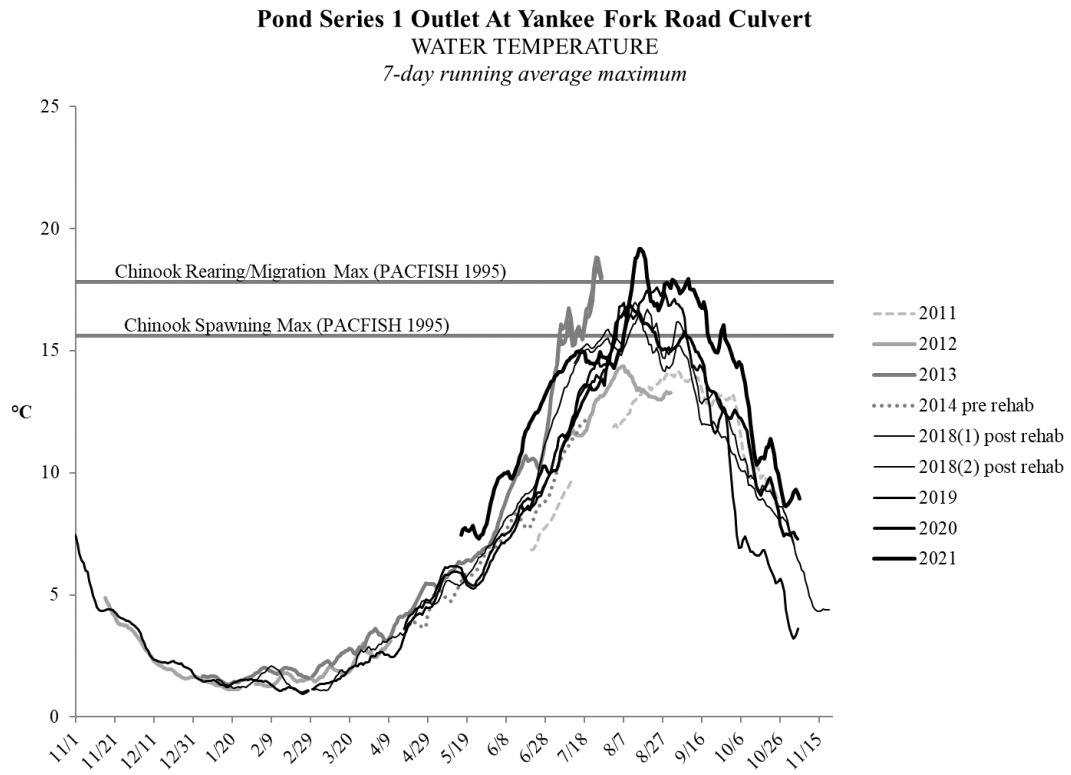


Figure 59. Pond Series 1 outlet at culvert under the Yankee Fork Road, 7-day running average maximum water temperatures, in 2011, 2012, 2013, and 2014 prior to the Pond Series 1 rehabilitation, and in 2018 (2 data sets), 2019, 2020 and 2021 post rehabilitation, using Onset HOBO (SBT and Jim Gregory, Lost River Fish Ecology, Inc.) and Tidbit (USFS) dataloggers.

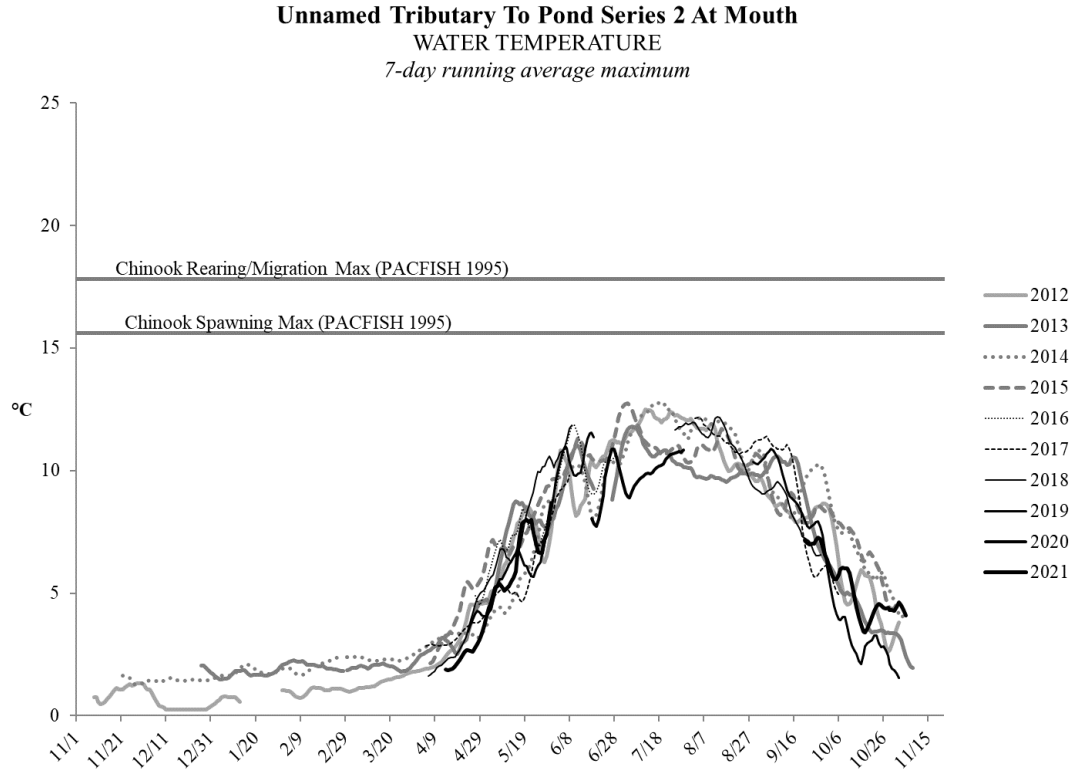


Figure 60. Unnamed Tributary to Pond Series 2 at mouth, 7-day running average maximum water temperatures, 2012 to 2021, using Onset HOBO dataloggers.

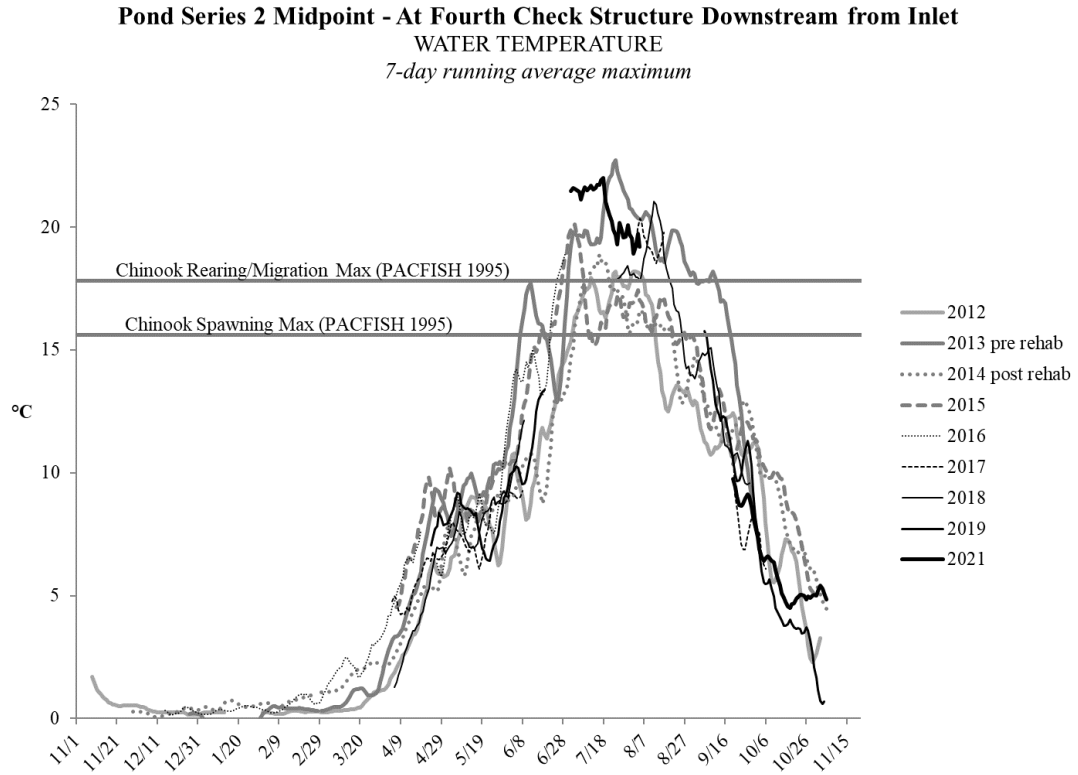


Figure 61. Pond Series 2 midpoint at 4th check structure downstream from inlet, 7-day running average maximum water temperatures, in 2012 and 2013 prior to rehabilitation work, and from 2014 to 2021 after rehabilitation work, using Onset HOBO dataloggers.

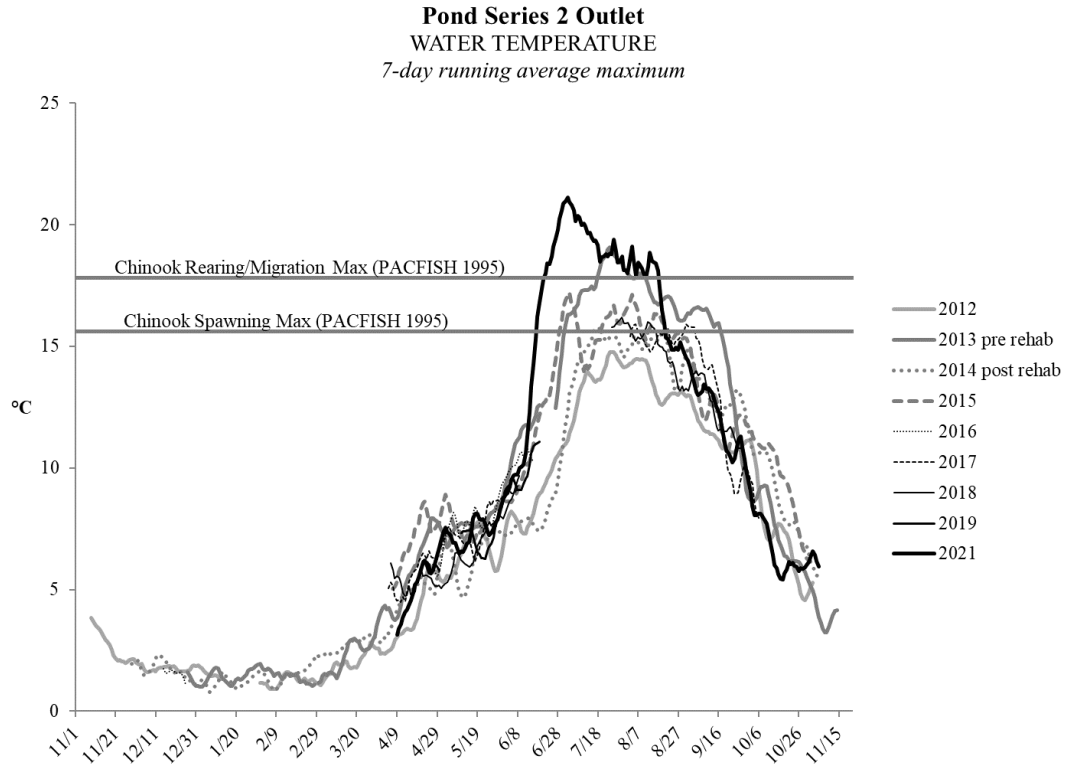


Figure 62. Pond Series 2 outlet, 7-day running average maximum water temperatures, in 2012 and 2013 prior to rehabilitation work, and in from 2014 to 2021 after rehabilitation work, using Onset HOBO dataloggers.

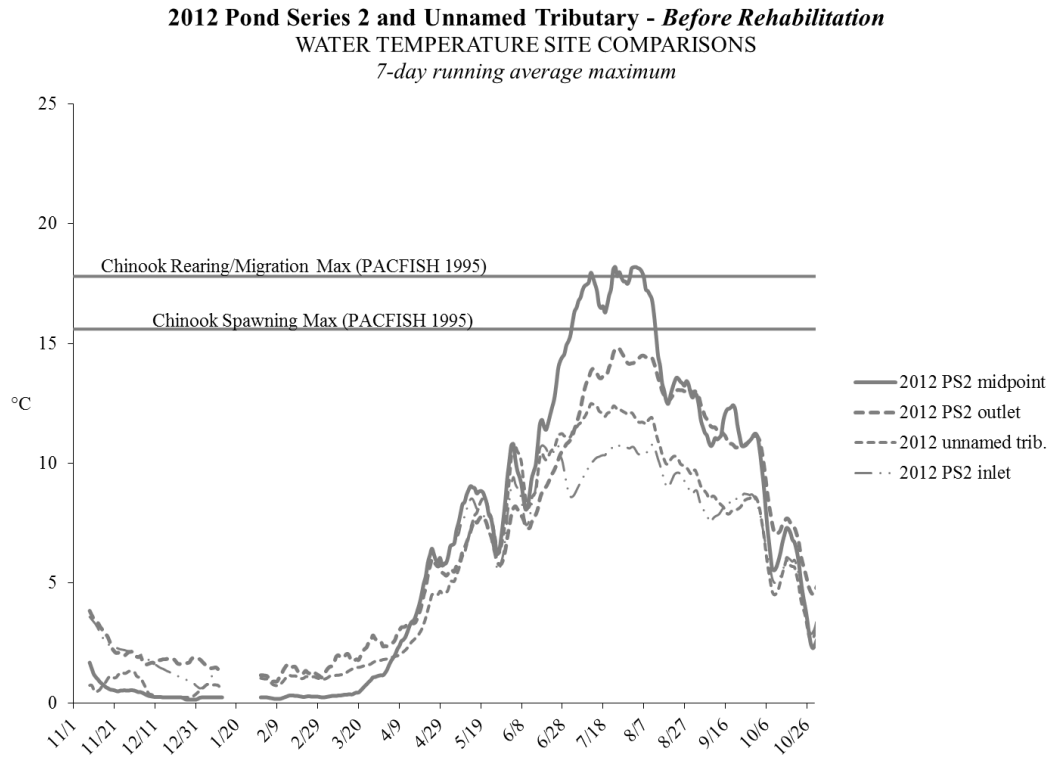


Figure 63. Pond Series 2 in 2012 prior to rehabilitation work, at inlet, midpoint, outlet and unnamed tributary to Pond Series 2, 7-day running average maximum water temperature site comparisons.

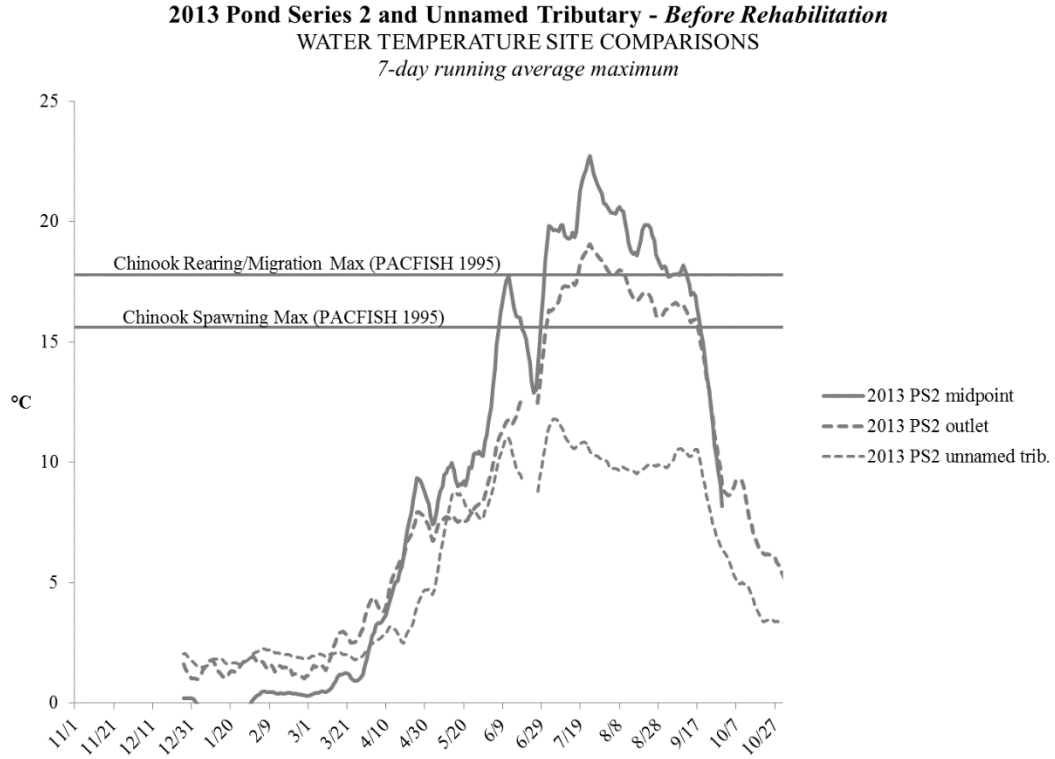


Figure 64. Pond Series 2 in 2013 prior to rehabilitation work, at midpoint, outlet and unnamed tributary to Pond Series 2, 7-day running average maximum water temperature site comparisons.

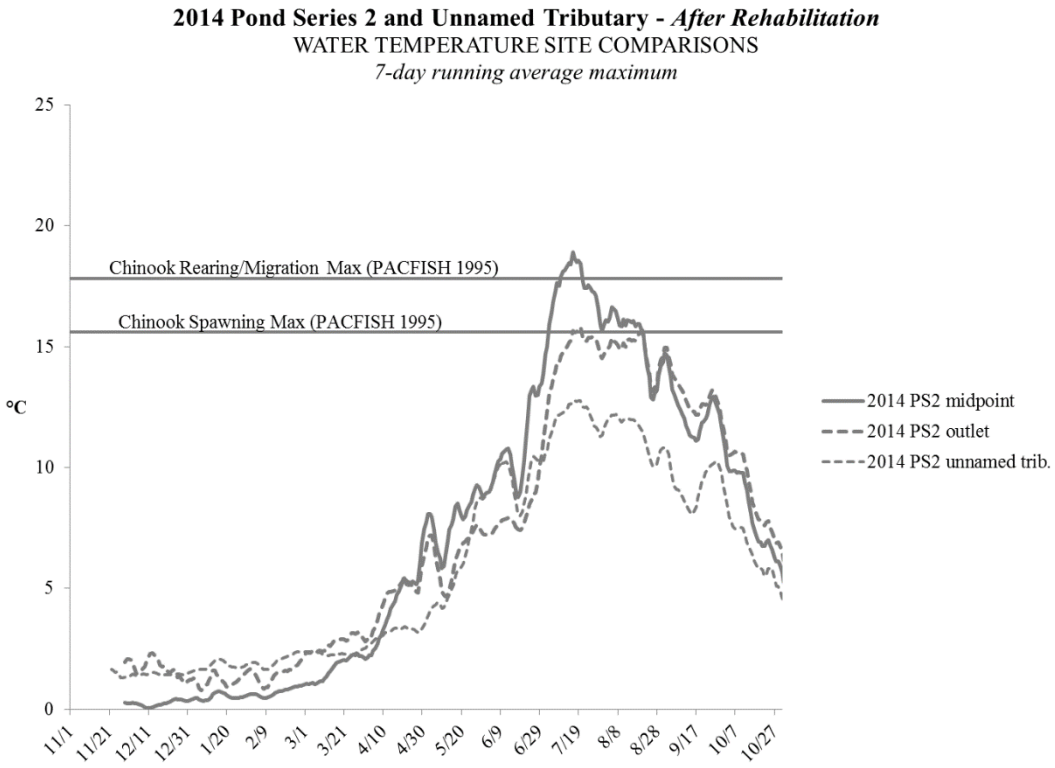


Figure 65. Pond Series 2 in 2014 after rehabilitation work, at midpoint, outlet and unnamed tributary to Pond Series 2, 7-day running average maximum water temperature site comparisons.

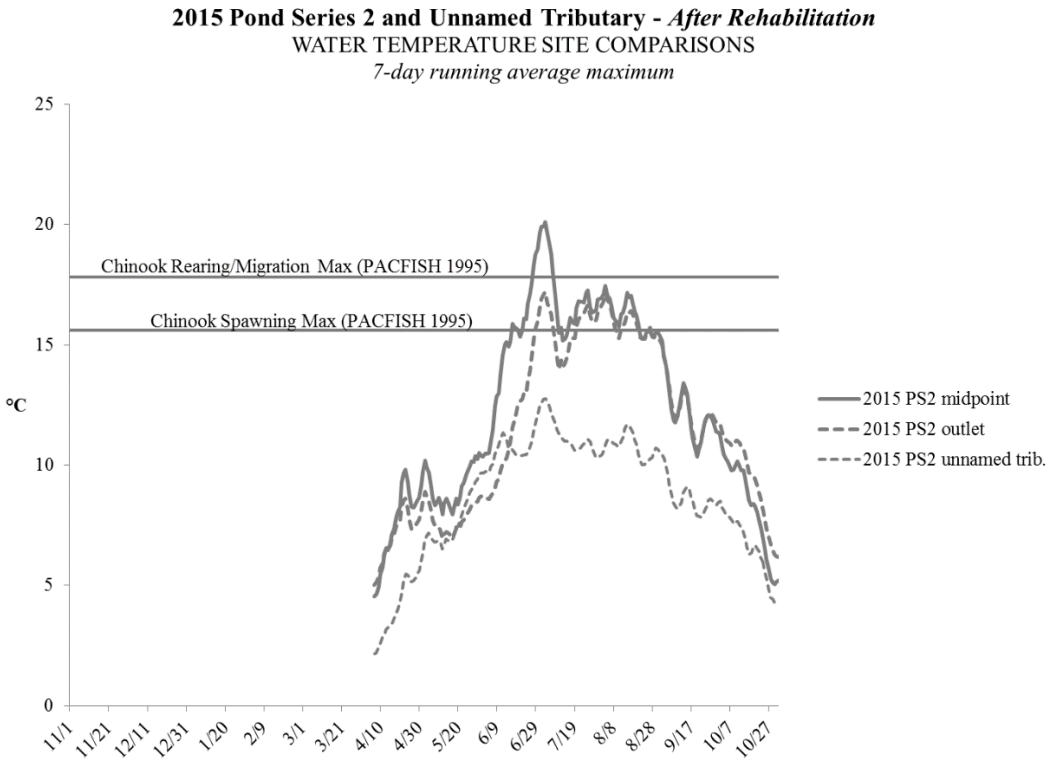


Figure 66. Pond Series 2 in 2015 after rehabilitation work, at midpoint, outlet and unnamed tributary to Pond Series 2, 7-day running average maximum water temperature site comparisons.

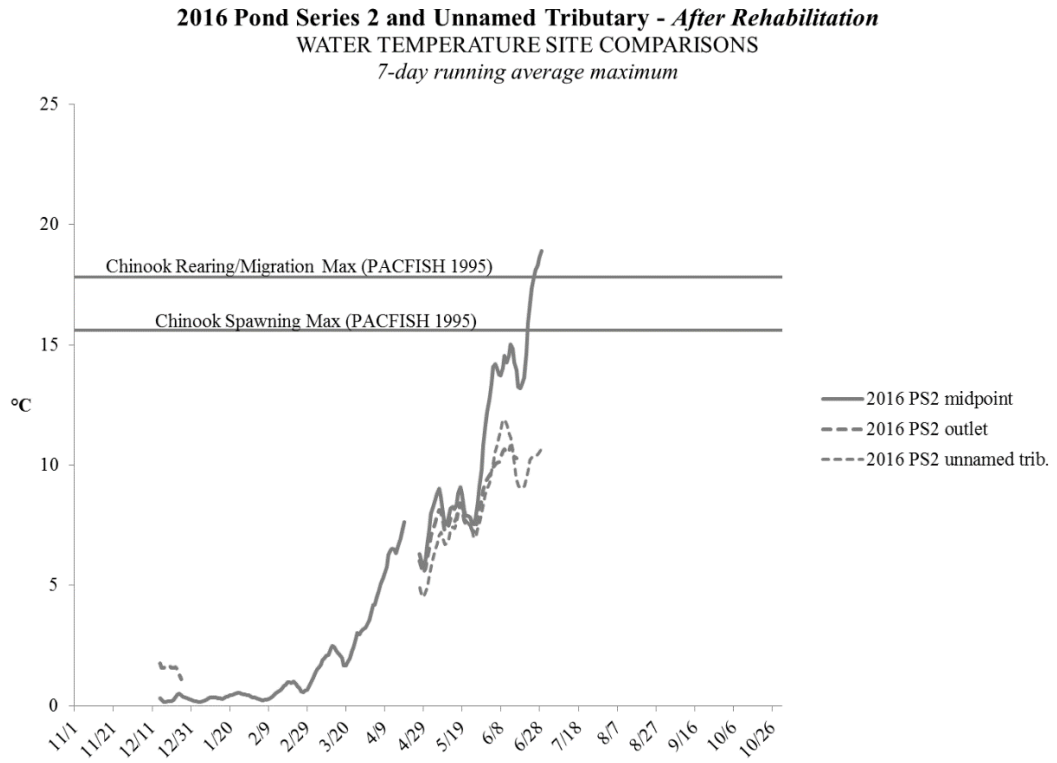


Figure 67. Pond Series 2 in 2016 after rehabilitation work, at midpoint, outlet and unnamed tributary to Pond Series 2, 7-day running average maximum water temperature site comparisons.

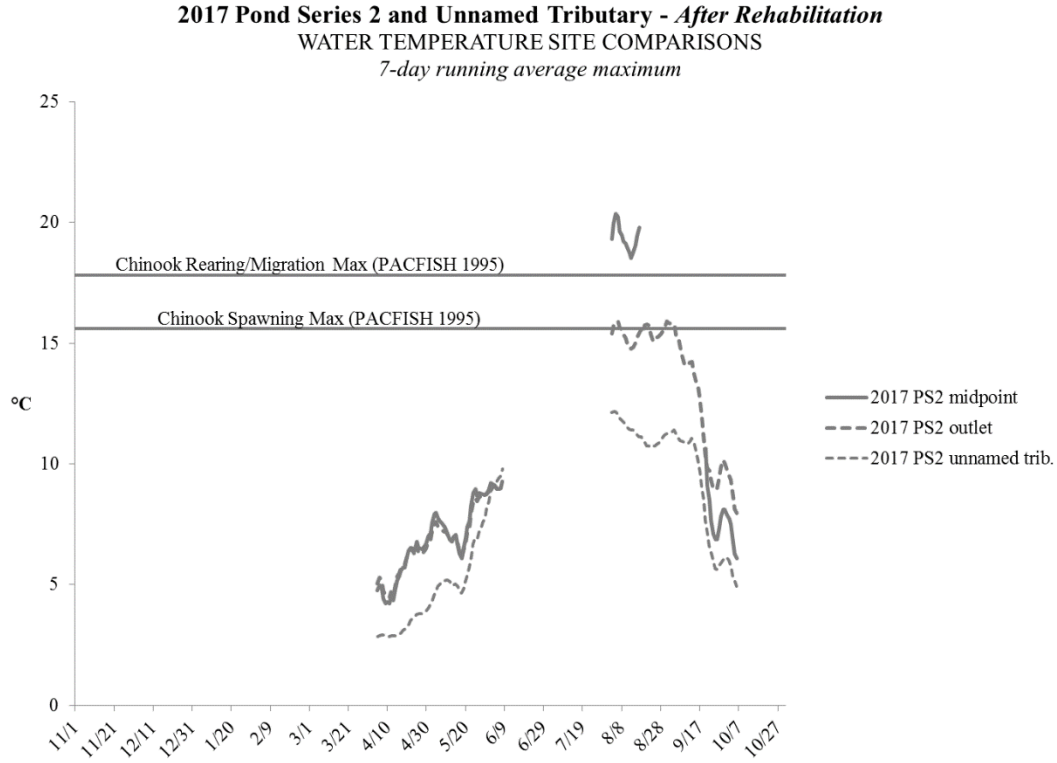


Figure 68. Pond Series 2 in 2017 after rehabilitation work, at midpoint, outlet and unnamed tributary to Pond Series 2, 7-day running average maximum water temperature site comparisons.

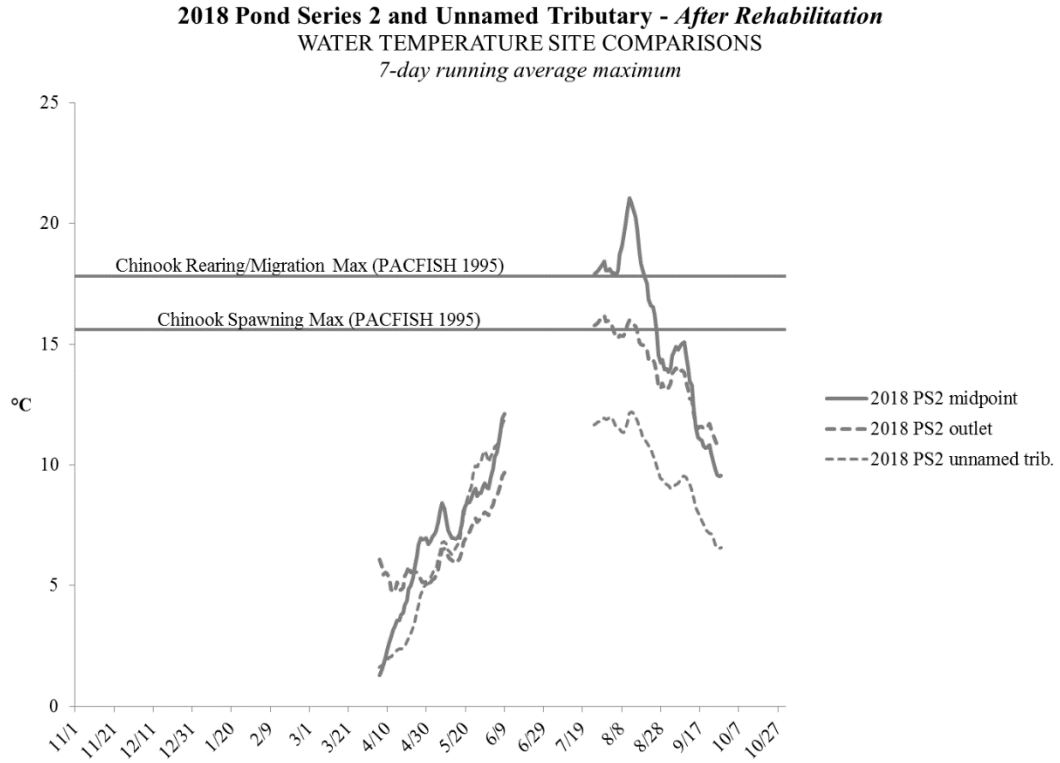


Figure 69. Pond Series 2 in 2018 after rehabilitation work, at midpoint, outlet and unnamed tributary to Pond Series 2, 7-day running average maximum water temperature site comparisons.

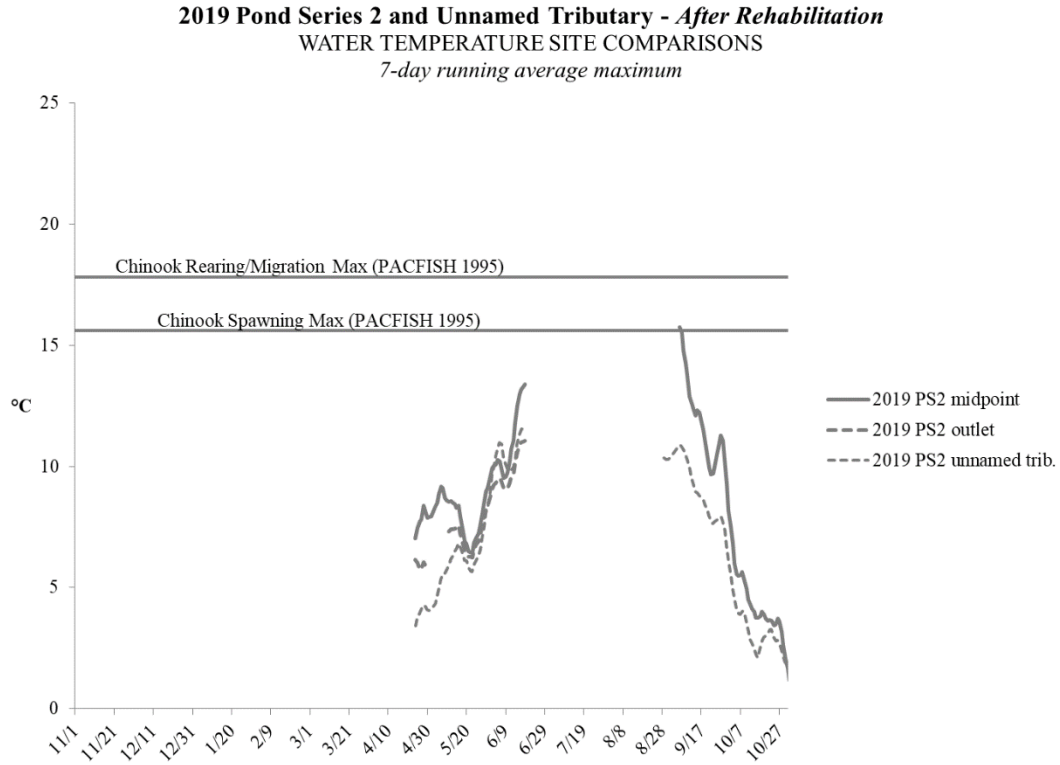


Figure 70. Pond Series 2 in 2019 after rehabilitation work, at midpoint, outlet and unnamed tributary to Pond Series 2, 7-day running average maximum water temperature site comparisons.

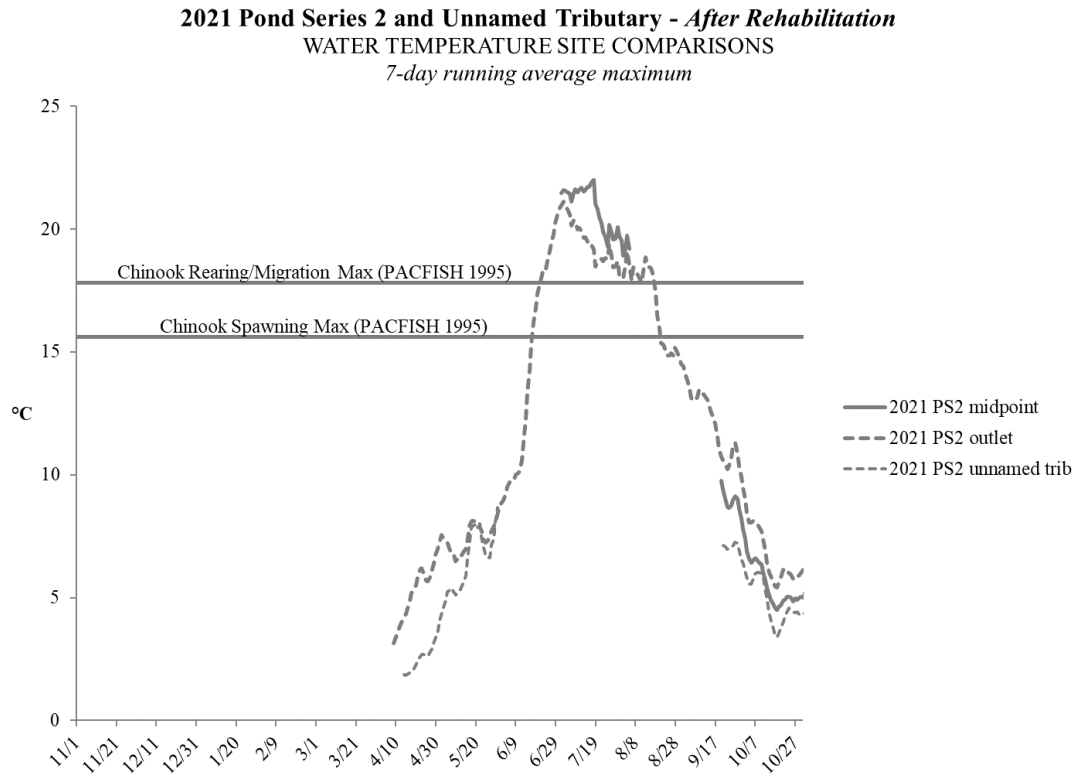


Figure 71. Pond Series 2 in 2021 after rehabilitation work, at midpoint, outlet and unnamed tributary to Pond Series 2, 7-day running average maximum water temperature site comparisons.

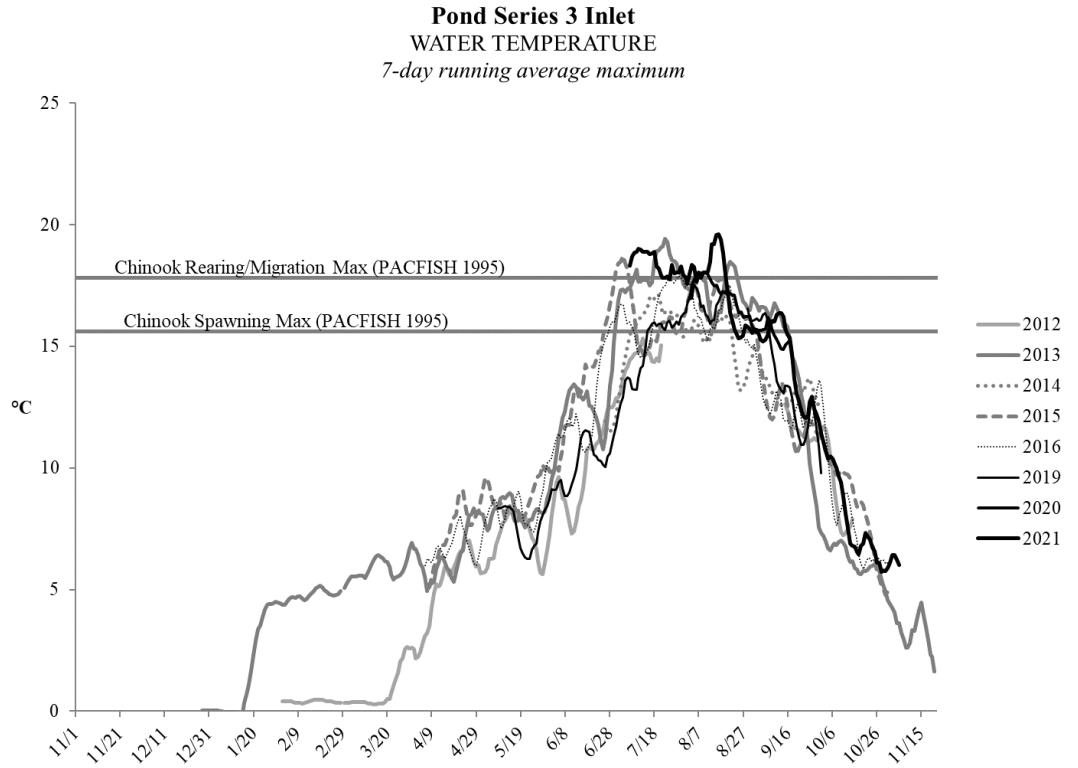


Figure 72. Pond Series 3 inlet, in the YFSR at the PS3 inlet in 2012, at ~4m above Cearley Creek in 2013, and at the inlet of the PS3 channel from 2014 to 2021, 7-day running average maximum temperatures, using Onset HOBO dataloggers.

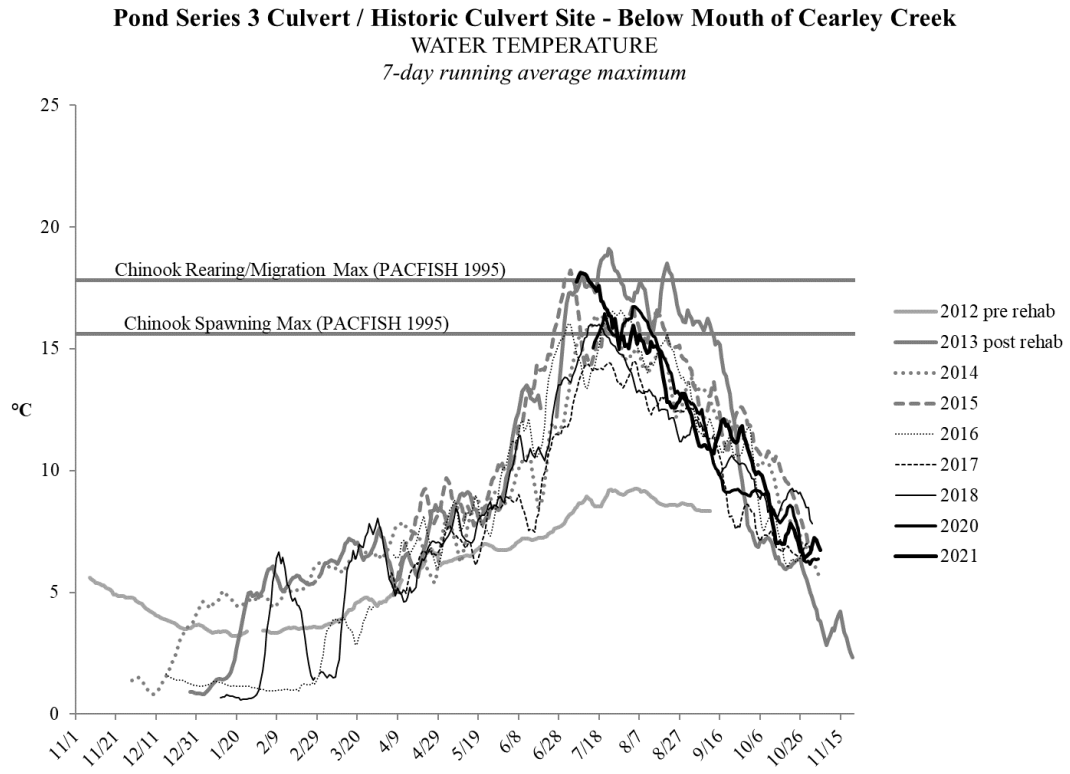


Figure 73. Pond Series 3 culvert below Cearley Creek before rehabilitation in 2012, and historic culvert site after rehabilitation from 2013 to 2018 and in 2020 and 2021, 7-day running average maximum water temperatures, using Onset HOBO dataloggers.

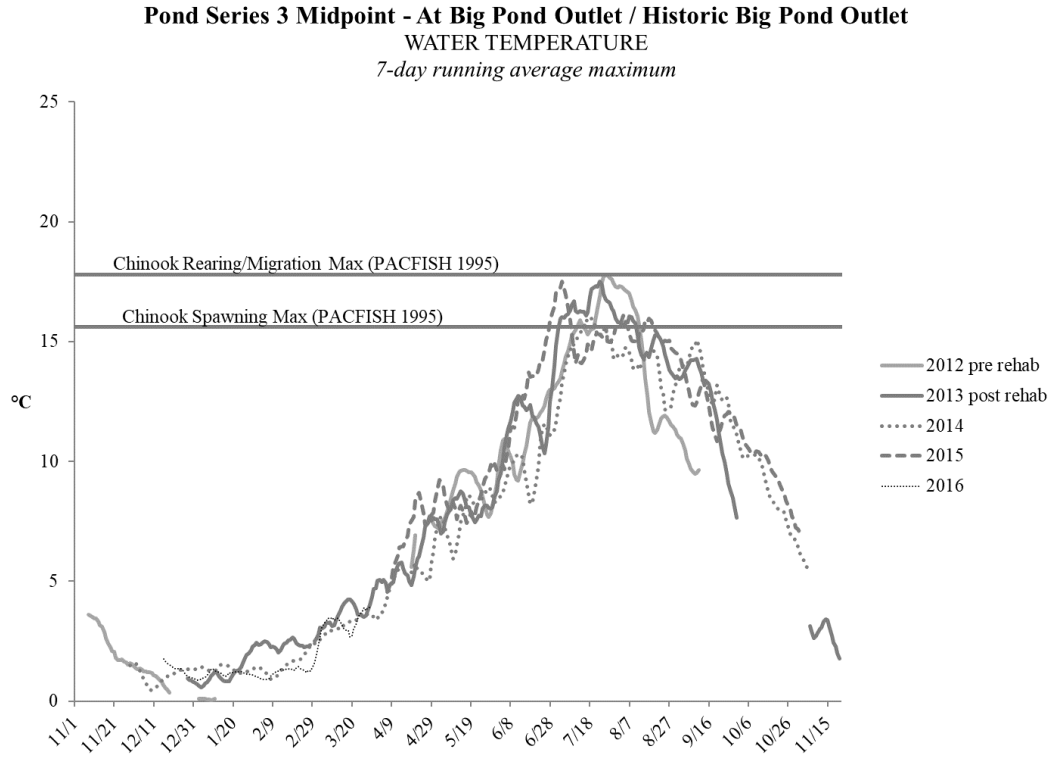


Figure 74. Pond Series 3 midpoint at big pond outlet check structure prior to rehabilitation, in 2012, and at historic big pond outlet check structure site after rehabilitation, from 2013 to 2016, 7-day running average maximum water temperatures, using Onset HOBO dataloggers.

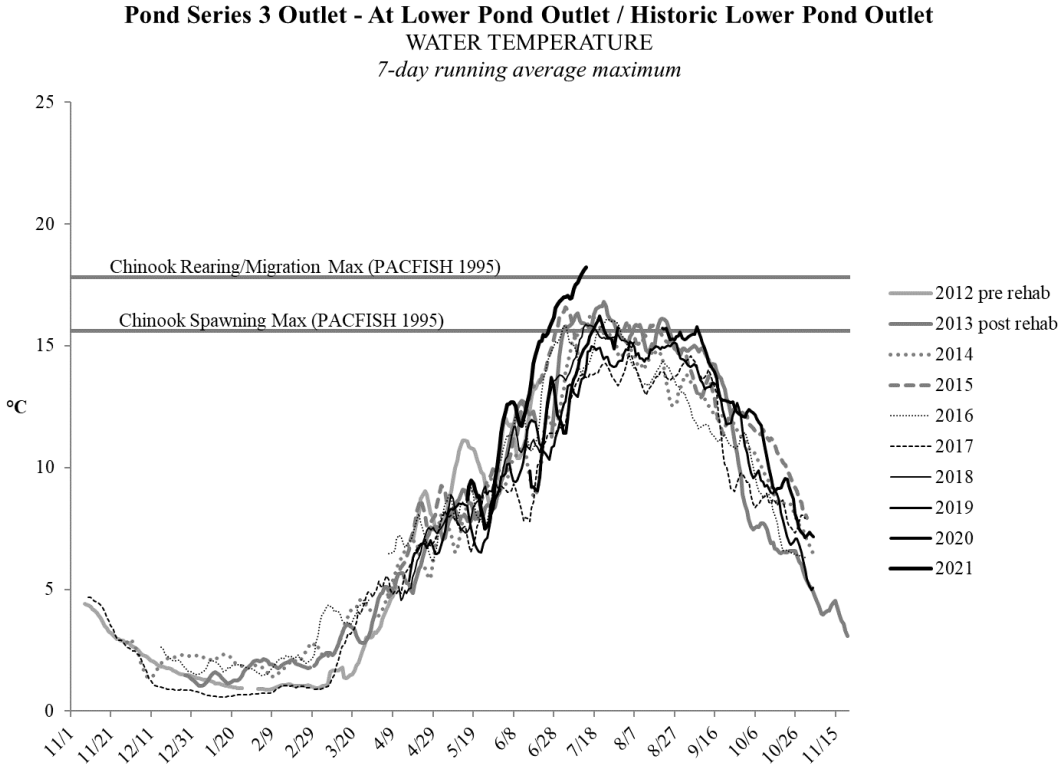


Figure 75. Pond Series 3 outlet at lower pond outlet check structure prior to rehabilitation, in 2012, and at historic lower pond outlet check structure site and at or just above the PIT tag array after rehabilitation, from 2013 to 2021, 7-day running average maximum water temperatures, using Onset HOBO dataloggers.

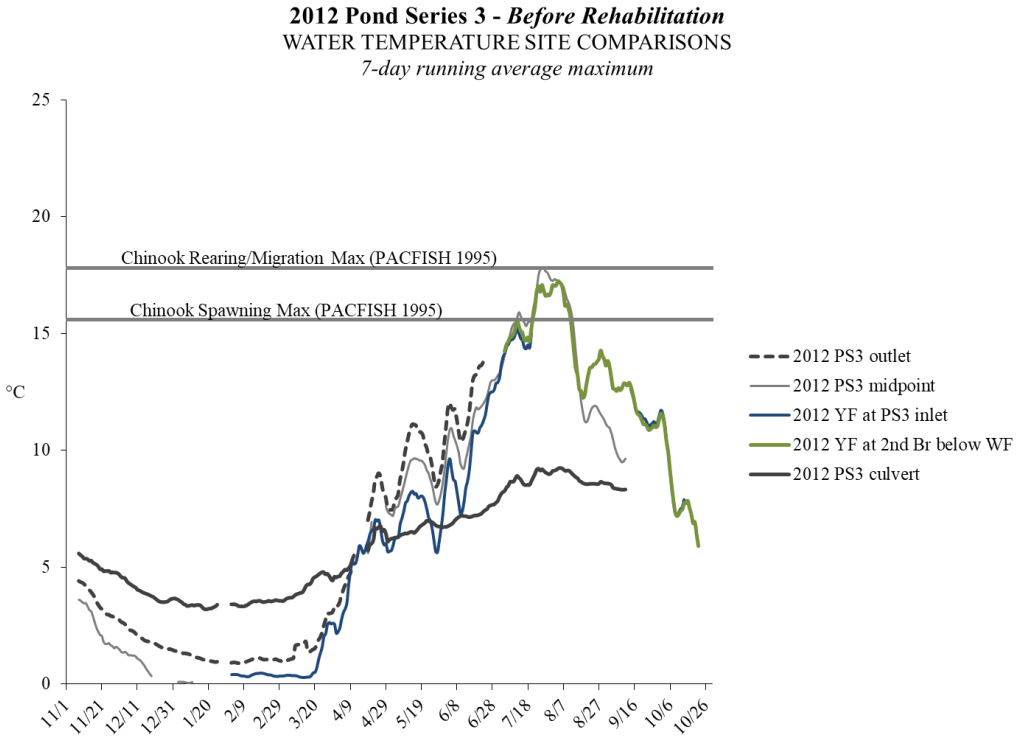


Figure 76. Pond Series 3 before rehabilitation in 2012, in YFSR at PS3 inlet, in YFSR at 2nd bridge below West Fork (USFS Onset Tidbit), at culvert below Cearley Creek, midpoint at big pond outlet, and outlet at lower pond outlet, 7-day running average maximum water temperature site comparisons.

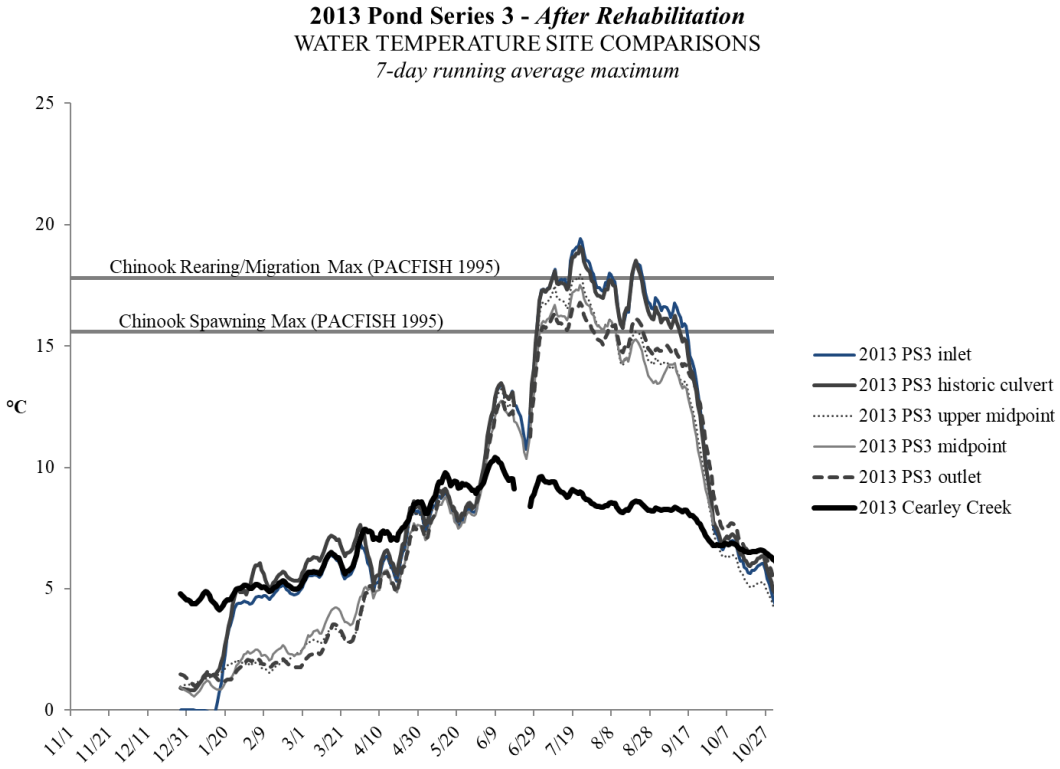


Figure 77. Pond Series 3 after rehabilitation in 2013, at PS3 inlet ~4m above Cearley Creek, Cearley Creek, historic culvert below Cearley Creek, upper midpoint at lower end of rehab- roughened channel, midpoint at historic big pond outlet, and outlet at historic lower pond outlet, 7-day running average maximum water temperature site comparisons.

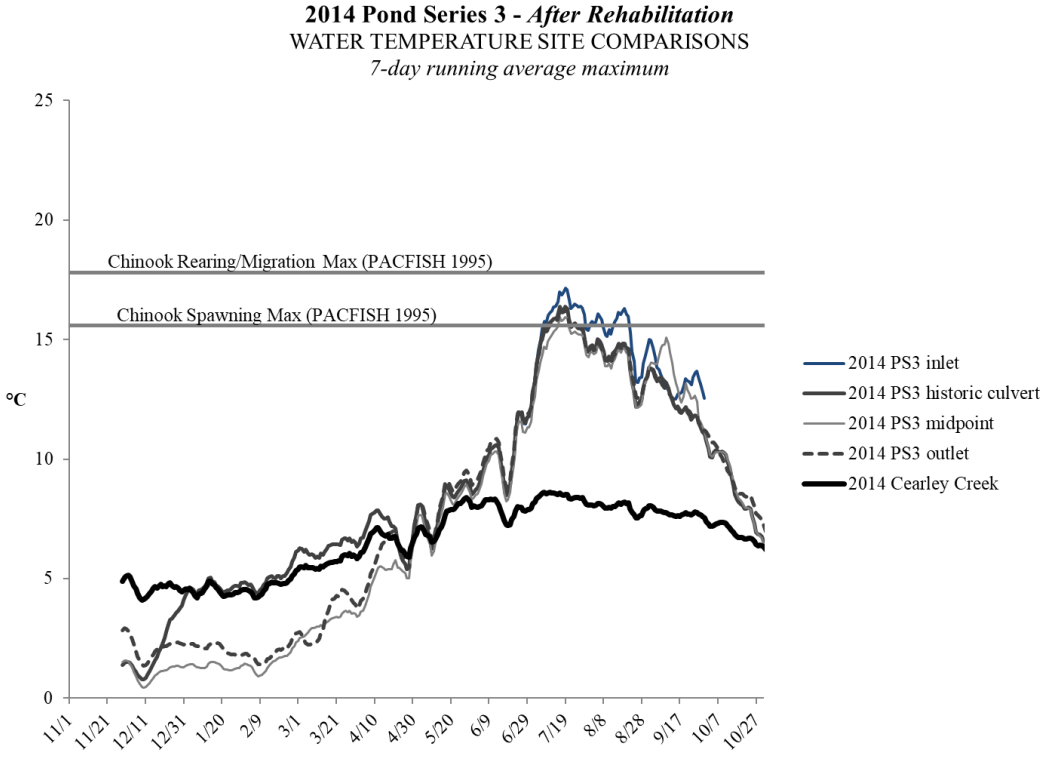


Figure 78. Pond Series 3 after rehabilitation in 2014, at inlet of PS3 channel, Cearley Creek, historic culvert below Cearley Creek, midpoint at historic big pond outlet, and outlet at historic lower pond outlet, 7-day running average maximum water temperature site comparisons.

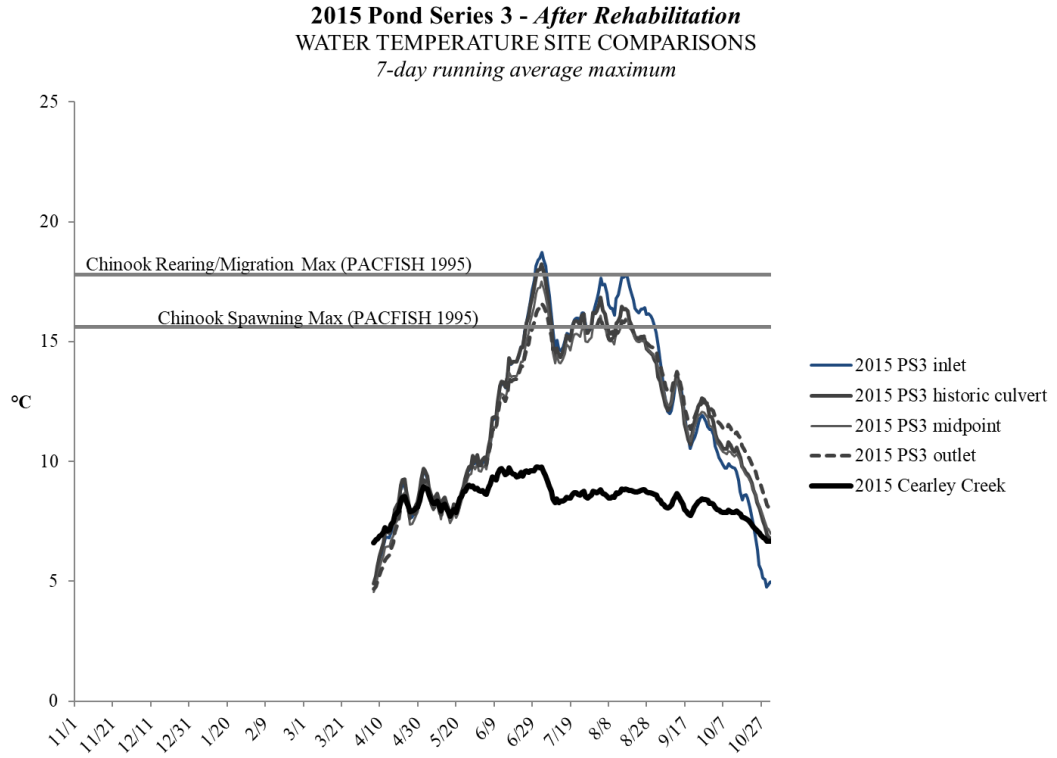


Figure 79. Pond Series 3 after rehabilitation in 2015, at inlet of PS3 channel, Cearley Creek, historic culvert below Cearley Creek, midpoint at historic big pond outlet, and outlet at historic lower pond outlet, 7-day running average maximum water temperature site comparisons.

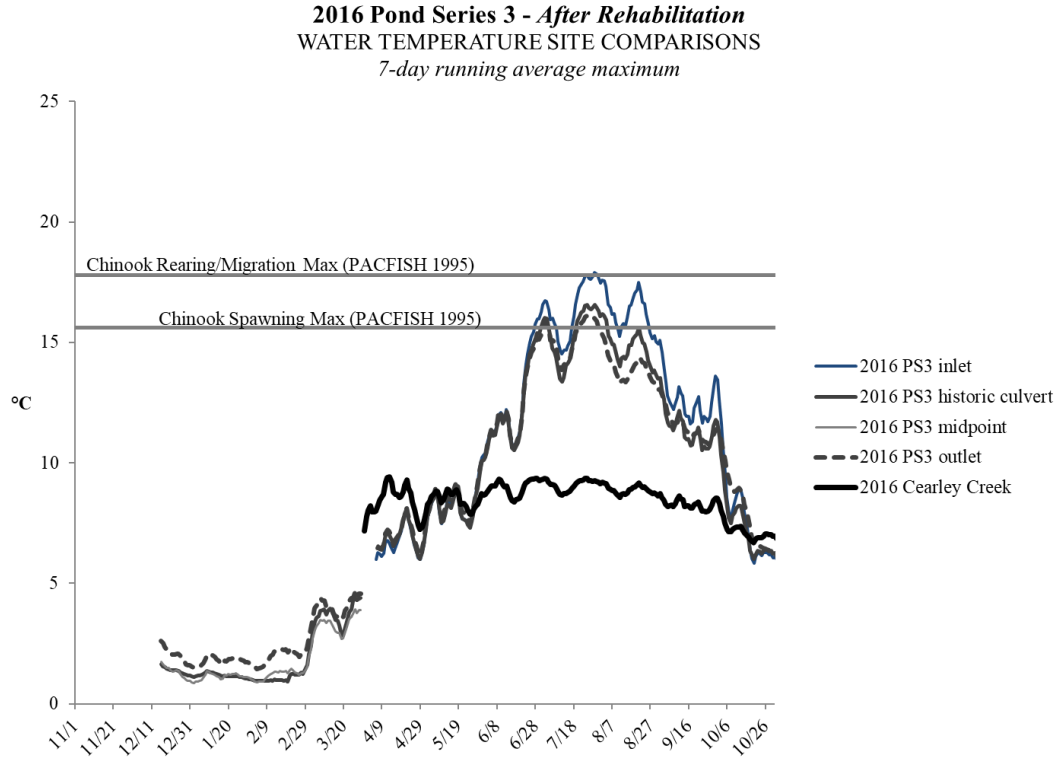


Figure 80. Pond Series 3 after rehabilitation in 2016, at inlet of PS3 channel, Cearley Creek, historic culvert below Cearley Creek, midpoint at historic big pond outlet, and outlet at historic lower pond outlet, 7-day running average maximum water temperature site comparisons.

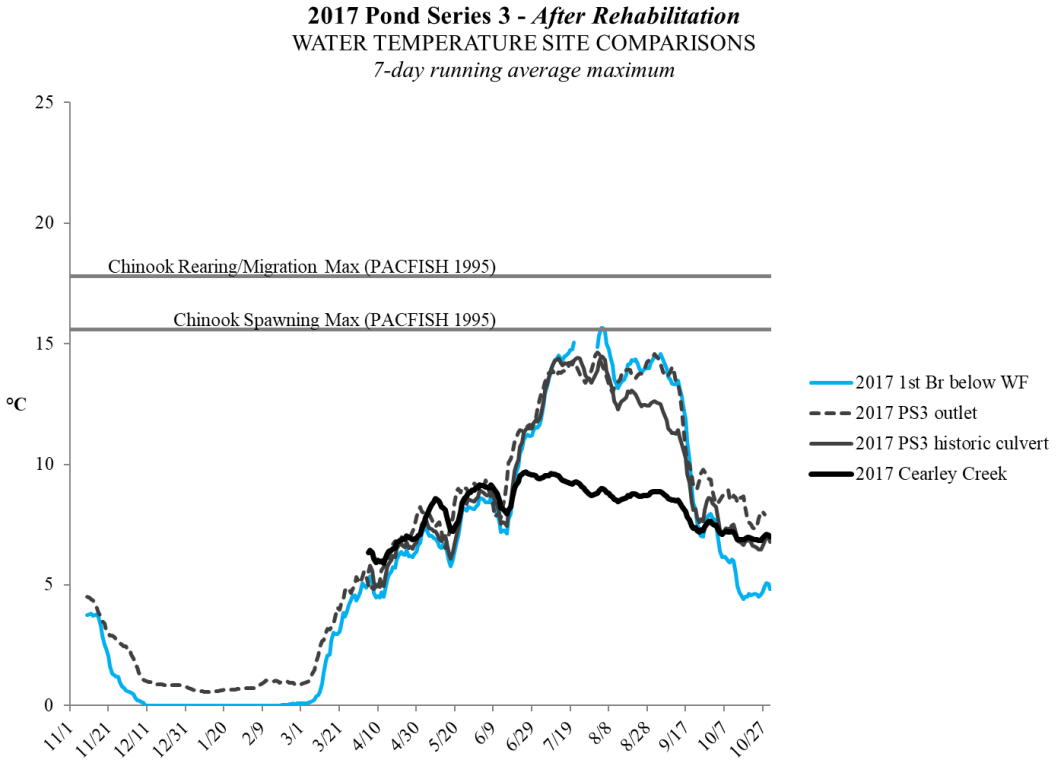


Figure 81. Pond Series 3 after rehabilitation in 2017, at YFSR at 1st bridge below the West Fork, Cearley Creek, historic culvert below Cearley Creek, and outlet at historic lower pond outlet, 7-day running average maximum water temperature site comparisons.

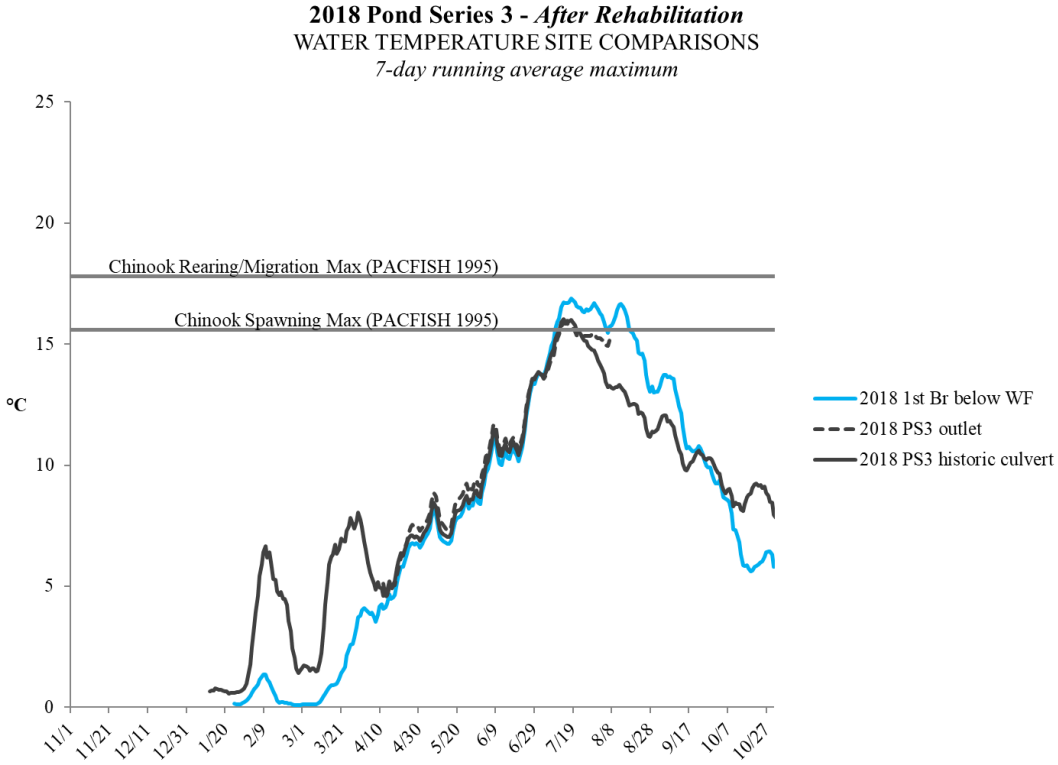


Figure 82. Pond Series 3 after rehabilitation in 2018, at YFSR at 1st bridge below the West Fork, historic culvert below Cearley Creek, and outlet at historic lower pond outlet, 7-day running average maximum water temperature site comparisons.

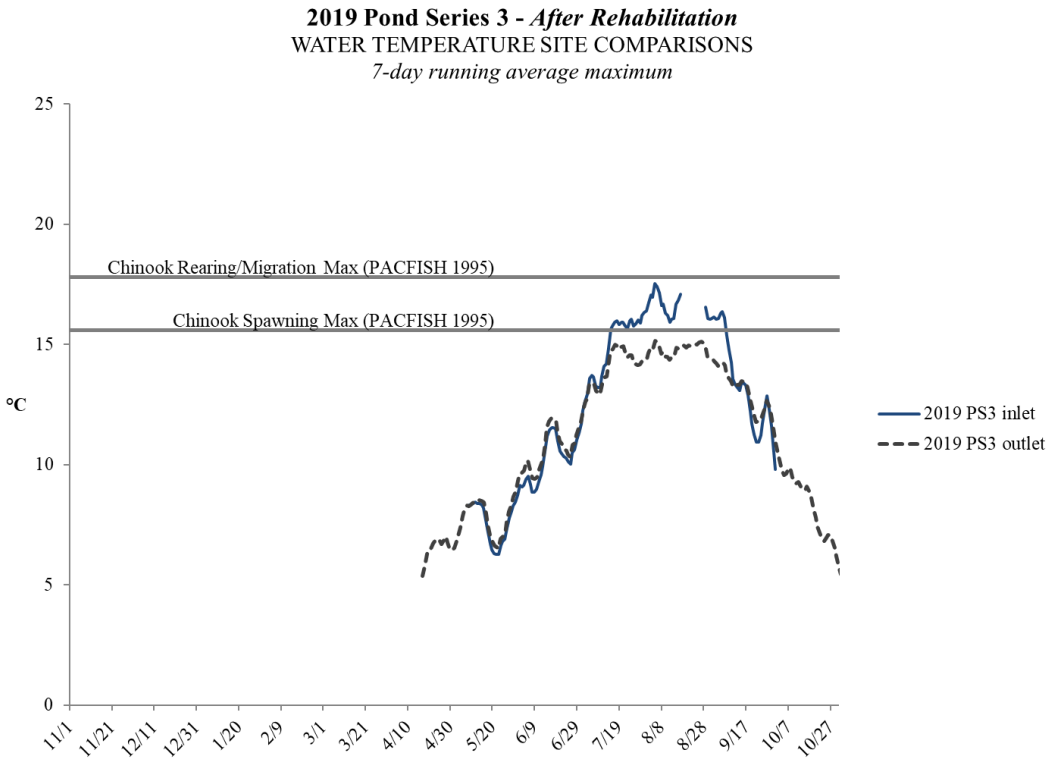


Figure 83. Pond Series 3 after rehabilitation in 2019, at inlet of PS3 channel, and outlet at log above the PIT tag array, 7-day running average maximum water temperature site comparisons.

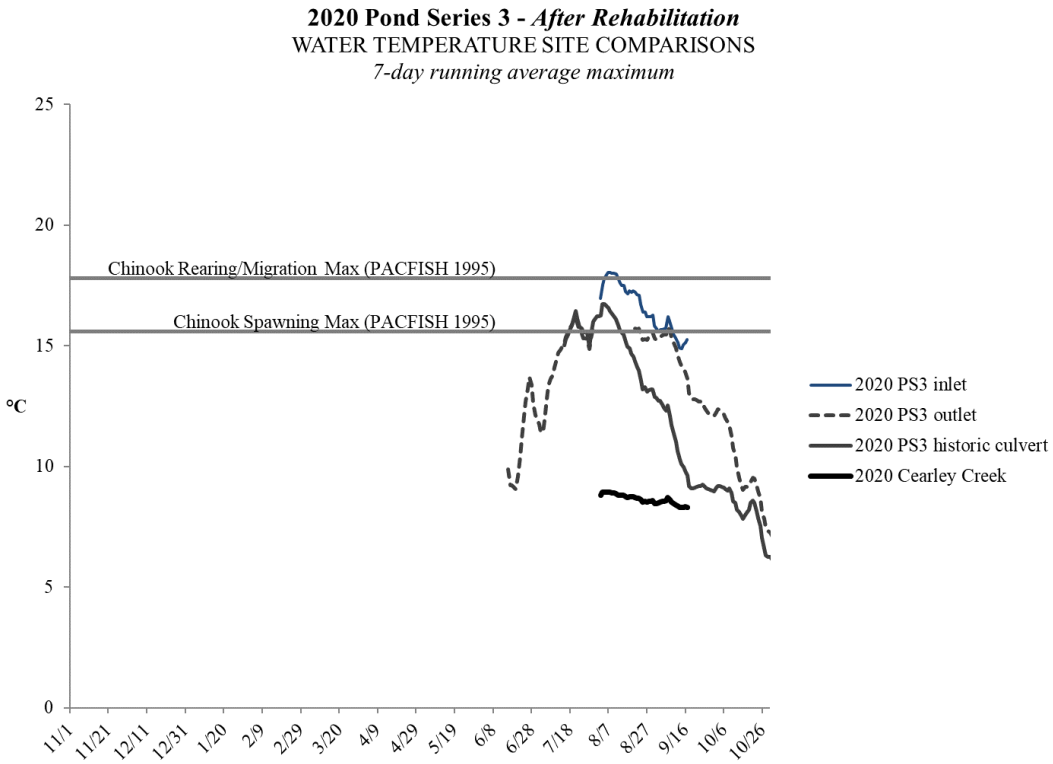


Figure 84. Pond Series 3 after rehabilitation in 2020, at inlet of PS3 channel, Cearley Creek, at the historic culvert site below Cearley Creek and outlet at log above the PIT tag array, 7-day running average maximum water temperature site comparisons.

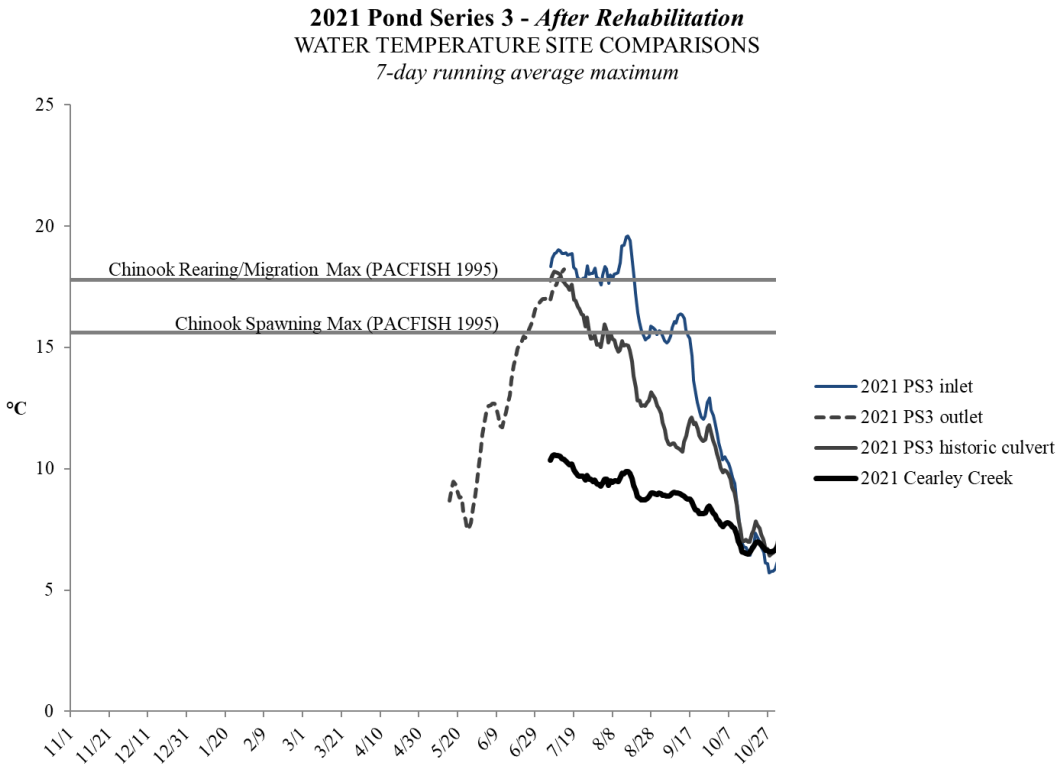


Figure 85. Pond Series 3 after rehabilitation in 2021, at inlet of PS3 channel, Cearley Creek, at the historic culvert site below Cearley Creek and outlet at log above the PIT tag array, 7-day running average maximum water temperature site comparisons.

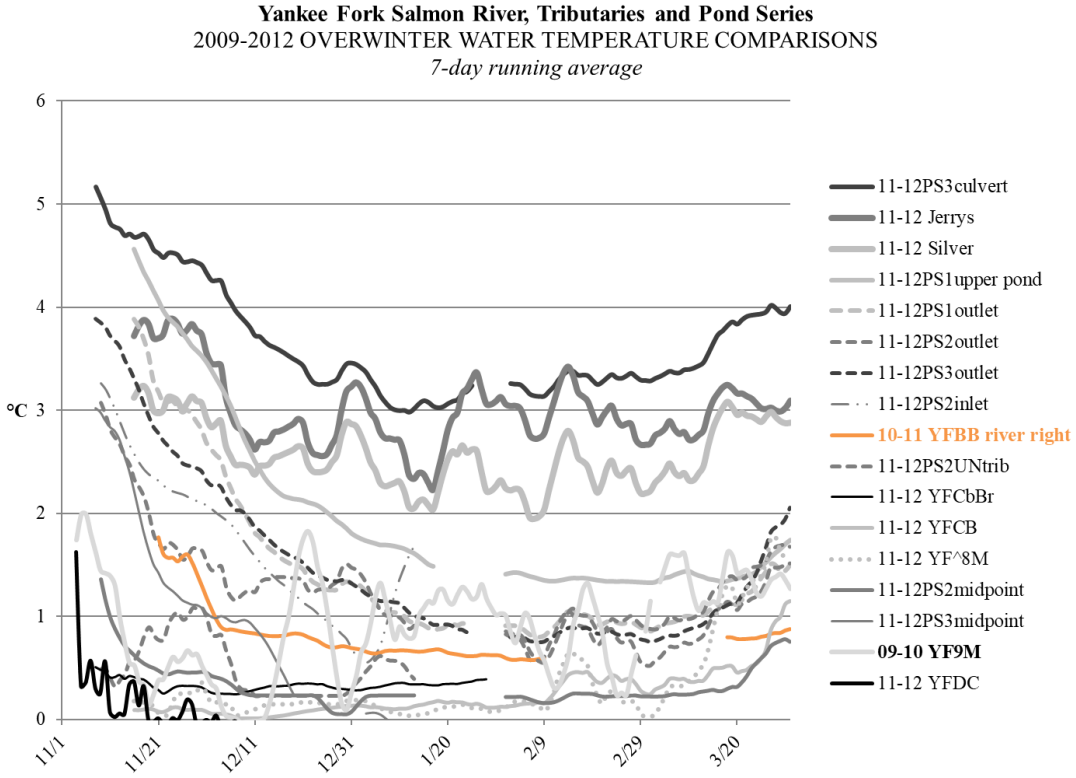


Figure 86. 2011 to 2012 overwinter 7-day running average water temperatures, November through March, comparison for sites in the Yankee Fork Salmon River, tributaries and Pond Series, including the YFSR above Ninemile monitored overwinter 2009-2010, and YFSR along river right bank below Bonanza Bridge, sampled from 2010 to 2011 (shown in orange).

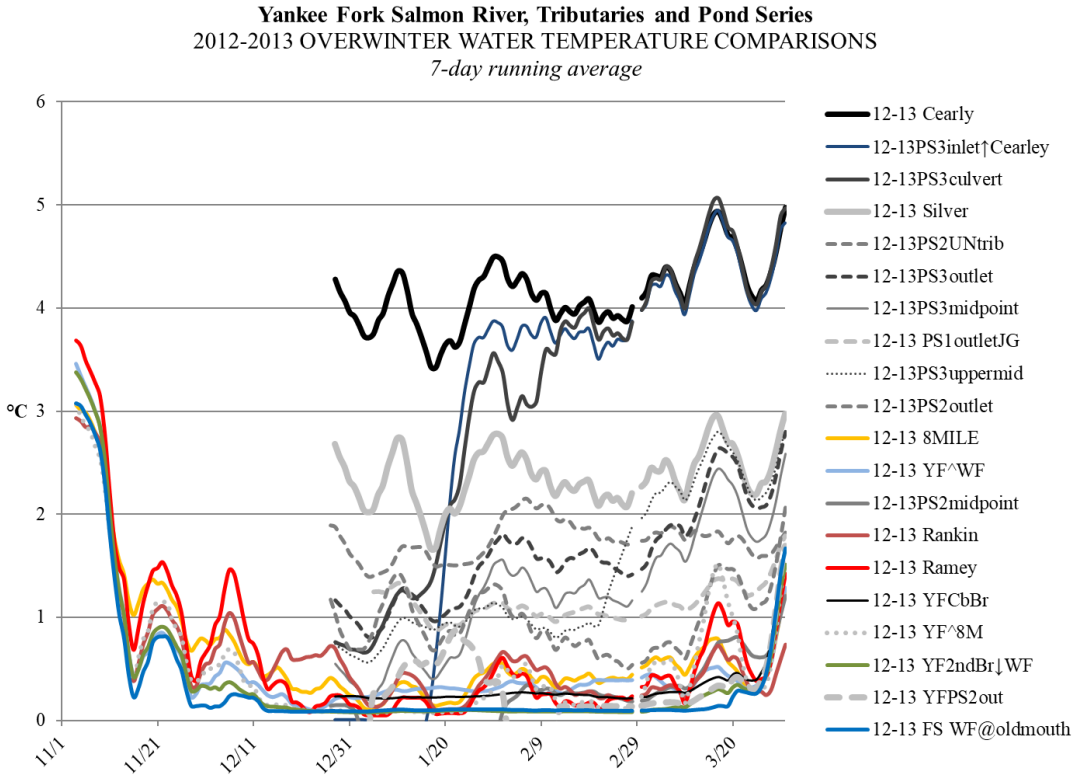


Figure 87. 2012 to 2013 overwinter 7-day running average water temperatures, November through March, comparison for sites in the Yankee Fork Salmon River, tributaries and Pond Series.

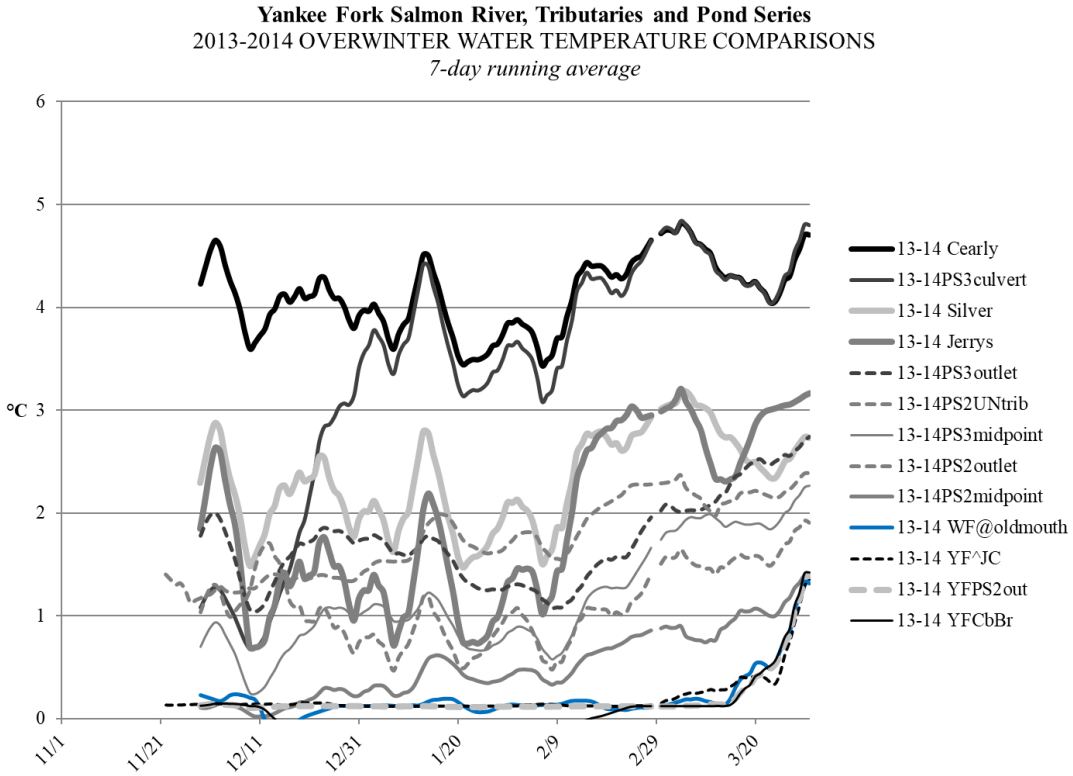


Figure 88. 2013 to 2014 overwinter 7-day running average water temperatures, late November through March, comparison for sites in the Yankee Fork Salmon River, tributaries and Pond Series.

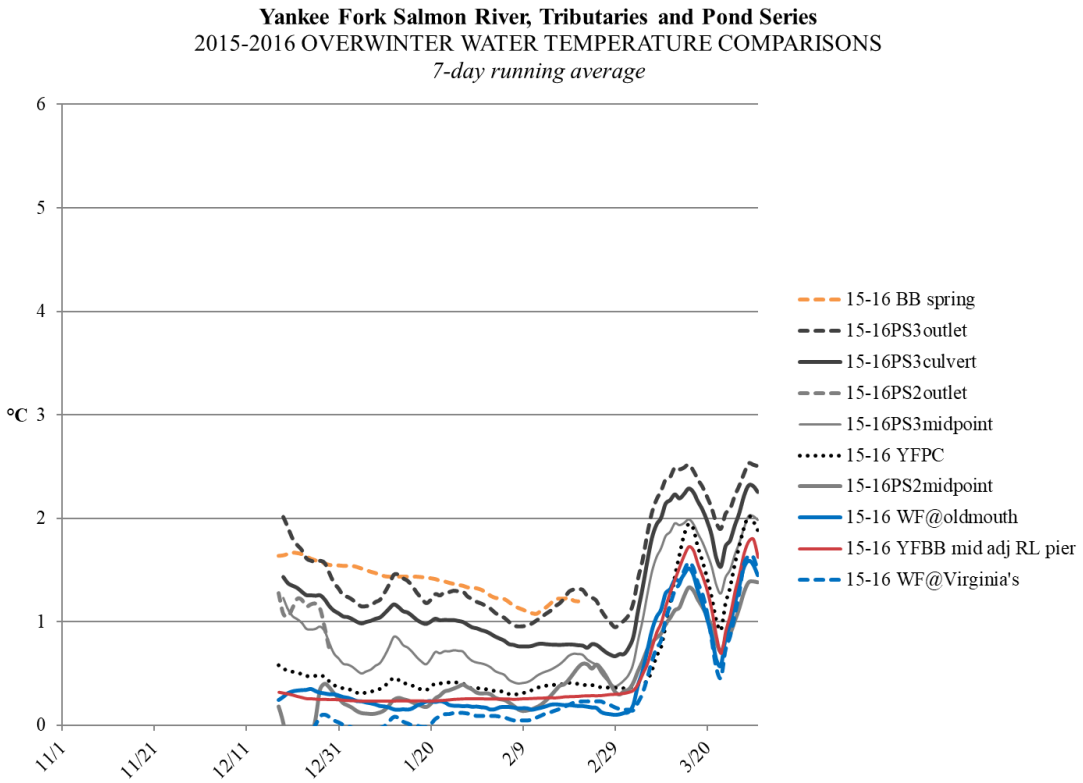


Figure 89. 2015 to 2016 overwinter 7-day running average water temperatures, mid-December through March, comparison for sites in the Yankee Fork Salmon River, tributaries and Pond Series.

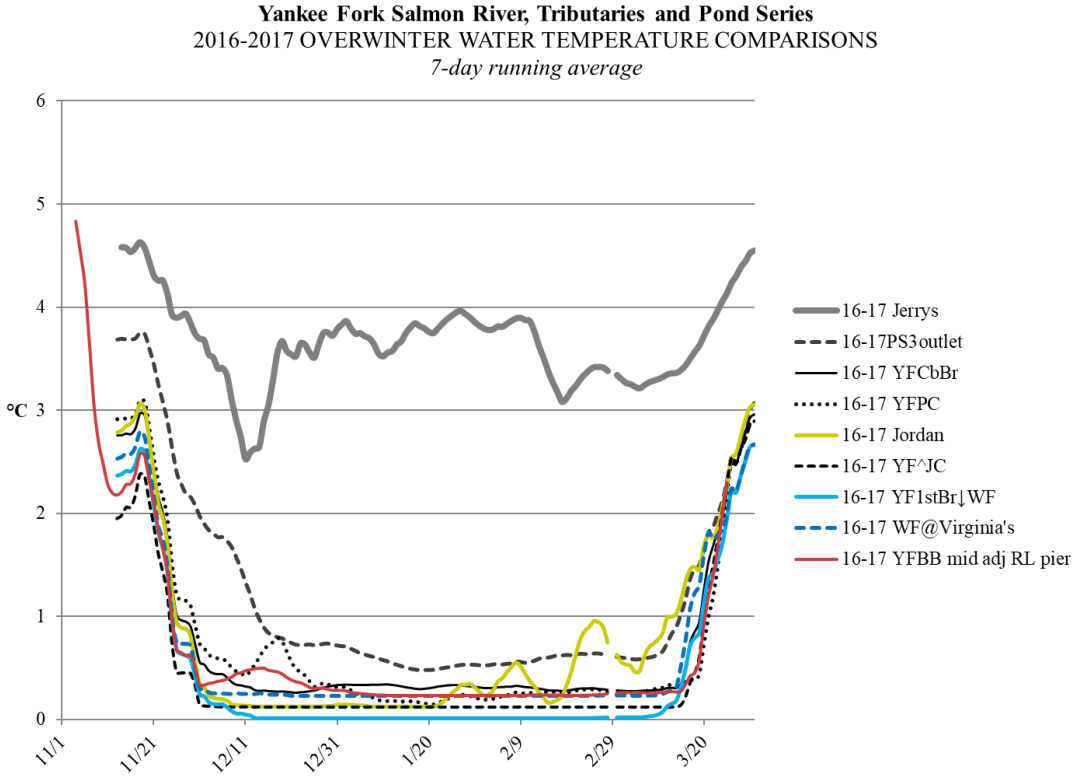


Figure 90. 2016 to 2017 overwinter 7-day running average water temperatures, November through March, comparison for sites in the Yankee Fork Salmon River, tributaries and Pond Series.

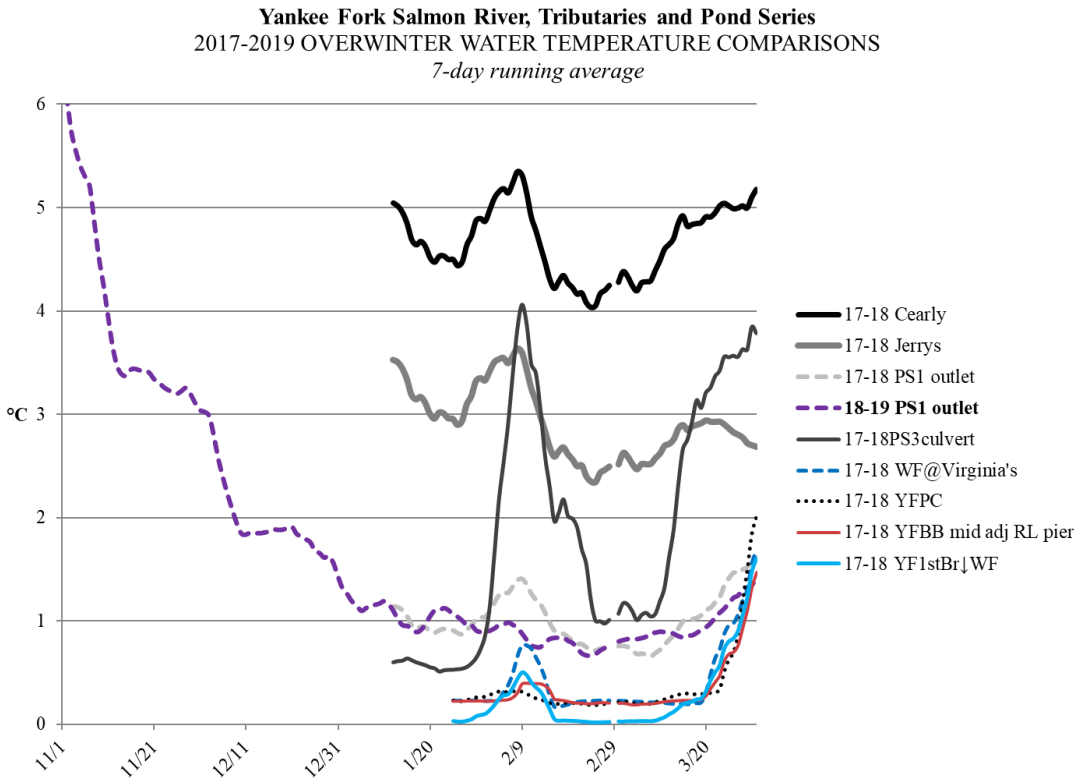


Figure 91. 2017 to 2018 overwinter 7-day running average water temperatures, mid-January through March, comparison for sites in the Yankee Fork Salmon River, tributaries and Pond Series, including Pond Series 1 outlet monitored overwinter 2018 to 2019.

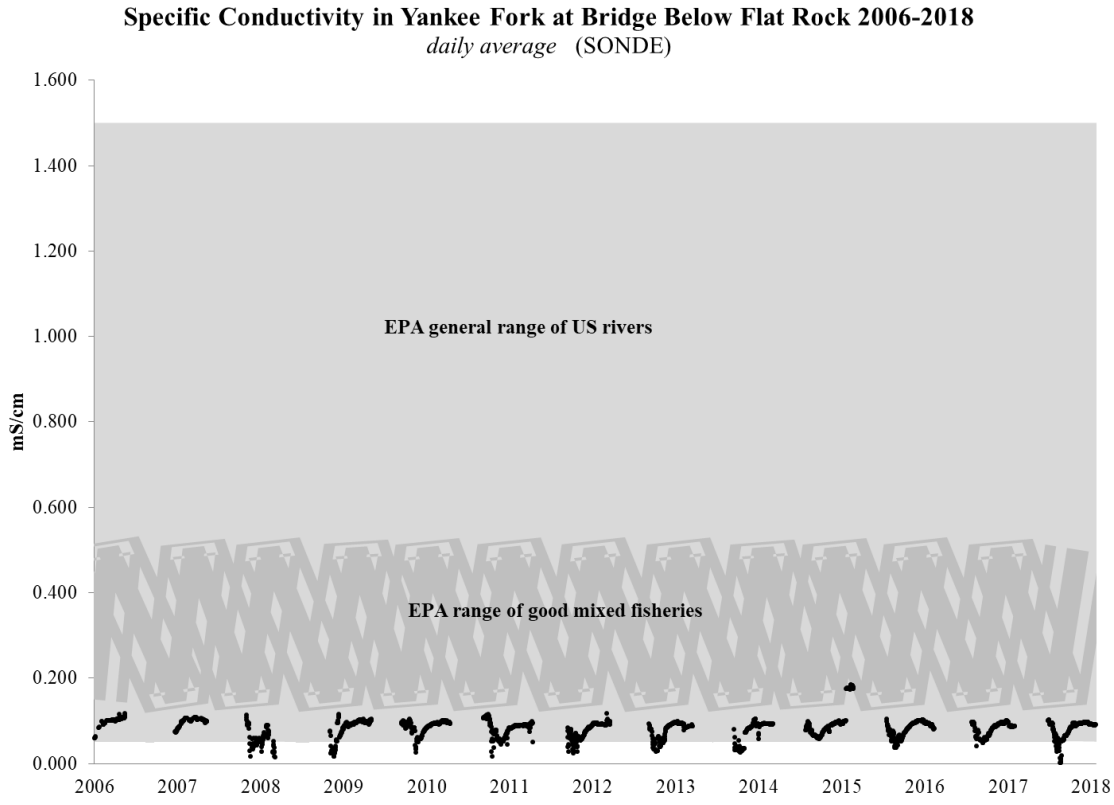


Figure 92. Specific Conductivity daily average in the Yankee Fork Salmon River at the bridge below Flat Rock Campground from 2006 to 2018, compared to EPA reported ranges.

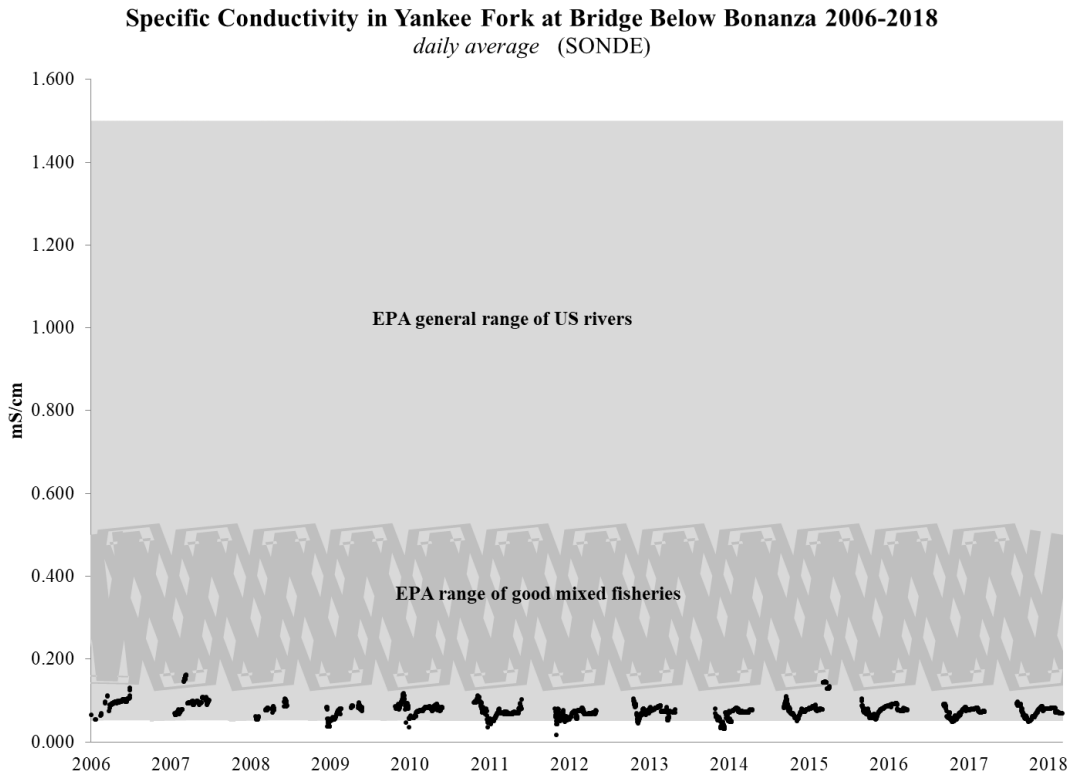


Figure 93. Specific Conductivity daily average in the Yankee Fork Salmon River at bridge below Bonanza from 2006 to 2018, compared to EPA reported ranges.

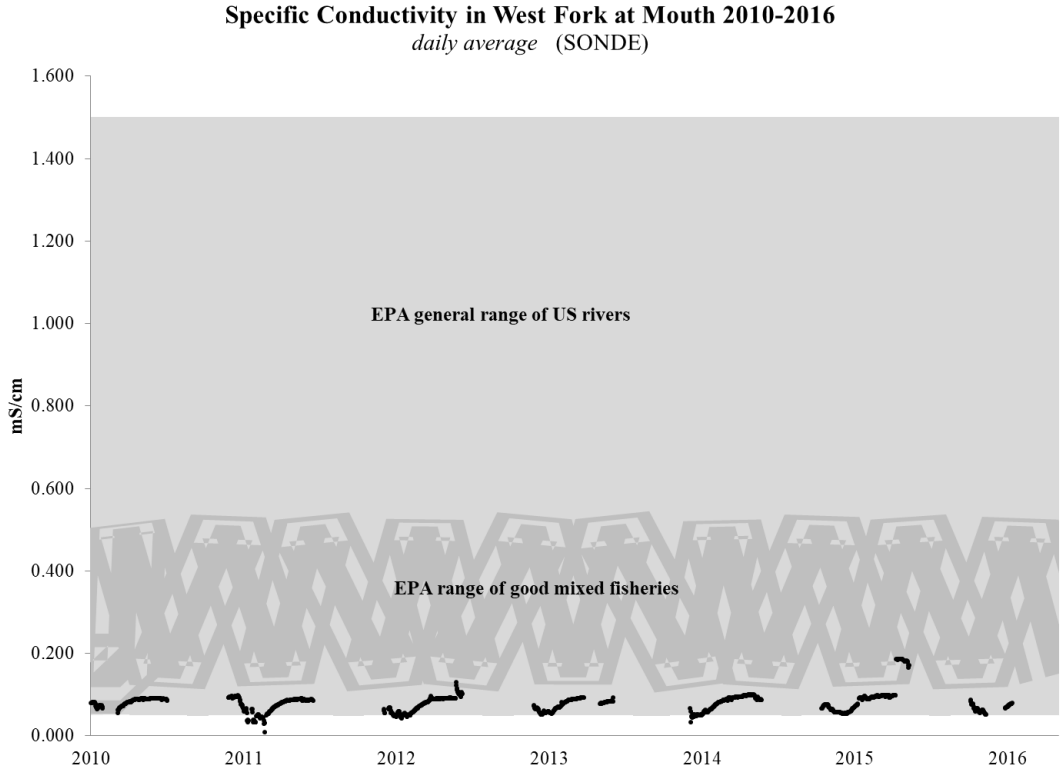


Figure 94. Specific Conductivity daily average at old mouth of the West Fork Yankee Fork from 2010 to 2016, compared to EPA reported ranges.

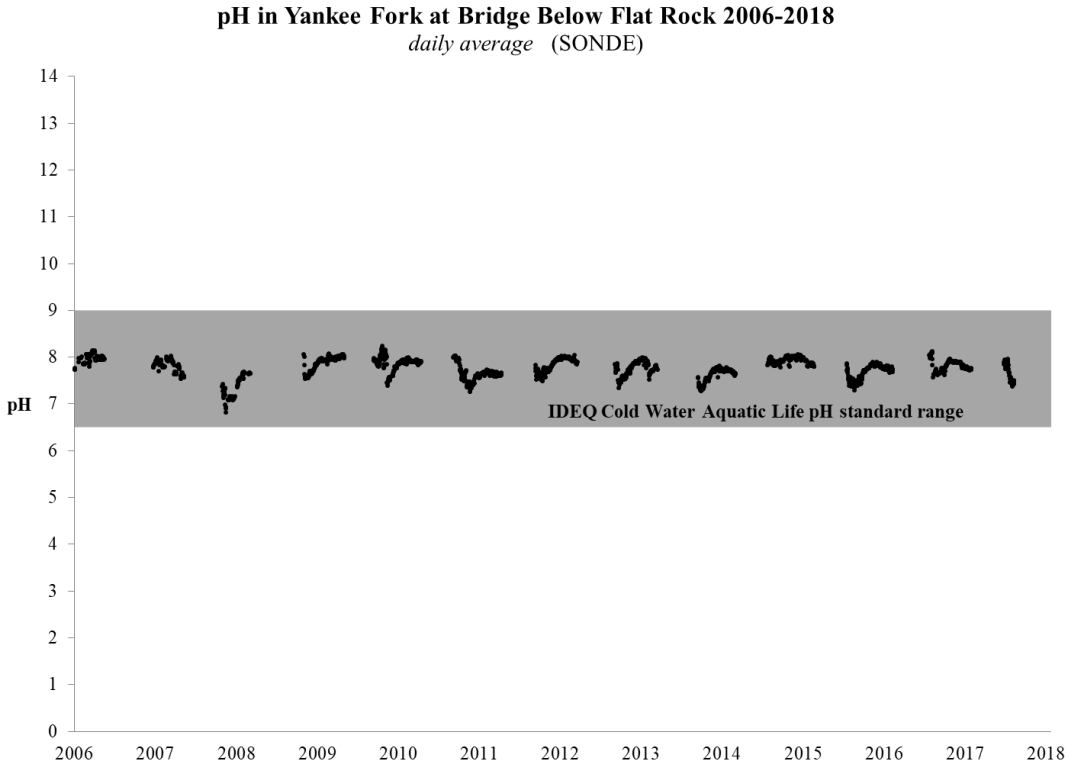


Figure 95. pH daily average in the Yankee Fork Salmon River at bridge below Flat Rock Campground from 2006 to 2018, compared to IDEQ Cold Water Aquatic Life Use recommended range.

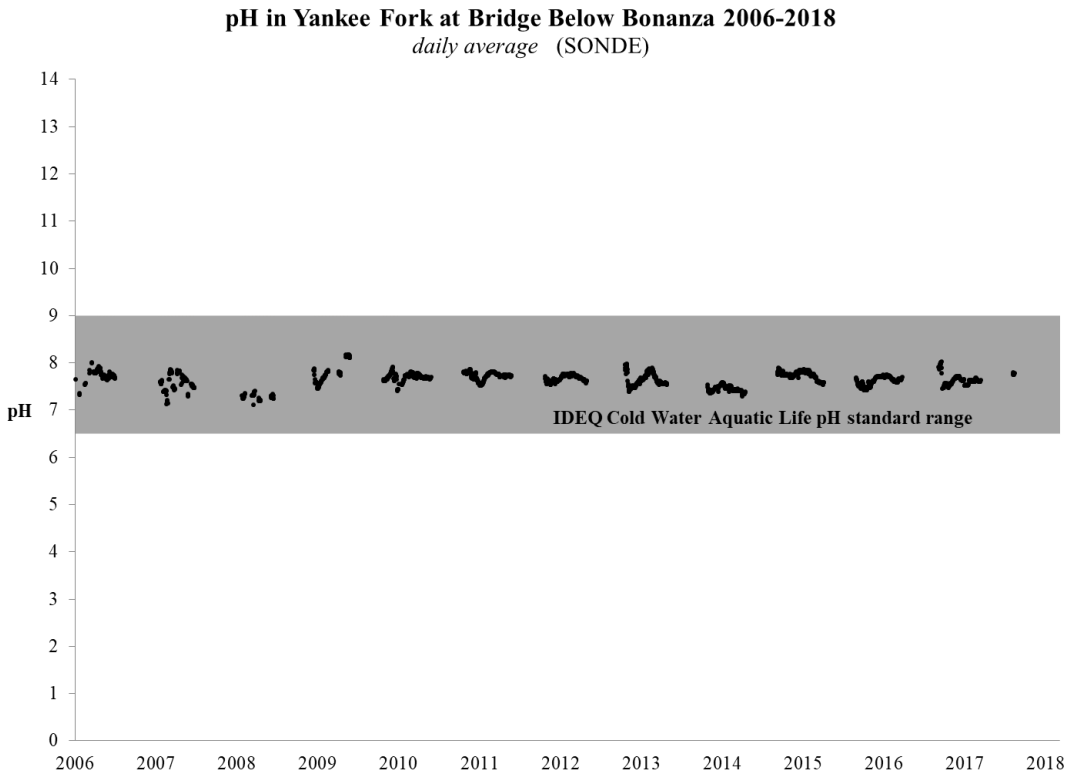


Figure 96. pH daily average in the Yankee Fork Salmon River at bridge below Bonanza from 2006 to 2018, compared to IDEQ Cold Water Aquatic Life Use recommended range.

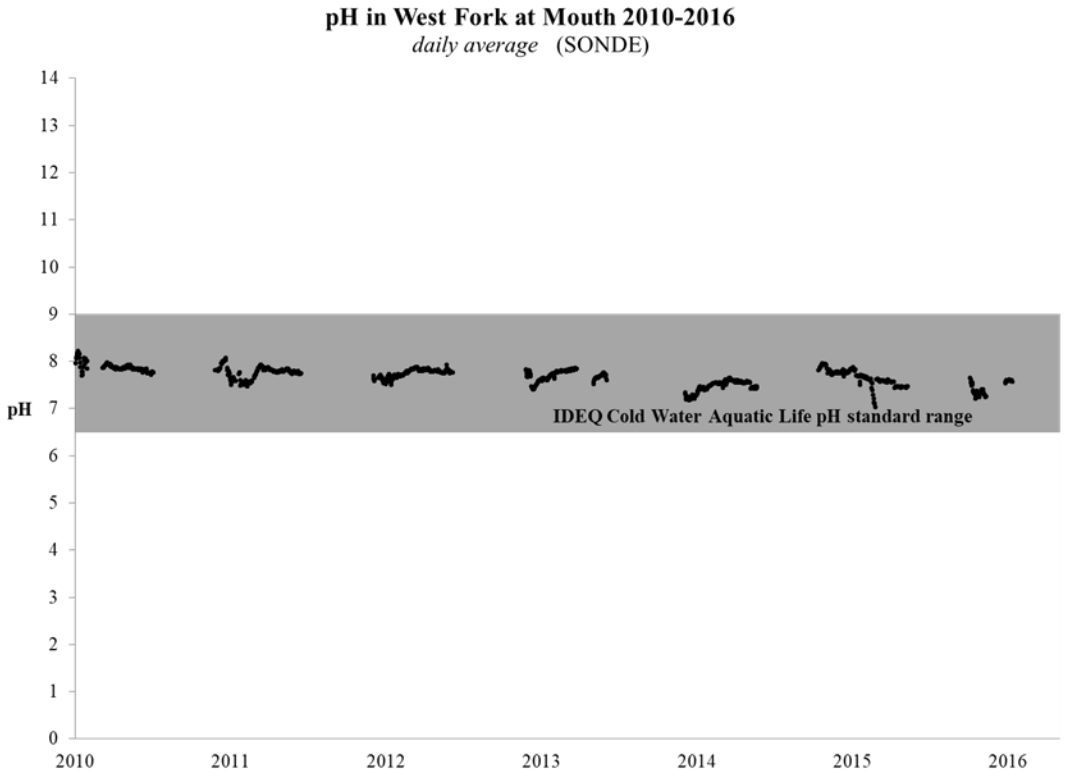


Figure 97. pH daily average at old mouth of the West Fork Yankee Fork from 2010 to 2016, compared to IDEQ Cold Water Aquatic Life Use recommended range.

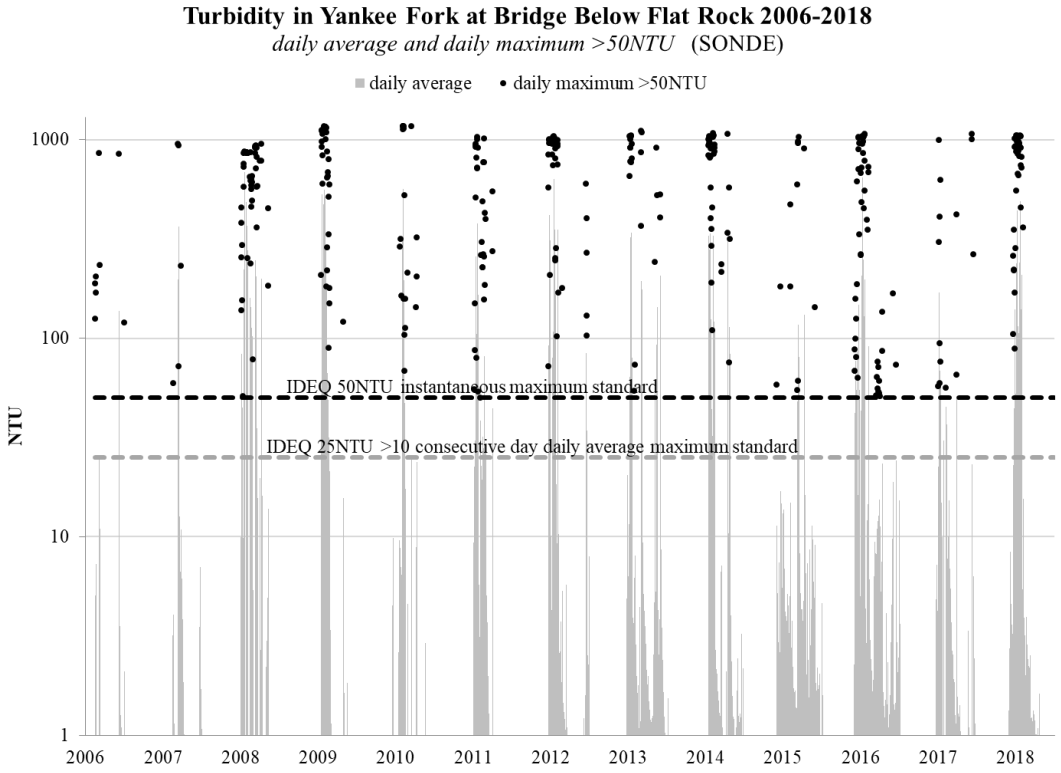


Figure 98. Turbidity daily average and daily maximum >50NTU in the Yankee Fork Salmon River at bridge below Flat Rock Campground from 2006 to 2018, compared to IDEQ Cold Water Aquatic Life Use recommended thresholds.

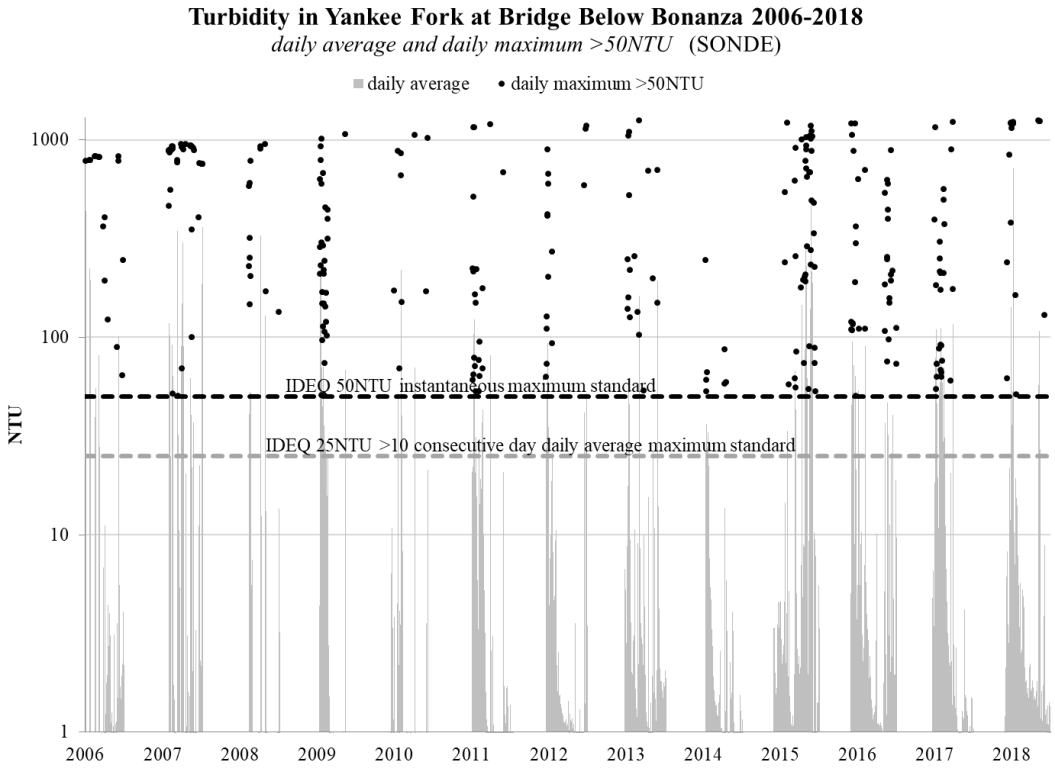


Figure 99. Turbidity daily average and daily maximum >50NTU in the Yankee Fork Salmon River at bridge below Bonanza from 2006 to 2018, compared to IDEQ Cold Water Aquatic Life Use recommended thresholds.

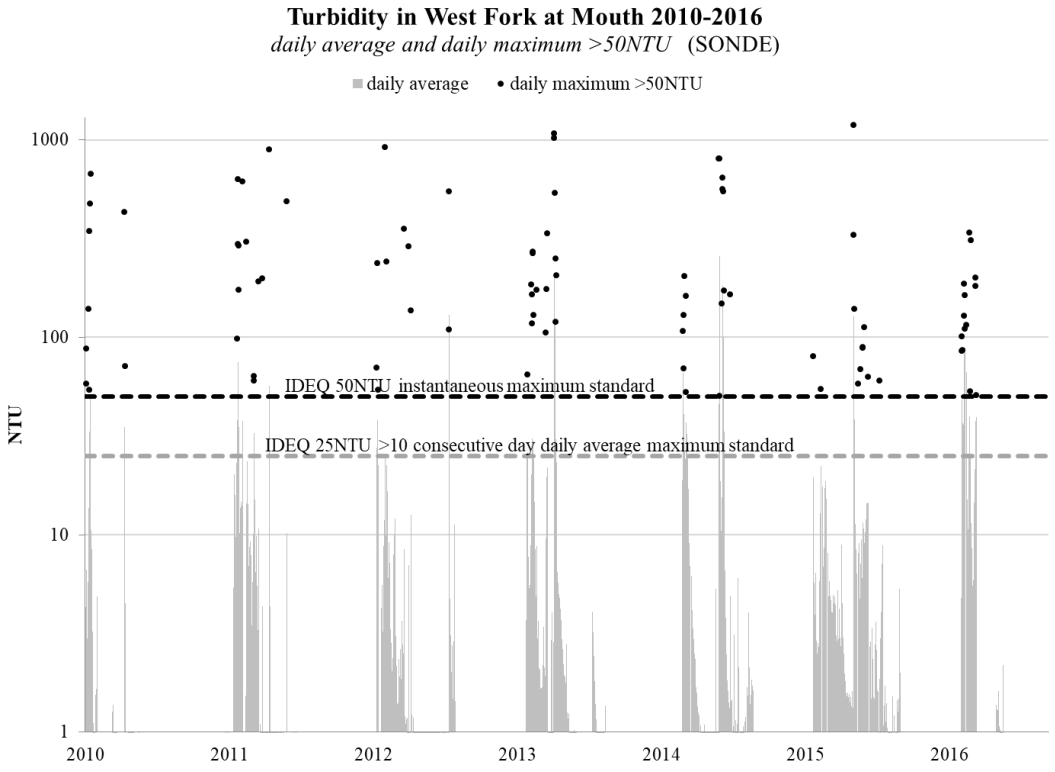


Figure 100. Turbidity daily average and daily maximum >50NTU at the old mouth of the West Fork Yankee Fork from 2010 to 2016, compared to IDEQ Cold Water Aquatic Life Use recommended thresholds.

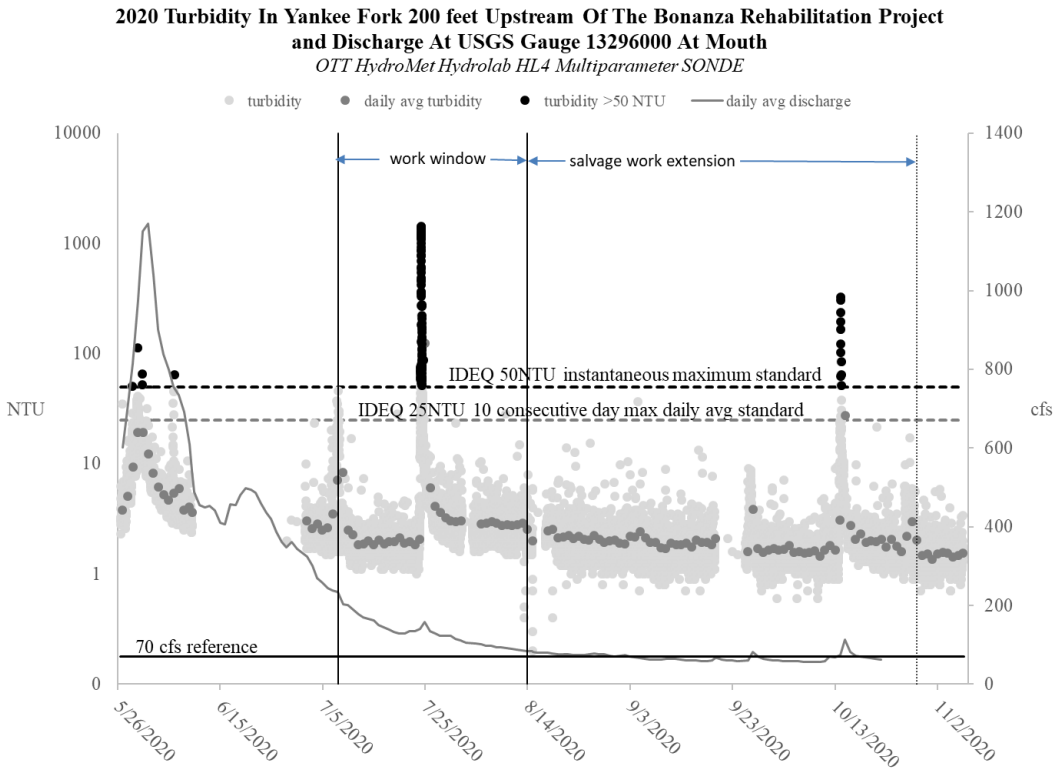


Figure 101. Yankee Fork Salmon River 200 feet upstream of the Bonanza Rehabilitation Project reach, turbidity, daily average turbidity and turbidity >50 NTU compared to IDEQ Cold Water Aquatic Life Use recommended thresholds; and Yankee Fork Salmon River daily average discharge at USGS Gauge 13296000 at mouth, including 70 cfs reference, in 2020.

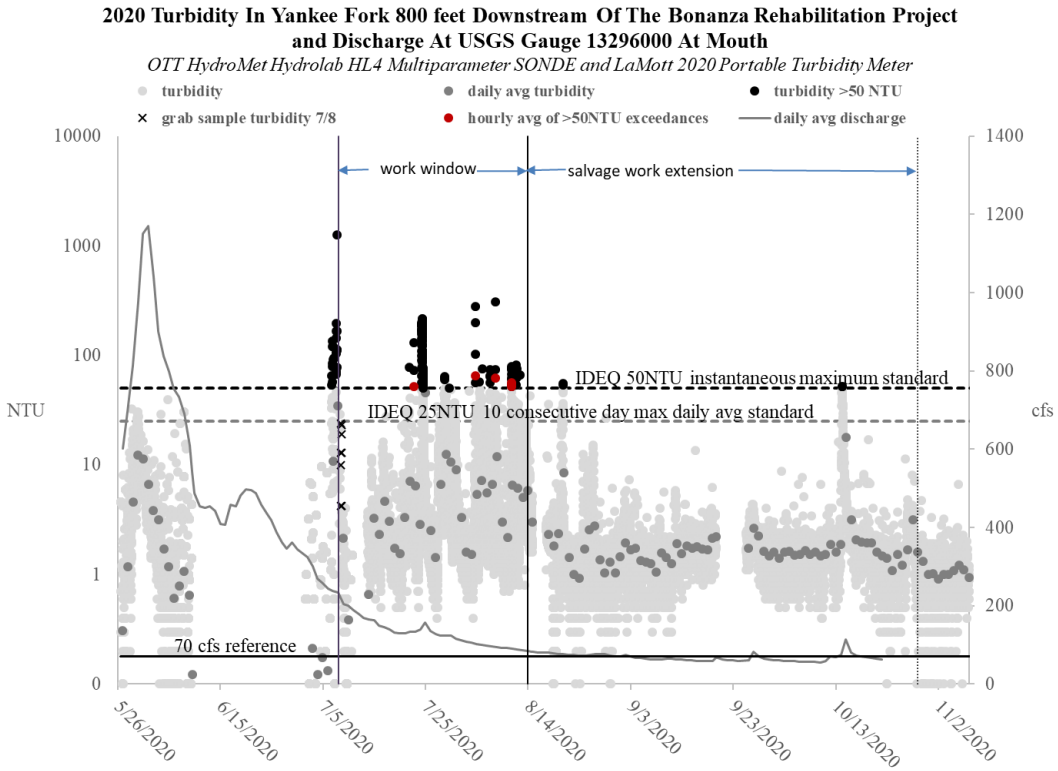


Figure 102. Yankee Fork Salmon River 800 feet downstream of the Bonanza Rehabilitation Project reach, turbidity, daily average turbidity, turbidity >50 NTU, and average of each reading >50 NTU through the hour following that are >50 NTU (during work window excluding natural events based on upstream meter), compared to IDEQ Cold Water Aquatic Life Use recommended thresholds; and Yankee Fork daily average discharge at USGS Gauge 13296000 at mouth, including 70 cfs reference, in 2020.

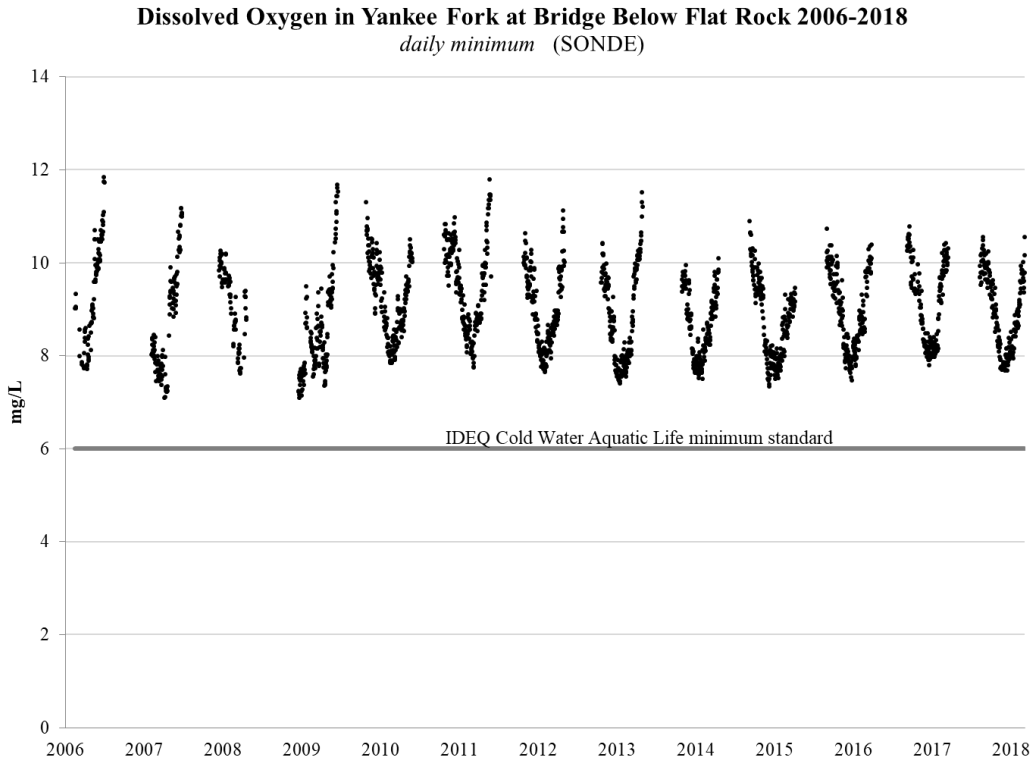


Figure 103. Dissolved oxygen daily minimum in the Yankee Fork Salmon River at bridge below Flat Campground from 2006 to 2018, compared to IDEQ Cold Water Aquatic Life Use recommended minimum threshold.

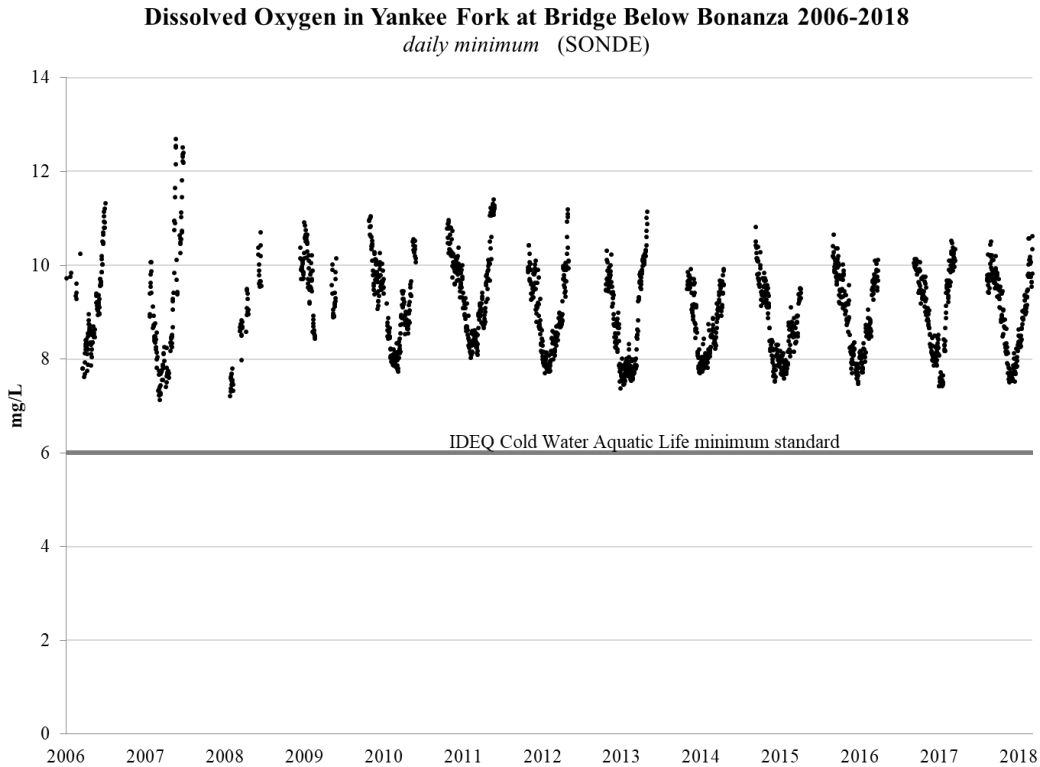


Figure 104. Dissolved oxygen daily minimum in the Yankee Fork Salmon River at bridge below Bonanza from 2006 to 2018, compared to IDEQ Cold Water Aquatic Life Use recommended minimum threshold.

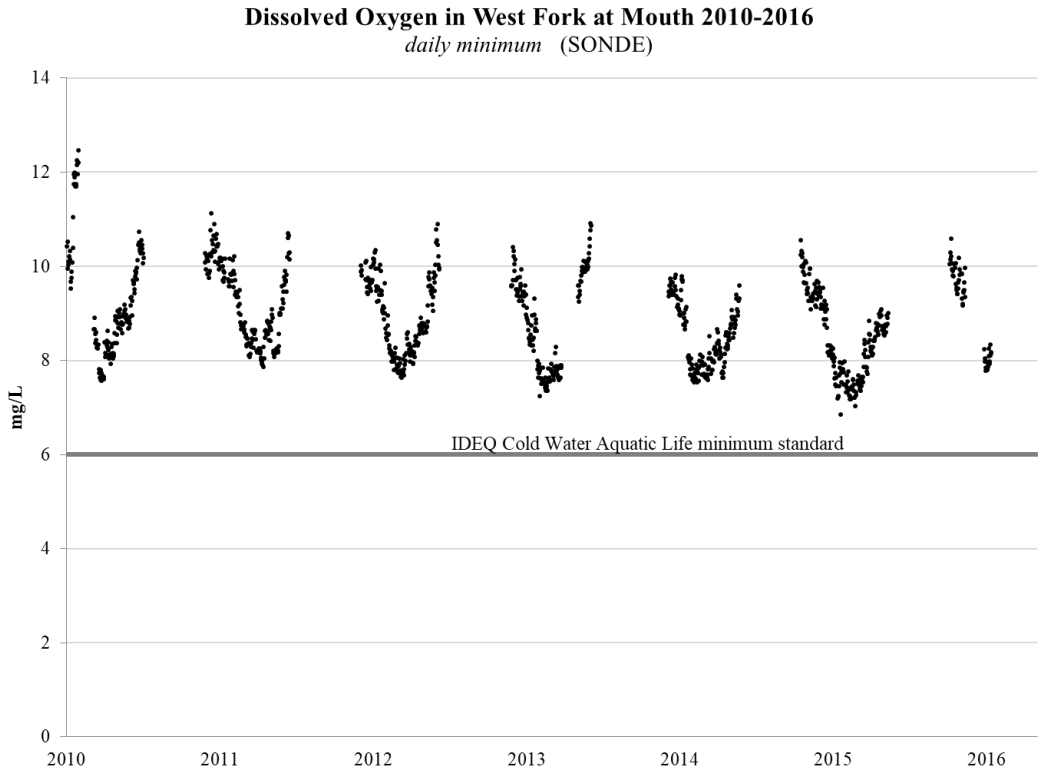
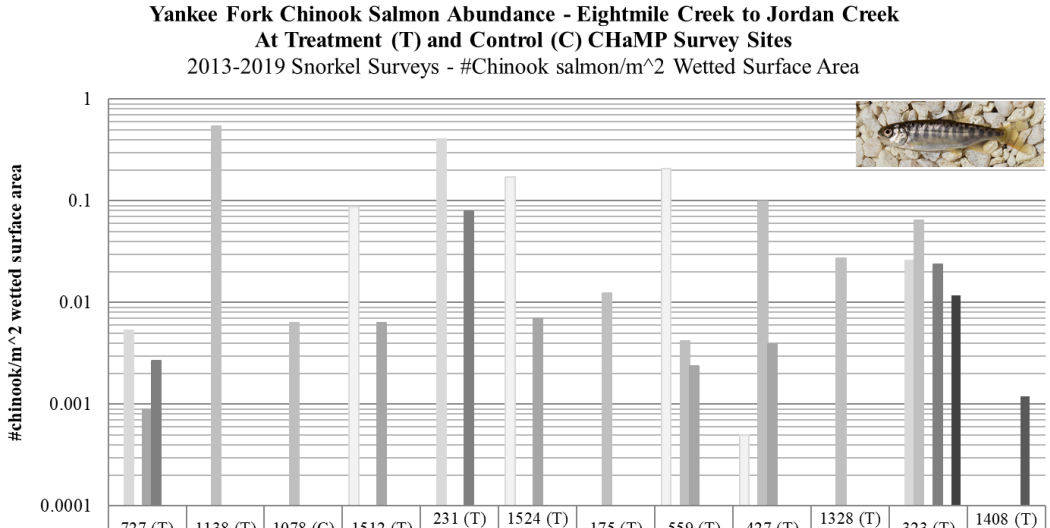
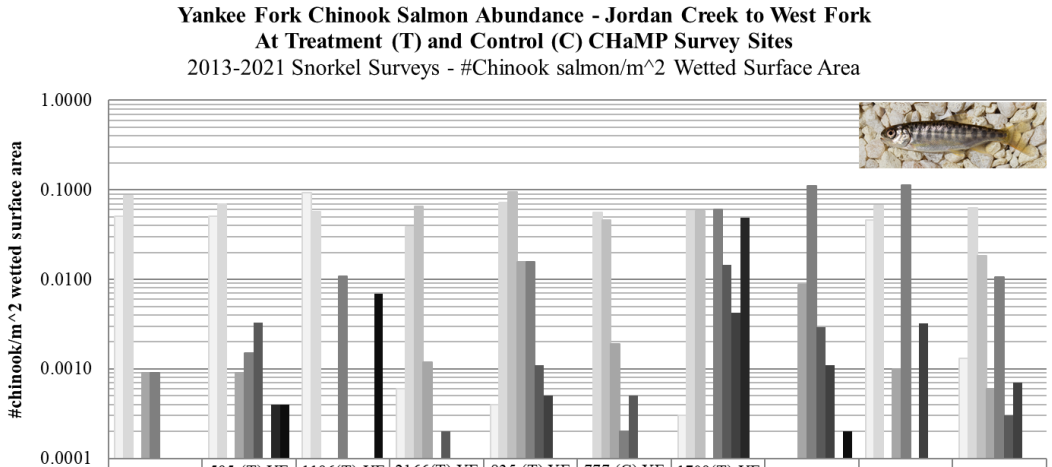


Figure 105. Dissolved oxygen daily minimum at the old mouth of the West Fork Yankee Fork from 2010 to 2016, compared to IDEQ Cold Water Aquatic Life Use recommended minimum threshold.



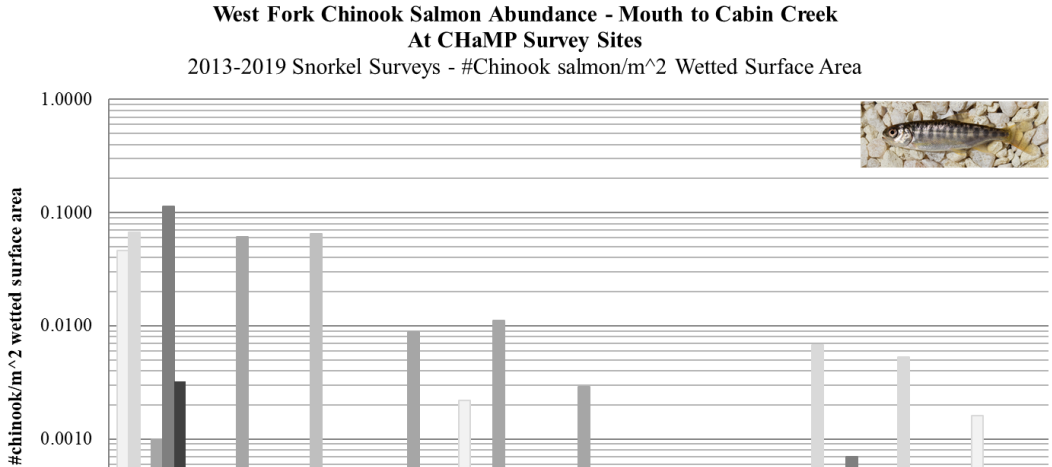
	727 (T) 8Mi at 0.6 mile	1138 (T) 8Mi at mouth	1078 (C) YF above Eightmile	1512 (T) YF below Eightmile	231 (T) YF 0.4mi above Sixmile	1524 (T) YF 0.2mi above Sixmile	175 (T) YF below Greylock	559 (T) YF above Fivemile	427 (T) YF below 4th July	1328 (T) YF above Swift Gulch	323 (T) YF below Adair	1408 (T) Jordan ↑Red Rock
2013				0.0880		0.1706		0.2061	0.0005			
2014	0.0053				0.4045						0.0260	
2015		0.5441	0.0063				0.0124	0.0042	0.0985	0.0274	0.0650	0
2016	0.0009			0.0063		0.0070		0.0024	0.0039			
2017	0.0027				0.0795						0.0239	
2018		0										0.0012
2019								0			0.0117	

Figure 106. Chinook salmon abundance on a logarithmic scale as #/ m^2 wetted surface area observed by snorkel survey, in the Yankee Fork Salmon River, at treatment (T) and control (C) CHaMP Sites located above the dredged reach, from just above Eightmile Creek down to Jordan Creek, including lower sampling sites in Eightmile Creek and Jordan Creek, from 2013 to 2019.



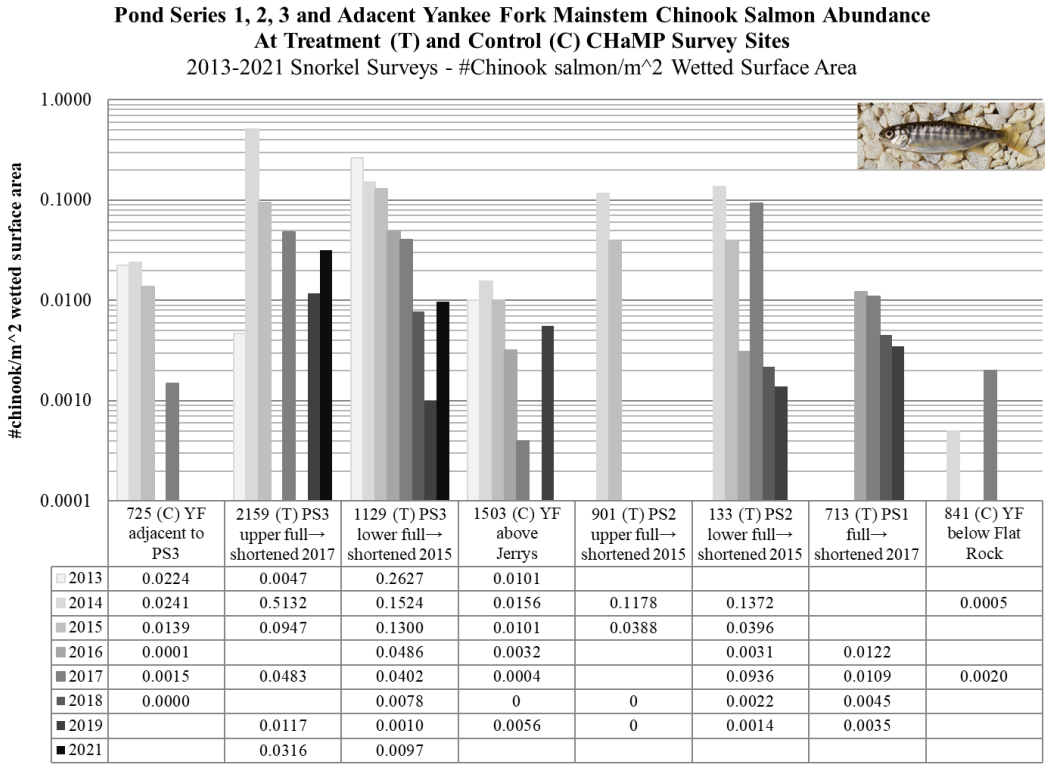
	851 (C) YF below Jordan	595 (T) YF Sluters Bonanza →extd2020	1196(T) YF bridge↓ Bonanza →extd2020	2166(T) YF upper Preacher Cove	835 (T) YF mid Preacher Cove	777 (C) YF lower Preacher Cove	1709(T) YF ↑West Fork → SC1 2016	1971(T) YF new ↑West Fork	1013(C)WF above mouth	213 (C) YF ↓West Fork
2013	0.0505	0.0503	0.0926	0.0006	0.0004	0	0.0003		0.0463	0.0013
2014	0.0853	0.0691	0.0575	0.0388	0.0721	0.0563	0.0585		0.0672	0.0626
2015				0.0654	0.0949	0.0463	0.0585			0.0183
2016	0.0009	0.0009		0.0012	0.0156	0.0019	0	0.0088	0.0010	0.0006
2017	0.0009	0.0015	0.0109		0.0158	0.0002	0.0600	0.1119	0.1128	0.0106
2018	0	0.0033	0	0.0002	0.0011	0.0005	0.0144	0.0029		0.0003
2019				0	0.0005	0	0.0042	0.0011	0.0032	0.0007
2020	0	0.0004	0			0	0.0487			
2021		0.0004	0.0069					0.0002		

Figure 107. Chinook salmon abundance on a logarithmic scale as #/ m^2 wetted surface area observed by snorkel survey, in the Yankee Fork Salmon River at treatment (T) and control (C) CHaMP Sites located within the dredged reach, between Jordan Creek and West Fork, from 2013 to 2021.



	1013 WF above mouth	1529 WF above Sawmill	643 WF above Sawmill	654 WF below Deadwood	1711 WF above Deadwood	1633 WF below Lightning	362 Lightning ↑mouth	106 Lightning @mouth	1411 WF above Lightning	218 WF above Lightning	482 WF below Cabin
2013	0.0463				0.0022			0			0.0016
2014	0.0672								0.0068	0.0053	
2015			0.0645				0				
2016	0.0010	0.0607		0.0088	0.0111	0.0029		0			0
2017	0.1128								0.0007	0	
2019	0.0032										

Figure 108. Chinook salmon abundance on a logarithmic scale as #/ m^2 wetted surface area observed by snorkel survey, in the West Fork Yankee Fork, at CHaMP Sites located between the mouth and Cabin Creek, including lower sampling sites in Lightning Creek, from 2013 to 2019.



	725 (C) YF adjacent to PS3	2159 (T) PS3 upper full→ shortened 2017	1129 (T) PS3 lower full→ shortened 2015	1503 (C) YF above Jerrys	901 (T) PS2 upper full→ shortened 2015	133 (T) PS2 lower full→ shortened 2015	713 (T) PS1 full→ shortened 2017	841 (C) YF below Flat Rock
2013	0.0224	0.0047	0.2627	0.0101				
2014	0.0241	0.5132	0.1524	0.0156	0.1178	0.1372		0.0005
2015	0.0139	0.0947	0.1300	0.0101	0.0388	0.0396		
2016	0.0001		0.0486	0.0032		0.0031	0.0122	
2017	0.0015	0.0483	0.0402	0.0004		0.0936	0.0109	0.0020
2018	0.0000		0.0078	0	0	0.0022	0.0045	
2019		0.0117	0.0010	0.0056	0	0.0014	0.0035	
2021		0.0316	0.0097					

Figure 109. Chinook salmon abundance on a logarithmic scale as #/ m^2 wetted surface area observed by snorkel survey, at treatment (T) and control (C) CHaMP Sites within the dredge tailings, in Pond Series side channels 1, 2 and 3, and adjacent Yankee Fork mainstem, from 2013 to 2021.

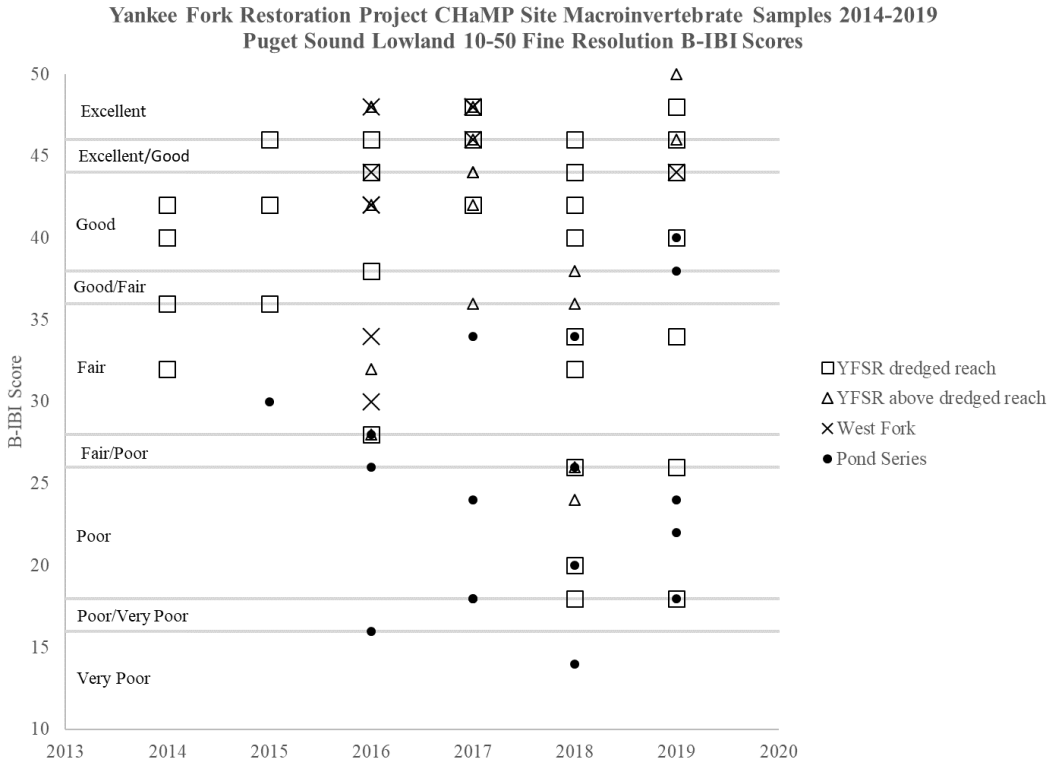


Figure 110. Macroinvertebrate sample Puget Sound Lowland 10-50 Fine Resolution B-IBI Scores from CHaMP Sites in the YFSR dredged reach from Jerrys Creek up to Jordan Creek, in the YFSR above the dredged reach from Jordan to McKay including tributaries, in the West Fork including Lightning Creek, and in the Pond Series 1, 2 and 3, from 2014 to 2019.

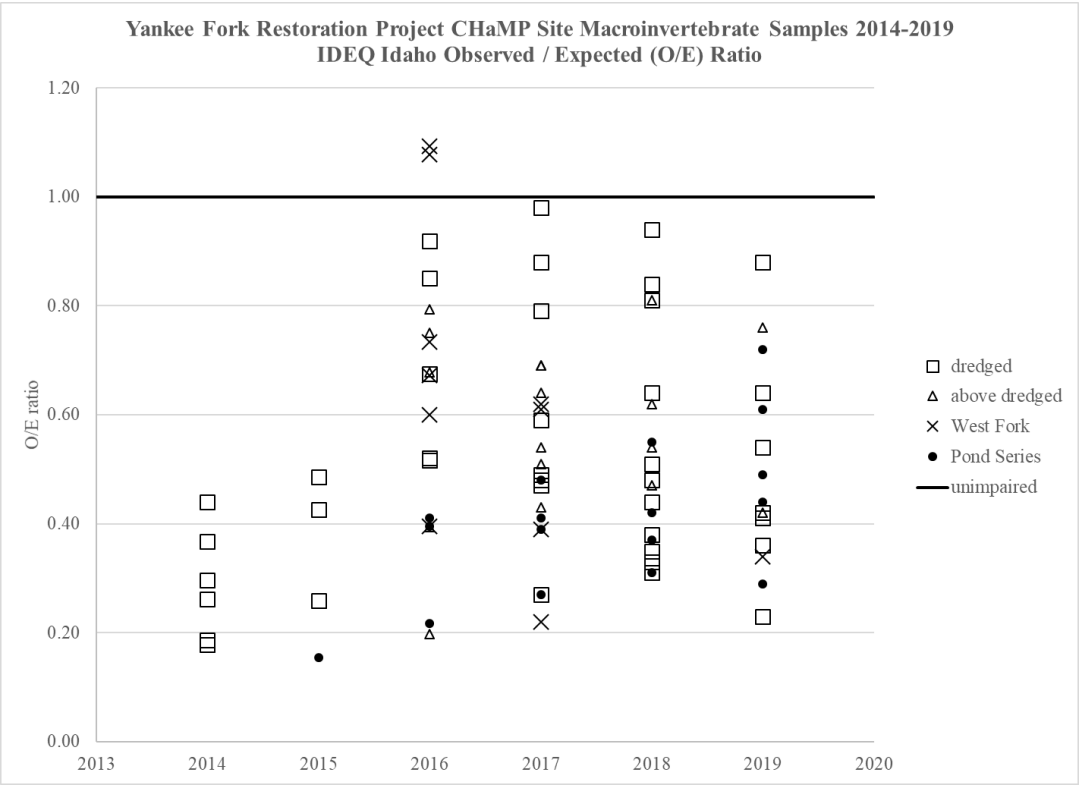


Figure 111. Macroinvertebrate sample IDEQ Idaho Observed / Expected (O/E) Scores from CHaMP Sites in the YFSR dredged reach from Jerrys Creek to Jordan Creek, in the YFSR above the dredged reach from Jordan Creek to McKay Creek including tributaries, in the West Fork including Lightning Creek, and in the Pond Series 1, 2 and 3, from 2014 to 2019.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