



FISH PASSAGE CENTER

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MEMORANDUM

TO: Dave Statler, Nez Perce Tribe
FPAC

FROM: Michele DeHart

DATE: May 26, 2015

SUBJECT: Estimated spill at FCRPS projects based on May 18, 2015, STP and
2015 Fish Operations Plan

In response to your request, the Fish Passage Center staff has modeled spill, according to the 2015 Fish Operations Plan (FOP), for the remainder of the 2015 season using the predicted flows from the May 18, 2015, STP (herein referred to as STP). Below is a brief synopsis of these analyses, followed by a more detailed explanation of the methodologies and results.

- Based on the May 20, 2015, forecast from the River Forecast Center, the 2015 April through August runoff volume at Lower Granite Dam is expected to rank 53rd over the last 55 years. The predicted rank for The Dalles runoff volume is 51st over the last 55 years.
- The combination of predicted low flows and fixed spill volumes at LGR, LMN, IHR, and BON will result in relatively high spill proportions for the remainder of the 2015 spill season. However, similarly high spill proportions have been observed in other low flow years, particularly since summer spill in the Snake River was first implemented in 2005. (Note: The predicted volume spill for 2015 does not take into account any spill restrictions that may occur due to total dissolved gas exceedences. Consequently, it is possible that actual spill proportions may be lower than predicted).
- Due to low flows and restrictions from powerhouse minimums and miscellaneous flows, fixed spill volumes at LGR, LMN, IHR, and BON will not be possible through most of

the summer spill season. During this time, spill at these projects will essentially be total flows minus powerhouse minimums and miscellaneous flows.

- Due to low flows and restrictions from powerhouse minimums and miscellaneous flows, the summer operation of 50% spill at MCN will not be possible through much of the summer spill season. During this time, spill at MCN will be total flows minus powerhouse minimums and miscellaneous flows. As a result, the predicted average spill proportion at MCN in the summer (June 16–August 31) was 0.48.

Methods for Modeling Spill

Daily average spill volumes and proportions at all eight FCRPS projects were modeled using the 2015 FOP and the May 18, 2015, STP model run, through August 31, 2015. Since these analyses were completed on May 26th, the flow and spill volumes for May 18–May 25 were actuals. Table 1 is a summary of the specified operations from the 2015 FOP. Spill schedules for alternating operations at Ice Harbor (IHR), John Day (JDA), and Bonneville (BON) were obtained from the Corps of Engineers (COE). The 2015 FOP calls for spill to the gas cap at two projects: Lower Monumental Dam (spring only) and Ice Harbor Dam (at night during the 45 Kcfs/Gas Cap operation). Spill caps for these two projects were assumed from the April 1, 2015, Spill Priority List at the 115%/125% TDG levels (http://www.nwd-wc.usace.army.mil/tmt/documents/ops/spill/priority/Spill-Priority-List_2015_0401.pdf). At low flows, many of the spill volumes in Table 1 are not possible due to powerhouse minimum requirements and miscellaneous flows. Modeled spill volumes and proportions accounted for powerhouse minimums and miscellaneous flows at each project. These powerhouse minimums and miscellaneous flow are also provided in Table 1.

Table 1. Spill levels, powerhouse minimums, and miscellaneous flows assumed for modeling daily spill proportions under the 2015 Fish Operations Plan.

Project	2015 Fish Operations Plan		Power House Minimums (Kcfs)	Miscellaneous Flows (Kcfs)
	Spring ^A	Summer ^B		
LGR	20 Kcfs/20 Kcfs	18 Kcfs/18 Kcfs	12	0.0
LGS	30%/30%	30%/30% ^C	11.5	0.0
LMN ^D	Gas Cap/Gas Cap	17 Kcfs/17 Kcfs	12	0.0
IHR ^E	45 Kcfs/Gas Cap and 30%/30%	45 Kcfs/Gas Cap and 30%/30%	9.5 (Apr–Jul) 9.0 (Aug)	1.0
MCN	40%/40%	50%/50%	50.0	5.0
JDA	30%/30% and 40%/40%	30%/30% and 40%/40%	50.0	5.0
TDA	40%/40%	40%/40%	50.0	6.0
BON	100 Kcfs/100 Kcfs	85 Kcfs/121 Kcfs and 95 Kcfs/95 Kcfs	30.0	12.0

^A Snake River sites (April 3–June 20), Lower Columbia sites (April 10–June 15)

^B Snake River sites (June 21–August 31), Lower Columbia sites (June 16–August 31)

^C 2015 FOP calls for flat spill of 7–11 Kcfs when flows \leq 32 Kcfs. Modeling assumed flat spill of 9 Kcfs when this criterion was met.

^D Assumed Gas Cap under Bulk spill pattern (28 Kcfs).

^E Assumed nighttime Gas Cap of 95 Kcfs.

Results from Modeling Spill

Lower Granite Dam

Based on actual flows from May 18–May 25 and predicted flows through August 31st from the STP, flows at LGR likely peaked at 71.3 Kcfs on May 18th and are predicted to decrease through the rest of the season (Figure 1). Under the 2015 FOP, spill at LGR is a fixed volume of 20 Kcfs in the spring and 18 Kcfs in the summer. However, due to predicted low flows and powerhouse minimums, spill volumes in the summer are predicted to be less than 18 Kcfs for much of the summer period (Figure 1). In addition, low flows and fixed spill volumes at LGR will result in relatively high spill proportions for the remainder of the season, particularly in the summer (Figure 1). Based on modeled spill, the average spill proportion for the May 18 to August 31 period will be approximately 0.51. Average spill proportion for the summer period (June 21–August 31) will be 0.57, which is within the range observed since summer spill was first implemented in 2005 (Figure 2).

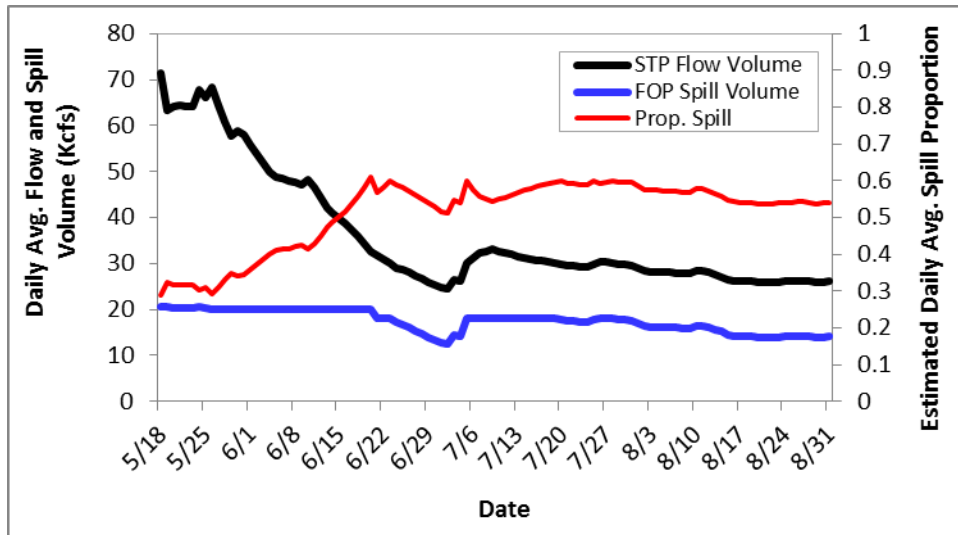


Figure 1. Estimated flows from May 18, 2015, STP, modeled FOP spill volumes, and modeled spill proportions at Lower Granite Dam.

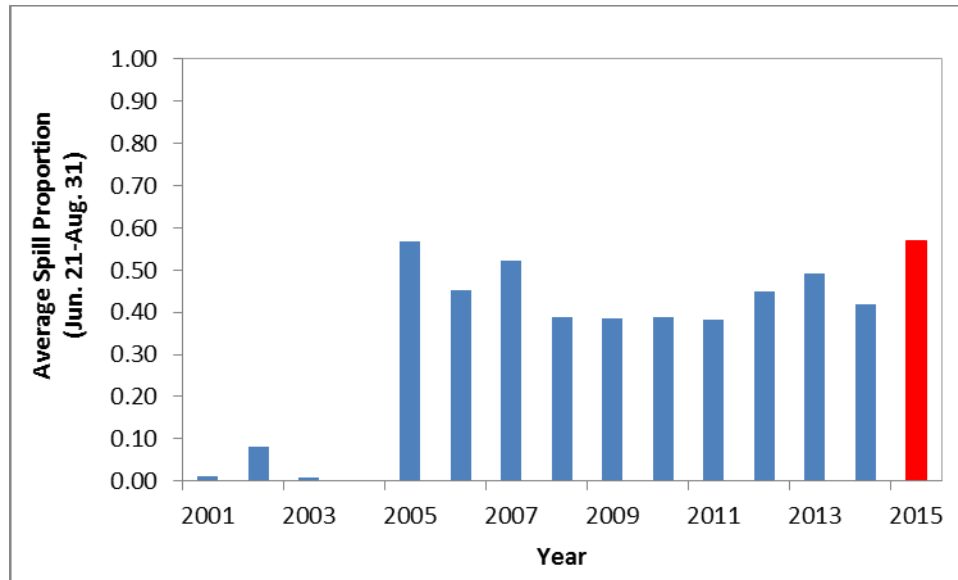


Figure 2. Average daily spill proportions (2001–2014) versus predicted daily spill proportions for summer (June 21–August 31) at Lower Granite Dam.

Little Goose Dam

Based on actual flows from May 18–May 25 and predicted flows through August 31st from the STP, flows at LGS likely peaked at 70.8 Kcfs on May 18th and are predicted to decrease through the rest of the season (Figure 3). Under the 2015 FOP, spill at LGS is 30% in both spring and summer, until flows fall below 32 Kcfs. When flows fall below 32 Kcfs, spill and LGS will change from 30% to a fixed volume of 7–11 Kcfs. According to the 2015 FOP, this modification is necessary to smooth LGS outflows, meet FOP spill levels at Lower Monumental Dam, and maintain Minimum Operating Pool elevation at LGS. However, there are no details as to when 11 Kcfs versus 7 Kcfs (or intermediate volumes) of flat spill would be provided. Therefore, we assumed a flat spill volume of 9 Kcfs when this low flow criterion was met.

Modeled spill proportions at LGS through June 20 were consistently 0.3 (Figure 3). Flows at LGS are predicted to fall below 32 Kcfs on June 21 where they will remain for much of the period through August 31st (Figure 3). During this time, spill will switch from 30% to the flat volume. With our assumed flat spill volume of 9 Kcfs, modeled spill proportions for this period ranged from 0.28 to 0.37 (Figure 3). Overall, the average predicted spill proportion for the May 18 to August 31 period will be approximately 0.31. Predicted average spill proportion for the summer period (June 21–August 31) will be 0.32, which is within the range of what has been observed since summer spill was first implemented in 2005 (Figure 4). Finally, the 2015 Fish Passage Plan (LGS-15) specifies that the TSW at LGS will be closed on or after August 1st, when daily average flows fall below 35 Kcfs for more than three consecutive days. Based on these criteria and the STP, the TSW at LGS will likely be closed on August 1st.

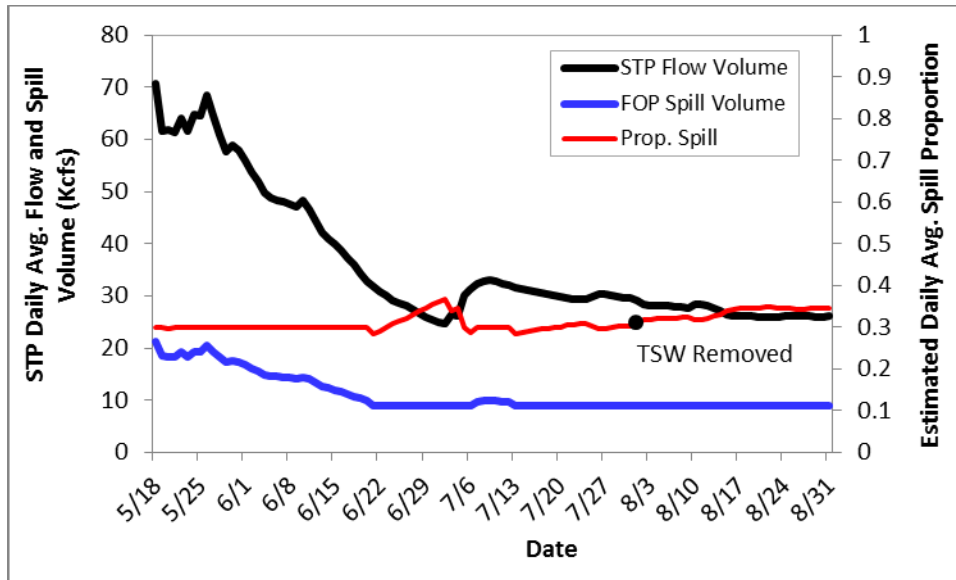


Figure 3. Estimated flows from May 18, 2015, STP, modeled FOP spill volumes, and modeled spill proportions at Little Goose Dam.

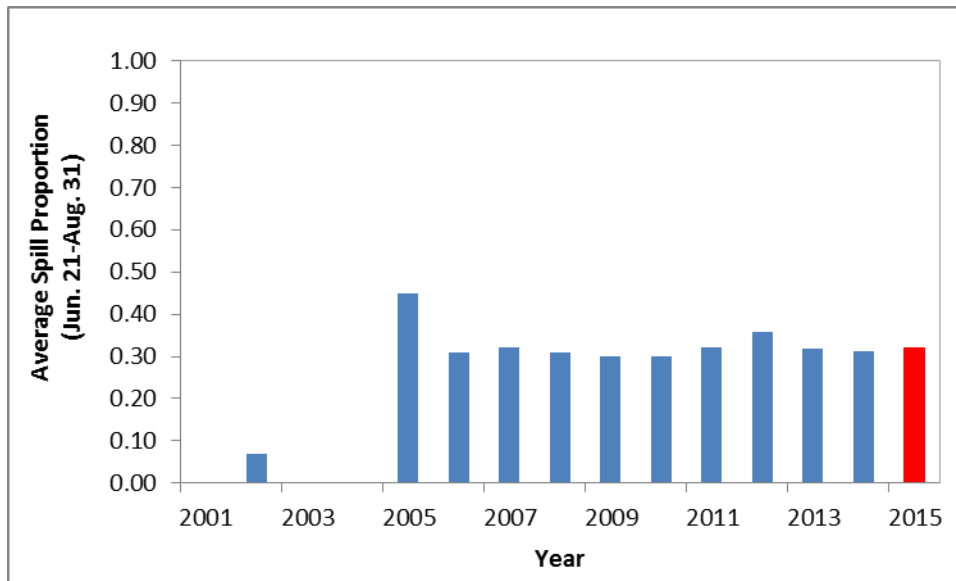


Figure 4. Average daily spill proportions (2001–2014) versus predicted daily spill proportions for summer (June 21–August 31) at Little Goose Dam.

Lower Monumental Dam

Based on actual flows from May 18–May 25 and predicted flows through August 31st from the STP, flows at Lower Monumental Dam (LMN) likely peaked at 72.2 Kcfs on May 18th and are predicted to decrease through the rest of the season (Figure 5). Under the 2015 FOP, spill at LMN is gas cap in the spring and a fixed volume (17 Kcfs) in the summer. As mentioned above, we assumed the gas cap from the April 1, 2015, Spill Priority List, which is 28 Kcfs.

However, this is likely an overestimate of spill. Although spill caps at LMN have ranged from 24 Kcfs to 30 Kcfs so far this year (Apr. 3–May 21), the spill cap during the month of May (May 1–May 25) have been in the 23–27 Kcfs range. As temperatures continue to increase, it is likely that the spill cap will be below 28 Kcfs for much of the remaining spring season.

Due to low predicted flows and powerhouse minimums, modeled spill volumes were less than gas cap (28 Kcfs) for about four days during the spring season and less than 17 Kcfs for much of the summer period (Figure 5). In addition, predicted low flows and fixed spill volumes at LMN will result in relatively high spill proportions for the remainder of the season (Figure 5). Based on modeled spill, the average spill proportion at LMN for the remainder of the season will be about 0.55. The average spill proportion for the summer period will also be approximately 0.55 at LMN, which is slightly above the range of what has been observed since summer spill was first implemented in 2005 (Figure 6).

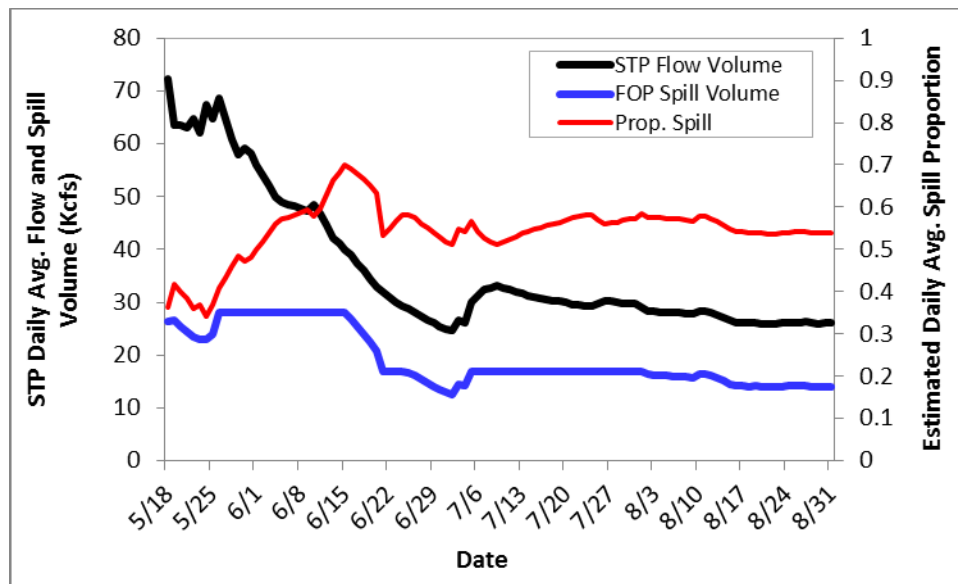


Figure 5. Estimated flows from May 18, 2015, STP, modeled FOP spill volumes, and modeled spill proportions at Lower Monumental Dam.

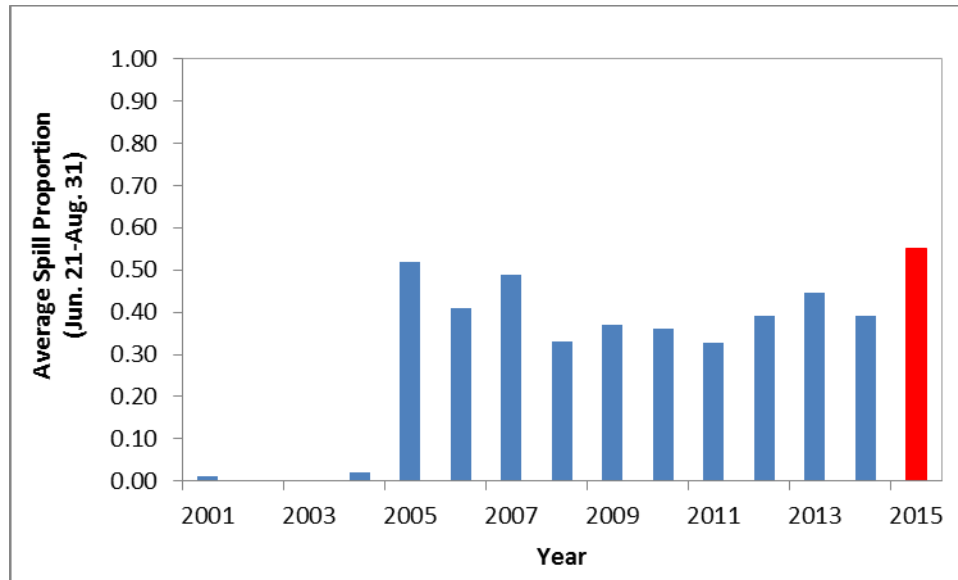


Figure 6. Average daily spill proportions (2001–2014) versus predicted daily spill proportions for summer (June 21–August 31) at Lower Monumental Dam.

Ice Harbor Dam

Based on actual flows from May 18–May 25 and predicted flows through August 31st from the STP, flows at Ice Harbor Dam (IHR) likely peaked at 73.5 Kcfs on May 18th and are predicted to decrease through the rest of the season (Figure 7). Under the 2015 FOP, spill at IHR is to alternate between 30% for 24-hours and 45 Kcfs daytime/gas cap at night. These two treatments alternate in 2-day blocks through July 13th. From July 13th to August 31st, spill at IHR is to be 45 Kcfs/Gas Cap. As mentioned above, when the FOP operation called for gas cap spill we assumed the night time gas cap from the April 1, 2015, Spill Priority List, which is 95 Kcfs. At no point in 2015 is it possible for IHR to spill this amount, as flows never gets this high. In this case, spill at night is essentially total discharge minus powerhouse minimums and miscellaneous flows.

Due to predicted low flows and powerhouse minimums at IHR, the 45 Kcfs daytime spill volume during one of the alternating operations was not possible for much of the remaining season. This is because spill at IHR is limited to total flow minus powerhouse minimum and miscellaneous flows once flows drop below about 55.5 Kcfs (Table 1). Based on the STP, flows are expected to first drop below 55.5 Kcfs on or around June 2nd (Figure 7). Based on modeled spill, the average spill proportion at IHR for the remainder of the season will be 0.57. The average spill proportion for the summer period is expected to be approximately 0.58, which is within the range of what has been observed since summer spill was first implemented in 2005 (Figure 8).

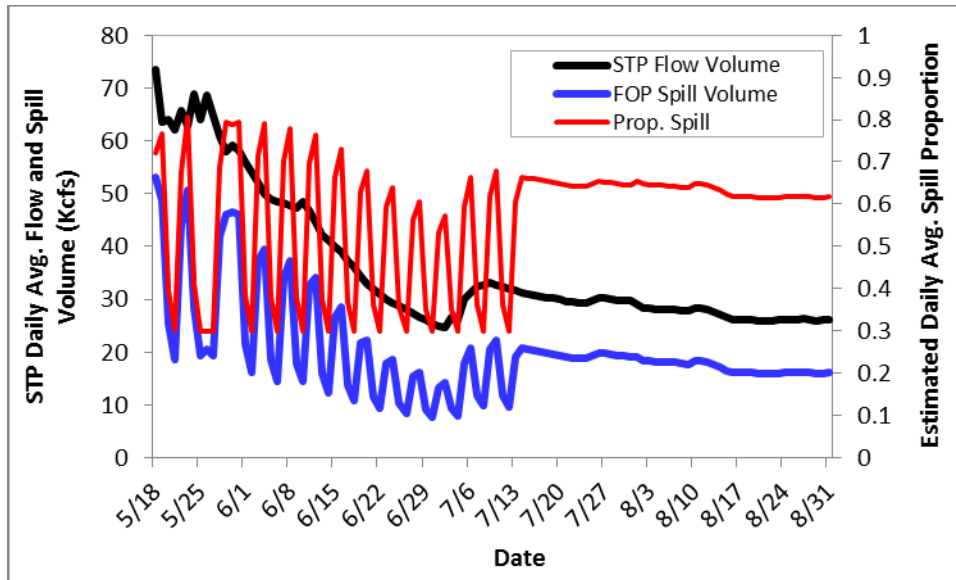


Figure 7. Estimated flows from May 18, 2015, STP, modeled FOP spill volumes, and modeled spill proportions at Ice Harbor Dam.

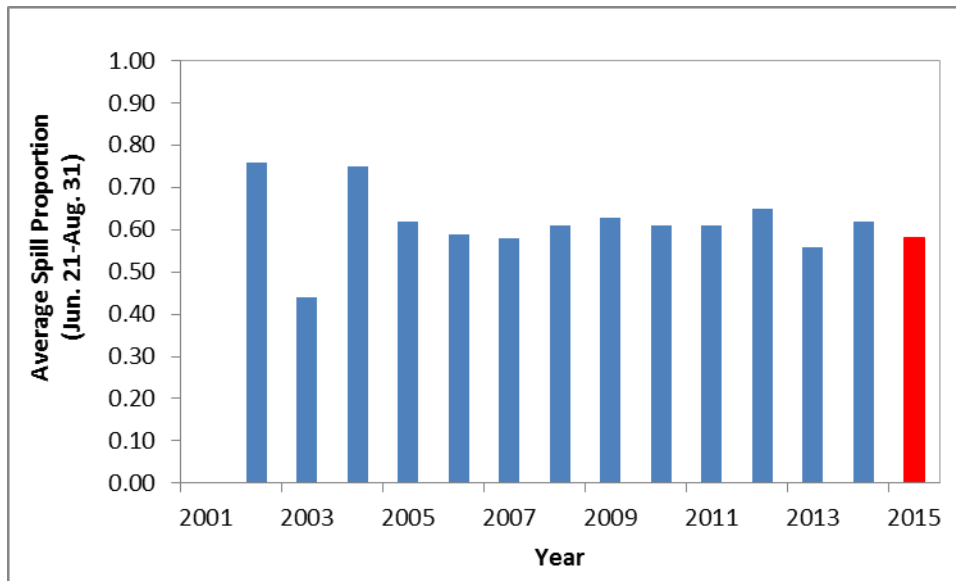


Figure 8. Average daily spill proportions (2001–2014) versus predicted daily spill proportions for summer (June 21–August 31) at Ice Harbor Dam.

McNary Dam

Based on actual flows from May 18–May 25 and predicted flows through August 31st from the STP, flows at McNary Dam (MCN) likely peaked at around 220 Kcfs on May 24th and are predicted to decrease through the rest of the season (Figure 9). Under the 2015 FOP, spill at MCN is 40% in spring and 50% in summer. Based on the STP predictions, 40% spill is possible for the remainder of the spring season. However, under the predicted low flows at MCN,

maintaining 50% spill is not possible for the entire summer period (Figure 9). This is due to restrictions imposed by powerhouse minimums and miscellaneous flows. Essentially, when flows drop below 110 Kcfs, spill at MCN is limited to total discharge minus about 55 Kcfs. According to the STP, flows at MCN first drop below 110 Kcfs on July 2nd where they remain for four days until they increase to above 110 Kcfs through August 2nd (Figure 9). On August 3rd, flows at MCN drop below 110 Kcfs again where they remain for the remainder of the spill season (Figure 9).

Overall, the average spill proportion for the May 18 to August 31 period will be approximately 0.46. Average spill proportion for the summer period (June 16–August 31) will be 0.48 (Figure 10), which is slightly below the summer spill proportion of 0.5 specified by the 2015 FOP. This is because of the low flows and restrictions imposed by powerhouse minimums and miscellaneous flows. In fact, the predicted average summer spill proportion for 2015 is slightly below what has been observed at McNary Dam since summer spill was first implemented in 2005 (Figure 10). Finally, the 2015 FOP specifies that the TSWs at MCN will be removed from service by June 8th.

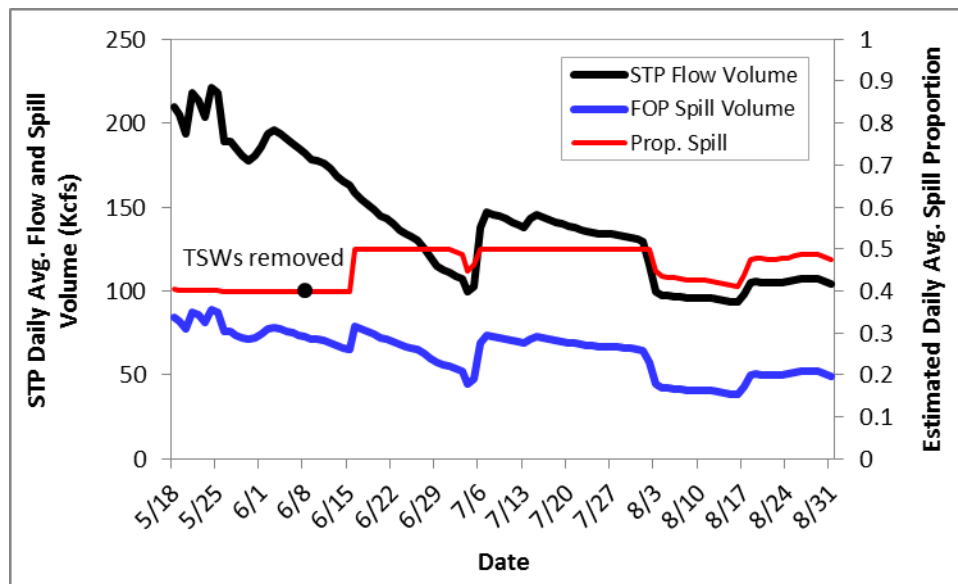


Figure 9. Estimated flows from May 18, 2015, STP, modeled FOP spill volumes, and modeled spill proportions at McNary Dam.

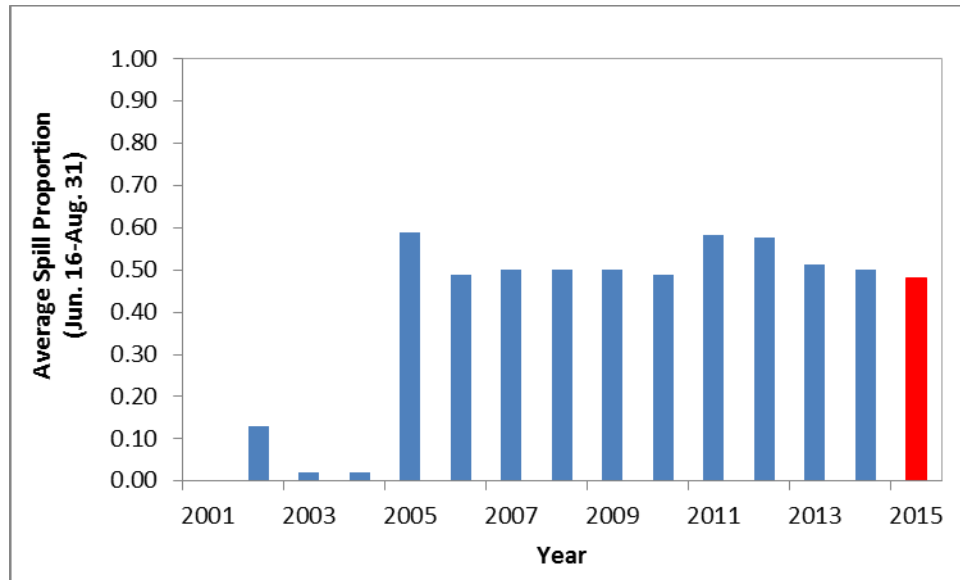


Figure 10. Average daily spill proportions (2001–2014) versus predicted daily spill proportions for summer (June 16–August 31) at McNary Dam.

John Day Dam

Based on actual flows from May 18–May 25 and predicted flows through August 31st from the STP, flows at John Day Dam (JDA) likely peaked at about 224 Kcfs on May 24th and will decrease through the rest of the season (Figure 11). Under the 2015 FOP, spill at JDA is to alternate between 30% and 40%. These two treatments will alternate every 2 days through July 20th. From July 21st through August 31st, spill at JDA will be 30%. Based on the STP predictions, achieving 30% and/or 40% spill levels is possible for the remainder of the spill season (Figure 11). Overall, the average spill proportion for the May 18 to August 31 period will be approximately 0.33. Average spill proportion for the summer period (June 16–August 31) will be 0.32, which is similar to what has been observed since 2002 (Figure 12).

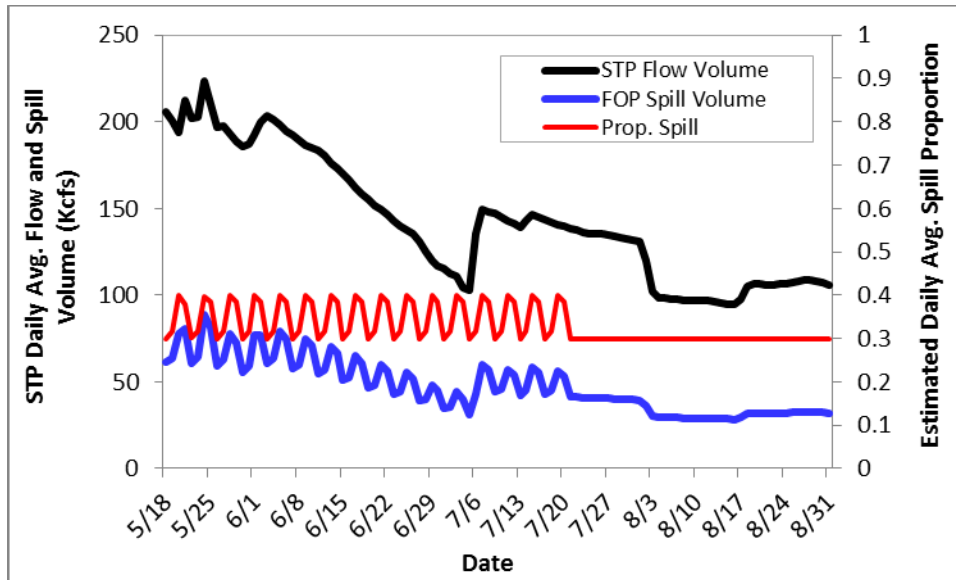


Figure 11. Estimated flows from May 18, 2015, STP, modeled FOP spill volumes, and modeled spill proportions at John Day Dam.

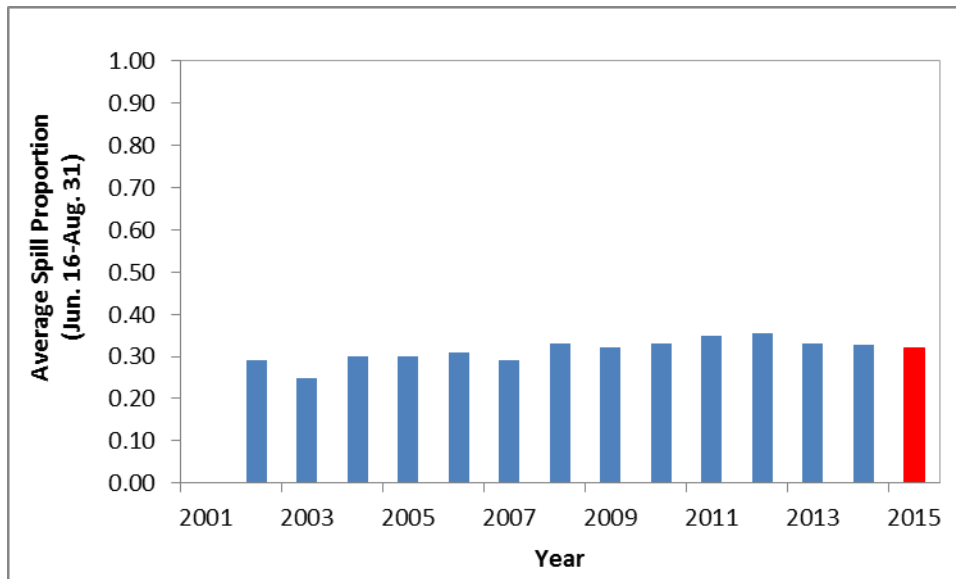


Figure 12. Average daily spill proportions (2001–2014) versus predicted daily spill proportions for summer (June 16–August 31) at John Day Dam.

The Dalles Dam

Based on actual flows from May 18–May 25 and predicted flows through August 31st from the STP, flows at The Dalles Dam (TDA) likely peaked at about 207 Kcfs on May 24th and will decrease through the rest of the season (Figure 13). Under the 2015 FOP, spill at TDA is 40% for both spring and summer. Based on the STP predictions, 40% spill levels are possible at TDA for the remainder of the spill season (Figure 13). Overall, the average spill proportion for

the rest of the spill season and over the entire summer period will be approximately 0.40 (Figure 14). This average summer spill proportion for summer is similar to what has been observed at TDA since 2002 (Figure 14).

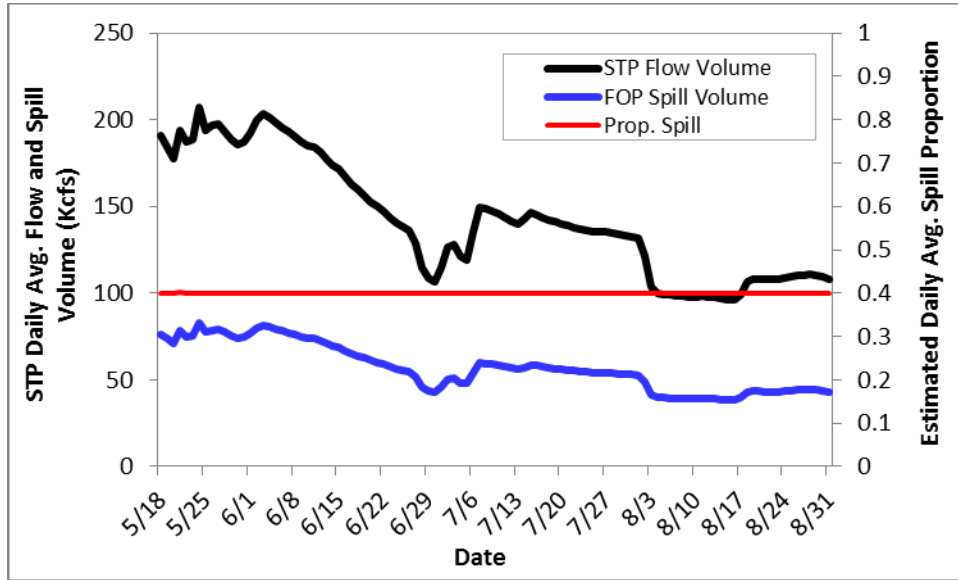


Figure 13. Estimated flows from May 18, 2015, STP, modeled FOP spill volumes, and modeled spill proportions at The Dalles Dam.

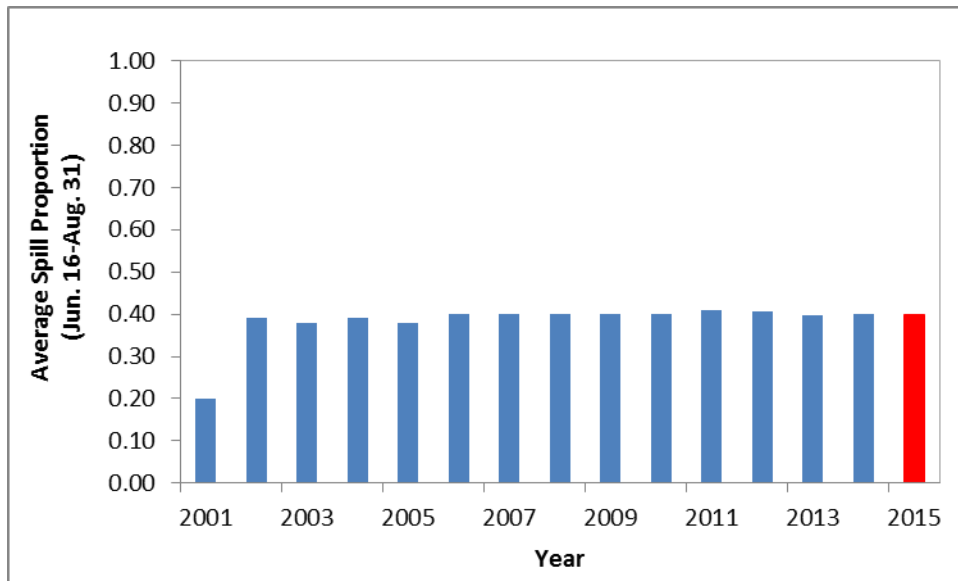


Figure 14. Average daily spill proportions (2001–2014) versus predicted daily spill proportions for summer (June 16–August 31) at The Dalles Dam.

Bonneville Dam

Based on actual flows from May 18–May 25 and predicted flows through August 31st from the STP, flows at Bonneville Dam (BON) likely peaked at about 218.5 Kcfs on May 25th and will decrease through the rest of the season (Figure 15). Under the 2015 FOP, summer spill at BON is to alternate between 85 Kcfs/121 Kcfs and 95 Kcfs/95 Kcfs. These two treatments will alternate in 2-day blocks for the entire summer season (June 16–August 31).

Due to predicted low flows and constraints from powerhouse minimums and miscellaneous flows, there are times when the 85 Kcfs, 95 Kcfs, and/or 121 Kcfs spill volumes from the summer spill treatments will not be possible. In fact, by about August 2nd, it will not matter what spill treatment the FOP spill schedule calls for, spill at BON will be limited to total flows minus powerhouse minimum (30 Kcfs) and miscellaneous flows (12 Kcfs) (Figure 15). Based on modeled spill, the average spill proportion at BON for the remainder of the season will be 0.60. The average spill proportion for the summer period is expected to be approximately 0.64, which is slightly above what has been observed in recent years (Figure 16).

The 2015 FOP states that the minimum spill level at BON is 50 Kcfs but, in extremely low flow conditions, lower spill levels may be considered and coordinated through the TMT process. In order for spill to be below 50 Kcfs, flows at BON would have to be below 92 Kcfs. According to the STP, flows at BON are not expected to drop below 92 Kcfs. The minimum flows at BON are predicted to be about 97.5 Kcfs, which is expected to occur on August 16th (Figure 15).

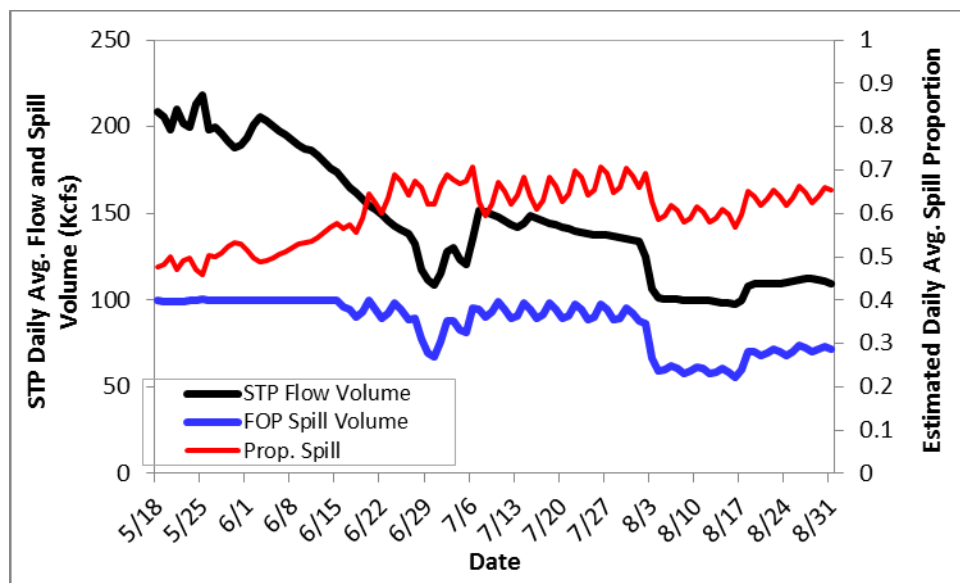


Figure 15. Estimated flows from May 18, 2015, STP, modeled FOP spill volumes, and modeled spill proportions at Bonneville Dam.

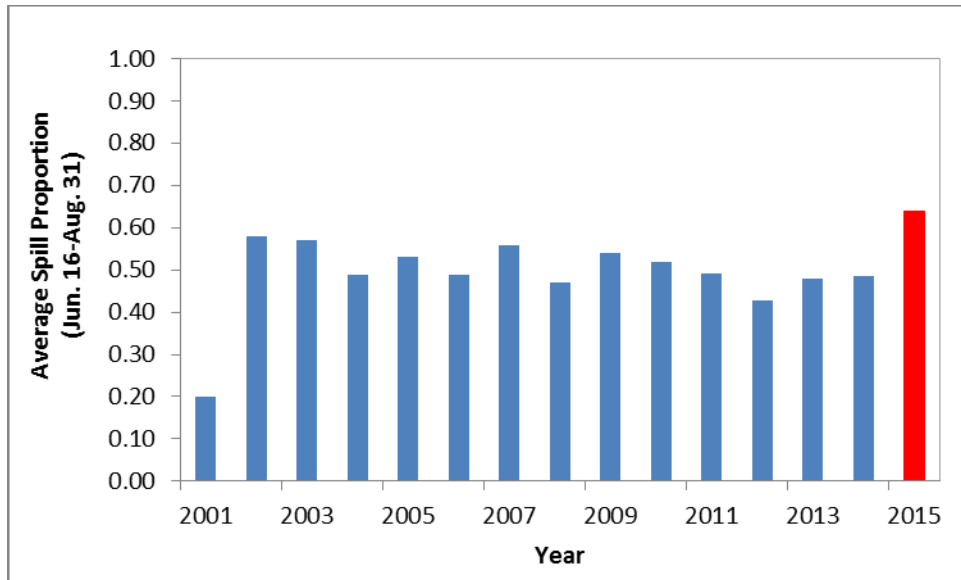


Figure 16. Average daily spill proportions (2001–2014) versus predicted daily spill proportions for summer (June 16–August 31) at Bonneville Dam.