

# ***Draft Spring / Summer Update to the 2004 Water Management Plan***

## **1. Introduction**

The 2004 Spring / Summer update to the Water Management Plan (WMP) 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 in the fall of 2003. Planned operations in the Spring / Summer update are based on the most current water supply forecast which is considered to be the best available forecast of the expected runoff water volume, and thus how the FCRPS will be operated in 2004. The “April Final” forecast is the most current forecast available when the final version of the Spring Summer update was written.

The *S/S Update* also reports 2004 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 (RSW). The Studies Review Work Group establishes the research study plan in the spring just prior to the commencement of the spring migration. The *S/S Update* summarizes the project operations that support these research activities.

The *S/S Update* does not repeat all of the information in the Water Management plan, but provides additional detail and specifies operations based on the current water supply forecast or changes that need to be made in operations because of the availability of current water supply forecasts and other new information.

## 2.0 Role of Water Supply Forecasts

There are four forecast points that are used to determine BiOp operation of the FCRPS reservoirs. The latest forecasts (March Final) are given below. Note: The mid-month trend continues to be lower than the final forecast

Forecast Point	Forecast Period	Forecast Date	Value (April Final Forecast)
Lower Granite	April – July	March Final	20.0 MAF <sup>A</sup>
Lower Granite	April – July	March Final	20.0 MAF
The Dalles	April – August	March Final	82.5 MAF <sup>A</sup>
The Dalles	April – August	March Final	82.5 MAF
Hungry Horse	April – August	March Final	1939 KAF <sup>AB</sup>
Libby	April - August	March	5.4 MAF <sup>C</sup>

All forecasts from Weather Service unless otherwise indicated

A – Value that is used to set operations

B – USBR Forecast      C – COE Forecast

## 3.0 Flow Objectives

### *Spring*

The spring flow objectives for Lower Granite and McNary are established by the April final water supply forecast. 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	100 KCFS
McNary	228 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	51 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-runoff shapes observed in the historical record to this forecast 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 2004 spring/summer flow objectives are listed below.

See Next Pages

**Assumptions:**

- \* Streamflows were adjusted to the March Final Water Supply Forecast for the period of March thru August of 90.6 MAF at The Dalles and shaped 59 different ways based on observed historical runoff.
- \* Starting elevations were observed data from February 29, 2004.
- \* Grand Coulee helps meet Vernita Bar minimum flow objective of 70 kcfs in Mar. Operate to meet McNary flow objective of 228.3 kcfs. Minimum draft elevations are based on a GCL/Dworshak shifted flood control and VECC/AER requirements.
- \* Hungry Horse operates to VARQ flood control or minimum flow from Mar - May and meets minimum flow of 3500 cfs at Columbia Falls, targets full in June, and drafts to 3540 ft by 31 Aug.
- \* Brownlee operates to flood control elevations.
- \* Dworshak targets elevation 1547.2 ft in Mar, 1557.5 ft by 15 Apr, and 1534.8 ft by 30 Apr, based on a GCL/DWR shifted flood control operation and maximum releases of 12.5 kcfs in April and 13 kcfs May-Jun. DWR targets full in June with a minimum flow of
- \* Libby operates on minimum flow or VARQ flood control Mar - Apr. Targets 13.9 kcfs in May and 9.4 kcfs in June for Sturgeon, based on an Apr-Aug forecast of 5.359 MAF and a Tier 2 required pulse of 0.80 MAF. Targets full in July with a minimum flow of 7,0

**Results:**

Priest Rapids Meets Flow Objectives of 70 kcfs in Mar - Apr 15 and 135 kcfs in Apr 16 - Jun.

Month	Occurrences out of 59 Years	Average Flow for 59 Years (kcfs)
Mar	59	74
Apr 15	59	82
Apr 30	39	149
May	45	148
Jun	48	132

Lower Granite Meets Flow Objectives of 100 kcfs in Apr - May, 84 kcfs in June and 52 kcfs in Jul - Aug:

Month	Occurrences out of 59 Years	Average Flow for 59 Years (kcfs)
Apr 30	17	86
May	32	104
Jun	43	96
Jul	27	49
Aug 15	0	41
Aug 31	0	31

Bonneville Meets Flow Objectives of 125 kcfs in Mar - Apr:

Month	Occurrences out of 59 Years	Average Flow for 59 Years (kcfs)
Mar	54	140
Apr 15	59	166
Apr 30	59	254

McNary Meets Flow Objectives of 228.3 kcfs in Apr 15 - Jun and 200 kcfs in Jul - Aug:

Month	Occurrences out of 59 Years	Average Flow for 59 Years (kcfs)
Apr 30	33	231
May	53	246
Jun	39	244
Jul	16	182
Aug 15	0	143
Aug 31	0	129

Projects Refill by 30 June:

Month	Occurrences out of 59 Years	Average Elevation on 30 Jun for 59 Years
Libby	14	2452
Hungry Horse	59	3560
Grand Coulee	59	1290
Dworshak	56	1600

Period Average Flows (kcfs)

	MAR 1-31	APR 1-15	APR 16-30	MAY 1-31	JUN 1-30	JUL 1-31	AUG 1-15	AUG 16-31
LIB	4	4	4	14	10	19	16	14
HGH	2	1	1	2	6	7	5	4
GCL	68	75	137	125	120	118	92	91
PRD	74	82	149	148	151	132	100	96
DWR	2	2	13	6	6	11	13	11
BRN	17	22	23	21	17	13	17	12
LWG	42	63	86	104	96	49	41	31
MCN	121	151	231	246	244	182	143	129
TDA	133	160	247	254	254	188	148	133
BON	140	166	254	257	256	191	150	135

## **4.0 Storage Project Operations**

### ***Libby Dam***

#### **Sturgeon Pulse**

The current water supply forecast (March) of 5.36 MAF for Libby (April – August) puts Libby operations in the 2nd tier of operations for sturgeon called for in the USFWS 2000 Biological Opinion. The 2nd tier sturgeon operation calls for a sturgeon flow volume of .8 MAF and minimum bull trout flows of 7 kcfs in July.

### ***Hungry Horse Dam***

#### **Bull Trout Flows & Ramping Rates**

Based on the Bureau of Reclamation February forecast for April – August of 1939 kaf, the minimum outflow from Hungry Horse will be 900 cfs and the minimum flow for Columbia Falls will be 3,500 cfs.

### ***Grand Coulee Dam***

#### **Grand Coulee Summer Draft Limit**

Based on the March final forecast of April – August runoff volume 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 provide information to aid in the making the decisions of when and how to draft Dworshak for water temperature control.

## **5.0 Upper Snake River Flow Augmentation**

The Bureau of Reclamation currently estimates 300 kaf will be available for flow augmentation in 2004.

## 6.0 Flood Control Operations

The flood control elevations based on the March final forecast are shown in the following table.

Note that April 10th flood control elevations are interpolated. As there is no official method of determining April 10th flood control elevations

Project	Date						
	31-Jan	28-Feb	15-Mar	31-Mar	10-Apr	15-Apr	30-Apr
ARDB	1430.5	1422.9		1414.1		1414.1	1414.1
LIB	2422.5	2431.6	2441.1	2441.1	2442.2	2442.8	2443.4
DCDB	1839.8	1807.7		1815.9		1815.9	1815.9
HGH	3543.8	3536.3		3538.5	3537.2	3536.6	3534.8
GCL	1290	1290		1283.3	1275.8	1272.1	1255.2
GCL-shifted	1290	1286		1277.7	1268.4	1263.7	
BRN	2077	2051.4		2053.4		2056	2057.6
BRN-shifted	2077	2077		2077		2077	
DWR	1539.5	1529.8		1538.3	1535.5	1534.1	1534.8
DWR-shifted	1539.5	1529.8		1547.2	1554.1	1557.5	

### ***Dworshak/Grand Coulee flood control shift***

No Dworshak/Grand Coulee flood control shift is planned this year.

## 7.0 Minimum Operating Pool

The minimum operating pool (MOP) operation for the Lower Snake projects is scheduled to start April 3rd. The table below shows planned operations in 2004. It was agreed at the March 17, 2004 TMT meeting that because of navigation concerns Ice Harbor, Little Goose, and Lower Granite would be operated at MOP+1 to MOP+2. TMT may address, on an in-season management basis, navigation or other concerns that may result in adjustments in BiOp MOP operations.

Project	Lower Range		Upper Range	
	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**

An agreement is being negotiated for 2004 and will be included when it is signed.

## **9.0 Spill for Juvenile Fish Passage**

Note: At this time the spill operations for the 2004 spill season have not been finalized yet. Information below is the best of our knowledge and subject to change.

### ***Spring Spill Operations – Snake River Dams***

At the current time it appears that the forecasted inflow will be greater than 85 kcfs this year we will be spilling the Lower Snake projects in the spring. The planning dates for spring spill season on the Snake River is from April 3rd to June 20th.

#### **Lower Granite Dam**

A test of the effect of the BGS (Behavioral Guidance Structure) impact on horizontal distribution of fish passage will occur this spring. Planned test dates are from April 15th to May 30th. During this test spill will consist of spilling the RSW (approximately 7 kcfs) along with a training spill (approximately 12 kcfs) 24 hours a day. (See section 11 for further details) It has not been decided yet what the non-test operation at Lower Granite will be. The options are spill using the spill as specified in the BiOp (spill at night to the gas cap) or spill using the RSW (spill 24 hours a day 7 kcfs through the RSW with a training spill of approximately 12 kcfs)

#### **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**

A test of the effect on juvenile fish of two different spill patterns will be tested this spring. The dates of this test will be from April 15 to June 17. The two spill patterns to be tested are the pattern in the FPP and a bulk spill pattern. (See section 11 for further details) During the test the project will be spilling 24 hours a day The spill amount during the test will be a percentage of the project outflow with the spill percentage being 45% when total project outflow is less than 75 kcfs or greater than 100 kcfs. The spill percentage is 50% when the total project outflow is between 75 and 100 kcfs. Spill not to exceed the TDG gas cap. When the test is not occurring the spill operation will be as described above using the spill pattern in the FPP.

Note: A near field TDG test is scheduled during the spring (See section 11 for further details)

### **Ice Harbor Dam**

A test of the effect on juvenile fish of two different spill patterns will be tested this spring and summer. The dates of this test will be from April 15th to July 15th. Spill operation will involve two distinct operations including one “bulk” spill pattern and one small gate-opening pattern. Specifics will be coordinated with the fishery agencies and others as needed. The “bulk” spill pattern will consist of spilling up to the gas cap 24 hours a day and spilling the small gate pattern will consist of spilling 45 kcfs 24 hours a day. (See section 11 for further details). At this time I am assuming that the non-test period spill operation will be as specified in the BiOp (spill limited to 45 kcfs during the day and spill to the gas cap at night).

### ***Summer Spill Operations – Snake River Dams***

Note: The Action Agencies are currently looking at the possibility of modifying the summer spill program. What is presented below is the BiOp summer spill program.

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**

See spring spill section for details.

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

Note: The Action Agencies are currently looking at the possibility of modifying the summer spill program. What is presented below is the BiOp summer spill program.

The spring spill planning period for the Lower Columbia River dams is 4/10-6/30. 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 exceptions are McNary Dam at which no summer spill occurs and at John Day where the spill percentage and spill period changes between the spring and summer spill periods.

### **McNary Dam**

Spring spill will be conducted as specified in the BiOp which calls for night spill (1800 – 0600) to the gas cap. 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**

Spill will be provided from April 10 through August 31 for spring and summer migrants as required in the NMFS Biological Opinion. Between May 15 and July 20, spill will occur from 1900 to 0600 hours (11 hours total). Before that time period, spill will be for 12 hours nightly, from 1800 to 0600 hours. From April 10 to July 20, spill discharges will be 60% of instantaneous project flow at project flows up to 300,000 cfs. Above 300,000 cfs project flow, spill discharges will be 180,000 cfs (up to the hydraulic limit of the powerhouse). From July 21 through August 31, spill will be 30% of instantaneous project flow 24-hours per day. Spill will be provided in a manner consistent with TDG management to avoid excessive gas supersaturation

### **The Dalles Dam**

Spill will be 40% of total project outflow out to exceed the TDG cap.

### **Bonneville Dam**

Spill will be as specified in the BiOp, spill to the TDG cap at night and spill 75 kcfs (fallback limit) during the day.

## **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 can be impacted by involuntary spill. Thus spill at research projects is given lower priority in the hope that involuntary spill can be eliminated during research. In 2004 involuntary spill will occur in the following order:

1. Little Goose
2. Lower Monumental
3. McNary
4. The Dalles
5. Bonneville
6. Priest Rapids
7. Rocky Reach
8. Wells
9. Rock Island
10. Lower Granite
11. Ice Harbor
12. John Day
13. Wanapum
14. Chief Joseph
15. Grand Coulee

## **2003 GAS Cap levels**

The range of gas caps during 2003 at the projects were:

	Min	Max
BON	100	170
TDA	85	135
JDA	95	165
MCN	100	160
IHR	51	110
LMN	15	44
LGS	27	43
LWG	36	43

## **Other Spill Operations**

Based on a study conducted by a subgroup of the Regional Forum Water Quality Team, it was determined that joint operations of Chief Joseph and Grand Coulee Dam for power and total dissolved gas production could result in an overall reduction in TDG levels both upstream and downstream of Chief Joseph dam by taking advantage of the larger generation flow capacity of Grand Coulee and the lower average TDG loading below the Chief Joseph spillways (absent deflectors). As a result of this study, and coordination with the Bureau of Reclamation and the Colville Tribe, the joint operation of Grand Coulee and Chief Joseph will be conducted during the 2004 spill season. Operationally, this will be as follows,

- When Lake Roosevelt is below 1260' elevation, spill from the Grand Coulee outlet tubes be avoided by shifting all spill to Chief Joseph for spill discharges up to 70 kcfs. If river conditions require spill releases above 70 kcfs at Chief Joseph, the additional spill should be distributed between Chief Joseph and Grand Coulee in a 2.5 to 1 ratio.
- When Lake Roosevelt TDG is elevated and at or above 1260' elevation, spill over the drum gates at Grand Coulee may be beneficial to the system due to potential degassing. The continuation of monitoring practices and additional investigations of these operational measures on TDG exchange are recommended to further establish efficient and effective joint operations at Grand Coulee and Chief Joseph.

## 11. 2004 Fish Passage Research

A summary of 2004 fish passage research studies that have the potential to change project operation are described below

### Lower Granite Dam

#### Lower Granite RSW 2004 Study Plan

##### Background

A Removable Spillway Weir (RSW) was installed in spillbay 1 at Lower Granite Dam in 2001. It was evaluated for fish passage in spring 2002 and fish passage and survival in spring 2003. In 2002, the Behavioral Guidance Structure (BGS), Surface Bypass Collector (SBC) and Simulated Wells Intake (SWI) were all in place in the Lower Granite Forebay. These structures presumably worked together to guide fish toward the RSW. For the 2003 evaluation, all of these guidance structures were removed and the RSW was tested as a “stand-alone” fish passage structure.

For 2004, the BGS will be shifted to the north. It is presently attached to the dam between units 3 and 4. The new attachment point will be between units 5 and 6. The downstream end of the BGS will also be made shallower. The bottom of several of the downstream sections will be removed. This will allow the use of the existing anchor system and will retain velocities of less than 2 feet per second beneath the BGS.

The 2004 Lower Granite RSW test will run from approximately April 15 to May 30.

##### RSW/spillway operation

The RSW will be operated 24 hours per day during the spring test. Training spill level will likely be around 12 kcfs, spread out over bays 2 – 8. This is one stop per bay, or around 1.7 kcfs per bay. This operation was tested in 2003, with high passage and survival. Training spill is to provide adequate tailrace hydraulic conditions. Few fish are expected to pass through training spill, based on results from the 2002 and 2003 evaluations.

The forebay level will be at MOP plus 1 foot. The actual forebay level will fluctuate between elevation 734 ft. and 735 ft. This is the forebay level that was used in both the 2002 and 2003 evaluations. The RSW flow in this forebay range will be approximately 6.7 to 7.7 kfs.

##### Powerhouse Operation

The proposed powerhouse operation will be a priority for units 2, 3 and 4, in any order. Unit 6 will be operated on a last-on, first-off basis. Unit 1 is expected to be out of service for the entire evaluation period.

## BGS Moves

The BGS will be moved in or out of position periodically to assess its impact on horizontal distribution of fish passage. RSW, spillway and powerhouse passage will be compared for periods when the BGS is in the deployed position compared to periods when it is in the stored (upstream) position. The test period is divided into 6 blocks. Each block has three days of BGS-IN and three days of BGS-OUT. The blocks each begin with a randomly chosen condition, so there are periods of up to six days with one condition in place.

This design is a combination of the desire to get a reasonable number of study blocks with the realization that each time the BGS is moved, it takes much of a day and that day cannot go into the BGS in/out analysis.

2004 Spring Lower Granite RSW Test

RSW operates 24 hours per day, every day

3 day treatment periods for BGS IN or BGS OUT, one day to move

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
April	11	12	13	14	15 BGS IN Begin blk 1	16 BGS IN	17 BGS IN
	18 BGS Move	19 BGS OUT	20 BGS OUT	21 BGS OUT	22 BGS Move	23 BGS IN Begin blk 2	24 BGS IN
May	25 BGS IN	26 BGS Move	27 BGS OUT	28 BGS OUT	29 BGS OUT	30 BGS OUT Begin blk 3	1 BGS OUT
	2 BGS OUT	3 BGS Move	4 BGS IN	5 BGS IN	6 BGS IN	7 BGS Move	8 BGS OUT Begin blk 4
	9 BGS OUT	10 BGS OUT	11 BGS Move	12 BGS IN	13 BGS IN	14 BGS IN	15 BGS IN Begin blk 5
	16 BGS IN	17 BGS IN	18 BGS Move	19 BGS OUT	20 BGS OUT	21 BGS OUT	22 BGS Move
	24 BGS IN Begin blk 6	25 BGS IN	26 BGS IN	27 BGS Move	28 BGS OUT	29 BGS OUT	30 BGS OUT

### Monitoring

Hydroacoustics is planned to monitor fish passage through the RSW, spillway and powerhouse in spring. One spillbay will be outfitted with a split-beam transducer. The other six bays will be monitored with single beam transducers. The RSW will have two uplooking split-beam transducers mounted on a frame in front of the structure. Powerhouse passage will be monitored with transducers mounted low on the inside of the Trashracks. One unit will have a transducer in each of the three intakes. Three units will have a single, randomly chosen intake monitored with a single beam transducer. Finally, one unit will have a split-beam transducer located in a randomly chosen intake bay. Unit 1 will not be instrumented, as it will be out of service during the test period.

### **Lower Monumental Dam**

**Lower Monumental Spillway Survival Study.** Survival studies will be conducted using radio-telemetry in 2004. Two spill patterns will be tested in a 2-day blocked design.

**Bulk spill pattern for Lower Monumental - 2004**

Spill Bay								Total Stops	Total Spill
1	2	3	4	5	6	7	8		
1								1	1.1
1							1	2	2.2
1	1						1	3	3.3
1	1					1	1	4	4.4
1	1	1				1	1	5	5.5
1	1	1			1	1	1	6	6.6
1	1	1	1		1	1	1	7	7.7
1	1	1	1	1	1	1	1	8	8.8
2	1	1	1	1	1	1	1	9	10.5
2	1	1	1	1	1	1	2	10	12.2
2	2	1	1	1	1	1	2	11	13.9
2	2	1	1	1	1	2	2	12	15.6
2	2	2	1	1	1	2	2	13	17.3
2	2	2	1	1	2	2	2	14	19
5		5				5		15	23.7
5.5		5				5.5		16	26.3
5.5		5.5				6		17	27.1
6		6				6		18	28.8
6.5		6				6.5		19	30.5
7		6				7		20	
7		7				7		21	31.4
5.5		5.5		5.5		5.5		22	35.0
6		5.5		5.5		6		23	36.7
6		6		6		6		24	38.4
6		6		6		7		25	40.1
7		6		6		7		26	41.8
7		7		6		7		27	43.5
7		7		7		7		28	45.2
2	5	4	4	4	4	4	2	29	44.8
2	5	4	4	4	4	5	2	30	46.4
2	5	5	4	4	4	5	2	31	48.1
2	5	5	4	4	5	5	2	32	49.8
2	5	5	5	4	5	5	2	33	51.5
2	5	5	5	5	5	5	2	34	53.2

2	6	5	5	5	5	5	2	35	54.9
2	6	5	5	5	5	6	2	36	56.6
2	6	6	5	5	5	6	2	37	58.3
2	6	6	5	5	6	6	2	38	60
2	6	6	6	5	6	6	2	39	61.7
2	6	6	6	6	6	6	2	40	63.4
2	7	6	6	6	6	6	2	41	65.1
2	7	6	6	6	6	7	2	42	66.8
2	7	7	6	6	6	7	2	43	68.5
2	7	7	6	6	7	7	2	44	70.2
2	7	7	7	6	7	7	2	45	71.9
2	7	7	7	7	7	7	2	46	73.6
2	8	7	7	7	7	7	2	47	75.3
2	8	7	7	7	7	8	2	48	77
2	8	8	7	7	7	8	2	49	78.8
2	8	8	7	7	8	8	2	50	80.6
2	8	8	8	7	8	8	2	51	82.4
2	8	8	8	8	8	8	2	52	84.2
2	9	8	8	8	8	8	2	53	86
2	9	8	8	8	8	9	2	54	87.8
2	9	9	8	8	8	9	2	55	89.5
2	9	9	8	8	9	9	2	56	91.2
2	9	9	9	8	9	9	2	57	92.9
2	9	9	9	9	9	9	2	58	94.6
2	10	9	9	9	9	9	2	59	96.3
2	10	9	9	9	9	10	2	60	98
2	10	10	9	9	9	10	2	61	99.7
2	10	10	9	9	10	10	2	62	101.4
2	10	10	10	9	10	10	2	63	103.1
2	10	10	10	10	10	10	2	64	104.8
2	11	10	10	10	10	10	2	65	106.5
2	11	10	10	10	10	11	2	66	108.2
2	11	11	10	10	10	11	2	67	109.9
2	11	11	10	10	11	11	2	68	111.6
2	11	11	11	10	11	11	2	69	113.3
2	11	11	11	11	11	11	2	70	115
2	12	11	11	11	11	11	2	71	116.7
2	12	11	11	11	11	12	2	72	118.4
2	12	12	11	11	11	12	2	73	120.2



2	12	12	11	11	12	12	2	74	122
2	12	12	12	11	12	12	2	75	123.8
2	12	12	12	12	12	12	2	76	125.6
2	13	12	12	12	12	12	2	77	127.4
2	13	12	12	12	12	13	2	78	129.2
2	13	13	12	12	12	13	2	79	130.9
2	13	13	12	12	13	13	2	80	132.6
2	13	13	13	12	13	13	2	81	134.3
2	13	13	13	13	13	13	2	82	136
2	14	13	13	13	13	13	2	83	137.7
2	14	13	13	13	13	14	2	84	139.4
2	14	14	13	13	13	14	2	85	141.1
2	14	14	13	13	14	14	2	86	142.8
2	14	14	14	13	14	14	2	87	144.5
2	14	14	14	14	14	14	2	88	146.2
2	15	14	14	14	14	14	2	89	147.9
2	15	14	14	14	14	15	2	90	149.6
2	15	15	14	14	14	15	2	91	151.4
2	15	15	14	14	15	15	2	92	153.2
2	15	15	15	14	15	15	2	93	155
2	15	15	15	15	15	15	2	94	156.8
2	16	15	15	15	15	15	2	95	158.6
2	16	15	15	15	15	16	2	96	160.4

## Lower Monumental Spill schedule - Spring 2004

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

**Near-field Study of Total Dissolved Gas Exchange and Evaluation of Added Spillway Deflector Performance.** As part of the COE Fastrack Gas Abatement Program, total dissolved gas abatement alternatives are being developed to reduce the TDG exchange associated with spill operations and to provide greater flexibility in scheduling spillway operations. Additional spillway deflectors for bays 1 and 8 were constructed in late 2002 and early 2003, and now all spillway bays are so equipped. A field study is proposed to address the TDG exchange associated with the modified spillway and associated operations under a wide range of operating conditions. The proposed long-term monitoring program will be initiated in April 2004 prior to the spill season and continue through the end of spill, typically in June.

This three month sampling period will provide for the widest range of operating and environmental conditions. This study will primarily focus on determining the total dissolved gas exchange characteristics associated with spillway operation for discharges up to the design spill for a 7-day, 10-year frequency flood. The incorporation of specific operations could significantly enhance study findings. These special operations could include scheduled spill outage to maintain TDG instruments, alternative spill patterns including bulk spill, management of tailwater stage through storage in Lake Sacagawea, and constant spill with and without powerhouse flows. Circulation patterns below the dam will also be described through a variety of sampling devices. This information will support the interpretation of study TDG data and related issues concerning fish passage through this river reach.

### **Ice Harbor Dam**

**Spillway Survival Study.** Radio telemetry, PIT, and balloon tag studies will estimate the survival rates of test fish passing over the spillway. Project operations (spill levels and possibly patterns) will change according to a randomized block schedule. Spill operation will involve two distinct operations including one “bulk” spill pattern and one small gate-opening pattern. Specifics will be coordinated with the fishery agencies and others as needed.

### IHR Bulk Spill Pattern - 2004

Spill Bay (stops)										Total Stops	Total Flow	
1	2	3	4	5	6	7	8	9	10			
		5		5		5		5			20	33.60
		5.5		5		5		5.5			21	35.3
		5.5		5.5		5.5		5.5			22	37
		5.5		5.5		5.5		5.5			22	37.00
		5.5		5.5		5.5		5.5			22	37
		6		6		6		6			24	40.4
		6	6	6		6		1			25	42.1
		6	6	6		6		2			26	43.8
		6	6	6		6		3			27	45.5
		6.5	6.5	6.5		6.5		2			28	47
		6.5	6.5	6.5		6.5		3			29	48.7
		6	6	6		6		6			30	50.5
		6	6	6		7		6			31	52.1
		6	6	6		7		7			32	53.7
		7	6	7		7		6			33	55.3
		7	6	7		7		7			34	56.9
		7	7	7		7		7			35	58.5
		6	6	6	6	6		6			36	60.6
		6	6	6	6	7		7			38	63.8
		6	6	6	7	7		7			39	65.4
		6	6	7	7	7		7			40	67
		6	7	7	7	7		7			41	68.6
		7	7	7	7	7		7			42	70.2
	6	6	6	6	6	7		6			43	72.3
	6	6	6	6	7	7		6			44	73.9

6	6	6	7	7	7		6		<b>45</b>	75.5
6	6	7	7	7	7		6		<b>46</b>	77.1
6	7	7	7	7	7		6		<b>47</b>	78.7
6	6	6	6	6	6	6	6		<b>48</b>	80.8
6	6	6	6	6	7	6	6		<b>49</b>	82.4
6	6	6	6	7	7	6	6		<b>50</b>	84
6	6	6	6	7	7	6	7		<b>51</b>	85.6
6	6	6	7	7	7	6	7		<b>52</b>	87.2
6	6	7	7	7	7	6	7		<b>53</b>	88.8
6	7	7	7	7	7	6	7		<b>54</b>	90.4

Ice Harbor Spill Schedule - Spring and Summer, 2004

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

## **McNary Dam**

**Operation of Turbine Units Outside of 1% best Operating Range.** An operation of turbine units at McNary Dam outside of the normal 1% best efficiency operating range, up to 115% of overload (approximately 80 MWs), is proposed for the spring of 2004. A plan for monitoring this operation is being prepared and coordinated with the region.

The McNary Modernization Program will be conducting both fish condition studies (gatewell) and Fish Guidance Efficiency (FGE) studies at McNary in 04. Purpose of these studies are two fold: 1) Evaluation of fish condition under higher gatewell conditions (also new Vertical Barrier Screens) and estimating FGE under higher turbine loading.

For these tests it will be required to operate up to 5 units in a two day blocked design with high and low loads. In other words, test units will be operated at 12,200 for two days, and then 16,400 for two days. Units 2, 3, 4 and 5 will be operating on the schedule below. Unit 9 will be operated the "opposite" of these units. We will need to ensure that units 5 and 9 are treatments on the same day for the fish condition testing.

Table 1. Proposed Randomized block treatment schedule.

Date	Block	Treatment	Date	Block	Treatment	Date	Block	Treatment
4/15	1	High Q	5/16	8	High Q	6/16	16	Low Q
4/16	1	High Q	5/17	9	Low Q	6/17	16	Low Q
4/17	1	Low Q	5/18	9	Low Q	6/18	17	Low Q
4/18	1	Low Q	5/19	9	High Q	6/19	17	Low Q
4/19	2	High Q	5/20	9	High Q	6/20	17	High Q
4/20	2	High Q	5/21	10	Low Q	6/21	17	High Q
4/21	2	Low Q	5/22	10	Low Q	6/22	18	High Q
4/22	2	Low Q	5/23	10	High Q	6/23	18	High Q
4/23	3	High Q	5/24	10	High Q	6/24	18	Low Q
4/24	3	High Q	5/25	11	Low Q	6/25	18	Low Q
4/25	3	Low Q	5/26	11	Low Q	6/26	19	High Q
4/26	3	Low Q	5/27	11	High Q	6/27	19	High Q
4/27	4	Low Q	5/28	11	High Q	6/28	19	Low Q
4/28	4	Low Q	5/29	12	High Q	6/29	19	Low Q
4/29	4	High Q	5/30	12	High Q	6/30	20	Low Q
4/30	4	High Q	5/31	12	Low Q	7/1	20	Low Q
5/1	5	High Q	6/1	12	Low Q	7/2	20	High Q
5/2	5	High Q	6/2	13	Low Q	7/3	20	High Q
5/3	5	Low Q	6/3	13	Low Q	7/4	21	Low Q
5/4	5	Low Q	6/4	13	High Q	7/5	21	Low Q
5/5	6	High Q	6/5	13	High Q	7/6	21	High Q
5/6	6	High Q	6/6	14	High Q	7/7	21	High Q
5/7	6	Low Q	6/7	14	High Q	7/8	22	High Q
5/8	6	Low Q	6/8	14	Low Q	7/9	22	High Q
5/9	7	High Q	6/9	14	Low Q	7/10	22	Low Q
5/10	7	High Q	6/10	15	High Q	7/11	22	Low Q
5/11	7	Low Q	6/11	15	High Q	7/12	23	Low Q
5/12	7	Low Q	6/12	15	Low Q	7/13	23	Low Q
5/13	8	Low Q	6/13	15	Low Q	7/14	23	High Q
5/14	8	Low Q	6/14	16	High Q	7/15	23	High Q
5/15	8	High Q	6/15	16	High Q			

### The Dalles Dam

**Spillwall Post Construction Evaluation.** Survival and injury estimates for spillway passed fish will be generated using balloon tag techniques. Test fish will be passed through bays 2 and 4 and 8 (optional, depending on river flow) via release hoses. Control fish will be released downstream of the end sill via a hose. Two test discharges will be evaluated: one per bay discharge that is between 12 and 18 kcfs, and 21 kcfs.

The 21 kcfs treatment may require a forebay restriction at Bonneville, in order to achieve an appropriate tailwater elevation at The Dalles. This will be coordinated with RCC, BPA and regional salmon managers during the study. The balloon-tag study is expected to run from 13 April – 1 May. Each day testing will begin at 0700 hours and conclude around 1900 hours. The balloon-tag study will occur only in the springtime. The start date will be selected prior to the finalization of the FPP. To conduct these evaluations,



tailrace BRZ access is required. The hydraulic environment encountered by test fish in the tailrace will be characterized using autonomous sensors released through spillway hoses. Total mortality rates will be estimated using radio telemetry. Radio tagged fish will be released in John Day Dam's tailrace, The Dalles Ice and Trash Sluiceway, and The Dalles tailrace. This study element will start in late April and conclude around July 20.

**Sluice Operations Evaluation.** An alternative sluiceway operation will be evaluated in 2004. Fixed hydroacoustics, 3-D acoustic telemetry, and radio telemetry will be used to estimate sluice passage. The schedule (Table 1 and Table 2) will include 2 treatments: operation of gates 1-1, 1-2, 1-3 and operation of gates 1-1, 1-2, 1-3, 18-1, 18-2, and 18-3. **Treatments will be switched at 0800 hours daily.** Testing will begin April 19 and end on July 17

**Table 1. TDA spring sluice operations(all 3 gates open for MU1 and MU18).**

Study Block	Study Day	Summer Date	Day of Week	Sluice Treatment	Study Block	Study Day	Summer Date	Day of Week	Sluice Treatment
1	1	19-Apr	Mon	MU 1	14	27	15-May	Sat	MU 1, MU 18
1	2	20-Apr	Tue	MU 1, MU 18	14	28	16-May	Sun	MU 1
2	3	21-Apr	Wed	MU 1, MU 18	15	29	17-May	Mon	MU 1
2	4	22-Apr	Thur	MU 1	15	30	18-May	Tue	MU 1, MU 18
3	5	23-Apr	Fri	MU 1, MU 18	16	31	19-May	Wed	MU 1, MU 18
3	6	24-Apr	Sat	MU 1	16	32	20-May	Thur	MU 1
4	7	25-Apr	Sun	MU 1, MU 18	17	33	21-May	Fri	MU 1
4	8	26-Apr	Mon	MU 1	17	34	22-May	Sat	MU 1, MU 18
5	9	27-Apr	Tue	MU 1	18	35	23-May	Sun	MU 1, MU 18
5	10	28-Apr	Wed	MU 1, MU 18	18	36	24-May	Mon	MU 1
6	11	29-Apr	Thur	MU 1, MU 18	19	37	25-May	Tue	MU 1, MU 18
6	12	30-Apr	Fri	MU 1	19	38	26-May	Wed	MU 1
7	13	1-May	Sat	MU 1	20	39	27-May	Thur	MU 1, MU 18
7	14	2-May	Sun	MU 1, MU 18	20	40	28-May	Fri	MU 1
8	15	3-May	Mon	MU 1	21	41	29-May	Sat	MU 1
8	16	4-May	Tue	MU 1, MU 18	21	42	30-May	Sun	MU 1, MU 18
9	17	5-May	Wed	MU 1	22	43	31-May	Mon	MU 1
9	18	6-May	Thur	MU 1, MU 18	22	44	1-Jun	Tue	MU 1, MU 18
10	19	7-May	Fri	MU 1	23	45	2-Jun	Wed	MU 1, MU 18
10	20	8-May	Sat	MU 1, MU 18	23	46	3-Jun	Thur	MU 1
11	21	9-May	Sun	MU 1, MU 18	24	47	4-Jun	Fri	MU 1
11	22	10-May	Mon	MU 1	24	48	5-Jun	Sat	MU 1, MU 18
12	23	11-May	Tue	MU 1, MU 18					
12	24	12-May	Wed	MU 1					
13	25	13-May	Thur	MU 1, MU 18					
13	26	14-May	Fri	MU 1					

**Table 2. TDA summer sluice operations**(all 3 gates open for MU1 and MU18).

Study Block	Study Day	Summer Date	Day of Week	Sluice Treatment	Study Block	Study Day	Summer Date	Day of Week	Sluice Treatment
1	1	6-Jun	Sun	MU 1	12	23	28-Jun	Mon	MU 1, MU 18
1	2	7-Jun	Mon	MU 1, MU 18	12	24	29-Jun	Tue	MU 1
2	3	8-Jun	Tue	MU 1, MU 18	13	25	30-Jun	Wed	MU 1, MU 18
2	4	9-Jun	Wed	MU 1	13	26	1-Jul	Thur	MU 1
3	5	10-Jun	Thur	MU 1, MU 18	14	27	2-Jul	Fri	MU 1, MU 18
3	6	11-Jun	Fri	MU 1	14	28	3-Jul	Sat	MU 1
4	7	12-Jun	Sat	MU 1, MU 18	15	29	4-Jul	Sun	MU 1
4	8	13-Jun	Sun	MU 1	15	30	5-Jul	Mon	MU 1, MU 18
5	9	14-Jun	Mon	MU 1	16	31	6-Jul	Tue	MU 1, MU 18
5	10	15-Jun	Tue	MU 1, MU 18	16	32	7-Jul	Wed	MU 1
6	11	16-Jun	Wed	MU 1, MU 18	17	33	8-Jul	Thur	MU 1
6	12	17-Jun	Thur	MU 1	17	34	9-Jul	Fri	MU 1, MU 18
7	13	18-Jun	Fri	MU 1	18	35	10-Jul	Sat	MU 1, MU 18
7	14	19-Jun	Sat	MU 1, MU 18	18	36	11-Jul	Sun	MU 1
8	15	20-Jun	Sun	MU 1	19	37	12-Jul	Mon	MU 1, MU 18
8	16	21-Jun	Mon	MU 1, MU 18	19	38	13-Jul	Tue	MU 1
9	17	22-Jun	Tue	MU 1	20	39	14-Jul	Wed	MU 1, MU 18
9	18	23-Jun	Wed	MU 1, MU 18	20	40	15-Jul	Thur	MU 1
10	19	24-Jun	Thur	MU 1	21	41	16-Jul	Fri	MU 1
10	20	25-Jun	Fri	MU 1, MU 18	21	42	17-Jul	Sat	MU 1, MU 18
11	21	26-Jun	Sat	MU 1, MU 18					
11	22	27-Jun	Sun	MU 1					

**Bonneville Dam**

**Bonneville Rehab Biological Testing (also testing under the Turbine Survival Program.** Main unit 1 will need to be commission tested once it returns to service in May 2004. The unit will undergo a series of pre-startup tests. A normal pre-start scenario is to mechanically roll the unit for 1 day. After the unit has been deemed structurally sound, the unit will be HIPOT tested for 2-3 days. After this test series is complete the unit will be subjected to a minimal run load rejection test. Once test are completed the unit will be then advanced to a 72 hour run test, followed by the 100 day commissioning test. Unit 1 is scheduled to return to normal operation by early June 2004. This commissioning test was coordinated with the FFDRWG group and endorsement was gained to complete the test on February 3, 2004.

**Survival Evaluation.** As part of the B2 corner collector evaluation, project and route specific survival, and passage distribution will be estimated for spring and summer migrants. We will evaluate survival of spring chinook salmon and steelhead through (1) the B1 ice and trash sluiceway, (specific gates to be evaluate are 2c, 4c, & 6c in the Spring, and 1c, 3c, & 6c in the Summer), (2) through an MGR turbine unit (MU-4), and from upstream releases through the B2 CC, B2 JBS, spillway, and both powerhouses. We will evaluate survival of fall chinook salmon through the B1 ice and trash sluiceway (specific sluice gates to be evaluated are 1c, 3c, & 6c in the Summer), and with upstream releases through the B2 CC, B2 JBS, Spillway and both powerhouses. It is expected that

unit 4 that is being used for turbine survival testing will need to be shut down for release pipe/hose installation, and potentially in-season fixes. Due to the potential for changes in operations that could affect presently planned survival research contingency plans are being formulated for discussions with regional fishery managers.

Research at MU-4 MGR likely will occur during the spring passage season only. Unit outages will be required for the installation and removal of monitoring equipment in the sluiceway and MU-4 both Spring and Summer. Further, there will likely be the need for unit outages in order to fix broken or non-functional equipment within the evaluation timeframe (April through July). Specific project operations required will be maintaining unit 4 as a priority unit for the spring passage season/evaluation. Powerhouse priority during the MGR testing should keep unit 4 as first on last off with a minimum of unit 2 operating as the same time during testing to maintain good egress conditions of test fish through the test period (April- July 2004).

**Prototype Testing of Fish Guidance Efficiency (FGE) Improvements and Unit Gap Loss at Bonneville Second Powerhouse.** In 2004, prototype testing of a newly designed VBS will be conducted with two differing technologies (DIDSON & hydroacoustics). Testing will begin in late April and conclude in late July and will require the test units (15 & 17) to be shut down for short periods for removal and placement of the DIDSON camera frame. The required outage will be for approximately 1-2 hours for each unit per day for two weeks. Additional hydroacoustics transducers have will be installed in units 11, 12, 15, 17 to measure changes in FGE minus Turbine Intake Extensions (TIEs) and the B2CC operating.

Hydroacoustics will be used to estimate FGE (ERDC and PNNL). For the PNNL deployment, transducers will be installed both on the STS and on the trash racks prior to the test start date. Testing will be completed by Mid July. Installation on both the trash racks and STS will require a one-day outage. As always, several outages should be expected throughout the testing season to repair equipment.

It is expected that the test units will be available for normal operation during non-testing periods (unless significant fish injury is seen) to meet project/regional needs.

**Unit Priorities for spring and summer.** Unit priorities will be the same at B2 for the spring and summer in order of first on last off – 11, 17, 12, 13, 18, 14, 15, & 16. These operations are in support of the FGE and survival tests planned. Unit priorities will differ at B1 from spring and summer. Spring priorities at B1 are 4, 2, 3, 5, 6, 7, 10, 8, & 9. Sluice gates at B1 that will be operational in the spring will be 2c, 4c, & 6c. Summer priorities at B1 are 1, 3, 4, 5, 6, 7, 10, 8, & 9. Sluice gates that will be operational in the summer will be 1c, 3c, & 6c.

## 12. Research Activities that will Impact Project Operations

Project	2004 Snake River Research Summary Table		
	Research Objectives	Spring Spill Plan	Summer Spill Plan
Lower Granite	RSW/BGS study	4/15 – 5/30: 24 hrs ~7kcfs RSW & 12kcfs training spill. 3-day blocks BGS in vs. BGS out.	N/A
Little Goose		N/A	N/A
Lower Monumental	Spillway survival study: bulk vs. BiOp/FPP spill	4/15 – 6/17: 24 hrs Bulk spill vs. FPP 2- day block design.	N/A
Ice Harbor	Spillway survival	4/15 – 7/15: 24 hrs Bulk spill vs. FPP 2-day block design.	

Project	2004 Lower Columbia River Research Summary Table		
	Research Objectives	Spring Spill Plan	Summer Spill Plan
Bonneville	Route specific and spill survival	6/20 – 7/31 50kcfs/24 hrs  vs.  <u>Day:</u> 75kcfs <u>Night:</u> Gas cap	
The Dalles	Post-construction evaluation of spillway wall	4/13 – 5/1: Daytime only balloon tag releases. 12-18kcfs vs. 21kcfs  Late April – 7/20: Radio tag mortality estimates	
	Sluice operations evaluation	4/19 – 6/30: 24 hrs 2-day block design 3 gates vs. 6 gates	7/1 – 7/17: 24 hrs 2- day block design 3 gates vs. 6 gates
John Day		N/A	N/A
McNary		N/A	N/A