# *Spring / Summer Update to the 2003 Water Management Plan*

## 1. Introduction

The Spring / Summer update to the Water Management plan updates information on how the Action Agencies plan on operating the Federal Columbia River Power System (FCRPS) reservoirs during the spring and summer seasons.

The *Spring / Summer WMP Update* (S/S Update) is needed because water supply forecasts for the spring and summer time period are not available at the time the water management plan is written. The Spring / Summer update uses the "April Final" water supply forecast which is considered a more reliable forecast of the expected runoff water volume, and thus how the FCRPS will be operated in 2003.

The *S/S Update* also reports 2003 research operations planned for the FCRPS projects. Research studies are routinely conducted to test the performance of current or new fish passage operations and the effects on a wide range of conditions, including spill survival, tailrace egress, transport benefits and the performance of new passage devices like the Bonneville corner collector and the Lower Granite Removable Spillway Weir. The Studies Review Work Group establishes the research study plan in the spring just prior to the commencement of spring spill passage. The *S/S Update* summarizes the project operations that support these research operations.

The *S/S Update* does not repeat information in the Water Management plan unless more detail or changes need to be provided because of the availability of water supply forecasts and other new information.

# 2.0 2003 Spring / Summer Operations Are Based on the Water Supply Forecast

There are four forecast points that are used to determine BiOp operation of the FCRPS reservoirs. The latest forecasts are given below.

| Forecast Point | Forecast Period | Forecast Date | Value (February Final Forecast) |
|---|---|---|---|
| Lower Granite | April – July | April Final | 17.1 MAF [A] |
| Lower Granite | April – July | April Final | 17.1 MAF |
| The Dalles | April – August | April Final | 72.4 MAF [A] |
| The Dalles | April – August | April Final | 72.4 MAF |
| Hungry Horse | April – August | February Final | 1.53 MAF [B] |
| Libby | April - August | April | 5.0 MAF [C] |

All forecasts from Weather Service unless otherwise indicated
A – Value that is used to set operations
B – USBR Forecast C – COE Forecast

Note: The April Final Forecast put out by the Weather Service assumes future precipitation to be normal.

# 3.0 Flow Objectives

## *Spring*

The April final water supply forecast sets the spring flow objectives for Lower Granite and McNary. The Priest Rapids spring flow objective is fixed (not dependent on the water supply forecast). Based on the April final forecast the spring flow objectives are shown below.

| Project | Spring Flow Objective |
|---|---|
| Lower Granite | 89.1 KCFS |
| McNary | 220 KCFS |
| Priest Rapids | 135 KCFS |

## *Summer*

Based on the latest water supply forecast (April Final) the summer flow objectives are shown below. The McNary summer flow objective is fixed (not dependent on the water supply forecast).

| Project | Summer Flow Objective |
|---|---|
| Lower Granite | 50.5 KCFS |
| McNary | 200 KCFS |

## *Prospects For Meeting Flow Objectives*

An analysis of the likelihood of meeting the flow objectives was conducted by using the Corps' QADJ runs of the HYSSR model. This model uses the volume of the current water supply forecast and applies the 59 shapes observed in the runoff record to this runoff volume. The likelihood of meeting the flow objectives and refilling the reservoirs by the targeted dates is a function of both the runoff volume and the timeframe in which the snowmelt and stream flows occur. The likelihood of meeting the 2003 spring/summer flow objectives are listed below.

# 4.0 Storage Project Operations

## *Libby Dam*

### Sturgeon Pulse

The current water supply forecast (4.96 MAF) for Libby (April – August) puts Libby operations in the 2nd tier of operation for sturgeon called for in the USFWS 2000 Biological Opinion. Tier 2 calls for a Sturgeon flow volume of .8 MAF.

The USFWS had planned on a low water year in 2003 and has moved spawning sturgeon upstream to better spawning habitat. They are unsure if the fish will remain in their new area. The USFWS has indicated (Bob Hallock) that they will want 21 days of high pulse flows with a ramp down to 7 kcfs. Based on the BiOp ramp rates and the sturgeon volume of 800 KAF, it looks like we will have a high flow of 22 kcfs (see table below).

Bob gave two scenarios for start dates for the pulse operations:
If the fish stay in the new area, we may start on 25 May (use this for STP runs).
If the fish leave the area, we may start on 15 June and focus on the hatchery larvae instead. Of course these dates are flexible and will depend on real-time conditions, but these can be used for planning purposes.

Assuming a 25 May start date a possible sturgeon operation would be as follows:

| Pulse Day | Date | Outflow (Kcfs) | Flow abv Min (Kcfs) | Sturgeon Volume (Kaf) |
|---|---|---|---|---|
| | 24-May | 4 | 0 | 0 |
| 1 | 25-May | 9 | 5 | 10 |
| 2 | 26-May | 14 | 10 | 30 |
| 3 | 27-May | 22 | 18 | 65 |
| 4 | 28-May | 22 | 18 | 101 |
| 5 | 29-May | 22 | 18 | 137 |
| 6 | 30-May | 22 | 18 | 173 |
| 7 | 31-May | 22 | 18 | 208 |
| 8 | 1-Jun | 22 | 18 | 244 |
| 9 | 2-Jun | 22 | 18 | 280 |
| 10 | 3-Jun | 22 | 18 | 315 |
| 11 | 4-Jun | 22 | 18 | 351 |
| 12 | 5-Jun | 22 | 18 | 387 |
| 13 | 6-Jun | 22 | 18 | 422 |
| 14 | 7-Jun | 22 | 18 | 458 |
| 15 | 8-Jun | 22 | 18 | 494 |
| 16 | 9-Jun | 22 | 18 | 530 |
| 17 | 10-Jun | 22 | 18 | 565 |
| 18 | 11-Jun | 22 | 18 | 601 |
| 19 | 12-Jun | 22 | 18 | 637 |
| 20 | 13-Jun | 22 | 18 | 672 |
| 21 | 14-Jun | 22 | 18 | 708 |
| 22 | 15-Jun | 17 | 13 | 734 |
| 23 | 16-Jun | 15 | 11 | 756 |
| 24 | 17-Jun | 13 | 9 | 774 |
| 25 | 18-Jun | 11 | 7 | 787 |
| 26 | 19-Jun | 9 | 5 | 797 |
| 27 | 20-Jun | 8 | 4 | **805** |
| 28 | 21-Jun | 7 | | |

## Bull Trout Flows & Ramping Rates

Tier 2 flows call for minimum bull trout releases of 7,000 cfs between the sturgeon and salmon flows (in July). A year-round instantaneous minimum flow of 4,000 cfs is required outside of this period.

Based upon daily average flows of 7,000 cfs, one generator may be added per day (about 5,000 cfs/day), and the ramp-up rate will be 2,000 cfs/hour from October 1 – April 30 and 1,000 cfs/hour from May 1 – September 30. Ramp-down rates will be 500 cfs/hour with a daily ramp down rate of 1,000 cfs/day.

## *Hungry Horse Dam*

### Bull Trout Flows & Ramping Rates

Based on the Bureau of Reclamation March forecast for April – August of 1534 kaf, the minimum outflow from Hungry Horse will be 687 cfs and the minimum flow for Columbia Falls will be 3,372 cfs.

## *Grand Coulee Dam*

### Grand Coulee Summer Draft Limit

Based on the current April – August forecast at the Dalles, the summer draft limit for Grand Coulee is expected to be 1278 feet.

## *Dworshak Dam*

### Summer Draft for Temperature Control

A key operation at Dworshak Dam is to draft cold water from the Dworshak reservoir in July and August to cool water temperatures in the Lower Snake River for the benefit of migrating salmon and steelhead. In-season modeling will be done to help decide when and how to draft Dworshak for water temperature control.

# 5.0 Upper Snake River Flow Augmentation

The Bureau of Reclamation currently estimates that between 250 and 300 kaf will be available for flow augmentation in 2003.

# 6.0 Flood Control Operations

The flood control elevations based on the March Final Forecast are as follows.
Note April 10th flood control elevations are interpolated. There is no official method of determining April 10th flood control elevations

| | Date | | | | | | |
|---|---|---|---|---|---|---|---|
| Project | 31-Jan | 28-Feb | 15-Mar | 31-Mar | 10-Apr | 15-Apr | 30-Apr |
| ARDB | 1435.5 | 1437.1 | | 1438.5 | | 1425.7 | 1425.7 |
| LIB | 2426.7 | 2436.4 | 2441.1 | 2448 | 2447.6 | 2447.4 | 2449.8 |
| DCDB | 1849.8 | 1828.6 | | 1830.9 | | 1822.5 | 1822.5 |
| HGH | 3548.1 | 3551.7 | | 3553 | 3543.5 | 3538.8 | 3537.3 |
| GCL | 1290 | 1290 | | 1283.3 | 1283.3 | 1283.3 | 1283.3 |
| BRN | 2077 | 2070 | | 2076.3 | | 2075.7 | 2077 |
| DWR | 1560.3 | 1565 | | 1578.9 | 1554.2 | 1541.9 | 1541.9 |

## *Dworshak/Grand Coulee flood control shift*

No information yet.

# 7.0 Minimum Operating Pool

The minimum operating pool (mop) operation for the Lower Snake projects is scheduled is scheduled to start April 3rd. The table below shows currently planned MOP operations.

| | Lower Range | | Upper Range | |
|---|---|---|---|---|
| Project | Operation | Elevation | Operation | Elevation |
| Ice Harbor | Mop +1 | 438 | Mop + 2 | 439 |
| Lower Monumental | Mop | 537 | Mop + 1 | 538 |
| Little Goose | Mop +1 | 634 | Mop + 2 | 635 |
| Lower Granite | Mop +1 | 734 | Mop + 2 | 735 |

At John Day the forebay will be operated within a 1.5 foot range between 262.5 and 264.0 feet from April 10th to September 30th.

# 8.0 Hanford Reach (minimum flows?)

## APPENDIX B: HANFORD REACH FALL CHINOOK PROTECTION

Subject to the limitations and conditions set out below, Grant PUD, shall provide the following flow regimes through the rearing period for fall Chinook salmon spawning and rearing in the Hanford Reach.

1. Spawning Period

(a) Flows maintained during the spawning period and escapement levels are factors influencing the placement of redds. The flow manipulation is directed to minimize formation of redds above the 70 kcfs elevation. Minimizing formation of redds above the 70 kcfs elevation in turn is a key factor influencing the success of the flow regime during the emergence period.

(b) During the spawning period, Grant PUD will operate the Priest Rapids Project to the extent feasible through use of the mid-Columbia hourly coordination and reverse load factoring to produce a Priest Rapids outflow during daylight hours equal to 68% of the daily average Wanapum inflow. This obligation shall be in effect only if the daily average Wanapum inflow is between 80 kcfs and 125 kcfs. The goal during the spawning period is to limit spawning to the area below the 70 kcfs elevation on Vernita Bar. In the event physical changes are made at Priest Rapids which affect Grant PUD's ability to provide reverse load factoring, Grant PUD agrees to meet with the Fishery Agencies and Tribes to determine what adjustments to Grant PUD's obligation shall be made.

2. Pre-Hatch Period

During the pre-hatch Period the Priest Rapids outflow may be reduced to 36 kcfs for up to 8 hours on weekdays and 12 hours on weekends (with no two consecutive minimum periods). All paricipants recognize that utilization of the 36 kcfs minimum may have to be limited to achieve the Priest Rapids outflow goal during the spawning period.

3. Post-Hatch Period

(a) After hatching has occurred at redds located in the 36 to 50 kcfs zone, the protection level flow shall be maintained over Vernita Bar so that the intergravel water level is no less than 15 cm below the 50 kcfs elevation.

(b) After hatching has occurred at redds located in the zone above the 50 kcfs elevation, the protection level flow shall be maintained over Vernita Bar through the post hatch period so that the intergravel water level is no less than 15 cm below the critical elevation.

4. Emergence Period

(a) During the emergence period, after emergence has occurred in the 36 to 50 kcfs zone, the protection level flow shall not be less than necessary to maintain water over Vernita Bar at the 50 kcfs elevation.

(b) During the emergence period, after emergence has occurred above the 50 kcfs elevation, the protection level flow shall be maintained at or above the critical elevation.

5. Rearing Period

(a) Flow fluctuations during the rearing period may impact juvenile fall chinook. Elimination of all flow fluctuations is not physically possible without severely impacting the ability of mid-Columbia operators to produce a reliable supply of electricity. The goal during the rearing period is to provide a high level of protection for juvenile fall chinook rearing in the Hanford Reach by limiting flow fluctuations while retaining a reasonable level of load-following capability at each of the 7 dams on the mid-Columbia River.

(b) During the rearing period, Grant PUD will operate the Priest Rapids Project to the extent feasible through use of the mid-Columbia Hourly Coordination Agreement to produce a Priest Rapids outflow that limits flow fluctuations according to the following criteria:

(1) When previous day average weekday Priest Rapids outflow is between 36 and 80 kcfs limit Priest Rapids outflow weekday delta to no more than 20 kcfs. When the average of BPA's Friday Priest Rapids outflow estimates for Saturday and Sunday is between 36 and 80 kcfs limit the Priest Rapids outflow weekend delta to no more than 20 kcfs.

(2) When previous day average weekday Priest Rapids outflow is between 80 and 110 kcfs limit Priest Rapids outflow weekday delta to no more than 30 kcfs. When the average of BPA's Friday Priest Rapids outflow estimates for Saturday and Sunday is between 80 and 110 kcfs limit the Priest Rapids outflow weekend delta to no more than 30 kcfs.

(3) When previous day average weekday Priest Rapids outflow is between 110 and 140 kcfs limit Priest Rapids outflow weekday delta to no more than 40 kcfs. When the average of BPA's Friday Priest Rapids outflow estimates for Saturday and Sunday is between 110 and 140 kcfs limit the Priest Rapids outflow weekend delta to no more than 40 kcfs.

(4) When previous day weekday average Priest Rapids outflow is between 140 and 170 kcfs limit Priest Rapids outflow weekday delta to no more than 60 kcfs. When the average of BPA's Friday Priest Rapids outflow estimates for Saturday and Sunday is between 140 and 170 kcfs limit the Priest Rapids outflow weekend delta to no more than 60 kcfs.

(5) When previous day average Priest Rapids outflow is greater than 170 kcfs Priest Rapids outflow for the following day will be at least 150 kcfs.

6. Monitoring Team

For purposes of determining the protection level flow during the post hatch and emergence periods, a critical elevation shall be determined each year as follows:

(a) The monitoring team will survey redds on Vernita Bar in a specified area for the purpose of determining the initiation of spawning, the location of redds and the extent of spawning. The surveys will be conducted on weekends beginning on the weekend closest to October 15 of each year.

(b) The monitoring team will make a final redd survey the weekend prior to Thanksgiving to determine the critical elevation, which will be set as follows: (Elevations must be in 5 kcfs increments beginning at the 40 kcfs elevation.)

(1) If 31 or more redds are located above the 65 kcfs elevation, the critical elevation will be the 70 kcfs elevation.

(2) If there are 15 to 30 redds above the 65 kcfs elevation, the critical elevation will be the 65 kcfs elevation.

(3) If there are fewer than 15 redds above the 65 kcfs elevation, then the critical elevation will be the first 5 kcfs elevation above the elevation containing the 16$^{th}$ highest redd within the survey area on Vernita Bar (see Table 1 below for examples of the application of these counts).

Table 1. Examples illustrating theoretical final Vernita Bar redd counts and the resulting critical elevations, elevations are provided in kcfs ranges.

| | 36-50 kcfs | 50-55 kcfs | 55-60 kcfs | 60-65 kcfs | 65-70 kcfs | 70+ kcfs | Resulting Critical Elevation |
|---|---|---|---|---|---|---|---|
| Example 1 | 836 | 418 | 148 | 71 | 48 | 34 | 70 |
| Example 2 | 283 | 94 | 65 | 28 | 16 | 4 | 65 |
| Example 3 | 105 | 35 | 10 | 3 | 1 | 0 | 55 |

(c) Additional activities of the monitoring team will include calculation of temperature units, determination of the dates of initiation of spawning, hatching, emergence, the end of the emergence period and the end of the rearing period. The monitoring team may also make nonbinding recommendations including non-binding recommendations to protect redds above the critical elevation or to address special circumstances. By August 1 of the following year, Grant PUD will submit an annual report to the monitoring team and BPA. The annual report will include, but not be limited to: 1) Vernita Bar redd counts, 2) dates on which the hatching, emergence, end of emergence and end of rearing occurred, 3) a record of Columbia River flows through the Hanford Reach based on

Priest Rapids discharges, and 4) a description of the actual flow regimes from the initiation of spawning through the rearing period based on available data. After review by the monitoring team, the final report will be sent to all participants.

7. Redds Above Critical Elevation

This Agreement is not intended either to preclude or require protection of redds above the critical elevation.

# 9.0 Spill for Juvenile Fish Passage

## *Spring Spill Operations – Snake River Dams*

Since the forecasted average flow at Lower Granite is 84.9 kcfs (close to the 85 kcfs trigger for spring spill on the Snake River) the Regional Forum Implementation Team (IT) decided that there would be spill for juvenile fish passage at Lower Granite, Little Goose, and Lower Monumental in 2003. If average flows drop significantly below this level during the spill season (4/3-6/20) IT agreed to revisit this decision and may decide to suspend spill and begin transport if river conditions are judged unfavorable for spring migrants.

### Lower Granite Dam

A special spill operation to test the Removable Spillway Weir is planned for 2003. See the 2003 Snake River Research Operations Summary Table (see below).

### Little Goose Dam

Spring spill passage at Little Goose Dam will be as specified in the BiOp. Spill nights to gas cap (1800 – 0600)

### Lower Monumental Dam

Spring spill at Lower Monumental Dam has been modified from that called for in the BiOp. Tailrace egress conditions will be tested in 2003 to verify that balanced flows from the spillway and the powerhouse present more favorable juvenile passage conditions. This operation is discussed in 2003 Fish Passage Plan and in the 2003 Snake River Research Operations Summary Table (see below).

### Ice Harbor Dam

In 2003 spill tests will be conducted to evaluate juvenile survival under lower spill levels and to provide information for designing an RSW at Ice Harbor. See the 2003 Snake River Research Operations Summary Table for more information on these tests.

## *Summer Spill Operations – Snake River Dams*

The summer spill planning period is June 21-August 31 for the Lower Snake projects.

### Lower Granite Dam, Little Goose, Lower Monumental Dam

As recommended in the BiOp, no spill and full transport will be conducted at the Snake River transport dams.

### Ice Harbor Dam

Summer spill tests (like the spring tests) will evaluate improved juvenile survival and to provide information for designing an RSW at Ice Harbor. See the 2003 Snake River Research Operations Summary Table for more information on these tests.

## *Spring and Summer Spill Operations – Lower Columbia River Dams*

The spring spill planning period for the Lower Columbia River dams is 4/10-6/30 (Spill started 4/14. The summer spill planning period is July 1 - August 31 for Lower Columbia River projects. Spring and summer spill operations on the Lower Columbia River Dams are nearly identical. The exception is McNary Dam at which no spill is recommended (because it is a transport/spread the risk dam).

### McNary Dam

Spring spill will be conducted as specified in the BiOp which calls for night spill (1800 – 0600) to the gas cap. A new gas cap of 160-180 kcfs will be used in 2003 following the installation of spillway deflectors. Spring spill will be suspended when river conditions are no longer spring-like (flows <200 kcfs and water temperature >62-degrees F) and transport initiated. No summer spill occurs at McNary Dam.

### John Day Dam

Juvenile survival through the project will be tested in 2003. See the 2003 Columbia River Research Operations Summary Table (see below) for more information.

### The Dalles Dam

Juvenile survival under different tailrace spill patterns will be tested in 2003. In non-test periods spill will correspond to that recommended in the BiOp (40% of the outflow up to the gas cap 24 hours a day). See also research below. See the 2003 Columbia River Research Operations Summary Table (see below) for more information.

### Bonneville Dam

Juvenile passage and adult fallback research at Bonneville Dam will continue in 2003. See the 2003 Columbia River Research Operations Summary Table (see below) for more information.

# 10. Water Quality – Spill Priority List

River operations are conducted to meet State Clean Water Act total maximum daily load (TMDL) dissolved gas standards. Also research operations at a particular dam would be impacted by involuntary spill thus spill at this project is given lower priority in the hope that involuntary spill can be eliminated at this project. In 2003 involuntary spill will occur in the following order: (Still preliminary)

1. McNary - Daytime to 120% TDG
2. Little Goose – Daytime to 120% TDG
3. John Day – Daytime to 120% TDG
4. McNary
5. John Day
6. The Dalles
7. Bonneville – Nighttime
8. Little Goose
9. Lower Monumental
10. Ice Harbor
11. Wells
12. Rocky Reach
13. Priest River
14. Rock Island
15. Bonneville – Daytime; adult fish passage study for 75 kcfs daytime
16. Lower Granite – RSW Test
17. Wanapum
18. Chief Joseph
19. Grand Coulee

## *2002 GAS Cap levels*

The range of gas caps during 2002 at the projects where:

| | Min | Max |
|---|---|---|
| BON | 90 | 170 |
| TDA | 75 | 135 |
| JDA | 75 | 170 |
| MCN | 90 | 185 |
| IHR | 85 | 102 |
| LGS | 25 | 50 |
| LWG | 33 | 55 |

# 11. 2003 Fish Passage Research

A summary of 2003 fish passage research studies are described below and in the 2003 Snake River and Lower Columbia River Spring-Summer Research Summary Tables (following pages).

## Lower Granite Dam

An evaluation of the RSW operation without the presence of the Behavioral Guidance System or the Surface Bypass Collector will be performed this spring. The spill schedule for this test period is presented in the 2003 Snake River Research Summary Table (Following Pages). See Appendix..

## Lower Monumental Dam

A modified spill schedule has been adopted at this project this year. This spill schedule was based on observations of the physical models at the WES facility. The objective of this new spill schedule is to reduce eddies in the tailrace and improve egress conditions for juveniles passing this project.

## Ice Harbor Dam

An evaluation of a modified spill schedule will be performed at this project this year. The objective of the modified schedule is to improve tailrace egress and improve survival for juveniles passing this project. The evaluation will follow a block design schedule presented in the Appendix.

## John Day Dam

An evaluation of a modified spill schedule will be performed at this project during the spring months. The objective of this modified schedule is to evaluate project FPE and survival under two treatment conditions. In addition, spill, bypass, and turbine survival will be evaluated with focus on improving egress conditions for juvenile fish exiting the bypass system. Summer testing will include an evaluation of 12-hour nighttime versus 24-hour spill under a block design schedule.

### The Dalles Dam

An evaluation of the spillway will be conducted in 2003. The focus of the study will be to determine the need and potential location of a training wall and its potential to reduce injury and mortality in The Dalles Stilling basin. The results of the study will determine whether a training wall will be constructed for the 2004 fish passage season.

## Bonneville Dam

An evaluation of 75 kcfs daytime spill versus gas cap daytime spill will be conducted to determine the effects on adult and juvenile passage. The evaluation will follow a block design schedule presented in the Appendix. The adult evaluation will focus on the influence of spill on delay and fallback at the project.

| Projects | 2003 Snake River Research Summary Table | | |
|---|---|---|---|
| | **Research Objective(s)** | **Spring Spill Plan (4/3-6/20)** | **Summer Spill Plan (6/21-8/31)** |
| Lower Granite | Test fish passage efficiency of the RSW without the behavioral guidance wall and the Surface Bypass Collector.<br><br>Test/compare RSW fish survival with gas cap spill.<br><br>Test TDG RSW versus gas cap spill.<br><br>Transportation versus in-river survival through the Snake River dams. | 4/3 – 4/14: Nighttime spill to the gas cap (~52-kcfs) if runoff forecast exceeds 85 kcfs season average.<br><br>4/15 – 4/24: (40-day test)<br>RSW flow of 6.5 kcfs with 12kcfs training flow (18.5 kcfs total) for 24-hours.<br>(versus)<br>4/25 – 6/30:<br>Nighttime: Spill to the Gas Cap (~52-kcfs) | No Spill – Transport fish from the bypass system. |
| Little Goose | No 2003 research is planned at Little Goose.<br><br>Transportation versus in-river survival through the Snake River dams. | Nighttime: Spill to the gas cap (~45 kcfs) if season average flows are projected to be >85kcfs | No Spill – Transport fish from the bypass system. |
| Lower Monumental | Preliminary evaluation of tailrace egress and fish survival in 2003 under a 50% spill / 50% powerhouse flow condition. Verify the conclusions reached via WES model studies.<br><br>Transportation versus in-river survival through the Snake River dams. | For flows less than 75 kcfs spill 50%.<br><br>Spill 45% of the river for flows between 75 and 100 kcfs.<br><br>For flows above 100 kcfs spill 50% of the river up to the gas cap.<br><br>If flows drop below 24 kcfs, provide 12 kcfs for minimum turbine capacity and spill the remainder. | No Spill – Transport fish from the bypass system. |

| Projects | 2003 Snake River Research Summary Table | | |
|---|---|---|---|
| | **Research Objective(s)** | **Spring Spill Plan (4/3-6/20)** | **Summer Spill Plan (6/21-8/31)** |
| Ice Harbor | Evaluations of project survival under two spill operations. 2003 testing will also help determine the location and design of an RSW for Ice Harbor.<br><br>Tests also will evaluate alternative spill levels to improve survival. | Test BiOp spill:<br>Daytime: Spill 45-kcfs<br>Nighttime: Spill 100 kcfs<br><br>(versus)<br><br>24 Hours: Spill 50% of flow | Test BiOp spill:<br>Daytime: Spill 45-kcfs<br>Nighttime: Spill 100 kcfs<br><br>(versus)<br><br>24 Hours: Spill 50% of flow |

| Project | 2003 Lower Columbia River Research Summary Table | | |
|---|---|---|---|
| | **Research Objective(s)** | **Spring Spill Plan (4/10-6/30)** | **Summer Spill Plan (7/1-8/31)** |
| Bonneville Dam | Jointly Evaluate Juvenile Passage and Adult Fallback alternating spill between 75-kcfs and the gas cap. | Alternate spill in two day blocks from 4/14 - 7/6 as follows:<br><br><u>Days 1 & 2:</u><br>Spill to gas cap (~140-kcfs) for 24-hours<br><br><u>Days 3 & 4 :</u><br>Spill 75-kcfs daytime<br>Spill to gas cap (~140-kcfs) nighttime<br><br>Outside of the test period implement BiOp spill.<br>Nighttime: Spill to gas cap (~90-150kcfs)<br>Daytime: 75-kcfs | (BiOp Spill)<br>Spill 75-kcfs daytime<br>Spill to gas cap (~140-kcfs) nighttime |
| The Dalles | Tests of juvenile survival at varied tailrace spill patterns will occur in 2003. Tests will be made of 8, 12, and 18 kcfs spill levels in bays 2 & 4. Also 21 kcfs will be tested at Bay 2. The test will begin around May 12.<br><br>An 80' tailwater elevation is desired for the test.<br><br>Turbine operation will be prioritized similar to that of 2000: every other unit (odd numbered units) from West to East, then fill in even units from West to East. | Spill 40% of instantaneous flow for 24-hours.<br><br>During test periods, special spill patterns will be used. | Spill 40% of instantaneous flow for 24-hours. (Minimum spill 36 kcfs?) |

| Project | 2003 Lower Columbia River Research Summary Table | | |
|---|---|---|---|
| | **Research Objective(s)** | **Spring Spill Plan (4/10-6/30)** | **Summer Spill Plan (7/1-8/31)** |
| John Day | Juvenile survival and fish passage efficiency will be tested in 2003.<br><br>The spring study will run from 24 of April through 7 June.<br><br>For both spring and summer, it will be important to ensure the powerhouse is operated with south units as first priority | 4/10-4/18: (BiOp)<br>Daytime: No spill<br>Nighttime: 60% of flow.<br><br>4/18 – 6/7: (Test)<br>Daytime: No spill<br>Nighttime: 60% of flow<br>(versus)<br>Daytime: No spill<br>Nighttime: 45% of flow<br><br>6/8-6/13: (BiOp)<br>Daytime: No spill<br>Nighttime: 60% of flow. | 6/13 – 7/26 (Test)*<br>(Depending on river temp).<br><br>Daytime: No spill<br>Nighttime: 60% of flow<br>(versus)<br>24-Hours: 30% of flow<br><br>* The summer study will follow a 4-day randomized block design. The schedule for the summer study is in Appendix A of the Fish Passage Plan (FPP).<br><br>7/27-8/31<br>(BiOp spill)<br>Daytime: No spill<br>Nighttime: 60% of flow |
| McNary | Spring Transport Evaluation<br>Survival of transported versus in-river migration. | Nighttime: Spill to the new gas cap 160-180 kcfs.<br><br>Daytime: Alternate daily full flow by-pass (no separation)<br><br>Versus<br><br>Separation/detection and transport of only PIT tagged fish. | Stop spill and initiate transport when conditions are no longer spring-like (flows <200kcfs and water temp. >62-degrees F) |

# Appendix - 2003 Spring/Summer WMP Update

## 1. Lower Granite RSW /Research Plan

### *RSW*

The overall goal of the 2003 RSW evaluation is to determine the fish passage performance of the RSW without forebay occlusion devices present, as well as determine relative survival of fish passing through spill during RSW operation and the BiOp spill condition. RSW performance and fish survival will be compared with spill to the gas cap.

### *Proposed Operation of Lower Granite Dam and the RSW*

The two operational conditions for the spring 2003 evaluation of the RSW at Lower Granite are:

1. Spill to the dissolved gas cap (~45 kcfs) for 12 hours per day (1800 to 0600). This is the BiOp spill condition. The RSW will not be operated during this condition. (Note: prior to 2002, the gas cap was around 60 kcfs spill. During the 2002 RSW evaluation, the gas cap condition (120% total dissolved gas), the gas cap was generally reached at spill levels of around 40 to 45 kcfs.) "Gas Cap" conditions will likely be adjusted during the season.
2. RSW operation (around 6.7 kcfs at the expected forebay elevation) plus around 12 kcfs training spill through bays 2 – 8. This is a 24-hour operation.

   If river flows exceed powerhouse capacity plus the planned spill condition, additional spill will be added to pass river flow. Test spill operations are detailed in table 1.

Table 1. LGR spill scenarios - spring 2003

| | RSW | | BiOp | |
|---|---|---|---|---|
| | Stops | flow | Stops | Flow |
| Bay 1/RSW | Open | 6.7 | Close | 0 |
| Bay 2 | 1 | 1.8 | 4 | 7.2 |
| Bay 3 | 1 | 1.8 | 4 | 7.2 |
| Bay 4 | 0 | 0 | 3 | 5.4 |
| Bay 5 | 1 | 1.8 | 3 | 5.4 |
| Bay 6 | 1 | 1.8 | 3 | 5.4 |
| Bay 7 | 1 | 1.8 | 4 | 7.2 |
| Bay 8 | 2 | 3.6 | 4 | 7.2 |
| Total volume (kcfs) | | 19.3 | | 45.0 |

Turbine Unit Priority

Unit number 1 will be out of service for the duration of the spring 2003 RSW test. Priority of the other units will be 2, 6, 3, 4, 5.

Study Design

The treatment calendar for the 2003 RSW test is summarized in Figure 1. The test period consists of 4-day blocks with 2 consecutive days for each treatment within each block. The beginning treatment of each block was randomly chosen.

The 46-day study period was chosen to allow time for surgical implants of radio transmitters. Surgical implants have been used for the past several years at Lower Granite, so the researchers wanted to maintain consistency between years by using this methodology again.

Figure 1. 2003 RSW test treatment calendar – 46-day test period.

| | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| **April** | **13** | **14** RSW | **15** RSW | **16** Gas Cap | **17** Gas Cap | **18** Gas Cap | **19** Gas Cap |
| | **20** RSW | **21** RSW | **22** Gas Cap | **23** Gas Cap | **24** RSW | **25** RSW | **26** Gas Cap |
| | **27** Gas Cap | **28** RSW | **29** RSW | **30** RSW | **1** RSW | **2** Gas Cap | **3** Gas Cap |
| **May** | **4** RSW | **5** RSW | **6** Gas Cap | **7** Gas Cap | **8** Gas Cap | **9** Gas Cap | **10** RSW |
| | **11** RSW | **12** Gas Cap | **13** Gas Cap | **14** RSW | **15** RSW | **16** Gas Cap | **17** Gas Cap |
| | **18** RSW | **19** RSW | **20** Gas Cap | **21** Gas Cap | **22** RSW | **23** RSW | **24** RSW |
| | **25** RSW | **26** Gas Cap | **27** Gas Cap | **28** RSW | **29** RSW | **30** | **31** |

RSW days are RSW plus 12 kcfs for 24 hours per day. (0600 - 0600)
(Test starts at 0600 on April 14)
Gas Cap days are spill to the cap (40 - 45 kcfs in 2002) for 12 hours per day (1800 - 0600)

## *2. Ice Harbor Project Survival Evaluation*

Two operations will be evaluated using 2 day blocks of BIOP operations (Fish Passage Plan) and 2 days of "test" conditions throughout the spill season. The pattern is described in the Ice Harbor Spill Table. The tests condition is a 50% spill operations for 24 hours, beginning at 0500. There may be a short time in early June where test operations may not be needed due to lack of test fish. Under that circumstance, BIOP flows will be allowed for those periods. This will be coordinated through RCC.

Ice Harbor Spill Evaluation – Treatment Blocks

| Month | Day | Test | Month | Day | Test | Month | Day | Test |
|---|---|---|---|---|---|---|---|---|
| April | 23 | BIOP | May | 28 | BIOP | July | 1 | TEST |
| April | 24 | BIOP | May | 29 | TEST | July | 2 | BIOP |
| April | 25 | BIOP | May | 30 | TEST | July | 3 | BIOP |
| April | 26 | TEST | May | 31 | BIOP | July | 4 | TEST |
| April | 27 | TEST | June | 1 | BIOP | July | 5 | TEST |
| April | 28 | BIOP | June | 2 | TEST | July | 6 | BIOP |
| April | 29 | BIOP | June | 3 | TEST | July | 7 | BIOP |
| May | 1 | TEST | June | 4 | BIOP | July | 8 | TEST |
| May | 2 | TEST | June | 5 | BIOP | July | 9 | TEST |
| May | 3 | BIOP | June | 6 | TEST | July | 10 | BIOP |
| May | 4 | BIOP | June | 7 | TEST | July | 11 | BIOP |
| May | 5 | TEST | June | 8 | BIOP | July | 12 | TEST |
| May | 6 | TEST | June | 9 | BIOP | July | 13 | TEST |
| May | 7 | BIOP | June | 10 | TEST | July | 14 | BIOP |
| May | 8 | BIOP | June | 11 | TEST | July | 15 | BIOP |
| May | 9 | TEST | June | 12 | BIOP | July | 16 | TEST |
| May | 10 | TEST | June | 13 | BIOP | July | 17 | TEST |
| May | 11 | BIOP | June | 14 | TEST | July | 18 | BIOP |
| May | 12 | BIOP | June | 15 | TEST | July | 19 | BIOP |
| May | 13 | TEST | June | 16 | BIOP | July | 20 | TEST |
| May | 14 | TEST | June | 17 | BIOP | July | 21 | TEST |
| May | 15 | BIOP | June | 18 | TEST | July | 22 | BIOP |
| May | 16 | BIOP | June | 19 | TEST | July | 23 | BIOP |
| May | 17 | TEST | June | 20 | BIOP | July | 24 | TEST |
| May | 18 | TEST | June | 21 | BIOP | July | 25 | TEST |
| May | 19 | BIOP | June | 22 | TEST | | | |
| May | 20 | BIOP | June | 23 | TEST | | | |
| May | 21 | TEST | June | 24 | BIOP | | | |
| May | 22 | TEST | June | 25 | BIOP | | | |
| May | 23 | BIOP | June | 26 | TEST | | | |
| May | 24 | BIOP | June | 27 | TEST | | | |
| May | 25 | TEST | June | 28 | BIOP | | | |
| May | 26 | TEST | June | 29 | BIOP | | | |
| May | 27 | BIOP | June | 30 | TEST | | | |

## *3. John Day Project Survival Test*

Spill treatments for JDA 2003 spring test

| Date | Spill Treatment | Date | Spill Treatment | Date | Spill Treatment |
|---|---|---|---|---|---|
| 24-Apr-03 | 0 day/45 night | 9-May-03 | 0 day/60 night | 24-May-03 | 0 day/45 night |
| 25-Apr-03 | 0 day/45 night | 10-May-03 | 0 day/45 night | 25-May-03 | 0 day/45 night |
| 26-Apr-03 | 0 day/60 night | 11-May-03 | 0 day/45 night | 26-May-03 | 0 day/45 night |
| 27-Apr-03 | 0 day/60 night | 12-May-03 | 0 day/60 night | 27-May-03 | 0 day/45 night |
| 28-Apr-03 | 0 day/60 night | 13-May-03 | 0 day/60 night | 28-May-03 | 0 day/60 night |
| 29-Apr-03 | 0 day/60 night | 14-May-03 | 0 day/60 night | 29-May-03 | 0 day/60 night |
| 30-Apr-03 | 0 day/45 night | 15-May-03 | 0 day/60 night | 30-May-03 | 0 day/45 night |
| 1-May-03 | 0 day/45 night | 16-May-03 | 0 day/45 night | 31-May-03 | 0 day/45 night |
| 2-May-03 | 0 day/60 night | 17-May-03 | 0 day/45 night | 1-Jun-03 | 0 day/60 night |
| 3-May-03 | 0 day/60 night | 18-May-03 | 0 day/60 night | 2-Jun-03 | 0 day/60 night |
| 4-May-03 | 0 day/45 night | 19-May-03 | 0 day/60 night | 3-Jun-03 | 0 day/45 night |
| 5-May-03 | 0 day/45 night | 20-May-03 | 0 day/45 night | 4-Jun-03 | 0 day/45 night |
| 6-May-03 | 0 day/45 night | 21-May-03 | 0 day/45 night | 5-Jun-03 | 0 day/60 night |
| 7-May-03 | 0 day/45 night | 22-May-03 | 0 day/60 night | 6-Jun-03 | 0 day/60 night |
| 8-May-03 | 0 day/60 night | 23-May-03 | 0 day/60 night | 7-Jun-03 | |

| Date | Spill Treatment | Date | Spill Treatment | Date | Spill Treatment |
|---|---|---|---|---|---|
| 9-Jun-03 | 30 day/30 night | 26-Jun-03 | 0 day/60 night | 13-Jul-03 | 30 day/30 night |
| 10-Jun-03 | 30 day/30 night | 27-Jun-03 | 30 day/30 night | 14-Jul-03 | 30 day/30 night |
| 11-Jun-03 | 0 day/60 night | 28-Jun-03 | 30 day/30 night | 15-Jul-03 | 0 day/60 night |
| 12-Jun-03 | 0 day/60 night | 29-Jun-03 | 30 day/30 night | 16-Jul-03 | 0 day/60 night |
| 13-Jun-03 | 30 day/30 night | 30-Jun-03 | 30 day/30 night | 17-Jul-03 | 30 day/30 night |
| 14-Jun-03 | 30 day/30 night | 1-Jul-03 | 0 day/60 night | 18-Jul-03 | 30 day/30 night |
| 15-Jun-03 | 0 day/60 night | 2-Jul-03 | 0 day/60 night | 19-Jul-03 | 30 day/30 night |
| 16-Jun-03 | 0 day/60 night | 3-Jul-03 | 30 day/30 night | 20-Jul-03 | 30 day/30 night |
| 17-Jun-03 | 30 day/30 night | 4-Jul-03 | 30 day/30 night | 21-Jul-03 | 0 day/60 night |
| 18-Jun-03 | 30 day/30 night | 5-Jul-03 | 0 day/60 night | 22-Jul-03 | 0 day/60 night |
| 19-Jun-03 | 0 day/60 night | 6-Jul-03 | 0 day/60 night | 23-Jul-03 | 0 day/60 night |
| 20-Jun-03 | 0 day/60 night | 7-Jul-03 | 0 day/60 night | 24-Jul-03 | 0 day/60 night |
| 21-Jun-03 | 30 day/30 night | 8-Jul-03 | 0 day/60 night | 25-Jul-03 | 30 day/30 night |
| 22-Jun-03 | 30 day/30 night | 9-Jul-03 | 30 day/30 night | 26-Jul-03 | 30 day/30 night |
| 23-Jun-03 | 0 day/60 night | 10-Jul-03 | 30 day/30 night | 27-Jul-03 | 30 day/30 night |
| 24-Jun-03 | 0 day/60 night | 11-Jul-03 | 0 day/60 night | 28-Jul-03 | 30 day/30 night |
| 25-Jun-03 | 0 day/60 night | 12-Jul-03 | 0 day/60 night | 29-Jul-03 | 0 day/60 night |
| | | | | 30-Jul-03 | 0 day/60 night |

## *TDA*

**Spill schedule for 2003 May-June balloon-tag test at TDA. Assumes river flows that will achieve an 80' tailwater. If actual river flows are different from assumed values, spill percentage will change.**

**Test days will run from approximately 0700 - 1900 hours. For each gate opening and closure, Normandeau will notify the project when testing is complete each day. The juvenile pattern will be run outside of test periods.**

| | Day of | Discharge (kcfs) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Test Day | Week | Bay 1 | Bay 2 | Bay 3 | Bay 4 | Bay 5 | Bay 6 | Bay 7 | Bay 8 | Bay 9 | Bay 10 | Bay 11 | Bay 12 | Total Spill | Assumed River | Spill % |
| 20-May-03 | Tues | 9 | 12 | 12 | 12 | 12 | 15 | 12 | 12 | 12 | 0 | 0 | 0 | 108.0 | 270 | 40.0 |
| 21-May-03 | Wed | 4.5 | 21 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 12 | 10 | 9 | 98.5 | 246 | 40.0 |
| 22-May-03 | Thurs | 9 | 18 | 18 | 18 | 18 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 102.0 | 255 | 40.0 |
| 23-May-03 | Fri | 4.5 | 21 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 12 | 10 | 9 | 98.5 | 246 | 40.0 |
| 24-May-03 | Sat | 9 | 18 | 18 | 18 | 18 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 102.0 | 255 | 40.0 |
| 25-May-03 | Sun | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 12 | 15 | 15 | 8 | 0 | 113.0 | 283 | 39.9 |
| 26-May-03 | Mon | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 12 | 15 | 15 | 8 | 0 | 113.0 | 283 | 39.9 |
| 27-May-03 | Tues | Make up day (weather/flow) | | | | | | | | | | | | | | |
| 28-May-03 | Wed | 9 | 12 | 12 | 12 | 12 | 15 | 12 | 12 | 12 | 0 | 0 | 0 | 108.0 | 270 | 40.0 |
| 29-May-03 | Thurs | 9 | 18 | 18 | 18 | 18 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 102.0 | 255 | 40.0 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30-May-03 | Fri | 4.5 | 21 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 12 | 10 | 9 | 98.5 | 246 | 40.0 |
| 31-May-03 | Sat | 9 | 12 | 12 | 12 | 12 | 15 | 12 | 12 | 12 | 0 | 0 | 0 | 108.0 | 270 | 40.0 |
| 1-Jun-03 | Sun | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 12 | 15 | 15 | 8 | 0 | 113.0 | 283 | 39.9 |
| 2-Jun-03 | Mon | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 12 | 15 | 15 | 8 | 0 | 113.0 | 283 | 39.9 |
| 3-Jun-03 | Tues | Make up day (weather/flow) | | | | | | | | | | | | | | |
| 4-Jun-03 | Wed | 9 | 12 | 12 | 12 | 12 | 15 | 12 | 12 | 12 | 0 | 0 | 0 | 108.0 | 270 | 40.0 |
| 5-Jun-03 | Thurs | 9 | 18 | 18 | 18 | 18 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 102.0 | 255 | 40.0 |
| 6-Jun-03 | Fri | 4.5 | 21 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 12 | 10 | 9 | 98.5 | 246 | 40.0 |
| 7-Jun-03 | Sat | 9 | 12 | 12 | 12 | 12 | 15 | 12 | 12 | 12 | 0 | 0 | 0 | 108.0 | 270 | 40.0 |
| 8-Jun-03 | Sun | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 12 | 15 | 15 | 8 | 0 | 113.0 | 283 | 39.9 |
| 9-Jun-03 | Mon | 9 | 18 | 18 | 18 | 18 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 102.0 | 255 | 40.0 |
| 10-Jun-03 | Tues | 9 | 18 | 18 | 18 | 18 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 102.0 | 255 | 40.0 |
| 11-Jun-03 | Wed | 4.5 | 21 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 12 | 10 | 9 | 98.5 | 246 | 40.0 |
| 12-Jun-03 | Thurs | Make up day (weather/flow) | | | | | | | | | | | | | | |

## *BON Adult Passage study*

Day time spill levels will alternate between 75 KCFS (Fallback limit) (low) and spilling to the TDG Gas Cap (high) as shown below.

| Date | Spill Treatment | Date | Spill Treatment | Date | Spill Treatment | Date | Spill Treatment |
|---|---|---|---|---|---|---|---|
| 10-Apr-03 | Low | 16-May-03 | High | 21-Jun-03 | Low | 27-Jul-03 | Low |
| 11-Apr-03 | Low | 17-May-03 | High | 22-Jun-03 | Low | 28-Jul-03 | Low |
| 12-Apr-03 | High | 18-May-03 | Low | 23-Jun-03 | High | 29-Jul-03 | High |
| 13-Apr-03 | High | 19-May-03 | Low | 24-Jun-03 | High | 30-Jul-03 | High |
| 14-Apr-03 | Low | 20-May-03 | High | 25-Jun-03 | High | 31-Jul-03 | High |
| 15-Apr-03 | Low | 21-May-03 | High | 26-Jun-03 | High | 1-Aug-03 | High |
| 16-Apr-03 | High | 22-May-03 | Low | 27-Jun-03 | Low | 2-Aug-03 | Low |
| 17-Apr-03 | High | 23-May-03 | Low | 28-Jun-03 | Low | 3-Aug-03 | Low |
| 18-Apr-03 | High | 24-May-03 | High | 29-Jun-03 | Low | 4-Aug-03 | High |
| 19-Apr-03 | High | 25-May-03 | High | 30-Jun-03 | Low | 5-Aug-03 | High |
| 20-Apr-03 | Low | 26-May-03 | Low | 1-Jul-03 | High | 6-Aug-03 | Low |
| 21-Apr-03 | Low | 27-May-03 | Low | 2-Jul-03 | High | 7-Aug-03 | Low |
| 22-Apr-03 | High | 28-May-03 | Low | 3-Jul-03 | Low | 8-Aug-03 | Low |
| 23-Apr-03 | High | 29-May-03 | Low | 4-Jul-03 | Low | 9-Aug-03 | Low |
| 24-Apr-03 | Low | 30-May-03 | High | 5-Jul-03 | High | 10-Aug-03 | High |
| 25-Apr-03 | Low | 31-May-03 | High | 6-Jul-03 | High | 11-Aug-03 | High |
| 26-Apr-03 | Low | 1-Jun-03 | Low | 7-Jul-03 | High | 12-Aug-03 | Low |
| 27-Apr-03 | Low | 2-Jun-03 | Low | 8-Jul-03 | High | 13-Aug-03 | Low |
| 28-Apr-03 | High | 3-Jun-03 | High | 9-Jul-03 | Low | 14-Aug-03 | High |
| 29-Apr-03 | High | 4-Jun-03 | High | 10-Jul-03 | Low | 15-Aug-03 | High |
| 30-Apr-03 | High | 5-Jun-03 | Low | 11-Jul-03 | High | 16-Aug-03 | High |
| 1-May-03 | High | 6-Jun-03 | Low | 12-Jul-03 | High | 17-Aug-03 | High |
| 2-May-03 | Low | 7-Jun-03 | High | 13-Jul-03 | Low | 18-Aug-03 | Low |
| 3-May-03 | Low | 8-Jun-03 | High | 14-Jul-03 | Low | 19-Aug-03 | Low |
| 4-May-03 | High | 9-Jun-03 | Low | 15-Jul-03 | High | 20-Aug-03 | High |
| 5-May-03 | High | 10-Jun-03 | Low | 16-Jul-03 | High | 21-Aug-03 | High |
| 6-May-03 | Low | 11-Jun-03 | High | 17-Jul-03 | Low | 22-Aug-03 | Low |
| 7-May-03 | Low | 12-Jun-03 | High | 18-Jul-03 | Low | 23-Aug-03 | Low |
| 8-May-03 | Low | 13-Jun-03 | Low | 19-Jul-03 | Low | 24-Aug-03 | Low |
| 9-May-03 | Low | 14-Jun-03 | Low | 20-Jul-03 | Low | 25-Aug-03 | Low |
| 10-May-03 | High | 15-Jun-03 | High | 21-Jul-03 | High | 26-Aug-03 | High |
| 11-May-03 | High | 16-Jun-03 | High | 22-Jul-03 | High | 27-Aug-03 | High |
| 12-May-03 | Low | 17-Jun-03 | Low | 23-Jul-03 | High | 28-Aug-03 | Low |
| 13-May-03 | Low | 18-Jun-03 | Low | 24-Jul-03 | High | 29-Aug-03 | Low |
| 14-May-03 | High | 19-Jun-03 | High | 25-Jul-03 | Low | 30-Aug-03 | High |
| 15-May-03 | High | 20-Jun-03 | High | 26-Jul-03 | Low | 31-Aug-03 | High |