FISH OPERATIONS PLAN IMPLEMENTATION REPORT

July 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 July 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 (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, 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 and next downstream forebay at each project.

This report also provides information on issues and unanticipated or emergency situations that arose during implementation of the 2020 FOP in July 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 summer fish passage spill program for the month of July, with hourly spill, target spill, adjusted spill, generation, and total flows. The monthly graphs begin on July 1 and end on July 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 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 July 2020 Average Percent TDG Values Table (Table 4). The numbers in red indicate the project exceeded the %TDG cap - i.e. 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 July 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).

"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 outflow 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 non-federal projects upstream are variable and

[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.

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).

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

July Operations

The month of July was characterized by below average precipitation and above average flows on the lower Snake and Columbia Rivers. The July 2020 observed precipitation was 53% of average on the Snake River above Ice Harbor and 57% of average on the Columbia River above The Dalles[5]. The NOAA Northwest River Forecast Center runoff summary for July indicated that the adjusted runoff for the Snake River at Lower Granite was 108% of the 30-year average (1981-2010) with a volume of 2.5 MAF (Million acre-feet). The July 2020 adjusted runoff for the Columbia River at The Dalles was 111% of the 30-year average (1981-2010) with a volume of 16.2 MAF.[6]

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

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 1).

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 July, 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).[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. Lower Monumental Dam

From July 24 at 1500 hours through July 28 at 1700 hours, a new spill pattern[8] was applied to spill at Lower Monumental Dam. 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[9]. Actual forebay elevations were different than the assumptions made in the coordinated spill pattern, and prevented the project from spilling to the intended pattern. However, the new spill pattern was corrected on July 28, and the total summer spill amount (17

[7] See 2020 FOP section 2.2
[8] See TMT meeting agenda from 7/24 for coordinated spill patterns: http://pweb.crohms.org/tmt/agendas/2020/0724_Agenda.html
[9] See FPP, Table LMN-7, Lower Monumental Dam Bulk Spill Patterns with RSW.

kcfs) was maintained. This operation was coordinated at the TMT meeting on July 24, and regional sovereigns either supported or did not object to this operational adjustment.

On July 28 at 1700 hours, an alternate spill pattern was applied[10] to spill at Lower Monumental due to dam safety concerns. This action was in response to the discovery of a potential cable failure at the project's floating navigation guide wall. This change was reported to TMT at the July 29 TMT meeting. On August 4 at 1100 hours, the project resumed spill under the bulk spill pattern[9].

[10] Table LMN-8, Lower Monumental Dam Uniform Spill Patterns with RSW was modified to take the RSW out of service due to dam safety concerns.

Table 2: Spill Variance Table – July 2020 (7/1 to 7/31)

Project	Parameter	Date	Time[11]	# of Hours	Type	Reason
Little Goose	Additional Spill	7/6	2300	1	Human Error	Hourly spill increased to 33% (greater than adjusted spill target of 30% ± 1%) due to a delay in changing to the appropriate target. Daily average spill was 30% of the total flow.
Little Goose	Additional Spill	7/7	1200	1	Human Error	Hourly spill increased to 32% (greater than adjusted spill target of 30% ± 1%) due to incorrect spillway gate settings. Daily average spill was 30% of the total flow.
Ice Harbor	Additional Spill	7/21 7/22 7/23	2400 0100, 1600-2400 0100-0200, 1300-1400	1 10 4	Maintenance	Hourly spill increased to between 34% and 54% (greater than adjusted spill target of 30% ± 1%) due to a forced unit outage resulting from emergency maintenance to the station service governor. Daily average spill was between 31% and 41% of the total flow.
Ice Harbor	Reduced Spill	7/27	1500, 1800	2	Maintenance	Hourly spill decreased to 28% (less than adjusted spill target of 30% ± 1%) due to unscheduled testing of Unit 1 following station service governor repair. Daily average spill was 32% of the total flow.
McNary	Additional Spill	7/4	1100	1	Human Error	Hourly spill remained at the target spill of 188 kcfs (greater than adjusted spill target of 185 ± 2 kcfs).
John Day	Reduced Spill	7/18	0800	1	Human Error	Hourly spill decreased to 33% (less than adjusted spill target of 35% ± 1%) due to a miscalculation of spill. Daily average spill was 35% of the total flow.

[11] 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 3: Pre-Coordinated Operations – July 2020 (7/1 to 7/31)

Project	Parameter	Date	Time[12]	# of Hours	Type	Reason
Little Goose	Reduced Spill	7/16	1100	1	Navigation	Hourly spill decreased to 28% (less than adjusted spill target of 30% ± 1%) for safe navigation. Daily average spill was 30% of the total flow. Regionally coordinated via 2020 FOP, Sections 4.1 and 4.6.
Little Goose	Reduced Spill	7/23	0800	1	Maintenance	Hourly spill decreased to 28% of total flow (less than 30% ±1% range) due to pre-annual testing of Unit 4. Daily average spill was 30%. Regionally coordinated via the 2020 FOP Section 4.5.
Little Goose	Additional Spill	7/27	0600-1900	14	Maintenance	Hourly spill increased to between 33% and 96% of total flow (greater than adjusted spill target of 30% ±1 %) while generation was reduced to speed no load (5 kcfs) for station service due to units taken offline to perform Doble testing. Daily average spill was 58% of total flow. Regionally coordinated via the 2020 FPP LGS Section 4.3.10 and Appendix A.
Lower Monumental	Additional Spill	7/27 7/28 7/29 7/30 7/31	0700-1800 0600-1700 0600-1600 0600-1400 0600-1500	12 12 11 9 10	Maintenance	Hourly spill increased to between 15 and 30 kcfs (greater than adjusted spill target of 8 to 17 kcfs) while generation was reduced to speed no load (5 kcfs) for station service due to units taken offline to perform transformer maintenance. Regionally coordinated via the 2020 FPP Appendix A.
Ice Harbor	Reduced Spill	7/6 7/17 7/27 7/30	0400 1300 1600 1100, 1600	1 1 1 2	Navigation	Hourly spill decreased to between 24% and 28% (less than adjusted spill target of 30% ± 1%) for safe navigation. Daily average spill was between 30% and 32% of the total flow. Regionally coordinated via 2020 FOP, Sections 4.1 and 4.6.
McNary	Additional Spill	7/2 7/3	2300-2400 0500	2 1	Transmission Reliability	Hourly spill increased to 59% (greater than adjusted spill target of 57% ± 1%) in order to provide reserves. Daily average spill was between 57 and 58% of the total flow. Regionally coordinated via 2020 FOP, Section 4.4.1

[12] 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.

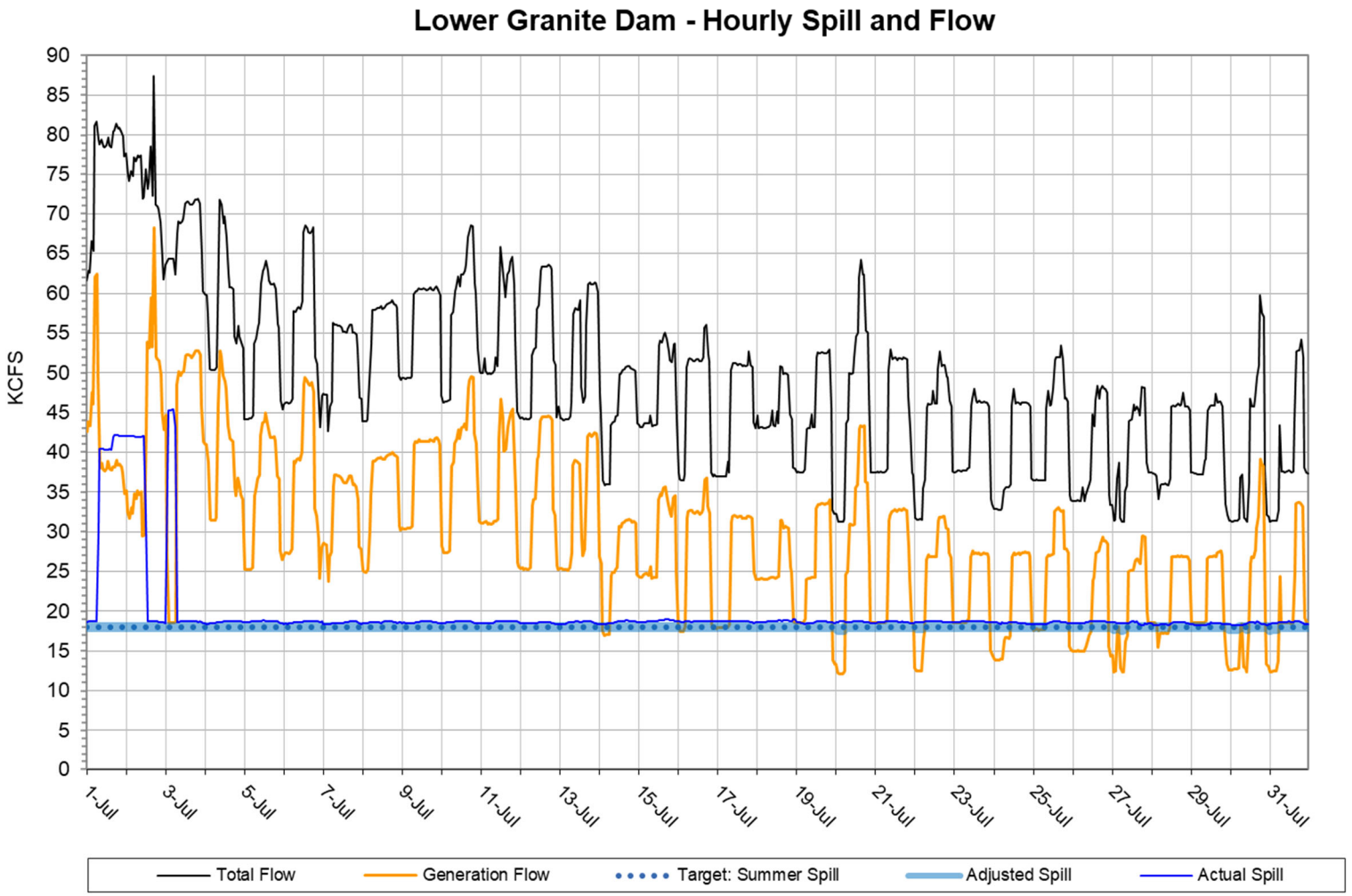
Project	Parameter	Date	Time[12]	# of Hours	Type	Reason
McNary	Additional Spill	7/3	1200-1300	2	Transmission Reliability	Hourly spill increased to between 193 and 194 kcfs (greater than adjusted spill target of 185 ± 2 kcfs which was limited by the spill cap) in order to provide reserves. Regionally coordinated via 2020 FOP, Section 4.4.1.
John Day	Additional Spill	7/9 7/11 7/21 7/22 7/23 7/24 7/27 7/28	2300 1400-1600 1900, 2300 0100-0200, 2200 0200-0300, 0900,1600-1700, 2400 0400, 0900 2300-2400 2400	1 3 2 3 6 2 2 1	Transmission Reliability	Hourly spill increased to between 37% and 41% (greater than adjusted spill target of 35%) in order to provide reserves. Daily average spill was between 35% and 36% of the total flow. Regionally coordinated via 2020 FOP, Section 4.4.1.
John Day	Reduced Spill	7/12 7/21	1900 0700	1 1	Transmission Reliability	Hourly spill decreased to 33% (less than adjusted spill target of 35% ± 1%) due to an increase in generation in order to deploy reserves. Daily average spill was 35% of the total flow. Regionally coordinated via 2020 FOP, Section 4.4.1.
The Dalles	Additional Spill	7/4 7/11 7/21 7/22 7/23 7/27 7/28	0000-0100 1400-1600 2300 0200 0200-0300, 0900 2300-2400 2400	2 3 1 1 3 2 1	Transmission Reliability	Hourly spill increased to between 42% and 45% (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	7/4 7/10 7/11 7/12 7/21 7/28	1000 1100 1200 1900, 2300 0700 0600	1 1 1 2 1 1	Transmission Reliability	Hourly spill decreased to 38% (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 4: July 2020 Average Percent TDG Values Table (7/1 to 7/31)

FIXED MONITORING STATIONS																
Station:	**LWG**	**LGNW**	**LGSA**	**LGSW**	**LMNA**	**LMNW**	**IHRA**	**IDSW**	**MCNA**	**MCPW**	**JDY**	**JHAW**	**TDA**	**TDDO**	**BON**	**CCIW**
Gas Cap %:	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**
7/1/2020	101	118	111	113	113	119	112	117	111	119	106	120	114	120	112	119
7/2/2020	101	118	109	113	111	118	110	115	109	120	105	120	115	120	114	120
7/3/2020	102	114	108	111	110	118	109	115	111	119	105	120	115	120	115	120
7/4/2020	102	111	109	113	110	118	110	115	113	119	106	117	114	119	114	120
7/5/2020	103	112	112	113	111	118	112	115	114	118	107	116	110	116	114	118
7/6/2020	103	112	113	113	112	117	113	116	114	119	109	115	109	116	112	117
7/7/2020	103	112	111	112	113	117	113	114	113	118	108	115	108	115	109	117
7/8/2020	103	112	111	112	112	118	112	114	110	118	108	115	110	116	110	117
7/9/2020	103	112	111	112	111	117	112	114	111	119	108	116	110	116	111	117
7/10/2020	102	112	110	112	112	118	113	114	110	119	107	117	111	117	112	118
7/11/2020	103	112	112	113	112	118	114	113	111	119	107	117	111	117	113	118
7/12/2020	103	112	111	113	112	118	114	114	111	119	108	116	109	116	111	117
7/13/2020	103	112	110	113	111	118	114	113	111	119	110	115	110	117	112	117
7/14/2020	103	114	110	113	111	117	113	112	111	120	111	116	112	118	113	117
7/15/2020	102	114	110	113	112	118	114	112	112	120	111	115	112	118	113	117
7/16/2020	102	113	110	114	112	118	115	113	112	119	111	115	111	116	112	117
7/17/2020	102	114	111	114	112	118	115	113	112	119	110	[13]	109	115	109	117
7/18/2020	103	113	113	115	112	119	115	112	111	118	111		109	116	109	117
7/19/2020	103	114	113	115	111	118	114	113	111	118	111		113	118	111	117
7/20/2020	103	114	112	115	113	119	114	114	112	119	112		113	118	113	117
7/21/2020	103	114	111	114	114	119	**116**	113	113	119	113	115	113	118	114	117
7/22/2020	103	114	113	115	113	119	**117**	114	113	119	111	115	110	116	111	117
7/23/2020	104	114	112	115	113	119	**117**	114	111	118	110	115	108	115	109	117
7/24/2020	103	114	111	114	112	117	115	113	110	117	108	115	107	114	106	116
7/25/2020	103	114	110	114	110	114	114	112	108	117	107	115	108	115	107	117
7/26/2020	102	114	109	113	109	114	113	112	108	118	108	115	111	118	110	117
7/27/2020	102	114	108	118	111	116	113	112	109	118	107	115	111	117	114	117
7/28/2020	101	114	109	114	113	115	114	113	110	117	107	115	110	116	114	117
7/29/2020	102	114	109	114	112	116	114	114	111	119	108	115	109	116	111	117
7/30/2020	105	114	111	114	113	114	114	114	111	118	110	115	111	117	111	117
7/31/2020	105	115	112	114	113	115	114	113	110	117	111	114	111	116	110	117
Exceedances:							**3**									

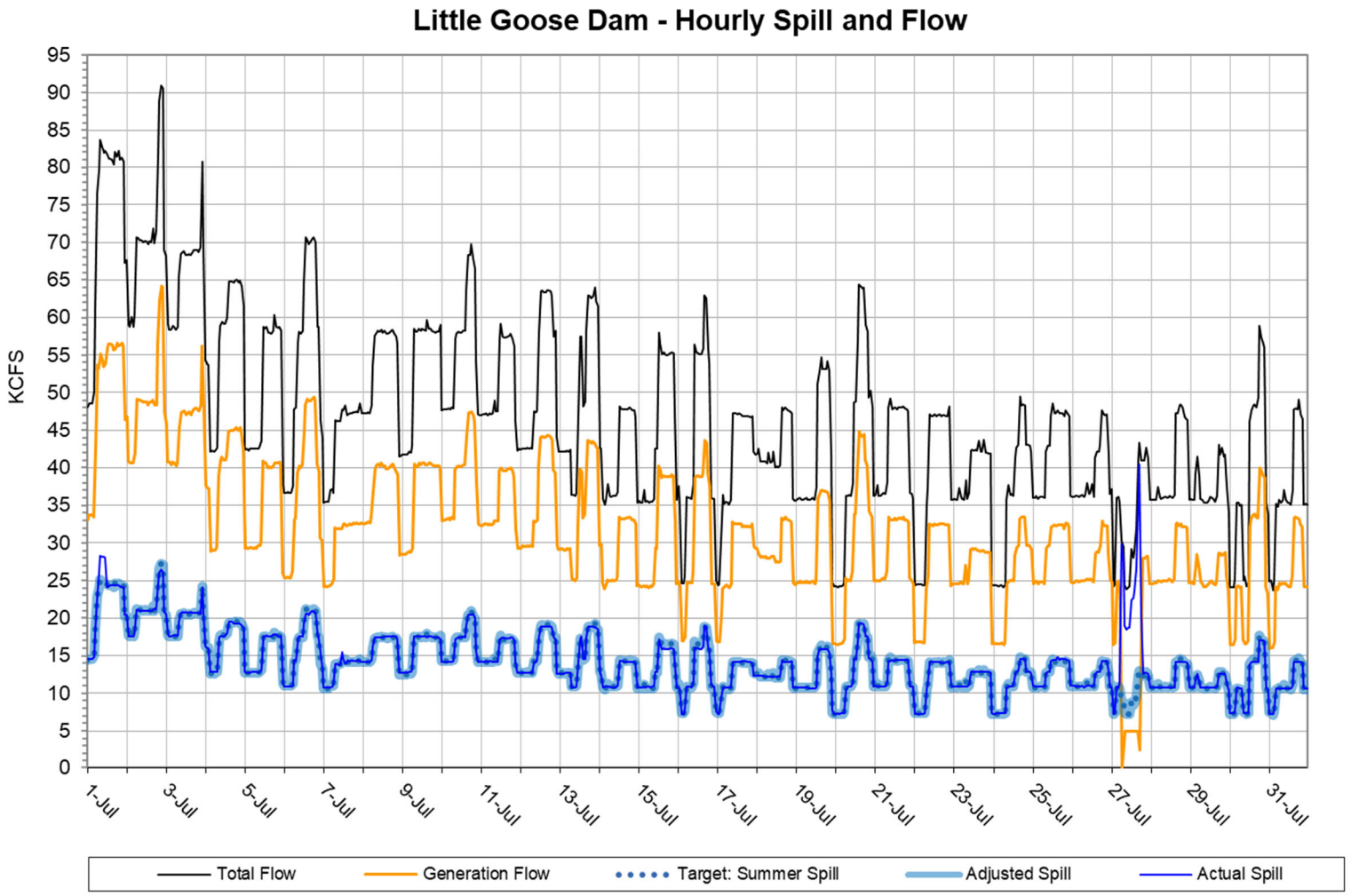
[13] Red shaded cells indicate no data due to malfunctioning gauge from a torn membrane.

Figure 1[14]



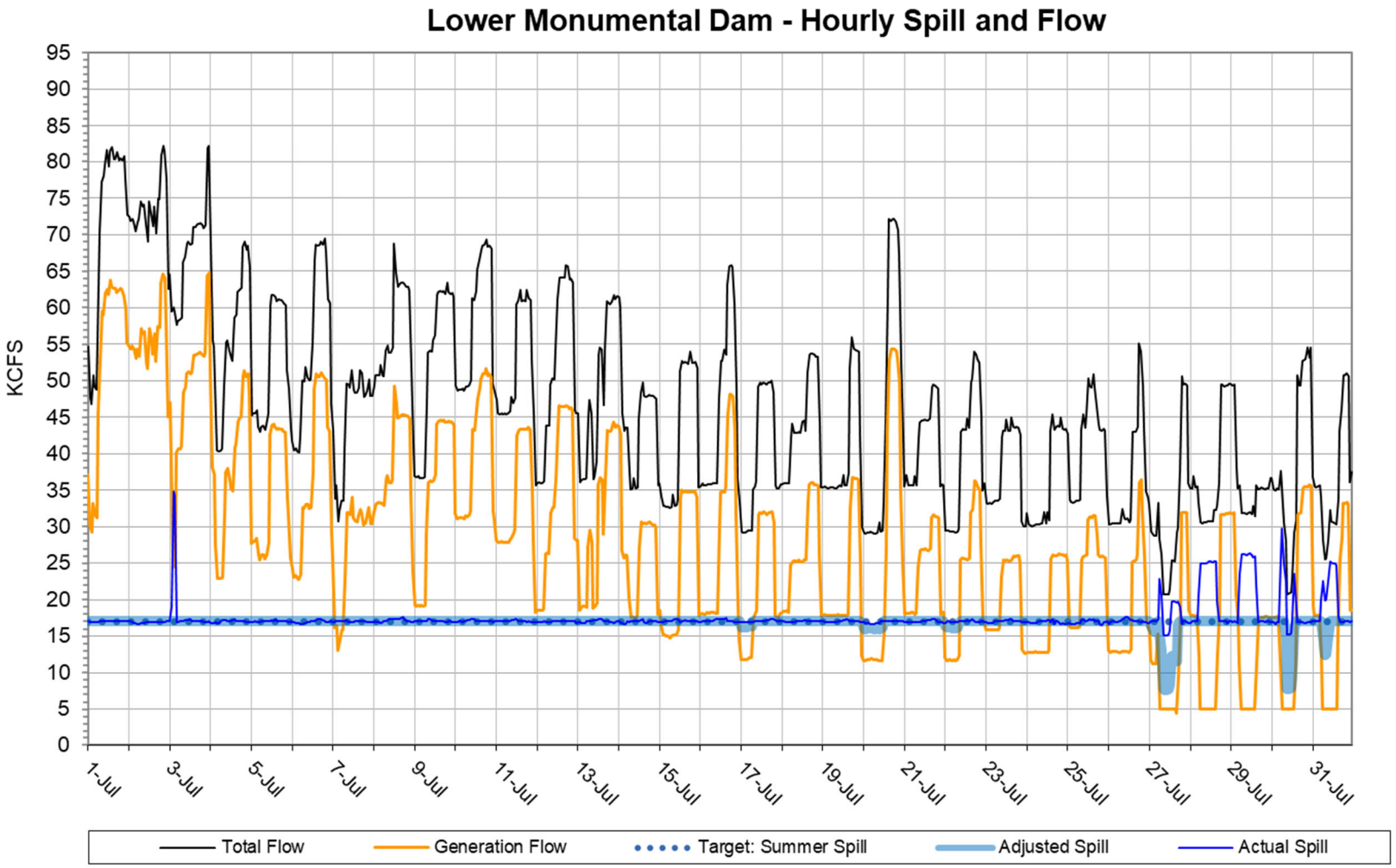
[14] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 2[15]



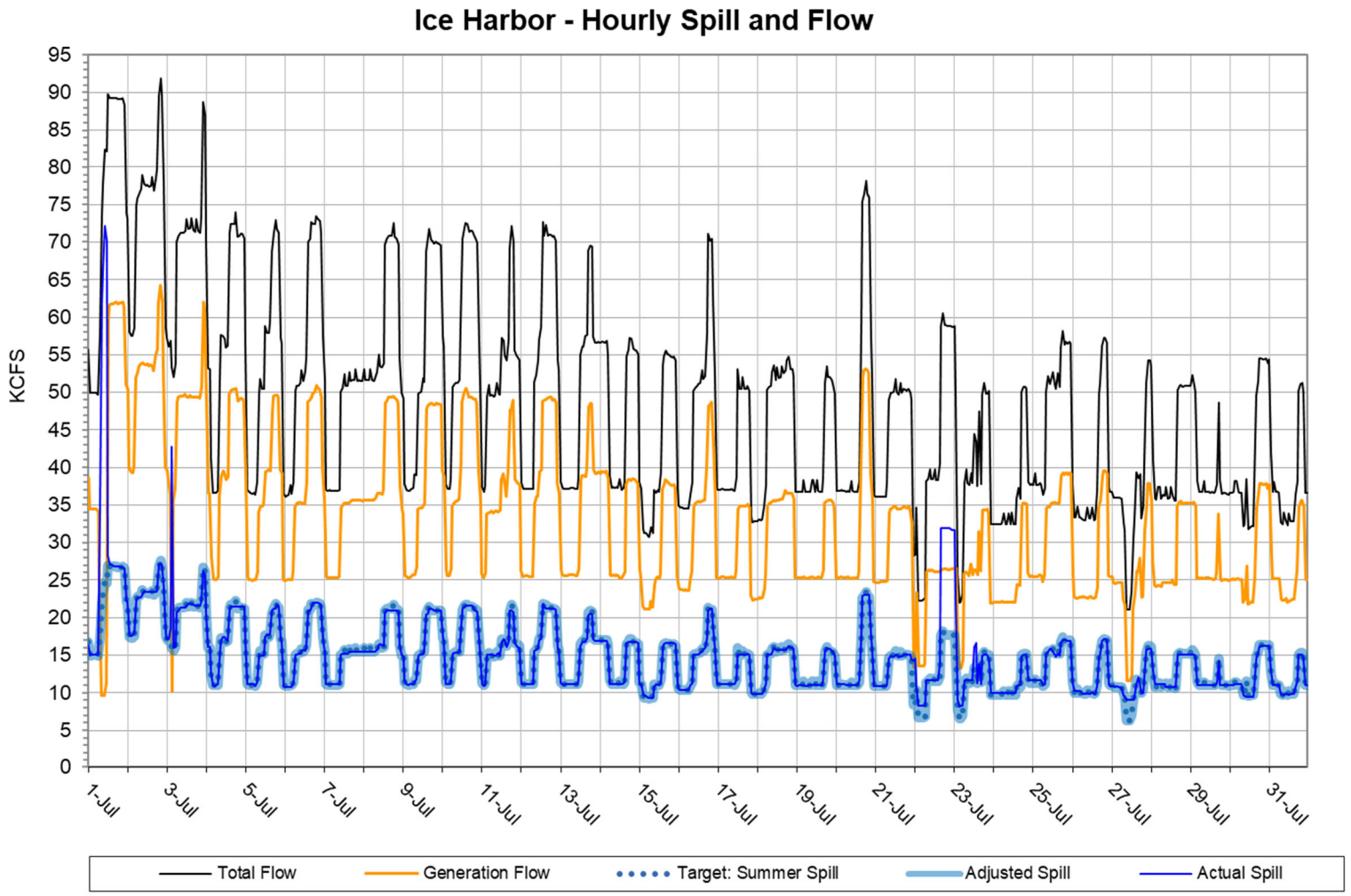
[15] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 3[16]



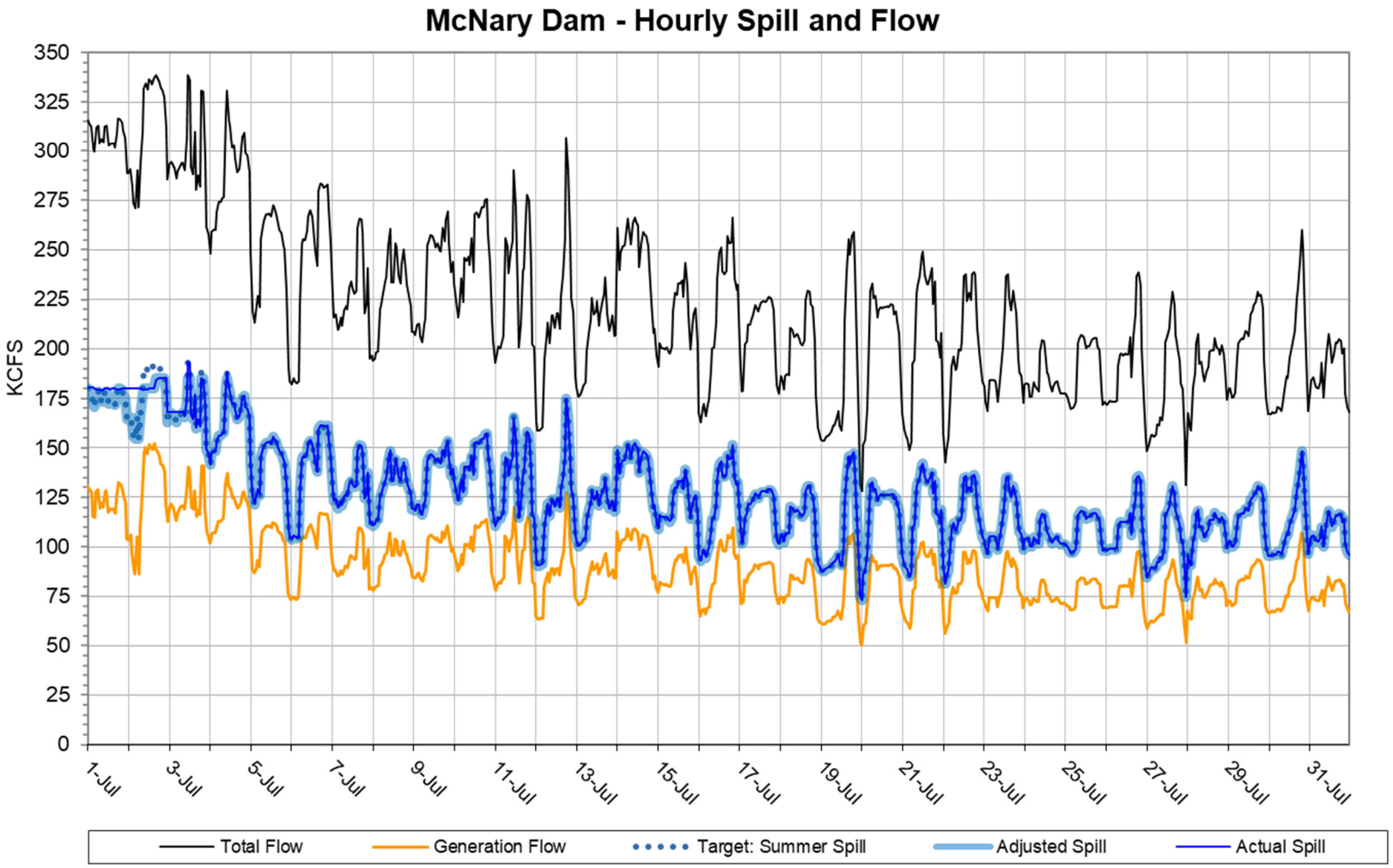
[16] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 4[17]



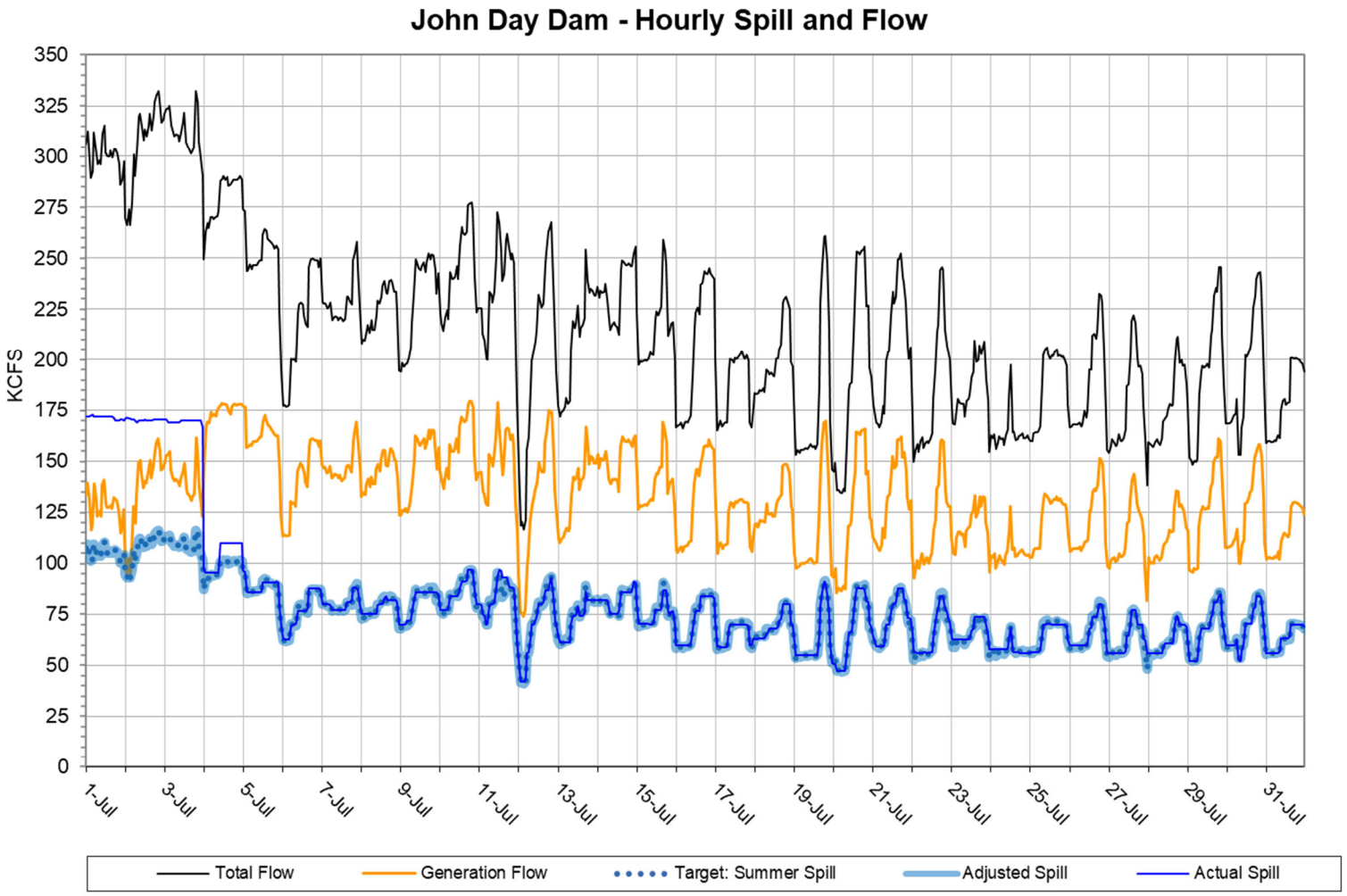
[17] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 5[18]



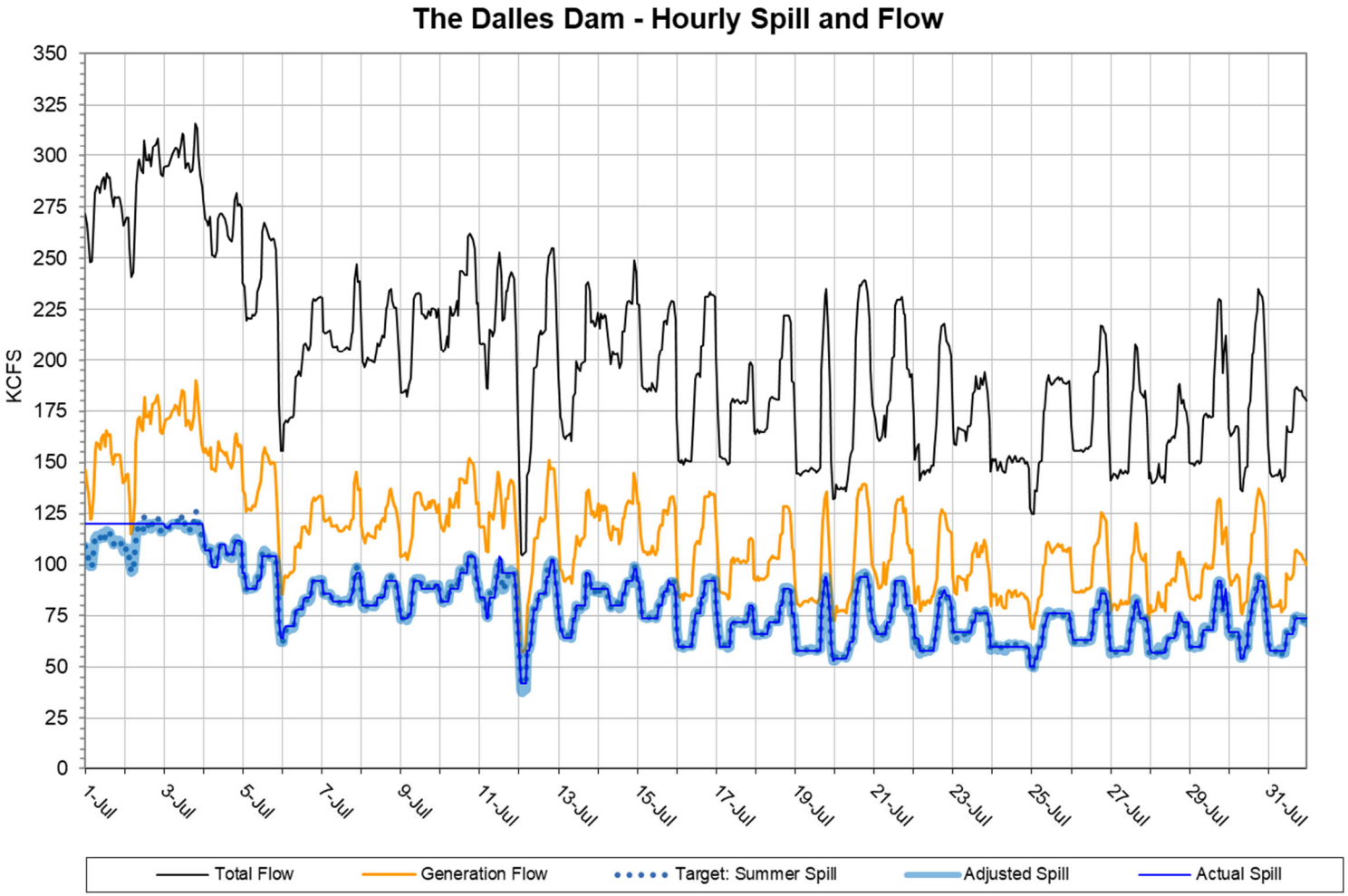
[18] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 6[19]



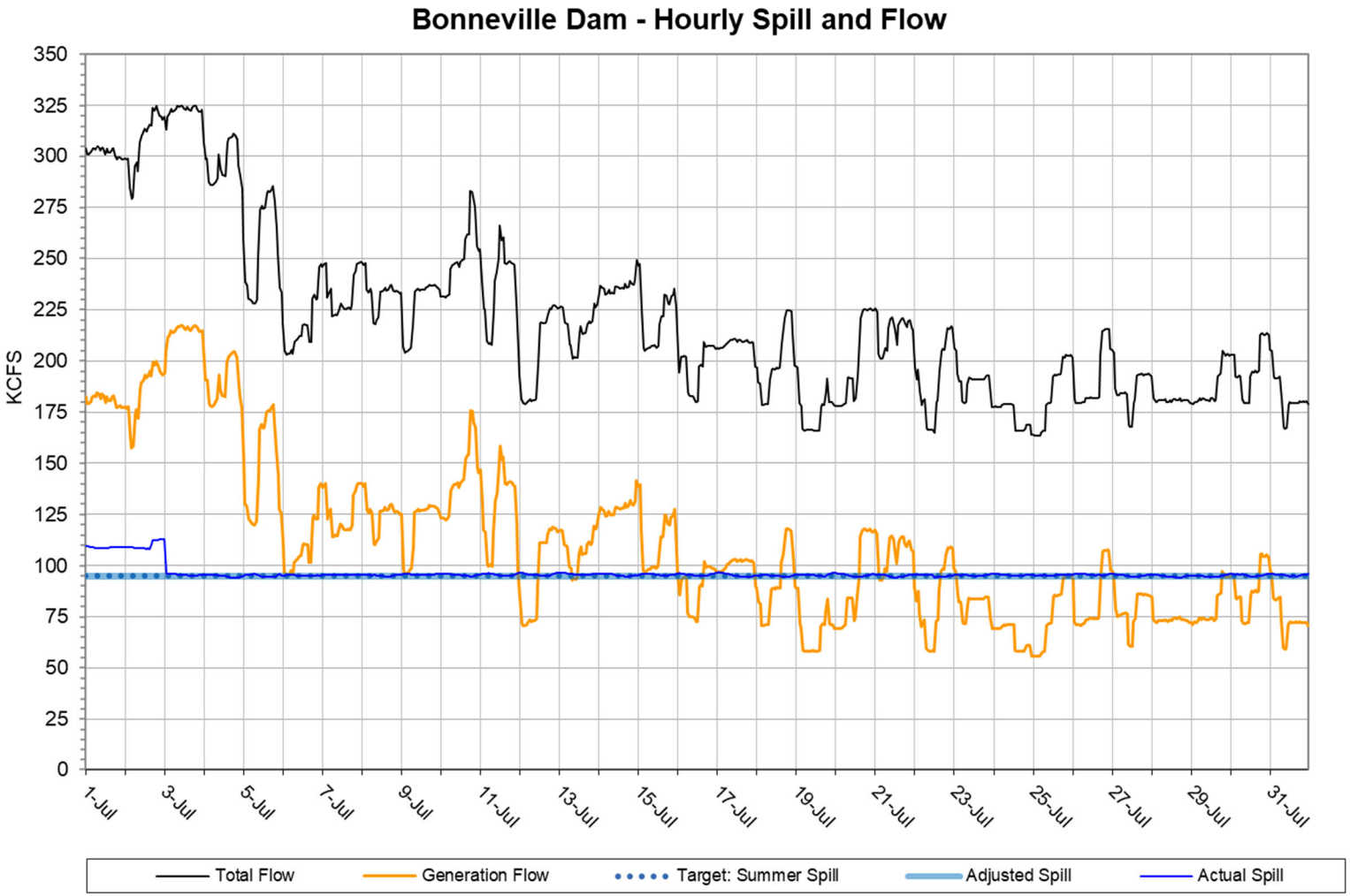
[19] The adjusted spill line is a simplified representation due to limitations of representing a range of minimum generation values. See Tables 2 and 3 for spill variances and pre-coordinated operations.

Figure 7[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 8[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.