FISH OPERATIONS PLAN IMPLEMENTATION REPORT
July 2015

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 2015 Fish Operations Plan (2015 FOP) posted to the TMT website on March 1, 2015. The 2015 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 2015 FOP, the FCRPS operations will be consistent with the 2014 NOAA Fisheries Supplemental Biological Opinion (2014 Supplemental BiOp), the USFWS 2000 and 2006 BiOps, and/or other operative documents, including the 2015 Water Management Plan (WMP), WMP seasonal updates, and the 2015 Fish Passage Plan (FPP).

The Corps' July 2015 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 2015 FOP in July 2015.

Data Reporting

I. For each project providing fish passage operations, this report contains two figures per operational week[2] in July displaying the performance of the fish passage spill program as follows:

(A) Average % TDG Values - displayed in the upper figure.
(B) Hourly Spill and Generation Flows - described in the lower figure.

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

[2] Operations are implemented Monday through Sunday.

The weekly figures begin on June 29 and end on August 2 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.

Each figure represents one week of a project's operation. The figures start at 0000 hours (%TDG graphs) and 0100 hours (flow/spill figures) on June 29 for the lower Snake River and the lower Columbia River projects.

June 29 – July 5	Figures 1 – 8
July 6 – July12	Figures 9 – 16
July 13 – July 19	Figures 17 – 24
July 20 – July 26	Figures 25 – 32
July 27 – August 2	Figures 33 – 40

A. Upper Figure: Displays the daily average %TDG for the Corps' lower Snake River and lower Columbia River projects. The Corps' objective is to operate each project in accordance with the spill levels in the 2015 FOP; and to the extent practicable, avoid exceeding the applicable state TDG limits.

1. The green dashed line represents the observed percent TDG in the tailwater of the dam using the Oregon 120 %TDG standard calculated with the high 12-hour average.[1] Applies only to figures which include the lower Columbia dams.
2. The blue dot-dash line represents the observed percent TDG in the tailwater of the dam using the Washington 120 %TDG standard calculated with the high 12-hour average.[1]
3. The black solid line represents the observed percent TDG in the forebay of the next dam downstream using the Washington 115 %TDG standard calculated with the high 12-hour average.[1]

B. Lower Figure: Displays the hourly flow and spill at each dam.

- The dashed blue line shows the flow through the powerhouse each hour, in thousand cubic feet per second (kcfs).
- The heavy grey line represents the average hourly total project outflow in kcfs.
- The dotted pink line represents the average hourly flow through the spillway in kcfs.
- The thin black line represents the hourly spill level as defined in the 2015 FOP.
- The heavy green line represents the target spill. This is the hourly maximum spill level. The hourly target spill may vary as a function of total project outflow, forebay elevation and generator capacity, subject to the following conditions:

    - spill percentage or flow rate specified in the 2015 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);
    - minimum spill at John Day (25% of project outflow).

II. A table is included at the end of the figures that lists the daily average of high %TDG values for all projects. 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 2015 FOP, the dotted pink line will be below or above the heavy green line in the figures. Actual deviations from the target operation during voluntary spill hours are described below in the July 2015 Spill Variance Table.[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 2015 FOP level of spill while also avoiding exceeding the %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 these variances occur, they are recorded in the monthly Spill Variance Table for Little Goose under the variance type "Navigation."

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 2015 FOP for Bonneville and The Dalles dams,[4] which may

[3] Involuntary spill conditions appear in the figures but are not considered variances and are not reported in the Spill Variance Table. Involuntary spill conditions 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, or any other operational and/or maintenance activities required to manage dam facilities for safety and authorized project uses.

[4] As specified in the 2015 FOP (p. 14), this applies when spill is below 40% of total outflow at The Dalles Dam.

range up to ±3 kcfs) as compared to those specified in the 2015 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 volume of spill since more water can pass under the spill gate).

The 2015 FOP describes project "Operations during Rapid Load Changes" (p. 6). For reporting purposes, the notation "Transmission Stability" in the Spill Variance Table replaces "Rapid Load Changes," and identifies instances when hourly spill levels were not met as a result of load swing hours and other related within-hour load variability issues. "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"). 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 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 2015 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 2015 Operations

The month of July was characterized by well below average flows for both the lower Snake and the lower Columbia rivers. The NOAA Northwest River Forecast Center's Runoff Processor indicated that the July 2015 adjusted volume runoff on the lower Snake River was below the 30 year average (1981-2010): 1.1 MAF (Million Acre Feet) or 48% of average as measured at Lower Granite Dam. For the lower Columbia, the Runoff Processor indicated the July 2015 adjusted volume runoff was below the 30 year average (1981-2010): 7.6 MAF or 52% of average as measured at The Dalles. The monthly precipitation summary for July was above average at 128% (1.29 inches) on the Snake River above Ice Harbor Dam but below average on the Columbia River above The Dalles Dam at 83%.

During the July 2015 reporting period, the planned 2015 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. Due to low flow conditions, the operation transitioned to an hourly constant spill

target of 7/9/11 kcfs operation[5], depending on the previous day's outflow as coordinated with TMT on June 25.

- 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 nighttime (gas cap range ~75 – 95 kcfs) until July 13 when the operation transitioned to 45 kcfs spill during the daytime and the %TDG cap spill during the nighttime. Nighttime spill hours (1800-0500).
- 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 40% and 30% of total project outflow, 24 hours/day until July 20 when the operation transitioned to 30% of total river flow for 24 hours/day. Spill level changes occurred 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 nighttime.

Operational Adjustments

1. Lower Granite Dam.

Beginning at 1210 hours on July 8, the Corps implemented the FPOM recommended operation intended to improve tailrace hydraulics and temperature conditions for the benefit of adult sockeye passage. The spillway weir was closed and spill was distributed uniformly across the spillway as described in the 2015 Fish Passage Plan, Table LWG-9. This operation did not alter FOP spill levels. The operation was coordinated to continue through 2400 hours on August 31.

Additionally, from 1500 hours on July 13 through 0500 hours on August 3, the Corps implemented the FPOM recommendation to change from operating Unit 2 to operating Unit 1 as the priority turbine unit to improve passage conditions for adult sockeye during emergency trap and haul operations implemented by the Idaho Department of Fish and Game. The operation of Unit 1 provides optimum attraction flow near the adult fish ladder, improves tailrace hydraulics near the ladder entrance by minimizing the eddy created by spill, and improves downstream temperature conditions by passing more cool water from deeper in the forebay to the tailrace. However, Unit 1 has fixed blades (non-adjustable) and operates at approximately 18.4 kcfs, compared to Unit 2 which can be adjusted as flow decreases down to minimum generation of approximately 12.4 kcfs. Consequently, during minimum generation operations, Unit 1 results in less spill (approximately 6 kcfs) than Unit 2.

The operations to improve Snake River sockeye passage conditions were discussed and coordinated with FPOM on several conference calls on July 6, 8, 9, 10, 13, 17, 20, 24, and 27; and with TMT at meetings on July 8, 15, 22, 27, 29, and 30. FPOM and TMT members either supported or did not object.

[5] See FOP (p. 6) for low flow operations at Little Goose Dam.

2. Little Goose Dam.

From 0400 hours on July 23 through 0400 hours on July 25, and again at 0400 hours on July 28 through 0400 hours on July 30, the Corps implemented experimental emergency operations at Little Goose Dam as recommended by NOAA Fisheries and other regional sovereigns to improve passage conditions for adult sockeye. In conjunction with the Lower Granite operations described above, the goal was to assess whether these actions could improve temperature and hydraulic conditions at the two projects as a means of facilitating adult sockeye passage at both dams during the Idaho Department of Fish and Game's emergency trap and haul operations.

The two 2-day experimental emergency operations at Little Goose consisted of a period of no spill during daytime hours (0400-2000) and the operation of one unit at minimum generation and spilling the remainder of project outflow during nighttime hours (2000-0400). As a result, hourly average spill during these operations ranged from 0–16.9 kcfs, as compared to the 2015 FOP low flow spill operation that would have resulted in fixed spill of 9 or 11 kcfs as determined by the previous day's average outflow.

These operations were coordinated with FPOM during conference calls on July 21, 24, and 27; and with TMT at meetings on July 22, 27, 29, and 30. Consensus at TMT on the 2-day experimental operation was not reached. After conferring with NOAA and reviewing their recommendation and supporting documents, the Corps proceeded with implementation of the 2-day experimental operation. Oregon's representative for Regional Implementation Oversight Group (RIOG) requested a RIOG meeting to further discuss the operation. The RIOG was convened on July 28, and after discussing these experimental emergency operations, no further objections were raised by sovereign representatives.

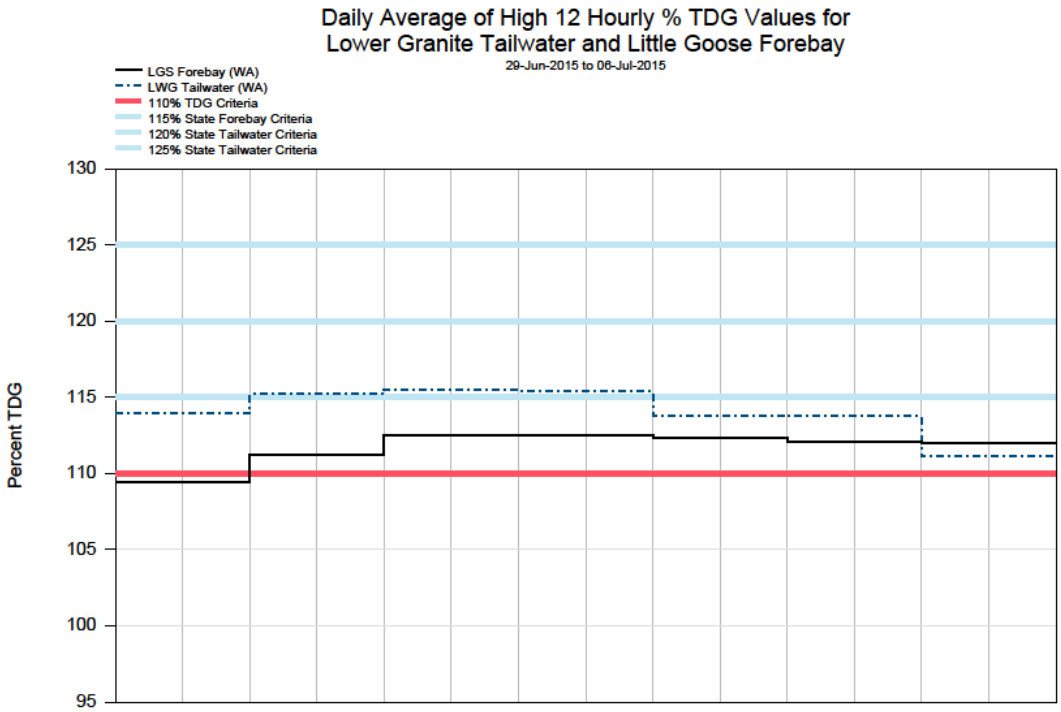
July 2015 Spill Variance Table

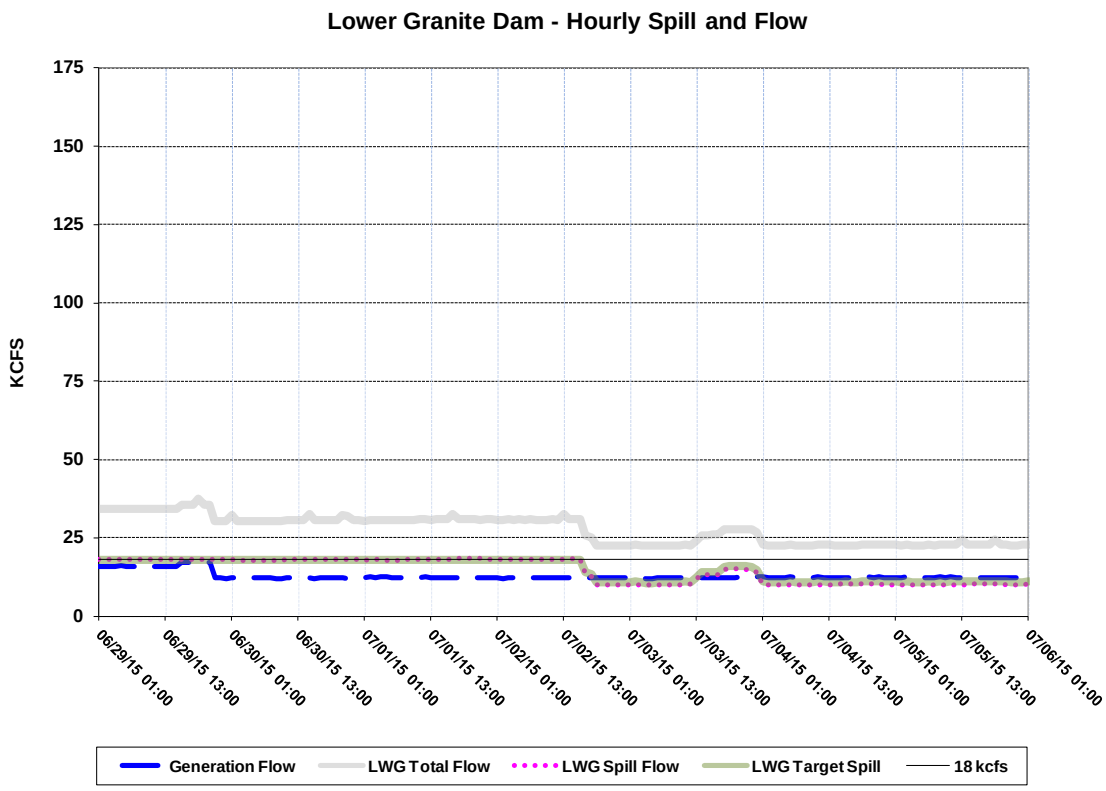
Project	Parameter	Date	Time[6]	Hours	Type	Reason
Lower Granite	Reduced Spill	7/30/15	1100	1	Maintenance	Hourly spill at 11.4 kcfs (below FOP 18 kcfs), while generation increased above the minimum range (16.4-19.5 kcfs) to 20.9 kcfs for testing necessary before planned annual maintenance.
Lower Monumental	Reduced Spill	6/29/15	1700-1800	2	Navigation	Hourly spill decreased to 7.1 kcfs and 11.6 kcfs (below 17 kcfs ±2 kcfs range). Reduced spill for safe passage of fish barge.
Lower Monumental	Reduced Spill	7/1/15	1700-1800	2	Navigation	Hourly spill decreased to11.3 kcfs and 13.2 kcfs (below 17 kcfs ±2 kcfs range). Reduced spill for safe passage of fish barge.
Ice Harbor	Reduced Spill	6/29/15	1000	1	Navigation	Hourly spill reduced from minimum generation spill of 29.9% to 28.5% (below 30.0% ±1% range) due to volume of water needed to empty the navigation lock. 24-hr avg spill 29.8%.
Ice Harbor	Reduced Spill	6/29/15	1300	1	Navigation	Hourly spill reduced from minimum generation spill of 30.0% to 28.8% (below 30.0% ±1% range) due to volume of water needed to empty the navigation lock. 24-hr avg spill 29.8%.
Ice Harbor	Reduced Spill	6/29/15	1600	1	Navigation	Hourly spill reduced from minimum generation spill of 30.0% to 28.7% (below 30.0% ±1% range) due to volume of water needed to empty the navigation lock. 24-hr avg spill 29.8%.
Ice Harbor	Reduced Spill	6/29/15	2100	1	Navigation	Hourly spill reduced from minimum generation spill of 30.0% to 28.7% (below 30.0% ±1% range) due to volume of water needed to empty the navigation lock. 24-hr avg spill 29.8%.
Ice Harbor	Reduced Spill	6/30/15	0100	1	Navigation	Hourly spill reduced from minimum generation spill of 30.1% to 28.7% (below 30.0% ±1% range) due to volume of water needed to empty the navigation lock.
Ice Harbor	Reduced Spill	7/30/15	1700	1	Maintenance	Hourly spill at 25.2 kcfs (below FOP 45 kcfs) while generation increased above Unit 1 minimum range (8.2-10.0 kcfs) to 11.3 kcfs, for returning unit 5 to service after planned annual maintenance and testing.
John Day	Additional Spill	7/1/15	0000	1	Transmission Stability	Hourly spill increased to 41.4% (above 40.0% ±1% range). Project on response during rapidly changing load and/or intermittent generation (see p. 3-4). 24-hr avg spill 40.0%.

[6] 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[6]	Hours	Type	Reason
John Day	Reduced Spill	7/8/15	0900	1	Transmission Stability	Hourly spill decreased to 38.9% (below 40.0% ±1% range). Project on response during rapidly changing load and/or intermittent generation (see p. 3-4). 24-hr avg spill 38.2%.
John Day	Reduced Spill	7/11/15	1100	1	Transmission Stability	Hourly spill decreased to 38.7% (below 40.0% ±1% range). Project on response during rapidly changing load and/or intermittent generation (see p. 3-4). 24-hr avg spill 40.1%.
John Day	Reduced Spill	7/23/15	1600	1	Program Error	Hourly spill decreased to 28.9% (below 30.0% ±1% range). Computer program failed to display spill changes so duty schedulers were unaware of low percent spill. 24-hr avg spill 30.0%.
John Day	Reduced Spill	7/29/15	1400	1	Maintenance	Hourly spill decreased to 28.6% (below 30.0% ±1% range) due to installation and testing of a digital governor during planned annual maintenance on Unit 15. 24-hr avg spill 29.8%.
The Dalles	Reduced Spill	7/16/15	1300	1	Transmission Stability	Hourly spill decreased to 38.4% (below 38.6 to 41.4 %). Project on response during rapidly changing load and/or intermittent generation (see p. 3-4). 24-hr avg spill 39.9%.

Figure 1


Daily Average of High 12 Hourly % TDG Values for
Lower Granite Tailwater and Little Goose Forebay
29-Jun-2015 to 06-Jul-2015
LGS Forebay (WA)
LWG Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95


Lower Granite Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
06/29/15 01:00
06/29/15 13:00
06/30/15 01:00
06/30/15 13:00
07/01/15 01:00
07/01/15 13:00
07/02/15 01:00
07/02/15 13:00
07/03/15 01:00
07/03/15 13:00
07/04/15 01:00
07/04/15 13:00
07/05/15 01:00
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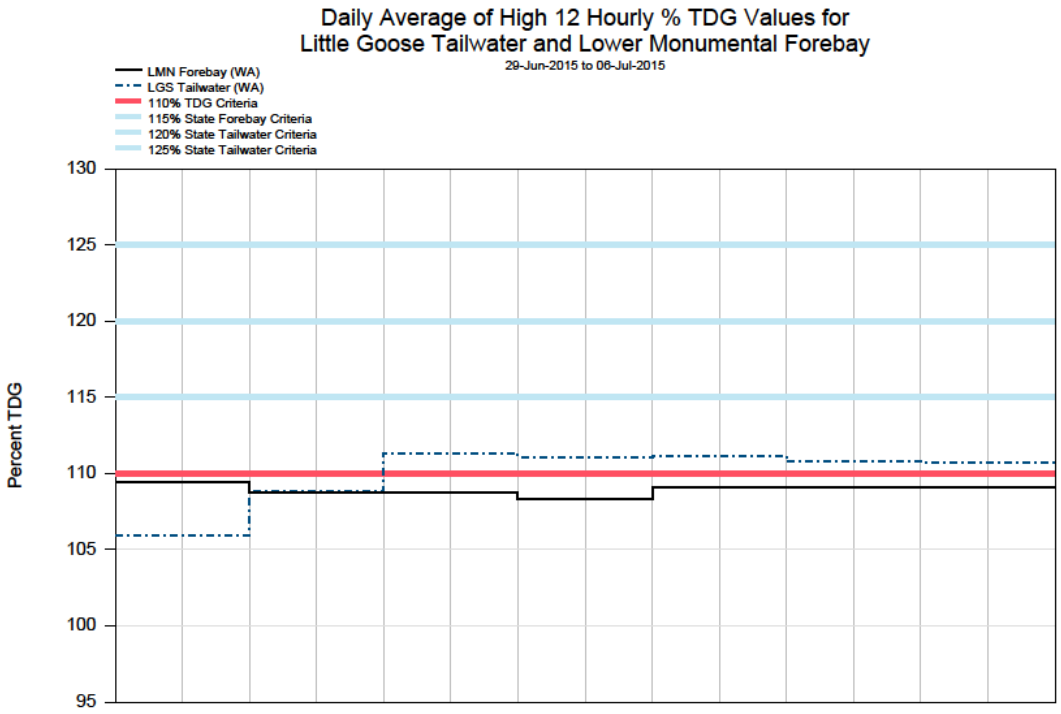
07/06/15 01:00
Generation Flow
LWG Total Flow
LWG Spill Flow
LWG Target Spill
18 kcfs

Figure 2


Daily Average of High 12 Hourly % TDG Values for
Little Goose Tailwater and Lower Monumental Forebay
29-Jun-2015 to 06-Jul-2015
LMN Forebay (WA)
LGS Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

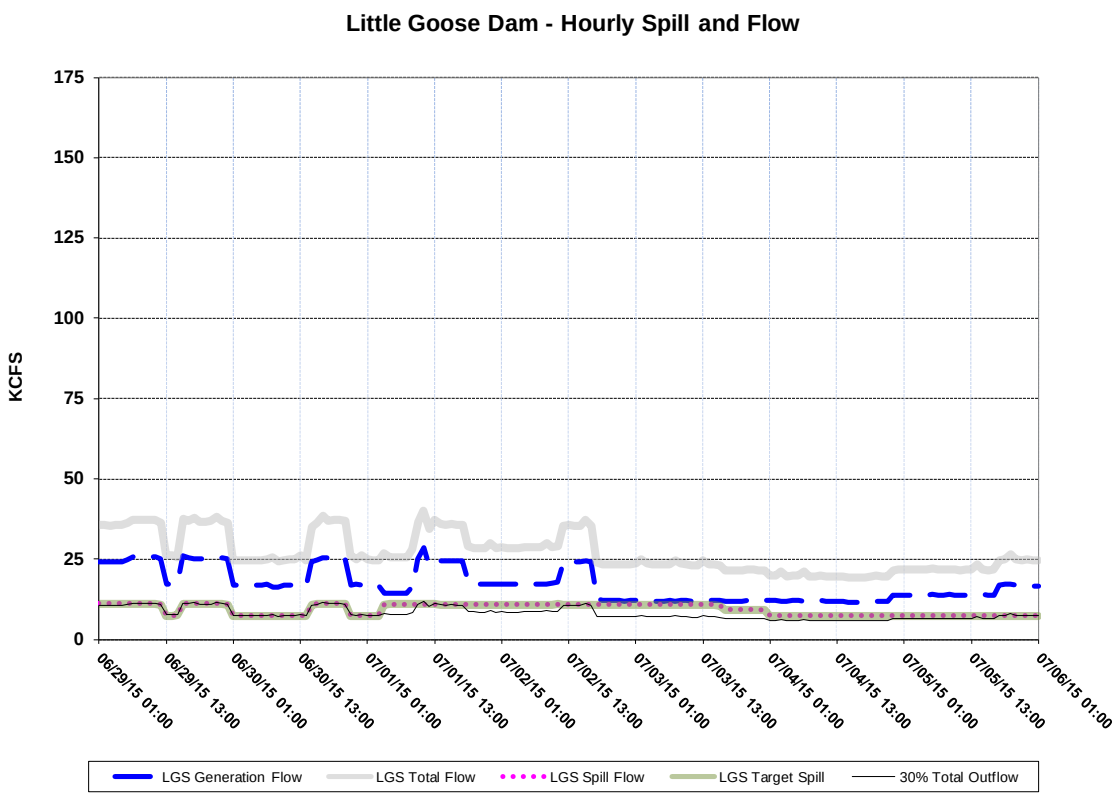
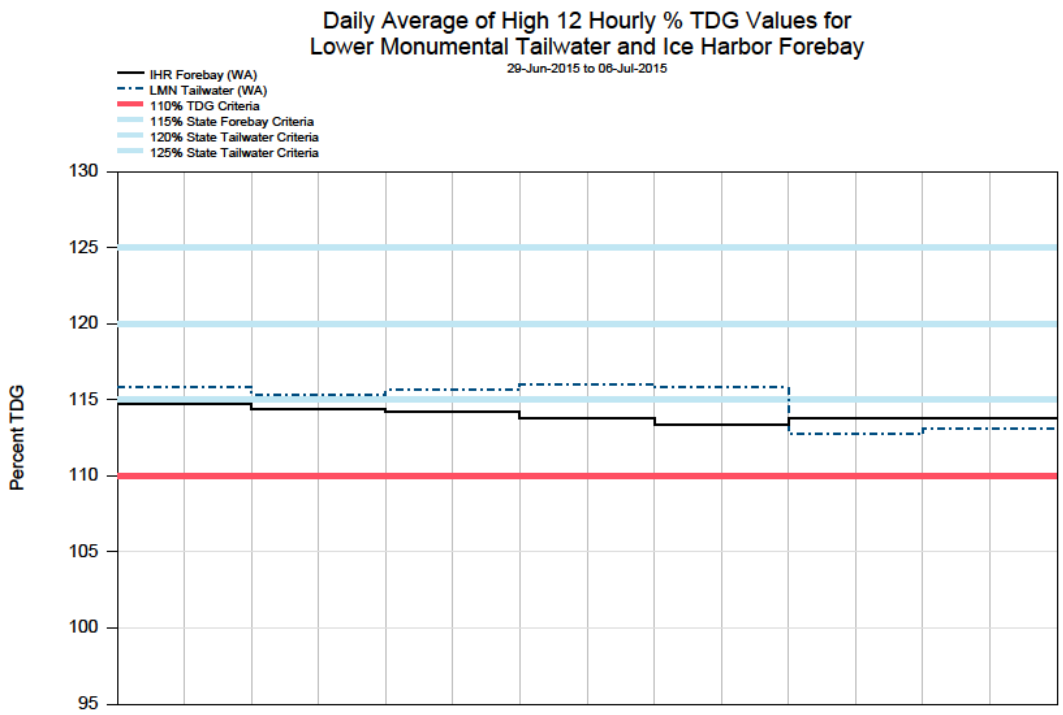

Little Goose Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
06/29/15 01:00
06/29/15 13:00
06/30/15 01:00
06/30/15 13:00
07/01/15 01:00
07/01/15 13:00
07/02/15 01:00
07/02/15 13:00
07/03/15 01:00
07/03/15 13:00
07/04/15 01:00
07/04/15 13:00
07/05/15 01:00
07/05/15 13:00
07/06/15 01:00
LGS Generation Flow
LGS Total Flow
LGS Spill Flow
LGS Target Spill
30% Total Outflow

Figure 3


Daily Average of High 12 Hourly % TDG Values for
Lower Monumental Tailwater and Ice Harbor Forebay
29-Jun-2015 to 06-Jul-2015
IHR Forebay (WA)
LMN Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

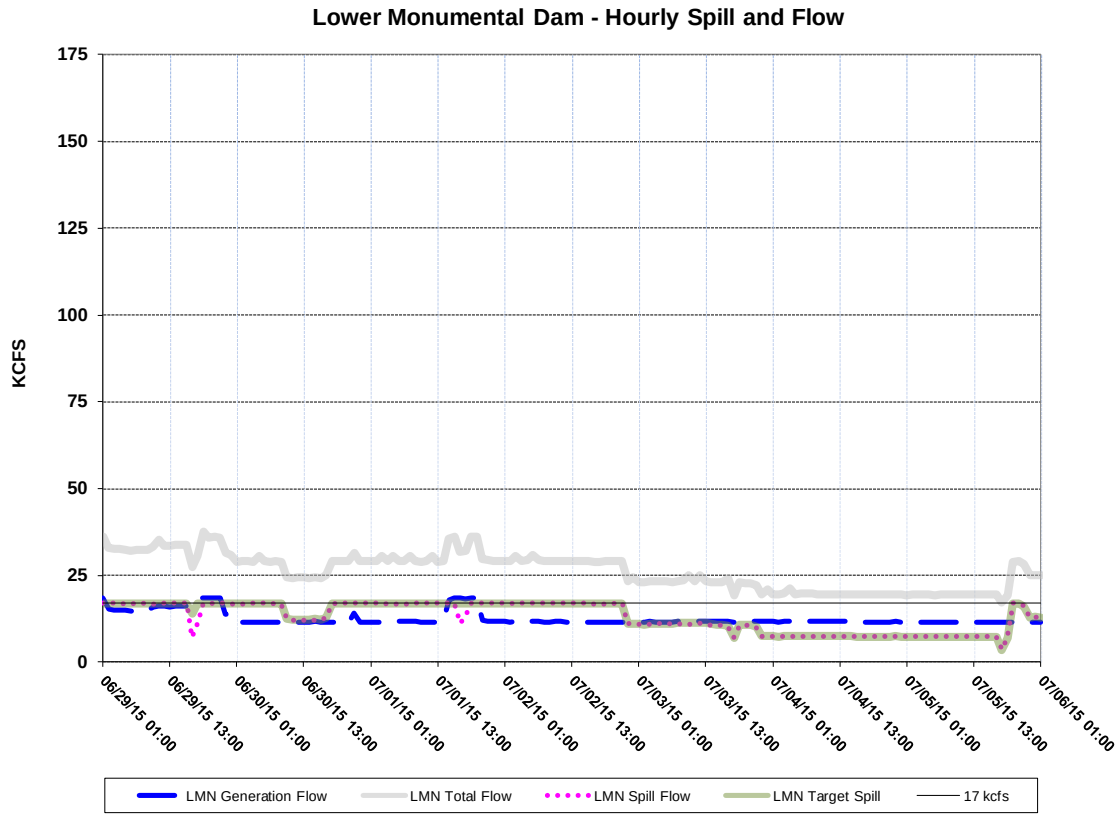
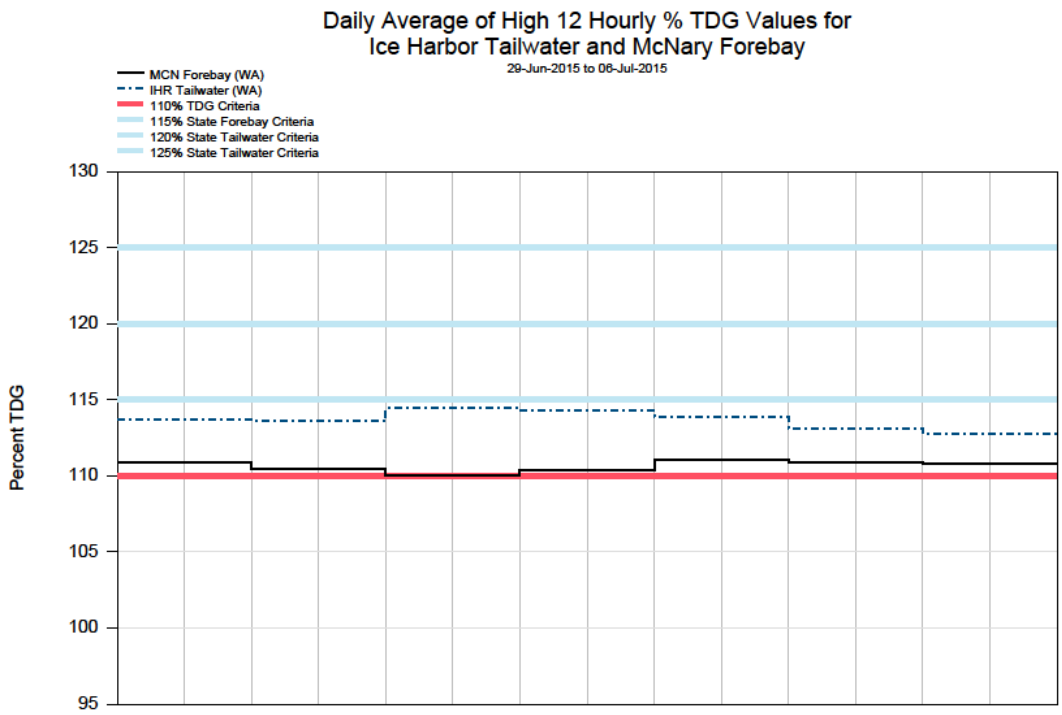

Lower Monumental Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
06/29/15 01:00
06/29/15 13:00
06/30/15 01:00
06/30/15 13:00
07/01/15 01:00
07/01/15 13:00
07/02/15 01:00
07/02/15 13:00
07/03/15 01:00
07/03/15 13:00
07/04/15 01:00
07/04/15 13:00
07/05/15 01:00
07/05/15 13:00
07/06/15 01:00
LMN Generation Flow
LMN Total Flow
LMN Spill Flow
LMN Target Spill
17 kcfs

Figure 4


Daily Average of High 12 Hourly % TDG Values for
Ice Harbor Tailwater and McNary Forebay
29-Jun-2015 to 06-Jul-2015
MCN Forebay (WA)
IHR Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

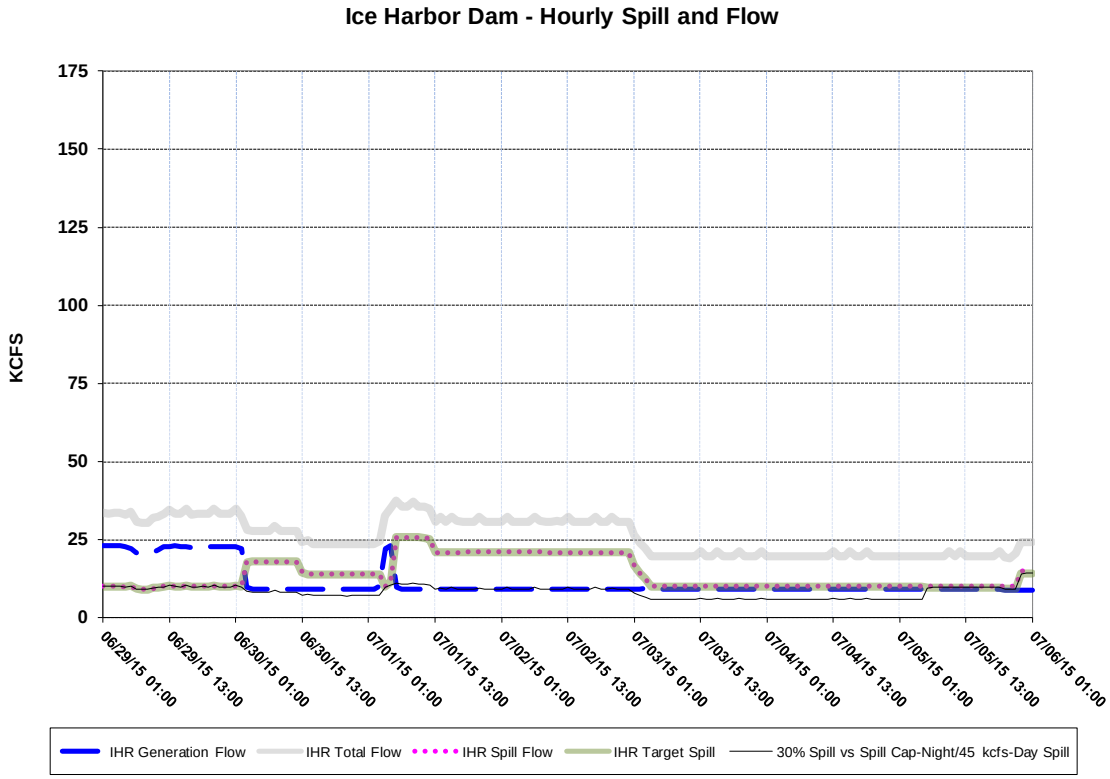
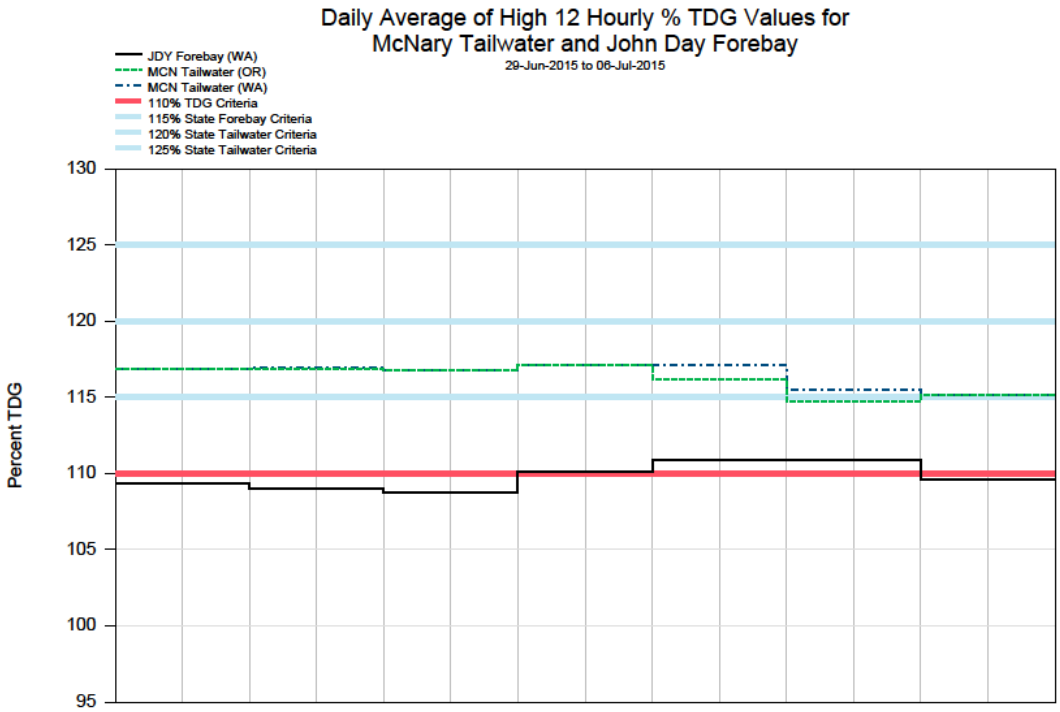

Ice Harbor Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
06/29/15 01:00
06/29/15 13:00
06/30/15 01:00
06/30/15 13:00
07/01/15 01:00
07/01/15 13:00
07/02/15 01:00
07/02/15 13:00
07/03/15 01:00
07/03/15 13:00
07/04/15 01:00
07/04/15 13:00
07/05/15 01:00
07/05/15 13:00
07/06/15 01:00
IHR Generation Flow
IHR Total Flow
IHR Spill Flow
IHR Target Spill
30% Spill vs Spill Cap-Night/45 kcfs-Day Spill

Figure 5


Daily Average of High 12 Hourly % TDG Values for
McNary Tailwater and John Day Forebay
29-Jun-2015 to 06-Jul-2015
JDY Forebay (WA)
MCN Tailwater (OR)
MCN Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

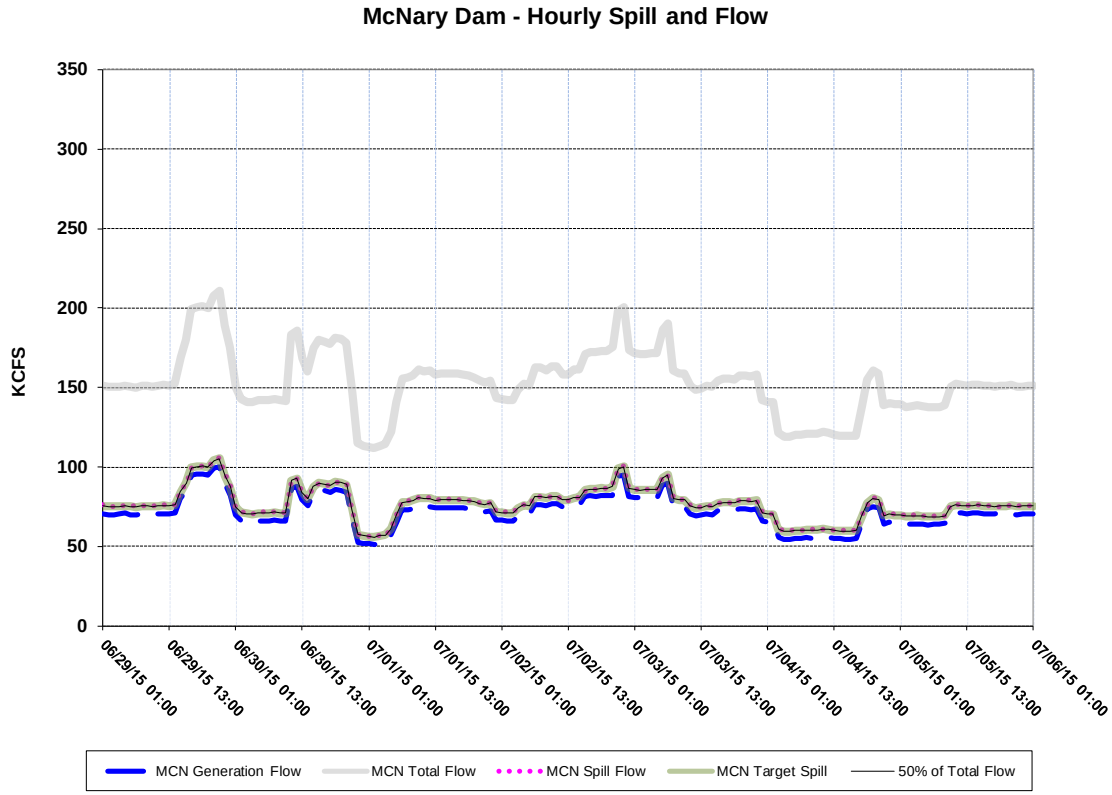
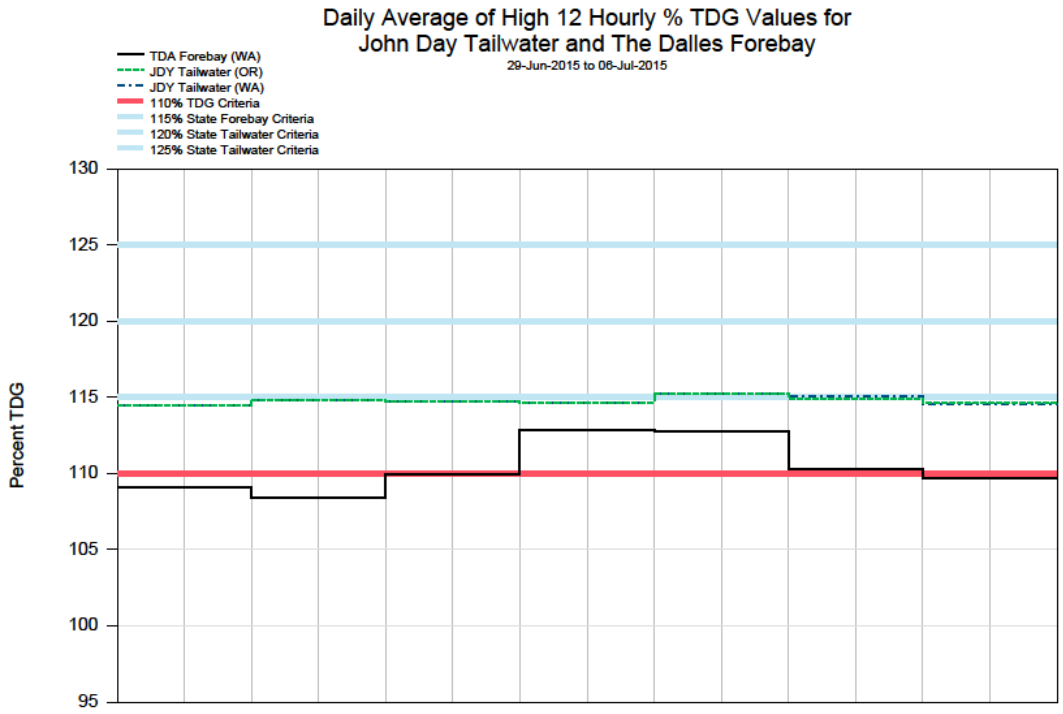

McNary Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
06/29/15 01:00
06/29/15 13:00
06/30/15 01:00
06/30/15 13:00
07/01/15 01:00
07/01/15 13:00
07/02/15 01:00
07/02/15 13:00
07/03/15 01:00
07/03/15 13:00
07/04/15 01:00
07/04/15 13:00
07/05/15 01:00
07/05/15 13:00
07/06/15 01:00
MCN Generation Flow
MCN Total Flow
MCN Spill Flow
MCN Target Spill
50% of Total Flow

Figure 6


Daily Average of High 12 Hourly % TDG Values for
John Day Tailwater and The Dalles Forebay
29-Jun-2015 to 06-Jul-2015
TDA Forebay (WA)
JDY Tailwater (OR)
JDY Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

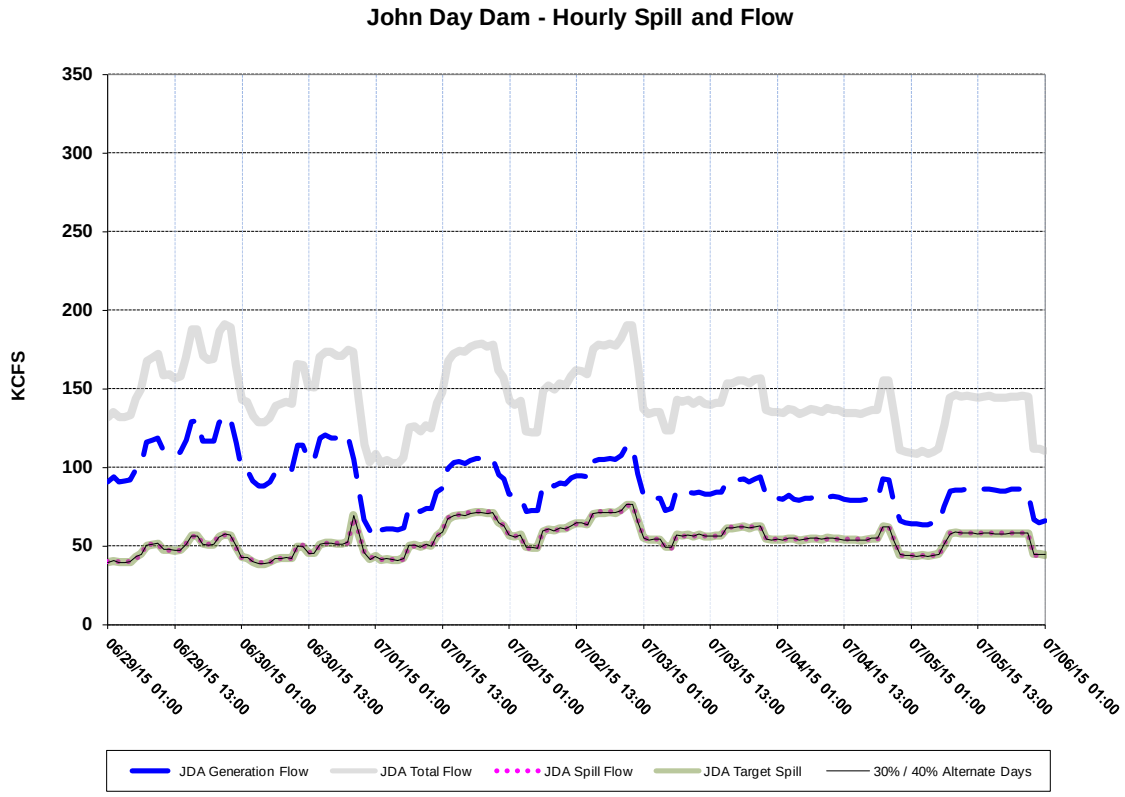
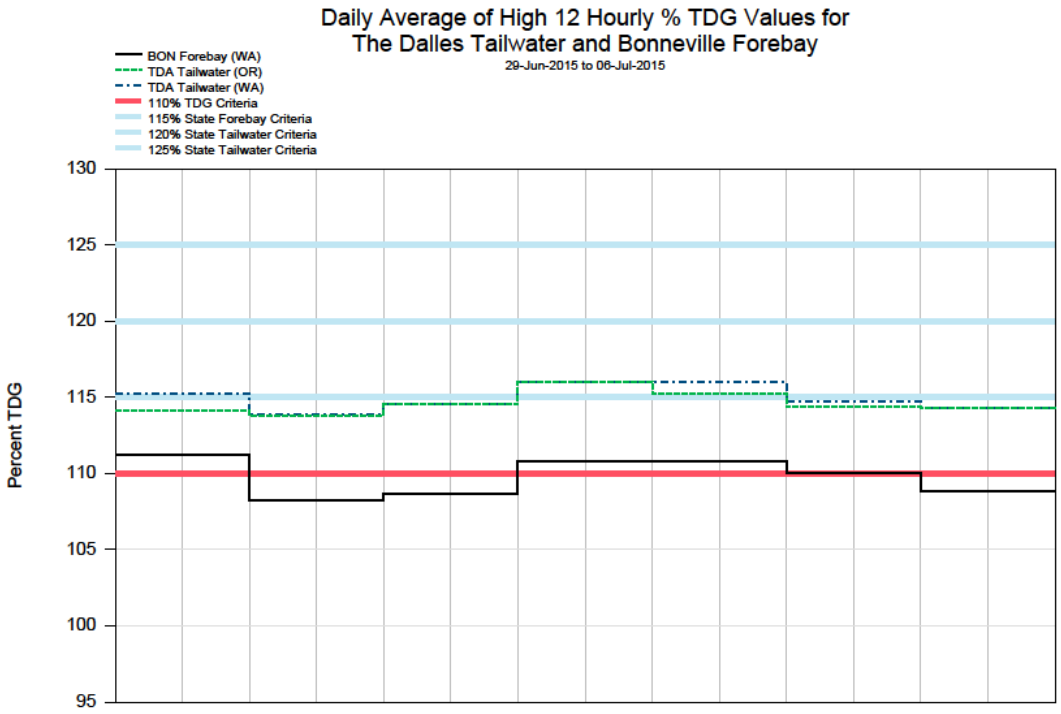

John Day Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
06/29/15 01:00
06/29/15 13:00
06/30/15 01:00
06/30/15 13:00
07/01/15 01:00
07/01/15 13:00
07/02/15 01:00
07/02/15 13:00
07/03/15 01:00
07/03/15 13:00
07/04/15 01:00
07/04/15 13:00
07/05/15 01:00
07/05/15 13:00
07/06/15 01:00
JDA Generation Flow
JDA Total Flow
JDA Spill Flow
JDA Target Spill
30% / 40% Alternate Days

Figure 7


Daily Average of High 12 Hourly % TDG Values for
The Dalles Tailwater and Bonneville Forebay
29-Jun-2015 to 06-Jul-2015
BON Forebay (WA)
TDA Tailwater (OR)
TDA Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

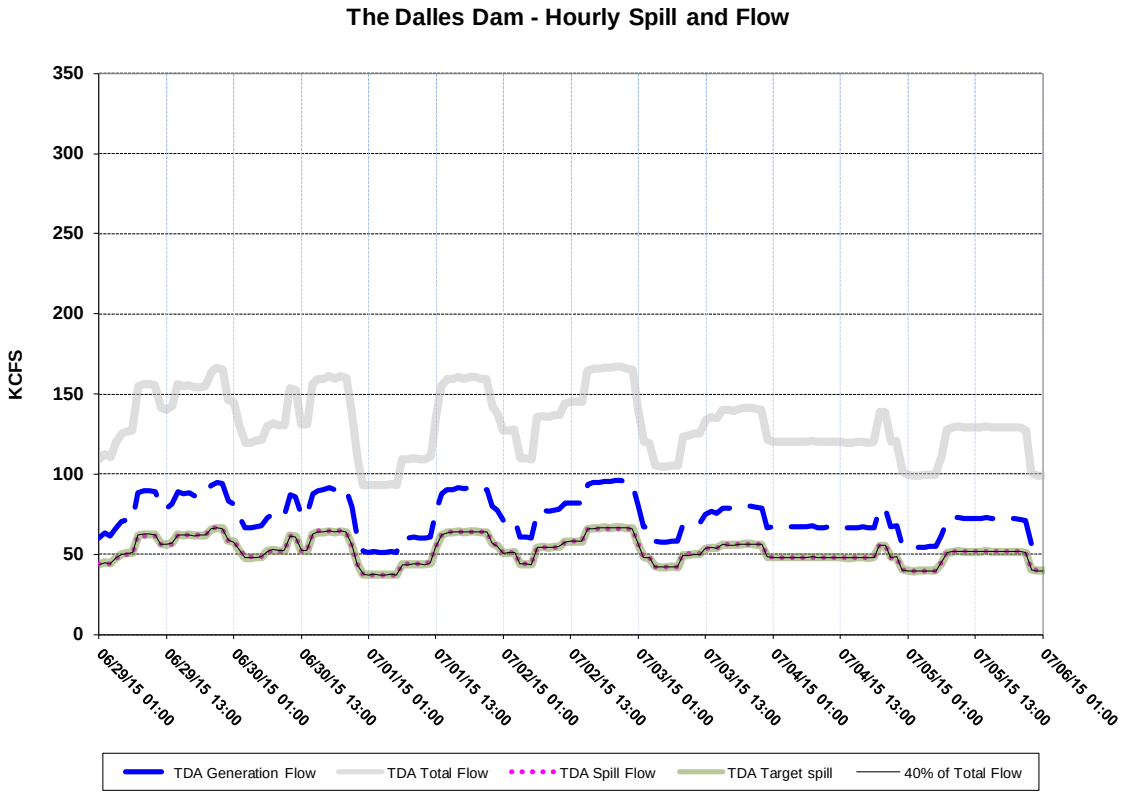
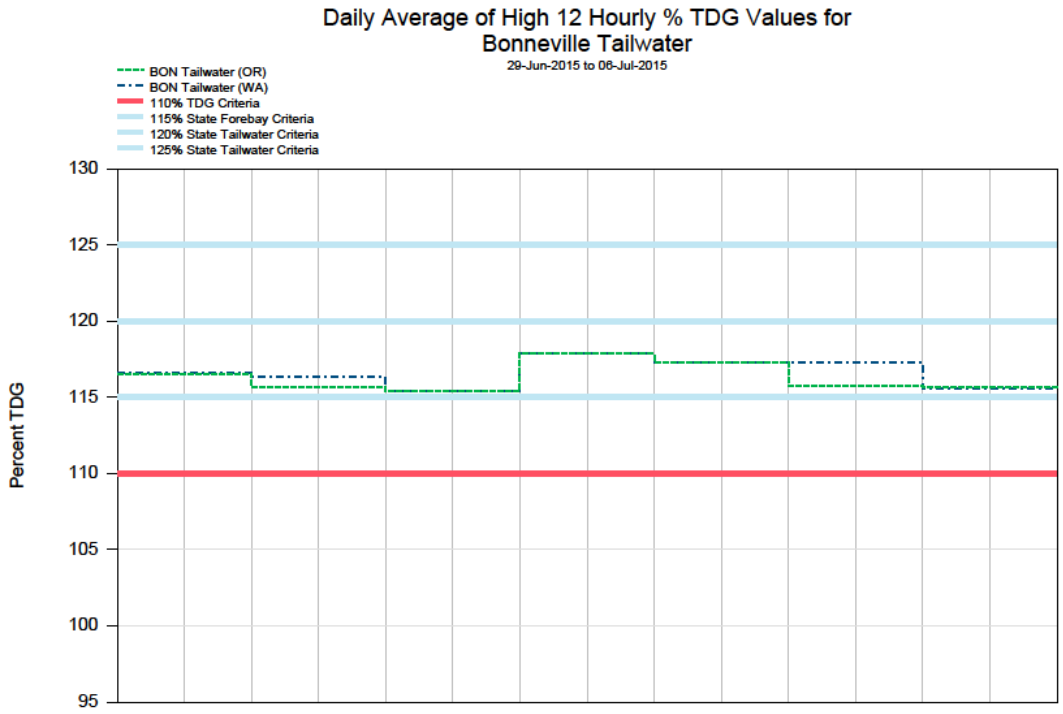

The Dalles Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
06/29/15 01:00
06/29/15 13:00
06/30/15 01:00
06/30/15 13:00
07/01/15 01:00
07/01/15 13:00
07/02/15 01:00
07/02/15 13:00
07/03/15 01:00
07/03/15 13:00
07/04/15 01:00
07/04/15 13:00
07/05/15 01:00
07/05/15 13:00
07/06/15 01:00
TDA Generation Flow
TDA Total Flow
TDA Spill Flow
TDA Target spill
40% of Total Flow

Figure 8


Daily Average of High 12 Hourly % TDG Values for
Bonneville Tailwater
29-Jun-2015 to 06-Jul-2015
BON Tailwater (OR)
BON Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

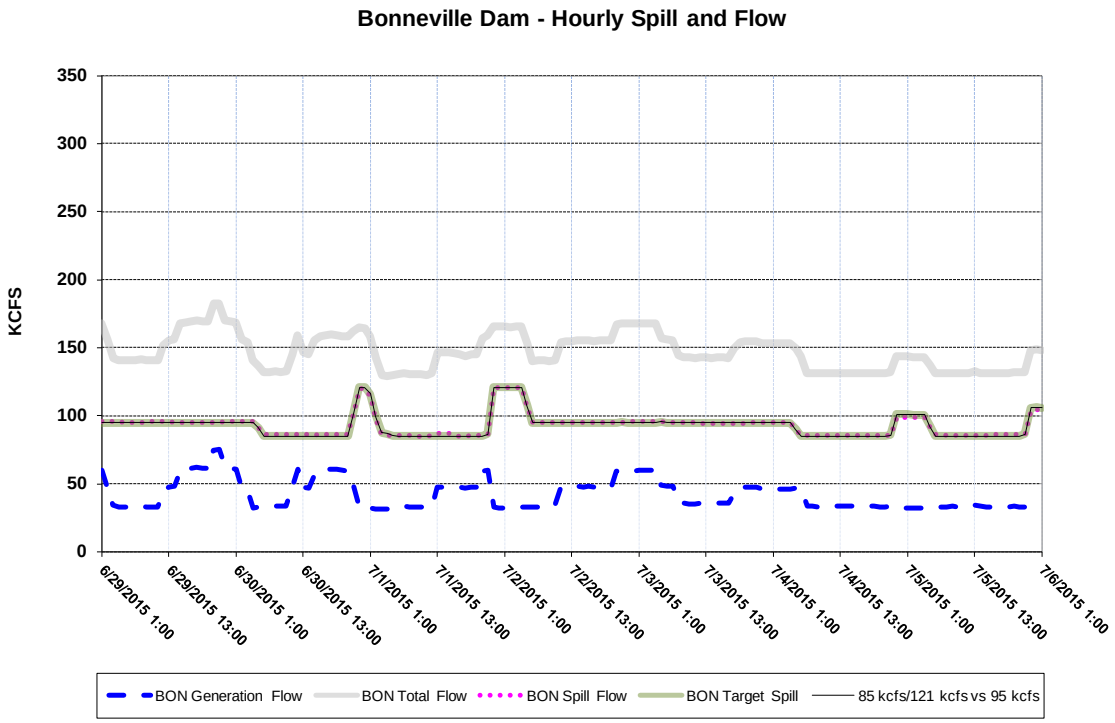
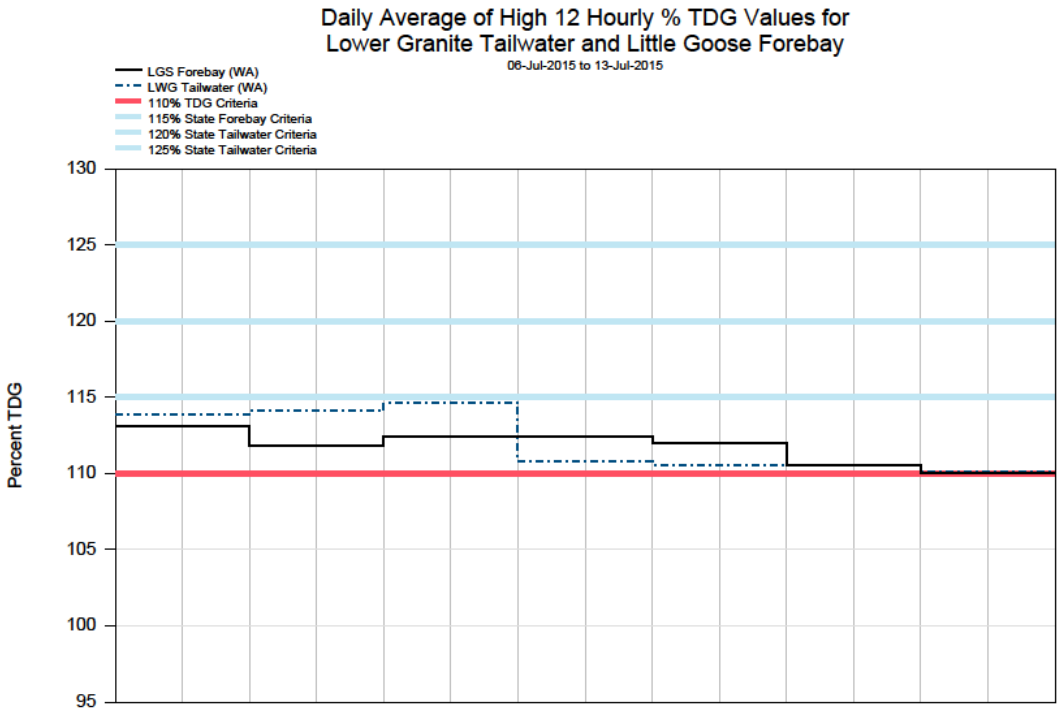

Bonneville Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
6/29/2015 1:00
6/29/2015 13:00
6/30/2015 1:00
6/30/2015 13:00
7/1/2015 1:00
7/1/2015 13:00
7/2/2015 1:00
7/2/2015 13:00
7/3/2015 1:00
7/3/2015 13:00
7/4/2015 1:00
7/4/2015 13:00
7/5/2015 1:00
7/5/2015 13:00
7/6/2015 1:00
BON Generation Flow
BON Total Flow
BON Spill Flow
BON Target Spill
85 kcfs/121 kcfs vs 95 kcfs

Figure 9


Daily Average of High 12 Hourly % TDG Values for
Lower Granite Tailwater and Little Goose Forebay
06-Jul-2015 to 13-Jul-2015
LGS Forebay (WA)
LWG Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

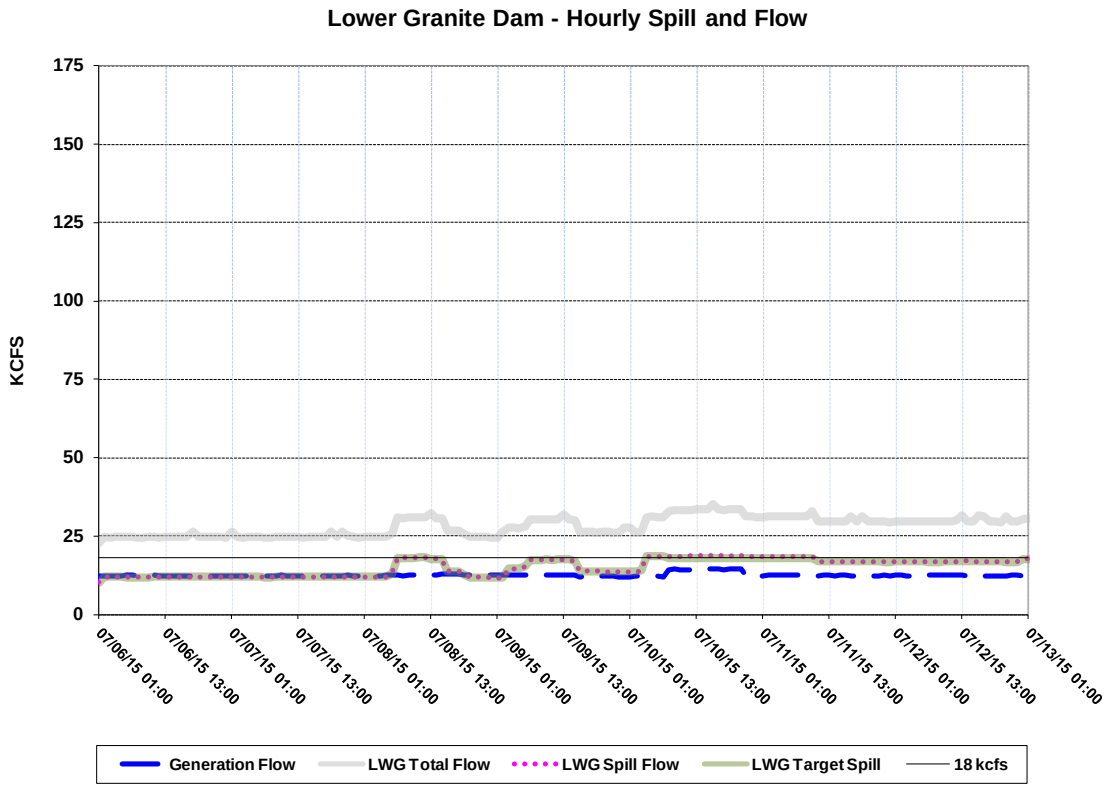
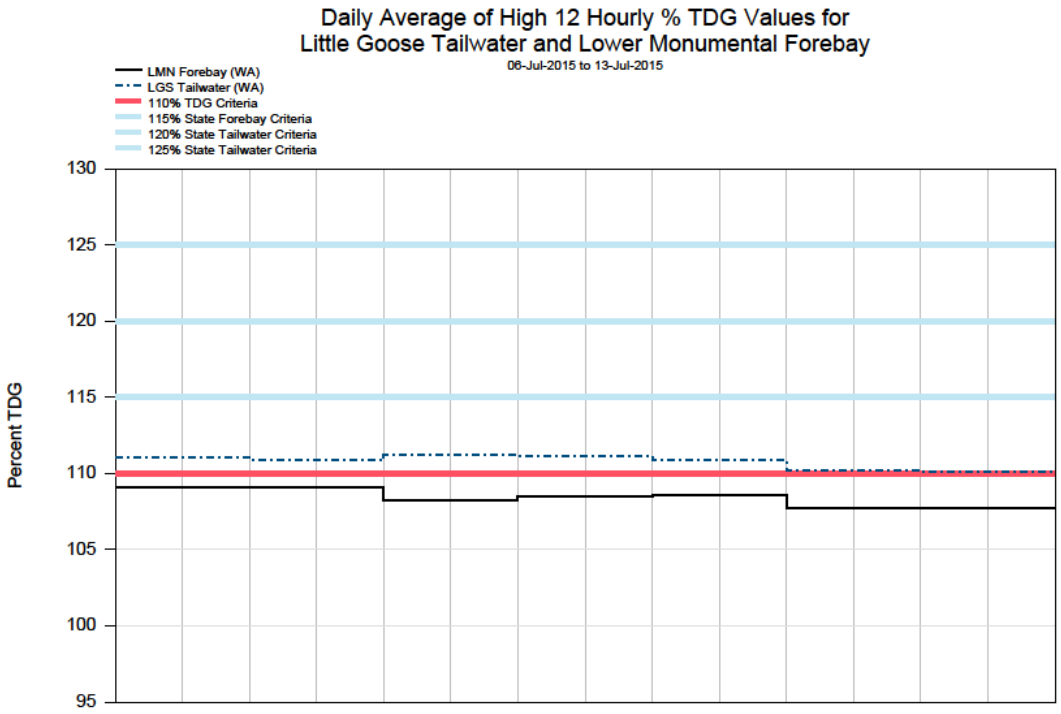

Lower Granite Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/06/15 01:00
07/06/15 13:00
07/07/15 01:00
07/07/15 13:00
07/08/15 01:00
07/08/15 13:00
07/09/15 01:00
07/09/15 13:00
07/10/15 01:00
07/10/15 13:00
07/11/15 01:00
07/11/15 13:00
07/12/15 01:00
07/12/15 13:00
07/13/15 01:00
Generation Flow
LWG Total Flow
LWG Spill Flow
LWG Target Spill
18 kcfs

Figure 10


Daily Average of High 12 Hourly % TDG Values for
Little Goose Tailwater and Lower Monumental Forebay
06-Jul-2015 to 13-Jul-2015
LMN Forebay (WA)
LGS Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

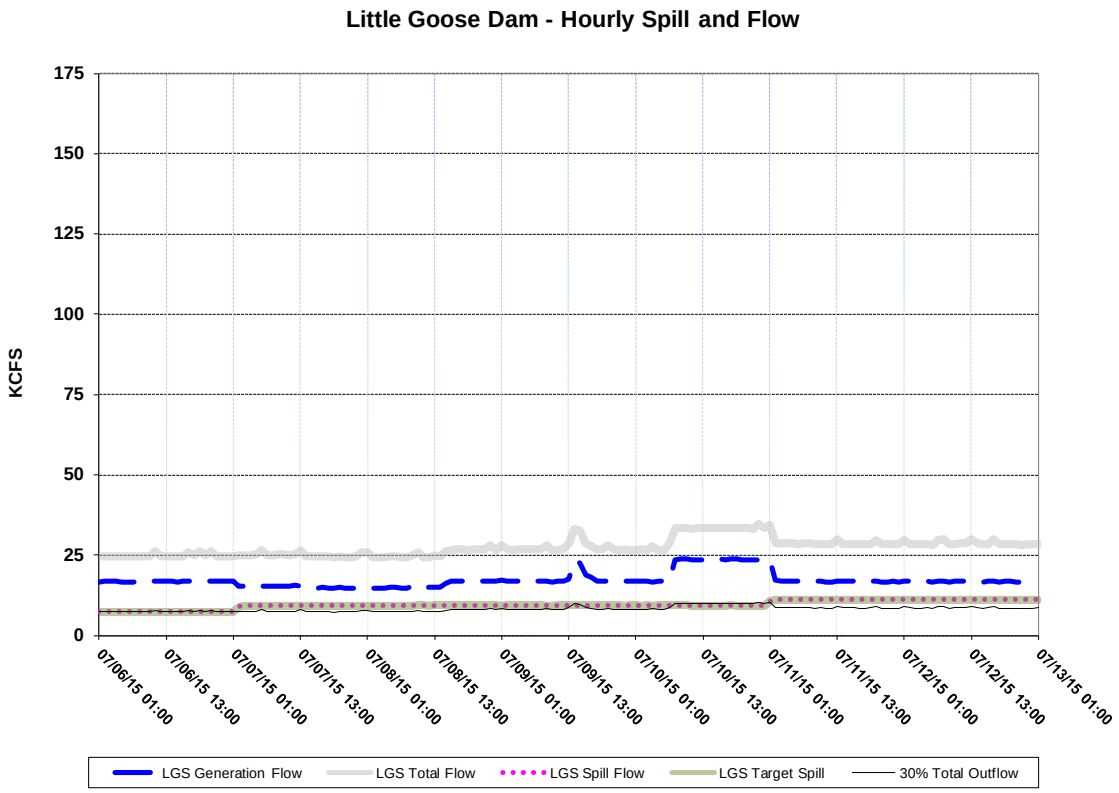
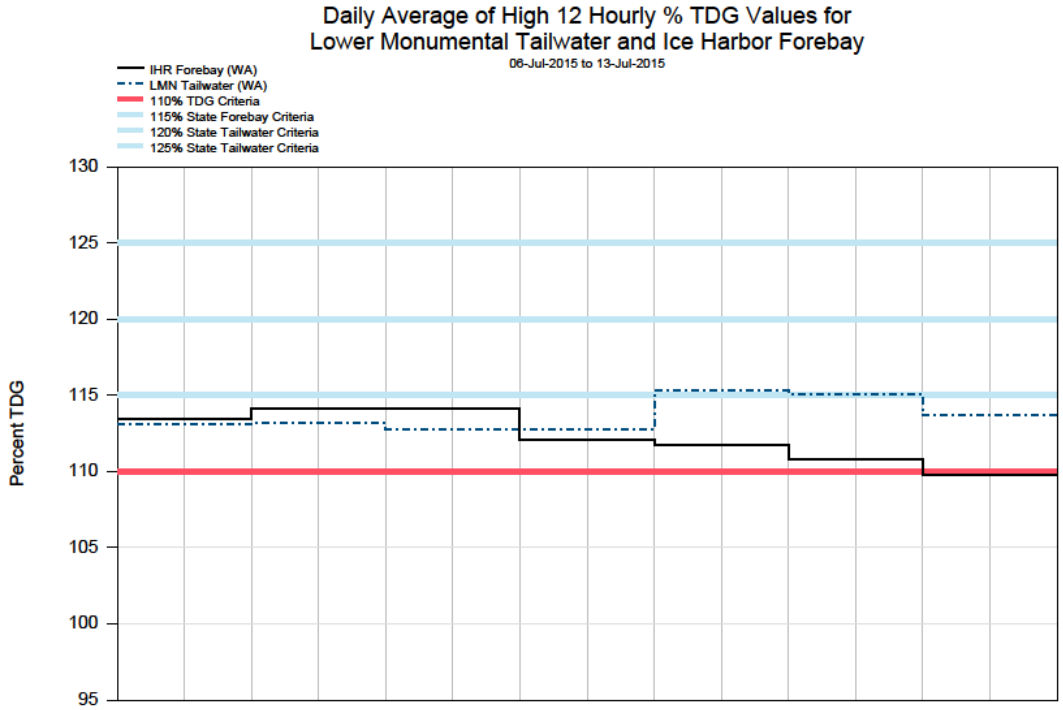

Little Goose Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/06/15 01:00
07/06/15 13:00
07/07/15 01:00
07/07/15 13:00
07/08/15 01:00
07/08/15 13:00
07/09/15 01:00
07/09/15 13:00
07/10/15 01:00
07/10/15 13:00
07/11/15 01:00
07/11/15 13:00
07/12/15 01:00
07/12/15 13:00
07/13/15 01:00
LGS Generation Flow
LGS Total Flow
LGS Spill Flow
LGS Target Spill
30% Total Outflow

Figure 11


Daily Average of High 12 Hourly % TDG Values for
Lower Monumental Tailwater and Ice Harbor Forebay
06-Jul-2015 to 13-Jul-2015
IHR Forebay (WA)
LMN Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

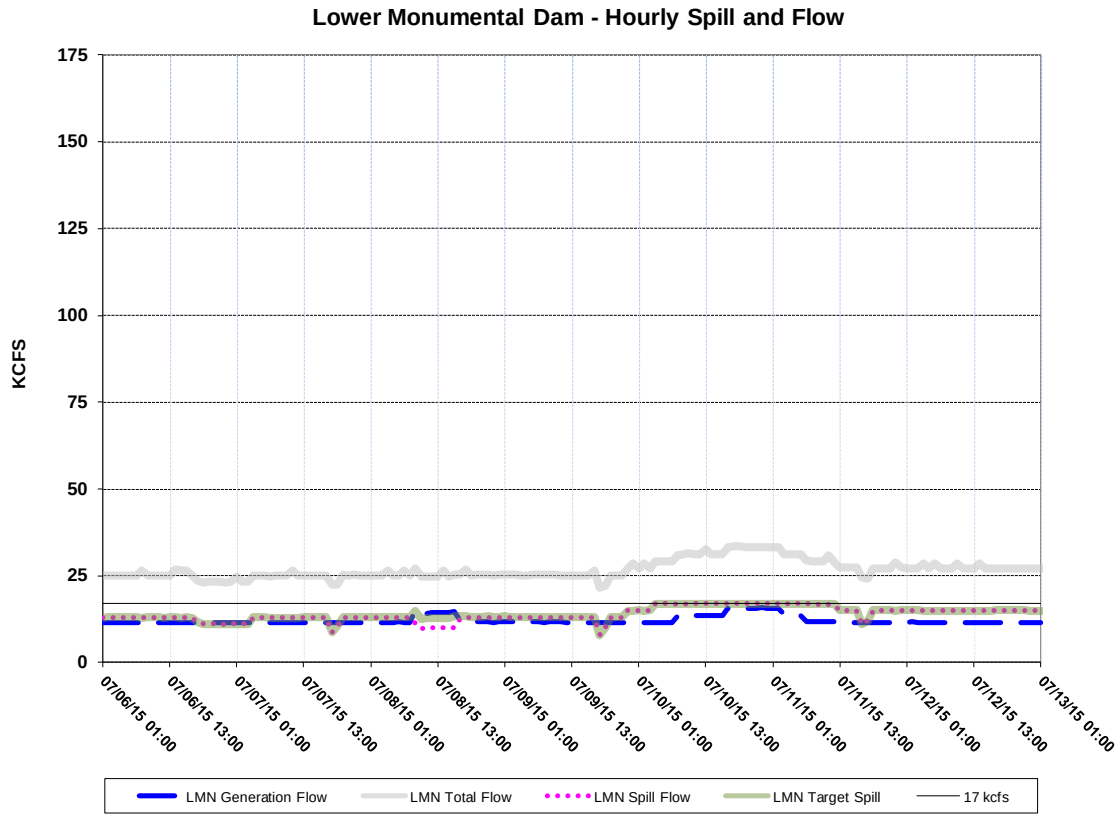
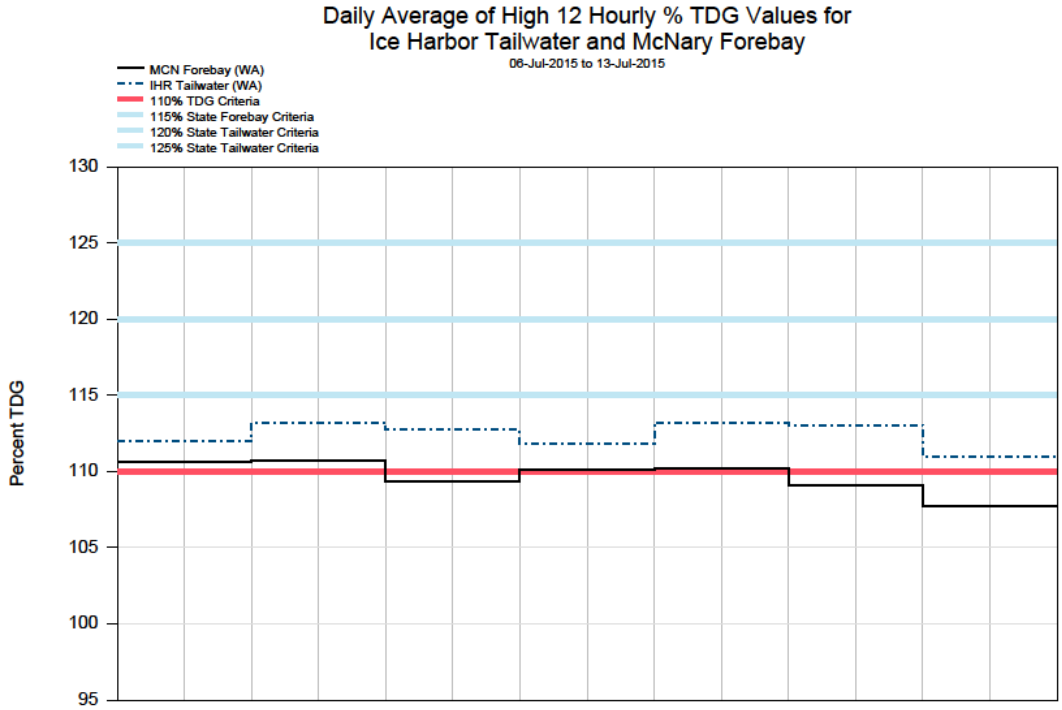

Lower Monumental Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/06/15 01:00
07/06/15 13:00
07/07/15 01:00
07/07/15 13:00
07/08/15 01:00
07/08/15 13:00
07/09/15 01:00
07/09/15 13:00
07/10/15 01:00
07/10/15 13:00
07/11/15 01:00
07/11/15 13:00
07/12/15 01:00
07/12/15 13:00
07/13/15 01:00
LMN Generation Flow
LMN Total Flow
LMN Spill Flow
LMN Target Spill
17 kcfs

Figure 12


Daily Average of High 12 Hourly % TDG Values for
Ice Harbor Tailwater and McNary Forebay
06-Jul-2015 to 13-Jul-2015
MCN Forebay (WA)
IHR Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

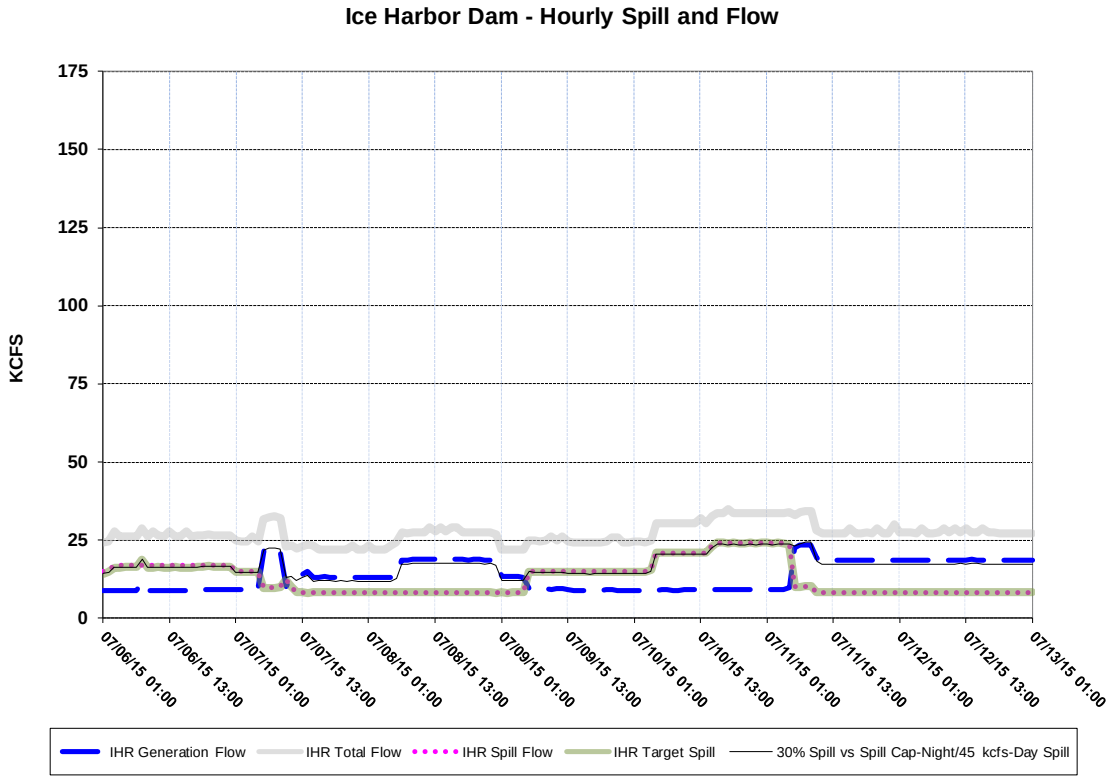
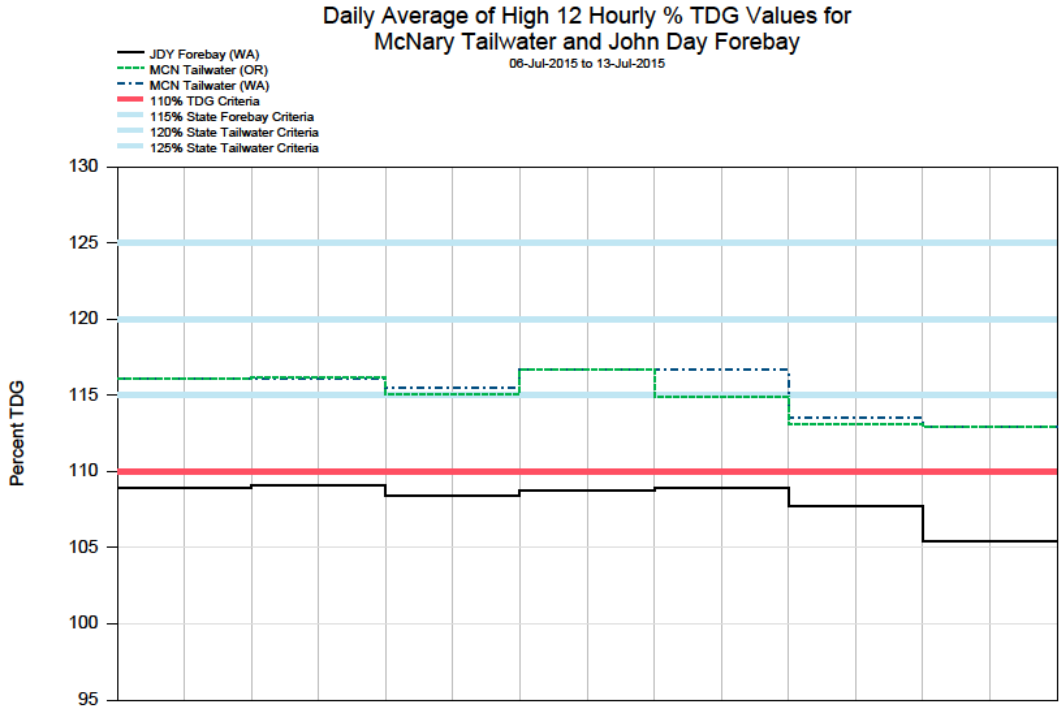

Ice Harbor Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/06/15 01:00
07/06/15 13:00
07/07/15 01:00
07/07/15 13:00
07/08/15 01:00
07/08/15 13:00
07/09/15 01:00
07/09/15 13:00
07/10/15 01:00
07/10/15 13:00
07/11/15 01:00
07/11/15 13:00
07/12/15 01:00
07/12/15 13:00
07/13/15 01:00
IHR Generation Flow
IHR Total Flow
IHR Spill Flow
IHR Target Spill
30% Spill vs Spill Cap-Night/45 kcfs-Day Spill

Figure 13


Daily Average of High 12 Hourly % TDG Values for
McNary Tailwater and John Day Forebay
06-Jul-2015 to 13-Jul-2015
JDY Forebay (WA)
MCN Tailwater (OR)
MCN Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

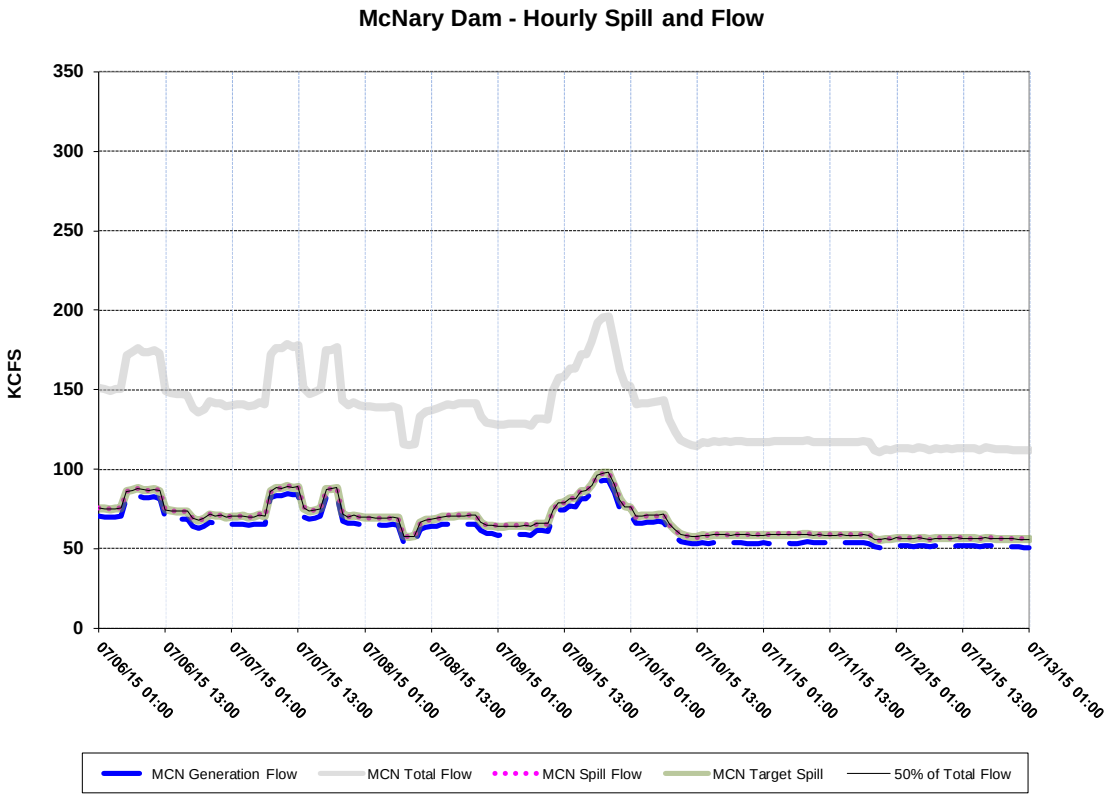
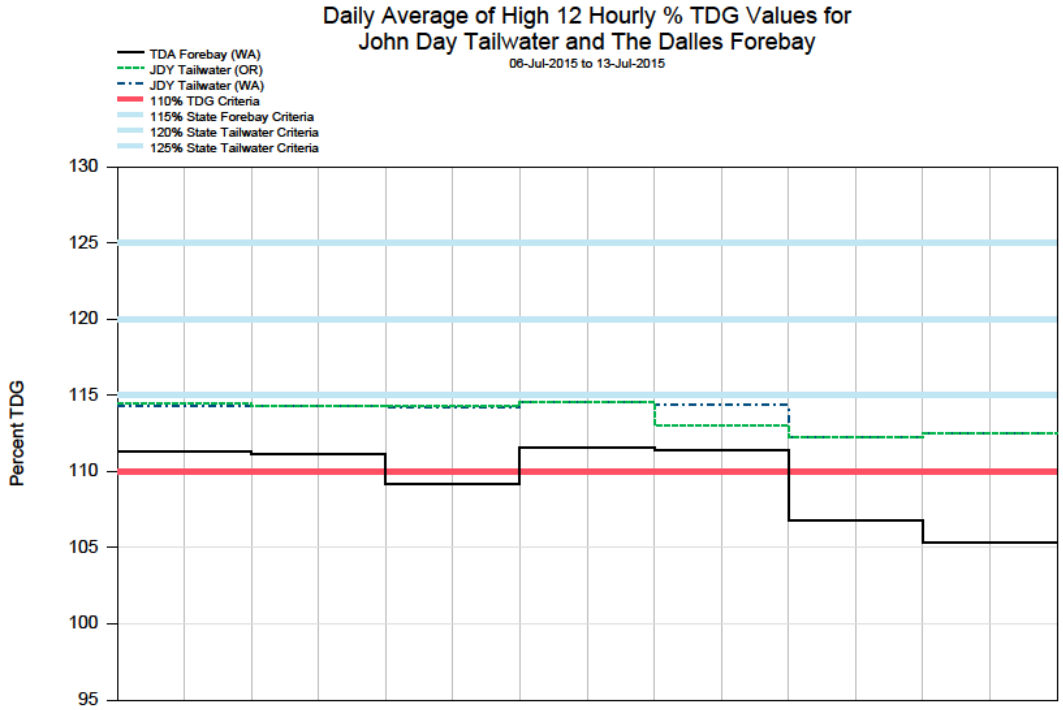

McNary Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/06/15 01:00
07/06/15 13:00
07/07/15 01:00
07/07/15 13:00
07/08/15 01:00
07/08/15 13:00
07/09/15 01:00
07/09/15 13:00
07/10/15 01:00
07/10/15 13:00
07/11/15 01:00
07/11/15 13:00
07/12/15 01:00
07/12/15 13:00
07/13/15 01:00
MCN Generation Flow
MCN Total Flow
MCN Spill Flow
MCN Target Spill
50% of Total Flow

Figure 14


Daily Average of High 12 Hourly % TDG Values for
John Day Tailwater and The Dalles Forebay
06-Jul-2015 to 13-Jul-2015
TDA Forebay (WA)
JDY Tailwater (OR)
JDY Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

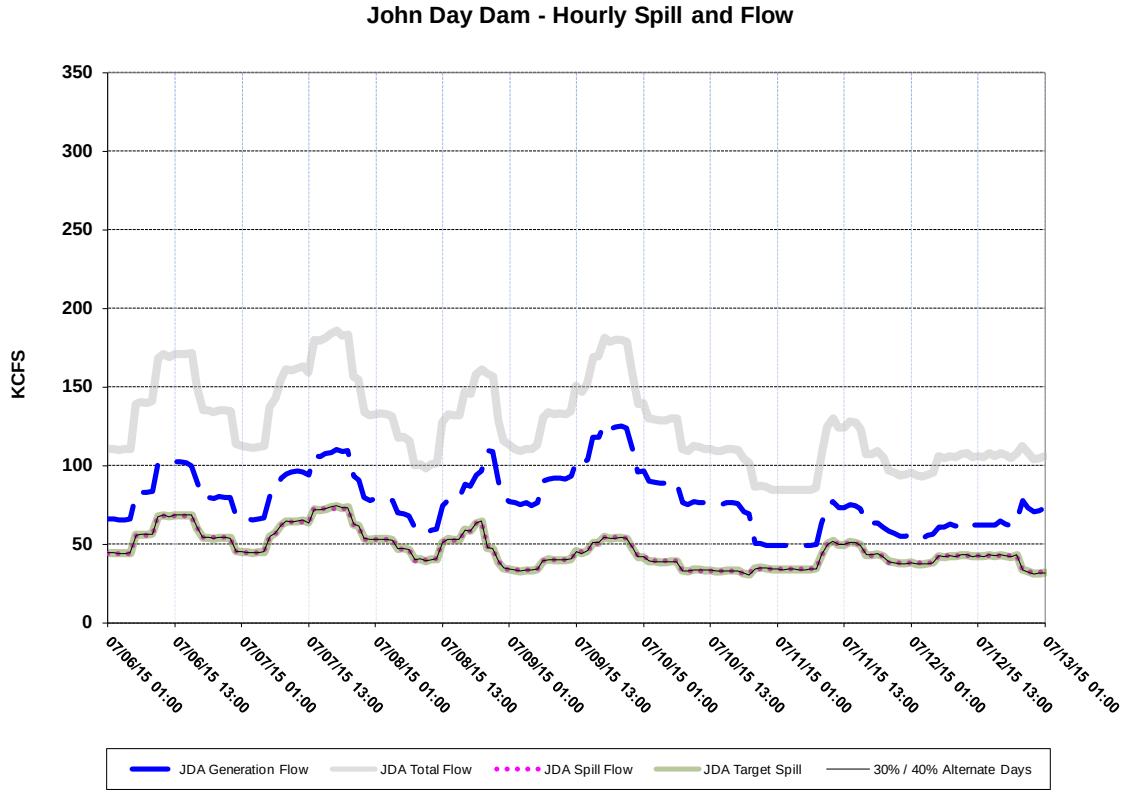
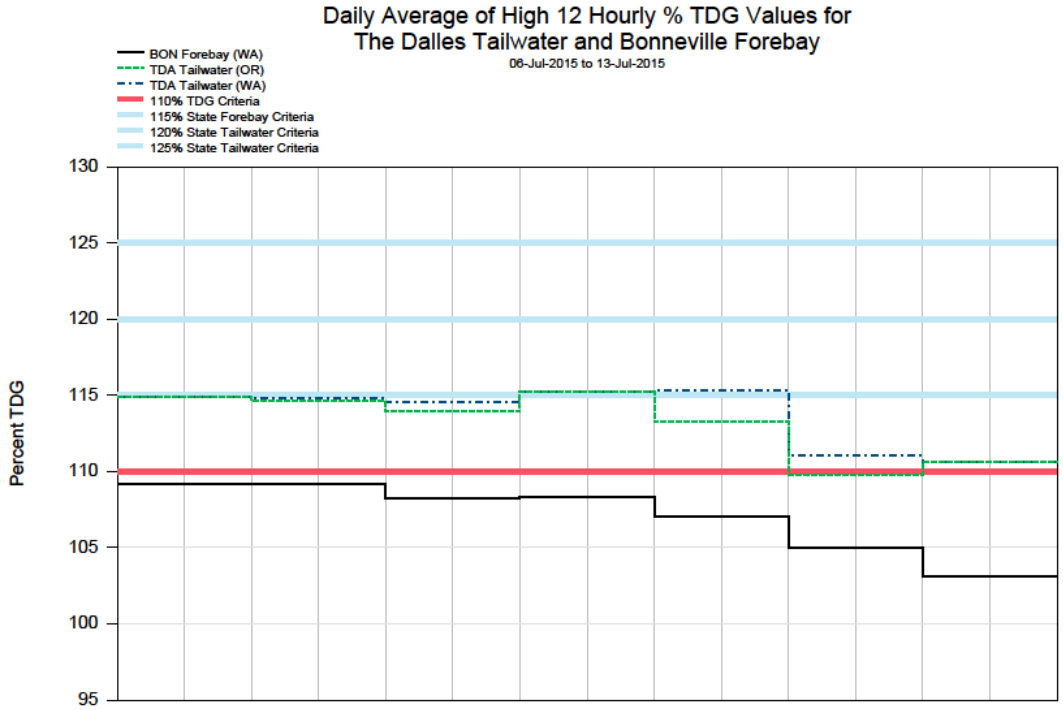

John Day Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/06/15 01:00
07/06/15 13:00
07/07/15 01:00
07/07/15 13:00
07/08/15 01:00
07/08/15 13:00
07/09/15 01:00
07/09/15 13:00
07/10/15 01:00
07/10/15 13:00
07/11/15 01:00
07/11/15 13:00
07/12/15 01:00
07/12/15 13:00
07/13/15 01:00
JDA Generation Flow
JDA Total Flow
JDA Spill Flow
JDA Target Spill
30% / 40% Alternate Days

Figure 15


Daily Average of High 12 Hourly % TDG Values for
The Dalles Tailwater and Bonneville Forebay
06-Jul-2015 to 13-Jul-2015
BON Forebay (WA)
TDA Tailwater (OR)
TDA Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

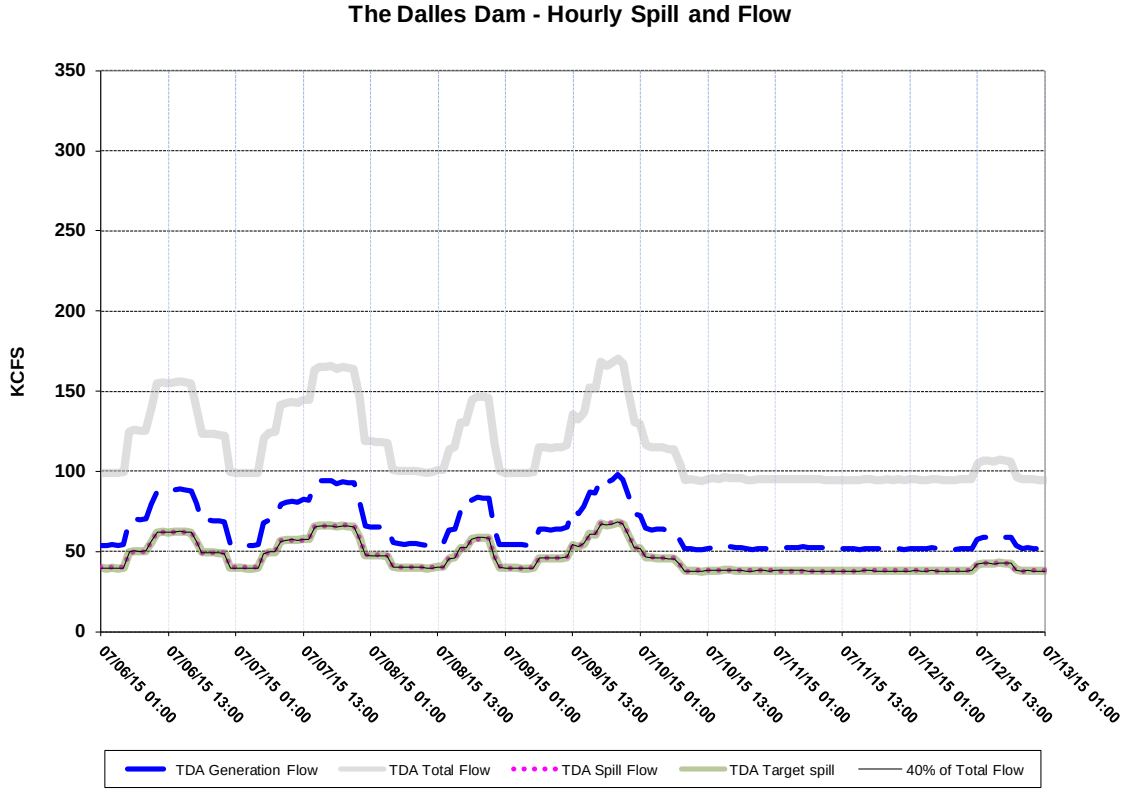
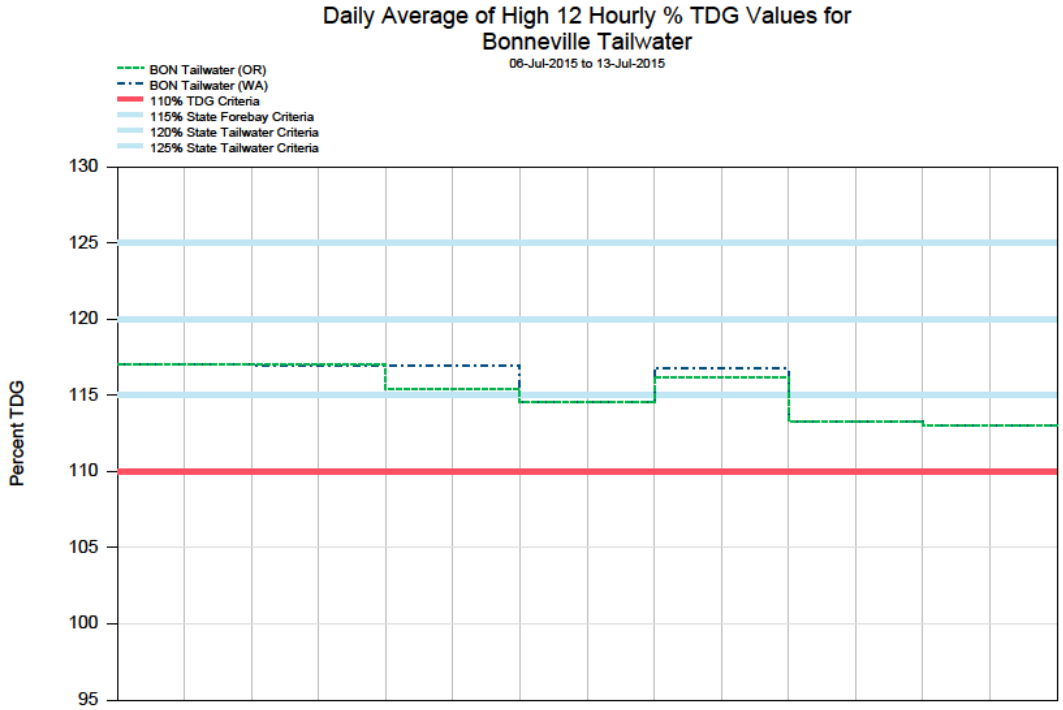

The Dalles Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/06/15 01:00
07/06/15 13:00
07/07/15 01:00
07/07/15 13:00
07/08/15 01:00
07/08/15 13:00
07/09/15 01:00
07/09/15 13:00
07/10/15 01:00
07/10/15 13:00
07/11/15 01:00
07/11/15 13:00
07/12/15 01:00
07/12/15 13:00
07/13/15 01:00
TDA Generation Flow
TDA Total Flow
TDA Spill Flow
TDA Target spill
40% of Total Flow

Figure 16


Daily Average of High 12 Hourly % TDG Values for
Bonneville Tailwater
06-Jul-2015 to 13-Jul-2015
BON Tailwater (OR)
BON Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

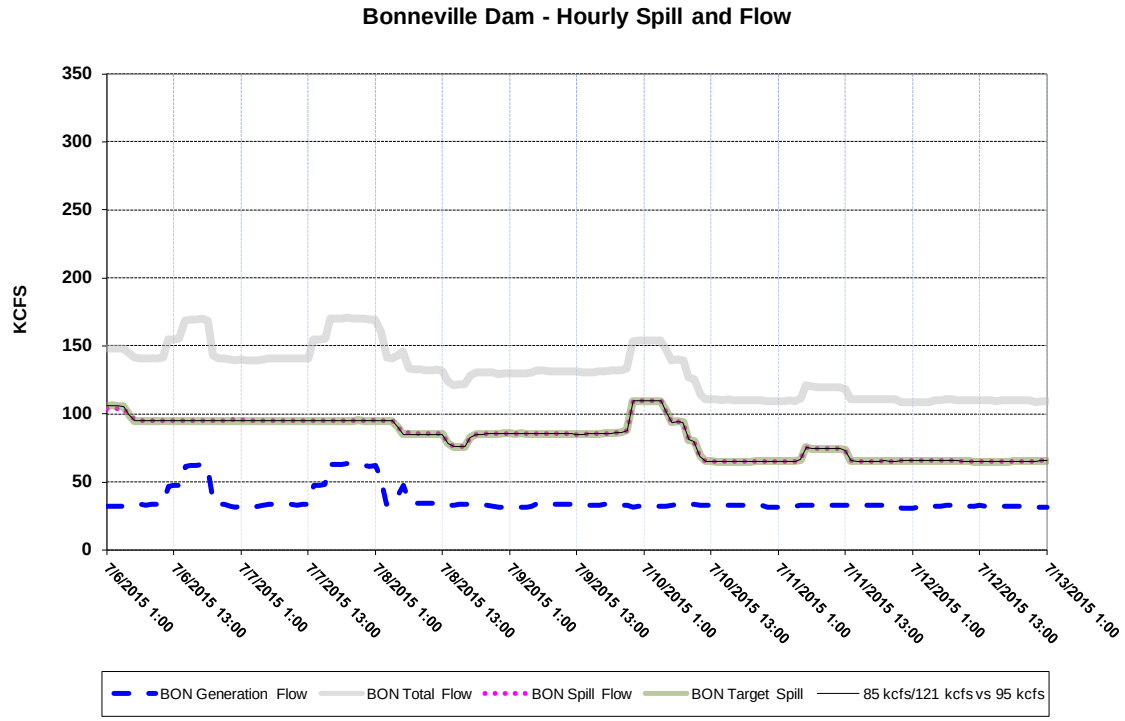
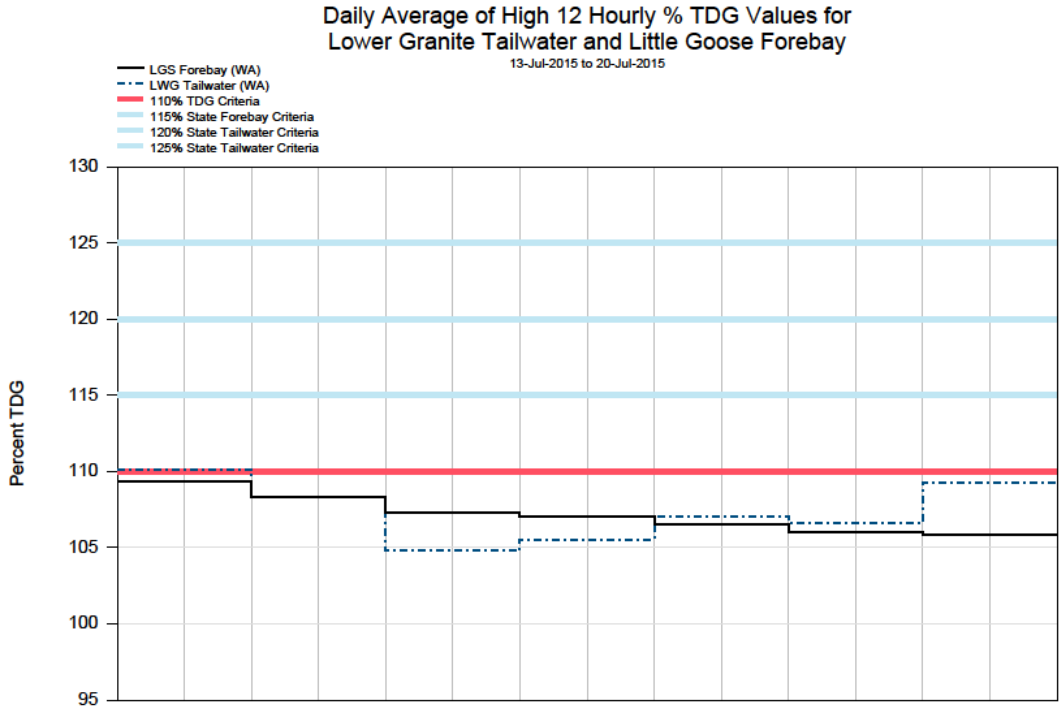

Bonneville Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
7/6/2015 1:00
7/6/2015 13:00
7/7/2015 1:00
7/7/2015 13:00
7/8/2015 1:00
7/8/2015 13:00
7/9/2015 1:00
7/9/2015 13:00
7/10/2015 1:00
7/10/2015 13:00
7/11/2015 1:00
7/11/2015 13:00
7/12/2015 1:00
7/12/2015 13:00
7/13/2015 1:00
BON Generation Flow
BON Total Flow
BON Spill Flow
BON Target Spill
85 kcfs/121 kcfs vs 95 kcfs

Figure 17


Daily Average of High 12 Hourly % TDG Values for
Lower Granite Tailwater and Little Goose Forebay
13-Jul-2015 to 20-Jul-2015
LGS Forebay (WA)
LWG Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

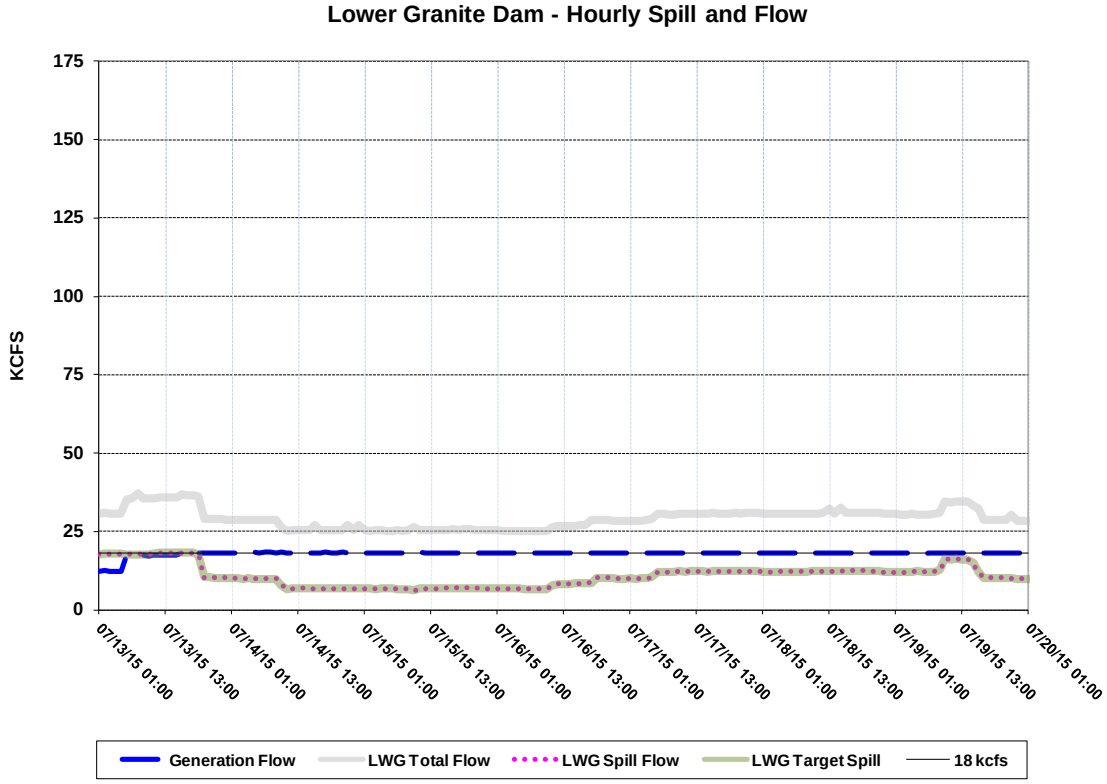
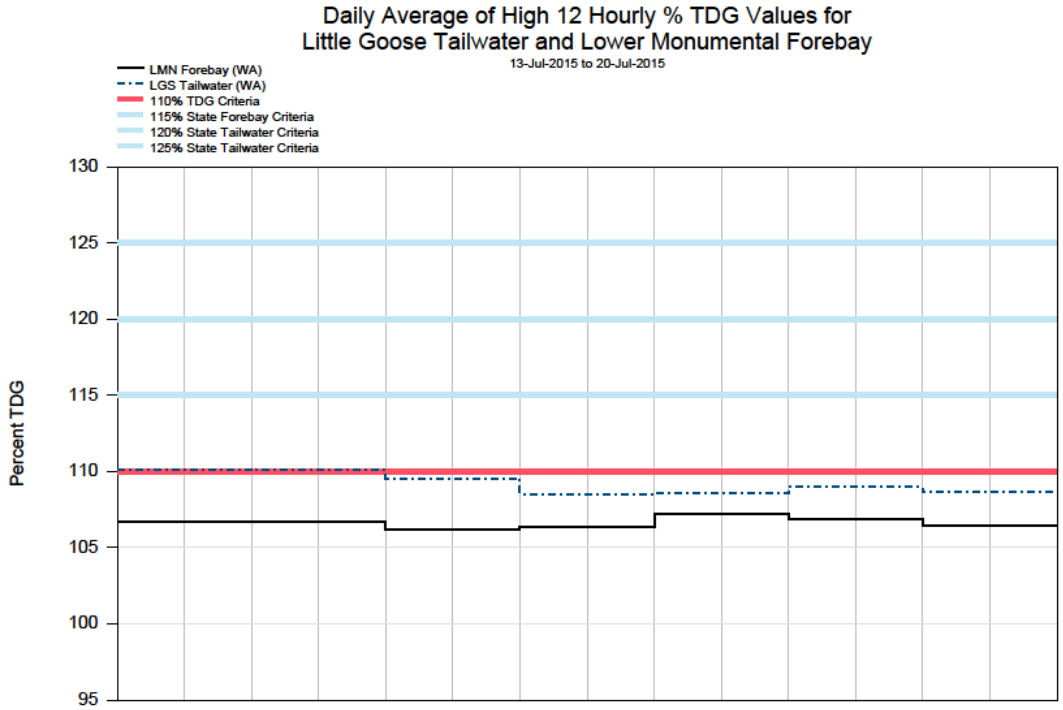

Lower Granite Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/13/15 01:00
07/13/15 13:00
07/14/15 01:00
07/14/15 13:00
07/15/15 01:00
07/15/15 13:00
07/16/15 01:00
07/16/15 13:00
07/17/15 01:00
07/17/15 13:00
07/18/15 01:00
07/18/15 13:00
07/19/15 01:00
07/19/15 13:00
07/20/15 01:00
Generation Flow
LWG Total Flow
LWG Spill Flow
LWG Target Spill
18 kcfs

Figure 18


Daily Average of High 12 Hourly % TDG Values for
Little Goose Tailwater and Lower Monumental Forebay
13-Jul-2015 to 20-Jul-2015
LMN Forebay (WA)
LGS Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

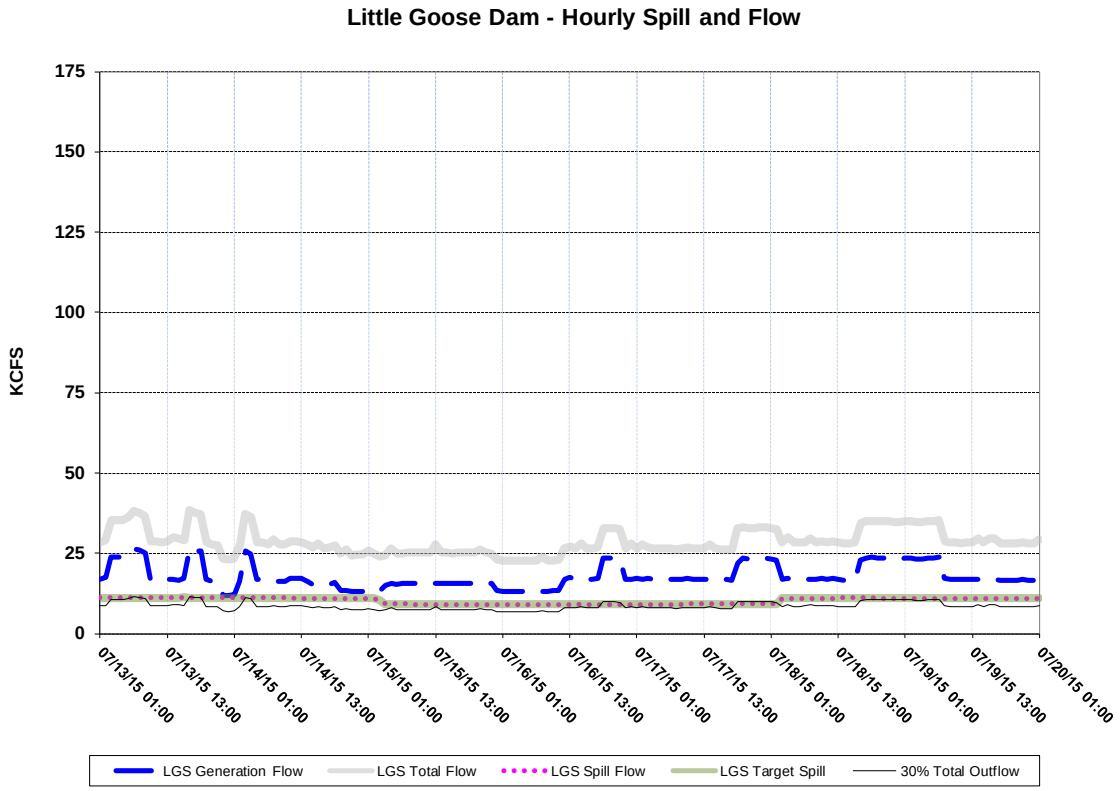
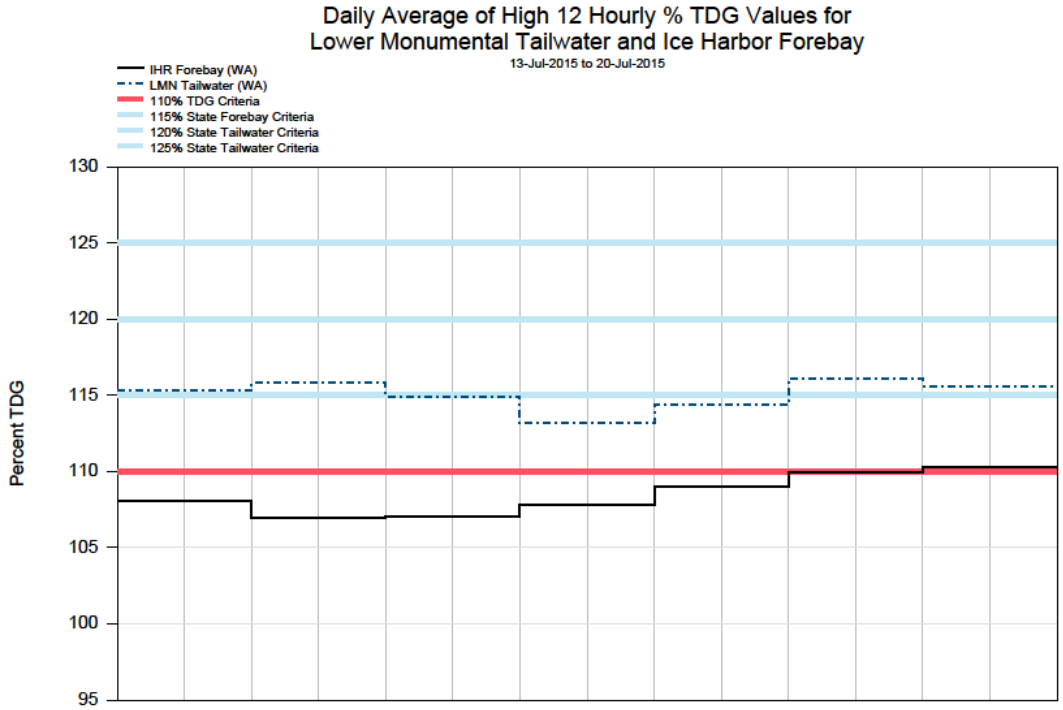

Little Goose Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/13/15 01:00
07/13/15 13:00
07/14/15 01:00
07/14/15 13:00
07/15/15 01:00
07/15/15 13:00
07/16/15 01:00
07/16/15 13:00
07/17/15 01:00
07/17/15 13:00
07/18/15 01:00
07/18/15 13:00
07/19/15 01:00
07/19/15 13:00
07/20/15 01:00
LGS Generation Flow
LGS Total Flow
LGS Spill Flow
LGS Target Spill
30% Total Outflow

Figure 19


Daily Average of High 12 Hourly % TDG Values for
Lower Monumental Tailwater and Ice Harbor Forebay
13-Jul-2015 to 20-Jul-2015
IHR Forebay (WA)
LMN Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

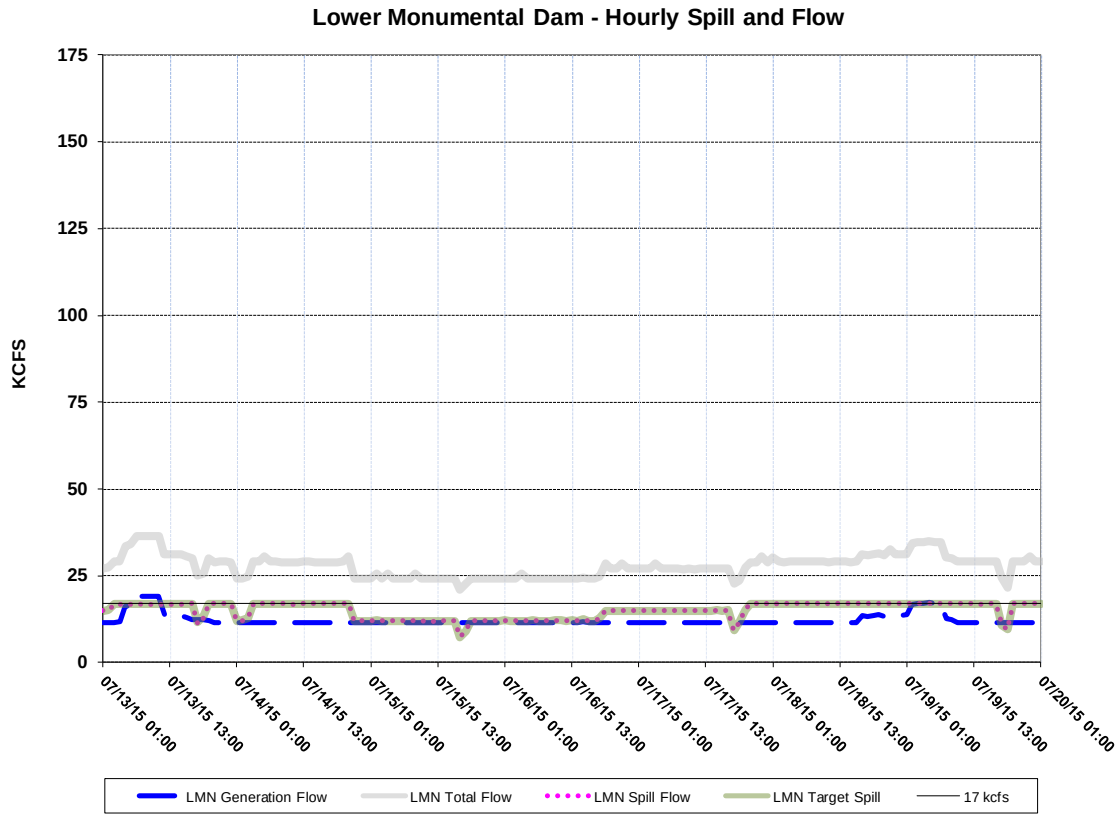
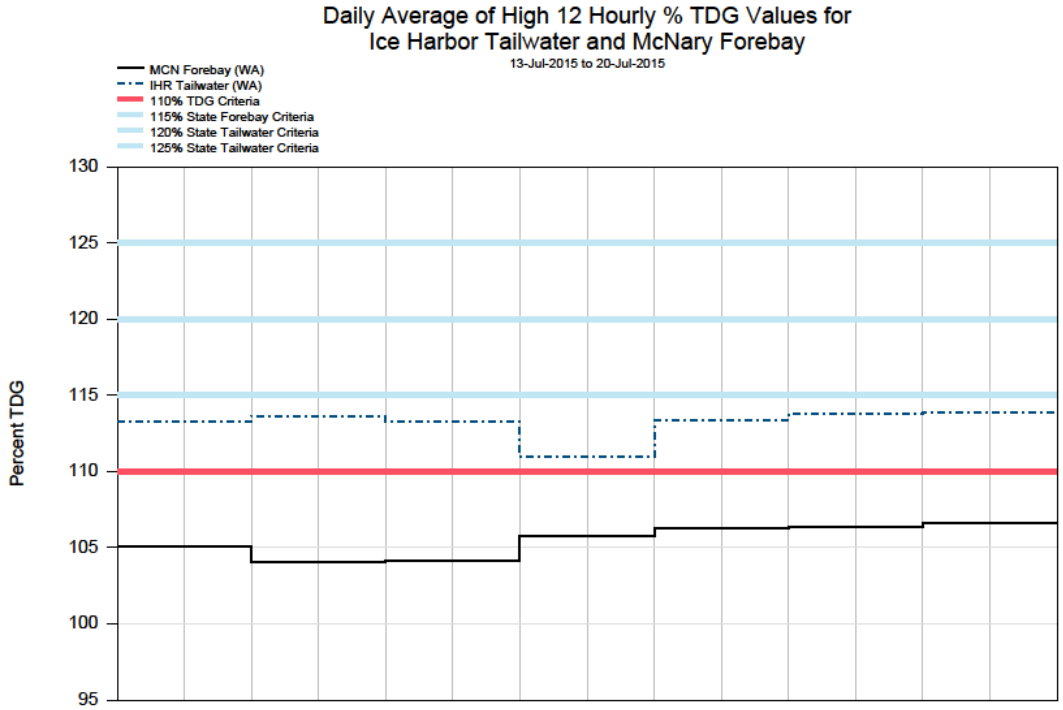

Lower Monumental Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/13/15 01:00
07/13/15 13:00
07/14/15 01:00
07/14/15 13:00
07/15/15 01:00
07/15/15 13:00
07/16/15 01:00
07/16/15 13:00
07/17/15 01:00
07/17/15 13:00
07/18/15 01:00
07/18/15 13:00
07/19/15 01:00
07/19/15 13:00
07/20/15 01:00
LMN Generation Flow
LMN Total Flow
LMN Spill Flow
LMN Target Spill
17 kcfs

Figure 20


Daily Average of High 12 Hourly % TDG Values for
Ice Harbor Tailwater and McNary Forebay
13-Jul-2015 to 20-Jul-2015
MCN Forebay (WA)
IHR Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

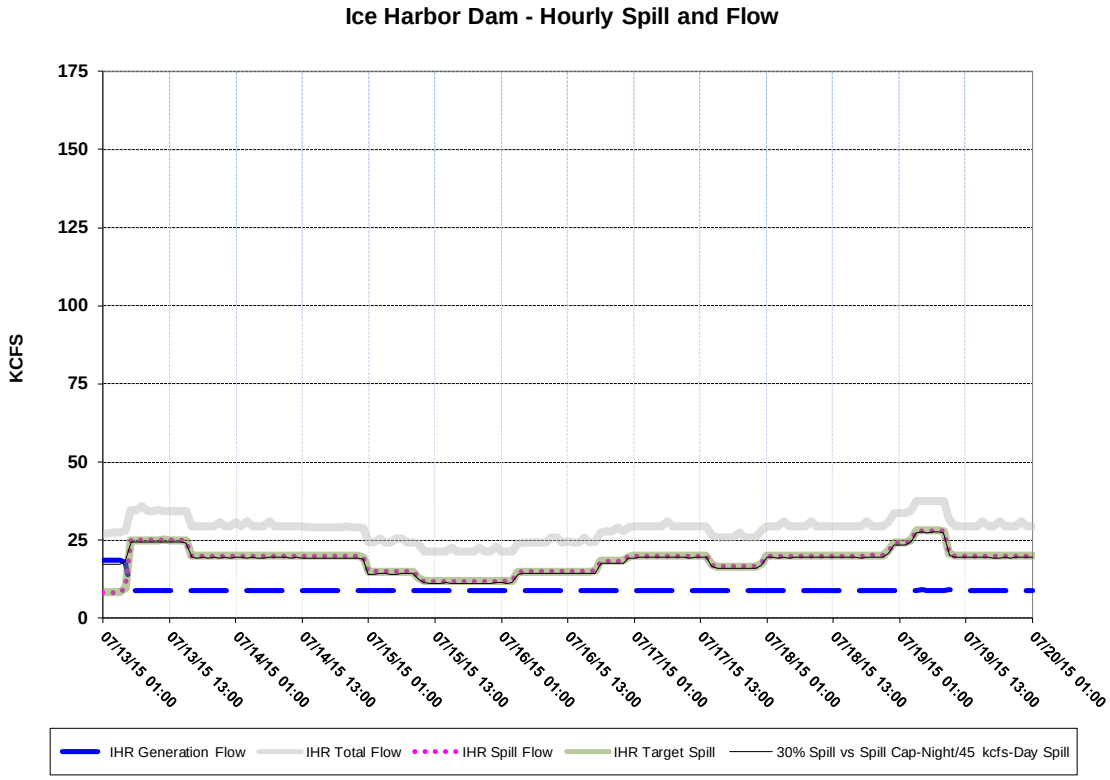
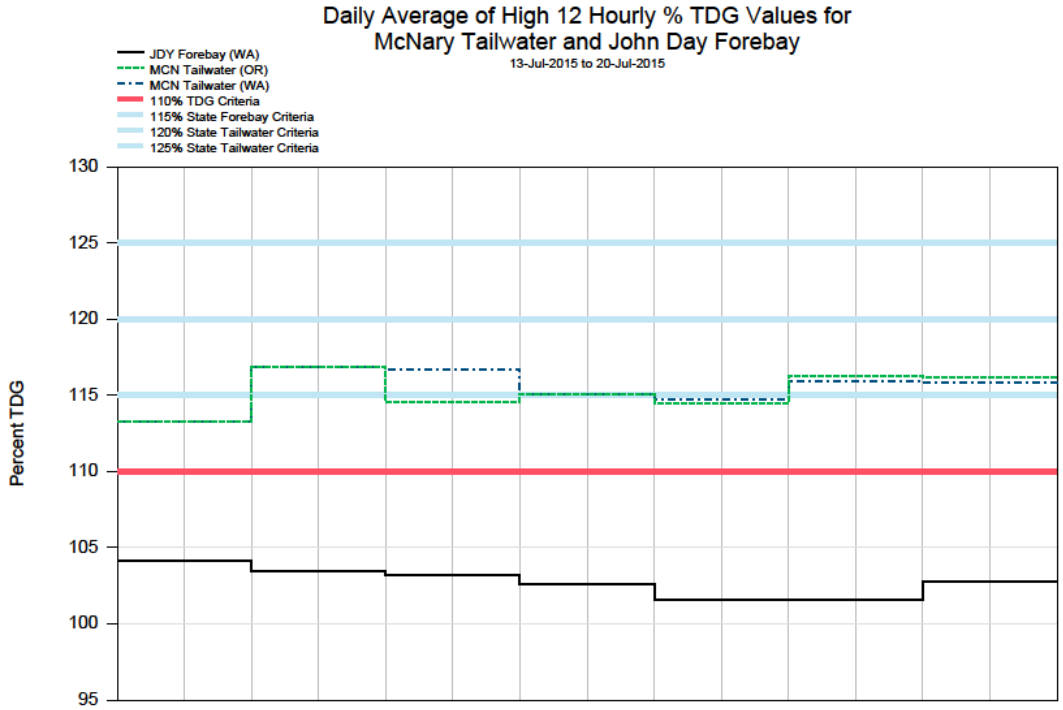

Ice Harbor Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/13/15 01:00
07/13/15 13:00
07/14/15 01:00
07/14/15 13:00
07/15/15 01:00
07/15/15 13:00
07/16/15 01:00
07/16/15 13:00
07/17/15 01:00
07/17/15 13:00
07/18/15 01:00
07/18/15 13:00
07/19/15 01:00
07/19/15 13:00
07/20/15 01:00
IHR Generation Flow
IHR Total Flow
IHR Spill Flow
IHR Target Spill
30% Spill vs Spill Cap-Night/45 kcfs-Day Spill

Figure 21


Daily Average of High 12 Hourly % TDG Values for
McNary Tailwater and John Day Forebay
13-Jul-2015 to 20-Jul-2015
JDY Forebay (WA)
MCN Tailwater (OR)
MCN Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

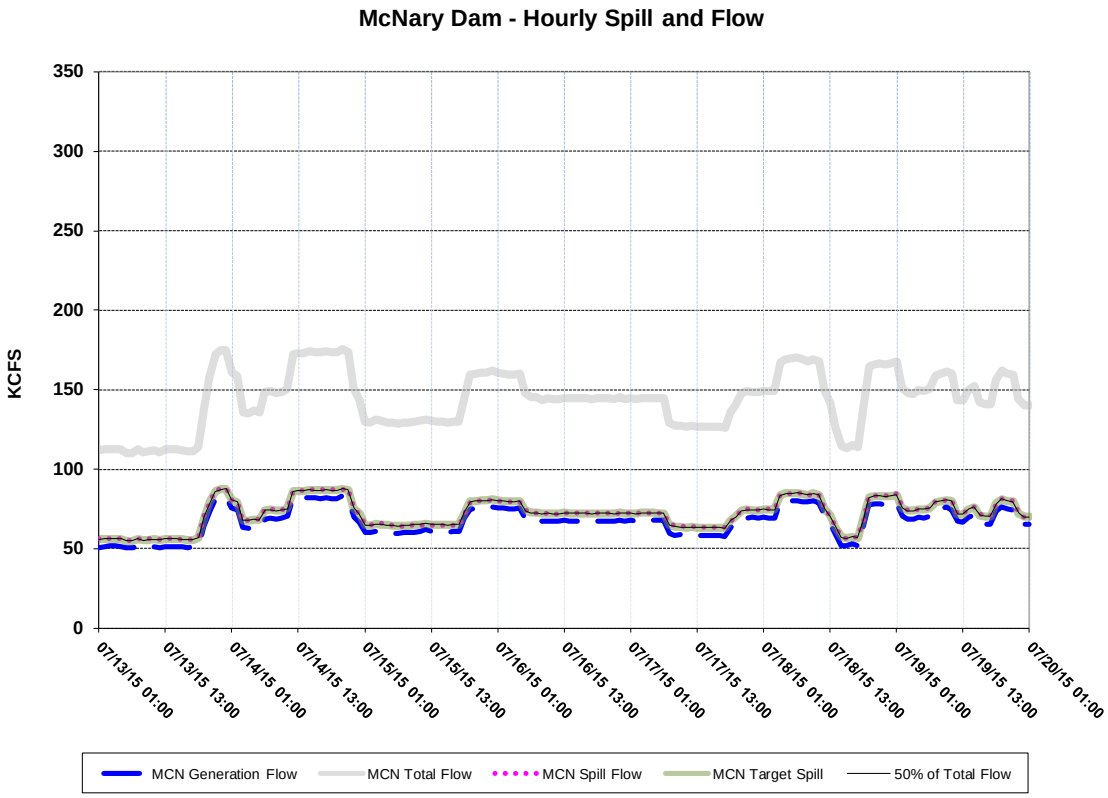
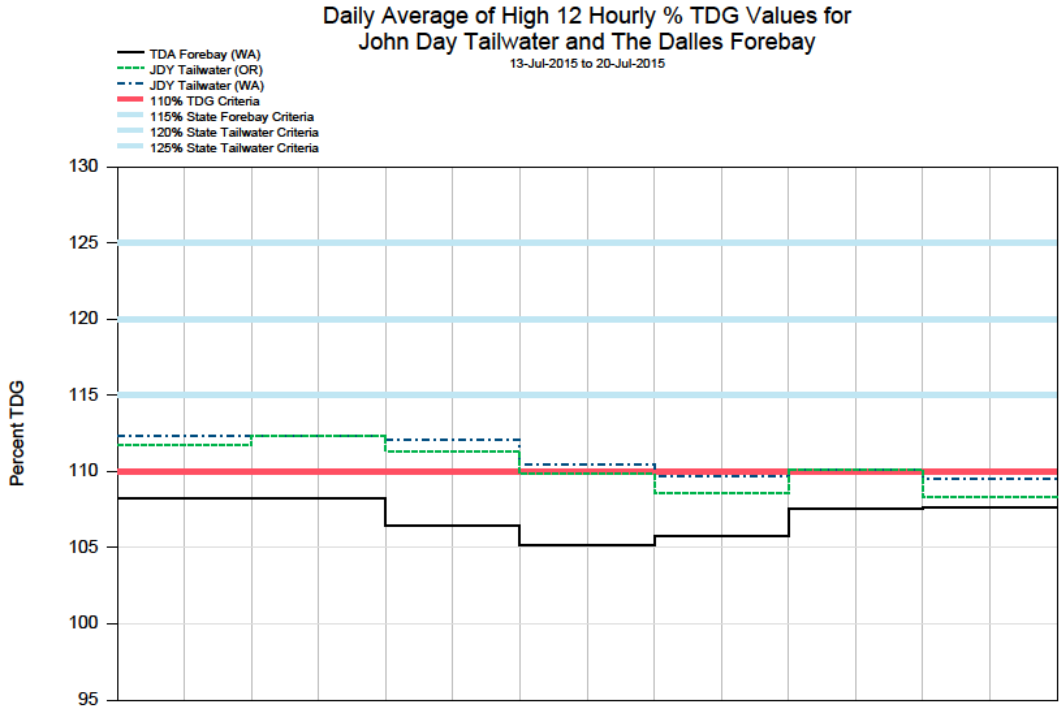

McNary Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/13/15 01:00
07/13/15 13:00
07/14/15 01:00
07/14/15 13:00
07/15/15 01:00
07/15/15 13:00
07/16/15 01:00
07/16/15 13:00
07/17/15 01:00
07/17/15 13:00
07/18/15 01:00
07/18/15 13:00
07/19/15 01:00
07/19/15 13:00
07/20/15 01:00
MCN Generation Flow
MCN Total Flow
MCN Spill Flow
MCN Target Spill
50% of Total Flow

Figure 22


Daily Average of High 12 Hourly % TDG Values for
John Day Tailwater and The Dalles Forebay
13-Jul-2015 to 20-Jul-2015
TDA Forebay (WA)
JDY Tailwater (OR)
JDY Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

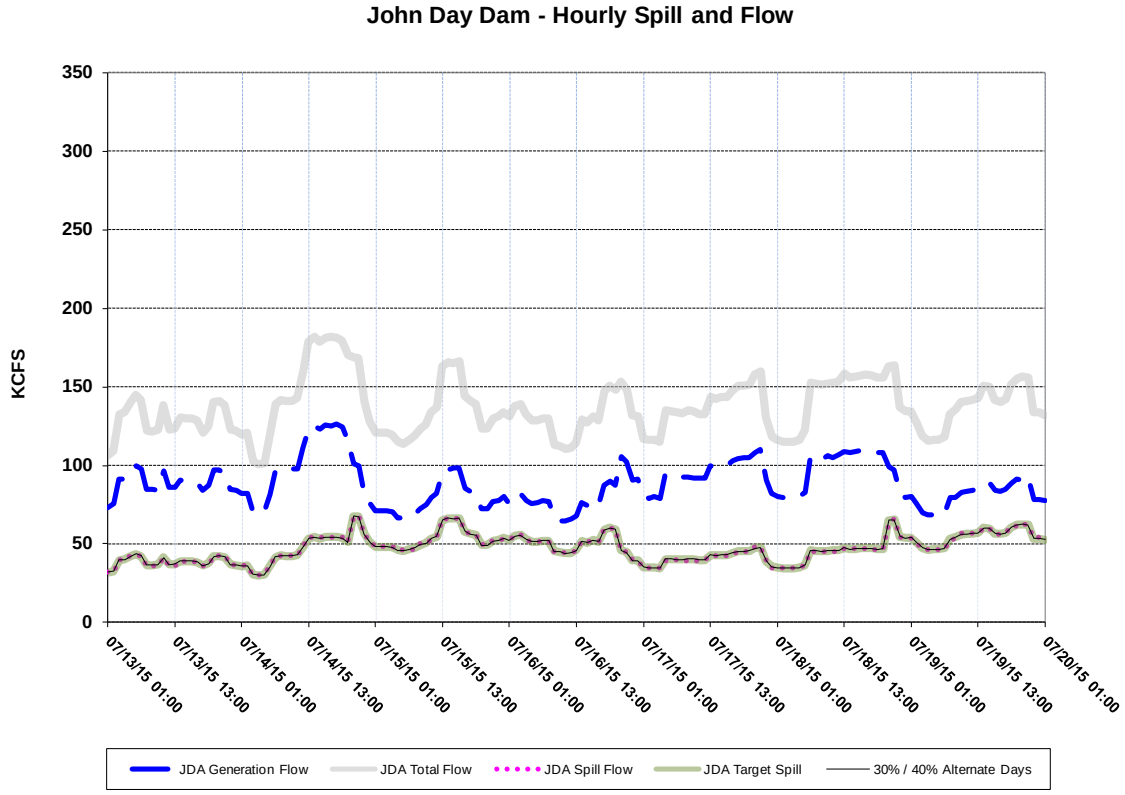
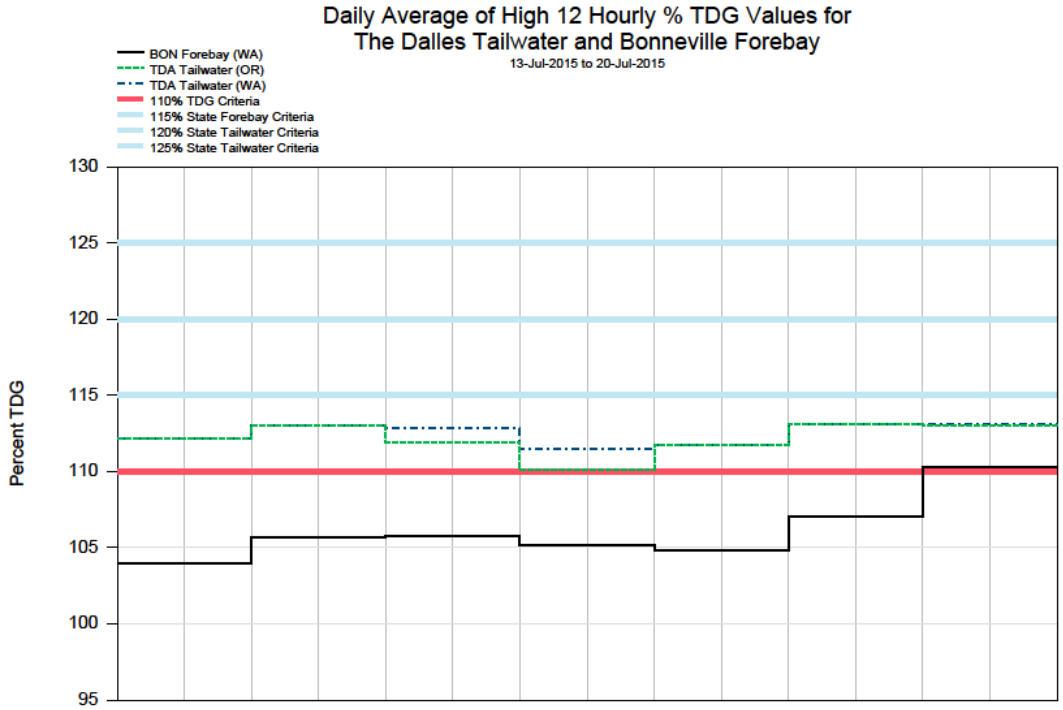

John Day Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/13/15 01:00
07/13/15 13:00
07/14/15 01:00
07/14/15 13:00
07/15/15 01:00
07/15/15 13:00
07/16/15 01:00
07/16/15 13:00
07/17/15 01:00
07/17/15 13:00
07/18/15 01:00
07/18/15 13:00
07/19/15 01:00
07/19/15 13:00
07/20/15 01:00
JDA Generation Flow
JDA Total Flow
JDA Spill Flow
JDA Target Spill
30% / 40% Alternate Days

Figure 23


Daily Average of High 12 Hourly % TDG Values for
The Dalles Tailwater and Bonneville Forebay
13-Jul-2015 to 20-Jul-2015
BON Forebay (WA)
TDA Tailwater (OR)
TDA Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

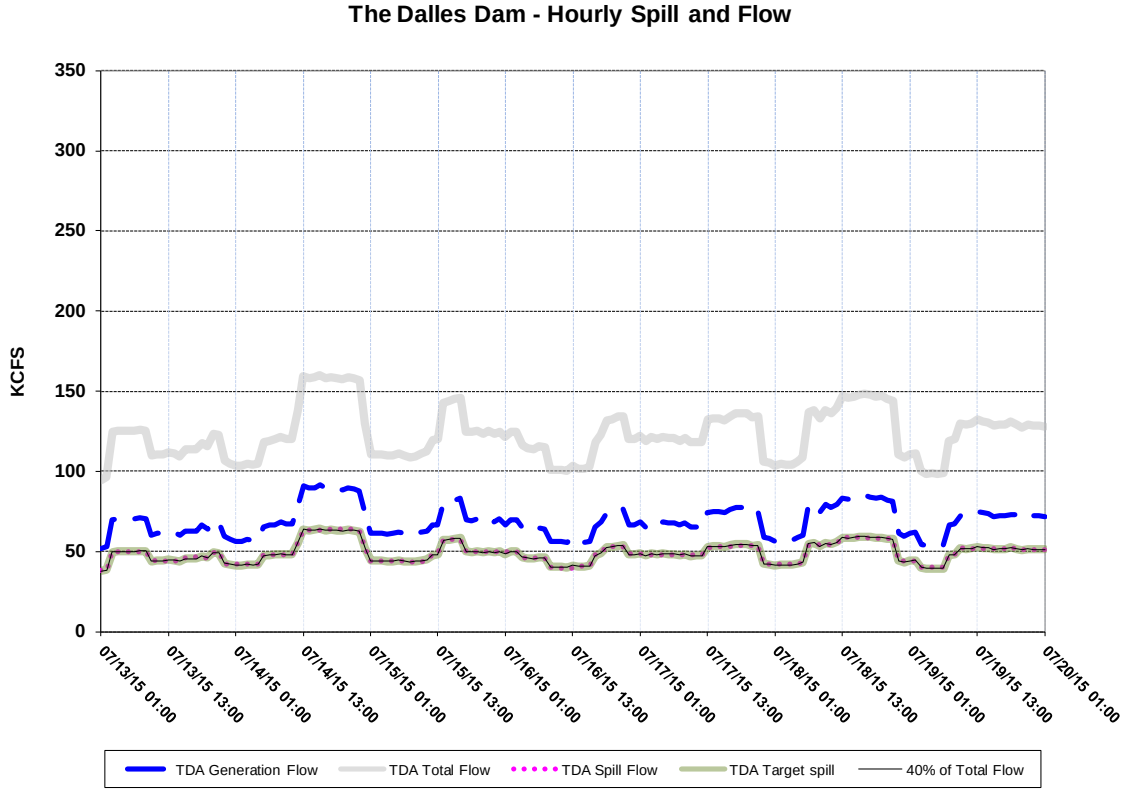
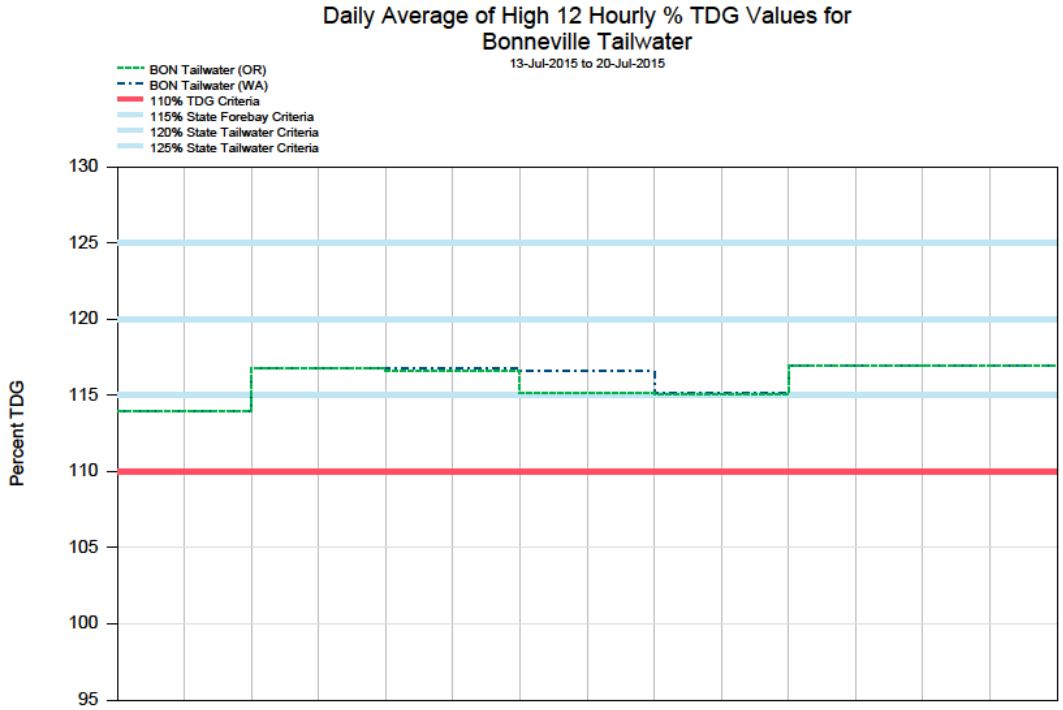

The Dalles Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/13/15 01:00
07/13/15 13:00
07/14/15 01:00
07/14/15 13:00
07/15/15 01:00
07/15/15 13:00
07/16/15 01:00
07/16/15 13:00
07/17/15 01:00
07/17/15 13:00
07/18/15 01:00
07/18/15 13:00
07/19/15 01:00
07/19/15 13:00
07/20/15 01:00
TDA Generation Flow
TDA Total Flow
TDA Spill Flow
TDA Target spill
40% of Total Flow

Figure 24


Daily Average of High 12 Hourly % TDG Values for
Bonneville Tailwater
13-Jul-2015 to 20-Jul-2015
BON Tailwater (OR)
BON Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

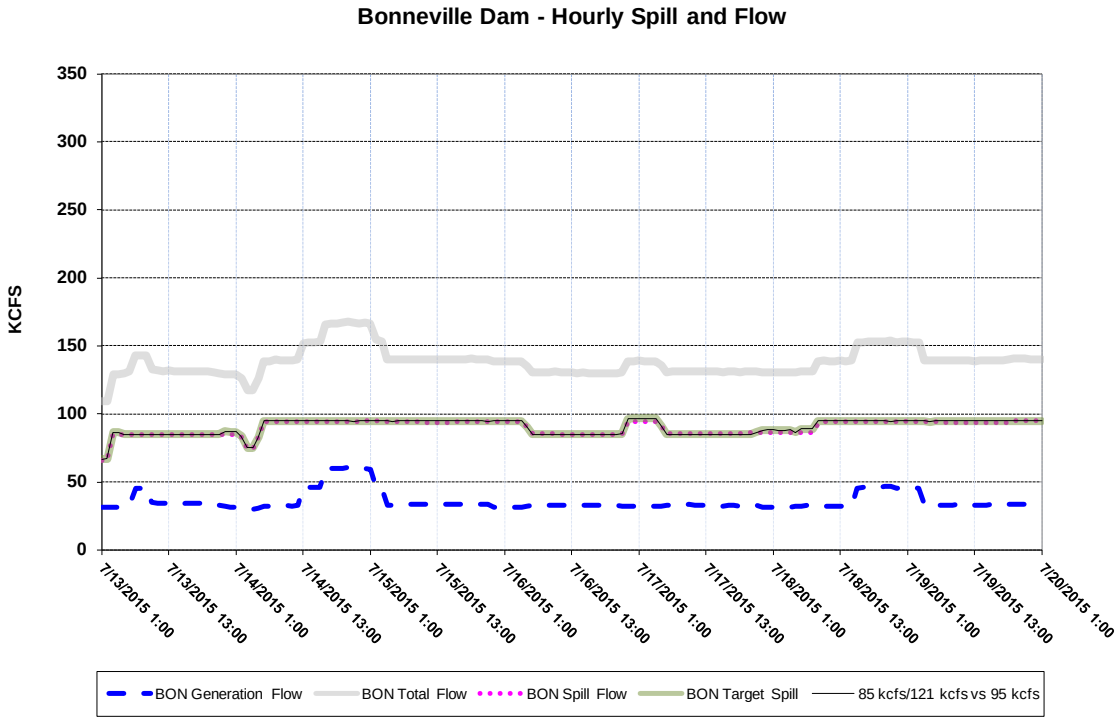
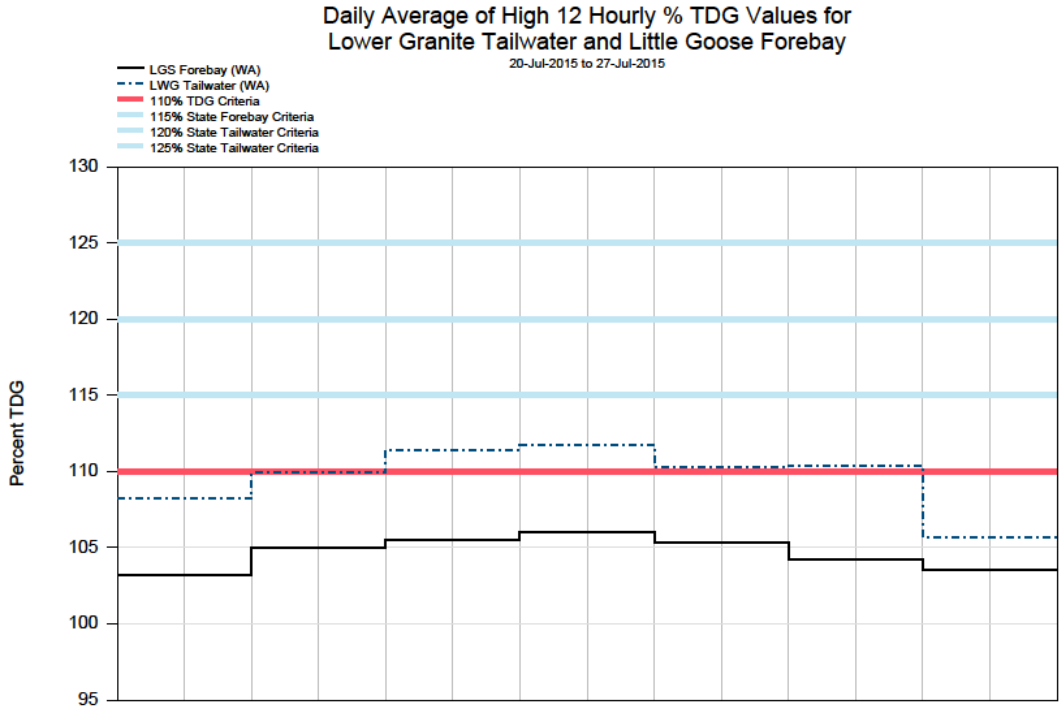

Bonneville Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
7/13/2015 1:00
7/13/2015 13:00
7/14/2015 1:00
7/14/2015 13:00
7/15/2015 1:00
7/15/2015 13:00
7/16/2015 1:00
7/16/2015 13:00
7/17/2015 1:00
7/17/2015 13:00
7/18/2015 1:00
7/18/2015 13:00
7/19/2015 1:00
7/19/2015 13:00
7/20/2015 1:00
BON Generation Flow
BON Total Flow
BON Spill Flow
BON Target Spill
85 kcfs/121 kcfs vs 95 kcfs

Figure 25


Daily Average of High 12 Hourly % TDG Values for
Lower Granite Tailwater and Little Goose Forebay
20-Jul-2015 to 27-Jul-2015
LGS Forebay (WA)
LWG Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

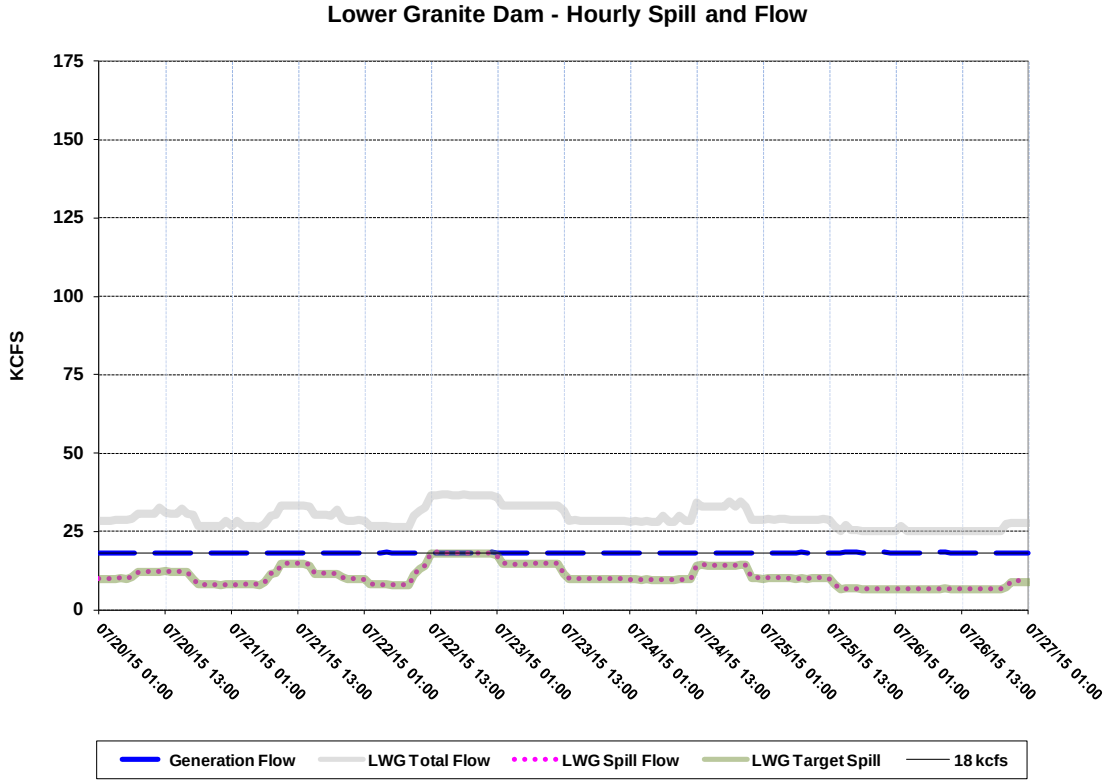
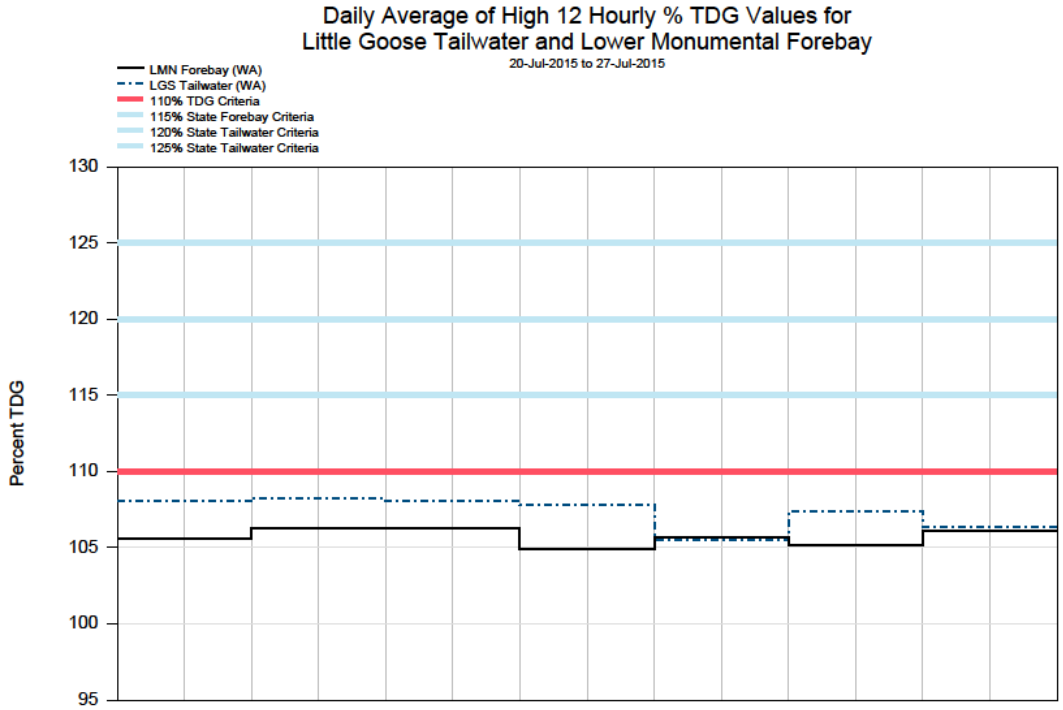

Lower Granite Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/20/15 01:00
07/20/15 13:00
07/21/15 01:00
07/21/15 13:00
07/22/15 01:00
07/22/15 13:00
07/23/15 01:00
07/23/15 13:00
07/24/15 01:00
07/24/15 13:00
07/25/15 01:00
07/25/15 13:00
07/26/15 01:00
07/26/15 13:00
07/27/15 01:00
Generation Flow
LWG Total Flow
LWG Spill Flow
LWG Target Spill
18 kcfs

Figure 26


Daily Average of High 12 Hourly % TDG Values for
Little Goose Tailwater and Lower Monumental Forebay
20-Jul-2015 to 27-Jul-2015
LMN Forebay (WA)
LGS Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

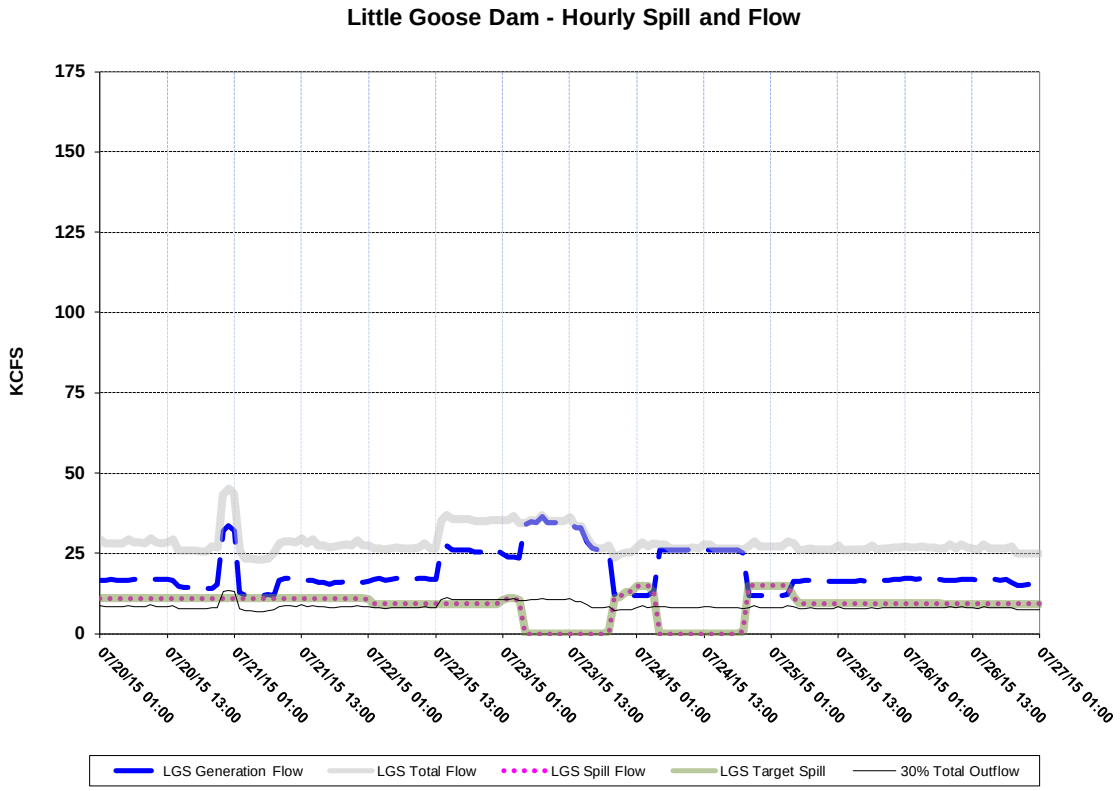
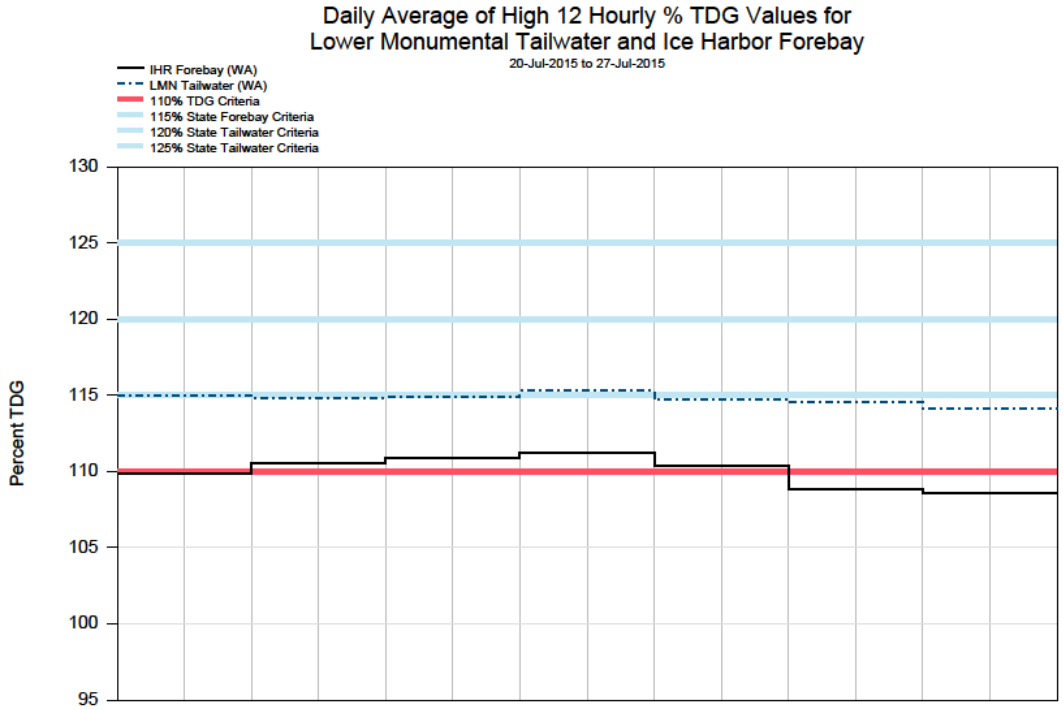

Little Goose Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/20/15 01:00
07/20/15 13:00
07/21/15 01:00
07/21/15 13:00
07/22/15 01:00
07/22/15 13:00
07/23/15 01:00
07/23/15 13:00
07/24/15 01:00
07/24/15 13:00
07/25/15 01:00
07/25/15 13:00
07/26/15 01:00
07/26/15 13:00
07/27/15 01:00
LGS Generation Flow
LGS Total Flow
LGS Spill Flow
LGS Target Spill
30% Total Outflow

Figure 27


Daily Average of High 12 Hourly % TDG Values for
Lower Monumental Tailwater and Ice Harbor Forebay
20-Jul-2015 to 27-Jul-2015
IHR Forebay (WA)
LMN Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

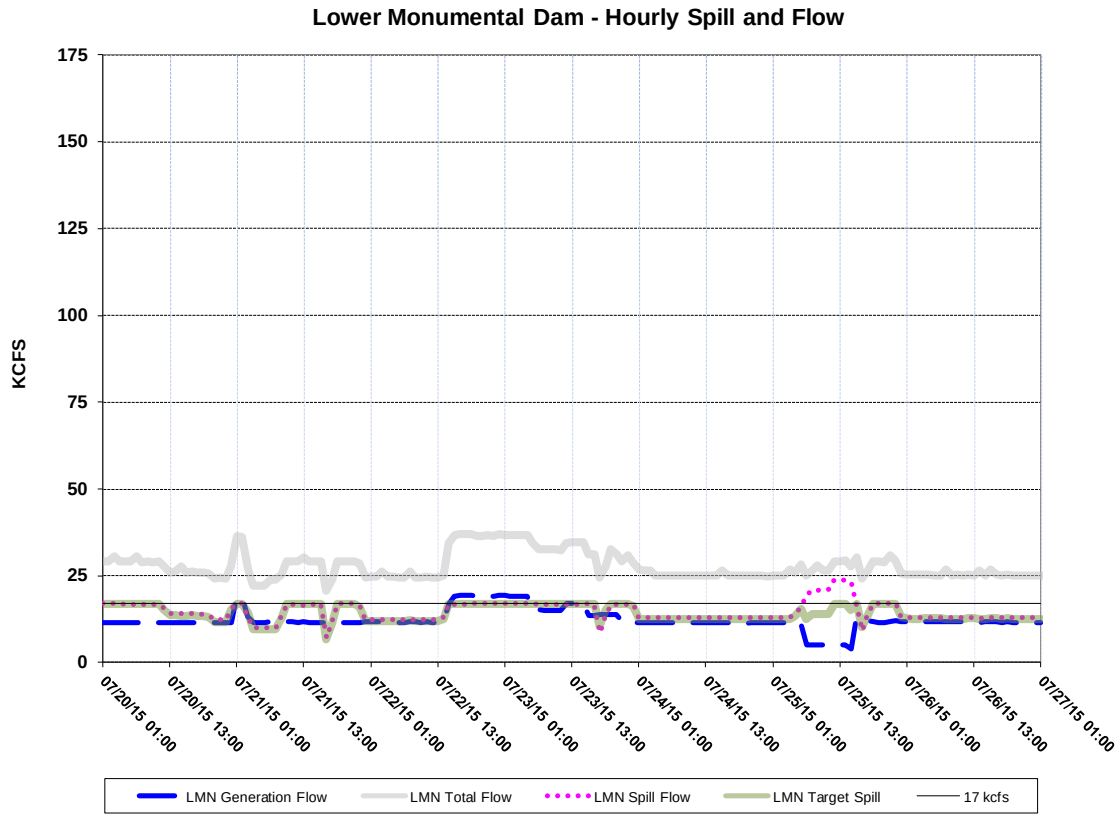
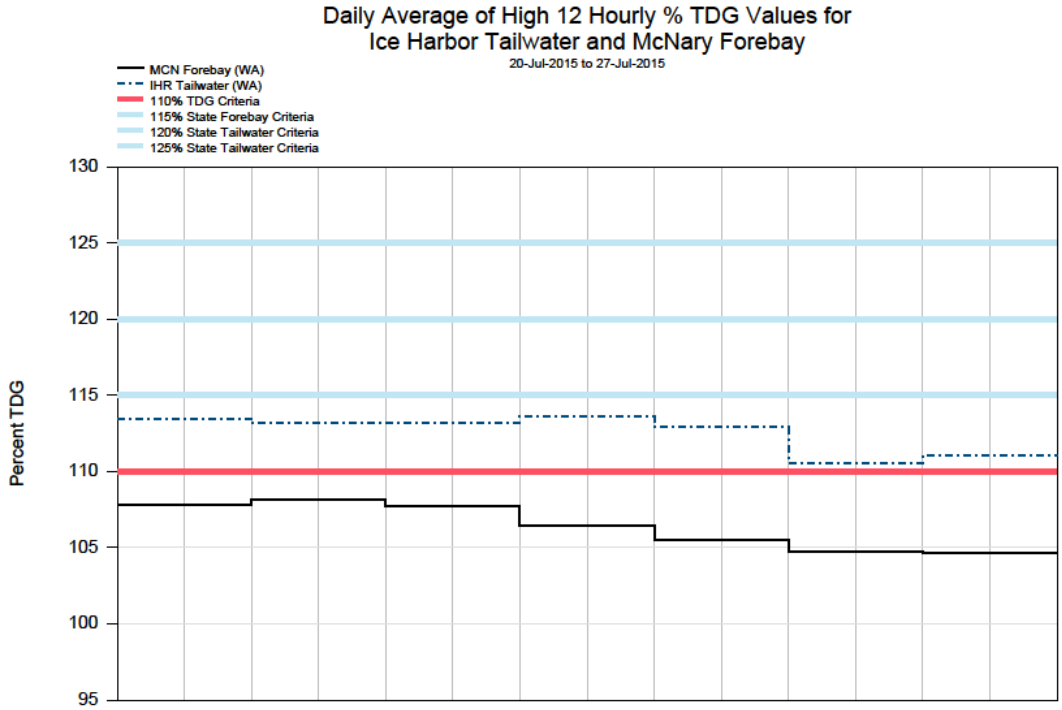

Lower Monumental Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/20/15 01:00
07/20/15 13:00
07/21/15 01:00
07/21/15 13:00
07/22/15 01:00
07/22/15 13:00
07/23/15 01:00
07/23/15 13:00
07/24/15 01:00
07/24/15 13:00
07/25/15 01:00
07/25/15 13:00
07/26/15 01:00
07/26/15 13:00
07/27/15 01:00
LMN Generation Flow
LMN Total Flow
LMN Spill Flow
LMN Target Spill
17 kcfs

Figure 28


Daily Average of High 12 Hourly % TDG Values for
Ice Harbor Tailwater and McNary Forebay
20-Jul-2015 to 27-Jul-2015
MCN Forebay (WA)
IHR Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

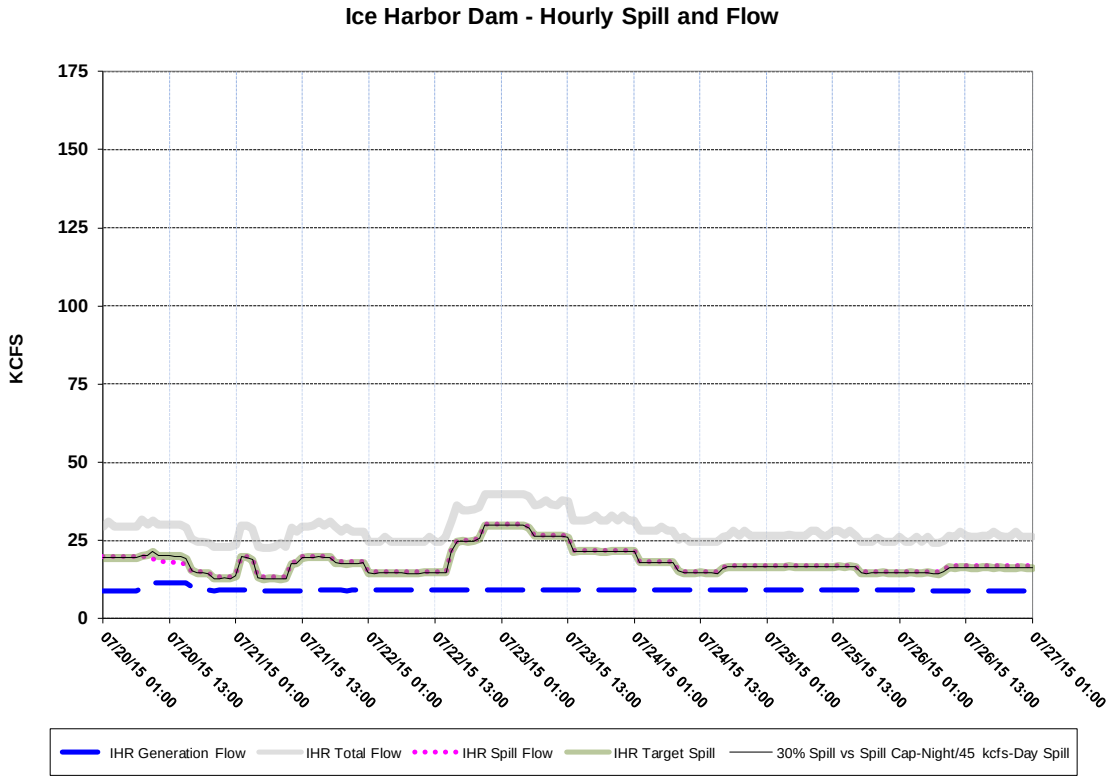
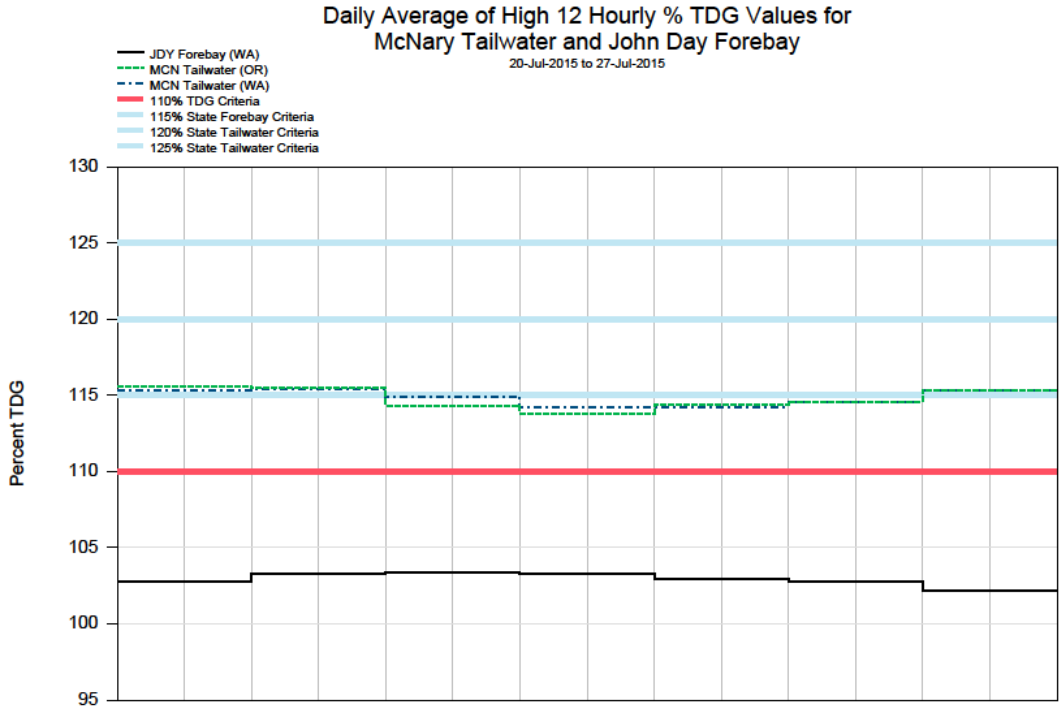

Ice Harbor Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/20/15 01:00
07/20/15 13:00
07/21/15 01:00
07/21/15 13:00
07/22/15 01:00
07/22/15 13:00
07/23/15 01:00
07/23/15 13:00
07/24/15 01:00
07/24/15 13:00
07/25/15 01:00
07/25/15 13:00
07/26/15 01:00
07/26/15 13:00
07/27/15 01:00
IHR Generation Flow
IHR Total Flow
IHR Spill Flow
IHR Target Spill
30% Spill vs Spill Cap-Night/45 kcfs-Day Spill

Figure 29


Daily Average of High 12 Hourly % TDG Values for
McNary Tailwater and John Day Forebay
20-Jul-2015 to 27-Jul-2015
JDY Forebay (WA)
MCN Tailwater (OR)
MCN Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

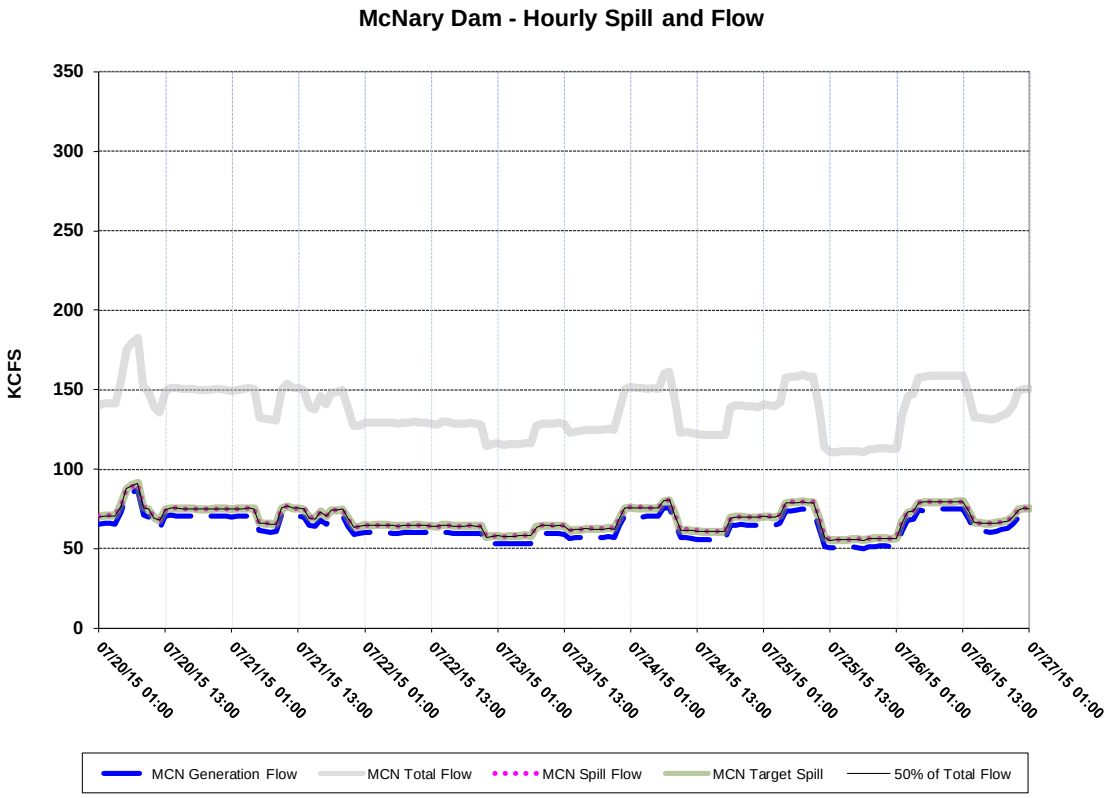
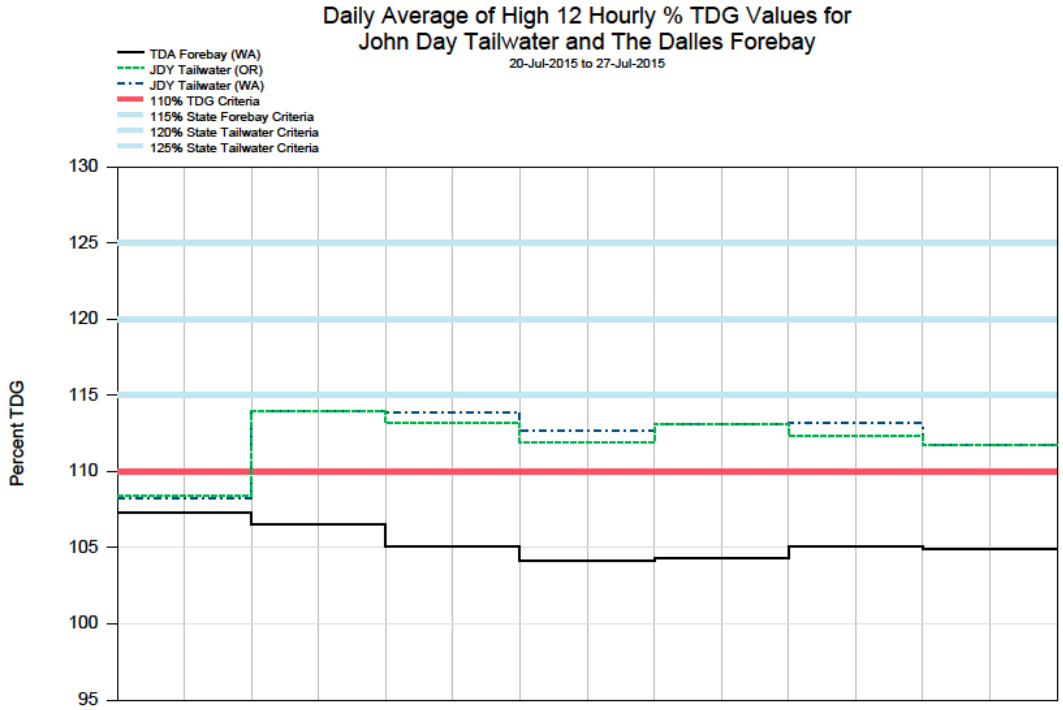

McNary Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/20/15 01:00
07/20/15 13:00
07/21/15 01:00
07/21/15 13:00
07/22/15 01:00
07/22/15 13:00
07/23/15 01:00
07/23/15 13:00
07/24/15 01:00
07/24/15 13:00
07/25/15 01:00
07/25/15 13:00
07/26/15 01:00
07/26/15 13:00
07/27/15 01:00
MCN Generation Flow
MCN Total Flow
MCN Spill Flow
MCN Target Spill
50% of Total Flow

Figure 30


Daily Average of High 12 Hourly % TDG Values for
John Day Tailwater and The Dalles Forebay
20-Jul-2015 to 27-Jul-2015
TDA Forebay (WA)
JDY Tailwater (OR)
JDY Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

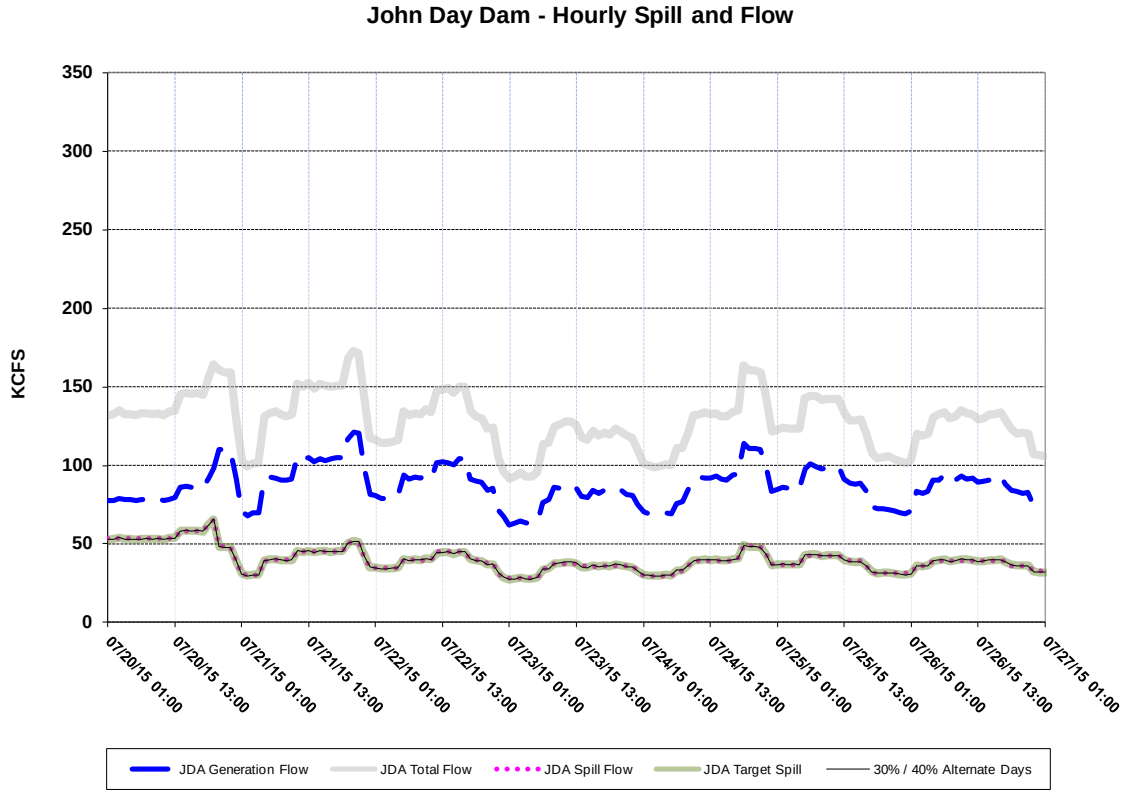
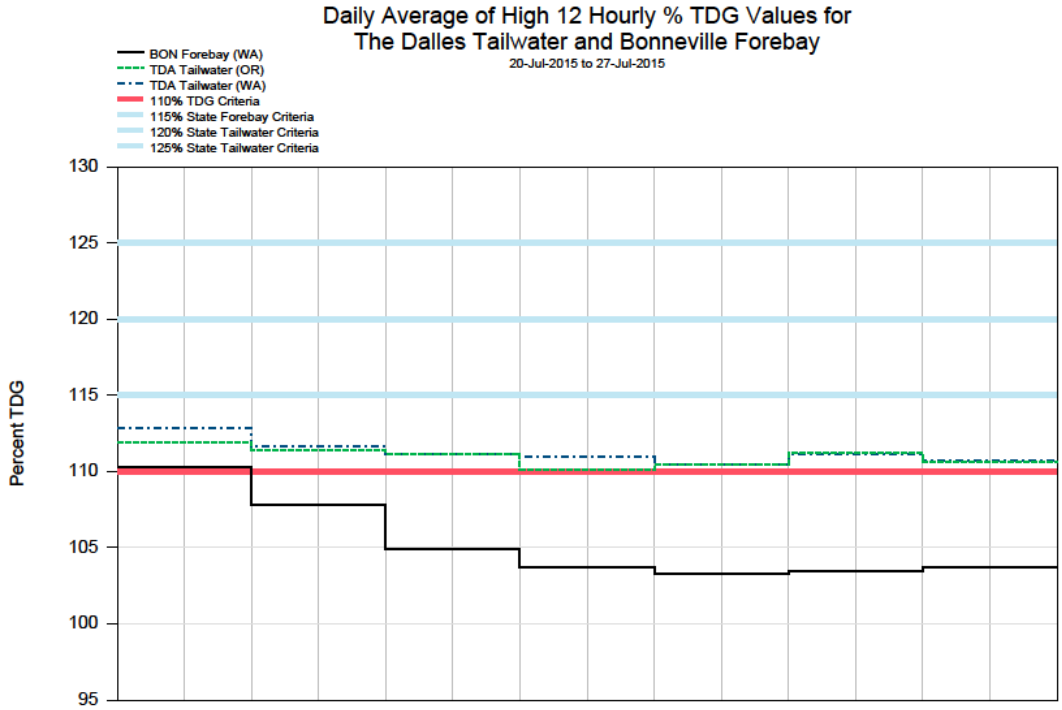

John Day Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/20/15 01:00
07/20/15 13:00
07/21/15 01:00
07/21/15 13:00
07/22/15 01:00
07/22/15 13:00
07/23/15 01:00
07/23/15 13:00
07/24/15 01:00
07/24/15 13:00
07/25/15 01:00
07/25/15 13:00
07/26/15 01:00
07/26/15 13:00
07/27/15 01:00
JDA Generation Flow
JDA Total Flow
JDA Spill Flow
JDA Target Spill
30% / 40% Alternate Days

Figure 31


Daily Average of High 12 Hourly % TDG Values for
The Dalles Tailwater and Bonneville Forebay
20-Jul-2015 to 27-Jul-2015
BON Forebay (WA)
TDA Tailwater (OR)
TDA Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

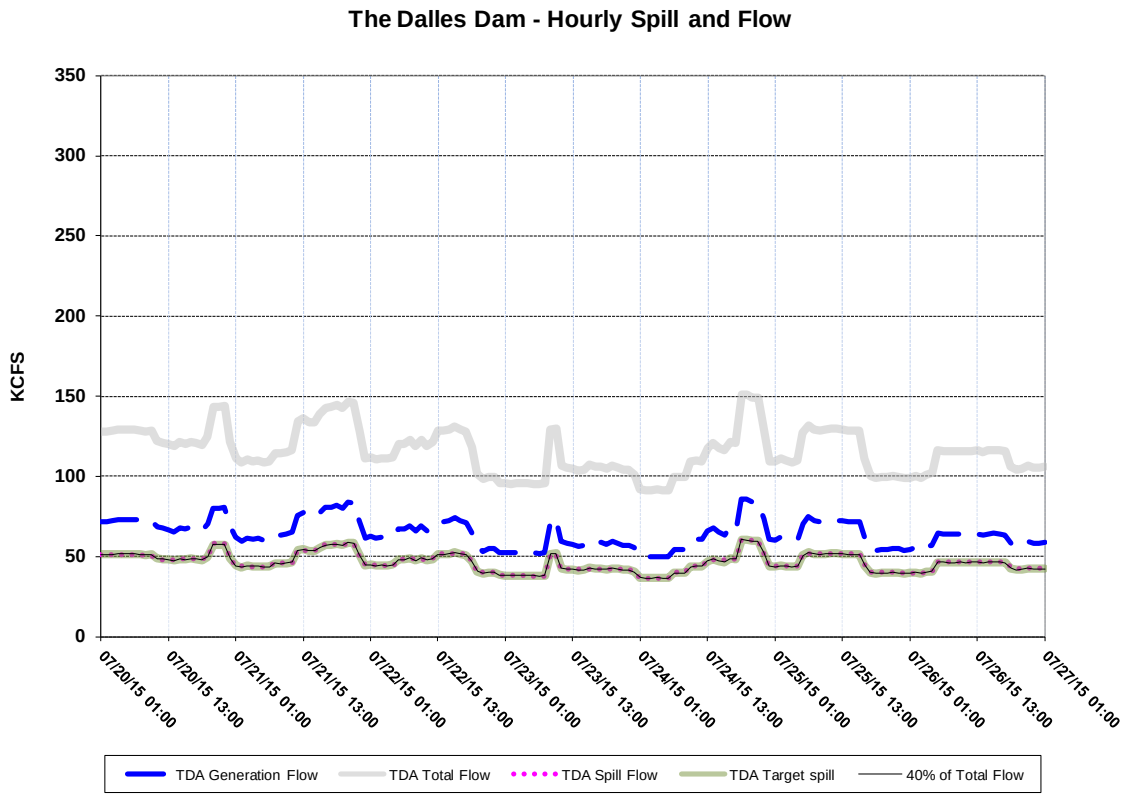
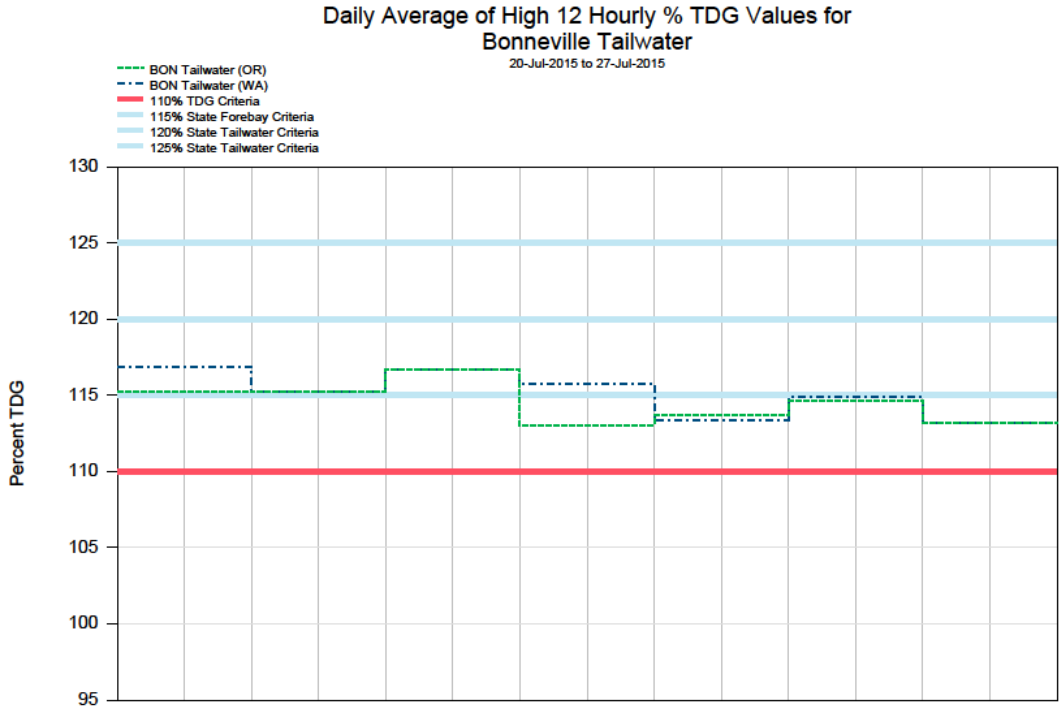

The Dalles Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/20/15 01:00
07/20/15 13:00
07/21/15 01:00
07/21/15 13:00
07/22/15 01:00
07/22/15 13:00
07/23/15 01:00
07/23/15 13:00
07/24/15 01:00
07/24/15 13:00
07/25/15 01:00
07/25/15 13:00
07/26/15 01:00
07/26/15 13:00
07/27/15 01:00
TDA Generation Flow
TDA Total Flow
TDA Spill Flow
TDA Target spill
40% of Total Flow

Figure 32


Daily Average of High 12 Hourly % TDG Values for
Bonneville Tailwater
20-Jul-2015 to 27-Jul-2015
BON Tailwater (OR)
BON Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

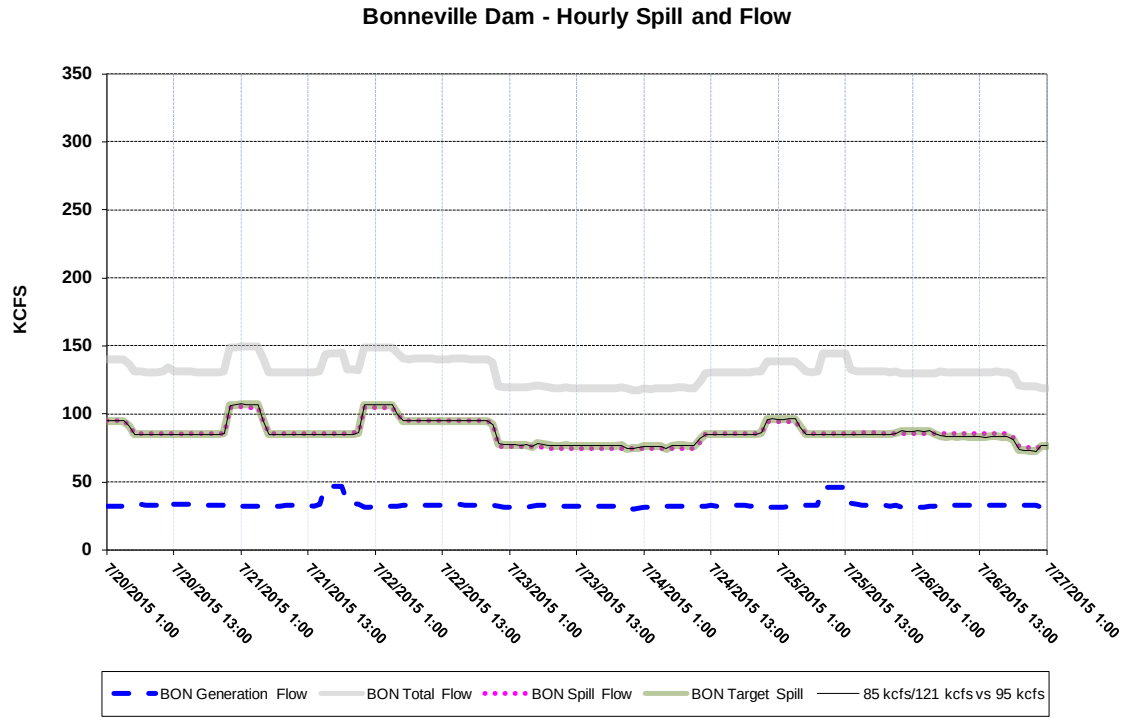
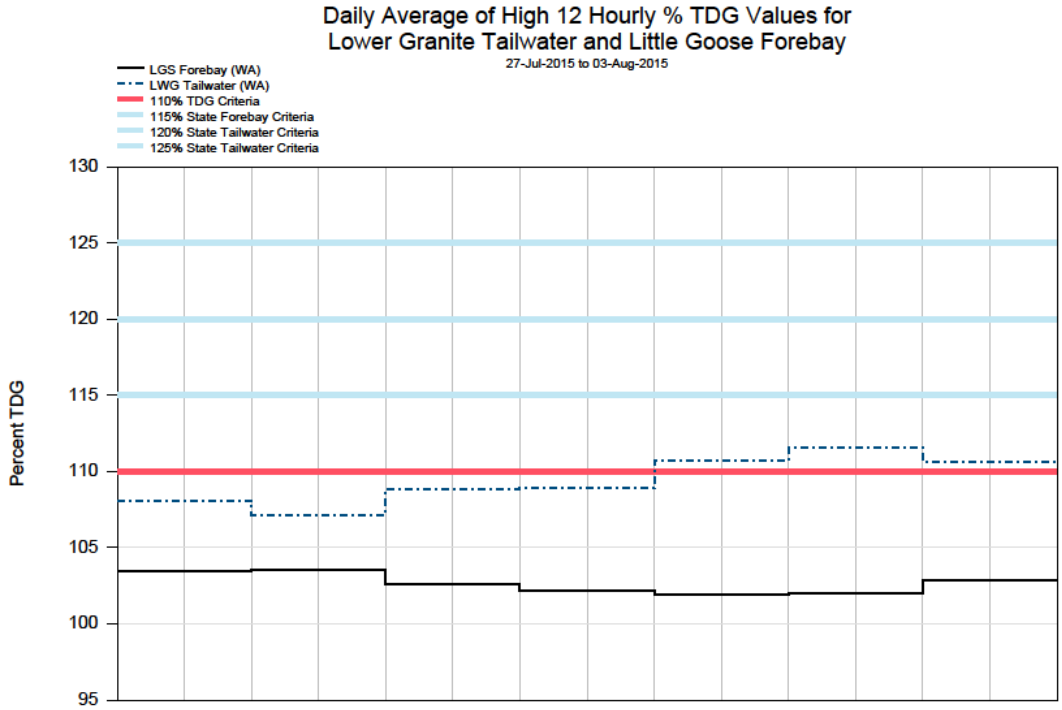

Bonneville Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
7/20/2015 1:00
7/20/2015 13:00
7/21/2015 1:00
7/21/2015 13:00
7/22/2015 1:00
7/22/2015 13:00
7/23/2015 1:00
7/23/2015 13:00
7/24/2015 1:00
7/24/2015 13:00
7/25/2015 1:00
7/25/2015 13:00
7/26/2015 1:00
7/26/2015 13:00
7/27/2015 1:00
BON Generation Flow
BON Total Flow
BON Spill Flow
BON Target Spill
85 kcfs/121 kcfs vs 95 kcfs

Figure 33


Daily Average of High 12 Hourly % TDG Values for
Lower Granite Tailwater and Little Goose Forebay
27-Jul-2015 to 03-Aug-2015
LGS Forebay (WA)
LWG Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

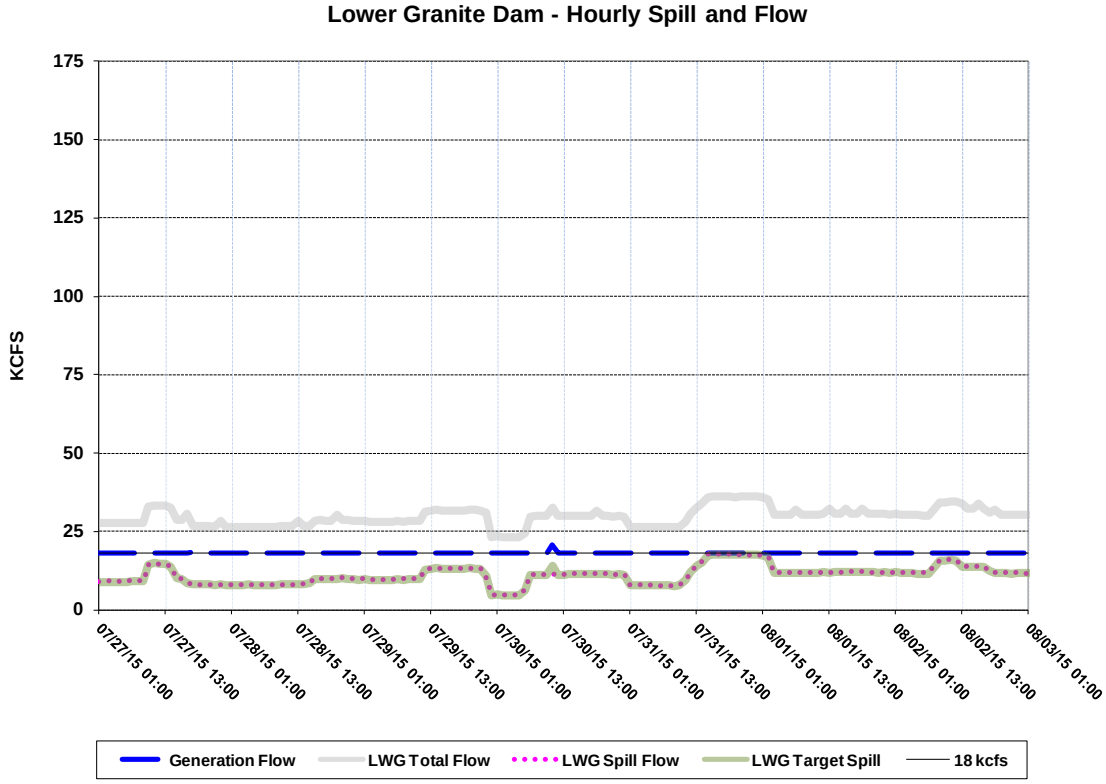
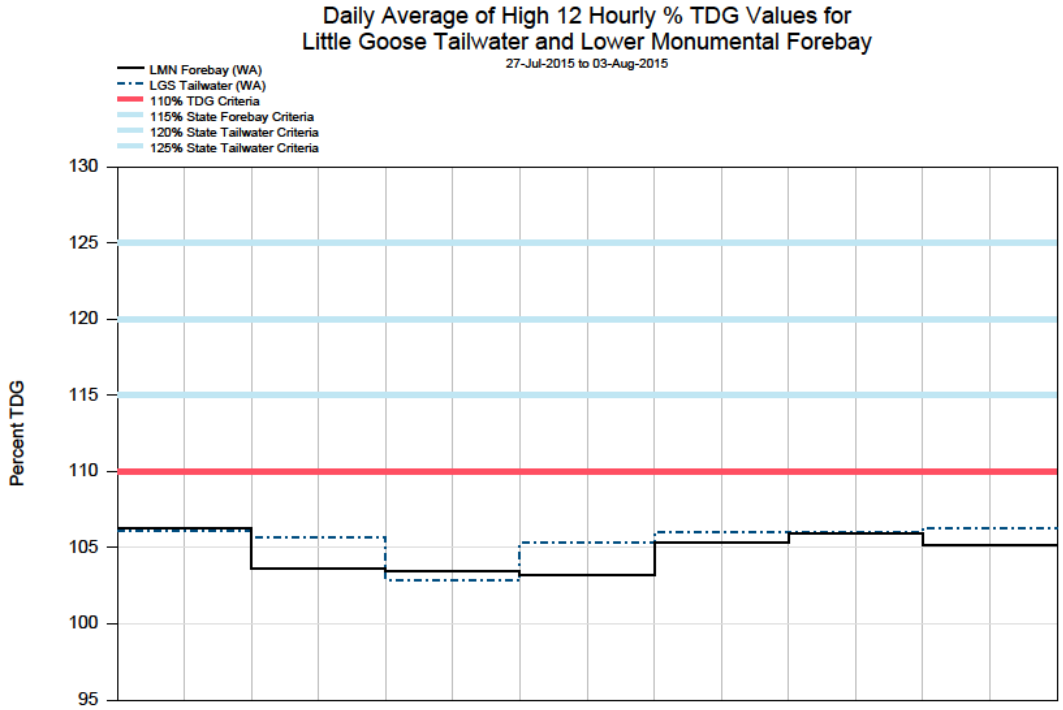

Lower Granite Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/27/15 01:00
07/27/15 13:00
07/28/15 01:00
07/28/15 13:00
07/29/15 01:00
07/29/15 13:00
07/30/15 01:00
07/30/15 13:00
07/31/15 01:00
07/31/15 13:00
08/01/15 01:00
08/01/15 13:00
08/02/15 01:00
08/02/15 13:00
08/03/15 01:00
Generation Flow
LWG Total Flow
LWG Spill Flow
LWG Target Spill
18 kcfs

Figure 34


Daily Average of High 12 Hourly % TDG Values for
Little Goose Tailwater and Lower Monumental Forebay
27-Jul-2015 to 03-Aug-2015
LMN Forebay (WA)
LGS Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

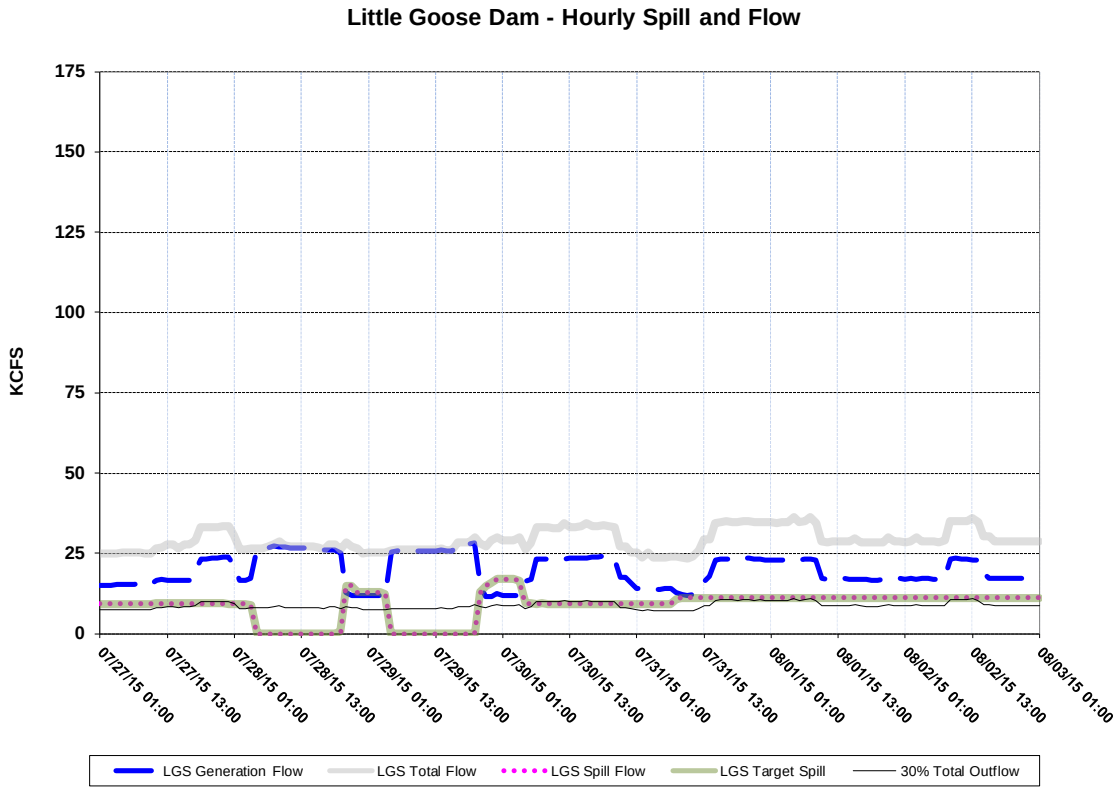
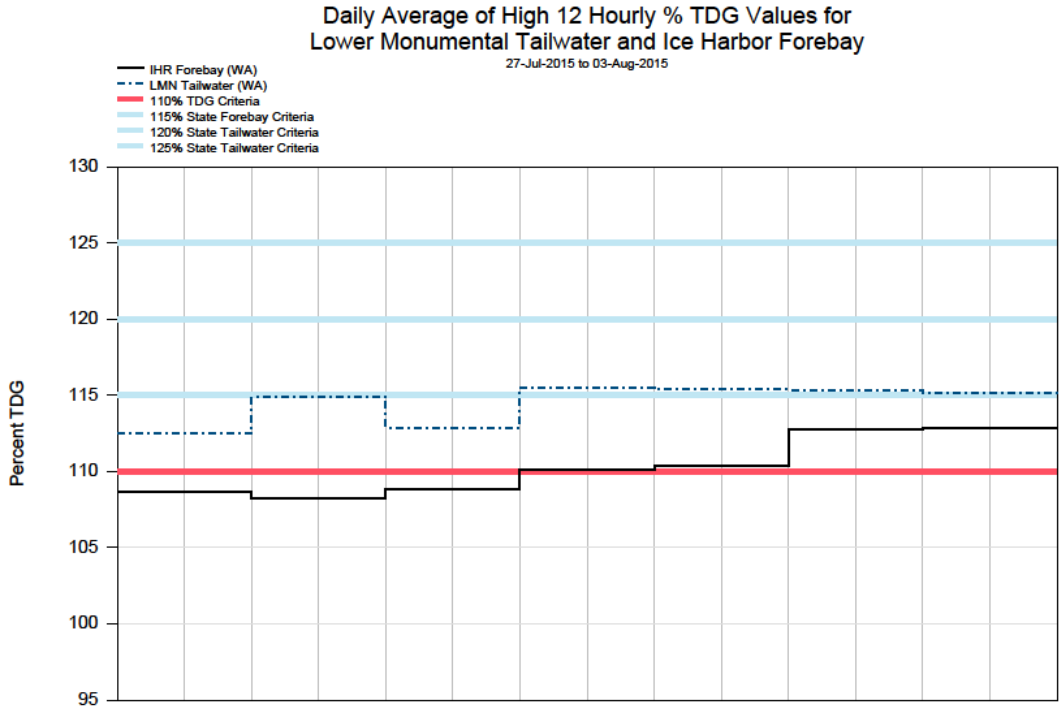

Little Goose Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/27/15 01:00
07/27/15 13:00
07/28/15 01:00
07/28/15 13:00
07/29/15 01:00
07/29/15 13:00
07/30/15 01:00
07/30/15 13:00
07/31/15 01:00
07/31/15 13:00
08/01/15 01:00
08/01/15 13:00
08/02/15 01:00
08/02/15 13:00
08/03/15 01:00
LGS Generation Flow
LGS Total Flow
LGS Spill Flow
LGS Target Spill
30% Total Outflow

Figure 35


Daily Average of High 12 Hourly % TDG Values for
Lower Monumental Tailwater and Ice Harbor Forebay
27-Jul-2015 to 03-Aug-2015
IHR Forebay (WA)
LMN Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

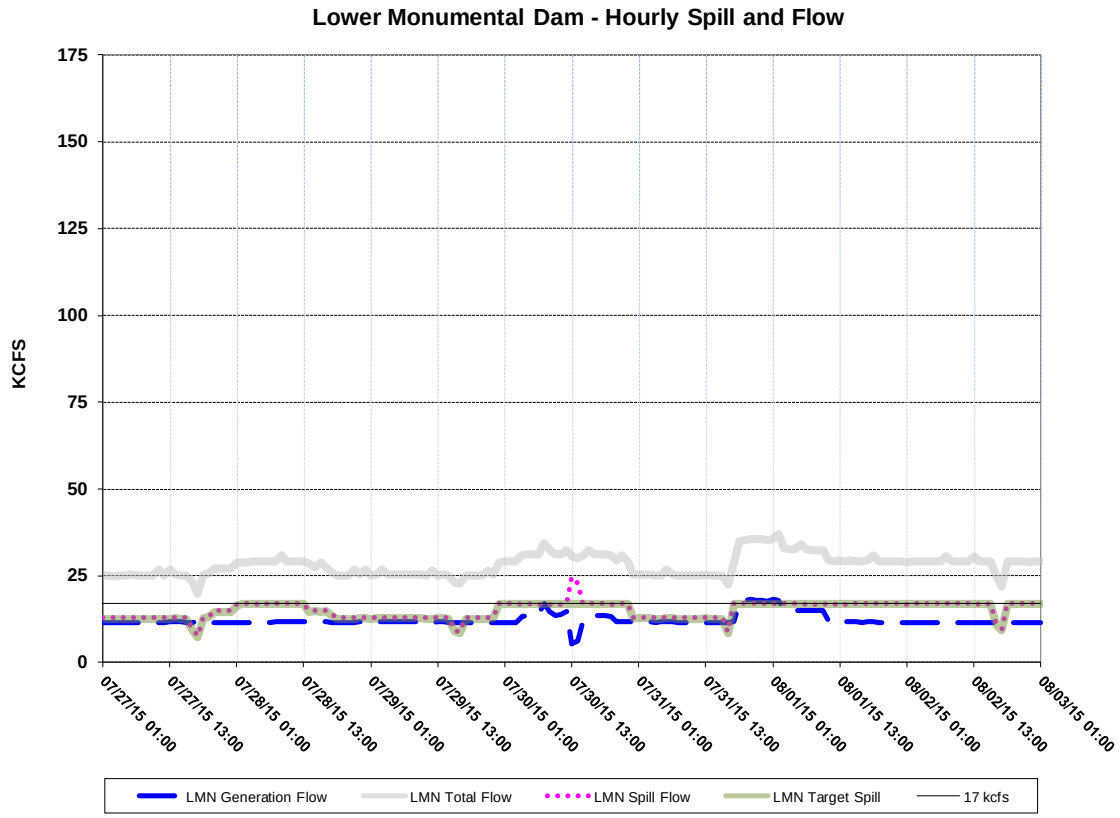
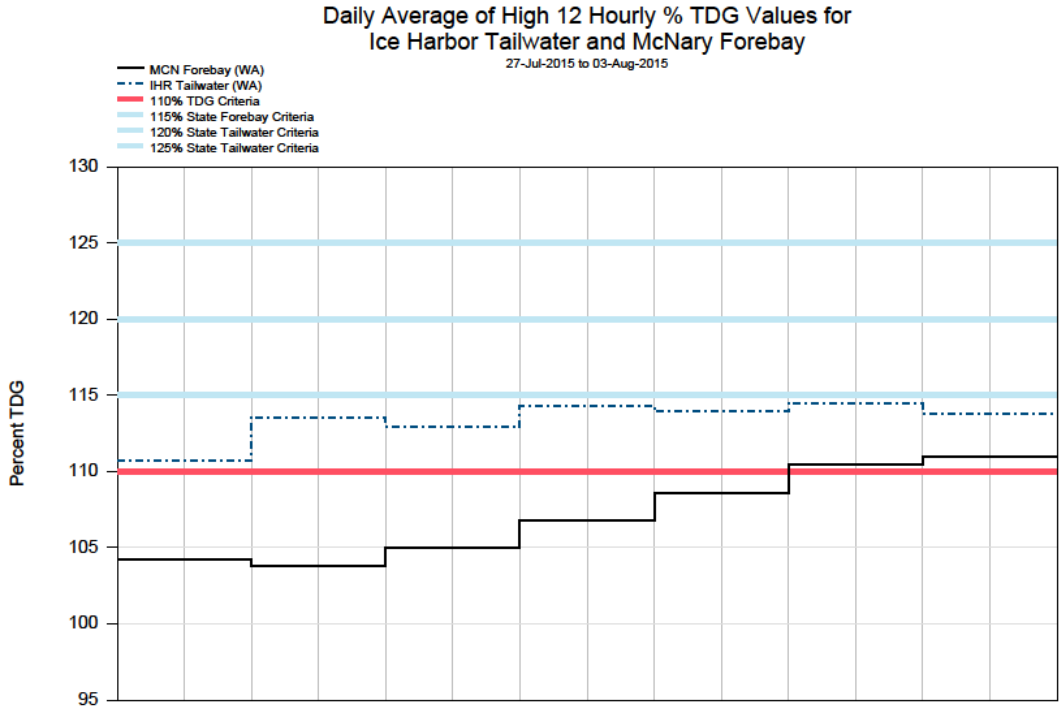

Lower Monumental Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/27/15 01:00
07/27/15 13:00
07/28/15 01:00
07/28/15 13:00
07/29/15 01:00
07/29/15 13:00
07/30/15 01:00
07/30/15 13:00
07/31/15 01:00
07/31/15 13:00
08/01/15 01:00
08/01/15 13:00
08/02/15 01:00
08/02/15 13:00
08/03/15 01:00
LMN Generation Flow
LMN Total Flow
LMN Spill Flow
LMN Target Spill
17 kcfs

Figure 36


Daily Average of High 12 Hourly % TDG Values for
Ice Harbor Tailwater and McNary Forebay
27-Jul-2015 to 03-Aug-2015
MCN Forebay (WA)
IHR Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

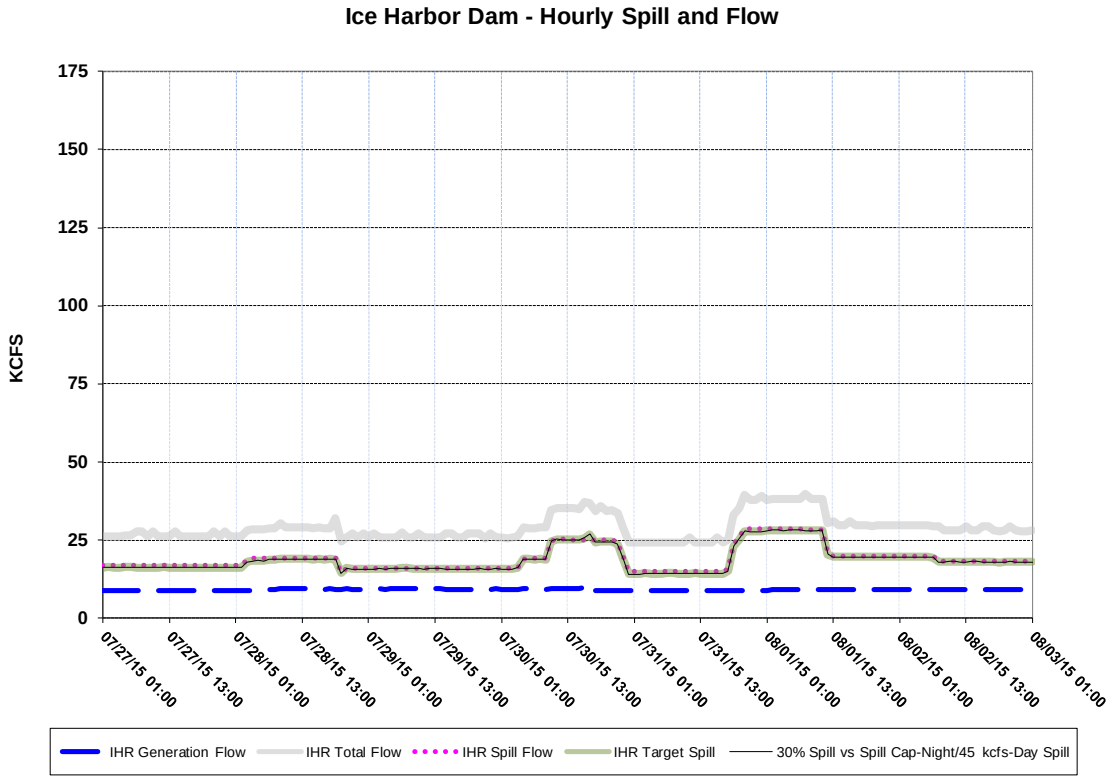
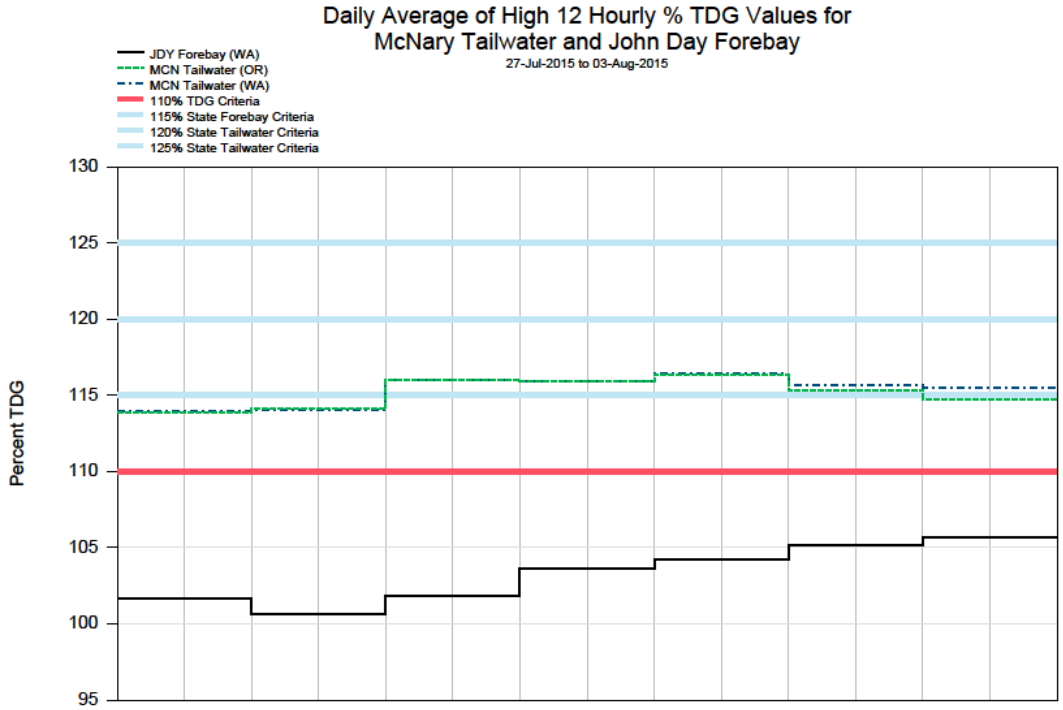

Ice Harbor Dam - Hourly Spill and Flow
KCFS
175
150
125
100
75
50
25
0
07/27/15 01:00
07/27/15 13:00
07/28/15 01:00
07/28/15 13:00
07/29/15 01:00
07/29/15 13:00
07/30/15 01:00
07/30/15 13:00
07/31/15 01:00
07/31/15 13:00
08/01/15 01:00
08/01/15 13:00
08/02/15 01:00
08/02/15 13:00
08/03/15 01:00
IHR Generation Flow
IHR Total Flow
IHR Spill Flow
IHR Target Spill
30% Spill vs Spill Cap-Night/45 kcfs-Day Spill

Figure 37


Daily Average of High 12 Hourly % TDG Values for
McNary Tailwater and John Day Forebay
27-Jul-2015 to 03-Aug-2015
JDY Forebay (WA)
MCN Tailwater (OR)
MCN Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

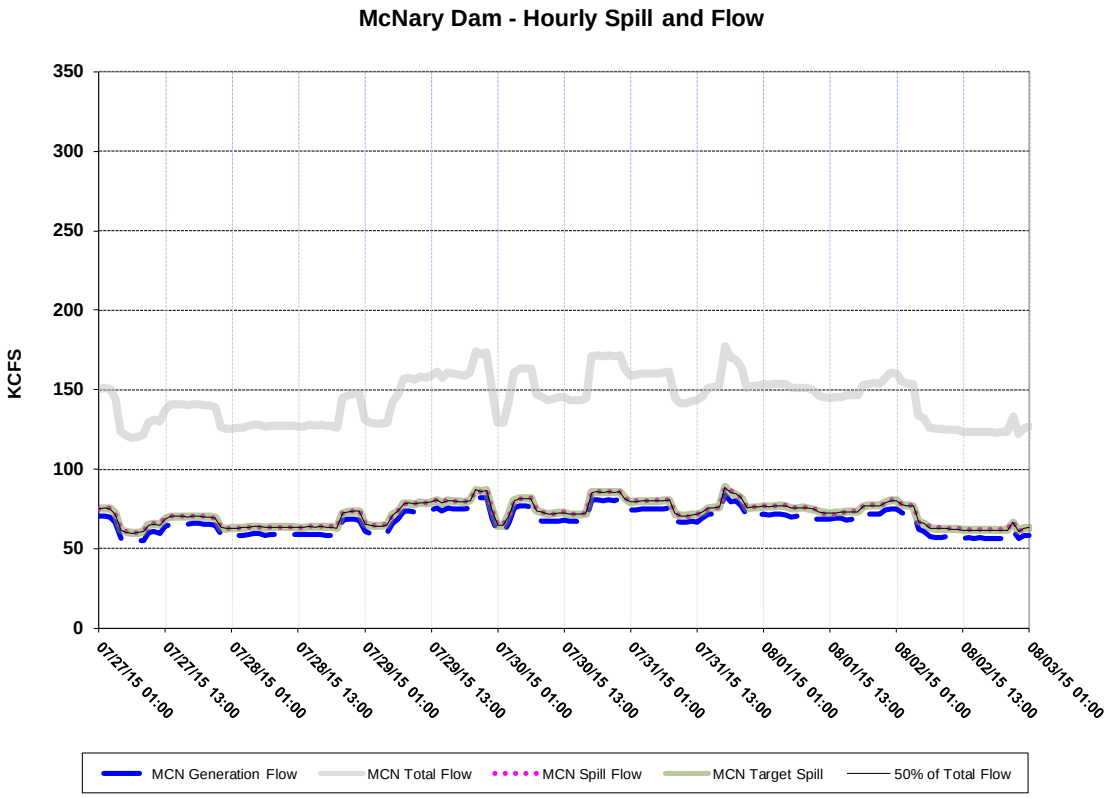
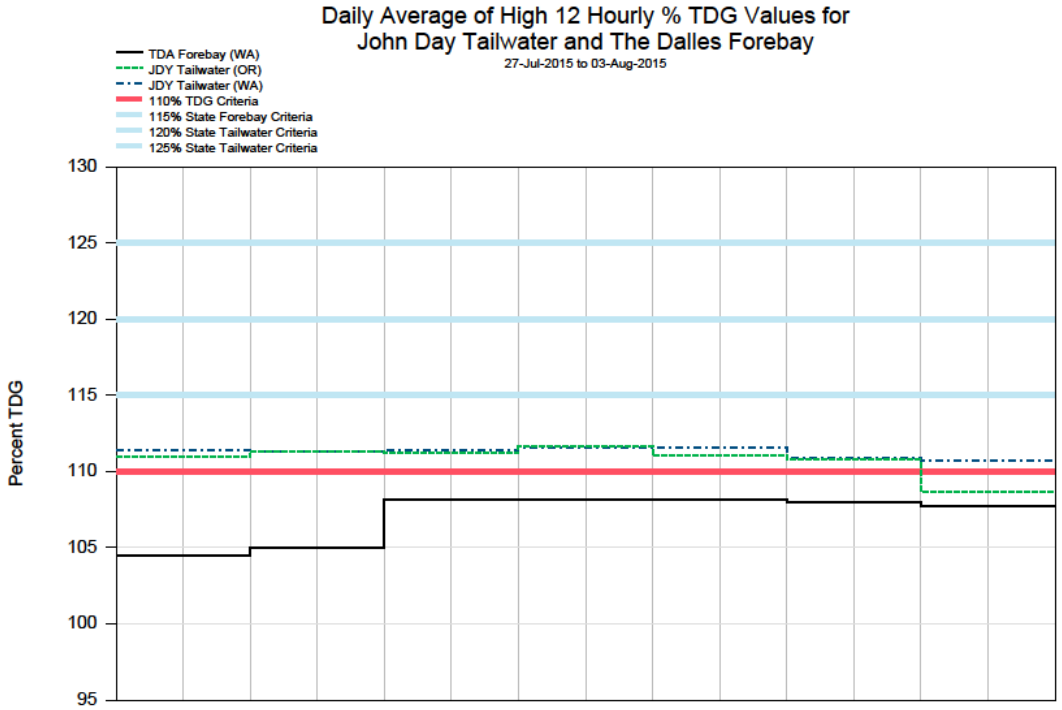

McNary Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/27/15 01:00
07/27/15 13:00
07/28/15 01:00
07/28/15 13:00
07/29/15 01:00
07/29/15 13:00
07/30/15 01:00
07/30/15 13:00
07/31/15 01:00
07/31/15 13:00
08/01/15 01:00
08/01/15 13:00
08/02/15 01:00
08/02/15 13:00
08/03/15 01:00
MCN Generation Flow
MCN Total Flow
MCN Spill Flow
MCN Target Spill
50% of Total Flow

Figure 38


Daily Average of High 12 Hourly % TDG Values for
John Day Tailwater and The Dalles Forebay
27-Jul-2015 to 03-Aug-2015
TDA Forebay (WA)
JDY Tailwater (OR)
JDY Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

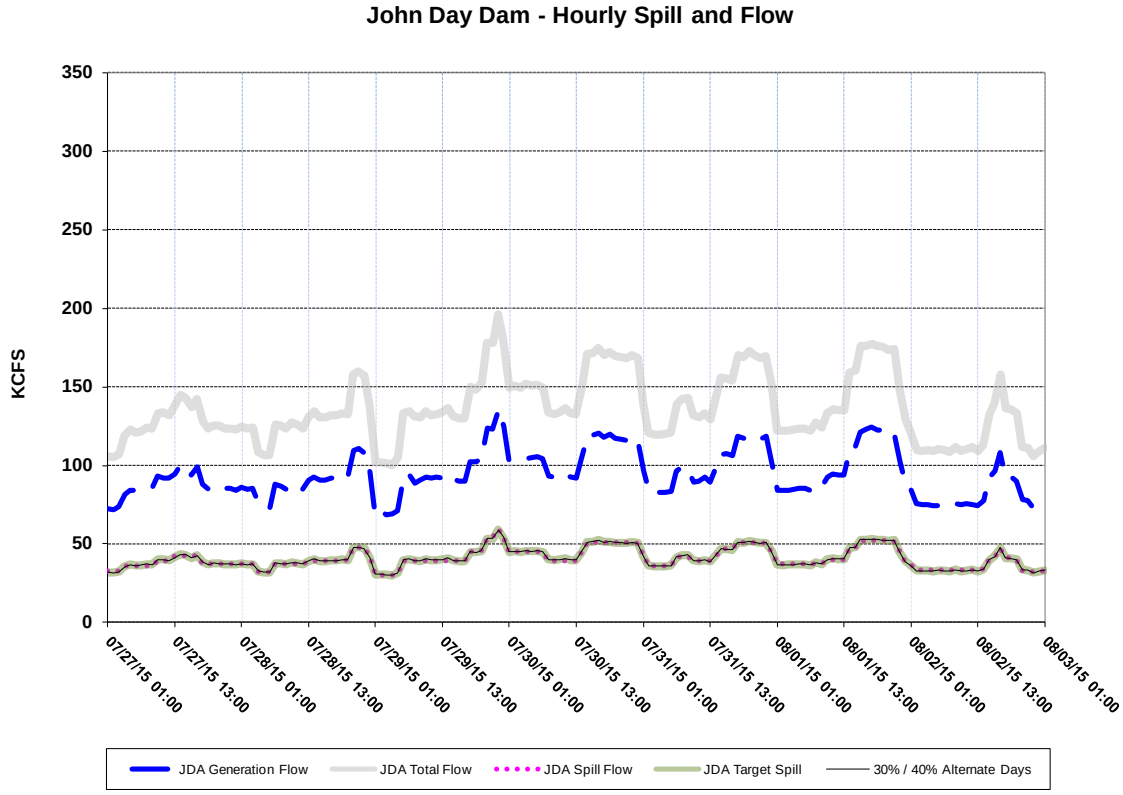
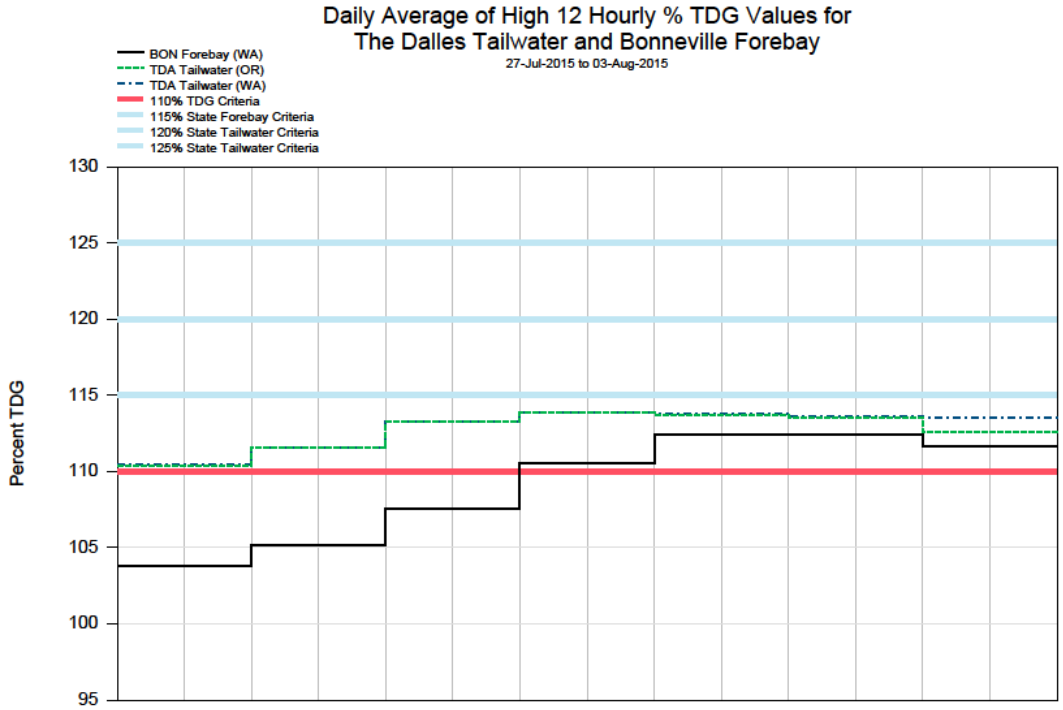

John Day Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/27/15 01:00
07/27/15 13:00
07/28/15 01:00
07/28/15 13:00
07/29/15 01:00
07/29/15 13:00
07/30/15 01:00
07/30/15 13:00
07/31/15 01:00
07/31/15 13:00
08/01/15 01:00
08/01/15 13:00
08/02/15 01:00
08/02/15 13:00
08/03/15 01:00
JDA Generation Flow
JDA Total Flow
JDA Spill Flow
JDA Target Spill
30% / 40% Alternate Days

Figure 39


Daily Average of High 12 Hourly % TDG Values for
The Dalles Tailwater and Bonneville Forebay
27-Jul-2015 to 03-Aug-2015
BON Forebay (WA)
TDA Tailwater (OR)
TDA Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

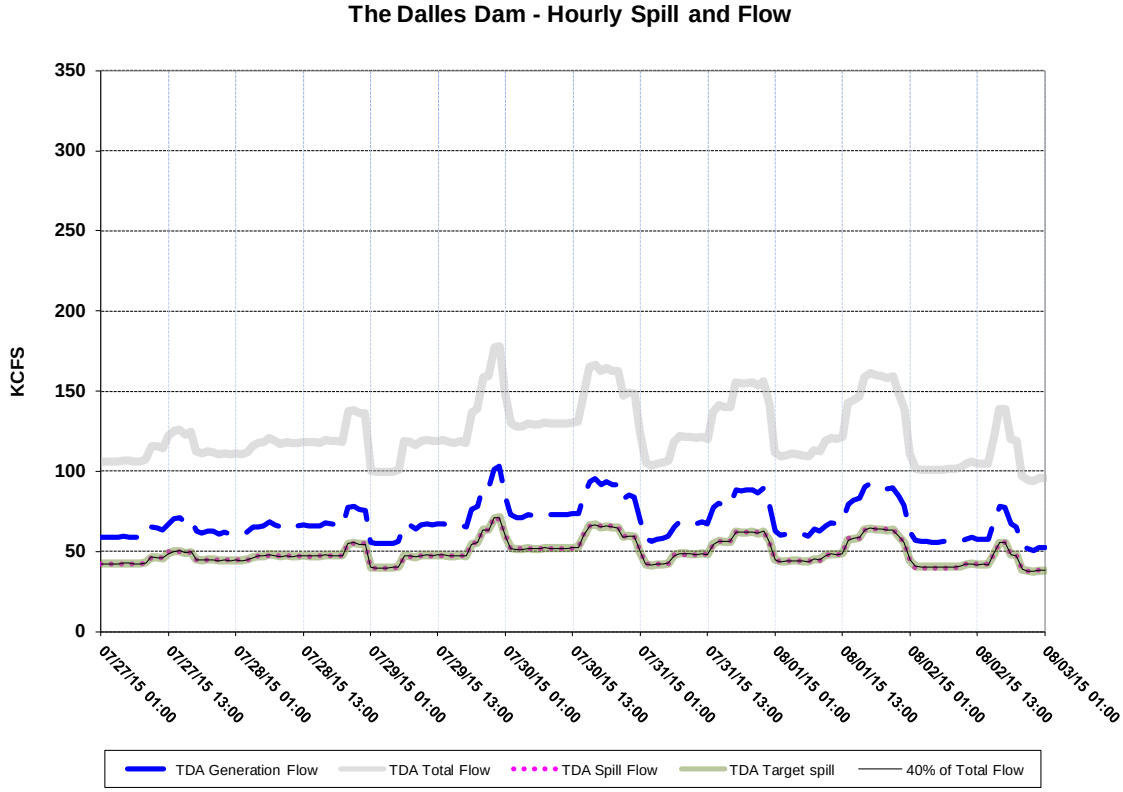
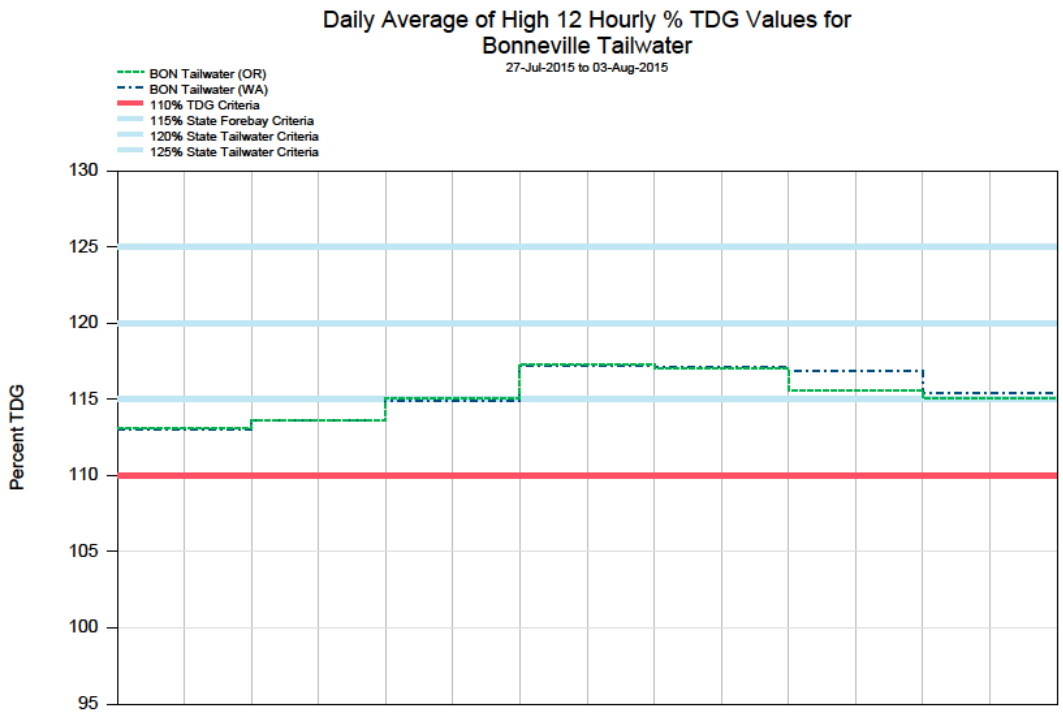

The Dalles Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
07/27/15 01:00
07/27/15 13:00
07/28/15 01:00
07/28/15 13:00
07/29/15 01:00
07/29/15 13:00
07/30/15 01:00
07/30/15 13:00
07/31/15 01:00
07/31/15 13:00
08/01/15 01:00
08/01/15 13:00
08/02/15 01:00
08/02/15 13:00
08/03/15 01:00
TDA Generation Flow
TDA Total Flow
TDA Spill Flow
TDA Target spill
40% of Total Flow

Figure 40


Daily Average of High 12 Hourly % TDG Values for
Bonneville Tailwater
27-Jul-2015 to 03-Aug-2015
BON Tailwater (OR)
BON Tailwater (WA)
110% TDG Criteria
115% State Forebay Criteria
120% State Tailwater Criteria
125% State Tailwater Criteria
Percent TDG
130
125
120
115
110
105
100
95

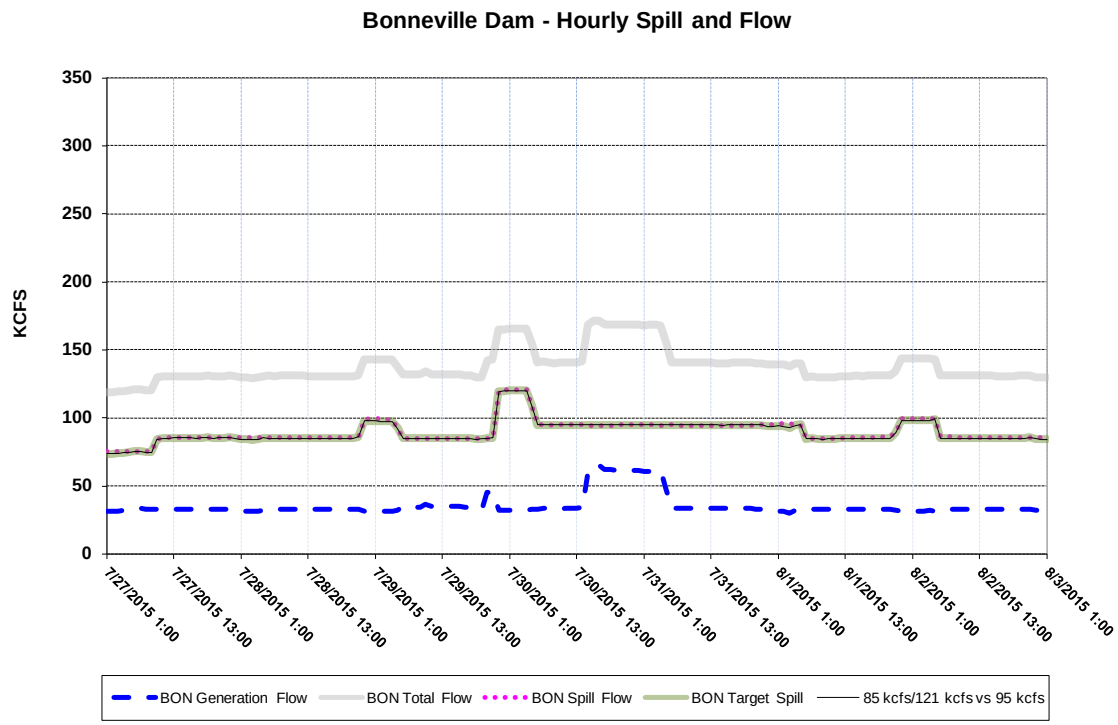

Bonneville Dam - Hourly Spill and Flow
KCFS
350
300
250
200
150
100
50
0
7/27/2015 1:00
7/27/2015 13:00
7/28/2015 1:00
7/28/2015 13:00
7/29/2015 1:00
7/29/2015 13:00
7/30/2015 1:00
7/30/2015 13:00
7/31/2015 1:00
7/31/2015 13:00
8/1/2015 1:00
8/1/2015 13:00
8/2/2015 1:00
8/2/2015 13:00
8/3/2015 1:00
BON Generation Flow
BON Total Flow
BON Spill Flow
BON Target Spill
85 kcfs/121 kcfs vs 95 kcfs

Table 2. Average Percent TDG Values For July 29 – August 2

Date	FIXED MONITORING STATIONS																			
	LWG	LGNW	LGSA	LGSW	LMNA	LMNW	IHRA	IDSW	MCNA	MCPW		JDY	JHAW		TDA	TDDO		BON	CCIW	
Method:	WA	WA	WA	WA	WA	WA	WA	WA	WA	OR	WA	WA	OR	WA	WA	OR	WA	WA	OR	WA
Gas Cap %	115	120	115	120	115	120	115	120	115	120	120	115	120	120	115	120	120	115	120	120
6/29/2015	106.8	113.9	109.4	106	109.4	115.8	114.7	113.6	110.9	116.9	~~116.9~~	109.3	114.5	~~114.5~~	109	~~114~~	115.1	111	~~116.8~~	116.9
6/30/2015	106.8	115.2	111.3	109.3	108.7	115.3	114.4	113.6	110.4	~~116.8~~	116.9	109	114.8	~~114.8~~	108.5	~~113~~	114	108.1	~~116~~	116.6
7/1/2015	103.4	115.5	112.5	111.3	108.7	115.6	114.2	114.4	110.2	116.7	~~116.7~~	108.8	114.7	~~114.7~~	109.9	114.6	~~114.6~~	108.8	115.7	~~115.6~~
7/2/2015	103.7	115.3	112.5	111.1	108.3	116	113.8	114.3	110.4	~~117.1~~	117.1	110.2	114.6	~~114.6~~	112.9	116	~~116~~	110.8	~~117.9~~	118
7/3/2015	104.9	113.8	112.3	111.2	109.1	115.5	113.4	113.7	111.1	~~116~~	117.1	110.9	~~115.2~~	115.2	112.6	~~115.2~~	116	110.8	117.5	~~117.5~~
7/4/2015	105.1	113.7	112.1	110.6	109.1	112.7	113.8	113.1	110.9	~~114.6~~	115.4	110.9	~~114.9~~	115	110.2	~~114.3~~	114.6	109.9	~~115.9~~	117.5
7/5/2015	105.2	111.1	112	110.7	109	113.1	113.8	112.5	110.8	115.1	~~115.1~~	109.6	114.6	~~114.6~~	109.7	~~114.3~~	114.3	108.9	115.8	~~115.7~~
7/6/2015	104.3	113.9	113.1	111.1	109.1	113.1	113.4	111.9	110.6	116.1	~~116.1~~	109	114.4	~~114.3~~	111.3	114.9	~~114.9~~	109.2	117.2	~~117.2~~
7/7/2015	104.3	114.1	111.8	110.9	109.1	113.1	114.1	113.2	110.7	116.1	~~116.1~~	109.1	114.3	~~114.3~~	111	~~114.6~~	114.7	109.1	117.2	~~117.1~~
7/8/2015	104.3	114.6	112.4	111.2	108.3	112.7	114.1	112.6	109.3	~~115.1~~	115.2	108.5	114.3	~~114.2~~	109	~~113.9~~	114.4	108.2	~~115.3~~	117.1
7/9/2015	104.1	110.8	112.4	111.2	108.5	112.8	111.9	111.7	110.2	116.7	~~116.7~~	108.8	114.6	~~114.6~~	111.5	115.3	~~115.3~~	108.3	115	~~115~~
7/10/2015	102.8	110.6	111.9	110.8	108.6	115.3	111.8	113.2	110.2	~~114.8~~	116.6	108.9	~~113~~	114.2	111.3	~~113~~	115.3	107	~~116~~	116.9
7/11/2015	101.6	110.5	110.5	110.2	107.7	115	110.7	113	109.1	~~113.1~~	113.4	107.6	112.3	~~112.3~~	106.6	~~109.8~~	110.9	105	113.4	~~113.4~~
7/12/2015	101.5	110.1	110.1	110.1	107.7	113.7	109.8	110.9	107.6	~~113~~	113	105.4	112.5	~~112.5~~	105.5	~~110.6~~	110.6	103.2	113.2	~~113.2~~
7/13/2015	101.5	109.9	109.3	110.1	106.7	115.3	108	113.3	105	113.6	~~113.5~~	104.1	~~111.7~~	112.2	108.3	112.2	~~112.2~~	104.1	114.2	~~114.1~~
7/14/2015	101.5	107.9	108.2	110.1	106.7	115.8	107	113.6	104.1	116.8	~~116.8~~	103.4	~~112.4~~	112.4	108.3	113	~~113~~	105.7	116.9	~~116.9~~
7/15/2015	102.2	104.8	107.2	109.4	106.2	114.6	107.1	113	104.2	~~114.6~~	116.3	103.1	~~111.3~~	111.9	106.3	~~111.9~~	112.7	105.8	~~116.8~~	116.9
7/16/2015	102.8	105.5	107	108.4	106.3	113.3	107.9	111	105.9	~~115~~	115	102.5	~~109.8~~	110.2	105	~~110.1~~	111.3	105.2	~~115.3~~	116.7
7/17/2015	102.8	107	106.5	108.6	107.2	114.4	109.2	113.4	106.3	~~114.6~~	114.7	101.5	~~108.5~~	109.5	105.9	111.8	~~111.8~~	104.9	~~115~~	115.3
7/18/2015	102.3	106.6	106	109	106.8	116.1	110	113.8	106.3	116.4	~~115.9~~	101.7	~~110.1~~	110.1	107.5	113.1	~~113.1~~	107.2	117.1	~~117.1~~
7/19/2015	102.3	109.3	105.8	108.5	106.4	115.6	110.2	113.9	106.6	116	~~115.9~~	102.7	~~108.3~~	109.3	107.6	~~113~~	113.1	110.3	~~117.1~~	117.1
7/20/2015	101.8	108.2	103.3	108	105.5	114.8	109.8	113.3	107.9	115.6	~~115.3~~	102.8	108.4	~~108.3~~	107.2	~~111.9~~	112.7	110.2	~~115.4~~	117
7/21/2015	101.9	109.9	105.1	108.3	106.3	114.8	110.6	113.2	108.1	~~115.4~~	115.4	103.3	114	~~114~~	106.4	~~111.3~~	111.6	107.8	115.4	~~115.4~~
7/22/2015	102.9	111.6	105.5	107.9	106.2	115	110.9	113	107.7	~~114.3~~	114.7	103.4	~~113.1~~	113.7	105	111.2	~~111.2~~	104.9	~~116.8~~	116.8
7/23/2015	103.3	111.7	106	107.8	105.1	115.3	111.2	113.6	106.4	~~113.8~~	114.2	103.3	~~111.9~~	112.5	104	~~110.1~~	110.8	103.7	~~113.2~~	115.6
7/24/2015	103.2	110.4	105.2	105.5	105.6	114.6	110.3	112.7	105.5	114.3	~~114.2~~	102.9	113.2	~~113.2~~	104.3	110.6	~~110.6~~	103.3	114.1	~~113.7~~
7/25/2015	102.4	110.4	104.2	107.4	105.1	114.5	108.8	110.4	104.7	114.6	~~114.6~~	102.8	~~112.3~~	113.1	105.1	111.2	~~111.2~~	103.5	~~114.5~~	115
7/26/2015	102.1	105.4	103.5	106.4	106.2	114	108.6	111.1	104.6	115.3	~~115.3~~	102.1	111.8	~~111.7~~	104.9	110.6	~~110.6~~	103.8	113.3	~~113.3~~
7/27/2015	101.8	108.1	103.5	106	106.3	112.4	108.7	110.7	104.2	113.8	~~113.8~~	101.6	~~111~~	111.3	104.4	110.4	~~110.4~~	103.8	113.2	~~113.2~~
7/28/2015	101	106.7	103.5	105.5	103.6	114.9	108.3	113.6	103.8	114.2	~~114~~	100.6	111.4	~~111.4~~	105	111.6	~~111.6~~	105.3	114	~~114~~
7/29/2015	100.8	108.9	102.5	102.9	103.4	112.6	108.9	112.6	105.2	116	~~116~~	102.1	~~111.3~~	111.3	108.2	113.3	~~113.3~~	107.8	115.3	~~115~~
7/30/2015	100.1	108.6	102.1	105.3	103.2	115.5	110.2	114.3	106.9	116	~~115.9~~	103.8	111.6	~~111.6~~	108.1	113.8	~~113.8~~	110.7	117.4	~~117.3~~
7/31/2015	99.9	111	101.9	106	105.5	115.1	110.4	113.7	108.7	~~116.3~~	116.4	104.2	~~111~~	111.5	108.1	~~113.7~~	113.7	112.4	~~117.1~~	117.2
8/1/2015	101	111.6	102	106.1	105.9	115.3	112.8	114.5	110.7	~~115.4~~	115.6	105.2	~~110.8~~	110.8	108	~~113.5~~	113.6	112.4	~~115.7~~	117
8/2/2015	103.5	110.6	103	106.3	105.1	115.1	112.9	113.8	111	~~114.6~~	115.5	105.7	~~108.5~~	110.6	107.6	~~112.6~~	113.5	111.6	~~114.9~~	115.6

Note: The Oregon TDG standard modification (OR) and Washington TDG criteria adjustments (WA) have different methodologies for calculating TDG. When standards vary or conflict, the Corps applies the more stringent standard. TDG values are presented in Table 1 by displaying highest value %TDG (more stringent), and the lower value is displayed with a strikethrough.

Total Dissolved Gas Monitoring Stations

Code	Station Name	Code	Station Name
LWG	Lower Granite Forebay	**LGNW**	Lower Granite Tailwater
LGSA	Little Goose Forebay	**LGSW**	Little Goose Tailwater
LMNA	Lower Monumental Forebay	**LMNW**	Lower Monumental Tailwater
IHRA	Ice Harbor Forebay	**IDSW**	Ice Harbor Tailwater
MCNA	McNary Forebay	**MCPW**	McNary Tailwater
JDY	John Day Forebay	**JHAW**	John Day Tailwater
TDA	The Dalles Forebay	**TDDO**	The Dalles Tailwater
BON	Bonneville Forebay	**CCIW**	Bonneville Tailwater (Cascade Island)
CWMW	Camas / Washougal		