FISH OPERATIONS PLAN IMPLEMENTATION REPORT

June 2021

U.S. Army Corps of Engineers
Northwestern Division
Portland, OR.

Introduction

The U.S. Army Corps of Engineers (Corps) developed this report in accordance with the 2021 Fish Operations Plan[1] (2021 FOP). The 2021 FOP describes the Corps' planned operations for juvenile fish passage at its four lower Snake River and four lower Columbia River dams during the 2021 spring and summer fish migration seasons, generally April 3 through August 31. The 2021 FOP is consistent with spill operations for juvenile fish passage and the regional forum process for adaptive management and in-season management provisions outlined in the 2020 NOAA Fisheries Columbia River System Biological Opinion (2020 BiOp)[2], the 2008 Columbia Basin Fish Accords[3], the Corps' requirements under the Endangered Species Act (ESA), and is the subject of ongoing communications with the relevant wildlife agencies to ensure consistency with the ESA. Other project operations and water management actions not specifically addressed in this document will be consistent with the 2020 BiOp and other guiding operative documents, including the 2021 Water Management Plan (WMP), seasonal WMP updates, and the 2021 Fish Passage Plan (FPP).

This report describes the Corps' implementation of the 2021 FOP during the month of June. In particular, information in this report includes the following:

- total flow: the total hourly river flow rate;
- generation flow: the hourly flow through the powerhouse units;
- target spill: the spill target for that hour (Table 1);
- adjusted spill: the hourly spill level that can be achieved taking into consideration that spill may vary as a function of total river flow, forebay elevation and generator capacity, and is subject to routine operational adjustments that limit the ability to spill to the target spill (see 2021 FOP, Section 4.1);
- actual spill: the hourly flow over the spillway; and,

[1] The 2021 FOP was posted to the Technical Management Team (TMT) website on March 31, 2021 (http://pweb.crohms.org/tmt/documents/fpp/2021/).
[2] The Corps, in coordination with the other Action Agencies, and National Marine Fisheries Service (NMFS), employs the Regional Implementation Oversight Group (RIOG) and technical teams including the Technical Management Team (TMT) and Fish Passage Operations & Maintenance (FPOM), to coordinate with state, tribal and other federal experts for recommendations for implementing operations consistent with NMFS' Columbia River System Biological Opinions.
[3] The 2020 Amendment to and 2018 Extension of the 2008 Columbia Basin Fish Accords are available at https://www.salmonrecovery.gov/Partners/FishAccords.aspx

- resultant 12-hour average TDG for the tailwater at each project.

This report also provides information on issues and unanticipated or emergency situations that arose during implementation of the 2021 FOP in June 2021.

Data Reporting

I. For each project providing fish passage operations, this report contains a graph displaying the performance of the spring fish passage spill program for the month of June, with hourly spill, target spill, adjusted spill, generation, and total flows. The monthly graphs begin on June 1 and end on June 30 and reflect the following operations for the lower Snake River and the lower Columbia River projects:

- The black line represents the average hourly total river flow through the project in thousand cubic feet per second (kcfs).
- The orange line represents the average hourly generation flow through the powerhouse each hour in kcfs.
- The thin solid blue line represents the actual average hourly spill level through the spillway in kcfs.
- The dashed blue line represents the spill cap portion of the target spill estimated to reach the gas cap or target TDG.
- The thick light blue line represents the performance standard spill level portion of the target spill.
- The thick dark blue line represents the adjusted spill cap spill: the hourly spill cap level that can be achieved taking into consideration that spill may vary as a function of total river flow, forebay elevation, and generator capacity, and is subject to routine operational adjustments that limit the ability to spill to the target spill (2021 FOP section 4.1).

II. The average daily %TDG for the 12 highest hours for all projects is shown in the June 2021 Average Percent TDG Values Table (Table 4). The numbers in red indicate the project exceeded the %TDG cap - i.e. 125% (tailwater) for each project.

General Implementation Remarks

For all projects that spill for fish passage, the actual spill may vary from the adjusted spill due to various conditions as described below. When actual spill varied from adjusted spill levels during periods of voluntary spill, the change in spill level is described below in the June 2021 Spill Variance Table (Table 2).[4] The Spill Variance Table includes average hourly data; but when spill varies from adjusted spill for a portion of an hour, it is characterized as a variance for a full hour. There are instances when the hourly adjusted spill levels are not achievable due to mechanical limitations in setting spill gates to implement the regionally coordinated spill pattern. The project operator sets the spill gate stops to most closely approximate the adjusted spill to the

[4] Forced spill conditions shown in the graphs are not considered variances and are not reported in the Spill Variance Table. Forced spill conditions may result from lack of load, high river inflows that exceed available powerhouse capacity, scheduled or unscheduled turbine unit outages or transmission outages of various durations, passing debris, etc.

extent practicable. Other routine activities that changed spill levels, which were coordinated with regional partners, are identified in the monthly Pre-Coordinated Operations Table (Table 3).

"Low flow" operations at the lower Columbia and lower Snake projects are triggered when inflow is insufficient to provide both minimum generation and the target spill levels. For this report, the decrease in target spill is represented as adjusted spill. In these situations, the projects operate at minimum generation and pass the remainder of project inflow as spill and through other routes, such as fish ladders, sluiceways, and navigation locks. As flows transition from higher flows to low flows, there may be situations when flows recede at a higher rate than forecasted. In addition, inflows provided by nonfederal projects upstream are variable and uncertain.

The combination of these factors may result in instances when unanticipated changes to inflow result in forebay elevations dropping to the low end of the Minimum Operating Pool (MOP). Since these projects have limited operating flexibility, maintaining minimum generation, MOP elevation, and the target spill may not be possible throughout every hour.

Actual spill levels at Corps projects may vary up to ±2 kcfs within the hour (except as otherwise noted in the 2021 FOP for Bonneville and The Dalles dams,[5] which may range up to ±3 kcfs) as compared to a target spill. A number of factors influence actual spill, including hydraulic efficiency, exact gate opening calibration, spillway gate hoist cable stretch due to temperature changes, and forebay elevation (e.g. a higher forebay results in a greater level of spill since more water can pass under the spill gate). Transition periods between gas cap spill and performance standard spill hours may result in actual hourly spill levels that are slightly higher or lower than target spill levels.

Occurrences requiring an adjustment in operations and/or regional coordination are described in greater detail in the "Operational Adjustments" section below.

June Operations

The month of June was characterized by below average precipitation and flows for the lower Snake and lower Columbia Rivers. The June 2021 observed precipitation was 30% of average on the Snake River above Ice Harbor and 39% of average on the Columbia River above The Dalles. The NOAA Northwest River Forecast Center runoff summary for June indicated that the adjusted runoff for the Snake River at Lower Granite was 56% of the 30-year average (1981-2010) with a volume of 3.4 MAF (Million acre-feet)[6]. The June 2021 adjusted runoff for the Columbia River at The Dalles was 90% of the 30-year average (1981-2010) with a volume of 23.4 MAF.[7]

[5] As specified in the 2021 FOP Section 3.
[6] Retrieved July 4, 2021: https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5
[7] Retrieved July 4, 2021: https://www.nwrfc.noaa.gov/runoff/runoff_summary.php

Spring spill operations occur April 3–June 20 at the four lower Snake River projects, and April 10–June 15 at the four lower Columbia River projects. Spring target spill levels for June 2021 at each project are defined in Table 1.

Table 1: Summary of 2021 spring target spill levels at lower Snake River and lower Columbia River projects.

PROJECT	SPRING FLEX SPILL (16 hours per day) [A, B, C, E]	SPRING PERFORMANCE STANDARD SPILL (8 hours per day) [B, D, E]
Lower Granite [E]	125% Gas Cap	20 kcfs
Little Goose [F, G]	125% Gas Cap	30%
Lower Monumental [E]	125% Gas Cap (uniform spill pattern)	30 kcfs (uniform spill pattern)
Ice Harbor	125% Gas Cap	30%
McNary	125% Gas Cap	48%
John Day	120% TDG target	32%
The Dalles [H]	40%	40%
Bonneville [I]	125% Gas Cap	100 kcfs

A. If deleterious impacts of the proposed spill operations are observed in-season, existing adaptive management processes may be employed to address the cause of the impacts.

B. Spill may be temporarily reduced at any project to ensure navigation safety or transmission reliability. In order to operate consistently with state water quality standards, spill may also be reduced if observed Gas Bubble Trauma (GBT) levels exceed those identified in state water quality standards or if minimum sample sizes for salmonid or native, non-salmonid fish are not met (*See* WASH. ADMIN. CODE § 173-201A-200(1)(f)(ii)(B)(III) and *Order Approving a Modification to the Oregon's Water Quality Standard for Total Dissolved Gas in the Columbia River Mainstem*, page 5).

C. 125% Gas Cap spill is spill to the maximum level that meets, but does not exceed, the TDG criteria allowed under state laws. This includes a criterion for not exceeding 126% TDG for the average of the two greatest hourly values within a day.

D. The 8 hours of performance standard spill may occur with some flexibility (except for Lower Granite, Little Goose, and Lower Monumental operations described in the footnotes below). Other than at The Dalles Dam, performance standard spill occurs in either a single 8-hour block or two separate blocks per calendar day. Performance standard spill is not to be implemented between 2200-0300 hours. No ponding above current MOP assumptions except as noted below.

E. If adult passage delays are observed at Lower Granite or Lower Monumental dams, the Corps may implement performance standard spill at these projects starting in the morning (AM) and continuing for at least 4 consecutive hours to target hours of peak adult passage. If performance standard spill is not able to be implemented due to lack of load conditions at the targeted start times, performance standard spill will begin as soon as practicable during morning hours and continue for at least 4 consecutive hours. Implementation of this modification will trigger in-season re-evaluation of options to balance power principle consistent with existing analysis in the CRSO EIS and 2020 BiOps.

F. Little Goose Exception One - Within 1 business day of a cumulative total of 25 adult spring Chinook salmon (not including jacks) passing Lower Monumental Dam, the Corps will implement performance standard spill at Little Goose Dam for 8 consecutive AM hours (April 3-15 starting at 0500 hours; April 16-June 20 starting at 0400 hours) to target hours of peak adult passage. If performance standard spill is not able to be implemented due to lack of load conditions at the targeted start times, performance standard spill will begin as soon as practicable during morning

hours and continue for up to 8 consecutive hours consistent with the adaptive management principles of the 2020 BiOps.

G. Little Goose Exception Two - During periods of lack of capacity, lack of load conditions, implementing performance standard spill for 8 consecutive hours as described in footnote F may result in storing additional inflow that exceeds hydraulic capacity in the forebay above MOP. If it is necessary to pond water to achieve the 8-hour block of 30% spill during high inflow, water stored above MOP should be drafted out over the remaining hours by increasing spill to pass inflow from 1200-1600 hours (or 1300-1700 hours from April 3-15), then increasing spill as necessary from 1600-0400 (or 1700-0500 hours from April 3-15) to draft the pool back to MOP. If it is forecasted that the drafting spill will result in exceeding 130% TDG in the tailrace, all 16 hours will be used to return the pool to MOP.

H. Fish passage spill at The Dalles Dam should be limited to spillbays 1-8 unless river flow exceeds 350 kcfs, then spill outside the spillwall is permitted. TDG levels in The Dalles tailrace may fluctuate up to 125% TDG prior to reducing spill at upstream projects or reducing spill below 40% at The Dalles.

I. Fish passage spill at Bonneville Dam should not exceed 150 kcfs due to erosion concerns.

In its implementation of the 2021 FOP in June, the Corps evaluated conditions every day to establish spill caps at a level that was estimated to meet, but not exceed, the gas cap or target TDG in the tailrace (see Table 4).[8] This evaluation considered: environmental conditions (e.g., river flow, wind, water temperature, barometric pressure, incoming TDG from upstream, and water travel time) and project operations (e.g., spill level, spill pattern, tailwater elevation, proportion of flow through the turbines, and project configuration).

Summer spill operations occur June 21–August 31 at the four lower Snake River projects, and June 16–August 31 at the four lower Columbia River projects (Table 2).

Table 2: Summary of 2021 summer target spill levels at lower Snake River and lower Columbia River projects.

PROJECT	SUMMER SPILL[A] (June 21/16 – August 14) (24 hrs/day)	SUMMER SPILL[A] (August 15 – August 31) (24 hrs/day)
Lower Granite[B]	18 kcfs	Spillway weir (SW) flow or ~7 kcfs spill
Little Goose[B]	30%	SW flow or ~7 kcfs spill
Lower Monumental[B]	17 kcfs	SW flow or ~7 kcfs spill
Ice Harbor[B]	30%	SW flow or ~8.5 kcfs spill
McNary	57%	20 kcfs
John Day	35%	20 kcfs
The Dalles	40%	30%
Bonneville	95 kcfs	50 kcfs

A. Spill may be temporarily reduced below the FOP target summer spill level at any project if necessary to ensure navigation safety or transmission reliability, or to avoid exceeding State TDG standards.

B. Summer spill from August 15-August 31 may be through the SW or through conventional spillbays using the appropriate FPP spill pattern for each project. The SWs will be operated consistent with the SW

[8] See 2021 FOP, Section 2.2

operational criteria in the FPP.

Operational Adjustments

1. Lower Monumental Dam

From June 28 at 1600 hours through July 6 at 1700 hours, the uniform spill pattern[9] was applied to spill at Lower Monumental Dam in place of the bulk spill pattern specified in the 2021 FOP. This action was in response to TDG exceeding state standards in the Ice Harbor Dam forebay resulting from summer spill (17 kcfs) at Lower Monumental dam using the bulk spill pattern.[10] Regional salmon managers were made aware of this operational adjustment on June 28.

2. McNary Dam

From June 9 to June 10, the spill pattern applied at McNary Dam during spillway weir (SW) removal was modified from the operation specified in the 2021 FPP[11]. Due to new safety requirements related to load limitations for the spillway cranes, bays being worked in and adjacent bays are to be closed, which includes the bays where the SW spillgate sections are stored. SW's (bays 19 and 20) were closed on June 9 at 0630 hours. At 0900 hours, bays 14 to 18 and 21 were also closed so gate sections could be retrieved and installed in bays 19 and 20. The day's activity concluded at 1700 hours with bays 14 to 18 and 21 reopened. On June 10, from 0645 to 1700 hours, the process was repeated, after which all bays were opened with standard spill gates in place. 2021 FPP Table MCN-10 for SW removal was used except for the time frames described above when gate sections were moved on June 9 and 10. The spill volume was averaged across active bays 1 through 13 and 22 when the other bays were closed both days. The bulk spill pattern necessitated a reduction in the 125% TDG spill cap. At the end of work on June 10, the spill pattern reflected FPP McNary Table MCN-9[12]. FPOM members were made aware of this operational adjustment via email on June 13[13].

3. John Day Dam

Beginning at 0500 on June 5, spill gate 3 at John Day Dam was inoperable. The gate remains in the closed position and spill is distributed to adjacent spill bays to maintain the target spill level. During spring spill, the 120% TDG target spill level was reduced due to increased tailwater TDG levels caused by the change in spill pattern. The estimated return to service date for spill gate 3 is

[9] See 2021 FPP, Table LMN-8, Lower Monumental Dam Uniform Spill Patterns with RSW.
[10] See 2021 FPP, Table LMN-7, Lower Monumental Dam Bulk Spill Patterns with RSW.
[11] See 2021 FPP, Table MCN 10, McNary Dam Spill Pattern During TSW Removal in Bays 19-20
[12] See 2021 FPP, Table MCN 9, McNary Dam Spill Pattern Without TSWs
[13] The Memorandum For Record (MFR) for this operation can be found at http://pweb.crohms.org/tmt/documents/FPOM/2010/NWW%20Memos%20of%20Coordination%20and%20Notification/MCN%20MOC%20and%20MFR/21%20MCN%2006%20MFR%20modified%20spill%20pattern%20for%20TSW%20removal.pdf

unknown. FPOM members were made aware of this operational adjustment via email on June 7[14].

[14] The MFR for this operation is can be found at http://pweb.crohms.org/tmt/documents/FPOM/2010/NWP%20Memos%20of%20Coordination%20and%20Notification/JDA%20MOC%20and%20MFR/

Table 3: Spill Variances – June 2021 (6/1 to 6/30)

Project	Parameter	Date	Time[15]	# of Hours	Type	Reason
Little Goose	Reduced Spill	6/22	0100-0300	3	Program Error	Hourly spill remained at 7 kcfs (less than adjusted spill target of 11 kcfs) due to inability to contact project operator to initiate a spill target change. [16]
John Day	Additional Spill	6/1	1200-1300	2	Human Error	Hourly spill increased to 179 kcfs (greater than adjusted spill target of 176 kcfs) due to implementation of an incorrect spill target.[17]
John Day	Additional Spill	6/29 6/30	1900-2400 0100-0700	6 7	Maintenance	Hourly spill increased to between 37% and 42% (greater than adjusted spill target of 35%) due to an unscheduled transmission line outage.
The Dalles	Additional Spill	6/29	2000-2300	4	Human Error	Hourly spill increased to 88 kcfs (greater than adjusted spill target of 75 kcfs) due to implementation of incorrect spill target. [18]

[15] Data collected for reporting spill variances is reported using hourly-averaged data. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented in the Spill Variance Table as an hour.
[16] Per the 2021 FOP section 8.2.3, during the 30% spill operation when project outflows are 32 kcfs, the spill operation will transition from 30% to a constant spill level of approximately 7-11 kcfs to help stabilize project outflow, meet Lower Monumental target spill levels, and maintain MOP elevation at Little Goose. The constant spill level will be based on the previous day's average total project outflow, as follows: 11 kcfs when total outflow is 28.0 to 32.0 kcfs, 9 kcfs when total outflow is 24.0 to 27.9 kcfs, and 7 kcfs when total outflow is = 23.9 kcfs. Actual spill may range up to ±1 kcfs from the target spill level. BPA schedulers were unable to contact the project to initiate this change due to issues with the phone line.
[17] An incorrect spill cap was used.
[18] Spill during this hour, spill was 40% of total outflow but should have been limited by the spill cap.

Table 4: Pre-Coordinated Operations – June 2021 (6/1 to 6/30)

Project	Parameter	Date	Time[19]	# of Hours	Type	Reason
Lower Monumental	Reduced Spill	6/2 6/4 6/6 6/8 6/10 6/12 6/14 6/16 6/18	1900-2000 1900 1800-1900 1700-1800 1800-1900 1600-1800 1800-1900 1900-2000 1700-1800	2 1 2 2 2 3 2 2 2	Navigation	Hourly spill decreased to between 14 and 27 kcfs (less than adjusted spill target of 30 kcfs) for safe navigation. Regionally coordinated via 2021 FOP, Sections 4.1 and 4.6.
Little Goose	Reduced Spill	6/27 6/28 6/30	1400 1600 0400	1 1 1	Navigation	Hourly spill decreased to 28% (less than adjusted spill target of 30% ± 1%) for navigation. Regionally coordinated via 2021 FOP, Sections 4.1 and 4.6.
Little Goose	Reduced Spill	6/27	1600	1	Transmission Reliability	Hourly spill decreased to 28% (less than adjusted spill target of 30% ± 1%). due to an increase in generation to deploy reserves. Regionally coordinated via 2021 FOP, Section 4.4.1.
Ice Harbor	Reduced Spill	6/24 6/28	0200, 0500 0700	2 1	Navigation	Hourly spill decreased to 28% (less than adjusted spill target of 30% ± 1%) for navigation. Regionally coordinated via 2021 FOP, Sections 4.1 and 4.6.
John Day	Reduced Spill	6/3 6/5 6/7 6/8 6/9	1200 0400-0600 0400 1300 1000	1 3 1 1 1	Navigation	Hourly spill decreased to between 127 and 171 kcfs (less than adjusted spill target of between 148 and 180 kcfs) for navigation. Regionally coordinated via 2021 FOP, Sections 4.1 and 4.6.
John Day	Reduced Spill	6/10	1900	1	Transmission Reliability	Hourly spill decreased to 30% (less than adjusted spill target of 32% ± 1%) due to an increase in generation to deploy reserves. Regionally coordinated via 2021 FOP, Section 4.4.1.
John Day	Additional Spill	6/30	2200	1	Transmission Reliability	Hourly spill increased to 37% (greater than adjusted spill target of 35% ± 1%) due to an increase in generation to provide reserves. Regionally coordinated via 2021 FOP, Section 4.4.1.

[19] Note: Data collected for reporting spill variances is reported using hourly-averaged data. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented in the Spill Variance Table as an hour.

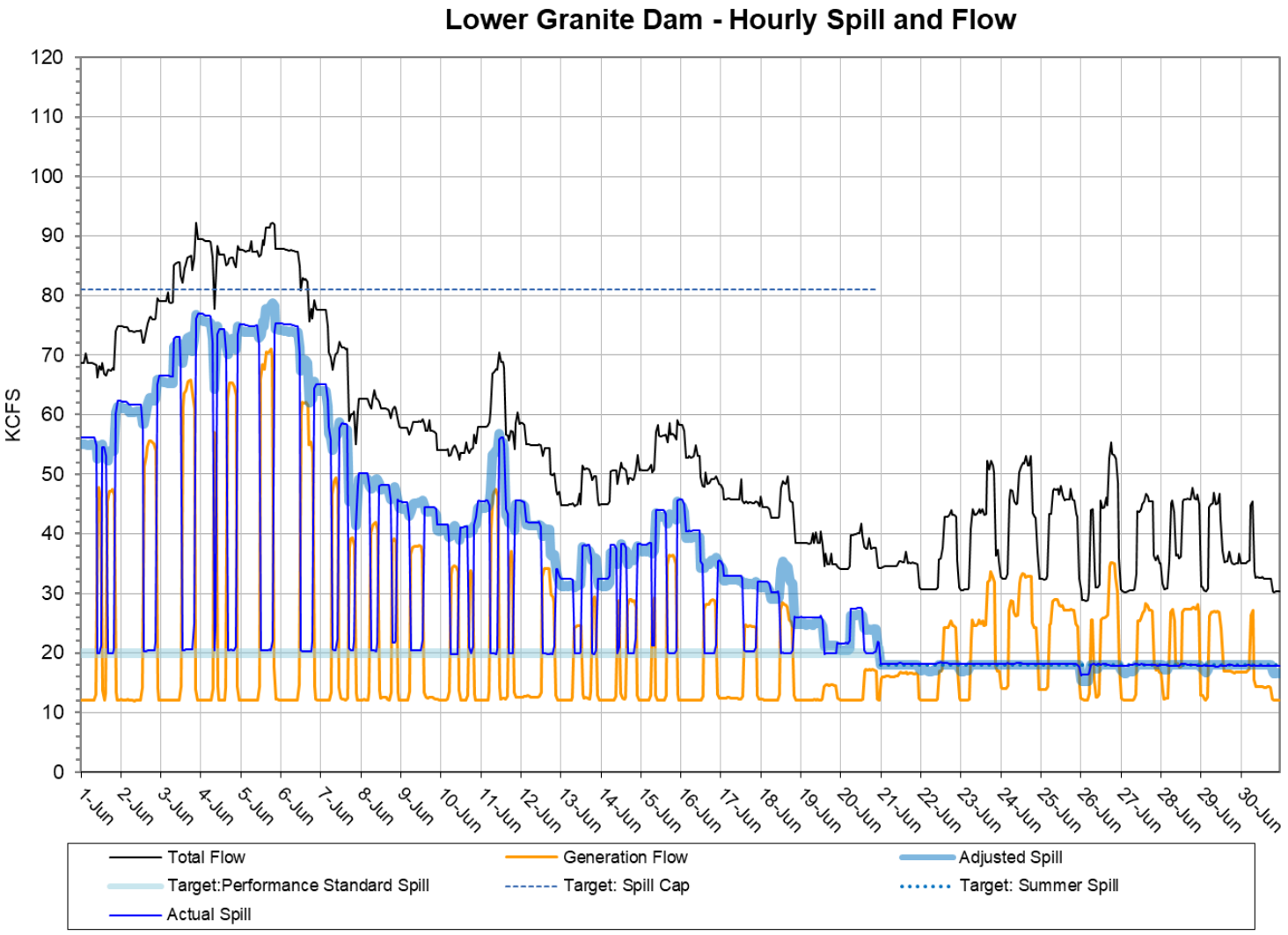
The Dalles	Reduced Spill	6/3 6/15	0700 1300	1 1	Transmission Reliability	Hourly spill decreased to 38% (less than adjusted spill target of 40% ± 1%) due to an increase in generation to deploy reserves. Regionally coordinated via 2021 FOP, Section 4.4.1.
The Dalles	Additional Spill	6/14 6/30	1500 2200	1 1	Transmission Reliability	Hourly spill increased to between 42% and 43% (greater than adjusted spill target of 40% ± 1%) due to an increase in generation to provide reserves. Regionally coordinated via 2021 FOP, Section 4.4.1.

Table 5: June 2021 Average Percent TDG Values (6/1 to 6/30)

Station:	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW
Gas Cap %:		125		125		125		125		125		125		125		125
		120	115	120	115	120	115	120	115	120	115	120	115	120	115	120
6/1/2021	•[20]	119	119	121	122	117	118	117	113	119	112	119	122	122	121	120
6/2/2021	•	121	120	123	123	118	119	117	114	119	114	120	122	122	121	121
6/3/2021	•	122	120	123	124	120	120	118	114	119	115	119	119	121	116	121
6/4/2021	•	122	120	124	123	120	120	118	113	122	115	119	117	120	113	121
6/5/2021	•	122	117	124	121	120	119	117	112	121	113	124	116	120	113	122
6/6/2021	•	122	114	124	118	119	116	117	109	120	110	125	119	121	114	122
6/7/2021	•	120	112	122	119	118	116	116	110	120	109	123	119	121	116	122
6/8/2021	•	118	112	120	120	116	116	115	111	120	108	123	118	120	117	121
6/9/2021	•	117	114	119	120	116	116	116	111	123	108	123	116	119	115	120
6/10/2021	•	116	113	119	120	116	115	115	111	123	108	121	115	119	113	120
6/11/2021	•	118	114	120	118	117	115	116	111	121	109	121	116	119	114	120
6/12/2021	•	117	113	119	118	116	115	116	112	119	111	120	118	120	117	120
6/13/2021	•	116	114	118	118	114	116	114	111	117	111	120	117	120	118	120
6/14/2021	•	117	113	119	119	115	116	114	112	118	111	120	115	118	116	121
6/15/2021	•	117	113	119	118	116	116	115	111	118	111	120	115	118	114	120
6/16/2021	•	118	114	119	116	116	114	115	110	117	113	116	114	119	114	117
6/17/2021	•	117	115	119	117	115	115	114	110	118	114	116	115	119	**117**	117
6/18/2021	102	117	115	119	120	115	116	114	113	118	114	116	114	118	**116**	117
6/19/2021	102	115	116	118	121	117	118	115	113	118	112	115	111	116	111	117
6/20/2021	102	117	116	118	120	118	118	115	113	118	113	116	113	117	111	117
6/21/2021	104	115	**116**	118	**120**	118	**118**	116	113	118	114	116	115	119	114	117
6/22/2021	104	116	•	118	**120**	118	**118**	115	114	118	114	116	114	118	115	117
6/23/2021	103	115	•	117	**119**	118	**118**	116	113	118	113	116	112	116	113	117
6/24/2021	103	114	**116**	116	**118**	117	**117**	115	111	118	111	116	111	116	110	117
6/25/2021	101	114	115	115	**116**	118	**117**	114	111	118	111	115	113	117	112	117
6/26/2021	100	114	115	113	**116**	117	**116**	114	112	118	113	115	114	118	115	118
6/27/2021	102	114	115	113	**117**	118	**116**	114	113	118	113	115	114	118	**117**	117
6/28/2021	104	114	115	113	**117**	117	**116**	114	113	118	114	115	114	118	**117**	117
6/29/2021	105	114	114	112	**117**	115	**116**	114	115	118	**116**	115	114	117	**116**	118
6/30/2021	106	115	114	112	**116**	114	115	•	114	118	114	116	112	116	110	117
Exceedances:	**0**	**0**	**2**	**0**	**10**	**0**	**9**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**5**	**0**

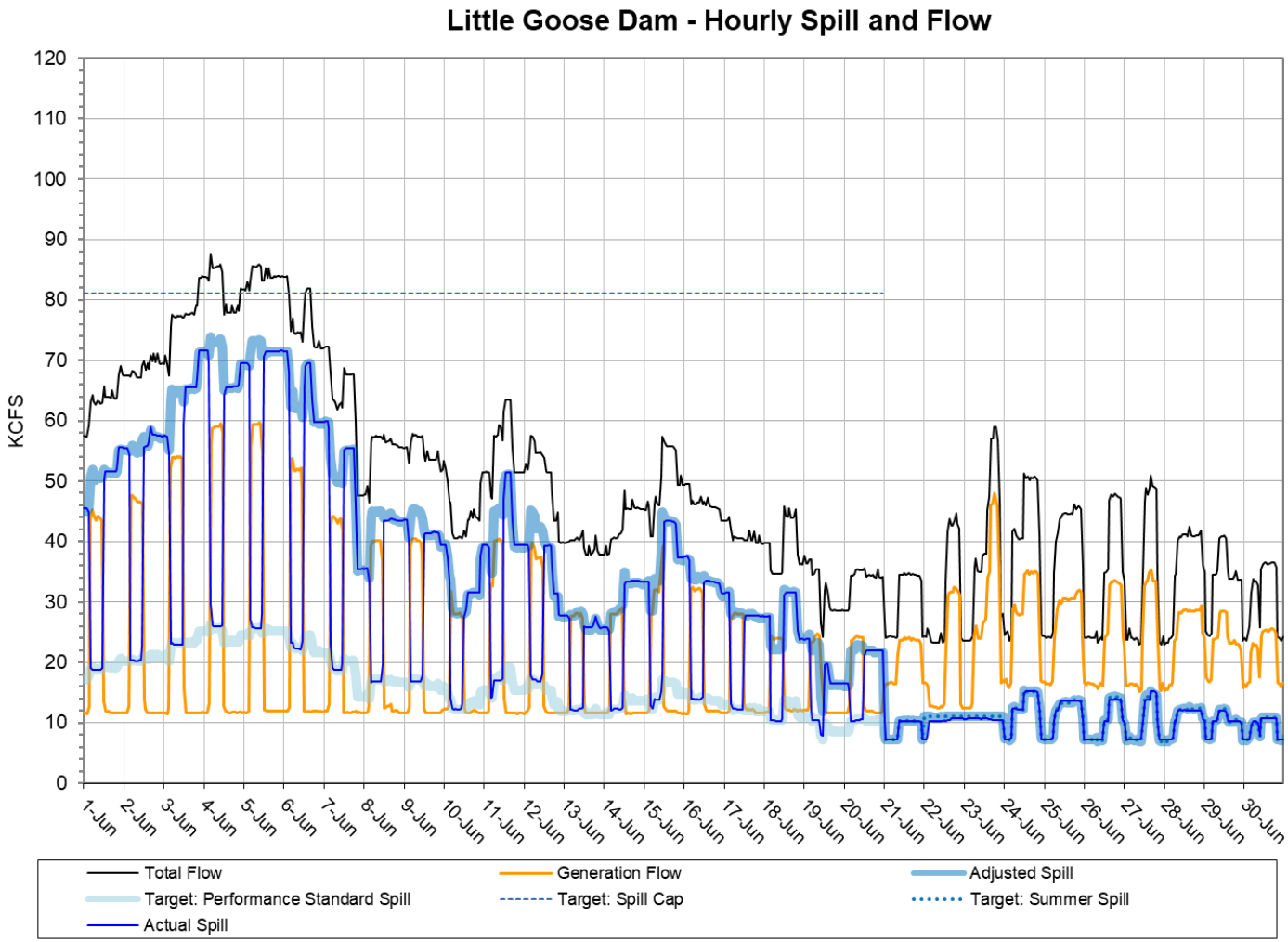
[20] Cells with '•' indicate no data due to malfunctioning gauge or a period when the gauge is not required.

Figure 1[21]



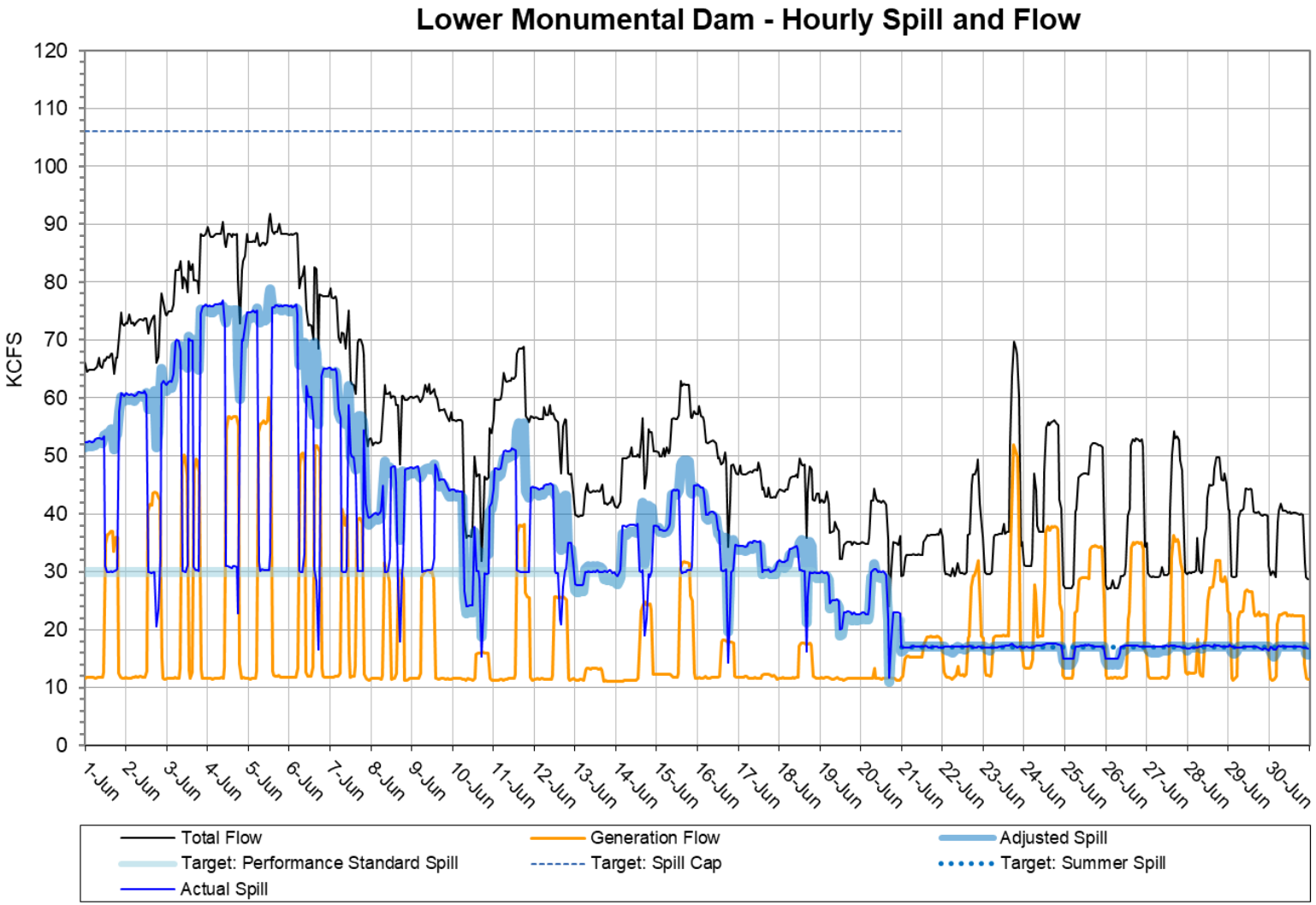
[21] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 2[22]



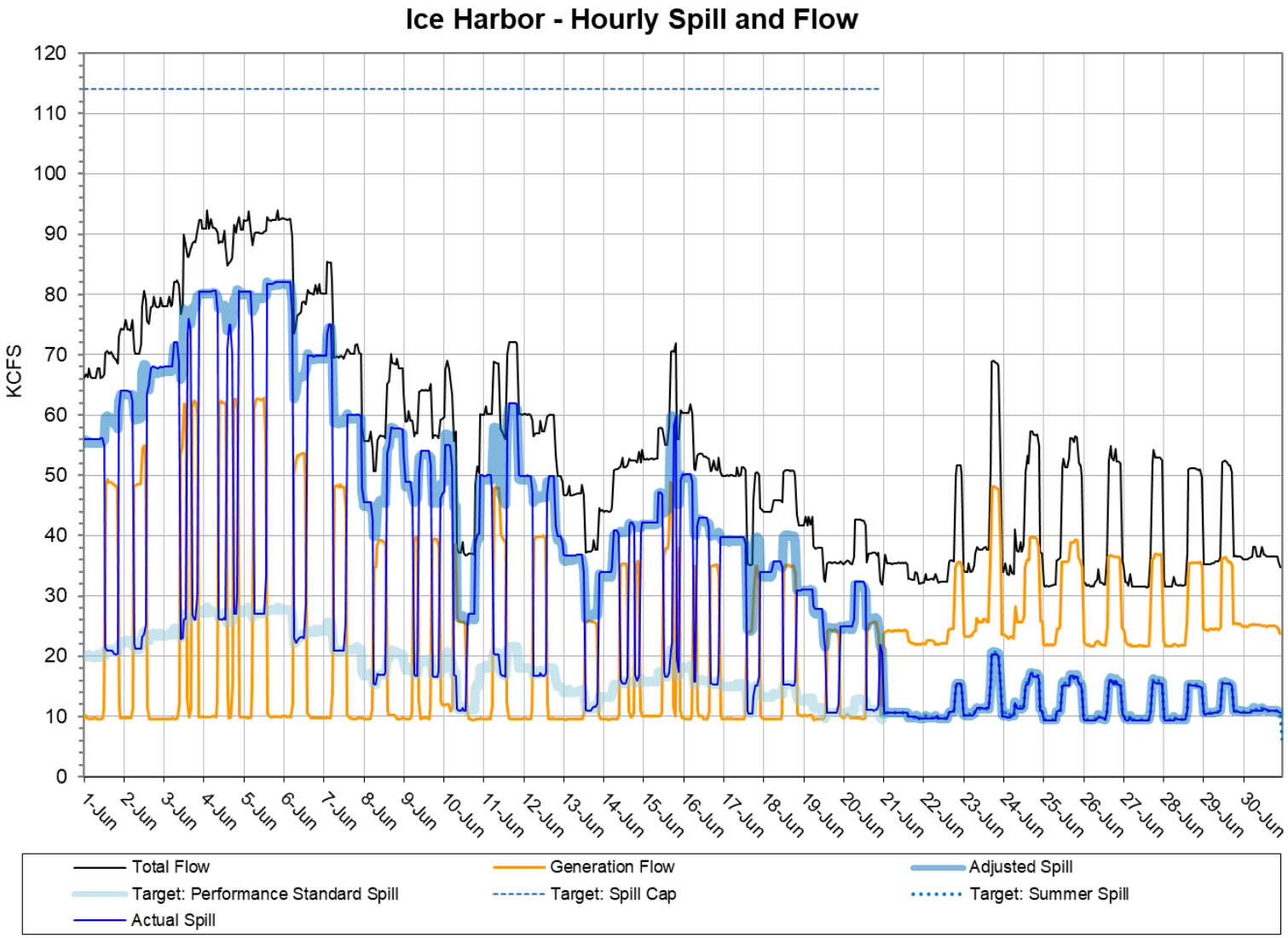
[22] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 3[23]



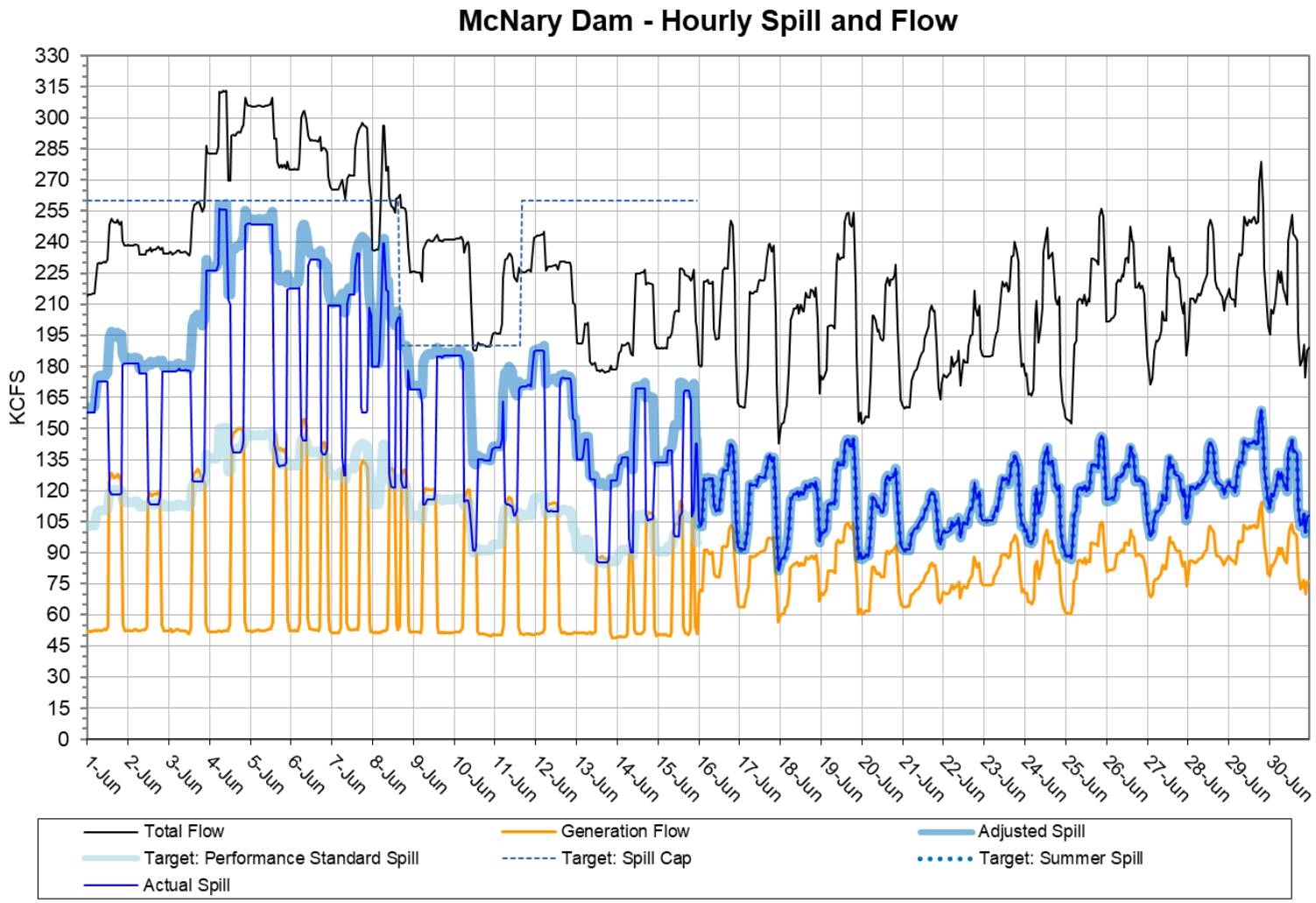
[23] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 4[24]



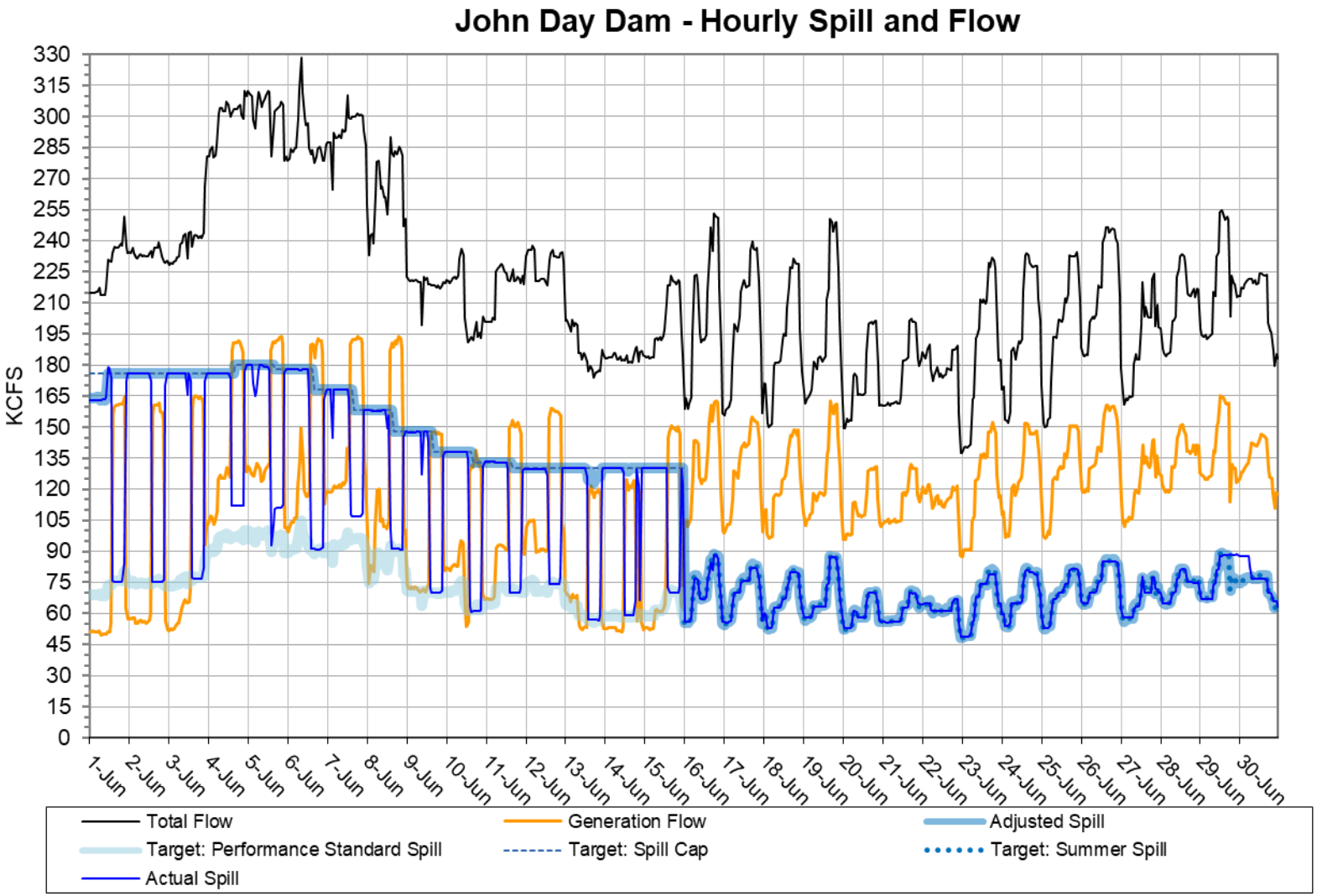
[24] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 5[25]



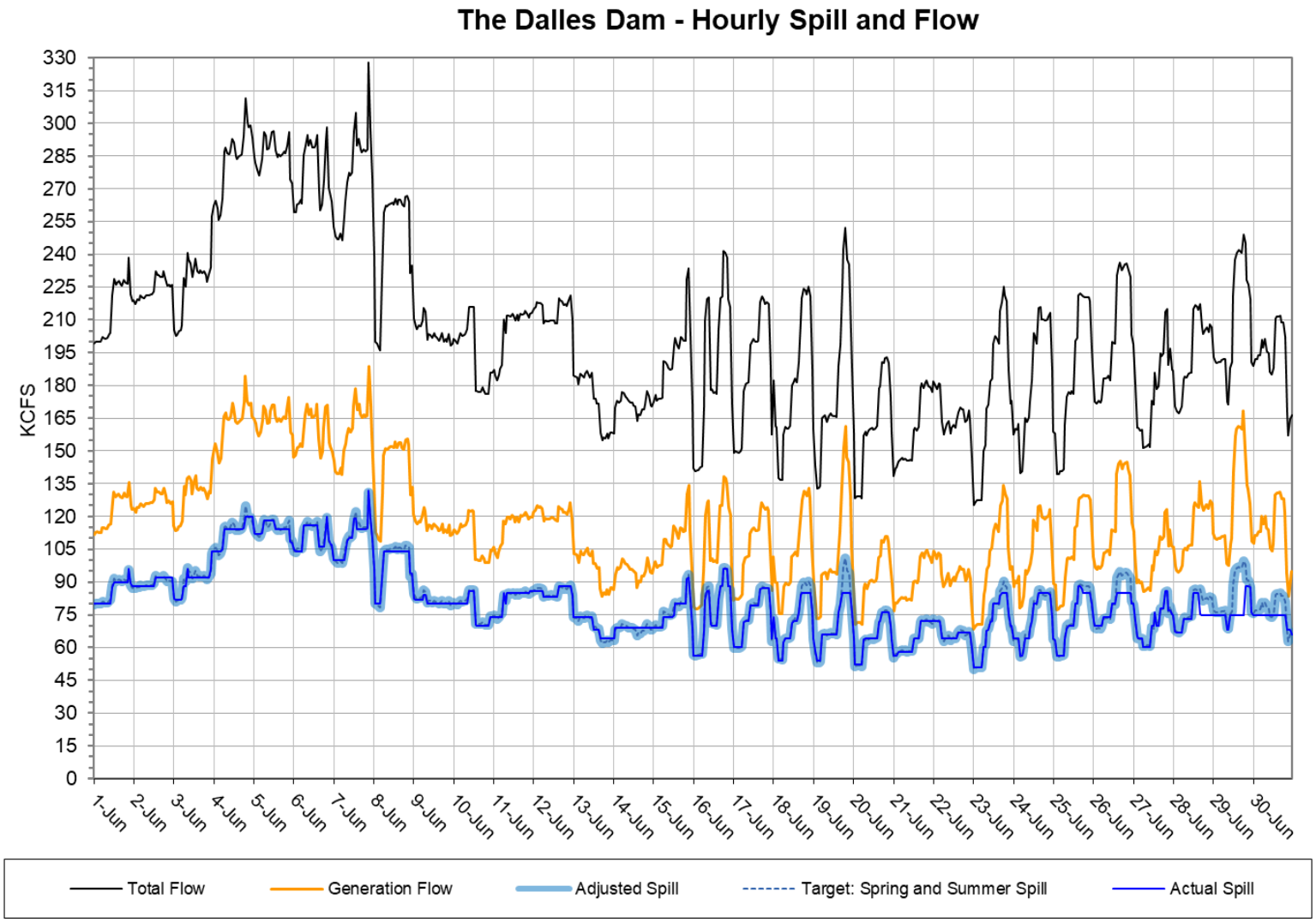
[25] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 6[26]



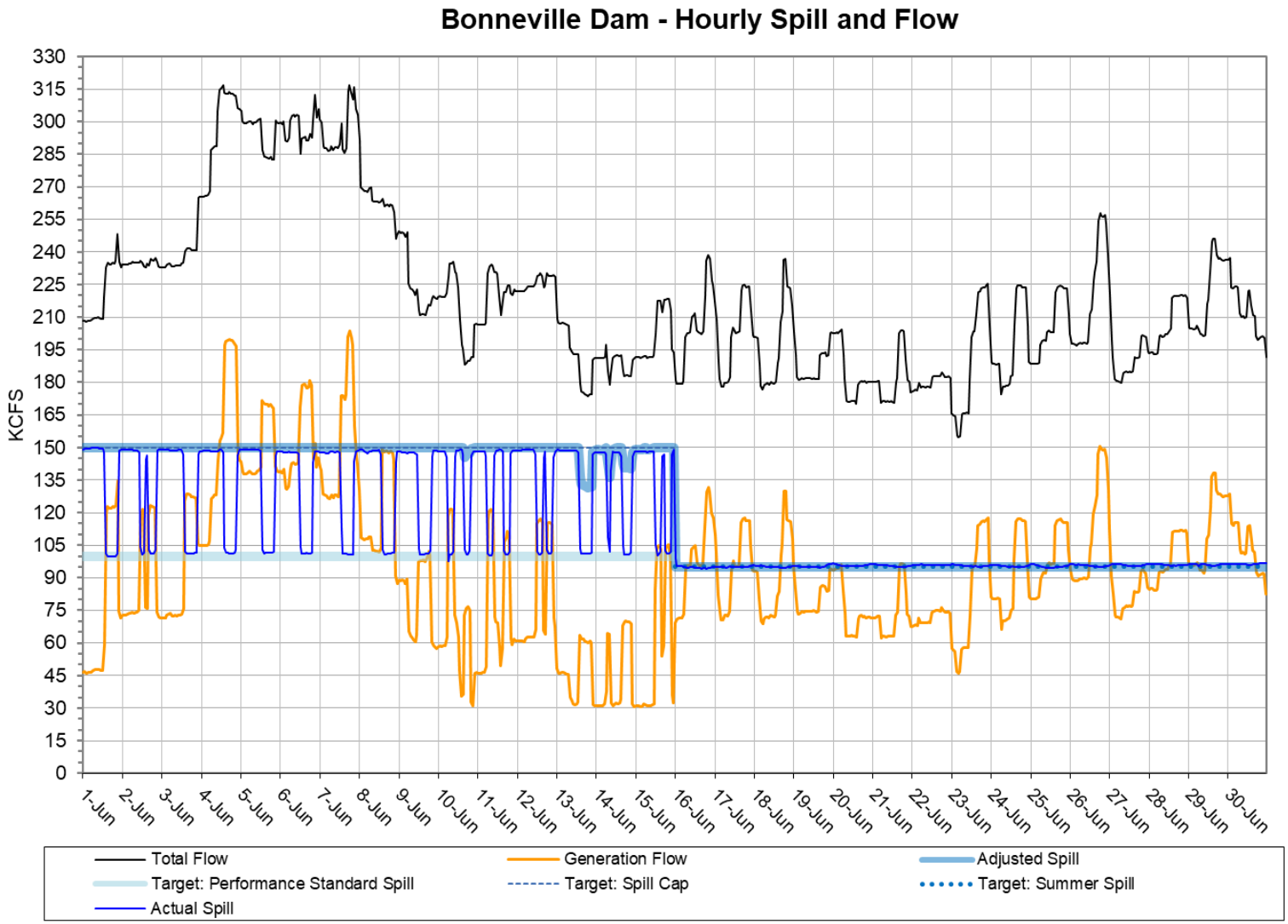
[26] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 7[27]



[27] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 8[28]



[28] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.