

Spring / Summer Update to the 2006 Water Management Plan

FINAL – May 3, 2006

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Draft Spring / Summer Update to the 2006 Water Management Plan

1. Introduction

The 2006 Spring/Summer update to the Water Management Plan (WMP) updates information on how the Action Agencies plan to operate 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. Planned operations in the *S/S 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 2006. The “May Final” water supply forecast was the most current forecast available when the final version of the *S/S Update* was completed.

The *S/S Update* also reports 2006 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 second powerhouse corner collector. 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 WMP but does provide 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, flow projections, and other new information.

The 2006 Fish Passage Implementation Plan is an addendum to this *S/S Update*. It was developed to implement the operations included in Judge Redden’s December 29, 2005 Preliminary Injunction Opinion and Order. See 2006 Water Management Plan for more details about this order and the Biological Opinion remand.

2. Role of Water Supply Forecasts (WSF)

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

Forecast Point	Forecast Period	Forecast Date	Value (MAF)	Percent of Normal
Lower Granite	April – July	April Final	25.5 A	118.3
Lower Granite	April – July	May Final	27.1	125.7
The Dalles	April – August	April Final	92.7 B	99.6
The Dalles	April – August	May Final	95.6	102.7
Hungry Horse	April – August	April Final	2.16 B	104.0
Hungry Horse	April – August	May Final	2.15 B	104.0
Libby	April - August	April Final	6.08 C	97.2
Libby	April – August	May Final	6.18 CD	98.9

All forecasts are from the National Weather Service unless otherwise indicated:

A – Value that is used to set operations for spring flow objectives

B – USBR Forecast C – COE Forecast

D – Value that is used to set operations for Libby sturgeon pulse

3. Seasonal Flow Objectives

Spring

The spring seasonal flow objectives for Lower Granite and McNary are established by the April final water supply forecast. The Priest Rapids spring seasonal 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 Seasonal Flow Objective
Lower Granite	100 KCFS
McNary	260 KCFS
Priest Rapids	135 KCFS

Summer

The summer seasonal flow objective for Lower Granite Dam is based on the June final water supply forecast. Based on the latest water supply forecast (May Final) the summer seasonal flow objectives are shown below. The McNary summer seasonal flow objective is fixed (not dependent on the water supply forecast).

Project	Summer Seasonal Flow Objective
Lower Granite	54.0 KCFS
McNary	200 KCFS

Prospects for Meeting Flow Objectives

An analysis of the likelihood of meeting the flow objectives was conducted by using the Northwest River Forecast Center Ensemble Streamflow Prediction (ESP) inflows in the Corps Hydro System Seasonal Regulation Program (HYSSR) model. This model uses the current basin conditions combined with 44 historical weather patterns (temperature and precipitation) to produce 44 ESP hydrographs for 2006. 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 time frame in which the snowmelt and stream flows occur. The likelihood of meeting the 2006 spring/summer flow objectives, based on April 25, 2006 ESP inflows, are shown in Section 13 of this document. This ESP/HYSRR model results indicate a high likelihood of meeting or exceeding Priest Rapids, Lower Granite and McNary flow objectives in May and June. The model also indicates a high likelihood of meeting or exceeding Lower Granite and McNary flow objectives in July (Priest Rapids flow objectives are only in effect through 30 June). Finally, the model forecasts a low probability of meeting Lower Granite and McNary August flow objectives.

4. Storage Project Operations

See Section 13, 14 and 15 for latest ESP HYSSR model runs, volume charts for Libby, Dworshak and Hungry Horse and latest Dworshak ESP graphs.

Libby Dam

Sturgeon Pulse

The May final WSF of 6.18 MAF for Libby (April – August) puts Libby operations in the 3rd tier of operations for sturgeon called for in the USFWS 2006 Biological Opinion. The 3rd tier sturgeon operation calls for a sturgeon pulse volume of 1.06 MAF.

Sturgeon pulse operations and subsequent salmon operations will be coordinated at TMT.

Bull trout flows

Based on the May final WSF and the 3rd tier of operations for sturgeon, the minimum bull trout flows are 8 kcfs in July. The project will also initiate bull trout flows of at least 6 kcfs on May 15 per the USFWS 2006 BiOp,

Hungry Horse Dam

Water Supply Forecast and Minimum Flows

The May final Bureau of Reclamation WSF for April – August was 2157 kaf, 104 percent of normal. Minimum flow requirements from Hungry Horse and Columbia Falls from March through December are based on the March final forecast. This year the minimum flow requirements were set at 900 cfs and 3500 cfs, respectively.

Hungry Horse April 10 and June 30 Refill Objectives

The Bureau of Reclamation computes Hungry Horse's April 10 elevation objective by linear interpolation between the March 31 and April 15 forecasted flood control elevations based on the March final water supply forecast (wsf). Based on the March final (wsf), the April 10 objective was elevation 3523.5 feet. The project was at elevation 3524.0 on April 10. Hungry Horse Dam is expected to refill by the end of the first week of July

Grand Coulee Dam

Grand Coulee April 10 and June 30 refill Objective

The Bureau of Reclamation computes Grand Coulee's April 10 elevation objective by linear interpolation between the March 31 and April 15 forecasted flood control elevations based on the March final water supply forecast (wsf). Based on the March final (wsf) and the corresponding shifted flood control elevations the April 10 objective was elevation 1248.4 feet. The project was at elevation 1249.9 feet on April 10. Grand Coulee is expected to refill to 1290 feet by the first week of July

Grand Coulee Summer Draft Limit

The Grand Coulee summer draft limit is set by the magnitude of the July final April – August wsf at The Dalles Dam. Based on the May Final forecast at The Dalles, the summer draft limit for Grand Coulee is expected to be 1280 feet.

Dworshak Dam

Summer Draft for Temperature Control and Flow Augmentation

A key operation at Dworshak Dam is to draft cold water from the Dworshak reservoir in July, August, and September to cool water temperatures and provide flow augmentation 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. The summer reservoir draft limit is 1,520 feet. This limit determines the maximum draft available for summer flow augmentation from Dworshak. The Action Agencies will draft Dworshak to 1520 feet in September. The extension of the draft limit from August 31 into September reflects requirements for about 200 kaf to be held for release by the Nez Perce Tribe as defined per the Snake River Basin Adjudication.

5. Upper Snake River Flow Augmentation

The Bureau of Reclamation currently estimates that the full 487 kaf of Upper Snake River flow augmentation will be provided in 2006.

6. Flood Control Operations

The 31 January – 30 April flood control elevations below are based on previous forecasts.

Project	31-Jan	28-Feb	15-Mar	31-Mar	30-Apr
ARDB	1430.5	1422.9		1414.1	1414.1
LIB	2426.7	2412.1	2404.1	2404.1	2412.3
DCDB	1845.1	1815.7		1812.4	1813.6
HGH	3543.8	3531.7		3526.2	3527.5
GCL	1290.0	1290.0		1265.9	1221.6
GCL-shifted	--	--		1263.6	N/A
BRN	2077.0	2044.5		2036.5	2023.4
BRN-shifted	--	--		2077.0	N/A
DWR*	1540.7	1524.2		1520.4	1536.9
DWR-shifted*	--	--		1532.4	N/A

Dworshak/Grand Coulee flood control shift

The Grand Coulee shift is based only on the Dworshak shift with no shift from Brownlee as Idaho Power Company (Brownlee owner) did not request shift until 3 April, at which time it was too late for Grand Coulee to accept this shift, reach their targeted 10 April flood control elevation and stay within their 1.5 ft/day draft limit based on project safety considerations.

Grand Coulee Dam Flood Control Deviation

Reclamation formally requested and received a deviation from standard flood control in April. The deviation allowed Grand Coulee to be above the April 30 flood control elevation (1229.0 feet) on April 30 with the proviso 1229.0 feet would be achieved by May 5th. This operation helped to avoid a drop in discharge while waiting for the spring freshet to arrive. Adjustments will be made on a weekly basis to the deviation as necessary.

Dworshak Dam Flood Control Deviation

The Corps Reservoir Control Center formally requested and received a deviation from standard flood control in April. The deviation allowed Dworshak to be above the April 30 flood control elevation on April 30 with the proviso the project draft would intersect the refill curve the first week in May. This operation helped reduce the amount of spill and helped to avoid an abrupt drop in discharge in early May. Adjustments will be made on a weekly basis to the deviation as necessary.

7. Minimum Operating Pool

The minimum operating pool (MOP) operation for the Lower Snake projects planning date is 3 April. The Salmon Managers submitted SOR 2006-2 requesting the Snake River projects begin MOP operations coincidentally with the initiation of Court ordered spill. It was agreed at the 29 March 2006, TMT meeting that lower Snake River reservoir levels would be transitioned to a MOP operation by gradually reducing each projects' operating range over the first few days of spill. The table below describes the reservoir elevation ranges under MOP operations in 2006. Below the table is a description of how the lower Snake River elevation levels were adjusted to reach MOP operational levels.

Project	Lower Range		Upper Range	
	Operation	Elevation	Operation	Elevation
Ice Harbor	MOP	437	MOP + 1	438
Lower Monumental	MOP	537	MOP + 1	538
Little Goose	MOP	633	MOP + 1	634
Lower Granite	MOP	733	MOP + 1	734

IHR MON, APRIL 3 437-439 FEET
 IHR TUE, APRIL 4 437-438 FEET (MOP TO MOP+1)

LMN MON, APRIL 3 537-539 FEET
 LMN TUE, APRIL 4 537-538 FEET (MOP TO MOP+1)

LGS MON, APRIL 3 633-637 FEET
 LGS TUE, APRIL 4 633-636 FEET
 LGS WED, APRIL 5 633-635 FEET
 LGS THU, APRIL 6 633-634 FEET (MOP TO MOP+1)

LWG MON, APRIL 3 733-737 FEET
 LWG TUE, APRIL 4 733-736 FEET
 LWG WED, APRIL 5 733-735 FEET
 LWG THU, APRIL 6 733-734 FEET (MOP TO MOP+1)

At John Day, the forebay is being operated within a 1.5-foot range of the minimum level that provides irrigation pumping from 10 April to 30 September. The initial range is 262.5 and 264.0 feet. The minimum level will be adjusted upward if needed to facilitate irrigation pumping. Actual John Day operations 262.5' – 264' range started 10 April 2006.

8. Hanford Reach

The Vernita Bar protection level flow was set at a level of 70 kcfs based on the 20 November 2005 redd count. This year's Vernita Bar protection operation is scheduled to end when the water over the eggs have accumulated 1400 (C degrees) thermal units after the initiation of spawning. See Appendix C for the Hanford Reach Agreement.

9. Spill and Transportation for Juvenile Fish Passage

Implementation of spill and transportation for juvenile fish passage is described in the 2006 Fish Passage Implementation Plan. This plan was finalized and submitted to the court along with the 2nd quarterly report on 3 April 2006. This plan is an attachment to the Water Management Plan.

The Corps' fish transportation expired on December 31, 2005 and was extended by NMFS through March 31, 2007. NMFS plans on processing an application for a new five-year permit next year, when the new FCRPS BiOp is issued.

10. Operation Considerations

John Day: The T-1 bank of transformers failed on 2 March 2006. This prevents operation of main units 1 – 4 which are the 2nd – 5th turbine unit operating priority units. As of 5 April 2006, the project estimates the best case scenario is the transformers will be repaired in September 2006.

The Dalles: Wire rope for spill bays 7 – 9 was replaced during the fish passage season. Bays 1 – 9 are the priority bays for spill. Work was completed on April 25, twenty days ahead of schedule. The fact these bays were not available did not affect fish for spill operations as the spill to the gas cap was achievable using bays 1 – 6.

11. 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. The initial spill priority list for the fish spill season was issued April 3 as shown below. Involuntary spill will occur in the order shown. The priorities will be modified as needed based on status of fish migration, spill/transport strategies, and studies, and other factors.

1. Lower Granite
2. Little Goose
3. Lower Monumental
4. Bonneville
5. John Day
6. The Dalles
7. Wanapum
8. Wells
9. Rocky Reach
10. Rock Island
11. Priest Rapids

- 12. McNary
- 13. Ice Harbor
- 14. Grand Coulee
- 15. Chief Joseph

Other Spill Operations

Until construction of the spill deflectors at Chief Joseph Dam has been completed, spill swapping between Chief Joseph Dam and Grand Coulee Dam will not be implemented if the spill deflector contractor is working downstream of Chief Joseph Dam. Construction of the deflectors is expected to take three years.

12. 2006 Fish Passage Research

Summaries of 2006 fish passage research studies not included in the 2006 Fish Passage Plan are described below.

Project	2006 Snake River Research Summary Table		
	Research Objectives	Spring Spill Plan 3 April – 20 June	Summer Spill Plan 21 June – 31 August
Lower Granite	<p>Examine RSW efficiency and effectiveness, and fish behavior in the vicinity of the RSW and the Behavioral Guidance Structure.</p> <p>Alternative barging strategies to improve survival of transported juvenile salmonids.</p> <p>Monitor adult migration behavior around modified weirs within the fishway.</p>	<p><u>15 April – 21 May</u> 20 kcfs spill (6kcfs RSW and 14kcfs training spill)</p> <p>Operate RSW 24/7 with BGS test in/out.</p> <p>6 alt. site releases of PIT yr. Chinook on Sundays starting 4/23 and ending 5/28.</p> <p>RT study with spring Chinook</p>	<p><u>20 June – 21 July</u> 18 kcfs spill 24/7 with RSW operating 24/7.</p> <p>Evaluate 2 spill training patterns on the survival of subyearling fall Chinook.</p>

<p>Little Goose</p>	<p>Examine route specific survival estimates, approach paths, passage distribution, forebay residence time, and tailrace egress.</p> <p>Migration behavior of juvenile salmonids at dam</p>	<p><u>15 April – 30 May</u> 30% spill 24/7</p> <p>Alternating two different spill patterns (see FPIP).</p>	<p><u>30 June -31 July</u> 30% spill 24/7</p> <p>Alternating two different spill patterns (see FPIP).</p>
<p>Lower Monumental</p>	<p>Radio telemetry study examining spring bulk spill versus a hybrid pattern.</p> <p>Evaluation of bulk spill for direct injury using balloon tagged juvenile salmonids.</p> <p>Evaluating the response of juvenile fall Chinook migration to hydraulic conditions in gatewells. Fish passage and survival at dam</p>	<p><u>25 April – 30 May</u> 40 kcfs spill 24/7</p> <p>Spill will vary between bulk spill and a hybrid pattern that has both bulk and flat spill gate openings.</p> <p>Interrupted and discontinuous spill to recover research fish in tailrace.</p>	<p><u>21 June – 31 August</u> 17 kcfs spill 24/7</p> <p>Continue RT and AT study to assist with a RSW post construction survival evaluation in 2007.</p>
<p>Ice Harbor</p>	<p>Radiotelemetry, hydroacoustic, and balloon tag studies to examine the passage and survival rates of fish passing over the RSW, spillway, and through the powerhouse.</p> <p>Fish passage and survival at dam</p>	<p><u>20 April – 10 June</u> 30% 24/7 versus 45 kcfs day/spill cap night</p> <p>Both treatments will have RSW operating 24/7.</p>	<p><u>11 June – 10 July</u> 30% 24/7 versus 45 kcfs day/spill cap night.</p>

Project	2006 Lower Columbia River Research Summary Table		
	Research Objectives	Spring Spill Plan 10 April – 30 June	Summer Spill Plan 1 July – 31 August
McNary	<p>Spring spill study to examine fish passage, survival rates and behavior under 2-treatments.</p> <p>Evaluate the effects of turbine passage on juvenile salmonids.</p>	<p><u>26 April – 30 June</u></p> <p>40% spill 24/7 versus 0 kcfs daytime/ spill cap night.</p> <p>17 April – 9 June</p>	<p><u>20 June – 22 July</u></p> <p>40% spill versus 60% spill 24/7 in 2-day blocks.</p> <p>Mid June – August</p>
John Day	<p>Monitor fish passage under special operation during spring.</p> <p>Comparative performance of acoustic tagged and PIT tagged juvenile salmonids.</p>	<p><u>10 April – 30 June</u></p> <p>Under a special operation due to turbine outage: maintain 30% spill 24/7 until further notice</p>	<p><u>20 June – 20 July</u></p> <p>30% spill 24/7</p> <p>Estimate tailrace survival and detection probabilities of subyearling Chinook for future AT research.</p>
The Dalles	<p>Survival and tailrace egress of yearling Chinook following spillway passage at dam (RT)</p> <p>Spring vortex suppression test delayed due to high river flows but may occur in fall</p>	<p><u>10 April – 30 June</u></p> <p>40% spill 24/7</p> <p>10 May -10 June</p>	<p><u>7 June – 20 July</u></p> <p>40% spill 24/7</p> <p>Estimate tailrace survival and detection probabilities of subyearling Chinook for future AT research.</p>

Bonneville	<p>Estimate total survival of yearling Chinook passing through the dam and spillway.</p> <p>Evaluate new PIT-tag detection system at dam.</p> <p>Evaluate passage timing and effects for fish passing through the B2 – JBS transport flume.</p> <p>Evaluate potential effects of modified entrance gates and pinniped deterrents on salmon passage at dam (RT).</p>	<p><u>26 April – 7 June</u></p> <p>100 kcfs spill 24/7</p> <p>Fish passage spill patterns exceeding 92 kcfs will follow FPP, see FPIP for new patterns below 92 kcfs.</p> <p>April - June</p>	<p><u>1 July – 31 August</u></p> <p>75 kcfs spill during day 120 kcfs night spill cap</p>
Other System wide	Adult straying, passage history and energy conditions relative to reproductive fitness		

13. Latest ESP HYSSR Model Runs (Apr 25 streamflows)

Summary of 01 May 2006 ESP HYSSR Model Runs

3-May-06

Assumptions:

- * Streamflows are from the 25 Apr ESP run, which uses current basin conditions combined with 44 historical weather patterns (temperatures and precipitation) to produce 44 ESP hydrographs for 2006.
- * Flood control is based on the April Final.
- * Grand Coulee operates to flood control May 31. Coulee tries to meet 135,000 cfs at Priest Rapids in June, while drafting no lower than 1287 ft by June 30 to meet the target. Summer lake targets are 1285.0 ft in July and 1280 ft in August.
- * Hungry Horse operates May and June for a controlled refill by 30 June and meets minimum flow of 3,500 cfs at Columbia Falls. The project drafts to 3540 ft by 31 Aug.
- * Brownlee operates for flood control in May and refills in June to 2077 ft, and drafts some in July - August.
- * Dworshak operates for flood control in May targeting full in June and drafting to 1534 ft by 31 Aug.
- * Libby increases in May to meet a 1 MAF sturgeon pulse and targets full in June. Libby drafts to 2439 ft by 31 Aug, while meeting bull trout minimum flows of 8,000 cfs.

Results:

Priest Rapids Meets the Following Flow Objectives:

Month	Occurrences out of 44 Years	Average Flow for 44 Years (kcfs)	Flow Objective (kcfs)
May	44	183	135
Jun	37	163	135

Lower Granite Meets the Following Flow Objectives:

Month	Occurrences out of 44 Years	Average Flow for 44 Years (kcfs)	Flow Objective (kcfs)
May	44	132	100
Jun	44	118	84
Jul	22	55	54
Aug 15	0	35	54
Aug 31	0	36	54

McNary Meets the Following Flow Objectives:

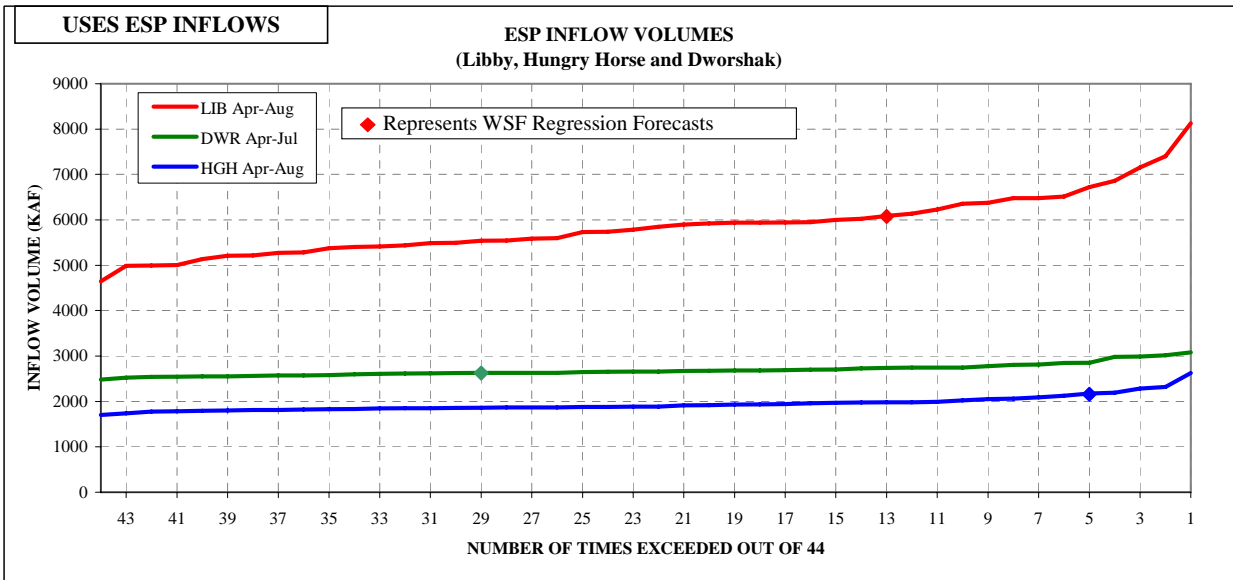
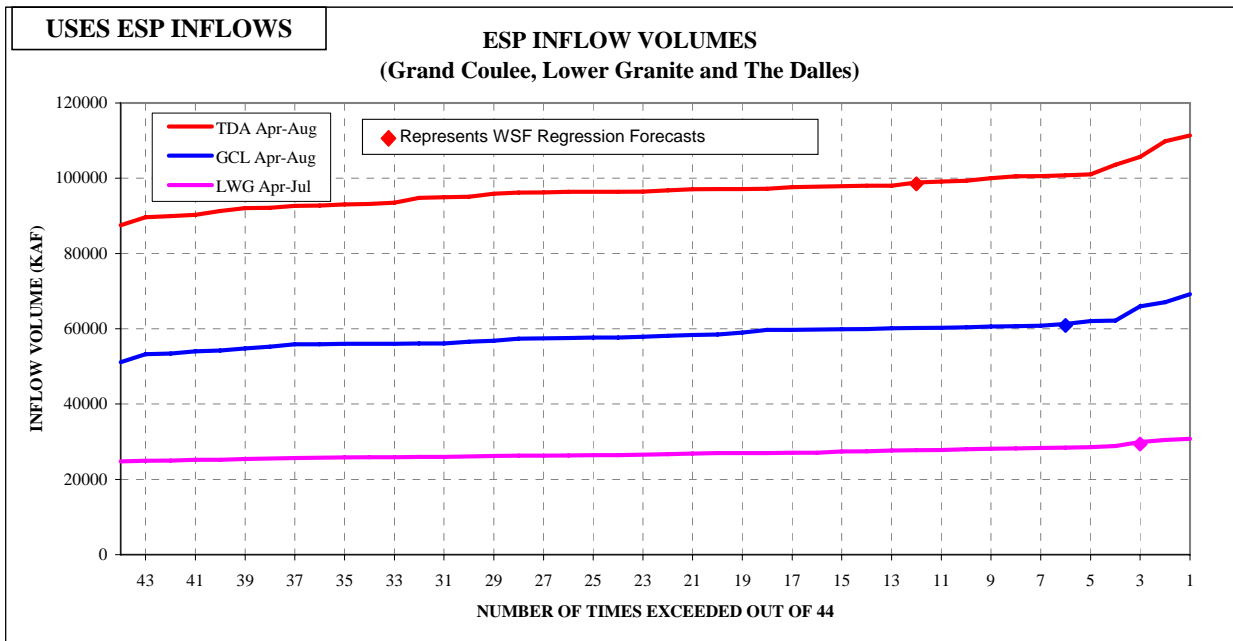
Month	Occurrences out of 44 Years	Average Flow for 44 Years (kcfs)	Flow Objective (kcfs)
May	41	321	260
Jun	36	288	260
Jul	30	215	200
Aug 15	0	137	200
Aug 31	0	132	200

Projects Refill to within 1 foot of full by 30 June:

Month	Occurrences out of 44 Years	Average Elevation on 30 Jun for 44 Years
Libby	28	2456
Hungry Horse	31	3559
Grand Coulee	37	1290
Dworshak	43	1600

Period Average Flows (kcfs):

	OBS FEB 1-28	OBS MAR 1-31	OBS APR 1-30	FCST MAY 1-31	FCST JUN 1-30	FCST JUL 1-31	FCST AUG 1-15	FCST AUG 16-31	FCST SEP 1-30
LIB	4.0	7.6	4.6	12.3	18.3	22.4	16.2	15.0	7.5
HGH	5.4	2.0	9.2	4.7	1.8	6.3	5.8	4.5	1.6
GCL	103	84	141	161	138	143	92	90	70
PRD	112	95	156	183	163	155	98	94	74
DWR	6.7	3.7	12.8	6.4	4.5	10.1	10.1	12.6	4.5
BRN	29	32	64	44	29	15	14	14	14
LWG	45	51	123	132	118	55	35	36	27
MCN	162	149	291	321	288	215	137	132	102
TDA	170	156	292	342	300	219	140	136	106
BON	177	165	308	347	305	222	142	138	108



Volume Comparison Table (ESP versus Regression) - May Earlybird:

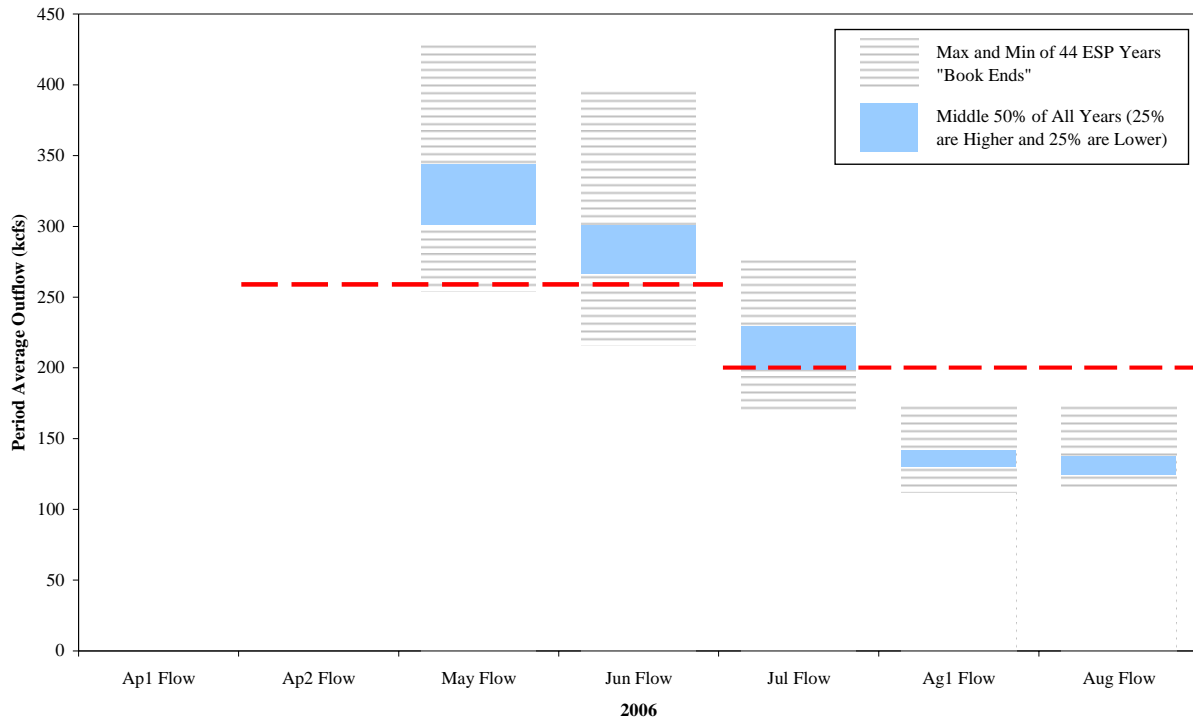
	Forecast Period	Official WSF (Regression)			ESP Volumes				
		Volume (kaf)	Percent of Average	30 year Average (kaf)	10% Exceedance Probability	30% Exceedance Probability	50% Exceedance Probability	70% Exceedance Probability	90% Exceedance Probability
Grand Coulee	Apr-Aug	60900	101%	60290	61800	59900	58000	56100	54400
Lower Granite	Apr-Jul	29400	136%	21550	28500	27500	26600	26000	25300
The Dalles	Apr-Aug	98500	106%	93090	101000	98100	96600	94900	91500
Hungry Horse *	Apr-Aug	2157	104%	2070	2160	1980	1880	1850	1790
Libby **	Apr-Aug	6076	97%	6248	6500	6010	5780	5470	5150
Dworshak **	Apr-Jul	2626	99%	2645	2840	2710	2660	2620	2550

* USBR Official Forecast (April Final)

** Corps Official Forecast (April Final for Libby, May Final for Dworshak)

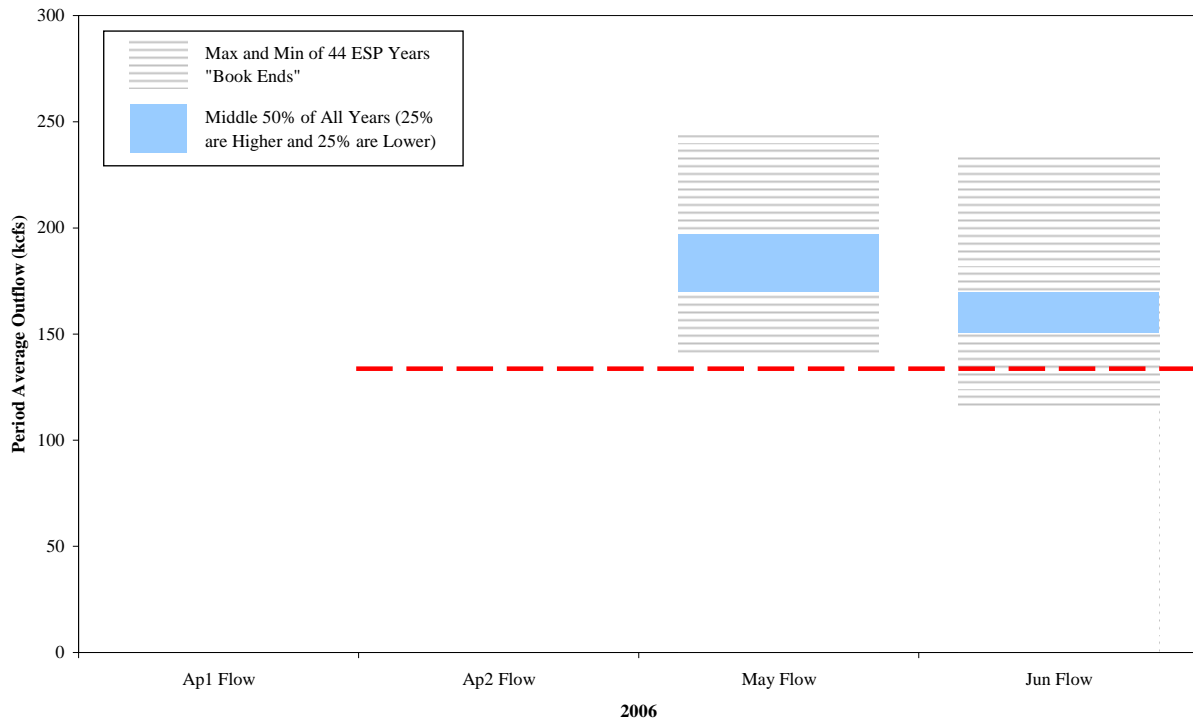
USES ESP INFLOWS

**MCNARY ESP HYSSR RESULTS
MONTHLY OUTFLOW PROJECTIONS**



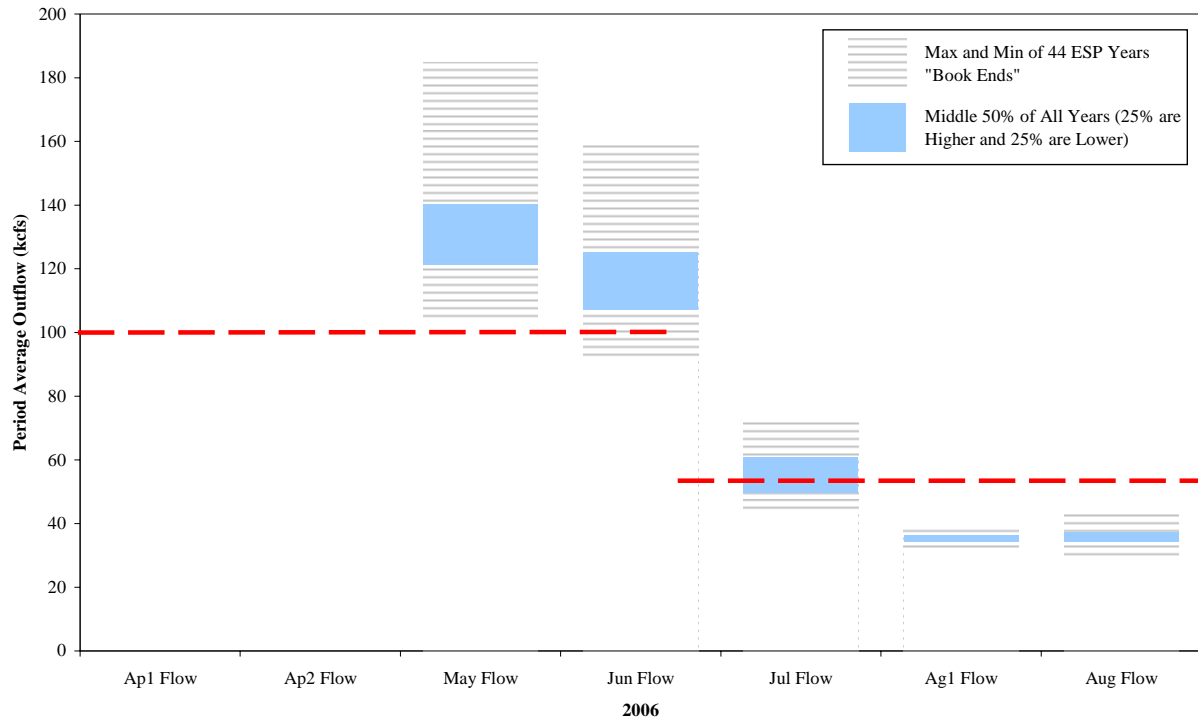
USES ESP INFLOWS

**PRIEST RAPIDS ESP HYSSR RESULTS
MONTHLY OUTFLOW PROJECTIONS**



USES ESP INFLOWS

**LOWER GRANITE ESP HYSSR RESULTS
MONTHLY OUTFLOW PROJECTIONS**

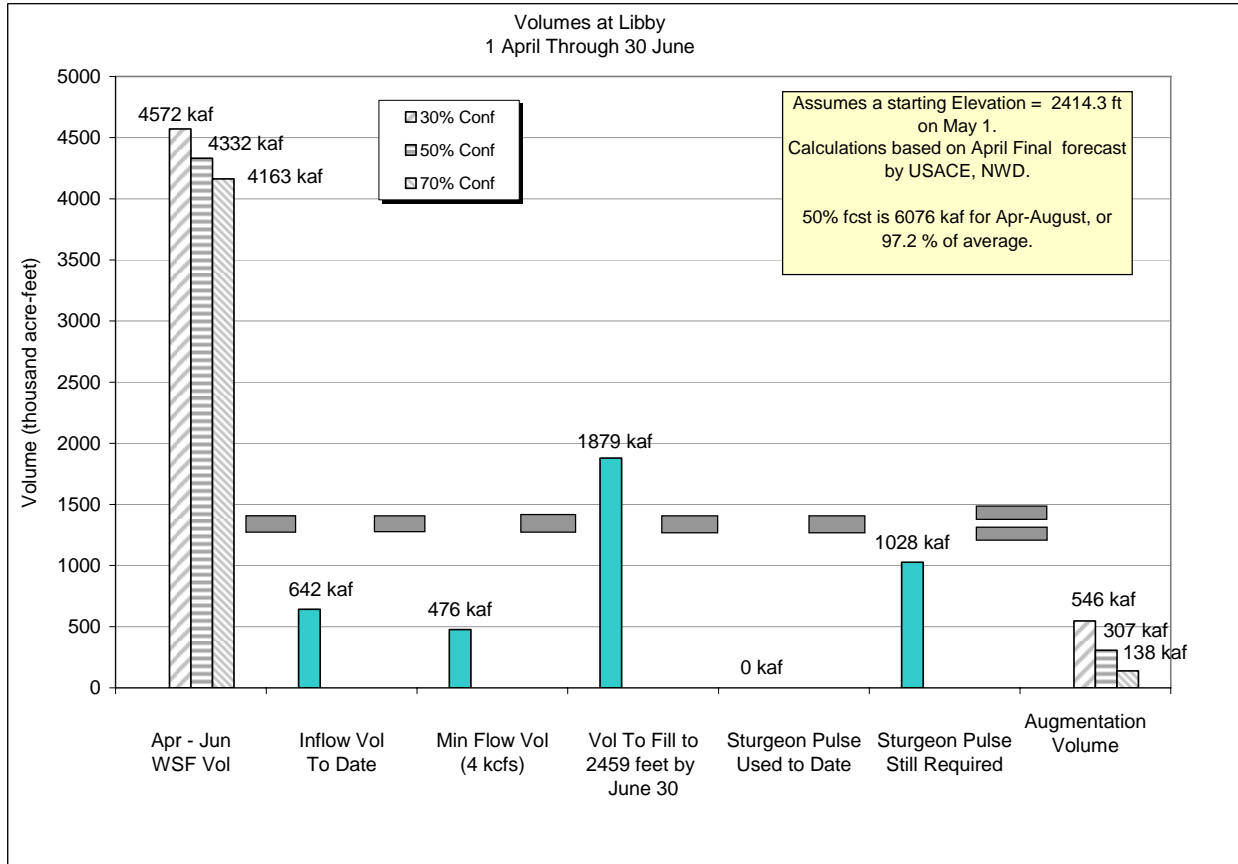


14. Latest Flow Augmentation Charts

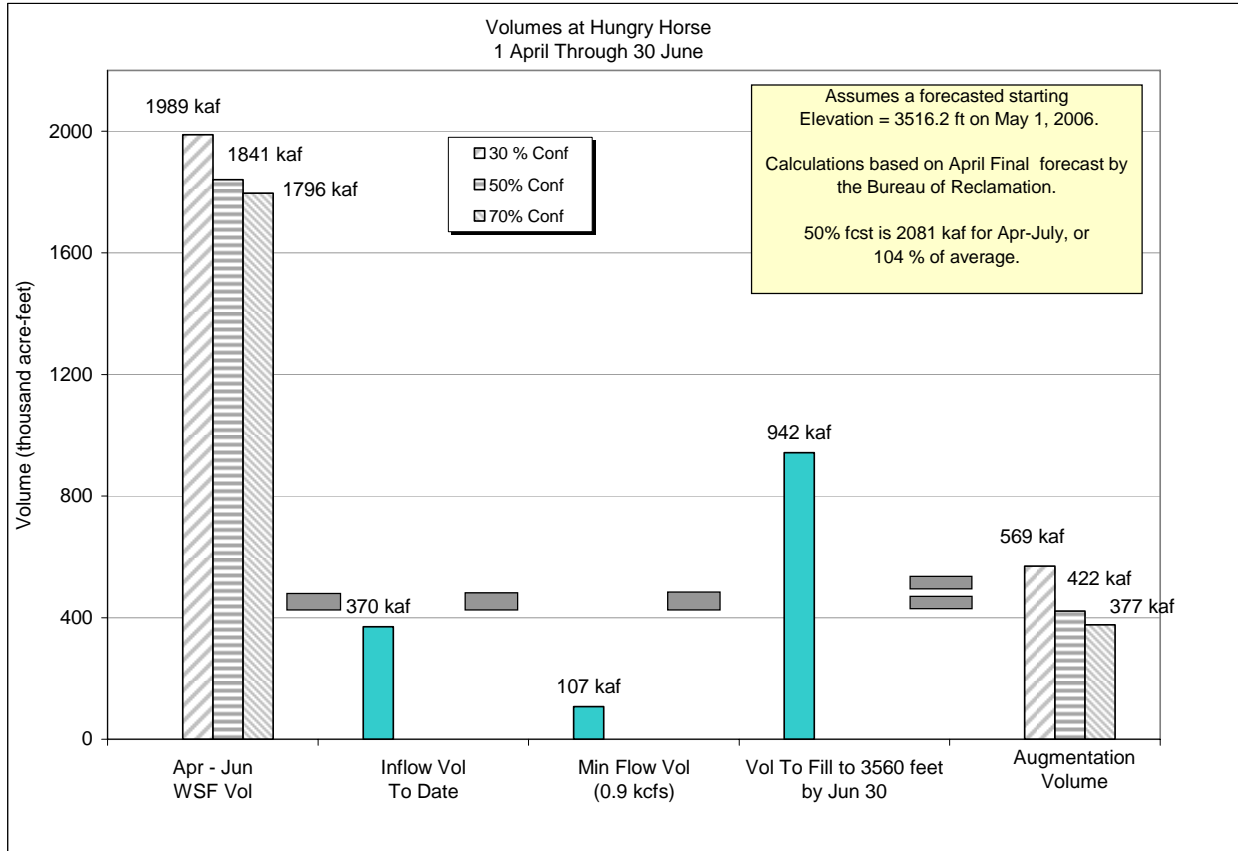
Assumes April final forecast and actual runoff through May 1.

Libby and Hungry Horse

Libby

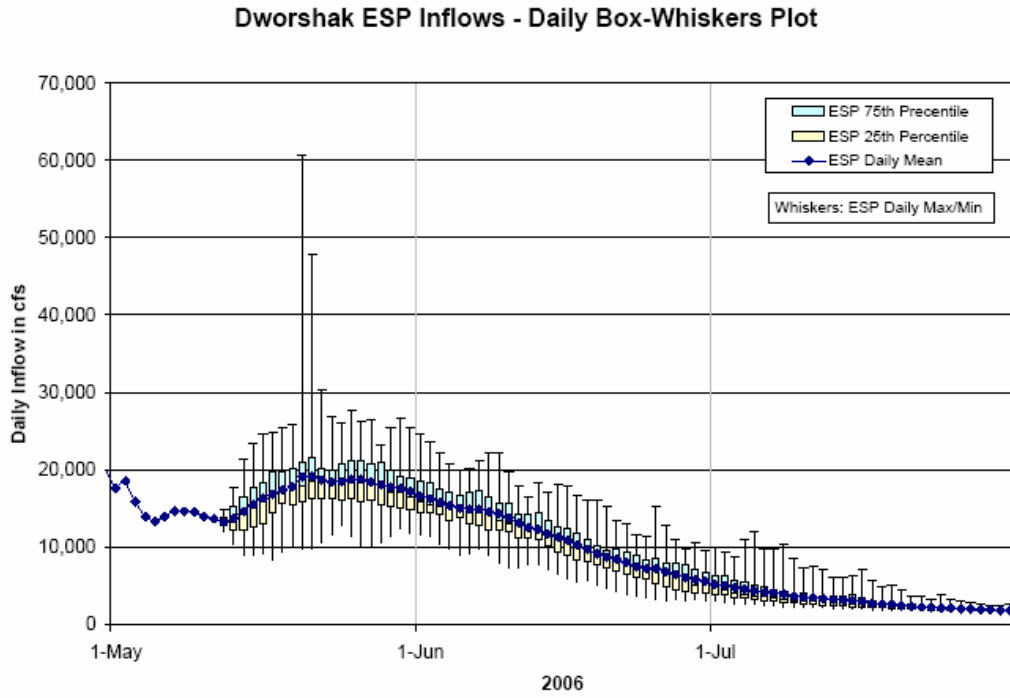


Hungry Horse

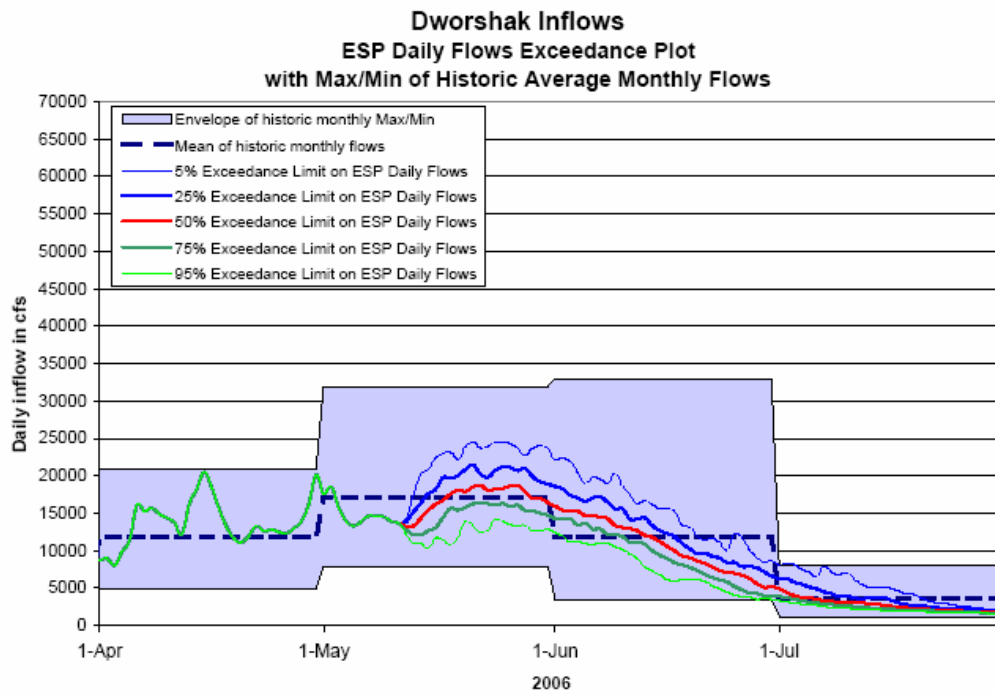


15. Latest DWR ESP Graphs (week of April 30)

ESP Inflow



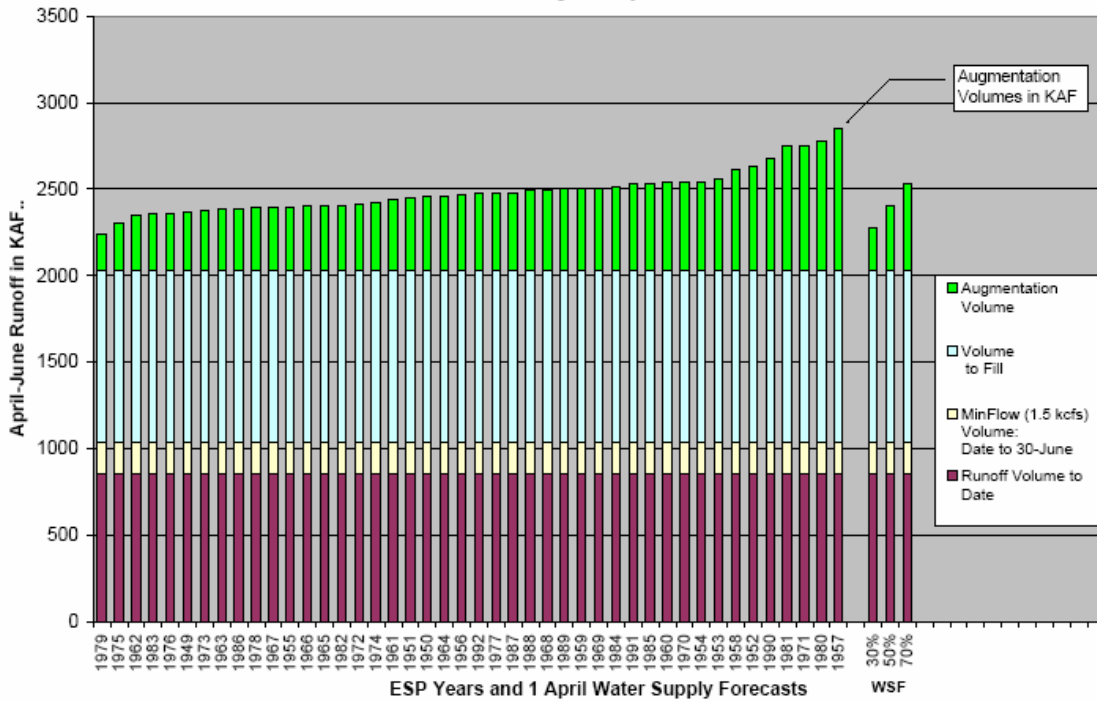
ESP Inflow – Exceedance



ESP Augmentation Volumes

Dworshak Augmentation Volumes ESP inflows and 1-May Water Supply Forecast

Observed data through 1-May



5/2/2006

