FISH OPERATIONS PLAN IMPLEMENTATION REPORT

June 2020

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 2020 Fish Operations Plan[1] (2020 FOP). The 2020 FOP describes the Corps' planned operations for juvenile fish passage at its four lower Snake River and four lower Columbia River dams during the 2020 spring and summer fish migration seasons, generally April 3 through August 31. The 2020 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 2019 NOAA Fisheries Columbia River System Biological Opinion (2019 BiOp)[2], the 2018 Extensions of the 2008 Columbia Basin Fish Accords (Accord Extensions), the 2019-2021 Spill Operation Agreement (Agreement) and subsequent Addendum, the Corps' requirements under the Endangered Species Act (ESA), and is the subject of ongoing consultation and 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 2019 BiOp and other guiding operative documents, including the 2020 Water Management Plan (WMP), seasonal WMP updates, and the 2020 Fish Passage Plan (FPP).

This report describes the Corps' implementation of the 2020 FOP during the month of June 2020. 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 (Tables 1 and 2);
- 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, including spill caps. (see 2020 FOP, section 4.1);
- actual spill: the hourly flow over the spillway; and,
- 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 2020 FOP in June 2020.

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[1] The 2020 FOP was posted to the Technical Management Team (TMT) website on March 23, 2020 (http://pweb.crohms.org/tmt/documents/fpp/2020/).

[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.

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 (spring only).
- The thick light blue line represents the performance standard spill level portion of the target spill (spring only).
- The dotted blue line represents the hourly target summer spill in kcfs (summer only).
- 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 (2020 FOP section 4.1).

II. The average daily %TDG for the 12 highest hours for all projects is shown in the June 2020 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 during spring spill and 120% (tailwater), 115% (forebay of the next downstream dam) during summer spill.

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 2020 Spill Variance Table (Table 2).[3] 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 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).

[3] Involuntary spill conditions shown in the graphs are not considered variances and are not reported in the Spill Variance Table. Involuntary 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.

"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 2020 FOP for Bonneville and The Dalles dams,[4] 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 above average precipitation with average flows on the lower Snake River and above average flows on the Lower Columbia river. The June 2020 observed precipitation was 190% of average on the Snake River above Ice Harbor and 150% of average on the Columbia River above The Dalles[5]. The NOAA Northwest River Forecast Center runoff summary for June indicated that the adjusted runoff for the Snake River at Lower Granite was 98% of the 30-year average (1981-2010) with a volume of 5.9 MAF (Million acre-feet). The June 2020 adjusted runoff for the Columbia River at The Dalles was 112% of the 30-year average (1981-2010) with a volume of 29.2 MAF.[6]

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 2020 through the dates listed above at each project are defined in Table 1.

[4] As specified in the 2020 FOP section 3.
[5] Retrieved July 2, 2020: https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5
[6] Retrieved July 2, 2020: https://www.nwrfc.noaa.gov/runoff/runoff_summary.php

Table 1: Summary of 2020 spring target spill levels at lower Snake River (until June 20) and lower Columbia River (until June 15) projects.

PROJECT	FLEX SPILL (16 hours per day)[A, B, C, E]	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	125% Gas Cap (uniform spill pattern)	30 kcfs (bulk spill pattern[H])
Ice Harbor	125% Gas Cap	30%
McNary	125% Gas Cap	48%
John Day	120% TDG target	32%
The Dalles[I]	40%	40%
Bonneville[J]	125% Gas Cap	100 kcfs

A. Attempts should be made to minimize in-season changes to the proposed operations; however, if serious deleterious impacts are observed, existing adaptive management processes may be employed to help address serious issues that may arise in-season as a result of implementing these proposed spill operations.

B. Spill may be temporarily reduced at any project if necessary to ensure navigation safety or transmission reliability. In order to operate consistently with state water quality standards, spill may be also reduced if observed Gas Bubble Trauma (GBT) levels exceed those identified in state water quality standards (see WASH. ADMIN. CODE §173-201A-200(l)(f))).

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 (with the exception of Little Goose and Lower Granite operations described in the next key points). Other than at TDA, performance standard spill occurs in either a single 8-hour block or up to two separate blocks per calendar day. No more than 5 hours of performance standard spill may occur between sunset and sunrise, as defined in Fish Passage Plan (FPP) Table BON-5. Performance standard spill is not be implemented between 2200-0300 hours. No ponding above current MOP assumptions except as noted below.

E. Lower Granite Exception One - If adult passage delays are observed at Lower Granite Dam, the Corps may implement performance standard spill at Lower Granite Dam for at least 4 hours in the AM (beginning at 0500 hours). Implementation of this modification may also trigger in-season reevaluation of options to balance power principle.

F. Little Goose Exception One - As soon as practicable (and, in any event, no more than 24 hours) after a cumulative total of 25 adult spring Chinook salmon (not including jacks) pass Lower Monumental Dam, operate Little Goose spill at 30% spill for 8 consecutive am hours (April 3-15 start at 0500 hours; April 16-June 20 start at 0400 hours).

G. Little Goose Exception Two - During periods of involuntary spill, spill at 30% for 8 hours/day during the hours described in footnote F above and store additional inflows that exceed hydraulic capacity in the forebay above MOP if necessary. When it is necessary to pond water to achieve the lower spill levels due to 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 forecast that the drafting spill will generate TDG levels in the tailrace in excess of 130% TDG, use all 16 hours to return the pool to MOP.

H. If the specified spill level at bulk pattern exceeds the gas cap, then spill pattern will be changed to uniform.

I. Fish passage spill at The Dalles 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.

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

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 1: Summary of 2020 summer target spill levels at lower Snake River and lower Columbia River projects.

PROJECT	2020 SUMMER SPILL[A] (June 21/16 – August 14) (24 hrs/day)	2020 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 operational criteria in the FPP.

In its implementation of the 2020 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 5).[7] 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

1. Little Goose Dam

From June 6, through June 20, the 8 hours of performance standard spill (30%) per day identified in the 2020 Fish Operations Plan (FOP) was changed from a morning fixed start time (0400 hours) to an adjustable start time (could occur after 0400 hours). The operational adjustment was made in order to minimize the upstream migration delay of adult spring Chinook salmon passing Little Goose Dam. This operational adjustment did not change the number of performance standard spill hours per day identified in the FOP, it only changed the performance standard spill start time from fixed to adjustable. This operation was coordinated at the Flex Spill Working

[7] See 2020 FOP section 2.2

Group meeting on June 5, and the TMT meeting on June 8, and regional sovereigns either supported or did not object to this operational adjustment.

2. Lower Monumental Dam

From June 2, through June 5, the 8 hours of performance standard spill (30 kcfs) per day identified in the 2020 FOP was changed from flexible (as defined in Table 1, footnote D) to a fixed 8-hour block from 0600 to 1400 each day. The operational adjustment was made in order to improve tailrace conditions during hours of peak adult fish passage. This operational adjustment did not change the number of performance standard spill hours per day identified in the FOP, it only changed the performance standard spill hours from adjustable to fixed. This operation was coordinated at the TMT meeting on May 29, and regional sovereigns either supported or did not object to this operational adjustment.

Table 3: Spill Variance Table – June 2020 (6/1 to 6/30)

Project	Parameter	Date	Time[8]	# of Hours	Type	Reason
Little Goose	Reduced Spill	6/9	2300	1	Human Error	Hourly spill decreased to 69.7 kcfs (less than adjusted spill of 71.7 kcfs) while generation was 14.0 kcfs, greater than the minimum generation range for Unit 1 (11.3 – 11.8 kcfs[9]) due to a delay in changing to the requested generation flow.
Little Goose	Reduced Spill	6/10 6/11 6/12 6/13 6/14 6/17	2000-2300 1400-1600 2300-2400 0100-0300 1400-1800 1400-1700, 1900-2300	4 3 2 3 5 9	Program Error [10]	Hourly spill decreased to 68.5 to 78.3 kcfs (less than adjusted spill of 68.6 to 78.6 kcfs) while generation was between 12.1 and 12.4 kcfs, greater than the minimum generation range for Unit 1 (11.3 – 11.8 kcfs[9]).

[8] 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.

[9] Range does not include ±2% due to generating unit governor "dead band." When 2% is applied to the minimum generation flow ranges for Little Goose turbine Unit 1, the range is 11.1-12.0 kcfs. See 2020 FOP section 4.3.1.

[10] The minimum generation flow range (kcfs) through the turbines is a function of power output (megawatts), turbine efficiency, and project head. Despite hourly updates and corrective operational actions, variable and changing conditions can lead to a turbine's flow rate drifting outside the minimum generation flow range identified in Table 1 of the 2020 FOP. The minimum generation flow ranges are evaluated annually and will be re-evaluated based on conditions observed when implementing the 2020 FOP.

Project	Parameter	Date	Time[8]	# of Hours	Type	Reason
Lower Monumental	Reduced Spill	6/8 6/11	0800-0900 1100	2 1	Program Error[10]	Hourly spill decreased to between 45.1 and 96.8 kcfs (less than adjusted spill target of 45.7 to 97.6 kcfs) while generation flow was between 12.6 and 13.1 kcfs, greater than the minimum generation range for Unit 1 (11.1 – 12.3 kcfs[11]).
Ice Harbor	Reduced Spill	6/2 6/9	1200 0700-0900	1 3	Program Error[10]	Hourly spill decreased to between 91.7 and 109.4 kcfs (less than adjusted spill target of 91.8 to 109.7 kcfs) while generation flow was between 10.4 and 10.6 kcfs, greater than the minimum generation range for Unit 1 (8.4 – 10.1 kcfs[12]).
The Dalles	Additional Spill	6/10	0100	1	Human Error	Hourly spill increased to 42% (greater than adjusted spill target of 40% ± 1%) due to a delay in changing to the appropriate target. Daily average spill was 40% of the total flow.

[11] Range does not include ±2% due to generating unit governor "dead band." When 2% is applied to the minimum generation flow ranges for Lower Monumental turbine Unit 1, the range is 10.9-12.5 kcfs. See 2020 FOP section 4.3.1.

[12] Range does not include ±2% due to generating unit governor "dead band." When 2% is applied to the minimum generation flow ranges for Ice Harbor turbine Unit 1, the range is 8.2-10.3 kcfs. See 2020 FOP section 4.3.1.

Table 4: Pre-Coordinated Operations – June 2020 (6/1 to 6/30)

Project	Parameter	Date	Time[13]	# of Hours	Type	Reason
Lower Monumental	Reduced Spill	6/1 6/3 6/7 6/9 6/11 6/13 6/15 6/17 6/19 6/21	1800-2000 1700-1800 1700 1900-2000 1700-1800 1800-1900 1700-1800 1900-2000 1600-1700 1900-2000	3 2 1 2 2 2 2 2 2 2	Navigation	Hourly spill decreased to between 15 and 105 kcfs (less than the spill target of 30 to 114 kcfs) for safe navigation. Regionally coordinated via 2020 FOP, Sections 4.1 and 4.6.
Lower Monumental	Reduced Spill	6/6 6/7	0800 0900-1100, 1300	1 4	Transmission Reliability	Hourly spill decreased to between 45 and 97 kcfs (less than adjusted spill target of 46 to 98 kcfs) while generation flow was between 12.6 and 13.2 kcfs, greater than the minimum generation range for Unit 1 (11.1 – 12.3 kcfs[14]).in order to provide reserves. Regionally coordinated via 2020 FOP, Section 4.4.1.
Ice Harbor	Reduced Spill	6/8	1000-1500	6	Maintenance	Hourly spill decreased to between 70 and 80 kcfs (less than adjusted spill target of 72 to 89 kcfs) while generation increased in order to perform GDAC testing of Units 2 and 4. Regionally coordinated via the 2020 FOP Section 4.5.

[13] 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.

[14] Range does not include ±2% due to generating unit governor "dead band." When 2% is applied to the minimum generation flow ranges for Lower Monumental turbine Unit 1, the range is 10.9-12.5 kcfs. See 2020 FOP section 4.3.1.

Project	Parameter	Date	Time[13]	# of Hours	Type	Reason
McNary	Additional Spill	6/19 6/30	2300-2400 1500	2 1	Transmission Reliability	Hourly spill increased to 59% (greater than adjusted spill target of 57% ± 1%) in order to provide reserves. Regionally coordinated via 2020 FOP, Section 4.4.1. Daily average spill was between 53% and 55% of the total flow due to multiple operations.
McNary	Reduced Spill	6/20	0400	1	Transmission Reliability	Hourly spill decreased to 55% (less than adjusted spill target of 57% ± 1%) in order to provide reserves. Regionally coordinated via 2020 FOP, Section 4.4.1. Daily average spill was 54% of the total flow due to multiple operations.
John Day	Additional Spill	6/1 6/2 6/3 6/8 6/17 6/19 6/20	0100-2400 0100-2400 0100-2200 0600-2300 2000 2300 1100-1300, 1900,2200	24 24 22 18 1 1 5	Transmission Reliability	Hourly spill increased to between 92 and 210 kcfs (greater than adjusted spill target of between 87 and 170 kcfs) in order to provide reserves. Regionally coordinated via 2020 FOP, Section 4.4.1.

Project	Parameter	Date	Time[13]	# of Hours	Type	Reason
The Dalles	Additional Spill	6/5 6/8 6/30	1800 0600-2400 1300-1500	1 19 3	Transmission Reliability	Hourly spill increased to between 42% and 49% (greater than adjusted spill target of 40% ± 1%) in order to provide reserves. Daily average spill was 40% of the total flow. Regionally coordinated via 2020 FOP, Section 4.4.1.
The Dalles	Reduced Spill	6/9	0100, 0300, 0500-0800	6	Transmission Reliability	Hourly spill decreased to 38% of total flow (less than adjusted spill target of 40% ± 1%) due to an increase in generation in order to deploy reserves. Daily average spill was 40% of the total flow. Regionally coordinated via 2020 FOP, Section 4.4.1.

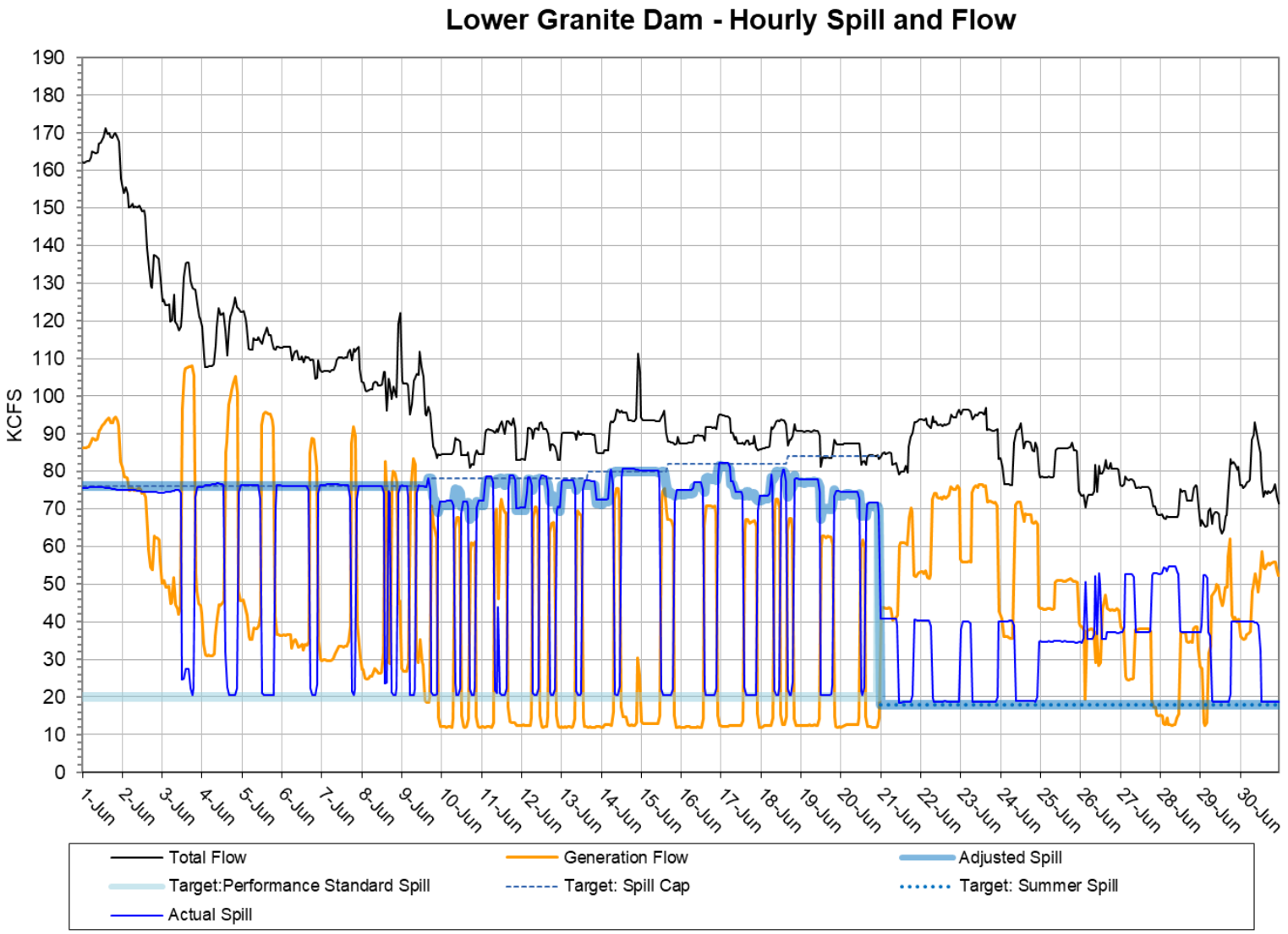
Table 5: June 2020 Average Percent TDG Values Table (6/1 to 6/30)

FIXED MONITORING STATIONS																
Station:	**LWG**	**LGNW**	**LGSA**	**LGSW**	**LMNA**	**LMNW**	**IHRA**	**IDSW**	**MCNA**	**MCPW**	**JDY**	**JHAW**	**TDA**	**TDDO**	**BON**	**CCIW**
Gas Cap %:	**115**[15]	**125 120**	**115**	**125 120**	**115**	**125 120**	**115**	**125 120**	**115**	**125 120**	**115**	**125 120**	**115**	**125 120**	**115**	**125 120**
6/1/2020	105	125	116	**126**	**128**	**126**	123	125	114	123	114	125	118	123	118	124
6/2/2020	106	125	120	**126**	**129**	**126**	125	124	117	124	110	125	118	124	121	124
6/3/2020	107	125	121	**126**	**127**	124	124	124	118	**126**	115	122	119	124	121	124
6/4/2020	107	125	122	125	**127**	123	124	125	119	**128**	117	121	119	124	120	124
6/5/2020	106	125	123	124	**127**	123	124	125	120	124	120	121	119	123	121	125
6/6/2020	106	125	119	124	**126**	123	123	123	118	125	119	123	119	122	118	124
6/7/2020	104	125	116	124	123	122	120	120	113	**126**	118	123	116	125	117	124
6/8/2020	102	124	113	124	119	123	116	124	110	**131**	111	124	116	123	116	123
6/9/2020	102	124	113	124	121	122	117	122	112	**130**	108	119	116	121	121	123
6/10/2020	104	123	115	123	123	121	121	119	116	•[16]	110	119	118	121	121	122
6/11/2020	105	123	117	124	125	120	122	118	117	**126**	114	120	118	122	119	122
6/12/2020	106	123	119	124	124	121	122	118	118	121	122	120	118	122	118	123
6/13/2020	106	123	119	124	122	122	120	118	117	124	122	120	116	120	116	122
6/14/2020	103	123	116	124	120	121	116	118	112	124	117	120	117	121	116	122
6/15/2020	102	123	115	124	120	122	117	120	111	123	114	120	118	122	118	122
6/16/2020	102	122	116	124	122	122	118	117	113	119	111	117	115	120	**118**	119
6/17/2020	102	123	117	124	121	122	118	118	112	119	109	118	112	117	115	119
6/18/2020	103	122	116	124	122	120	119	118	114	119	111	117	113	118	114	119
6/19/2020	104	123	118	124	125	121	120	118	115	120	113	118	115	119	**117**	120
6/20/2020	105	122	119	125	125	122	121	118	**116**	120	113	118	114	118	**117**	120
6/21/2020	105	118	**118**	116	**122**	120	**119**	117	114	119	114	118	114	119	114	119
6/22/2020	103	114	**118**	116	**122**	118	**118**	117	113	119	113	119	**117**	120	114	119
6/23/2020	105	114	**120**	116	**119**	120	**119**	118	**117**	120	114	120	**119**	**122**	**119**	120
6/24/2020	106	116	**118**	117	**119**	120	**120**	119	**118**	120	114	119	**116**	**121**	**119**	120
6/25/2020	105	117	114	113	**118**	119	**117**	118	115	120	115	119	**117**	120	115	120
6/26/2020	105	119	114	116	**117**	119	**117**	118	**116**	120	**116**	119	**116**	119	115	120
6/27/2020	105	120	114	119	**116**	119	**117**	118	**116**	120	114	119	113	118	114	120
6/28/2020	104	120	114	**121**	115	118	**116**	119	114	120	110	120	114	120	111	120
6/29/2020	103	118	114	116	115	119	114	119	113	120	109	120	113	119	112	120
6/30/2020	102	118	112	116	**116**	120	114	120	113	120	108	**121**	113	119	111	120
Exceedances:	**0**	**0**	**4**	**4**	**14**	**2**	**8**	**0**	**5**	**6**	**1**	**1**	**5**	**2**	**5**	**0**

[15] The State water quality standards for the summer state that TDG must not exceed an average of 115% as measured in the forebays of the next downstream dams and must not exceed an average of 120% as measured in the tailraces of each dam.

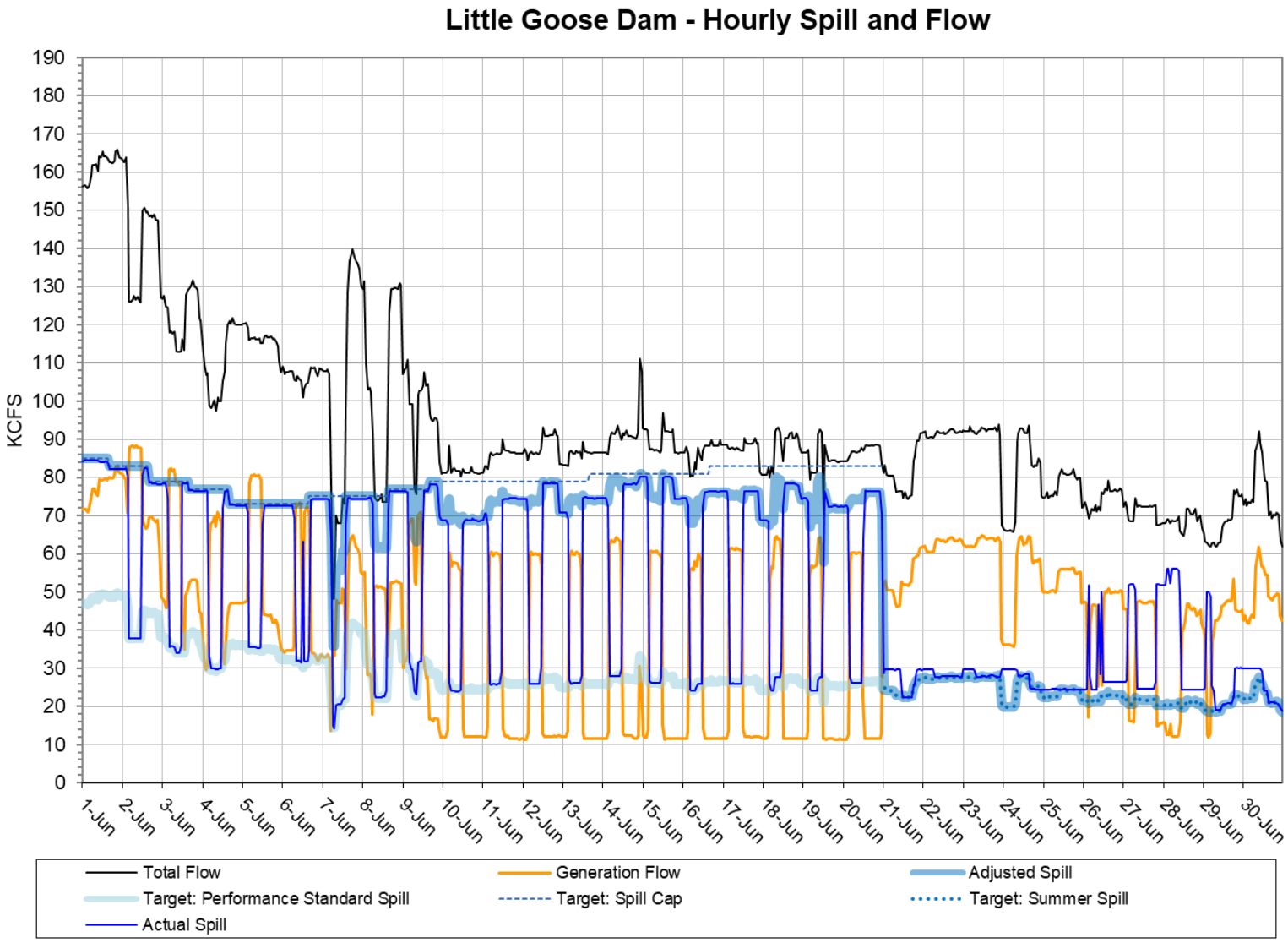
[16] Red shaded cells indicate no data due to malfunctioning gauge.

Figure 1[17]



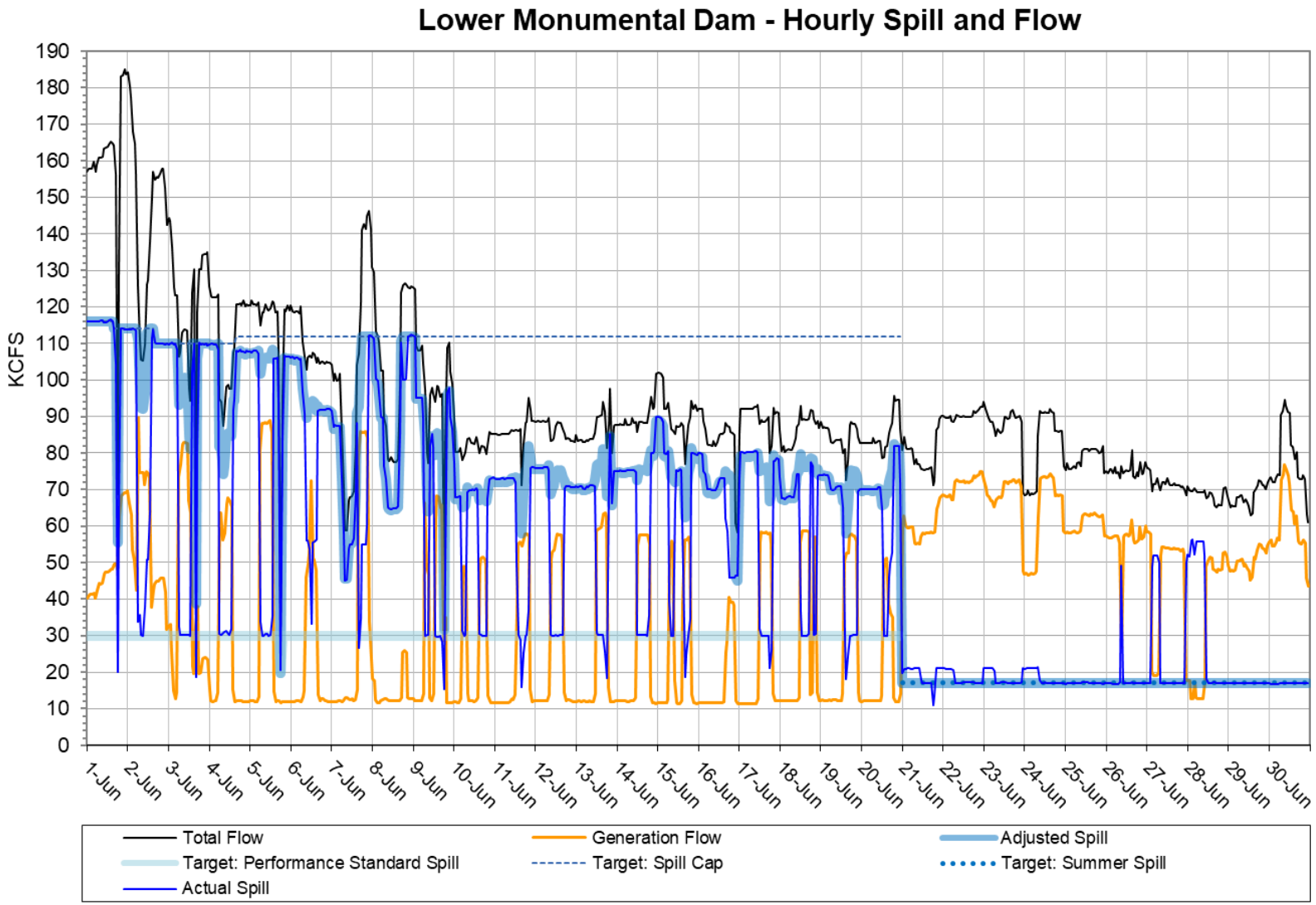
[17] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 2[18]



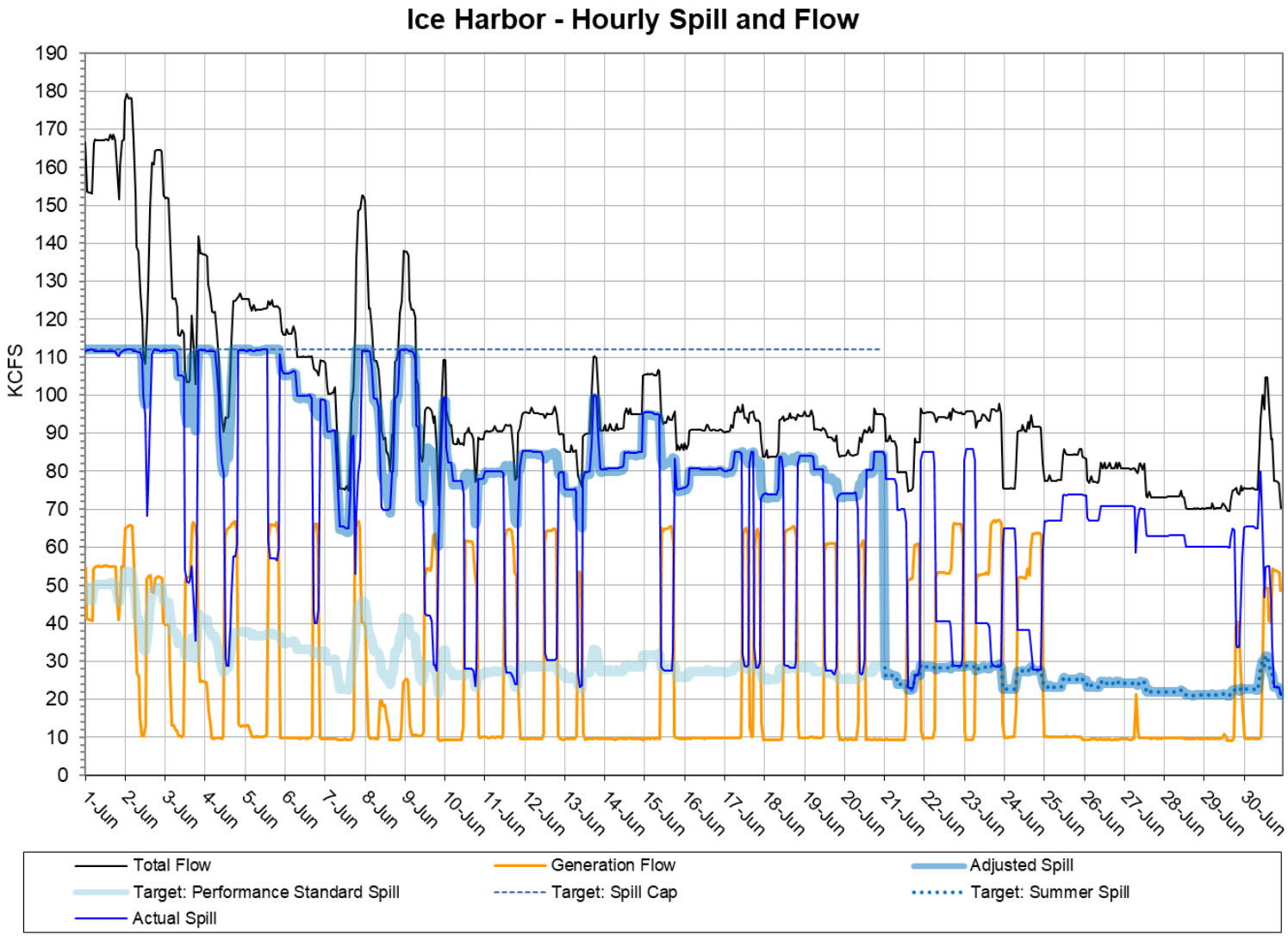
[18] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 3[19]



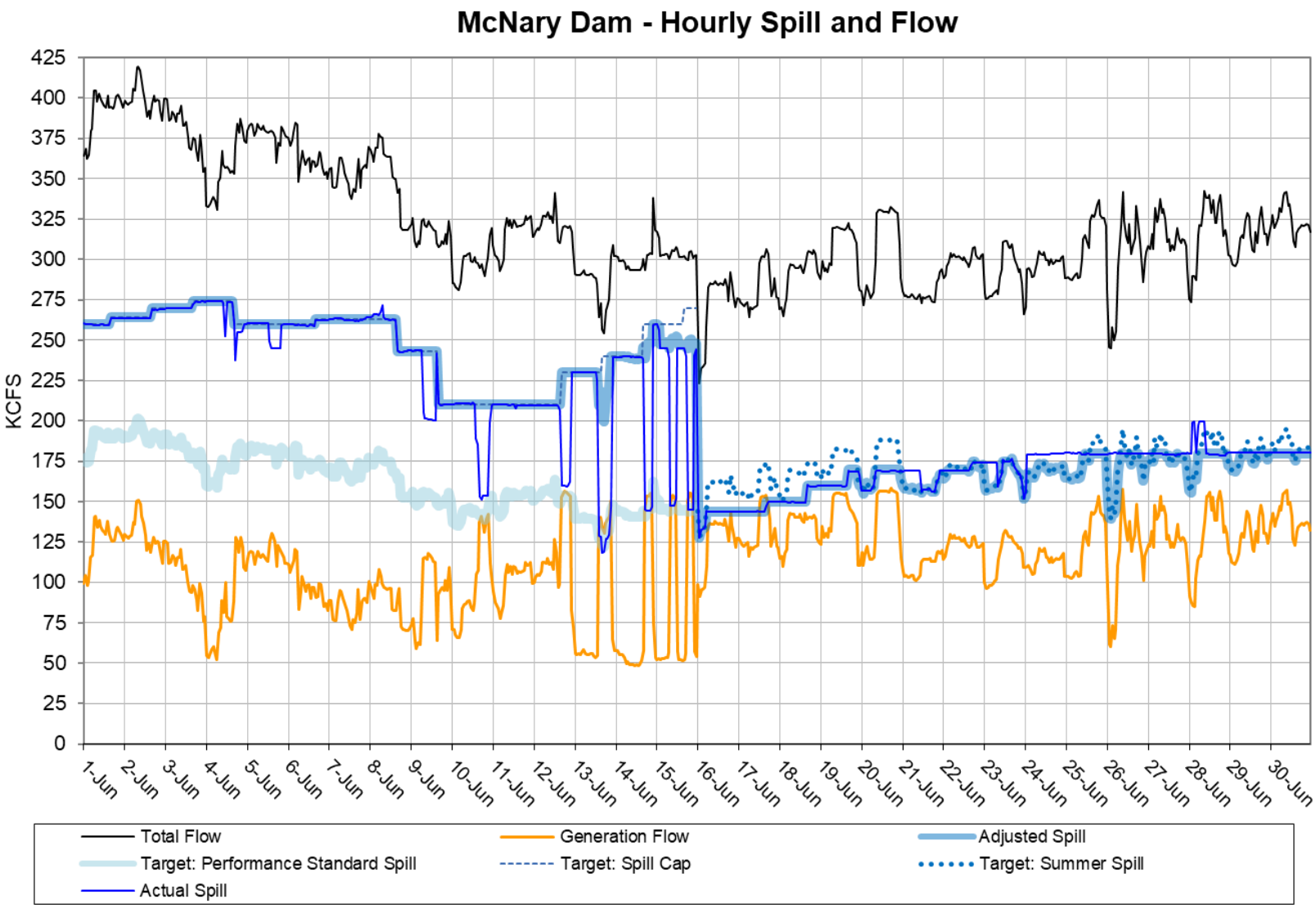
[19] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 4[20]



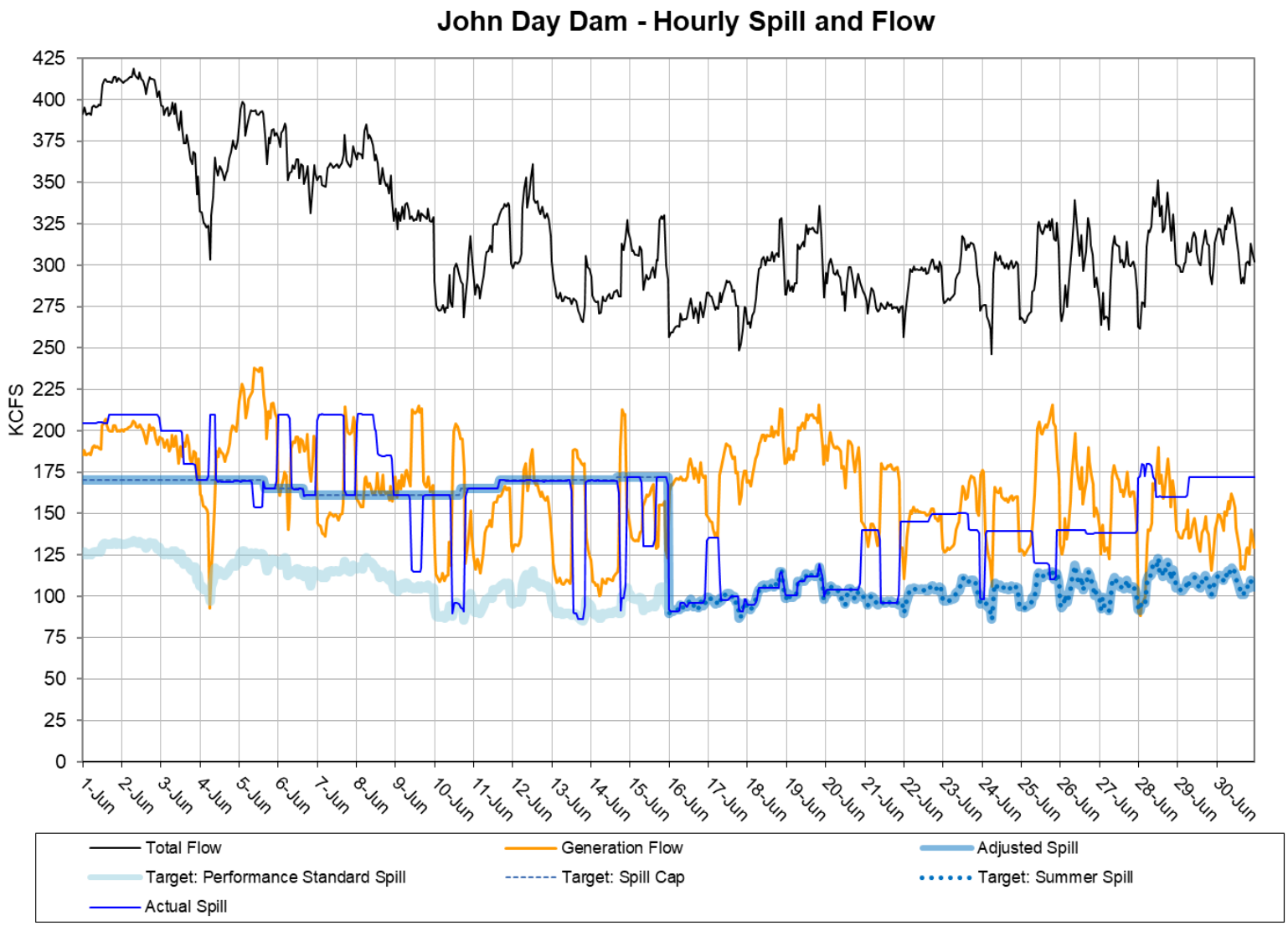
[20] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 5[21]



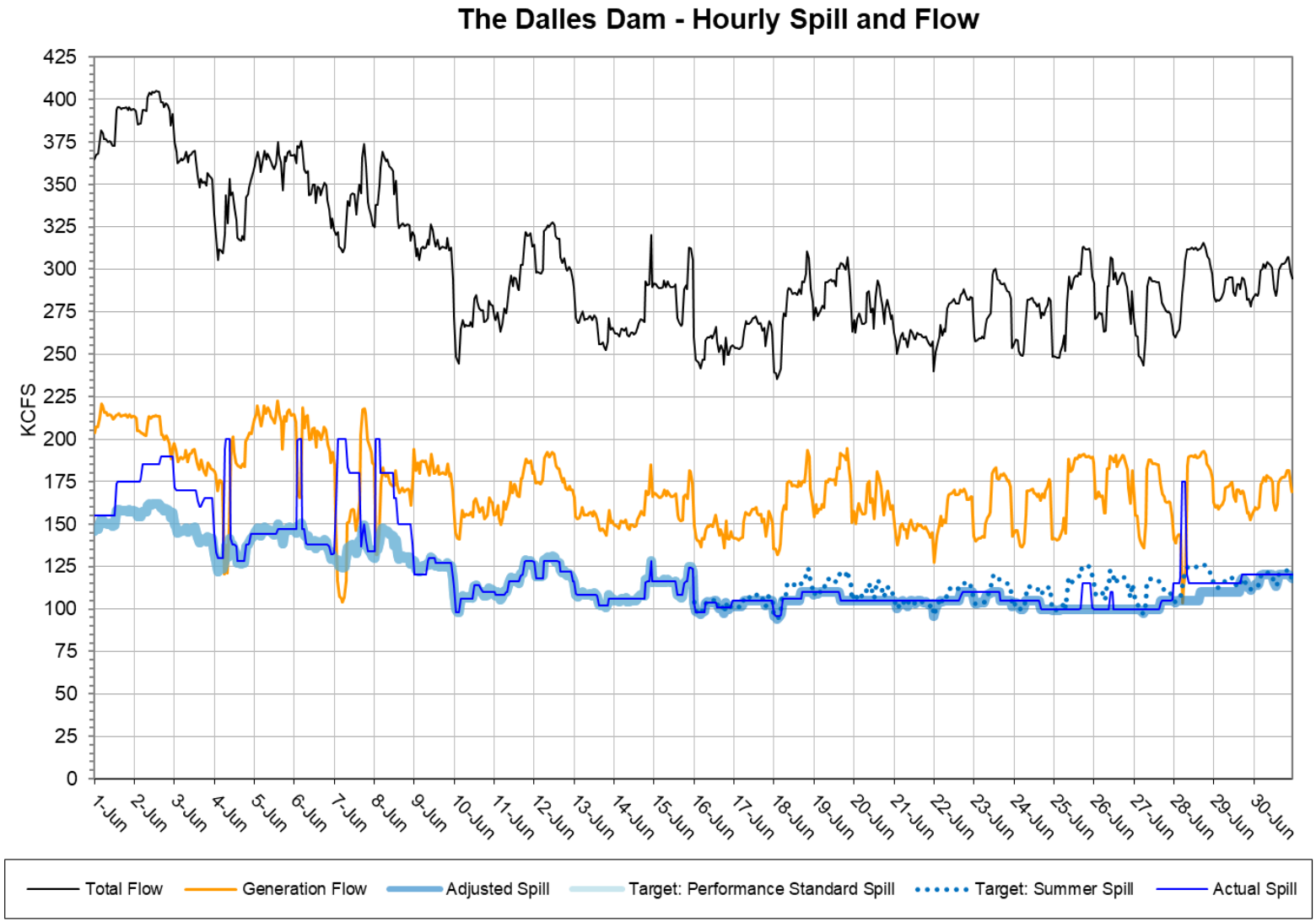
[21] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 6[22]



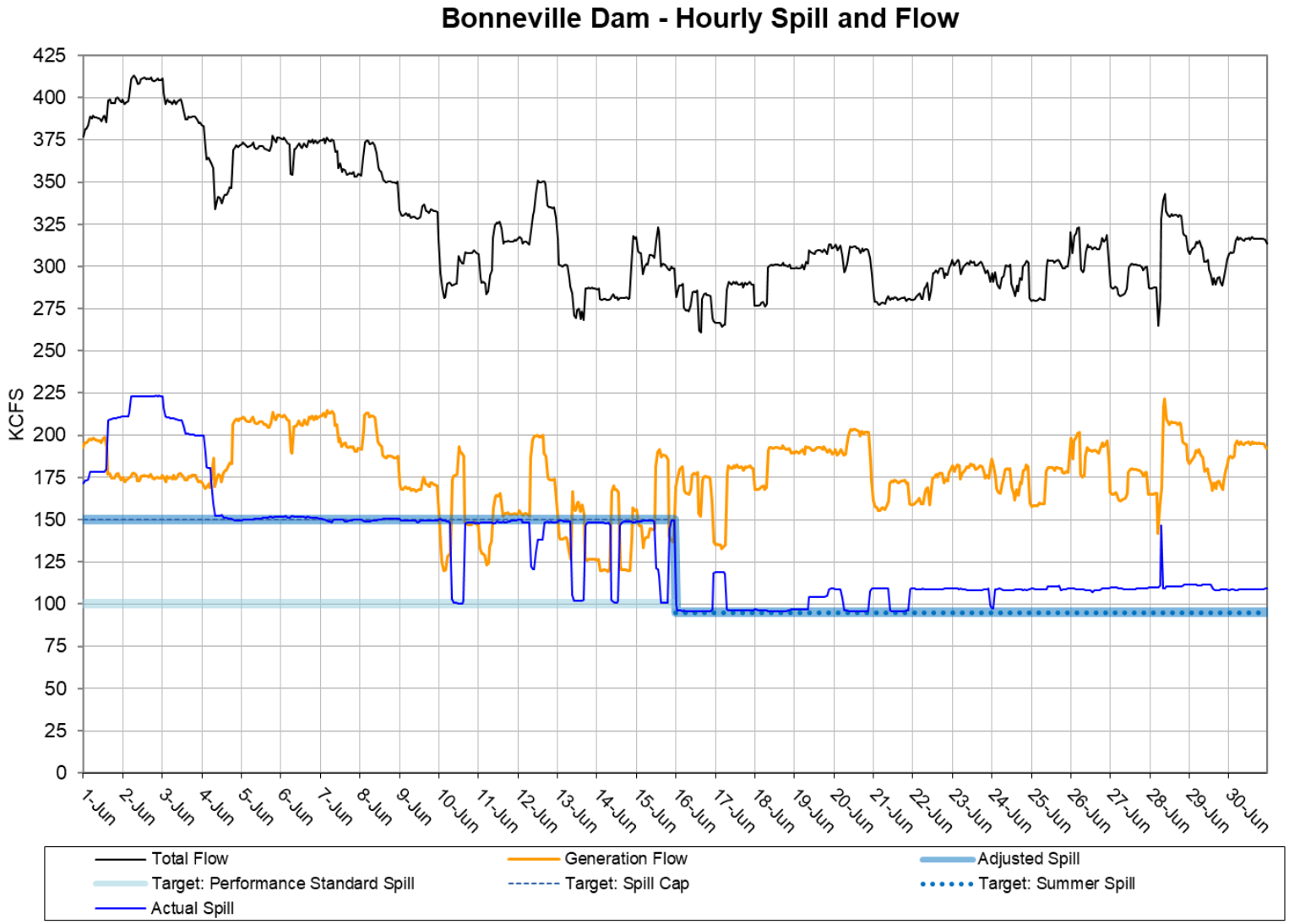
[22] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 7[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 8[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.