AVISTA CORPORATION

2022

LONG LAKE

TOTAL DISSOLVED GAS

MONITORING REPORT

WASHINGTON 401 CERTIFICATION, SECTION 5.4(D)

Spokane River Hydroelectric Project
FERC Project No. 2545

Prepared By:

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICIES

LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
7Q10	7-day average flow with a 10-year return period
ft amsl	feet above mean sea level
Avista	Avista Corporation
BAR	barometric pressure
cfs	cubic feet per second
DO	dissolved oxygen
DQO	data quality objective(s)
Ecology	Washington State Department of Ecology
FERC	Federal Energy Regulatory Commission
Golder	Golder Associates Inc.
HED	hydroelectric development
LLFB	monitoring station at Long Lake forebay
LLGEN	monitoring station at Long Lake HED Unit 4 generation plume
LLTR	monitoring station at Long Lake tailrace
LLTRSP1	monitoring station across the river from LLTR
m	meter(s)
mg/L	milligrams per liter
mmHg	millimeters mercury (pressure)
MQO	measurement quality objective
MS5	Hydrolab® MS5 Multiprobe®
RMSE	root mean squared error
Spokane Tribe	Spokane Tribe of Indians
TDG	total dissolved gas
TDG%	total dissolved gas, as percent of saturation
WQAP	Water Quality Attainment Plan

1.0 INTRODUCTION

1.1 Background

On June 18, 2009, the Federal Energy Regulatory Commission (FERC) issued Avista Corporation (Avista) a new License for the Spokane River Project, which includes Long Lake Dam (FERC 2009). Article 401(a) of the License required Avista to develop a Total Dissolved Gas (TDG) monitoring plan and a TDG Water Quality Attainment Plan (WQAP) for Long Lake Dam.

Avista consulted with the Washington State Department of Ecology (Ecology) and the Spokane Tribe of Indians (Spokane Tribe) as it developed the Washington TDG Monitoring Plan, which addresses TDG associated with spills from the Long Lake and Nine Mile Hydroelectric Development (HEDs) (Golder 2010a). Ecology approved this plan on March 17, 2010, and Avista filed the Ecology-approved plan with FERC on March 26, 2010. Avista filed the WQAP with FERC on July 16, 2010, and FERC approved it, and the Washington TDG Monitoring Plan, on December 14, 2010 (FERC 2010). Upon FERC's approval, Avista began implementing the WQAP in accordance with the Revised Long Lake HED TDG Compliance Schedule, which included the following components: general monitoring; operational changes – spill protocols; structural modifications; and effectiveness monitoring.

Avista began implementing the WQAP (Golder 2010b) in 2010 and continued seasonal TDG monitoring through 2013 at Long Lake Dam. Annual reports document the TDG monitoring for 2010, 2011, 2012, and 2013 (Golder 2011, 2012, 2013, and 2014). In accordance with the approved Revised Long Lake HED TDG Compliance Schedule (Figure 1-1)[1], 2013 was the last season of monitoring TDG before construction began on structural changes to address TDG abatement. Monitoring was to be re-initiated once the changes were complete.

Avista implemented the structural modification components of the Revised Long Lake HED TDG Compliance Schedule from 2010 through 2018. These components included Phase II and III Feasibility Analyses, computational and physical modeling, and the selection of the spillway deflectors as the alternative for gas abatement at Long Lake Dam. The Long Lake Dam Spillway Modification Project was complete by December 2016 and included the installation of two deflectors at the base of the spillway, removal of a portion of a rock outcrop, and filling the 60-80 foot deep plunge pool at the base of the dam. Effectiveness monitoring was conducted from 2017 through 2020. On April 3, 2020, Ecology approved Avista's plans to conduct an additional three years of effectiveness monitoring and reporting, as outlined in the 2019 Long Lake Total Dissolved Gas Monitoring Report (Avista 2020). Avista filed the Ecology-approved 2019 report with FERC on April 14, 2020.

This report discusses the results of the TDG monitoring at Long Lake Dam during 2022. A summary of the 2022 data quality is provided in Appendix A and a record of consultation with Ecology and the Spokane Tribe is provided in Appendix B.

[1] Ecology and FERC approved the Revised Long Lake HED TDG Compliance Schedule on November 21, 2014 and February 19, 2015, respectively.

1.2 Objectives

The objectives of the Long Lake HED TDG Monitoring Plan, a component of the Washington TDG Monitoring Plan, are to:

- Collect data to test the efficacy of selected operational measures in reducing gas production by Long Lake Dam spillway(s);
- Collect data for modeling the effectiveness of selected structural measures in reducing gas production by Long Lake Dam spillway(s);
- Test the effectiveness of selected operational and structural TDG abatement measures for Long Lake HED; and
- Confirm that Long Lake Dam does not cause exceedances of the TDG standard after implementation of selected operational and/or structural measures.

2.0 METHODS

Water quality parameters that were recorded include TDG (millimeters mercury [mmHg]), dissolved oxygen (DO) concentration (milligrams per Liter [mg/L] and percent saturation [%]), and water temperature (°C). Water depth (meters [m]) was also recorded and used in conjunction with water temperature to evaluate the timing for any water quality monitoring instruments being out of water and above the minimum TDG compensation depth. In addition, barometric pressure (BAR; mmHg) was recorded.

2.1 Equipment and Calibration

Hydrolab® MS5 Multiprobe® (MS5) instruments (ID Numbers 48762, 48763, 48764, 60376, and 68482) measured and recorded TDG (pressure), optical DO, temperature, and depth. When applicable, MS5s that were deployed for extended periods were connected to an external alternating current power source throughout the entire monitoring period to address problems from low power or power loss.

Solinst® barologgers measured and recorded local barometric pressure (BAR). A primary barologger was deployed at the Long Lake Tailrace monitoring location (LLTR). As an additional quality assurance measure, site-specific barometric pressures were compared to corresponding values published for the Spokane International Airport. The Spokane International Airport station's sea-level daily ranges for barometric pressure were downloaded from the Weather Underground[2] and adjusted by subtracting 37.05 mmHg to account for the altitude of the Long Lake Dam tailrace (1,365 feet above mean sea level [ft amsl]).

Monitoring equipment was calibrated according to the manufacturer's instructions and following the data quality objectives for the project prior to deployment and on periodic site visits. All instruments were maintained and calibrated by the factory's service department prior to the 2022 monitoring season. Pre-deployment field verification included synchronizing the clocks, comparing the MS5s' TDG pressure value with the silastic membrane removed to the ambient

[2] On each site visit day, Spokane, Washington KGEG barometric pressure data were downloaded from the History section of: Spokane, WA Weather History | Weather Underground (wunderground.com).

barometric pressure, confirming the MS5s' patency of the TDG silastic membrane, and testing the barologgers to confirm that the recorded values were comparable to the Spokane International Airport.

During service periods, each MS5 was retrieved and the pull time recorded. Each service session included verification of logging status and downloading the data to a portable field computer. The Solinst® barologgers also were downloaded during these service periods. Patency of the original TDG membrane was confirmed by observing a rapid increase in TDG pressure while pressurizing the sensor with carbonated soda water. Depth, temperature, and DO sensors were calibrated according to the manufacturer's instructions.

2.2 Station Facilities

To facilitate TDG and DO monitoring at Long Lake Dam, permanent water quality monitoring facilities were constructed at three locations: 1) 0.6 mile downstream of the Long Lake Dam, referred to as LLTR, 2) in the Long Lake HED Unit 4 generation plume, referred to as LLGEN, and 3) in the Long Lake HED forebay, referred to as LLFB (Table 2-1; Figure 2-1). The long-term monitoring strategy described in the TDG monitoring plan (Golder 2010a) calls for TDG monitoring at two of the permanent monitoring stations, LLTR and LLGEN.

Each permanent station consists of a 4-inch-diameter pipe stilling-well (standpipe), which is sealed at the pipes' submerged end to prevent the MS5 from falling out of the pipe. Each standpipe has ½-inch-diameter perforations along its sides and a hole at the bottom to provide water exchange between the interior and exterior of the pipe and limit accumulation of sediment and debris in the bottom of the pipe. Each standpipe's top end is protected by an enclosed box containing AC power and data communication equipment.

2.3 Spot Measurements

Spot measurements of TDG, water temperature, and DO were made during each site visit, on two week intervals, beginning in January. Spot measurements were taken across the river from LLTR, at LLTRSP1 (Table 2-1). Spot measurements were not conducted at LLGEN due to the extremely turbulent waters at this location, which made it unsafe to deploy a temporary MS5.

2.4 Data Collection and Processing

Parameters monitored at 15-minute log intervals with the MS5s described above included:

- Barometric pressure (mmHg)
- Air Temperature (°C)
- Depth (m)
- TDG (mmHg)
- Dissolved Oxygen (mg/L)
- Dissolved Oxygen (% saturation)
- Water Temperature (°C)

In addition, TDG percent of saturation (TDG%) was computed, as:

- TDG% = TDG in mmHg / Barometric pressure in mmHg x 100

Data downloaded to the laptop computer were transferred to an office server and were checked for errors using Microsoft Excel®. Erroneous data were identified, assigned data quality codes, and removed from the final data set (see Appendix A).

Long Lake Dam's operations are monitored and recorded by Avista's internal plant control software, which was used to extract data including: discharge passing over the dam's spillway; discharge passing through the dam's generation units; and total discharge on a fifteen minute basis during the extent of the TDG monitoring period.

2.5 Monitoring Difficulties

Prior to the TDG monitoring season, all eight of Avista's MS5s were serviced and calibrated at Hach's Technical Support & Service Department. Before deployment, seven MS5s successfully passed the mass verification test, indicating they were operating correctly and providing reliable values. The one MS5 that failed the mass verification test was due to a communication issue but was later verified following support from Hach Tech Support.

- Due to technical issues communicating barometric pressure data from the previously used Solinst gold series barologgers, new Solinst barologger 5s were used to collect barometric pressure data at LLTR from 11:15 on April 14 through the end of the monitoring season. To calculate TDG% from March 4 to April 14, barometric pressure from the Spokane International airport was used. The Spokane International Airport station's sea-level daily ranges for barometric pressure were downloaded from the Weather Underground[1] and adjusted by subtracting 37.05 mmHg to account for the altitude of the Long Lake Dam tailrace (1,365 feet above mean sea level [ft amsl]).

- MS5 #68482 was calibrated and redeployed at LLTR on March 4. At the next site visit on March 17, the MS5 passed TDG, DO, depth, and temperature calibration, but the TDG membrane failed its patency test. MS5 #68482 was replaced and MS5 #48764 was deployed at LLTR for the remainder of the monitoring season. Because there was no clear indication of when the membrane failed following the March 4 deployment, all TDG data from March 4 through March 17 was removed from the final data set.

- MS5 #60376 was used to do the spot reading at LLTRSP1 on May 13. Following May 13, MS5 #60376 was needed to replace a failed probe at Nine Mile HED, therefore MS5#48763 was used for spot readings for the remainder of the monitoring season.

- On the June 21 site visit, the water level at LLTR prevented the retrieval of MS5 #48764. A spot reading at LLTRSP1 and the probe at LLGEN were able to be collected at the site visit. On June 28, water levels decreased to where MS5 #48764 could be retrieved, calibrated, and redeployed. MS5 #48764 met calibration Measurement Quality

Objectives (MQOs) and the spot reading from June 21 met the spot measurement MQOs, therefore this data was included in the final data set.

- No site visit was able to be conducted from June 28 until July 14, resulting in a longer than typical interval between site visits. MQOs were met for MS5s at LLTR, LLGEN, and LLTRSP1 on the July 14 site visit, therefore these data were included in the final dataset.

- Spilling at Long Lake Dam occurred much later in the season than is typical, continuing periodically until July 17. The MS5 at LLGEN was removed on July 14, anticipating spill to no longer occur, therefore no data was recorded at LLGEN from June 14 at 11:30 until spilling concluded on July 17. This resulted in data from LLTR not being able to be compared to data at LLGEN from July 14 at 11:30 until the end of the monitoring season. Data at LLTR was recorded through July 17.

3.0 RESULTS

The License requires Avista to monitor TDG below Long Lake Dam during flows close to the 7Q10 (32,000 cubic feet per second) (Section 5.4(B), FERC 2009). At LLTR, the TDG monitoring season consisted of the period from March 4 at 17:00 PT through July 17 at 23:45 and included 12,988 15-minute periods. At LLGEN, the TDG monitoring season consisted of the period from March 4 at 17:00 PT through July 14 at 11:30 and included 12,651 15-minute periods (Table 2-2). The MS5 at LLGEN was deployed the entire monitoring season and recorded data for 99-100% of the sampling season. The MS5 at LLTR was deployed the entire monitoring season and recorded data for 88-97% of the sampling season (Appendix A, Table A-4).

Use of the Long Lake Dam spillway occurred from March 4 through April 14, then briefly stopped until April 16, then continued consistently through June 29, then occurred periodically from July 1 to July 17. Discharge at the Long Lake Dam did not exceed the 7Q10 discharge in 2022 (see section 3.1).

The primary barologger deployed at LLTR provided local barometric pressure for 66% of the monitoring period and airport barometric pressure was used for 33% of the monitoring season, resulting in barometric pressure data being collected for 99% of the monitoring season (Appendix A, Table A-4). Spot measurements were collected at LLTRSP1 on March 17 and 31, April 14 and 27, May 13 and 27, and June 8, 21, and 30 (Table 2-3). All results of continuous and spot measurements are displayed in Figures 2-2 through 2-6.

3.1 Discharge

Total Long Lake Dam generation plus spill discharge for the 2022 monitoring period ranged from approximately 3,043 cubic feet per second (cfs) to 26,931 cfs and spills at Long Lake Dam reached a maximum of approximately 20,210 cfs on June 18. Overall, spill occurred at the dam until July 17. Long Lake Dam generation was near full capacity through June and then was down

one to two units in July. Total river discharge did not exceed the Ecology-designated 7Q10 (32,000 cfs) in 2022.

3.2 Water Temperature

Water temperature during the monitoring period at LLTR reached a low of 4.1°C in early March and a high of 19.8°C in mid-July (Table 2-2; Figure 2-2). Similarly, water temperature measured at LLGEN reached a low of 3.9°C in early March and a high of 18.6°C in mid-July. Water temperatures remained low through April and then increased steadily throughout the monitoring season as atmospheric temperatures began to increase and precipitation became less frequent.

3.3 Barometric Pressure

Site-specific barometric pressures ranged from 710 to 737 mmHg based on the Solonist® barologger deployed at LLTR (Table 2-2).

3.4 Total Dissolved Gas

TDG percent values for LLGEN, which is essentially unaffected by spill at Long Lake Dam, exceeded 110 percent of saturation between March 10 and March 14, then for short periods of time on March 21 and 22, and then between March 22 and April 5. TDG percent exceeded 110 percent sporadically from April 8 through April 12 and then again from May 12 through May 13. After May 13, TDG percent remained above 110 percent for most of the time until July 9, then for a short time on July 12. The TDG percent values at LLGEN ranged from 99.1 to 123.1 percent. TDG percent at LLTR, which is affected by spill at the dam, exceeded 110 percent of saturation from March 17 to April 12, then for short periods of time on May 5 and 6, then consistently from May 6 through May 13, and continuously from May 16 to July 9. TDG percent values at LLTR ranged from 105.5 to 118.7 percent (Table 2-2; Figure 2-4).

The 110 percent of saturation TDG criterion is not applicable when stream discharge exceeds the 7-day average flow with a 10-year return period (7Q10), which Ecology specified as 32,000 cfs for the Spokane River at Long Lake Dam and Nine Mile Dam (Ecology 2009). During the 2022 monitoring season, maximum total discharge (spill plus turbine discharge) was 26,931 cfs, hence the 7Q10 was not exceeded. Table 2-4 provides the specific periods where TDG saturation was greater than the 110 percent of saturation criterion when total discharge was less than the 7Q10.

Spot values for LLTRSP1 coincided with the continuous monitoring data for LLTR, ranging in difference from 0-7 mmHg and an average of 2 mmHg.

3.5 Dissolved Oxygen

Measured DO concentrations ranged from 8.5 to 14.1 mg/L for LLTR, and 8.8 to 13.6 mg/L for LLGEN (Table 2-2; Figure 2-5). Peak DO concentrations during the 2022 monitoring period occurred during the first spring runoff in early March and declined steadily through the rest of the monitoring season. DO values remained above the 8.0 mg/L DO criterion throughout the entire monitoring period at both monitoring stations.

Measured DO percent saturation ranged from 96.3 to 121.0 % saturation for LLTR, and 94.1 to 117.2 % saturation for LLGEN (Table 2-2; Figure 2-6).

4.0 DISCUSSION

Overall, 2022 TDG levels at LLTR and LLGEN increased as river flows increased. Contrary to historic measurements at Long Lake Dam (Golder 2003, 2004, 2011, 2012, 2013), but similar to previous post-spillway modification monitoring (Avista 2018, 2019, 2020, 2021, 2022), 2022 TDG levels at LLTR were less than the TDG levels at LLGEN for portions of the monitoring season. In 2022, TDG % at LLTR was less than or equal to background values measured at LLGEN for 51.0% of the monitoring season. During the times that TDG at LLTR exceeded LLGEN, it was never more than 6.6% greater (Figure 2-4). At times when TDG % at LLTR was greater than 110%, TDG % at LLTR was less than or equal to LLGEN 37.1% of the 11,059 15-minute data pairs and was never more than 6.6% greater than LLGEN. TDG levels at LLTR did not reach the maximum values seen at LLGEN.

Comparison of the TDG % at LLTR by month indicates TDG % was greater than the 110 percent criterion 100% of the time in March, 38% in April, 84% in May, 100% in June, and 51% in July. At LLGEN, TDG % was greater than the 110 percent criterion 73% of the time in March, 27% in April, 61% in May, 98% in June, and 64% in July. When comparing LLTR TDG % to LLGEN TDG % for the data pairs, TDG % values at LLTR were greater than at LLGEN and exceeded the 110 percent criterion for 34% of the data pairs in March, 35% in April, 51% in May, 49% in June, and 2% in July (Table 2-5).

In 2022, the maximum TDG % at LLTR was 118.7% and the maximum TDG % at LLGEN was 123.1% (Table 2-6). Additionally, the 2022 data corresponds with the data from 2018, 2020, and 2021 (Avista 2019, 2021, 2022) monitoring, where the maximum TDG % at LLTR was less than the maximum seen at LLGEN.

5.0 CURRENT STATUS

Avista completed the Long Lake Dam Spillway Modification Project in 2016 to reduce the production of excess TDG. Effectiveness monitoring was initially conducted in 2017, 2018, and 2019 to evaluate spillway gate operational protocols and to assess the effectiveness of the structural modifications.

Post-spillway modification gate testing was conducted in 2017 and 2018 to evaluate whether adjusting the number of gates used and how high the gates were opened would influence TDG % trends downstream (Avista 2018). Results showed that spreading out the spill discharge between multiple gates at lower gate heights decreased TDG % downstream when compared to upstream values. Based upon the 2017 and 2018 data, the altered spillway gate operational protocol was adopted for continued implementation following the 2018 spill season and includes opening more gates at a lesser height, ultimately spreading out spill over a greater area.

Initial spillway modification effectiveness monitoring data show that TDG % at LLTR, which includes water that is spilled over the dam's spillway, were frequently lower than the values from

LLGEN and LLFB, at higher river flows. This relationship, seen in both 2017 and 2018, had not been seen in the pre-spillway modification annual monitoring, reinforcing the conclusion that the spillway modification project significantly reduces TDG levels downstream of Long Lake Dam.

The maximum TDG % downstream of the dam before the Spillway Modification Project were frequently above 130% and reached a maximum of 143% in 2012 when discharge reached just over 37,000 cfs. After the Spillway Modification Project, the greatest maximum TDG level downstream reached only 126% in 2017, at a discharge of over 46,000 cfs (a flow greater than the 7Q10).

In 2020, Ecology and FERC approved Avista's plans to conduct an additional three years of effectiveness monitoring and reporting, as outlined in the 2019 Long Lake Total Dissolved Gas Monitoring Report (Avista 2020). 2022 marks the third year of TDG effectiveness monitoring under this extension.

The goal of the three-year monitoring extension (2020 – 2022) was to obtain additional data at flows near the 7Q10 (32,000 cfs), where there was limited data following completion of the Spillway Modification Project, and to further assess the effectiveness of the Spillway Modification Project at flows below the 7Q10 following the implementation of the spillway gate operational protocol. Total discharge during 2020 through 2022 reached 21,835 cfs, 14,133 cfs, and 26,931 cfs respectively, with maximum spill recorded at 18,217 cfs, 7,202 cfs, and 20,210 cfs respectively, indicating that the 7Q10 was not reached over this time-period.

Comparing 2017 through 2022 data pairs from LLTR and LLGEN, when river flows are less than the Ecology-specified 7Q10 of 32,000 cfs and the TDG % at either LLTR or LLGEN are at or above 110%, TDG % values at LLTR were less than or equal to TDG % values at LLGEN 64.0% of the time. Stated differently, under these conditions, Long Lake Dam was either not creating or actually reducing TDG for 64.0% of the monitoring seasons following the Spillway Modification Project and with the new spillway gate operational protocol in place. When LLTR exceeded LLGEN, it was by less than or equal to 1% saturation 46.1% of the time, and by less than or equal to 3% saturation nearly 81.3% of the time.

The additional three years of monitoring confirm the initial conclusions from the previous, post-spillway project dataset and are outlined below:

- Overall, TDG % at LLTR, LLGEN, and LLFB increase as river flows increase.
- TDG % at LLTR exceeds the 110% criterion earlier in the season than at LLGEN and LLFB.
- TDG % at all stations appear to increase/decrease in response to incoming environmental conditions (water temperature, dissolved oxygen).
- Maximum TDG % at LLTR is lower than the maximum TDG % at LLGEN annually.
- At similar discharge, maximum TDG % at LLTR no longer reach the values seen at LLTR prior to the construction of the Spillway Modification Project.

6.0 NEXT STEPS

The three-year monitoring extension (2020 – 2022) did not accomplish the goal to obtain additional data at flows near the 7Q10 (32,000 cfs) as river flows fell short of the targeted flows. The Long Lake TDG Monitoring Report submitted to Ecology for review in February 2023 proposed Avista conducting annual TDG monitoring at Long Lake Dam for an additional three years (2023 through 2025) to address the gap in TDG data at higher flows.

Following discussions with Ecology in March and April of 2023, and in response to Ecology's March 23, 2023 comment letter, Avista proposes to work with Ecology to develop a new TDG WQAP and compliance schedule for Long Lake Dam, utilizing Ecology's "Guidance for Preparing a Dam Compliance Schedule Request and Water quality Attainment Plan," (dated March 2023). As part of this process, Avista looks forward to discussing the following components with Ecology and the Spokane Tribe.

- Review the alternatives studied, modeled and selected as part of the Phase I, II, and III TDG Feasibility Analyses completed from 2006 through 2012.
- Review the 2016 construction of the selected alternative (spillway deflectors) along with its performance since construction, compared to designed/modeled performance.
- Review and evaluate spillgate protocol, gate configurations, then assess any other incremental spillgate modifications.
- Peer review of data collected, patterns/correlations observed and reported conclusions of Avista and the Spokane Tribe downstream data/studies.
- Identify any data gaps, impacts or patterns based upon hydrology, water temperature, dissolved oxygen, upstream environmental conditions and incoming TDG levels.

Additionally, Avista plans to monitor TDG at Long Lake Dam in 2023 in accordance with the Long Lake HED TDG Monitoring Plan and reporting structure used in previous annual monitoring.

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TABLES

Table 2-1. Long Lake HED TDG monitoring stations.

Station Code	Description	Latitude / Longitude (NAD83)	Monitoring Type
LLGEN	Long Lake HED Unit 4 generation plume	47°37'48" / 117°31'47"	Long-term
LLTR	On left downstream bank, at a water pump house approximately 0.6 mile downstream from Long Lake dam	47°37'48"/ 117°31'47"	Long-term
LLTRSP1	On right downstream bank, across river from LLTR station	47° 50'19" / 117° 51'02"	Spot during spillway use

Table 2-2. Summary of continuous monitoring results.

Parameter	LLGEN			LLTR		
	Minimum	Maximum	Count	Minimum	Maximum	Count
Date/Time (m/dd/yyyy PDT)	3/4/22 17:00	7/14/22 11:30	12,651	3/4/22 17:00	7/17/22 23:45	12,988
Water Temperature (°C)	3.9	18.6	12,593	4.1	19.8	12,662
Dissolved Oxygen (mg/L)	8.8	13.6	12,590	8.5	14.1	12,660
Dissolved Oxygen (% saturation)	94.1	117.2	12,590	96.3	121.0	12,660
BAR (mm Hg)	Used LLTR BAR			710	737	12,686
TDG (mm Hg)	717	890	12,555	762	863	11,426
TDG (% saturation)[1]	99.1	123.1	12,475	105.5	118.7	11,426

Notes:

1. TDG (% saturation) calculated using site-specific barometric pressure (BAR) data collected at LLTR and corrected for altitude.

Table 2-3. Spot measurement results.

Station Code	Date Time (PDT)	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% saturation)	TDG (mm Hg)	LLTR BAR (mm Hg)	TDG (% of saturation)[1]
LLTRSP1	3/17/22 11:45	4.4	13.2		808	727	111.1
LLTRSP1	3/31/22 12:15	6.3	13.0	110.4	819	725	113.0
LLTRSP1	4/14/22 12:00	6.5	12.7	109.2	780	722	108.1
LLTRSP1	4/27/22 12:15	7.5	12.1	105.6	781	724	107.8
LLTRSP1	5/13/22 12:15	9.4	11.8	107.5	828	728	113.7
LLTRSP1	5/27/22 11:45	11.0	11.5	109.5	818	721	113.5
LLTRSP1	6/8/22 10:15	14.3	10.7	109.4	821	723	113.6
LLTRSP1	6/21/22 11:30	14.8	11.0	113.0	865	731	118.4
LLTRSP1	6/30/22 0:00	16.2	11.0	118.4	856	726	117.9
LLTR	7/17/22 23:45	18.8	8.7	98.3	760	719	105.7

Notes:
1. TDG (% saturation) calculated using site-specific barometric pressure (BAR) data collected at LLTR.

Table 2-4. Summary of exceedance of TDG criterion when total discharge was less than or equal to Ecology-specified 7Q10 of 32,000 cfs.

	LLTR			LLGEN		
# of records that exceeded 110% saturation	8,439			8,110		
Total # of records	11,426			12,475		
Periods when TDG exceeded 110% saturation (PDT)[1,2]	3/17/2022 14:30	to	4/12/2022 7:45	3/10/2022 18:00	to	3/13/2022 4:45
	5/5/2022 3:00	to	5/5/2022 4:15	3/14/2022 1:00	to	3/21/2022 8:00
	5/5/2022 10:15			3/21/2022 9:00		
	5/5/2022 10:45	to	5/6/2022 2:45	3/21/2022 10:00	to	3/21/2022 10:15
	5/6/2022 5:15	to	5/13/2022 13:15	3/21/2022 11:15	to	3/21/2022 11:30
	5/16/2022 11:00	to	7/9/2022 0:15	3/21/2022 12:15	to	3/21/2022 19:45
	7/9/2022 11:30	to	7/9/2022 23:45	3/22/2022 19:00	to	3/22/2022 21:30
				3/22/2022 23:00	to	4/5/2022 14:30
				4/8/2022 1:00	to	4/9/2022 4:15
				4/9/2022 4:45		
				4/9/2022 13:00		
				4/9/2022 15:00	to	4/9/2022 23:15
				4/10/2022 1:00	to	4/10/2022 2:45
				4/10/2022 4:00	to	4/10/2022 4:45
				4/10/2022 5:30		
				4/10/2022 9:00	to	4/12/2022 5:45
				5/8/2022 18:00		
				5/12/2022 20:30	to	5/12/2022 21:00
				5/12/2022 21:30	to	5/13/2022 1:45
				5/13/2022 2:15	to	5/13/2022 2:45
				5/13/2022 5:15	to	5/13/2022 6:45
				5/13/2022 12:00	to	6/15/2022 3:00
				6/15/2022 14:00		
				6/15/2022 14:45	to	7/9/2022 0:00
				7/9/2022 5:15	to	7/9/2022 5:30
				7/9/2022 8:15	to	7/9/2022 23:15
				7/12/2022 18:15		

Table 2-5. Summary of LLTR and LLGEN TDG% by month and LLTR paired with LLGEN TDG%.

	All LLTR TDG% Values			All LLGEN TDG% Values			LLTR TDG% Paired with LLGEN TDG%[1]		
Date	Total Count	Count >110%	% >110%	Total Count	Count >110%	% >110%	Total Count	Count >110% and >LLGEN	% >110% and >LLGEN
March	1,377	1,377	100%	2,498	1,813	73%	1,358	461	34%
April	2,872	1,088	38%	2,864	782	27%	2,864	1,008	35%
May	2,693	2,265	84%	2,958	1,791	61%	2,686	1,378	51%
June	2,867	2,867	100%	2,860	2,815	98%	2,856	1,404	49%
July	1,617	820	51%	1,295	833	64%	1,295	27	2%
All	11,426	8,417	74%	12,475	8,034	64%	11,059	4,278	39%

Notes:

1. TDG (% saturation) calculated using site-specific barometric pressure (BAR) data collected at LLTR and corrected for altitude.

Table 2-6. Maximum discharge flow and TDG% at LLTR, LLGEN, and LLFB.

Year [2]	Max. Discharge (cfs)	Max. TDG%		
		LLTR	LLGEN [1]	LLFB [1]
2003	22,310	129	-	123
2004	22,420	125	-	123
2010	17,910	121	113	-
2011	34,400	138	-	123
2012	37,100	143	123	118
2013	20,480	130	116	112
2017	46,331	126	125	119
2018	28,463	120	126	126
2020	21,835	115	117	-
2021 [3]	14,133	113	114	-
2022	26,931	119	123	-

Notes:

(1) LLGEN was not monitored in 2003, 2004, and 2011; LLFB was not monitored in 2010, 2020 - 2022.

(2) Data from 2019 is not included in the table because monitoring difficulties resulted in TDG data not being collected during 2019's maximum discharge.

(3) A discharge of 17,460 cfs was reached in 2021, however it was not considered representative of the natural conditions, or the maximum discharge, since it was due to a FERC required short-term gate test.

FIGURES

Revised January 8, 2015

Revised Long Lake HED TDG Compliance Schedule

Schedule for Operational Adjustments and Structural Modifications to Address TDG Production at Long Lake Dam

Action	Task	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
General Monitoring	Select/design permanent monitoring stations and develop monitoring plan	M	M										
	Monitor TDG and other relevant water quality conditions at the Unit 4 generation plume (LLGEN) and the tailrace (LLTR) [1]		M	M	M	M					M	M	
	Annual Monitoring Report[2]			M	M	M	M					M	M
Operational Changes - Spill Protocols	Continue historical preferential use of spill gates	O	O										
	Develop reasonable and feasible interim spill gate protocol based on the 2003/2004 spill testing		O										
	Implement selected reasonable and feasible interim spill gate protocol based on 2003/2004 spill testing			O	O	O	O	O					
	Suspend interim spill operations in 2016 and 2017 during construction								O	O			
	Implement revised spill gate protocol, which takes advantage of constructed structural modifications										O	O	O
Structural Modifications	Phase II Feasibility Study- Evaluation of Alternatives		S										
	Phase III Feasibility Study - Select Alternatives, Physical Model			S	S								
	Submit and request agency review of Phase III Recommendation					S							
	Upon FERC approval, prepare RFP for design engineering services and secure contract					S							
	Phase IV - Formulate design, plans, and specs						S						
	Phase V – Award construction bid and permit project						S	S					
	Phase VI - Construction								S	S			
	Phase VII – Testing, performance evaluation, and define spillgate protocol										S	S	
Effectiveness Monitoring	Confirm effectiveness of structural modifications and spillgate operations at reducing TDG										M	M	M

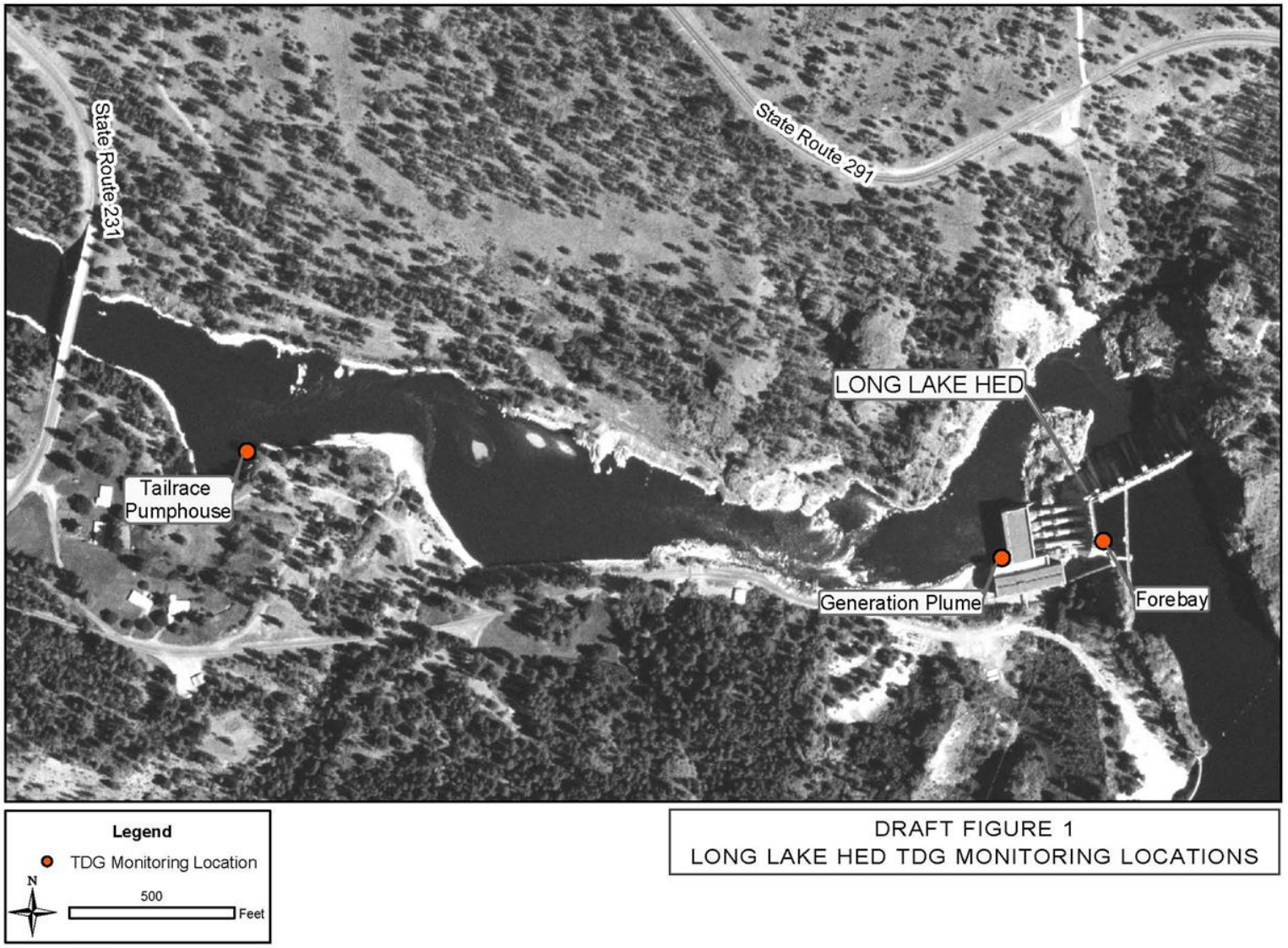
Notes

S	Structural
O	Operations
M	Monitoring

(1) Monitoring will be suspended following FERC approval of the Phase III recommendation and will resume once construction has been completed.
(2) Annual Monitoring Reports are only required following a monitoring season.

Figure 1-1: Revised Long Lake HED TDG compliance schedule.

Note: Approved by Ecology on November 21, 2014 and approved by FERC in an Order Granting Extension of Time Under Total Dissolved Gas Attainment Plan issued February 19, 2015 (FERC 2015).



Source: Avista

Figure 2-1: Long Lake HED long-term water quality monitoring locations.

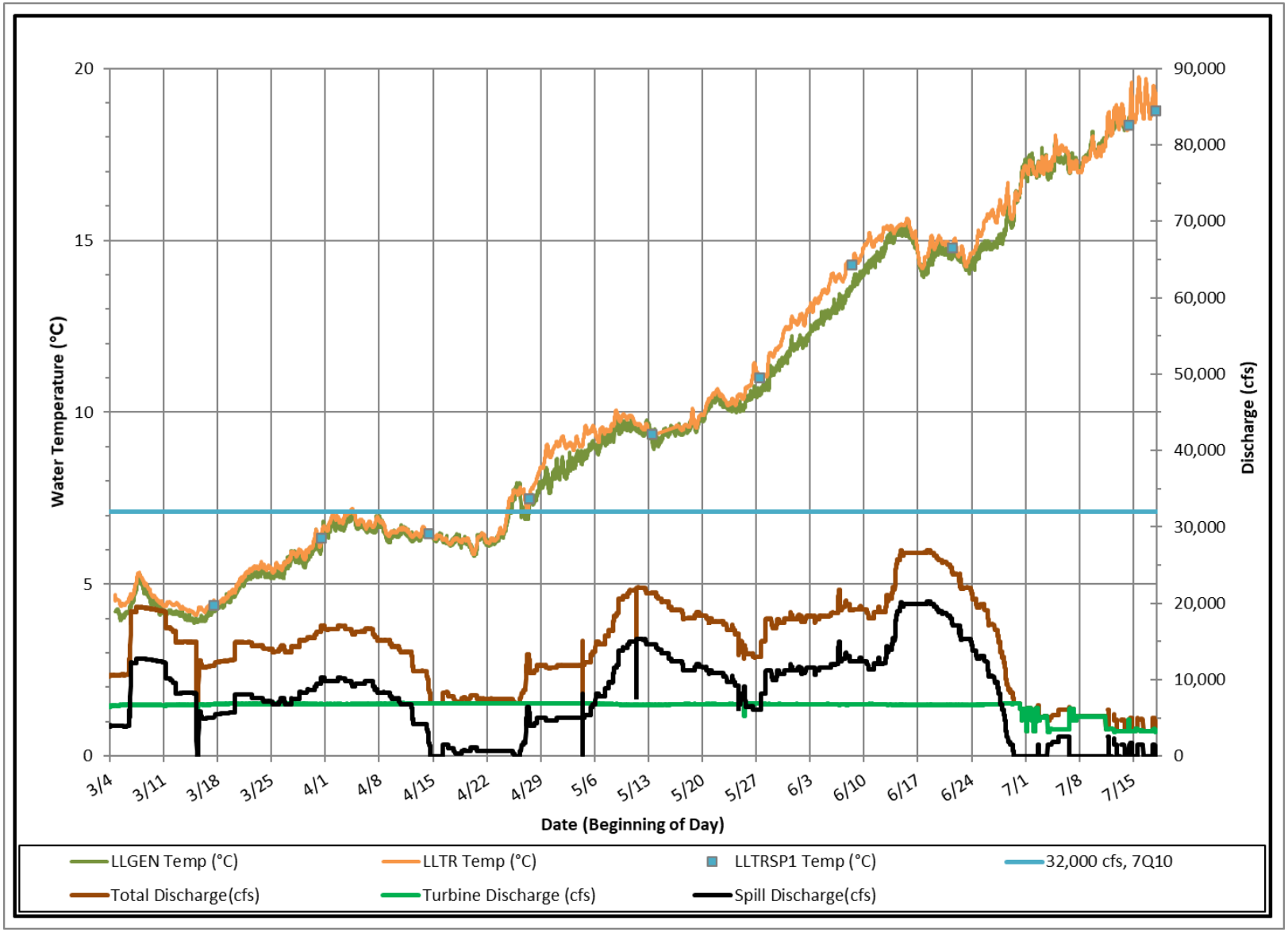


Figure 2-2: Long Lake HED 2022 water temperature (°C) and operations

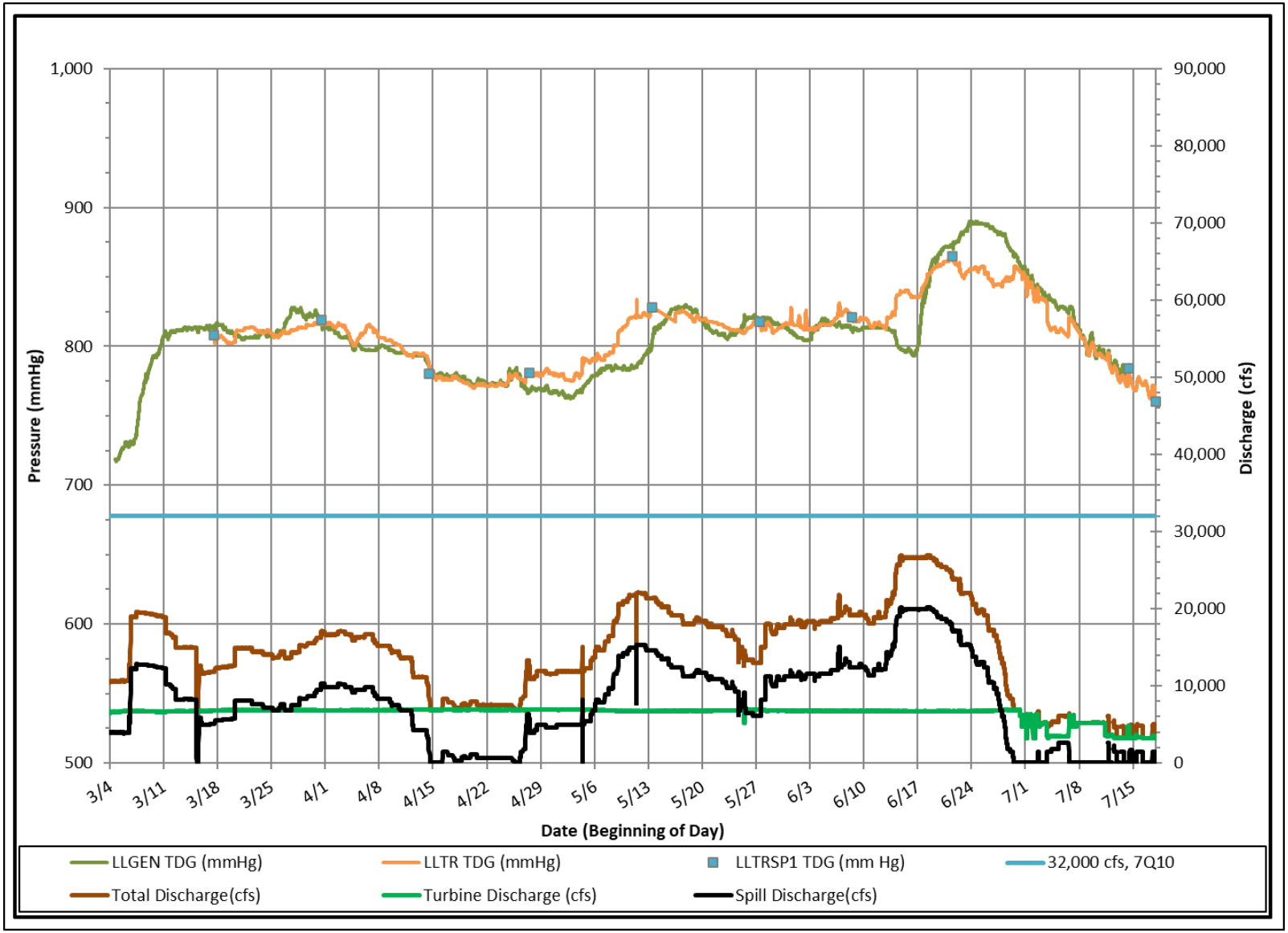


Figure 2-3. Long Lake HED 2022 barometric pressure (mmHg) and operations.

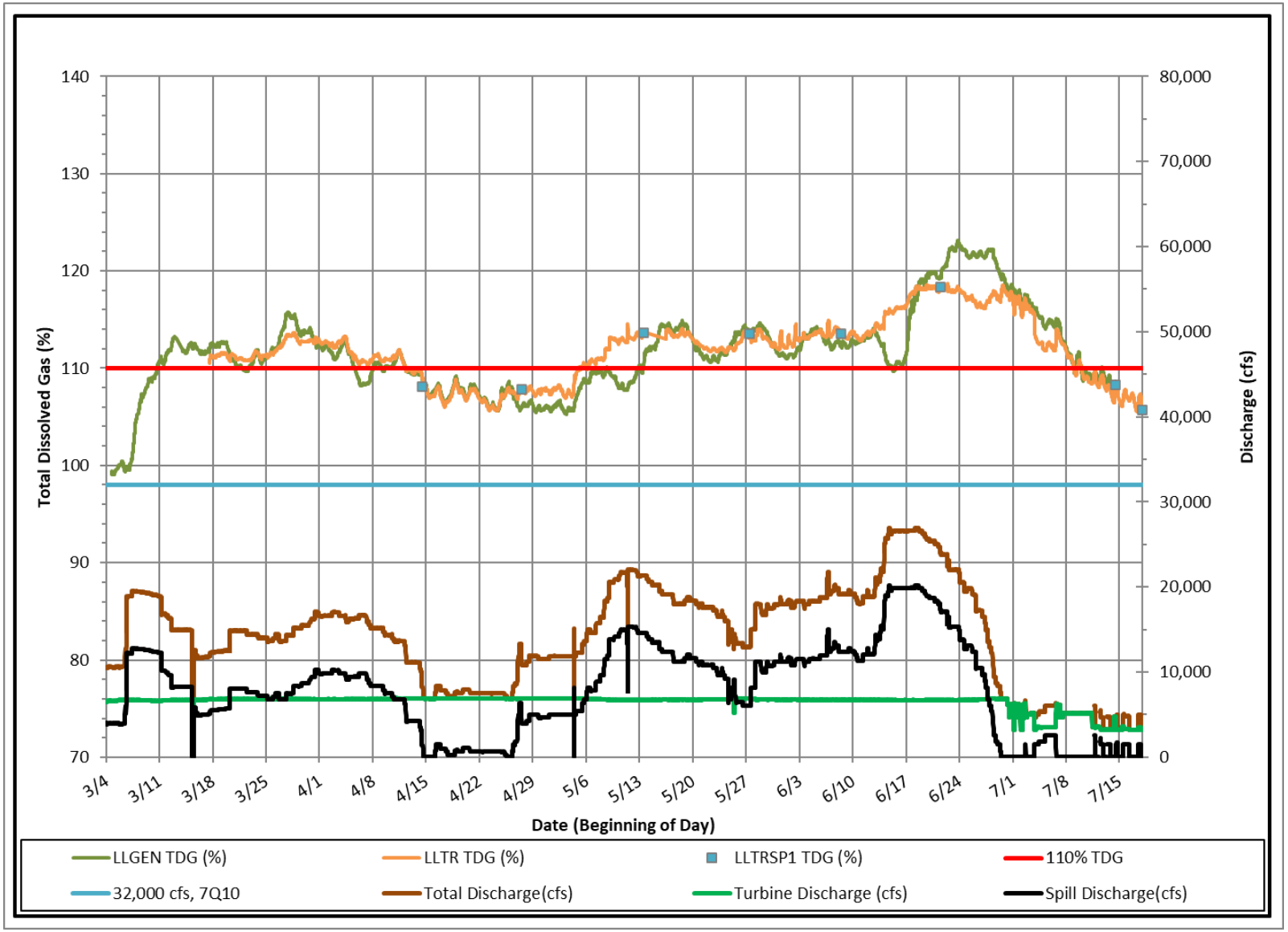


Figure 2-4: Long Lake HED 2022 total dissolved gas (%) and operations.

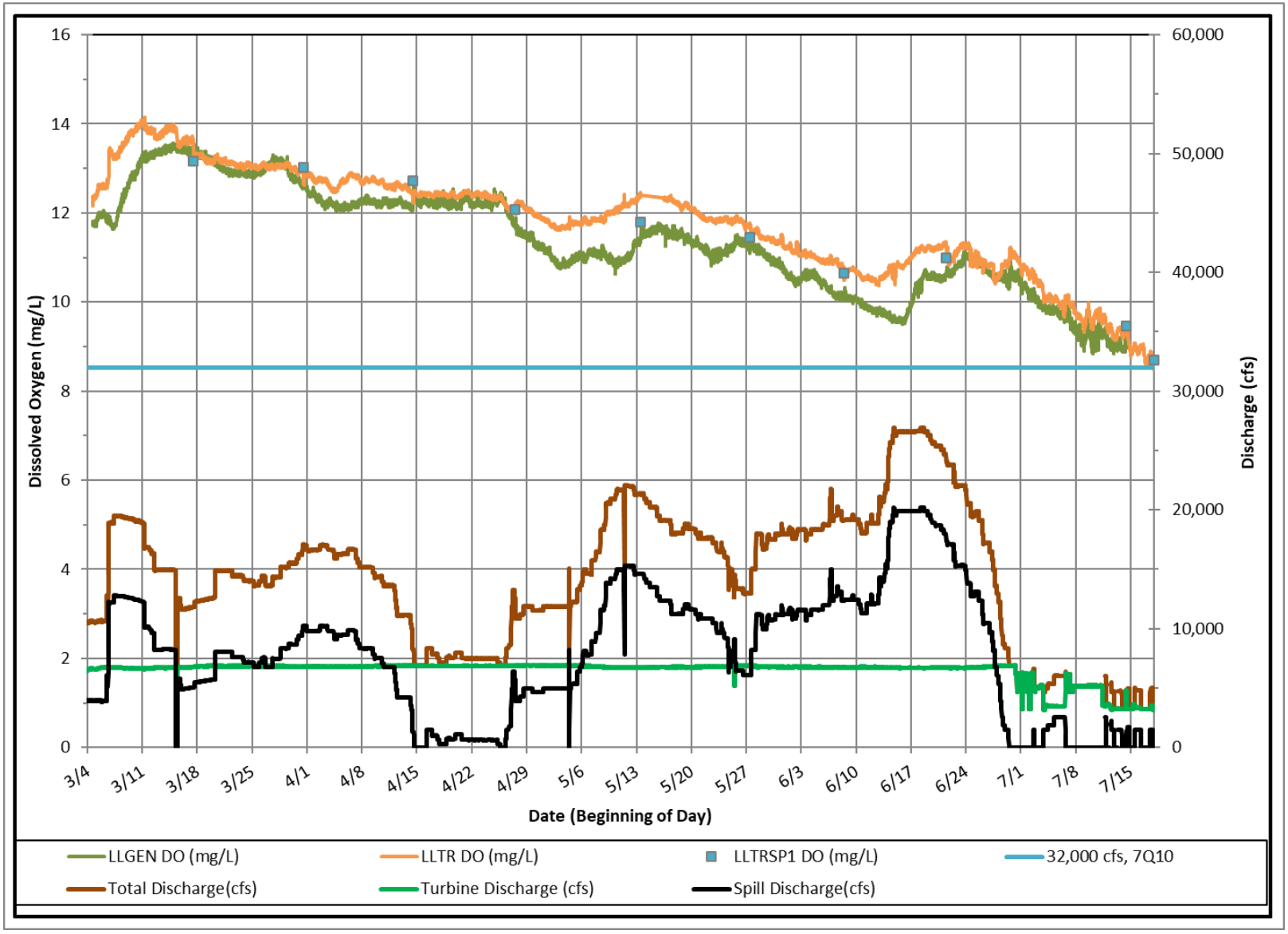


Figure 2-5: Long Lake HED 2022 dissolved oxygen (mg/l) and operations.

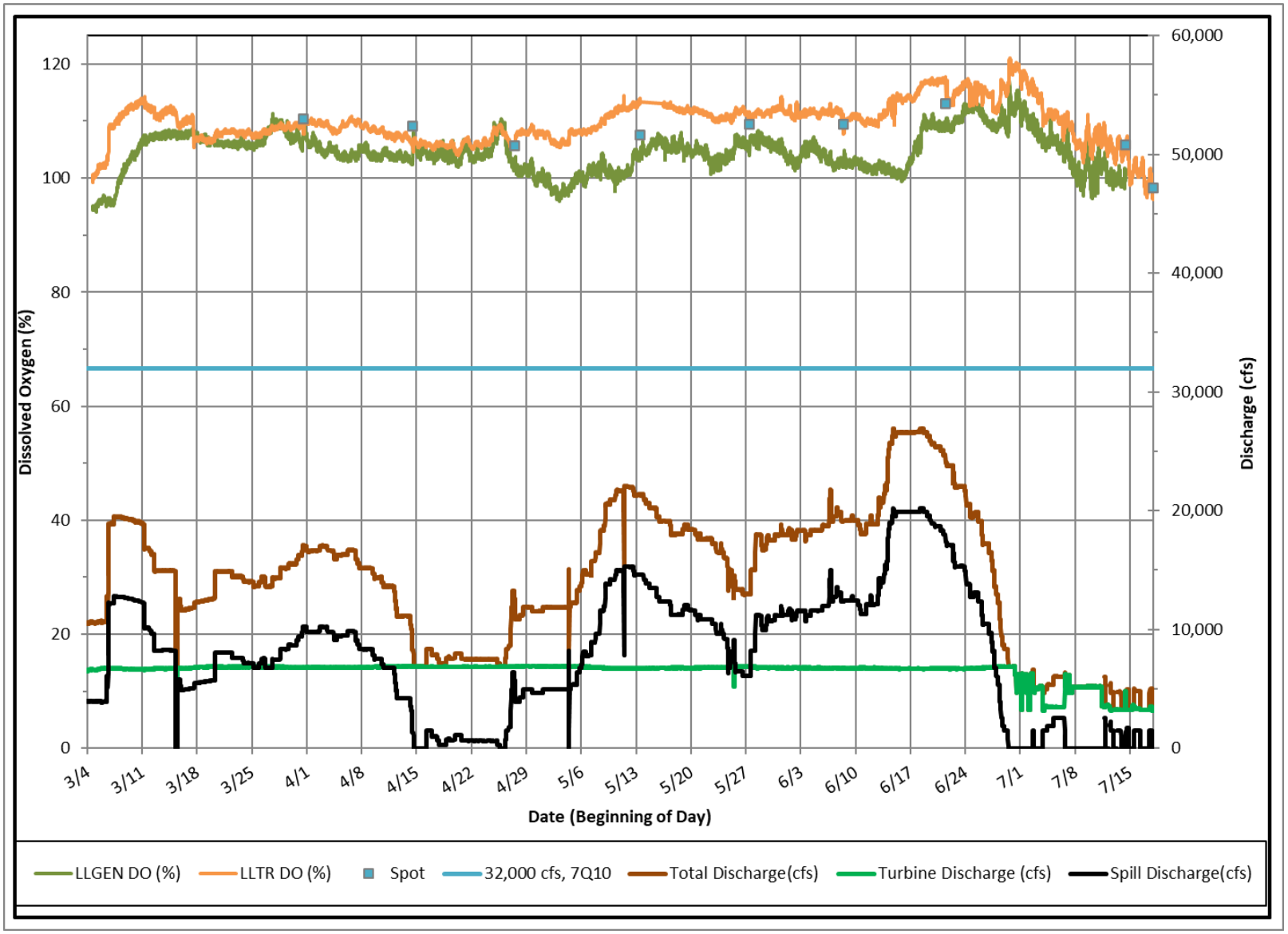


Figure 2-6: Long Lake HED 2022 dissolved oxygen (% saturation) and operations.

APPENDIX A
DATA QUALITY ANALYSIS

DATA QUALITY SUMMARY

Data quality objectives (DQOs) and Measurement Quality Objectives (MQOs) are the quantitative and qualitative terms used to specify how good the data need to be to meet the project's specific monitoring objectives. DQOs for measurement data, also referred to as data quality indicators, include measurement range, accuracy, precision, representativeness, completeness, and comparability. The range, accuracy, and resolution for each measured parameter are provided in Table A-1.

Table A-1. Range, accuracy and resolution of parameters recorded.

Instrument and Parameter	Range	Accuracy	Resolution
MS5 Total Dissolved Gas	400 to 1300 mmHg	±0.1% of span	1.0 mmHg
MS5 Dissolved Oxygen	0 to 30 mg/L	±0.01 mg/L for 0 to 8 mg/L ±0.02 mg/L for >8 mg/L	0.01 mg/L
MS5 Temperature	-5 to 50°C	±0.10°C	0.01°C
MS5 Depth (0-25 meters)	0 to 25 meters	±0.05 meters	0.01 meters
Barologger Relative Barometric Pressure		±0.05 kPa	0.002% FS
Barologger Temperature	-10 to 50°C	±0.05°C	0.003°C

Notes: Sources: Hach MS5 User Manual and Solinist Levelogger User Guide [3]

MQOs are the performance or acceptance thresholds or goals for the project's data, based primarily on the data quality indicators precision, bias, and sensitivity. Table A-2 presents MQOs selected during preparation of the Washington TDG Monitoring Plan along with the same MQO for DO as used for the Long Lake HED Tailrace DO Monitoring Plan. The meter-specific root mean squared error (RMSE) of the calibration corrections applied after each calibration, and an overall RMSE for all meters compared to MQOs are shown in Table A-3. Table A-4 shows which MS5 was deployed at each monitoring location during the sampling period.

Table A-2. Measurement quality objectives (MQOs).

Parameter	MQOs
Barometric Pressure	2 mmHg
Temperature	0.5ºC
Total Pressure	1% (5 to 8 mmHg)
TDG%	1%
Dissolved Oxygen	0.5 mg/L

[3] Hach Corporation. 2006. Hydrolab DS5X, DS5, and MS5 Water Quality Multiprobes User Manual. February 2006, Edition 3. Catalog Number 003078HY and Solinist. 2021. Levelogger Series 5 User Guide. September 15, 2021.

Table A-3: Difference between RMSE and MQOs by MS5

Table Part 1: Barometric pressure (BAR), total pressure, total dissolved gas (TDG).

LLHED TDG Monitoring	RMSE [1]				MQO				RMSE - MQO (positive shaded values denote exceedance of MQO)			
Meter and Site IDs	BAR[2]	Total Pressure[3]	TDG-cal[4]	TDG-spot	BAR	Total Pressure	TDG	TDG	BAR	Total Pressure	TDG-cal	TDG-spot
	mm Hg	%	%	mm Hg	mm Hg	%	%	mmHg	mm Hg	%	%	mm Hg
48762	1.60	0.23	0.23	2.00	2	1	1	5	-0.40	-0.77	-0.77	-3.00
48764	0.89	0.13	0.13	1.60	2	1	1	5	-1.11	-0.87	-0.87	-3.40
68482	1.00	0.14	0.14	N/A	2	1	1	5	-1.00	-0.86	-0.86	N/A
48763	1.80	0.25	0.25	0.71	2	1	1	5	-0.20	-0.75	-0.75	-4.29
60376	0.71	0.10	0.10	1.77	2	1	1	5	-1.29	-0.90	-0.90	-3.23
Overall RMSE	1.32	0.19	0.19	1.52	2	1	1	5	-0.68	-0.81	-0.81	-3.48

[1] RMSE calculated for each meter during calibration checks while in use and between spot measurements from multiple meters.

[2] RMSE calculated from BAR measured during calibration compared to the TDG in air uncorrected reading.

[3] RMSE calculated as the difference in TDG in air uncorrected measured during calibration minus the BAR, then divided by the TDG and multiplied by 100%.

[4] RMSE calculated as TDG in air uncorrected measured during calibrations divided by the BAR and multiplied by 100%

N/A - No value reported or not applicable

Table A-3 (Continued): Difference between RMSE and MQOs by MS5

Table Part 2: Temperature and dissolved oxygen (DO).

LLHED DO Monitoring	RMSE				MQO		RMSE - MQO (positive shaded values denote exceedance of MQO)			
Meter and Site IDs	Temperature[1]		Dissolved Oxygen[2]		Temp	DO	Temperature[1]		Dissolved Oxygen[2]	
	Calibration	Spot	Calibration	Spot			Calibration	Spot	Calibration	Spot
	ºC	ºC	mg/L	mg/L	ºC	mg/L	ºC	ºC	mg/L	mg/L
48762	0.05	0.02	0.06	0.07	0.5	0.5	-0.45	-0.48	-0.44	-0.43
48764	0.06	0.03	0.03	0.16	0.5	0.5	-0.44	-0.47	-0.47	-0.34
68482	0.12	0.07	0.07	0.24	0.5	0.5	-0.38	-0.43	-0.43	-0.26
48763	0.05	0.01	0.06	0.13	0.5	0.5	-0.45	-0.49	-0.44	-0.37
60376	0.04	0.03	0.09	0.17	0.5	0.5	-0.46	-0.47	-0.41	-0.33
Overall RMSE	0.06	0.03	0.06	0.15	0.5	0.5	-0.44	-0.47	-0.44	-0.35

[1] For Calibration, RMSE calculated from the difference between the meter and calibration thermometer at all calibration checks while the meter was in use. Spot differences are average differences between measured values from group average.

[2] Calibration RMSE as difference of the calculated pre-calibration and post-calibration measurement. Spot RMSE calculated as average difference between measured values from group average.

N/A - No value reported or not applicable

Root mean squared error (RMSE) = $\sqrt{\frac{\sum_{i=1}^{n}(x_{1,i}-x_{2,i})^2}{n}}$.

Table A-4. ID number, and deployment station and timeframe of MS5s used in 2022.

Deployment Timeframe	LLTR	LLGEN	LLTRSP1
3/4 - 3/17	68482	48762	48764
3/17 - 3/31	48764	48762	60376
3/31 - 4/14	48764	48762	60376
4/14 - 4/27	48764	48762	60376
4/27 - 5/13	48764	48762	60376
5/13 - 5/27	48764	48762	48763
5/27 - 6/08	48764	48762	48763
6/08 - 6/21	48764	48762	48763
6/21 - 7/14	48764	48762	48763
7/14 - 7/17	48762		48764

Measurement Range

The measurement range, range of reliable readings of an instrument or measuring device, specified by the manufacturer is displayed in Table A-1 for each measured parameter. Maintenance of field sampling equipment was conducted in a manner consistent with the corresponding manufacturer's recommendations to provide reliable readings within each instrument's reported measurement range.

Bias

TDG meters, like other field monitoring instruments, are subject to bias due to systematic errors introduced by calibration, equipment hardware or software functioning, or field methods. Bias was minimized by following standard protocols for calibration and maintenance, and by following field protocols for stabilization of meter readings.

Precision

Precision refers to the degree of variability in replicate measurements and is typically defined by the instrument's manufacturer. Manufacturer values for the MS5 and barologger (Table A-1) were within MQOs.

Accuracy

Accuracy is a measure of confidence that describes how close the average of a series of replicate measurements is to the "true" value (low bias). Throughout this seasonal TDG monitoring study, the MS5s underwent calibration and verification procedures.

Instrument accuracy was evaluated through the calibration and maintenance activities. MQOs for barometric pressure, total pressure, pre-calibration TDG %, and TDG-Spot were met for all meters (Table A-3). All MS5s met the 0.5 mg/L DO MQO for pre-calibration and spot measurements. All MS5s met the 0.5°C MQO for temperature and spot measurements (Table A-3).

Discharge data were obtained from Avista's internal plant control software and is found to be accurate and reliable.

Representativeness

Representativeness qualitatively reflects the extent to which sample data represent a characteristic of actual environmental conditions. For this project, representativeness was addressed through proper design of the sampling program to ensure that the monitoring locations were properly located and sufficient data were collected to characterize TDG at that location.

Comparability

Comparability is the degree to which data can be compared directly to previously collected data. Comparability was achieved by consistently monitoring the same long-term monitoring stations as in the past, and conducting spot measurements at the same location across the river from LLTR as in past years.

Completeness

Completeness is the comparison between the quantity of data planned to be collected and how much usable data was actually collected, expressed as a percentage (Table A-5). The TDG data collection period consisted of 12,988 15-minute periods at LLTR and 12,651 at LLGEN. Data completeness was 97 percent for water temperature, 97 percent for dissolved oxygen, 98 percent of barometric pressure, and 88 percent for TDG and TDG % at LLTR. Completeness at LLGEN was 100 percent for water temperature, dissolved oxygen, and 99 percent for TDG and TDG %.

Table A-6 summarizes the number of specific DQCodes applied to LLTR and LLGEN data.

Table A-5. Project completeness.

	LLGEN		LLTR	
Parameter	**Count**	**Completeness (%)**	**Count**	**Completeness (%)**
Monitoring Period	12,651	--	12,988	--
Water Temperature (°C)	12,593	100%	12,662	97%
Dissolved Oxygen (mg/L)	12,590	100%	12,660	97%
Dissolved Oxygen (% saturation)	12,590	100%	12,660	97%
BAR (mm Hg)	Used LLTR BAR		12,686	98%
TDG (mm Hg)	12,555	99%	11,426	88%
TDG (% saturation)	12,475	99%	11,426	88%

Table A-6. Number of specific DQ Codes during the monitoring period.

DQ Code	DQ Code Description	LLGEN					LLTR						
		Temp (°C)	TDG (mmHg)	Depth (meters)	DO (mg/L)	Batt (volts)	Temp (°C)	TDG (mmHg)	Depth (meters)	DO (mg/L)	Batt (volts)	Level (m H2O)	ATemp (°C)
999	Instrument logging data before deployment at monitoring station	11	11	11	11	11	3	2	3	3	3	0	0
998	Out of water after recovery	13	13	13	13	13	4	4	4	4	4	0	0
997	Equilibrating after deployment	0	38	0	1	0	0	28	0	0	0	0	0
993	Out of water for calibration/servicing	23	23	23	23	23	20	20	20	20	20	0	0
992	Moved instrument; it is not at standard station or is out of water	0	0	0	0	0	276	276	276	276	276	0	0
991	Instrument not deployed at typical long-term depth	12	12	12	12	12	0	0	0	0	0	0	0
990	Depth <0.25 meter at LLTR or <0.5 m at LLGEN	0	0	0	0	0	4	0	4	4	0	0	0
599	Suspect out of water based on depth	0	0	0	0	0	20	0	20	20	0	0	0
499	Faulty silastic (TDG) membrane	0	0	0	0	0	0	1,233	0	0	0	0	0
304	Suspect DO value not accurate	0	0	0	2	0	0	0	0	2	0	0	0
-211	Depth < TDG compensation depth, but data appear reliable	0	262	0	0	0	0	432	0	0	0	0	0
-1002	Corresponds with spot measurement	0	0	0	0	0	10	8	10	10	10	0	0
0	No data qualifiers	12,593	12,293	12,593	12,590	12,593	12,652	10,986	12,652	12,650	12,676	12,988	12,988
	Monitoring Period[1]	12,651	12,651	12,651	12,651	12,651	12,988	12,988	12,988	12,988	12,988	12,988	12,988

Notes:

1. Monitoring periods consisted of 3/5/2022 17:00 to 7/17/2022 23:45 for LLTR and 3/4/2022 17:00 to 7/14/2022 11:30 for LLGEN.

APPENDIX B
CONSULTATION RECORD

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

February 28, 2023

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

Subject: Federal Energy Regulatory Commission's Spokane River Hydroelectric Project License, Appendix B, Sections 5.4 and 5.6.B, Long Lake TDG, Nine Mile TDG and Long Lake DO Reporting Requirements

Dear Jordan:

Ordering Paragraph E of the Federal Energy Regulatory Commission (FERC) Spokane River Hydroelectric Project License incorporated the Washington Department of Ecology (Ecology) Certification Conditions under Section 401 of the Federal Clean Water Act Water Quality Certification (Certification) as Appendix B of the License. Per Sections 5.4 and 5.6.B of the Certification, Avista is submitting the following project status and reports for your review and comment.

Section 5.4: Total Dissolved Gas
There are two components related to Total Dissolved Gas (TDG), which include the following:

- *2022 Long Lake Total Dissolved Gas Monitoring Report.*
  Avista completed the Long Lake Dam Spillway Modification Project in December 2016. Following completion of the project, Avista monitored TDG to assess the effectiveness of the modifications and to evaluate spillgate operational protocols. The enclosed 2022 Long Lake TDG Monitoring Report provides the results of the TDG monitoring completed during 2022. It also includes an assessment of TDG monitoring since monitoring was extended for an additional three years in 2020.

  The three-year monitoring extension (2020 – 2022) did not accomplish the goal to obtain additional data at flows near the 7Q10 (32,000 cfs) as river flows fell short of the targeted flows. Therefore, Avista proposes to conduct annual TDG monitoring at Long Lake Dam for an additional three years (2023 through 2025), following the same Long Lake HED TDG Monitoring Plan and reporting structure used in previous annual monitoring

  As this additional monitoring data is collected, Avista will consult and engage with Ecology and the Spokane Tribe to discuss the milestones achieved in the WQAP including the Phase I, II, and III Feasibility Studies, Spillway Modification construction, effectiveness monitoring, spillgate protocols to reduce TDG, identification of data gaps, and impacts or patterns based upon hydrology, water temperature, dissolved oxygen, upstream environmental conditions and incoming TDG levels.

During 2025, Avista, Ecology and the Spokane Tribe will have a pathway and schedule of next steps in accordance with the regulatory tools outlined in WAC 173-201A-510(5).

- *2022 Nine Mile Dam Total Dissolved Gas Monitoring Report*
  Per Section 5.4(C), Avista shall collect TDG data for two years when flows occur during the 7Q10 median flow (25,400 cfs) or higher. In February 2012, Ecology approved Avista's request to delay TDG monitoring at Nine Mile Dam pending the completion of the turbine units 1 and 2 replacement project, the sediment bypass system and associated intake deck and trashrack cleaning system upgrades. These projects were completed by 2018 and TDG monitoring resumed in 2019.

  The enclosed 2022 Nine Mile HED Total Dissolved Gas Monitoring Report provides the results of TDG monitoring conducted for Nine Mile HED during 2022, as well as a summary of the two years of TDG data collected post-construction. Monitoring results from 2019 and 2022 demonstrate that Nine Mile Dam did not contribute TDG compared to upstream levels, except for a time period from June 14 to June 25, 2022 when TDG in the tailrace increased, correlated with an increase in river flows, but TDG in the forebay did not increase, resulting in tailrace TDG values being greater than forebay values.

  Based on the inconsistencies seen in the relationship between forebay TDG and tailrace TDG in the two years of monitoring, Avista proposes monitoring TDG annually until flows reach or are near the median 7Q10, in order to better assess the influence Nine Mile Dam has on TDG, without the influence/impact from high sediment loading. Avista will submit a three-year summary report following the next year flow conditions have been met.

Section 5.6.B: Dissolved Oxygen
The enclosed 2022 Long Lake HED Tailrace Dissolved Oxygen (DO) Monitoring Report provides the results of the 2022 DO monitoring immediately downstream of Long Lake Dam for the low-flow period of the year and summarizes the use of draft tube aeration to increase DO levels in the river below the dam's tailrace. Avista plans to continue with the aeration program in 2023 and to continue monitoring DO and TDG at the Long Lake Dam Tailrace Station.

Attached, please find the 2022 Long Lake TDG Monitoring Report, 2022 Nine Mile Dam TDG Monitoring Report, and the 2022 Long Lake HED Tailrace Dissolved Oxygen Monitoring Report for the Ecology's review and approval. We would like to receive any comments or recommendations that you may have by **March 31, 2023**, which will allow us time to file these reports with FERC by April 15, 2023.

Please feel free to contact me at (509) 495-4084 or Meghan Lunney at (509) 495-4643 if you have any questions or wish to discuss the report.

Sincerely,

Chris Moan
Fisheries Habitat Biologist

Enclosures (3)

cc: Brian Crossley, Spokane Tribe
Conor Giorgi, Spokane Tribe
Meghan Lunney, Avista

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Eastern Region Office
4601 North Monroe St., Spokane, WA 99205-1295 • 509-329-3400

March 23, 2023

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

RE: Request for Ecology Review and Comment – Avista 2022 Long Lake Tailrace HED Dissolved Oxygen, Long Lake Total Dissolved Gas, and Nine Mile Total Dissolved Gas Monitoring Reports – Spokane River FERC Project No. 2545

Dear Chris Moan:

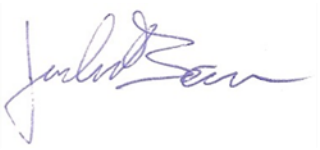
The Department of Ecology (Ecology) has reviewed Avista's submittal of the "2022 Long Lake Total Dissolved Gas Monitoring Report", "2022 Nine Mile Dam Total Dissolved Gas Monitoring Report", and "2022 Long Lake HED Tailrace Dissolved Oxygen Monitoring Report". These reports were received by Ecology on February 28, 2023, via email. The reports were completed in accordance with Sections 5.4(C & D) and 5.6(B) of Ecology's 401 Certification (Certification) and consistent with Spokane River Hydroelectric Project No. 2545 (License) Appendix B.

In summary of the enclosed comments, we have highlighted the following for Avista to pursue:

1. Develop and submit a new Water Quality Attainment Plan (WQAP) for TDG at Long Lake Dam according to WAC 173-201A-510(5) "Compliance schedule for dams". We encourage using the attached guidance document for developing a WQAP with reasonable and feasible TDG abatement measures. A compliance schedule developed with the WQAP must identify the necessary time of up to ten years to evaluate and implement the proposed TDG abatement measures.
2. Using the enclosed guidance document, please prepare a TDG WQAP submittal schedule for Long Lake Dam for Ecology review by April 14, 2023.
3. Continue TDG monitoring at Nine Mile Dam to evaluate TDG dynamics at or higher than the median 7Q10 flows at the Spokane River gage according to Section 5.4(C) of the Certification. Furthermore, continued monitoring is needed to evaluate Hangman Creek's influence on TDG.
4. Continue monitoring DO and TDG at the Long Lake Dam Tailrace Station according to the aeration program's adaptive management measures.

Ecology looks forward to working with Avista during development of the next TDG WQAP at Long Lake Dam. We think it would be beneficial to meet and discuss reasonable and feasible TDG abatement measures for the WQAP given the data collected and past implementation projects. We appreciate the regular conversations and look forward to connecting soon. 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
Enclosures
cc: Meghan Lunney, Avista
Chad Atkins, Ecology
Brian Crossley, Spokane Tribe
Conor Giorgi, Spokane Tribe

Avista 2022 TDG Annual Reports and Long Lake HED Tailrace DO/TDG Annual Report
Ecology Review and Comment

2022 Long Lake TDG Monitoring Report ECY review and comment.

Comment No.	Section	Page No.	Comment/Questions
1	2.5	5	Last bulleted item – I think July 14th was meant as the last data recorded at LLGEN and not June 14th? July 14th would match dates further into the document.
2	4.0	7	We suggest including some language explaining how varying flows effect TDG exceedances as in past years' discussion sections and reports. It appears TDG response downstream in the tailrace is dependent on incoming flows and TDG values.
3	5.0	7	Paragraph 2 – Spill gate testing and effectiveness monitoring during the 2017 and 2018 seasons concluded the structural modifications are effective at reducing TDG from pre-construction TDG levels. This analysis included spreading out gate levels more evenly and decreasing TDG further between discharges of approximately 6.5kcfs-13.3kcfs. To supplement these results, we recommend additional gate testing at greater discharges to evaluate opportunities for further maximizing TDG reductions during a higher flow spectrum.
4	5.0	8	Paragraph 3 "Comparing…" – This is a good level of evaluation here, especially the last sentence. Using this further when describing TDG at varying discharge regimes will be beneficial for future abatement investigations and determining the greatest level of TDG reduction (magnitude, duration, frequency).
5	5.0	8	Third bullet – How was this conclusion decided? We did not see discussion on this comparison in the report that would help us understand this conclusion.
6	6.0	9	Though a three-year extension for the TDG compliance schedule was granted in the past for monitoring effectiveness, we typically don't permit extensions but rather request a new compliance schedule be developed. Additionally, we haven't seen a flow year get even to the median 7Q10 value since 2017, therefore there's uncertainty that we see flows near the 7Q10 in the next three years. We believe from instances of continued TDG exceedances, especially during higher flows, there's reason to pursue evaluation and possible implementation of new TDG abatement measures. Actions identified in the final bullet list of the report can be included in determining new TDG abatement actions and pertinent evaluation methods within a new compliance schedule. Therefore, development of a new TDG water quality attainment plan and compliance schedule is the appropriate next step in accordance with WAC 173-201A-510(5) at Long Lake Dam consistent with the 401 Certification Section 5.4(D).

2022 Nine Mile Dam TDG Monitoring Report

Comment No.	Section	Page No.	Comment/Questions
1	3.6	6	Last paragraph – We appreciate Avista adding this notification.
2	4.0	7	Last paragraph, sentence 4 – According to the Hangman Creek USGS monitoring location #12424000 flows peaked at 5,410 cfs on June 14th at 4:45PM (see Hangman Creek #12424000). Consider revising the peak flow value unless the value is referring to a different monitoring location. If that's the case, please include the monitoring site ID.
3	4.0, 5.4, 6.0	7-9	4.0 and 5.4, last paragraphs and Section 6.0 – Ecology agrees more data collection is needed to understand the impacts of Hangman Creek high episodic discharges into the Spokane River during spill events and TDG response at Nine Mile Dam. It is largely unclear how Hangman water quality data effects TDG and how the relationship between NMFB and NMTR respond. Additionally, the median 7Q10 of 25,400 cfs at the Spokane River gage (USGS 12422500) has not been met during annual monitoring periods since the construction projects at Nine Mile Dam were completed. Though flows during 2019 and 2022 came close, we agree continued monitoring is beneficial to further evaluate TDG at Nine Mile Dam. We disagree the data is erroneous during increase flows from Hangman Creek, since QAQC spot checks supported the results and TDG increases were observed at the LLGEN TDG values downstream at Long Lake Dam. There may be more to understand how Hangman Creek discharges influence TDG. Hangman Creek typically reaches high flows earlier in the year than seen in 2022 when TDG levels increase from Spokane River flows over Spokane Falls. There may be some level of interaction explaining the higher TDG at NMTR given how TDG saturation equilibrates from the higher discharges of Hangman Creek with the Spokane River during these periodic events. Additional data collection will hopefully shed some light on these uncertainties. Please provide more information on why nutrients and sediments were assumed to be impacting TDG from Hangman Creek (e.g., cited literature, previous TDG studies). At constant TDG levels, natural environmental conditions impacting TDG typically include barometric pressure, biological activity, and temperature.

2022 Long Lake HED Tailrace DO Monitoring Report ECY review and comment.

Comment No.	Section	Page No.	Comment/Questions
1	General Comment	-	Ecology agrees continued monitoring is needed in the tailrace and during aeration to effectively manage and operate periods of aeration. As mentioned, continued upstream DO, temperature, and TDG water quality attainment plan improvements should only continue to benefit downstream DO conditions.

Ecology Guidance for Preparing a Dam Compliance Schedule Request and Water Quality Attainment Plan

March 2023

This Washington Department of Ecology (Ecology) guidance presents a recommended series of actions for dam owners to pursue to achieve an approvable Water Quality Attainment Plan (WQAP) and compliance schedule in accordance with WAC 173-201A-510(5). Dam owners are encouraged to begin preparations for a WQAP submittal at a minimum one year prior to the due date. As an example, a dam owner may begin working through the guidance actions during the final year(s) of a dam compliance schedule to ensure a new schedule and WQAP is approved by Ecology and begins immediately thereafter. We suggest dam owners consult with Ecology early and often during the recommended guidance process.

The following actions outline a strategy for dam owners to choose reasonable and feasible implementation projects to meet water quality standards, engage key stakeholders, and develop an approvable WQAP:

1. Assemble a WQAP project team with pertinent personnel (e.g., consultants, in-house engineering personnel, etc.) to consider projects for evaluation and implementation as part of the WQAP. The assembled team will review and/or modify past project alternatives and propose new projects in preparation of an extensive list of potential improvement actions. For all potential projects, water quality improvements may include any one or combination of the following factors to achieve compliance:
    - Magnitude
    - Duration
    - Frequency

    Incremental improvement made to any of these factors must be considered to achieve the highest attainable water quality condition if numeric criteria cannot be met.
2. Develop or revise evaluation criteria for ranking and prioritizing projects that are considered reasonable and feasible to achieve the maximum water quality condition. Submit the developed evaluation criteria to Ecology for review and comment.
3. Finalize the criteria and prepare a preliminary list of potential projects from the original extensive list to begin outlining the WQAP. The list of prioritized projects could be informed by the criteria, preliminary modelling, and existing science on water quality improvement strategies, as appropriate.
4. Once the reasonable and feasible list of actions is prepared, the dam owner should hold a series of advisory workshops (see No. 5) to vet actions, decisions, and assumptions made developing the list and evaluation criteria.
5. Form an advisory group including the WQAP project team, regulatory agencies, tribes, and experts in water resources specific to reservoir management, design, and function. Engage the advisory group in a series of workshops facilitated by the dam owner to include the following content:
    - Introduce the general project background and need for water quality attainment of WA water quality standards, past project proposals, evaluation criteria, and the developed reasonable and feasible list of actions and how each measure was evaluated using the criteria.

- Based on the information presented, the dam owner will request from the group any additional implementation projects and alternatives. This may include supplementary water quality studies or data collection needs to support project evaluation and implementation proposals.

2. Following the series of workshops, a final evaluation criteria and vetted project list would be integrated into a draft WQAP for Ecology review and comment. At a minimum, the draft must include all parts of WAC 173-201A-510(5)(b) and the developed evaluation criteria as an attachment.

3. Once having addressed Ecology's comments, we recommend the dam owner present the WQAP to the advisory workgroup and/or broader group of stakeholders for final review. The dam owner should consider recommendations from this review and finalize for Ecology approval and subsequent submittal to the appropriate federal agency.

Ecology Proposed WQAP Submittal Schedule

The following table may be revised based on project scope and conversations between Ecology and the dam owner. Ecology recommends dam owners work with the agency to agree on a schedule incorporating each of the defined tasks to ensure the final WQAP submittal due date is met.

Task No.	Task	Time Required (days)	Notes
1 & 2	Assemble Project team, create comprehensive list of project ideas, and develop evaluation criteria	60	Dam owner schedules advisory meetings ~100 days out
2	Ecology review and comment of evaluation criteria	20	
3	Dam owner addresses Ecology comments and finalizes evaluation criteria	20	
4 & 5	Dam owner prioritizes projects using criteria and presents project proposals to advisory workgroup	10	Approximately three workshops facilitated over 10-day period. Dam owner schedules final advisory group meeting ~100 days out during last workshop.
6a	Dam owner updates project list and develops draft WQAP for Ecology review and comment	45	
6b	Ecology review and comment of draft WQAP	30	
7a	Dam owner addresses Ecology comments and presents to advisory group	30	
7b	Dam owner makes final changes to WQAP based on meeting presentation and submits to Ecology for final approval	10	
7c	Ecology approves WQAP and dam owner submits to the federal agency	10	
	Total	235 or ~8 months	

ECOLOGY COMMENTS AND AVISTA RESPONSES

Ecology Comment

1. Develop and submit a new Water Quality Attainment Plan (WQAP) for TDG at Long Lake Dam according to WAC 173-201A-510(5) "Compliance schedule for dams". We encourage using the attached guidance document for developing a WQAP with reasonable and feasible TDG abatement measures. A compliance schedule developed with the WQAP must identify the necessary time of up to ten years to evaluate and implement the proposed TDG abatement measures.

Avista Response

Section 6.0 of the report was modified to incorporate Avista working with Ecology to develop a new TDG WQAP and compliance schedule, following Ecology's "Guidance for Preparing a Dam Compliance Schedule Request and Water quality Attainment Plan," (dated March 2023).

Ecology Comment

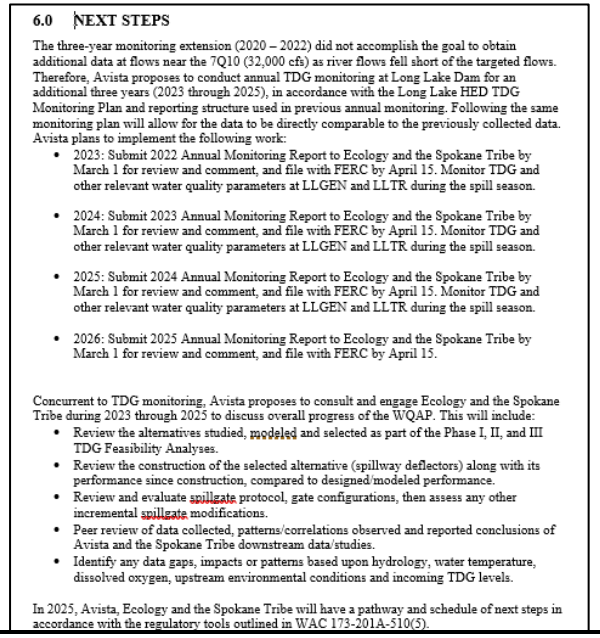
2. Using the enclosed guidance document, please prepare a TDG WQAP submittal schedule for Long Lake Dam for Ecology review by April 14, 2023.

Avista Response

Per Avista's communication with Ecology dated April 11, 2023, a TDG WQAP schedule for Long Lake Dam will be submitted to Ecology by April 21, 2023 (see p. B-13).

2022 Long Lake TDG Monitoring Report ECY review and comment.

#	Section	Page No.	Ecology Comment/Questions	Avista Response
1	2.5	5	Last bulleted item – I think July 14th was meant as the last data recorded at LLGEN and not June 14th? July 14th would match dates further into the document.	The report was modified to correct the date to July 14.
2	4.0	7	We suggest including some language explaining how varying flows effect TDG exceedances as in past years' discussion sections and reports. It appears TDG response downstream in the tailrace is dependent on incoming flows and TDG values.	The report was modified to incorporate a new table (Table 2-5, titled *Summary of LLTR and LLGEN TDG% by month and LLTR paired with LLGEN TDG%*) along with text in Section 4.0 summarizing TDG% by month at each station and comparing LLTR paired with LLGEN TDG% to clarify the relationship between incoming TDG, outgoing TDG, and the 110% criteria.
3	5.0	7	Paragraph 2 – Spill gate testing and effectiveness monitoring during the 2017 and 2018 seasons concluded the structural modifications are effective at reducing TDG from pre-construction TDG levels. This analysis included spreading out gate levels more evenly and decreasing TDG further between discharges of approximately 6.5kcfs-13.3kcfs. To supplement these results, we recommend additional gate testing at greater discharges to evaluate opportunities for further maximizing TDG reductions during a higher flow spectrum.	The 2018 spill gate testing study design included conducting 2 gate tests at 25,160 cfs spill, as well as gate tests at lower flows. While the lower flow gate tests were completed in 2018, spill did not reach over 21,000 cfs from 2018 – 2022, so the higher flow tests have not been conducted. Avista will plan to conduct the higher flow gate tests when flows reach the needed cfs (around the 7Q10 flow of 32,000 cfs when Long Lake Dam is at full capacity).
4	5.0	8	Paragraph 3 "Comparing…" – This is a good level of evaluation here, especially the last sentence. Using this further when describing TDG at varying discharge regimes will be beneficial for future abatement investigations and determining the greatest level of TDG reduction (magnitude, duration, frequency).	Avista appreciates the insight and will consider this type of evaluation when describing TDG at varying flow regimes and future investigations.

5	5.0	8	Third bullet – How was this conclusion decided? We did not see discussion on this comparison in the report that would help us understand this conclusion.	TDG data at LLGEN and LLTR appear to be influenced by multiple variables including flow, water temperature, dissolved oxygen and barometric pressure, in different ways, at different times of the season. Additional TDG data collection efforts along with research observations from cited literature, equipment manufacturer observations, and previous TDG studies will provide greater clarification of these data patterns. We look forward to discussing these with Ecology.
6	6.0	9	Though a three-year extension for the TDG compliance schedule was granted in the past for monitoring effectiveness, we typically don't permit extensions but rather request a new compliance schedule be developed. Additionally, we haven't seen a flow year get even to the median 7Q10 value since 2017, therefore there's uncertainty that we see flows near the 7Q10 in the next three years. We believe from instances of continued TDG exceedances, especially during higher flows, there's reason to pursue evaluation and possible implementation of new TDG abatement measures. Actions identified in the final bullet list of the report can be included in determining new TDG abatement actions and pertinent evaluation methods within a new compliance schedule. Therefore, development of a new TDG water quality attainment plan and compliance schedule is the appropriate next step in accordance with WAC 173-201A-510(5) at Long Lake Dam consistent with the 401 Certification Section 5.4(D).	Section 6.0 of the report was modified from the previous version below, and now incorporates Avista working with Ecology to develop a new TDG WQAP and compliance schedule for Long Lake Dam, utilizing Ecology's "Guidance for Preparing a Dam Compliance Schedule Request and Water quality Attainment Plan," (dated March 2023). Previous Report Version (2/28/23) of Section 6.0 

6.0 NEXT STEPS

The three-year monitoring extension (2020 – 2022) did not accomplish the goal to obtain additional data at flows near the 7Q10 (32,000 cfs) as river flows fell short of the targeted flows. Therefore, Avista proposes to conduct annual TDG monitoring at Long Lake Dam for an additional three years (2023 through 2025), in accordance with the Long Lake HED TDG Monitoring Plan and reporting structure used in previous annual monitoring. Following the same monitoring plan will allow for the data to be directly comparable to the previously collected data. Avista plans to implement the following work:

- 2023: Submit 2022 Annual Monitoring Report to Ecology and the Spokane Tribe by March 1 for review and comment, and file with FERC by April 15. Monitor TDG and other relevant water quality parameters at LLGEN and LLTR during the spill season.
- 2024: Submit 2023 Annual Monitoring Report to Ecology and the Spokane Tribe by March 1 for review and comment, and file with FERC by April 15. Monitor TDG and other relevant water quality parameters at LLGEN and LLTR during the spill season.
- 2025: Submit 2024 Annual Monitoring Report to Ecology and the Spokane Tribe by March 1 for review and comment, and file with FERC by April 15. Monitor TDG and other relevant water quality parameters at LLGEN and LLTR during the spill season.
- 2026: Submit 2025 Annual Monitoring Report to Ecology and the Spokane Tribe by March 1 for review and comment, and file with FERC by April 15.

Concurrent to TDG monitoring, Avista proposes to consult and engage Ecology and the Spokane Tribe during 2023 through 2025 to discuss overall progress of the WQAP. This will include:

- Review the alternatives studied, modeled and selected as part of the Phase I, II, and III TDG Feasibility Analyses.
- Review the construction of the selected alternative (spillway deflectors) along with its performance since construction, compared to designed/modeled performance.
- Review and evaluate spillgate protocol, gate configurations, then assess any other incremental spillgate modifications.
- Peer review of data collected, patterns/correlations observed and reported conclusions of Avista and the Spokane Tribe downstream data/studies.
- Identify any data gaps, impacts or patterns based upon hydrology, water temperature, dissolved oxygen, upstream environmental conditions and incoming TDG levels.

In 2025, Avista, Ecology and the Spokane Tribe will have a pathway and schedule of next steps in accordance with the regulatory tools outlined in WAC 173-201A-510(5).

ECOLOGY AND AVISTA APRIL 11, 2023 COMMUNICATION

From: Bauer, Jordan (ECY) <jbau461@ECY.WA.GOV>
Sent: Tuesday, April 11, 2023 4:39 PM
To: Clement, Marcie
Subject: RE: [External] RE: Extension request for Long Lake Dam TDG WQAP submittal schedule

Hi Marcie,

No problem on the extension request. We'll look forward on seeing the TDG schedule on April 21st, 2023.

Have a nice evening,

Jordan Bauer
Hydropower Compliance Coordinator
Washington Department of Ecology – Eastern Region
Water Quality Program
(509)-688-9403

From: Clement, Marcie <Marcie.Clement@avistacorp.com>
Sent: Tuesday, April 11, 2023 1:50 PM
To: Bauer, Jordan (ECY) <jbau461@ECY.WA.GOV>
Subject: RE: [External] RE: Extension request for Long Lake Dam TDG WQAP submittal schedule

Good afternoon Jordan,

Thank you for sending along the contacts for Seattle City Light.

I had a chance to discuss with Meghan, and we would like to request a one week extension for the Long Lake Dam Total Dissolved Gas (TDG) Water Quality Attainment Plan (WQAP) submittal schedule please.

We would like to submit the TDG WQAP schedule on *April 21, 2023*, rather than April 14, 2023 as discussed in your March 23, 2023 comment letter to Avista (attached). Please let us know if that date will work for you.

Sincerely,
Marcie Clement

Marcie Clement
WATER QUALITY SPECIALIST | ENVIRONMENTAL AFFAIRS

1411 E MISSION AVE | MSC-1 | SPOKANE, WA 99202
PHONE 509-495-8362 | **CELL** 509-760-9402 | **FAX** 509-495-8469
www.myavista.com

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

February 28, 2023

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

Subject: Federal Energy Regulatory Commission's Spokane River Hydroelectric Project License, Appendix B, Sections 5.4 and 5.6.B, Long Lake TDG, Nine Mile TDG and Long Lake DO Reporting Requirements

Dear Brian:

Ordering Paragraph E of the Federal Energy Regulatory Commission (FERC) Spokane River Hydroelectric Project License incorporated the Washington Department of Ecology (Ecology) Certification Conditions under Section 401 of the Federal Clean Water Act Water Quality Certification (Certification) as Appendix B of the License. Per Sections 5.4 and 5.6.B of the Certification and the October 2008 Settlement Agreement between Avista and the Spokane Tribe, Avista is submitting the following project status and reports for your review and comment.

Section 5.4: Total Dissolved Gas
There are two components related to Total Dissolved Gas (TDG), which include the following:

- *2022 Long Lake Total Dissolved Gas Monitoring Report.*
  Avista completed the Long Lake Dam Spillway Modification Project in December 2016. Following completion of the project, Avista monitored TDG to assess the effectiveness of the modifications and to evaluate spillgate operational protocols. The enclosed 2022 Long Lake TDG Monitoring Report provides the results of the TDG monitoring completed during 2022. It also includes an assessment of TDG monitoring since monitoring was extended for an additional three years in 2020.

  The three-year monitoring extension (2020 – 2022) did not accomplish the goal to obtain additional data at flows near the 7Q10 (32,000 cfs) as river flows fell short of the targeted flows. Therefore, Avista proposes to conduct annual TDG monitoring at Long Lake Dam for an additional three years (2023 through 2025), following the same Long Lake HED TDG Monitoring Plan and reporting structure used in previous annual monitoring

  As this additional monitoring data is collected, Avista will consult and engage with Ecology and the Spokane Tribe to discuss the milestones achieved in the WQAP including the Phase I, II, and III Feasibility Studies, Spillway Modification construction, effectiveness monitoring, spillgate protocols to reduce TDG, identification of data gaps, and impacts or patterns based upon hydrology, water temperature, dissolved oxygen, upstream environmental conditions and incoming TDG levels.

During 2025, Avista, Ecology and the Spokane Tribe will have a pathway and schedule of next steps in accordance with the regulatory tools outlined in WAC 173-201A-510(5).

- *Nine Mile Dam TDG Monitoring Report*
  Per Section 5.4(C), Avista shall collect TDG data for two years when flows occur during the 7Q10 median flow (25,400 cfs) or higher. In February 2012, Ecology approved Avista's request to delay TDG monitoring at Nine Mile Dam pending the completion of the turbine units 1 and 2 replacement project, the sediment bypass system and associated intake deck and trashrack cleaning system upgrades. These projects were completed by 2018 and TDG monitoring resumed in 2019.

  The enclosed 2022 Nine Mile HED Total Dissolved Gas Monitoring Report provides the results of TDG monitoring conducted for Nine Mile HED during 2022, as well as a summary of the two years of TDG data collected post-construction. Monitoring results from 2019 and 2022 demonstrate that Nine Mile Dam did not contribute TDG compared to upstream levels, except for a time period from June 14 to June 25, 2022 when TDG in the tailrace increased, correlated with an increase in river flows, but TDG in the forebay did not increase, resulting in tailrace TDG values being greater than forebay values.

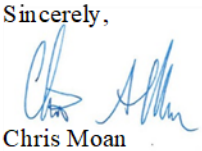
  Based on the inconsistencies seen in the relationship between forebay TDG and tailrace TDG in the two years of monitoring, Avista proposes monitoring TDG annually until flows reach or are near the median 7Q10, in order to better assess the influence Nine Mile Dam has on TDG, without the influence/impact from high sediment loading. Avista will submit a three-year summary report following the next year flow conditions have been met.

Section 5.6.B: Dissolved Oxygen
The enclosed 2022 Long Lake HED Tailrace Dissolved Oxygen (DO) Monitoring Report provides the results of the 2022 DO monitoring immediately downstream of Long Lake Dam for the low-flow period of the year and summarizes the use of draft tube aeration to increase DO levels in the river below the dam's tailrace. Avista plans to continue with the aeration program in 2023 and to continue monitoring DO and TDG at the Long Lake Dam Tailrace Station.

Attached, please find the 2022 Long Lake TDG Monitoring Report, 2022 Nine Mile Dam TDG Monitoring Report, and the 2022 Long Lake HED Tailrace Dissolved Oxygen Monitoring Report for the Spokane Tribe's review and comment. We would like to receive any comments or recommendations that you may have by **March 31, 2023**, which will allow us time to file these reports with FERC by April 15, 2023.

Please feel free to contact me at (509) 495-4084 or Meghan Lunney at (509) 495-4643 if you have any questions or wish to discuss the report.

Sincerely,



Chris Moan
Fisheries Habitat Biologist

Enclosures (3)

cc: Jordan Bauer, Ecology
Conor Giorgi, Spokane Tribe
Meghan Lunney, Avista

Spokane Tribal Natural Resources
P.O. Box 480 • Wellpinit, WA 99040 • (509) 626 - 4400 • fax 258 - 9600

3/30/2023

Chris Moan
1411 East Mission Avenue
PO Box 3727 MSC-25
Spokane WA 99220

Dear Chris:

I have reviewed the 2022 total dissolved gas reports for Long Lake and Nine Mile Dams and the 2022 dissolved oxygen report for Long Lake Dam with the assistance of Brian Crossley, Water & Fish Program Manager.

In 2016, spill deflectors were installed on Long Lake Dam to help mitigate total dissolved gas impacts. In 2022 Avista recorded TDG levels between 105%-118.7% at LLTR. Although this is an improvement from TDG levels recorded prior to the spill deflector installation, TDG levels are still exceeding the 110% saturation standard below 7Q10 flows. We read in the report the specific dates that LLTR and LLGEN exceeded 110% standard, but it was unclear what percentage of the sampling season the locations exceeded the standard. Please provide percentages (monthly or throughout the entire season) that both locations exceeded 110%. With dam operations being modified over time to better regulate TDG concentrations below Long Lake Dam, we hope that total dissolved gas concentrations continue to be reduced so that native species are not critically impacted. We promote future monitoring and adaptive management to effectively maintain low TDG during spring runoff.

When reviewing the TDG report for Nine Mile Dam we acknowledge that total dissolved gas concentrations both above and below the dam are exceeding the 110% standard. The report does show that for a majority of the season NMTR had a lower TDG than NMFB, and that for 10% of the study period NMTR exceeded levels seen at NMFB. Avista states they believe that data where NMTR exceeded NMFB was erroneous, and was higher because of impacts from high nutrients and sediments in the water column. Please explain how increased levels of nutrients and sediments can result in higher total dissolved gas levels, and how this anomaly is not seen every year when Hangman Creek freshet occurs.

The dissolved oxygen mitigation continues to be modified and improved below Long Lake dam. However, as noted in previous comments of annual reports, dissolved oxygen declines and dips below 8mg/L when the Long Lake Dam is not generating. These declines in dissolved oxygen can negatively impact native species that reside in this reservoir and reduce their already limited available habitat during that time. While reading the document we found the conclusions difficult to interpret when the percent exceedances or compliances were split within a month. We suggest Avista lists the date range for the percentages, as well as add what percent of DO or TDG

readings exceeded or complied over the entire month so there is more clarity and comparability. We encourage Avista to continue their efforts in improving water quality at Nine Mile Dam, in Long Lake (Lake Spokane) and at Long Lake Dam so native species can benefit from those efforts within the reservoirs as well as downstream in Reservation waters.

Sincerely,

C. Flanagan

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

cc: Jordan Bauer, Dept. of Ecology
Chad McCrea, Director Dept. of Natural Resources
Brian Crossley, Water and Fish Program Manager

SPOKANE TRIBE COMMENTS AND AVISTA RESPONSES

Spokane Tribe Comment
In 2016, spill deflectors were installed on Long Lake Dam to help mitigate total dissolved gas impacts. In 2022 Avista recorded TDG levels between 105%-118.7% at LLTR. Although this is an improvement from TDG levels recorded prior to the spill deflector installation, TDG levels are still exceeding the 110% saturation standard below 7Q10 flows. We read in the report the specific dates that LLTR and LLGEN exceeded 110% standard, but it was unclear what percentage of the sampling season the locations exceeded the standard. Please provide percentages (monthly or throughout the entire season) that both locations exceeded 110%.

Avista Response
The report was modified to incorporate a new table, Table 2-5 (titled, *Summary of LLTR and LLGEN TDG% by month and LLTR paired with LLGEN TDG%*) along with text in Section 4.0 summarizing TDG% by month at each station and comparing LLTR paired with LLGEN TDG% to clarify the relationship between incoming TDG, outgoing TDG, and the 110% criteria.

Spokane Tribe Comment
With dam operations being modified over time to better regulate TDG concentrations below Long Lake Dam, we hope that total dissolved gas concentrations continue to be reduced so that native species are not critically impacted. We promote future monitoring and adaptive management to effectively maintain low TDG during spring runoff.

Avista Response
Avista will continue to monitor TDG at Long Lake Dam in 2023 and will continue evaluating the impact Long Lake Dam has on TDG% as part of developing a new TDG Water Quality Attainment Plan and compliance schedule.