FISH OPERATIONS PLAN IMPLEMENTATION REPORT

July 2019

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 2019 Fish Operations Plan[1] (2019 FOP). The 2019 FOP describes the Corps' planned operations for juvenile fish passage at its four lower Snake River and four lower Columbia River dams during the 2019 spring and summer fish migration seasons, generally April 3 through August 31. The 2019 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), 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 2019 Water Management Plan (WMP), seasonal WMP updates, and the 2019 Fish Passage Plan (FPP).

This report describes the Corps' implementation of the 2019 FOP during the month of July 2019. In particular, information in this report includes the following:

- total flow: the total hourly river outflow 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 2019 FOP, section 4.1);
- actual spill: the hourly flow over the spillway; and,

[1] The 2019 FOP was posted to the Technical Management Team (TMT) website on April 1, 2019 (http://pweb.crohms.org/tmt/documents/fpp/2019/).

[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.

- resultant 12-hour average TDG for the tailwater at each project and for the next project's forebay downstream[3].

This report also provides information on issues and unanticipated or emergency situations that arose during implementation of the 2019 FOP in July 2019.

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 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 dotted blue line represents the hourly target summer spill in kcfs.
- 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 (2019 FOP section 4.1).

II. The average daily %TDG for the 12 highest hours for all projects is shown in the July 2019 Average Percent TDG Values Table (Table 4). The numbers in red indicate the project exceeded the %TDG cap - i.e. 120% (tailwater) for each project and 115% (forebay of the next downstream dam).

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 2019 Spill Variance Table (Table 2).[4] The Spill Variance Table includes average hourly data; but

[3] Averages reported are consistent with the current and applicable Oregon TDG standard modification (120% tailwater) and Washington TDG criteria adjustments (120% tailwater/115% forebay during summer spill). The Oregon TDG standard modification and the Washington TDG criteria adjustments during summer spill have different methodologies for calculating TDG. When the standards vary or conflict, the Corps applies the more stringent standard. See 2019 FOP section 2.1.

[4] 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.

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 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 2019 FOP for Bonneville and The Dalles dams,[5] which may range up to ±3 kcfs) as compared to a target spill rate. When target spill is a percentage of total outflow, the hourly spill level is calculated to be within +/-1% of the target percentage (or ±4% at Little Goose during low flows as described in Section 8 of the 2019 FOP). 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.

July Operations

The month of July was characterized by below average flows for the lower Snake and lower Columbia Rivers with near average air temperatures and well below average precipitation in the Columbia Basin. Observed precipitation in July was 26% of average on the Snake River above Ice Harbor and 64% of average on the Columbia River above The Dalles[6]. The NOAA Northwest River Forecast Center runoff summary for July indicated that the adjusted runoff for the Snake River at Lower Granite was 75% of the 30-year average (1981-2010) with a volume of

[5] As specified in the 2019 FOP section 3.
[6] Retrieved 1 August 2019: https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=5

1.7 MAF (Million acre-feet). The adjusted runoff for the Columbia River at The Dalles was 74% of the 30-year average (1981-2010) with a volume of 10.7 MAF[7].

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 2019 summer target spill levels at lower Snake River and lower Columbia River projects.

PROJECT	2019 SUMMER SPILL[1] (24 hrs/day)
Lower Granite	18 kcfs
Little Goose	30%[2]
Lower Monumental	17 kcfs
Ice Harbor	30%
McNary	57%
John Day	35%
The Dalles	40%
Bonneville	95 kcfs

1. Spill may be temporarily reduced below the 2019 FOP summer target spill level at any project if necessary to ensure navigation safety or transmission reliability, or to avoid exceeding State TDG standards.
2. When river flow is ≤ 32 kcfs at Little Goose, the project cannot maintain 30% spill. Therefore, the project will transition to constant spill of 7-11 kcfs, as described in Section 4.3.3 of the FOP.

In its implementation of the 2019 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 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

No operational adjustments to report during this period.

[7] Retrieved 1 August 2019: https://www.nwrfc.noaa.gov/runoff/runoff_summary.php?date=08/01/2019
[8] See 2019 FOP section 2.2

Table 2: Spill Variances - July 2019 (7/1 to 7/31)

Project	Parameter	Date	Time[9]	# of Hours	Type	Reason
Little Goose	Reduced Spill	7/31/19	2200	1	Human Error	Hourly spill decreased to 9 kcfs (less than the spill target 11 kcfs) due to a miscalculation. Daily average spill was 11 kcfs.
Ice Harbor	Additional spill	7/24/19 7/25/19 7/26/19 7/27/19 7/28/19 7/29/19 7/30/19 7/31/19	1400-1600 0400-1400 0700-1700 1300-1800 1100-1400 1500-1800 1300-1700 1500-1700	3 11 11 6 4 4 5 3	Operational Limitation	Hourly spill increased to between 33% and 40% of total flow (greater than the spill target of 30% ±1% range) due to the removable spillway weir (RSW) in bay 1 that physically limits the minimum spill rate to 8 kcfs.
Ice Harbor	Reduced Spill	7/31/19	1000-1200, 1400	4	Human Error	Hourly spill decreased to 5 and 6 kcfs (below minimum 8 kcfs spill with the RSW open) due to implementing the incorrect spill pattern.

[9] Data collected for reporting spill variances are reported as hourly averages. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented as an hour. The hourly average data is reported at the end of the hour (i.e., hour ending).

Table 3: Pre-Coordinated Operations - July 2019 (7/1 to 7/31)

Project	Parameter	Date	Time[10]	# of Hours	Type	Reason
Little Goose	Reduced Spill	7/11/19 7/22/19	1600 1300	1 1	Navigation	Hourly spill decreased to 28% of total flow (less than the spill target of 30% ± 1% range) due to volume of water needed to empty the navigation lock. Daily average spill was 30%. Regionally coordinated via 2019 FOP, Sections 4.1 and 4.6.
Lower Monumental	Reduced Spill	7/2/19 7/4/19 7/6/19 7/8/19 7/10/19 7/12/19 7/14/19 7/16/19 7/18/19 7/20/19 7/22/19 7/24/19 7/26/19 7/28/19 7/30/19	1800-1900 1800-1900 1700-1800 1800 1800 1800 1700-1800 1700-1800 1700-1800 1700-1800 1800 1900 1700 1800 1900	2 2 2 1 1 1 2 2 2 2 1 1 1 1 1	Navigation	Hourly spill decreased to between 8 kcfs and 14 kcfs (less than the spill target of 17 kcfs ± 2 kcfs) for safe navigation. Regionally coordinated via 2019 FOP, Sections 4.1 and 4.6.
Lower Monumental	Additional Spill	7/25/19 7/26/19 7/27/19 7/28/19 7/29/19 7/30/19 7/31/19	0600-1700 0600-1700 0700-1700 0600-1600 0600-1700 0600-1700 0600-1700	12 12 11 11 12 12 12	Maintenance	Hourly spill increased while generation was reduced to speed no load (5 kcfs) for station service due to units taken offline to perform Doble testing. Regionally coordinated via the 2019 FPP LMN Section 4.3.5.
Ice Harbor	Reduced Spill	7/7/19 7/11/19 7/12/19 7/31/19	1000 0400 1000 1300	1 1 1 1	Navigation	Hourly spill decreased to 28% of the total flow (less than the spill target of 30% ± 1% range) for safe navigation. Daily average spill was 30%. Regionally coordinated via 2019 FOP, Sections 4.1 and 4.6.
Ice Harbor	Additional Spill	7/10/19	0000	1	Transmission Reliability	Hourly spill increased to 34% of the total flow (greater than 30% ±1 % range) due to a generation decrease in order to balance load. Daily average spill was 30%. Regionally coordinated via 2019 FOP Section 4.4.1 Item 2.
Ice Harbor	Reduced Spill	7/22/19	0800	1	Maintenance	Hourly spill decreased to 28% of total flow (less than 30% ±1 % range) due to units taken offline in order to perform Doble testing. Daily average spill was 30%. Regionally coordinated via the 2019 FPP IHR Section 4.3.4.

[10] Data collected for reporting pre-coordinated operations are reported as hourly averages. Therefore, while spill may be increased or decreased for only a portion of an hour, it is represented as an hour. The hourly average data are reported at the end of the hour (i.e., hour ending).

Project	Parameter	Date	Time[10]	# of Hours	Type	Reason
John Day	Additional Spill	7/6/19	2200	1	Transmission Reliability	Hourly spill increased to 37% of total flow (greater than 35% ±1 % range) due to a generation decrease in order to balance load. Daily average spill was 30%. Regionally coordinated via 2019 FOP Section 4.4.1 Item 2.

Table 4: July 2019 Average Percent TDG Values Table (7/1 to 7/31)

Date	FIXED MONITORING STATIONS															
	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW	JDY	JHAW	TDA	TDDO	BON	CCIW
	Lower Granite FB	Lower Granite TW	Little Goose FB	Little Goose TW	Lower Monumental FB	Lower Monumental TW	Ice Harbor FB	Ice Harbor TW	McNary FB	McNary TW	John Day FB	John Day TW	The Dalles FB	The Dalles TW	Bonneville FB	Bonneville TW
Gas Cap %:	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**	**115**	**120**
7/1/2019	103	116	113	111	112	117	113	113	111	•[11]	107	115	109	116	112	117
7/2/2019	104	116	114	112	113	117	114	113	111	116	107	114	109	115	110	117
7/3/2019	104	116	113	111	113	118	114	113	110	116	106	115	106	114	108	117
7/4/2019	105	116	113	110	112	117	113	113	109	115	106	115	107	114	107	117
7/5/2019	105	116	112	111	112	117	113	113	108	115	106	115	108	114	107	117
7/6/2019	103	116	113	111	113	117	113	114	109	115	106	114	107	114	107	117
7/7/2019	102	116	114	111	113	117	114	113	109	115	105	114	107	113	107	117
7/8/2019	102	115	114	111	113	118	114	113	109	116	105	114	107	114	107	117
7/9/2019	102	115	113	111	112	117	114	113	109	116	104	115	108	114	108	117
7/10/2019	101	115	112	111	113	117	114	113	109	116	104	114	109	115	110	117
7/11/2019	101	116	112	111	113	118	114	114	110	116	104	114	109	115	110	117
7/12/2019	102	116	112	111	113	117	115	114	110	116	105	114	109	115	110	117
7/13/2019	102	116	113	111	113	117	**116**	114	110	117	105	114	109	115	110	117
7/14/2019	102	116	112	110	113	117	**116**	114	110	116	105	115	107	114	109	117
7/15/2019	103	116	112	110	112	117	115	113	110	116	106	115	108	114	108	117
7/16/2019	103	116	112	111	112	117	114	113	109	116	106	115	109	115	109	117
7/17/2019	103	116	112	114	112	117	114	113	109	116	106	114	108	114	109	117
7/18/2019	102	115	112	115	112	117	114	113	108	116	106	114	107	114	108	117
7/19/2019	102	116	111	114	111	117	112	112	106	116	105	115	106	113	106	117
7/20/2019	101	116	110	114	110	117	111	112	105	116	105	115	108	115	107	117
7/21/2019	101	116	109	114	109	117	111	112	107	115	105	115	110	116	110	118
7/22/2019	101	116	108	114	111	117	112	112	108	116	106	115	110	116	110	118
7/23/2019	103	116	108	113	112	117	112	113	108	117	105	114	109	115	110	117
7/24/2019	102	116	109	111	112	116	112	112	108	116	104	114	106	113	106	117
7/25/2019	103	116	110	110	111	118	112	112	107	117	105	114	109	115	108	117
7/26/2019	104	116	110	110	111	118	112	112	108	116	105	114	109	115	110	117
7/27/2019	104	116	110	110	110	118	112	112	107	116	105	114	109	115	110	117
7/28/2019	101	116	110	110	108	118	111	112	107	115	105	114	106	113	108	117
7/29/2019	102	117	111	111	109	118	113	113	108	117	105	114	109	115	108	117
7/30/2019	102	116	111	111	108	118	113	112	108	116	105	114	109	114	108	117
7/31/2019	102	116	111	111	107	118	112	112	108	117	105	114	106	113	106	117
Exceedances:	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

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

Figure 1

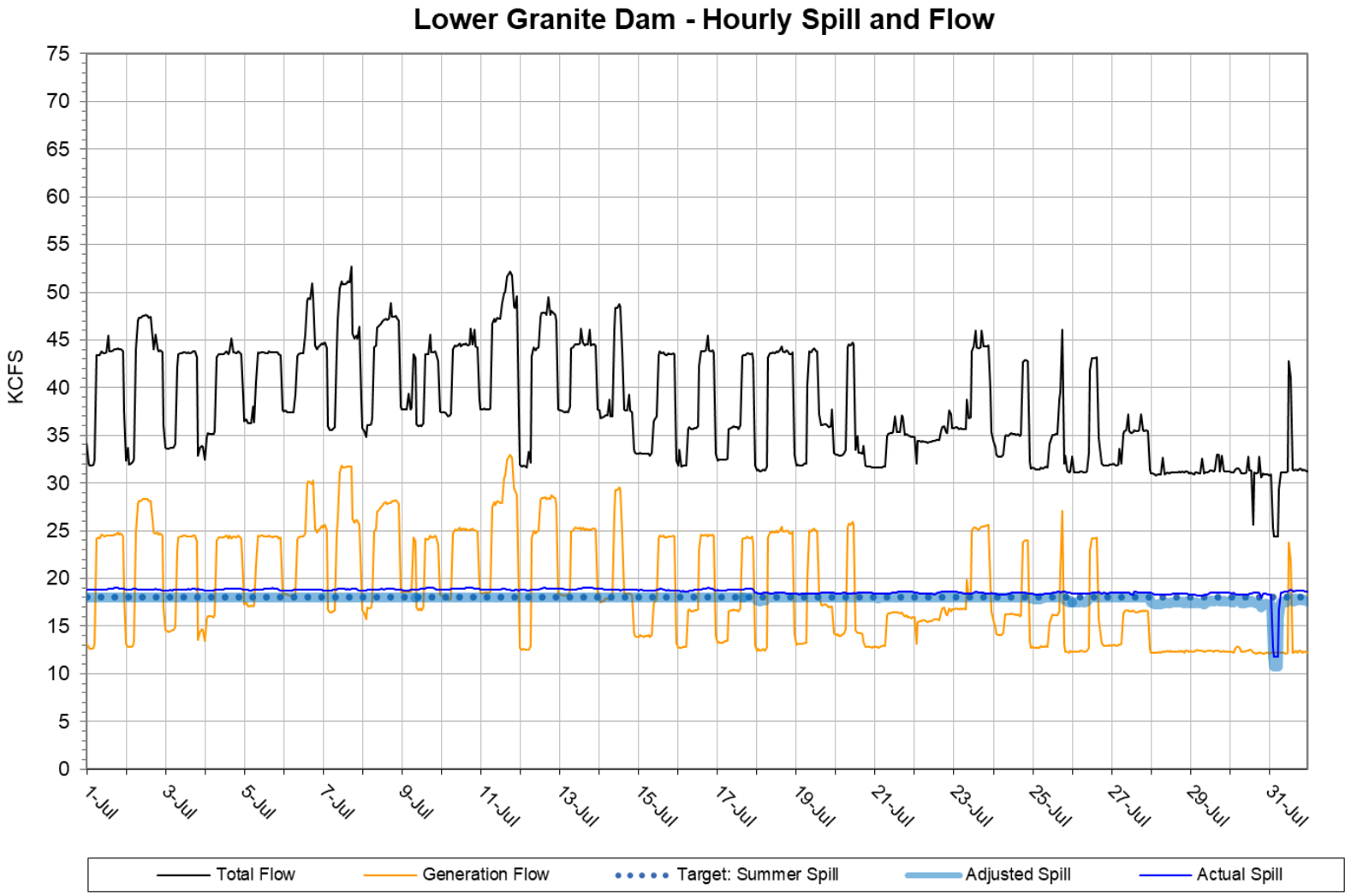

Lower Granite Dam - Hourly Spill and Flow
KCFS
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 2

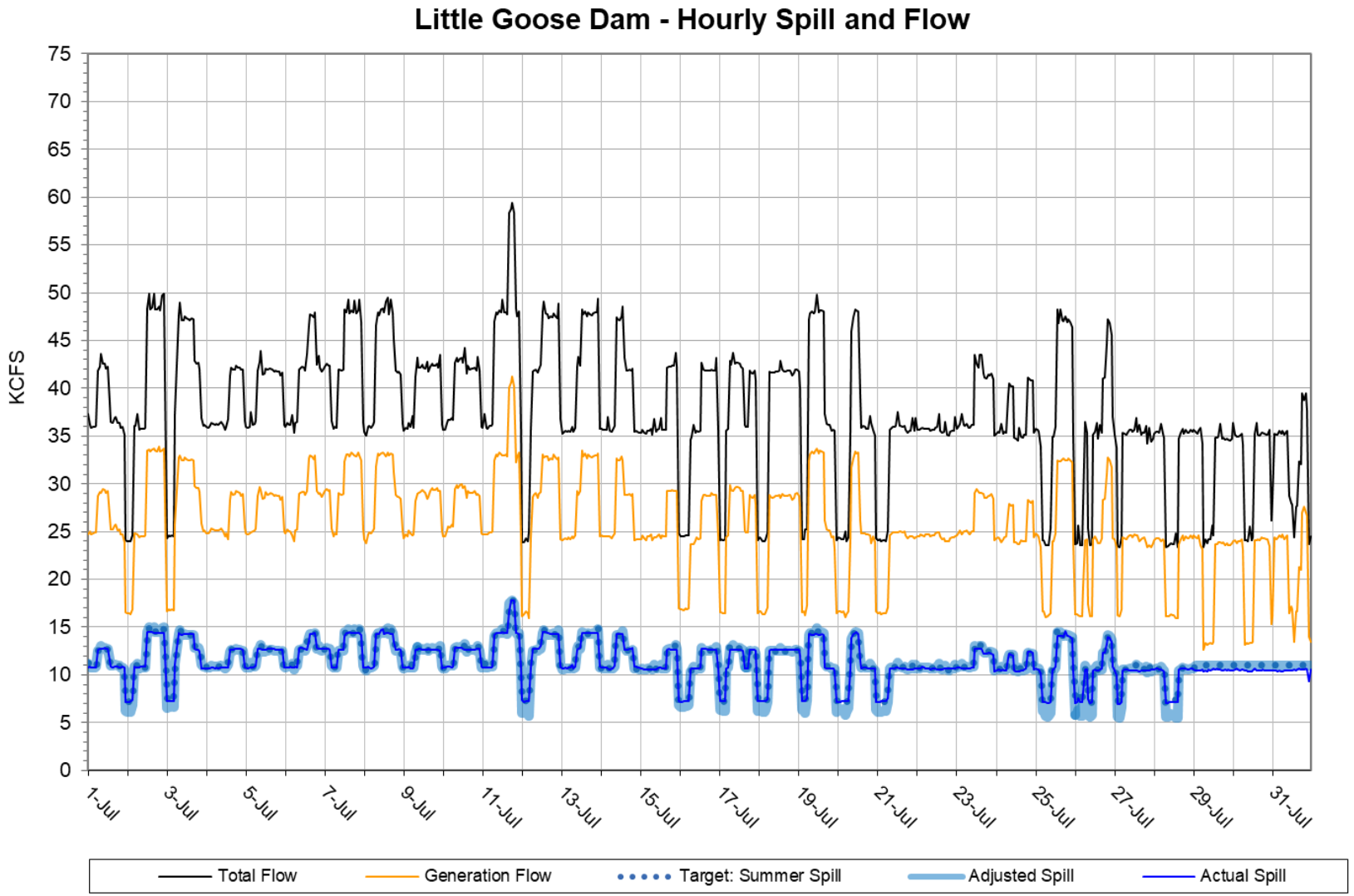

Little Goose Dam - Hourly Spill and Flow
KCFS
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 3

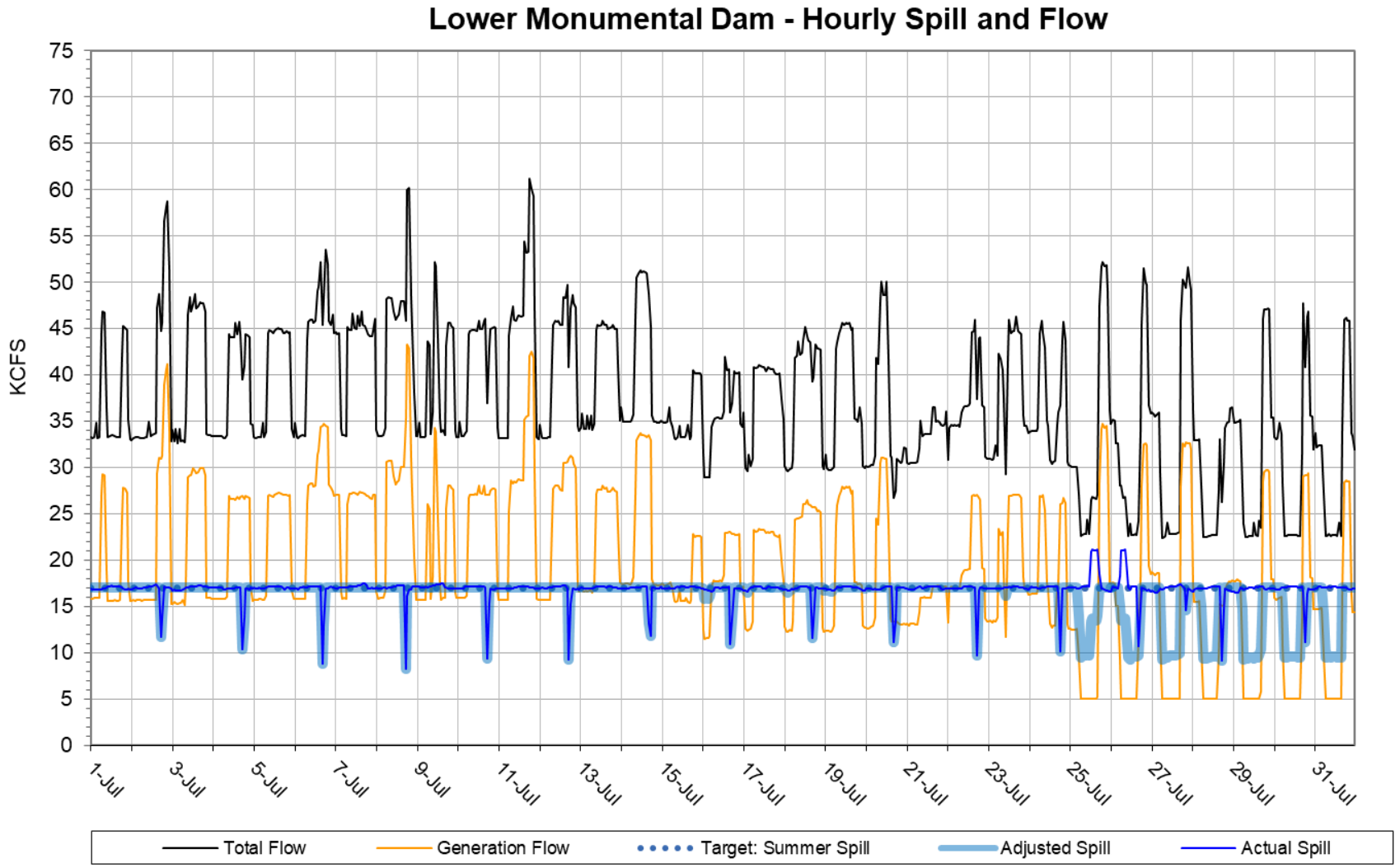

Lower Monumental Dam - Hourly Spill and Flow
KCFS
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 4

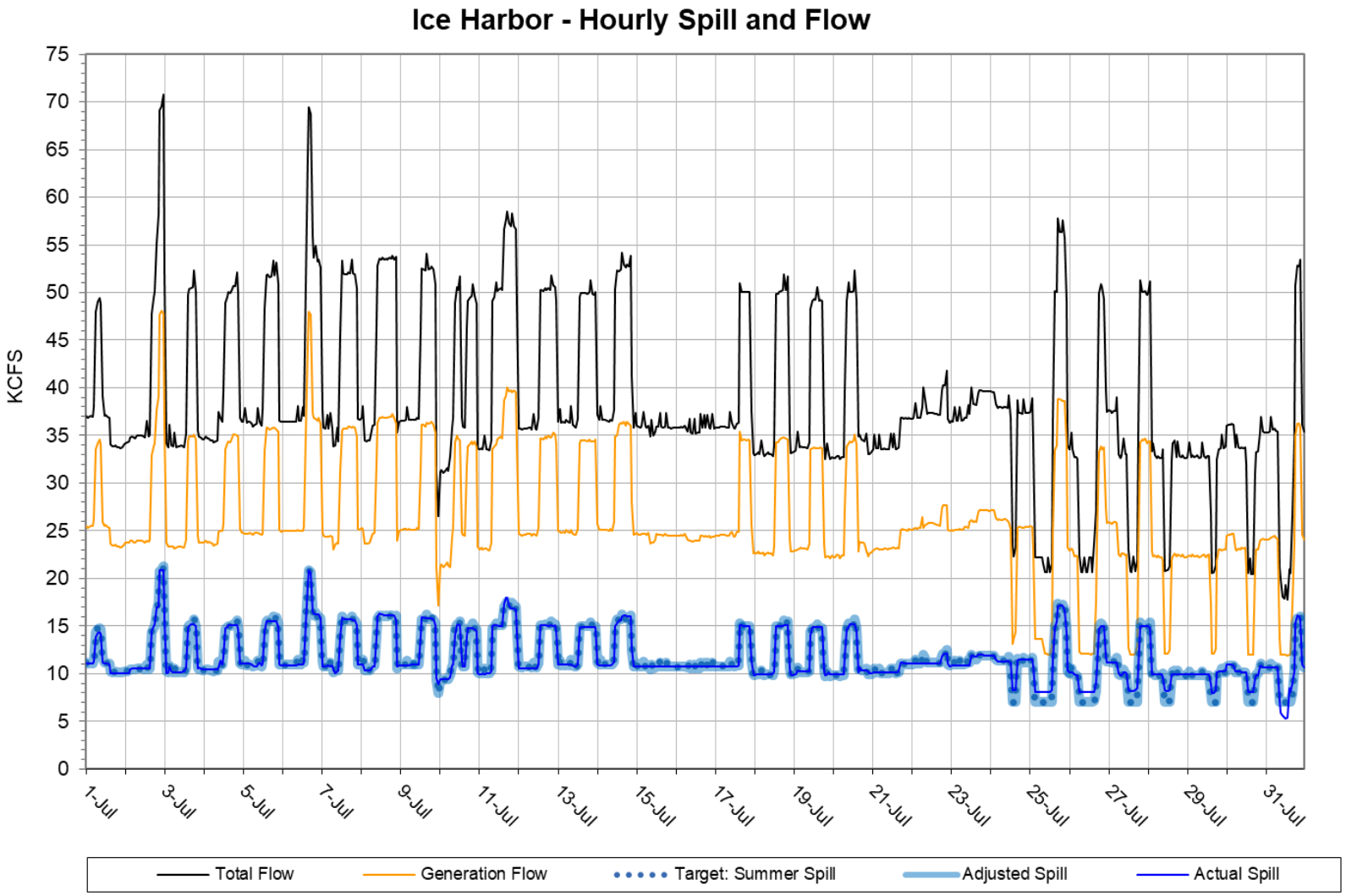

Ice Harbor - Hourly Spill and Flow
KCFS
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 5

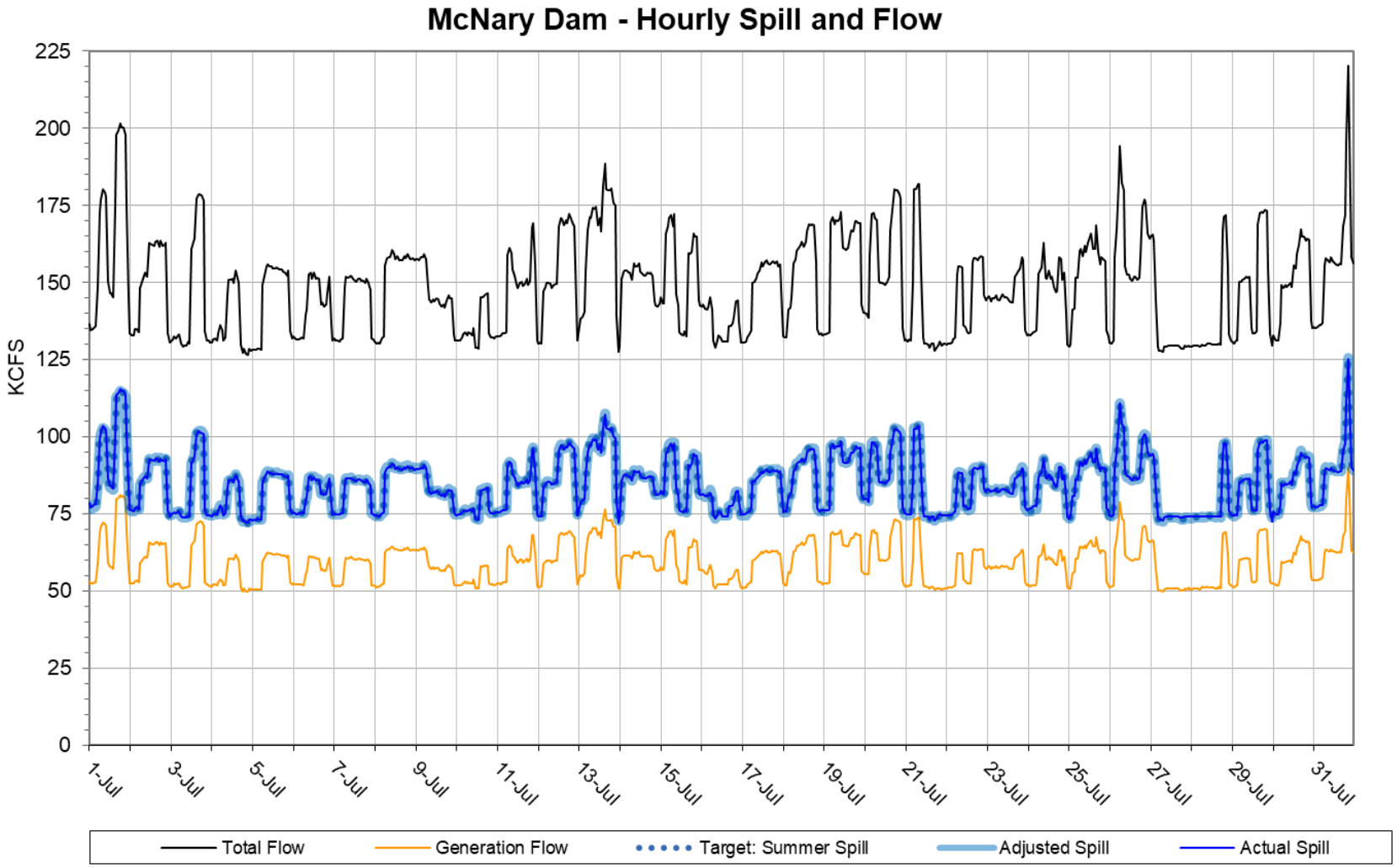

McNary Dam - Hourly Spill and Flow
KCFS
225
200
175
150
125
100
75
50
25
0
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 6

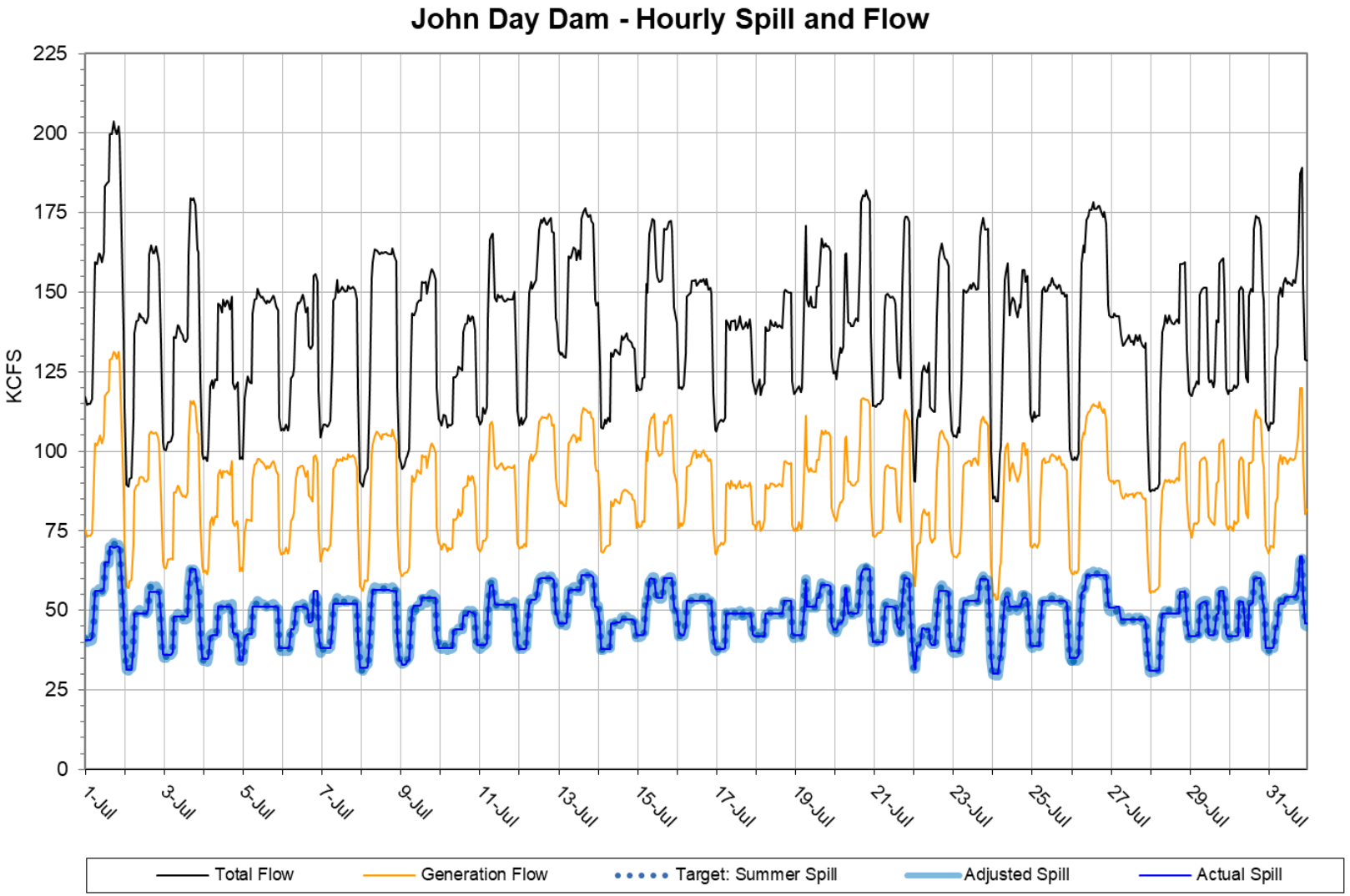

John Day Dam - Hourly Spill and Flow
KCFS
225
200
175
150
125
100
75
50
25
0
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 7

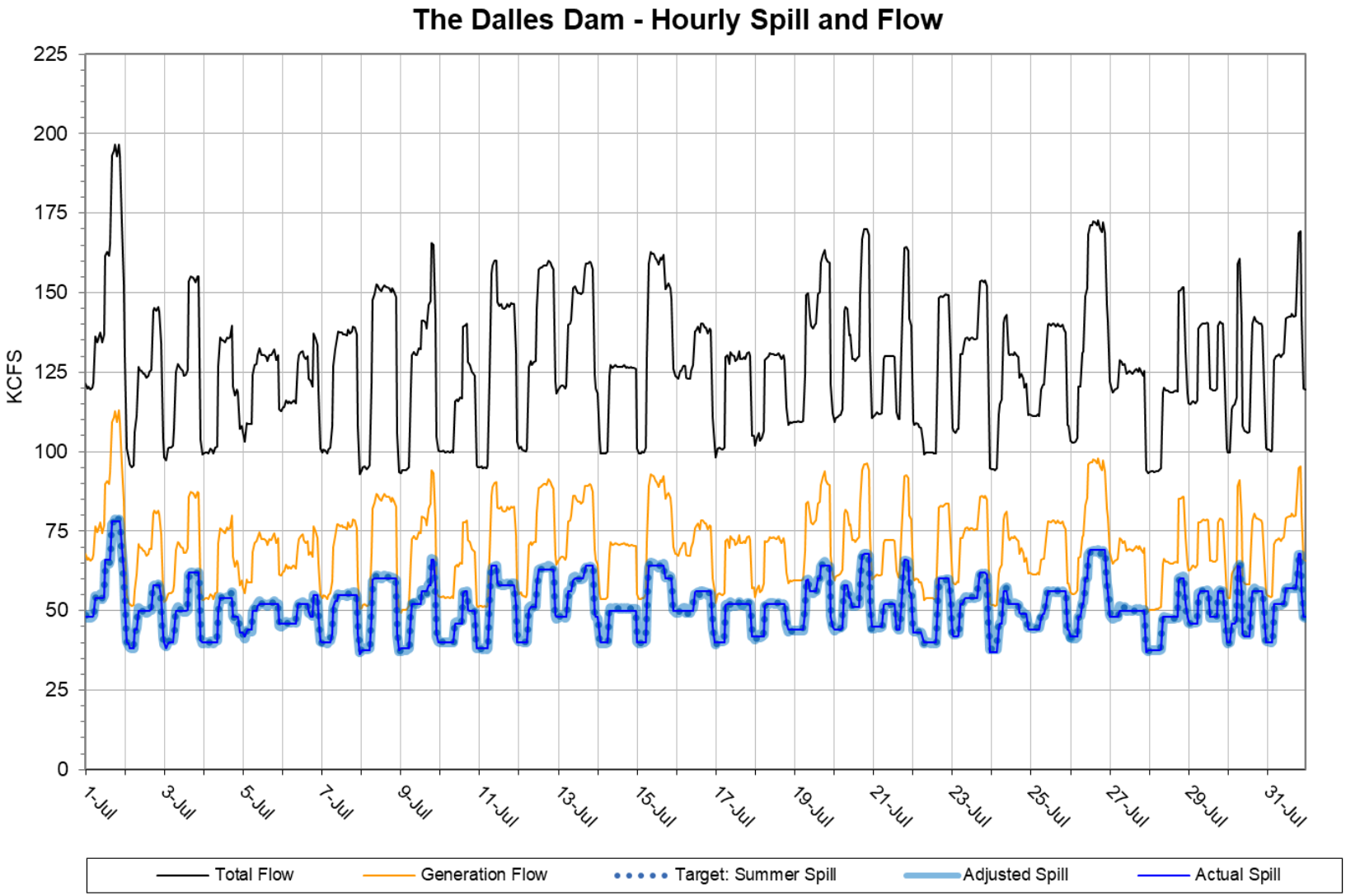
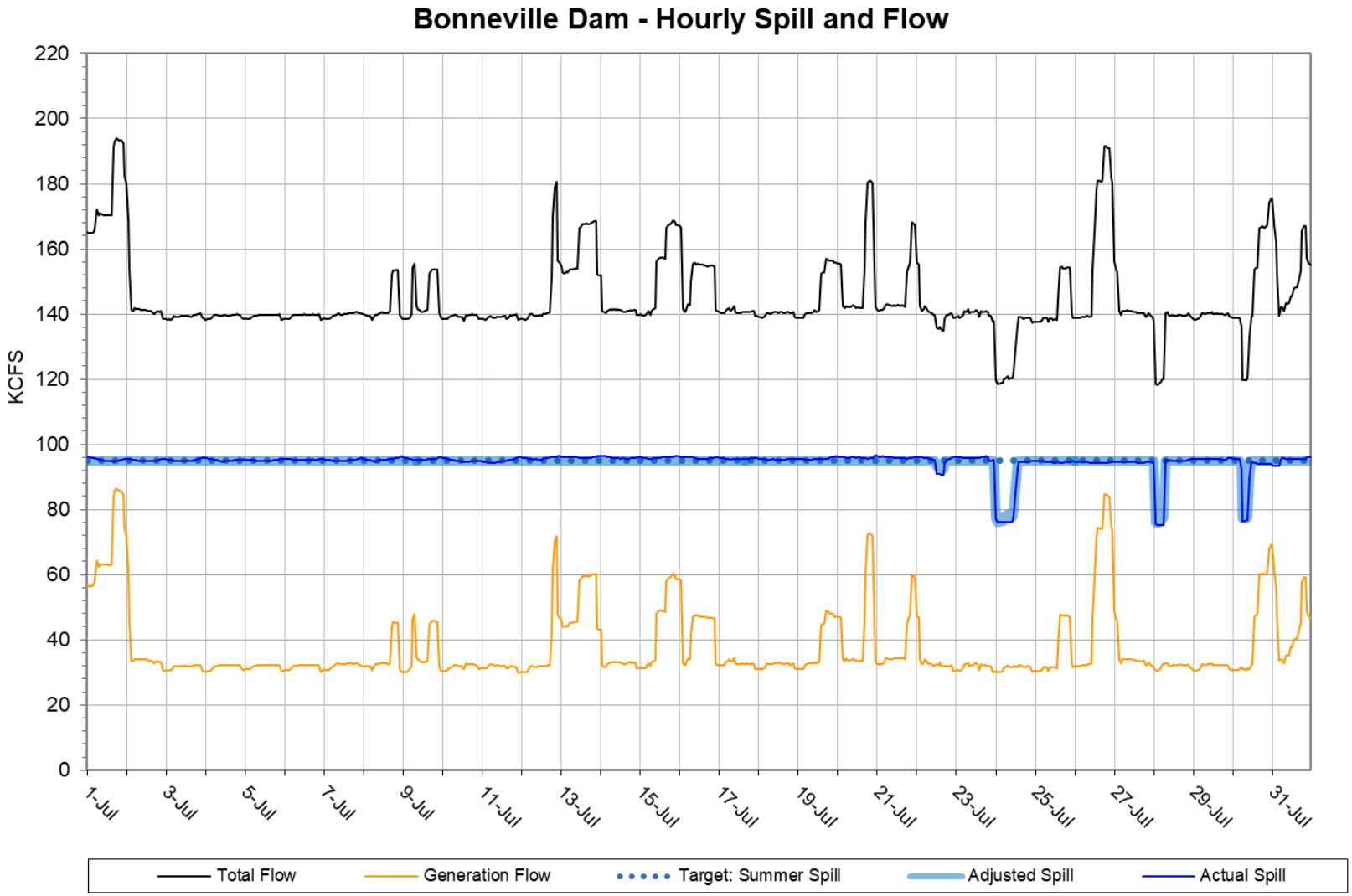

The Dalles Dam - Hourly Spill and Flow
KCFS
225
200
175
150
125
100
75
50
25
0
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill

Figure 8


Bonneville Dam - Hourly Spill and Flow
KCFS
220
200
180
160
140
120
100
80
60
40
20
0
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
Total Flow
Generation Flow
Target: Summer Spill
Adjusted Spill
Actual Spill