FISH OPERATIONS PLAN IMPLEMENTATION REPORT

May 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 May. 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 May 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 May, with hourly spill, target spill, adjusted spill, generation, and total flows. The monthly graphs begin on May 1 and end on May 31 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 May 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 May 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.

May Operations

The month of May was characterized by below average precipitation and flows for the lower Snake and lower Columbia Rivers. The May 2021 observed precipitation was 49% of average on the Snake River above Ice Harbor and 55% of average on the Columbia River above The Dalles. The NOAA Northwest River Forecast Center runoff summary for May indicated that the adjusted runoff for the Snake River at Lower Granite was 79% of the 30-year average (1981-2010) with a volume of 5.5 MAF (Million acre-feet)[6]. The May 2021 adjusted runoff for the Columbia River at The Dalles was 88% of the 30-year average (1981-2010) with a volume of 22.1 MAF.[7] 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. Target spill levels for May 2021 at each project are defined in Table 1.

[5] As specified in the 2021 FOP Section 3.
[6] Retrieved June 1, 2021: https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5
[7] Retrieved June 1, 2021: https://www.nwrfc.noaa.gov/runoff/runoff_summary.php

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 May, 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).

Operational Adjustments

There were no operational adjustments during the month of May 2021.

[8] See 2021 FOP, Section 2.2

Table 2: Spill Variances – May 2021 (5/1 to 5/31)

There were no spill variances during the month of May 2021.

Table 3: Pre-Coordinated Operations – May 2021 (5/1 to 5/31)

Project	Parameter	Date	Time[9]	# of Hours	Type	Reason
Lower Monumental	Reduced Spill	5/1 5/2 5/3 5/4 5/5 5/6 5/7 5/8 5/9 5/10 5/11 5/12 5/13 5/14 5/15 5/16 5/17 5/19 5/21 5/23 5/25 5/27 5/29 5/31	1800-1900 1700-1900 1800-1900 1900 1800-1900 1800 1800-1900 1700-1800 1800-1900 1800-1900 1700-1800 1700-1800 1700-1900 1700-1800 1700-1800 1700-1800 1800-1900 1800-1900 1800-1900 1800 1900-2000 1700-1800 1700-1800 1700-1800	2 3 2 1 2 1 2 2 2 2 2 2 3 2 2 2 2 2 2 1 2 2 2 2	Navigation	Hourly spill decreased to between 7 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.
John Day	Reduced Spill	5/24	1300-1400	2	Transmission Reliability	Hourly spill decreased to between 114 and 115 kcfs (less than adjusted spill target of 129 kcfs) due to an increase in generation to deploy reserves. Regionally coordinated via 2021 FOP, Section 4.4.1.
The Dalles	Reduced Spill	5/2 5/4 5/18 5/25 5/26 5/28	0700 1000 0300, 0700 1700 1200, 1300, 1600 1200-1300	1 1 2 1 3 2	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	5/3 5/17 5/24 5/25	1000 0300, 1000 1600 1600	1 2 1 1	Transmission Reliability	Hourly spill increased to 42% (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.

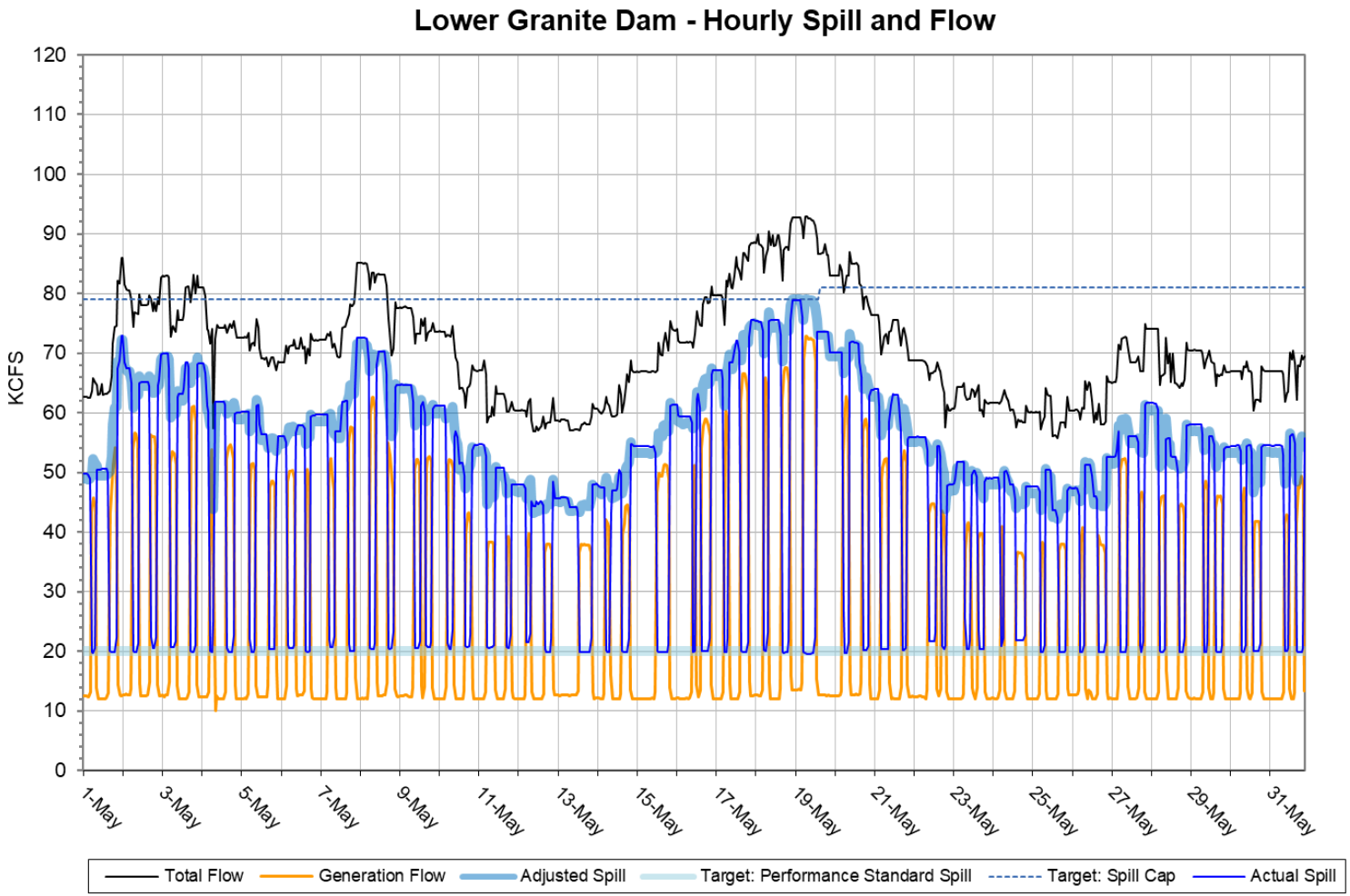
[9] Note: Data collected for reporting spill variances is reported using hourly-averaged data. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented in the Spill Variance Table as an hour.

Table 4: May 2021 Average Percent TDG Values (5/1 to 5/31)

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
5/1/2021	•[10]	119	115	121	119	117	116	116	111	117	•	118	•	118	•	120
5/2/2021	•	121	114	123	117	120	115	116	110	117	•	118	•	116	•	120
5/3/2021	•	121	114	123	118	119	116	116	111	118	•	119	•	118	•	120
5/4/2021	•	120	114	122	119	120	117	116	110	118	•	120	•	119	•	120
5/5/2021	•	120	116	121	121	118	118	116	111	118	•	119	•	121	•	120
5/6/2021	•	120	117	121	122	118	119	117	112	118	•	119	•	121	•	120
5/7/2021	•	120	115	121	121	118	117	116	110	118	•	119	•	118	•	119
5/8/2021	•	122	113	122	117	120	114	116	107	118	•	119	•	117	•	119
5/9/2021	•	120	112	122	117	119	114	116	108	118	•	120	•	119	•	120
5/10/2021	•	119	113	120	120	118	117	117	110	119	•	120	•	121	•	120
5/11/2021	•	118	115	120	121	117	118	117	112	119	•	120	•	121	•	120
5/12/2021	•	118	117	120	122	117	119	115	113	119	•	120	•	122	•	120
5/13/2021	•	118	117	120	122	117	119	117	113	118	•	119	•	121	•	120
5/14/2021	•	118	118	119	121	117	118	116	113	118	•	119	•	122	•	120
5/15/2021	•	119	119	121	122	118	119	117	115	119	•	119	•	122	•	120
5/16/2021	•	120	120	122	122	118	119	117	115	118	•	119	•	122	•	120
5/17/2021	•	122	120	123	123	121	119	118	115	118	•	119	•	121	•	120
5/18/2021	•	122	117	124	120	120	117	117	111	117	•	118	•	117	•	119
5/19/2021	•	123	114	124	120	121	117	117	109	119	113	119	•	119	•	120
5/20/2021	•	122	113	123	122	120	118	117	109	118	111	119	114	118	•	119
5/21/2021	•	120	114	121	122	118	118	117	109	118	109	118	116	119	110	119
5/22/2021	•	119	113	120	121	118	117	116	109	118	108	118	117	119	111	119
5/23/2021	•	118	116	120	121	117	116	116	110	117	107	118	116	119	113	119
5/24/2021	•	118	114	119	118	117	115	116	108	117	107	117	113	117	112	119
5/25/2021	•	118	112	119	116	116	112	115	106	117	108	118	114	118	112	120
5/26/2021	•	118	111	119	115	116	112	115	107	117	107	118	115	118	113	119
5/27/2021	•	119	112	120	118	118	114	116	109	118	107	119	117	120	113	120
5/28/2021	•	119	112	120	116	118	112	116	107	117	106	118	114	118	112	119
5/29/2021	•	118	114	120	116	118	113	116	108	118	107	118	116	119	114	120
5/30/2021	•	119	114	120	119	117	115	116	109	118	109	120	120	121	118	120
5/31/2021	•	119	116	120	121	117	117	116	111	118	110	120	121	122	118	120
Exceedances:		0		0		0		0		0		0		0		0

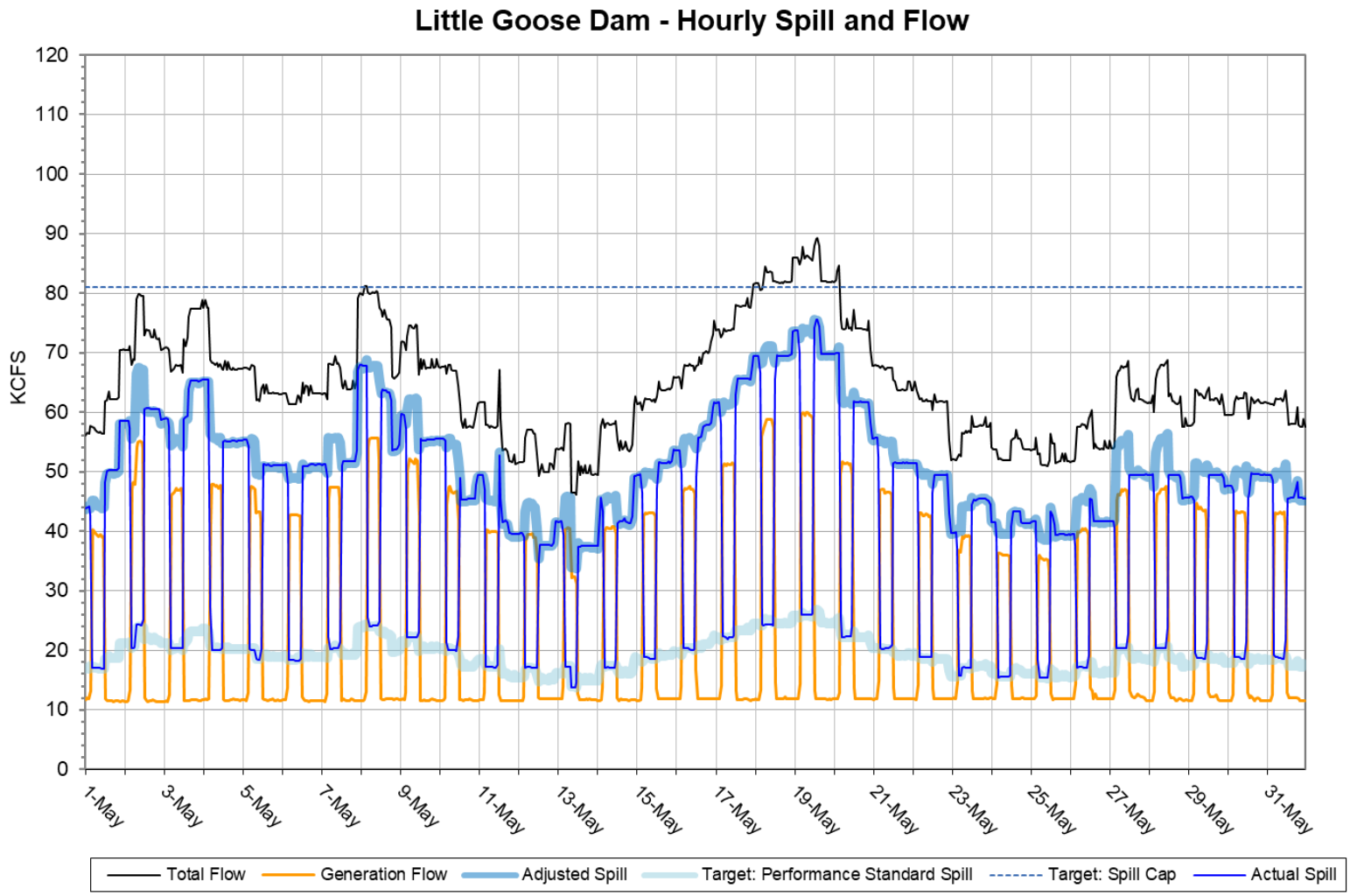
[10] Cells with '•' indicate no data due to malfunctioning gauge or a period when the gauge is not required.

Figure 1[11]



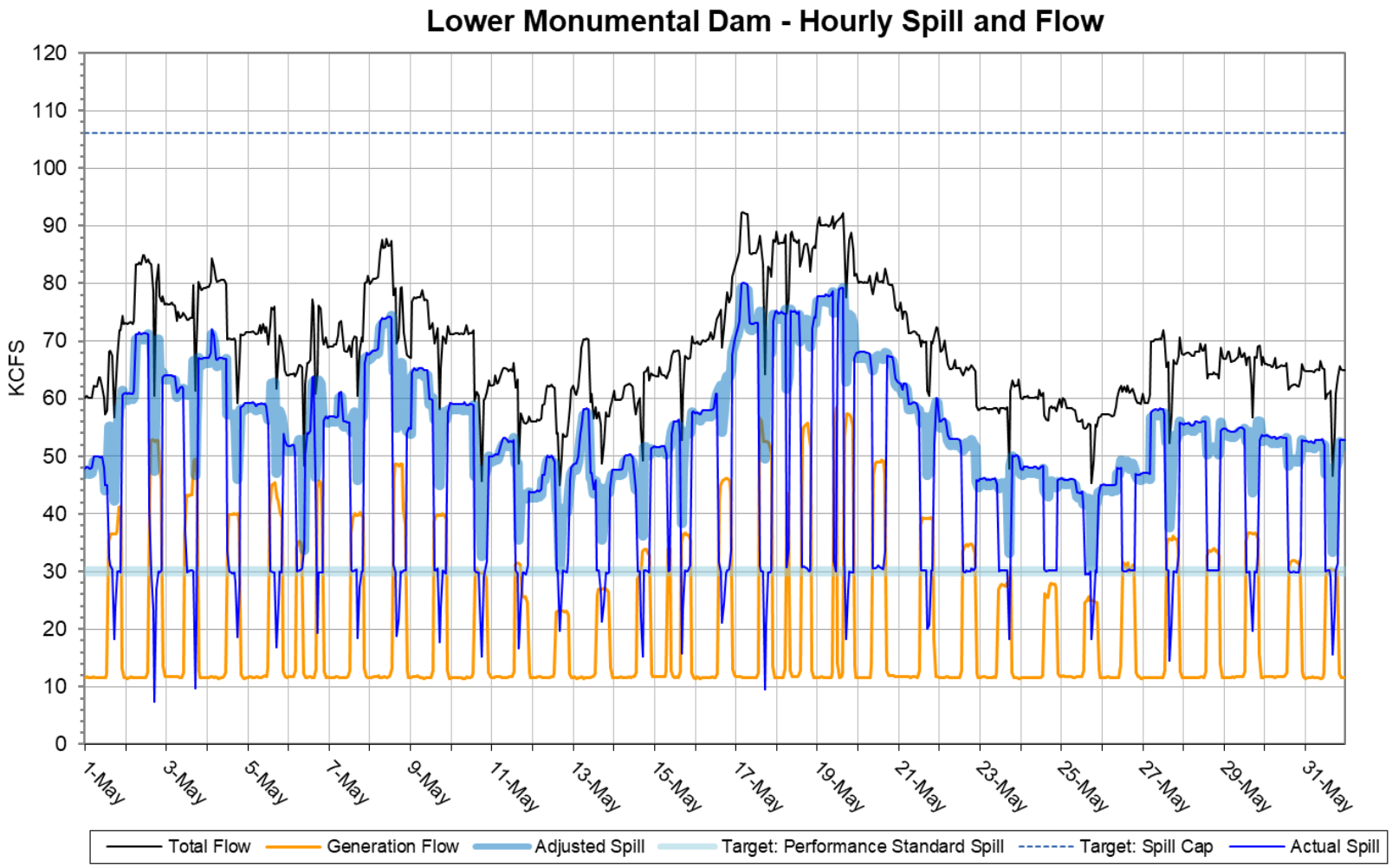
[11] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 2[12]



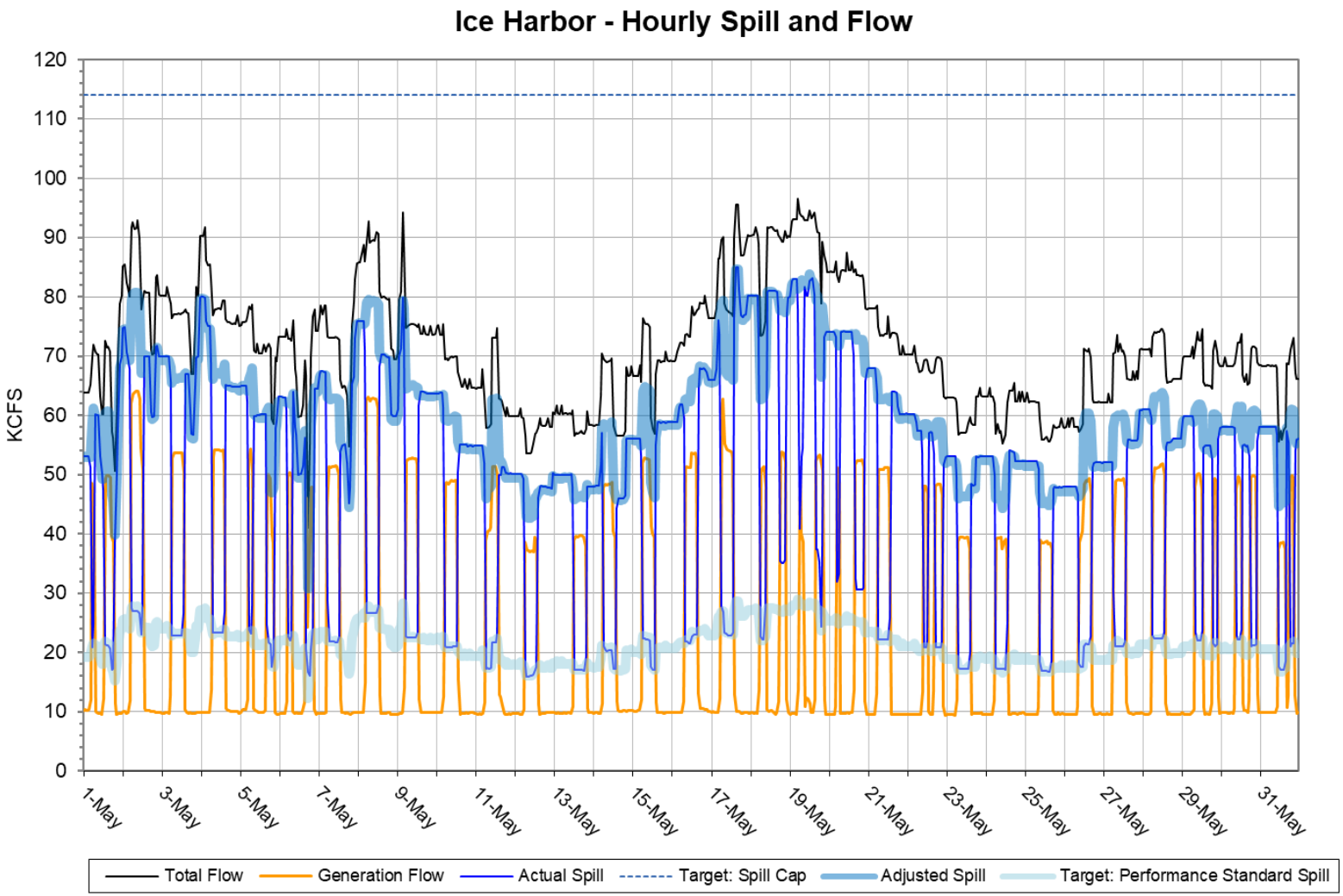
[12] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 3[13]



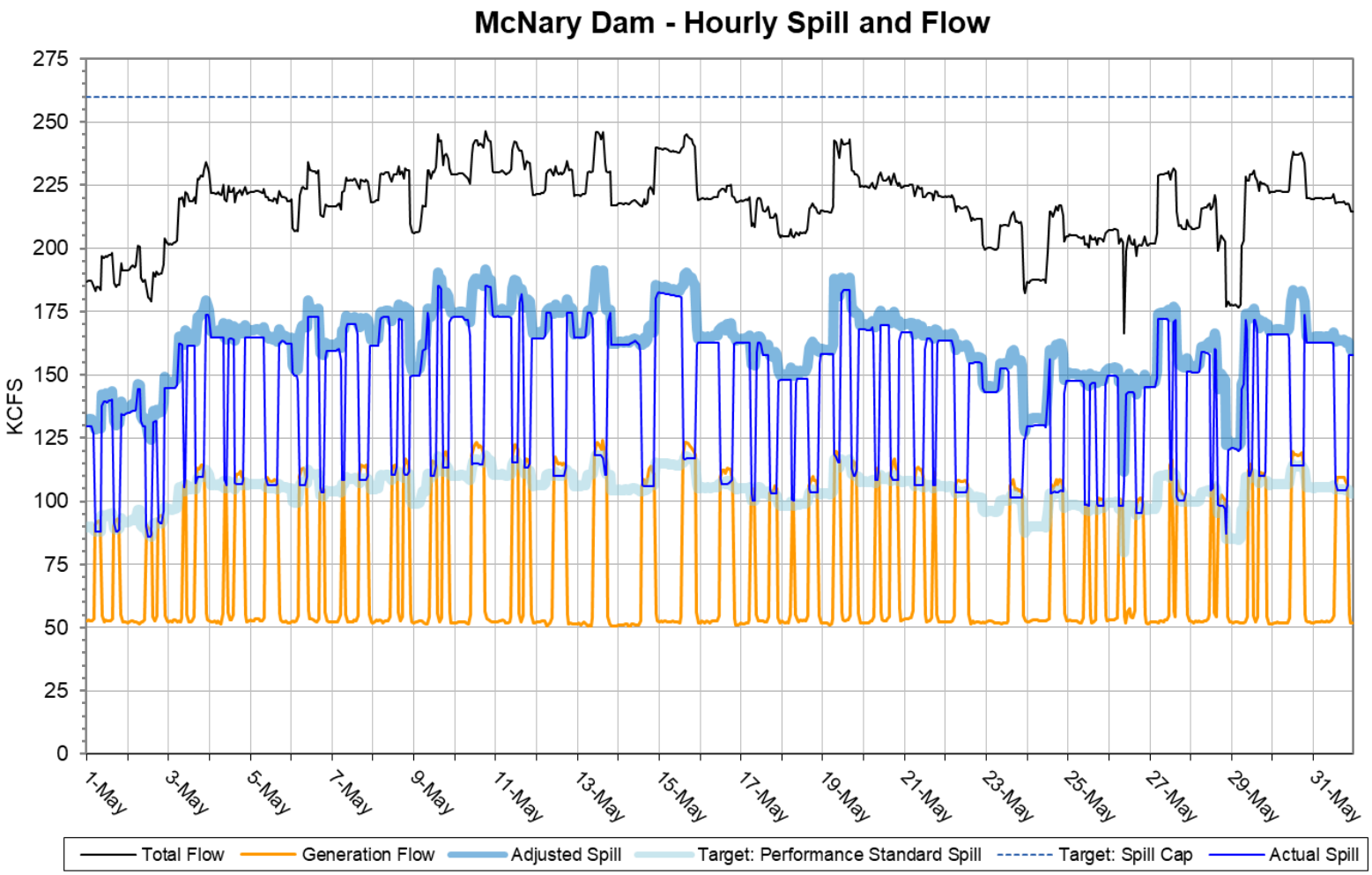
[13] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 4[14]



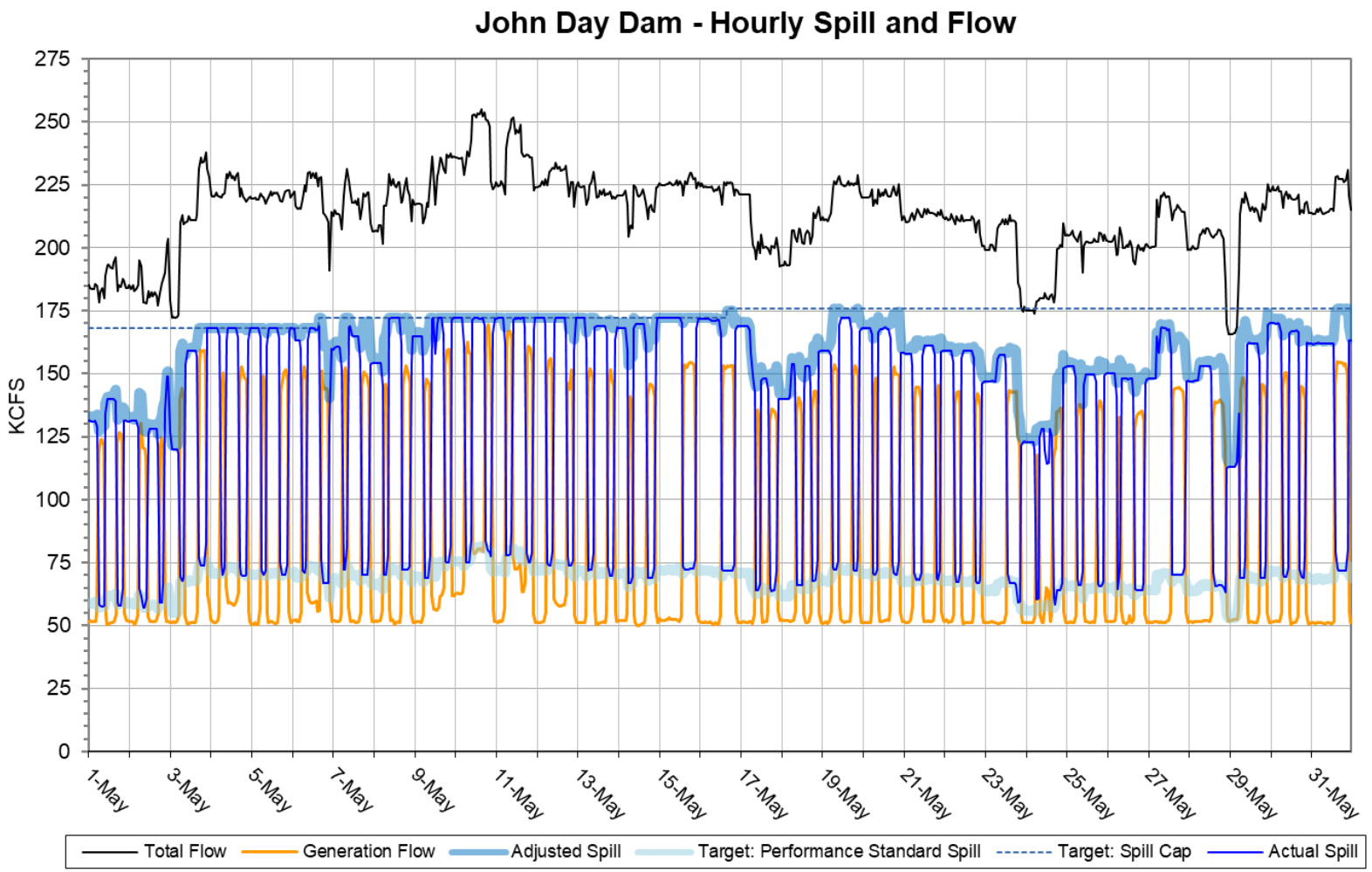
[14] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 5[15]



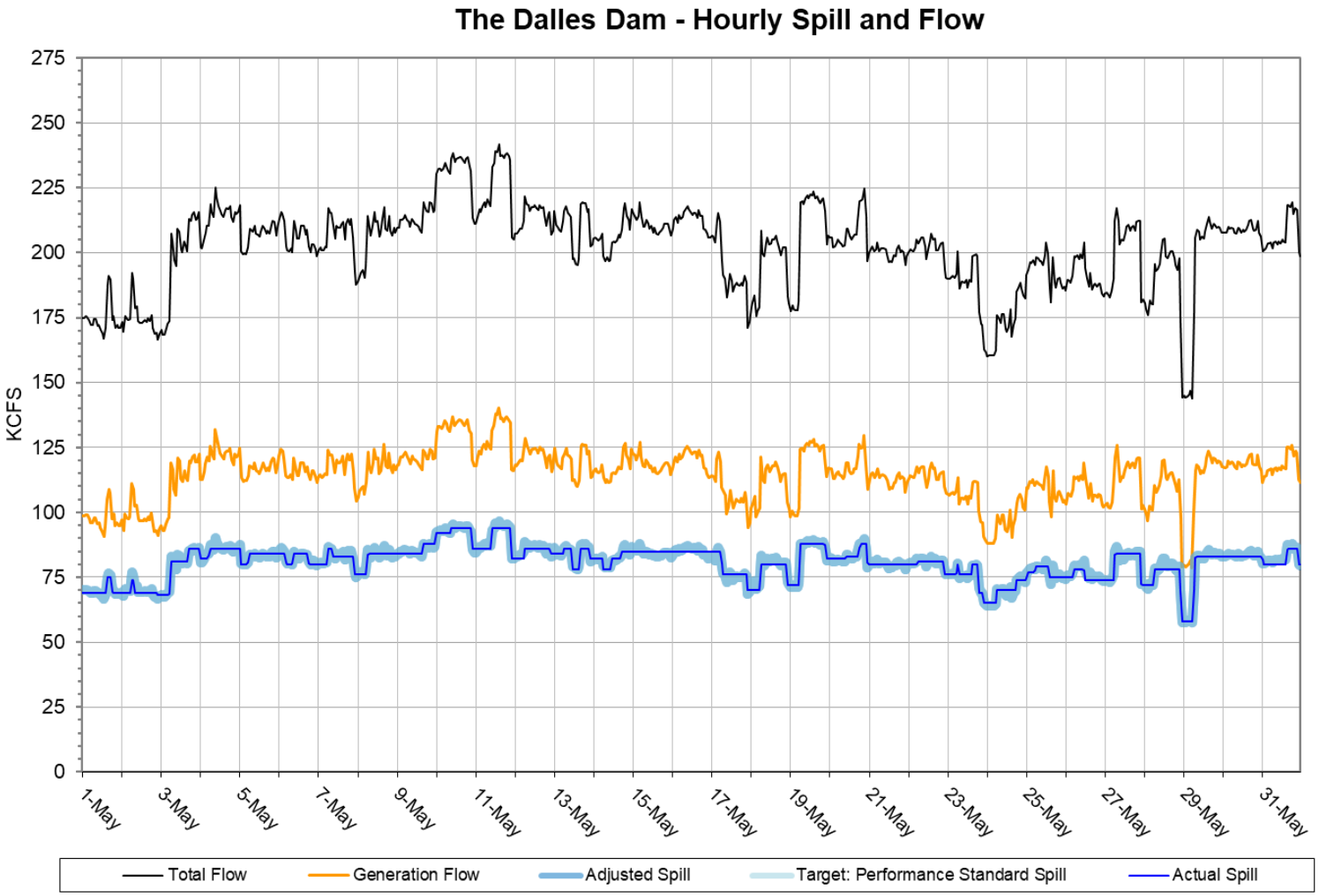
[15] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 6[16]



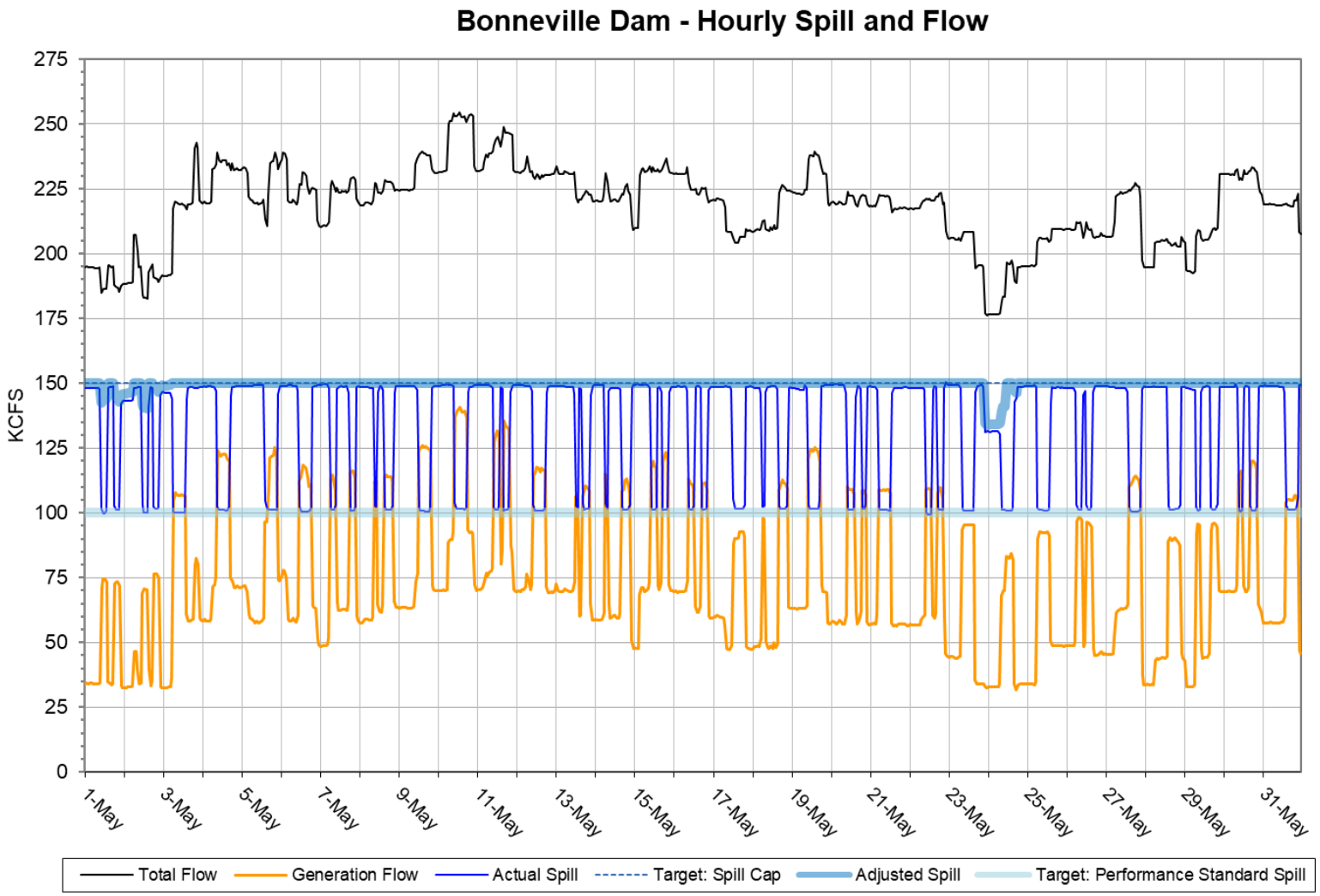
[16] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 7[17]



[17] 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[18]



[18] 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.