NORMANSKILL PROJECT
FERC NO. 2955
Draft
2019 Relicensing Study Report

Water Quality Monitoring

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Prepared for:

The City of Watervliet, New York

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1 INTRODUCTION

1.1 Background

The Normanskill Project (the Project) is located on the Normans Kill in the Town of Guilderland, NY. The Normans Kill flows over 45 miles through the Capital District of New York State to its confluence with the Hudson River. The Project is located approximately 22.4 river miles upstream of the mouth, with a watershed encompassing approximately 113 square miles. The project dam is located within a moderately deep ravine of the Normans Kill.

The Project was built on an existing water supply dam that was constructed in 1915. The dam impounds the Watervliet Reservoir, which has a surface area of 430 acres and a usable storage capacity of 1,290 acre-feet at normal pool elevation of 262 feet. It is the sole source of drinking water for the City of Watervliet (the City) and is the primary water source for the Town of Guilderland.

The City is currently performing studies to support its licensing process according to study plans developed in consultation with representatives of the New York State Department of Environmental Conservation (NYSDEC), the U.S. Fish and Wildlife Service (USFWS), the Town of Guilderland, and the City. Following a March 27, 2018 Study Plan meeting, the City submitted a Study Plan to the agencies on May 30, 2018 which included a Water Quality Study. In addition, on January 22, 2019, the NYSDEC requested that the City supplement this study to incorporate how a year round 1 cfs release would impact the temperature and dissolved oxygen (DO) within the bypass reach.

This study report provides information and results pertaining to the Water Quality Monitoring Study conducted at the Normanskill Project in 2018.

1.2 Goals and Objectives

The City conducted a water quality study at the Project from June through September 2018 in accordance with its May Study Plan. The goals of the original study were to: 1) collect baseline water quality information (DO and temperature data) on a continuous basis from the Project's bypass reach between the dam and tailrace discharge and downstream of the tailrace during low flow, warm water temperature conditions; and 2) to determine if water quality in the Project vicinity is in compliance with NYS water quality standards. In addition, the study will address the additional information that the NYSDEC requested with regards to the potential impact that a year round 1 cfs release would have on water temperature and dissolved oxygen within the bypass reach.

1.3 Resource Management Goals

The portion of the Normans Kill that is downstream of the dam is classified as a Class B (non-trout) waterbody. The best usages of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival (NYSDEC).

According to NYSDEC's regulations, the minimum daily average DO for Class B (non-trout) waters shall not be less than 5.0 mg/L, and at no time shall the instantaneous DO concentration be less than 4.0 mg/L.

2 METHODS

2.1 Monitoring Locations

Water quality monitoring in 2018 was conducted at two general locations at the Normanskill Project. Sites 1a and 1b (Bypass) were located in the bypass reach between the dam and the Project discharge and represented the water quality for flow passing via routes other than through the turbines (i.e. tributary inflow, spill, flashboard leakage, and dam seepage). Site 2 (Tailrace) was located downstream of the Project tailrace and represented the overall water quality conditions just below the Project. At these two locations, continuous monitoring of dissolved oxygen and water temperature occurred.

Figure 2.1-1 provides a map of the Project area showing the water quality monitoring locations. Representative photographs of the monitoring locations are contained in Figures 2.1-2 through 2.1-4.

2.2 Continuous Water Quality Monitoring

Continuous monitoring of temperature and DO were conducted using HOBO Dissolved Oxygen Loggers (Model U26-001). A HOBO Water Level Logger (U20-001-01) was used to collect barometric pressure and air temperature data. The accuracy, range, and resolution of each sensor are outlined in Table 2.2-1.

The water quality loggers were attached to cinderblocks which were anchored to the selected locations using wire rope and clamps. Site 1a was initially located in the bypass reach approximately 400 feet downstream of the dam, next to an exposed portion of the penstock. The logger was attached to a cinderblock with wire rope. The cinderblock was attached via additional wire rope to a loop embedded in the concrete covering the penstock. The cinderblock and attached logger were then lowered to the streambed, approximately 4 feet below the water surface. The equipment at Site 1a was vandalized soon after installation, so Site 1b was selected as a replacement. Site 1b was located in the bypass reach upstream of the railroad bridge and approximately 55 feet downstream of the dam. This location was selected for its more challenging accessibility, to minimize the likelihood for further vandalism. The cinderblock was attached to a piece of rebar that was hammered into the stream bed. The depth of the water at this location was approximately 2 feet. Site 2 (Tailrace) was located approximately 300 feet downstream of the project discharge. The cinderblock was attached to a tree on river-right and lowered to the stream bed, approximately 3 feet[1] below the water surface. The names and locations of the water quality loggers are summarized in Table 2.2-2.

The water quality loggers were programmed to collect DO and water temperature measurements in 15-minute intervals. The loggers were serviced on a biweekly basis. Servicing included collecting independent spot measurements, downloading the continuous data, checking the meter for calibration, and then re-deploying the meter. Offloaded data were reviewed between visits to assure the loggers were preforming properly.

[1] The water depth at Site 2 varied from less than one foot to more than three feet depending on the hydro operation status. The hydroelectric station was generating when the logger was installed at Site 2.

2.3 Field QA/QC Methods

Adherence to standard methods and QA/QC procedures for all water quality monitoring helps ensure that the resulting data will be accurate, precise, comparable, and representative. This section describes the QA/QC procedures that were conducted throughout the study period. Only personnel trained or experienced in the measurement and data recording techniques described above conducted the field data collection.

Independent spot measurements were performed at each monitoring site during the biweekly service visits using a YSI Model 55 Handheld DO/temperature meter. The YSI-55 meter was calibrated prior to each service visit. Temperature sensors were factory calibrated and each DO logger was calibrated according to manufacturer's specifications prior to deployment.

2.4 Data Compilation and Review

2.4.1 Weather, Flow and Operations Data

To support the analysis of the water quality data, weather and Project operations data were obtained for the period concurrent with the water quality monitoring period. The City of Watervliet provided operations data from June through September 2018 and included turbine generation and reservoir elevation. This data was used to calculate flow in the tailrace via generation and flow in the bypass reach via spill over the flashboards. A base flow is constantly released into the bypass reach as a result of flashboard leakage, dam seepage, and flow from a pipe that discharges on river-right about 50 feet downstream of the dam. This flow was measured several times throughout the water quality monitoring period and averaged 1.44 cfs.

Weather data were obtained from the online Northeast Region Climate Center NOWData – NOAA Online Weather Data[2] from the Albany International Airport NY weather station, located approximately 8 miles northeast of the Project dam. The data included long-term (1981-2010[3]) monthly normal air temperature and precipitation data.

2.4.2 Water Quality Data Compilation and Review

Each site was visited bi-weekly to download the data, service the logger and collect discrete spot check measurements. Discrete data were recorded on field data sheets the day of sampling. Collected data included DO and water temperature measurements, general weather and flow conditions, and meter calibration notes. Continuous temperature and DO data collected using the data loggers were stored in the instruments' memory and downloaded during each bi-weekly sampling event. Barometric pressure data from the HOBO logger located near the powerhouse access door was used to calculate DO percent saturation from the DO concentration data.

All field collected data underwent a thorough QA/QC review process to ensure accuracy of the dataset. Data were reviewed after each bi-weekly service throughout the course of the study. Data were retrieved and analyzed for consistency by an experienced biologist/engineer after each field visit. Raw data from each logger were processed and plotted after the service visit to confirm the accurate transfer of data and to screen for instrument or sensor error. Continuous

[2] http://www.nrcc.cornell.edu/wxstation/nowdata.html

[3] The 1981-2010 U.S. Monthly Climate Normals data set is the most recent long-term monthly normals data released by NOAA as of February 2019. This data set is produced once every 10 years.

water quality data were analyzed for outliers and erroneous data points. Erroneous data were removed from the data set, as explained further in Section 3.

Table 2.2-1: Water Quality Instrument Specifications

Parameter	Specification	Description
HOBO® Dissolved Oxygen Logger (U26-001)		
Optical Dissolved Oxygen (mg/L)	Operating Range	0 to 30 mg/L
	Accuracy	0.2 mg/L up to 8 mg/L; 0.5 mg/L from 8 to 20 mg/L
	Resolution	0.02 mg/L
Temperature (°C)	Operating Range	-5 to 40°C
	Accuracy	0.2°C
	Resolution	0.02°C
YSI Model 55 Handheld Dissolved Oxygen and Temperature Meter		
Dissolved Oxygen (% saturation)	Sensor Type	Membrane covered polarographic
	Range	0 to 200 % air saturation
	Accuracy	± 2 % air saturation
	Resolution	0.1 % air saturation
Dissolved Oxygen (mg/L)	Sensor Type	Calculated from % air saturation, temperature and salinity
	Range	0 to 20 mg/L
	Accuracy	± 0.3 mg/L
	Resolution	0.01 mg/L
Temperature (°C)	Sensor Type	Thermistor
	Range	-5 to +45°C
	Accuracy	± 0.2°C
	Resolution	0.1°C
HOBO® Pressure Logger (U20-001-01)		
Temperature (°C)	Range	-20° to 50°C
	Accuracy	0.37°C at 20°C
	Resolution	0.1°C at 20°C
Pressure	Operating Range	0 to 30 psia
	Resolution	0.003 psi

Table 2.2-2: Normanskill Project 2018 Water Quality Monitoring Sites

Site Number and Name	Location	Site Depth (ft)
Site 1a (Bypass)	Adjacent to exposed portion of penstock	4 ft
Site 1b (Bypass)	Upstream of railroad bridge	2 ft
Site 2 (Tailrace)	River-right approx. 300 ft downstream of Project discharge	Varies from 1 to >3 ft depending on hydroelectric generation

Figure 2.1-1: Water Quality Monitoring Locations.

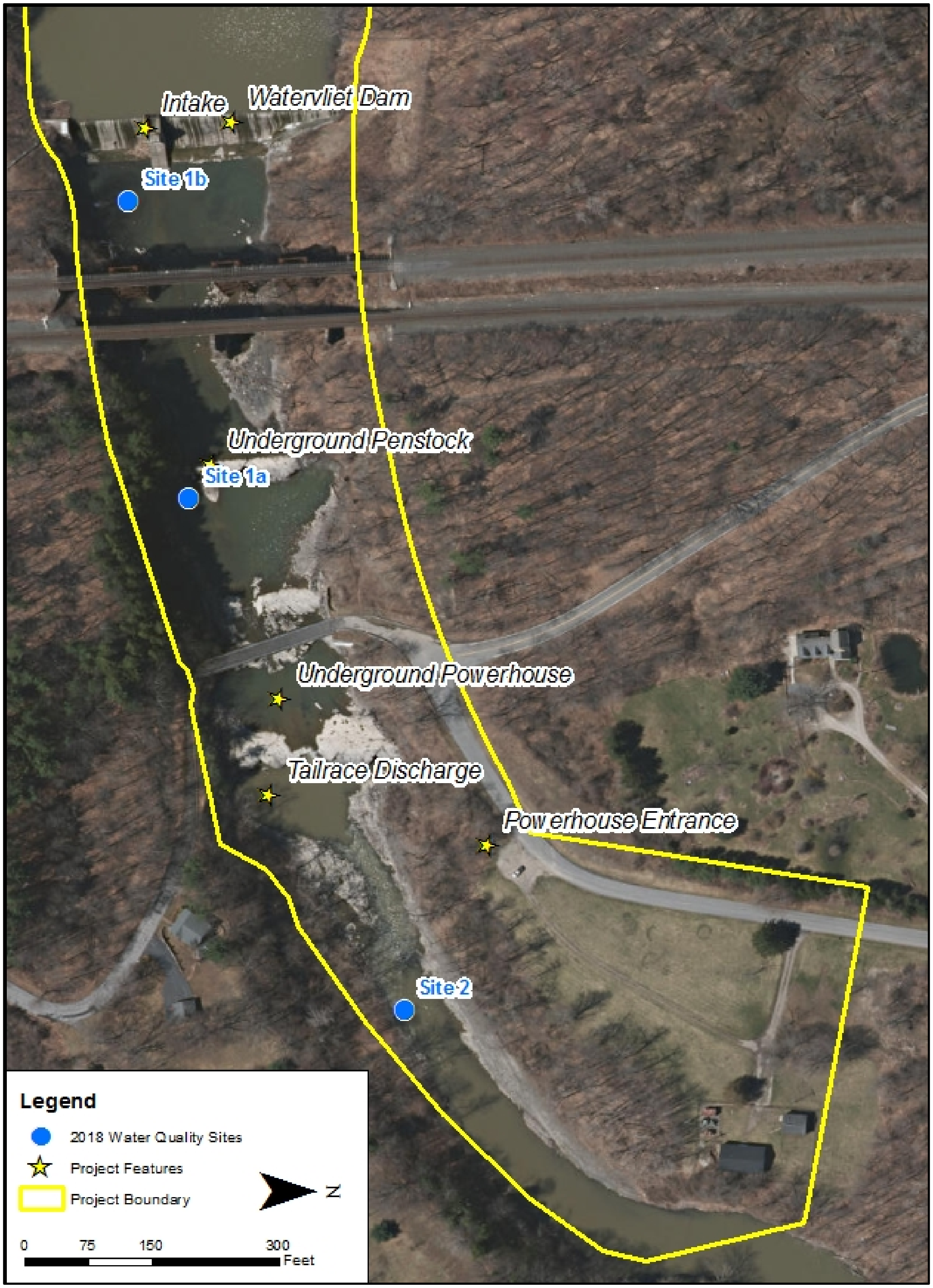


Figure 2.1-2: Photograph of Bypass Monitoring Location 1a

View looking upstream. Logger deployed to the left of the penstock. The yellow circle indicates where the wire rope attached to the cinderblock was tethered to the penstock.

Figure 2.1-3: Photograph of Bypass Monitoring Location 1b

View looking upstream from river-right. Logger deployed approximately 55 feet downstream of the dam. The rebar securing the cinderblock is indicated in the yellow circle.

Figure 2.1-4: Photograph of Tailrace Monitoring Location 2

View from river-left. Logger deployed near river-right. The yellow circle indicates where the wire rope attached the cinderblock was tethered to the tree.

3 RESULTS

3.1 2018 Weather and Flow Conditions

Water quality data collection occurred from June 6 through October 5, 2018. Flow and weather conditions in the study area during the monitoring period were compared to long-term averages. Table 3.1-1 displays the 2018 monthly temperature and precipitation data against the long term normal (1981-2010). In general, the summer of 2018 in the Project area was wetter and warmer than normal. Mean daily air temperatures were above normal for June through September 2018 and were approximately 5°F higher for July through September. June 2018 was slightly drier than normal, and July through September 2018 were all wetter than normal. September 2018 was especially wetter than normal (5.62 total inches of precipitation in September 2018 versus an average 3.3 inches of precipitation in September 1981-2010).

3.2 City of Watervliet Operations Data

The hydroelectric intake structure draws water from near the surface of the reservoir, at an elevation of 256 feet and above. The hydraulic capacity of the Normanskill Project during the 2018 water quality monitoring period was 120 cfs, which is half of the Project's total capacity of 240 cfs. The capacity of the single generating unit was reduced due to an electrical problem that should be fixed in 2019. Spilling during June and July of the 2018 monitoring period was infrequent or did not occur at all and hydropower generation (i.e. tailrace flow) occurred occasionally, typically for less than 48 hours each time. Several spill events exceeding 400 cfs occurred in August, and near-continuous hydropower generation created additional flow in the tailrace for most of the month. September brought more spill events in the bypass, one exceeding 800 cfs. Hydropower generation occurred almost daily in the latter half of September. Spill and generation are shown on the biweekly data plots shown in Figure 3.4.-5 though Figure 3.4.-13.

3.3 Continuous Monitoring Data Review

Continuous data collection resulted in approximately 20,000 records among the three water quality loggers. Issues encountered with the continuous data loggers are described below.

When the Normanskill Project is not generating and the reservoir water surface elevation is below the flashboards (i.e. no spill), the flow in the bypass reach and tailrace is low, resulting in shallow, slow-moving water that is prone to biological growth. Upon review of the data, it appeared that the DO sensor for the continuous logger downstream the tailrace may have become fouled with biological growth occasionally during the monitoring period, which may have affected the readings. The spot check closely matched the concurrent reading from the continuous logger at the beginning of the biweekly period (after the logger was cleaned and calibrated), but during review of the data, it was not apparent exactly when the biofouling began to occur. On two occasions in the tailrace, the data that occurred near the end of the biweekly period contained erratic data that normalized after the logger was cleaned and calibrated. While the data during these occasions contained erratic and often low DO readings, they were not rejected from the dataset.

A period of erratic DO readings occurred in the bypass on July 30 to 31, 2018. There was no spill on these days and it is unlikely that the sensor was fouled as the readings resumed a typical diurnal pattern following the period of erratic readings. The logger had most recently been serviced on July 27 and was next serviced on August 9, 2018. Since the other DO readings at this site for the entire monitoring period except these two days are above 8 mg/L, these readings seem to be an anomaly.

Of the 19,965 continuous DO data points, just under 0.5% were rejected primarily due to erroneous readings (e.g. isolated low spikes or sensor errors). Site-specific details are provided in Table 3.3-1. Rejected data were removed from the biweekly data plots shown in Appendix A.

3.4 Continuous Monitoring Results

After QA/QC review of the continuous data, the final data set was evaluated. Water temperature from the three monitoring locations is plotted for each month from June through September in Figure 3.4-1 through Figure 3.4-4.

Table 3.4-1 shows monthly minimum, average and maximum DO and water temperature values for each of the three Normanskill Project monitoring sites. The maximum water temperature of 30.72 °C was observed at Site 2 (Tailrace) on July 4, 2018. By comparison, the maximum water temperature recorded in the bypass was 28.06 °C recorded on August 5, 2018. Water temperatures were slightly cooler in both bypass locations compared to the tailrace except when there was spill over the flashboards during which time water temperatures were similar in the bypass and tailrace. There was no logger in the bypass between 5:00 PM on June 12 and 10:45 AM on July 16 as the logger at Site 1a was missing for several weeks after it had been vandalized.

Daily water temperature fluctuations were typically between 3 to 5 °C per day at all locations during periods of no spill over the flashboards, warming during the day and cooling at night. When spill did occur, daily water temperature fluctuations were less.

An overview of all biweekly dissolved oxygen plots is presented in Figure 3.4-5 though Figure 3.4-13. Generation flow and spillway flow are also shown on the plots as they appear to influence DO levels. During low-flow periods when there is no generation or spill, diurnal patterns were observed at both bypass and tailrace sites whereby DO levels increased during the daytime (due to plant photosynthesis) and decreased at night (due to plant respiration). In the tailrace, the DO exhibited particularly large diurnal swings, often fluctuating as much as 10 mg/L between the highest and lowest daily readings.

When the hydroelectric plant starts generating, the DO levels in the tailrace typically decrease and tend to stay low for the duration of hydropower generation, as seen on June 19-20 (see Figure 3.4-6). After the hydroelectric plant stops generating, diurnal patterns resume. The DO in the tailrace fell below the instantaneous NYS standard of 4.0 mg/L several times throughout the duration of hydropower generation. The lowest DO concentration of 0.64 mg/L occurred on September 21 (see Figure 3.4.3-13) several days after the Project was continuously generating; but the DO increased the next couple days although the Project continued generating.

In general, the DO is the bypass is good (usually above 8 mg/l) regardless of whether water is spilling over the flashboards or not. The DO in the initial bypass site (1a) never fell below 9.3 mg/L[4], and the DO in the replacement bypass site (1b) briefly fell below 4.0 mg/L on July 30-31 (see Figure 3.4-9). This period of low DO is an anomaly compared to the rest of the data, as

[4] The DO logger at site 1a was in place from June 6 until June 12, 2018. The DO logger at site 1b was in place from July 16 until October 5, 2018. There was no logger in the bypass between June 12 and July 16.

explained in Section 3.3. Table 3.4-2 shows that the percentage of DO values that were below the instantaneous state standard of 4.0 mg/L at the three sites ranged from 0% (Site 1a) to 4.6% (Site 2).

The NYS standard for the daily average DO is 5.0 mg/L. This standard was always attained in the bypass. However, the average DO in the tailrace fell below the 5.0 mg/L daily average standard on 10 days which are listed in Table 3.4-3. The longest period of days that fell below the daily average DO standard occurred from September 21 to September 25. The Project was generating during most of this time. When the hydroelectric plant stopped generating on September 24, the DO increased to be above the average daily DO standard of 5.0 mg/L. When the hydroelectric plant began generating again on September 25, the DO dropped again, once more falling below the daily average standard.

3.5 Water Quality Information from the City of Watervliet

The City of Watervliet Water Treatment Plant provided data for dissolved oxygen and temperature (among other parameters including pH and turbidity) at the Watervliet raw water intake which is at Elevation 243 feet (approximately 19 feet below the normal pool elevation of 262 feet). The sample is collected in the pump station from a hose that comes off the intake pump. The hose is typically run for about 20 minutes before the sample is collected. After the sample is collected, it is tested at the Water Treatment Plant for pH, DO, temperature, and turbidity. The DO percent saturation is calculated using the DO concentration and temperature. A summary table of the data is found in Table 3.5-1. Samples are typically collected and analyzed once per month; three samples coincided with the 2018 water quality monitoring period. The DO concentration at the raw water intake was 3.5 mg/L, 0.4 mg/L, and 3.1 mg/L on June 28, August 31, and September 24, respectively.

3.6 Water Quality in the Bypass Reach if there was a Year Round 1 cfs Release

As previously explained in Section 2.4.1, there is a relatively constant flow in the bypass reach as a result of flashboard leakage, dam seepage, and flow from a pipe[5] that discharges on river-right about 50 feet downstream of the dam. This flow was measured several times throughout the water quality monitoring period and is fairly steady if water is not spilled over the flashboards. The flow averaged 1.44 cfs during the water quality monitoring period. In addition to flow measurements, the City installed a water level logger in the bypass on June 28, 2018 to monitor water level. When water does not spill over the flashboards, the water level during the monitoring period typically varied 0.15 feet. This data indicates that a continuous year round release of more than 1 cfs is currently being provided.

Water temperatures in the bypass reach varied between 13 °C and 28 °C during the monitoring period (June to September) when critical low flow, warm water temperature conditions were experienced. Water temperatures in the bypass reach increased when warmer water from the top of the impoundment was spilled over the flashboards. Despite warmer water temperatures, the DO in the bypass was generally above 8 mg/l during the monitoring period and complied with stream standards.

[5] The source of water in the pipe is an underground stream that has been re-routed to discharge below the dam.

Since the existing flow in the bypass reach during the 2018 monitoring period is of the same order of magnitude as a 1 cfs release, it is expected that a 1 cfs flow release would have similar water quality as was observed in 2018.

Table 3.1-1: Monthly Long-Term Average Air Temperatures and Precipitation Compared to 2018 at Albany International Airport, NY.

Month	Average Daily Air Temperature (°F)			Monthly Precipitation (inches)		
	Mean (2018)	Normal (1981-2010)	Departure	Total (2018)	Normal (1981-2010)	Departure
June	67.9	67.2	+0.7	3.00	3.79	-0.79
July	76.5	71.8	+4.7	4.72	4.12	+0.60
August	75.1	70.1	+5.0	4.20	3.46	+0.74
September	67.2	61.9	+5.3	5.62	3.3	+2.32

Source: NOAA Online Weather Data for Albany International Airport, NY.

Table 3.3-1: Data QA Summary

Site	Total DO Data Points	Percent Rejected	Reason
Site 1a: Bypass	586	1.19%	Erroneous readings or possible tampering with logger
Site 1b: Bypass	7772	0.15%	Erroneous readings
Site 2: Tailrace	11607	0.68%	Erroneous readings or possible exposure of logger to air
Total	19965	0.49%	-

Table 3.4-1: June – September 2018 Monthly Water Quality Summary Results

	Site 1a: Bypass[6]			Site 1b: Bypass[7]			Site 2: Tailrace		
	Temp (°C)	DO (mg/L)	DO (% sat)	Temp (°C)	DO (mg/L)	DO (% sat)	Temp (°C)	DO (mg/L)	DO (% sat)
June									
Average	17.25	10.31	107.4				21.42	7.21	82.3
Minimum	14.68	9.43	99.2				17.66	1.56	18.8
Maximum	21.02	10.91	115.5				28.04	14.12	167.0
July									
Average				19.97	8.60	94.8	25.58	6.87	84.7
Minimum				14.92	1.85	21.5	22.04	3.12	37.4
Maximum				26.18	10.60	119.1	30.72	15.81	200.9
August									
Average				21.01	9.26	104.1	23.83	6.47	77.2
Minimum				15.72	5.48	58.4	20.68	1.75	19.9
Maximum				28.06	14.03	163.6	28.22	11.08	131.2
September									
Average				17.73	10.60	111.1	20.77	6.55	73.1
Minimum				13.14	7.44	77.5	15.28	0.64	7.0
Maximum				23.66	17.16	174.4	27.10	13.13	143.7

[6] The HOBO logger at Site 1a was installed on 6/6/2018 and was vandalized on 6/12/2018, so there is no data for July through August 2018.
[7] The HOBO logger at Site 1b was installed on 7/16/2018 and was removed on 10/5/2018, so there is no data for June 2018.

Table 3.4-2: Normanskill Project Instantaneous DO Standard Violations in the Bypass and Tailrace

Site	Total DO Data Points	Number of Approved DO Data Points	Number of Measurements < 4.0 mg/L	Percent of Approved Values < 4.0 mg/L
Site 1a: Bypass	586	579	0	0
Site 1b: Bypass	7,772	7,760	18	0.23%
Site 2: Tailrace	11,607	11,528	526	4.6%

Table 3.4-3: Normanskill Project Average Daily DO Standard Violations in the Tailrace (Site 2)

Date	Average Daily DO (mg/L)
7/25/2018	4.06
8/20/2018	4.98
8/21/2018	3.04
8/22/2018	4.63
9/11/2018	4.72
9/12/2018	4.67
9/21/2018	1.51
9/22/2018	3.95
9/23/2018	4.84
9/25/2018	4.87

Table 3.5-1: Watervliet Raw Water Intake Sampling Results (at El. 243 feet)

Date	Time	Temperature (°C)	DO (mg/L)	DO Saturation (%)
6/28/2018	12:15 PM	20.3	3.5	38.5
8/31/2018	9:30 AM	22.4	0.4	4.4
9/24/2018	1:00 PM	19.1	3.1	33.8

Figure 3.4-1: Normanskill Project Water Temperatures, June 2018

Figure 3.4-2: Normanskill Project Water Temperatures, July 2018

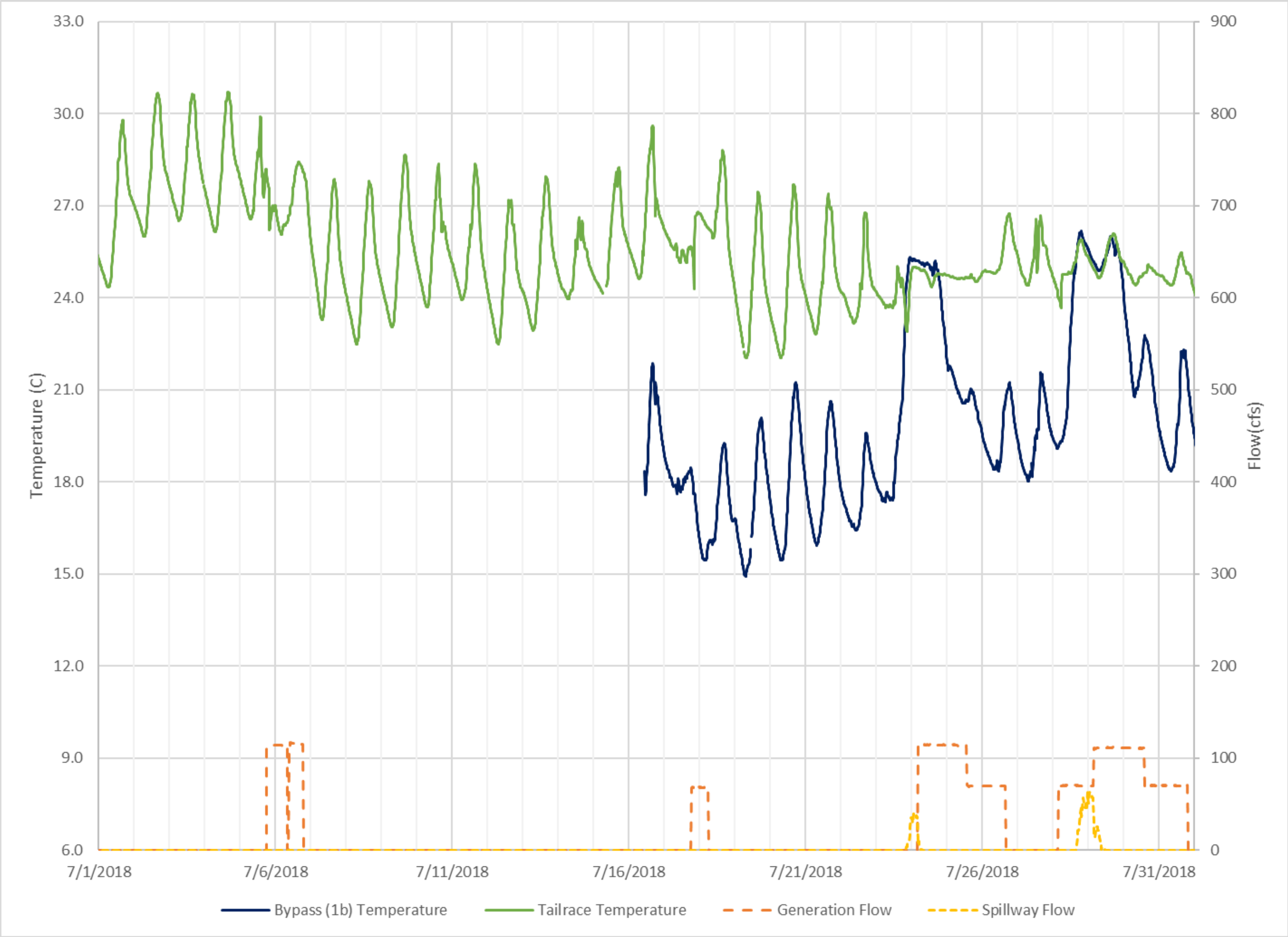


Figure 3.4-3: Normanskill Project Water Temperatures, August 2018

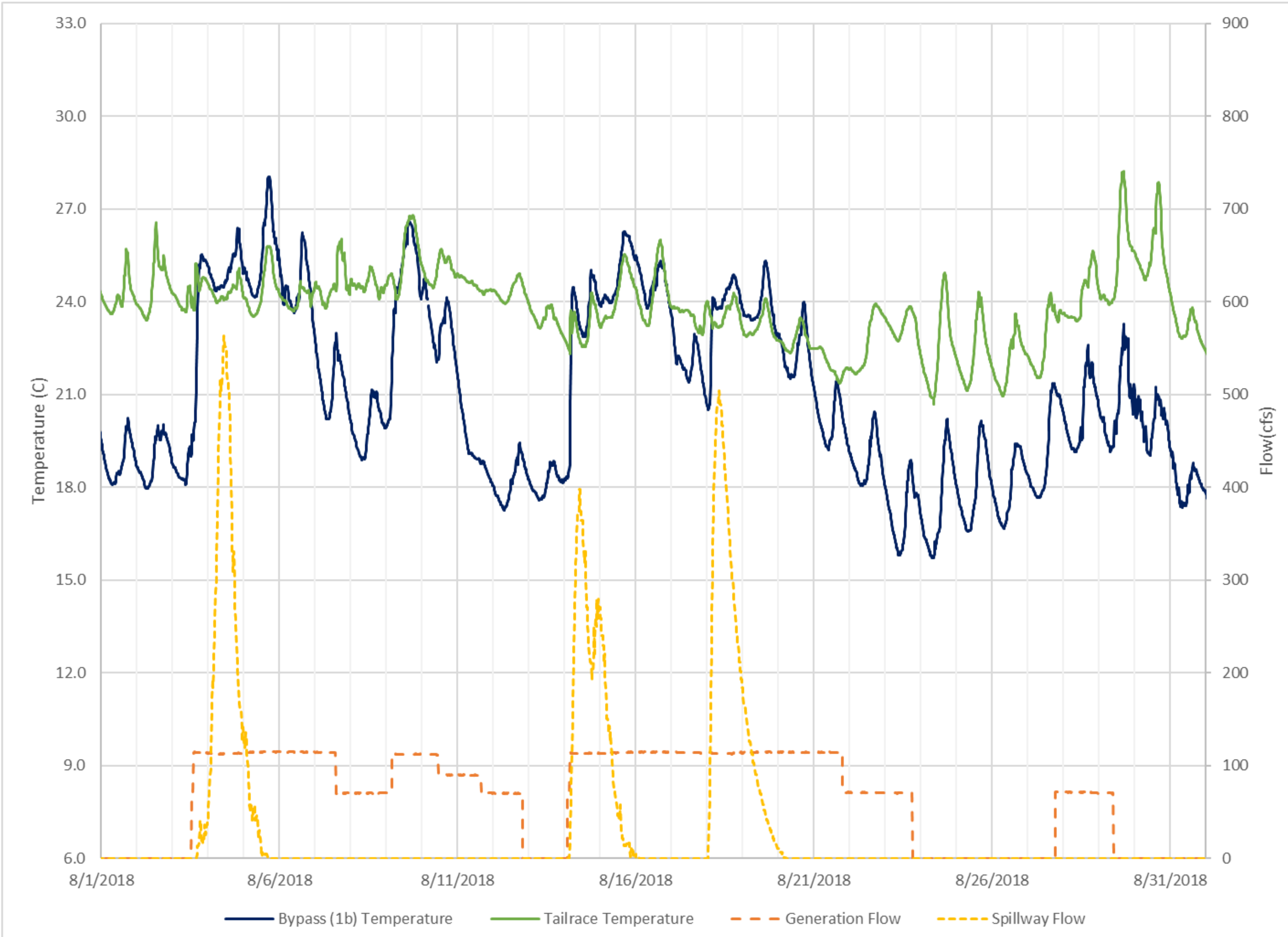


Figure 3.4-4: Normanskill Project Water Temperatures, September 2018

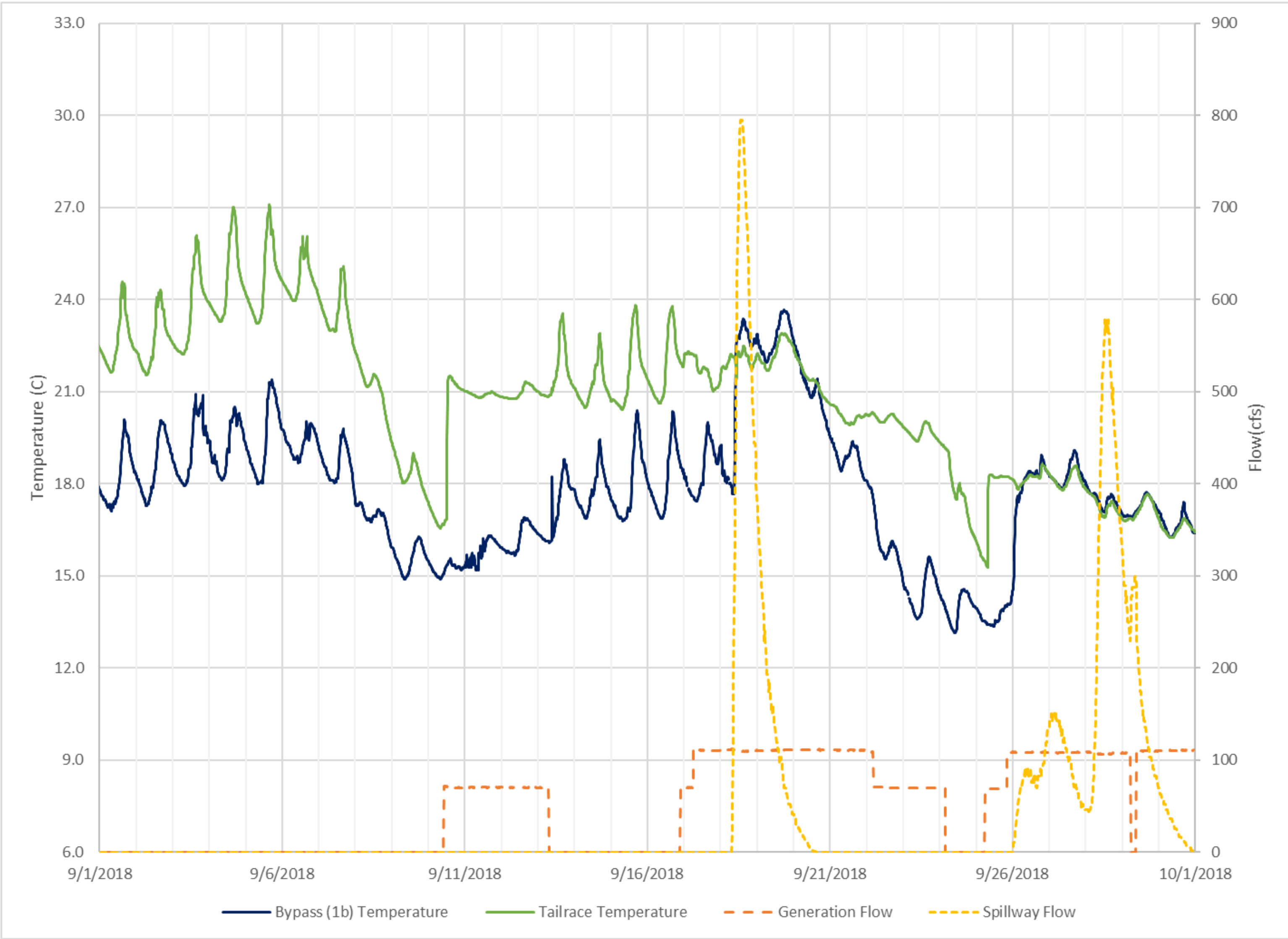


Figure 3.4-5: Normanskill Project Dissolved Oxygen Results, June 6-15, 2018

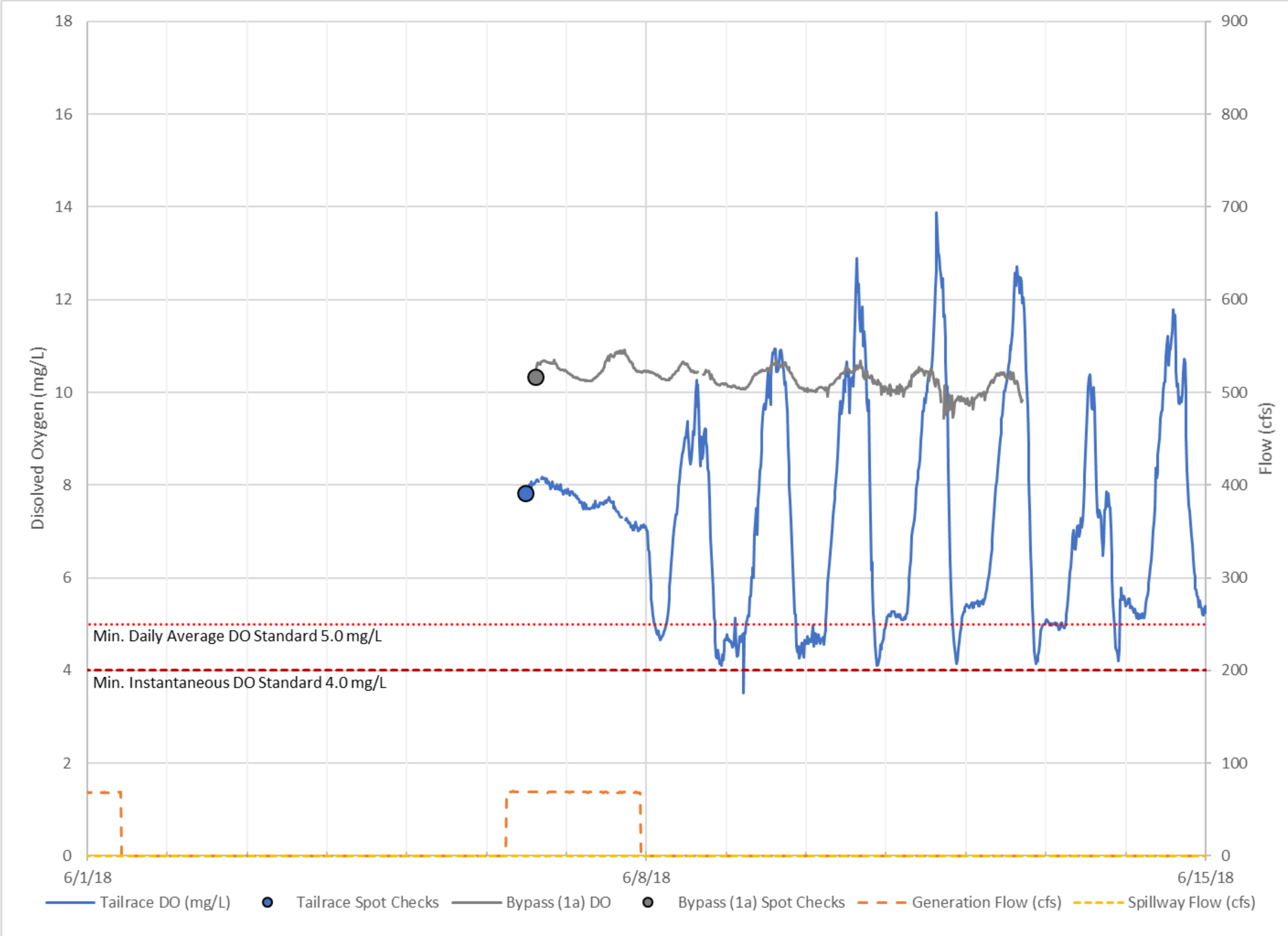


Figure 3.4-6: Normanskill Project Dissolved Oxygen Results, June 15-29, 2018

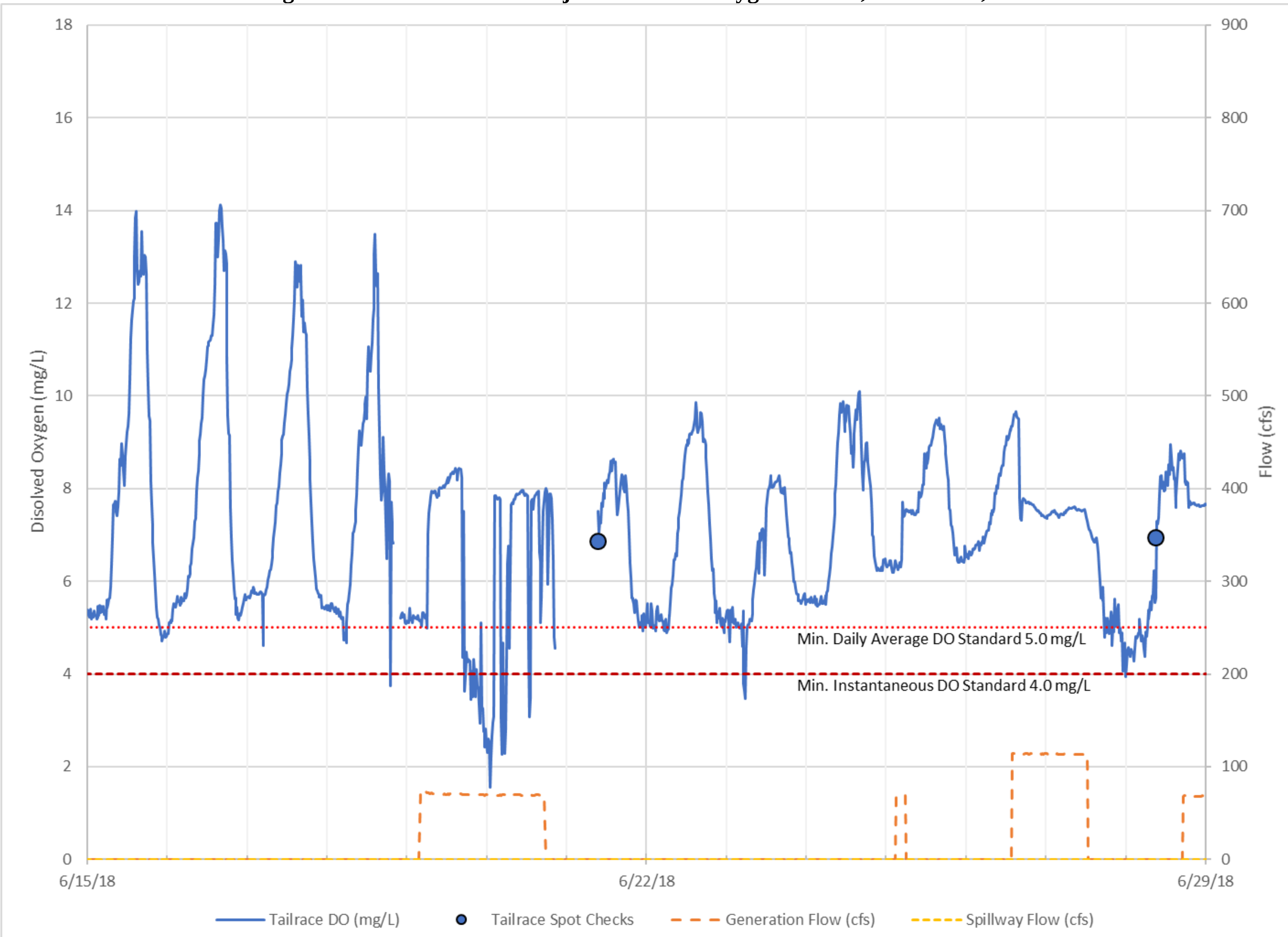


Figure 3.4-7: Normanskill Project Dissolved Oxygen Results, June 29-July 13, 2018

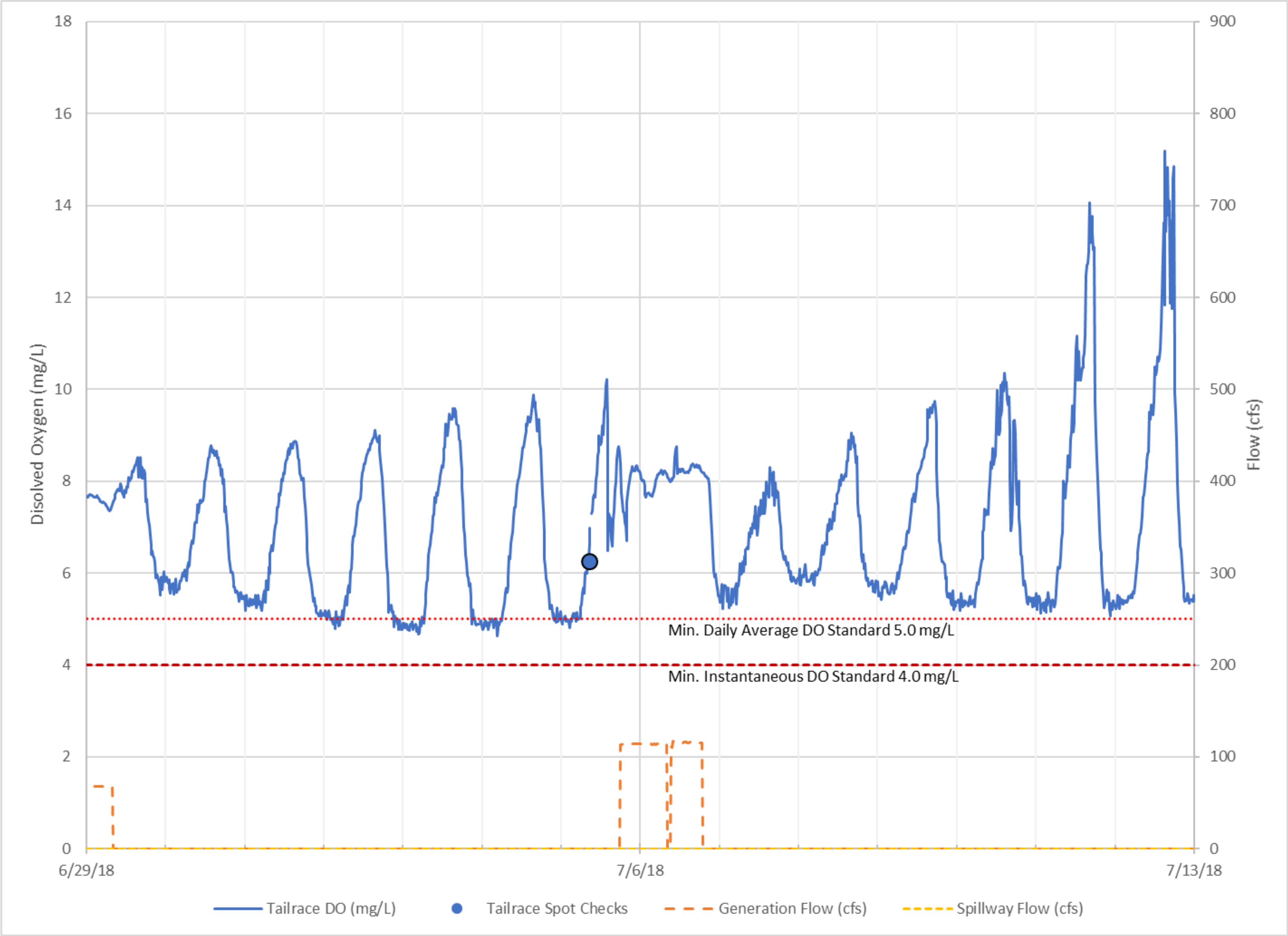


Figure 3.4-8: Normanskill Project Dissolved Oxygen Results, July 13-27, 2018

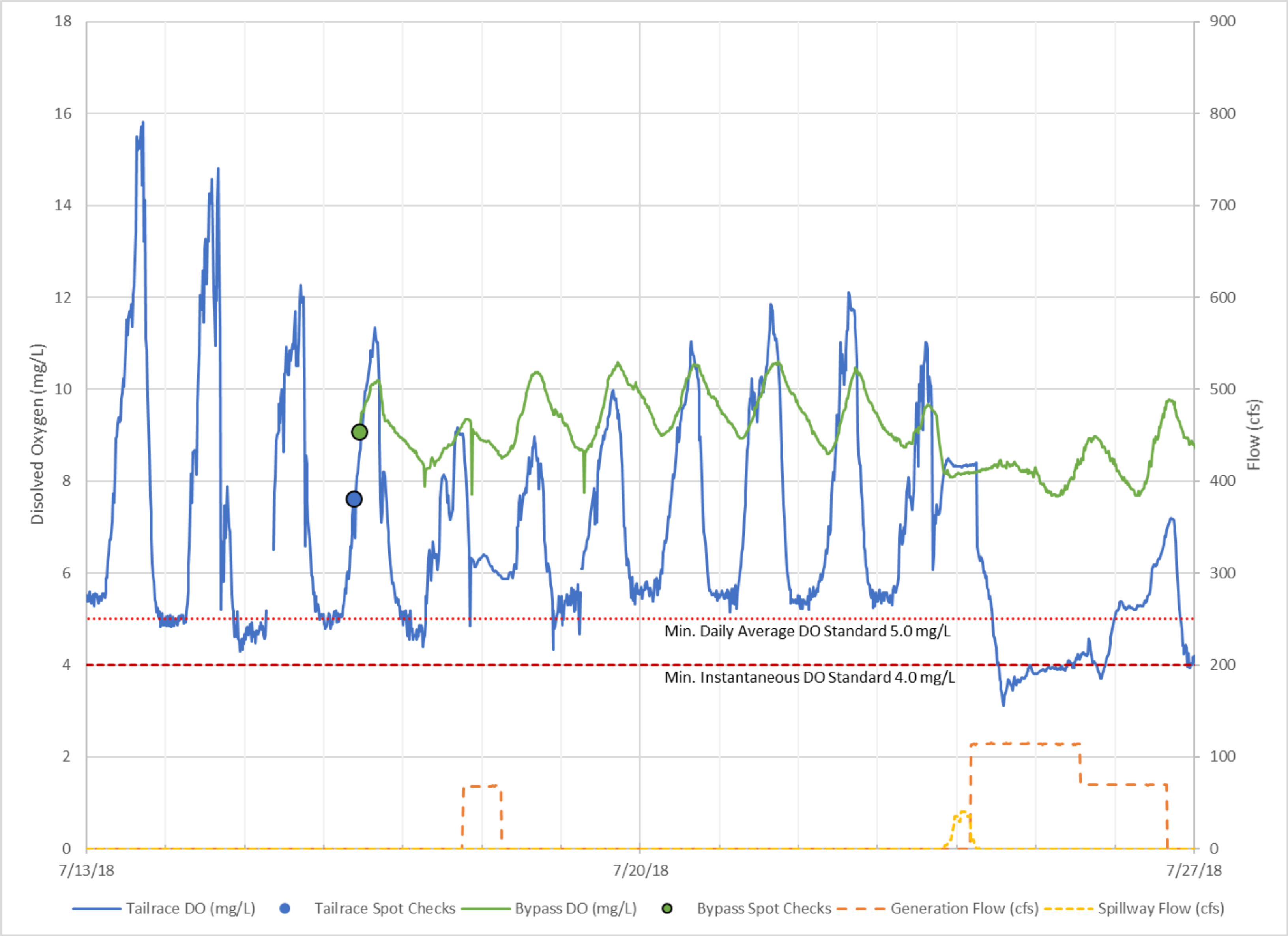


Figure 3.4-9: Normanskill Project Dissolved Oxygen Results, July 27-August 10, 2018

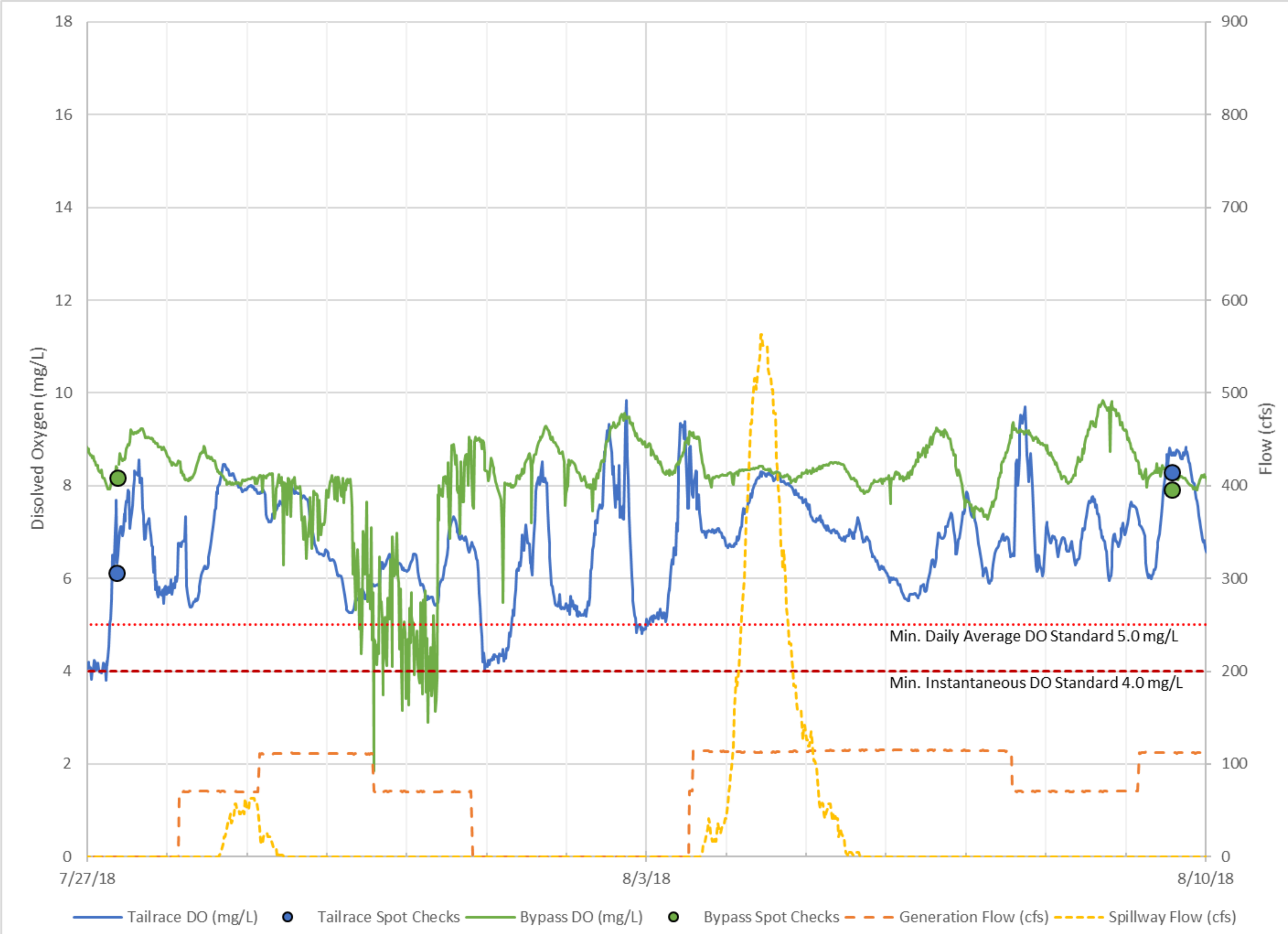


Figure 3.4-10: Normanskill Project Dissolved Oxygen Results, August 10-24, 2018

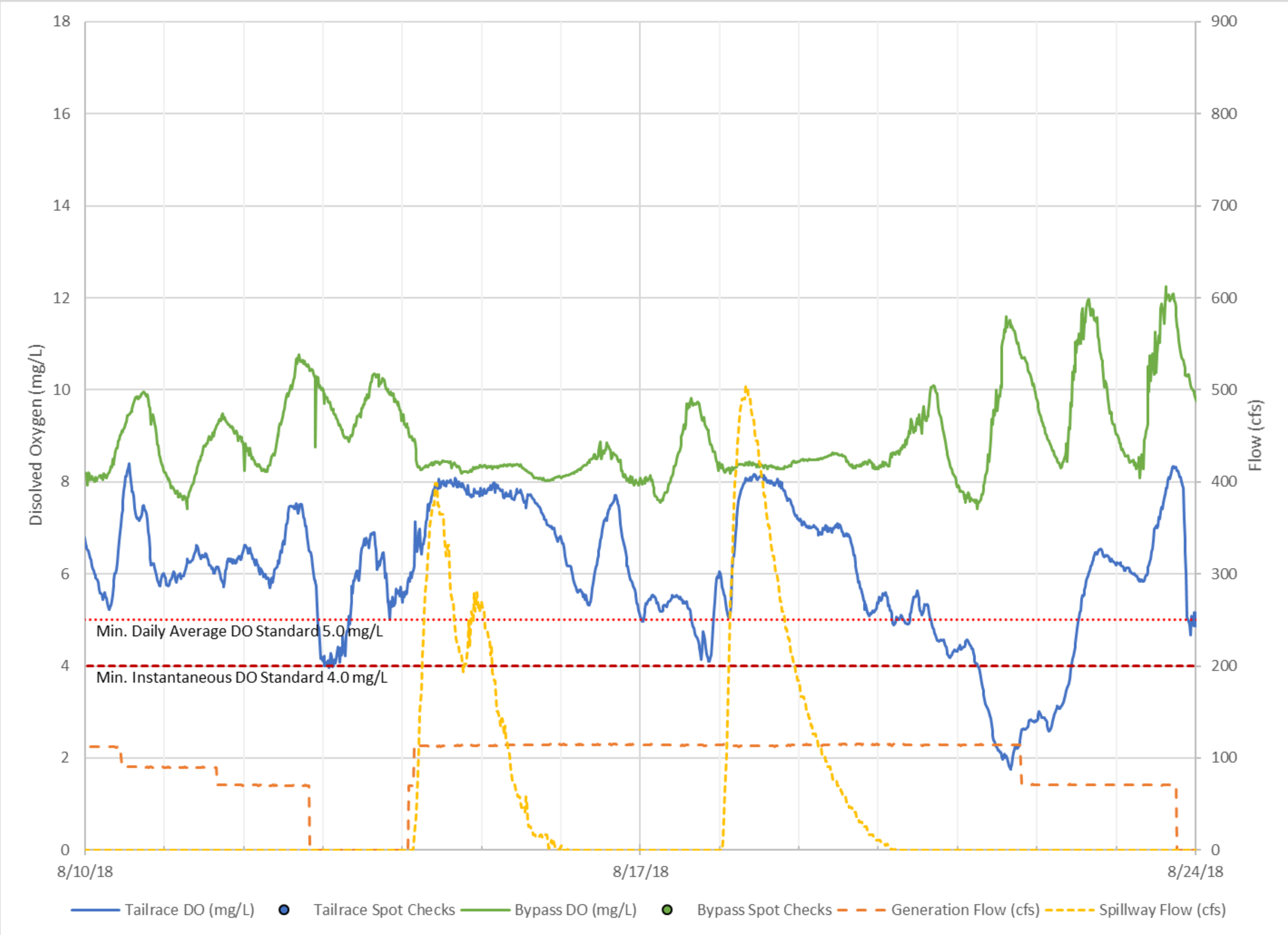


Figure 3.4-11: Normanskill Project Dissolved Oxygen Results, August 24-September 7, 2018

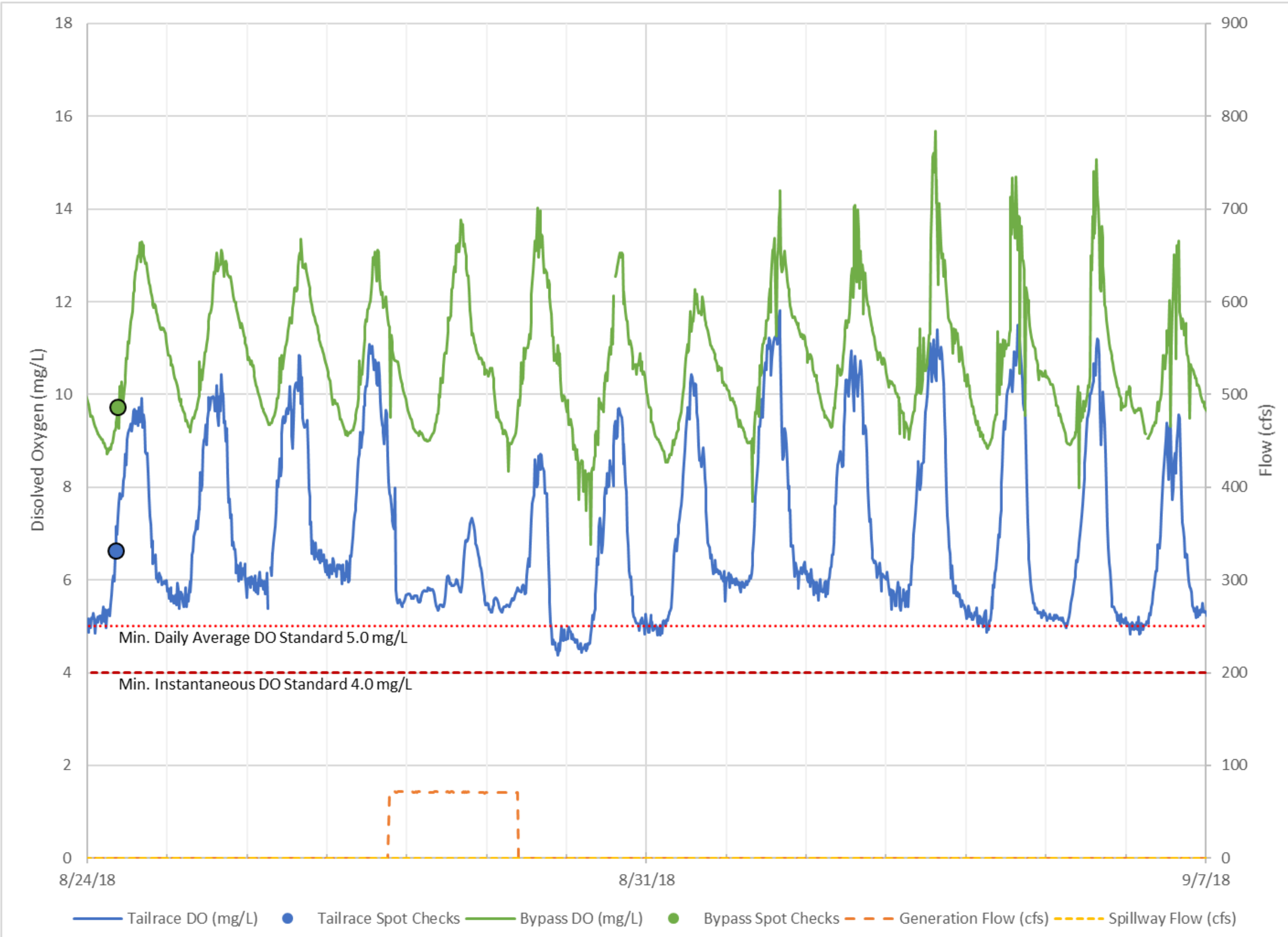


Figure 3.4-12: Normanskill Project Dissolved Oxygen Results, September 7-21, 2018

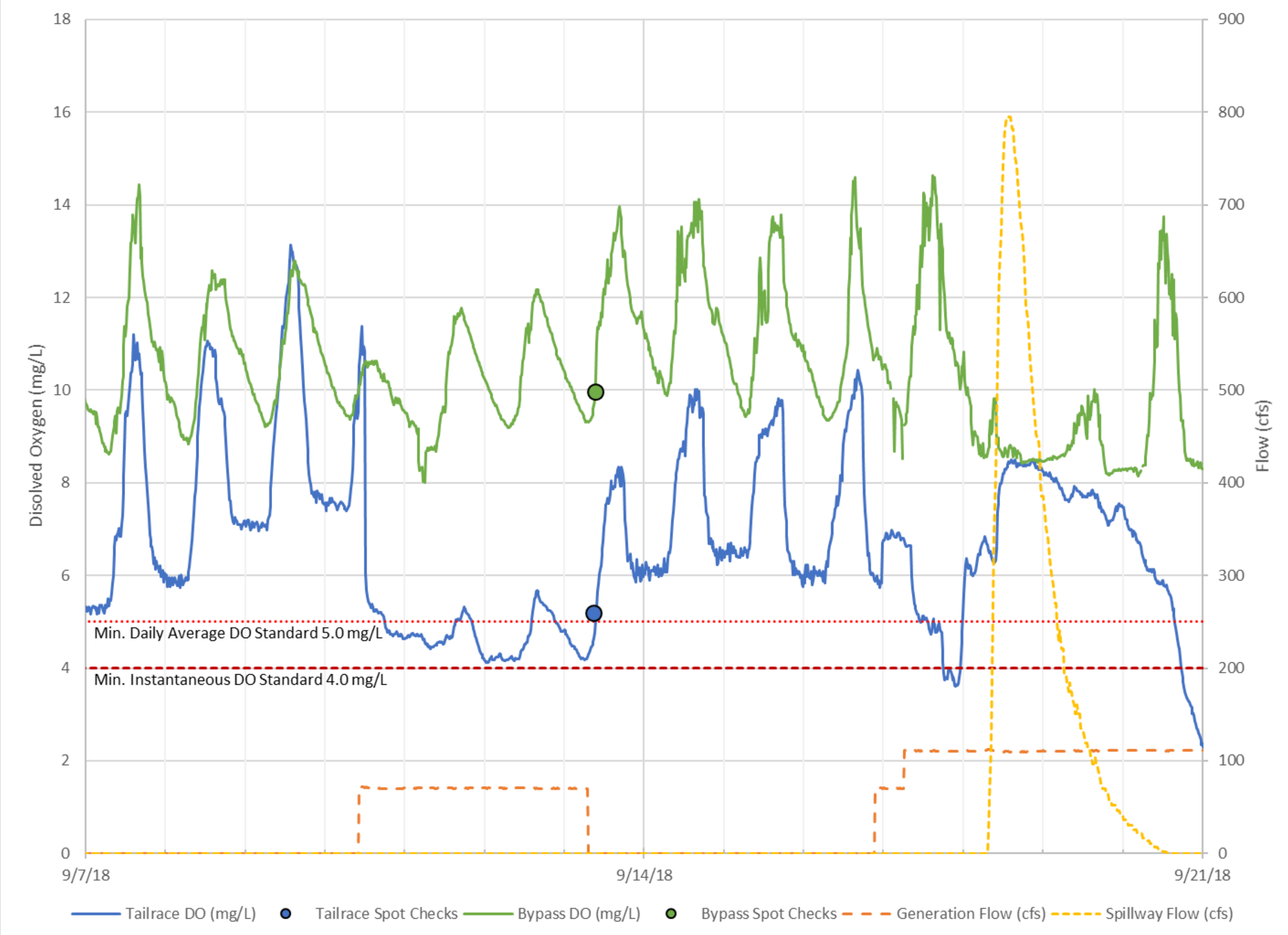
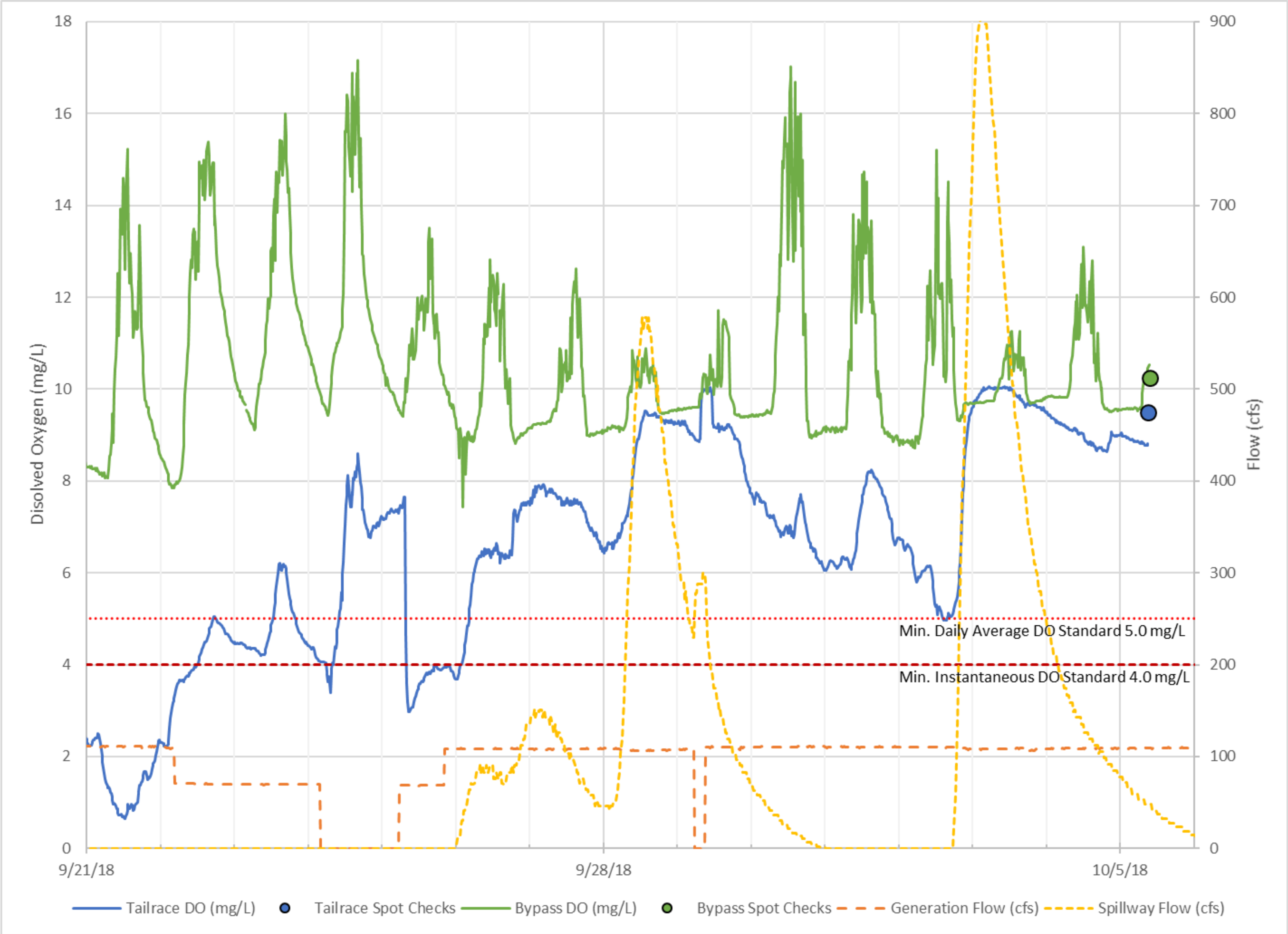


Figure 3.4-13: Normanskill Project Dissolved Oxygen Results, September 21-October 6, 2018



4 CONCLUSIONS

The study collected baseline water quality information for the Normanskill Project vicinity for the months of June through September including continuous water temperature and dissolved oxygen. Data was collected over a range of typical flow and weather conditions during the summer of 2018 including periods of low river flow and warm air temperatures, as well as occasional high flow events near the end of the monitoring period. The study found that water quality conditions in the Normans Kill in the bypass are good with DO generally being above 8 mg/L and meeting state DO standards.

Although DO readings downstream of the tailrace are generally above NYS water quality standards during low flow periods, they can fall below the instantaneous NYS water quality standard of 4.0 mg/L and the NYS daily average water quality standard of 5.0 mg/L on occasions during generation. The low tailrace DO data during power generation seems to indicate that the reservoir may experience low DO which is further collaborated by data at the water supply intake collected by the City of Watervliet.

Flow data collected in the bypass reach in 2018 averaged 1.44 cfs during the water quality monitoring period indicating that a continuous year-round release of more than 1 cfs is already being provided. Although low DO conditions may occur in the reservoir, the DO in the bypass released from the continuous base flow was generally above 8 mg/L during the monitoring season and therefore complies with water quality standards.

5 REFERENCES

NYSDEC. New York Codes, Rules and Regulations. Title 6 Department of Environmental Conservation. Part 701: Classifications-Surface Waters and Groundwaters.

NYSDEC. New York Codes, Rules and Regulations. Title 6 Department of Environmental Conservation. Part 703: Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations.