AVISTA CORPORATION

2020

LONG LAKE HED

TEMPERATURE MONITORING REPORT

WASHINGTON 401 CERTIFICATION, SECTION 5.5

Spokane River Hydroelectric Project
FERC Project No. 2545

Prepared By:

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List of Acronyms and Abbreviations

7-DADM	7-day average daily maximum temperature
°C	degrees Celsius
Avista	Avista Corporation
Certification	Section 401 water quality certification
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
DO WQAP	Dissolved Oxygen Water Quality Attainment Plan
FERC	Federal Energy Regulatory Commission
Golder	Golder Associates Inc.
HED	hydroelectric development
LLFB	Long Lake forebay monitoring station
LLTR	Long Lake HED tailwater monitoring station
LLGEN	Long Lake generation plume monitoring station
m	meter(s)
MS5	Hydrolab® MS5 Multiprobe®
Project	Spokane River Project
QAPP	Quality Assurance Project Plan
RM	River mile
Spokane Tribe	Spokane Tribe of Indians
TDG	total dissolved gas
Temperature WQAP	Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area
WQM QAPP	Water Quality Monitoring and Quality Assurance Project Plan

1.0 INTRODUCTION

On June 18, 2009, the Federal Energy Regulatory Commission (FERC) issued a new license for the Spokane River Project (Project), FERC Project No. 2545 (FERC 2009a), which incorporated the Washington Department of Ecology (Ecology) Section 401 Water Quality Certification (Certification; Ecology 2009). In accordance with Section 5.10 and 5.5 of the Certification, Avista Corporation (Avista) developed the Water Quality Monitoring and Quality Assurance Project Plan (WQM QAPP; Avista 2009) and the Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan (Temperature WQAP; Avista 2011) in consultation with Ecology and the Spokane Tribe of Indians (Spokane Tribe). The Temperature WQAP outlined a 10-year strategy for achieving the highest attainable, reasonable and feasible water temperature condition in Long Lake Dam reservoir and tailrace to optimize overall biological protection. Avista filed the Ecology-approved WQM QAPP with FERC on August 13, 2009 and FERC approved it with modification on September 17, 2009 (FERC 2009b). Avista filed the Ecology-approved Temperature WQAP with FERC on January 26, 2011. On May 10, 2011, FERC (2011) issued an order approving the Temperature WQAP and amending the 2009 WQM QAPP, pursuant to Article 401(A)(12) of the license.

As part of the Temperature WQAP, Avista is required to provide an annual summary report of the available temperature water quality monitoring results to Ecology by March 1. Previous reports summarized Long Lake Hydroelectric Development (HED) temperature data collected in 2010 through 2014 (Golder 2012, Golder 2013, Golder 2014, Golder 2015), in 2015 and 2016 (Golder and Mattax Solutions 2016, Golder and Mattax Solutions 2017), and in 2017 through 2019 (Avista 2018a, Avista 2019, and 2020a). This report summarizes temperature monitoring conducted for Long Lake HED during the 2020 calendar year. Additionally, this report also falls within the tenth and final year of the Temperature WQAP and includes detailed discussion on Avista's compliance with maintaining the highest attainable water temperature condition to optimize overall biological protection within Lake Spokane and the Long Lake Dam tailrace.

2.0 MONITORING ACTIVITIES

2.1 2020 Monitoring Objectives

The overall objectives of the Temperature WQAP Monitoring Report are to:

- Document monitoring activities
- Summarize temperature monitoring results
- Document compliance with temperature criteria set forth in the Certification
- Describe any proposed changes to the Temperature WQAP and WQM QAPP

In addition to the above objectives, we have included information pertaining to the Spokane Tribe's water quality standards for the Spokane River downstream of the Project.

2.2 Monitoring Locations and Periods

Water temperature data included in annual summary reports are from a number of water quality monitoring programs as described in the Temperature WQAP (Avista 2011). This report presents temperature data obtained as a component of monitoring programs focused on Spokane River water quality (Ecology 2021b and 2021c), Lake Spokane water quality (Avista 2020c and 2021a), Long Lake HED total dissolved gas (Avista 2021a), and Long Lake HED dissolved oxygen (Avista 2021b). Additional temperature data from previous years are available from Avista upon request.

2.2.1 Lake Spokane

Temperature monitoring was conducted at two river stations upstream of Lake Spokane (inflow stations), three temporary near-shore stations within Lake Spokane, and one location in the Long Lake Dam Tailrace (Table 2-1 and Figure 2-1). These monitoring efforts are described in more detail below.

2.2.1.1 Inflow Stations

Ecology has monitored temperature, along with other water quality parameters, in the Spokane River and Little Spokane River upstream of Lake Spokane. This monitoring was performed under Ecology's River and Stream Water Quality Ambient Monitoring Program, which monitors by water year.[1] Ecology's monitoring at these two stations was conducted in accordance with the Stream Ambient Monitoring QAPP (Ecology 2003). Preliminary data for the Spokane River at Nine Mile Bridge station (54A090) and Little Spokane River near Mouth station (55B070) located on the Little Spokane River at River Mile (RM) 1.1 were accessed on February 1, 2021.

2.2.1.2 Within Lake Spokane

As was discussed in the 2018 and 2019 Long Lake HED Temperature Monitoring Reports (Avista 2019, Avista 2020a), temperature monitoring was not conducted at the Lake Spokane baseline nutrient monitoring stations (LL5 through LL0) in 2020. However, per Ecology's request, Avista conducted diurnal monitoring of temperature and dissolved oxygen at three shallow locations within Lake Spokane. All sampling was completed in accordance with the Ecology-approved QAPP addendum for the Lake Spokane Nutrient Monitoring. Diurnal monitoring data are summarized in Appendix A.

2.2.2 Long Lake Dam Tailrace

In 2020, Avista monitored temperature at one station at the Long Lake HED, 0.6 mile downstream of Long Lake Dam, referred to as LLTR. All monitoring, including quality control protocols, was conducted in accordance with Avista's Total Dissolved Gas (TDG) Monitoring Plan (Golder Associates Inc 2010) and Detailed Dissolved Oxygen (DO) Phase II Feasibility and Implementation Plan (Avista 2010). Under this program, water temperature, total dissolved gas, and DO concentrations were monitored with Hydrolab® MS5 Multiprobe® (MS5) instruments.

[1] The "water year" is defined as the 12-month period from October 1 to September 30 of the following year.

In the past, Ecology has conducted monitoring at Station 54A070 located below Long Lake Dam. Ecology ceased monitoring at this station in 2010, and hence no new temperature data were available when Ecology's database was accessed on February 1, 2021 (Ecology 2021c).

2.3 Temperature Criteria

The Washington State temperature criterion for Lake Spokane and the Long Lake HED tailrace (WAC 173-201A-602, WRIA 54 Notes 1, 2, and 3) limits 1-day maximum temperature to no more than 20.0 degrees Celsius (°C) due to human activities. In addition, water temperature shall not be increased by greater than 0.3°C when natural conditions exceed 20.0°C.

Temperature criteria within the Spokane Tribe reservation downstream of the Project are applicable from the upstream Spokane Indian Reservation boundary (approximately RM 32.7) to the mouth of the Spokane River (RM 0). For reference, the upstream boundary of the Spokane Indian Reservation is located approximately 1.2 miles downstream of Long Lake Dam and approximately 0.6 miles downstream of the Avista and Ecology monitoring stations located below the dam (LLTR). The Class A 7-day average daily maximum temperature (7-DADM) criteria are applicable to this downstream reach of the Spokane River. The 7-DADM is calculated as the arithmetic average of seven consecutive measures of daily maximum temperatures, with the 7-DADM for any individual day calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days before and the three days after that date. The maximum allowable limit (7-DADM) for the Spokane River varies throughout the year as described below (Spokane Tribe 2003):

- 18.5°C between June 1 and August 31;
- 13.5°C between September 1 and September 30;
- 11°C between October 1 and March 31; and
- 13.5°C between April 1 and May 31.

3.0 RESULTS

Results of the 2020 temperature monitoring are discussed below by monitoring location, along with a comparison to the 20.0°C Washington State water quality criterion. In addition, the discussion in Section 5.0 presents a comparison of the temperature results for the monitoring location below Long Lake Dam with the corresponding Spokane Tribe temperature criteria.

3.1.1 Lake Spokane

Water temperature was monitored at three locations: Ecology's Spokane River at Nine Mile Bridge station (54A090), Ecology's Little Spokane River station (55B070), and Avista's LLTR station in the Long Lake Dam Tailrace.

3.1.1.1 Inflow Stations

Ecology's Spokane River at Nine Mile Bridge station (54A090) was monitored once per month during the months of January, February, March, July, August, October, November and December. Reported water temperatures for this timeframe ranged from 3.5°C in February to 17.6°C in July (Table 3-1). All monitored water temperatures in 2020 met the 20.0°C Washington State criterion.

Ecology's Little Spokane River station (55B070) was monitored once per month during the months of January, February, March, July, August, October, November and December. Water temperatures during this timeframe ranged from 4.0°C in February to 14.8°C in July (Table 3-2). All monitored water temperatures met the 20.0°C Washington State criterion.

3.1.2 Long Lake Dam Tailrace

Water temperature in the Long Lake Dam Tailrace was measured at one location, LLTR. Water temperature data was collected in 15-minute intervals from February 6 through October 31 as part of Avista's Washington Total Dissolved Gas Monitoring Plan and the Detailed DO Phase II Feasibility and Implementation Plan (Figure 3-1).

LLTR

Daily maximum water temperatures ranged from 3.9°C in Mid-February to 20.3°C on September 7 and 8 (Table 3-3). With the exception of two days (September 7 and 8), all LLTR monitored water temperatures in 2020 met the 20.0°C Washington State criterion.

4.0 WATER QUALITY ATTAINMENT PLAN SCHEDULE

Consistent with Section 5.5 of the Certification and the agency-approved Temperature WQAP (Avista 2011), Avista has performed detailed water quality monitoring and implemented a wide range of projects designed to achieve the highest feasible water quality condition in Lake Spokane and the Long Lake HED tailrace. Over the past 10 years, Avista has prepared, obtained approval for, and implemented the Temperature WQAP and WQM QAPP, as well as other plans to address Lake Spokane temperature, DO, and other water quality parameters to address Certification requirements. Plans that have been implemented by Avista to meet these objectives are summarized below:

- **WQM QAPP** – Avista prepared the WQM QAPP (Avista 2009) in consultation with Ecology and the Spokane Tribe. Approval of this plan was obtained from Ecology on August 13, 2009 and from FERC with modifications on September 17, 2009 (FERC 2009b).

- **Temperature WQAP** – Avista prepared the Temperature WQAP (Avista 2011) in consultation with Ecology and the Spokane Tribe. Approval of this plan was obtained from Ecology on January 25, 2011 and from FERC (2011) on May 10, 2011 in an order approving and amending the 2009 WQM QAPP, pursuant to Article 401(A)(12). Avista has provided annual reports summarizing water temperature data for the Long Lake HED in accordance to the approved Temperature WQAP, WQ QAPP and WQM QAPP.

- **Lake Spokane DO WQAP** – Avista prepared the Lake Spokane DO WQAP (Avista and Golder 2012), which discussed nine feasible potential measures to improve DO conditions. Upon receiving FERC approval (December 19, 2012), Avista began implementing the DO WQAP and has submitted Annual Reports for the work completed in 2013 through 2015, 2017 to 2018, and 2020 (Avista 2014, 2015, 2016a, 2018b, and 2019b, 2021c), a Five-Year Summary Report for the work completed from 2013 through 2016 (Avista 2017), and an Eight-Year Summary Report for the work completed from 2013 through 2019 (Avista 2020c). The Lake Spokane DO WQAP Annual Reports provided a summary of the baseline monitoring, implementation activities, effectiveness of the implementation activities, and proposed further actions. In accordance with the DO WQAP, following completion of the 2017 nutrient monitoring season, Avista and Ecology evaluated the results and success of monitoring baseline nutrient conditions in Lake Spokane. Nutrient monitoring (e.g., nitrogen and phosphorus) was not conducted in 2018, but in-situ DO, temperature, conductivity and pH were measured and zooplankton were collected at the six baseline monitoring stations (LL5 through LL0), and at the four supplemental monitoring stations (LL3a, LL2a, LL2b, and LL1a). In 2019, Avista shifted focus from baseline monitoring to conducting more detailed analysis on the 2010 through 2018 water quality data in an effort to explore the relationship between rainbow trout habitat utilization in Lake Spokane and the multitude of water quality attribute information that is available from the lake (Avista 2020c).

  Additionally, in 2019, Avista worked with Ecology to develop a plan for monthly 24-hour temperature and DO monitoring. This new technique used automated recorders affixed to buoys at three different locations in the epilimnion of Lake Spokane during the summer of 2020. The purpose of this monitoring was to provide a better understanding of the diurnal fluctuations that may be present during the summer and how primary productivity influences water quality conditions.

  The Lake Spokane DO WQAP Annual, Five-Year and Eight-Year Reports provide a summary of the baseline monitoring, implementation activities, effectiveness of the implementation activities, and proposed actions of the upcoming year. The implementation activities' goals are primarily related to improving DO in the lake. These measures also support a beneficial impact on water temperatures in the lake.

- **Cold Water Fish Habitat Evaluation** – Avista continued to evaluate the extent of cold-water fish habitat in Lake Spokane. Relative to Ecology's 20°C and 8.0 milligram per liter (mg/L) temperature and DO criteria for cold-water fish, respectively, a large volume of suitable water quality for rainbow trout is present below the upper stratified layers of Lake Spokane (see Section 5.1). As discussed in the Lake Spokane DO WQAP Eight-Year Report (Avista 2020c), Avista's multi-year fish population and habitat assessment revealed that rainbow trout are frequently present in waters warmer than 16°C (up to 23.6°C measured in 2017), based on results of seasonal tracking of tagged rainbow trout in Lake Spokane from 2017 to 2018. Avista will continue to work with Ecology and WDFW to further evaluate the results of the rainbow trout habitat assessment, in conjunction with lake-wide water quality parameters, with the goal of maintaining Lake Spokane's core summer salmonid habitat and optimizing overall biological protection within Lake Spokane.

- **Hangman Creek Basin Shoreline Stabilization and Agricultural Practices** - Avista continues to track plans and progress addressing erosion control in the Hangman Creek Basin by participating in meetings, including the Spokane Conservation District's

Hangman Creek Bi-State Watershed Project and Ecology's Spokane River and Lake Spokane DO TMDL Advisory Committee meetings.

- **Upper Hangman Creek Wetland Restoration-** Avista and the Coeur d'Alene Tribe have acquired approximately 1,022 acres on upper Hangman Creek, within the southern portion of the Coeur d'Alene Tribe Reservation in Benewah County, Idaho approximately 10 miles east of the Washington-Idaho Stateline. Site-specific wetland management plans are updated annually for approximately 600-acres of these properties and include establishing long-term, self-sustaining native emergent, scrub-shrub and/or forested wetlands, riparian habitat and associated uplands, through preservation, restoration and enhancement activities. These properties were all previously in agricultural use and include straightened creek beds prior to the acquisition. Given that Hangman Creek is a significant contributor of sediment and associated phosphorus loading to the Spokane River, Avista anticipates a phosphorus load reduction from the wetland mitigation work. Since 2013, approximately 18,978 native tree and shrub species have been planted on this wetland complex. Maintenance and replacement of trees is evaluated on an annual basis.

- **Wetland Restoration/Enhancement** – In 2013, Avista acquired the 109-acre Sacheen Springs property, located on the west branch of the Little Spokane River. This property contains a highly valuable wetland complex with approximately 51 acres of emergent, scrub-shrub and forested wetlands and approximately 59 acres of adjacent upland forested buffer. Several seeps, springs, perennial and annual creeks are also found on the property. Avista completed a detailed site-specific wetland management plan and began implementing it upon Ecology and FERC's approval in 2014. Herbicide application to control terrestrial invasive weeds was completed in 2014, 2015, and 2016, improving the overall biodiversity and function of the wetland property. Avista placed the property into a conservation easement with the Inland Northwest Land Conservancy in 2018. Additional activities conducted during 2018 included monitoring site conditions, performing maintenance as needed, and controlling invasive weeds in accordance with the site-specific wetland management plan. Invasive weed control measures included herbicide treatment of 8.5 acres, primarily to control infestation of Reed canary grass, an invasive species present along the access road. Management activities conducted in 2020 included: (a) understory thinning of approximately 0.5 acres of the mature upland forest to remove ladder fuels and promote forest health; (b) development of a primitive trail along the interface of the wetland and mature upland forest; and (c) herbicide application to control terrestrial invasive weeds on 0.5 miles of 2-track access road.

- **Little Spokane Wetland & Shoreline Restoration** - As part of the Nine Mile HED's Rehabilitation Program, Avista partnered with the Washington State Parks and Recreation Commission Parks (State Parks) to complete a wetland and shoreline restoration project on four acres within the Little Spokane Natural Area Preserve. The Natural Area Preserve is a popular location for recreation; however two invasive weed species, yellow flag iris and purple loosestrife, have constricted large sections of the river and adjacent shoreline. The mitigation project included herbicide treatments on four acres of yellow flag iris and purple loosestrife invasive weed species during 2014 and 2015. Additionally, in 2014 four trees were removed from the Nine Mile barge landing site and relocated to the Little Spokane River Mitigation Site for large woody debris habitat. After two consecutive years of herbicide applications, the stands of invasive weeds were reduced by an estimated 90%-100%. Also, during 2015, Avista partnered with the Washington State Department of Natural Resources (DNR) to implement re-vegetation of

the site, which included planting 400 trees and shrubs (black cottonwoods, quaking aspens, choke cherry and red osier dogwood). Individual plants were enclosed with four-foot welded wire fencing for protection from browsing and the bases were wrapped with a protective sleeve for protection from small mammals; herbicide spot treatments were also completed. During 2018, Avista monitored site conditions and performed maintenance as needed, including noxious weed control by mechanical and chemical means along with fence repair and removal. Avista transferred the long-term maintenance of this project back to State Parks (owner of the property) in 2019, having fulfilled the project components.

- **Floating Treatment Wetland** - Avista partnered with the Stevens County Conservation District (SCCD) and Spokane Community College (SCC) to install a floating wetland in the downstream portion of Lake Spokane, adjacent to Avista-owned shoreline. The purpose of the floating wetland is to promote phosphorus removal and wave attenuation, as well as to gain information on plant species growth and fish habitat. The floating wetland was installed during the spring of 2018 and consisted of two 40-foot long log structures (each consisting of three logs bolted together), located approximately 100 feet from the shore. During June of 2018, SCC students assembled approximately 20 floating wetland platforms, anchored the platforms to the log structure, and planted the platforms with approximately 240 plants (including, but not limited to, sedge, rush, willow, and bulrush species). Throughout the summer season, the SCC students monitored the site for plant survivability, presence of invasive plants, wildlife activity, fish habitat, and shoreline wave impacts. The floating wetland platform was removed in October and approximately 180 of the plants were planted along the adjacent shoreline. Three plant samples (two sedge and one rush) were submitted for total phosphorus and total nitrogen analyses in order to estimate the total phosphorus and nitrogen removed by the plants. Additionally, basic field water quality parameters were collected, including the deployment of temperature logger arrays.

  In June 2019, SCC constructed and installed 30 wetland structures. Avista supplemented this effort with 12 additional wetland structures planted with 200 common rush and 400 beaked sedge seedlings. SCC conducted similar monitoring to 2018, including water quality monitoring, minimal plant tissue nutrient analysis and underwater video recording. Avista focused monitoring efforts in 2019 on both plant biomass changes and wave attenuation potential.

  In June 2020, Avista and the SCCD installed 17 floating wetland structures on Lake Spokane. Each structure contained approximately 40 plants of mixed beaked sedge and common rush.

- **Grazing Land Conversion** – As early as 2009, Avista identified 215 acres of Lake Spokane property that DNR leased for cattle grazing. This land is located within the south half of Section 16 in Township 27 North, Rand 40 E.W. M. in Stevens County. Avista and State Parks pursued a lease for the 215 acres of land from DNR with the intent of changing the land use. DNR leased the property to State Parks in 2017 for public recreation, and therefore grazing has been eliminated on this property.

- **Vegetative Shoreline Buffer on Avista Lake Spokane Property** - Avista owns approximately 350 acres of land located within 200 feet of the Lake Spokane shoreline in Spokane, Stevens, and Lincoln counties at the downstream end of the reservoir. This includes approximately 14-miles of Avista-owned shoreline that is managed in accordance

with Avista's FERC-approved Spokane River Project Land Use Management Plan (Avista 2016b). These northern and southern lake shorelines are largely contiguous and are managed primarily as Conservation Land. In August 2019, Avista finalized a conservation easement with the Inland Northwest Land Conservancy to permanently protect the properties located along the south shore of Lake Spokane. Avista has maintained a 200-foot buffer along the lake's shoreline on these properties, protecting riparian habitat functions and providing sediment filtering.

To enhance the vegetative buffer, reduce erosion and provide shade, Avista began a tree planting program in 2013, planting trees and shrubs along Avista-owned shoreline on a two-year cycle. In 2020, Avista conducted vegetation monitoring of trees planted during past planting events along the shoreline of Lake Spokane. Vegetation survival assessments consisted of monitoring the condition and location of living trees. In 2020, Avista planted 250 seedlings of red osier dogwood, willow and cottonwoods at four of Avista's Lake Spokane recreation sites. The seedlings were fenced to protect them from browsing. Once mature, the trees will form canopy cover along the lake and provide shade, reduce water temperature, encourage fish habitat, and help stabilize the shoreline.

- **Bulkhead Removal** - During 2019, Avista worked with several Lake Spokane shoreline landowners in Spokane County to replace existing concrete, stacked rock, riprap, or other similar hardened bulkheads with natural shoreline materials or those that utilize bioengineered products that use native vegetation, when and where possible. The 2018/2019 winter drawdown allowed construction to begin on one of these bulkhead replacement projects, the Wright Project, located just downstream of Sportsman's Paradise. Construction was completed in January 2019 and plantings were installed in April 2019. The Wright Project is intended to help reduce non-point source phosphorus loading into Lake Spokane. It will also be used as a prototype to educate other Lake Spokane shoreline homeowners about how they too can improve water quality in Lake Spokane with these types of projects.

  2020 was the first year of vegetation monitoring at the Wright Project. Avista conducted two monitoring events in the summer of 2020 and worked with the landowner to complete the annual report. Additionally, Avista presented at the Northern Idaho/Eastern Washington Regional Lakes Conference, using the Wright Project to demonstrate the benefits of replacing bulkheads or lawns with naturalized shorelines, including native vegetation buffers. Education is an important tool in reducing phosphorus loads to the lake.

- **Carp Population Reduction Program** – During 2020, Avista implemented the fourth year of its common carp (Cyprinus carpio) removal program on Lake Spokane. The removal effort was done in cooperation with WDFW and completed under a Scientific Collection Permit issued by WDFW.

  The removal effort occurred during a five week-long event from May 18 through June 18 and focused on sampling carp during their spring spawning behavior. Removal efforts were focused in the upper portion of Lake Spokane between McLellan Slough and the Nine Mile Recreation Area. In total, 1,227 carp were collected along with 2,801 other fish considered by-catch. All carp were removed from the water and placed into a refuse bin and transported to the Greater Wenatchee Regional Landfill for disposal. The 1,227 carp collected in 2020 totaled approximately 13,580 pounds of biomass removed from the watershed.

- **Education and Outreach** – In 2020, Avista sponsored and presented at the Northern Idaho/Eastern Washington Regional Lakes Conference, highlighting the bulkhead removal project at the Wright property and the carp removal efforts on Lake Spokane. Additionally, Avista produced an article discussing water quality monitoring efforts on Lake Spokane as well as the relationship between dissolved oxygen and fish habitat. This article was published in the Spokane Indian Baseball team newsletter, social media, and myavista.com website. Avista also worked with WDFW and Ecology in 2019 and 2020 to produce two educational videos focused on natural shorelines and how to properly install a bottom barrier to control nuisance aquatic weeds. The two videos are available for viewing at: http://myavista.com/about-us/celebrate-our-rivers/shoreline-health and the article is available at: https://www.myavista.com/connect/articles/2020/09/protecting-the-health-of-our-waterways

- **Long Lake HED Turbine Aeration and Tailrace DO Monitoring** – Avista will continue to refine implementation of turbine aeration that was initiated in 2010, based on real-time water quality measurements that are monitored 0.6 miles downstream of Long Lake Dam from July 1 through October 30. Avista also will continue to coordinate results with the DO TMDL efforts in accordance with the FERC-approved schedule (FERC 2010).

- **Long Lake Dam Spillway Modification Project for TDG Abatement and Monitoring** Avista completed construction of the Long Lake Dam spillway modifications for the TDG project in December 2016. The performance of the structural modifications and spillgate protocols were evaluated during 2017 and 2018. Water quality monitoring was also conducted from 2017 through 2020 to verify the effectiveness of the spillway modifications and spillgate operations. The water quality monitoring confirmed that TDG values downstream were reduced at higher flows, verifying that the spillway modification project positively influenced TDG percent saturation downstream (Avista 2018c and 2019c). Results from 2020 further corroborate the 2017 and 2018 monitoring, continuing to demonstrate that downstream TDG values are reduced (Avista 2021a).

5.0 DISCUSSION

5.1 Lake Spokane

As discussed in Section 4.0, over the past 10 years, Avista has performed extensive temperature, DO, and other water quality parameter monitoring in Lake Spokane. These monitoring data provide a detailed characterization of water quality under current hydrologic, nutrient loading, and Project operating conditions. As set forth in the Certification, the objective of the Temperature WQAP is to optimize overall biological protection within and downstream of Lake Spokane. The discussion below evaluates current water quality conditions in the lake relative to this optimization objective.

To provide context for current water quality conditions in Lake Spokane, it is useful to consider pre-Project baseline conditions within this 24-mile reach of the Spokane River that existed prior to construction of the Long Lake Dam in 1915. Given similar geology and topography throughout the Spokane River watershed, the relationship between river discharge, width, and

depth in this historical reach was likely similar to current unimpounded reaches of the upstream Spokane River (Patmont et al. 1985). Given this similarity, during the summer season[2] this historically unimpounded reach likely had the following characteristics:

- Average width: 190 feet
- Average depth: 8.5 ft
- Reach volume: 4,864 acre-ft
- Average travel time through the 24-mile reach: 1 day

As summarized by HDR (2005), under this historical unimpounded condition, river temperatures and other water quality conditions at the outlet of the reach (the current tailrace location) were likely not significantly different from inflow conditions.

Currently, a shallow riverine environment is present in the upper four miles of the reservoir where water depths are less than approximately 25 feet (ft). Lake Spokane water quality monitoring station LL5 is located within this riverine reach (Figure 2-1). Water quality monitoring data collected at station LL5 are reflective of inflow (and without Project outflow) conditions. As discussed below, during the warmer summer months, Spokane River water temperatures entering Lake Spokane at station LL5 regularly exceed the 20ºC Washington State temperature criterion (WAC 173-201A-602); temperatures above 20ºC at station LL5 reflect upstream inputs to the Project area.

Downstream of station LL5, Lake Spokane transitions into a deeper reservoir system; the deepest portion of the reservoir (approximately 200 ft) is located at the Long Lake HED forebay. Like most large river impoundments and many natural lakes, Lake Spokane stratifies during the summer. Stratification refers to the vertical temperature layers occurring in reservoirs and lakes. The layers above and below the depth with the steepest vertical temperature gradient, denoted as the thermocline, are the epilimnion and hypolimnion, respectively. During stratification, the epilimnion and hypolimnion do not readily mix across the thermocline. This allows the epilimnion in Lake Spokane to become heated while the deeper hypolimnion stays cool during summer. In Lake Spokane, stratification generally starts to set up in June and persists through October. The average June to October temperature contours measured in Lake Spokane from 2010 to 2018 are presented on Figure 5-1.

During the summer months, as riverine water moves through Lake Spokane downstream of station LL5, it plunges below the warmer and less dense epilimnion, flowing above the cooler and denser hypolimnion. Because specific conductance of the Spokane River increases seasonally, this water quality parameter provides a useful tracer to track riverine flow through the reservoir. A typical summer specific conductance contour in Lake Spokane is depicted on Figure 5-2. As discussed in Patmont et al. (1987) and HDR (2005), specific conductance and other tracer data reveal that during summer stratification, a riverine interflow zone sets up at depths between approximately 30 and 55 ft downstream of station LL4 (Figure 5-3). The summer discharge through the reservoir goes through this riverine interflow zone, with an average residence time of approximately 20 days (at a river discharge of 2,400 cubic feet per

[2] Comparison completed by averaging river flows from the summer season, July to September, from 2010 to 2018 river which is approximately 2,400 cubic feet per second; Avista 2020c.

second^2). The Long Lake HED intake withdraws reservoir water from this riverine interflow zone.

Figure 5-4 summarizes monthly average 2010 to 2018 water temperatures in Lake Spokane within five zones including, the inflow, outflow, epilimnion, riverine, and hypolimnion. The **inflow** zone, measured at LL5, reflects upstream inputs to the Project area. The **outflow** zone, measured at LL0, represents the water that is passed downstream below Long Lake Dam. The next three zones, **epilimnion**, **riverine interflow, and hypolimnion** represent the different layers in Lake Spokane.

The **epilimnion** zone represents the greatest volume of water in Lake Spokane at 40% (4.6 billion ft^3) and is generally found at depths ranging from the lake surface to approximately 30 ft. The epilimnion warms to above 20^{o}C during the months of July and August (Figure 5-4). As discussed in Section 4.0, Avista's multi-year rainbow trout habitat assessment revealed that rainbow trout are frequently present in these warmer epilimnetic waters (Avista 2020c).

The **Riverine Interflow** zone represents 35% of the lake's volume (3.8 billion ft^3), and is found at depths ranging from approximately 30 to 55 ft.

The **hypolimnion** represents 25% of the lake's volume (2.8 billion ft^3) and is found at a depth below approximately 55 ft. The deeper hypolimnion typically remains at or below 16^{o}C throughout the summer (Figure 5-4), providing a refuge for cold-water fish.

Importantly, water temperatures in the riverine interflow zone are lower than those in the epilimnion, and similar to water temperatures entering Lake Spokane at station LL5 (Figure 5-4). This is also reflected in cooler water temperatures downstream of the Long Lake HED as compared to the epilimnion. During the peak temperature month of August, water temperatures in the riverine interflow and outflow zones were slightly lower than those entering Lake Spokane at station LL5 and generally below the 20^{o}C Washington State temperature criterion (WAC 173-201A-602). Thus, like the hypolimnion, the Lake Spokane riverine interflow zone also provides a temperature refuge within Lake Spokane that concurrently cools the downstream Long Lake Dam tailrace, compared to how conditions would be without the Project. Note that the volume of the Lake Spokane riverine interflow zone is approximately 20 times larger than it was in the historically unimpounded reach.

Habitat

While Ecology's core summer salmonid DO water quality standard is 9.5 mg/L, a 1-day minimum DO level of 8 mg/L is protective of salmonid early life stages (e.g., within gravel streams; EPA 1986). Moreover, optimal growth and development of adult and juvenile rainbow trout, particularly within a reservoir/lake habitat, occurs when DO is at or above 5.0 mg/L (Raleigh et al. 1984; Molony 2001; Powers 2014). Mortalities increase below this level, with asphyxiation occurring at 4.0 mg/L. DO levels below roughly 3 mg/L are acutely lethal to salmonids.

As discussed in the Lake Spokane DO WQAP Eight Year Annual Report (Avista 2020c), DO levels in the Lake Spokane hypolimnion have recovered dramatically over the past 40 plus years following significant (85%) reductions of point source phosphorus loading to the Spokane River.

Prior to these controls, the minimum volume-weighted hypolimnetic DO level in the lake ranged between approximately 0.2 and 3 mg/L, within the acutely lethal range.

Figure 5-5 summarizes monthly average 2010 to 2018 DO levels in Lake Spokane within the same five temperature zones discussed above (i.e., inflow; riverine interflow; outflow; lake epilimnion; and lake hypolimnion). Average DO levels within the epilimnion and riverine interflow were regularly at or above the protective 8 mg/L criterion (EPA 1986). During the months of August and September, lower DO levels between approximately 5 and 6 mg/L were present in the hypolimnion and near the lake outflow.

After initial testing in 2010, Avista began aerating the water flowing through the Long Lake HED turbines to more frequently achieve the DO water quality criterion downstream of the HED. Figure 5-6 presents the 2020 LLTR DO diurnal time series, which is typical of recent monitoring during the critical summer timeframe when aeration is implemented. Since 2011, Avista has maintained the tailrace DO level at or above 8 mg/L during approximately 88% of the summer period (July through October).

While hypolimnetic DO levels in Lake Spokane still drop below the fully-protective 8 mg/L numeric criterion, significant hypolimnetic DO recovery to levels that support juvenile and adult fish growth have contributed to the overall optimization of biological productivity and protection within Lake Spokane.

As discussed in the Lake Spokane DO WQAP Eight Year Annual Report (Avista 2020c), seasonal DO levels in the hypolimnion of Lake Spokane are affected by nutrient (especially phosphorus) loadings to Lake Spokane, as well as the residence time of water within the lake. Although Avista does not discharge phosphorus into the watershed, the impoundment that creates Lake Spokane increases the residence time of water within the lake, rendering DO levels in the lake more susceptible to phosphorus loading. The Certification targeted Avista's proportional responsibility for this condition as a total phosphorus load reduction to Lake Spokane of approximately 510 to 1,900 kilograms per year. As discussed in Section 4.0, over the past 10 years Avista has implemented a variety of wetland acquisition, restoration, and enhancement projects in the watershed, along with other measures to comply with this total phosphorus load reduction requirement, improving current and future water quality conditions in Lake Spokane.

Finally, Figure 5-7 summarizes monthly average 2010 to 2017 chlorophyll concentrations in Lake Spokane within the same five temperature zones discussed above (i.e., inflow; riverine interflow; outflow; lake epilimnion; and lake hypolimnion). Chlorophyll concentrations provide an index of primary production and associated prey resources available within these different zones of the lake. While low photosynthetic light levels in the hypolimnion limit primary production and food supplies in this zone, both the epilimnion and riverine interflow zones had similar chlorophyll concentrations and thus likely provide similar prey resources for fish growth.

Based on the weight-of-evidence of temperature, DO, and chlorophyll data collected over the past 10 years, overall biological protection and productivity, particularly within the important

riverine interflow zone, is currently being optimized within Lake Spokane and the Long Lake Dam tailrace, consistent with Certification objectives.

5.2 Long Lake Dam Tailrace

Temperatures measured at the Long Lake Dam Tailrace monitoring station of LLTR met the Washington State criterion of 20.0°C during approximately 99% of the monitoring season. The criterion was exceeded at LLTR on two days (September 7 and 8,) reaching a maximum temperature of 20.3°C on both days (Table 3-3).

Monitoring results indicate the Spokane Tribe's 7-DADM criteria established for tribal waters were exceeded at LLTR on May 30 and 31, and from July 17 through October 28 (Table 5-1, Figure 5-8). It is important to note the LLTR monitoring station, from which 2020 temperature data were collected, is located approximately 0.6 miles upstream from the reservation boundary where the Tribe's criteria are applicable.

As part of a non-License Agreement, Avista provides the Spokane Tribe with funds to complete water quality improvements to help address temperature exceedances, along with other water quality improvement needs downstream of the Project. To date, the Spokane Tribe has planted trees and completed stream stabilization efforts in the Tshimikain Creek watershed to reduce surface water temperatures. Avista and the Spokane Tribe will continue working together in the future to improve water quality within the reservation. These projects relate to DO, TDG, and temperature within the reservation.

6.0 PROPOSED CHANGES TO THE TEMPERATURE WQAP AND WQM QAPP

6.1 Spring Season Monitoring

Avista plans to continue monitoring TDG at LLTR and LLGEN during the high-flow season (typically March/April through June) in 2021.

6.2 Summer Season, Tailrace Monitoring

As approved by Ecology in 2015, Avista will continue to monitor summer critical season water quality at the LLTR station, but not at LLFB because the complex hydraulic dynamics near the forebay intake cause substantial temperature variability near the dam over short time periods.

6.3 Summer Season, Lake Spokane Monitoring

Avista will not monitor water quality in Lake Spokane in the summer of 2021, since Ecology's DO TMDL 10-Year Assessment Monitoring in Lake Spokane is anticipated to begin in 2021.

7.0 CERTIFICATION COMPLIANCE

Section 5.5(B) of the Certification states the following.

B. Lake Spokane

> The Licensee shall develop a temperature Water Quality Attainment Plan (WQAP) for review and approval by Ecology within 18 months of FERC license issuance, in accordance with WAC 173-201A-510(5), that provides a detailed strategy for maintaining the highest attainable water quality condition to best protect the biota with respect to temperature that is reasonable and feasible to achieve in the Long Lake Dam reservoir and tailrace. Any operational or structural change that conflicts with other conditions of this Certification requires prior approval by Ecology.
>
> The WQAP shall also identify a temperature regime that is reasonably and feasibly achievable based upon such evaluation, such that the summer temperature discharge from the Dam is not increased from current levels. Ecology recognizes that a trade-off between surface temperature and downstream temperatures may be required (i.e. discharging the preferred cooler waters from deep in a reservoir as opposed to mixing in the reservoir).
>
> Thus, when it is not reasonable and feasible to meet the temperature criteria both upstream and downstream, the intent is to find the balance where biological protection would be optimized.
>
> If at the end of the ten year compliance period, the Licensee is unable to meet water quality standards, after evaluating and implementing all reasonable and feasible alternatives under WAC 173-201A-510(5)(g), then the Licensee will propose an alternative action to achieve compliance with the standards, such as new reasonable and feasible technologies or other options to achieve compliance with the standards, a new compliance schedule, or other alternatives as allowed by WAC173-201A-510.

The Certification recognizes that when it is not reasonable and feasible to meet the temperature criteria both upstream and downstream of Long Lake Dam, the intent is to find the balance where biological protection would be optimized. Consistent with Section 5.5(B) of the Certification, the agency-approved Temperature WQAP, and WQM QAPP, over the past 10 years Avista has performed detailed water quality monitoring and implemented a wide range of projects designed to achieve the highest feasible water quality condition in Lake Spokane and the Long Lake HED tailrace. Avista believes that biological optimization has been met as indicated by the data summarized below.

- The Lake Spokane riverine interflow zone (35% of the reservoir volume) meets water quality standards and provides slightly cooler water downstream compared to what would have passed downstream with no impoundment. This is evidenced by water temperatures in the riverine interflow zone that are lower than those in the epilimnion, and similar to water temperatures entering Lake Spokane at station LL5. During the peak temperature month of August, water temperatures in the riverine interflow and outflow zones were slightly lower than those entering Lake Spokane at station LL5 and generally below the 20^{o}C Washington State temperature criterion.

- The temperature criterion would not be met in the lake under natural conditions without the impoundment. Additionally, the downstream water temperature would not have met the Washington State or the Spokane Tribe temperature criteria.
- Although the Lake Spokane epilimnion warms during summer months, it still meets biological objectives by providing adequate warm water and cold-water habitat. This is evidenced by the presence of both warm-water and cold-water fish and chlorophyll concentrations supporting an adequate food supply for fisheries production.
- The hypolimnion (25% of the reservoir volume) is providing a cold-water refuge, which would not be present without the impoundment.
- Like the hypolimnion, the Lake Spokane riverine interflow zone also provides a temperature refuge within Lake Spokane that concurrently cools the downstream Spokane River, compared to conditions without the Project.
- The riverine interflow zone is approximately 20 times larger than that of the historically unimpounded reach, contributing to overall optimization of biological productivity within Lake Spokane. Consistent with the 10-year strategy for providing the highest attainable, reasonable and feasible water temperature condition in Lake Spokane and the Long Lake Dam tailrace outlined in the Temperature WQAP, the overall biological protection objective has now been achieved. This is based on the weight-of-evidence of temperature, DO, and chlorophyll data collected over the past 10 years as discussed above. Biological protection and productivity, particularly within the important riverine interflow zone, is currently being optimized within Lake Spokane consistent with Certification objectives.

Avista has met the objective set forth in the Certification and in the Temperature WQAP to optimize overall biological protection within Lake Spokane and Long Lake Dam tailrace. As 2021 is the last year of the temperature ten-year compliance period, Avista will meet with Ecology during 2021 to review the data presented in this report and evaluate Long Lake HED's compliance with the requirements of the License.

8.0 REFERENCES

Avista Corporation (Avista). 2009. Spokane River Hydroelectric Project, FERC Project No. 2545, Water Quality Monitoring and Quality Assurance Project Plan. August 13.

_____. 2010. Detailed Dissolved Oxygen Phase II Feasibility and Implementation Plan, Washington 401 Certification, Section 5.6(B). Prepared By: Golder Associates Inc. June 11.

_____. 2011. Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan. Washington 401 Certification, Section 5.5. Spokane River Hydroelectric Project FERC Project No. 2545. June 25.

_____. 2014. Lake Spokane Dissolved Oxygen Water Quality Attainment Plan 2013 Annual Summary Report. Washington 401 Certification, Section 5.6. Spokane River Hydroelectric Project FERC Project No. 2545. January 31.

_____. 2015. Lake Spokane Dissolved Oxygen Water Quality Attainment Plan 2014 Annual Summary Report. Washington 401 Certification, Section 5.6. Spokane River Hydroelectric Project FERC Project No. 2545. February 2May 19.

_____. 2016a. Lake Spokane Dissolved Oxygen Water Quality Attainment Plan 2015 Annual Summary Report. Washington 401 Certification, Section 5.6. Spokane River Hydroelectric Project FERC Project No. 2545. January 29.

_____. 2016b. Land Use Management Plan, Article 419, Spokane River Hydroelectric Project, FERC Project No. 2545. March 9.

_____. 2017. Lake Spokane Dissolved Water Quality Attainment Plan Five Year Report. Long Lake Dam. Washington 401 Certification, Section 5.6. Spokane River Hydroelectric Project FERC Project No. 2545. January 31.

_____. 2018a. 2017 Long Lake HED Temperature Monitoring Report. Washington 401 Certification, Section 5.5. Spokane River Hydroelectric Project FERC Project No. 2545.

_____. 2018b. Lake Spokane Dissolved Oxygen Water Quality Attainment Plan 2017 Annual Summary Report. Washington 401 Certification, Section 5.6. Spokane River Hydroelectric Project FERC Project No. 2545. January 29.

_____. 2018c. 2017 Long Lake Total Dissolved Gas Monitoring Report. Washington 401 Certification, Section 5.4(D). Spokane River Hydroelectric Project FERC Project No. 2545.

_____. 2019. 2018 Long Lake HED Temperature Monitoring Report. Washington 401 Certification, Section 5.5. Spokane River Hydroelectric Project FERC Project No. 2545.

_____. 2020a. 2019 Long Lake HED Temperature Monitoring Report. Washington 401 Certification, Section 5.5. Spokane River Hydroelectric Project FERC Project No. 2545.

_____. 2020b. 2019 Long Lake Total Dissolved Gas Monitoring Report. Washington 401 Certification, Section 5.4(D). Spokane River Hydroelectric Project FERC Project No. 2545. In preparation.

_____. 2020c. Lake Spokane Dissolved Oxygen Water Quality Attainment Plan Eight-Year Report. Washington 401 Certification, Section 5.6. Spokane River Hydroelectric Project FERC Project No. 2545. January 31.

_____. 2021a. Lake Spokane Dissolved Oxygen Water Quality Attainment Plan 2020 Annual Summary Report. Washington 401 Certification, Section 5.6. Spokane River Hydroelectric Project FERC Project No. 2545. January 29.

_____. 2021b. 2020 Long Lake Total Dissolved Gas Monitoring Report. Washington 401 Certification, Section 5.4(D). Spokane River Hydroelectric Project FERC Project No. 2545. In preparation.

_____. 2021c. 2020 Long Lake HED Tailrace Dissolved Oxygen Monitoring Report. Washington 401 Certification, Section 5.6(B). Spokane River Hydroelectric Project FERC Project No. 2545. In preparation.

Avista Corporation and Golder Associates Inc. (Avista and Golder). 2012. Lake Spokane Dissolved Oxygen Water Quality Attainment Plan. Spokane River Hydroelectric Project FERC Project No. 2545. Washington 401 Certification, Section 5.6. October 5.

Federal Energy Regulatory Commission (FERC). 2009a. Order Issuing New License and Approving Annual Charges for Use of Reservation Lands. Issued June 18.

_____. 2009b. Order Modifying and Approving Water Quality Monitoring and Quality Assurance Project Plan Pursuant to Article 401(A)(12). Issued September 17. 5 pp.

_____. 2010. Project No. 2545-125 Order Modifying and Approving Dissolved Oxygen Feasibility and Implementation Plan for the Long Lake Development – Article 401. Issued December 9.

_____. 2011. Order Amending Water Quality Monitoring and Quality Assurance Project Plan Pursuant to Article 401(A)(12). Issued May 10. 3 pp.

Golder Associates Inc. (Golder). 2010. Washington Total Dissolved Gas Monitoring Plan. Prepared for Avista Corporation. March 26.

_____. 2012. 2010 and 2011 Long Lake HED Annual Temperature Monitoring Report. Washington 401 Certification, Section 5.5. Spokane River Hydroelectric Project FERC Project No. 2545. Prepared for Avista Corporation. April 9.

_____. 2013. 2012 Long Lake HED Temperature Monitoring Report. Washington 401 Certification, Section 5.5. Spokane River Hydroelectric Project FERC Project No. 2545. Prepared for Avista Corporation. April 10.

_____. 2014. 2013 Long Lake HED Temperature Monitoring Report. Washington 401 Certification, Section 5.5. Spokane River Hydroelectric Project FERC Project No. 2545. Prepared for Avista Corporation. April 10.

_____. 2015. 2014 Long Lake HED Temperature Monitoring Report. Washington 401 Certification, Section 5.5. Spokane River Hydroelectric Project FERC Project No. 2545. Prepared for Avista Corporation. April 14.

Golder Associates Inc. and Mattax Solutions LLC (Golder and Mattax Solutions). 2016. 2015 Long Lake HED Temperature Monitoring Report. Washington 401 Certification, Section 5.5. Spokane River Hydroelectric Project FERC Project No. 2545. Prepared for Avista Corporation. April 11.

_____. 2017. 2016 Long Lake HED Tailrace Dissolved Oxygen Monitoring Report. Washington 401 Certification, Section 5.6(B). Spokane River Hydroelectric Project FERC Project No. 2545. Prepared for Avista Corporation.

HDR Engineering (HDR), 1995. Spokane River Hydroelectric Project: Current Operations Water Quality Report. Report prepared for Avista Utilities. May 9.

Molony, B. 2001. Environmental requirements and tolerances of Rainbow Trout (*Oncorhynchus mykiss*) and Brown Trout (*Salmo trutta*) with special reference to Western Australia: A Review. Fisheries Research Division Western Australia. Report No. 130: 1-28.

Patmont, C.R., G.W. Pelletier, and M.E. Harper, 1985. Phosphorus Attenuation in the Spokane River. Report prepared by Harper-Owes for Washington State Department of Ecology, Contract No. C84-076. Ecology Publication No. 85-e28.

Patmont, C.R., G.W. Pelletier, L.R. Singleton, R.A. Soltero, W.T. Trial, and E.B. Welch, 1987. The Spokane River Basin: Allowable Phosphorus Loading. Report prepared by Harper-Owes for Washington State Department of Ecology, Contract No. C0087874. Ecology Publication No. 87-e29.

Powers, E. 2014. Defining the Physiochemical, Biological and Habitat Requirements for the Upper Extant of *Oncorhynchus mykiss* Distribution. Bemidji State University Journal of Student Research: 1-8.

Raleigh, R.F., T. Hickman, R.C. Solomon, and P.C. Nelson. 1984. Habitat suitability information: Rainbow Trout. U.S. Fish and Wildlife Service Report FWS/OBS-82/10.60: 1-64.

Spokane Tribe of Indians (Spokane Tribe). 2003. Surface Water Quality Standards. March 7. Resolution 2003-259.

U.S. Environmental Protection Agency (EPA), 1986. Ambient Water Quality Criteria for Dissolved Oxygen (Freshwater). EPA 440/5-86-003. April.

Washington State Department of Ecology (Ecology). 2003. Quality Assurance Project Plan, Stream Ambient Water Quality Monitoring, Publication No. 03-03-200. April. http://www.ecy.wa.gov/biblio/0303200.html.

_____. 2009. 401 Certification-Order Spokane River Hydroelectric Project, Certification-Order No. 5492, FERC License No. 2545, As amended May 8, 2009 by Order 6702. Prepared by Eastern Regional Office Water Quality Program staff, Spokane, WA. May 8.

_____. 2021a. River and Stream Water Quality Ambient Monitoring Program, Spokane R @ Ninemile Br. Available at: https://apps.ecology.wa.gov/eim/search/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&LocationUserIds=54A090&LocationUserIdSearchType=Contains&LocationUserIDAliasSearchFlag=True&FieldActivityDateRangeBeginning=1%2f1%2f2020+12%3a00%3a00+AM&FieldActivityDateRangeEnding=2%2f1%2f2021+12%3a00%3a00+AM. Downloaded February 1.

_____. 2021b. River and Stream Water Quality Ambient Monitoring Program, Little Spokane R nr Mouth. Available at: https://apps.ecology.wa.gov/eim/search/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&LocationUserIds=55B070&LocationUserIdSearchType=Contains&LocationUserIDAliasSearchFlag=True&FieldActivityDateRangeBeginning=1%2f1%2f2020+12%3a00%3a00+AM&FieldActivityDateRangeEnding=2%2f1%2f2021+12%3a00%3a00+AM. Downloaded February 1.

_____. 2021c. EIM Search, Location ID equals 54A070. Available at: https://apps.ecology.wa.gov/eim/search/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&LocationUserIds=54A070&LocationUserIdSearchType=Contains&LocationUserIDAliasSearchFlag=True&FieldActivityDateRangeBeginning=1%2f1%2f2020+12%3a00%3a00+AM&FieldActivityDateRangeEnding=2%2f1%2f2021+12%3a00%3a00+AM. Accessed February 1.

TABLES

Table 2-1: Long Lake HED Temperature Monitoring Stations and Periods.

Monitoring Station	Location	NAD83 Decimal Degrees		2020 Monitoring Year	
		Latitude	Longitude	Start	End
54A090	Spokane River at Nine mile Bridge approximately 0.2 miles downstream of Nine Mile Dam, at river mile (RM) 58	47.7767	117.5448	1/8/2020	12/9/2020
55B070	On the Little Spokane River approximately 1.5 miles upstream from its confluence with Lake Spokane, at RM 1.1	47.7829	117.5305	1/8/2020	12/9/2020
LLTR	On left downstream bank, at water pump house approximately 0.6 mile downstream from Long Lake Dam.	47.8375	117.8503	2/6/2020	10/31/2020
54A070	Approximately 0.6 mile downstream of Long Lake Dam, at the Highway 231 Bridge and RM 33.3.	47.8391	117.8525	Not Available	

Table 3-1: Spokane River at Nine Mile Bridge (54A090) Temperature Monitored in 2020.

Date	Maximum Daily Water Temperature (°C)
01/08/20	6.3
02/05/20	3.5
03/04/20	5.7
07/07/20	17.6
08/05/20	17.1
10/07/20	12.8
11/04/20	9.5
12/09/20	6.7

Notes:

On February 1, 2021, accessed preliminary data from Ecology's website: https://apps.ecology.wa.gov/eim/search/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&LocationUserIds=54A090&LocationUserIdSearchType=Contains&LocationUserIDAliasSearchFlag=True&FieldActivityDateRangeBeginning=1%2f1%2f2020+12%3a00%3a00+AM&FieldActivityDateRangeEnding=2%2f1%2f2021+12%3a00%3a00+AM.

The 20.0°C criterion was not exceeded at this monitoring location in 2021.

Table 3-2: Little Spokane River Upstream of Lake Spokane (55B070) Temperature Monitored in 2020.

Date	Maximum Daily Water Temperature (°C)
01/08/20	6.4
02/05/20	4.0
03/04/20	7.3
07/07/20	14.8
08/05/20	14.1
10/07/20	10.6
11/04/20	8.1
12/09/20	6.8

Notes:
On February 1, 2021, accessed preliminary data from Ecology's website: https://apps.ecology.wa.gov/eim/search/Eim/EIMSearchResults.aspx?ResultType=EIMTabs&LocationUserIds=55B070&LocationUserIdSearchType=Contains&LocationUserIDAliasSearchFlag=True&FieldActivityDateRangeBeginning=1%2f1%2f2020+12%3a00%3a00+AM&FieldActivityDateRangeEnding=2%2f1%2f2021+12%3a00%3a00+AM.

The 20.0°C criterion was not exceeded at this monitoring location in 2021.

Table 3-3: LLTR Daily Maximum Temperature in 2020.

Day	Water Temperature (°C)								
	February	March	April	May	June	July	August	September	October
1		4.9	7.2	10.8	14.4	17.9	19.6	19.0	16.3
2		5.0	7.2	10.7	14.7	17.8	20.0	18.9	16.3
3		5.1	7.2	10.7	14.4	18.1	19.4	18.7	16.3
4		5.2	7.4	10.8	14.4	17.7	19.7	18.8	16.2
5		5.3	7.6	11.1	14.7	17.6	19.9	18.9	16.1
6	4.6	5.3	7.7	11.0	14.9	18.0	19.8	19.0	16.1
7	4.7	5.4	7.5	11.2	14.8	18.2	19.4	**20.3**	16.0
8	4.8	5.7	7.4	11.4	15.0	18.2	19.7	**20.3**	16.0
9	4.7	5.8	7.5	11.6	14.9	18.2	19.6	18.9	16.0
10	4.4	6.0	7.4	11.6	15.1	17.9	19.5	19.0	15.9
11	4.1	6.4	7.4	11.5	15.0	18.2	19.6	18.5	15.2
12	4.0	5.9	8.3	11.7	14.8	17.9	19.7	18.5	15.3
13	3.9	6.2	8.2	12.0	14.7	18.4	19.7	18.3	15.2
14	4.1	6.1	8.1	12.2	14.8	18.4	19.5	18.1	14.8
15	4.2	6.1	8.2	12.2	14.7	18.6	19.5	18.1	14.7
16	4.3	6.1	8.5	12.6	14.8	18.7	19.5	18.0	14.6
17	4.3	6.2	8.4	12.4	14.9	18.4	19.5	17.8	14.4
18	4.4	6.2	8.4	12.0	14.8	18.5	19.5	17.7	14.3
19	4.3	6.2	8.5	11.6	NA	18.7	19.4	17.8	14.3
20	4.3	6.2	8.6	11.6	NA	18.8	19.6	17.6	14.1
21	4.4	6.0	8.7	12.0	NA	19.1	19.8	17.4	13.9
22	4.4	5.8	9.0	12.2	15.7	19.3	19.7	17.5	13.6
23	4.5	6.0	8.9	12.3	16.3	19.0	19.2	17.5	13.4
24	4.5	6.1	9.5	12.3	15.9	18.8	19.2	17.0	13.1
25	4.6	6.4	9.5	12.2	16.3	19.2	19.1	17.1	12.8
26	4.6	6.7	9.5	12.4	16.9	19.4	19.3	16.7	12.6
27	4.7	6.8	9.6	12.4	16.5	19.3	19.3	16.6	12.4
28	4.8	7.1	10.3	12.9	17.5	19.6	19.1	16.6	12.2
29	4.8	7.1	10.2	13.4	18.5	19.8	19.0	16.6	11.8
30		7.3	10.3	13.3	17.9	19.8	18.8	16.4	11.5
31		7.3		13.9		19.7	18.6		10.9

Notes:

NA= not enough data to calculate the daily maximum.
Shaded and bold values indicate an exceedance of the 20.0°C criterion.
Data collected as part of Avista's Washington Total Dissolved Gas Monitoring Plan and Detailed DO Phase II Feasibility and Implementation Plan.

Table 5-1: Comparison of LLTR 2020 Monitoring to Spokane Tribe Temperature Standards.

Day	Water Temperature (°C)								
	February	March	April	May	June	July	August	September	October
1		5.0	7.2	10.5	14.1	17.9	**19.7**	**18.8**	**16.4**
2		5.0	7.3	10.6	14.3	17.9	**19.7**	**18.8**	**16.3**
3		5.1	7.4	10.8	14.5	17.9	**19.7**	**18.8**	**16.2**
4		5.1	7.4	10.9	14.6	17.9	**19.7**	**19.1**	**16.2**
5		5.3	7.4	11.0	14.7	17.9	**19.7**	**19.3**	**16.1**
6	N/A	5.4	7.5	11.1	14.7	18.0	**19.6**	**19.3**	**16.1**
7	N/A	5.5	7.5	11.2	14.8	18.0	**19.7**	**19.3**	**16.0**
8	N/A	5.7	7.5	11.3	14.9	18.0	**19.6**	**19.3**	**15.9**
9	4.7	5.8	7.6	11.4	14.9	18.1	**19.6**	**19.2**	**15.8**
10	4.6	5.9	7.7	11.6	14.9	18.1	**19.6**	**19.1**	**15.6**
11	4.5	6.0	7.8	11.7	14.9	18.2	**19.6**	**18.8**	**15.5**
12	4.4	6.1	7.9	11.8	14.9	18.2	**19.6**	**18.5**	**15.3**
13	4.3	6.1	8.0	12.0	14.8	18.3	**19.6**	**18.4**	**15.1**
14	4.3	6.1	8.2	12.1	14.8	18.4	**19.6**	**18.2**	**14.9**
15	4.3	6.1	8.3	12.1	14.8	18.4	**19.6**	**18.1**	**14.8**
16	4.4	6.2	8.3	12.1	N/A	**18.5**	**19.5**	**18.0**	**14.6**
17	4.4	6.2	8.4	12.1	N/A	**18.6**	**19.5**	**17.9**	**14.5**
18	4.4	6.1	8.5	12.1	N/A	**18.7**	**19.5**	**17.8**	**14.3**
19	4.5	6.1	8.6	12.0	N/A	**18.8**	**19.6**	**17.7**	**14.2**
20	4.5	6.1	8.6	12.0	N/A	**18.8**	**19.5**	**17.6**	**14.0**
21	4.5	6.1	8.8	12.0	N/A	**18.9**	**19.5**	**17.5**	**13.8**
22	4.5	6.1	9.0	12.0	N/A	**19.0**	**19.4**	**17.4**	**13.6**
23	4.6	6.2	9.1	12.1	N/A	**19.1**	**19.4**	**17.3**	**13.4**
24	4.7	6.3	9.2	12.3	N/A	**19.2**	**19.4**	**17.1**	**13.1**
25	4.7	6.4	9.5	12.4	16.4	**19.2**	**19.3**	**17.0**	**12.9**
26	4.8	6.6	9.6	12.6	16.8	**19.3**	**19.2**	**16.9**	**12.6**
27	4.8	6.8	9.8	12.7	17.1	**19.4**	**19.1**	**16.7**	**12.3**
28	4.9	6.9	10.0	12.9	17.3	**19.5**	**19.0**	**16.6**	**12.0**
29	4.9	7.1	10.2	13.3	17.6	**19.6**	**19.0**	**16.5**	N/A
30		7.1	10.4	**13.6**	17.7	**19.7**	**19.0**	**16.4**	N/A
31		7.2		**13.9**		**19.7**	**18.9**		N/A

Notes:

NA= not enough data to calculate the 7-DADM
Shaded and bold values indicate an exceedance of the 20.0°C criterion.
Data collected as part of Avista's Washington Total Dissolved Gas Monitoring Plan and Detailed DO Phase II Feasibility and Implementation Plan.

FIGURES

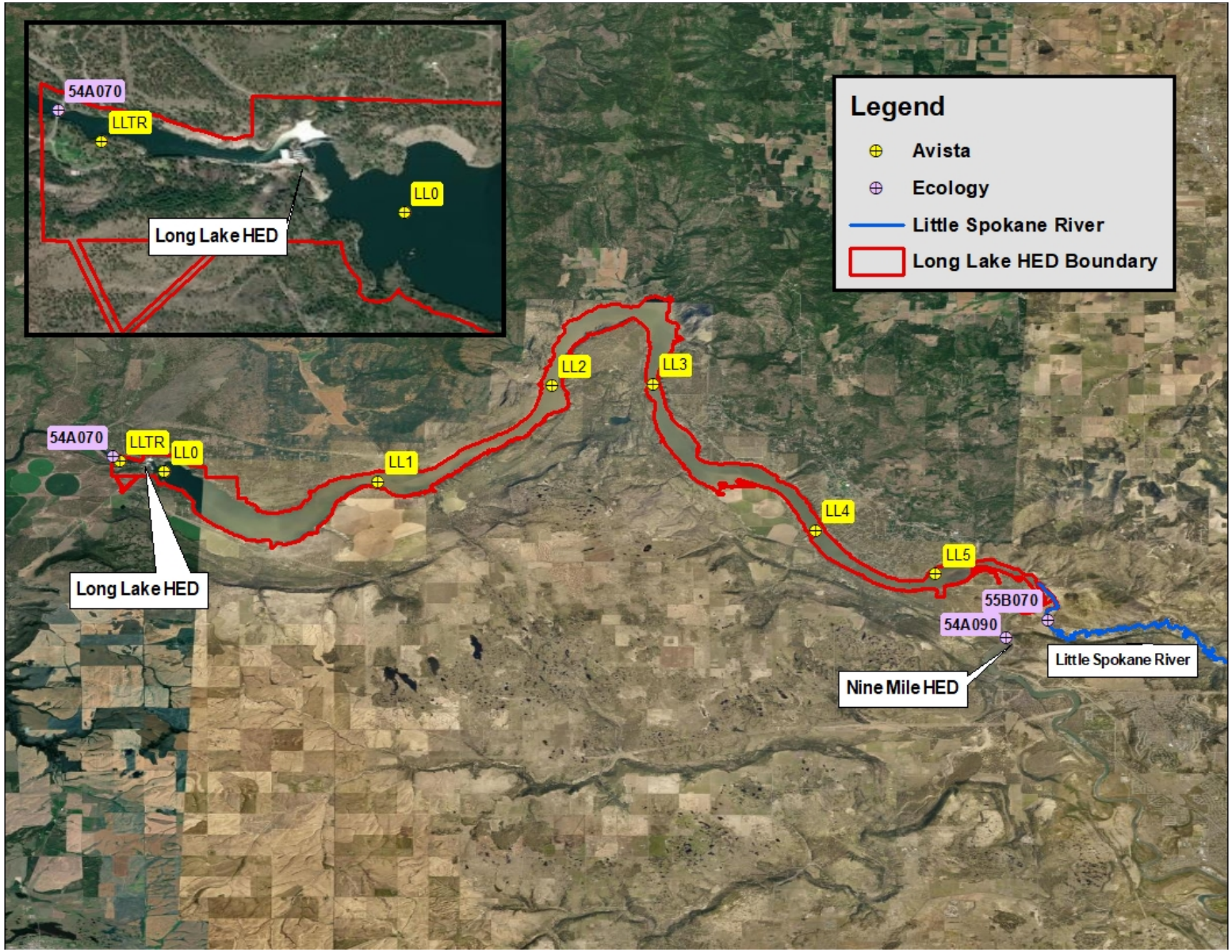

Figure 2-1: Long Lake Temperature Monitoring Stations.

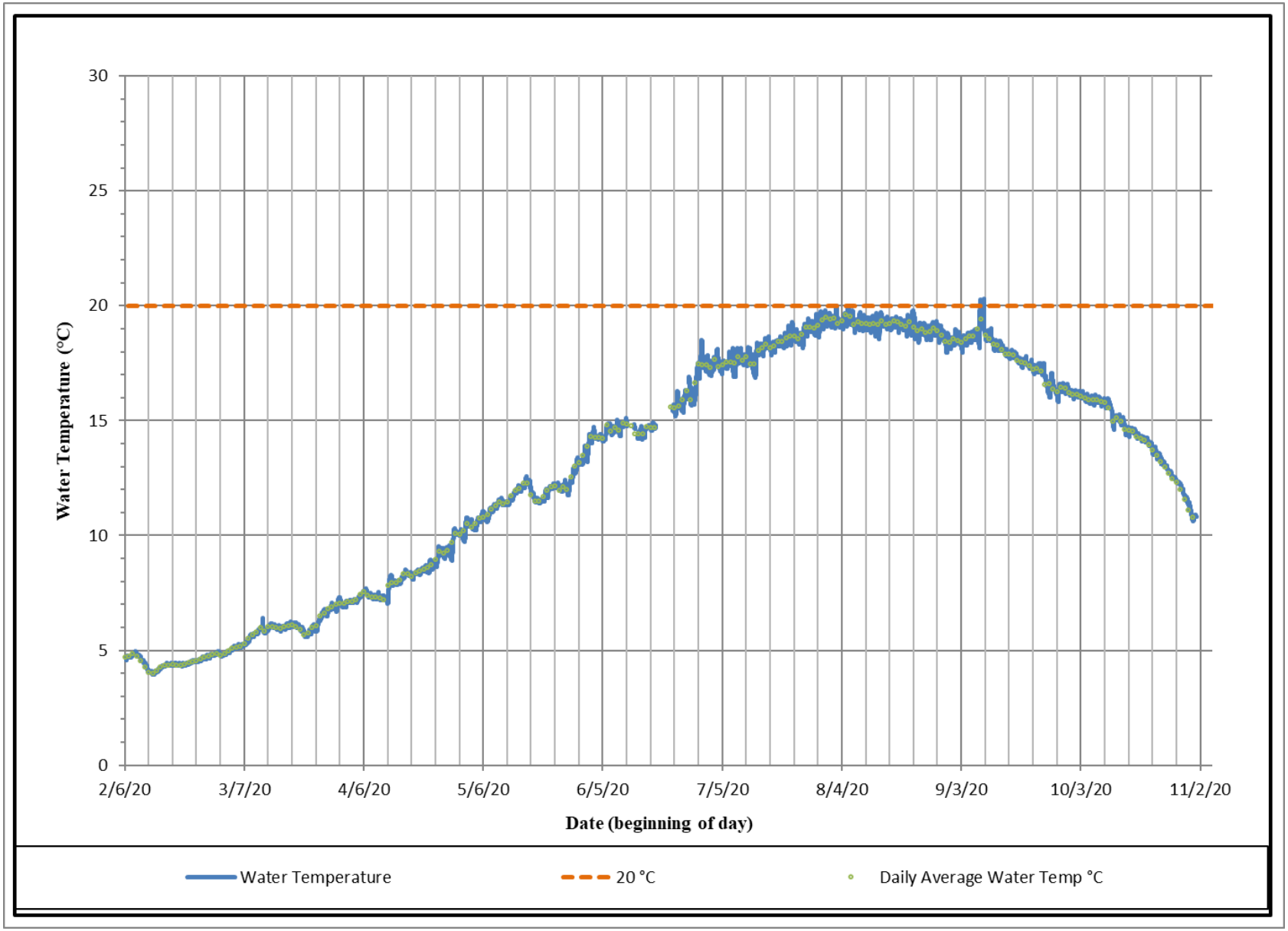

Figure 3-1: LLTR Temperature Time Series, 2020.

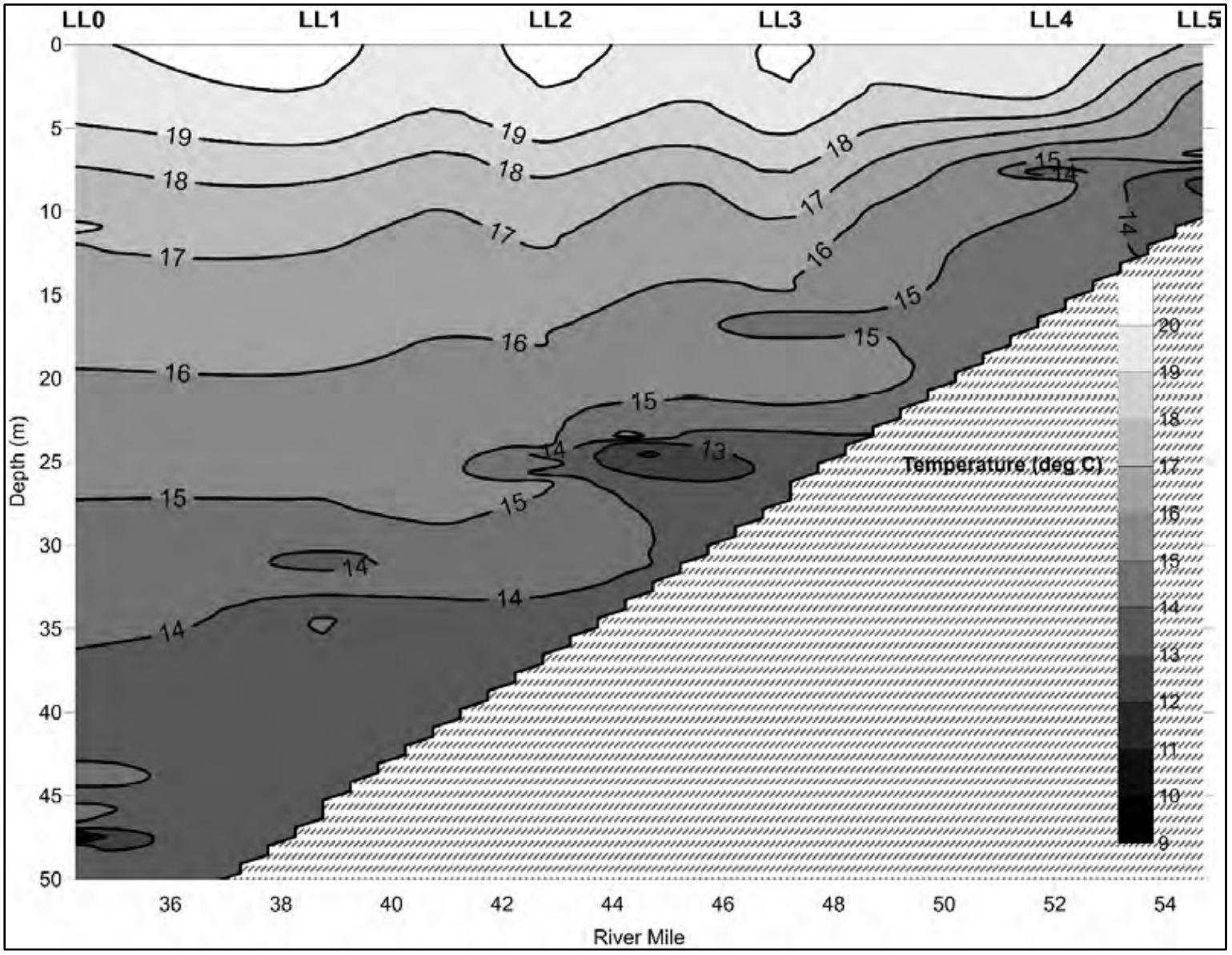

Figure 5-1: Average June – October Water Temperature Contours in Lake Spokane, 2010 – 2018.

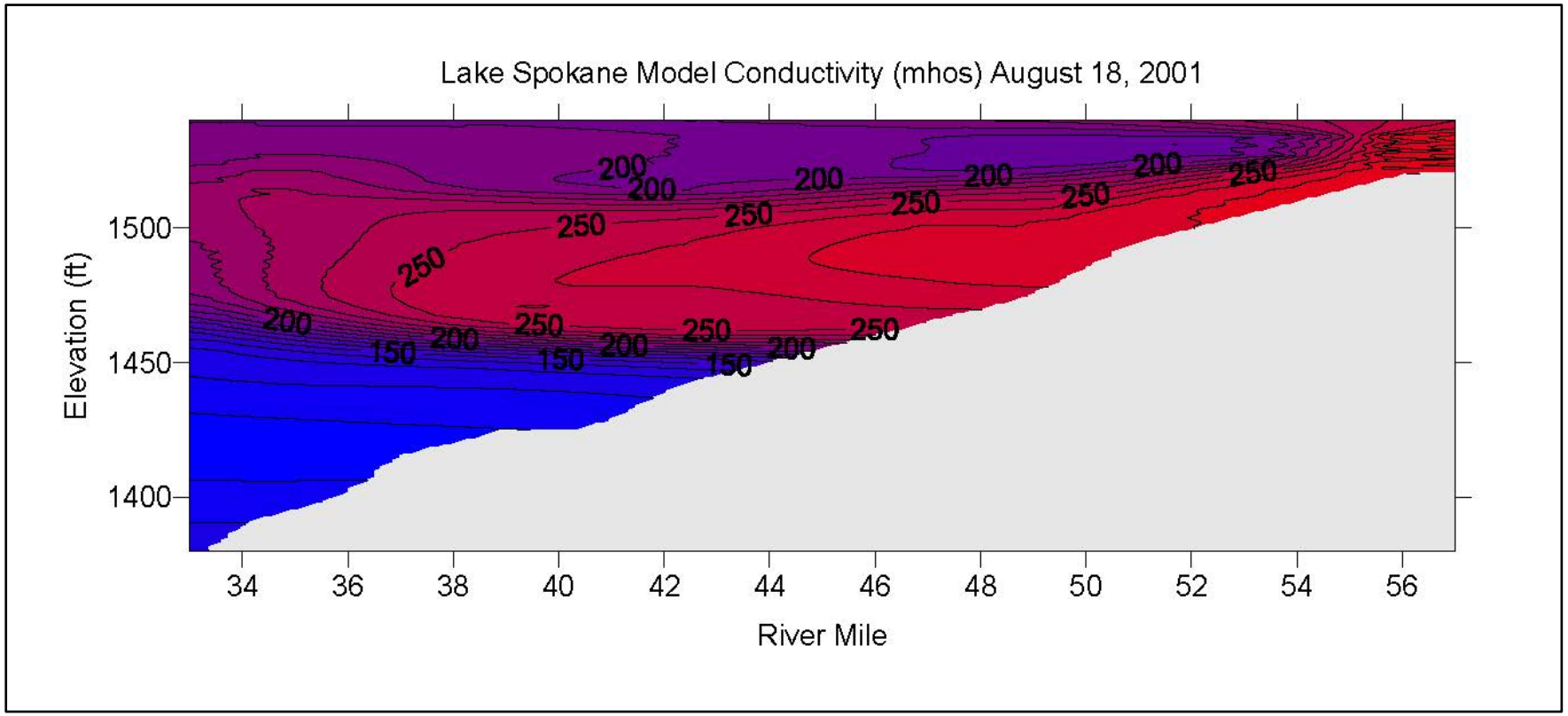

Figure 5-2: Typical Summer Specific Conductance Contours in Lake Spokane (from HDR 2005).

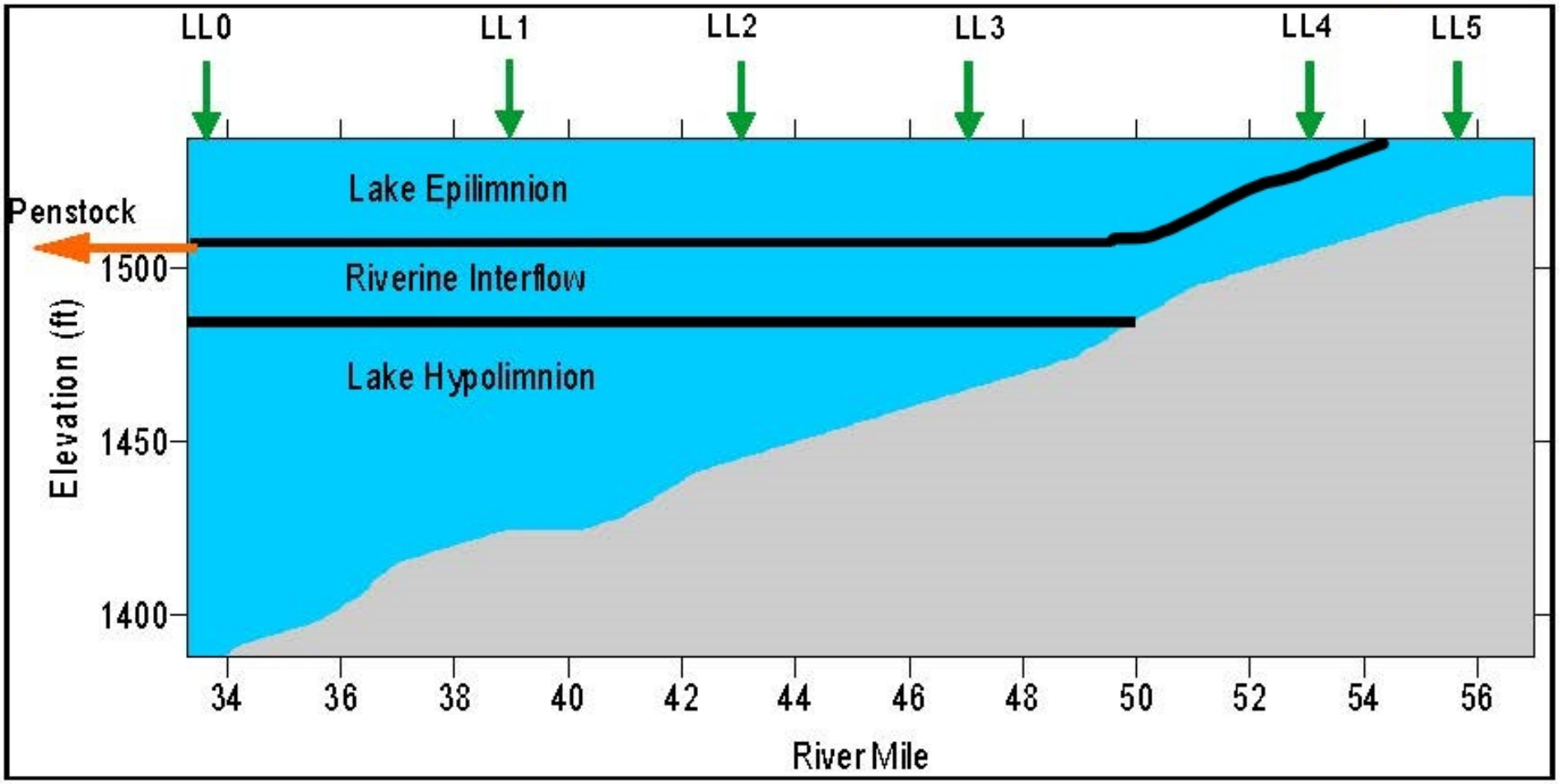

Figure 5-3: Typical Summer Stratification and Riverine Interflow Structure in Lake Spokane.

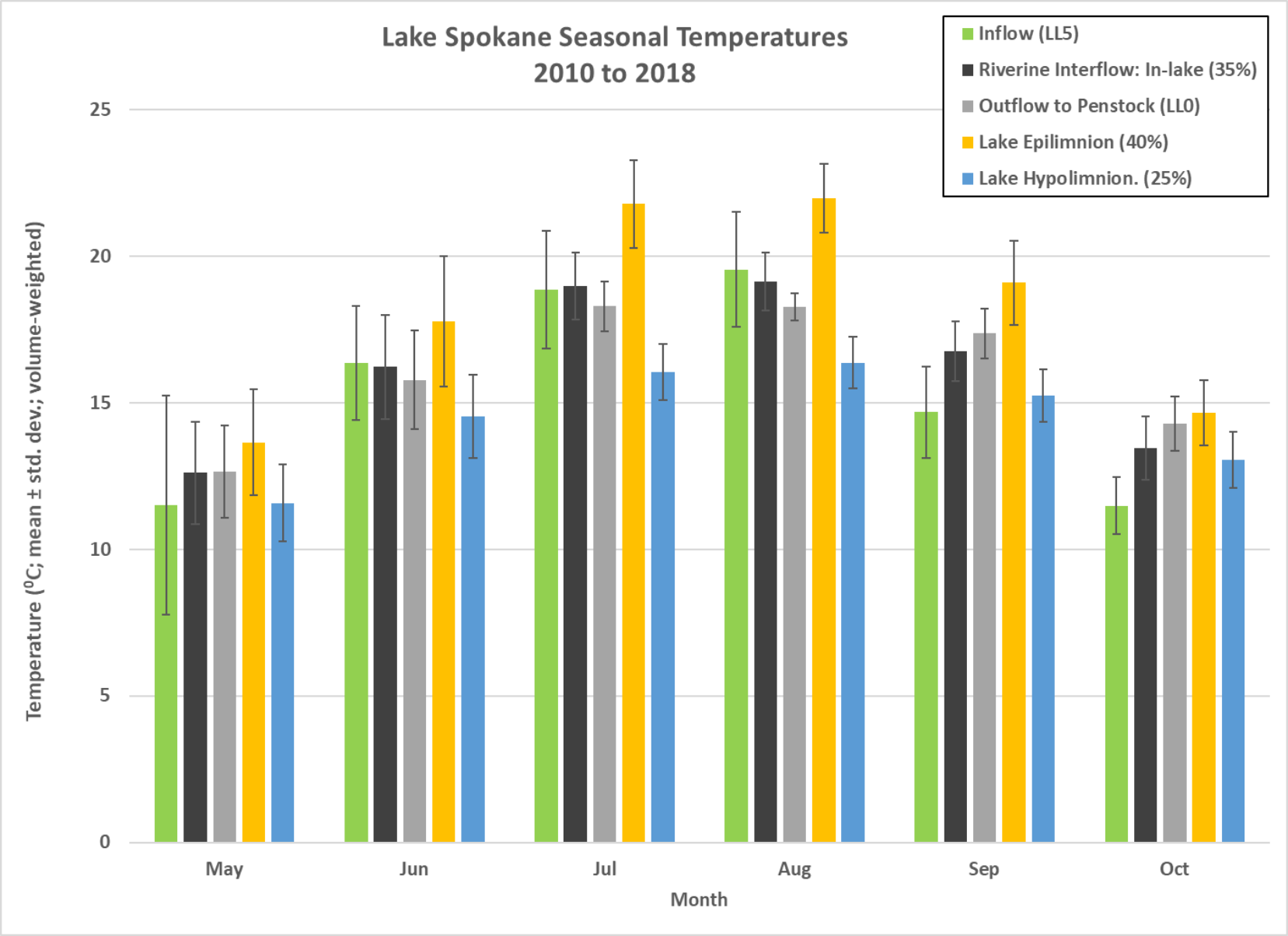

Figure 5-4: Monthly Temperatures in Lake Spokane, 2010 – 2018.

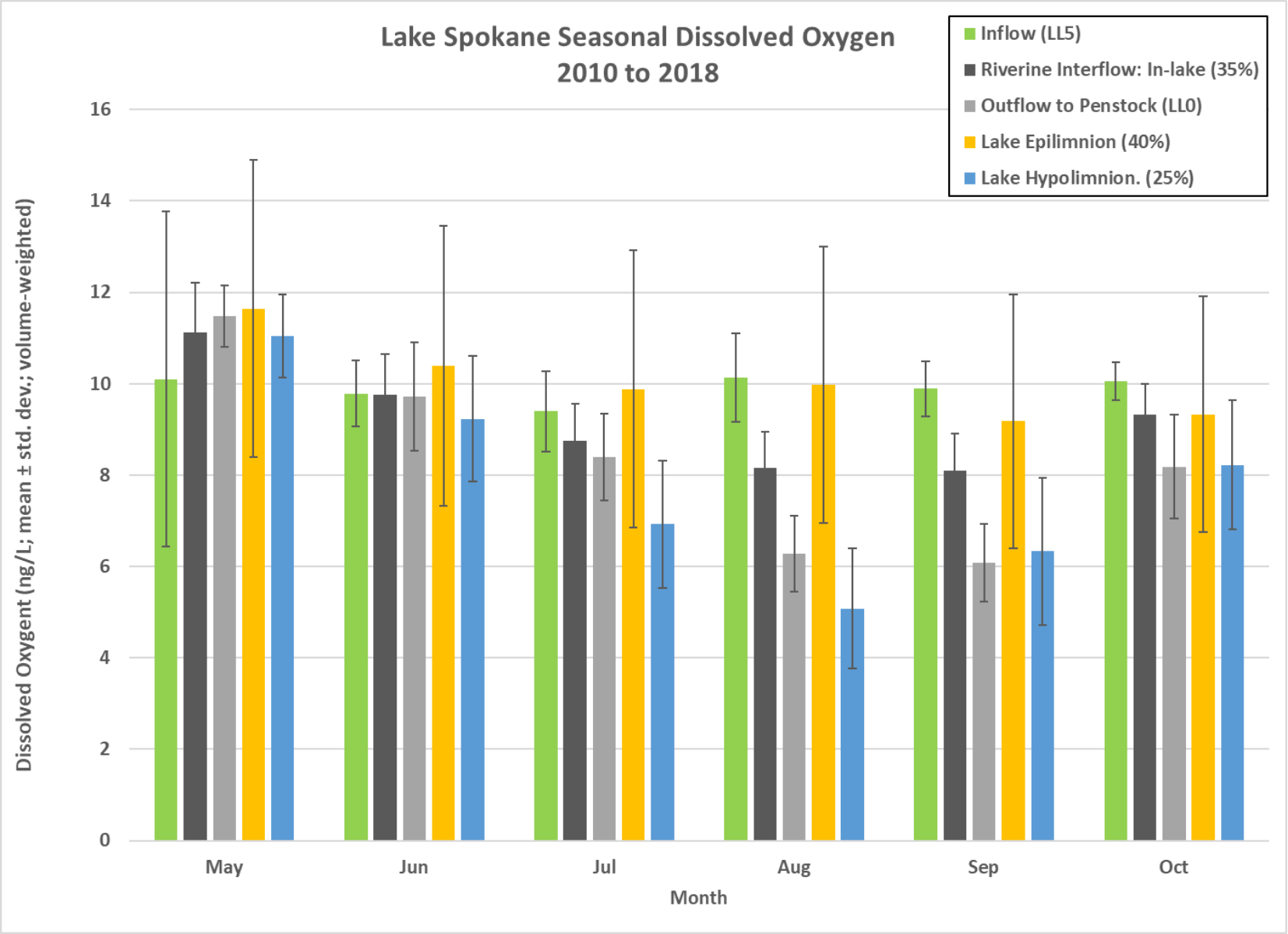

Figure 5-5: Monthly Dissolved Oxygen Levels in Lake Spokane, 2010 – 2018.

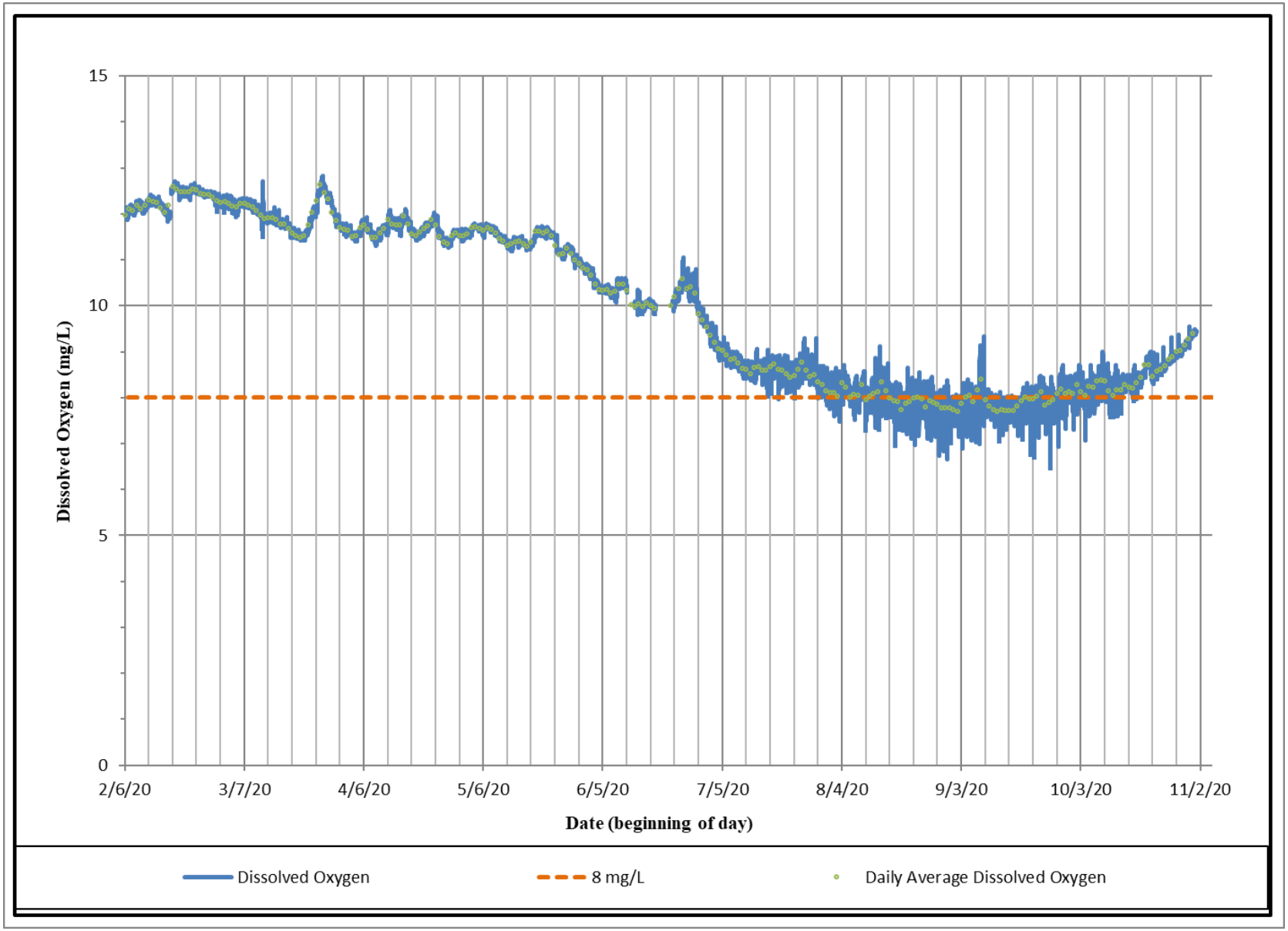

Figure 5-6: LLTR Dissolved Oxygen Time Series, 2020.

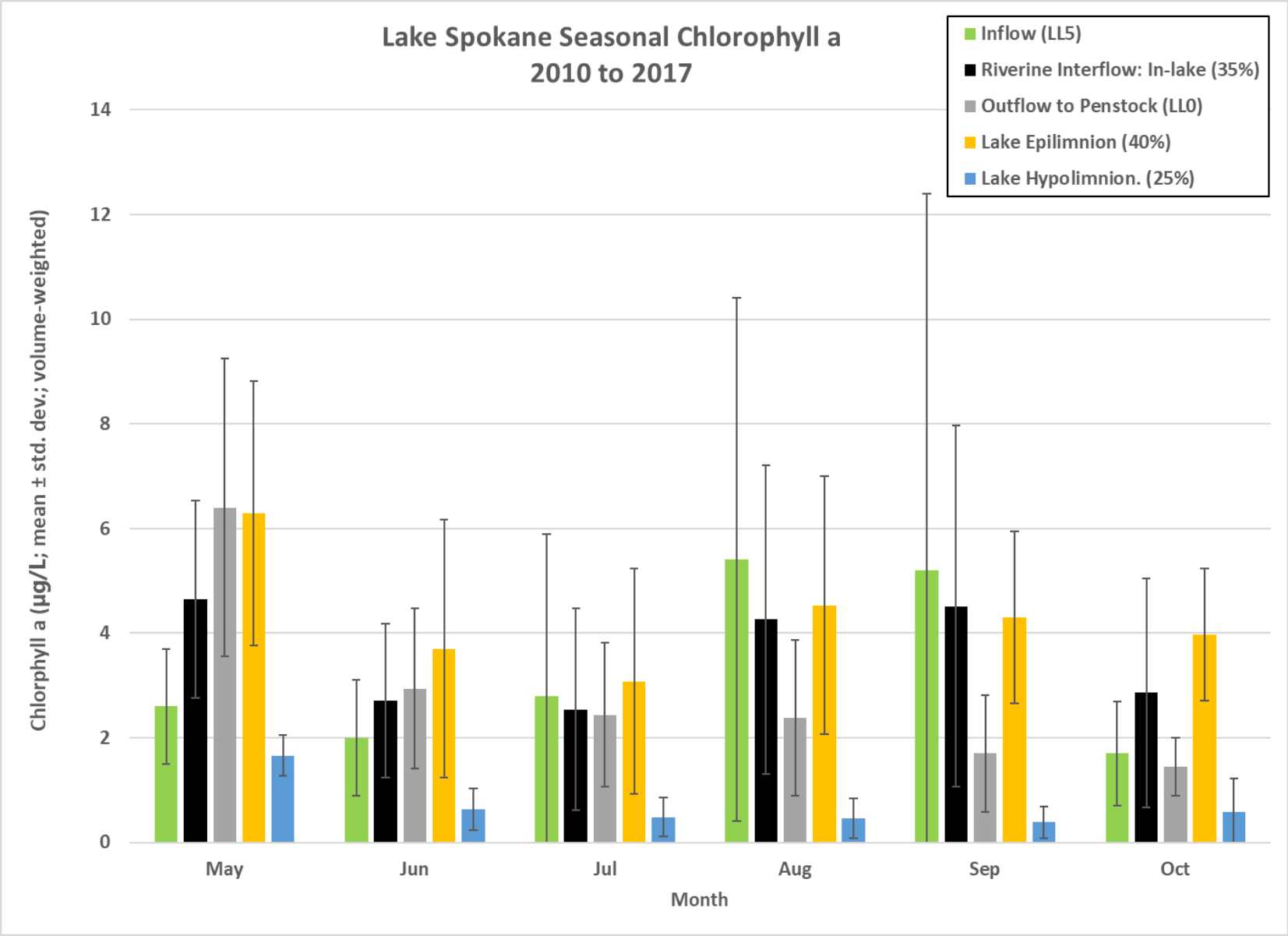

Figure 5-7: Monthly Chlorophyll Levels in Lake Spokane, 2010 – 2017.

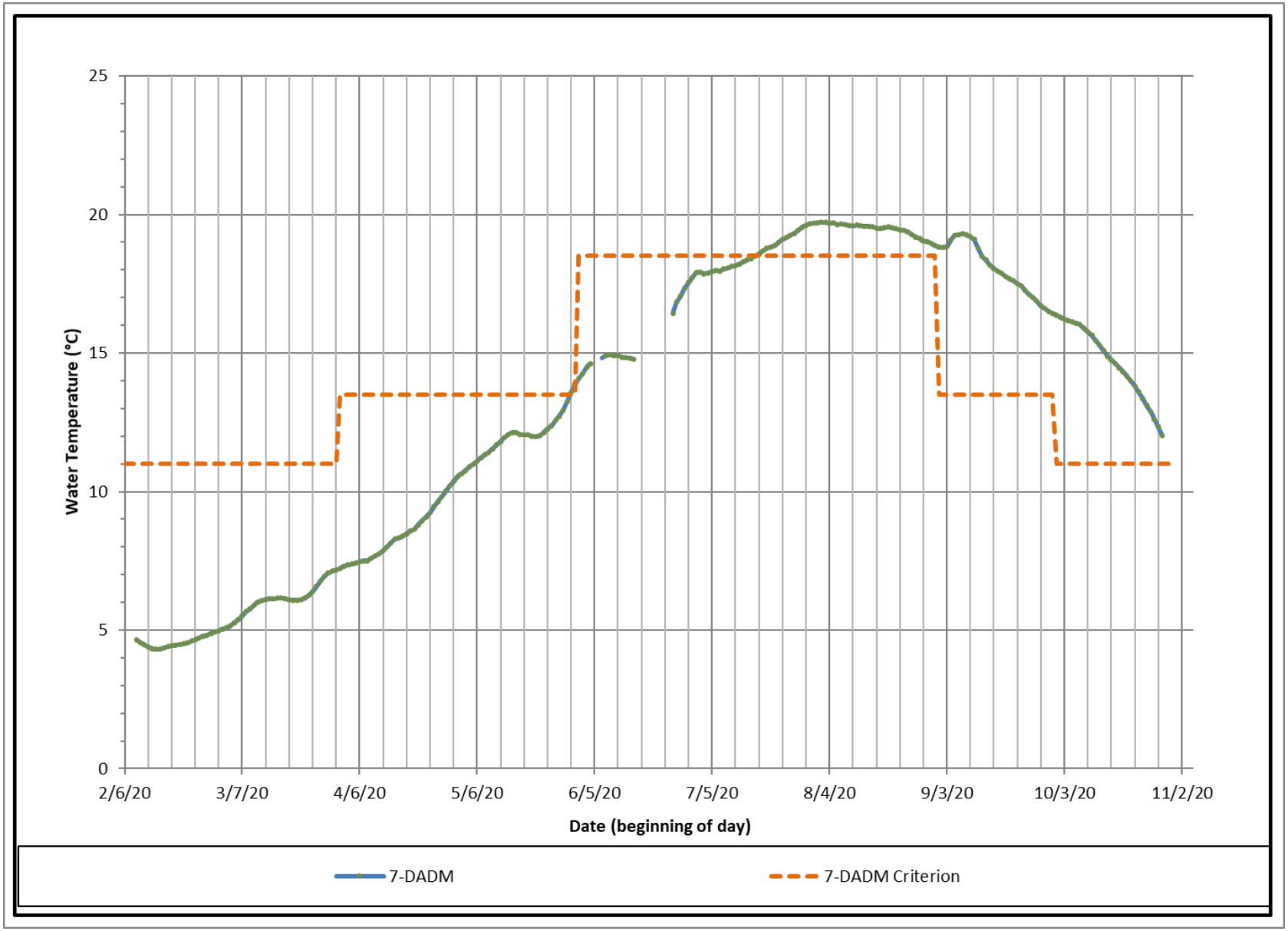

Figure 5-8: LLTR 7-DADM Temperature Time Series, 2020.

APPENDIX A

2020 LAKE SPOKANE DIURNAL MONITORING

2020 Lake Spokane Diurnal Monitoring

Per Ecology's request, Avista collected water temperature data in 15-minute intervals from June through September as part of Avista's DO WQAP. This new technique used automated recorders affixed to temporary buoys at three temporary sampling locations, Daily A, Daily B, and Daily C, all located within the epilimnion of lake. The three continuous monitoring locations (Figure A-1) were chosen based on bathymetry, water current, flow, access and security. The purpose of the monitoring was to provide a better understanding of the diurnal fluctuations that may be present during the summer and how primary productivity influences water quality conditions.

Results of the monitoring are reported in the Lake Spokane Dissolved Oxygen Water Quality Attainment Plan 2020 Annual Summary Report (Avista 2021c). Data from this collection effort has been uploaded to Ecology's EIM database. The continuous monitoring of temperature at the three stations indicates maximum temperature occurred in July and August reaching around 26 ºC with the highest temperatures recorded at the surface. Daily mean temperature fluctuations were around 1 to 2 ºC and maximum fluctuations around 2-4 ºC, diminishing through the summer. The minimum and maximum temperatures recorded at Daily A, Daily B, and Daily C are summarized in Table A-2.

Table A-1: Daily A, Daily B, and Daily C Monitoring Station Site ID, Description, Logger Depths, Longitude and Latitude.

Site ID	Description	Logger Depths (m)	Longitude	Latitude
Daily A	Along the north shore of the reservoir, downstream of Station LL1. Water depth at the deployment location varied from 5 to 7 m (16.4 to 23 ft).	0.6 2.4 4.0	117°45' 38.118" W	47°49' 57.638" N
Daily B	Near north shore of TumTum Bay. Water depth at the deployment location varied from 5 to 6 m (16.4 to 19.7 ft).	0.6 2.4 4.0	117°41' 6.417" W	47° 53' 21.274" N
Daily C	Just outside the swim area at Suncrest Park along the northern shore of the reservoir. Water depth at the deployment location varied from 3 to 4 m (9.8 to 13.1 ft)	0.6 1.5 2.4	117°36' 40.191" W	47°48' 58.594" N

Table A-2: Lake Spokane Diurnal Monitoring at Daily A, Daily B, and Daily C within Lake Spokane, June through September of 2020.

Monthly Minimum and Maximum Temperature (deg C) at Daily A

Month	0.6 m		2.4 m		4.0 m	
	Min	Max	Min	Max	Min	Max
June	15.4	22.8	14.8	22.4	14.8	21.8
July	19.0	25.8	18.6	25.3	18.6	25.3
August	21.1	26.4	21.1	24.7	20.7	24.7

September	17.1	23.0	17.0	21.9	17.1	21.8

Monthly Minimum and Maximum Temperature (deg C) at Daily B

Month	0.6 m		2.4 m		4.0 m	
	Min	Max	Min	Max	Min	Max
June	15.6	24.6	14.9	23.5	13.8	22.6
July	19.6	26.2	19.6	25.1	18.7	24.4
August	21.3	26.3	21.4	25.2	21.3	24.9
September	17.3	23.3	17.3	22.5	17.4	22.3

Monthly Minimum and Maximum Temperature (deg C) at Daily C

Month	0.6 m		2.4 m		4.0 m	
	Min	Max	Min	Max	Min	Max
June	13.5	20.1	13.5	19.9	13.3	19.6
July	15.8	26.5	15.7	26.3	15.7	24.7
August	21.3	26.1	21.3	26.0	20.9	25.0
September	16.1	23.2	16.1	22.8	14.4	22.1

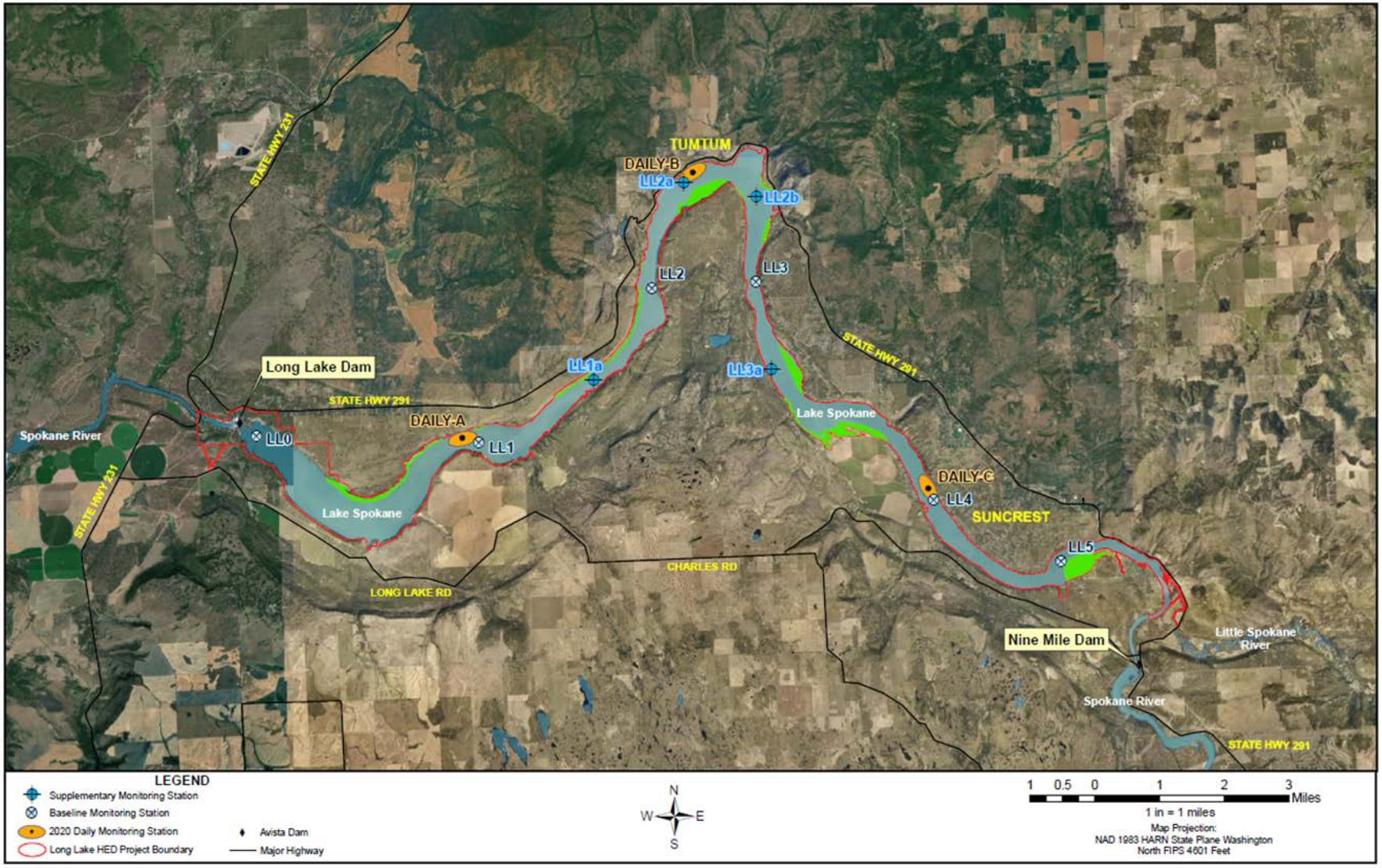

Figure A-1: 2020 Lake Spokane Diurnal Monitoring Stations.

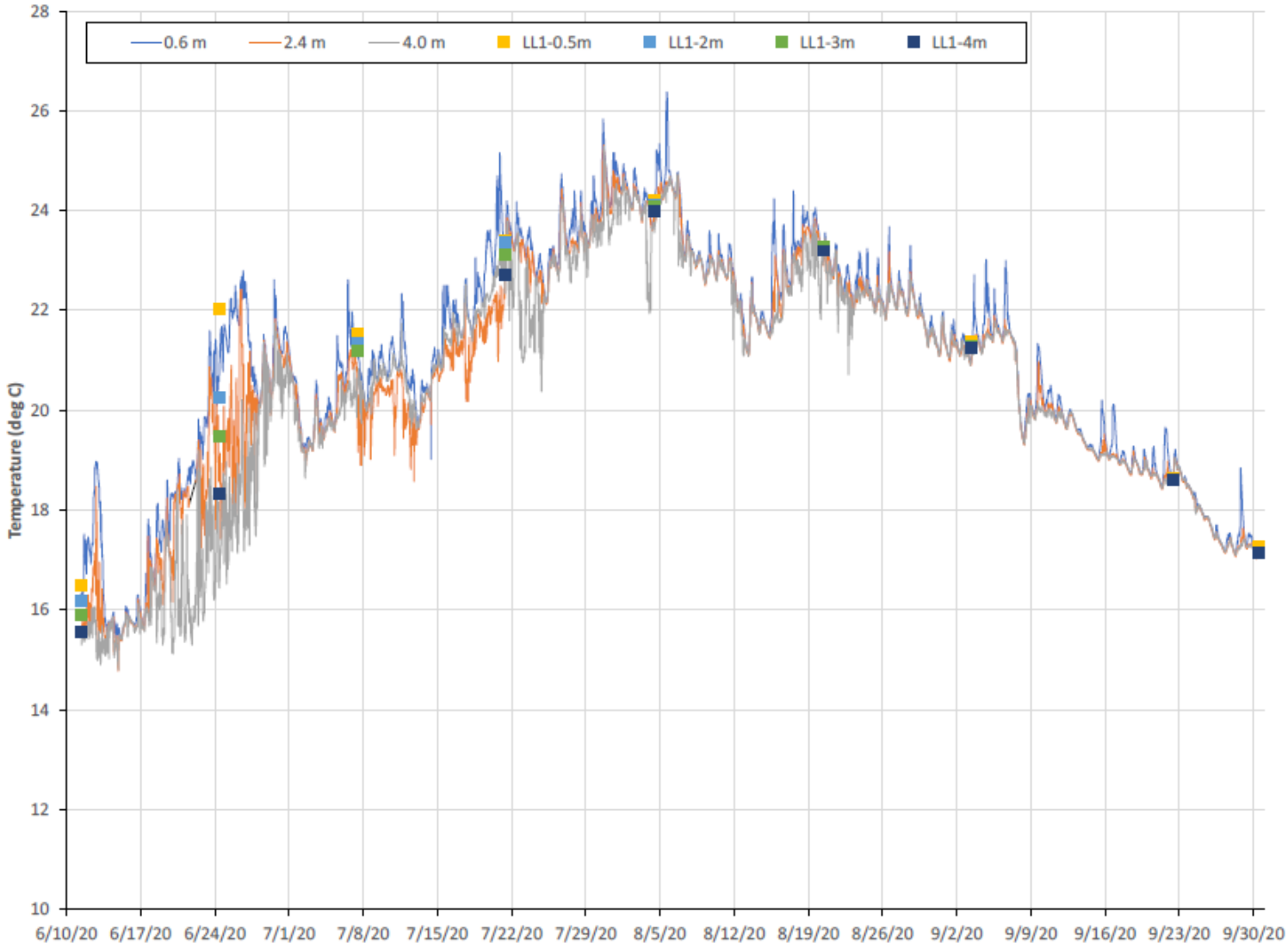

Figure A-2: Continuous temperature (lines) at Daily A and regular profile sampling at LL1 (squares), June through September 2020 (Figure A5, Avista 2021c).

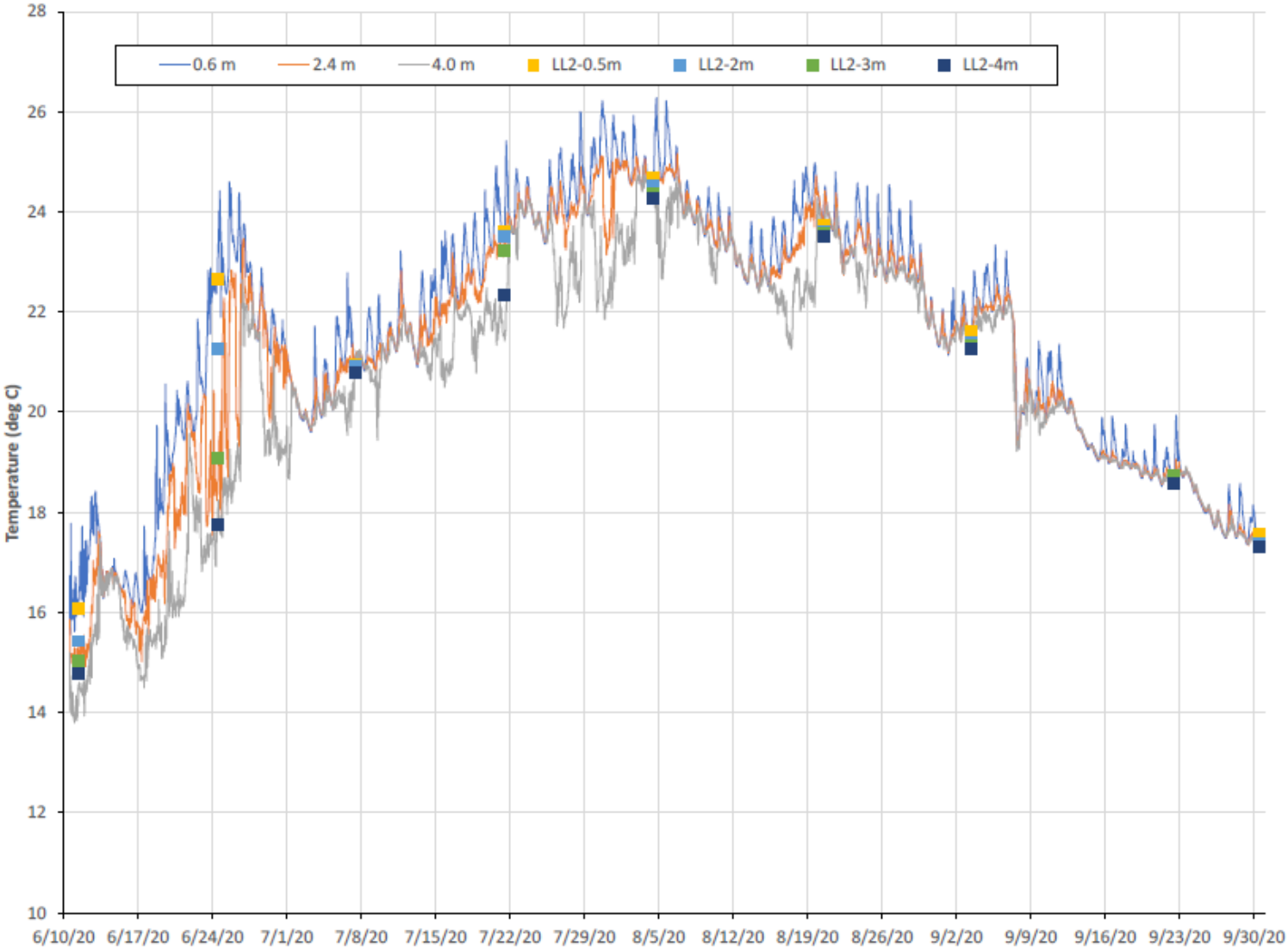

Figure A-3: Continuous temperature (lines) at Daily B and regular profile sampling at LL2 (squares), June through September 2020 (Figure A20, Avista 2021c).

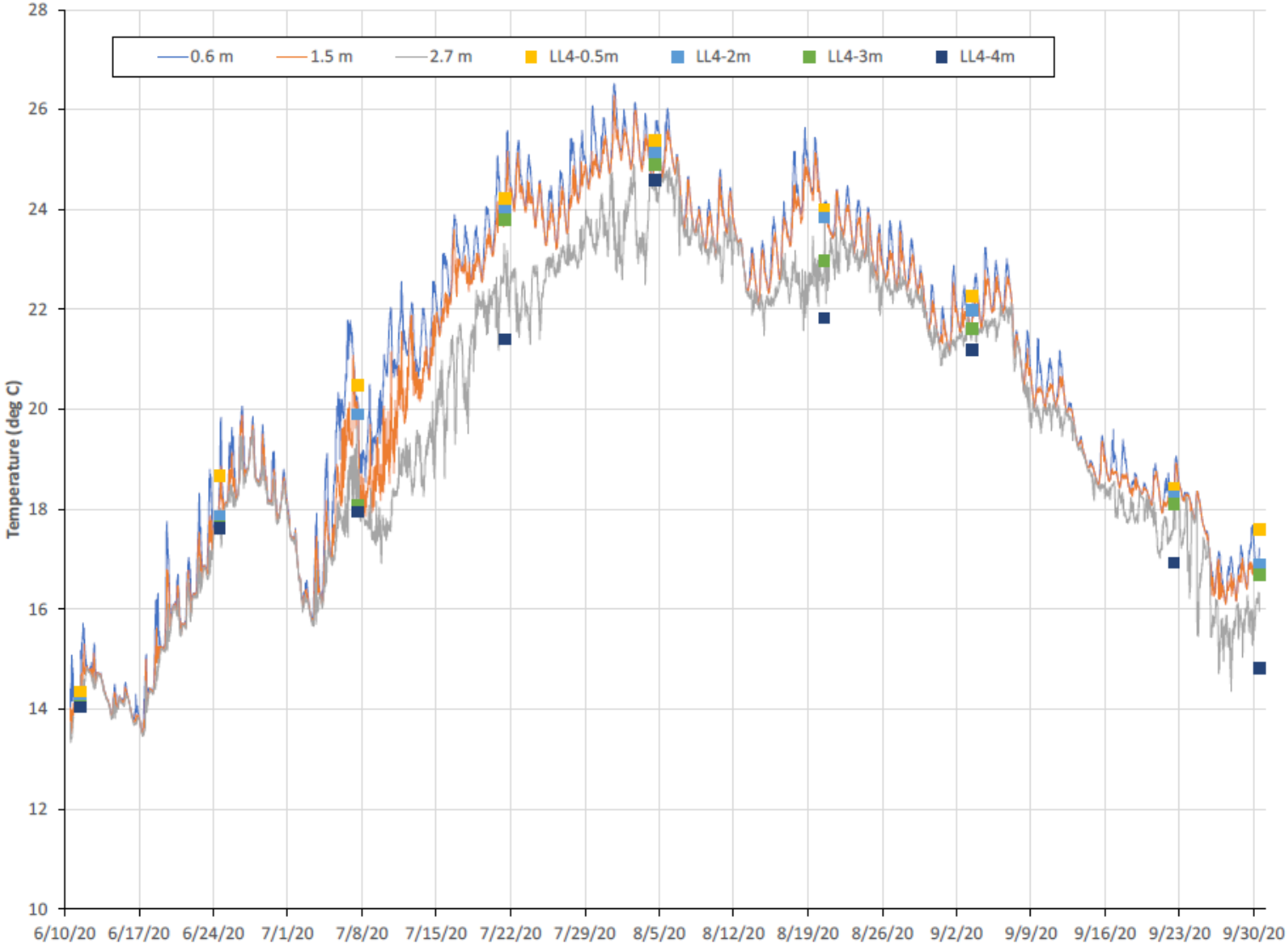

Figure A-4: Continuous temperature (lines) at Daily C and regular profile sampling at LL4 (squares), June through September 2020 (Figure A35, Avista 2021c).

APPENDIX B

CONSULTATION RECORD

AVISTA
1411 East Mission Avenue
PO Box 3727
Spokane, WA 99220-3727

March 1, 2021

Jordan Bauer, Hydropower Compliance Coordinator
Washington Department of Ecology
Eastern Regional Office
4601 N Monroe Street
Spokane, WA 99205-1295

Subject: Spokane River Hydroelectric Project, FERC Project No. 2545
2020 Long Lake Hydroelectric Development Temperature Monitoring Report

Dear Jordan:

I have enclosed the 2020 Long Lake Hydroelectric Development Temperature Monitoring Report (Temperature Monitoring Report), completed in accordance with the Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan, which was required by the Federal Energy Regulatory Commission (FERC) Spokane River Hydroelectric Project License Appendix B, Section 5.5.B.

The Temperature Monitoring Report summarizes temperature monitoring conducted for Long Lake HED during the 2020 calendar year. Additionally, this report also falls within the tenth and final year of the Temperature WQAP and includes detailed discussion on Avista's compliance with maintaining the highest attainable water temperature condition to optimize overall biological protection within Lake Spokane and the Long Lake Dam tailrace.

We request your review and approval by **March 31, 2021**. This will allow us time to incorporate your comments and recommendations as appropriate and submit the Temperature Monitoring Report to FERC by April 15, 2021.

Please feel free to call me at (509) 495-4084 or Meghan Lunney at (509) 495-4643 if you have any questions about the Temperature Monitoring Report.

Sincerely,

Chris Moan
Fisheries Habitat Biologist

Enclosure (1)

cc: Brian Crossley, Spokane Tribe
Chad Brown, Ecology
Meghan Lunney, Avista

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

4601 N. Monroe Street • Spokane, Washington 99205-1295 • (509) 329-3400

March 24, 2021

Chris Moan
Avista Corp.
1411 East Mission Avenue
PO Box 3727
Spokane, WA 99220

RE: Request for Ecology Review and Approval – 2020 Long Lake HED Temperature Monitoring Report – Spokane River FERC Project No. 2545

Dear Chris Moan:

The Department of Ecology (Ecology) has reviewed Avista's submittal of the "2020 Long Lake HED Temperature Monitoring Report". This report was received by Ecology on March 1, 2021, via email. The report was completed in accordance with the "Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan", required by Section 5.5 of Ecology's 401 Certification (Certification) and consistent with Spokane River Hydroelectric Project No. 2545 (License) Appendix B.

Ecology suggests additional discussion may be helpful to address the extent to which cold water fish utilize approximately 40 percent of the reservoir volume that continues to exceed temperature standards. Cold water fish species have been observed passing through upper epilimnetic waters, but providing context between the temperature regime and the actual cold water fish-occupied water would provide further clarification. This is a sensitive area of the water column due to the creeping lower dissolved oxygen levels in the hypolimnion and relevant to understanding the current aquatic life use in the reservoir.

Ecology agrees a meeting is needed to discuss the overall progress and completion of the 10-year compliance schedule while defining the next steps given the regulatory tools of WAC173-201A-510(5). Ecology has no additional comments and **APPROVES** the "2020 Long Lake HED Temperature Monitoring Report" as submitted.

Please contact me with any questions at (509) 688-9403 or jordan.bauer@ecy.wa.gov.

Sincerely,

Jordan Bauer
Hydropower Compliance Coordinator
Water Quality Program

JB:red
cc: Meghan Lunney, Avista
Brian Crossley, Spokane Tribe
Chad Atkins, Ecology

ECOLOGY COMMENTS AND AVISTA RESPONSES

Ecology Comment
Ecology suggests additional discussion may be helpful to address the extent to which cold water fish utilize approximately 40 percent of the reservoir volume that continues to exceed temperature standards. Cold water fish species have been observed passing through upper epilimnetic waters, but providing context between the temperature regime and the actual cold water fish-occupied water would provide further clarification. This is a sensitive area of the water column due to the creeping lower dissolved oxygen levels in the hypolimnion and relevant to understanding the current aquatic life use in the reservoir.

Avista Response
Avista will work with Ecology to schedule a meeting(s) in 2021 to discuss the findings of Avista's Lake Spokane rainbow trout habitat utilization research conducted in 2017 and 2018 and implications this research has on our understanding of salmonid use in the lake.

Ecology Comment
Ecology agrees a meeting is needed to discuss the overall progress and completion of the 10-year compliance schedule while defining the next steps given the regulatory tools of WAC173-201A-510(5).

Avista Response
Avista will work with Ecology to coordinate a meeting(s) in 2021 to further discuss the overall progress and completion of the 10-year compliance schedule.

Ecology Comment
Ecology has no additional comments and **APPROVES** the "2020 Long Lake HED Temperature Monitoring Report" a submitted.

Avista Response
Avista appreciates Ecology's review and approval of the 2020 Long Lake HED Temperature Monitoring Report.

1411 East Mission Avenue
PO Box 3727
Spokane, WA 99220-3727

March 1, 2021

Brian Crossley
Water and Fish Program Manager
Spokane Tribe Natural Resources
P.O. Box 480
Wellpinit, WA 99040

Subject: Spokane River Hydroelectric Project, FERC Project No. 2545
2020 Long Lake Hydroelectric Development Temperature Monitoring Report

Dear Brian:

I have enclosed the 2020 Long Lake Hydroelectric Development Temperature Monitoring Report (Temperature Monitoring Report), completed in accordance with the Long Lake Dam Reservoir and Tailrace Temperature Water Quality Attainment Plan, which was required by the Federal Energy Regulatory Commission (FERC) Spokane River Hydroelectric Project License Appendix B, Section 5.5.B.

The Temperature Monitoring Report summarizes temperature monitoring conducted for Long Lake HED during the 2020 calendar year. Additionally, this report also falls within the tenth and final year of the Temperature WQAP and includes detailed discussion on Avista's compliance with maintaining the highest attainable water temperature condition to optimize overall biological protection within Lake Spokane and the Long Lake Dam tailrace.

Per the October 2008 Settlement Agreement between Avista and the Spokane Tribe, we would like to receive any comments that you may have on the Temperature Monitoring Report by **March 31, 2021**. This will allow us time to incorporate your comments as appropriate and submit the Temperature Monitoring Report to FERC by April 15, 2021.

Please feel free to call me at (509) 495-4084 or Meghan Lunney at (509) 495-4643 if you have any questions about the Temperature Monitoring Report.

Sincerely,

Chris Moan
Fisheries Habitat Biologist

Enclosure (1)

cc: Jordan Bauer, Ecology
Meghan Lunney, Avista

Spokane Tribal Natural Resources
PO BOX 480 • Wellpinit, WA 99040 • (509) 258-9042 • fax 258-9600

MEMORANDUM

TO: **Chris Moan; Avista Corp.**

FROM: **Casey Flanagan, Water & Fish Program**

SUBJECT: **Spokane Tribe Review of Avista 2020 DO, Temperature and TDG Reports**

DATE: **March 31, 2021**

Dear Chris Moan,

The Spokane Tribe of Indians has reviewed Avista's 2020 Long Lake HED Tailrace Dissolved Oxygen Monitoring Report, the 2020 Long Lake Total Dissolved Gas Monitoring Report and the 2020 Long Lake HED Temperature Monitoring Report.

In regards to the Dissolved Oxygen Monitoring Report, the Tribe is optimistic by Avista meeting 8.0mg/L standard 88.8% of the time during generation. We also observed that dissolved oxygen standards were met 57.2% of the time during non-generation. We encourage Avista to look at aeration during non-generation in order to meet the dissolved oxygen standard throughout 24-hour periods in the summer months. We noticed that dissolved oxygen standards were met after Mid-September, but the dam continued to aerate until October 20th; a brief explanation of why that happened would be beneficial to the report.

When reviewing the Total Dissolved Gas Monitoring Report, the Tribe is encouraged to see improvements in TDG due to spillway deflectors installed on Long Lake Dam in 2016. The report shows that TDG concentrations are still above the 110% standard even when the Spokane River flows are below the 7Q10, with 2020 maximum TDG being 114.6% at LLTR. The Tribe recommends Avista to study reducing TDG through gate operations specifically when flows are greater than or equal to 11,000cfs.

The Tribe recognizes in the Lake Spokane Temperature Report that Lake Spokane continues to have issues with temperature in the epilimnion while also having issues with

dissolved oxygen in the hypolimnion in the summer and fall months. This can limit available summer habitat to cold water species in Lake Spokane, as well as downstream of Long Lake Dam on Spokane Indian Reservation waters. The Tribe is interested in reading the report regarding habitat utilization of cold-water species in Lake Spokane. We suggest that the habitat utilization report be included in the appendices or be referenced heavily within the discussion of the temperature report to allow readers to understand Avista's biological optimization justification of Lake Spokane.

If you have any questions regarding the Spokane Tribe's comments, please contact Brian Crossley or Casey Flanagan with the Spokane Tribe's Water and Fish Program.

Sincerely,

C. Flanagan

Casey Flanagan
Water and Fish Project Manager
caseyf@spokanetribe.com

cc: Brent Nichols, Fisheries and Water Division Manager
Brian Crossley, Water & Fish Program Manager
Jordan Bauer, Dept. of Ecology
BJ Kieffer, Director Dept. of Natural Resources
Danny Kieffer, Spokane Tribal Council

SPOKANE TRIBE COMMENTS AND AVISTA RESPONSES

Spokane Tribe Comment
The Tribe recognizes in the Lake Spokane Temperature Report that Lake Spokane continues to have issues with temperature in the epilimnion while also having issues with dissolved oxygen in the hypolimnion in the summer and fall months. This can limit available summer habitat to cold water species in Lake Spokane, as well as downstream of Long Lake Dam on Spokane Indian Reservation waters.

Avista Response 1
Avista conducted a Rainbow Trout Habitat Assessment during 2017 and 2018 to gain a better understanding of rainbow trout habitat utilization throughout Lake Spokane. Results of the assessment indicated rainbow trout were frequently found in the epilimnion during the summer of 2017 and 2018, and often in water temperatures that were higher than anticipated (up to 23.6 °C). The hypolimnion (25% of the reservoir volume) is providing a cold-water refuge, which would not be present without Long Lake Dam. Temperature, DO, and chlorophyll data collected over the past 10 years suggest overall biological protection and productivity, particularly in the riverine interflow zone, is currently being optimized within Lake Spokane and the Long Lake Dam tailrace, consistent with the WA Certification objectives.

With regard to DO since 2011, Avista has maintained the tailrace DO level at or above 8 mg/L during approximately 88% of the summer period (July through October) when the dam was generating and 74.7 percent of the time independent of the dam's operations. Avista looks forward to discussing water quality data the Tribe has collected downstream of Long Lake Dam to better understand DO and temperature conditions throughout this entire river reach.

Spokane Tribe Comment
The Tribe is interested in reading the report regarding habitat utilization of cold-water species in Lake Spokane. We suggest that the habitat utilization report be included in the appendices or be referenced heavily within the discussion of the temperature report to allow readers to understand Avista's biological optimization justification of Lake Spokane.

Avista Response
Results of Avista's Lake Spokane Rainbow Trout Habitat Assessment are incorporated into the Lake Spokane Dissolved Oxygen Water Quality Attainment Plan 2017 and 2018 Annual Summary Reports, as well as the Lake Spokane Dissolved Oxygen Water Quality Attainment Plan Eight-Year Report (Eight-Year Report) completed in March of 2020. Avista will provide these reports to the Tribe and schedule a meeting to discuss the findings and implications this research has on our understanding of salmonid use in the lake.