CENWD-PDD April 18, 2007

2007 Fish Operations Plan

BACKGROUND

The 2007 Fish Operations Plan (FOP) describes actions by the U.S. Army Corps of Engineers (Corps) to implement project operations for fish passage at its Federal Columbia River Power System (FCRPS) dams during the April – August 2007 fish migration season. Consistent with the 2004 Biological Opinion adaptive management strategy, this plan incorporates the project operations contained in the "Agreement Regarding 2007 Federal Columbia River Power System Fish Operations" (Agreement)[1]. The Corps has agreed to provide 2007 fish passage operations in accordance with the Agreement as identified in Attachment 1 of the Agreement[2]. Water Management operations not addressed in the Agreement will continue to be consistent with the operations considered in the 2004 Biological Opinion and in particular, the 2007 Water Management Plan and 2007 Fish Passage Plan (FPP). The following is a detailed description of the fish passage operations for the 2007 migration season.

SPRING SPILL OPERATIONS

Lower Snake River - spring spill will occur from April 3, 2007 through June 20, 2007 at the Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams.

Lower Columbia River - spring spill will occur from April 10, 2007 through June 30, 2007 at the McNary, John Day, The Dalles and Bonneville dams.

Table 1 below, from Attachment 1 of the Agreement, summarizes spring spill operations planned for each mainstem dam.

In this Plan, the term "gas cap" refers to the total dissolved gas (TDG) state criteria waiver limits. The gas caps are TDG saturation levels of 120% in the project tailrace and 115% in the forebay of the next project downstream. The project spill discharge level needed to meet but not exceed the gas caps is referred to as the "spill cap". Therefore, the spill cap is the maximum flow rate a project can spill for fish passage that does not exceed the gas caps. The gas caps (120% tailrace and 115% forebay) do not change for dams providing spill for fish passage in the spring and summer. Spill caps, on the other hand, may vary daily depending on flow, temperature, and other environmental conditions.

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[1] The Agreement signed by the Bonneville Power Administration (BPA), Confederated Tribes of the Warm Springs Reservation, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes and Bands of the Yakama Nation, and Confederated Tribes of the Colville Indian Reservation, was submitted to the Federal District Court on January 9, 2007.

[2] Brigadier General Martin committed to implement the 2007 operations identified in Attachment 1 of the Agreement by letter dated December 15, 2006.

Table 1. Spring 2007 project spill levels and transport criteria in the Agreement.

Spring 2007

	Planned Operations for Spring 2007 (Day/Night)	**Comments**
Transport	**Initiate transport at Lower Granite Dam between April 20 – May 1 with staggered transport start dates at Little Goose and Lower Monumental. Criteria for start date and stagger days will be provided to TMT *1**	**Same as 2006 except potential later start of transport**
Lower Granite	**20kcfs / 20kcfs**	**Same as 2006 with planned main turbine unit outage**
Little Goose	**30%/30% Allow for 14 days night Gas Cap spill within the last week of April – second week of May (April 22 – May 15)*. Dates of actual night time spill to be determined by salmon managers within the window of time identified above**	**Same as 2006 except 14 days of gas cap night spill**
Lower Monumental	**27 kcfs / 27 kcfs Gas Cap**	**Same as 2006 test program (24 hr Gas Cap spill)**
Ice Harbor	**30%/30% vs 45kcfs/Gas Cap**	**Same as 2006 test program**
McNary	**40%/40% (April 10 – June 30)**	**Same as 2006 except elimination of 0/150 kcfs operation to provide testing of the prototype temporary spillway weir (PTSW)**
John Day	**0 / 60% Planning for PTSW test with 24 hour spill in 2008**	**Same as 2006**
The Dalles	**40%/40%**	**Same as 2006**
Bonneville	**100kcfs/100kcfs**	**Same as 2006**

*1 Initiation of Transport

* The timing of the 14 days of spill to nighttime gas cap levels will be determined in-season through the TMT processes and is intended to coincide with the peak of the wild spring yearling Chinook migration at Little Goose Dam within the window specified.

SUMMER SPILL OPERATIONS

Lower Snake River - summer spill will occur from June 21, 2007 through August 31, 2007 at the Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams.

Lower Columbia River -summer spill will occur from July 1, 2007 through August 31, 2007 at the McNary, John Day, The Dalles and Bonneville dams.

Table 2 below, from Attachment 1 of the Agreement, summarizes summer spill operations planned for each mainstem dam.

In this Plan, the term "gas cap" refers to the total dissolved gas (TDG) state criteria waiver limits. The gas caps are TDG saturation levels of 120% in the project tailrace and 115% in the forebay of the next project downstream. The project spill discharge level needed to meet but not exceed the gas caps is referred to as the "spill cap". Therefore, the spill cap is the maximum flow rate a project can spill for fish passage that does not exceed the gas caps. The gas caps (120% tailrace and 115% forebay) do not change for dams providing spill for fish passage in the spring and summer. Spill caps, on the other hand, may vary daily depending on flow, temperature, and other environmental conditions.

Table 2. Summer 2007 project spill levels in the Agreement.

Summer 2007

Project	**Planned Operations for Summer 2007 (Day/Night)**	**Comments**
Lower Granite	**18 kcfs / 18 kcfs**	**Same as 2006**
Little Goose	**30% / 30%**	**Same as 2006**
Lower Monumental	**17 kcfs / 17 kcfs**	**Same as 2006**
Ice Harbor	**30%/30% vs 45kcfs/Gas cap**	**Same as 2006 test program**
McNary	**40%/40% vs 60%/60**	**Same as 2006 test program**
John Day	**30% / 30%**	**Same as 2006**
The Dalles	**40%/40%**	**Same as 2006**
Bonneville	**75kcfs / 120kcfs**	**Same as 2006**

General Guidance for 2007 Fish Operations

For planning purposes, the Corps' 2007 FOP operations for fish passage assume "average" run-off conditions. However, actual run-off conditions may be higher or lower than average, requiring adjustments to avoid or minimize poor juvenile or adult fish passage conditions or powerhouse constraints. Therefore, actual spill levels may vary from the tables above. In addition, spill levels may require adjustments for the following reasons:

- TDG is managed daily in response to changing conditions. Adjustments will be made to manage the spill operation consistent with the Oregon and Washington state TDG waiver limits for fish passage.
- Power system and other project emergencies, including unplanned/unanticipated facility maintenance or outages, may necessitate temporary adjustments in accordance with established protocols.

The following sections describe the processes for spill management during high and low runoff conditions, TDG management, spillway operation, minimum generation, specific spring and summer operations for fish passage for each mainstem project, juvenile fish transportation program operations, protocols for emergencies, and reporting.

Spill Management

The Corps will initiate spill at 0001 hours, or shortly after midnight, at each of the projects on the start dates specified above. Spill caps will be established at the specified amounts and will continue unless conditions require changing to maintain TDG within the limits established by the States of Oregon and Washington: 120% in the tailwater of a dam and 115% in the forebay of the next project downstream (and at Camas/Washougal). Spill will terminate at 2359 hours, or shortly before midnight, at each project on the end dates specified above.

The spill rates represented in Tables 1 and 2 assume average runoff conditions; however, actual conditions may require adjustments to these spill rates. Actual spill rates may increase above the specified rates for two reasons: (1) high runoff conditions where flows exceed the powerhouse hydraulic capacity with the specified spill rates; and, (2) a lack of power load resulting in an increase in the rate of spill.

Spill below the specified rates could occur during low runoff conditions when meeting minimum generation levels at a project requires reducing spill rates. This would most likely occur in late July and August. Minimum generation and spill rates are included below in the project specific information. Spill also may be reduced to accommodate navigation issues or other exigencies.

To make adjustments in response to changes in conditions, the Corps will utilize the existing Regional Forum committees. Changes in spill rates when flow conditions are higher or lower than anticipated will be coordinated through the regional forum Technical Management Team (TMT). This could include potential issues and adjustments to the juvenile fish transportation program. Spill patterns and biological test issues that have not been coordinated to date will be coordinated through the Corps' Anadromous Fish Evaluation Program (AFEP) subcommittees, which include the Studies Review Work Group (SRWG), Fish Facility Design Review Work Group (FFDRWG), and Fish Passage Operations and Maintenance Coordination Team (FPOM).

Total Dissolved Gas Management

In order to manage gas cap spill rates consistent with the Oregon and Washington state TDG waiver limits for fish passage, the Corps' Reservoir Control Center (RCC) establishes the spill caps for each project on the lower Columbia and Snake rivers on a daily basis throughout the fish passage season. These spill caps are set so that resultant TDG percent saturation levels are not

expected to exceed the states' 120%/115% TDG limits, as measured as an average of the highest 12 hourly readings each day. Within any given day, some hours of measured TDG levels may be higher or lower than the gas caps due to changing environmental conditions (wind, air temperature, etc). The process of establishing daily spill caps entails reviewing existing hourly data at each dam (including flow, spill, temperature, and TDG levels) and taking into consideration a number of forecast conditions (including total flow, flow through the powerhouse, wind and temperature forecast, etc.). This information is used as input into the SYSTDG modeling tool. The SYSTDG model estimates TDG levels in the rivers several days into the future and is a tool integral to daily decision-making when establishing spill caps at individual dams.

SYSTDG output is used to guide decisions to establish spill caps at each dam to avoid exceedances of the gas caps. However, during the spring freshet when flows are expected to be greater than hydraulic capacity with the specified spill rates at the dams, or if a lack of power load results in an increase in the spill rate, the Corps will attempt to minimize TDG on a system-wide basis. In this case, spill caps are also developed for 125%, 130%, or 135% saturation to minimize TDG throughout the system.

Spill caps set by RCC in daily spill priority requests will be met at the projects by using the spill pattern in the appropriate FPP spill table which most closely corresponds to the requested spill, either over or under the spill request. Spill caps will be adjusted on a daily basis as needed to avoid exceeding the gas caps. Operations to manage TDG will continue to be coordinated through the TMT.

Spillway Operations

Actual hourly spill quantities at dams will be slightly greater or less than the tables in the Agreement (Table 3). The Action Agencies will meet the requested spill levels to the extent possible. However, actual spill levels depend on the precision of spill gate settings, flow variations in real time, varying project head (the elevation difference between a project's forebay and tailwater), and other factors. Operations considerations are as follows:

Spill discharge rates: Due to limits in the precision of spill gates and control devices, short term flow variations, and head changes, it is not possible to discharge exactly the spill rates stated in the Agreement, or as stated in RCC spill requests to projects that call for specific spill discharges. Therefore, spillway gates are opened to the settings in FPP spill pattern tables which provide discharges that are the closest to the agreed upon spill discharge rate. The spill rates in Table 3 coincide with specific gate settings in the FPP spill tables. Actual spill may be higher or lower than the identified spill rate.

Spill percentages: Spill percentages are considered target spill levels. The project control room operator and BPA duty scheduler calculate spill rates to attempt to be within +/- 1% of the target percentage for the following hour (Table 3). These percentages may not be attained due to low flow conditions, periods of minimum generation, when spill caps limit spill amounts, when spill is curtailed for navigation safety, and other circumstances. Operators and schedulers will review the percentages achieved during the day and adjust spill rates in later hours, with the objective of ending the day with a day average spill that achieves the target.

Table 3. Comparison of 2007 spill levels in the Agreement with operational spill levels at mainstem dams.

Season/Project	2007 Agreement Spill Levels	2007 Operational Spill Levels	Comments
Spring			
Lower Granite	20 kcfs day/night	20.4 kcfs	Will fluctuate due to project head changes
Little Goose	30% day/night	30% +/- 1% hourly	Target* 30% as a day average
Lower Monumental	27 kcfs day/night (Gas Cap)	spill cap day/night	Meet spill cap daily
Ice Harbor	30% day/night vs. 45 kcfs day / Gas Cap night	30% +/- 1% hourly; 45.6 kcfs day / spill cap night	Target 30% as a day average; 45.6 kcfs will fluctuate due to head changes; meet nightly spill cap
McNary	40% day/night	40% +/- 1% hourly	Target 40% as a day average
John Day	0 day / 60% night	60% +/- 1% hourly	Target 60% as a nightly average
The Dalles	40% day/night	40% +/- 1% hourly	Target 40% as a day average
Bonneville	100 kcfs day/night	100 kcfs	Will fluctuate due to head changes
Summer			
Lower Granite	18 kcfs day/night	18.6 kcfs	Will fluctuate due to head changes
Little Goose	30% day/night	30% +/- 1% hourly	Target 30% as a day average
Lower Monumental	17 kcfs day/night	17.1 kcfs	Will fluctuate due to head changes
Ice Harbor	30% day/night vs. 45 kcfs day / Gas Cap night	30% +/- 1% hourly; 45.6 kcfs day / spill cap night	Target 30% as a day average; 45.6 kcfs will fluctuate due to head changes; meet nightly spill cap
McNary	40% day/night vs. 60% day/night	40% +/- 1% hourly; 60% +/- 1% hourly	Target 40% or 60% as a day average
John Day	30% day/night	30% +/- 1% hourly	Target 30% as a day average
The Dalles	40% day/night	40% +/- 1% hourly	Target 40% as a day average
Bonneville	75 kcfs day / 120 kcfs night	74.6 kcfs day / spill cap night **	74.6 kcfs will fluctuate due to head changes; meet nightly spill cap

* Target: Make best effort to meet a specified spill level through frequent monitoring, projections, and spill adjustments within the defined range of variation. This will occur for each project through analysis and coordination between the Corps and BPA.

** The Bonneville Dam summer daytime spill discharge rate may increase from 75 kcfs to 81 – 83 kcfs, summer nighttime spill may be reduced from the spill cap to a specified level (not yet defined), and the start date of summer spill may be moved from July 1 to June 21. These changes are being regionally coordinated through FPOM, FFDRWG, and TMT.

Minimum Generation

The Corps has identified minimum generation flows derived from FPP tables which specify turbine operation within the 1% of best efficiency range. These figures are approximations and do not account for varying head or other small adjustments that may result in variations in the reported minimum generation flow and spill amount. Conditions that may result in minor variations include:

1. Varying pool elevation: as reservoirs fluctuate within the operating range, flow rates through the generating unit change.
2. Generating unit governor "dead band": the governor controls the number of megawatts the unit should generate and cannot precisely control a unit; variations can be +/- 1% to 2% of generation.
3. System disturbances: once the generator is online and connected to the grid, it responds to changes in system voltage and frequency. These changes may cause the unit to increase flow and generation slightly within an hour.
4. Individual units may behave slightly differently or have unit specific constraints.
5. Generation control systems regulate megawatts (MW) generation only, and not flow through turbines.

All of the lower Snake River powerhouses may be required to keep one generating unit on line at all times for power system reliability. During low flows, one generator is run at the bottom of the 1% of best efficiency range. All of the Snake River plants have 2 “families” of turbines with slightly different capacities. In most cases one of the smaller units, with somewhat less generation and flow, will be online during these times. At the Snake River dams, the smaller units are generally numbered 1 – 3 and are the first priority for operation during the fish passage season. However, if smaller units are unavailable, one of the larger units may be used. Further, at Lower Monumental, generating unit 1, which is the first priority unit during fish passage, is damaged and cannot operate at the low end of the design range. However, because this unit is a fish passage priority TMT may recommend use of this unit, which will result in higher turbine discharge rates than shown in the Lower Monumental Summer Operation Considerations section below. In addition, Ice Harbor units cannot be operated at the lower end of the 1% of best efficiency range. These units experience cavitation at a generation level somewhat higher than the lower 1% limit, which damages the turbine and can be detrimental to fish. Therefore, Ice Harbor units will operate at their lower cavitation limits, as in 2006.

Spring and Summer Operations for Fish Passage by Project

The following describes the spring and summer operations by project. Included in the description is planned research as considered in the 2004 Biological Opinion. The Corps, and the regional agencies and Tribes are interested in the continuation of project research studies under the Corps’ AFEP. These studies have undergone review by the regional agencies and Tribes and are consistent with the Agreement. The studies are intended to provide further information on project survival and assist the region in making decisions on future operations and configuration actions to improve fish passage at the Lower Snake and Columbia River dams.

Lower Granite

Spring Spill Operations April 3 – June 20, 2007: 20 kcfs (including approximately 6 kcfs from the RSW and 14 kcfs from the training spill) 24 hours/day with the Removable Spillway Weir (RSW) operating. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spring research operations: Normal spring spill patterns and rates as described in the FPP will be used. There will be no specific spill variations for testing.

Operation considerations:

  - The Behavioral Guidance Structure (BGS) will be removed from the forebay in March 2007, prior to the fish passage season. The trash/shear boom will be modified, repaired and repositioned when the BGS is removed.
  - Unit 2 will be out of service until mid-June. The powerhouse will operate with no more than 5 units on during the spring spill season. Contracts for unit breaker replacement and fire protection installation will take one unit at a time out of service, starting in early July and continuing through the summer.
  - With one unit out of service, powerhouse capacity is about 85 kcfs. If total river discharge is greater than approximately 105 kcfs, then spillway discharge will be forced above RSW spill + training spill levels. This involuntary spill could result in gas cap exceedances. Lack of power load also could cause involuntary spill at higher total river discharges.

Once the operations for research are completed, the spill pattern will return to RSW plus training spill for a total 20 kcfs spill as described in the FPP. This is the same as during the test.

Summer Spill Operations June 21 – August 31, 2007: 18 kcfs (including approximately 6 kcfs from the RSW and 12 kcfs from the training spill) 24 hours/day with the RSW operating. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for RSW testing (timing): Approximately mid-June to late July. The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final test dates will be coordinated through the SRWG.

- Summer research operations: The RSW spill pattern may be modified to conduct a summer test of RSW performance. Final spill conditions will be coordinated through the SRWG.

- Objectives of the biological test: The purpose of the summer test will be to evaluate the performance of the RSW relative to passage and survival of subyearling fall Chinook.

- Spill pattern during biological test: Test spill patterns are being developed and coordinated through SRWG.

Operation considerations:

  - Contracts for unit breaker replacement and fire protection installation will be completed in 2007. These activities could limit unit availability.
  - Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. If such low runoff conditions occur, alternative spill operations at the dam will be coordinated through the TMT.
  - Minimum generation: The minimum generation amount represents the operation of one unit at the lower end of its 1% efficiency range and is needed for power system reliability. This generation will be controlled to approximately 81 – 83 MW at units 1 – 3, the priority fish units. If these units are not available, the larger units 4 – 6 will be run at 96 - 100 MW. This will result in turbine flows of approximately 11 kcfs – 12 kcfs at units 1 – 3 and 12.5 kcfs - 13.5 kcfs at units 4 - 6. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This condition may occur in early spring before the freshet and during the late summer period with low flow conditions.

Once the operations for research are completed, spill patterns will return to summer spill normal operations as described in the FPP and to the levels shown in the tables above.

Little Goose

Spring Spill Operations April 3 – June 20, 2007: 30% spill 24 hours/day. In addition, allow for 14 nights of spill up to gas cap spill rates between April 22 and May 15. Nighttime spill hours are 1800 – 0600. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Approximately mid April to late May. The dates of testing will be dependent on the size of fish and fish availability. Final dates for testing will be coordinated through the SRWG.

- Spring research operations: 30% spill 24 hour/day. A tapered bulk spill pattern will be tested. Final test conditions will be coordinated through the SRWG.

- Objectives of the biological test: The primary objectives of the spring test will be to determine route specific survival estimates, approach paths, passage distribution, forebay residence time, and tailrace egress under a tapered bulk spill pattern.

- Spill pattern during the biological test: The test spill pattern is provided in Appendix 1.

Operation considerations:

  - In both spring and summer, day average flows in the lower Snake River near 30 kcfs can result in incompatible operations with Lower Monumental Dam and cause spill quantity fluctuations.
  - The fire suppression system for each turbine unit will be replaced in 2007. One unit at a time will be taken out of service for 9 days per unit to complete this work. This will result in a 5 unit powerhouse operation. This portion of the work is scheduled to take place during late April through late June. Multiple unit outages to finish the installation are scheduled for July and August.
  - Contracts for unit breaker replacement and fire protection installation will be completed in 2007. These activities could limit unit availability.
  - The powerhouse capacity with one unit out of service is approximately 108 kcfs. If total river discharge is greater than approximately 140 kcfs, then spillway discharge will be forced above the planned operation of 30% spill.
  - Nighttime spill up to gas cap rates will be provided for 14 days between April 22 and May 15. The spill is intended to coincide with peak passage periods for wild yearling Chinook. The 14 spill days do not have to be consecutive. Actual dates will be determined through coordination with TMT.

Once the operations for research are completed, spill patterns will return to normal operation as described in the FPP and to the levels shown in Table 3.

Summer Spill Operations June 21 – August 31, 2007: 30% spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Approximately mid-June – end of July. The dates of testing will be dependent on the size of fish and fish availability. Final dates for testing will be coordinated through the SRWG.

- Summer research operations: 30% spill 24 hour/day. The modified bulk spill pattern used in the spring will be continued in the summer test. Final test conditions will be coordinated through the SRWG.

- Objectives of the biological test: The summer test will determine route specific survival estimates, approach paths, passage distribution, forebay residence time, and tailrace egress for subyearling fall Chinook.

- Spill pattern during the biological test: The test spill pattern is provided in Appendix 1.

Operation considerations:

  - In the 2005 summer spill period, adult passage was blocked when daytime spill levels were above 30%. Therefore, it is possible that as flow recedes in summer of 2007, the summer spill patterns and treatments may need to be changed through TMT adaptive management process so that good adult passage is maintained.
  - Contracts for unit fire protection installation will be completed in 2007. These activities could limit unit availability.
  - Minimum spill: During periods of low flow before the spring freshet and during the late summer period, there may be periods where spill quantities are so low that it creates tailrace conditions not advantageous to fish passage. If such flow conditions occur, alternative operations at the dam will be coordinated through the TMT.
  - Minimum generation: The minimum generation amount represents the operation of one unit at the lower end of its 1% efficiency range and is needed for power system reliability. This generation will be controlled to approximately 81 – 83 MW at units 1 – 3, the priority fish units. If these units are not available, the larger units 4 – 6 will be run at 100 - 104 MW. This should result in turbine flows of 11 kcfs – 12 kcfs at units 1 – 3 and 13 kcfs – 14 kcfs at units 4 – 6. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This situation may occur in early spring before the freshet and during the late summer period with low flow conditions.

Once the operations for research are completed, the spill patterns will return to normal operation as described in the FPP and to the spill levels as shown in the tables above.

Lower Monumental

Spring Spill Operations April 3 – June 20, 2007: Spill to the spill cap 24 hours/day. The estimated spring spill cap rate is 27 kcfs. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Approximately mid-April to early June. The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.

- Spring research operations: Two spill patterns will be used depending on total river flow. A bulk spill pattern (high gate opening alternative) will be evaluated at river flows less than 120 kcfs simulating an RSW operation. For river flow in excess of 120 kcfs, a more uniform spill pattern will be used. Final test conditions will be coordinated through the SRWG.

- Objectives of the biological test: The primary objective is to provide a relative survival estimate for fish using Radio Tags (RT) that travel volitionally through the project. This will provide a third year of survival and passage data for yearling Chinook and a second year of data for steelhead. This will be the second year of testing a spill pattern developed for use assuming an RSW installed in spillbay 8. A single treatment test is planned in order to provide a strong baseline estimate for future comparisons with different operations.

- Spill pattern during the biological test: Spill patterns in the FPP will be used (FPP Tables LMN-9 and LMN-10).

Operation considerations:

  - In the spring and summer, day average flows near 30 kcfs results in incompatible operations with Little Goose Dam and results in spill quantity fluctuation.
  - The Lower Monumental spill cap is affected by Little Goose Dam operations. Therefore, spill discharge could be lower than 27 kcfs.
  - The removable spillway weir (RSW) that was planned for installation and use beginning April 2007 will not be installed until after the 2007 fish spill season. However, pre-installation work at the spillway may result in temporary spill pattern changes in early April (about April 3 – 13). This is being coordinated through SCT and TMT. For diver and barge safety, spill will be confined to the south half of the spillway (4 spill bays) and will not exceed 27 kcfs during this special operation.
  - Operating units within the 1% of best efficiency range yields up to 19 kcfs per unit at each of the 6 units for a maximum hydraulic capacity of approximately 114 kcfs. The expected spill cap is 27 kcfs. Therefore, if total river discharge is greater than 149 kcfs the gas cap will be exceeded. Either lack of power load or unit outages can also cause forced spill above spill cap rates at higher total river discharges.

During non-test periods, the spill patterns will return to normal operation as described in the FPP and to the spill levels as shown in the tables above.

Summer Spill Operations June 21 – August 31, 2007: Spill 17 kcfs 24 hours per day, subject to gas cap limits. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: June 21 – August 31 (entire summer spill period). The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.

- Summer research operations: A single pattern spill survival and passage evaluation will continue into July. The acoustic telemetry study will extend beyond the summer spill period.

- Objectives of the biological test: Monitor fall Chinook movement with RT to provide a relative survival estimate. Additionally, there will be an acoustic telemetry study to characterize the relationship between fish movement, mortality, and hydrodynamic conditions in the reservoir during summer months. Findings are intended as a baseline for comparison to a RSW Post Construction Survival Evaluation study in 2008.

- Spill pattern during the biological test: FPP spill patterns will be used (FPP Table LMN-9).

Operation considerations:

  - As in the spring, the summer spill caps may be affected by Little Goose operations.
  - Contracts for unit breaker replacement and fire protection installation will be completed in 2007. Single unit outages are scheduled during mid-May through July. Multiple unit outages to complete the work are scheduled for August through September.
  - Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods when spill quantities are limited so that tailrace conditions are not advantageous to fish passage. This is interpreted to be a minimum of a 4 gate stop opening in spillbay 8 (6.2 kcfs), based on general model investigations during February 2007. If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
  - Minimum generation: The minimum generation amount represents the operation of one unit at the lower end of its 1% of best efficiency range and is needed for power system reliability. This generation will be controlled to approximately 81 – 83 MW at units 2 – 3, the priority fish units. If these units are not available, the larger units 4 – 6 will be run at 104 - 106 MW on units 4 – 6, or 126 – 129 MW on unit 1 which has welded fixed blades. This will result in turbine flows of approximately 11 kcfs – 14 kcfs at units 2 – 6 and 17 kcfs – 19 kcfs if unit 1 is used. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at

the dam. This limit may occur in early spring before the freshet and during the late summer period with low flow conditions.

Operations for research will continue throughout the summer spill period.

Ice Harbor

Spring Spill Operations April 3 – June 20, 2007: 45 kcfs day/spill cap night with the RSW operating. Nighttime spill hours are 1800 – 0500. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing (timing): Approximately April 20 – June 10. The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.

- Spring research operations: Randomized block schedule will be used to test the 2 conditions of 30% spill 24 hours per day and 45 kcfs day / spill cap night. Both treatments will have the RSW operating.

- Objectives of the biological test: Determine the passage rates and survival of fish during 2 operations of 30% spill 24 hours per day and 45 kcfs day / spill cap night.

- Spill pattern during the biological test: FPP spill patterns will be used (FPP Tables IHR-9 and IHR-10).

Operation considerations:

  - Powerhouse capacity at Ice Harbor is approximately 94 kcfs with all 6 units operating, while spill cap rates are about 100 kcfs. If total river flows exceed about 194 kcfs, TDG levels may exceed the limits set by the states of Oregon and Washington.
  - Minimum generation or higher powerhouse operation will occur at all times during both the spring and summer fish spill seasons in 2007. This is due to a transformer failure at BPA's Sacajawea transmission facility near the project. Mobile capacitor groups will be installed at BPA's Franklin transmission facility to partially resolve power system issues. In addition, continuous generation is required at Ice Harbor Dam for power system stability and reliability.

Operations for research will continue through the entire spring period.

Summer Spill Operations June 21 – August 31, 2007: 45 kcfs day/spill cap night with the RSW operating. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Approximately June 11 – July 10. The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.

- Summer research operations: Continue 30% spill vs. 45 kcfs day / spill cap night. Both treatments will have the RSW operating.

- Objectives of the biological test: Determine the passage rates and survival through all passage routes for subyearling fall Chinook.

- Spill pattern during the biological test: FPP spill patterns will be used (FPP Tables IHR-9 and IHR-10, same as spring).

Operation considerations:

  - Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. The minimum spill for Ice Harbor Dam is 15.2 kcfs, which includes providing spill through the RSW and training spill to ensure good tailrace egress conditions. If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
  - Minimum generation: The minimum generation amount represents the operation of one unit at the lower cavitation limit. The cavitation limit is within the 1% of best efficiency range. This generation will be controlled to approximately 65 – 70 MW at units 1 – 3, the priority fish units. If these units are not available, the larger units 4 – 6 will be run at 80 – 81 MW. This will result in turbine flows of approximately 9 kcfs – 10 kcfs at units 1 – 3 and 11 kcfs – 12 kcfs at units 4 – 6. There may be slight variations in the generation due to power system fluctuations. Also, the outflow will fluctuate because of changing head at the dam. This limit may occur in early spring before the freshet and during the late summer period with low flow conditions.
  - Sacajawea transformer failure will require continuous powerhouse operation at the minimum generation level or higher.
  - Contracts for unit breaker replacement and fire protection installation will remove 1 – 2 units at a time from service during early July through August.

Once research spill operations are completed, the 45 kcfs day / spill cap night spill pattern in the FPP with the RSW operating will be used (FPP Table IHR-10), at the levels shown in Table 3.

McNary

Spring Spill Operations April 10 – June 30, 2007: 40% spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: April to early June (tentative). The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.

- Spring research operations: 40% spill 24 hours/day for Prototype Temporary Spillway Weir (PTSW) testing. Two project spill configurations will be tested. Final test conditions will be coordinated through the SRWG.

- Objectives of the biological test:

    - Estimate passage and survival rates of yearling Chinook salmon under two treatments of project operations.
    - Estimate passage and survival rates of juvenile steelhead under two treatments of project operations.
    - Characterize juvenile salmon behavior in the forebay of McNary Dam under two treatments of project operations.

- Spill pattern: As outlined in an addendum to the FPP. The Corps' Walla Walla District coordinated with regional fishery managers and evaluated new spill patterns with general model observations. A two treatment test utilizing two different spill patterns is anticipated for research evaluation. Test spill patterns are provided in Appendix 1.

Operation considerations:

- During the periods when total river discharge exceeds approximately 320 kcfs, involuntary spill in excess of the states' TDG limits for fish passage, may occur.
- In addition, low power demand may also necessitate involuntary spill during any given spill treatment at total river discharges of less than 320 kcfs.

Once research spill operations are completed, the spill patterns will return to normal operation as described in the FPP (Table MCN-6).

Summer Spill Operations July 1 – August 31, 2007: 40% spill vs. 60% spill 24 hours/day. Spill conditions will be alternated every two days. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: Late June until August (tentative). The dates of testing will be dependent on the size of fish, fish availability, and the number of treatments needed for testing. Final dates for testing will be coordinated through the SRWG.

- Summer research operations: 40% spill 24 hours/day vs. 60% spill 24 hours/day. Continue to evaluate PTSW performance. The spill will be alternated in two day blocks which will be randomized during testing.

- Objectives of the biological test:

    - Estimate passage and survival rates of subyearling fall Chinook salmon under two treatments of project operations.
    - Characterize juvenile salmon behavior in the forebay of McNary Dam under two treatments of project operations.

- Spill pattern during the biological test: Spill pattern details were identified using the general model at ERDC by USACE Walla Walla District staff and representatives of the regional fisheries agencies and tribes. Test spill patterns are provided in Appendix 1. A single spill pattern will be tested at the 40% and 60% spill levels.

Operation considerations:

- Minimum generation: A minimum powerhouse discharge of 50 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 50 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 50 kcfs for all hours.
- If total river discharge drops below about 90 kcfs, 40% spill treatments may be reduced to maintain 50 kcfs powerhouse discharge. Similarly, if total river discharge drops below about 135 kcfs, 60% spill treatments may be reduced to maintain a 50 kcfs powerhouse discharge.
- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
- Units 11 and 12 are scheduled out of service July through August for transformer replacement.

Once research spill operations are completed, the spill patterns will return to normal operation as described in the FPP (Table MCN-6).

John Day

Spring Spill Operations April 10 – June 30, 2007: 0 kcfs spill day/60% spill night. Nighttime spill hours are 1800 – 0600 from April 10 through May 14 and 1900 – 0600 May 15 through June 30. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

Spring research operations: There is no research planned for 2007 that requires specific spill operations.

Operation considerations:

- The hydraulic capacity for John Day is approximately 272 kcfs with all 16 units operating. If total river discharge exceeds this level, involuntary spill will occur during the daytime.
- Planning for a 2008 PTSW test will occur, leading to 24-hour spring spill in 2008 at John Day.
- If total river flow exceeds approximately 400 kcfs at night, 60% night spill levels would be 160 kcfs which may exceed TDG levels.
- Units 5 – 8 are currently out of service and expected to return to service in late April. Units 4 and 5 are scheduled for overhaul during August through September.

Summer Spill Operations July 1 – August 31, 2007: 30% spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

Spill pattern during the biological test: There is no biological test planned for John Day in 2007, therefore no special operations are required. Spill patterns described in the FPP will be used.

Operation considerations:

- Minimum spill: During periods of low flow before the spring freshet and during the summer period, there may be periods where spill quantities are limited so that tailrace conditions are not advantageous to fish passage. If such a low flow condition occurs, alternative operations at the dam will be coordinated through the TMT.
- Minimum generation: A minimum powerhouse discharge of 50 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 50 kcfs flow cannot be

maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 50 kcfs for all hours.

- If river flows drop below about 75 kcfs then spill may need to drop below 30% spill in order to maintain station service and power system needs.

The Dalles

Spring Spill Operations April 10 – June 30, 2007: 40% spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Objectives of the biological test:
  - Smolt response to hydrodynamic conditions upstream of the ice and trash sluiceway will be evaluated in 2007. The DIDSON camera and acoustic Doppler current profiler will be used to collect field data for this study. No special spill operations are required for this test.

- Spill pattern during the biological test: The FPP spill patterns will be used. Spill patterns for high flows (450 kcfs or higher) are provided in Appendix 1. Research will not change spill patterns or levels.

Operation considerations:

- Spillway wire ropes at The Dalles Dam were replaced on Bays 1-9 in 2006. These bays are fully operational in 2007. It is anticipated that spill bays 10 – 22 can be operated in emergencies.
- When high river flows exceed those shown in the table below such that available bays 1 – 9 cannot maintain 40% spill, FPOM and TMT will discuss the preferred spill pattern and rate. The project may maintain 40% spill of the total river flow and depart from the spill pattern, or spill less than 40% of the total river flow using a pattern other than that shown in the FPP. At no time is spill recommend on the south side of the spillway (Bays 14-22) as this creates a poor tailrace egress condition for spillway-passed fish.
- There will be one or more turbine units out of service for most of the 2007 spill season. Units 5 and 6 will be out of service from late March to late April. Unit 17 will be out of service from late May to late June. Unit 18 will be out of service from late May to mid-July. Units 5 – 8 will be out of service from late July to late August, followed by units 9 – 12 out of service from late August into September.

Summer Spill Operations July 1 – August 31, 2007: 40% spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Objectives of the biological test:
    - Smolt response to hydrodynamic conditions upstream of the ice and trash sluiceway will be evaluated in 2007. The DIDSON camera and acoustic Doppler current profiler will be used to collect field data for this study. No special operations are required for this test.

- Spill pattern during the biological test: as outlined in the FPP. Research will not change spill patterns or levels.

Operation considerations:

- When high river flows exceed those shown in the table above such that available bays 1 – 9 cannot maintain 40% spill, FPOM and TMT will discuss the preferred spill pattern and rate. The project may maintain 40% spill of the total river flow and depart from the spill pattern, or spill less than 40% of the total river flow using a pattern other than that shown in the FPP. At no time is spill recommend on the south side of the spillway (Bays 14-22) as this creates a poor tailrace egress condition for spillway-passed fish.
- Minimum generation: A minimum powerhouse discharge of 50 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 50 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 50 kcfs for all hours.
- If river flows drop below about 90 kcfs then spill may need to drop below 40% spill in order to maintain station service and power system needs.

Bonneville

Spring Spill Operations April 10 – June 30, 2007: 100 kcfs spill 24 hours/day. See Table 3 for operational spill levels.

Changes in Operations for Research Purposes:

- Spill duration for testing: April 26 – June 7. The dates of testing will be dependent on the size of fish and fish availability. Final dates for testing will be coordinated through the SRWG.

- Spring research operations: 100 kcfs spill 24 hours/day.

- Objectives of the biological test: Estimate total survival of yearling Chinook passing through the dam and spillway. Focus will be on new spill patterns to improve project spill survival.

- Spill pattern during the biological test: Fish passage spill patterns for 81 – 100 kcfs discharge rates are provided in Appendix 1. For spill rates exceeding 100 kcfs, spill patterns described in the FPP will be used. Modified spill patterns may be developed at ERDC for discharge rates below 81 kcfs and above 100 kcfs. If so, these will be provided as an addendum to the FPP.

Operation considerations:

  - Minimum spill discharge rate is 50 kcfs. This is to provide acceptable juvenile fish egress conditions in the tailrace.
  - At spring flows less than 135 kcfs, spill will be less than 100 kcfs to maintain minimum powerhouse generation of 30 kcfs plus fish ladder and facility spill (e.g. corner collector).
  - Currently units 8, 10, 13, and 15 are out of service. Without these units operating, the current total hydraulic capacity for the two powerhouses is about 195 kcfs. Unit 13 is expected to return to service in late March, adding about 18 kcfs, (213 kcfs total). Unit 10 will be back in late April, adding 13 kcfs (226 kcfs total), and unit 15 is expected to be back in service by mid-May, adding 18 kcfs (244 kcfs total). Unit 8 will remain out of service through February 2008. Each of the reported dates is subject to change. If inflows exceed the capacities stated above plus 100 kcfs spill, spill levels will exceed the levels in the Agreement.

Summer Spill Operations July 1 through August 31, 2007: 75 kcfs day / spill cap night. The estimated summer spill cap rate is 120 kcfs. Daytime spill hours change periodically and are defined in FPP Table BON-6. See Table 3 for operational spill levels. The summer daytime spill discharge rate may increase to 81 – 83 kcfs, nighttime spill may be reduced to a specified level (not yet defined), and the start date of summer spill may be moved to June 21. These changes are being regionally coordinated. See Operation Considerations below for explanations.

Changes in Operations for Research Purposes:

- Spill duration for testing: Late June through July. Continue tests of new spill patterns in the summer. Final dates for testing will be coordinated through the SRWG.

- Summer research operations: 75 (or 81 – 83) kcfs spill day / spill cap night.

- Objectives of the biological test: Estimate total survival of subyearling Chinook passing through the dam and spillway. Focus will be on new spill patterns to improve project spill survival.

- Spill Patterns for summer operations: Fish passage spill patterns are provided in Appendix 1. For spill rates exceeding 100 kcfs, spill patterns described in the FPP will be used. Modified spill patterns may be developed at ERDC for discharge rates below 81 kcfs and above 100 kcfs. If so, these will be provided as an addendum to the FPP.

Operation considerations:

- Minimum generation: A minimum powerhouse discharge of 30 kcfs is required at all times to meet minimum generation requirements. The lower Columbia River dams provide some of the required generation capacity reserves for the power system. Due to this requirement and the constant fluctuations in power demands throughout the day, the 30 kcfs flow cannot be maintained precisely on an hourly basis. The flow may increase by as much as 10 kcfs for short periods. Therefore, the minimum generation flow should meet or exceed 30 kcfs for all hours.
- Minimum spill discharge level is 50 kcfs. This is to provide acceptable juvenile fish egress conditions in the tailrace.
- The summer daytime spill level may be 81 – 83 kcfs instead of 75 kcfs. In model studies at ERDC, higher discharges appear to provide a more effective spill pattern for juvenile fish egress than does the 75 kcfs pattern. Also, summer nighttime spill at Bonneville may be reduced from gas cap spill levels to a specified maximum spill discharge rate in kcfs (not yet defined). Because fish survival is currently less than desired at the Bonneville Dam spillway, there is a need to implement operational changes in 2007 to improve project passage conditions. This change has been coordinated through FPOM and will be coordinated through FFDRWG and TMT.
- For fish passage research, the start date for summer spill may be moved to June 21, rather than July 1. This would enable data collection through a larger portion of the subyearling Chinook salmon outmigration and thus improve the study. Fish passage and survival benefits are expected from this operational change as well. This has been coordinated through FPOM and will be coordinated through FFDRWG and TMT.

Juvenile Fish Transportation Program Operations

As noted above, the Corps' planned fish operations assume average runoff conditions. Based on collaborative discussion with the regional agencies and tribes, and as described in the Agreement, the following explains the juvenile fish transportation program under all runoff conditions. The lower Snake River projects are described first, followed by McNary project operations. Detailed descriptions of project and transport facility operations to implement the program are contained in FPP Appendix B.

Lower Snake River Dams - Operation and Timing:

If the Snake River projected seasonal average (April 3 – June 20) flow is greater than 70 kcfs, the Corps will initiate transportation at Lower Granite Dam no earlier than April 20 and no later

than May 1. The seasonal average flow projection will be based on the Corps' STP model and the April final water supply forecast for Lower Granite. The actual start date in 2007 will be determined through coordination with TMT as informed by the in-season river condition (e.g. river flow and temperature) and the status of the juvenile Chinook and steelhead runs (e.g. percentage of runs having passed the project). Also if the projected flow is greater than 70 kcfs, transportation will start 8 days and 11 days after the Lower Granite Dam start date for Little Goose and Lower Monumental dams, respectively. The actual start dates at Little Goose and Lower Monumental dams will be further considered through the TMT process, depending on in-season river conditions and the status of the juvenile Chinook and steelhead runs. As of April 18, the Corps is discussing with the region and signatory parties the start date criteria and transportation research actions that may occur prior to the start date.

In exceptionally low water years, when the projected seasonal average flow is less than 70 kcfs, the Corps will begin transportation on April 20 at all three Snake collector projects. Spill for fish passage will occur under all flow conditions.

a. Lower Granite: All ESBSs will be installed by March 25 and juvenile fish bypassed via normal separator operations and routed to the mid-river release outfall. All juvenile fish collected will be interrogated for PIT tags and normal 24-hour sampling for the Smolt Monitoring Program will take place.

b. Little Goose and Lower Monumental: All ESBSs and STSs will be installed by April 1 and juvenile fish bypassed will occur via the normal separator operations and fish will be routed to normal facility bypass outfalls. All juvenile fish will be interrogated for PIT tags and limited sampling may take place every 3 to 5 days to monitor fish condition.

April 20 – June 20: The collection of fish at lower Snake River projects for transportation will commence at 0700 hours on the agreed to start dates. Barging of fish will begin the following day and collected juvenile fish will be barged from each facility on a daily or every-other-day basis (depending on the number of fish) throughout the spring. Transport operations will be carried out concurrent with spill operations at each project and in accordance with all relevant FPP operating criteria.

June 21 – August 15: Transportation of juvenile fish from all three Snake River transport projects will continue on an every-other-day basis from June 21 through August 15, via barges.

August 16 – August 31: After August 15, trucks will be used for transporting juvenile fish from the Snake River collector projects on an every-other-day basis through August 31.

September 1 – Completion: Transportation of juvenile fish via trucks on an every-other-day basis will continue through October 31, 2007 at Lower Granite and Little Goose dams. At Lower Monumental Dam, transportation of fish via every-other-day trucking will continue through September 30, 2007.

McNary Dam - Operation and Timing:

Spring: Juvenile fish collected at McNary during the spring, April 1 through June 20, will be bypassed to the river. The normal operation will be to bypass fish through the full flow bypass pipe, which has interrogation capability to monitor for PIT tags. Every other day, however, in order to sample fish for the Smolt Monitoring Program, fish will be routed through the separator, interrogated for PIT tags, and then bypassed to the river.

Summer: When river conditions are determined to no longer be "spring like" as defined in the FPP and discussed at TMT, transportation of juvenile fish will begin. Collected juvenile fish will be barged every other day through August 16 unless they have been marked for in-river passage research. From August 16 through September 30, transportation will occur via trucks.

Navigation Safety

Short-term adjustments in spill patterns or reductions in spill discharge rates may be required for navigation safety, primarily at the lower Snake projects but may also be necessary at the lower Columbia projects. This includes both commercial tows and fish barges.

Emergency Protocols

The Corps will operate the projects in emergency situations in accordance with the Water Management Plan (WMP) Emergency Protocols (WMP Appendix 1). The Protocols define emergency conditions and situations that may arise which affect the generation and delivery of energy produced by the FCRPS, and the immediate actions that may be taken in the face of the emergency. The Corps, BPA, and the Bureau of Reclamation are revising the Emergency Protocols in coordination with TMT. The most recent version of the Emergency Protocols, dated August 22, 2006, is located at:
http://www.nwd-wc.usace.army.mil/tmt/documents/wmp/2007/draft/app1.pdf

Reporting

The Corps will prepare monthly (April – August) reports on the implementation of 2007 fish passage operations. The reports will include the following information:

- the hourly flow through the powerhouse;
- the hourly flow over the spillway compared to the spill target for that hour; and,
- the resultant 12-hour average TDG for the tailwater at each project and for the next project's forebay downstream.

The reports will also provide information on substantial issues that arise as a result of the spill program (e.g. Little Goose adult passage issue in 2005). The reports also will address any emergency situations that arise.

The Corps will continue to provide the following data to the public regarding project flow, spill rate, TDG level, and water temperature.

- Flow and spill quantity data for the lower Snake and Columbia River dams are posted to the following website every hour: http://www.nwd-wc.usace.army.mil/report/projdata.htm

- Water Quality: TDG and water temperature data are posted to the following website every six hours: http://www.nwd-wc.usace.army.mil/report/total.html These data are received via satellite from fixed monitoring sites in the Columbia and Snake rivers every six hours, and placed on a Corps public website upon receipt. Using the hourly TDG readings for each station in the lower Snake and Columbia rivers, the Corps calculates the highest 12-hour average TDG for each station. These averages are reported at: http://www.nwd-wc.usace.army.mil/ftppub/water_quality/12hr/html/

Appendix 1

Test Spill Patterns

Special spill patterns for 2007 tests and high flow conditions are provided for Little Goose, McNary, The Dalles, and Bonneville dams.

Little Goose Dam: Tapered Bulk Spill Pattern for 2007

Spill Bays -- Stops								Total Stops	Total Spill Q (kcfs)	Total PH Q (kcfs)	Total River Q (kcfs) *(see Note 1)*
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**				
	3							3	5.7	13.3	18.9
	4							4	7.7	17.9	25.5
	4	1						5	9.4	22.0	31.4
1	4	1						6	11.2	26.1	37.3
1	4	2						7	13.1	30.6	43.7
1	5	2						8	15.1	35.2	50.3
1	5	3						9	17.1	39.9	57.0
1	5	3	1					10	18.9	44.0	62.9
1	5	4	1					11	20.8	48.6	69.5
1	5	4	2					12	22.8	53.1	75.8
1	5	4	3					13	24.8	57.8	82.5
1	5	5	3					14	26.7	62.4	89.1
1	5	5	3	1				15	28.5	66.5	95.0
1	5	5	3	2				16	30.4	71.0	101.4
1	5	5	3	3				17	32.4	75.6	108.0
	5	4	3	3	2	1		18	34.1	79.6	113.7 *(Note 2)*
	5	4	3	3	2	2		19	36.0	84.0	120.1
	5	4	3	3	3	2		20	38.0	88.7	126.7
	5	4	3	3	3	3		21	40.0	93.4	133.4 *(Note 3)*
	5	4	4	3	3	3		22	42.0	98.0	140.0
	5	4	4	4	3	3		23	44.0	102.6	146.6
	5	4	4	4	4	3		24	46.0	107.2	153.2
	5	4	4	4	4	4		25	47.9	110.0	157.1 *(Note 4)*
	5	5	4	4	4	4		26	49.9	109.9	159.1
	5	5	5	4	4	4		27	51.9	109.9	161.1
	5	5	5	5	4	4		28	53.9	109.9	163.1
	5	5	5	5	5	4		29	55.9	109.9	165.1
	5	5	5	5	5	5		30	57.8	109.9	167.0
	6	5	5	5	5	5		31	59.8	109.9	169.0
	6	6	5	5	5	5		32	61.8	109.9	171.0
	6	6	6	5	5	5		33	63.8	109.9	173.0
	6	6	6	6	5	5		34	65.7	109.9	174.9
	6	6	6	6	6	5		35	67.7	109.9	176.9
	6	6	6	6	6	6		36	69.7	109.9	178.9
	7	6	6	6	6	6		37	71.6	109.9	180.8
	7	7	6	6	6	6		38	73.6	109.9	182.8
	7	7	7	6	6	6		39	75.5	109.9	184.7
	7	7	7	7	6	6		40	77.5	109.9	186.7
	7	7	7	7	7	6		41	79.4	109.9	188.6
	7	7	7	7	7	7		42	81.4	109.9	190.6
	8	7	7	7	7	7		43	83.3	109.9	192.5
	8	8	7	7	7	7		44	85.3	109.9	194.5
	8	8	8	7	7	7		45	87.3	109.9	196.5
	8	8	8	8	7	7		46	89.3	109.9	198.5
	8	8	8	8	8	7		47	91.3	109.9	200.5
	8	8	8	8	8	8		48	93.2	109.9	202.4
	9	8	8	8	8	8		49	95.2	109.9	204.4
	9	9	8	8	8	8		50	97.1	109.9	206.3

Spill Bays -- Stops								Total Stops	Total Spill Q (kcfs)	Total PH Q (kcfs)	Total River Q (kcfs) *(see Note 1)*
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**				
	9	9	9	8	8	8		51	99.1	109.9	208.3
	9	9	9	9	8	8		52	101.0	109.9	210.2
	9	9	9	9	9	8		53	102.9	109.9	212.1
	9	9	9	9	9	9		54	104.9	109.9	214.1
	10	9	9	9	9	9		55	106.9	109.9	216.1
	10	10	9	9	9	9		56	108.9	109.9	218.1
	10	10	10	9	9	9		57	110.9	109.9	220.1
	10	10	10	10	9	9		58	113.0	109.9	222.2
	10	10	10	10	10	9		59	115.0	109.9	224.2
	10	10	10	10	10	10		60	117.0	109.9	226.2
	11	10	10	10	10	10		61	119.0	109.9	228.2
	11	11	10	10	10	10		62	121.1	109.9	230.3
	11	11	11	10	10	10		63	123.1	109.9	232.3
	11	11	11	11	10	10		64	125.1	109.9	234.3
	11	11	11	11	11	10		65	127.2	109.9	236.4
	11	11	11	11	11	11		66	129.2	109.9	238.4
	12	11	11	11	11	11		67	131.2	109.9	240.4
	12	12	11	11	11	11		68	133.2	109.9	242.4
	12	12	12	11	11	11		69	135.3	109.9	244.5
	12	12	12	12	11	11		70	137.3	109.9	246.5
	12	12	12	12	12	11		71	139.3	109.9	248.5
	12	12	12	12	12	12		72	141.4	109.9	250.6
	13	12	12	12	12	12		73	143.4	109.9	252.6
	13	13	12	12	12	12		74	145.4	109.9	254.6
	13	13	13	12	12	12		75	147.4	109.9	256.6
	13	13	13	13	12	12		76	149.4	109.9	258.6
	13	13	13	13	13	12		77	151.4	109.9	260.6
	13	13	13	13	13	13		78	153.4	109.9	262.6
	14	13	13	13	13	13		79	155.4	109.9	264.6
	14	14	13	13	13	13		80	157.4	109.9	266.6
	14	14	14	13	13	13		81	159.4	109.9	268.6
	14	14	14	14	13	13		82	161.4	109.9	270.6
	14	14	14	14	14	13		83	163.4	109.9	272.6
	14	14	14	14	14	14		84	165.4	109.9	274.6
	15	14	14	14	14	14		85	167.4	109.9	276.6
	15	15	14	14	14	14		86	169.4	109.9	278.6
	15	15	15	14	14	14		87	171.4	109.9	280.6
	15	15	15	15	14	14		88	173.4	109.9	282.6
	15	15	15	15	15	14		89	175.4	109.9	284.6
	15	15	15	15	15	15		90	177.4	109.9	286.6
	16	15	15	15	15	15		91	179.3	109.9	288.5
	16	16	15	15	15	15		92	181.3	109.9	290.5
	16	16	16	15	15	15		93	183.3	109.9	292.5
	16	16	16	16	15	15		94	185.2	109.9	294.4
	16	16	16	16	16	15		95	187.2	109.9	296.4
	16	16	16	16	16	16		96	189.2	109.9	298.4

Notes (Little Goose):

1. The total river discharges shown in this table assume 30% spill. Actual total discharge (and thus % spill) may vary slightly for a given spill pattern to keep turbines within 1% of peak efficiency. This is true up to 25 total stops, after which powerhouse capacity is reached and higher than 30% spill will be required as in Note 4.
2. This is the spill level (18 total stops or 34.1 kcfs) where the spill pattern starts transitioning from a tapered bulk spill pattern to a uniform spill pattern, with 5 stops retained in Bay 2 to simulate an RSW. This will require 4 spillway gate setting changes between 17 and 18 total stops, rather than just 1. The intent is to transition between the tapered bulk spill pattern and the uniform spill pattern by the time the gas cap is reached.
3. This is the spill level (21 total stops or 40.0 kcfs) where the spill pattern reaches a nominal uniform spill pattern, with 5 stops retained in Bay 2 to simulate an RSW. This assumes the gas cap will be reached at about 40 kcfs spill discharge. If the actual gas cap is less than 40 kcfs spill, use the spill pattern in this table for the actual gas cap spill discharge, with a larger powerhouse discharge, rather than defaulting to a uniform spill pattern. This will result is less than 30% spill, but is deemed more desirable than disrupting the spill pattern.
4. This the approximate powerhouse discharge (110 kcfs) at which full powerhouse capacity is reached, with 6 turbine units operating within 1% peak efficiency rules. This is the maximum river discharge for which 30% spill can be maintained; above this will be a higher % spill.
5. Discharge estimates shown in this table are based on a forebay elevation of 634.0 ft.
6. Once the spill pattern starts transitioning to a uniform spill pattern for gas cap purposes, Bays 1 and 8 are not operated because there are no spillway deflectors in those bays.
7. Powerhouse unit priority should be 1 - 6. If more than one unit is operating, maximize discharge through the southernmost units, starting with Unit 1, to the extent possible without violating 1% peak efficiency rules. e.g. If powerhouse discharge is 26.0 kcfs, operate Unit 1 at 14.7 kcfs and Unit 2 at 11.3 kcfs, rather than both at 13.0 kcfs.

McNary Dam: Two modified spill patterns for 2007 tests (pages MCN-1 – MCN-10).

Table MCN-7. McNary "Modified 2006 Spill Pattern" for fish passage. (Discharge at forebay elevation 339)

(5 April 2007)

SPILLWAY BAY (Gate Opening in feet)																						Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
																			5.2		5.5	10.7	18.7
																		1	5.2		5.5	11.7	20.7
																		2	5.2		5.5	12.7	22.6
																		2	5.2	1	5.5	13.7	24.6
																	1	2	5.2	1	5.5	14.7	26.6
																	2	2	5.2	1	5.5	15.7	28.5
																1	2	2	5.2	1	5.5	16.7	30.5
																2	2	2	5.2	1	5.5	17.7	32.4
														1		2	2	2	5.2	1	5.5	18.7	34.4
														2		2	2	2	5.2	1	5.5	19.7	36.3
														1	1	3	2	2	5.2	1	5.5	20.7	38.1
														2	1	3	2	2	5.2	1	5.5	21.7	40.0
													1	2	1	3	2	2	5.2	1	5.5	22.7	42.0
													1	3	1	3	2	2	5.2	1	5.5	23.7	43.7
												1	1	3	1	3	2	2	5.2	1	5.5	24.7	45.7
												2	1	3	1	3	2	2	5.2	1	5.5	25.7	47.6
												2	1	3	2	3	2	2	5.2	1	5.5	26.7	49.5
												2	1	3	3	3	2	2	5.2	1	5.5	27.7	51.2
										1		2	1	3	3	3	2	2	5.2	1	5.5	28.7	53.2
										2		2	1	3	3	3	2	2	5.2	1	5.5	29.7	55.1
										2		2	2	3	3	3	2	2	5.2	1	5.5	30.7	57.0
										2		3	2	3	3	3	2	2	5.2	1	5.5	31.7	58.7
										2	1	3	2	3	3	3	2	2	5.2	1	5.5	32.7	60.7
										2	1	3	2	3	3	3	2	2	5.2	2	5.5	33.7	62.6
								1		2	1	3	2	3	3	3	2	2	5.2	2	5.5	34.7	64.6

1) TSWs in bays 20 and 22 have flow equivalent to 5.2 and 5.5 stops at forebay elevation of 339, respectively.

2) Raise gates for TSWs approximately 3 to 5 feet above water surface to ensure free surface and debris passage.

Table MCN-7. McNary "Modified 2006 Spill Pattern" for fish passage. (Discharge at forebay elevation 339)

(5 April 2007)

SPILLWAY BAY (Gate Opening in feet)																						Total Stops	Total Spill
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		(kcfs)
								2		2	1	3	2	3	3	3	2	2	5.2	2	5.5	35.7	66.5
								2	1	2	1	3	2	3	3	3	2	2	5.2	2	5.5	36.7	68.5
						1		2	1	2	1	3	2	3	3	3	2	2	5.2	2	5.5	37.7	70.5
						2		2	1	2	1	3	2	3	3	3	2	2	5.2	2	5.5	38.7	72.4
						2		2	1	2	1	3	2	3	4	3	2	2	5.2	2	5.5	39.7	74.0
				1		2		2	1	2	1	3	2	3	4	3	2	2	5.2	2	5.5	40.7	76.0
				2		2		2	1	2	1	3	2	3	4	3	2	2	5.2	2	5.5	41.7	77.9
2.5	2	3.5	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	5.2		5.5	42.7	81.0
2.5	2	3.5	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	5.2	1	5.5	43.7	83.0
2.5	2	3.5	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	5.2	2	5.5	44.7	84.9
2.5	2	3.5	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	2	5.2	2	5.5	45.7	86.8
2.5	2	3.5	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	3	5.2	2	5.5	46.7	88.5
2.5	2	3.5	1	2	1	2	1	2	1	2	1	2	1	2	2	2	2	3	5.2	2	5.5	47.7	90.4
2.5	2	3.5	1	2	2	2	1	2	1	2	1	2	1	2	2	2	2	3	5.2	2	5.5	48.7	92.3
2.5	2	3.5	1	2	2	2	1	2	2	2	1	2	1	2	2	2	2	3	5.2	2	5.5	49.7	94.2
2.5	2	3.5	1	2	2	2	1	2	2	2	2	2	1	2	2	2	2	3	5.2	2	5.5	50.7	96.1
2.5	2	3.5	1	2	2	2	2	2	2	2	2	2	1	2	2	2	2	3	5.2	2	5.5	51.7	98.0
2.5	2	3.5	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5.2	2	5.5	52.7	99.9
2.5	2	3.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5.2	2	5.5	53.7	101.8
2.5	2.5	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5.2	2	5.5	54.7	103.4
2.5	2.5	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	5.2	3	5.5	55.7	105.1
2.5	2.5	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	5.2	3	5.5	56.7	106.8
2.5	2.5	4	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2.5	3	3	5.2	3	5.5	57.7	108.5
2.5	2.5	4	2	2	2	2.5	2	2	2	2.5	2	2	2	2	2.5	2.5	3	3	5.2	3	5.5	58.7	110.2
2.5	2.5	4	2	2.5	2	2.5	2	2	2	2.5	2	2	2	2.5	2.5	2.5	3	3	5.2	3	5.5	59.7	111.9

1) TSWs in bays 20 and 22 have flow equivalent to 5.2 and 5.5 stops at forebay elevation of 339, respectively.

2) Raise gates for TSWs approximately 3 to 5 feet above water surface to ensure free surface and debris passage.

Table MCN-7. McNary "Modified 2006 Spill Pattern" for fish passage. (Discharge at forebay elevation 339)

(5 April 2007)

SPILLWAY BAY (Gate Opening in feet)																						Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
2.5	2.5	4	2	2.5	2	2.5	2	2.5	2	2.5	2	2.5	2	2.5	2.5	2.5	3	3	5.2	3	5.5	60.7	113.6
2.5	2.5	4	2	2.5	2.5	2.5	2	2.5	2.5	2.5	2	2.5	2	2.5	2.5	2.5	3	3	5.2	3	5.5	61.7	115.3
2.5	2.5	4	2	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2	2.5	2.5	2.5	3	3	5.2	3	5.5	62.7	117.0
2.5	2.5	4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3	5.2	3	5.5	63.7	118.7
2.5	2.5	4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	3	3	3	5.2	3	5.5	64.7	120.4
2.5	2.5	4.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	2.5	2.5	2.5	2.5	3	3	3	3	5.2	3	5.5	65.7	122.1
2.5	2.5	4.5	2.5	2.5	2.5	3	2.5	2.5	2.5	3	2.5	3	2.5	2.5	3	3	3	3	5.2	3	5.5	66.7	123.8
2.5	2.5	4.5	2.5	3	2.5	3	2.5	3	2.5	3	2.5	3	2.5	2.5	3	3	3	3	5.2	3	5.5	67.7	125.5
2.5	2.5	4.5	2.5	3	3	3	2.5	3	2.5	3	2.5	3	2.5	3	3	3	3	3	5.2	3	5.5	68.7	127.2
2.5	2.5	4.5	2.5	3	3	3	2.5	3	3	3	2.5	3	3	3	3	3	3	3	5.2	3	5.5	69.7	128.9
2.5	2.5	4.5	2.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5.2	3	5.5	70.7	130.6
2.5	2.5	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5.2	3	5.5	71.7	132.2
3	3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5.2	3	5.5	72.7	133.9
3	3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	5.2	3	5.5	73.7	135.5
3	3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	5.2	3	5.5	74.7	137.1
3	3	5	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	5.2	3	5.5	75.7	138.7
3	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	5.2	3	5.5	76.7	140.3
4	4	5	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	5.2	3	5.5	77.7	141.9
4	4	5	3	3	3	4	3	3	3	3	3	3	3	3	3	4	4	4	5.2	3	5.5	78.7	143.5
4	4	5	3	3	3	4	3	3	3	4	3	3	3	3	3	4	4	4	5.2	3	5.5	79.7	145.1
4	4	5	3	4	3	4	3	3	3	4	3	3	3	3	3	4	4	4	5.2	3	5.5	80.7	146.7
4	4	5	3	4	3	4	3	3	3	4	3	3	3	4	3	4	4	4	5.2	3	5.5	81.7	148.3
4	4	5	3	4	3	4	3	4	3	4	3	3	3	4	3	4	4	4	5.2	3	5.5	82.7	149.9
4	4	5	3	4	3	4	3	4	3	4	3	4	3	4	3	4	4	4	5.2	3	5.5	83.7	151.5
4	4	5	3	4	3	4	3	4	3	4	3	4	3	4	4	4	4	4	5.2	3	5.5	84.7	153.1

1) TSWs in bays 20 and 22 have flow equivalent to 5.2 and 5.5 stops at forebay elevation of 339, respectively.

2) Raise gates for TSWs approximately 3 to 5 feet above water surface to ensure free surface and debris passage.

Table MCN-7. McNary "Modified 2006 Spill Pattern" for fish passage. (Discharge at forebay elevation 339)

(5 April 2007)

SPILLWAY BAY (Gate Opening in feet)																						Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
4	4	5	3	4	4	4	3	4	3	4	3	4	3	4	4	4	4	4	5.2	3	5.5	85.7	154.7
4	4	5	3	4	4	4	3	4	4	4	3	4	3	4	4	4	4	4	5.2	3	5.5	86.7	156.3
4	4	5	3	4	4	4	3	4	4	4	4	4	3	4	4	4	4	4	5.2	3	5.5	87.7	157.9
4	4	5	3	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	5.2	3	5.5	88.7	159.5
4	4	5	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5.2	3	5.5	89.7	161.1
4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5.2	3	5.5	90.7	162.7
4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5.2	4	5.5	91.7	164.3
4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5.2	4	5.5	92.7	165.9
4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5.2	4	5.5	93.7	167.5
4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5.2	4	5.5	94.7	169.1
4	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5.2	4	5.5	95.7	170.7
5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5.2	4	5.5	96.7	172.3
5	5	5	4	4	4	5	4	4	4	4	4	4	4	4	4	5	5	5	5.2	4	5.5	97.7	173.9
5	5	5	4	4	4	5	4	4	4	5	4	4	4	4	4	5	5	5	5.2	4	5.5	98.7	175.5
5	5	5	4	5	4	5	4	4	4	5	4	4	4	4	4	5	5	5	5.2	4	5.5	99.7	177.1
5	5	5	4	5	4	5	4	4	4	5	4	4	4	5	4	5	5	5	5.2	4	5.5	100.7	178.7
5	5	5	4	5	4	5	4	5	4	5	4	4	4	5	4	5	5	5	5.2	4	5.5	101.7	180.3
5	5	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	5	5	5.2	4	5.5	102.7	181.9
5	5	5	4	5	4	5	4	5	4	5	4	5	4	5	4	5	5	5	5.2	5	5.5	103.7	183.5
5	5	5	4	5	4	5	4	5	4	5	4	5	4	5	5	5	5	5	5.2	5	5.5	104.7	185.1
5	5	5	4	5	5	5	4	5	4	5	4	5	4	5	5	5	5	5	5.2	5	5.5	105.7	186.7
5	5	5	4	5	5	5	4	5	5	5	4	5	4	5	5	5	5	5	5.2	5	5.5	106.7	188.3
5	5	5	4	5	5	5	4	5	5	5	5	5	4	5	5	5	5	5	5.2	5	5.5	107.7	189.9
5	5	5	4	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5.2	5	5.5	108.7	191.5
5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5.2	5	5.5	109.7	193.1

1) TSWs in bays 20 and 22 have flow equivalent to 5.2 and 5.5 stops at forebay elevation of 339, respectively.

2) Raise gates for TSWs approximately 3 to 5 feet above water surface to ensure free surface and debris passage.

Table MCN-7. McNary "Modified 2006 Spill Pattern" for fish passage. (Discharge at forebay elevation 339)

(5 April 2007)

SPILLWAY BAY (Gate Opening in feet)																						Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5.2	5	5.5	110.7	194.7
5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5.2	5	5.5	111.7	196.3
5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	5.2	5	5.5	112.7	197.9
5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	6	6	5.2	5	5.5	113.7	199.5
5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6	5.2	5	5.5	114.7	201.1
5	5	6	5	5	5	5	5	5	5	5	5	5	5	5	6	6	6	6	5.2	5	5.5	115.7	202.7
5	5	6	5	5	5	5	5	5	5	5	5	5	5	6	6	6	6	6	5.2	5	5.5	116.7	204.3
5	5	6	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	5.2	5	5.5	118.7	207.5
5	5	6	6	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	5.2	6	5.5	120.7	210.7
5	5	6	6	6	5	5	5	5	5	5	6	6	6	6	6	6	6	6	5.2	6	5.5	122.7	213.9
5	5	6	6	6	5	6	5	5	5	6	6	6	6	6	6	6	6	6	5.2	6	5.5	124.7	217.1
5	5	6	6	6	6	6	5	6	5	6	6	6	6	6	6	6	6	6	5.2	6	5.5	126.7	220.3
5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5.2	6	5.5	128.7	223.5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5.2	6	5.5	130.7	226.7
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	5.2	7	5.5	132.7	229.9
6	6	6	6	6	6	6	6	6	6	7	6	7	6	7	6	7	6	6	5.2	6	5.5	134.7	233.1
6	6	6	6	6	6	7	6	7	6	7	6	7	6	7	6	7	6	6	5.2	6	5.5	136.7	236.3
6	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	6	5.2	6	5.5	138.7	239.5
7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	7	6	5.2	6	5.5	140.7	242.7
7	6	7	6	7	6	7	6	7	6	7	6	7	7	7	7	7	7	6	5.2	6	5.5	142.7	245.9
7	6	7	6	7	6	7	6	7	7	7	7	7	7	7	7	7	7	6	5.2	6	5.5	144.7	249.1
7	6	7	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	5.2	6	5.5	146.7	252.3
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	5.2	6	5.5	148.7	255.5
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5.2	7	5.5	150.7	258.7

1) TSWs in bays 20 and 22 have flow equivalent to 5.2 and 5.5 stops at forebay elevation of 339, respectively.

2) Raise gates for TSWs approximately 3 to 5 feet above water surface to ensure free surface and debris passage.

Table MCN-8. McNary "2007 Test Spill Pattern" for fish passage. (Discharge at forebay elevation 339)

(5 April 2007)

SPILLWAY BAY (Gate Opening in feet)																						Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
																			5.2		5.5	10.7	18.7
																		1	5.2		5.5	11.7	20.7
																		2	5.2		5.5	12.7	22.6
																		2	5.2	1	5.5	13.7	24.6
																	1	2	5.2	1	5.5	14.7	26.6
																	2	2	5.2	1	5.5	15.7	28.5
																1	2	2	5.2	1	5.5	16.7	30.5
																2	2	2	5.2	1	5.5	17.7	32.4
														1		2	2	2	5.2	1	5.5	18.7	34.4
														2		2	2	2	5.2	1	5.5	19.7	36.3
														2	1	2	2	2	5.2	1	5.5	20.7	38.3
														2	1	3	2	2	5.2	1	5.5	21.7	40.0
													1	2	1	3	2	2	5.2	1	5.5	22.7	42.0
													1	3	1	3	2	2	5.2	1	5.5	23.7	43.7
												1	1	3	1	3	2	2	5.2	1	5.5	24.7	45.7
												2	1	3	1	3	2	2	5.2	1	5.5	25.7	47.6
												2	1	3	2	3	2	2	5.2	1	5.5	26.7	49.5
												2	1	3	3	3	2	2	5.2	1	5.5	27.7	51.2
										1		2	1	3	3	3	2	2	5.2	1	5.5	28.7	53.2
										2		2	1	3	3	3	2	2	5.2	1	5.5	29.7	55.1
										2		2	2	3	3	3	2	2	5.2	1	5.5	30.7	57.0
										2		3	2	3	3	3	2	2	5.2	1	5.5	31.7	58.7
										2	1	3	2	3	3	3	2	2	5.2	1	5.5	32.7	60.7
										2	1	3	2	3	3	3	2	2	5.2	2	5.5	33.7	62.6
								1		2	1	3	2	3	3	3	2	2	5.2	2	5.5	34.7	64.6

1) TSWs in bays 20 and 22 have flow equivalent to 5.2 and 5.5 stops at forebay elevation of 339, respectively.

2) Raise gates for TSWs approximately 3 to 5 feet above water surface to ensure free surface and debris passage.

Table MCN-8. McNary "2007 Test Spill Pattern" for fish passage. (Discharge at forebay elevation 339)

(5 April 2007)

SPILLWAY BAY (Gate Opening in feet)																						Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
								2		2	1	3	2	3	3	3	2	2	5.2	2	5.5	35.7	66.5
								2	1	2	1	3	2	3	3	3	2	2	5.2	2	5.5	36.7	68.5
						1		2	1	2	1	3	2	3	3	3	2	2	5.2	2	5.5	37.7	70.5
						2		2	1	2	1	3	2	3	3	3	2	2	5.2	2	5.5	38.7	72.4
						2		2	1	2	1	3	2	3	4	3	2	2	5.2	2	5.5	39.7	74.0
				1		2		2	1	2	1	3	2	3	4	3	2	2	5.2	2	5.5	40.7	76.0
				2		2		2	1	2	1	3	2	3	4	3	2	2	5.2	2	5.5	41.7	77.9
2.5	2	3.5		2		2		2		2		2		3	4	3	2	1	5.2	1	5.5	42.7	79.6
2.5	2	3.5		2		2		2		2		2		3	4	3	2	1	5.2	2	5.5	43.7	81.5
2.5	2	3.5		2		2		2		2		2	1	3	4	3	2	1	5.2	2	5.5	44.7	83.5
2.5	2	3.5		2		2		2		2		2	1	3	4	3	2	2	5.2	2	5.5	45.7	85.4
2.5	2	3.5		2		2		2		2		2	2	3	4	3	2	2	5.2	2	5.5	46.7	87.3
2.5	2	3.5		2		2		2		2	1	2	2	3	4	3	2	2	5.2	2	5.5	47.7	89.3
2.5	2	3.5		2	1	2		2		2	1	2	2	3	4	3	2	2	5.2	2	5.5	48.7	91.3
2.5	2	3.5		2	1	2		2	1	2	1	2	2	3	4	3	2	2	5.2	2	5.5	49.7	93.3
2.5	2	3.5		2	1	2	1	2	1	2	1	2	2	3	4	3	2	2	5.2	2	5.5	50.7	95.3
2.5	2	3.5	1	2	1	2	1	2	1	2	1	2	2	3	4	3	2	2	5.2	2	5.5	51.7	97.3
2.5	2	3.5	1	2	1	2	1	2	1	2	2	2	2	3	4	3	2	2	5.2	2	5.5	52.7	99.2
2.5	2	3.5	1	2	1	2	1	2	1	2	2	2	2	3	4	4	2	2	5.2	2	5.5	53.7	100.8
2.5	2	4.5	1	2	1	2	1	2	1	2	2	2	2	3	4	4	2	2	5.2	2	5.5	54.7	102.4
2.5	2	4.5	1	2	1	2	1	2	1	2	2	2	3	3	4	4	2	2	5.2	2	5.5	55.7	104.1
2.5	2	4.5	1	2	1	2	1	2	1	2	2	2	3	3	5	4	2	2	5.2	2	5.5	56.7	105.7
2.5	2	4.5	1	2	1	2	1	2	1	2	2	2	3	3	5	5	2	2	5.2	2	5.5	57.7	107.3
2.5	2	4.5	1	2	1	2	1	2	1	2	2	2	3	3	5	5	2	2	5.2	3	5.5	58.7	109.0
2.5	2	4.5	1	2	1	2	1	2	1	2	2	2	3	3	5	5	3	2	5.2	3	5.5	59.7	110.7

1) TSWs in bays 20 and 22 have flow equivalent to 5.2 and 5.5 stops at forebay elevation of 339, respectively.

2) Raise gates for TSWs approximately 3 to 5 feet above water surface to ensure free surface and debris passage.

Table MCN-8. McNary "2007 Test Spill Pattern" for fish passage. (Discharge at forebay elevation 339)

(5 April 2007)

SPILLWAY BAY (Gate Opening in feet)																						Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
2.5	2	4.5	2	2	1	2	1	2	1	2	2	2	3	3	5	5	3	2	5.2	3	5.5	60.7	112.6
2.5	2	4.5	2	2	2	2	1	2	1	2	2	2	3	3	5	5	3	2	5.2	3	5.5	61.7	114.5
2.5	2	4.5	2	2	2	2	1	2	2	2	2	2	3	3	5	5	3	2	5.2	3	5.5	62.7	116.4
2.5	2	4.5	2	2	2	2	2	2	2	2	2	2	3	3	5	5	3	2	5.2	3	5.5	63.7	118.3
2.5	2	4.5	2	2	2	2	2	2	2	2	2	2	3	4	5	5	3	2	5.2	3	5.5	64.7	119.9
2.5	2	4.5	2	2	2	2	2	2	2	2	2	3	3	4	5	5	3	2	5.2	3	5.5	65.7	121.6
2.5	2	4.5	2	2	2	2	2	2	2	2	2	3	4	4	5	5	3	2	5.2	3	5.5	66.7	123.2
3	2	5	2	2	2	2	2	2	2	2	2	3	4	4	5	5	3	2	5.2	3	5.5	67.7	124.8
3	3	5	2	2	2	2	2	2	2	2	2	3	4	4	5	5	3	2	5.2	3	5.5	68.7	126.5
3	3	5	2	2	2	2.5	2	2	2	2.5	2	3	4	4	5	5	3	2	5.2	3	5.5	69.7	128.2
3	3	5	2	2.5	2	2.5	2	2.5	2	2.5	2	3	4	4	5	5	3	2	5.2	3	5.5	70.7	129.9
3	3	5	2	2.5	2	2.5	2	2.5	2	2.5	2	3	4	5	5	5	3	2	5.2	3	5.5	71.7	131.5
3	3	5	2.5	2.5	2	2.5	2	2.5	2	2.5	2.5	3	4	5	5	5	3	2	5.2	3	5.5	72.7	133.2
3	3	5	2.5	2.5	2	2.5	2	2.5	2	2.5	2.5	3	5	5	5	5	3	2	5.2	3	5.5	73.7	134.8
4	3	5	2.5	2.5	2	2.5	2	2.5	2	2.5	2.5	3	5	5	5	5	3	2	5.2	3	5.5	74.7	136.4
4	3	5	3	2.5	2	2.5	2	2.5	2	2.5	3	3	5	5	5	5	3	2	5.2	3	5.5	75.7	138.1
4	3	5	3	2.5	2	2.5	2	2.5	2	2.5	3	4	5	5	5	5	3	2	5.2	3	5.5	76.7	139.7
4	3	5	3	2.5	2	2.5	2	2.5	2	2.5	3	4	5	6	5	5	3	2	5.2	3	5.5	77.7	141.3
4	3	6	3	2.5	2	2.5	2	2.5	2	2.5	3	4	5	6	5	5	3	2	5.2	3	5.5	78.7	142.9
4	3	6	3	2.5	2	2.5	2	2.5	2	2.5	3	4	5	6	5	5	3	3	5.2	3	5.5	79.7	144.6
4	3	6	3	2.5	2	2.5	2	2.5	2	2.5	3	4	5	6	5	5	4	3	5.2	3	5.5	80.7	146.2
4	3	6	4	2.5	2	2.5	2	2.5	2	2.5	3	4	5	6	5	5	4	3	5.2	3	5.5	81.7	147.8
4	3	6	4	2.5	2	2.5	2	2.5	2	2.5	3	4	5	6	6	5	4	3	5.2	3	5.5	82.7	149.4
4	3	6	4	2.5	2	3	2	2.5	2	3	3	4	5	6	6	5	4	3	5.2	3	5.5	83.7	151.1
4	3	6	4	3	2	3	2	3	2	3	3	4	5	6	6	5	4	3	5.2	3	5.5	84.7	152.8

1) TSWs in bays 20 and 22 have flow equivalent to 5.2 and 5.5 stops at forebay elevation of 339, respectively.

2) Raise gates for TSWs approximately 3 to 5 feet above water surface to ensure free surface and debris passage.

Table MCN-8. McNary "2007 Test Spill Pattern" for fish passage. (Discharge at forebay elevation 339)

(5 April 2007)

SPILLWAY BAY (Gate Opening in feet)																					Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
4	4	6	4	3	2	3	2	3	2	3	3	4	5	6	6	5	4	3	5.2	3	5.5	85.7	154.4
4	4	6	4	3	2	3	2	3	2	3	3	4	5	6	6	5	4	4	5.2	3	5.5	86.7	156.0
4	4	6	4	3	2	3	2	3	2	3	3	4	5	6	6	5	5	4	5.2	3	5.5	87.7	157.6
4	4	6	4	3	2.5	3	2	3	2.5	3	3	4	5	6	6	5	5	4	5.2	3	5.5	88.7	159.3
4	4	6	4	3	2.5	3	3	3	2.5	3	3	4	5	6	6	5	5	4	5.2	3	5.5	89.7	161.0
4	4	6	4	3	3	3	3	3	3	3	3	4	5	6	6	5	5	4	5.2	3	5.5	90.7	162.7
4	4	6	4	3	3	3	3	3	3	3	3	4	6	6	6	5	5	4	5.2	3	5.5	91.7	164.3
4	4	6	4	3	3	3	3	3	3	3	4	4	6	6	6	5	5	4	5.2	3	5.5	92.7	165.9
4	4	6	4	3	3	3	3	3	3	3	4	4	6	6	6	5	5	4	5.2	4	5.5	93.7	167.5
4	4	6	4	4	3	3	3	3	3	3	4	4	6	6	6	5	5	4	5.2	4	5.5	94.7	169.1
4	4	6	4	4	3	4	3	3	3	3	4	4	6	6	6	5	5	4	5.2	4	5.5	95.7	170.7
4	4	6	4	4	3	4	3	3	3	4	4	4	6	6	6	5	5	4	5.2	4	5.5	96.7	172.3
4	4	6	4	4	3	4	3	4	3	4	4	4	6	6	6	5	5	4	5.2	4	5.5	97.7	173.9
4	4	6	4	4	4	4	3	4	3	4	4	4	6	6	6	5	5	4	5.2	4	5.5	98.7	175.5
4	4	6	4	4	4	4	3	4	4	4	4	4	6	6	6	5	5	4	5.2	4	5.5	99.7	177.1
4	4	6	4	4	4	4	4	4	4	4	4	4	6	6	6	5	5	4	5.2	4	5.5	100.7	178.7
4	4	6	4	4	4	4	4	4	4	4	4	4	6	6	6	5	5	5	5.2	4	5.5	101.7	180.3
4	4	6	4	4	4	4	4	4	4	4	4	4	6	6	6	5	5	5	5.2	5	5.5	102.7	181.9
4	4	6	4	4	4	4	4	4	4	4	4	5	6	6	6	5	5	5	5.2	5	5.5	103.7	183.5
4	4	6	5	4	4	4	4	4	4	4	4	5	6	6	6	5	5	5	5.2	5	5.5	104.7	185.1
4	4	6	5	4	4	4	4	4	4	4	4	5	6	6	6	6	5	5	5.2	5	5.5	105.7	186.7
4	4	6	5	4	4	4	4	4	4	4	4	6	6	6	6	6	5	5	5.2	5	5.5	106.7	188.3
4	4	6	5	4	4	4	4	4	4	4	5	6	6	6	6	6	5	5	5.2	5	5.5	107.7	189.9
4	4	6	5	5	4	4	4	4	4	4	5	6	6	6	6	6	5	5	5.2	5	5.5	108.7	191.5
4	4	6	5	5	4	5	4	4	4	4	5	6	6	6	6	6	5	5	5.2	5	5.5	109.7	193.1

1) TSWs in bays 20 and 22 have flow equivalent to 5.2 and 5.5 stops at forebay elevation of 339, respectively.

2) Raise gates for TSWs approximately 3 to 5 feet above water surface to ensure free surface and debris passage.

Table MCN-8. McNary "2007 Test Spill Pattern" for fish passage. (Discharge at forebay elevation 339)

(5 April 2007)

SPILLWAY BAY (Gate Opening in feet)																						Total Stops	Total Spill (kcfs)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
4	4	6	5	5	4	5	4	4	4	5	5	6	6	6	6	6	5	5	5.2	5	5.5	110.7	194.7
4	4	6	5	5	4	5	4	5	4	5	5	6	6	6	6	6	5	5	5.2	5	5.5	111.7	196.3
4	4	6	5	5	5	5	4	5	4	5	5	6	6	6	6	6	5	5	5.2	5	5.5	112.7	197.9
4	4	6	5	5	5	5	4	5	5	5	5	6	6	6	6	6	5	5	5.2	5	5.5	113.7	199.5
4	4	6	5	5	5	5	5	5	5	5	5	6	6	6	6	6	5	5	5.2	5	5.5	114.7	201.1
4	4	6	6	5	5	5	5	5	5	5	5	6	6	6	6	6	5	5	5.2	5	5.5	115.7	202.7
4	4	6	6	5	5	5	5	5	5	5	5	6	6	6	6	6	6	5	5.2	5	5.5	116.7	204.3
5	5	6	6	5	5	5	5	5	5	5	5	6	6	6	6	6	6	5	5.2	5	5.5	118.7	207.5
5	5	6	6	6	5	5	5	5	5	5	6	6	6	6	6	6	6	5	5.2	5	5.5	120.7	210.7
5	5	6	6	6	5	6	5	5	5	6	6	6	6	6	6	6	6	5	5.2	5	5.5	122.7	213.9
5	5	6	6	6	6	6	5	6	5	6	6	6	6	6	6	6	6	5	5.2	5	5.5	124.7	217.1
5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5.2	5	5.5	126.7	220.3
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	5.2	5	5.5	128.7	223.5
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5.2	6	5.5	130.7	226.7
6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	6	7	6	6	5.2	6	5.5	132.7	229.9
6	6	6	6	6	6	6	6	6	6	7	6	7	6	7	6	7	6	6	5.2	6	5.5	134.7	233.1
6	6	6	6	6	6	7	6	7	6	7	6	7	6	7	6	7	6	6	5.2	6	5.5	136.7	236.3
6	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	6	5.2	6	5.5	138.7	239.5
7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	7	6	5.2	6	5.5	140.7	242.7
7	6	7	6	7	6	7	6	7	6	7	6	7	7	7	7	7	7	6	5.2	6	5.5	142.7	245.9
7	6	7	6	7	6	7	6	7	7	7	7	7	7	7	7	7	7	6	5.2	6	5.5	144.7	249.1
7	6	7	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	5.2	6	5.5	146.7	252.3
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	5.2	6	5.5	148.7	255.5
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5.2	7	5.5	150.7	258.7

1) TSWs in bays 20 and 22 have flow equivalent to 5.2 and 5.5 stops at forebay elevation of 339, respectively.

2) Raise gates for TSWs approximately 3 to 5 feet above water surface to ensure free surface and debris passage.

The Dalles Dam:

The Dalles Dam, Special and Emergency Spill Operations, 2007 (and beyond). A total river volume greater than 450,000 cfs is possible that would require additional spillway flows. With Bays 10 – 23 out-of-service, the table below shows the special and emergency spill operations that are recommended at TDA in 2007 to safely accommodate higher flows.

Spill condition	Bays in use	Gate Opening (ft)	Spillway Q (cfs)	Powerhouse Q (cfs)	Total Q (cfs)
Normal, 40% BiOp	1-6 + 7-9	14 + 12	180,000	270,000	450,000
Special spill	1-9	14	189,000	270,000	459,000
	1-6 + 7-9	15 + 14	198,000	270,000	468,000
	1-9	15	202,500	270,000	472,500
	1-6 + 7 -9	16 + 15	211,500	270,000	481,500
	1-9	16	216,000	270,000	486,000
	Continue sequence	Continue sequence			
	1-9	30	405,000	270,000	**675,000***
Emergency spill	1-9 + 14	30	450,000	270,000	720,000
	1-9 + 14-15	30	495,000	270,000	765,000
	1-9 + 14-16	30	540,000	270,000	810,000
	1-9 + 14-17	30	585,000	270,000	855,000
	Continue sequence to Bay 21	Max. of 30' opening			
	1-9 + 14-21	30	765,000	270,000	1,035,000
	1-9 + 12 + 14-21	30	810,000	270,000	1,080,000
	1-9 + 12+ 14-22	30	855,000	270,000	1,125,000
	1-9 + 12+ 14-23	30	900,000	270,000	1,170,000
	1-10+ 12 + 14-23	30	945,000	270,000	1,215,000
	1-12 + 14-23	30	990,000	270,000	1,260,000
	1-23	30	1,035,000	270,000	1,305,000

* Project discharge level at which the Corps may declare an emergency operation at The Dalles Dam to open spill bays 14 – 23.

Bonneville Dam: Spill Pattern for 81 – 100 kcfs.

Bonneville 2007 Spring Spill Pattern in Feet (minimum 2 ft opening, 0.5 ft increments)																			
Spill Bay																		Total	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	Ft. Open	Q spill
3	3	3	2.5	2.5	2	2	2	2.5	2	2	2.5	2	2.5	2.5	3	3	3	45	100
3	3	3	2.5	2.5	2	2	2	2	2	2	2	2	2.5	2.5	3	3	3	44	98
3	3	3	2.5	2	2	2	2	2	2	2	2	2	2	2.5	3	3	3	43	96
3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	42	94
3	3	2.5	2	2	2	2	2	2	2	2	2	2	2	2	2.5	3	3	41	91
2.5	3	2.5	2	2	2	2	2	2	2	2	2	2	2	2	2.5	3	2.5	40	89
2.5	2.5	2.5	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2.5	2.5	39	87
2	2.5	2.5	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2.5	2	38	85
2	2.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2	37	83
3	3	2.5	2	2	2	2	2	2	0	2	0	2	2	2	3	3	2	36.5	81

Bays 1-3, 16-18 = spill bays with flow deflectors at 7 ft. elevation

Bays 4-15 = spill bays with flow deflectors at 14 ft. elevation