FISH OPERATIONS PLAN IMPLEMENTATION REPORT

July 2017

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

Introduction

The U.S. Army Corps of Engineers (Corps) is submitting this report in accordance with the 2017 Fish Operations Plan (2017 FOP) posted to the Technical Management Team (TMT) website on March 6, 2017. The 2017 FOP describes the Corps' project operations for fish passage at its Federal Columbia River Power System (FCRPS) dams during the spring and summer fish migration season, generally April through August. To the extent Corps project operations are not specified in the 2017 FOP, the FCRPS operations will be consistent with the 2014 NOAA Fisheries Supplemental Biological Opinion (2014 Supplemental BiOp), the United States Fish and Wildlife Service's 2000 and 2006 Biological Opinions, and/or other operative documents, including the 2017 Water Management Plan (WMP), WMP seasonal updates, and the 2017 Fish Passage Plan (FPP).

The Corps' July 2017 lower Snake and Columbia River project and fish passage operations are contained in this report. In particular, information in this report includes the following:

- Hourly flow through the powerhouse at each dam;
- Hourly flow over the spillway compared to the spill target for that hour; and
- Daily average Total Dissolved Gas (TDG) levels (percent of saturation) in the tailwater at each project, and in the subsequent downstream project's forebay.[1]

This report also provides information on presented issues and unanticipated or emergency situations that arose during implementation of the 2017 FOP in July 2017.

Data Reporting

I. For each project providing fish passage operations, this report contains one graph per operational month (July) displaying the performance of the fish passage spill program, with hourly spill, FOP spill, generation, and total flows. The monthly graphs begin on July 1 and end on July 31 for the following lower Snake River and lower Columbia River projects: Lower Granite, Little Goose, Lower Monumental, Ice Harbor, McNary, John Day, The Dalles, and Bonneville.

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

Operations represented on the monthly graphs start at 0100 hours on July 1 for the lower Snake River and the lower Columbia River projects as follows:

- The dark tan line represents the average hourly total river flow through the project in thousand cubic feet per second (kcfs).
- The dotted blue line represents the average hourly flow through the powerhouse each hour in kcfs.
- The dotted pink line represents the actual average hourly spill level through the spillway in kcfs.
- The thin green line represents the hourly FOP spill level as defined in the 2017 FOP.
- The thick green line represents the adjusted FOP spill. This is the hourly maximum 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 the following conditions:
    - spill percentage or flow rate specified in the 2017 FOP;
    - spill caps as set daily for TDG management;
    - test spill levels for fish passage research;
    - minimum generation for power system needs;
    - minimum spill at Bonneville Dam (50 kcfs); and
    - minimum spill at John Day Dam is 25 percent of project outflow.

II. The average daily %TDG for the 12 highest hours for all projects is shown in the July 2017 Average Percent TDG Values Table (Table 3). The numbers in red indicate the project exceeded the %TDG cap - i.e. 115% (forebay of the next downstream dam) or 120% (tailwater) for each project. For the lower Columbia projects, tailwater TDG values are presented by displaying the highest value %TDG (controlling limit), and the lower value is displayed with a strikethrough.

General Implementation Remarks

For all projects that spill for fish passage, the actual spill may vary from the target spill due to various conditions as described below. When spill levels briefly deviate below or above the level specified in the 2017 FOP, the dotted pink line will be below or above the heavy green line in the figures.[2] Actual deviations from the target operation during voluntary spill hours are described below in the July 2017 Spill Variance Table (Table 1).[3] The Spill Variance Table includes average hourly data; therefore, while spill may vary from target FOP spill for only a portion of an hour, the Spill Variance Table characterizes the variance as a full hour. There are instances when the hourly FOP 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 2017 FOP level of spill while also avoiding exceeding the

[2] The actual thickness of the heavy green line (adjusted FOP spill) is not representative of the spill cap range; if the dotted pink line is slightly outside the thick green line, it should not be construed to indicate a spill variance or involuntary spill.

[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, and passing debris.

%TDG spill cap to the extent practicable.

"Low flow" operations at the lower Columbia and Snake projects are triggered when inflow is insufficient to provide both minimum generation and the specified spill levels. 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. During low flow periods at Little Goose Dam, the overall project spill percentage appears to be reduced because the calculations do not account for the volume of water released during navigational lockages; however, the actual spill volume remains constant. When this occurs, it is recorded in the monthly Pre-Coordinated Operations Table (Table 2)[4] denoted as "Navigation" type.

Actual spill levels at Corps projects with set flow targets may vary up to ±2 kcfs within the hour (except as otherwise noted in the 2017 FOP for Bonneville and The Dalles dams[5], which may range up to ±3 kcfs) as compared to those specified in the 2017 FOP and the RCC spill priority list (defining the project %TDG spill caps). 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).

The 2017 FOP describes project "Operations during Rapid Load Changes" (p. 6). For reporting purposes, when hourly spill levels were not met as a result of load swing hours and other related within-hour load variability issues, the notation "Transmission Stability" will be used in the Spill Variance Table. "Transmission Stability" occurs because projects must be available to respond to within-hour load variability to satisfy North American Electric Reliability Corporation (NERC) reserve requirements ("on response") or other NERC mandatory reliability regulatory requirements. In addition to within-hour load variability, projects on response must be responsive to within hour changes resulting from intermittent generation (such as wind generation). During periods of rapidly changing loads and intermittent generation, projects on response may have significant changes in turbine discharge within the hour while spill quantity remains the same within the hour. Under normal conditions, within-hour load changes primarily occur immediately preceding and following the peak load hours; however, within-hour changes in intermittent generation can occur at any hour of the day. Occasionally, several hours after peak load hours, the project may be decreasing total outflow and generation faster than the corresponding spill decreases causing the percent spill to be slightly higher. Due to the high

[4] Other routine activities that change spill levels and have been coordinated with regional partners will be identified in Table 2.

[5] As specified in the 2017 FOP (p. 14), this applies when the spill level is below 40% of total flow at The Dalles Dam.

variability of within-hour load, reporting actual spill percentages that vary by more than the ±1 percent within hour requirement (or other ranges specified in the 2017 FOP) may occur with greater frequency with "Transmission Stability" hours than other hours.

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 near average flows for the lower Snake and lower Columbia rivers along with above average air temperatures and well below average precipitation across the Columbia Basin. The NOAA Northwest River Forecast Center[6] reported the July 2017 adjusted runoff for the Snake River at Lower Granite at 107% of the 30-year average (1981-2010) with a volume of 2.5 MAF (Million Acre Feet). The July 2017 adjusted runoff for the Columbia River at The Dalles was 89% of average with a volume of 12.9 MAF. Observed precipitation in July was 24% of average for the Snake River above Ice Harbor and 15% of average for the Columbia River above The Dalles. Observed air temperatures in July were 4.8°F above average for the Snake River above Ice Harbor and 4.3°F above average for the Columbia River above The Dalles.

During the July 2017 reporting period, the planned 2017 FOP spill operations were carried out as follows:

- Lower Granite Dam - The hourly target spill level was 18 kcfs, 24 hours/day.
- Little Goose Dam - The hourly target spill level was 30% of total project outflow, 24 hours/day.
- Lower Monumental Dam - The hourly target spill level was 17 kcfs, 24 hours/day.
- Ice Harbor Dam - The hourly target spill level alternated in 2-day blocks between 30% of total project outflow, 24 hours/day and 45 kcfs during the day and the %TDG cap during the night (%TDG cap range ~75 – 95 kcfs) through July 13 when the operation transitioned to 45 kcfs during the day and the %TDG cap during the night.
- McNary Dam - The hourly target spill level was 50% of total project outflow, 24 hours/day.
- John Day Dam - The hourly target spill level alternated in 2-day blocks between 30% and 40% of total project outflow, 24 hours/day until July 20 when the operation transitioned to 30% of total project outflow, 24 hours/day. Spill level changes occur at 2000 hours.
- The Dalles Dam - The hourly target spill level was 40% of total project outflow, 24 hours/day.
- Bonneville Dam - The hourly target spill level alternated in 2-day blocks between 95 kcfs, 24 hours/day vs. 85 kcfs during the day and 121 kcfs during the night.

Operational Adjustments

1. McNary Dam

Please see the revised (08/10/2017) June FOP Implementation Report for a description of the

[6] Retrieved August 1, 2017 from: https://www.nwrfc.noaa.gov/runoff/runoff_summary.php

adjustment that occurred from June 29 at 1630 hours through June 30 at 2400 hours, and July 1 at 0000 hours through July 13 at 1105 hours at McNary Dam.

2. **Ice Harbor Dam**

On July 6 from 2000–2100 hours, spill at Ice Harbor Dam was reduced below the 2017 FOP summer spill target due to a transmission system emergency. At the time of the event, the FOP target was nighttime spill to the gas cap (90 kcfs); however, due to low flows, in the absence of the transmission emergency, the project would have operated at minimum generation and spilled the remainder of outflow (58 kcfs), pursuant to low flow provisions in the FOP. At 1958 hours, the Bonneville Power Administration (BPA) declared a System Emergency when a transformer in the Tri-Cities area was forced out of service by a cooling system failure during a period of high temperatures and heavy power demand in the Tri-Cities. In order to maintain transmission system reliability and avoid power outages, generation was increased at Ice Harbor Dam for approximately 1 hour. The remainder of outflow for spill was 47 kcfs, which is below the FOP target spill rate of 58 kcfs under minimum generation conditions.

The Action Agencies notified TMT of this event via email on July 7 at 1330 hours and at the meeting on July 10.

Table 1: Spill Variance Table – July 2017 (7/1 to 7/31)

Project	Parameter	Date	Time[7]	Hours	Type	Reason
Little Goose	Additional Spill	7/11/17	0100	1	Maintenance	Hourly spill increased to 33% (above 30% ± 1% range) due to the malfunctioning of an oil pump governor. Daily average spill was 30%.
Little Goose	Reduced Spill	7/28/17	1100	1	Human Error	Hourly spill decreased to 28% (below 30% ± 1% range). Delay in changing to 14 kcfs. Daily average spill was 30%.
Lower Monumental	Additional Spill	7/12/17	1000-1100	2	Human Error	Hourly spill increased to 26 kcfs (above 17 kcfs ± 2 kcfs range) due to a miscommunication of unit availability.
Lower Monumental	Additional Spill	7/12/17	1400	1	Human Error	Hourly spill increased to 20 kcfs (above 17 kcfs ± 2 kcfs range) due to a delay in shifting flow to generation.
Ice Harbor	Reduced Spill	7/6/17	2100	1	Transmission Stability	Hourly spill decreased to 47 kcfs (below 58 kcfs ± 2 kcfs range) due to transmission system emergency.
McNary	Reduced Spill	7/1/17 – 7/13/17	0000 - 0900	245	Human Error	Hourly spill decreased to 47% and 48% (below 50% ± 1 % range). As reported in the revised June FOP implementation report, the setting for the spill control software program was not updated for spillbay 2 operations.

[7] 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 2: Pre-Coordinated Operations – July 2017 (7/1 to 7/31)

Project	Date	Type	Description of Event	Regional Coordination
Little Goose	July 3 1600, July 29 0900 and July 31 0300	Navigation	The volume of water needed to empty the navigation lock reduces the spill percentage.	2017 FOP, page 6
Lower Monumental	Every other day from 7/1 through 7/19 and 7/25 through 7/31	Navigation	Spill was reduced for safe passage of fish barges crossing project tailwater.	2017 FOP, pages 2, 4, 7 and 12
Lower Monumental	July 12 from 0800-1300	Maintenance	Spill was increased during the Submersible Traveling Screens (STS) inspections.	2017 FPP, Lower Monumental Dam section 2.3.2.2.
Ice Harbor	July 19 1000, 1500	Maintenance	Spill was decreased during the STS inspections.	2017 FPP, Ice Harbor Dam section 2.3.2.2.

Table 3: July 2017 Average Percent TDG Values Table (7/1 to 7/31)[8]

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	
Method:	WA	WA	WA	WA	WA	WA	WA	WA	WA	OR	WA	WA	OR	WA	WA	OR	WA	WA	OR	WA
7/1/2017	105	109	109	112	114	117	114	116	115	~~119~~	119	111	116	~~116~~	112	~~115~~	116	116	~~117~~	118
7/2/2017	105	109	109	111	113	117	115	116	115	~~118~~	119	112	116	~~116~~	111	~~114~~	115	112	~~118~~	118
7/3/2017	105	109	108	111	112	116	115	115	114	~~117~~	118	112	117	~~117~~	111	~~114~~	114	110	117	~~117~~
7/4/2017	104	110	108	112	111	116	114	115	113	118	~~118~~	112	~~116~~	117	112	115	~~115~~	111	~~116~~	117
7/5/2017	105	110	109	112	111	116	114	116	114	~~117~~	118	112	~~115~~	116	112	~~115~~	116	113	~~117~~	117
7/6/2017	105	112	109	111	111	116	114	116	115	~~116~~	117	111	116	~~115~~	112	~~114~~	114	114	~~117~~	117
7/7/2017	104	112	109	111	111	116	114	115	113	~~117~~	117	111	116	~~116~~	111	114	~~114~~	114	117	~~117~~
7/8/2017	104	113	109	112	111	116	114	115	113	~~116~~	117	111	~~115~~	116	111	~~114~~	114	110	~~116~~	116
7/9/2017	105	113	108	112	111	116	114	115	113	~~115~~	116	111	~~114~~	115	111	~~114~~	114	110	116	~~116~~
7/10/2017	104	113	109	112	111	114	114	115	112	115	~~115~~	109	~~113~~	114	109	~~112~~	113	109	~~116~~	117
7/11/2017	104	112	109	112	111	114	114	115	111	~~116~~	116	108	115	~~115~~	107	113	~~113~~	108	116	~~116~~
7/12/2017	104	113	108	112	110	117	113	113	111	117	~~117~~	107	~~113~~	114	109	~~113~~	113	108	~~115~~	116
7/13/2017	103	111	107	111	110	116	112	113	110	117	~~117~~	106	~~113~~	113	108	~~112~~	112	108	115	~~115~~
7/14/2017	102	111	110	113	110	116	112	115	110	118	~~118~~	105	113	~~113~~	107	113	~~113~~	108	116	~~116~~
7/15/2017	103	111	110	113	110	116	112	114	110	~~116~~	117	105	~~113~~	113	108	~~112~~	113	109	~~116~~	116
7/16/2017	103	110	110	113	110	117	112	114	110	~~115~~	116	103	~~112~~	112	107	112	~~112~~	107	~~115~~	115
7/17/2017	104	110	109	113	111	116	113	113	110	116	~~116~~	104	~~113~~	113	108	~~112~~	112	108	115	~~115~~
7/18/2017	104	110	109	112	111	117	113	114	111	117	~~117~~	104	114	~~114~~	108	113	~~113~~	109	~~116~~	116
7/19/2017	102	110	108	112	110	116	113	113	112	116	~~116~~	105	~~113~~	113	108	~~113~~	113	109	116	~~116~~
7/20/2017	103	110	107	109	111	116	113	114	111	~~115~~	116	105	114	~~113~~	108	112	~~112~~	108	~~115~~	116
7/21/2017	104	110	107	109	110	116	112	114	109	115	~~115~~	105	114	~~114~~	108	113	~~113~~	108	~~116~~	116
7/22/2017	104	110	107	109	109	116	112	114	108	~~115~~	115	106	115	~~115~~	108	~~112~~	112	110	117	~~117~~
7/23/2017	103	109	107	109	107	116	111	114	110	~~114~~	115	107	~~114~~	114	109	113	~~113~~	110	117	~~117~~
7/24/2017	103	109	107	109	107	116	111	113	111	116	~~116~~	107	114	~~114~~	108	~~112~~	113	109	~~116~~	117
7/25/2017	103	109	107	110	107	116	112	114	112	~~116~~	116	107	114	~~114~~	109	113	~~113~~	110	~~116~~	116
7/26/2017	105	112	107	110	107	116	113	114	111	~~115~~	116	106	~~114~~	114	109	113	~~113~~	110	117	~~117~~
7/27/2017	105	112	108	110	106	116	113	114	110	114	~~114~~	106	114	~~114~~	108	~~112~~	112	109	117	~~117~~
7/28/2017	105	112	109	110	107	116	113	114	110	116	~~116~~	106	~~114~~	114	106	~~112~~	112	107	~~115~~	117
7/29/2017	104	112	109	110	107	116	113	113	110	116	~~116~~	106	~~114~~	114	106	112	~~112~~	106	~~115~~	115
7/30/2017	104	112	108	110	106	115	112	114	109	~~114~~	115	106	~~113~~	113	107	112	~~112~~	106	116	~~116~~
7/31/2017	104	112	108	110	107	116	112	113	110	116	~~115~~	105	113	~~113~~	108	114	~~114~~	108	116	~~116~~

[8] Two TDG values are reported for fixed monitoring stations where both Oregon's standard and Washington's criteria applies. The two states' standards/criteria and calculation methodologies differ as represented in the two columns. The smaller of the two values is denoted with a strikethrough because the Corps operates to the more stringent standard/criteria.

Figure 1

Lower Granite Dam - Hourly Spill and Flow

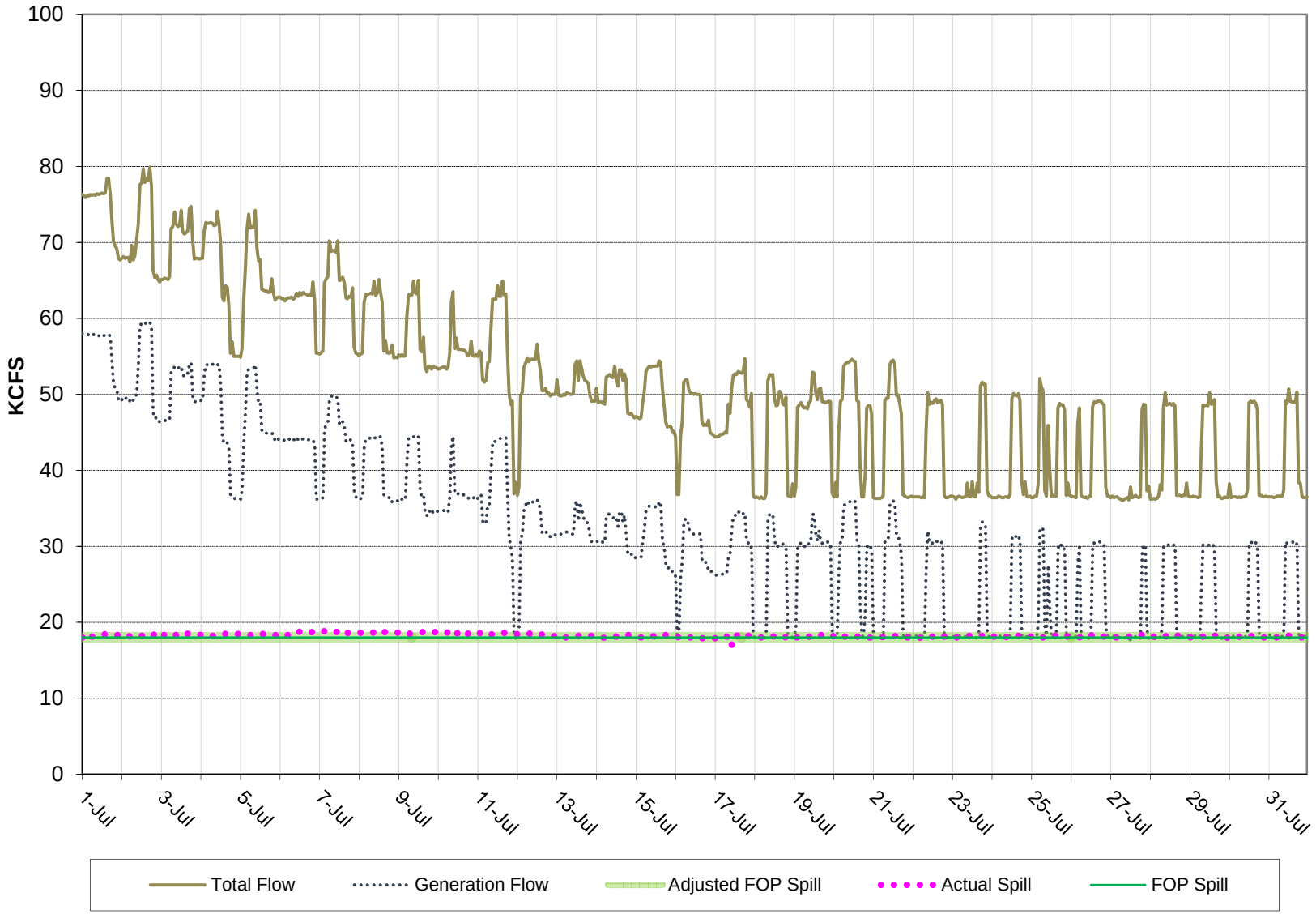


Figure 2

Little Goose Dam - Hourly Spill and Flow

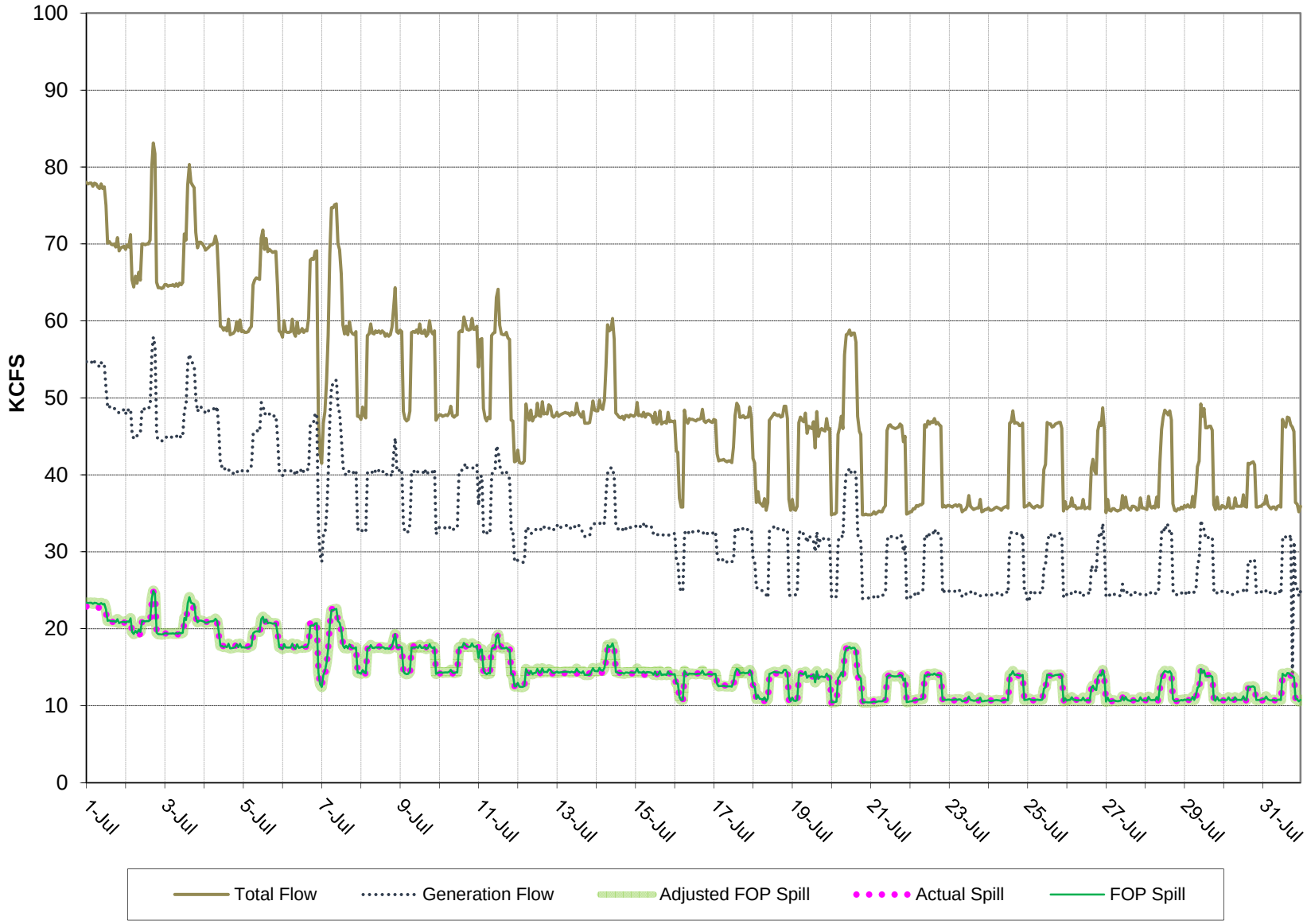


Figure 3

Lower Monumental Dam - Hourly Spill and Flow

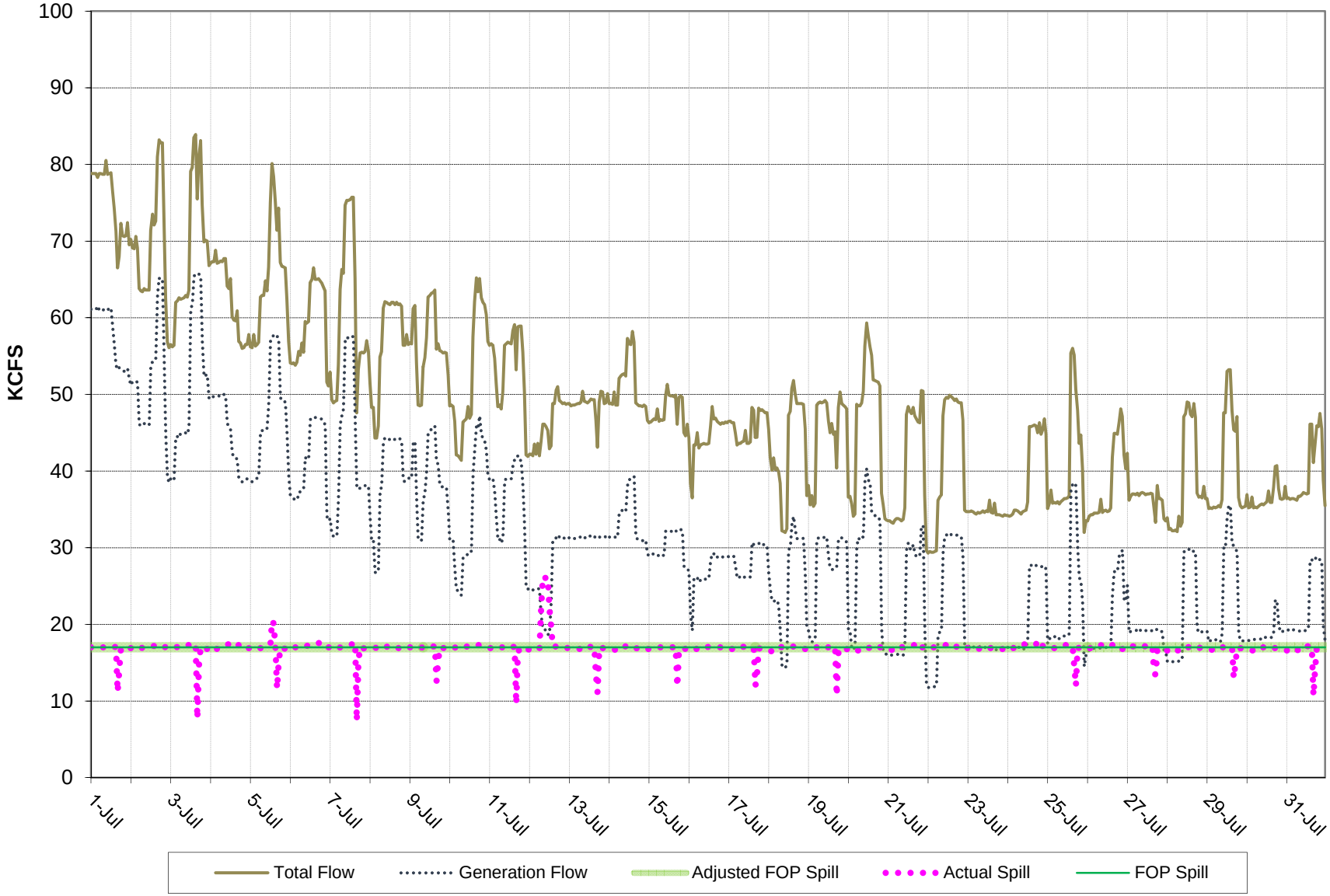


Figure 4

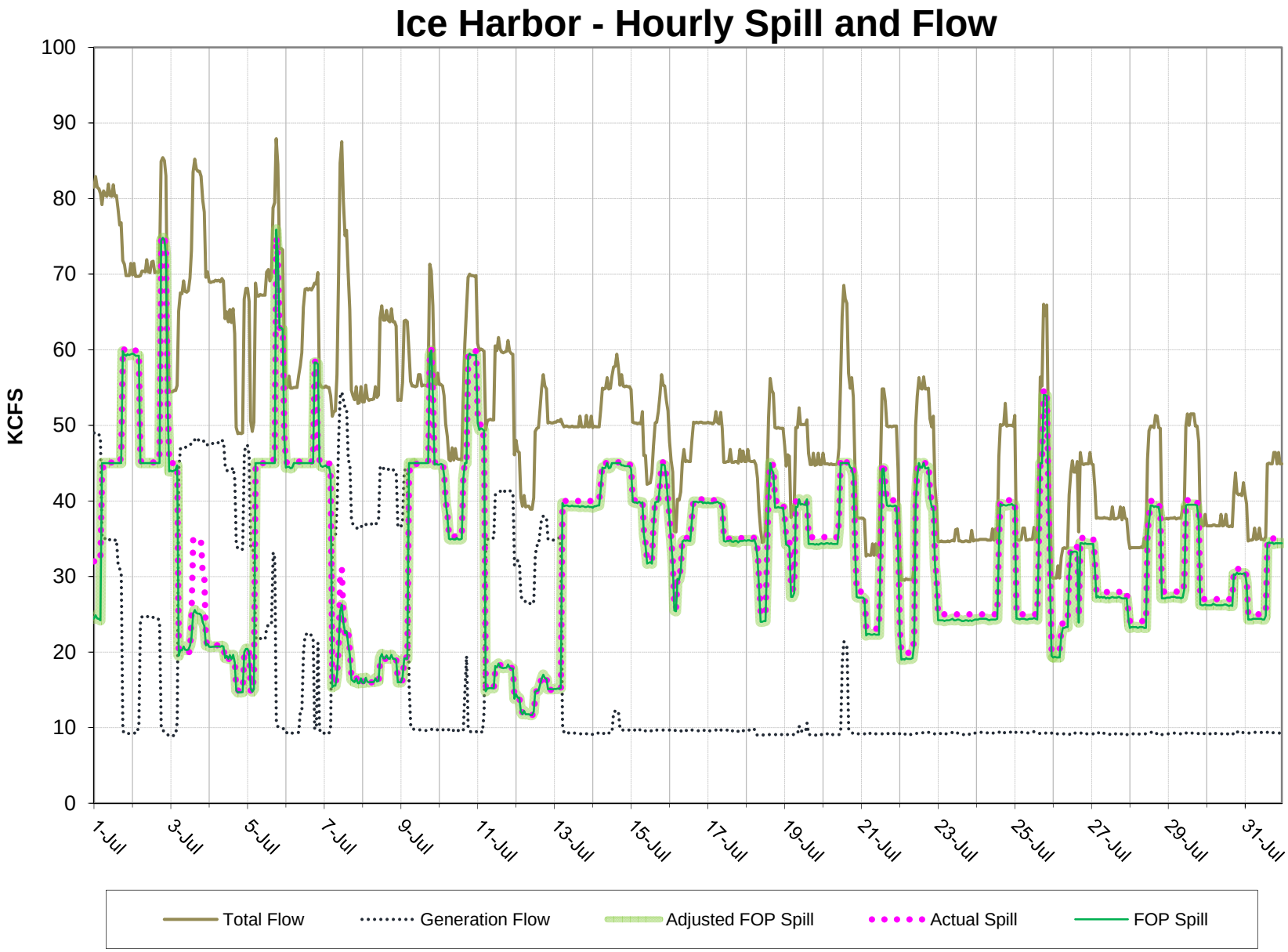

Ice Harbor - Hourly Spill and Flow
KCFS
100
90
80
70
60
50
40
30
20
10
0
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
Total Flow
Generation Flow
Adjusted FOP Spill
Actual Spill
FOP Spill

Figure 5

McNary Dam - Hourly Spill and Flow

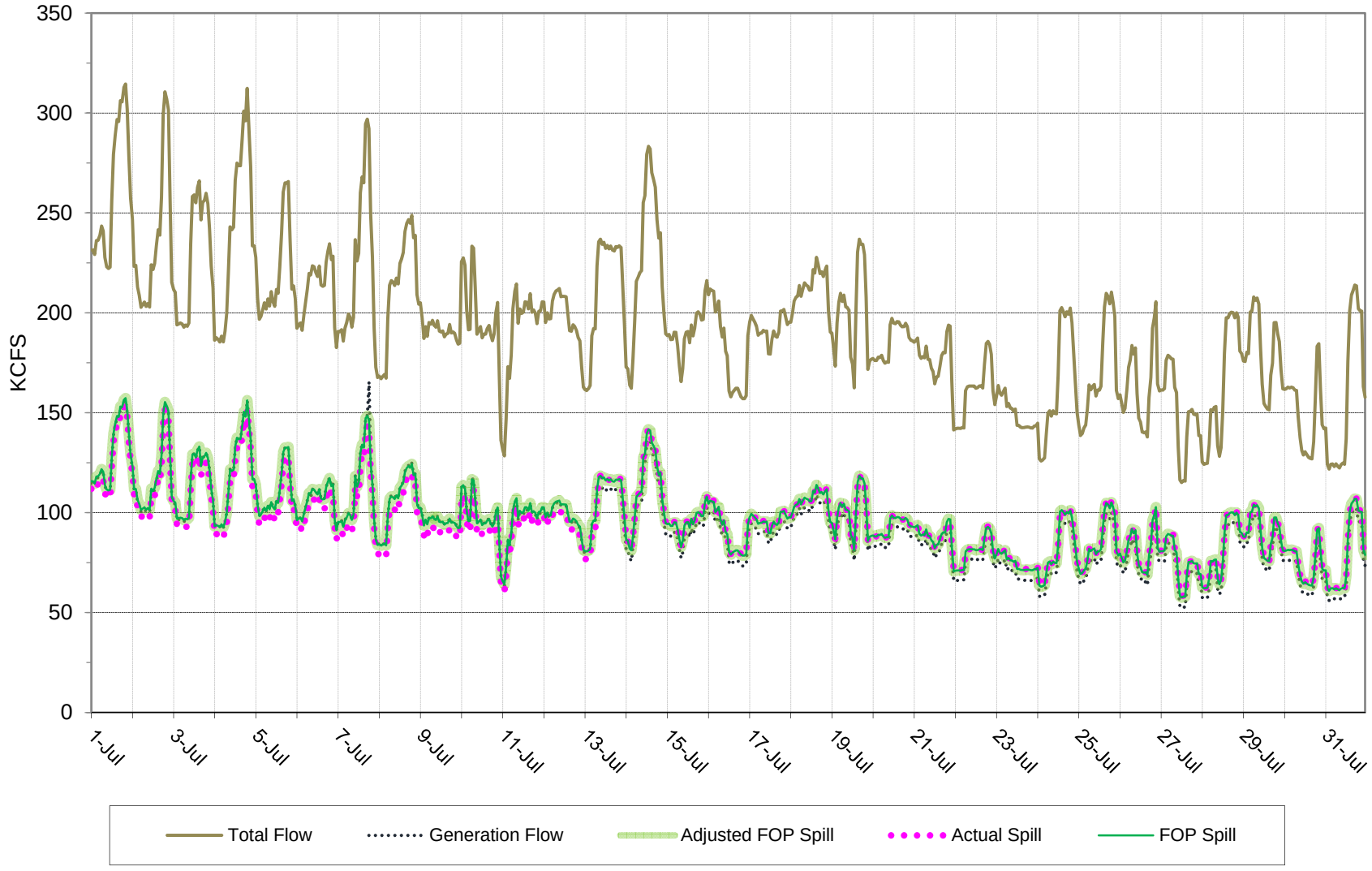


Figure 6

John Day Dam - Hourly Spill and Flow

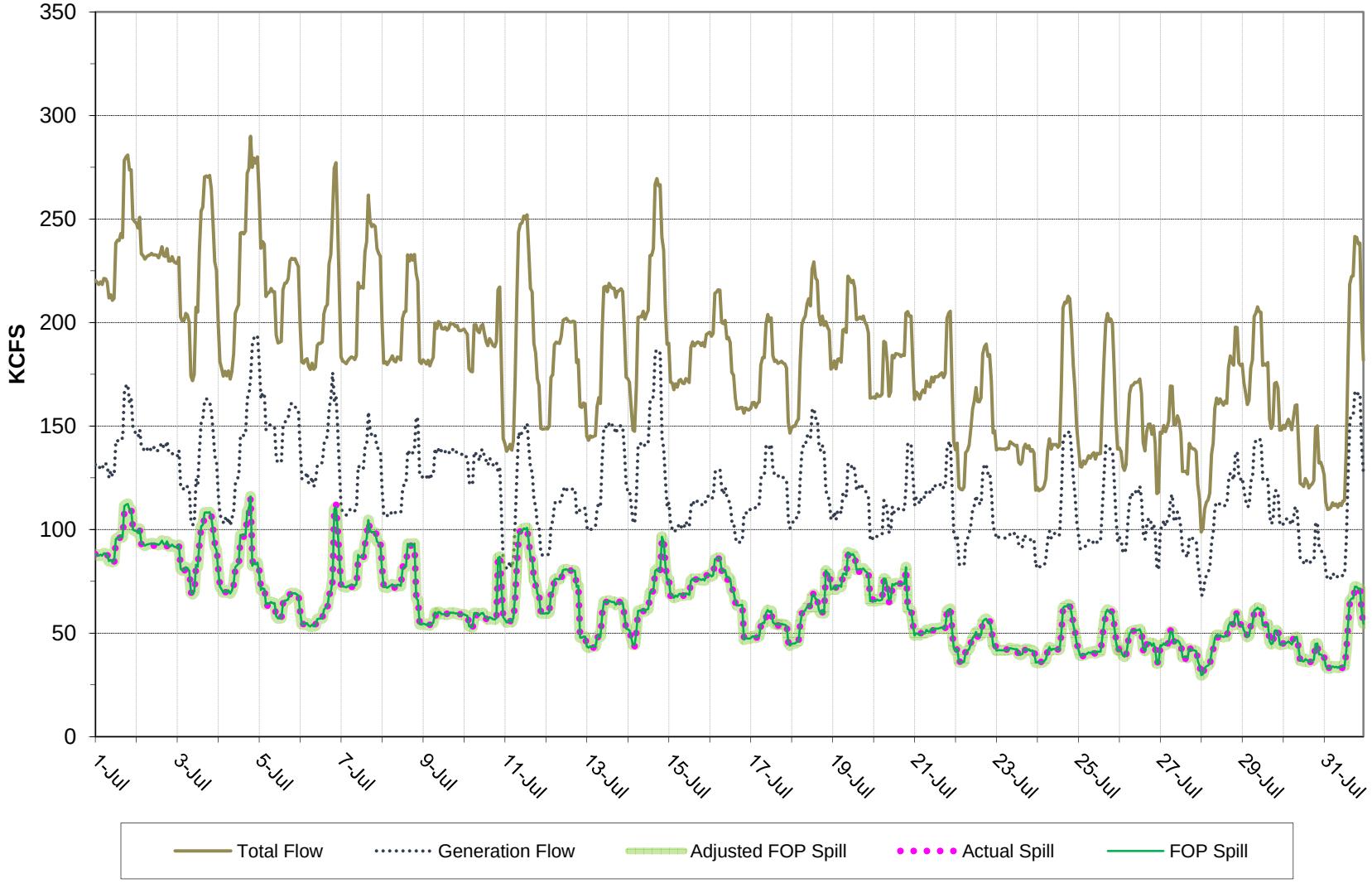


Figure 7

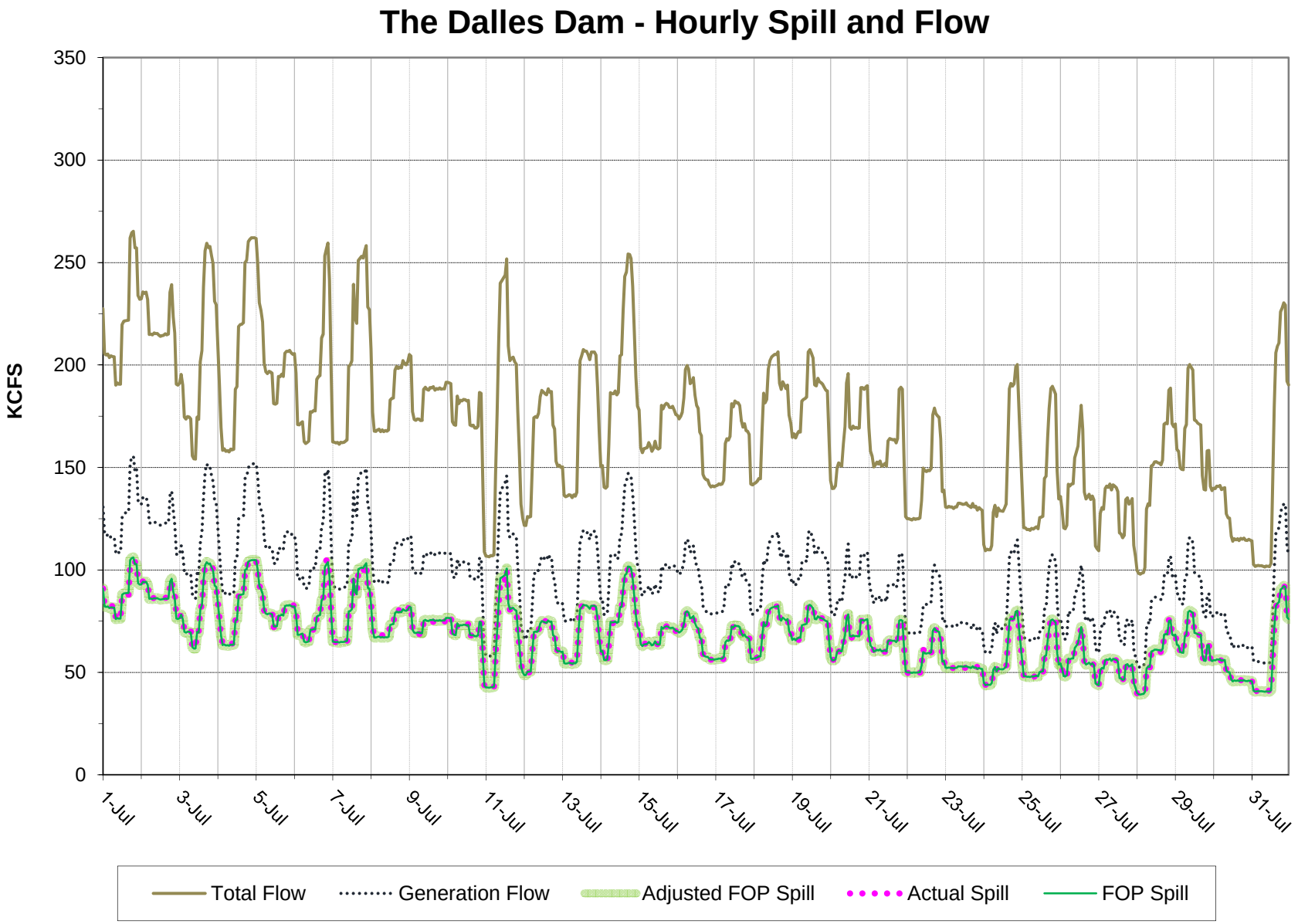
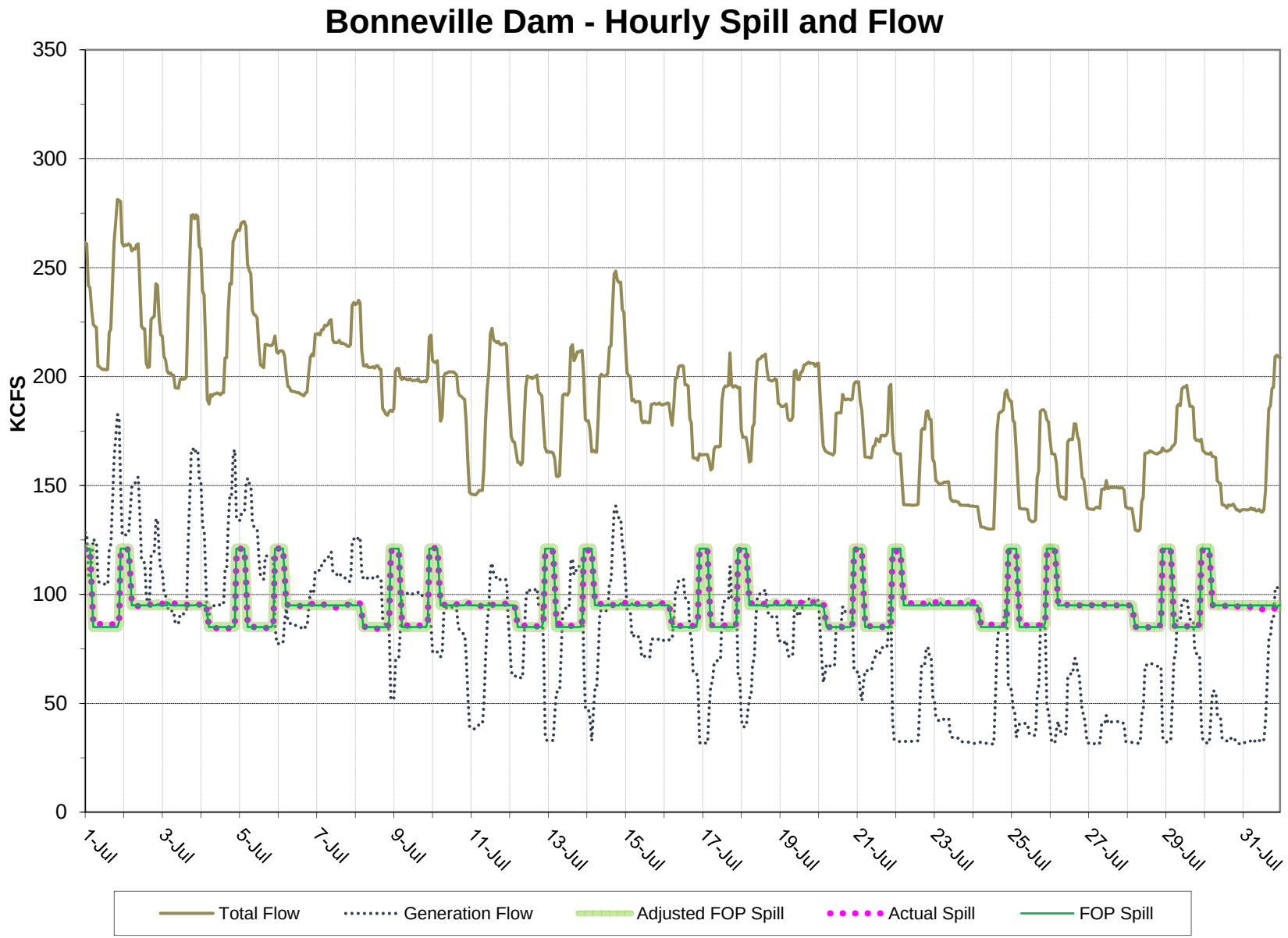

The Dalles Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
1-Jul
3-Jul
5-Jul
7-Jul
9-Jul
11-Jul
13-Jul
15-Jul
17-Jul
19-Jul
21-Jul
23-Jul
25-Jul
27-Jul
29-Jul
31-Jul
Total Flow
Generation Flow
Adjusted FOP Spill
Actual Spill
FOP Spill

Figure 8


Bonneville Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
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
Adjusted FOP Spill
Actual Spill
FOP Spill